NAM NGIEP 1 POWER COMPANY

Nam Ngiep 1 Hydropower Project

Quarterly Environment Monitoring Report
Third Quarter of 2022

July to September 2022

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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
BOMU	Biodiversity Offset Management Unit
BSP	Biodiversity Service Provider
CA	Concession Agreement between the NNP1PC and GOL
CAP	Corrective Action Plan
CCA	Community Conservation Agreement
CDP	Community Development Plan
COD	Commercial Operation Date
CVC	Conventional Vibrated Concrete
CWC	Civil Works Contract
DAFO	District Agriculture and Forestry Office
DD	Data Deficient of IUCN conservation status
DOF	Department of Forestry of Ministry of Agriculture and Forestry
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
FMM	Financial Management Manual
GOL	Government of Lao PDR
GIS	Geographic Information Systems
HMWC	Hydraulic Metal Works Contract
HR	Human Resources

IAP	Independent Advisory Panel
IEE	Initial Environmental Examination
IMA	Independent Monitoring Agency
INRMP	Integrated Natural Resources Management Plan
IUCN	International Union for Conservation of Nature
ISP	Intergraded Spatial Planning
kV	kilo-Volt
LC	Least Concern of IUCN conservation status
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
NC-NX	Nam Chouane-Nam Xang
NCR	Non-Compliance Report
NNP1PC	Nam Ngiep 1 Power Company Limited
OAA	Other aquatic animals
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
TPZ	Totally Protected Zone
TSS	Total Suspended Solids
UAE	United Analysis and Engineering Consultant Company Ltd.
VU	Vulnerable of IUCN conservation status

WCS	Wildlife Conservation Organization
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 Q3 2022, NNP1PC continued activities related to ISO14001:2015 implementation such as conducting the annual ISO14001 Internal Audit and following up on the implementation of the Environmental Management Plan and its achievements. The internal audit completed 27 out of 31 areas/work functions and the 04 remaining areas will be completed by early Q4 2022.

EMO received one Site Decommissioning Plan from the contractor of main dam grouting works for review and approval. Two Non-Compliance Reports (NCRs) were active (one NCR level 1 was carried over from last quarter, and one NCR was newly opened) during Q3 2022. All of these NCRs were unresolved and carried over to Q4 2022.

The operation and adjustment of the constructed wastewater treatment systems continued in Q3 2022. Approximately 0.2 m^3 of sludge was collected from the biofilm septic tanks of OSOV1 and applied into the Sequencing Batch Reactor (SBR) system of OSOV2 to aid the sludge creation and micro-organic matter under the designed specifications of the system. The results of the effluent analyses after adding sludge indicated reduction of nitrogen and phosphorus in the effluent but still non-compliance with the standards. EMO contacted the contractor to assist and get additional sludge from proper sources such as sugar factory or another hydropower project and apply to the system during completion of the contractor's one year warranty in early October 2022. It is expected that the operation of the system can be adjusted to meet the effluent standards by Q4 2022.

During Q3 2022, EMO continued to monitor the status of revegetation at 30 sites. EMO did not find any significant issues of land disturbance, erosion or vegetation destruction during the quarterly inspection. The memorandum on acceptance of handover to GOL prepared by the inspection committee is currently being reviewing by the provincial governor.

A total of 28.71 m^3 solid waste from NNP1 project sites and camps was disposed of at the NNP1 Project Landfill, a decrease of 9.28 m^3 compared with Q2 2022. No solid waste from Phouhomxay, Thahuea and Hat Gniun villages was disposed of at the Houay Soup Landfill, and no recyclable waste was stored at the Community Waste Bank with no recyclables received in Q3 2022.

The environmental flow requirements have been monitored in accordance with the ESMMP-OP and the results show full compliance with the requirements, except for the thalweg water depth measurements that indicated some depths below the required 0.5 m at 5.7 km from the Re-regulation Dam during times with dam discharge less than 30 m^3/s.

The concentration of dissolved oxygen (DO) at the surface level in R05 (Main Reservoir immediately upstream of the main dam) ranged between 6.6 mg/L and 8.6 mg/L. In addition, the

DO concentrations in Nam Chian, Nam Phouan, Nam Xao and Nam Houay Soup were above 6 mg/L.

The DO concentrations at the surface level in the Re-regulation Reservoir (R07) were between 2.4 and 7.9 mg/L.

The DO levels in Nam Ngiep downstream of the Re-regulation Dam (NNG05) during the quarter were generally below 6 mg/L for the first few kilometres. However, DO measurement further downstream indicated a gradual increase in DO concentration (above 6 mg/L at NNG07, 25 km downstream for 07 out of a total 13 weekly monitoring during the reported period).

The depth profile monitoring during the period indicates formation of oxyclines in the Main Reservoir at the monitored stations at varying depths.

The implementation of activities under the AIP2022 of Xaysomboun and Bolikhamxay Watershed and Reservoir Protection Office (WRPO) and Bolikhamxay Nam Chouane-Nam Xang (NC-NX) Biodiversity Offset Management Unit (BOMU) were delayed because of a long internal document and fund transfer process within the committee as well as at Department of Forestry (DOF)-Ministry of Agriculture and Forestry (MAF).

The five species that dominated the fish catch by weight in Q3 2022 include one species *Oreochromis niloticus* and four species group of Mastacembelus, Hampala, Poropuntius, and *Sikukia gudgeri* and *Amblyrhynchichthys truncates* that are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species, except *Sikukia gudgeri* is classified as Data Deficient species (DD). The recorded catch of threatened species includes three Vulnerable species (VU): *Cirrhinus cirrhosis*, *Scaphognathops bandanensis*, *Tor sinensis*.

2 INTRODUCTION

The Nam Ngiep originates in the mountains of Xiengkhouang 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 **Q3 2022**. 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 the implementation of the relevant sub-plans and programmes of the Environmental and Social Management and Monitoring Plan for the Operation Phase during Q3 2022.

3.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

During Q3 2022, NNP1PC continued activities related to ISO14001:2015 implementation such as conducting the annual ISO14001 Internal Audit and following up on the implementation of the Environmental Management Plan and its achievements. The internal audit completed 27 out of 31 areas/work functions and the 04 remaining areas will be completed by early Q4 2022.

The progress of ISO14001:2015 annual internal audit for 2022 is shown in **Table 3-1**. The results of Internal Audit 2022 will be reported in the Q4 2022 Report. The first external Surveillance Audit by SGS (Lao) Sole Co., Ltd. is confirmed to be conducted on-site during 16-17 February 2023.

TABLE 3-1: THE ISO14001:2015 AUDIT AREAS AND RESPONSIBLE INTERNAL AUDITORS' GROUPS

Department / Area	Auditors	Progress
Industrial Areas (Powerhouses and Dams)		
Control rooms	Team 6	Completed
Dams		Completed
Equipment Storage Rooms		Completed
Chemical & Hazmat Storage Areas		Completed
Reservoirs and Downstream of the Dams		Completed
Transmission Lines (230 kV and 115 kV) and 22kV DL		Completed
Emergency response and preparedness system		Completed
Wastewater treatment systems		Completed
Camps Facilities		
Wastewater treatment systems (OSOV1, OSOV2)	Team 2	Completed
Fuel Storage Tank/ Fuel Station		Completed
Clinic (OSOV1)		Completed
Security guard houses		Completed
Emergency response and preparedness system		Completed
Environmental Laboratory		Completed
Project Waste Management and Landfill Operation	Team 5	Completed
Canteen		Completed
Site decommissioned and rehabillated		Completed
Watershed and Biodiverstiy Management		Completed
Resettlement Management		Completed
Management System		
Management Represenntative (MR)	Team 4	Completed
Organization Contexts/Needs and Expectations of Interested Parties/Risks and Opportunities/Legal and Compliance Evaluation		Completed
Compliance Obligation and Compliance Evaluation		Completed
Communication		Completed
DCC	Team 1	Pending
Incident Investigation/NC/CA/PA		Pending
Internal Audit		Pending
Management Review		Pending
E Objectives, Targets and Programs	Team 3	Completed
Training		Completed
Procurement Management		Completed
Logistic and transportation		Completed

PHOTOGRAPH 1: ISO14001:2015 ANNUALLY INTERNAL AUDIT 2022

CANTEEN 	**ENVIRONMENTAL LAB** 
CLINIC 	**MANAGEMENT REPRESENTATIVE** 
EMERGENCY PREPAREDNESS 	**WATERSHED AND BIODIVERSITY** 
DAMS 	**CONTROL ROOM** 

3.2 CONTRACTOR SS-ESMMPS

During Q3 2022, EMO received one Site Decommissioning Plan from the contractor of main dam grouting works for review and approval. This submitted document was cleared as shown in **Table 3-2** and more details can be found in **Appendix 1**.

TABLE 3-2*: DOCUMENTS REVIEWED DURING Q3 2022*

Document Name	Rev. 1	Rev. 2	Rev. 3	Approved
Site Decommissioning Plan for KENBER (contractor) temporary construction site (Main dam grouting work) and camp (rental houses)	√	√	√	√

3.3 RESULTS OF COMPLIANCE INSPECTIONS AT CONSTRUCTION SITES

During Q3 2022, EMO conducted its own weekly site inspections and bi-weekly joint site inspections with Technical Division, Administration Division and the Contractor at a total of 10 sites. These included the four main operation sites, two landfills, one contractor camp (rental houses), and three construction sites. The same number of monitoring sites as in Q2 2022. EMO has also conducted a quarterly site visit and monitoring of the 31 rehabilitated sites.

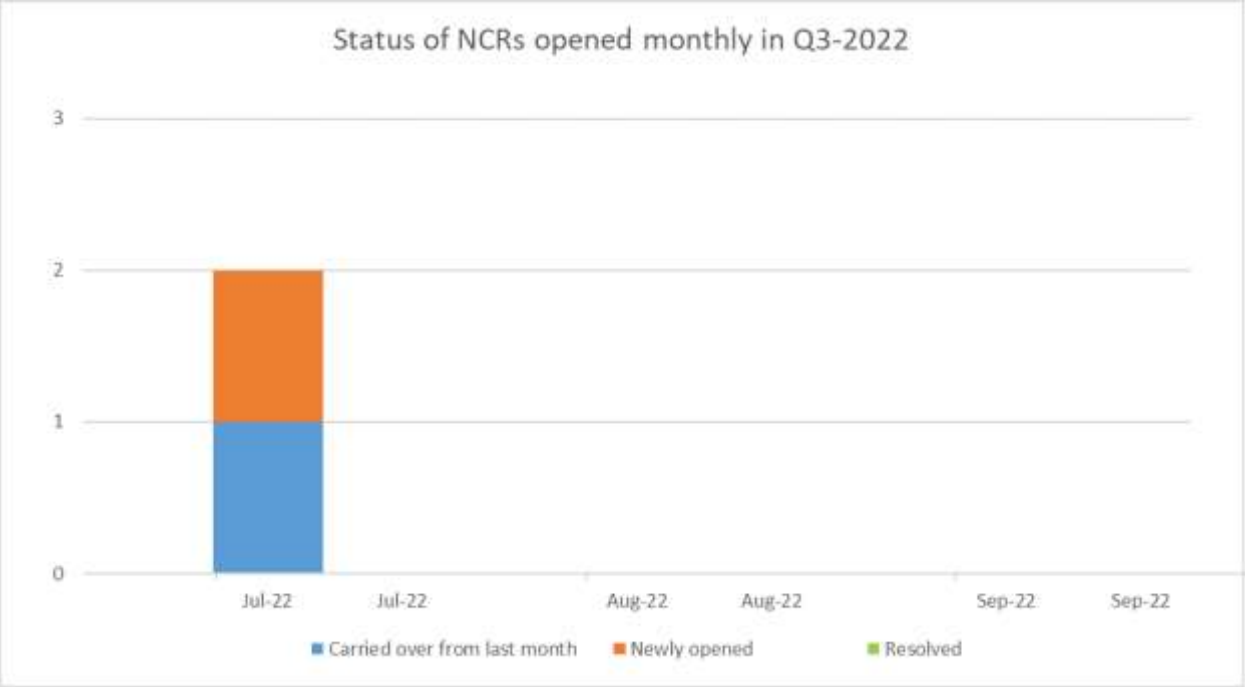
Two Non-Compliance Reports (NCRs) were active (one NCR level 1 related to the effluent discharged from the 3 wastewater treatment systems was carried over from last quarter and one NCR level 2 related to the tree cuttings at the Right of Way of 22 kV distribution line was newly opened) during Q3 2022. For both of these two NCRs the corrective actions are under implementation and the progress of corrective actions is presented in **Appendix 2**.

The status of the NCRs is summarized in **Table 3-3** and **Figure 3-1**.

TABLE 3-3: *STATUS OF NON-COMPLIANCE REPORT DURING Q3 2022*

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

FIGURE 3-1*: STATUS OF NCRS DURING Q3 2022*



PHOTOGRAPH 1: JOINT SITE INSPECTION AT CONTRACTOR'S TEMPORARY EQUIPMENT STOCK YARD	PHOTOGRAPH 1: JOINT SITE INSPECTION WITH TD AND TREE EXPERT FROM FACULTY OF FORESTRY-NUOL ALONG THE 22KV DL.
	

3.4 RESULTS OF SITE DECOMMISSIONING AND REHABILITATION

During Q3 2022, EMO continued to monitor the status of revegetation at 31 sites. EMO did not find any significant issues of land disturbance, erosion or vegetation destruction during the quarterly inspection. The vegetation cover at two sites, the former LILAMA10 camp and Phouhomxay village's Irrigation Canal's rock and spoil disposal, had slightly increased compared to the previous quarter.

The progress of site rehabilitation and revegetation cover since June 2020 is summarized in **Table 3-4** and the current vegetation cover is indicated in **Figure 3-2**.

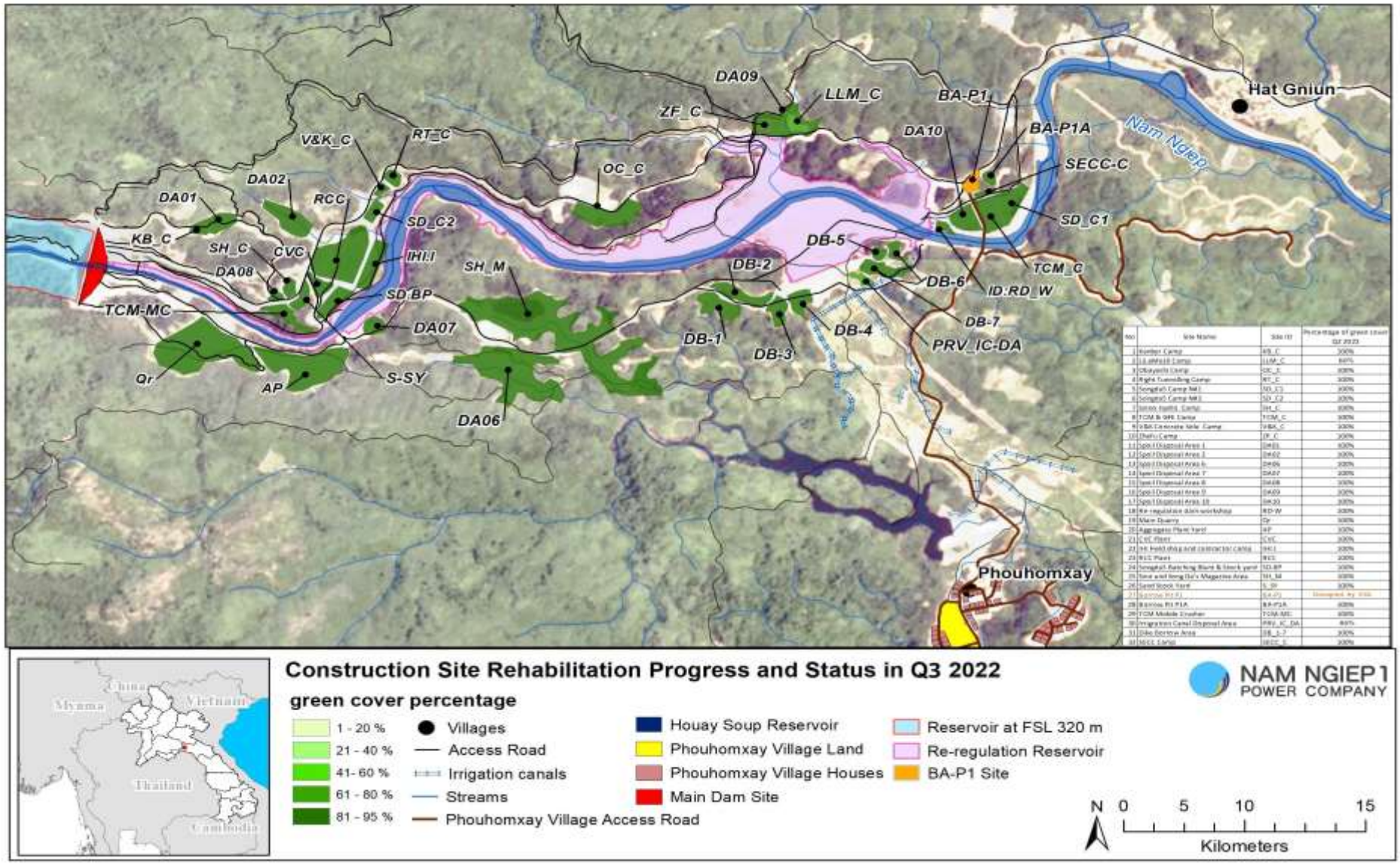
Table 3-4*: Summary of Construction Sites Rehabilitation as of September 2022*

No	Site Name	Status of Decommissioning	Percentage of Vegetation Cover Evaluation							
			Jun-2020	Sep-2020	Dec-2020	Mar-2021	Jun-2021	Sep-2021	Jun-2022	Sep-2022
01	TCM & GFE Camp	Completed	70%	90%	90%	90%	100%	100%	100%	100%
02	Spoil Disposal Area 7	Completed	-	98%	98%	98%	100%	100%	100%	100%
03	Spoil Disposal Area 9	Completed	-	75%	75%	75%	90%	95%	100%	100%
04	Spoil Disposal Area 10	Completed	80%	95%	95%	95%	100%	100%	100%	100%
05	Borrow Pit P1A	No need for decommissioning	-	80%	80%	80%	95%	100%	100%	100%
06	TCM Mobile Crusher	Completed	-	90%	90%	90%	100%	100%	100%	100%
07	Dike Borrow Areas	No need for decommissioning	-	75%	75%	75%	85%	90%	100%	100%
08	SECC camp	Completed	-	90%	90%	90%	100%	100%	100%	100%
09	KENBER Camp	Completed	80%	95%	95%	95%	100%	100%	100%	100%
10	LILAMA10 Camp	Completed	5%	20%	40%	45%	50%	65%	75%	80%
11	Obayashi Camp	Completed	80%	90%	90%	90%	95	100%	100%	100%
12	Right Tunnelling Camp	Completed	70%	90%	90%	90%	95	100%	100%	100%
13	Songda5 Camp N#1	Completed	90%	98%	98%	98%	100%	100%	100%	100%
14	Songda5 Camp N#2	Completed	80%	95%	95%	95%	100%	100%	100%	100%
15	Sino Hydro Camp	Completed	80%	95%	95%	95%	100%	100%	100%	100%
16	V&K Concrete Sole Camp	Completed	50%	70%	70%	70%	85%	95%	100%	100%
17	Zhefu Camp	Completed	60%	75%	75%	75%	100%	100%	100%	100%
18	Spoil Disposal Area 1	Completed	80%	90%	90%	90%	100%	100%	100%	100%
19	Spoil Disposal Area 2 & main dam workshop	Completed	60%	75%	75%	75%	90%	95%	100%	100%
20	Spoil Disposal Area 6	Completed	70%	75%	75%	75%	90%	95%	100%	100%
21	Spoil Disposal Area 8	No need for decommissioning	40%	60%	60%	60%	100%	100%	100%	100%

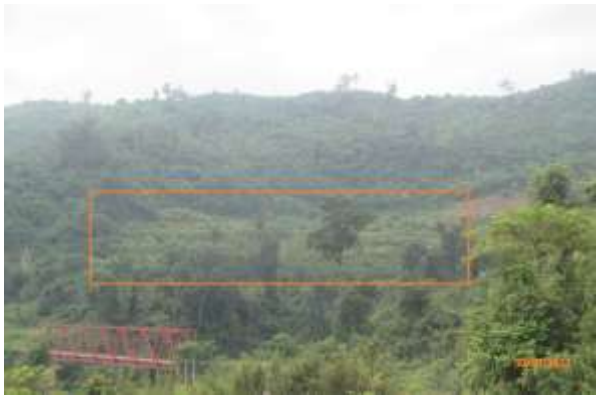
No	Site Name	Status of Decommissioning	Percentage of Vegetation Cover Evaluation							
			Jun-2020	Sep-2020	Dec-2020	Mar-2021	Jun-2021	Sep-2021	Jun-2022	Sep-2022
22	Re-regulation dam workshop	Completed	80%	85%	85%	85%	95%	100%	100%	100%
23	Main Quarry	Completed	50%	70%	70%	70%	85%	90%	100%	100%
24	Aggregate Plant Yard	Completed	80%	85%	85%	85%	95%	100%	100%	100%
25	CVC Plant	Completed	60%	70%	70%	70%	85%	95%	100%	100%
26	IHI Field shop and contractor camp	Completed	70%	85%	85%	85%	95%	95%	100%	100%
27	RCC Plant	Completed	50%	70%	70%	70%	80%	95%	100%	100%
28	Songda5 Batching Plant & Stock yard	Completed	80%	95%	95%	95%	100%	100%	100%	100%
29	Sino and Song Da's Magazine Area	Completed	70%	80%	80%	80%	95%	100%	100%	100%
30	Sand Stock Yard	No need for decommissioning	-	60%	60%	60%	75%	90%	100%	100%
31	Phouhomxay Village's Irrigation Canal Spoil Disposal Area	No need for decommissioning	-	5%	10%	15%	20%	70%	80%	85%

Note: 'No need for decommissioning' means no construction site or installed equipment to be removed.

FIGURE 3-2*: REVEGETATION SITES MAP DURING Q2 2022*



The photos below present the current vegetation cover of some of the main decommissioned construction sites. Overall, it is assessed that the vegetation cover has slightly increased compared with Q2 2022.

QUARRY 	**AGGREGATE PLANT YARD** 
RCC PLANT YARD 	**CVC PLANT YARD** 
SPOIL DISPOSAL NO.6 	**SPOIL DISPOSAL NO.10** 

FORMER LILAMA10 CAMP	PHX'S IRRIGATION CANAL'S SPOIL DISPOSAL AREA
	

A plan for handover of decommissioned and rehabilitated sites back to the GOL is under preparation. The site inspection memorandum and inspection report of inspection committee's acceptance for handover is currently being reviewed by the provincial governor.

3.5 WASTE MANAGEMENT AT THE CONSTRUCTION SITES

3.5.1 General Waste Management

A total of 28.71 m^3 solid waste from NNP1 project sites and camps was disposed of at the NNP1 Project Landfill, a decrease of 9.28 m^3 compared with Q2 2022.

During this reporting period, the Contractor continued the regular waste collection from the NNP1PC's operation sites and operated the project landfill for three days per week. The work included waste segregation and disposal, waste cover, grass cutting and repairing of perimeter fences.

During the Q3 2022, 76 kg of recyclable waste was sold to the authorized recycle waste trading company. Glass sold in Q3 was considerably low because the local vendor only come to site occasionally and accept specific type of grass bottle. NNP1PC EMO is searching for the recycle waste trader in Vientiane for routine management of recyclables. The amount of recyclable waste managed on site during the reporting period is shown in **Table 3-5**.

TABLE 3-5*: AMOUNTS OF RECYCLABLE WASTE DURING Q3 2022*

Source and Type of Recyclables		Unit	Total in Q3 2022 (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	127	0	**127**
3	Aluminium Can	kg	0	0	**0**
4	Paper/Cardboard	kg	90	57	**33**
5	Glass	kg	159	19	**140**
7	Scrap metal	Kg	10	0	**10**
Sub-Total 2		**kg**	**386**	**76**	**310**
Grand Total (Sub-Total 1+2)		**kg**	**386**	**76**	**310**

3.5.2 Hazardous Waste Management

The amounts of hazardous waste and hazardous materials that were collected, stored and disposed of during Q1 2022 are shown in **Table 3-6.**

During Q3 2022, no hazardous waste trade in the project area.

TABLE 3-6*: HAZARDOUS MATERIAL AND HAZARDOUS WASTE RECORDED DURING Q3 2022*

No.	Type of Hazardous Material	Unit	Total in Q3 2022	Used/ Disposed	Remaining
1	Diesel	Litre	16,380	14,387	1,993
2	Gasoline	Litre	2,108	1,521	587
3	Lubricant (Turbine oil)	Litre	5,120	18	5,102
4	Colour paint	Litre	299	0	299
5	Thinner	Litre	10	0	10
6	Grease oil	Litre	153	3	150
7	Gear Oil	Litre	435	8	427
8	Chlorine Liquid	Litre	130	35	95
9	Chlorine Powder	Kg	70	69	1
10	Colour Spray	Piece	3	0	3
11	HA Cut AF	Litre	3,925	0	3,925
12	HA Cut Cat AF	Litre	373	0	373
	Type of Hazardous Waste				
13	Used Oil (Hydraulic + Engine)	Litre	355	0	355
14	Used oil mixed with water	Litre	0	0	0
15	Empty used oil drum/container (drum 200L)	Unit	53	3	50
16	Use Oil Filter	Unit	7	0	7
17	Contaminated soil, sawdust and textile material	M3	0.54	0	0.54
18	Used tyre	Piece	14	0	14
19	Empty used chemical drum/container (drum 20L)	Unit	33	2	31
20	Lead acid batteries	Unit	9	3	6
21	Empty paint and spray cans	Can	185	154	31
22	Halogen/fluorescent bulbs	Unit	99	5	94
23	Empty cartridge (Ink)	Piece	182	0	182
24	Clinic Waste	Kg	7	0	7.2
25	Expired Chlorine Powder	Kg	65	0	65

3.5.3 Animal Fodder (Pig Feed) Collection Programme

During Q3 2022, local villagers collected 761 kg food waste from the Owner's Site Office and Village (OSOV) for feeding their animals.

3.5.4 Community Solid Waste Management and Recycling Programme

The handover of the community solid waste management program, Houay Soup landfill operation and the community waste bank is in process by the Bolikhan District EMU. No recycle waste trade activities in the community recycle waste bank with no recyclables received in Q3 2022.

3.5.5 Houay Soup Landfill

There was no waste collection from Phouhomxay, Thahuea and Hat Gniun villages to dispose of at Houay Soup Landfill during the reporting period because the waste collection service from the Contractor hired by NNP1PC ended the contract in April 2022. Since then, the Bolikhan District EMU and the villagers have managed the communities' solid wastes. NNP1PC did not observe waste accumulation during the period but conducted a quarterly visual inspection at the Houaysoup landfill and noted that some solid waste was self-disposed by some villagers (relatively little). The handover of the community solid waste management program, Houay Soup landfill operation and the community waste bank is in process by the Bolikhan District EMU. NNP1PC raised an issue with the Bolikhan district EMU to speed up the taking-over process to ensure that community solid waste is adequately managed. No recyclable waste was stored at the Community Waste Bank, with no recyclables received in Q3 2022.

The report on the community consultations is still under review and consideration by the Bolikhan District Governor. EMO expects that the community solid waste management can be fully handed over to the local authority within Q4 2022.

3.6 RESERVOIR OPERATIONS

3.6.1 Main Reservoir

The water level in the main reservoir, inflow to the reservoir and discharge from the reservoir since January 2020 are displayed in the graphs in **Figure 3-4** and **Figure 3-3**.

During Q3 2022, the mean daily inflow to the main reservoir was 230 m^3/s. The minimum daily inflow was 115 m^3/s, maximum daily inflow was recorded at 605 m^3/s, and 25th percentile of 177 m^3/s and 75th percentile of 264 m^3/s. As indicated in **Figure 3-3,** the inflow during Q3 2022 was higher compared to the same period in 2021.

The water level in the main reservoir increased with 16.33 m from El. 301.22 m asl (01 July 2022) to El. 317.55 m asl. (30 September 2022).

FIGURE 3-3: ***INFLOW TO THE MAIN RESERVOIR***

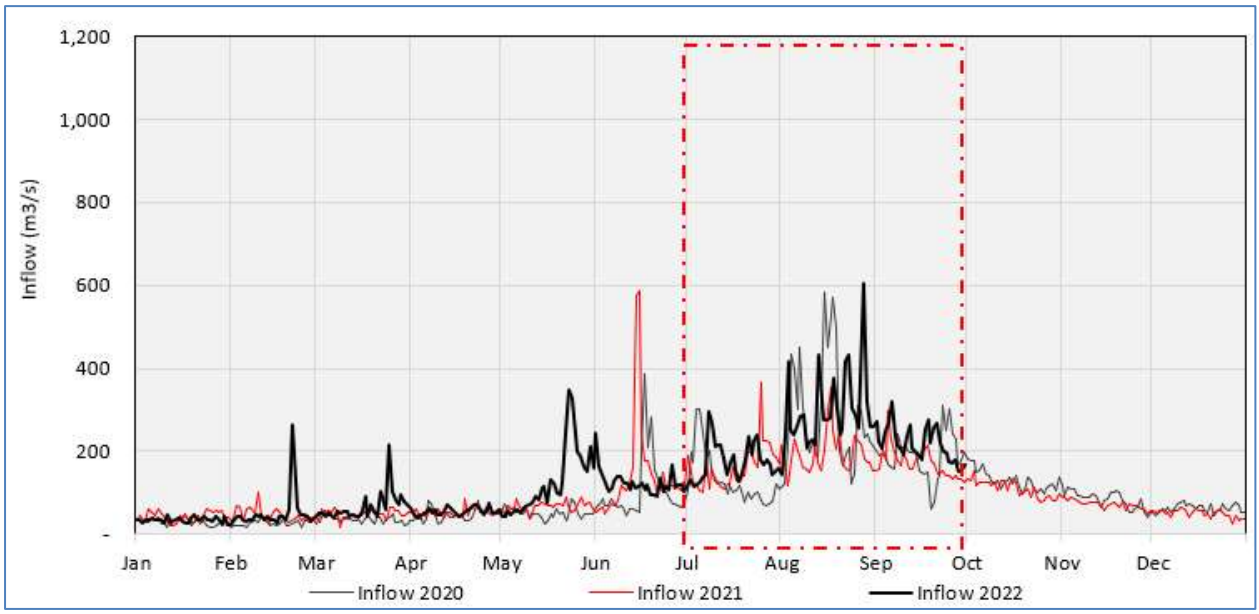
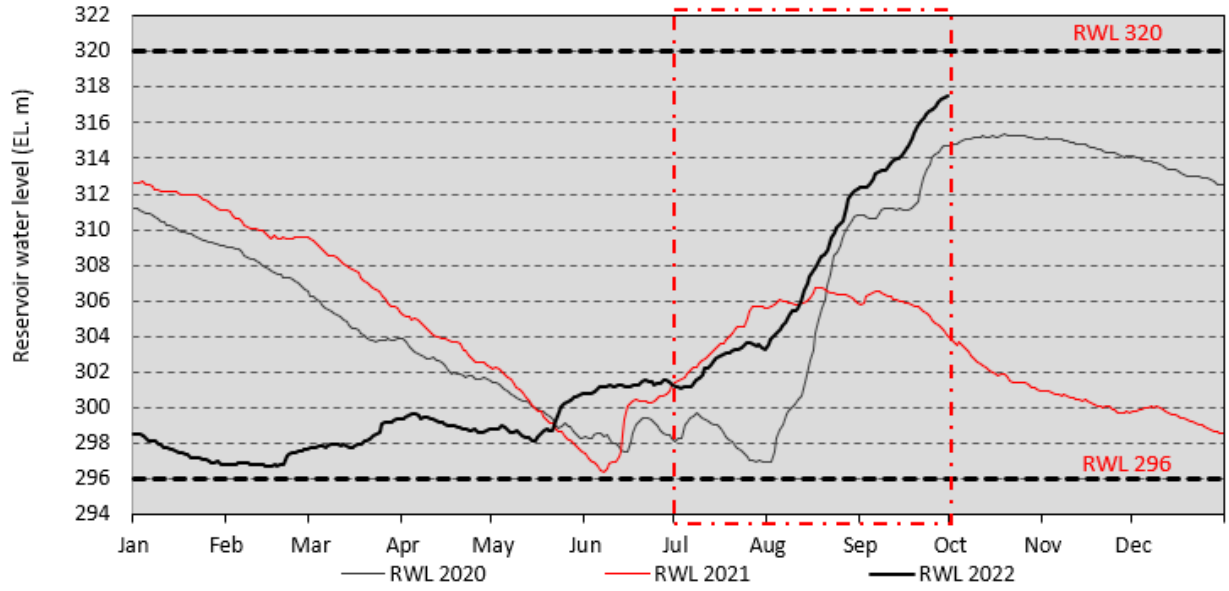


FIGURE 3-4: ***WATER LEVEL OF THE MAIN RESERVOIR***



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 Q3 2022 are summarized in **Table 3-7**.

TABLE 3-7: *SUMMARY OF EFRS COMPLIANCE MONITORING IN Q3 2022*

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 4.3 km downstream the dam (measured at cross-sections where visual observations or boat navigation indicate shallow waters)	One measurement at 2 measuring points located within 5.7 km from the re-regulation dam did not comply during times with dam discharge less than 30 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

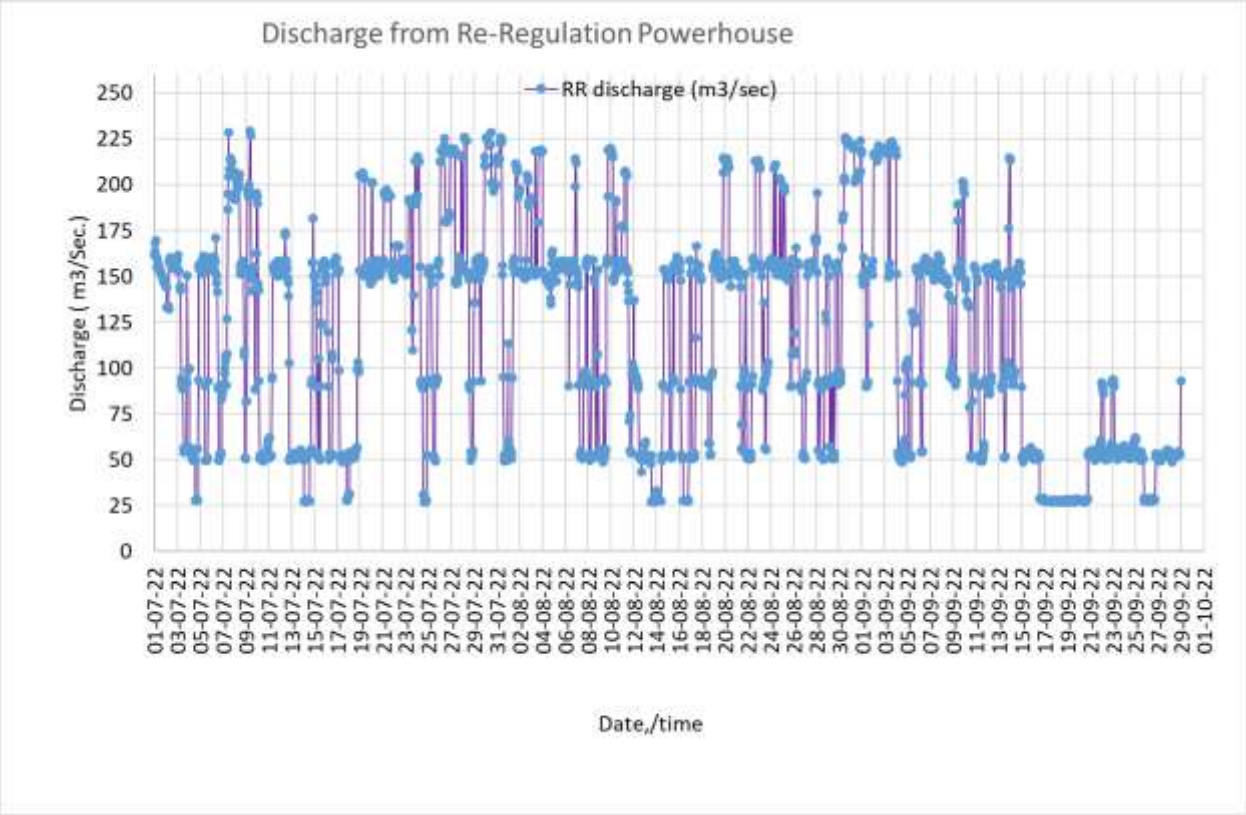
3.6.2.1 Minimum Flow Requirements

The discharge monitoring data for the re-regulation dam during Q3 2022 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 3-5.**

During Q3 2022, the mean discharge from the re-regulation dam was about 134 m^3/s in July 2022 and about 126 m^3/s and 94 m^3/s in August and September 2022 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 were no complaints related to the flow discharges or fluctuation levels downstream the Re-regulation dam during the reporting period.

