



Nam Ngiep 1 Hydropower Project

Quarterly Environment Monitoring Report First Quarter of 2023

January to March 2023

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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
FPF	Forest Protection Fund
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 report 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 Q1 2023, the first ISO14001:2015 on site surveillance audit was carried out in February 2023 by the SGS. The audit included site tours, interviews with the NNP1's key personnel and verification of the Environmental Management System (EMS) performance. In March 2023, the SGS submitted a surveillance audit report to NNP1PC. A summary of a surveillance audit report is outlined in section 3, which pointed out one non-conformity concerning leachate from the food waste storage area at the OSOV1 canteen. However, immediate corrective actions were taken, and the mentioned non-compliance issue was closed. The report also included four general observations and opportunity of improvements (OFIs) that need to be followed up in the next surveillance audit scheduled for February 2024.

NNP1PC has developed Environmental Management Plans (EMPs) that will be implemented in 2023. The EMPs include four key areas of focus, including HSE awareness training for NNP1PC staff and contractors, reducing the paper consumption in NNP1 offices, reducing the quantity of waste disposal at NNP1 project landfill and tree planting.

During Q1 2023, no new document was submitted to the Environment Management Office (EMO) for review and approval. EMO issued one non-conformity concerning leachate from the food waste storage area at the OSOV1 canteen.

The wastewater treatment system operation and maintenance were closely monitored in February 2023 including chlorine dosing and bi-weekly inspections of the septic tanks and wetland systems. The results of the effluent analyses of the WWTSSs provide important feedback for guiding continuous adjustments and implementing necessary corrective actions.

During Q1 2023, all 31 rehabilitated areas were inspected, and no site disturbances were identified. The assessment of the vegetation cover will be resumed in the rainy season of 2023.

On 10 February 2023, a discussion on the handover of land (with non-exclusive land use rights) was carried out at OSOV1 with participation from the Department of Energy Business (DEB) of the Ministry of Energy and Mines (MEM), Ministry of Natural Resource and Environment (MONRE), Bolikhamxay Provincial Administration, Bolikhan District Office of Energy and Mine (DOEM), District Office of Natural Resource and Environment (DONRE), District Agriculture and Forestry Office (DAFO-BLK), Hat Gniun Village, Phouhomxay Village and NNP1.

A total of 25.2 m³ solid waste from NNP1 project sites and camps was disposed of at the NNP1 Project Landfill, an increase of 2.4 m³ compared with Q4 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 Q1 2023. The communities' general waste collection and the Houay Soup Landfill operation are in the process

of being handed over to the local authorities (Bolikhan District Environment Management Unit or EMU in Bolikhamxay Province).

The environmental flow requirements have been monitored in accordance with the ESMMP-OP and the results show full compliance with the requirements.

The concentration of dissolved oxygen (DO) at the surface level in R05 (Main Reservoir immediately upstream of the main dam) ranged between 4.3 mg/L and 8.7 mg/L. The explanation of DO, along with a table of DO measurement results at the intake level will be included from the next quarterly report. In addition, the DO concentrations in Nam Chian, Nam Xao and Nam Phouan were above 6 mg/L.

The DO concentrations at the surface level in the Re-regulation Reservoir (R07) were between 3.0 and 7.0 mg/L.

The DO levels in Nam Ngiep downstream the Re-regulation Dam (NNG05) during the gate discharges in January and February 2023 were generally around 7 mg/L for the first few kilometres, gradually decreasing to approximately 6.4 mg/L over the following 25 km sometimes. However, in March 2023, during turbine discharge, DO levels at NNG05 was less than 6 mg/L as well as all the other Nam Ngiep Downstream stations.

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

The Bolikhamxay Watershed and Reservoir Protection Office (WRPO) continued with the forest and reservoir patrolling from January to March 2023 using the fund under the approved Annual Implementation Plan (IAP) 2022. It was noted that the Bolikhamxay WRPO did not receive their fund under the approved AIP2023 until end of March 2023 because of the slow process of fund disbursement from FPF DOF-MAF.

The Xaysomboun WRPO could not implement the long-due activities under the previous AIPs during the first quarter of 2023. These activities include the meeting on the roles and responsibilities for the reservoir fishery co-management, boat registration, and the construction of patrolling substations and reservoir checkpoints. After discussing with Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS), NNP1 Management, ADB, and IAP, NNP1 EMO submitted an official letter about proposed actions to deal with outstanding delays and pending issues related to the NNP1 watershed management to the Head of Xaysomboun PAFO on 17 March 2023. There was no response from the Head of Xaysomboun PAFO as of the end of March 2023. The Xaysomboun WRPO submitted the draft AIP2023 to NNP1 EMO on 1 February 2023. NNP1 EMO reviewed the draft and shared it with BSP-WCS on 9 February 2023. EMO temporarily paused AIP2023 discussions during the development of the "Discussion paper on the proposed actions to XSB PAFO". Discussions were initially planned to resume after the letter to the Head of Xaysomboun PAFO was submitted and discussed. But NNP1 management advised to continue the work while waiting for the responses or discussion with the Head of Xaysomboun PAFO. BSP-WCS reviewed the draft AIP2023 on 24 March 2023. NNP1 EMO, Xaysomboun WRPO, and BSP-WCS will discuss the revised plan after the Law Enforcement (LE) training in the first week of April 2023.

The meeting for the approval of the Nam Chouane-Nam Xang (NC-NX) and its Totally Protected Zone (TPZ) boundary could not be organized from January to March 2023 because of the unavailability of the Head of Bolikhamxay Province Agriculture and Forestry Office (PAFO) and the Vice Governor of Bolikhamxay Province. The Bolikhamxay Biodiversity Offset Management

Unit (BOMU) continued with the patrolling, organized Participatory Land Use Planning (PLUP) kick-off meeting, organized training for the patrolling and snare removal team, as well as training for outreach campaign during January to March 2023 using the fund under the approved AIP2022. BOMU submitted the draft AIP2023 on 15 February 2023 which was reviewed by the NNP1 EMO and shared with BOMU and BSP-WCS on 21 February 2023. ADB and IAP confirmed no objection on 28 March 2023.

The five species that dominated the fish catch by weight in Q1 2023 include one species *Oreochromis niloticus*, *Scaphiodonichthys acanthopterus*, *Channa striata*, and two species group of *Poropuntius* and *Hampala* that are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species and *Oreochromis niloticus* is an exotic species. The recorded catch of threatened species includes three Vulnerable species (VU): *Cirrhinus cirrhosis*, *Scaphognathops bandanensis*, and *Tor sinensis*.

2. INTRODUCTION

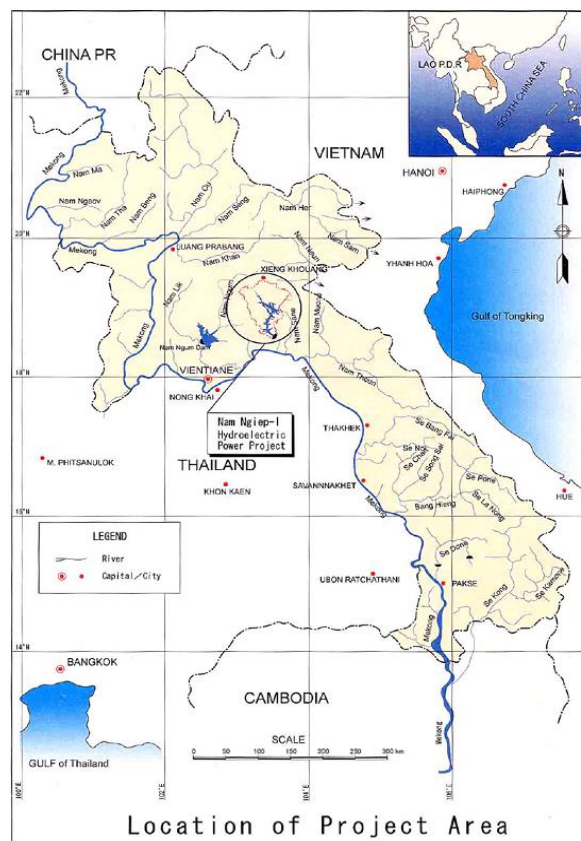
The Nam Ngiep originates in the mountains of Xiengkhouang Province, flowing through Khoun District into Thathom District of Xaysomboun Province, through Hom District and into Bolikhamxay Province. The Nam Ngiep meets the Mekong River just upstream from Pakxan in Bolikhamxay Province.

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 **Q1 2023**. 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 Q1 2023.

3.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

During Q1 2023, the first ISO14001:2015 on site surveillance audit was carried out in February 2023 by the SGS. The audit included site tours, interviews with the NNP1's key personnel and verification of the Environmental Management System (EMS) performance. In March 2023, the SGS submitted a surveillance audit report to NNP1PC. The report pointed out one non-conformity concerning leachate from the food waste storage area at the OSOV1 canteen. However, immediate corrective actions were taken, and the mentioned non-compliance issue was closed. The report also included four general observations and opportunity of improvements (OFIs) that need to be followed up in the next surveillance audit scheduled for February 2024.

The details of one non-conformity and four general observations and OFIs are shown shown in **Table 3-1**.

TABLE 3-1: THE DETAILS OF ONE NON-CONFORMITY AND GENERAL OBSERVATION AND OPPORTUNITY OF IMPROVEMENT

OFI	Description	Corrective Action
1.	Non-conformity Leachate from the food waste storage area at the OSOV1 canteen	Immediately Closed during the surveillance audit in February 2023 The corrective actions were completed and an internal NCR level 1 was issued as a reference for the performance monitoring and following up, and relevant training will be provided.
2.	The lubricant oil container at the re-regulation Dam PH and the alcohol spray bottle at the Main Dam PH were found without an SDS label.	Completed Safety Data Sheet labels were attached by the O&M team
3.	The safety period timing of emergency evacuation stated in the rehearsal sessions requires further testing in different situations across various operation sites such as fire, flooding, explosion, etc.	Ongoing The emergency evacuation plan will be reviewed, updated and relevant drills will be conducted accordingly
4.	It is necessary to identify and address hazardous waste management in the environmental aspect assessment for transmission line works and emergency case of dam collapse.	Ongoing The environmental aspect assessment for transmission line works and emergency case of dam collapse will be reviewed and updated accordingly to cover the management of hazardous waste.
5.	EMP04 of 2023 aims to plant 100 seedlings and ensure that over 50% of them survive. In order to maximise the effectiveness of the project, it is suggested to review objectives of the program with regards to its potential contribution to the reduction of Greenhouse Gas (GHG) emissions. Please note that, according to the GHG report 2022, GHG emissions does not pose any significant concerns in NNP1. However, it is important to note that tree planting is recognized as part of the EMS. The external ISO14001-auditing firm (SGS) has recommended that the objectives of the tree planting should align with efforts to combat climate change which include address GHG emissions as one of contributing factors to the climate change	Ongoing The tree planting plan was developed by incorporating the assessment of planting sites, suitable local seedlings, and timeline of planting, monitoring and maintenance.

3.1.1 Environmental Management Plan (EMP)

NNP1PC has developed Environmental Management Plans (EMPs) that will be implemented in 2023. The EMPs include four key areas of focus, including HSE awareness training for NNP1PC staff and contractors, reducing the paper consumption in NNP1 offices, minimising waste generation and maximising waste separation at sources to reduce the quantity of waste disposal at NNP1 project landfill and tree planting as shown in **Table 3-2**.

TABLE 3-2: THE ENVIRONMENTAL MANAGEMENT PLAN (EMP) OF 2023

No	EMP	Key Performance Indicator (KPI)
6.	EMP01: Providing HSE awareness training to NNP1PC staff and contractors	80% of NNP1PC staff and the Contractors are trained on Health, Safety and Environmental awareness during April 2023 to March 2024. The training is conducted every year to provide updated knowledge and skills to all individuals involved.
7.	EMP02: Reducing the paper consumption in NNP1 offices	Total use of A4 paper for printing in the NNP1PC's offices (VTE, OSOV1, OSOV2) is reduced by 10% during April 2023 to March 2024 compared with the previous 12 months
8.	EMP03: reducing the quantity of waste disposal at NNP1 Project Landfill	General waste disposal at the NNP1 Project Landfill is reduced by 05% during 2023 compared with the disposal quantity during April 2023 to March 2024 compared with the previous 12 months
9.	EMP04: Tree Planting	Percentage of plant survival, the potential plantation fields in contributing to the environmentally sustainability objectives (refer to Tree Planting Plan)

3.2 CONTRACTOR SS-ESMMPs

During Q1 2023, no new documents was submitted to the Environment Management Office (EMO) for review and approval.

3.3 RESULTS OF COMPLIANCE INSPECTIONS AT CONSTRUCTION SITES

During Q1 2023, 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 08 sites. These included the four main operation sites, NNP1 landfill and three construction sites. EMO conducted a quarterly site visit and monitoring of all 31 rehabilitated sites no site

disturbances were identified. The assessment of the vegetation cover is scheduled to resume during the rainy season of 2023.

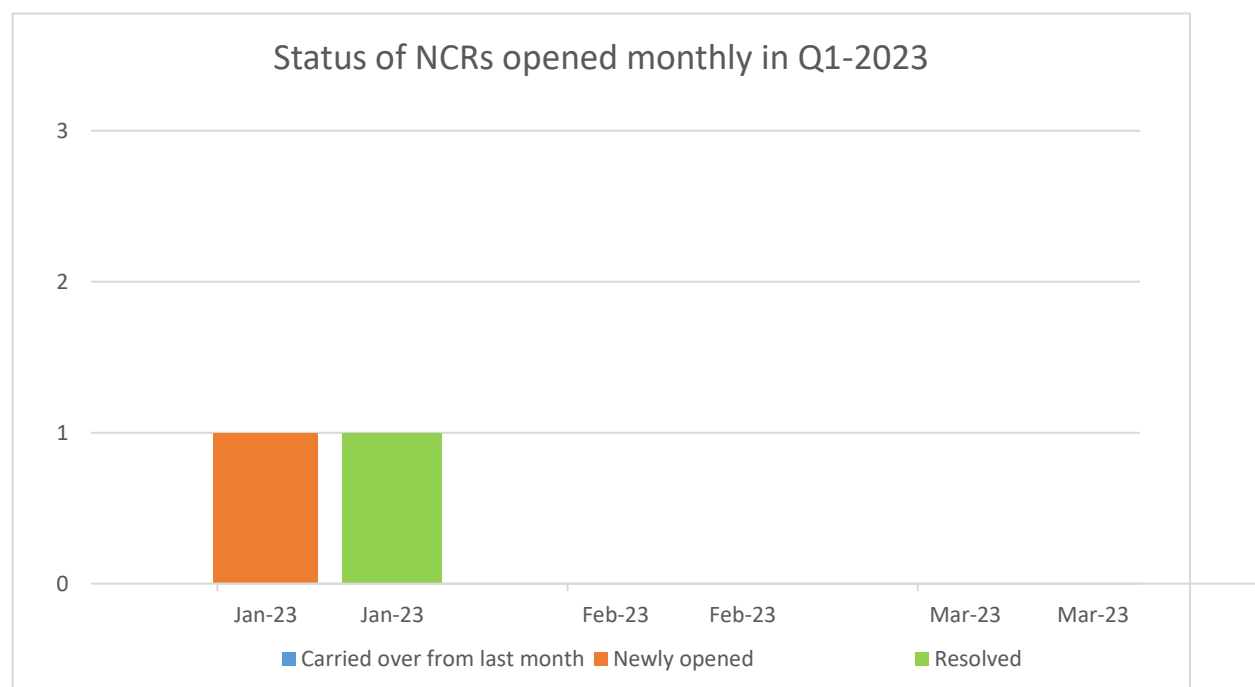
During Q1 2023, no new document was submitted to the Environment Management Office (EMO) for review and approval. EMO issued one non-conformity concerning leachate from the food waste storage area at the OSOV1 canteen. However, immediate corrective actions were taken, and the mentioned non-compliance issue was closed as summarized in **Table 3-3** and

Figure 3-1. The progress of corrective actions is presented in **Appendix 1**.

TABLE 3-3: STATUS OF NON-COMPLIANCE REPORT DURING Q1 2023

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

FIGURE 3-1: STATUS OF NCRs DURING Q1 2023



3.4 SITE DECOMMISSIONING AND REHABILITATION

In June 2022, the signed memo of land use handover from the District Office of Energy and Mines confirmed their acceptance of the land use handover to GOL and was reported to the higher provincial government levels.

On 10 February 2023, a discussion on the handover of land (with non-exclusive land use rights) was carried out at OSOV1 with participation from the Department of Energy Business (DEB) of the Ministry of Energy and Mines (MEM), Ministry of Natural Resources and Environment (MONRE), Bolikhamxay Provincial Administration, Bolikhan District Office of Energy and Mine (DOEM), District Office of Natural Resource and Environment (DONRE), District Office of Agriculture and Forestry (DOAF-BLK) Hat Gniun village, Phouhomxay village and NNP1. The meeting concluded that:

1. NNP1 will send a letter to GOL (DEB-MEM) to consider the hand-over of sites with non-exclusive land use rights following CA requirements;
2. DEB-MEM will issue a letter to MONRE requesting the issuance of a certificate for the hand-over of sites with non-exclusive land use rights for NNP1PC;
3. NNP1PC will coordinate directly with the relevant Bolikhamxay provincial offices for the use of some parts of the land during the concession period.

During February 2023, all 31 rehabilitated areas were inspected, and no site disturbances were identified. The assessment of the vegetation cover will be resumed in the rainy season of 2023.

3.5 WASTE MANAGEMENT AT THE CONSTRUCTION SITES

3.5.1 General Waste Management

A total of 25.2 m³ solid waste from NNP1 project sites and camps was disposed of at the NNP1 Project Landfill, an increase of 2.4 m³ compared with Q4 2022. The slight increase in the waste quantity of waste disposal was due to a transition of New Year, However, in general, the NNP1 landfill has experienced in the amount of waste dumped since 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 and compaction, grass cutting and repairing of perimeter fences.

During the Q1 2023, The amount of recyclable waste managed on site during the reporting period is shown in **Table 3-4**.

TABLE 3-4: AMOUNTS OF RECYCLABLE WASTE DURING Q1 2023

Source and Type of Recyclables		Unit	Total in Q1 2023 (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	249.5	181	68.5
3	Aluminium Can	kg	0	0	0
4	Paper/Cardboard	kg	96	0	96
5	Glass	kg	474	388	86
7	Scrap metal	Kg	10	10	0
Sub-Total 2		kg	829.5	579	250.5
Grand Total (Sub-Total 1+2)		kg	829.5	579	250.5

3.5.2 Hazardous Waste Management

The amounts of hazardous waste and hazardous materials that were collected, stored and disposed of during Q1 2023 are shown in **Table 3-5**.

TABLE 3-5: HAZARDOUS MATERIAL AND HAZARDOUS WASTE RECORDED DURING Q1 2023

No.	Type of Hazardous Material	Unit	Total in Q1 2023	Used/ Disposed	Remaining
1	Diesel	Litre	13,208	12,221	987
2	Gasoline	Litre	1,821	1,446	375
3	Lubricant (Turbine oil)	Litre	91	0	91
4	Colour paint	Litre	299	0	299
5	Thinner	Litre	10	0	10
6	Grease oil	Litre	785	0	785
7	Gear Oil	Litre	427	0	427
8	Chlorine Liquid	Litre	38	30	18

No.	Type of Hazardous Material	Unit	Total in Q1 2023	Used/ Disposed	Remaining
9	HA Cut AF	Litre	3,925	0	3,925
10	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	0	53
16	Use Oil Filter	Unit	7	0	7
17	Contaminated soil, sawdust and textile material	M3	1	0	0.54
18	Used tyre	Piece	5	0	5
19	Empty used chemical drum/container (drum 20L)	Unit	34	34	0
20	Lead acid batteries	Unit	10	0	10
21	Empty paint and spray cans	Can	61	0	61
22	Halogen/fluorescent bulbs	Unit	346	0	346
23	Empty cartridge (Ink)	Piece	108	0	108
24	Clinic Waste	Kg	7,4	0	7,4
25	Expired Chlorine Powder	Kg	65	0	65

3.5.3 Animal Fodder (Pig Feed) Collection Programme

During Q1 2023, local villagers collected 1,073 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

In Q1 2023, NNP1 EMO communicated with the Bolikhan District Environment Management Unit or EMU to discuss the process of transferring the management of the communities' general waste collection and the Houay Soup Landfill operation to the local authorities. However, the EMU later requested a postponement of the meeting and informed that an update on the matter will be provided after April 2023. There were no recyclable waste trade activities in the community recyclable waste bank in Q1 2023.

3.5.5 Houay Soup Landfill

There was no waste collection from communities to dispose of at Houay Soup Landfill during the reporting period due to the waste collection service by NNP1PC's hired contractor ended in April 2022. Since then, the Bolikhan District EMU and villagers have managed solid waste. Some self-disposed solid waste was observed at the landfill. As of May 2023, NNP1 EMO highlighted the efforts made in coordinating with the Bolikhan District Environment Management Unit or EMU for transferring the management of the communities' solid waste and Houay Soup Landfill to the local authorities. The EMU will initiate discussions involving NNP1, village, and district authorities after receiving the 2022 monitoring fund, which NNP1 transferred to MONRE on 11 May 2023 following the fund disbursement request by MONRE on 20 April 2023.

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 3-3** and **Figure 3-2**.

During Q1 2023, the mean daily inflow to the main reservoir was 43 m³/s. The minimum daily inflow was 21 m³/s, maximum daily inflow was recorded at 68 m³/s, and 25th percentile of 36 m³/s and 75th percentile of 50 m³/s. As indicated in **Figure 3-2**, the inflow during Q1 2023 was lower compared to the same period in 2022.

The water level in the main reservoir decreased with 4.74 m from El. 315.74 m asl. (01 January 2023) to El. 311.00 m asl. (31 March 2023).

FIGURE 3-2: INFLOW TO THE MAIN RESERVOIR

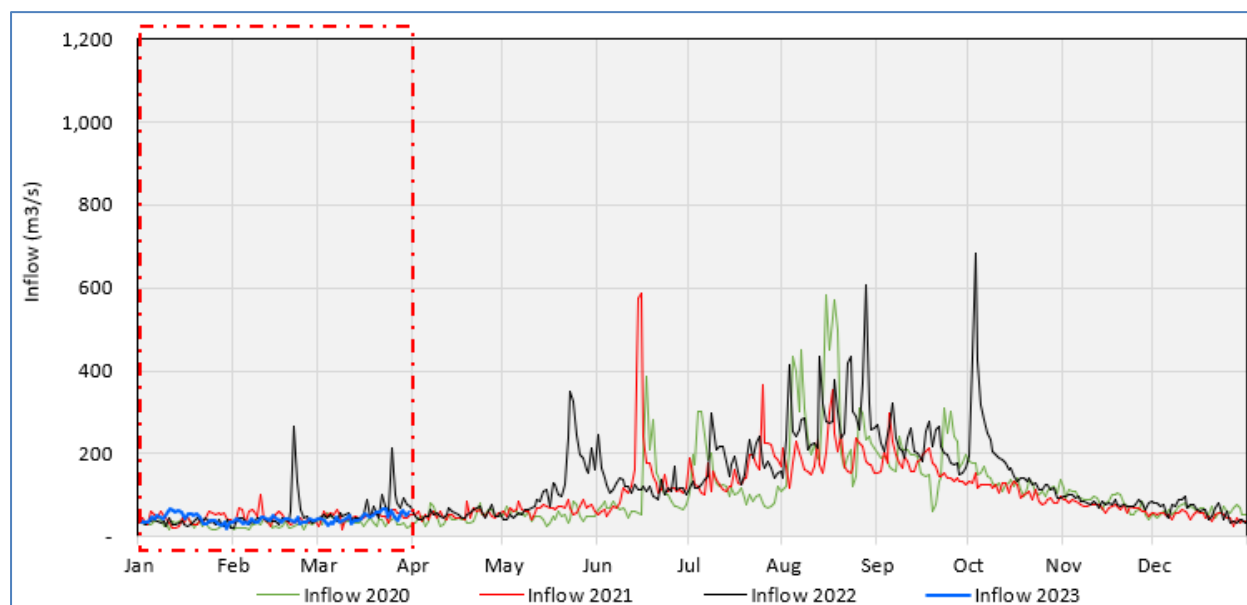
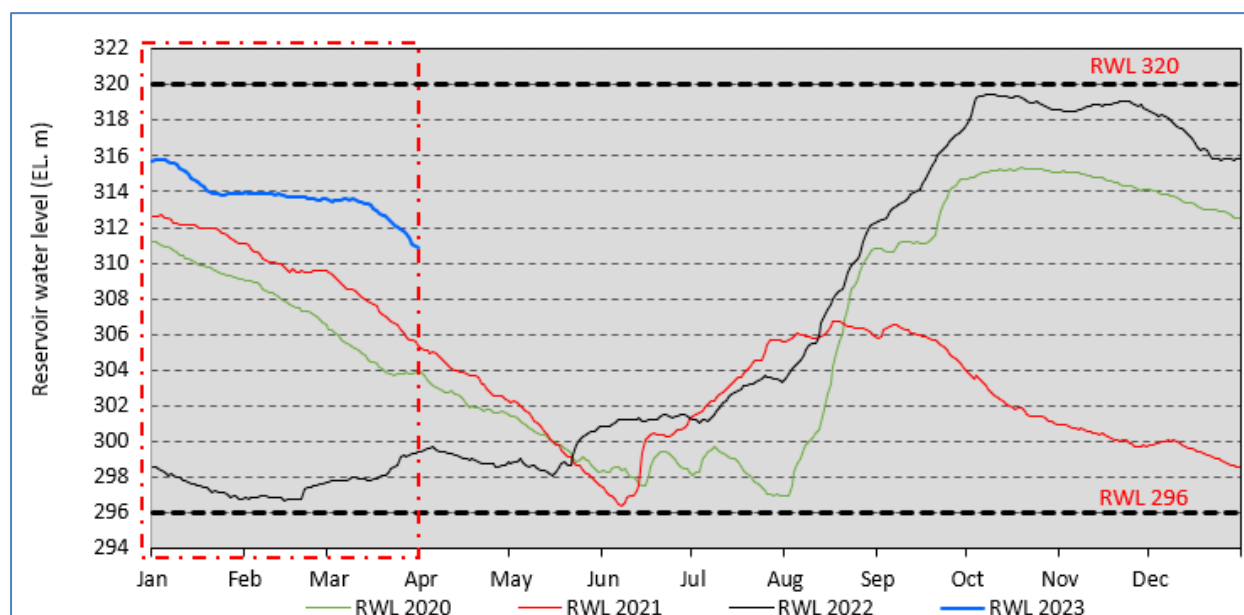


FIGURE 3-3: WATER LEVEL OF THE MAIN RESERVOIR

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 Q1 2023 are summarized in **Table 3-6**.