FIGURE 3-5: *DISCHARGE FROM THE RE-REGULATION DAM DURING Q3 2022*



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 3-6.** 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 (Thalweg water depth at least 0.5 m in the entire reach from immediately downstream of the Re-regulation dam until 4.3 km 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 during Q3 2022 are presented in **Table 3-8**. A monitoring mission at the low discharge (<30 m^3/s) recorded two measuring points located within 5.7 km downstream of the re-regulation dam had a depth of less than 0.5 m but there were no difficulties navigating the boat except a station at RWD05 (5.7 km downstream the Re-regulating Dam). There were no complaints related to the water depth less than 0.5 m downstream the Re-regulation dam during the reporting period.

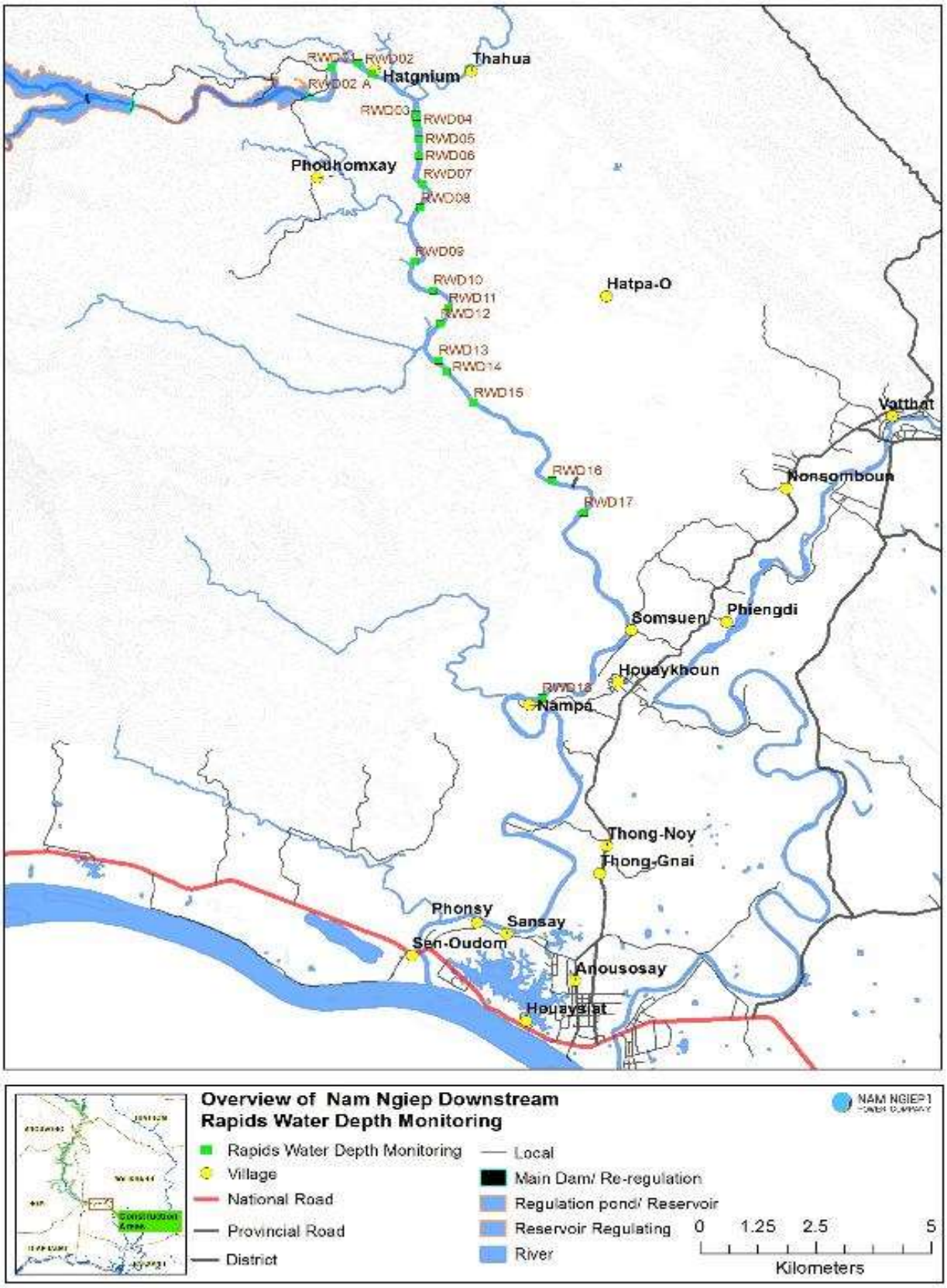
According to the recommendation by Lenders' Technical Advisor (LTA) during the virtual site visit on 21 to 26 November 2021, NNP1PC will continue to monitor the situation at the critical sites under conditions with discharge of less than 30 m^3/s for detecting the navigation problems and

also monitor whether any complaint is raised to consider the methodologies for solving where necessary.

TABLE 3-8: ***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	5.7	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-Jul-22	91	1.62	1.58	1.54	1.69	1.78	1.71	1.82	1.89	2	2.05	2.1	2.13	2.29	2.33	2.45	2.5	2.72	2.82	2.47
14-Jul-22	27.54	0.54	0.48	0.56	0.61	0.65	0.4	0.7	0.76	0.84	0.75	0.83	0.91	0.87	0.96	1.15	1.28	1.36	1.5	1.2
28-Jul-22	90.9	1.2	1.36	1.32	1.47	1.56	1.5	1.6	1.73	1.85	1.9	1.97	2.03	2.19	2.25	2.38	2.44	2.66	2.75	2.4
4-Aug-22	148.2	1.65	1.61	1.56	1.71	1.8	1.75	1.86	1.95	2.05	2.1	2.15	2.18	2.36	2.4	2.54	2.62	2.85	2.96	2.6
26-Aug-22	156.2	1.8	1.76	1.71	1.9	2	1.95	2.06	2.2	2.25	2.4	2.45	2.58	2.76	2.9	3.14	3.22	3.45	3.66	3.2
31-Aug-22	151	1.92	1.88	1.83	2.01	2.12	2.07	2.18	2.32	2.37	2.52	2.57	2.6	2.88	3.02	3.26	3.32	3.55	3.75	3.3
8-Sep-22	147.8	1.6	1.56	1.51	1.66	1.75	1.7	1.81	1.9	2	2.05	2.1	2.13	2.31	2.1	2.5	2.58	2.8	2.9	2.55
15-Sep-22	51.4	0.84	0.78	0.86	0.91	0.95	0.71	1.02	1.08	1.16	1.05	1.13	1.2	1.16	1.25	1.42	1.54	1.62	1.71	1.3
22-Sep-22	50	0.85	0.8	0.88	0.95	1	0.82	1.1	1.16	1.25	1.15	1.23	1.35	1.41	1.5	1.67	1.8	1.92	2.05	1.6
29-Sep-22	51.8	0.78	0.7	0.8	0.85	0.89	0.75	0.96	1.02	1.1	1	1.08	1.15	1.11	1.2	1.38	1.49	1.57	1.66	1.25

FIGURE 3-6: *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.

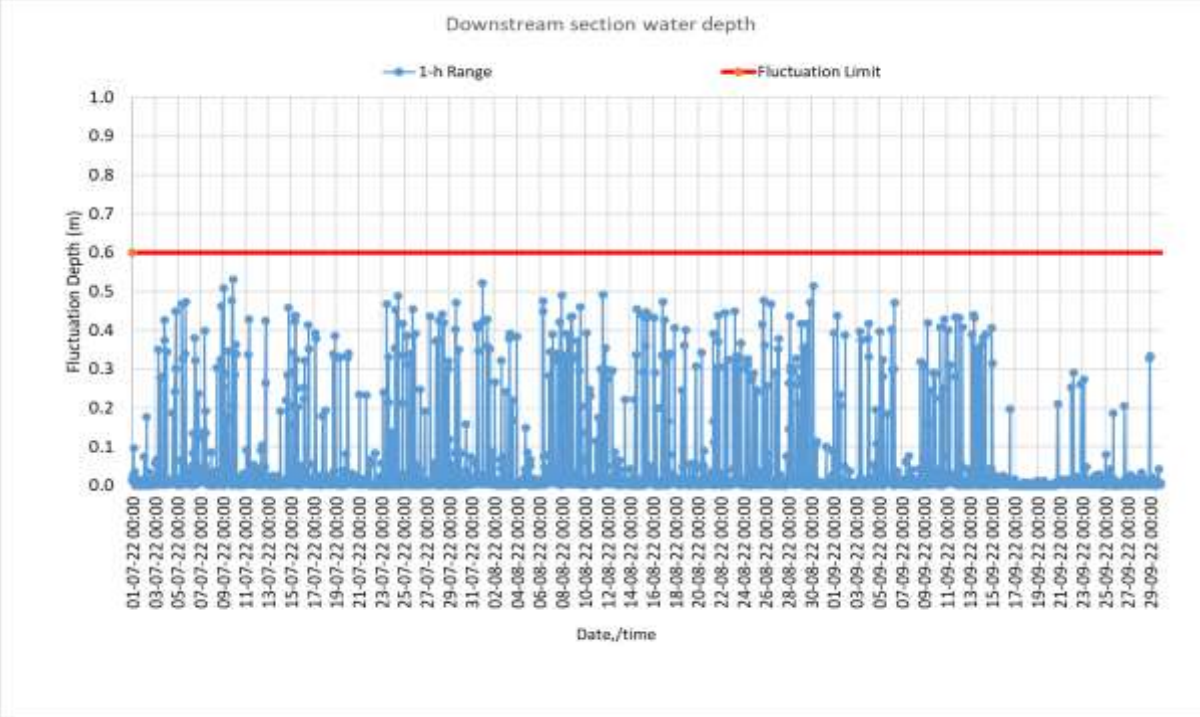
For the 0.6 m in 1-hour maximum fluctuation EFR, the cumulative rises and falls are calculated from the hourly water level recordings.

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 Q3 2022, 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 3-7**.

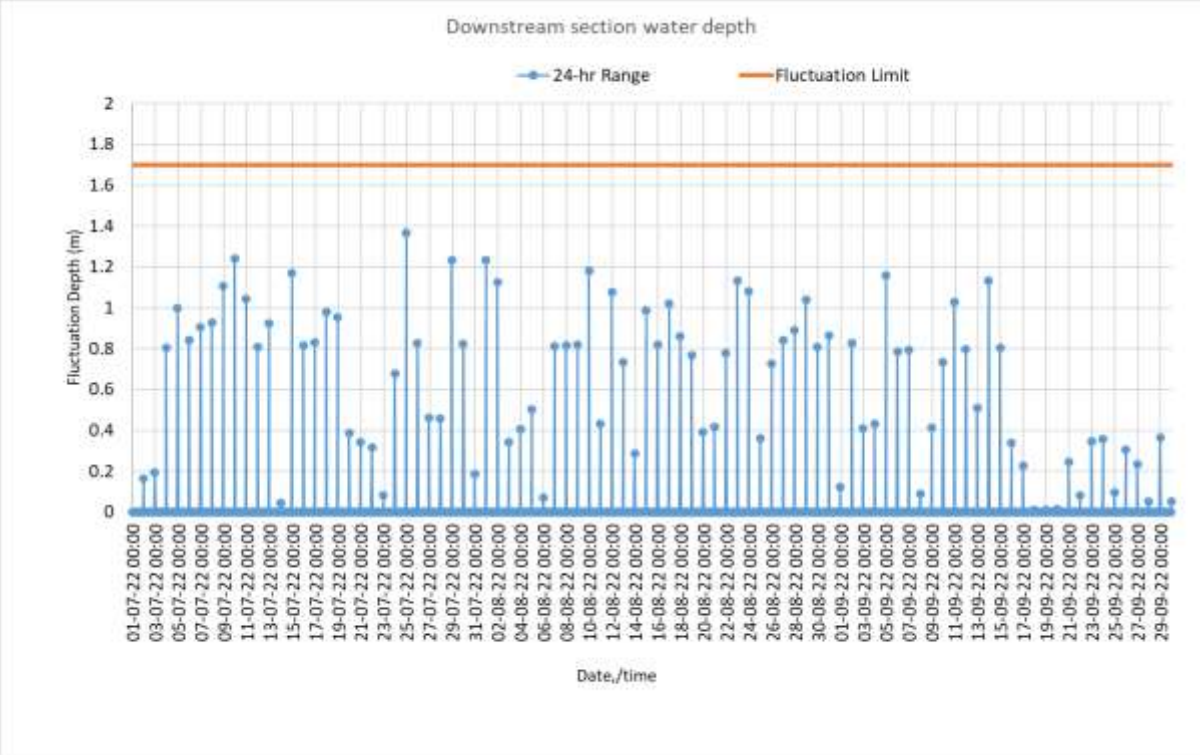
FIGURE 3-7: *HOURLY STAGE HEIGHT FLUCTUATIONS DURING Q3 2022*



During Q3 2022, the maximum range in stage of 1.7 m over 24-hour was complied with for all 24-hour periods (00:00 – 23:00).

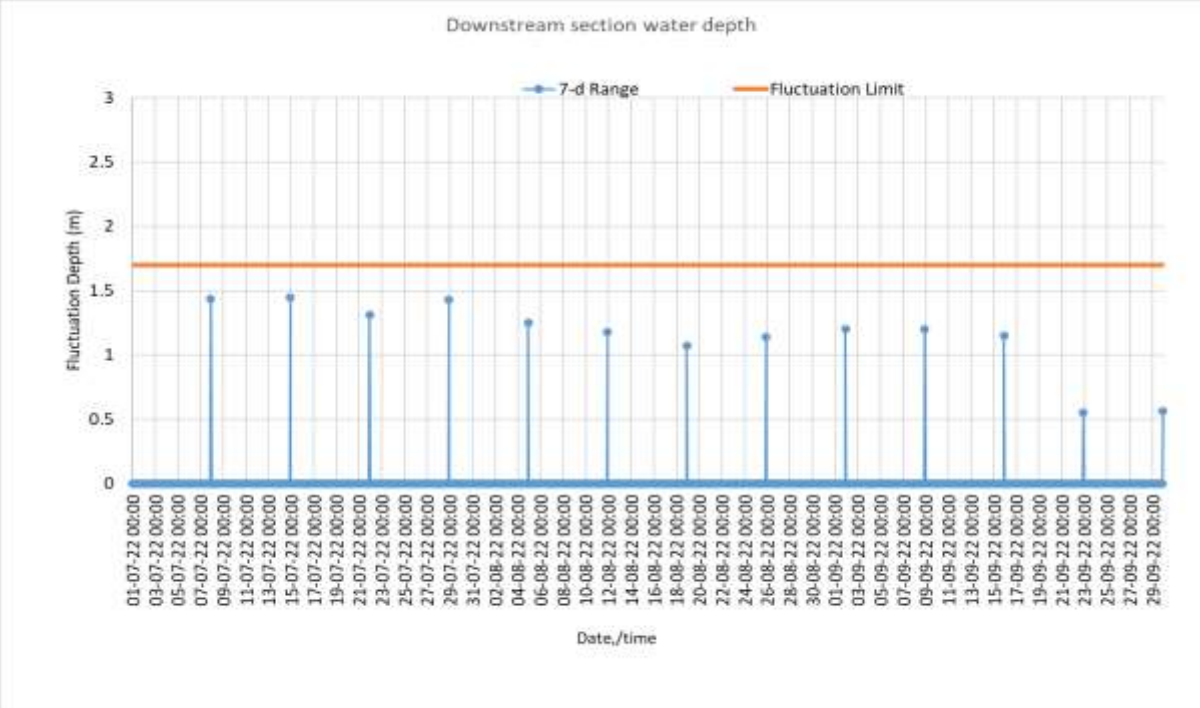
The results of the monitoring are presented in **Figure 3-8.**

FIGURE 3-8: *24-HOUR STAGE HEIGHT DIFFERENCE (M) DURING Q3 2022*



During Q3 2022, 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 3-9**.

FIGURE 3-9: *7-DAY STAGE HEIGHT DIFFERENCE (M) DURING Q3 2022*



3.7 WATER QUALITY MONITORING

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 Q3 2022 are listed in **Appendix 5.1**

Dissolved Oxygen (DO)

The results of DO measurements for the station immediately upstream of the main dam (R05 – surface and intake at 276 m asl.) and station R07 in the re-regulation dam (surface) and immediately downstream of the re-regulation dam (NNG05) are presented in **Figure 3-10,** the DO long profile measurement as timeseries are presented in **Figure 3-11**, and the full set of DO surface water quality data are shown in **Table 3-9**.

The water temperature and DO depth profiles in the main reservoir at R05 during Q3 2021, Q2 2022 and Q3 2022 are presented in **Figure 3-12** to **Figure 3-14.**

FIGURE 3-10: ***DISSOLVED OXYGEN IMMEDIATELY UPSTREAM AND DOWNSTREAM OF THE MAIN DAM***

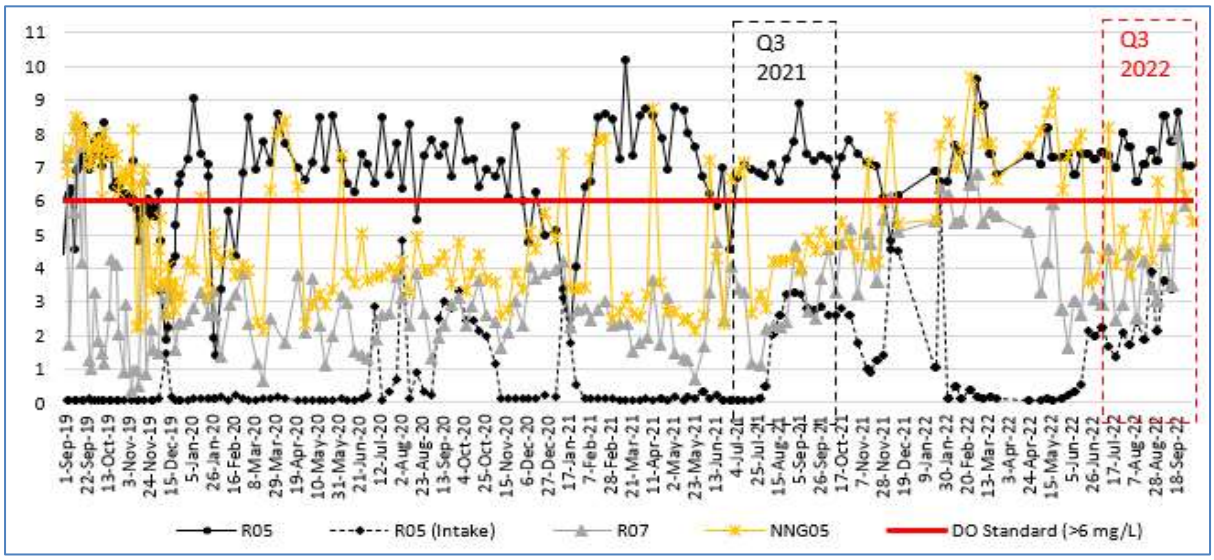
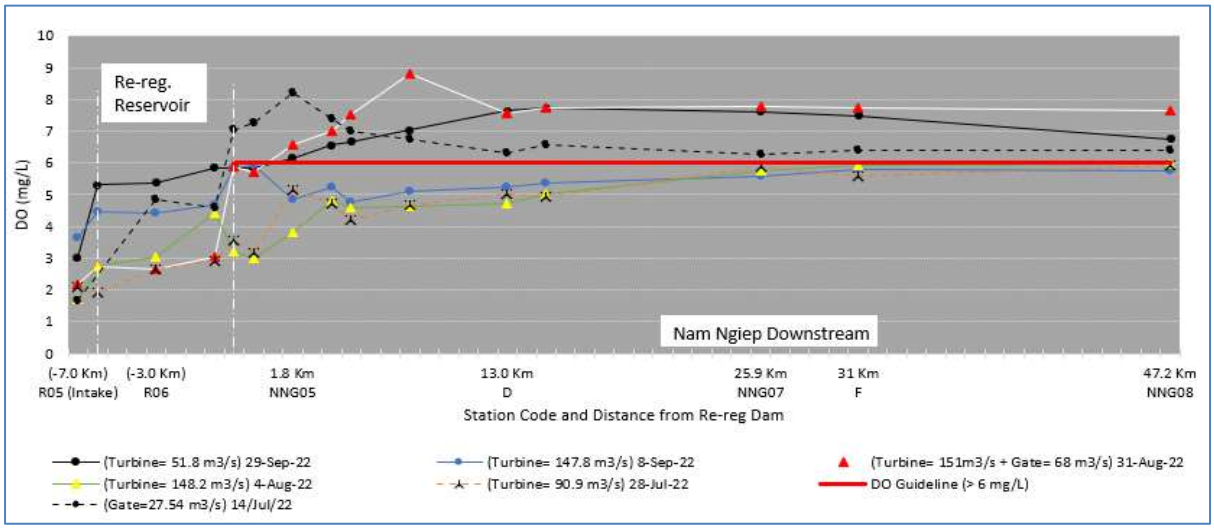


FIGURE 3-11: ***DISSOLVED OXYGEN LONG PROFILE MEASUREMENT FROM IMMEDIATELY UPPER MAIN DAM TO LOWER NAM NGIEP***



Main Reservoir

Figure 3-14 presents the DO and water temperature depth profile timeseries in the Main Reservoir (R04 and R05) from September 2018 to September 2022, 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 profile monitoring during Q3 2022 indicates formation of oxyclines in the main reservoir at the monitored stations at varying depths.

As R05, when comparing Q3 2022 with Q3 2021, overall, Q3 2022 shows a slightly deeper thermocline and a corresponding deeper oxycline.

At R05 (the station closest to the main dam), the mean DO concentration was 7.5 mg/L in the upper 5.0 m (slightly higher than both Q2 2022 and Q3 2021) and generally varied between 5.7 mg/L to 8.8 mg/L. A band of low oxygen water with DO concentrations at or below 2 mg/L was measured at depths between 6 m and 12 m followed by a layer with slightly higher DO concentrations around 2 mg/L – 3 mg/L down to a depth of about 36 m. The monthly mean DO concentration at the intake level increased from 1.8 mg/L in July 2022, to 2.4 mg/L in August 2022 and 3.4 mg/L in September 2022. Anoxic levels were from 28 m in July 2022 to 50 m in September 2022 corresponding to 2.0 m above to 6.0 m below the intake.

The mean DO concentration over the entire water column in R02 was about 6 mg/L in July, August and first half of September 2022. In the second half of September 2022, a band of low oxygen with DO at or below 2 mg/L was measured at a depth interval from 3.5 m to 8 m, followed a layer of slightly higher concentrations of DO.

In R03 and R04 the oxycline was found at depths around 7.5 m in July, August and first half of September 2022, however with relatively high DO levels around 4 mg/l down to 30 m below surface. In the second half of September 2022, a low oxygen layer appeared at a depth interval from 7.5 m to 12 m, similar to R02.

Anoxic condition at R04 were found at depths between 30 m and 70 m in July 2022, between 36 m and 70 m in August 2022, and between 50 m and 70 m in September 2021.

At R03, anoxic conditions were found at depths between 30 m and 45 m in July 2022, between 38 m and 45 m in August 2022, and between 55 m and 60 m in September 2021.

Re-regulation Reservoir (R6 and R7)

The depth profiles at R06 and R07 in the Re-regulation Reservoir showed no indications of a thermocline, because the Re-regulation Reservoir behaves more like a river than a lake.

The DO concentrations at R06 have increased in the last month of the quarter with a monthly average over the entire water column of 2.9 mg/L in July, 2.8 mg/L in August to 4.3 mg/L in September 2022. A similar pattern was found at R07. This corresponds well with the increase in DO concentrations at the intake level in the main reservoir although the DO concentrations in R06 and R07 occasionally were slightly higher than the corresponding DO concentrations at or near the intake level in R05. However, it should be noted that the actual flow patterns and movements of water from R05 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, R01 in the upper end of the Main Reservoir, and the reservoir tributaries Nam Chian (NCH01) and Nam Phouan (NPH01) had DO concentrations above 6 mg/L during Q3 2022.

Downstream Stations

During Q3 2022, the discharge from the Re-regulation Dam mainly went through the turbine and occasionally through the gate (14 July 2022) and the combination of turbine and gate/Labyrinth.

The downstream DO concentrations at NNG05 located 1.8 km from the Re-regulation dam were less than 6 mg/L (the National Surface Water Quality Standard), except 14 July 2022, 31 August 2022, 22 and 29 September 2022. Further downstream from the dam, the DO concentrations generally increased reaching about 6.5 mg/L at NNG07 located 25 km from the dam.

No dead fish was observed in Nam Ngiep downstream during Q3 2022.

NNP1PC continues to carefully compile and assess all monitoring data to determine if any additional water aeration measures may be necessary to improve the DO levels in Nam Ngiep River downstream the Re-regulation Dam.

FIGURE 3-12: ***MAIN RESERVOIR DISSOLVED OXYGEN AT THE END OF Q3 2022***

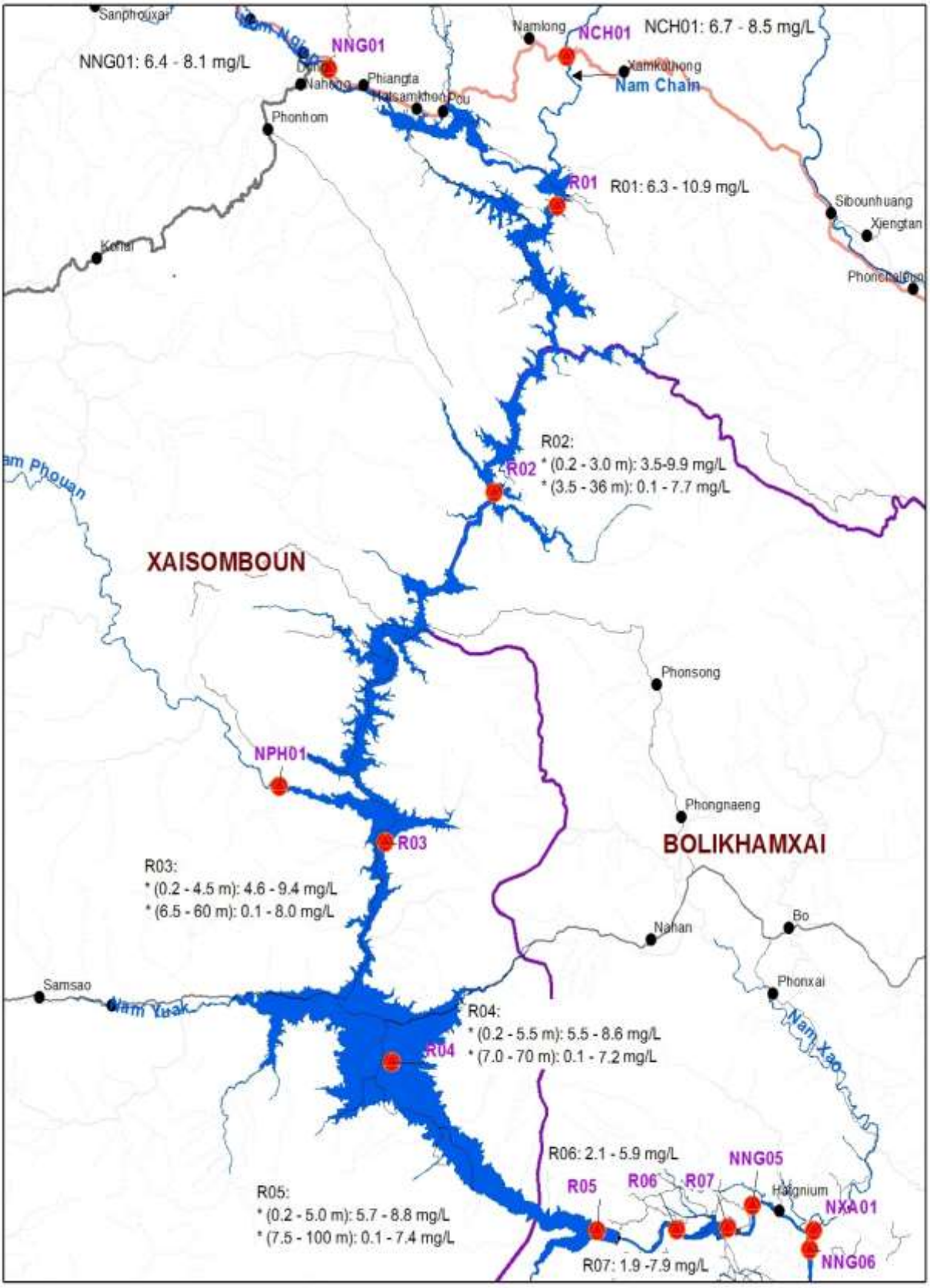
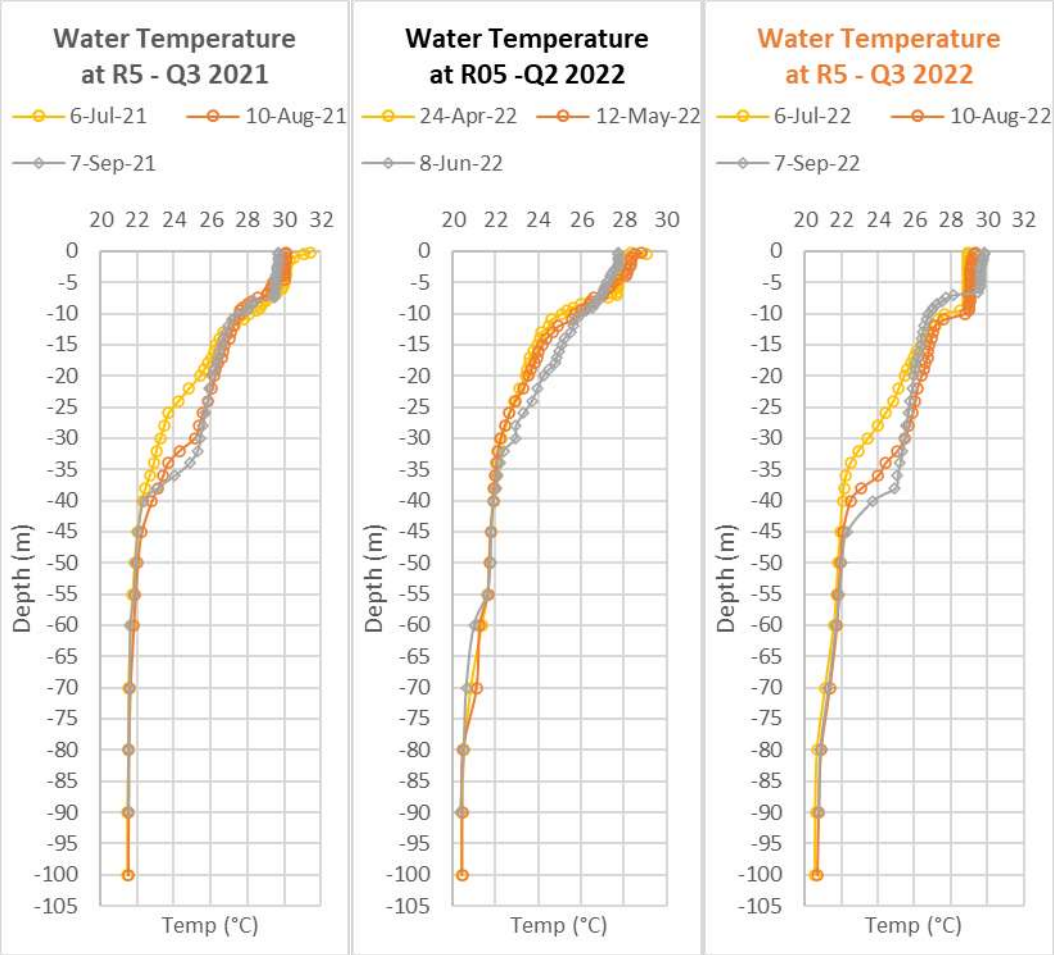


FIGURE 3-13: ***WATER TEMPERATURE AND DISSOLVED OXYGEN – DEPTH PROFILES IN THE MAIN RESERVOIR IMMEDIATELY UPSTREAM OF THE MAIN DAM (R05)***