TABLE 3-6: SUMMARY OF EFRs COMPLIANCE MONITORING IN Q1 2023

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)	The two monthly missions (January and February 2023) for thalweg water depth monitoring were carried out during the Re-regulation Dam discharged of 27 m ³ /s. Six measurements at 4 measuring points located within 5.7 km from the re-regulation dam did not comply.
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

No	EFRs in the Downstream of the Re-regulation dam	EFRs compliance
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

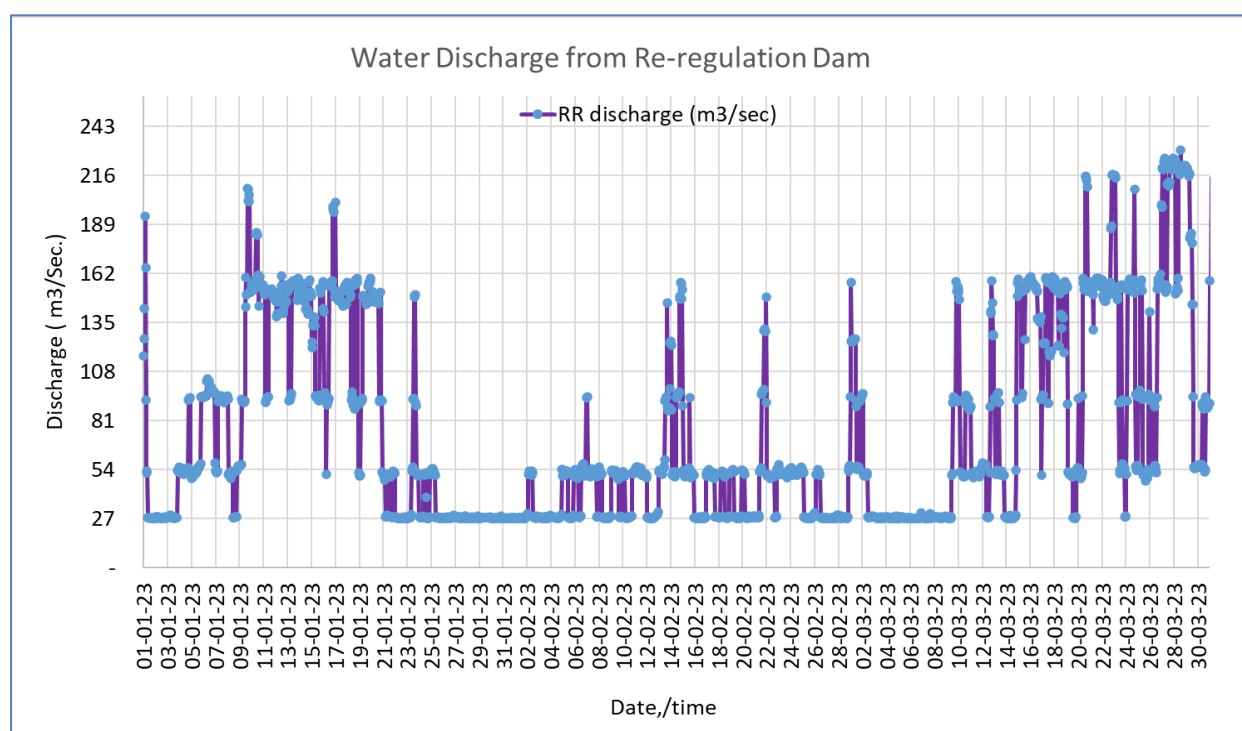
3.6.2.1 Minimum Flow Requirements

The discharge monitoring data for the re-regulation dam during Q1 2023 indicates that the minimum flow requirement of 27 m³/s has been met at all times. The Re-regulation Dam discharge graph can be found in **Figure 3-4**.

During Q1 2023, the mean discharge from the re-regulation dam was about 80 m³/s in January 2023 and about 43 m³/s in February and 92 m³/s in March 2023 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 3-4: DISCHARGE FROM THE RE-REGULATION DAM DURING Q1 2023



3.6.2.2 Minimum Water Depth

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

The monitoring is undertaken to confirm compliance with the water depth requirements in the Concession Agreement, Annex C, and the approved Environmental Flow Assessment (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 have been measured across the river channel where visual observations or boat navigation indicate shallow waters to ensure that the measurements represent the river thalweg.

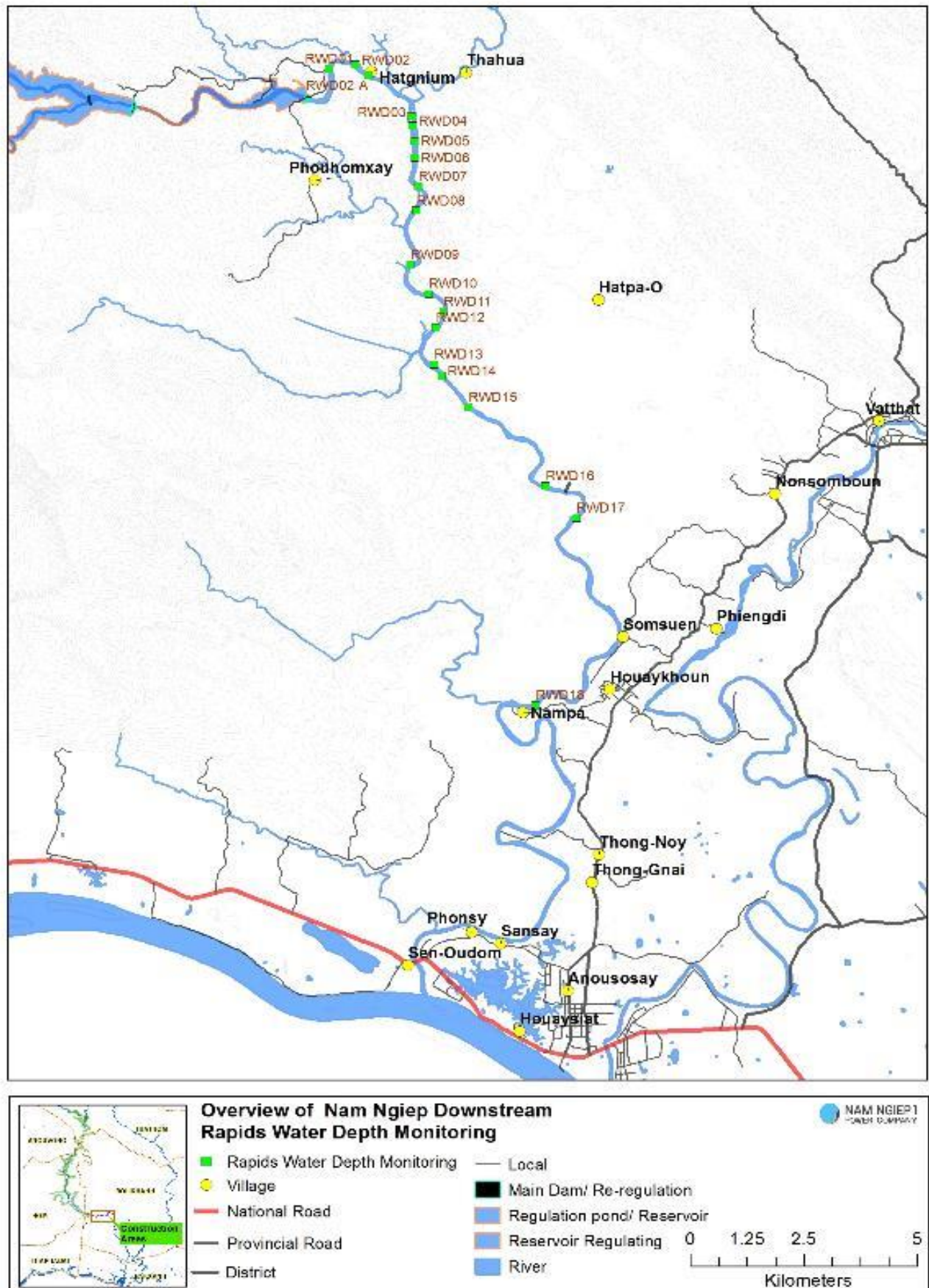
The results of the monitoring during Q1 2023 is presented in **Table 3-7**. There were two monitoring missions at the low discharge ($<30 \text{ m}^3/\text{s}$) recorded.

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 $30 \text{ m}^3/\text{s}$ for detecting the navigation problems and also monitor whether any complaint is raised to consider the methodologies for solving where necessary.

TABLE 3-7: 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 (m ³ /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)
26-Jan-23	27.6	0.59	0.53	0.62	0.66	0.7	0.46	0.77	0.83	0.9	0.8	0.88	0.94	0.92	1	1.15	1.27	1.35	1.44	1.03
25-Feb-23	27.3	0.39	0.33	0.42	0.46	0.5	0.26	0.57	0.65	0.75	0.65	0.73	0.8	0.8	0.9	1.05	1.2	1.3	1.4	0.97
16-Mar-23	155.6	- Measuring thalweg water depth is unnecessary when the discharge from the Re-regulation Dam exceeds 30 m³/s, as suggested by the LTA, ADB and NNP1PC; - NP1 (EMO and TD) will closely monitor the Nam Ngiep River downstream and verify local boat travelling difficulty throughout the transition from wet to dry seasons in 2023 for the case of water depth falls below 0.5 m, and will confirm the results by mid-Q4 2023.																		

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



3.6.2.3 Stage Height Fluctuations

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

1. A requirement on the rate of change which is set at a maximum of 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.

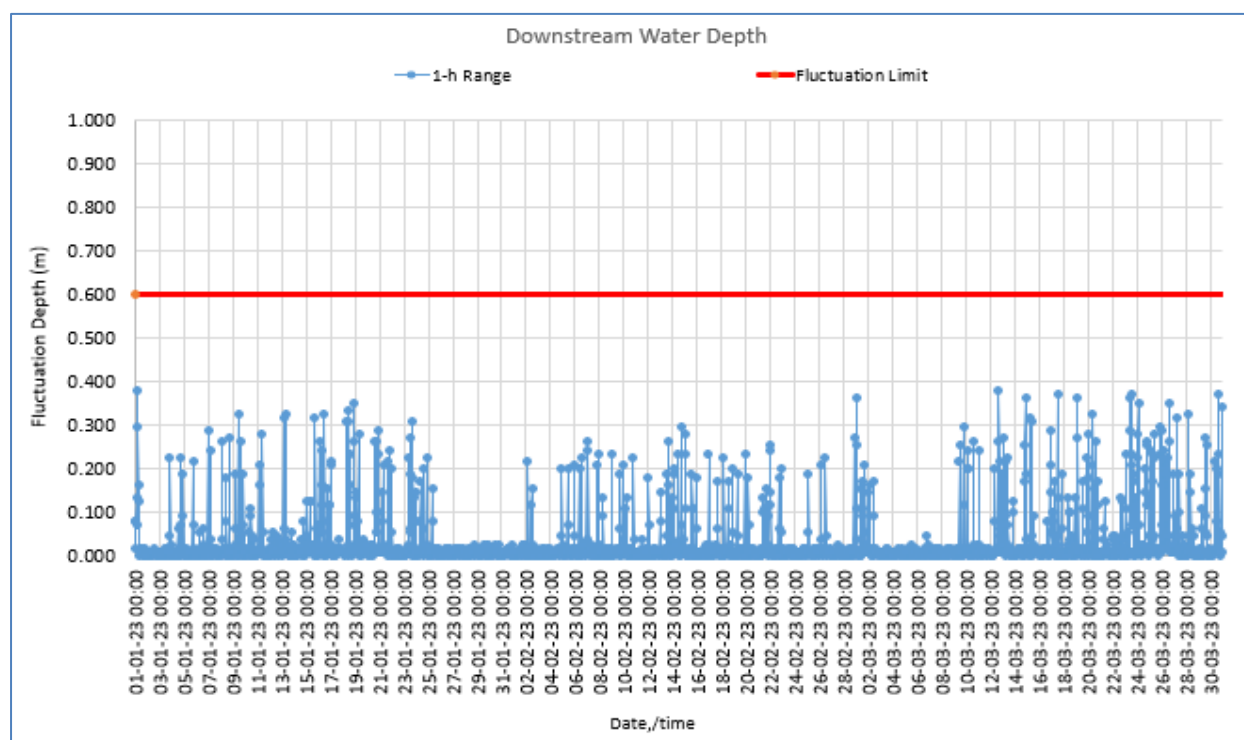
For the 0.6 m in 1-hour maximum fluctuation EFR, the cumulative rises and falls are calculated from the hourly water level recordings.

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 Q1 2023, the maximum rate of change of 0.6 m over 1-hour was complied with for 100% of the hourly fluctuations. The results are presented in **Figure 3-6**.

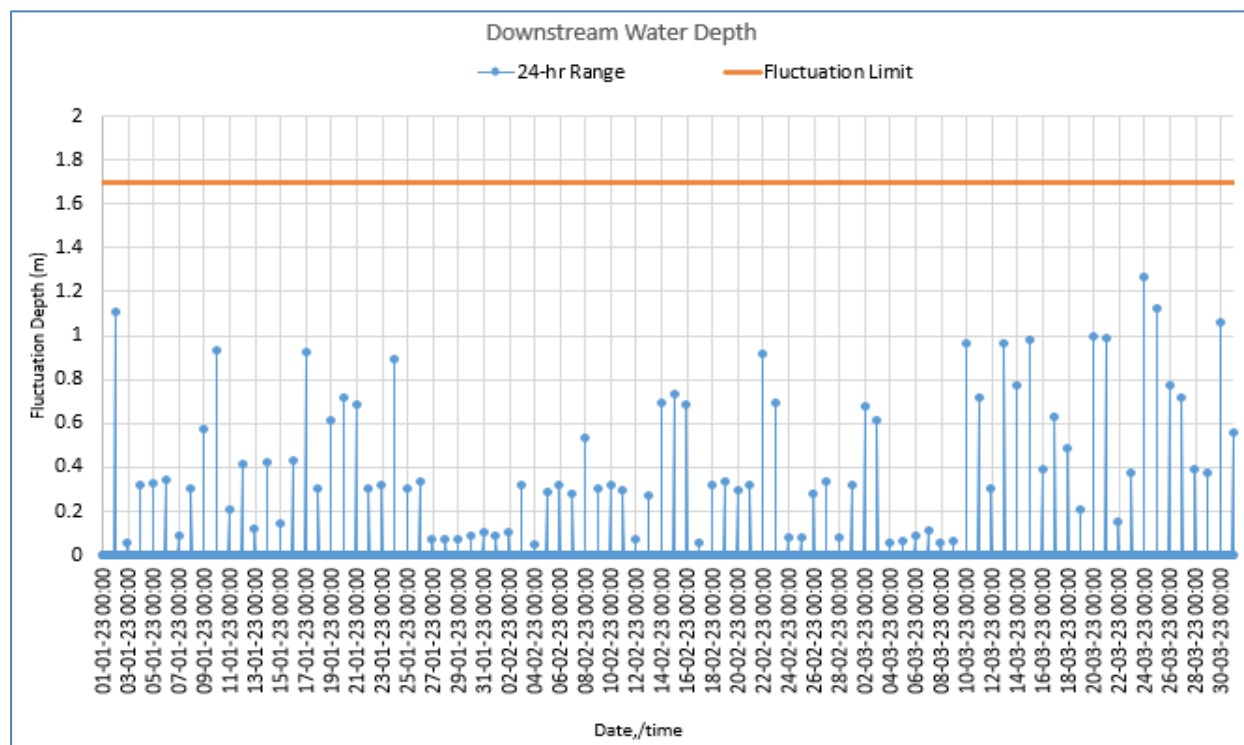
FIGURE 3-6: HOURLY STAGE HEIGHT FLUCTUATIONS DURING Q3 2023



During Q1 2023, the maximum range in stage of 1.7 m over 24-hour was complied with for all 24-hour periods (00:00 – 23:59).

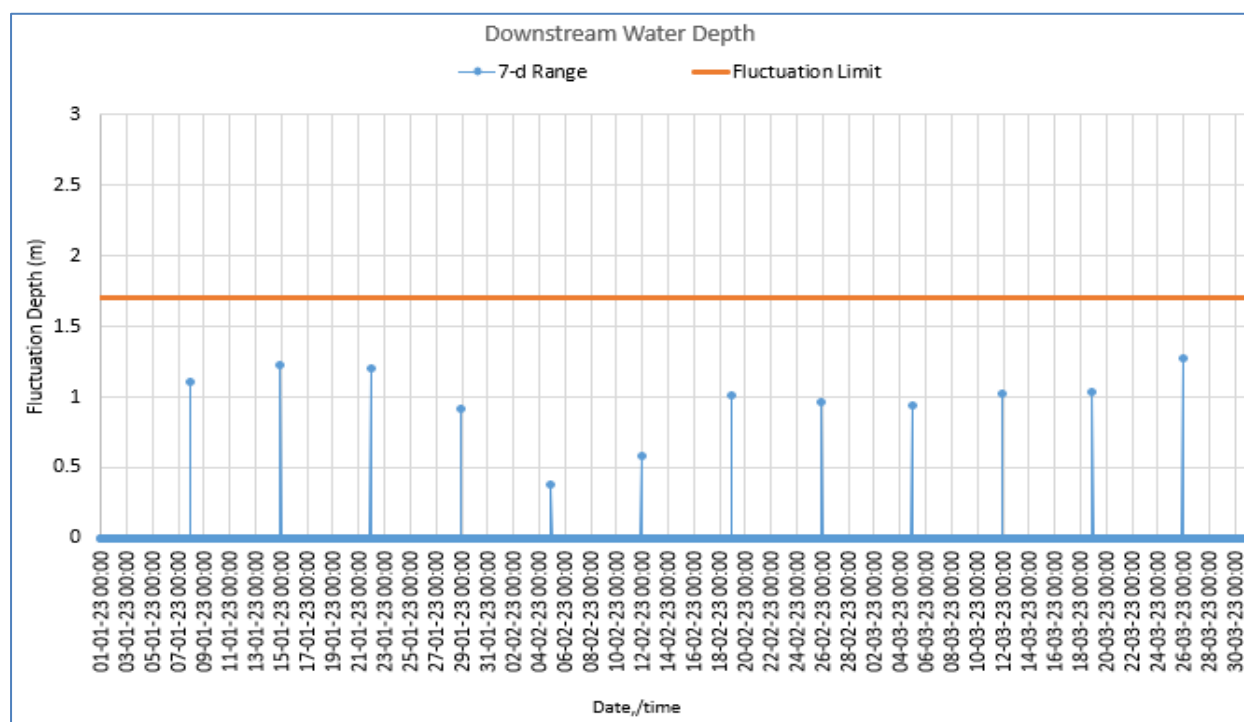
The results of the monitoring are presented in **Figure 3-7**.

FIGURE 3-7: 24-HOUR STAGE HEIGHT DIFFERENCE (M) DURING Q1 2023



During Q1 2023, the maximum range in stage of 1.7 m over 7-days was complied with for all 7-day periods. The results are presented in **Figure 3-8**.

FIGURE 3-8: 7-DAY STAGE HEIGHT DIFFERENCE (M) DURING Q1 2023



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 2** and all surface water quality data for Q1 2023 are listed in **Appendix 4.1**

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 3-9**, the DO long profile measurement as timeseries are presented in **Figure 3-10**, and the full set of DO surface water quality data are shown in **Table 3-8**.

The water temperature and DO depth profiles in the main reservoir at R05 during Q1 2022, Q4 2022 and Q1 2023 are presented in **Figure 3-11** to **Figure 3-13**.

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

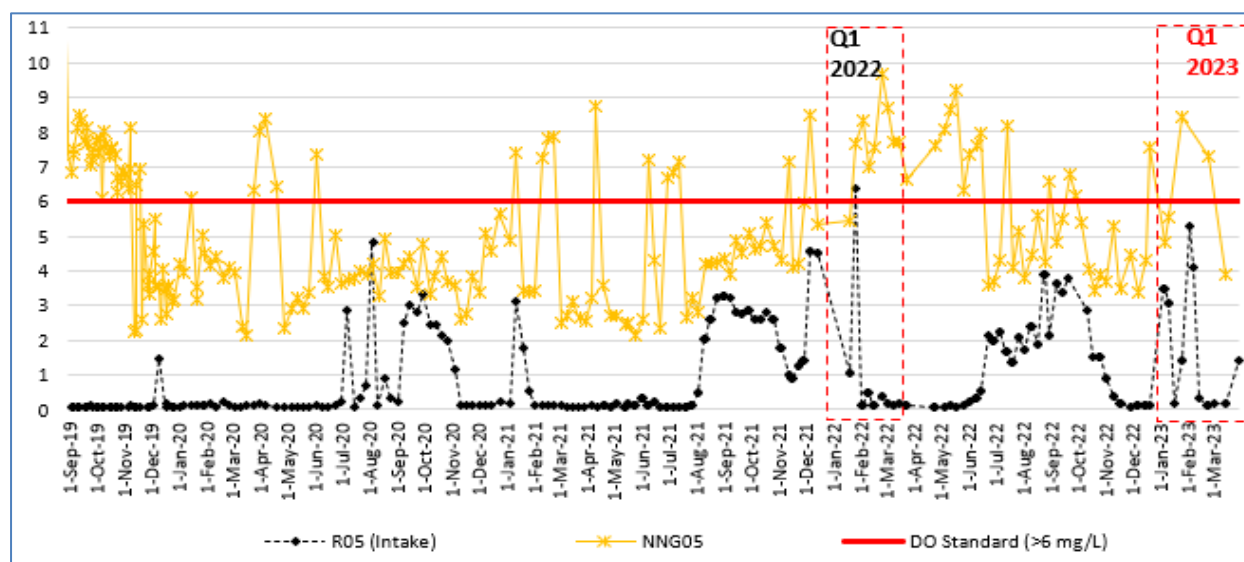
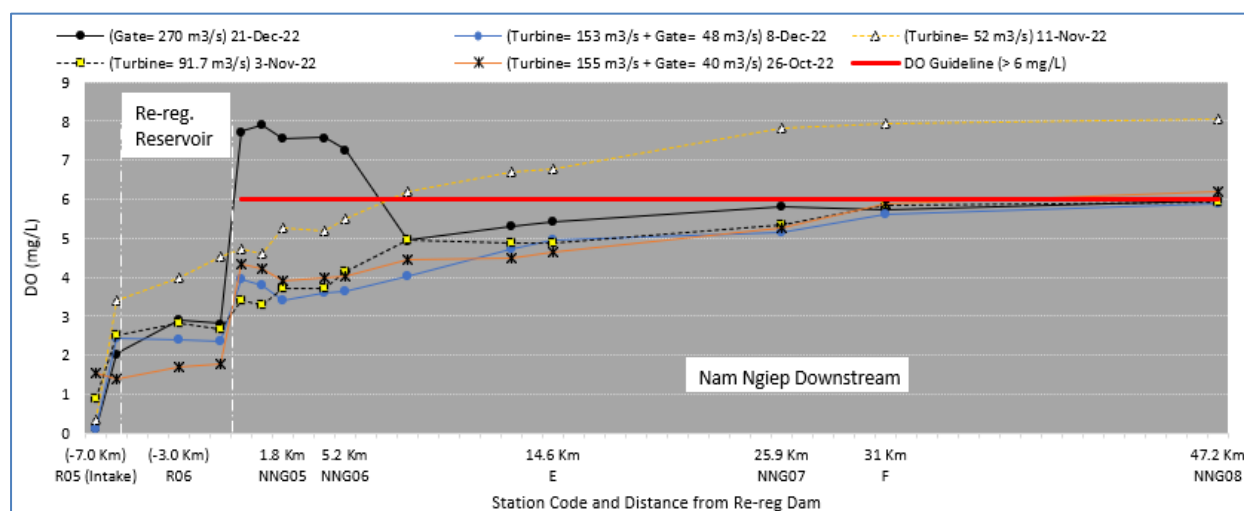
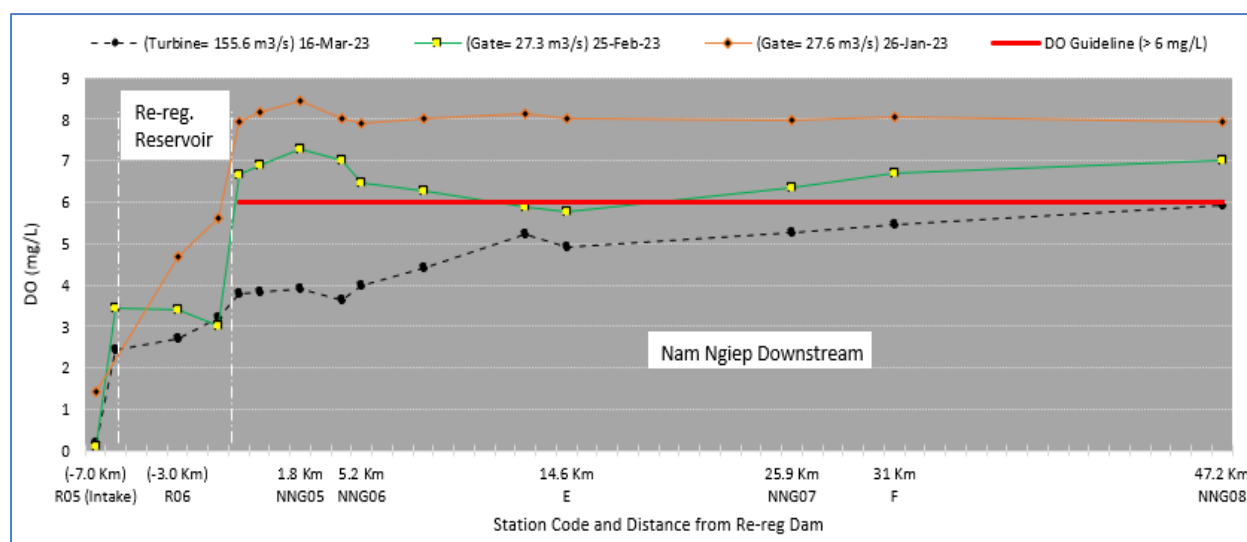


FIGURE 3-10: DISSOLVED OXYGEN LONG PROFILE MEASUREMENT FROM IMMEDIATELY UPPER MAIN DAM TO LOWER NAM NGIEP (Q4 2022 vs Q1 2023)





Main Reservoir

Figure 3-13 presents the DO and water temperature depth profile timeseries in the Main Reservoir (R04 and R05) from September 2018 to March 2023, 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 Q1 2023 indicates formation of oxyclines in the main reservoir at the monitored stations at different depths.

At R05, when comparing Q1 2023 with Q1 2022, overall, the thermocline and oxycline show a similar pattern.