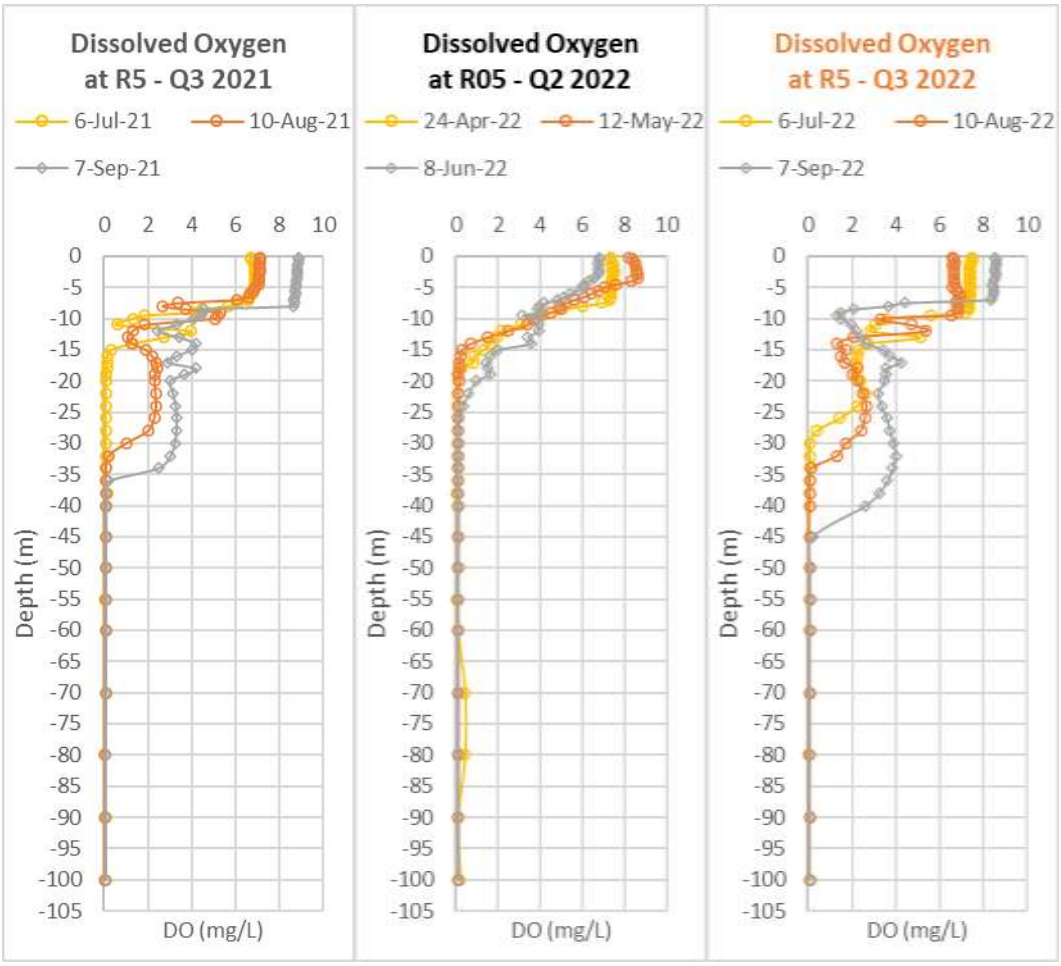

Dissolved Oxygen at R5 - Q3 2021
6-Jul-21
10-Aug-21
7-Sep-21
Depth (m)
DO (mg/L)
Dissolved Oxygen at R05 - Q2 2022
24-Apr-22
12-May-22
8-Jun-22
Depth (m)
DO (mg/L)
Dissolved Oxygen at R5 - Q3 2022
6-Jul-22
10-Aug-22
7-Sep-22
Depth (m)
DO (mg/L)

FIGURE 3-14: ***WATER TEMPERATURE AND DO DEPTH PROFILES IN THE MAIN RESERVOIR (R04 - R05), WITH POSITION OF INTAKE AT THE ACTUAL WATER LEVEL DURING SEPTEMBER 2018 – SEPTEMBER 2022***

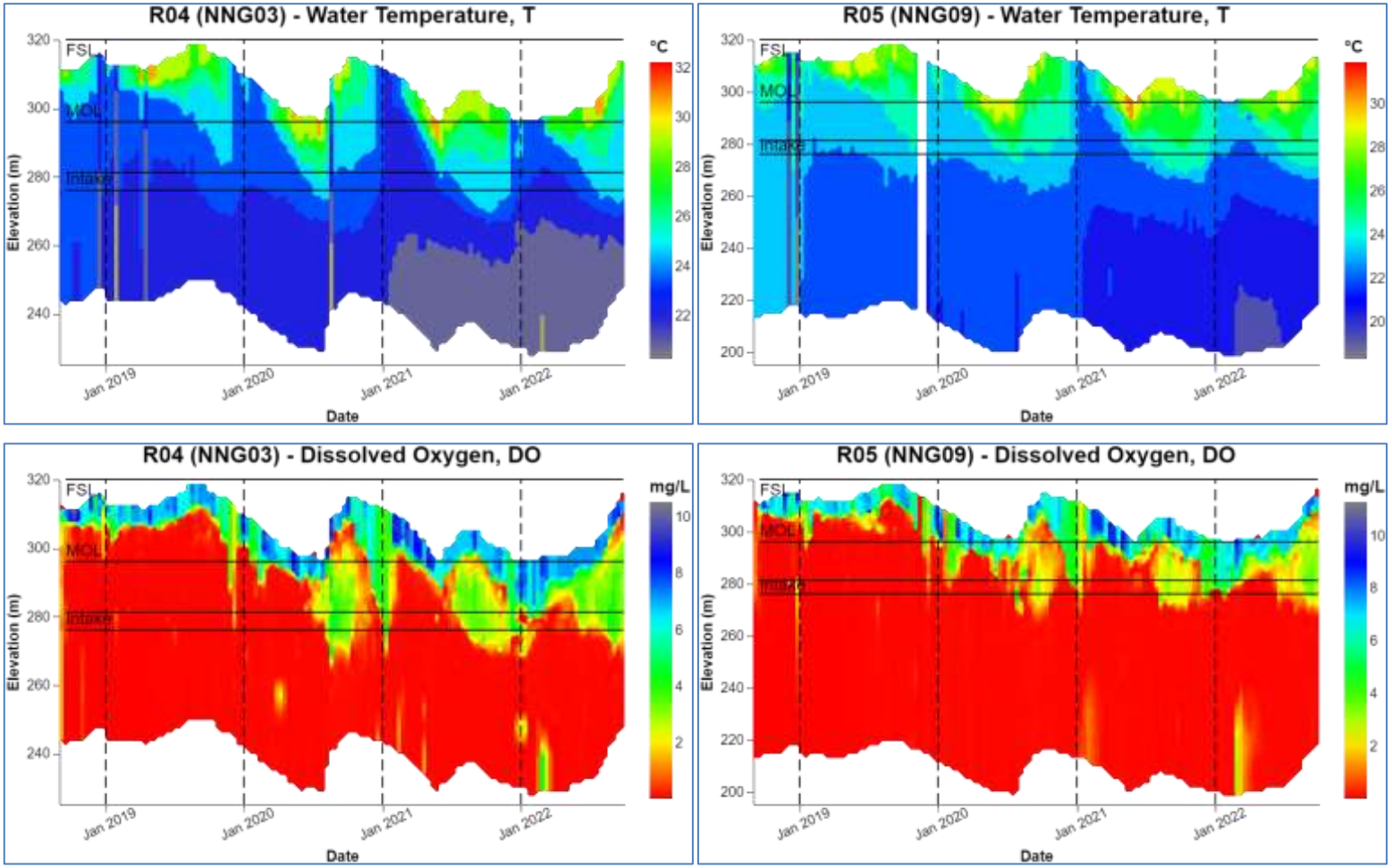


TABLE 3-9: *DO (MG/L) RESULTS OF SURFACE WATER IN MAIN RESERVOIR, RE-REGULATION RESERVOIR, NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q3 2022*

(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
4-Jul-22	6.36												6.75			
5-Jul-22		8.03	6.88	7.56										7.55		
6-Jul-22					7.68	7.46	3.27	2.91								
7-Jul-22									4.33	4.3	5.37	4.54			6.31	6.25
12-Jul-22		8.28	8.31	8.08												
13-Jul-22					7.34	7.37	4.83	4.59								
14-Jul-22									8.2	7.01	6.25	6.38			6.82	6.52
18-Jul-22	7.3												7.73			
19-Jul-22		8.85	9.44	8.88										9.39		
20-Jul-22					6.72	6.98	3.63	2.47								
21-Jul-22									4.09		5.38	5.99			7.36	7.3
26-Jul-22		7.15	7.4	7.55										7.47		
27-Jul-22					7.93	8.01	2.65	2.9								
28-Jul-22									5.14	4.21	5.88	5.94			6.36	6.41
1-Aug-22	7.61												7.01			
2-Aug-22		7.34	7.24	8.05										8.05		
3-Aug-22					7.52	7.6	3.04	4.4								
4-Aug-22									3.8	4.6	5.77	5.98			6.33	6.39
9-Aug-22		7.52	8.18	8.09												
10-Aug-22					6.6	6.6	2.65	2.48								
11-Aug-22									4.48		5.27	7.15			6.92	7.91
16-Aug-22		8.17	8.12	8.35										8.1		
17-Aug-22					7.78	7.11	3.51	4.21								
18-Aug-22									5.6		6.69	6.09			6.98	7.86
22-Aug-22	7.23												6.77			
24-Aug-22		7.98	8.43	9.08										9.34		
25-Aug-22					7.41	7.5	3.89	3.39								

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
26-Aug-22									4.28	4.96	6.06	6.52			7.67	6.75
29-Aug-22		6.5	7.52	7.6										8.35		
30-Aug-22					7.62	7.18	2.64	3.02								
31-Aug-22									6.59	7.53	7.76	7.63			9.54	8.78
5-Sep-22	8.07												8.49			
6-Sep-22		6.72	8.47	8.69										9.02		
7-Sep-22					8.27	8.54	4.4	4.69								
8-Sep-22									4.83	4.76	5.56	5.75			6.75	6.36
13-Sep-22		7.15	8.84	8.55										8.96		
14-Sep-22					7.82	7.76	3.07	3.49								
15-Sep-22									5.5	6.07	7.28	6.2			7.83	7.9
19-Sep-22	7.25												7.72			
20-Sep-22		6.78	8.55	7.42												
21-Sep-22					8.61	8.65	5.93	7.92								
22-Sep-22									6.8	6.95	7.89	7.72			8.27	8.42
27-Sep-22		10.44	8.05	7.4												
28-Sep-22					7.65	7.06	5.38	5.86								
29-Sep-22									6.15	6.66	7.61	6.75			7.72	8.39

Ammonia Nitrogen

In Q3 2022, Ammonia Nitrogen complied with the National Surface Water Quality Standard (<0.2 mg/L) in all monitored stations.

TABLE 3-10: ***AMMONIA NITROGEN (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q3 2022***

(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
4-Jul-22	<0.2												<0.2			
5-Jul-22		<0.2		<0.2										<0.2		
6-Jul-22					<0.2	<0.2										
1-Aug-22	<0.2												<0.2			
2-Aug-22		<0.2														
5-Sep-22	<0.2												<0.2			
6-Sep-22		<0.2		<0.2										<0.2		
7-Sep-22					<0.2	<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 a measurement exceeding the National Surface Water Quality Standard (< 1.5 mg/L). The results for Q3 2022 indicate that the BOD_5 levels are in compliance with the standard. In addition, NNP1PC continues to carefully compile and assess all monitoring data to determine if any additional water aeration measures may be necessary to improve the DO levels in Nam Ngiep River downstream the Re-regulation Dam.

TABLE 3-11: ***BOD_5 (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q3 2022***

(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
4-Jul-22	<1												<1			
5-Jul-22		<1		<1										<1		
6-Jul-22					<1	<1	<1	<1								
7-Jul-22									<1	<1	<1	<1			<1	<1
1-Aug-22	1.05												1.5			
2-Aug-22		<1		<1										<1		
3-Aug-22					<1	<1	<1	<1								
4-Aug-22									<1	<1	<1	<1			<1	<1
5-Sep-22	<1												1.3			
6-Sep-22		<1		1.26										<1		
7-Sep-22					<1	<1	<1	<1								
8-Sep-22									<1	<1	<1	<1			<1	<1

Chemical Oxygen Demand (COD)

The COD measurements in Q3 2022 are presented in ***Table 3-12***.

TABLE 3-12: ***COD (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q3 2022 (NATIONAL SURFACE WATER QUALITY STANDARD FOR COD: < 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
4-Jul-22	6.4												<5			
5-Jul-22														<5		
6-Jul-22							<5	<5								
7-Jul-22									<5	9.6	<5	10			<5	6.8
1-Aug-22	16												<5			
3-Aug-22							<5	6.4								
4-Aug-22															12.8	9.6
5-Sep-22	18.8												<5			
6-Sep-22																
7-Sep-22							<5	<5						<5		
8-Sep-22									9.6	<5	<5	<5			<5	<5

Faecal Coliform Bacteria

The results of the faecal coliform analyses in Q3 2022 are presented in **Table 3-13**.

Faecal coliform complied with the standard in all stations during Q3 2022, except NNG01, NCH01 and NPH01.

TABLE 3-13: ***FAECAL COLIFORMS (MPN/100 ML) RESULTS IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q3 2022 (NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <1,000 MPN/100 ML)***

Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH01	NPH01	NXA01	NHS01
4-Jul-22	1,600												1,600			
5-Jul-22													220			
6-Jul-22							5	5								
7-Jul-22									17	170	220	540			920	350
1-Aug-22	1,600												920			
2-Aug-22														1,600		
3-Aug-22							920	79								
4-Aug-22									70	350	140	220			920	220
5-Sep-22	1,600												350			
6-Sep-22														540		
7-Sep-22							11	22								
8-Sep-22									49	70	110	220			540	110

Total Coliform Bacteria

The results of measurements for total coliform bacteria are presented in **Table 3-14.** 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 3-14: ***TOTAL COLIFORM (MPN/100 ML) RESULTS IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q3 2022 (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	NNG0 6	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
4-Jul-22	1,600												1,600			
5-Jul-22														250		
6-Jul-22							27	22								
7-Jul-22									22	220	280	920			1,600	920
1-Aug-22	1,600												1,600			
2-Aug-22														1,600		
3-Aug-22							1,600	110								
4-Aug-22									110	350	280	920			1,600	280
5-Sep-22	1,600												930			
6-Sep-22														1,600		
7-Sep-22							17	27								
8-Sep-22									130	170	280	280			920	140

3.7.2 Compliance Monitoring of Effluents from Camps

A total of 03 sites discharged effluents in Q3 2022, 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 3-15.**

The results are described in **Table 3-15** and the full data set is in **Appendix 5.2**.

The status of compliance as of 30 September 2022 can be summarized as follows:

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

FIGURE 3-15: ***LOCATION OF EFFLUENT MONITORING POINTS***

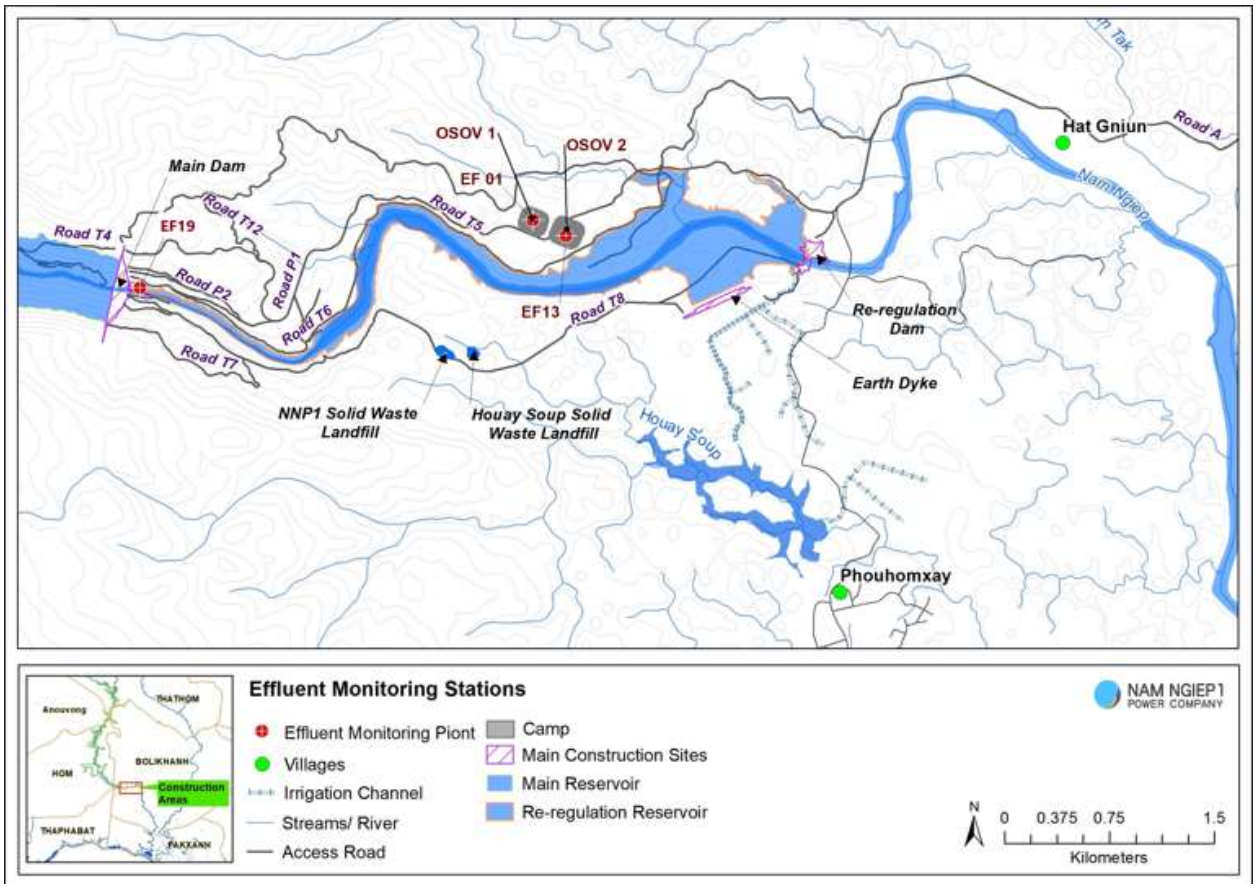


TABLE 3-15*: RESULTS OF THE EFFLUENT WATER QUALITY MONITORING OF THE CAMPS IN Q3 2022 (NON-COMPLIANCE PARAMETERS ONLY)*

		Site Name	OSOV1	OSOV 2	Main Powerhouse
		Station Code	(EF01)	(EF13)	(EF19)
Date	Parameter (Unit)	Guideline in the CA			
15-Jul-22	BOD_5 (mg/L)	<30	<6	<6	<6
11-Aug-22	BOD_5 (mg/L)	<30	11.91	18	62.7
23-Aug-22	BOD_5 (mg/L)	<30	<6	20.34	17.7
01-Sep-22	BOD_5 (mg/L)	<30	6.78	13.07	97.05
16-Sep-22	BOD_5 (mg/L)	<30	<6	11.37	66
01-Jul-22	COD (mg/L)	<125	<25	36.5	92
15-Jul-22	COD (mg/L)	<125	<25	30.0	116
11-Aug-22	COD (mg/L)	<125	<25	30.0	121
23-Aug-22	COD (mg/L)	<125	<25	52.5	50
01-Sep-22	COD (mg/L)	<125	<25	47.5	168
16-Sep-22	COD (mg/L)	<125	<25	32.2	150
01-Jul-22	NH_3-N (mg/L)	<10.0	<2	22.1	91
15-Jul-22	NH_3-N (mg/L)	<10.0	<2	18.9	77
11-Aug-22	NH_3-N (mg/L)	<10.0	<2	19.8	80
23-Aug-22	NH_3-N (mg/L)	<10.0	<2	13.5	63
01-Sep-22	NH_3-N (mg/L)	<10.0	<2	19.8	103
16-Sep-22	NH_3-N (mg/L)	<10.0	<2	25.4	89
01-Jul-22	Total Nitrogen (mg/L)	<10.0	0.58	24.0	96
15-Jul-22	Total Nitrogen (mg/L)	<10.0	0.37	20.4	83
11-Aug-22	Total Nitrogen (mg/L)	<10.0	0.38	21.2	84
23-Aug-22	Total Nitrogen (mg/L)	<10.0	0.58	14.4	74
01-Sep-22	Total Nitrogen (mg/L)	<10.0	0.21	21.2	107
16-Sep-22	Total Nitrogen (mg/L)	<10.0	2.38	26.9	91
01-Jul-22	Total Phosphorus (mg/L)	<2	1.13	2.4	8
15-Jul-22	Total Phosphorus (mg/L)	<2	1.2	1.6	6.7
11-Aug-22	Total Phosphorus (mg/L)	<2	1.0	1.7	8.2
23-Aug-22	Total Phosphorus (mg/L)	<2	0.9	1.4	5.6
01-Sep-22	Total Phosphorus (mg/L)	<2	1.2	2.0	7.4
16-Sep-22	Total Phosphorus (mg/L)	<2	1.3	2.2	7.0
01-Jul-22	Fecal Coliform (MPN/100mL)	<400	2,400	0	240
15-Jul-22	Fecal Coliform (MPN/100mL)	<400	5,400	0	1,600
11-Aug-22	Fecal Coliform (MPN/100mL)	<400	1,600	9,200	16,000
23-Aug-22	Fecal Coliform (MPN/100mL)	<400	920	5,400	3,500
01-Sep-22	Fecal Coliform (MPN/100mL)	<400	1,600	31	16,000
16-Sep-22	Fecal Coliform (MPN/100mL)	<400	1,600	130	92,000
01-Jul-22	Total coliform (MPN/100mL)	<400	9,200	13	1,600
15-Jul-22	Total coliform (MPN/100mL)	<400	5,400	0	1,600
11-Aug-22	Total coliform (MPN/100mL)	<400	1,600	16,000	16,000
23-Aug-22	Total coliform (MPN/100mL)	<400	1,600	16,000	16,000
01-Sep-22	Total coliform (MPN/100mL)	<400	1,600	540	16,000
16-Sep-22	Total coliform (MPN/100mL)	<400	1,600	250	92,000

TABLE 3-16: *COMPLIANCE STATUS OF EFFLUENT DISCHARGE FROM THE CAMPS IN Q3-2022*

Site	ID	WWTS	Key Non-Compliance Issues[1] in Q3-2022	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	- Faecal coliform (<400 MPN/100 mL): Non-compliance in all 6 samplings. Q3 mean 2,253 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in all 6 samplings. Q3 mean 3,500 MPN/100 mL.	The construction of the improved Wastewater Treatment System was completed at the end of August 2021 and the operation of the system is undergoing adjustments.
OSOV 2 (ESD Camp)	EF13	Septic tanks (kitchen and black water) and SBR with chlorination system.	- Ammonia-nitrogen (<10 mg/L): Non-compliance in all 6 samplings. Q3 mean 19.9 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in all 6 samplings. Q3 mean 21.4 mg/L. - Total Phosphorus (<2 mg/L): Non-compliance in 2 out of 6 samplings. Q3 mean 1.9 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 2 out of 6 samplings. Q3 mean 2,460 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 3 out of 6 samplings. Q3 mean 5,467 MPN/100 mL.	As above.

[1] The values in brackets indicate the applicable standard

Site	ID	WWTS	Key Non-Compliance Issues[1] in Q3-2022	Corrective Actions
Main Powerhouse	EF19	Septic tanks (grey and black water), biofilm tank and chlorination tank.	- BOD_5 (<30 mg/L): Non-compliance in 3 out of 5 samplings. Q3 means 49 mg/L. - COD (<125 mg/L): Non-compliance in 4 out of 6 samplings. Q3 mean 116 mg/L. - Ammonia-nitrogen (<10 mg/L): Non-compliance in all 6 samplings. Q3 mean 84 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in all 6 samplings. Q3 mean 89 mg/L. - Total Phosphorus (<2 mg/L): Non-compliance in all 6 samplings. Q3 mean 7 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 5 out of 6 samplings. Q3 mean 21,557 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in all 6 samplings. Q3 mean 23,867 MPN/100 mL. -	As above

3.7.3 Groundwater Quality Monitoring

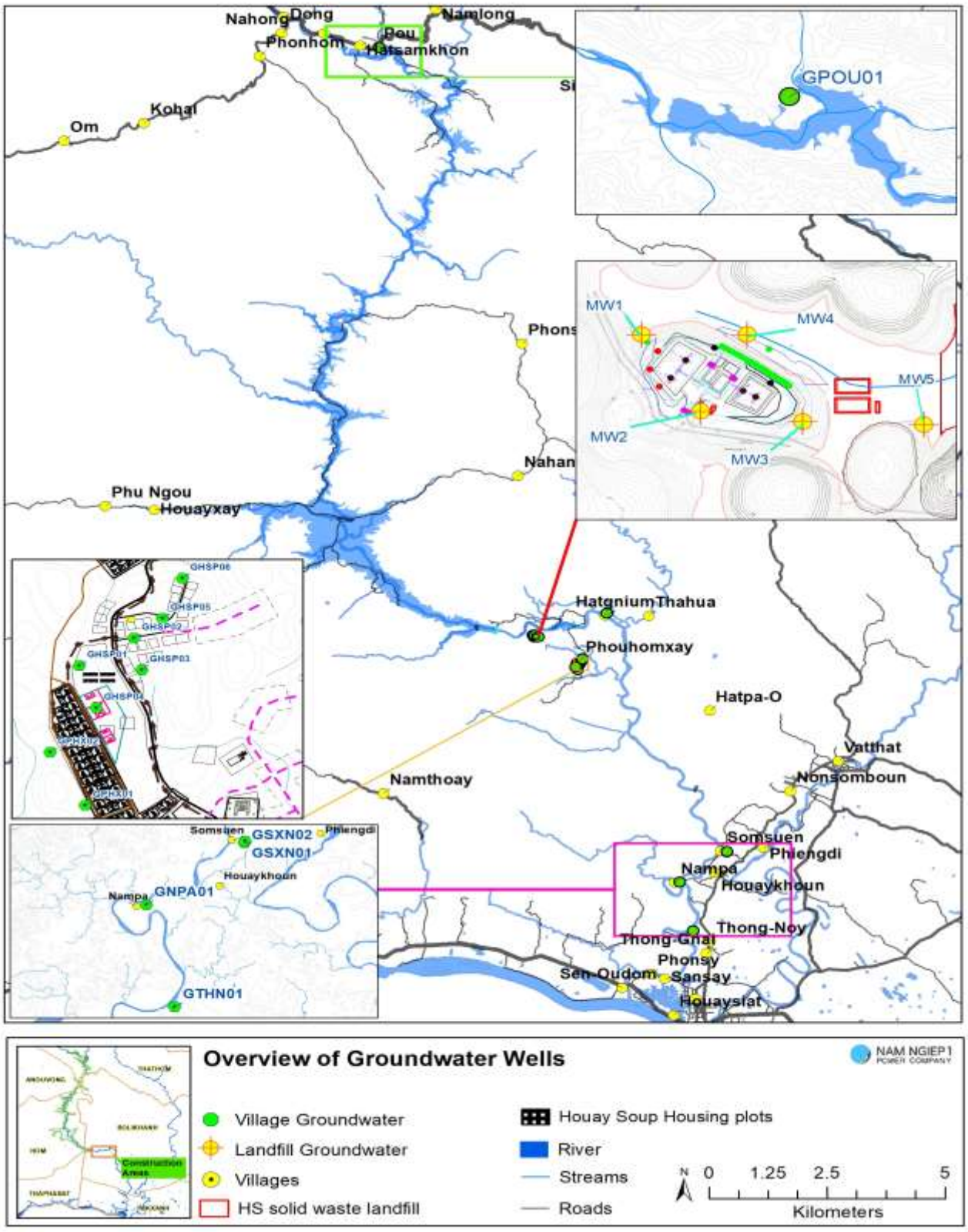
During Q3 2022, a total of seven boreholes at Somseun, Nam Pa, Thong Noy, (one borehole in each village), Pou Villages (two boreholes) and Phouhomxay Village (two boreholes – but they were broken) have been monitored for the following parameters:

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 (This Quarter)*: 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 3-16*** and the groundwater monitoring data is presented in ***Appendix 5.3.***

FIGURE 3-16*: 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 bacteria.

Somsuen Village: all monitored parameters complied with the standard.

NamPa Village: all monitored parameters complied with the standard, except faecal coliform and E. coli bacteria.

Pou Village: One out of two boreholes (GPOU01) did not comply with the standard for faecal coliform and *E.coli* parameters.

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.

There are two types of water supply systems in Lao PDR:

(A) Nam Papa systems (water supply) – water from natural water sources that has gone through a treatment process to become clean and safe water in compliance with the drinking water quality standards. These systems are managed by the Department of Water Supply, Ministry of Public Works and Transport; and

(B) Nam Saat Systems (domestic water supply) – provide water to rural areas that are not connected to Nam Papa systems. Nam Saat systems include gravity fed systems and boreholes with motorised pumps or hand pumps. These systems are managed by the Centre for Environmental Health and Water Supply (Nam Saat) under the Department of Hygiene and Health Promotion, Ministry of Health.

The community water supply systems related to the NNP1 hydropower project are under Nam Saat systems with the monitoring requirements identify in the Minister's Decision on the Water Quality Standard Management for Drinking and Domestic Use, No. 561/MoH dated 27 February 2014.

The issue of bacterial contamination in the communities' water supply have been investigated by ESD team together with the respective local authorities and the villagers to find the potential root causes. A series of actions have been taken to prevent the contamination according to the Water Safety Plans (WSP); however, the Project, Nam Saat (GOL) and the villagers considered that disinfection treatment processes (e.g., chlorination, ceramic filtration) would not be sustainable and cost effective in a long run. It is well understood and agreed with the villagers that the water shall be boiled before drinking as mentioned above. It is also noted that boiling of water from domestic water supply (Nam Saat) systems before drinking is a general practice in the rural areas of Lao PDR.

During the Q3 2022, the landfill groundwater monitoring results were similar to the previous monitoring results, where the concentration of Lead (Pb) in the monitoring wells MW1, MW3, MW4 and MW5 exceeded the relevant groundwater quality standard. This is most likely the background (natural) level and is not attributed to the landfill. Lead has been detected in all wells from time to time both upstream and downstream the landfill. Furthermore, lead has not been

detected in the leachate from the landfill treatment ponds and the waste pits. All ponds of both landfills are lined with a HDPE liner protecting the groundwater against infiltration of leachate; therefore, it is most likely that the presence of Lead is due to the geology of the area. Note also that these boreholes are more than 50 m deep and are not used by staff or villagers.

The monitoring well MW2 was not monitored due to the blocked sampling pump inside the well and the water sample could not be taken.

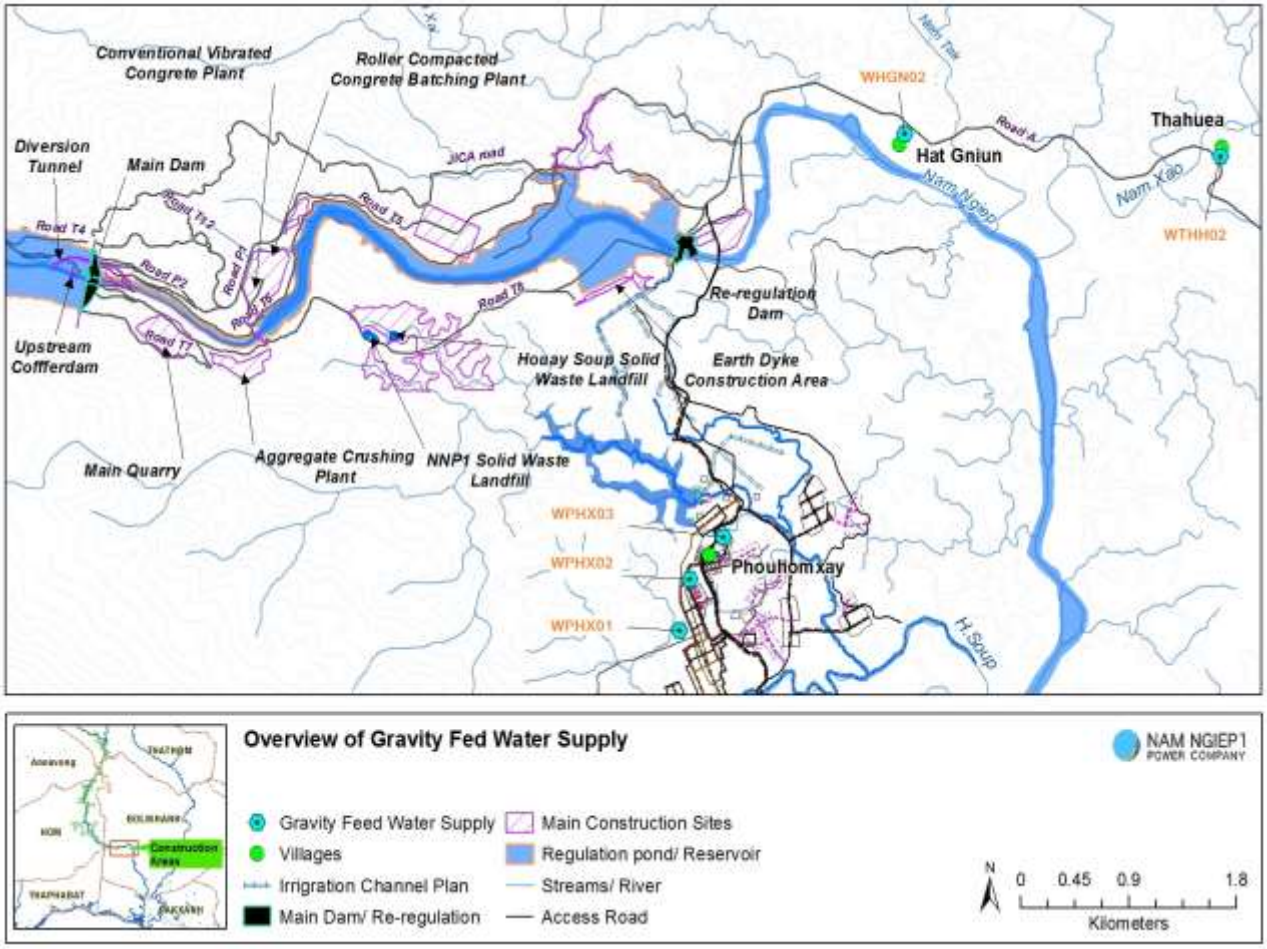
TABLE 3-17: *LANDFILL GROUNDWATER QUALITY MONITORING RESULTS IN NNP1 AND HOUAY SOUP LANDFILLS*

		Site Name	NNP1 Landfill			Houay Soup Landfill
		Station	MW1	MW3	MW4	MW5
Date	Parameter (Unit)	Guideline				
02-Sep-22	pH		6.03	6.2	5.7	5.51
02-Sep-22	Sat. DO (%)		76.9	10.3	18	48
02-Sep-22	DO (mg/L)		6.09	0.82	1.41	3.73
02-Sep-22	Conductivity (µS/cm)		193	298	181	87
02-Sep-22	Temperature (°C)		27.72	27.25	28.35	28.77
02-Sep-22	Turbidity		29.9	7.09	2.96	40.3
02-Sep-22	Lead (mg/L)	<0.01	2.37	1.04	0.315	0.406
02-Sep-22	Faecal Coliform (MPN/100ml)		920	4.5	0	1.8
02-Sep-22	E. coli (MPN/100ml)		920	4.5	0	0
02-Sep-22	NH_3-N (mg/L)		<2	<2	<2	<2
02-Sep-22	Total Nitrogen (mg/L)		0.22	0.5	0.21	0.22
02-Sep-22	Copper (mg/L)	<1	0.006	0.004	<0.003	<0.003
02-Sep-22	Total Petroleum (mg/L)		<3	<3	<3	<3
02-Sep-22	Water level (m)		21.3	19.1	16.0	5.5

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.

FIGURE 3-17: *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 Q3 2022*

Date	Parameter (Unit)	Site Name	Tha Heua Village	Hat Gnuin Village	Phouhomxay Village	
		Station	WTHH02	WHGN02	WPHX02	WPHX03
		Guideline				
25-Jul-22	E. Coli (MPN/100 mL)	0	94	49	17	17
15-Aug-22		0	17	170	11	11
12-Sep-22		0	23	4.5	170	130
25-Jul-22	Faecal coliform (MPN/100 mL)	0	94	49	17	26
15-Aug-22		0	21	170	11	11
12-Sep-22		0	33	7.8	350	170

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

Hat Gniun Village (WHGN02): all parameters complied with the standard, except for 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 Q3 2022 samples. Note here that during sampling of tap water in Phouhomxay Village, surface water from Houay Soup Stream was still supplied into the system due to the water pump of two boreholes were broken.

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 prevent the bacterial contamination by removing livestock from the intake areas and boil water before drinking. The advice to boil the water 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.