At R05 (the station closest to the main dam), during the period with cooler weather in January and beginning of February 2023, the thermocline deepened to about 30 m below surface and the DO concentrations were equalized over the epilimnic water column to about 4.8 mg/L and gradually increasing over the period. During the remaining period of February 2023 until the end of March 2023, an upper 7-13 m layer with DO concentrations between about 7 mg/L to 8 mg/L formed with slightly lower DO concentrations of 3 mg/L to 5 mg/L down to a depth of about 30 m. The monthly mean DO concentration at the intake level fluctuated from 2.0 mg/L in January 2023, to 2.4 mg/L in February 2023 and 0.5 mg/L in March 2023. Anoxic levels were found at depths of about 36 m to bottom in January 2023, about 34 m in February 2023 and 32 m in March 2023 corresponding to 2.0 m below to 6.0 m above the intake.

The DO concentrations at R03 and R04 showed a similar pattern to R05.

At R02, in the upper 12 m, DO concentration varied between 2.0 mg/L and 4.8 mg/L with a mean DO concentration of 3.4 mg/L until the first week of February 2023. During this period, the DO concentrations varied from 1.3 mg/L to 5.2 mg/L in the depth below 13 m to bottom. During the second week of February 2023 and March 2023, in upper 3.5 m, the DO concentrations varied from 5.3 mg/L to 9.4 mg/L and below 4.0 m, DO were between 0.09 mg/L and 8.8 mg/L.

At R01, the mean DO concentration throughout the quarter was about 7.1 mg/L over the entire water column with no measurements below 5.3 mg/L.

Re-regulation Reservoir (R06 and R07)

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 mean monthly DO concentrations at R06 over the entire water column varied from 4.18 mg/L in January, 4.42 mg/L in February to 2.86 mg/L in March 2023. 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 Q1 2023.

Downstream Stations

During Q1 2023, the discharge from the Re-regulation Dam mainly went through the turbine and occasionally through the gate (26 January and 25 February 2023) or through both the turbine and the gate.

The monthly downstream DO concentrations measured at NNG05 located 1.8 km from the Re-regulation dam were greater than 6 mg/L (the National Surface Water Quality Standard) for January and February 2023 during gate discharge, except for March 2023 due to the turbine discharge. Further downstream from the dam, the DO concentrations generally increased reaching about 7.9 mg/L at NNG07 located 25 km from the dam.

No dead fish was observed in Nam Ngiep downstream during Q1 2023.

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 3-11: MAIN RESERVOIR DISSOLVED OXYGEN AT THE END OF Q1 2023

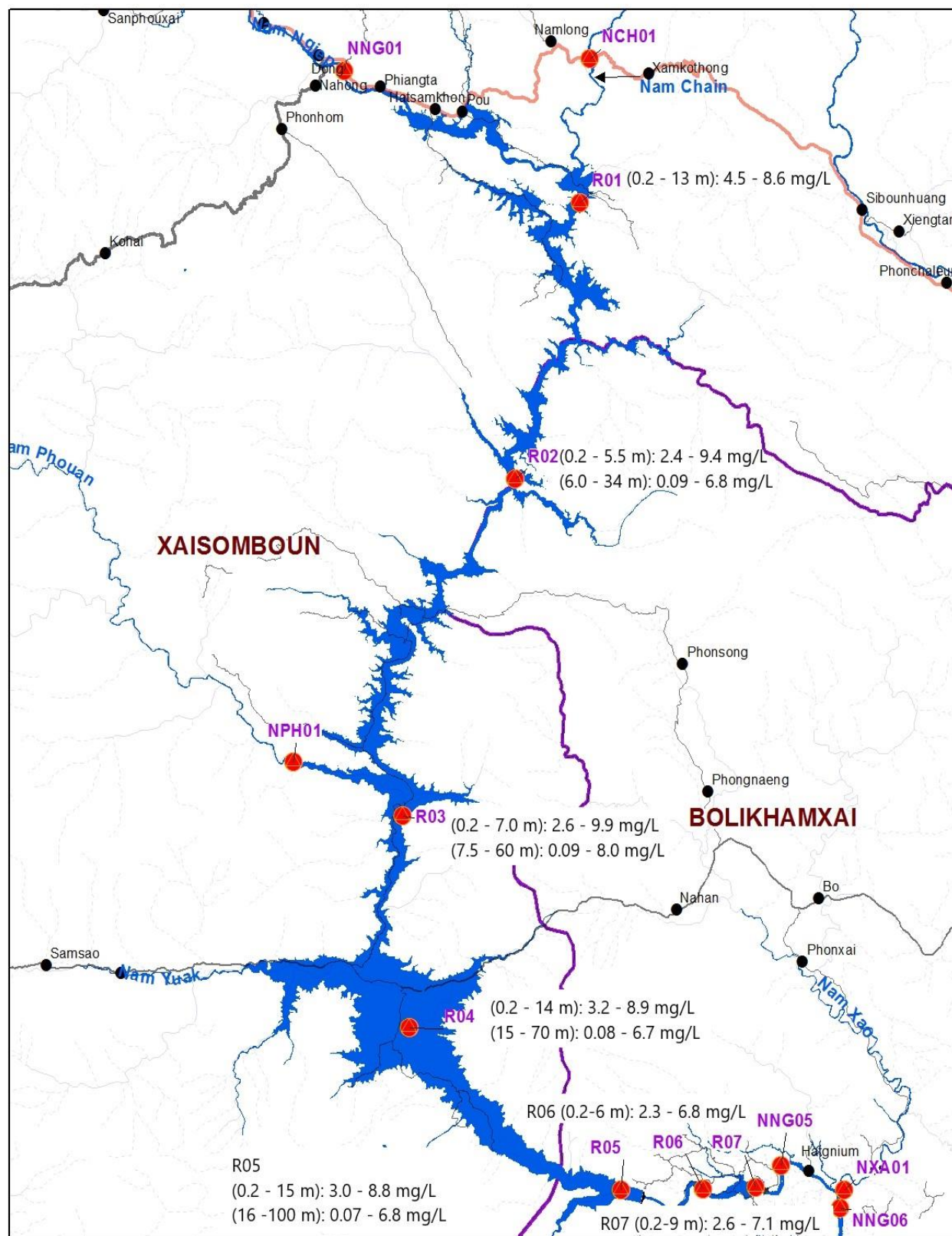


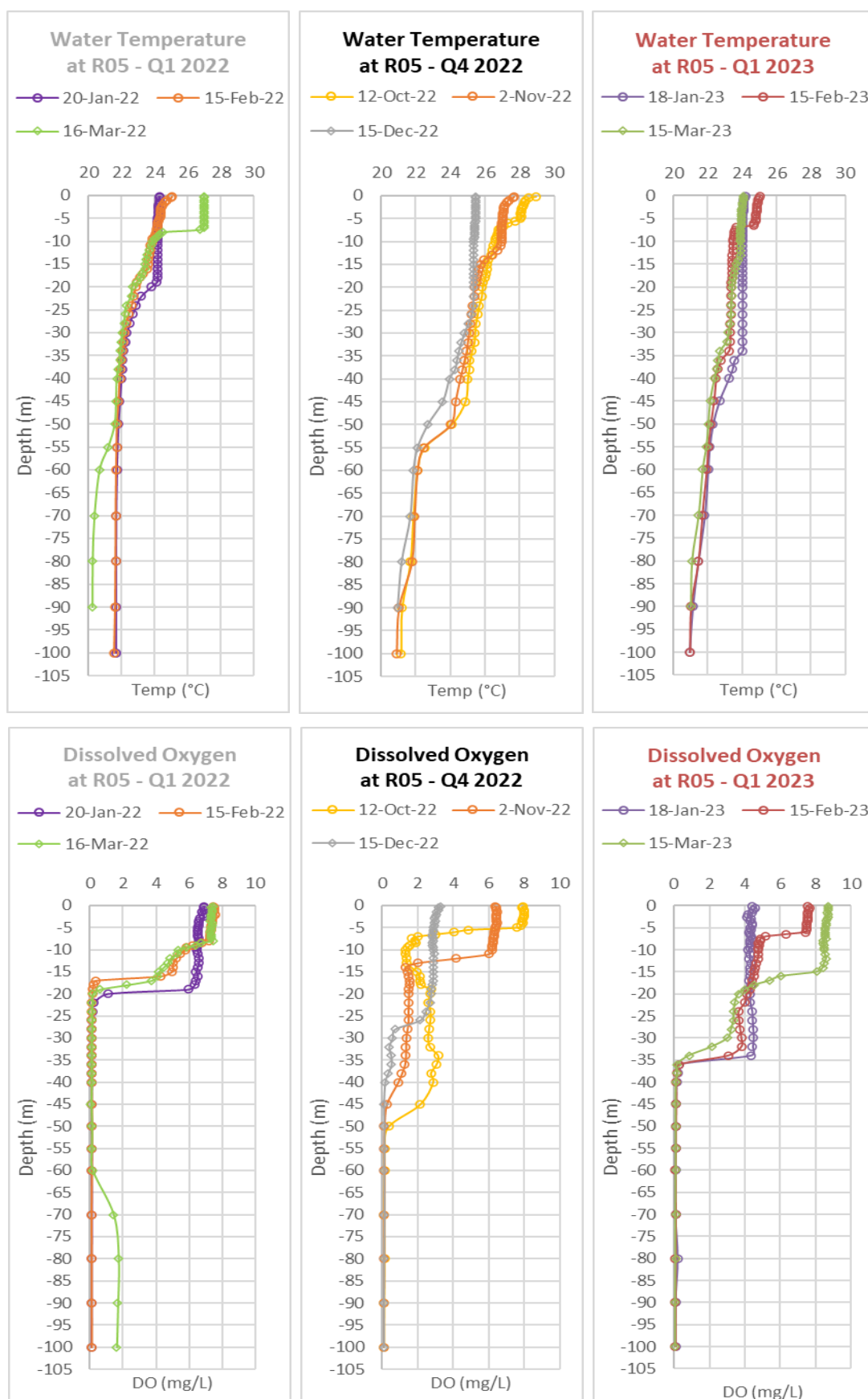
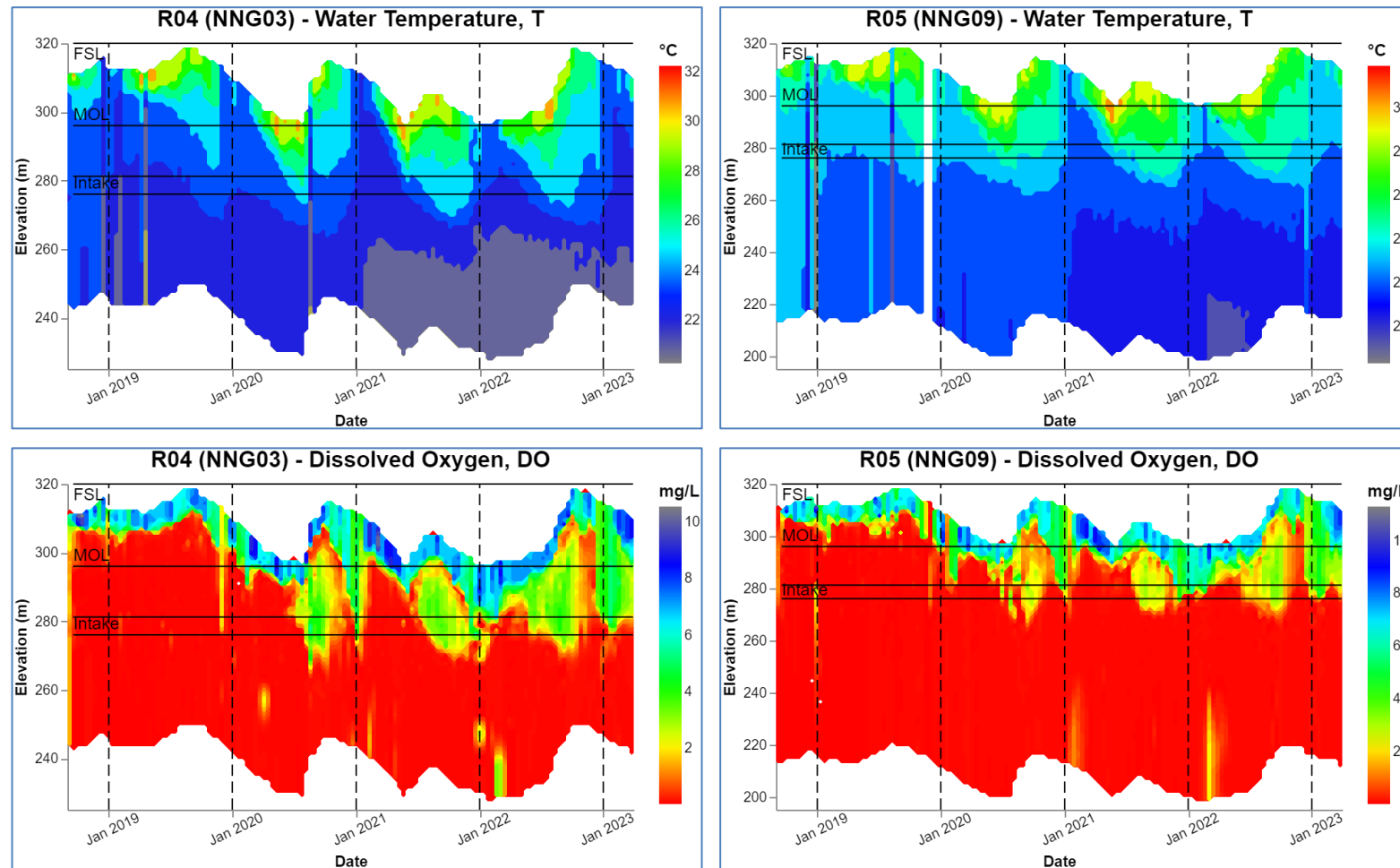
FIGURE 3-12: WATER TEMPERATURE AND DISSOLVED OXYGEN – DEPTH PROFILES IN THE MAIN RESERVOIR IMMEDIATELY UPSTREAM OF THE MAIN DAM (R05)

FIGURE 3-13: WATER TEMPERATURE AND DO DEPTH PROFILES IN THE MAIN RESERVOIR (R04 - R05), WITH POSITION OF INTAKE AT THE ACTUAL WATER LEVEL DURING SEPTEMBER 2018 – MARCH 2023



NOTED: THE STRAIGHT LINE GRAPH OF DO WILL BE INCLUDED IN THE NEXT QUARTERLY REPORT PER LTA SUGGESTION.

TABLE 3-8: DO (MG/L) RESULTS OF SURFACE WATER IN MAIN RESERVOIR, RE-REGULATION RESERVOIR, NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q1 2023**(NATIONAL SURFACE WATER QUALITY STANDARD FOR DISSOLVED OXYGEN: ≥ 6 MG/L)**

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
5-Jan-23				4.73	4.66	4.31	3.84	4.66								
9-Jan-23	9.41												9.32			
10-Jan-23		7.05	4.82	4.87												
11-Jan-23					5.12	5.07	5.06	4.4								
17-Jan-23		7.2	3.83	5.7												
18-Jan-23					4.53	4.43	3.62	4.77								
24-Jan-23		7.14	4.29	4.98												
25-Jan-23					4.82	4.96	4.7	5.6								
26-Jan-23									8.45	7.92	7.98	7.95			8.3	8.49
31-Jan-23	9.44												9.34			
2-Feb-23		6.57	4.29	5.55												
3-Feb-23					7.3	6.57	6.8	7.05								
7-Feb-23		8.08	6.57	7.21												
8-Feb-23					7.32	7.13	4.79	6.11								
14-Feb-23		6.41	7.21	6.66												
15-Feb-23					7.93	7.52	4.52	4.03								
23-Feb-23					8.22	7	3.41	3.02								
24-Feb-23		7.53	8.65	8.21										8.37		
25-Feb-23						7	3.41	3.02	7.29	6.48	6.37	7.02			6.4	5.8
27-Feb-23	8.42												8.67			
1-Mar-23		7.76	7.22	8.23										9.24		
2-Mar-23					7.54	7.42	4.16	5.35								
8-Mar-23		7.8	7.83	9.92												
9-Mar-23					8.16	7.99	2.52	4.72								
13-Mar-23	8.54												8.32			
14-Mar-23		7.91	8.42	8.68										8.72		
15-Mar-23					8.63	8.68	2.7	3.2								

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
16-Mar-23									3.9	3.98	5.27	5.92			6.07	6.13
22-Mar-23		7.91	8.31	8.93												
23-Mar-23					7.67	7.69	2.73	3.62								
29-Mar-23		8.42	9.34	9.55												
30-Mar-23					8.82	8.62	3.32	4.17								

Ammonia Nitrogen

In Q1 2023, Ammonia Nitrogen complied with the National Surface Water Quality Standard (<0.2 mg/L) in all monitored stations.

TABLE 3-9: AMMONIA NITROGEN (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q1 2023

(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	NPH 01	NXA 01	NHS 01
23-Feb-23					<0.2	<0.2										
24-Feb-23		0.3		0.2										<0.2		
27-Feb-23	<0.2												<0.2			
13-Mar-23	<0.2												<0.2			
14-Mar-23		<0.2		<0.2										<0.2		
15-Mar-23					<0.2	<0.2										

Biochemical Oxygen Demand (BOD₅)

Since 2014, the Biochemical Oxygen Demand (BOD₅) values in the Nam Ngiep River and its tributaries have generally been below the detection limit (< 1 mg/L). The results for Q1 2023 indicate that the BOD₅ 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 3-10: BOD₅ (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q1 2023

(NATIONAL SURFACE WATER QUALITY STANDARD FOR BOD₅: <1.5 MG/L)

Station Code	NNG 01	R0 1	R0 2	R0 3	R0 4	R0 5	R0 6	R0 7	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
24-Jan-23		<1		<1												
25-Jan-23					<1	<1	<1	<1								
26-Jan-23									<1	<1	<1	<1			<1	<1
31-Jan-23	<1												<1			
23-Feb-23					<1	<1	<1	<1								
24-Feb-23		<1		<1										<1		
25-Feb-23									<1	<1	1.01	1			1.34	1.22
27-Feb-23	<1												<1			
13-Mar-23	<1												<1			
14-Mar-23		<1		<1										<1		
15-Mar-23					<1	<1	<1	<1								
16-Mar-23									<1	<1	<1	<1			<1	<1

Chemical Oxygen Demand (COD)

The COD measurements in Q1 2023 are presented in **Table 3-11**.

TABLE 3-11: COD (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q1 2023**(NATIONAL SURFACE WATER QUALITY STANDARD FOR COD: < 5 MG/L)**

Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R0 7	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
23-Feb-23							<5	6.4								
24-Feb-23														<5		
25-Feb-23									<5	<5	<5	<5			6.4	<5
27-Feb-23	<5												<5			
13-Mar-23	<5												<5			
14-Mar-23														<5		
15-Mar-23							<5	6.4								
16-Mar-23									<5	9.6	6.4	<5			13.8	6.4

Faecal Coliform Bacteria

The results of the faecal coliform analyses in Q1 2023 are presented in **Table 3-12**.

Faecal coliform complied with the standard in all stations, except NHS01 in March 2023.

TABLE 3-12: FAECAL COLIFORMS (MPN/100 ML) RESULTS IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q1 2023**(NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <1,000 MPN/100 ML)**

Station Code	NNG 01	R0 1	R0 2	R0 3	R0 4	R0 5	R0 6	R0 7	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS01
26-Jan-23									11	17	4	27			170	79
31-Jan-23	240												130			
24-Feb-23														17		
25-Feb-23									7	8	11	14			34	33
27-Feb-23	21												33			
13-Mar-23	170												540			
14-Mar-23														79		
16-Mar-23									49	39	130	79			70	1,600

Total Coliform Bacteria

The results of measurements for total coliform bacteria are presented in **Table 3-13**. 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 3-13: TOTAL COLIFORM (MPN/100 ML) RESULTS IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q1 2023**(NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <5,000 MPN/100 ML)**

Station Code	NNG 01	R0 1	R0 2	R0 3	R0 4	R0 5	R0 6	R0 7	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
26-Jan-23									27	170	27	240			920	110
31-Jan-23	1,600												350			
24-Feb-23														920		
25-Feb-23									240	110	350	540			920	920
27-Feb-23	540												240			
13-Mar-23	540												350			
14-Mar-23														920		
16-Mar-23									49	39	170	110			70	1,600

3.7.2 Compliance Monitoring of Effluents from Camps

A total of 03 sites discharged effluents in Q1 2023, including 02 camps (OSO V1 and OSOV2) and at the Wastewater Treatment System of the Main Powerhouse. The effluent monitoring location sites can be found in **Figure 3-14**.

The results are described in **Table 3-14** and the full data set is in **Appendix 4.2**.

The status of compliance as of 31 March 2023 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 Main Powerhouse (EF19), OSOV1 (EF01) and OSOV2 (EF13).

FIGURE 3-14: LOCATION OF EFFLUENT MONITORING POINTS

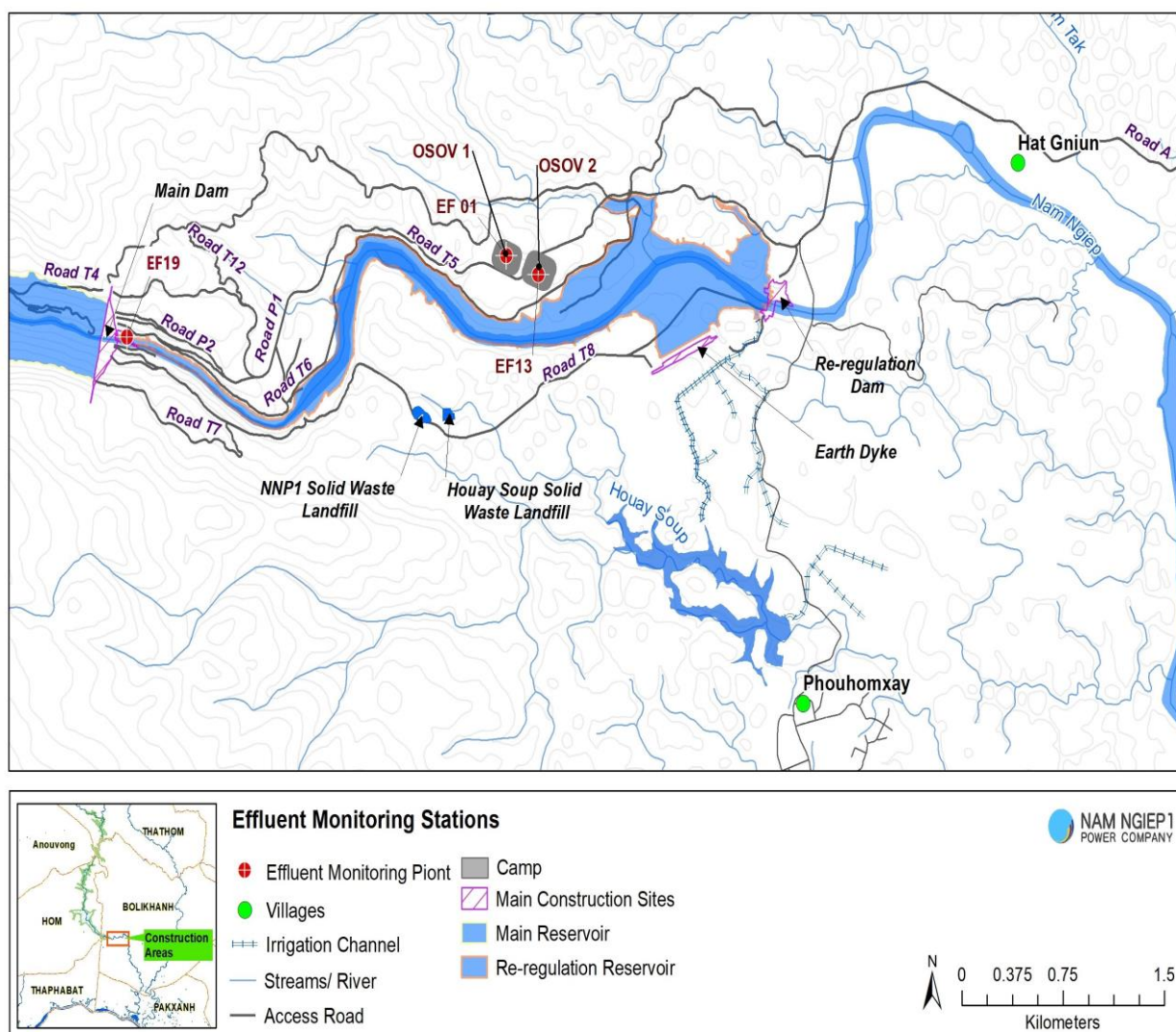


TABLE 3-14: RESULTS OF THE EFFLUENT WATER QUALITY MONITORING OF THE CAMPS IN Q1 2023 (NON-COMPLIANCE PARAMETERS ONLY)

		Site Name	OSOV1	OSOV 2	Main Powerhouse
		Station Code	(EF01)	(EF13)	(EF19)
Date	Parameter (Unit)	Guideline in the CA			
16-Jan-23	TSS (mg/L)	<50	<5	7.6	76.25
30-Jan-23	TSS (mg/L)	<50	<5	9.05	56.03
10-Feb-23	TSS (mg/L)	<50	<5	20.33	56.47
22-Feb-23	TSS (mg/L)	<50	<5	<5	59.13
06-Mar-23	TSS (mg/L)	<50	<5	9.4	80
20-Mar-23	TSS (mg/L)	<50	<5	7.63	44.58
16-Jan-23	BOD ₅ (mg/L)	<30	<6	<6	32.34
30-Jan-23	BOD ₅ (mg/L)	<30	<6	10.65	31.02
10-Feb-23	BOD ₅ (mg/L)	<30	<6	9.57	<6
22-Feb-23	BOD ₅ (mg/L)	<30	<6	<6	<6
06-Mar-23	BOD ₅ (mg/L)	<30	<6	<6	<6
20-Mar-23	BOD ₅ (mg/L)	<30	<6	<6	8
22-Feb-23	COD (mg/L)	<125	<25	52.5	113
06-Mar-23	COD (mg/L)	<125	<25	37.8	188
20-Mar-23	COD (mg/L)	<125	<25	40.2	70
22-Feb-23	NH ₃ -N (mg/L)	<10.0	4.1	16.4	8.9
06-Mar-23	NH ₃ -N (mg/L)	<10.0	<2	23.5	3.1
20-Mar-23	NH ₃ -N (mg/L)	<10.0	3	28.1	21.3
22-Feb-23	Total Nitrogen (mg/L)	<10.0	4.5	17.6	24.8
06-Mar-23	Total Nitrogen (mg/L)	<10.0	3.1	23.8	10.8
20-Mar-23	Total Nitrogen (mg/L)	<10.0	3.1	29.5	58.0
22-Feb-23	Total Phosphorus (mg/L)	<2	1.13	1.8	13.8
06-Mar-23	Total Phosphorus (mg/L)	<2	0.76	2.5	13.0
20-Mar-23	Total Phosphorus (mg/L)	<2	1.48	2.4	10.3
16-Jan-23	Faecal Coliform (MPN/100 mL)	<400	540	170	79
30-Jan-23	Faecal Coliform (MPN/100 mL)	<400	540	5,400	5,400
10-Feb-23	Faecal Coliform (MPN/100 mL)	<400	460	9,200	0
22-Feb-23	Faecal Coliform (MPN/100 mL)	<400	5	0	1,600
06-Mar-23	Faecal Coliform (MPN/100 mL)	<400	79	0	0
20-Mar-23	Faecal Coliform (MPN/100 mL)	<400	140	0	920
16-Jan-23	Total coliform (MPN/100 mL)	<400	540	210	140
30-Jan-23	Total coliform (MPN/100 mL)	<400	1,600	9,200	9,200
10-Feb-23	Total coliform (MPN/100 mL)	<400	700	16,000	0
22-Feb-23	Total coliform (MPN/100 mL)	<400	1,600	0	1,600
06-Mar-23	Total coliform (MPN/100 mL)	<400	240	0	0
20-Mar-23	Total coliform (MPN/100 mL)	<400	1,600	2	1,600
22-Feb-23	Oil & Grease (mg/L)	<10.0	<1	<1	<1
06-Mar-23	Oil & Grease (mg/L)	<10.0	<1	1.2	2.1