As mentioned in section **3.7.3**, the gravity fed system is a domestic water supply under Nam Saat System managed by the Centre for Environmental Health and Water Supply (Nam Saat) under the Department of Hygiene and Health Promotion, Ministry of Health. It is well understood and agreed with the villagers that the water shall be boiled before drinking.

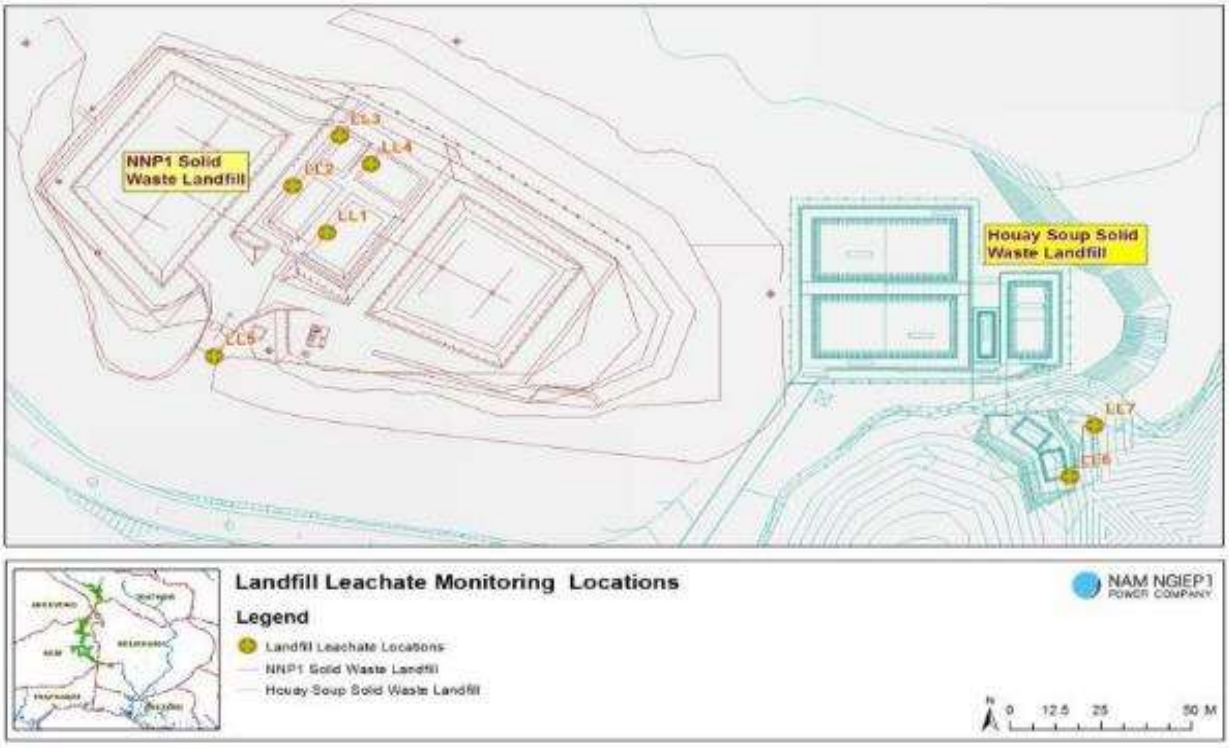
For Phouhomxay Village, the villagers requested NNP1PC and the District Water Supply Office during a meeting in March 2022 to reuse the Gravity Fed System (GFS) as a main supply and reserve the existing ground water supply system for times when the GFS would have to be repaired. The water from the gravity fed system needs to be boiled before drinking, but may be used for other purposes such as washing, feeding animals, watering the garden, and other households' activities.

In addition, to ensure sufficient water quantity, the ESD will work with the District Water Supply Office to improve the water intake of the GFS under NNP1PC's Corporate Social Responsibility (CSR). For the presence of bacteria, the community confirmed that they will boil water before drinking. It is also noted that boiling domestic water supply (Nam Saat) before drinking is a general practice in the rural areas of Lao PDR.

3.7.5 Landfill Leachate Monitoring

The landfill leachate treatment systems at NNP1 Project landfill and Houay Soup landfill are monitored to control the functioning of the treatment process and ensure compliance with effluent standards. The monitoring locations are presented in the ***Figure 3-18***.

FIGURE 3-18: *LANDFILL LEACHATE MONITORING LOCATION*



The monitoring results in Q3 2022 indicate compliance with the applicable standards for all monitored parameters, except for total coliform for NNP1PC Landfill Leachate (July 2022) and Houay Soup Landfill Leachate (July and August 2022). The monitoring data can be found in ***Appendix 5.6***.

3.7.6 Water Quality Compliance Monitoring

The water quality non-compliance issues in Q3 2022 are summarized in **Table 3-19**.

TABLE 3-19: *NON-COMPLIANCES RELATING TO WATER QUALITY MONITORING IN Q3 2022*

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 and analysing the water quality data and evaluating if additional aeration to improve the DO level at downstream would be warranted. - Preliminary studies have been conducted on the feasibility and costs (including implications for electricity generation) of various aeration systems. The summary of preliminary study result is presented in **Appendix 5.6.**	- NNP1PC has proposed to ADB and LTA to keep monitoring the water quality in the Reservoir, Re-regulation Reservoir, and the Nam Ngeip downstream the Re-regulation Dam to study the changes and take actions where necessary.

No	Non-compliance Issues	Corrective Actions	Status
			- A trial to operate the labyrinth spillway at the Re-regulation Dam was implemented in November 2021 to see the improvement of DO values downstream and the report was prepared by TD and shared to LTA and ADB during the mission in Q4 2021. - It is also worth noting that over the course of the last three years, no fish kill has been observed or reported.
2	Effluents discharged from the Wastewater Treatment Systems (WWTS) at OSOV1, OSOV2 and the Main Dam exceeded the National Effluent Standard Guideline for some parameters	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 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 WWTS improvement work was completed by the end of August 2021 and the treatment systems have since then been undergoing adjustments to ensure compliance with the effluent standards. - Expect to complete the adjustments in Q4 2022.
3	Groundwater quality monitored for the communities (Thong Noy, Som Seun, Nam Pa, and Pou Villages) were not complied with the National Groundwater Quality Standard for drinking purpose on Faecal	- A full inspection of the water supply systems in Som Seun, Nam Pa and Thong Noy Village was conducted in September 2020 by NNP1PC team including consultations with the Village Water Use Committee (VWUC) and also interviews with some consumers (detailed in Q4 2020 Report). - Potential contamination sources of coliform were identified and	- The villagers were advised/encouraged to boil water before drinking. - Continue to monitor.

No	Non-compliance Issues	Corrective Actions	Status
	Coliform and E.*coli* parameters	recommendations on operation and maintenance of the water supply system 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.	
4	Gravity Fed Water Supply monitored for the communities (Tha Heua, Hat Gnuin, 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 faeces from livestock and birds may contribute 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. - Continue monitoring.
5	Non-compliance on total coliform parameter in NNP1PC and Houay Soup Landfills	- Continue monitoring.	- Continue monitoring.
6	Non-compliance with the groundwater quality standard for lead in the landfill groundwater monitoring wells	- Lead has been detected in all wells from time to time both upstream and downstream the landfill. - Lead has not been detected in the leachate from the landfill treatment ponds and the waste pits. - The presence of Lead is most likely due to the geology of the area. These boreholes are used for landfill groundwater monitoring and they are not used by staff or villagers	- Lead concentrations still exceed the groundwater quality standard. - Continue monitoring.

4 WATERSHED AND BIODIVERSITY MANAGEMENT

4.1 WATERSHED MANAGEMENT

4.1.1 Implementation of Watershed Management Plan

4.1.1.1 Xaysomboun Watershed and Reservoir Protection Office (WRPO)

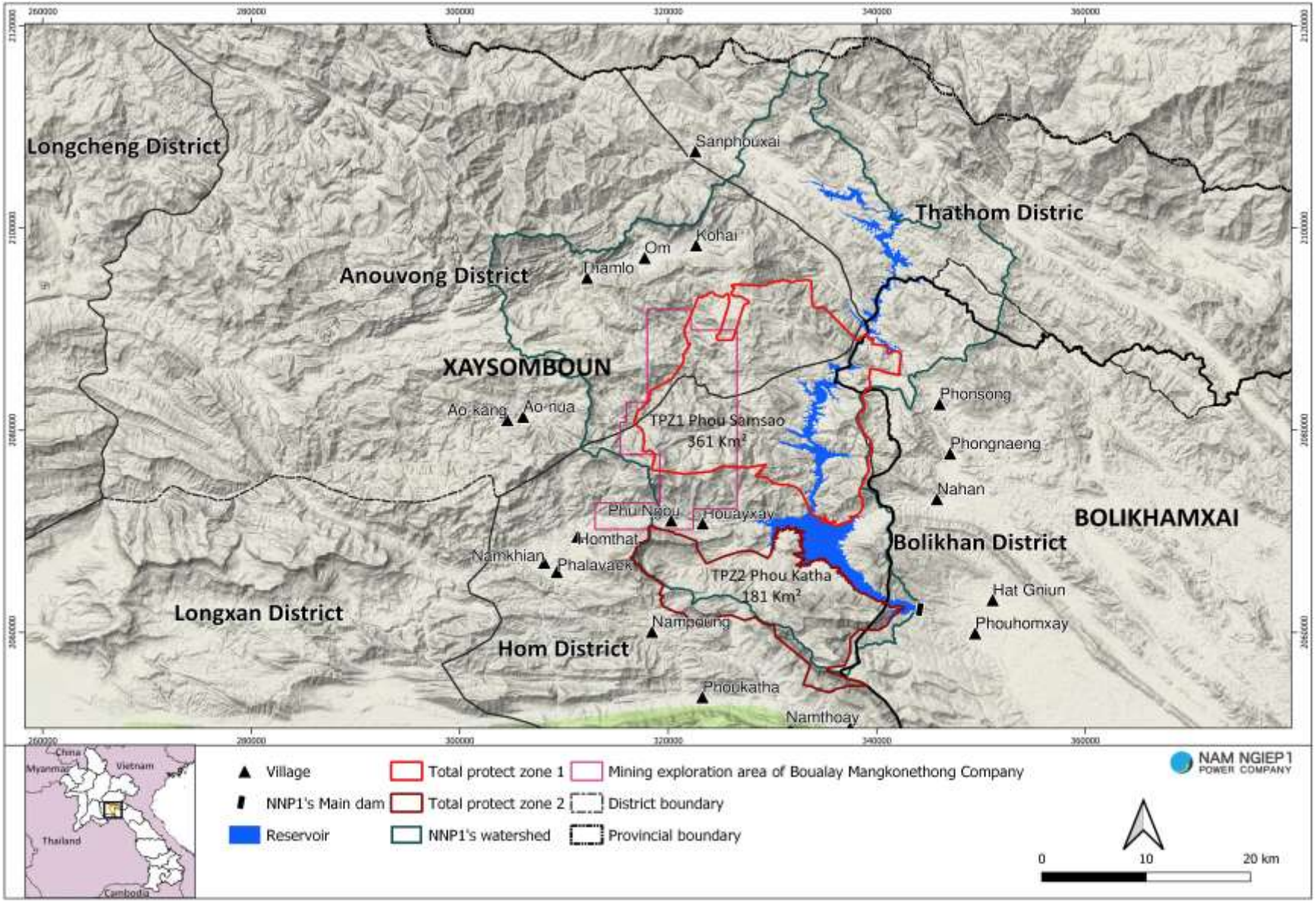
A monthly technical meeting between Xaysomboun Provincial Agriculture Forestry Office (PAFO)-WRPO, EMO, and Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS) was agreed to be conducted. However, due to the key members of Xaysomboun WRPO were occupied with other assignments then only one technical meeting was organized on 5 July 2022 at Xaysomboun PAFO office in Anouvong District to follow up on the progress and pending issues as discussed in the previous meeting. Some key discussion points and the relevant progresses from the follow up until end of September 2022 are summarized below:

- Xaysomboun WRPO was working with the technical staff of Provincial Department of Home Affairs to draft the Agreement on establishment of provincial task force for addressing the forest encroachment and occupation in the watershed Total Protected Zones (TPZs). However, there was no further updates from Xaysomboun WRPO despite series of follow up calls by EMO.
- Xaysomboun WRPO agreed on the plan to conduct a site inspection of the mineral exploration by Boualay Mangkonthong Company in the watershed TPZ1. However, they proposed the budget for site inspection to be revised following the be Ministry of Finance (MoF) agreement or the activity would have to be postponed until agreement on accommodation allowance is made. NNP1PC has received the response from MoF on 26 July 2022 with the confirmation for NNP1PC to follow the Minister's Agreement No.4000/MoF particularly Section 4.1.1 under Article 4 about meal and accommodation for the business trip allowance within the country. NNP1PC has no objection to provide the allowances following Minister's Agreement No.4000/MoF and then requested Xaysomboun WRPO to update the budget plan and schedule for the site visit. Xaysomboun WRPO did not submit any plan and the access to site became difficult during the rainy season.
- Xaysomboun WRPO confirmed that the consultation meeting on the role and responsibilities of reservoir fishery management for Hom and Thathom District was scheduled during 18-22 July 2022. However, the respective District Agriculture and Forestry Offices (DAFOs) did not confirm the actual date of the meeting until end of July 2022. After series of follow up, EMO noted that the Head of Xaysomboun WRPO was also fully occupied with assignment from Xaysomboun PAFO during August to September 2022. The meeting is then rescheduled to October or November 2022 depending on the availability of staffs from Xaysomboun WRPO and relevant GOL offices at district level.
- The Hom District Governor Agreement on the establishment of District Watershed and Reservoir Protection Committee (WRPC), WRPO and staff assignment for WRPO sub-office, No. 0202/DG.HOM, dated 23 April 2022, does not specify the roles and responsibilities of the District WRPC, WRPO and appointed officials in detail. EMO team requested the representatives of Hom DAFO to further consult with their Management to include detailed roles and responsibilities within the agreement and include clarification on the assignment of

only military staffs to be based in the sub-office. EMO noted in August 2022 that the Xaysomboun WRPO at provincial level disagreed with staff allowance for the sub-office operation that have been discussed during the Financial Management Manual (FMM) meeting in December 2021. They decided in September 2022 to exclude any staff mobilization for sub-office operation under the AIP2022.

- The discussion highlighted the information from SMART database of Xaysomboun WRPO. A total of 345 cases were recorded during the reservoir patrols from August 2021 – March 2022 comprising 242 cases of forest encroachment for agriculture purpose, 31 cases of wildlife hunting, 44 cases of illegal fishing, 15 cases of illegal logging, 6 cases of illegal NFTP collection, and 7 cases of forest fire. These cases warrant actions from the Xaysomboun WRPO as continuously being followed up by EMO and BSP-WCS. Xaysomboun WRPO with the support form BSP-WCS team will also prepare a list of repeated offenders to be further discussed for the TPZ or forest patrol activity under the AIP2022.
- BSP-WCS team also emphasized that the mineral exploration within watershed TPZ1 (Figure 4-1) does not comply with Xaysomboun Provincial Governor Agreement of NNP1 Watershed Management that was issued in 2019 and most importantly it poses a challenge in achieving the No Net Loss (NNL) for biodiversity. An action must be taken as soon as possible to avoid further destruction. EMO management has asked support from DOF-MAF and NNP1PC noted that the Deputy Director General (DDG) of DOF-MAF will communicate with Vice Minister of MAF accordingly. EMO in consultation with DOF-MAF noted about the situation and proposed for Xaysomboun WRPO to organize a meeting with relevant GOL offices including from the provincial department of Energy and Mines to be chaired by Xaysomboun Provincial Management under the AIP2022 budget to discuss and find solution about the mineral exploration activity within NNP1 watershed TPZ area.
- Xaysomboun WRPO shared a draft Agreement on the establishment of four TPZ Patrolling Teams and one forest patrol team. The draft was further improved with the inputs from EMO and BSP-WCS and is expected to be ready before the commencement of patrolling work under AIP2022.
- Xaysomboun WRPO will discuss and have a written agreement with the fishermen on how to manage their boats until the reservoir checkpoint is built or until the assigned staff are relocated to the sub-office. However, EMO noted that as of end of September 2022, no discussions had been organized between Xaysomboun WRPO and the fishermen.
- Xaysomboun WRPO clarified that the contract for building the two ranger stations and two reservoir checkpoints was signed between the PAFO and the Contractor with the contract duration of six months. EMO team has requested Xaysomboun WRPO to provide an update on the progress of work, but until end of September 2022, the Contractor had not yet mobilized due to difficult access at the start of the rainy season.

FIGURE 4-1. NNP1 WATERSHED AREA WITH THE MINING EXLORATION ZONE INT THE TOTALLY PROTECTED ZONE 1 (PHOU SAMSAO)



4.1.1.2 Bolikhamxay Watershed and Reservoir Protection Office (WRPO)

Bolikhamxay WRPO had discussion with BSP-WCS on 14 September 2022 with the following summary:

- Bolikhamxay WRPO requested NNP1PC EMO and BSP-WCS to support them in prioritizing activities for the rest of 2022 particularly relevant to No Net Loss (NNL) in biodiversity. This includes the consideration for a two-week outreach campaign that is planned in 2022. BSP-WCS had originally planned this for November 2022 but it might be necessary to postpone the activity to January 2023 because of several reasons such as: a) resource arrangement for BSP-WCS team support because the Nam Chouane-Nam Xang (NC-NX) offset site outreach campaign was also planned in November 2022; and b) December will be a short month because of harvest season and Hmong New Year festivities.
- It was noted that POFI is no longer participating in Law Enforcement patrols (both reservoir and forest patrols) because of staff availability. The two POFI staffs from each ranger team will be replaced with two staffs from the Forest Unit of District Agriculture and Forestry Office (DAFO). This approach has been agreed to by the Head of Bolikhamxay PAFO. The agreement is being prepared by Bolikhamxay WRPO and DAFO and is expected to be finalized in October 2022.
- The SMART training that was originally planned as a refresher training will be adjusted to a full training that will be organized after the new agreement of patrol team is finalized. It is likely to be held in the second or third week of October 2022.
- Bolikhamxay WRPO also requested the support from BSP-WCS and NNP1PC EMO in prioritizing the key activities for the remaining months of 2022. A follow up discussion will be organized in the second week of October 2022.

4.1.1.3 NNP1PC EMO

Implementation of the agriculture extension service plan for improving home gardening and Kai Noi rice production continued during Q3 2022. Thathom DAFO regularly submit the monitoring report of Kai Noi rice farming to EMO. Thathom DAFO also completed building the last greenhouse at Ban Phonhome at the end of July 2022.

Hom Women's Union prepared a training plan on the processing of pineapples for pineapple farmers at Ban Phoungou and Houaysai in Hom District which is part of activity promoting processed cash crop products of the 5-year action plan for strengthening local production and market linkages. The training aims to build basic knowledge and skills in adding value for pineapple cultivation. The farmers will learn making pineapple jam, dried pineapple and dishwashing liquid from pineapple waste. The training was scheduled for the third week of July 2022, but the document was not internally approved by ESD management until the end of August 2022 and so the training was dropped because it passed the farming season already.

The trainers who are professors from Faculty of Agriculture of National University of Laos (NUOL) finalized the training and budget plan for cattle farming program at the end of June 2022. A training on beef cattle farming management for farmers at four villages: PhouNgou and Houayxai in Hom District and Phonhom and Nahong in Thathom District was tentatively scheduled for July 2022 but postponed. A meeting on the readiness and preparation of available local materials

with the village authorities and producer groups of 2 respective villages in Thathom District was organized on 20 July 2022. The producer groups confirmed that training can be organized during the first week of August 2022. EMO also organized a meeting with the producer groups of 2 respective villages in Hom District at the end of July 2022 and the training can be organized after the training in Thathom District.

A training on organic farming took place on 14 August 2022 at the Faculty of Agriculture of the National University of Laos (NUOL). The training was chaired by Professor Somsanouk Phonepadith, Head of Agriculture Faculty, National University of Laos and attended by 10 trainees including one representative from Hom DAFO, 4 pineapple and orange farmers from PhouNgou and Houaxay Village, 3 farmers from Phouhomxay Village and 2 livelihood staffs from NNP1PC-Social Management Office. The training was delivered by 3 trainers including Dr. Phouthasone Sibounnavong, Mr. Phonepadith Phiwphanh and Mr. Khonsavanh Phialathounheuan from Department of Plant Science, Faculty of Agriculture. In the morning session, farming principles for orange and pineapple, identification of plant pests, insects, and different organic farming techniques to protect crops against plant insects and related pests as well as enriching soil and plants were presented by the trainers. In the afternoon session, the training focused on practical skills in making compost and using wood vinegar and beneficial microbes to enrich soil, plants and to help protecting crops against plant insects and related pests. At the end of the training, some wood vinegar and beneficial microorganism products were given to the participants for applying to their gardens and plants and sharing with other farmers. The trainers shared the training report with EMO.

EMO in collaboration with the Faculty of Agriculture, National University of Laos organized a back-to-back training on cattle farming management for farmers at PhouNgou Village on 15 August 2022, at Houayxay Village on 16 August 2022 in Hom District and at Nahong Village on 18 August 2022 in Thathom District. The training was delivered by two trainers: PhD Professor Viengsakoun Napaseuth and Mrs. Orlaya Douangpachanh from Department of Livestock and Fishery, Faculty of Agriculture. The training organized at PhouNgou Village was chaired by Deputy Head of Hom DAFO and attended by one technical staff from Hom DAFO and 16 farmers (included 4 women) from PhouNgou Village. The training organized at Houayxay Village was attended by 25 farmers (included one woman) from Houayxay Village. The training organized at Nahong Village was chaired by Head of Thathom DAFO and attended by one technical staff from Hom DAFO, one technical staff from Xaysomboun PAFO/WRPO and 64 farmers (included 24 women) from Nahong Village and 5 farmers from Phonhom Village. The training focused on principle cattle management and different cattle farming management in Laos, care and feeding management, herd health management, and cattle fattening techniques. The participants also learned practical skills in making pasture silage, protein supplement and mineral block feeding. The training report will be shared with EMO by the trainers. Some animal medicines, equipment and training manuals were also given to the cattle production group of each village. EMO also conducted a follow up discussion with the cattle farmer working group at the end of August 2022 for their readiness in cattle farming management including selecting a household for demonstration practice in cattle fattening program.

Following a training on organic farming held on 14 August 2022 at Faculty of Agriculture, a knowledge sharing session between trained farmers and other orange and pineapple farmers

was organized on 6 September 2022 at Ban PhouNgou and Houayxai of Hom District Xaysomboun Province. The knowledge sharing session organized at Ban Houayxai was attended by 29 farmers (included 8 women) and the knowledge sharing session held at Ban PhouNgou was attended by 29 farmers (included 13 women). The farmers learned how to make photosynthetic bacteria that improves plant growth and crop quality and learned how to use the wood vinegar that improves soil quality, helps elimination of pests, and assists plan growth.

Two cattle farmers at Ban PhouNgou were selected as representatives of the cattle farming management program based on their readiness and capacity. They received some support as part of the cattle farming management training to start the cattle fattening in September 2022. Each of them received 7 zinc roof sheets, 2 kg of nails and 1 kg of molasses as feed ingredient. These two farmers are selected as representatives for cattle fattening who will be a knowledge resource for other farmers. They have started the program by building the small cow shelter in the third week of September 2022.

NNP1PC EMO team was conducting post training evaluation on cattle fattening and organic farming for orange and pineapple farmers in September 2022. EMO distributed 69 questionnaire forms to cattle farmers in Thathom Districts, 49 forms were distributed to cattle farmers in Hom Districts, 49 forms were distributed to farmers in Hom Districts, and 57 forms were distributed to orange and pineapple farmers in Hom District. Collecting the post training evaluation feedback from the surveyed farmers is expected to be completed before the end of December 2022 and the results will be presented in Q4 2022 Report.

A database in Microsoft Excel of the farmers (cattle, orange, pineapple) engaged in the watershed sustainable livelihood opportunity program is being developed. The data will be used to analyze the capacity and behaviour of each farmer as well as the farming issues for the planning interventions.

EMO had a meeting with Thathom DAFO on 21 July 2022 for the work arrangement in connection with establishing the local producer groups at Nahong and Phonhome Village. The kick-off meeting was scheduled for early August 2022 depending on the availability of assigned DAFO staffs. After series of follow up and discussion, Thathom DAFO confirmed that the producer group establishment will be postpone to next year because they are not ready for it.

The progress of actions to deal with the pending issues under NNP1 Watershed and Biodiversity Program could be summarized in **Table 4-1**.

TABLE 4-1*: THE ACTION TAKEN UNDER NNP1 WATERSHED AND BIODIVERSITY PROGRAM*

No.	Actions	Target date	Status as of September 2022
1	Financial Management Manual (FMM) for WPROs and NC-NX BOMU		
	Approval	Q2 2022 (original) **Nov 2022 (new)**	**In progress:** • On 26 July 2022, NNP1PC received a response letter from MoF on the clarification of allowances in accordance with the GOL financial policy. In the letter, MOF confirmed that the daily allowances and accommodation for staffs who are assigned or working in the area where there are no accommodation facilities available shall be paid. This refers to meal allowance of 100,000 Kip/person/day and accommodation allowance of 150,000 Kip/person/day. NNP1PC management had further internal discussion and agreed with no objection for providing the allowances following the guidance from MoF. The final draft FMM has been adjusted accordingly. • NNP1PC proposed to finalize and approve the FMM as soon as possible or by the latest in December 2022 as one of the key financial references for the implementation of GOL AIP starting from 2023. The date for the consultation meeting with DoF-MAF, WRPOs and BOMU for finalizing the FMM is yet to be confirmed by DoF-MAF. In parallel, NNP1PC is also requesting support from Biodiversity Service Provider (BSP) to provide the financial analysis on the impact of the increased in allowances on the overall WMP and NC-NX BOMP budget and the solutions for it for the GOL consideration on the sustainable financing until end of concession period. BSP has been working on the analysis since August 2022 and the analysis is expected to be ready in October 2022 for further discussion with NNP1PC EMO.
2	Specific activity under WMP and NC-NX BOMP		
a	The Law Enforcement Strategy for the NNP1 sub-catchment will adapt or learn from the NC-NX Law	Q2 2022 (original) **Q4 2022 (new)**	**In progress** NC-NX offset site

No.	Actions	Target date	Status as of September 2022
	Enforcement Strategy and the strategy		• The Law Enforcement Strategy (LES) preparation for the NC-NX offset site lead by BSP-WCS. The additional annexes were discussed among BSP, EMO, and BOMU in which one of the revised documents was just submitted to EMO team on 22 Jun 2022. LES for NC-NX offset site was approved by Bolikhamxay PAFO on 22 July 2022 and shared by BOMU on 29 July 2022. NNP1 sub-catchment • Bolikhamxay WRPO had discussion with BSP-WCS on the preparation of LES for the NNP1 sub-catchment on 10 May 2022. It was noted that LES topic could be further discussed during the SMART refresher training and training on new standard operation procedures (SOP) for Bolikhamxay rangers that was originally scheduled in June 2022. However, due to internal restructuring of law enforcement team in which POFI is not participating due to limited resource and the key members of Bolikhamxay WRPO as well as some of patrolling members have assignments from their respective offices and so the training will be organized in October 2022. • BSP-WCS will also lead the discussion of LES for the NNP1 sub-catchment with Xaysomboun WRPO. The SMART training that will also discuss the topic on the LES for Xaysomboun rangers will be organized after the Bolikhamxay WRPO training. • It is expected to have several follow up discussions, review, or workshop during October – December 2022 among NNP1PC EMO, WRPOs, and BSP-WCS on the LES document for the NNP1 sub-catchment. BSP-WCS will share the new timeline for LES document preparation in October 2022.
b	The operation of Xaysomboun WRPO sub-office at Hom District	Jan 2022 (original) **Jan 2023 (new)**	• Construction of the Xaysomboun WRPO sub-office at Hom District was completed in September 2021. • The assignment of GOL staffs to be stationed in the Xaysomboun WRPO sub-office refers to an official agreement on the appointment of WRPC and WRPO at district level in Hom District (Ref No. 0202/DG.

No.	Actions	Target date	Status as of September 2022
			Hom) issued by Hom District Governor on 23 April 2022. However, NNP1PC EMO noted that only military security and national public military will be based in the sub-office in which they do not have management and technical role or capacity to deal with the overall NNP1 WMP or Xaysomboun WRPO AIP implementation. • NNP1PC EMO have already inquired for further clarification and provided the recommendation to reconsider the staff assignments during the monthly meeting between NNP1PC EMO, Xaysomboun WRPO, and BSP-WCS in May 2022. • Xaysomboun WRPO provided confirmation on 6 September 2022 that they disagreed with the allowances for staff who is assigned for the operation of sub-office in Hom district that was already discussed and agreed during the FMM discussion in December 2021. Xaysomboun WRPO decided to drop the budget for sub-office operation under the AIP2022. Therefore, the sub-office is not yet in operation
c	Checkpoints in the NNP1 sub-catchment	Dec 2020 (original) **Dec 2022 (new)**	• Xaysomboun WRPO submitted the design and construction cost to Department of Provincial Work and Transport (PWT) for the confirmation of design and construction cost unit on 23 August 2021. • Xaysomboun Public Work and Transport (PWT) issued a certificate on design and construction cost for 2 ranger stations on 30 August 2021 (Ref. No. 2103/PWT.XSB). • The provincial bidding committee organized a meeting on 21 September 2021 for opening the bidding document for the construction of 2 ranger stations and 2 reservoir checkpoints. This refers to Xaysomboun Provincial Agreement No. 1303/PG.XSB, dated 19/11/2020 on bidding approach. The meeting agreed that Xernlong Company to continue with the construction. • After the meeting, the bidding committee invited Xernlong company to discuss and agree on the followings: ○ Xernlong company agreed to continue for the construction of ranger station and reservoir checkpoint

No.	Actions	Target date	Status as of September 2022
			○ Xernlong company agreed to contribute the solar panel for each station ○ The procurement process will refer to Lao Procurement Law • The Xaysomboun WRPO/PAFO as bidding committee member drafted the report on the result of the bidding, prepared the MOM of the bidding results, and prepared the provincial governor agreement on the selection of the company for construction of the ranger stations and reservoir checkpoints. The MOM was signed on 22 February 2022 while the Provincial Governor approval on the construction cost and contractor for ranger station in TPZs and reservoir checkpoints was issued on 23 May 2022 (Ref. No.0475/PG.XSB). • Xaysomboun WRPO/PAFO drafted the contract with the construction company and prepared the work handover sheet. The contract with a duration of 6 months period was approved by Xaysomboun Provincial Governor in August 2022. Xaysomboun WRPO and contractor planned to visit the site and followed up by mobilization of the contractor in September 2022. However, the activity could not be commenced because of the difficult access during the rainy season. NNP1PC EMO will continue to follow up on the progress with Xaysomboun WRPO.
d	TPZ demarcation in the NC-NX offset site	Jan 2022 (original) **Nov 2022 (new)**	• As of 03 March 2022, the full completed report and the finalized map are still being processed by NX-NX BOMU and not yet shared with NNP1PC. EMO provided assistance to NC-NX BOMU in finalizing the map of NC-NX and its TPZ boundaries. The updated map was circulated among EMO, NC-NX BOMU and BSP-WCS on 27 April 2022 and NC-NX BOMU. • NC-NX BOMU further requested EMO to provide all the GIS mapping, data and explanation on the change/update of NC-NX and its TPZ since 2015 to date. The requested information was shared to BOMU and BSP on 11 May 2022. BOMU, NNP1-EMO and BSP organized a technical discussion/meeting on 30 June 2022 to clarify and agree on data and mapping.

No.	Actions	Target date	Status as of September 2022
			• NC-NX BOMU, EMO, and BSP-WCS agreed that the official recognizance process meeting will be organized as soon as the fund under the AIP2022 is available.
e	Reservoir fishery management	Jan 2022 (original) **Nov 2022 (new)**	• No clear timeline for workshop on the Fishery Co-Management Plan (FCMP). NNP1PC EMO was informed that a new head of PAFO has been appointed and is catching up with the pending activities. He called for a meeting with the secretariat and NNP1PC to brief him on the WMP 08 April 2022. • In May 2022, Xaysomboun WRPO in collaboration with DAFOs of Hom and Thathom scheduled to organize the consultation meeting on role and responsibilities for reservoir fishery management of relevant provincial and district offices at respective district level but it was postponed to June then July 2022. After series of follow up with Xaysomboun WRPO then it was noted that the meeting with the district will be organized at the end of September 2022. However, Xaysomboun WRPO informed BSP-WCS during the meeting on 23 September 2022 that the meeting will be postponed to October 2022. • NNP1PC EMO and BSP-WCS will continue to follow up with Xaysomboun WRPO as this is one of the recommended or prioritized activities for the remaining months in 2022.

4.1.2 Preparation of Annual Implementation Plan (AIP) 2022

4.1.2.1 Xaysomboun WRPO

Xaysomboun WRPO submitted the budget plan of their AIP2022 to EMO on 30 March 2022. EMO team has reviewed the budget plan of Xaysomboun AIP2022 and submitted to ADB and IAP on 10 May 2022 for their review and approval. IAP and ADB provided confirmation of no objection on 7 and 30 June 2022 respectively. EMO has further revised the budget plan 2022 considering the remaining period for the implementation activity. The revised budget was sent to Xaysomboun WRPO on 19 July 2022 and noted that Xaysomboun WRPO requested a further discussion with EMO team after their internal review. Xaysomboun WRPO submitted the revised AIP2022 on 10 August 2022 and EMO has further reviewed and revised the AIP2022 to cover the remaining months of 2022. The final AIP2022 was concluded on 22 August 2022 and EMO advised Xaysomboun WRPO to proceed further with the fund disbursement. However, Xaysomboun WRPO still return back to EMO on 30 August 2022 with some disagreement on the allowances for the staff to be assigned at the Hom District sub-office and admin operation cost. EMO has prepared an official response letter on 31 August 2022. Xaysomboun WRPO AIP2022 covering the implementation period from September to December 2022 with the total budget of LAK 1,544,578,000 was approved by Xaysomboun PAFO on 9 September 2022. Xaysomboun WRPO informed that they are still preparing the document for submission to Department of Forestry (DOF), Ministry of Agriculture and Forestry (MAF) as of 30 September 2022.

4.1.2.2 Bolikhamxay WRPO

Bolikhamxay WRPO submitted the budget plan for the Q3 and Q4 fund disbursement which was concluded on 22 August 2022. NNP1PC received a fund disbursement request totalling LAK 327,005,000 from DOF-MAF on 2 September 2022. The fund was disbursed to DOF-MAF on 15 September 2022. Bolikhamxay WRPO is preparing the document for the fund transfer from DOF-MAF to their account.

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

Nam Chouane-Nam Xan (NC-NX) Biodiversity Offset Management Unit (BOMU), EMO and BSP-WCS organized a technical discussion/meeting on 30 June 2022 to clarify and agree on data and mapping for the recognition of NC-NX and TPZ boundary. It was noted that per further discussion and recommendation from Bolikhamxay PAFO management then a meeting with relevant provincial, district and village authorities will be organized to present the final boundaries to be officially recognized. The presentation material and relevant documents were prepared by NC-NX BOMU with the support from EMO in the third week of July 2022. The meeting will be organized after the confirmation of availability of participants and the fund available under the AIP2022.

b. Component 2 – Enforcement

The remaining budget from other activities under the previous AIP was only sufficient to mobilize two patrol teams within the TPZ highest priority area in June 2022 and to safe-

guarding the three patrol sub-stations (Na Gnang, Nam Ma, and Nam San) during 5-31 August and 3-29 September 2022.

The SMART and first aid training agenda was finalized and shared by BSP-WCS on 12 September 2022. The trainings are tentatively scheduled to be carried out on 17-21 October 2022 in Viengthong District. BOMU and the Lao Red Cross (first aid trainers) are preparing for the training while NNP1PC EMO also support to prepare the necessary materials for the training including the maps.

The patrolling and training will be resumed after BOMU received the fund under the AIP2022.

c. Component 3 – Conservation Outreach

BSP-WCS shared the improved draft NC-NX outreach strategy to EMO on 23 June 2022. EMO reviewed and agreed with proposed revision by BSP-WCS and on the timeframe that will now cover the period between 2022 to 2026 with additional minor comments on the draft. The reviewed draft was returned to BSP-WCS on 29 June 2022. The NC-NX outreach strategy was finalized on 1 August 2022 and approved by Bolikhamxay PAFO on 6 September 2022. The outreach will be conducted after receiving the funds under the AIP2022. The radio-broadcast outreach continued to be implemented until July 2022 as planned.

d. Component 4 – Conservation linked livelihood

BSP-WCS continued improving the Lao version of the draft Community Conservation Agreement (CCA) for BOMU review and comments.

It was discussed and agreed among EMO, NC-NX BOMU, and BSP-WCS that an annual meeting for snare removal activity as well as the basic first aid training for snare removal team following the recommendation for the assessment of snare removal team performance should be conducted in July 2022. However, due to lack of sufficient remaining budget from other activities under the previous AIP, only the annual meeting could be held (it was organized on 27 July 2022). The meeting was participated by the Viengthong DAFO, Viengthong Administration office, NC-NX BOMU, Chouan Village cluster police, BSP-WCS, EMO, Vangphieng village authorities and snare removal team. It was noted from the meeting that three of the snare removal team members voluntarily withdrew from the team due to their own family matters and health issues. In regards to the withdrawal of the team members, three new members were selected and agreed by the committee. It was also noted that the team still have weak capacity in terms of the technical skills, so refresher and first aid trainings are needed.

The snare removal activity will be resumed after receiving the funds under the AIP2022.

4.2.2 Preparation of Annual Implementation Plan (AIP) 2022

EMO submitted an official response to the compiled comments from GOL committees on the final draft Financial Management Manual (FMM) to Department of Forestry (DOF) of Ministry of Agriculture and Forestry (MAF) on 20 May 2022. A meeting on this matter will be organized after the review by DOF-MAF. However, there was no responses from GOL team until end of June 2022 and per discussion between DoF-MAF and NNP1 management then it was recommended that NNP1PC should submit an official letter to the Ministry of Finance to seek the clarification and guidance on the accommodation allowance issues. The letter was submitted on 6 July 2022 and MoF responded on 26 July 2022 with the confirmation for NNP1PC to follow the Minister's Agreement No.4000/MoF particularly Section 4.1.1 under

Article 4 about meal and accommodation for the business trip allowance within the country. NC-NX AIP2022 that will cover the implementation period from September to December 2022 was finalized on 18 August 2022 after series of review by BOMU, NNP1 and BSP-WCS. The plan was approved by Bolikhamxay PAFO on 22 August 2022 and NNP1PC received the fund disbursement request from DoF-MAF on 1 September 2022. NNP1PC transferred the fund to Ministry of Finance (MoF) on 15 September 2022. NC-NX BOMU is preparing the document for the fund transfer from DOF-MAF to their account until the last week of September 2022.

5 FISHERY MONITORING

Four species groups and one species dominated the fish catch by weight in Q3 2022 as listed in ***Table 5-1.*** All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species[2], except *Sikukia gudgeri* is classified as Data Deficient species (DD) and *Oreochromis niloticus* is an exotic species.

TABLE 5-1: *FISH SPECIES DOMINATING THE FISH CATCH IN Q3 2022*

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Mastacembelus armatus, Mastacembelus favus	ปาຫຼາດ	499.8	LC
Hampala dispar, Hampala macrolepidota	ปาสูด	464	LC
Poropuntius normani, Poropuntius laoensis, Poropuntius carinatus	ปาจาด	330.3	LC
Oreochromis niloticus	ปานิน	242.4	LC
Sikukia gudgeri, Amblyrhynchichthys truncatus	ปาขาวอุาย	230.4	DD,LC

The recorded catch of Threatened species (IUCN Red List classification) in Q3 2022 are presented in ***Table 5-2.*** The list includes three species that are classified as Vulnerable species (VU).

Table 5-2*: Threatened Species of Q3 2022 Fish Catch*

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Cirrhinus cirrhosus	ปาแกง/ปาบอมจัน	0.4	VU
Scaphognathops bandanensis	ปาวຽนไฝ/ปาป่ຽน	36.2	VU
Tor sinensis	ปาแดง	117.6	VU

[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.

The occurrence of Threatened species in the fish catch by quarter since the start of species identification in Q3 2015 is displayed in **Table 5-3**. Based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey, no specimens of *Luciocyprinus striolatus*[3] have been reported since Q4 2018.

[3] It is important to highlight the population status of *Luciocyprinus striolatus* referring to the NNP1 Project Critical Habitat assessment as discussed and agreed between NNP1PC and ADB during 2018.

TABLE 5-3: *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	Q3 2021	Q4 2021	Q1 2022	Q2 2022	Q3 2022
Bangana behri (VU)	+	+	+	+	+	+	+	+	+			+	+	+		+													
Cirrhinus cirrhosus (VU)	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+		+	+	+		+		+	+	+	+	+
*Datnioides undecimradiatus **																+													
Epalzeorhynchos munense (VU)												+																	
Luciocyprinus striolatus (EN)	+	+	+	+			+	+	+	+			+	+															
Pangasianodon hypophthalmus (EN)	+																												
Probarbus jullieni (EN)	+	+	+			+		+	+	+		+		+			+	+			+	+				+			
Probarbus labeamajor (EN)				+	+			+																					
Scaphognathops bandanensis (VU	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Tor sinensis (VU)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

**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 Q3 2022. The catch is divided in 3 areas including above the main dam, below the main dam and Mekong area. Main biodiversity indicators in Q3 2022 for above dam, below dam and Mekong area are presented in ***Table 5-44*** to explain the diversity of fish. This diversity index (Shannon) explains that the high value means high diversity.

TABLE 5-4*: MAIN BIODIVERSITY INDICATORS FOR Q3 2022*

Biodiversity Indicators	Mekong	Below dam	Above dam
Total species and groups	35	42	48
Single species	28	29	34
Species groups	7	13	14
Top 15 species (% total catch weight)	88.80%	81.53%	88.59%
Proportion for species groups	12.05%	60.20%	52.98%
Diversity index (Shannon)	2.8245	2.9004	2.7766

The mean daily fish catch per household from July 2015 to September 2022 is displayed in ***Figure 5-1*** and the mean fish catch per household per fishing day for Q3 from 2015 to 2022 are shown in ***Table 5-5.***

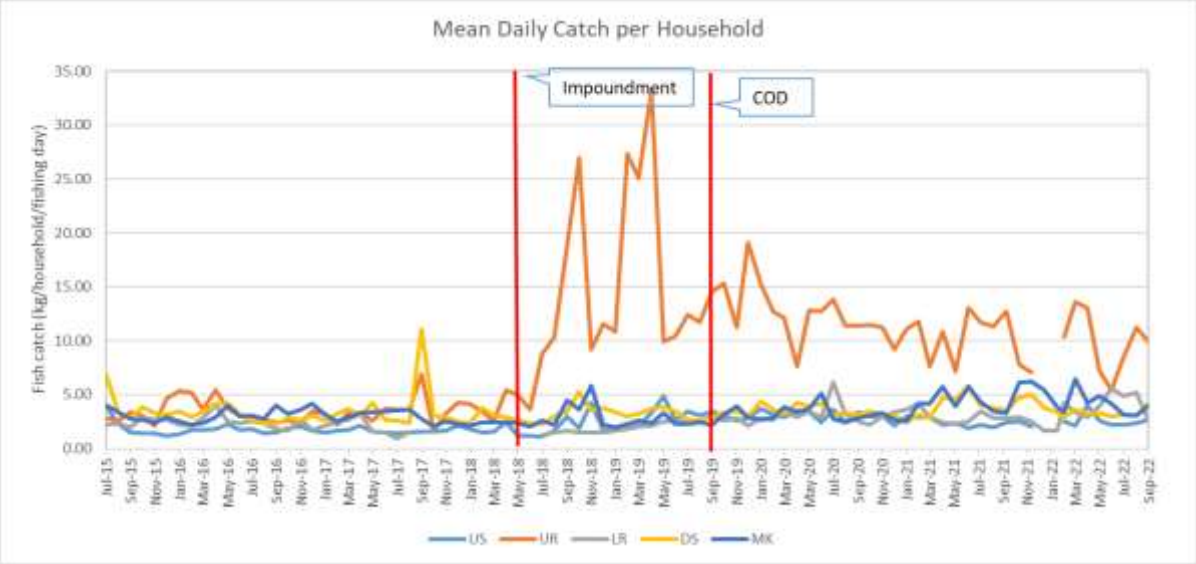


FIGURE 5-1*: MEAN DAILY FISH CATCH PER HOUSEHOLD FROM JULY 2015 TO SEPTEMBER 2022*

TABLE 5-5*: MEAN DAILY FISH CATCH PER HOUSEHOLD FOR Q3 FROM 2015 TO 2022*

Fishing Zone	Q3 2015 (kg)	Q3 2016 (kg)	Q3 2017 (kg)	Q3 2018 (kg)	Q3 2019 (kg)	Q3 2020 (kg)	Q3 2021 (kg)	Q3 2022 (kg)
Upstream	2.56	1.59	1.49	1.94	3.31	3.12	2.21	2.40
Upper reservoir	2.94	2.71	4.71	12.64	12.90	12.20	11.92	9.87
Lower reservoir	2.16	2.24	1.24	1.49	2.67	3.97	3.05	4.21

Fishing Zone	Q3 2015 (kg)	Q3 2016 (kg)	Q3 2017 (kg)	Q3 2018 (kg)	Q3 2019 (kg)	Q3 2020 (kg)	Q3 2021 (kg)	Q3 2022 (kg)
Downstream	4.32	2.42	5.31	2.93	2.73	3.20	3.79	3.46
Mekong	3.38	3.30	3.32	3.08	2.30	2.67	3.70	3.40

The survey results in Q3 2022 indicate that Nam Ngiep is the main fishing habitat for the upstream and downstream zones, while the main fishing habitat for the upper reservoir, lower reservoir and Mekong zones are the reservoir, tributaries and streams and Mekong respectively. The proportion of fishing habitats in Q3 2022 are displayed in ***Table 5-6***.

TABLE 5-6*: PROPORTION OF THE CATCH REPORTED BY MAIN HABITATS (%) IN Q3 2022*

Habitats	US	UR	LR	DS	MK
Mekong	0.0%	0.0%	0.0%	1.3%	68.2%
Nam Ngiep	54.0%	11.7%	0.0%	56.0%	5.0%
Nam Xan	0.0%	0.0%	0.0%	0.0%	0.0%
Reservoir	0.0%	83.9%	35.9%	0.0%	0.0%
Tributary and stream	39.0%	2.9%	59.8%	35.2%	0.1%
Wetland	7.0%	1.4%	4.3%	7.6%	26.8%
Others	0.0%	0.0%	0.0%	0.0%	0.0%

Total reported fish and other aquatic animal (OAA) catch (proportion of OAA) for the same 7-day period in Q3 from 2015 to 2022 are shown in ***Figure 5-2.***

It is noted from the long observation of fishing in the Nam Ngiep that OAA is mostly collected from wetlands compared to other habitats. After the impoundment, the household seems more interested in catching the fish from the main reservoir and tributary, as reflected in ***Table 5-6***. Therefore, the proportion of OAA has been lesser since 2019 and only Lower Reservoir (LR) area that shows a consistent value.

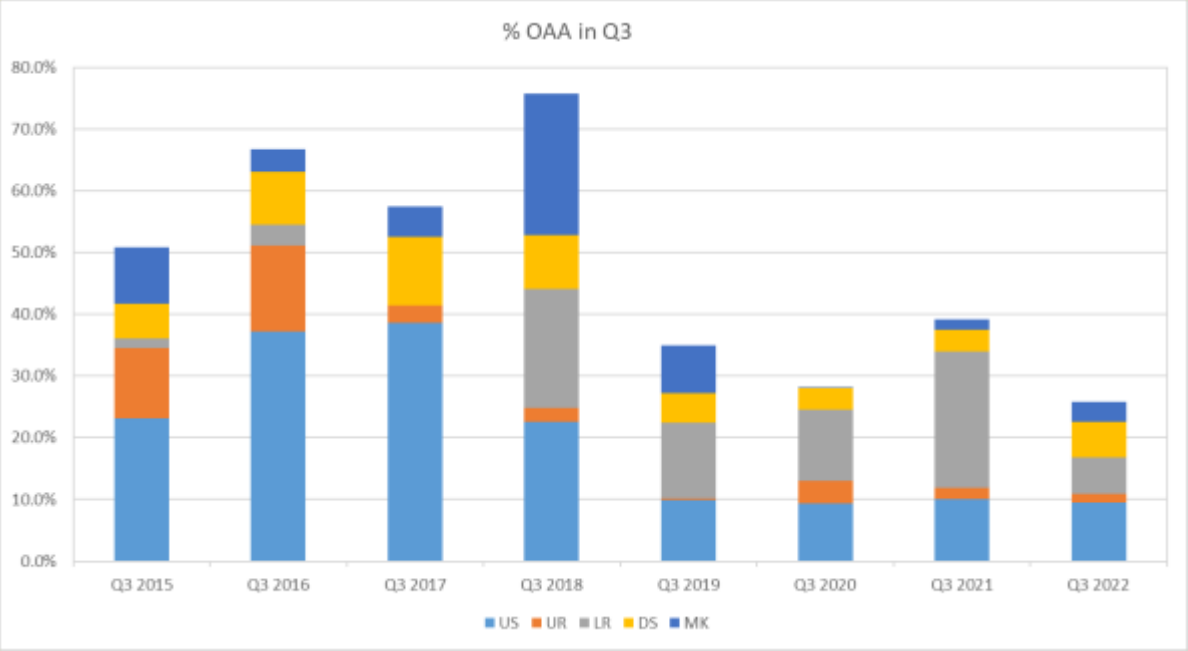


FIGURE 5-2*: PROPORTION OF OAA TO THE TOTAL REPORTED KILOGRAM (KG) OF FISH AND OAA FOR A 7-DAY PERIOD BY FISHING ZONE IN Q3 FROM 2015 TO 2022*

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 September 2022) are provided in **Table 6-1.**

TABLE 6-1: *SAFETY INCIDENTS REPORTED DURING THE OPERATION PHASE (SEPTEMBER 2019 TO SEPTEMBER 2022)*

Type of Incidents	LTI	RI	NM	PD	FI	MVI	Total
No. of Incidents in Q3, 2022	0	0	0	0	0	0	0
Cumulative Total Incidents to 30 September 2022	0	3	0	0	0	1	**4**

LEGEND:
- LTI - Lost Time Incident
- RI - Recordable Injury[4]
- NM - Near Miss
- PD - Property Damage
- FI - Fire Incident
- MVI - Motor Vehicle Incident

There were no incidents or accident reported in the third quarter 2022.

The histogram below in ***Figure 6-1*** shows the number of reported incidents occurring in each month since the Operation Phase (September 2019) with the colour indicating the type of incident including near misses. The graph superimposed on the histogram shows the frequency of incidents, including reported near misses, with the number of incidents occurring each month expressed as a percentage of the total number of Project workers employed in each month being the total man-months.

All reported incidents that have involved the Owner and its Contractors and Subcontractors are included in the histogram and shown graphically below.

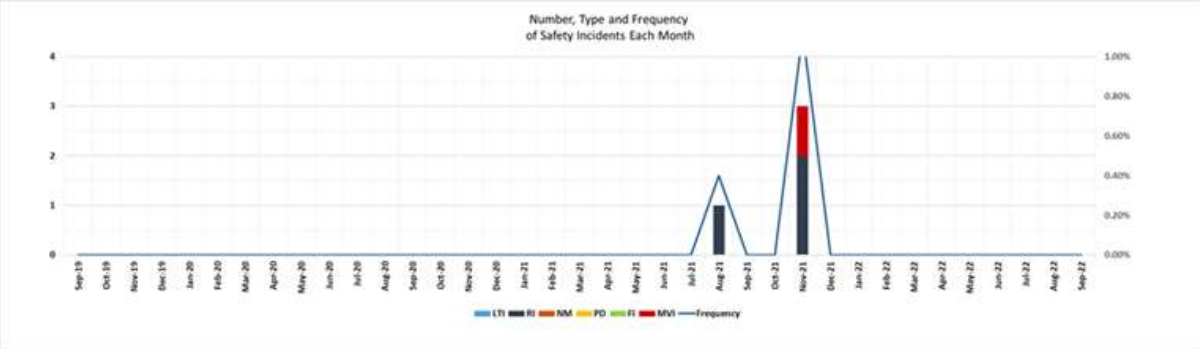


Figure 6-1: Number, Type and Frequency of Safety Incidents since September 2019 to 30 September 2022

The second histogram in ***Figure 6-2*** shows the number of persons who were injured, or lost their lives in the reported Lost Time Incidents.

Since Q4 of 2021, there are two cases of Recordable Injury (RI) and one case of Motor Vehicle Incident (MVI) recorded as follows and the detailed report with preventive and corrective actions were prepared and recorded by the Health and Safety Team:

- The first RI occurred at the Main Power Station; a staff had fallen into the opening pit causing an injury to his thigh.

[4] An **injury** or illness is **recordable** if it involves restricted work or transfer to another job. An employee is said to be on "restricted work" when he or she is unable to perform one or more routine functions of the job, beginning on the day after the **injury** or illness occurs

- The second RI occurred at the main dam right bank; a contractor's staff attempted to turn off a ball valve of hydraulic hose but it was exploded during the drilling operation causing his hand injuries.
- The first MVI occurred at the Main Dam Top Right Bank, the crane truck has collided with the parked NNP1 pickup car.

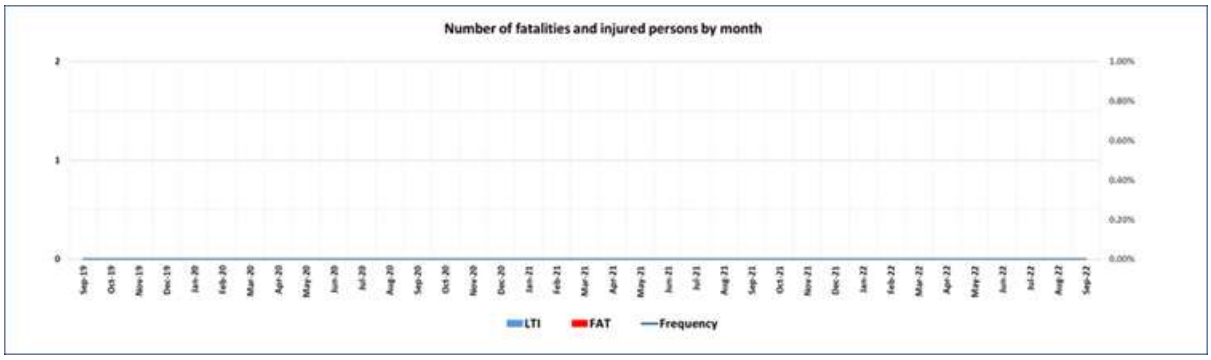


Figure 6-2: Number of Fatalities and Injured Persons since September 2019 to 30 September 2022

Approximately:

[Incidents = Accidents (with injury) + Near Misses + Other Incidents (with damage, no injury)]

6.1.1 Health and Safety Training and Emergency Drills

During the third quarter 2022, NNP1PC Health and Safety Officer conducted health and safety trainings to NNP1PC Technical Division and Admin team, Environmental and Social Division team, and the internship students from National University of Lao on 12 July 2022, 13 July 2022, and 29 August 2022 respectively. There was no health and safety-related drill conducted during the reporting period.

Figure 6-3: Health and safety training for NNP1PC TD and Admin team on 12 July 2022 at NNP1 OSOV1

Figure 6-4: Health and safety training for NNP1PC ESD team on 13 July 2022 at NNP1 OSOV2

Figure 6-5: Health and safety training for internship students on 29 August 2022 at NNP1 OSOV1

6.2 RELATED TO COVID-19

The country is officially opened in September 2022. However, NNP1PC still encourages COVID-19 countermeasures such as physical distancing, practicing personal hygiene by frequent washing hands with alcohol-based gel, mask wearing in the work place as well as avoiding mass gathering.

6.2.1 NNP1PC COVID-19 Measures

General Instructions:

- All staff are requested to strictly follow preventative measures against COVID-19 such as:
  - keeping physical distance of at least 1 meter from others, even if they do not appear to be sick;
  - avoiding the 3Cs, spaces that are closed, crowded or involve close contact;
  - wearing a properly fitted mask when physical distancing is not possible and in poorly ventilated settings;
  - cleaning the hands frequently with alcohol-based hand rub or soap and water;

- covering the mouth and nose with a bent elbow or tissue when you cough or sneeze. Dispose of used tissues immediately and clean hands regularly; and
- self-isolating until recovery in case of any symptoms or tested positive for COVID-19.

- A disposable medical face mask will be provided for each staff every day and more as appropriate upon agreement by the supervisor for high-risk staff who need to be working with local communities/contact with external stakeholders. Appropriate disposal in the bin is required to avoid possible infection.

Specific Instructions:
Contractors inside and outside the Project areas are required to implement the followings at all times:

(A) All contractors' personnel are required to strictly follow preventative measures against COVID-19 such as:
- getting vaccinated as soon as possible following Governmental guidance on vaccination;
- keeping physical distance of at least 1 meter from others, even if they do not appear to be sick;
- avoiding the 3Cs, spaces that are closed, crowded or involve close contact;
- wearing a properly fitted mask when physical distancing is not possible and in poorly ventilated settings;
- cleaning your hands frequently with alcohol-based hand rub or soap and water;
- covering your mouth and nose with a bent elbow or tissue when you cough or sneeze. Dispose of used tissues immediately and clean hands regularly; and
- self-isolating until recovery in case of any symptoms or tested positive for COVID-19.

(B) Relevant Division shall ensure that all contractors' personnel working for the NNP1 Project are regularly checked for body temperatures and use of face masks/hand gel in their camps and working places.

(C) Contractors' personnel in OSOV1 or OSOV2 have to continuously check their body temperature using a thermometer provided at the entrance of OSOV1 and OSOV2 at least once a day.

(D) If a contractors' personnel is found to have any symptoms of COVID-19 (i.e. dry cough, high fever, difficult breathing, sweats, chills, headaches), high temperature or flulike symptoms, the contractor shall inform NNP1PC of relevant information immediately.

6.2.2 General situation of COVID-19 in NNP1PC

- Vaccination rate as of October 2021 – 100% of NNP1PC staff
- Number of positive tests of NNP1PC staff on site – 11 cases

7 External missions and visits

There was no external missions and visits by ADB, IAP, and LTA carried out during July-September 2022.

The action priorities recommended by ADB, IAP, and LTA during the mission in November 2021 are listed for further follow-up as shown in the **Table 7-1**.

Table 7-1: *NNP1 CORRECTIVE ACTION PLAN (CAP)*

No	Requested/Recommended Actions	Status as of end of September 2022
1	**E&S Capacity** i) NNP1PC to provide Job Descriptions of Key EMO and SMO staff. ii) NNP1PC to provide also job descriptions for H&S staff. iii) NNP1PC to include the updated chart in the ESMS and next Q monitoring report iv)The Job Descriptions of key SMO staff will be assessed by ADB to ensure that their deliverables are aligned with the deliverables in the REDP, SDP, CDP and Masterplan for Livelihood Development	i) Three TORs of EMO key positions and H&S staff were already provided since the November 2021 mission. The remaining job descriptions of EMO &SMO key staff positions was completed by Q4, 2021. iii) The organization chart of E&S is added in the Env Q4 2021 Report.
2	**Emergency Preparedness** For Stage 1 NN1 has provided the updated EAP April 2021 and EEP, but ADB doesn't know whether EAP comments provided in Dec 2020 have been incorporated. NN1 needs to provide a response to the EAP comments and actions raised in Dec 2020 for Stage 1 and the timeline for the completion of the plans and drills for LTA and ADB review.	• The Emergency Evacuation drills were completed on 01 April 2022 in all 13 villages and 1 Polytechnic school in Houaykoun Village, Bolikhan District, Bolikhamxay Province. • The final draft of the Village Emergency Evacuation Plan (EEP) for Downstream Villages was shared with ADB and LTA and comments from the LTA were received on 18 July 2022. The VEEP was revised by the Consultant and the updated version was shared with LTA/ADB for another review on 10 August 2022. In parallel, the revised version was translated and submitted to the relevant GOL parties (District Disaster Management Committees of Bolikhan and Paksan Districts or DDMC's) for their reviews (since the Plan covers two Districts). The DDMC of Paksan provided the certification of approval on 13September 2022 and expects to get approval from the DMMC of Bolikhan by mid-October 2022. • For EAP, the current version shared with ADB/LTA (on 30 June 2022) is the same version that was already submitted to GOL for their review and approval. NNP1PC has not yet received any comments on the EAP from MEM since the submission despite the follow up during their visit to the Project site. The comments from LTA (Dr. Robert) is in process to be consolidated into the existing version.
3	**Impacts caused by water level variations**	• NNP1PC already responded during the mission and provided photos to document

No	Requested/Recommended Actions	Status as of end of September 2022
	• EAP & EAP Socialisation: Prior to the onset of the wet season each year, annual emergency evacuation drills are to be undertaken with each downstream village • Compensation Upstream: Confirm whether there have been any flooding impacts upstream above 320masl due to backwater effects or the wet season/abnormal flooding. Also confirm if compensation has been provided for the new suspension bridge design which is to be built at 323.2 MASL. Provide evidence that National Road 1D (which is to be raised to 322 MASL) used to get flooded prior to filling the reservoir the level of the road. Clarify NNP1PC funding contribution to Road 1D. CDF funds should not be used.	the flooding related to the upstream flooding and road 1 D improvements. The relevant info and materials (including the compensation maps both upstream and downstream area) were shared with ADB during and after the latest virtual mission. • NNP1 waiting for further discussion with ADB if more information is needed.
4	**Operation manual** • NNP1PC to indicate what changes have been made in the manuals to address outstanding comments on managing backwater effects and irrigation system water availability through operations. • Share the full EPRP • Share manuals and plans with LTA for review	• NNP1PC-TD has prepared a draft report on back water effect in the main reservoir under different scenarios for discussing the possible impacts and mitigation measures during the incoming ADB mission scheduled in November 2022. • The management of re-regulation reservoir to accommodate the need for the irrigation system was also addressed over the past few months to ensure that the water level is maintained above EL. 177.6 m of the irrigation system intake level except in case of emergency and scheduled maintenance. In the later event, a new irrigation pump is being installed to supply the water. The design and cost estimate were submitted to ADB (DMD-ESD to Joyce) on 07 September 2022 as part of the Project Completion Date discussion. The Operation and Maintenance Plan for Phouhomxay Irrigation System being prepared by the national irrigation expert from MAF. • The EPRP was shared with ADB in the Google Drive folder no. (11) and 18) on 1 Mar 2022 (responded by EMO Manager to Aida - 4th time). • The EPRP was also shared with LTA for review and the comments from LTA was provided to NNP1 on 25 August 2022

No	Requested/Recommended Actions	Status as of end of September 2022
		that all major aspects seem to be covered. There is also a comment on the missing Emergency Phone Numbers for all emergency cases and NNP1 confirmed that the phone numbers are already identified the Annex 2 of EPRP.
5	**Eflows** NN1PC to continue monitoring compliance with the eflows and fluctuation thresholds set in the ESIA and CA.	Noted. No further response is required.
6	**Water Quality (Reservoir)** • NN1PC provided an update on H2S monitoring as indicated in the EMP-O documents. No additional requirements for PCD. • NN1PC provided an update on H2S monitoring as indicated in the EMP-O documents. No additional requirements for PCD.	A report of Hydrogen Sulphide and Phytoplankton Biomass analysis was shared with LTA for review and the comments from LTA was provided to NNP1 on 25 August 2022 that: (i) the H_2S monitoring is suggested to abandon (but to be discussed further if it can really be abandoned or requires a more precise analysis method); and (ii) the phytoplankton biomass monitoring by gravimetric method can be stopped and to be discussed further for Chlorophyll a.
7	**Wastewater Treatment** • NNP1PC to provide maps and description of the land use where the effluents are and indicate whether there are any wells or groundwater that may be affected. • Provide SoPs for waste management for review	A report and info relating to the Effluent discharge was shared with LTA for review and the comments from LTA was provided to NNP1 on 25 August 2022. The report will be revised/updated per comments and further shared with LTA/ADB before the incoming ADB mission scheduled in November 2022.
8	**Watershed Management Plan - Budget** • NN1 provides a clear approach and next steps to resolve the AIP government approvals and acceptable to ADB.	i) The action taken for the pending issue related with NNP1 watershed and biodiversity program is documented in separate monitoring sheet and will be regularly updated to ADB starting in October 2022. NNP1 management (MD, DMD ESD), EMO Manager and a representative of LHSE organized a short discussion with Vice Minister of MAF accompanied by Deputy Director of DOF-MAF and the representatives from the Ministry's Administration Office on 30 May 2022 to discuss the outstanding issues particularly on the allowance for the field work and the threat to NNP1 NNL program. The Vice-Minister advised the Deputy Director of DOF-MAF to lead the finalization of the FMM in coordination with relevant

No	Requested/Recommended Actions	Status as of end of September 2022
		agencies (including the consultation with MoF) and NNP1PC as soon as possible and to make sure that everything is aligned with the GOL financial policy (referring to MoF Decree No. 4000). The issue is still under discussion internally among the GOL. DoF-MAF recommended NNP1 to submit an official letter to Ministry of Finance (MoF) to seek the clarification and further guidance on the practical implementation of GOL policy No. 4000/MoF for NNP1 Project. NNP1PC has submitted an official letter to MoF on 6 July 2022 and followed up with DoF-MAF and MoF afterward. On 26 July 2022, NNP1PC received a response letter from MoF on the clarification of allowances in accordance with the GOL financial policy. In the letter, MOF confirmed that the daily allowances and accommodation for staffs who are assigned or work in the area where there are no accommodation facilities available shall be paid. This refers to meal allowance of 100,000 Kip/person/day and accommodation allowance of 150,000 Kip/person/day. NNP1 management had further internal discussion and agreed with no objection for providing the allowances following the guidance from MoF. NNP1 management also agree with IAP (Dr. Will) recommendation and requesting BSP-WCS to evaluate how much realistically the budget can be reallocated from other management components without simply transferring the increased risk of failing NNL into those components themselves. After this evaluation, then GOL (DOF, WRPOs and NC-NX BOMU), ADB, IAP, LTA, BSP and NNP1PC can organize further discussion how to manage the budget within the sealing of the approved NNP1 WMP and NC-NX BOMP. ii) EMO and BSP-WCS had discussion on 30 September 2022 on the approach for the

No	Requested/Recommended Actions	Status as of end of September 2022
		preparation of GOL AIP2023. The preliminary draft with the recommended activities and estimated budget considering the key activities related to No Net Loss (NNL) and the actual capacity of GOL implementing units is being prepared by EMO in collaboration with BSP-WCS. It expected to be finalized in the middle of October 2022 and it will be circulated to Xaysomboun and Bolikhamxay WRPO as well as Bolikhamxay NC-NX BOMU for their review. Series of small workshop and follow up discussion are expected after that to have the first draft in November 2022. iii) AIP2022 Bolikhamxay AIP2022 was approved by ADB and IAP on 10 February 2022. The Fund for Q1-Q2 and Q3-Q4 was disbursed by NNP1PC to DOF-MAF account on 15 March and 15 September 2022 respectively. Xaysomboun AIP2022 was approved by IAP and ADB on 7 and 30 June 2022 respectively. However, XSB WRPO still disagree with allowance unit rate until an official response from MoF issued on 26 July 2022 confirming that the daily allowances and accommodation for staffs who are assigned or working in the area where there are no accommodation facilities available shall be paid. After series of follow up and further revisions, the plan was approved by XSB PAFO on 9 September 2022 and Xaysomboun WRPO is preparing the document for submission to DOF-MAF. NNP1 expects to receive the request for fund disbursement in October 2022.
9	**Watershed Management Plan - Law Enforcement** a. The Law Enforcement Strategy for the NNP1 sub-catchment will adapt or learn from the NC-NX Law Enforcement Strategy and the strategy will be ready by the end of Q2 2022.	a. The Law Enforcement Strategy (LES) is in progress for the preparation led by BSP-WCS. NC-NX LES document with additional annexes were discussed among BSP, EMO and BOMU for finalization in June 2022. LES for NC-NX offset site was approved by BLX PAFO on 22 Jul 2022

No	Requested/Recommended Actions	Status as of end of September 2022
	b. 'Hom sub-office' – the construction was completed in September and the activity can be shared by 31 December 2021. c. 'checkpoints' – same response as for the WMP/BOMP budget. d. 'TPZ demarcation' – The NC-NX TPZ demarcation in the last village (Ban Vangphieng) was completed on 12 December 2021. The evidence of its completion can be provided by 31 December 2021.	Due to delay in AIP2022 implementation by Xaysomboun WRPO then the LES for NNP1 watershed is expected to be further delayed. BSP-WCS will provide the new timeline for the LES preparation for NNP1 watershed in October 2022. b. 'Hom sub-office' - the construction was completed in September and the evidence was shared on 31 December 2021. Noted that during the finalization of Xaysomboun AIP2022 then they provided the confirmation to EMO on 6 September 2022 that they still disagree with the allowances for staff who is assigned for sub-office in Hom district and so there will be no mobilization of the staff under the AIP2022. It will be further discussed during the AIP2023 preparation. c. Checkpoint construction: Xaysomboun WRPO submitted the design and construction cost to the Provincial Department of Public Works and Transport (DPWT) for the confirmation of design and construction cost unit on 23 August 2021. Xaysomboun DPWT issued a certificate on design and construction cost for 2 ranger stations on 30 August 2021 (Ref. No. 2103/PWT.XSB). The provincial bidding committee organize a meeting on 21 September 2021 for opening the bidding document for the construction of 2 ranger stations and 2 reservoir checkpoints. This refers to Xaysomboun Provincial Agreement No. 1303/PG.XSB, dated 19/11/2020 on bidding approach. The meeting agreed that Xernlong Company to continue with the construction. After the meeting, the bidding committee invited Xernlong company to discuss and agree on the followings: • Xernlong company agreed to continue for the construction of ranger station and reservoir checkpoint

No	Requested/Recommended Actions	Status as of end of September 2022
		• Xernlong company agreed to contribute the solar panel for each station • The procurement process will refer to Lao Procurement Law The Xaysomboun WRPO/PAFO as bidding committee member drafted the report on the result of bidding, prepare the MOM of the bidding results, and prepare provincial governor agreement on the approval company for construction ranger stations and reservoir checkpoints during November 2021 to February 2022. The MOM was signed on 22 February 2022 while the Provincial Governor approval on the construction cost and contractor for ranger station in TPZs and reservoir checkpoints was issued on 23 May 2022 (Ref. No.0475/PG.XSB). Xaysomboun WRPO/PAFO drafted the contract with the construction company and prepare the work hand over sheet. The contract with duration of 6 months period was approved by XSB Provincial Governor in August 2022. Xaysomboun WRPO and contractor planned to visit the site and followed up by mobilization of contractor equipment and the construction materials in September 2022. However, the activity could not be commenced yet because of the difficult access during the rainy season. d. TPZ demarcation As of 03 March 2022, the full completed report and the finalized map are still being processed by NX-NX BOMU and not yet shared with NNP1PC. The report will be shared to ADB, IAP and BSP once received (already responded to ADB for the 4th time on 03 March). EMO provided assistance to NC-NX BOMU in finalizing the map of NC-NX and its TPZ boundaries. The updated map was circulated among EMO, NC-NX BOMU and BSP-WCS on 27 April 2022 and NC-NX BOMU.