TABLE 3-15: COMPLIANCE STATUS OF EFFLUENT DISCHARGE FROM THE CAMPS IN Q1-2023

Site	ID	WWTS	Key Non-Compliance Issues ¹ in Q1-2023	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. - The effluent from this site was flowed into Re-regulation Reservoir.	- Faecal coliform (<400 MPN/100 mL): Non-compliance in 3 out of 6 samplings. Q1 mean 294 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 5 out of 6 samplings. Q1 mean 1,047 MPN/100 mL.	The Wastewater Treatment System improvement and modification was completed at the end of August 2021 and adjustments to the system operation are being made to ensure optimal operation of the system.
OSOV 2 (ESD Camp)	EF13	- Septic tanks (kitchen and black water) and SBR with chlorination system. - The effluent from this site was flowed into Re-regulation Reservoir.	- Ammonia-nitrogen (<10 mg/L): Non-compliance in all 3 samplings. Q1 mean 22.7 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in all 3 samplings. Q1 mean 23.6 mg/L. - Total Phosphorus (<2 mg/L): Non-compliance in 2 out of 3 samplings. Q1 mean 2.2 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 2 out of 6 samplings. Q1 mean 2,462 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 2 out of 6 samplings. Q1 mean 4,235 MPN/100 mL.	As above.

¹ The values in brackets indicate the applicable standard

Site	ID	WWTS	Key Non-Compliance Issues ¹ in Q1-2023	Corrective Actions
Main Powerhouse	EF19	- Septic tanks (grey and black water), biofilm tank and chlorination tank. - The effluent from this site was flowed into Tailrace of Main Powerhouse and then Re-regulation Reservoir.	- TSS (<50 mg/L): Non-compliance in 5 out of 6 samplings. Q1 means 62 mg/L. - BOD₅ (<30 mg/L): Non-compliance in 2 out of 6 samplings. Q1 means 13 mg/L. - COD (<125 mg/L): Non-compliance in 1 out of 3 samplings. Q1 means 124 mg/L. - Ammonia-nitrogen (<10 mg/L): Non-compliance in 1 out of 3 samplings. Q1 mean 11.1 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in all 3 samplings. Q1 mean 31.2 mg/L. - Total Phosphorus (<2 mg/L): Non-compliance in all 3 samplings. Q4 mean 12.4 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 3 out of 6 samplings. Q1 mean 1,333 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 2 out of 6 samplings. Q1 mean 2,090 MPN/100 mL.	As above

3.7.3 Groundwater Quality Monitoring

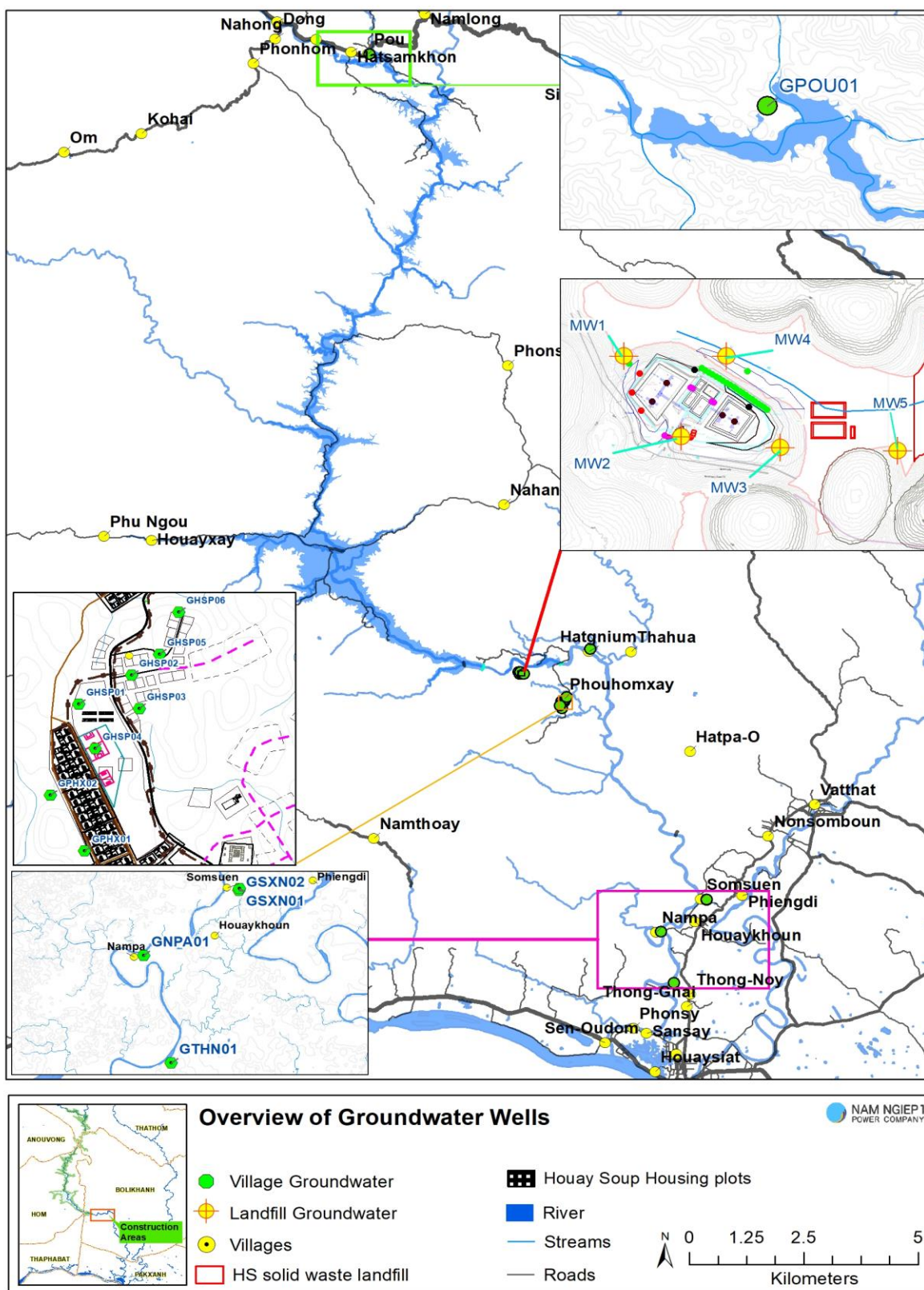
During Q1 2023, a total of five boreholes at Somseun, Nam Pa, Thong Noy, (one borehole in each village) and Pou Villages (two boreholes) have been monitored for the following parameters:

- a. *Monthly:* pH, DO (%), DO (mg/L), Conductivity ($\mu\text{S}/\text{cm}$), Temperature ($^{\circ}\text{C}$), 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).

Noted: The two broken boreholes were repaired and put back into operation in April 2023. EMO resumed its monthly water quality monitoring as scheduled.

The groundwater sampling locations are displayed in **Figure 3-15** and the groundwater monitoring data is presented in **Appendix 4.3**.

FIGURE 3-15: 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, except faecal coliform and *E. coli* bacteria in March 2023.

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

Pou Village: all monitored parameters complied with the standard, except pH for GPOU01 in January 2023, and faecal coliform and *E.Coli* bacteria for GPOU02 in March 2023.

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 system 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 likely 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.

In March 2023, NNP1PC carried out landfill groundwater monitoring at NNP1 Solid Waste Landfill (only three monitoring wells due to water sampling equipment was stuck in monitoring well MW2) and at Houay Soup Solids Waste Landfill (one monitoring well). The lead concentration exceeded the groundwater quality standard in monitoring wells MW1, MW3, MW4 and MW5.

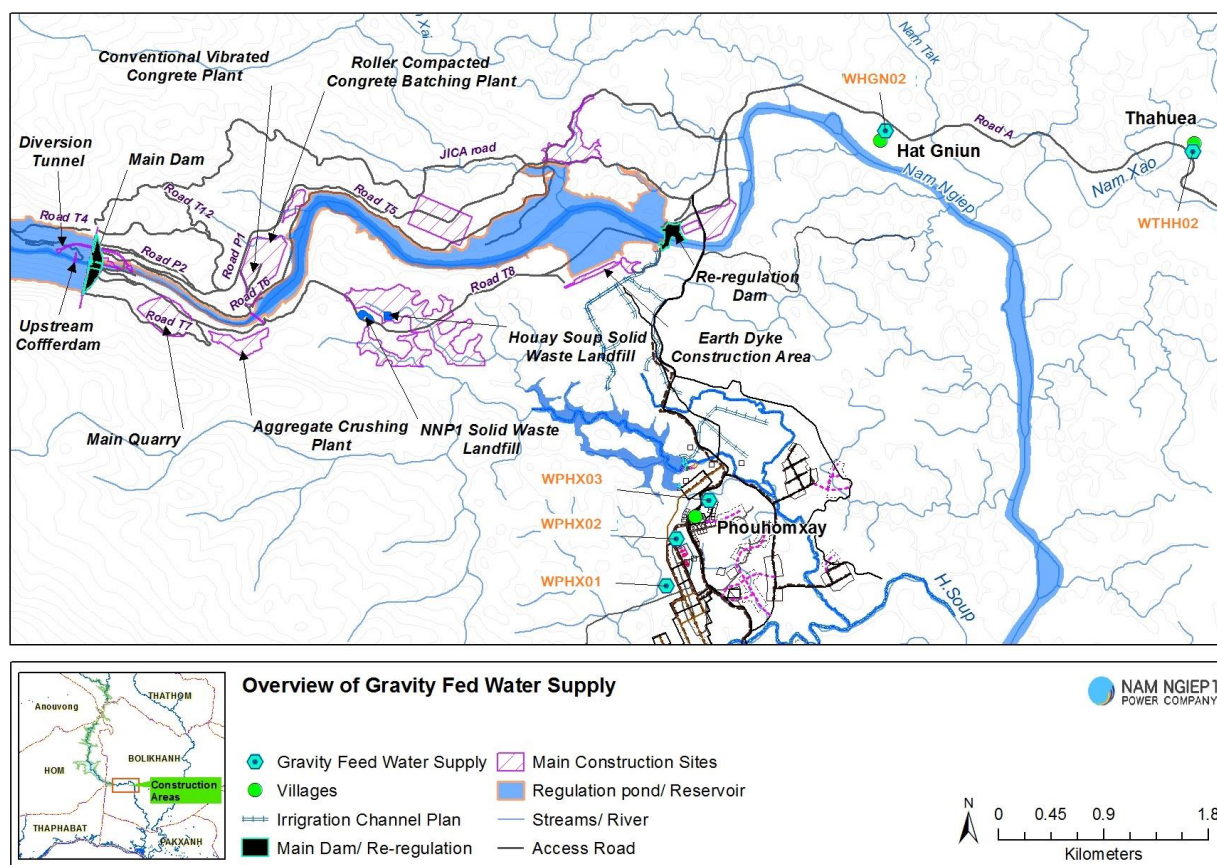
However, this is likely due to the natural background level. Lead has been detected in both upstream and downstream wells, and leachate from the treatment ponds did not contain lead. The landfills are HDPE lined to prevent leachate and the boreholes are over 50 m deep and not accessible to staff or villagers.

TABLE 3-16: THE LANDFILL GROUNDWATER MONITORING RESULT IN Q1 2023

		Site Name	NNP1 Landfill				Houay Soup Landfill
		Station	MW1	MW2	MW3	MW4	MW5
Date	Parameter (Unit)	Guideline					
20-Mar-23	pH		6.92		6.89	7.00	7.05
20-Mar-23	Sat. DO (%)		63.1		25.6	18	44.6
20-Mar-23	DO (mg/L)		5.02		2.05	2.2	3.48
20-Mar-23	Conductivity (µS/cm)		184		124	51	98
20-Mar-23	Temperature (°C)		27.08		26.9	27.57	28.21
20-Mar-23	Turbidity		26.9		6.5	7.2	21.6
20-Mar-23	Lead (mg/L)	<0.01	0.6		0.64	0.315	0.406
20-Mar-23	Faecal Coliform (MPN/100ml)		1,600		11	0	0
20-Mar-23	E. coli (MPN/100ml)		1,600		11	0	0
20-Mar-23	NH ₃ -N (mg/L)		<2		<2	<2	<2
20-Mar-23	Total Nitrogen (mg/L)		0.91		0.43	0.4	0.83
20-Mar-23	Copper (mg/L)	<1	0.006		0.004	<0.003	<0.003
20-Mar-23	Total Petroleum (mg/L)		<3		<3	<3	<3
20-Mar-23	Water level (m)		29.5	-	26.7	25.1	14.9

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 3-16: 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 3-17**. The full set of data is presented in **Appendix 4.4**.