No	Requested/Recommended Actions	Status as of end of September 2022
		NC-NX BOMU further requested NNP1 EMO to provide all the GIS mapping, data and explanation on the change/update of NC-NX and its TPZ since 2015 to date. The requested information was shared to BOMU and BSP on 11 May 2022. BOMU, NNP1-EMO and BSP organized a technical discussion/meeting on 30 June 2022 to clarify and agree on data and mapping. NC-NX BOMU, EMO, and BSP-WCS agreed that the official recognizance process meeting will be organized using the fund under the AIP2022.
10	**Watershed Management Plan - Health and Safety** WCS prepared a safety protocol for patrolling and field activities. NN1PC needs to update H&S plans for operation considering occupational risks associated with navigation and works around the reservoir (applicable to project activities, staff and contractors). Provide updated H&S plans to ADB and LTA for review.	'The revised/improved EPRP was shared in the Google Drive folder no. 11 and 18 on 01 Mar 2022. The mentioned info was added in the Attachment 22: Incident while working over water (reservoir). See above updated responses.
11	**Downstream Impacts** During the Nov 2021 it was evident that during the rainy season water levels reached a maximum of 230 m3/s, but PAP have only been compensated for the land affected for discharges up to 160m3/s. NN1PC needs to provide maps of affected compensated areas and a plan of action.	The map of compensated land (mostly riverbank garden) in each village downstream was already provided but not the pegging map which NNP1-ESD team cannot find from the existing record and believed that the data may have been lost through team transition. Nevertheless, NNP1PC (TD) continues to conduct downstream and upstream monitoring through conducting river cross section study annually at key location and have timely early warning before water discharges downstream following the Project's EAP and VEEP for downstream villages.
12	**Reservoir & Watershed Management - Fisheries and Livelihood Development** Agree to remove as PCD condition since government approval process is beyond NNP1PC control. Dissemination of WMP regulations is beyond NNP1PC control. NNP1PC to continue to follow up.	The final draft of the Fisheries Co-Management Plan is still on hold by the Xaysomboun PAFO due to pending workshop to decide on the role and responsibilities including budget division between the Province and District levels. EMO were informed that a new head of PAFO has been on board and is catching up with the pending activities. He called for a meeting with the secretariat and NNP1PC to

No	Requested/Recommended Actions	Status as of end of September 2022
	As a PCD condition, NNP1PC only needs to provide indicative timeline to finalize the FMP and obtain government approval. As a continuing CAP, NNP1PC to provide English version of Livelihood Program for 9 Villages. NNP1PC to indicate timing when this will be received since only translation is pending.	brief him on the WMP 08 April 2022. In May 2022, Xaysomboun WRPO in collaboration with DAFOs of Hom and Thathom was scheduled to organize the consultation meeting on role and responsibilities for reservoir fishery management of relevant provincial and district offices at respective district level but it was postponed to June then July 2022. After series of follow-up with XSB WRPO, NNP1 was informed that the meeting with the districts on the division of responsibility and the final draft FCMP is expected to be organized in October 2022.
13	**Implementation of the biodiversity mitigation and offset framework** NN1PC to provide a clear approach and next steps to resolve the AIP government approvals by Friday 26 Nov. ADB supports taking this issue to the highest level and involve ADB's country director in Lao. i) Finalize the AIP for 2021 asap ii) Resolve the allowance issue with WRPOs considering how this has been addressed for other similar NNL programs in the provinces and Lao. iii) Provide an efficient and rapid way of generating the AIP or suggest improvements to the current process. iv) provide an agreement on the TPZ demarcation and checkpoints by all relevant parties. v) Budget (AIP) for 2022 agreed by December 2021 with GoL. vi) Commence biological monitoring survey as planned for 2021. vii) procurement and engagement of the NNL audit consultant in 2021	Completed for PCD purposes
14	**BOMP – Law enforcement**	Complete for PCD purposes.
15	**BOMP – Community Development Plan** CDP monitoring and implementation	Complete for PCD purposes.
16	**Occupational Health and Safety** i) NN1PC to share the landslide inspection results with LTA for review (December 2021) ii) A revised Emergency Preparedness and Response Plan (EPRP) for operations and share the annual training and drills	See responses on watershed health and safety (#10) above

No	Requested/Recommended Actions	Status as of end of September 2022
	calendar shared with ADB and LTA for review iii) Provide the NNPC1 COVID-19 prevention and response protocols (for staff and contractors), and inform NNPC1 of any potential/positive cases of infections;	
17	**Dam safety** NNP1PC to provide evidence of completion of grouting and slope stabilization works of the main dam and an update on the dam safety recommendations. LTA to review and clear	Complete for PCD purposes.
18	**Site disposal areas/ Site rehabilitation/ quarry site** e. Submit a handover plan for ADB/LTA review that includes responsibilities and how the GoL will check the conditions of the site or KPIs, and agreed future uses f. Agree on the handover plan with GoL	Complete for PCD purposes.
19	**Paragraph (b) of the definition of Project Completion Date** NNP1PC to provide estimated cost of CAP items once list is completed and identify the budget source for each line item.	This was confirmed by NNP1PC through DMD-ESD to ADB on 04 September 2022 as part of the PCD confirmation that the required operation budget for a total of $450,000 is needed to complete the remaining suspension bridge work of about 50% and the installation of a pump at the intake of the irrigation system.
20	**Paragraph (k) of the definition of Project Completion Date** NN1PC to provide evidence of compliance in relation to the Safeguards Costs Reserve Account	Complete for PCD purposes.
21	**Section 29,a,ii of Annex C of CA, and clauses related to permits** Compliance with the CA	This was determined and provided in Q1 of 2022 according to the CA requirements.
22	**Clauses 51-82 in Annex C of the CA** Compliance with the CA	This was determined and provided in Q1 of 2022 according to the CA requirements.

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 Q3 2022

No	Site name	Document Name	Contractor / Subcontractor	Approval Status by EMO/NNP1 (date)	Detailed Site Information	Monthly Construction & Operation Status as of 30 September 2022
1	Main Dam and Contractor (KENBER) temporary camp (rental houses)	Site Decommissioning	KENBER Geotechnic (Thailand) Co., Ltd	3rd submission on 28 June 2022. No objection with no further comments on 01 July 2022	Main Dam Remedial Grouting Works	Completed Site closed on 02 August 2022

APPENDIX 2: ENVIRONMENTAL MONITORING CORRECTIVE ACTIONS Q3 2022

No	Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
1	NCR01/2022 Issued date 13-02-22 (NCR Level 1)	13.02.2022	OSOV1 & OSOV2	The Waste Water Treatment Systems at three main operation sites (OSOV1, OSOV2 and Main Powerhouse) are fully operated for almost three months since a significant improvement and modification completed in September 2021. After closely monitoring on their effluents, it is observed some monitoring parameters are sometimes exceeded the	- Proper fencing installation to prevent the cattle's encroachment in the OSOV1 wetlands' ponds. - Additional planting of reeds in the OSOV1 wetlands' ponds. - Adding the proper sludges/seeds into the Aeration Tank at OSOV2 WWTS and the Biofilm Septic Tank at the Main Powerhouse System. - Replacing the detergent materials in the Main Powerhouse by using lower Phosphate detergent. - Closely monitor the Residual Chlorine content in the effluents of OSOV2 and the Main Powerhouse WWTS and adjust as necessary. - Closely monitor the Influent to compare with the Effluent for the specific parameters to check their treatment effectiveness.	30.04.2022	30.06.2022 (Carried over from Q1 2022, planned to be resolved by Q3)	**In progress** Continue to monitor the influent and effluent to check the treatment effectiveness to be adjusted as necessary.

No	Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				effluent guidelines.				
2	NC No. 02/22 Issued Date: 01-07-22 (NCR Level 2)	25-06-22	Transmission line 22 kV distribution line	On 25 June 2022, one big tree with a diameter around 50 cm was found on the road side to the Main Dam. It was observed to be cut from the upper slope into 7 pieces at about 2 meters each together with a stump of another specie (total 8 pieces). A group of about six contractor staff would take the log back to their camp but was asked to suspend their actions immediately until further	- Immediately suspend the cutting of the remaining three (03) standing trees as planned and the cut trees were not allowed to be moved until receiving relevant GOL's permission in writing. - Internally investigate on the root cause and inspect the cut trees/logs to confirm species and volume for reporting to GOL as well as the current plan relating to the 22 kV DL preventive maintenance. - Officially inform the relevant GOL parties (Resettlement Management Unit and the Bolikhan District Agriculture and Forestry Office) and inviting them for the trees/logs inspection and consultation on the proper steps to follow to be in line with the GOL related laws. - Organise internal discussions to finalize further actions on the remaining three trees which were in the plan to be cut and ensuring the	30-09-2022	30-09-2022	**In progress** The main corrective action tasks are done. Waiting for PCD to procure contractor to remove the log and then hand over to local authority per Bolikhan DAFO recommendation. This issue can close once the logs are removed to the designated stockpile area and been handed over to the local authority.

No	Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				instruction is given. After checking with one of TD staff who was on duty on the same day, it was known that this tree was cut as part of the 22 kV TL maintenance work. Three trees were cut and three more are in the plan to be cut by the Contractor. Due to the fact that these trees are more than 30 cm in diameter and a few of them are known to be protected species in class I and II in the Forestry Law, DMD-ESD	necessary actions will be taken properly. - Organise refreshing training on the General Environmental Awareness and ESMMP dissemination to the relevant NNP1 staff and the Contractors. - Updating the training matrix to ensure that necessary topics relating to the environment matters are well-organized to the right target groups in a proper frequency. - Rechecking the list of relevant GOL environmental regulations and laws to be updated in the DCC system and ensure its distribution to the relevant parties for awareness internally. - Work with the Administration Division especially the Procurement and Contract Department (PCD) to incorporate the environmental requirements during the contract negotiation, before and after issuing the Notice to Proceed and before the release of the retention money into the updated Procurement Procedure and Procurement Policy. Training of			

No	Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				proposed to discuss with the Forestry unit for registration and approval prior to removal according to the Forestry Law. - The Notice to Proceed was issued by Procurement and Contract Department, Administration Division, to the Contractor without prior clearance from Owners' on submitted SS-ESMMP; - The Contractor proposed "trimming of 6 trees" but in fact,	PCD staff on these requirements also need to be carried out separately.			

No	Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				they used the "cut" method. This change in method without prior notification and revision of SS-ESMMP submitted to NNP1-TD has resulted in significant impacts on biodiversity especially when these are protected species listed in category II and III of the Forestry Law and IUCN as endangered or vulnerable (EIA of NNP1 Project prepared by ERM dated 2014). - All of these valuable trees are				

No	Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				located outside the ROW of 22 kV DL of 5 m from each side so cutting is prohibited and shall be minimized to the extent possible. The plan was made and cutting was undertaken without a risk evaluation matrix and proposed alternative options for prior review and approval by ESD-EMO and GOL. - Breaching of the approved ESMMP-OP, the related SS-ESMMP was not submitted to ESD-EMO for prior				

No	Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				review and approval before commencing the work as per the signed contract. - Breaching of the ADB Safeguard Requirement 2019 under ADB Facility Agreement and IFC Performance Standard on Biodiversity Conservation under the Concession Agreement. - Breaching of Forestry Law 2019: Clause 134.10 that prohibits any business entity from cutting, selling, buying				

No	Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				and moving natural trees that are in the list of protection and endangered species as per the List of Tree Species which is updated from time to time without approval from the Government.				

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

SITE CODES AND LOCATION STATION FOR SURFACE WATER QUALITY MONITORING

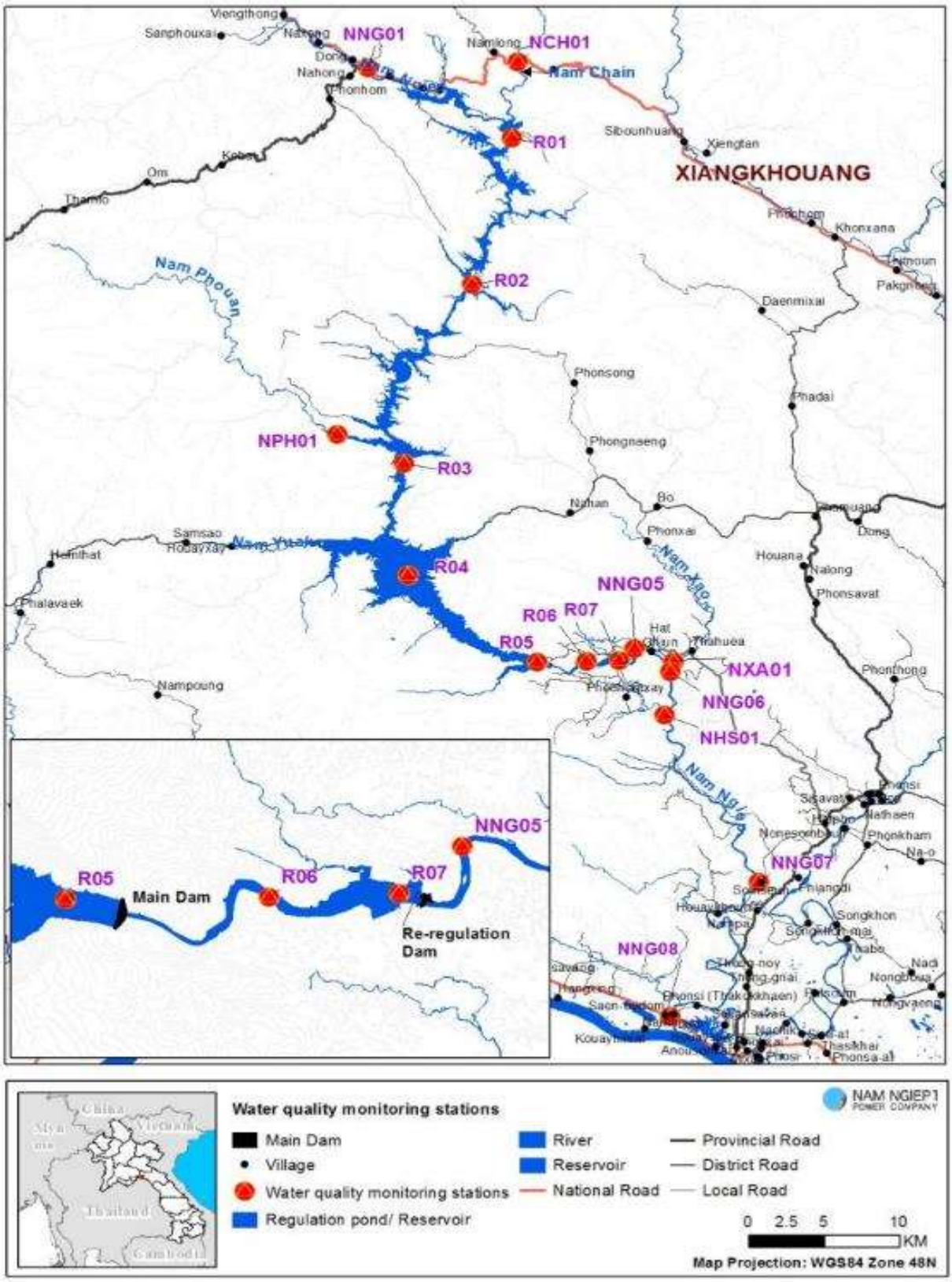
Site Code	Location station	Zone
NNG01	Nam Ngiep Upstream of Phiengta Village	Upstream Project Construction Site
R01	Main reservoir upstream main dam approx. 50 Km.	
R02	Main reservoir upstream main dam approx. 35 Km.	
NNG02/R03	Nam Ngiep Upstream of Nam Phouan Confluence / Main reservoir upstream main dam approx. 21 Km.	
NNG03/R04	Nam Ngiep Downstream of Sopyouak Village/ 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 Hat Gniun Village	Downstream Project Construction Site
NNG06	Nam Ngiep Downstream of Nam Xao Confluence	
NNG07	Nam Ngiep at Somsuen Village	
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 SURFACE WATER QUALITY PARAMETERS

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Weekly	pH, DO (%), DO (mg/L), Conductivity (µs/cm), 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].

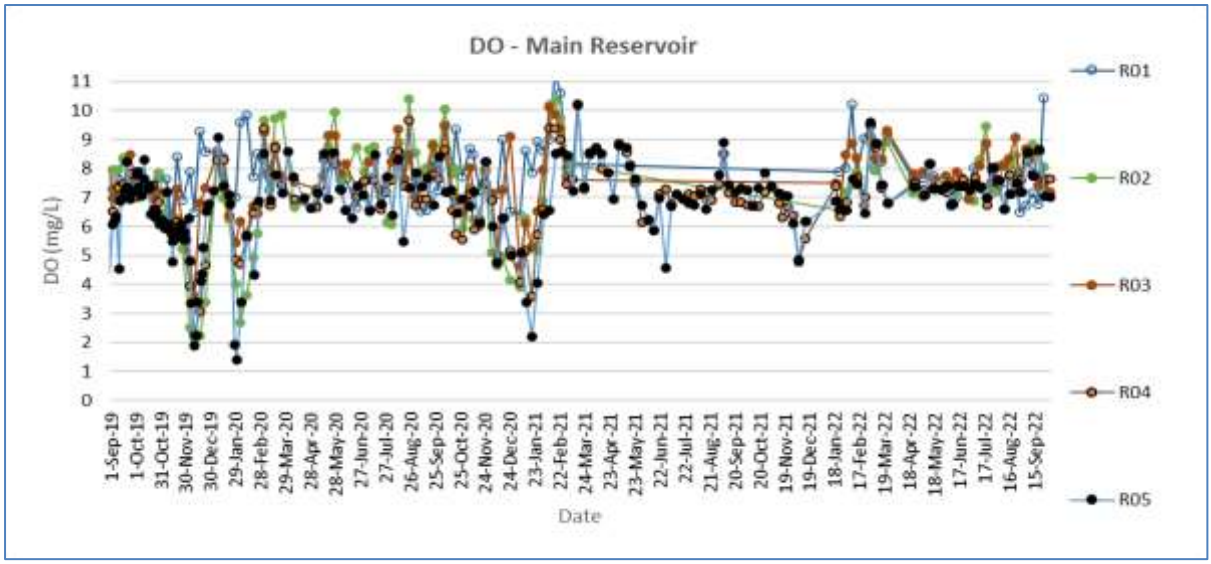
Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Fortnightly	pH, DO (%), DO (mg/L), Conductivity (µs/cm), Temperature (°C), Turbidity (NTU)	All stations
Monthly	TSS (mg/L), BOD_5 (mg/L), COD (mg/L), NH_3-N (mg/L), NO_3-N (mg/L), total coliform (MPN/100 mL), faecal coliform (MPN/100 mL), Hydrogen sulphide (mg/L), Phytoplankton biomass, TOC and TKN.	As per ESMMP-OP.

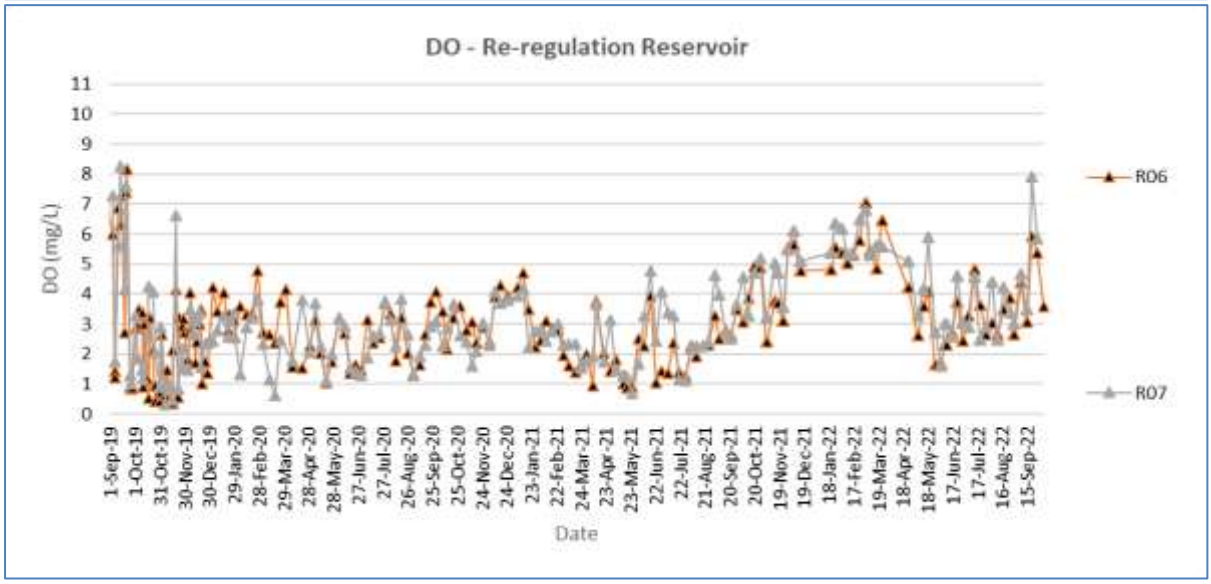
SURFACE WATER QUALITY MONITORING LOCATIONS

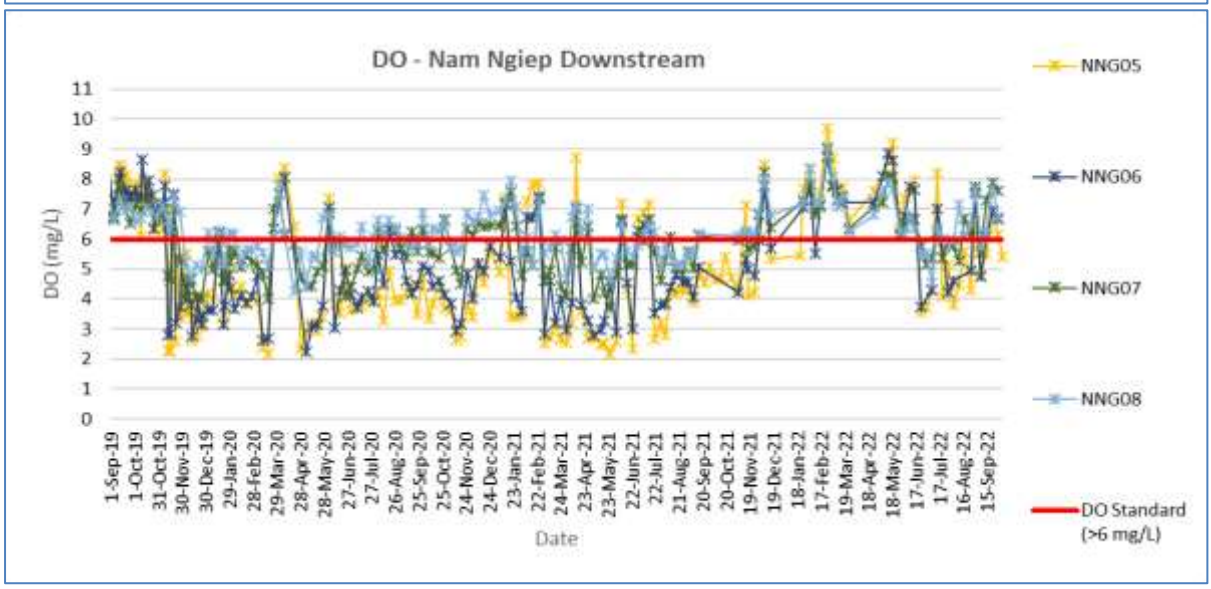


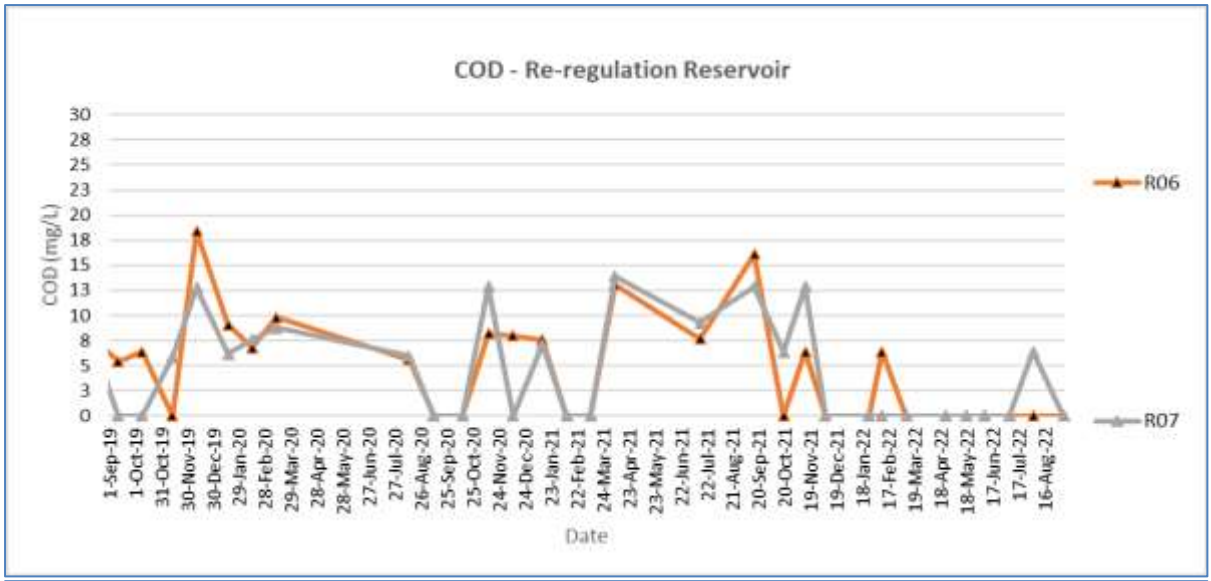
APPENDIX 4: KEY TRENDS OF WATER QUALITY MONITORING FROM JANUARY 2020 TO END OF MARCH 2022 (ONLY PARAMETERS THAT EXCEEDED THE STANDARDS)

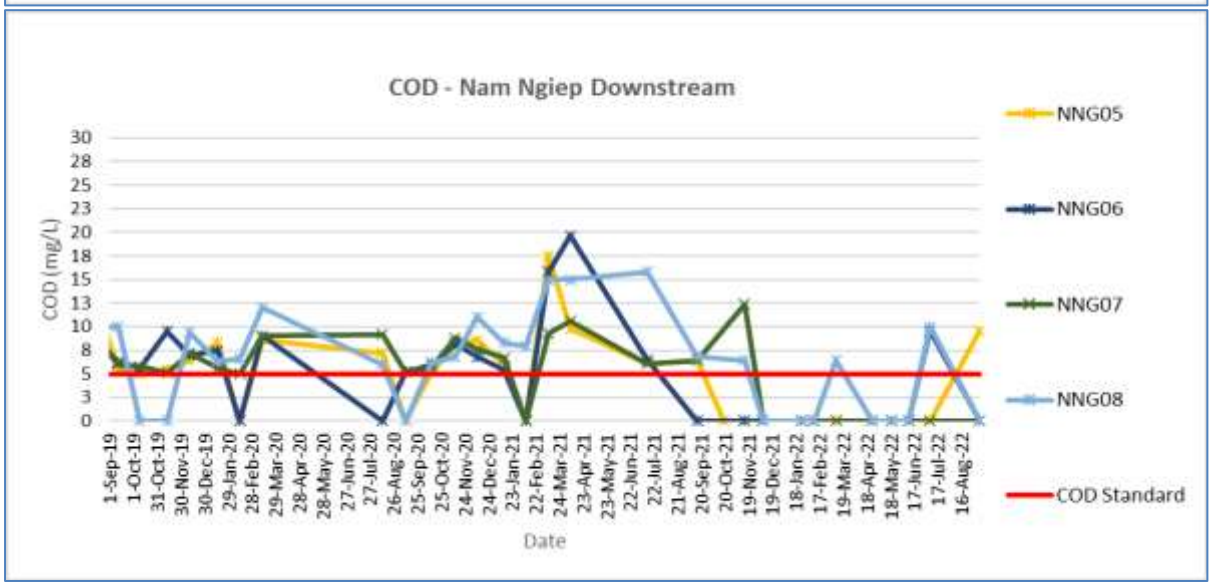
Nam Ngiep Surface Water



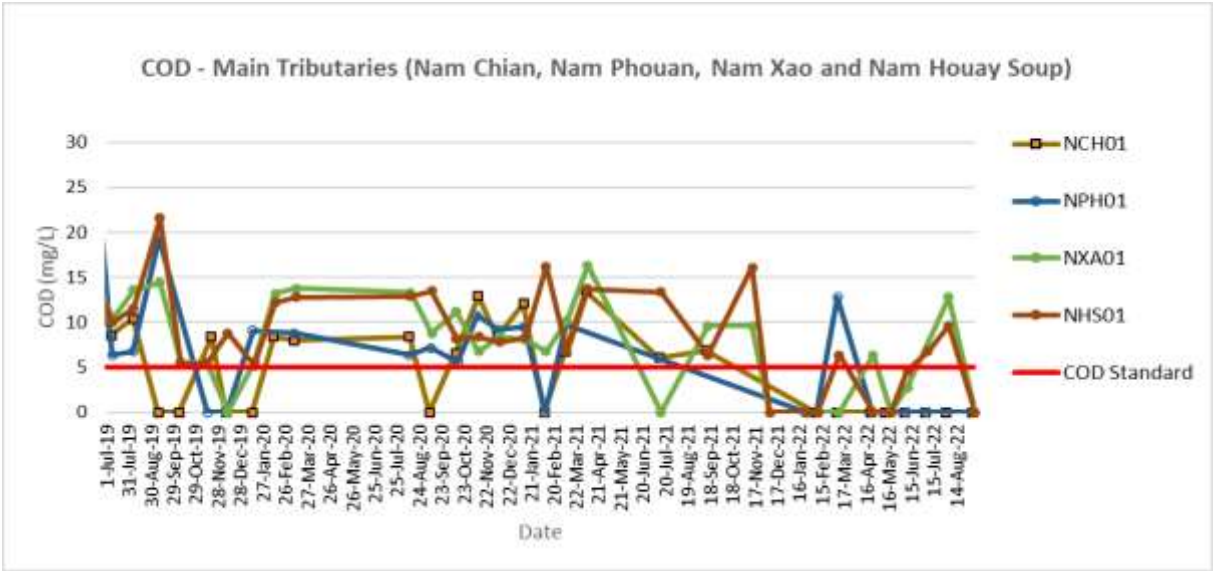




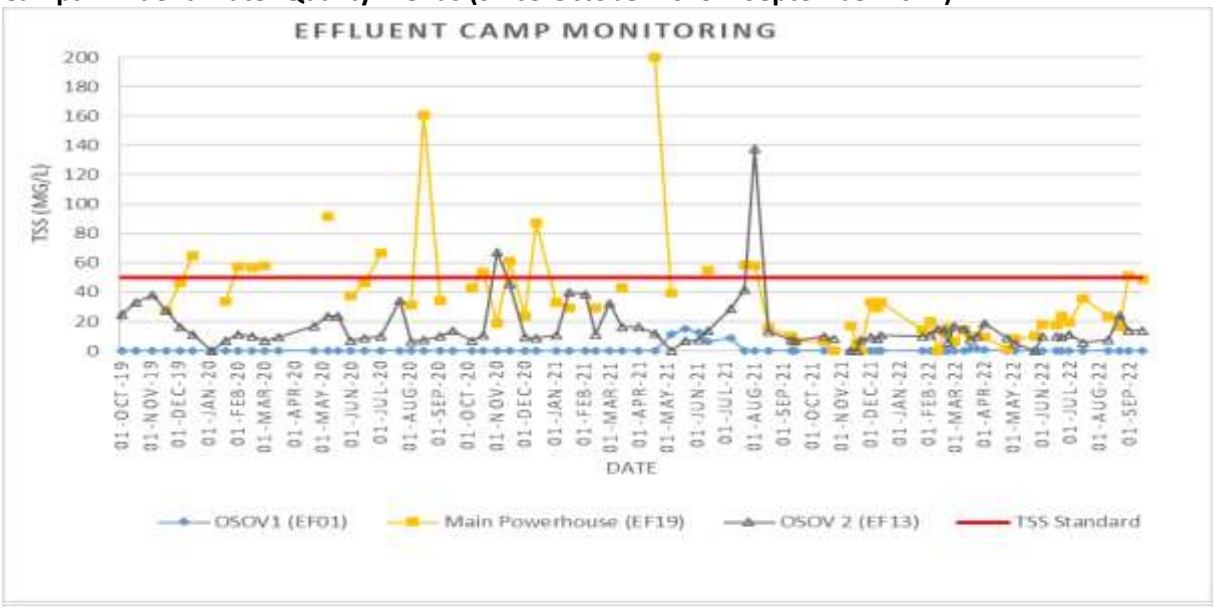


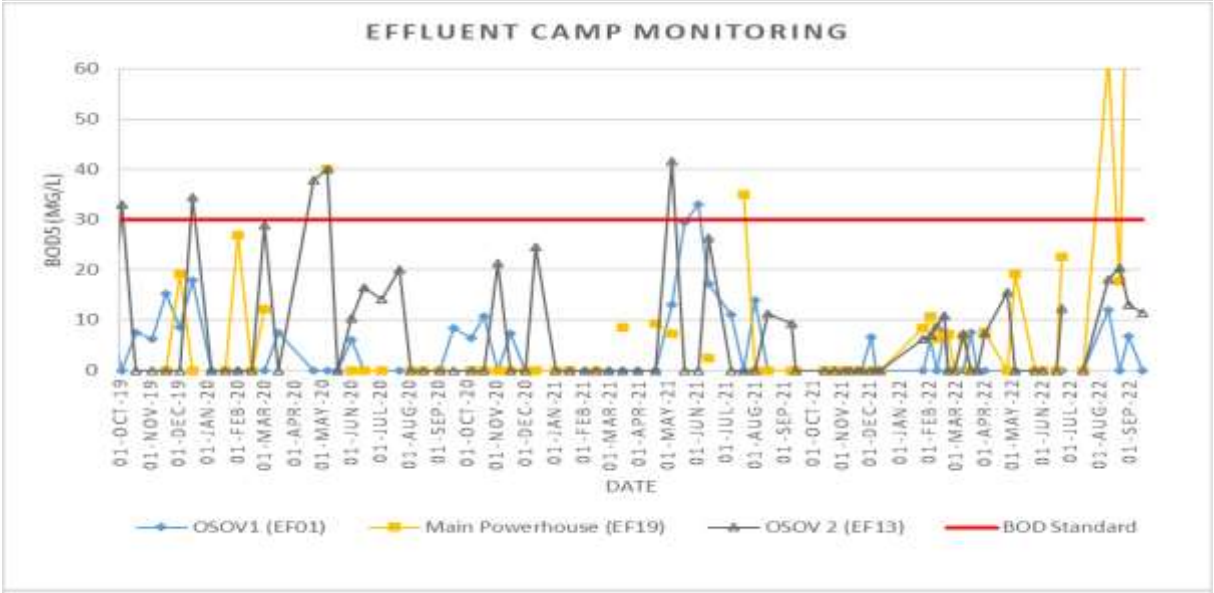


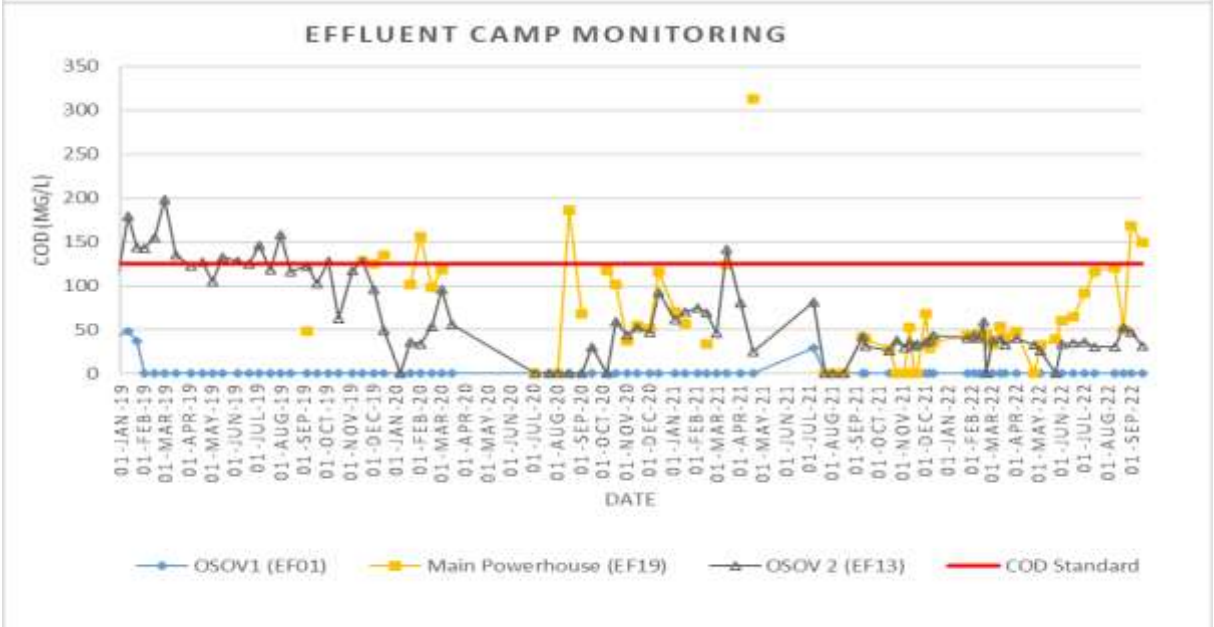
Key Water Quality Parameters for the Nam Ngiep Tributaries: Nam Chian, Nam Phouan, Nam Xao, Nam Houay Soup

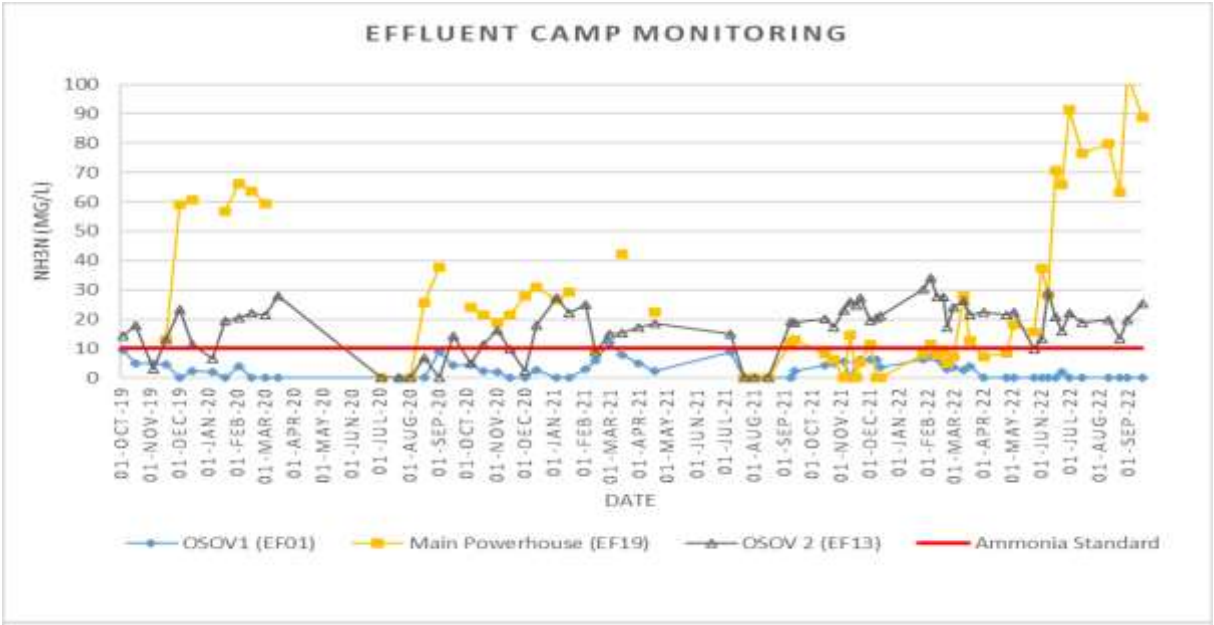


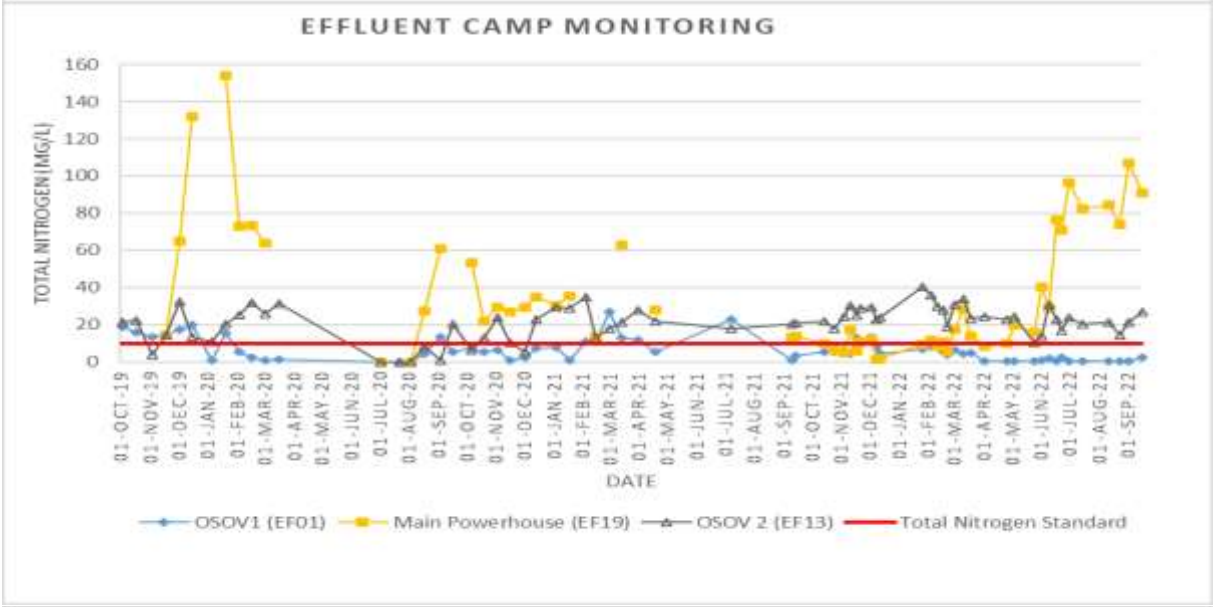
Camps' Effluent Water Quality Trends (Since October 2019 – September 2022)

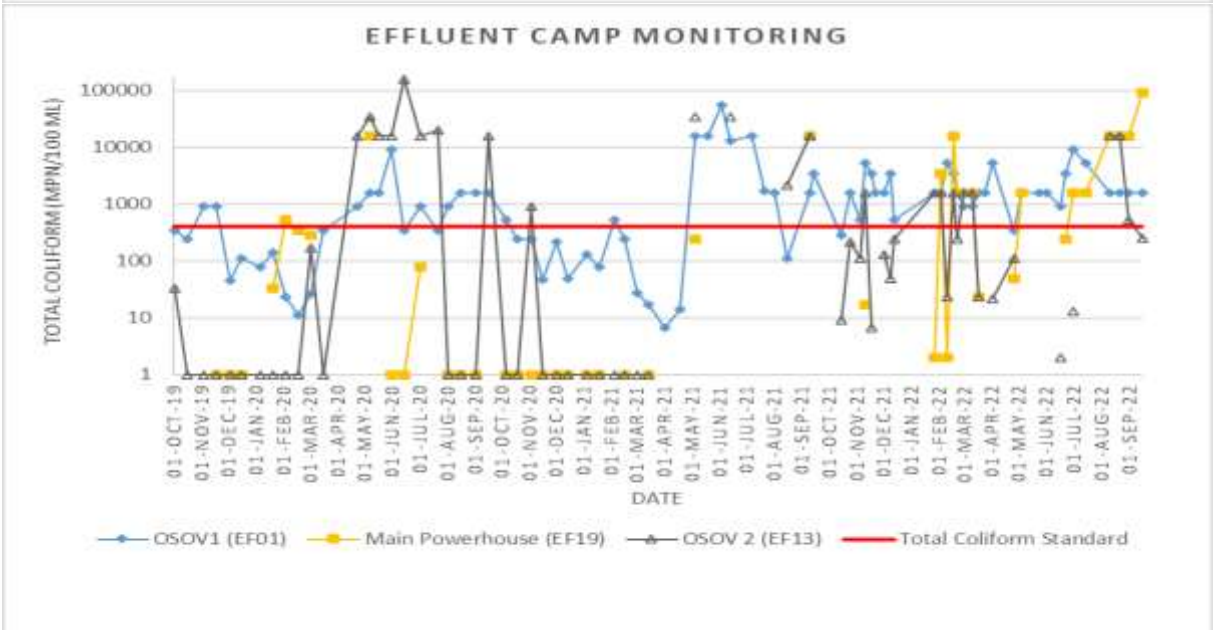


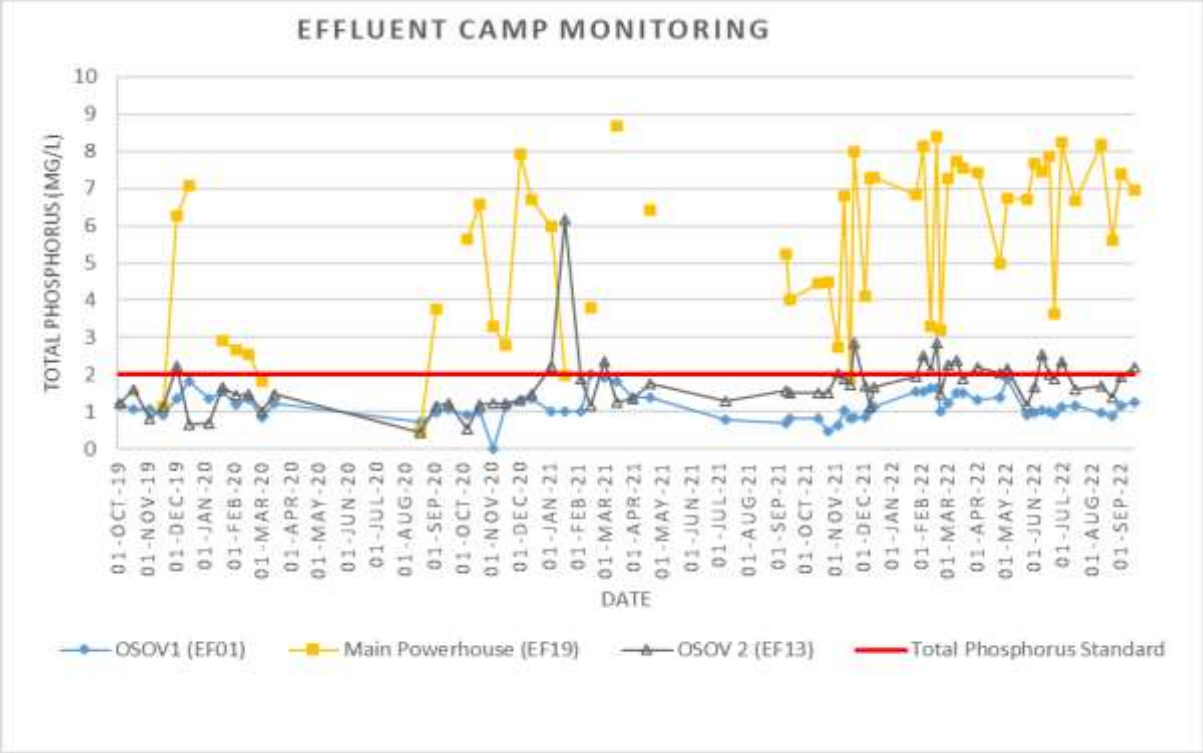





EFFLUENT CAMP MONITORING
NH3N (MG/L)
DATE
OSOV1 (EF01)
Main Powerhouse (EF19)
OSOV 2 (EF13)
Ammonia Standard


EFFLUENT CAMP MONITORING
TOTAL NITROGEN (MG/L)
DATE
OSOV1 (EF01)
Main Powerhouse (EF19)
OSOV 2 (EF13)
Total Nitrogen Standard


EFFLUENT CAMP MONITORING
TOTAL COLIFORM (MPN/100 ML)
DATE
OSOV1 (EF01)
Main Powerhouse (EF19)
OSOV 2 (EF13)
Total Coliform Standard


EFFLUENT CAMP MONITORING
TOTAL PHOSPHORUS (MG/L)
10
9
8
7
6
5
4
3
2
1
0
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
01-MAY-21
01-JUN-21
01-JUL-21
01-AUG-21
01-SEP-21
01-OCT-21
01-NOV-21
01-DEC-21
01-JAN-22
01-FEB-22
01-MAR-22
01-APR-22
01-MAY-22
01-JUN-22
01-JUL-22
01-AUG-22
01-SEP-22
DATE
OSOV1 (EF01)
Main Powerhouse (EF19)
OSOV 2 (EF13)
Total Phosphorus Standard

APPENDIX 5: WATER QUALITY MONITORING DATA

APPENDIX 5-1: SURFACE WATER QUALITY MONITORING – Q3 2022

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
4-Jul-22	pH	5.0 - 9.0	6.62												6.72			
5-Jul-22	pH	5.0 - 9.0		6.89	6.86	7.2										6.85		
6-Jul-22	pH	5.0 - 9.0					7.16	7.24	7.04	6.93								
7-Jul-22	pH	5.0 - 9.0									7.14	7.08	7.08	6.95			7.19	7.03
12-Jul-22	pH	5.0 - 9.0		6.79	7.27	7.3												
13-Jul-22	pH	5.0 - 9.0					7.42	7.24										
14-Jul-22	pH	5.0 - 9.0							7.35	7.21	7.36	7.05	7.89	8.09			7.1	7.85
18-Jul-22	pH	5.0 - 9.0	7.78												7.81			
19-Jul-22	pH	5.0 - 9.0		7.91	7.99	7.62										8.05		
20-Jul-22	pH	5.0 - 9.0					7.62	6.98	7.69	7.67								
21-Jul-22	pH	5.0 - 9.0									7.63		8.1	8.19			7.8	8.59
26-Jul-22	pH	5.0 - 9.0		8.19	8.6	8.08										8.55		
27-Jul-22	pH	5.0 - 9.0					7.41	7.16	7.09	7.92								
28-Jul-22	pH	5.0 - 9.0									7.58	6.64	7.71	7.6			6.49	7.26
1-Aug-22	pH	5.0 - 9.0	7.46												8.49			
2-Aug-22	pH	5.0 - 9.0		7.3	7.69	7.98										7.73		
3-Aug-22	pH	5.0 - 9.0					7.43	7.88	7.46	7.43								
4-Aug-22	pH	5.0 - 9.0									7.64	7.95	8.21	8.3			7.4	8.14
9-Aug-22	pH	5.0 - 9.0		7.96	7.03	6.79												
10-Aug-22	pH	5.0 - 9.0					6.61	6.87	6.64	6.84								
11-Aug-22	pH	5.0 - 9.0									6.77		6.81	7.45			7.27	7.11
16-Aug-22	pH	5.0 - 9.0		7.74	8.29	8.5										8.03		
17-Aug-22	pH	5.0 - 9.0					8.04	7.8	8.09	7.98								

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
18-Aug-22	pH	5.0 - 9.0									8.16		8.67	7.32			8.01	8.45
22-Aug-22	pH	5.0 - 9.0	6.67												7.72			
24-Aug-22	pH	5.0 - 9.0		7.15	7.56	8.52										7.76		
25-Aug-22	pH	5.0 - 9.0					7.66	7.33	6.89	6.9								
26-Aug-22	pH	5.0 - 9.0									6.85	6.95	6.95	6.73			7.1	6.09
29-Aug-22	pH	5.0 - 9.0		7.37	7.6	8.24										7.87		
30-Aug-22	pH	5.0 - 9.0					8.02	7.58	6.8	6.83								
31-Aug-22	pH	5.0 - 9.0									6.73	6.95	7	6.87			7.09	6.52
5-Sep-22	pH	5.0 - 9.0	6.79												6.56			
6-Sep-22	pH	5.0 - 9.0		6.93	7.95	8.55										7.84		
7-Sep-22	pH	5.0 - 9.0					7.85	7.75	6.86	6.93								
8-Sep-22	pH	5.0 - 9.0									6.86	7.12	7.06	7.13			7.09	6.28
13-Sep-22	pH	5.0 - 9.0		7.15	8.04	7.8										7.88		
14-Sep-22	pH	5.0 - 9.0					7.96	7.18	6.84	7								
15-Sep-22	pH	5.0 - 9.0									6.89	7.12	7.04	6.88			7.31	6.68
19-Sep-22	pH	5.0 - 9.0	7.18												6.99			
20-Sep-22	pH	5.0 - 9.0		7.25	8.34	7.92												
21-Sep-22	pH	5.0 - 9.0					7.27	7.49	6.87	7.05								
22-Sep-22	pH	5.0 - 9.0									7.05	7.11	7.14	7			7.2	6.99
27-Sep-22	pH	5.0 - 9.0		8.32	7.08	7.05												
28-Sep-22	pH	5.0 - 9.0					7.14	7.03	6.75	6.75								
29-Sep-22	pH	5.0 - 9.0									6.82	7.13	7.07	6.87			7.13	7.07
4-Jul-22	Sat. DO (%)		80.4												82.7			
5-Jul-22	Sat. DO (%)			98.9	91.1	101.5										92.1		
6-Jul-22	Sat. DO (%)						101.8	96.8	40.7	35.9								
7-Jul-22	Sat. DO (%)										52.3	52.2	65.4	54.4			78.6	75.9
12-Jul-22	Sat. DO (%)			99.3	109.5	109.4												

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
13-Jul-22	Sat. DO (%)						97.3	97	61.3	61.8								
14-Jul-22	Sat. DO (%)										101.7	88.2	78.3	80			87.5	80.9
18-Jul-22	Sat. DO (%)		93.4												94.2			
19-Jul-22	Sat. DO (%)			108.8	129.3	120.1										114.4		
20-Jul-22	Sat. DO (%)						90.3	92.3	44.3	31.3								
21-Jul-22	Sat. DO (%)										49.8		65.9	74.2			95.1	87.1
26-Jul-22	Sat. DO (%)			88.2	102.3	105.7										94.5		
27-Jul-22	Sat. DO (%)						107.6	107.1	32.5	36.2								
28-Jul-22	Sat. DO (%)										63.7	52.4	74	76.8			83.9	81.9
1-Aug-22	Sat. DO (%)		94.4												83.7			
2-Aug-22	Sat. DO (%)			89.4	98.7	110.5										96.4		
3-Aug-22	Sat. DO (%)						101.6	101.5	37.4	55.2								
4-Aug-22	Sat. DO (%)										46.6	56.9	72.7	75.2			81.9	82.5
9-Aug-22	Sat. DO (%)			90.4	109.9	109.1												
10-Aug-22	Sat. DO (%)						87.6	86.4	32.8	30.8								
11-Aug-22	Sat. DO (%)										54.9		64.9	88.5			87.2	94.7
16-Aug-22	Sat. DO (%)			97.5	108.7	112.8												
17-Aug-22	Sat. DO (%)						102.7	92.2	43.1	53.1								
18-Aug-22	Sat. DO (%)										68.7		81.7	76.6			85.9	93.9
22-Aug-22	Sat. DO (%)		86.5												68.1			
24-Aug-22	Sat. DO (%)			96.8	113.6	121.9										113.1		
25-Aug-22	Sat. DO (%)						97.8	96.9	47.4	41.4								
26-Aug-22	Sat. DO (%)										52.2	60.5	74.8	79.7			94.5	82.2
29-Aug-22	Sat. DO (%)			80.7	101.2	105.2										99.9		
30-Aug-22	Sat. DO (%)						101.2	94.6	32.4	37.6								
31-Aug-22	Sat. DO (%)										80.8	93	96.8	95.4			121.1	109.7
5-Sep-22	Sat. DO (%)		99.1												102.1			

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
6-Sep-22	Sat. DO (%)			82.5	119.7	119.5										108.7		
7-Sep-22	Sat. DO (%)						110.3	112.8	53.9	59.2								
8-Sep-22	Sat. DO (%)										58.7	58	68.4	70.6			85.5	79.1
13-Sep-22	Sat. DO (%)			91.2	121.6	114.2										106.8		
14-Sep-22	Sat. DO (%)						103	102.8	37.5	43.3								
15-Sep-22	Sat. DO (%)										67.5	75	89.4	82.1			99.1	98.4
19-Sep-22	Sat. DO (%)		89.6												93.1			
20-Sep-22	Sat. DO (%)			85.9	118.3	102.1												
21-Sep-22	Sat. DO (%)						112.9	112.8	72.7	105.3								
22-Sep-22	Sat. DO (%)										83.7	85.9	98.4	97.7			103.6	103.5
27-Sep-22	Sat. DO (%)			139.1	109.8	100.3												
28-Sep-22	Sat. DO (%)						99.6	91.6	65.5	71.7								
29-Sep-22	Sat. DO (%)										75.1	81.4	93.4	82.3			95.6	102.7
4-Jul-22	DO (mg/L)	>6.0	6.36												6.75			
5-Jul-22	DO (mg/L)	>6.0		8.03	6.88	7.56										7.55		
6-Jul-22	DO (mg/L)	>6.0					7.68	7.46	3.27	2.91								
7-Jul-22	DO (mg/L)	>6.0									4.33	4.3	5.37	4.54			6.31	6.25
12-Jul-22	DO (mg/L)	>6.0		8.28	8.31	8.08												
13-Jul-22	DO (mg/L)	>6.0					7.34	7.37	4.83	4.59								
14-Jul-22	DO (mg/L)	>6.0									8.2	7.01	6.25	6.38			6.82	6.52
18-Jul-22	DO (mg/L)	>6.0	7.3												7.73			
19-Jul-22	DO (mg/L)	>6.0		8.85	9.44	8.88										9.39		
20-Jul-22	DO (mg/L)	>6.0					6.72	6.98	3.63	2.47								
21-Jul-22	DO (mg/L)	>6.0									4.09		5.38	5.99			7.36	7.3
26-Jul-22	DO (mg/L)	>6.0		7.15	7.4	7.55										7.47		
27-Jul-22	DO (mg/L)	>6.0					7.93	8.01	2.65	2.9								
28-Jul-22	DO (mg/L)	>6.0									5.14	4.21	5.88	5.94			6.36	6.41

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
1-Aug-22	DO (mg/L)	>6.0	7.61												7.01			
2-Aug-22	DO (mg/L)	>6.0		7.34	7.24	8.05										8.05		
3-Aug-22	DO (mg/L)	>6.0					7.52	7.6	3.04	4.4								
4-Aug-22	DO (mg/L)	>6.0									3.8	4.6	5.77	5.98			6.33	6.39
9-Aug-22	DO (mg/L)	>6.0		7.52	8.18	8.09												
10-Aug-22	DO (mg/L)	>6.0					6.6	6.6	2.65	2.48								
11-Aug-22	DO (mg/L)	>6.0									4.48		5.27	7.15			6.92	7.91
16-Aug-22	DO (mg/L)	>6.0		8.17	8.12	8.35										8.1		
17-Aug-22	DO (mg/L)	>6.0					7.78	7.11	3.51	4.21								
18-Aug-22	DO (mg/L)	>6.0									5.6		6.69	6.09			6.98	7.86
22-Aug-22	DO (mg/L)	>6.0	7.23												6.77			
24-Aug-22	DO (mg/L)	>6.0		7.98	8.43	9.08										9.34		
25-Aug-22	DO (mg/L)	>6.0					7.41	7.5	3.89	3.39								
26-Aug-22	DO (mg/L)	>6.0									4.28	4.96	6.06	6.52			7.67	6.75
29-Aug-22	DO (mg/L)	>6.0		6.5	7.52	7.6										8.35		
30-Aug-22	DO (mg/L)	>6.0					7.62	7.18	2.64	3.02								
31-Aug-22	DO (mg/L)	>6.0									6.59	7.53	7.76	7.63			9.54	8.78
5-Sep-22	DO (mg/L)	>6.0	8.07												8.49			
6-Sep-22	DO (mg/L)	>6.0		6.72	8.47	8.69										9.02		
7-Sep-22	DO (mg/L)	>6.0					8.27	8.54	4.4	4.69								
8-Sep-22	DO (mg/L)	>6.0									4.83	4.76	5.56	5.75			6.75	6.36
13-Sep-22	DO (mg/L)	>6.0		7.15	8.84	8.55										8.96		
14-Sep-22	DO (mg/L)	>6.0					7.82	7.76	3.07	3.49								
15-Sep-22	DO (mg/L)	>6.0									5.5	6.07	7.28	6.2			7.83	7.9
19-Sep-22	DO (mg/L)	>6.0	7.25												7.72			
20-Sep-22	DO (mg/L)	>6.0		6.78	8.55	7.42												
21-Sep-22	DO (mg/L)	>6.0					8.61	8.65	5.93	7.92								

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
22-Sep-22	DO (mg/L)	>6.0									6.8	6.95	7.89	7.72			8.27	8.42
27-Sep-22	DO (mg/L)	>6.0		10.44	8.05	7.4												
28-Sep-22	DO (mg/L)	>6.0					7.65	7.06	5.38	5.86								
29-Sep-22	DO (mg/L)	>6.0									6.15	6.66	7.61	6.75			7.72	8.39
4-Jul-22	Conductivity (µs/cm)		99												37			
5-Jul-22	Conductivity (µs/cm)			87	79	73										90		
6-Jul-22	Conductivity (µs/cm)						70	69	79	80								
7-Jul-22	Conductivity (µs/cm)										79	81	61	48			102	15
12-Jul-22	Conductivity (µs/cm)			80	77	73												
13-Jul-22	Conductivity (µs/cm)						69	68	77	73								
14-Jul-22	Conductivity (µs/cm)										69	78	74	64			97	18
18-Jul-22	Conductivity (µs/cm)		107												33			
19-Jul-22	Conductivity (µs/cm)			78	78	71										93		
20-Jul-22	Conductivity (µs/cm)						63	63	75	74								
21-Jul-22	Conductivity (µs/cm)										77		74	54			100	15
26-Jul-22	Conductivity (µs/cm)			79	73	68										82		
27-Jul-22	Conductivity (µs/cm)						64	64	74	73								
28-Jul-22	Conductivity (µs/cm)										76	77	75	65			102	20
1-Aug-22	Conductivity (µs/cm)		84												28			
2-Aug-22	Conductivity (µs/cm)			78	70	68										63		
3-Aug-22	Conductivity (µs/cm)						63	61	70	69								
4-Aug-22	Conductivity (µs/cm)										69	70	65	58			97	15
9-Aug-22	Conductivity (µs/cm)			78	76	68												
10-Aug-22	Conductivity (µs/cm)						66	63	78	77								
11-Aug-22	Conductivity (µs/cm)										78		73				87	11
16-Aug-22	Conductivity (µs/cm)			85	76	67										68		
17-Aug-22	Conductivity (µs/cm)						65	63	74	72								

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
18-Aug-22	Conductivity (µs/cm)										55		30	62			42	11
22-Aug-22	Conductivity (µs/cm)		113												28			
24-Aug-22	Conductivity (µs/cm)			92	78	68										77		
25-Aug-22	Conductivity (µs/cm)						67	66	77	78								
26-Aug-22	Conductivity (µs/cm)										78	78	65	49			110	16
29-Aug-22	Conductivity (µs/cm)			105	77	68										86		
30-Aug-22	Conductivity (µs/cm)						67	65	77	76								
31-Aug-22	Conductivity (µs/cm)										77	78	77	65			93	21
5-Sep-22	Conductivity (µs/cm)		91												32			
6-Sep-22	Conductivity (µs/cm)			78	74	67										88		
7-Sep-22	Conductivity (µs/cm)						67	65	80	79								
8-Sep-22	Conductivity (µs/cm)										79	79	78	74			96	22
13-Sep-22	Conductivity (µs/cm)			96	72	63										81		
14-Sep-22	Conductivity (µs/cm)						64	61	75	74								
15-Sep-22	Conductivity (µs/cm)										73	75	70	63			95	17
19-Sep-22	Conductivity (µs/cm)		92												32			
20-Sep-22	Conductivity (µs/cm)			92	71	64												
21-Sep-22	Conductivity (µs/cm)						64	61	74	68								
22-Sep-22	Conductivity (µs/cm)										72	74	69	55			87	16
27-Sep-22	Conductivity (µs/cm)			69	68	60												
28-Sep-22	Conductivity (µs/cm)						61	58	71	68								
29-Sep-22	Conductivity (µs/cm)										69	72	69	62			92	19
4-Jul-22	Temperature (°C)		26.62												25.57			
5-Jul-22	Temperature (°C)			25.9	29.98	30.87										25.39		
6-Jul-22	Temperature (°C)						30.06	28.95	26.4	26.06								
7-Jul-22	Temperature (°C)										25.03	25.21	25.36	25.47			26.89	25.31
12-Jul-22	Temperature (°C)			24.57	29.88	31.22												

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
13-Jul-22	Temperature (°C)						30.05	29.73	27.23	30.54								
14-Jul-22	Temperature (°C)										26.41	26.96	26.92	28.09			28.22	26.37
18-Jul-22	Temperature (°C)		22.5												9.78			
19-Jul-22	Temperature (°C)			25.72	31.93	31.21										25.37		
20-Jul-22	Temperature (°C)						30.95	29.89	25.91	27.37								
21-Jul-22	Temperature (°C)										25.41		25.54	26.3			28.55	24.28
26-Jul-22	Temperature (°C)			26.13	32.62	33.3										27.42		
27-Jul-22	Temperature (°C)						31.39	30.58	25.96	26.94								
28-Jul-22	Temperature (°C)										26.28	26.48	27.03	27.08			29.65	28.01
1-Aug-22	Temperature (°C)		26.3												24.87			
2-Aug-22	Temperature (°C)			25.4	31.65	32.17										24.55		
3-Aug-22	Temperature (°C)						31.19	30.58	26.12	27.26								
4-Aug-22	Temperature (°C)										25.76	26.23	27.02	27.33			28.69	27.2
9-Aug-22	Temperature (°C)			24.65	30.95	30.74												
10-Aug-22	Temperature (°C)						30.22	29.33	26.25	27.05								
11-Aug-22	Temperature (°C)										25.7		25.9	26.2			27.21	24.39
16-Aug-22	Temperature (°C)			24.29	30.71	31.06										30.72		
17-Aug-22	Temperature (°C)						29.75	28.87	26.07	26.99								
18-Aug-22	Temperature (°C)										25.74		25.51	27.29			25.89	24.36
22-Aug-22	Temperature (°C)		24.37												23.9			
24-Aug-22	Temperature (°C)			24.89	31.2	30.87										24.6		
25-Aug-22	Temperature (°C)						29.81	28.67	25.74	26.4								
26-Aug-22	Temperature (°C)										25.38	25.5	25.49	25.54			26	25.35
29-Aug-22	Temperature (°C)			26.34	30.96	30.99										24.38		
30-Aug-22	Temperature (°C)						30.12	29.73	25.65	26.66								
31-Aug-22	Temperature (°C)										25.67	26.09	26.57	26.7			27.64	26.82
5-Sep-22	Temperature (°C)		25.8												24.53			

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
6-Sep-22	Temperature (°C)			26.02	34.1	32.03										24.66		
7-Sep-22	Temperature (°C)						30.43	29.83	25.7	27.44								
8-Sep-22	Temperature (°C)										25.4	25.62	25.85	26.35			27.46	26.53
13-Sep-22	Temperature (°C)			27.58	32.46	30.48										24.13		
14-Sep-22	Temperature (°C)						29.76	29.93	25.56	26.34								
15-Sep-22	Temperature (°C)										25.74	26.05	26.34	26.52			27.46	26.56
19-Sep-22	Temperature (°C)		26.19												24.75			
20-Sep-22	Temperature (°C)			27.7	32.48	32.2												
21-Sep-22	Temperature (°C)						29.78	29.08	25.88	30.33								
22-Sep-22	Temperature (°C)										25.91	26.12	26.63	27.99			27.24	26.22
27-Sep-22	Temperature (°C)			30.45	31.7	31.29												
28-Sep-22	Temperature (°C)						29.04	28.78	25.46	25.58								
29-Sep-22	Temperature (°C)										25.44	25.47	25.94	26.77			26.21	25.67
4-Jul-22	Turbidity (NTU)		49.5												19			
5-Jul-22	Turbidity (NTU)			59.3	3.02	1.68										18		
6-Jul-22	Turbidity (NTU)						3.11	1.6	1.9	2.31								
7-Jul-22	Turbidity (NTU)										3.17	4.56	20.2	33.9			60.3	40
12-Jul-22	Turbidity (NTU)			39.8	3.08	1.05												
13-Jul-22	Turbidity (NTU)						1.33	1.32	1.83	1.58								
14-Jul-22	Turbidity (NTU)										2.54	13.9	13.4	12.6			36	9.49
19-Jul-22	Turbidity (NTU)			64.8	2.07	1.54										13.1		
20-Jul-22	Turbidity (NTU)						1.71	1.13	1.35	1.31								
21-Jul-22	Turbidity (NTU)										2.22		16.7	29.9			137	2.49
26-Jul-22	Turbidity (NTU)			68.8	2.13	1.16										18.4		
27-Jul-22	Turbidity (NTU)						1.59	1.34										
16-Aug-22	Turbidity (NTU)			101	2.13	1.34										4.17		
17-Aug-22	Turbidity (NTU)						1.42	1.39	2.78	2.69								

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
18-Aug-22	Turbidity (NTU)										68.4		245	17.7			304	34.7
22-Aug-22	Turbidity (NTU)		151												13.5			
24-Aug-22	Turbidity (NTU)			30	1.8	1.31										27.5		
25-Aug-22	Turbidity (NTU)						1.6	1.14	3.35	3								
26-Aug-22	Turbidity (NTU)										5.36	15.4	22.4	35			51.7	46.8
29-Aug-22	Turbidity (NTU)			19.1	1.96	2										34.6		
30-Aug-22	Turbidity (NTU)						1.52	2.21	4.81	3.85								
31-Aug-22	Turbidity (NTU)										4.49	6.33	9.65	7.49			25.4	5.22
5-Sep-22	Turbidity (NTU)		214												14.9			
6-Sep-22	Turbidity (NTU)			70.4	2.09	1.96										29.1		
7-Sep-22	Turbidity (NTU)						2.38	1.64	3.58	3.37								
8-Sep-22	Turbidity (NTU)										4.53	4.95	7.16	6.53			19.9	3.72
13-Sep-22	Turbidity (NTU)			25.2	4.36	2.1										20.7		
14-Sep-22	Turbidity (NTU)						1.45	1.41	3.56	3.62								
15-Sep-22	Turbidity (NTU)										3.01	5.78	8.55	9.13			20.6	3.96
19-Sep-22	Turbidity (NTU)		81												12.8			
20-Sep-22	Turbidity (NTU)			41.7	3.58	2.29												
21-Sep-22	Turbidity (NTU)						2.07	1.75	3	8.92								
22-Sep-22	Turbidity (NTU)										3.33	6.62	13.5	11.6			22.7	4.41
27-Sep-22	Turbidity (NTU)			9.31	43.4	1.7												
28-Sep-22	Turbidity (NTU)						1.73	1.62	2.71	3.22								
29-Sep-22	Turbidity (NTU)										3.1	4.4	6.52	5.69			11	4.11
4-Jul-22	TSS (mg/L)		43.06												12.55			
5-Jul-22	TSS (mg/L)			43.38		<5										23.37		
6-Jul-22	TSS (mg/L)						<5	<5	<5	<5								
7-Jul-22	TSS (mg/L)										<5	<5	18.4	28.66			35	21.2
1-Aug-22	TSS (mg/L)		116												10.42			

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
2-Aug-22	TSS (mg/L)			490		<5										110		
3-Aug-22	TSS (mg/L)						<5	<5	<5	<5								
4-Aug-22	TSS (mg/L)										<5	6.23	10.8	14.62			42.8	<5
5-Sep-22	TSS (mg/L)		392.5												14.46			
6-Sep-22	TSS (mg/L)			32.02		<5										29.23		
7-Sep-22	TSS (mg/L)						<5	<5	<5	<5								
8-Sep-22	TSS (mg/L)										<5	<5	5.8	13.36			<5	<5
4-Jul-22	BOD_5 (mg/L)	<1.5	<1												<1			
5-Jul-22	BOD_5 (mg/L)	<1.5		<1		<1										<1		
6-Jul-22	BOD_5 (mg/L)	<1.5					<1	<1	<1	<1								
7-Jul-22	BOD_5 (mg/L)	<1.5									<1	<1	<1	<1			<1	<1
1-Aug-22	BOD_5 (mg/L)	<1.5	1.05												1.5			
2-Aug-22	BOD_5 (mg/L)	<1.5		<1		<1										<1		
3-Aug-22	BOD_5 (mg/L)	<1.5					<1	<1	<1	<1								
4-Aug-22	BOD_5 (mg/L)	<1.5									<1	<1	<1	<1			<1	<1
5-Sep-22	BOD_5 (mg/L)	<1.5	<1												1.3			
6-Sep-22	BOD_5 (mg/L)	<1.5		<1		1.26										<1		
7-Sep-22	BOD_5 (mg/L)	<1.5					<1	<1	<1	<1								
8-Sep-22	BOD_5 (mg/L)	<1.5									<1	<1	<1	<1			<1	<1
4-Jul-22	COD (mg/L)	<5.0	6.4												<5			
5-Jul-22	COD (mg/L)	<5.0														<5		
6-Jul-22	COD (mg/L)	<5.0							<5	<5								
7-Jul-22	COD (mg/L)	<5.0									<5	9.6	<5	10				6.8
1-Aug-22	COD (mg/L)	<5.0	16												<5			
3-Aug-22	COD (mg/L)	<5.0							<5	6.4								
4-Aug-22	COD (mg/L)	<5.0															12.8	9.6
5-Sep-22	COD (mg/L)	<5.0	18.8												<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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
6-Sep-22	COD (mg/L)	<5.0																
7-Sep-22	COD (mg/L)	<5.0							<5	<5						<5		
8-Sep-22	COD (mg/L)	<5.0									9.6	<5	<5	<5			<5	<5
4-Jul-22	NH_3-N (mg/L)	<0.2	<0.2												<0.2			
5-Jul-22	NH_3-N (mg/L)	<0.2		<0.2		<0.2										<0.2		
6-Jul-22	NH_3-N (mg/L)	<0.2					<0.2	<0.2										
1-Aug-22	NH_3-N (mg/L)	<0.2	<0.2												<0.2			
2-Aug-22	NH_3-N (mg/L)	<0.2		<0.2														
5-Sep-22	NH_3-N (mg/L)	<0.2	<0.2												<0.2			
6-Sep-22	NH_3-N (mg/L)	<0.2		<0.2		<0.2										<0.2		
7-Sep-22	NH_3-N (mg/L)	<0.2					<0.2	<0.2										
4-Jul-22	NO_3-N (mg/L)	<5.0	0.07												0.07			
5-Jul-22	NO_3-N (mg/L)	<5.0		0.06		0.07										0.06		
6-Jul-22	NO_3-N (mg/L)	<5.0					<0.02	0.06										
1-Aug-22	NO_3-N (mg/L)	<5.0	0.13												0.1			
4-Aug-22	NO_3-N (mg/L)	<5.0		0.14														
5-Sep-22	NO_3-N (mg/L)	<5.0	0.09												0.05			
6-Sep-22	NO_3-N (mg/L)	<5.0		0.08		0.05										0.04		
7-Sep-22	NO_3-N (mg/L)	<5.0					0.05	0.05										
4-Jul-22	Faecal coliform (MPN/100 mL)	<1,000	1,600												1,600			
5-Jul-22	Faecal coliform (MPN/100 mL)	<1,000													220			
6-Jul-22	Faecal coliform (MPN/100 mL)	<1,000							5	5								
7-Jul-22	Faecal coliform (MPN/100 mL)	<1,000									17	170	220	540			920	350

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
1-Aug-22	Faecal coliform (MPN/100 mL)	<1,000	1,600												920			
2-Aug-22	Faecal coliform (MPN/100 mL)	<1,000														1,600		
3-Aug-22	Faecal coliform (MPN/100 mL)	<1,000							920	79								
4-Aug-22	Faecal coliform (MPN/100 mL)	<1,000									70	350	140	220			920	220
5-Sep-22	Faecal coliform (MPN/100 mL)	<1,000	1,600												350			
6-Sep-22	Faecal coliform (MPN/100 mL)	<1,000														540		
7-Sep-22	Faecal coliform (MPN/100 mL)	<1,000							11	22								
8-Sep-22	Faecal coliform (MPN/100 mL)	<1,000									49	70	110	220			540	110
4-Jul-22	Total Coliform (MPN/100 mL)	<5,000	1,600												1,600			
5-Jul-22	Total Coliform (MPN/100 mL)	<5,000														250		
6-Jul-22	Total Coliform (MPN/100 mL)	<5,000							27	22								
7-Jul-22	Total Coliform (MPN/100 mL)	<5,000									22	220	280	920			1,600	920
1-Aug-22	Total Coliform (MPN/100 mL)	<5,000	1,600												1,600			
2-Aug-22	Total Coliform (MPN/100 mL)	<5,000														1,600		
3-Aug-22	Total Coliform (MPN/100 mL)	<5,000							1,600	110								
4-Aug-22	Total Coliform (MPN/100 mL)	<5,000									110	350	280	920			1,600	280

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
5-Sep-22	Total Coliform (MPN/100 mL)	<5,000	1,600												930			
6-Sep-22	Total Coliform (MPN/100 mL)	<5,000														1,600		
7-Sep-22	Total Coliform (MPN/100 mL)	<5,000							17	27								
8-Sep-22	Total Coliform (MPN/100 mL)	<5,000									130	170	280	280			920	140
4-Jul-22	TKN		<1.5												<1.5			
5-Jul-22	TKN			<1.5		<1.5										<1.5		
6-Jul-22	TKN						<1.5	<1.5										
1-Aug-22	TKN		<1.5												<1.5			
2-Aug-22	TKN			<1.5														
5-Sep-22	TKN		<1.5												<1.5			
6-Sep-22	TKN			<1.5		<1.5										<1.5		
7-Sep-22	TKN						<1.5	<1.5										
5-Jul-22	Secchi Disk (m)				2	3												
6-Jul-22	Secchi Disk (m)						2.75	3	3.5	3								
12-Jul-22	Secchi Disk (m)				1.75	3.5												
13-Jul-22	Secchi Disk (m)						3.25	3.3	3.5	3.3								
19-Jul-22	Secchi Disk (m)				2.1	3												
20-Jul-22	Secchi Disk (m)						2.75	3	3.6	4								
26-Jul-22	Secchi Disk (m)				2.2	3												
27-Jul-22	Secchi Disk (m)						3	3.2	3.4	3								
2-Aug-22	Secchi Disk (m)				1.75	2.75												
3-Aug-22	Secchi Disk (m)						3	3.25	1.75	2								
9-Aug-22	Secchi Disk (m)				2	2.9												
10-Aug-22	Secchi Disk (m)						3	3.2	2.5	2.4								

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
16-Aug-22	Secchi Disk (m)				3	3.2												
17-Aug-22	Secchi Disk (m)						3.25	3	2.7	2.2								
24-Aug-22	Secchi Disk (m)			0.2	2	3.7												
25-Aug-22	Secchi Disk (m)						3	3.1	2	2.5								
29-Aug-22	Secchi Disk (m)			0.5	2.5	3												
30-Aug-22	Secchi Disk (m)						2.8	2.7	2	2.3								
6-Sep-22	Secchi Disk (m)			0.15	2	3.2												
7-Sep-22	Secchi Disk (m)						3.1	2.9	2.1	2.75								
13-Sep-22	Secchi Disk (m)			0.5	1.5	3												
14-Sep-22	Secchi Disk (m)						3	2.75	2.25	2.2								
20-Sep-22	Secchi Disk (m)			0.5	2.5	2.2												
21-Sep-22	Secchi Disk (m)						2.8	3	2.4	1.6								
27-Sep-22	Secchi Disk (m)			1	1.5	2.75												
28-Sep-22	Secchi Disk (m)						3.25	3.5	2.75	2.5								
4-Jul-22	TOC (mg/L)		2.34												2.07			
5-Jul-22	TOC (mg/L)															2.42		
6-Jul-22	TOC (mg/L)								2.01	1.87								
7-Jul-22	TOC (mg/L)										2	1.97	2.9	3.16				7.56
1-Aug-22	TOC (mg/L)		4.16												6.88			
3-Aug-22	TOC (mg/L)								2.89	2.72								
4-Aug-22	TOC (mg/L)																3.34	2.37
5-Sep-22	TOC (mg/L)		3.32												2			
6-Sep-22	TOC (mg/L)															0.62		
7-Sep-22	TOC (mg/L)								1.89	1.63								
8-Sep-22	TOC (mg/L)										2.18	1.65	1.6	1.72			1.62	3.54
5-Jul-22	Phytoplankton Biomass (g dry wt/m^3)			43.2		1												

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
6-Jul-22	Phytoplankton Biomass (g dry wt/m³)						0.6	0.4										
1-Aug-22	Phytoplankton Biomass (g dry wt/m³)			489														
4-Jul-22	Total Phosphorus (mg/L)		0.03												0.01			
5-Jul-22	Total Phosphorus (mg/L)			0.02		0.01										0.02		
6-Jul-22	Total Phosphorus (mg/L)						<0.01	<0.01										
1-Aug-22	Total Phosphorus (mg/L)		0.11												0.02			
2-Aug-22	Total Phosphorus (mg/L)			0.16														
5-Sep-22	Total Phosphorus (mg/L)		0.06												0.02			
6-Sep-22	Total Phosphorus (mg/L)			0.05		0.02										0.05		
7-Sep-22	Total Phosphorus (mg/L)						0.02	0.02										
4-Jul-22	Total Dissolved Phosphorus (mg/L)		0.02												<0.01			
5-Jul-22	Total Dissolved Phosphorus (mg/L)			0.01		0.01										0.02		
6-Jul-22	Total Dissolved Phosphorus (mg/L)						<0.01	<0.01										
1-Aug-22	Total Dissolved Phosphorus (mg/L)		0.07												0.01			
2-Aug-22	Total Dissolved Phosphorus (mg/L)			0.06														
5-Sep-22	Total Dissolved Phosphorus (mg/L)		0.03												0.01			

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
6-Sep-22	Total Dissolved Phosphorus (mg/L)			0.03		0.01										0.01		
7-Sep-22	Total Dissolved Phosphorus (mg/L)						<0.01	<0.01										
5-Jul-22	Hydrogen Sulfide (mg/L)			<0.02		<0.02												
6-Jul-22	Hydrogen Sulfide (mg/L)						<0.02	<0.02										
1-Aug-22	Hydrogen Sulfide (mg/L)			0.02														
6-Sep-22	Hydrogen Sulfide (mg/L)			<0.02		<0.02												
7-Sep-22	Hydrogen Sulfide (mg/L)						<0.02	<0.02										
5-Jul-22	Turbidity (NTU)-bottom					73.9												
6-Jul-22	Turbidity (NTU)-bottom						1	2										
6-Sep-22	Turbidity (NTU)-bottom					1.96												
7-Sep-22	Turbidity (NTU)-bottom						2.38	1.64										
5-Jul-22	TSS (mg/L)-bottom					83.33												
6-Jul-22	TSS (mg/L)-bottom						<5	<5										
2-Aug-22	TSS (mg/L)-bottom					18.02												
3-Aug-22	TSS (mg/L)-bottom						10.33	<5										
6-Sep-22	TSS (mg/L)-bottom					21.83												
7-Sep-22	TSS (mg/L)-bottom						<5	<5										
5-Jul-22	BOD_5 (mg/L)-bottom					4.46												
6-Jul-22	BOD_5 (mg/L)-bottom						4.16	<1										

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
2-Aug-22	BOD_5 (mg/L)-bottom					<1												
3-Aug-22	BOD_5 (mg/L)-bottom						5.4	7.28										
6-Sep-22	BOD_5 (mg/L)-bottom					<1												
7-Sep-22	BOD_5 (mg/L)-bottom						6.54	<1										
5-Jul-22	NH_3-N (mg/L)-bottom					0.51												
6-Jul-22	NH_3-N (mg/L)-bottom						0.3	<0.2										
6-Sep-22	NH_3-N (mg/L)-bottom					0.77												
7-Sep-22	NH_3-N (mg/L)-bottom						0.4	0.5										
5-Jul-22	NO_3-N (mg/L)-bottom					0.06												
6-Jul-22	NO_3-N (mg/L)-bottom						0.07	0.07										
6-Sep-22	NO_3-N (mg/L)-bottom					0.05												
7-Sep-22	NO_3-N (mg/L)-bottom						0.05	0.05										
5-Jul-22	TKN-bottom					<1.5												
6-Jul-22	TKN-bottom						<1.5	<1.5										
6-Sep-22	TKN-bottom					<1.5												
7-Sep-22	TKN-bottom						<1.5	<1.5										
5-Jul-22	Total Dissolved Phosphorus (mg/L)-bottom					0.01												
6-Jul-22	Total Dissolved Phosphorus (mg/L)-bottom						0.13	<0.01										
6-Sep-22	Total Dissolved Phosphorus (mg/L)-bottom					0.02												
7-Sep-22	Total Dissolved Phosphorus (mg/L)-bottom						0.03	0.02										

		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						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
5-Jul-22	Total Phosphorus (mg/L)-bottom					0.02												
6-Jul-22	Total Phosphorus (mg/L)-bottom						0.16	0.01										
6-Sep-22	Total Phosphorus (mg/L)-bottom					0.03												
7-Sep-22	Total Phosphorus (mg/L)-bottom						0.05	0.04										
5-Jul-22	Hydrogen Sulfide (mg/L)-bottom					<0.02												
6-Jul-22	Hydrogen Sulfide (mg/L)-bottom						<0.02	<0.02										
6-Sep-22	Hydrogen Sulfide (mg/L)-bottom					0.02												
7-Sep-22	Hydrogen Sulfide (mg/L)-bottom						0.02	<0.02										
5-Jul-22	Phytoplankton Biomass (g dry wt/m^3)-bottom					11.6												
6-Jul-22	Phytoplankton Biomass (g dry wt/m^3)-bottom						11.7	1.6										

APPENDIX 5-2: EFFLUENT CAMP MONITORING RESULTS – Q3 2022

		Site Name	OSOV1	OSOV 2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameter (Unit)	Guideline in the CA			
01-Jul-22	pH	6.0 - 9.0	7.27	7.39	7.3
15-Jul-22	pH	6.0 - 9.0	7.27	7.02	7.55
11-Aug-22	pH	6.0 - 9.0	7.05	6.73	7.09
23-Aug-22	pH	6.0 - 9.0	6.53	7.06	7.84
01-Sep-22	pH	6.0 - 9.0	6.4	7.6	7.77
16-Sep-22	pH	6.0 - 9.0	6.32	7.74	8.03
01-Jul-22	Sat. DO (%)		66.9	66.9	10.8
15-Jul-22	Sat. DO (%)		78.5	82.6	67.4
11-Aug-22	Sat. DO (%)		82.5	91.2	43.5
23-Aug-22	Sat. DO (%)		76.3	64	50.2
01-Sep-22	Sat. DO (%)		61.9	71.4	49.8
16-Sep-22	Sat. DO (%)		77.4	89.4	43.3
01-Jul-22	DO (mg/L)		5.22	5.14	0.81
15-Jul-22	DO (mg/L)		6	6.34	5.11
11-Aug-22	DO (mg/L)		6.54	7.14	3.35
23-Aug-22	DO (mg/L)		5.86	4.82	3.81
01-Sep-22	DO (mg/L)		4.72	5.36	3.7
16-Sep-22	DO (mg/L)		6.15	7.42	3.29
01-Jul-22	Conductivity (µs/cm)	-	275	552	1520
15-Jul-22	Conductivity (µs/cm)	-	312	522	1409
11-Aug-22	Conductivity (µs/cm)	-	228	509	1550
23-Aug-22	Conductivity (µs/cm)	-	270	454	1136
01-Sep-22	Conductivity (µs/cm)	-	402	591	1700
16-Sep-22	Conductivity (µs/cm)	-	322	531	1560
01-Jul-22	Temperature (°C)		27.67	28.63	29.74
15-Jul-22	Temperature (°C)		29.26	29.02	29.58
11-Aug-22	Temperature (°C)		27.23	27.88	28.54
23-Aug-22	Temperature (°C)		29.03	30.17	29.41
01-Sep-22	Temperature (°C)		29.36	30.24	30.66
16-Sep-22	Temperature (°C)		27.09	24.59	29.58
01-Jul-22	Turbidity (NTU)		1.31	9.74	26.3
15-Jul-22	Turbidity (NTU)		0.92	9.81	34.9
11-Aug-22	Turbidity (NTU)				
23-Aug-22	Turbidity (NTU)		1.16	17	13.6
01-Sep-22	Turbidity (NTU)		1.57	12.5	74.1
16-Sep-22	Turbidity (NTU)		0.48	11	66.5
01-Jul-22	TSS (mg/L)	<50	<5	11.2	19.6
15-Jul-22	TSS (mg/L)	<50	<5	5.82	35.86
11-Aug-22	TSS (mg/L)	<50	<5	7.3	24
23-Aug-22	TSS (mg/L)	<50	<5	24.4	16.33
01-Sep-22	TSS (mg/L)	<50	<5	14	51
16-Sep-22	TSS (mg/L)	<50	<5	13.56	48.84
01-Jul-22	BOD5 (mg/L)	<30			
15-Jul-22	BOD5 (mg/L)	<30	<6	<6	<6
11-Aug-22	BOD5 (mg/L)	<30	11.91	18	62.7
23-Aug-22	BOD5 (mg/L)	<30	<6	20.34	17.7

		Site Name	OSOV1	OSOV 2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameter (Unit)	Guideline in the CA			
01-Sep-22	BOD5 (mg/L)	<30	6.78	13.07	97.05
16-Sep-22	BOD5 (mg/L)	<30	<6	11.37	66
01-Jul-22	COD (mg/L)	<125	<25	36.5	92
15-Jul-22	COD (mg/L)	<125	<25	30.0	116
11-Aug-22	COD (mg/L)	<125	<25	30.0	121
23-Aug-22	COD (mg/L)	<125	<25	52.5	50
01-Sep-22	COD (mg/L)	<125	<25	47.5	168
16-Sep-22	COD (mg/L)	<125	<25	32.2	150
01-Jul-22	NH3-N (mg/L)	<10.0	<2	22.1	91
15-Jul-22	NH3-N (mg/L)	<10.0	<2	18.9	77
11-Aug-22	NH3-N (mg/L)	<10.0	<2	19.8	80
23-Aug-22	NH3-N (mg/L)	<10.0	<2	13.5	63
01-Sep-22	NH3-N (mg/L)	<10.0	<2	19.8	103
16-Sep-22	NH3-N (mg/L)	<10.0	<2	25.4	89
01-Jul-22	Total Nitrogen (mg/L)	<10.0	0.58	24.0	96
15-Jul-22	Total Nitrogen (mg/L)	<10.0	0.37	20.4	83
11-Aug-22	Total Nitrogen (mg/L)	<10.0	0.38	21.2	84
23-Aug-22	Total Nitrogen (mg/L)	<10.0	0.58	14.4	74
01-Sep-22	Total Nitrogen (mg/L)	<10.0	0.21	21.2	107
16-Sep-22	Total Nitrogen (mg/L)	<10.0	2.38	26.9	91
01-Jul-22	Total Phosphorus (mg/L)	<2	1.13	2.4	8
15-Jul-22	Total Phosphorus (mg/L)	<2	1.2	1.6	6.7
11-Aug-22	Total Phosphorus (mg/L)	<2	1.0	1.7	8.2
23-Aug-22	Total Phosphorus (mg/L)	<2	0.9	1.4	5.6
01-Sep-22	Total Phosphorus (mg/L)	<2	1.2	2.0	7.4
16-Sep-22	Total Phosphorus (mg/L)	<2	1.3	2.2	7.0
01-Jul-22	Fecal Coliform (MPN/100mL)	<400	2,400	0	240
15-Jul-22	Fecal Coliform (MPN/100mL)	<400	5,400	0	1,600
11-Aug-22	Fecal Coliform (MPN/100mL)	<400	1,600	9,200	16,000
23-Aug-22	Fecal Coliform (MPN/100mL)	<400	920	5,400	3,500
01-Sep-22	Fecal Coliform (MPN/100mL)	<400	1,600	31	16,000
16-Sep-22	Fecal Coliform (MPN/100mL)	<400	1,600	130	92,000
01-Jul-22	Total coliform (MPN/100mL)	<400	9,200	13	1,600
15-Jul-22	Total coliform (MPN/100mL)	<400	5,400	0	1,600
11-Aug-22	Total coliform (MPN/100mL)	<400	1,600	16,000	16,000
23-Aug-22	Total coliform (MPN/100mL)	<400	1,600	16,000	16,000
01-Sep-22	Total coliform (MPN/100mL)	<400	1,600	540	16,000
16-Sep-22	Total coliform (MPN/100mL)	<400	1,600	250	92,000
01-Jul-22	Oil & Grease (mg/)	<10.0	<1	1	2
11-Aug-22	Oil & Grease (mg/)	<10.0	<1	<1	2
01-Sep-22	Oil & Grease (mg/)	<10.0	<1	<1	1
01-Jul-22	Residual Chlorine (mg/L)	<1.0		0.40	0.02
15-Jul-22	Residual Chlorine (mg/L)	<1.0		0.23	0.66
11-Aug-22	Residual Chlorine (mg/L)	<1.0		0.17	0.02
23-Aug-22	Residual Chlorine (mg/L)	<1.0		0.08	0.08
01-Sep-22	Residual Chlorine (mg/L)	<1.0		0.27	0.02
16-Sep-22	Residual Chlorine (mg/L)	<1.0		0.27	0.00

APPENDIX 5-3: COMMUNITY GROUNDWATER QUALITY MONITORING RESULTS – Q3 2022

		Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village	
Month Year	Parameter (Unit)	Station	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
		Guideline					
04-Jul-22	pH	6.5 - 9.2				6.38	6.66
25-Jul-22	pH	6.5 - 9.2	7.58	7.88	7.79		
01-Aug-22	pH	6.5 - 9.2				7.2	6.57
15-Aug-22	pH	6.5 - 9.2	7.13	6.77	6.73		
05-Sep-22	pH	6.5 - 9.2				6.02	6.81
12-Sep-22	pH	6.5 - 9.2	7.05	7.35	6.82		
04-Jul-22	Sat. DO (%)					68.5	64
25-Jul-22	Sat. DO (%)		73.2	78.2	74.5		
01-Aug-22	Sat. DO (%)					89.1	90.2
15-Aug-22	Sat. DO (%)		62.1	81.2	82.7		
05-Sep-22	Sat. DO (%)					87.2	84.8
12-Sep-22	Sat. DO (%)		72.8	84.8	43		
04-Jul-22	DO (mg/l)					5.27	5.11
25-Jul-22	DO (mg/l)		5.41	5.99	5.61		
01-Aug-22	DO (mg/l)					7.06	7.18
15-Aug-22	DO (mg/l)		4.88	6.42	6.53		
05-Sep-22	DO (mg/l)					7.04	6.85
12-Sep-22	DO (mg/l)		5.72	6.7	3.32		
04-Jul-22	Conductivity (µS/cm)					21	265
25-Jul-22	Conductivity (µS/cm)		355	422	350		
01-Aug-22	Conductivity (µS/cm)					17	208
15-Aug-22	Conductivity (µS/cm)		371	442	302		
05-Sep-22	Conductivity (µS/cm)					20	324
12-Sep-22	Conductivity (µS/cm)		379	467	318		
04-Jul-22	Temperature (°C)					28.93	26.96
25-Jul-22	Temperature (°C)		31.45	29.22	29.71		
01-Aug-22	Temperature (°C)					27.5	27.02
15-Aug-22	Temperature (°C)		27.99	27.39	27.44		
05-Sep-22	Temperature (°C)					26.29	26.18
12-Sep-22	Temperature (°C)		27.8	27.46	29.03		
04-Jul-22	Turbidity (NTU)	<20				2.31	1.8
25-Jul-22	Turbidity (NTU)	<20	1.58	0.59	2.18		
05-Sep-22	Turbidity (NTU)	<20				0.79	0.52
12-Sep-22	Turbidity (NTU)	<20	0.19	0.29	1.28		
04-Jul-22	Fecal coliform (MPN/100ml)	0				2	0

		Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village	
Month Year	**Parameter (Unit)**	**Station**	**GSXN01**	**GNPA01**	**GTHN01**	**GPOU01**	**GPOU02**
		Guideline					
25-Jul-22	Fecal coliform (MPN/100ml)	0	0	1.8	49		
01-Aug-22	Fecal coliform (MPN/100ml)	0				240	0
15-Aug-22	Fecal coliform (MPN/100ml)	0	0	9.3	130		
05-Sep-22	Fecal coliform (MPN/100ml)	0				240	0
12-Sep-22	Fecal coliform (MPN/100ml)	0	0	4.5	920		
04-Jul-22	E.coli Bacteria (MPN/100ml)	0				2	0
25-Jul-22	E.coli Bacteria (MPN/100ml)	0	0	1.8	49		
01-Aug-22	E.coli Bacteria (MPN/100ml)	0				240	0
15-Aug-22	E.coli Bacteria (MPN/100ml)	0	0	9.3	240		
05-Sep-22	E.coli Bacteria (MPN/100ml)	0				240	0
12-Sep-22	E.coli Bacteria (MPN/100ml)	0	0	4.5	920		
12-Sep-22	Arsenic (mg/)	<0.05	0.0013	0.0007	0.001		
12-Sep-22	Cadmium (mg/l)	<0.01	<0.003	<0.003	<0.003		
12-Sep-22	Total Iron (mg/l)	<1	<0.01	<0.01	0.019		
12-Sep-22	Total hardness (mg/l)	<500	177	190	141		
12-Sep-22	Selenium (mg/l)	<0.01	<0.0002	<0.0002	<0.0002		
12-Sep-22	Lead (mg/l)	<0.05	<0.008	<0.008	<0.008		

APPENDIX 5-4: GRAVITY FED WATER SUPPLY QUALITY MONITORING RESULTS – Q3 2022

		Site Name	Thaheau Village	Hat Gnuin Village	Phouhomxay Village	
		Station	WTHH02	WHGN02	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline				
25-Jul-22	pH	6.5 - 8.5	7.74	7.95	8.31	8.46
15-Aug-22	pH	6.5 - 8.5	7.8	7.88	8.57	8.71
12-Sep-22	pH	6.5 - 8.5	6.84	7.02	5.74	5.52
25-Jul-22	Sat. DO (%)		90	91.3	100.4	103
15-Aug-22	Sat. DO (%)		95.4	84.7	83.5	91.1
12-Sep-22	Sat. DO (%)		92.9	69.8	94.5	92.2
25-Jul-22	DO (mg/L)		6.05	6.84	7.54	7.92
15-Aug-22	DO (mg/L)		7.45	6.59	6.45	6.95
12-Sep-22	DO (mg/L)		7.4	5.5	7.12	
25-Jul-22	Conductivity (µS/cm)	<1,000	47	104	9	10
15-Aug-22	Conductivity (µS/cm)	<1,000	32	58	8	7
12-Sep-22	Conductivity (µS/cm)	<1,000	42	76	9	8
25-Jul-22	Temperature (°C)	<35	30.15	30.5	30.38	29.04
15-Aug-22	Temperature (°C)	<35	28.02	28.19	28.72	29.51
12-Sep-22	Temperature (°C)	<35	26.45	27.33	28.28	28.64
25-Jul-22	Turbidity (NTU)	<10	6.34	5.03	1.13	1.04
12-Sep-22	Turbidity (NTU)	<10	9.36	1.38	4.07	1.26
25-Jul-22	Faecal Coliform (MPN/100 mL)	0	94	49	17	26
15-Aug-22	Faecal Coliform (MPN/100 mL)	0	21	170	11	11
12-Sep-22	Faecal Coliform (MPN/100 mL)	0	33	7.8	350	170
25-Jul-22	E.coli Bacteria (MPN/100 mL)	0	94	49	17	17
15-Aug-22	E.coli Bacteria (MPN/100 mL)	0	17	170	11	11
12-Sep-22	E.coli Bacteria (MPN/100 mL)	0	23	4.5	170	130
12-Sep-22	Iron (mg/L)		0.243	0.023	0.14	0.167
12-Sep-22	Lead (mg/L)	<0.10	<0.01	<0.01	<0.01	<0.01
12-Sep-22	Total hardness (mg/L)	<300	23.3	41.2	5.4	5.4
12-Sep-22	Mercury (mg/L)	<0.001	<0.0002	<0.0002	<0.0002	<0.0002

APPENDIX 5-5: LANDFILL LEACHATE QUALITY MONITORING RESULTS – Q3 2022

		Site Name	NNP1 Landfill Leachate					Houay Soup Landfill	
		Location	Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point	Last pond	Discharged Point
		Station	LL1	LL2	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline							
1-Jul-22	pH	6.0-9.0				8.08		8.1	
12-Aug-22	pH	6.0-9.0				7.23		7.09	
2-Sep-22	pH	6.0-9.0				7.99		8.08	
1-Jul-22	Sat. DO (%)					80.9		126.7	
12-Aug-22	Sat. DO (%)					98		97.5	
2-Sep-22	Sat. DO (%)					95.1		116.4	
1-Jul-22	DO (mg/L)					6.02		9.36	
12-Aug-22	DO (mg/L)					7.7		7.73	
2-Sep-22	DO (mg/L)					6.71		8.24	
1-Jul-22	Conductivity (µS/cm)					73		160	
12-Aug-22	Conductivity (µS/cm)					52		121	
2-Sep-22	Conductivity (µS/cm)					47		148	
1-Jul-22	Temperature (°C)					31.44		31.21	
12-Aug-22	Temperature (°C)					27.75		27.3	
2-Sep-22	Temperature (°C)					34.11		33.76	
1-Jul-22	Turbidity (NTU)					34.9		8.29	
2-Sep-22	Turbidity (NTU)					21.7		5.16	
12-Aug-22	BOD_5 (mg/L)	<30				14.97		10.23	
2-Sep-22	BOD_5 (mg/L)	<30				11.5		11.7	
1-Jul-22	COD (mg/L)	<125				52.8		25	
12-Aug-22	COD (mg/L)	<125				41.2		<25	
2-Sep-22	COD (mg/L)	<125				36.8		<25	
1-Jul-22	Faecal Coliform (MPN/100mL)	<400				13		17	
12-Aug-22	Faecal Coliform (MPN/100mL)	<400				350		220	
2-Sep-22	Faecal Coliform (MPN/100mL)	<400				2		13	
1-Jul-22	Total Coliform (MPN/100mL)	<400				350		920	
12-Aug-22	Total Coliform (MPN/100mL)	<400				1,600		1,600	
2-Sep-22	Total Coliform (MPN/100mL)	<400				110		240	
1-Jul-22	Total Nitrogen (mg/L)	<10				1.66		2.8	
12-Aug-22	Total Nitrogen (mg/L)	<10				0.74		1.91	
2-Sep-22	Total Nitrogen (mg/L)	<10				0.22		1.99	

		Site Name	NNP1 Landfill Leachate					Houay Soup Landfill	
		Location	Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point	Last pond	Discharged Point
		Station	LL1	LL2	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline							
12-Aug-22	Lead (mg/L)	<0.2				<0.01		<0.01	
12-Aug-22	Copper (mg/L)					<0.005		<0.006	
12-Aug-22	Iron (mg/L)					0.62		0.753	
1-Jul-22	Ammonia nitrogen (mg/L)	<10				<2		2.20	
12-Aug-22	Ammonia nitrogen (mg/L)	<10				<2		<2	
2-Sep-22	Ammonia nitrogen (mg/L)	<10				<2		1.90	
1-Jul-22	Oil & Grease (mg/L)	<10				4		1	
12-Aug-22	Oil & Grease (mg/L)	<10				<1		1.8	
2-Sep-22	Oil & Grease (mg/L)	<10				<1		<1	

APPENDIX 5-6: SUMMARY PRELIMINARY STUDY RESULT OF POSSIBLE PROTOTYPE OF HYDRAULIC

	Drop Type	River Channel Structure	Tailrace Outlet Structure	Pump up and Drop	Combination Discharge
Feature	 NT2	On riverbed  	 NT2 		 Re-regulation gate discharge
Function	Air supplied during dropping	Air supplied caused by turbulence up to the structure on river bed	Air supplied by hitting water to obstruction with high velocity at tailrace outlet	Pump up water and drop	Combined with high DO through gate discharge and turbine discharge
Aerator Performance	Middle-High	Low	Middle	High	Middle (Depending on MPH discharge)
Construction Cost	0.5 MUSD	0.03 MUSD	0.1 MUSD	5 MUSD + Operation cost	None
Adverse Impact on Generation	-0.4 MUSD/year x 26 years = -10.4 MUSD	-0.05 MUSD/year x 26 years = -1.3 MUSD	-0.5 MUSD/year x 26 years = -13.0 MUSD	None	-2.7 MUSD/year x 26 years = -70.2 MUSD