TABLE 3-17: THE GFWS MONITORING RESULT IN Q1 2023

Date	Parameter (Unit)	Site Name	Tha Heua Village	Hat Gniun Village	Phouhomxay Village	
		Station	WTHH02	WHGN02	WPHX02	WPHX03
		Guideline				
12-Jan-23	E. Coli (MPN/100 mL)	0	79	22	130	170
26-Feb-23		0	5	49	49	33
21-Mar-23		0	13	17	79	49
12-Jan-23	Faecal coliform (MPN/100 mL)	0	79	49	130	170
26-Feb-23		0	8	49	33	40
21-Mar-23		0	17	21	130	70

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 pH, faecal coliform and *E.coli* in Q1 2023 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. However, in April 2023, the two broken boreholes were repaired and put back into operation.

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. According to the 2019 site condition survey, it is not feasible for fencing off the upstream water course due to cattle having access from all directions along the stream. 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 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

Water sampling was not carried out for landfill leachate treatment systems at NNP1 Project landfill and Houay Soup landfill due to the ponds are dry.

3.7.6 Water Quality Compliance Monitoring

The water quality non-compliance issues in Q1 2023 are summarized in **Table 3-18**.

TABLE 3-18: NON-COMPLIANCES RELATING TO WATER QUALITY MONITORING IN Q1 2023

No	Non-compliance Issues	Corrective Actions	Status
1	During turbine discharge (March 2023), 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.	- NNP1PC has proposed to ADB and LTA to keep monitoring the water quality in the Reservoir, Re-regulation Reservoir, and the Nam Ngiep downstream the Re-regulation Dam to study the changes and take actions where necessary. - It should be noted that since the Commercial Operation Date (COD) in September 2019 no dead fish have been observed in Nam Ngiep downstream the Re-regulation Dam
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. - The WWTS operation and maintenance were closely monitored including chlorine dosing and bi-weekly inspections of the septic tanks and wetland systems. The results of the effluent analyses of the WWTSs provide important feedback for guiding continuous adjustments and implementing necessary corrective actions.
3	Groundwater quality monitored for the communities (Thong	- A full inspection of the water supply systems in Som Seun, Nam Pa and Thong Noy Village was conducted in	- The villagers were advised/encouraged to boil water before drinking.

No	Non-compliance Issues	Corrective Actions	Status
	Noy, Som Seun and Nam Pa Villages) were not complied with the National Groundwater Quality Standard for drinking purpose on Faecal Coliform and <i>E.coli</i> parameters	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 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.	- Continue to monitor.
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 <i>E.coli</i> 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. It is not feasible for fencing off the upstream water course due to cattle having access from all directions along the stream. 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 lead parameter in Landfill groundwater.	- Continue monitoring.	- 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)

The Head of Xaysomboun WRPO shared the official agreement of patrol team establishment to NNP1PC EMO and Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS) on 4 January 2023. NNP1PC EMO and BSP-WCS team noted that the agreement was already signed on 12 December 2022 and the Head of Xaysomboun WRPO had not provided any clarification for not sharing the agreement after the approval. It was also noted that Xaysomboun WRPO did not incorporate the recommendations that NNP1PC EMO and BSP-WCS provided to the draft agreement before the approval. Therefore, NNP1PC EMO and BSP-WCS agreed during the internal meeting on 18 January 2023 to assess the team organization and future arrangements including the agreement between Xaysomboun WRPO and the Xaysomboun Provincial Military office as well as the commitment of the assigned staff. Xaysomboun WRPO agreed to have a meeting with NNP1PC EMO and BSP-WCS on 25 January 2023 but none of the representatives of the Xaysomboun patrolling teams showed up to the meeting. The Head of Xaysomboun insisted that it is not necessary to question the qualification of the patrol team members or their assignment and the performance could be evaluated after the implementation. After a series of follow-ups for the patrolling preparation, Xaysomboun WRPO finally agreed to have a discussion with BSP-WCS on 14 March 2023 for the preparation of the Law Enforcement Strategy (LES) in the NNP1 watershed. It is expected that the LES preparation to take at least three months from April to June 2023 and a higher-level validation workshop as part of the approval process will be organized in July 2023 as soonest. The discussion also emphasized that the Totally Protected Zone (TPZ) patrolling shall be started as soon as AIP2022 disbursement is complete and not to wait for the finalization of the LES. Xaysomboun WRPO agreed with the approach. BSP-WCS will continue the process for the LES preparation in close collaboration with EMO and WRPOs.

NNP1PC EMO, Xaysomboun WRPO, and BSP-WCS had a discussion on 24 January 2023 on the patrolling sub-station location re-survey and the delay with construction work since 2021. Xaysomboun WRPO agreed with the technical explanation from BSP-WCS to shift the method of patrolling from the sub-station model to the mobile patrolling model. NNP1PC EMO and BSP-WCS recommended documenting the technical discussion as a reference for the Xaysomboun WRPO to postpone the construction work for TPZ land-based sub-stations and only proceed with the construction of reservoir checkpoints. NNP1PC EMO, Xaysomboun WRPO, and BSP-WCS revisited the TPZ reservoir checkpoint locations on 13 February 2023 and the Head of Xaysomboun WRPO confirmed that the construction can start immediately after the survey. However, there was no progress until the end of March 2023 with no clear explanation from the Head of Xaysomboun WRPO.

NNP1 EMO had discussions with the Hom District Office of Energy and Mines on 17 and 21 February 2023 regarding the continuation of mining exploration as well as the Nam Phouan Hydropower project in the NNP1 watershed Phou Samsao Totally Protected Zone (TPZ). NNP1 EMO noted from a letter by the mining company, Boualaiy Mongkone Thong, to Xaysomboun

Province Department of Energy and Mines on 9 January 2023 stating that the Company will bring 5 excavators, 2 suction trucks, 5 trucks, 3 pick-up cars, 1 tractor, and 3 drilling equipment into the area. The staff of Hom District Office of Energy and Mines informed the NNP1 EMO on 7 March 2023 that the mining company plans to expand the existing access road from Ban Homthat to Nam Phouan Noy to reach the mining site in the NNP1 watershed TPZ1. The staff informed the NNP1 EMO on 29 March 2023 that the mining company currently focuses their activity in the Phouthat area at Homthat village and will return to the site within the NNP1 TPZ1 area for exploring mining thereafter. The staff does not have detailed information about the new road alignment from the Phouthat area to Nam Phouan Noy.

NNP1 EMO noted from the explanation from the staff of Hom District Office of Energy and Mines on 21 February 2023 that the Nam Phouan Company has transported 2 excavators to Phou Ngou village in the week of 13 February 2023 and will construct an access road to the Nam Phouan site for drilling and collecting soil samples. NNP1 EMO learned from the Head of Phou Ngou Village on 7 March 2023 that there is only one excavator parked in Phou Ngou Village and The Nam Phouan Company is considering a new access road due to difficulties in mobilizing heavy equipment on the existing access road that is also used for mining exploration. The Company is in discussion with the villagers on the road alignment and compensation related to it. The staff of the Hom District Office of Energy and Mines informed the NNP1 EMO on 29 March 2023 that the contractor of Nam Phouan HHP has cleared and modified some sections of the existing access road from Phou Ngou village to Houay Pasong for 4-5 days. The contractor will construct a new road alignment around 2 Km from Houay Pasong to the Nam Phouan project site. NNP1 EMO noted that the update from the Hom District Office of Energy and Mines is different from the information provided by the Head of Phou Ngou Village on 7 March 2023. In addition, the staff of the Hom District Office of Energy and Mines also informed that the Xaysomboun Provincial Department of Energy and Mines issued an urgent notification to the Hom District Office of Energy and Mines to ask the Nam Phouan HPP to discontinue the construction of a new access road and construction until the project obtains the agreement and approval from the provincial level.

The meeting on the roles and responsibilities of the NNP1PC reservoir fishery management still could not be organized during the first quarter of 2023 because the Head of Xaysomboun WRPO was occupied with other assignments including the meeting on the Financial Management Manual (FMM), the internal PAFO monthly meetings, the survey to land concession area in Thathom District, the resurvey of reservoir checkpoints and his leave.

NNP1PC EMO in consultation with BSP-WCS prepared a discussion paper including the action plan to deal with the long delays and pending issues of the Xaysomboun WRPO in January 2023. The document was reviewed and discussed by NNP1 Management, ADB, and IAP from February to March 2023. NNP1PC submitted an official letter on the proposed actions to address the long delays and pending issues of the Xaysomboun WRPO activities to the Head of Xaysomboun PAFO on 17 March 2023. The NNP1 EMO follow-up with the Head of Xaysomboun PAFO on 29 March 2023 and noted that he did not receive the letter and he was in Longcheng District for other assignments. He will review the letter in the first week of April 2023.

4.1.1.2 Bolikhamxay Watershed and Reservoir Protection Office (WRPO)

Bolikhamxay WRPO organized January monthly meeting on 12 January 2023 at the Bolikhamxay WRPO office in Bolikhan District. The meeting was attended by 10 members of Bolikhamxay WRPO, two members of BSP-WCS, and one member of NNP1PC EMO. It was noted that the forestry patrol team did not find any threats during the period of 19-26 December 2022. However, NNP1PC EMO and BSP-WCS noted that the patrolling was not conducted according to the plan that was discussed during the monthly meeting in December 2022. This includes no proper recording of observations around the concerned area and the tracking was done only along the road. NNP1PC EMO and BSP-WCS strongly recommended the patrolling in January 2023 should only focus within the NNP1 watershed area and the BSP-WCS team will join the patrolling.

Bolikhamxay WRPO also shared the reservoir patrol report of December 2022 and noted the finding of illegal logs with a total volume of around 17 m³ at Phou Houay Sue. The reservoir patrol team has informed the Head of Bolikhamxay WRPO for further coordination with the Bolikhamxay Provincial Office of Forest Inspection (POFI) to process the case according to the law.

The January 2023 Forest and Reservoir Patrolling were commenced during 16-25 January 2023 and 13-22 January 2023, respectively. Bolikhamxay WRPO organized the February monthly meeting on 13 February 2023 at the Bolikhamxay WRPO office in Bolikhan District. NNP1 EMO and BSP-WCS noted that the January 2023 patrolling has focused on some areas outside the NNP1 watershed which as noted in the patrolling report included illegal logging with a volume of 7.731 m³ in Phou Houa Sue (outside NNP1 watershed). The findings were reported and referred to the Bolikhamxay Province Office of Forest Inspection (POFI) for further processing. NNP1 EMO requested BSP-WCS to assess the patrolling planning and implementation for discussion at the next monthly meeting.

The February 2023 Forest and Reservoir Patrolling were commenced during 15-24 February 2023. The Bolikhamxay WRPO organized the March monthly meeting on 13 March 2023 at the Bolikhamxay WRPO office in Bolikhan District. The February 2023 patrolling results showed that there are still some villagers accessing the compensated rubber trees in the Nahan village area but there are no details about these villagers from the patrol team or hotline operation. Bolikhamxay WRPO requested NNP1 EMO to further communicate with provincial resettlement committees to deal with it. Bolikhamxay WRPO requested NNP1 to consider improving the access from Nahan village to the NNP1 reservoir area. NNP1 EMO clarified as communicated on many different occasions that the improved access will increase threats to the NNP1 watershed and its reservoir.

Bolikhamxay WRPO agreed with the recommendation from NNP1 EMO and BSP-WCS to focus on patrolling efforts within the NNP1 watershed. The forest patrol was scheduled on 28 March to 8 April 2023. The reservoir patrol of March 2023 is subject to boat engine repair. Bolikhamxay WRPO will further discuss with NNP1 EMO if there are no feasible options to repair the broken boat engine.

4.1.1.3 NNP1PC EMO

Thathom DAFO shared the information on Kai Noy Rice production under the agriculture extension program from the three households at Nahong and Phonhom villages on 20 January

2023. It was noted that the organic farming demo plot with the total area of 1,600 m² produced more Kao Noi rice as compared with the conventional farming demo plot. Farmers requested the GOL and NNP1 staff to continue assisting and monitoring their activity so that they could do better recording and make improvement as necessary.

NNP1 EMO distributed a form for the farmers in PhouNgou and Houayxay villages at Hom District to record their investment costs of the cattle program in early January 2023. NNP1 EMO checked with the farmers at the end of January 2023 and noted that they would like to have more guidance.

There was no activity implemented under the NNP1 EMO watershed livelihood program from February to March 2023 because the team is fully occupied with other assignments, especially addressing the delays and pending issues of Xaysomboun WRPO.

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 March 2023
1	Financial Management Manual (FMM) for WPROs and NC-NX BOMU		
	Approval	Q2 2022 (original) Q2 2023 (new)	In progress: - The FMM Finalization workshop was organized on 21 Dec 2022 at Longxan District and the followed-up workshop was organized on 19-20 Jan 2023 at DoF-MAF. The MOMs were signed and shared by FPF DOF-MAF on 11 Jan and 14 March 2023 respectively. - There were no further comments from GoL regarding the revised FMM that referred to the new GOL Financial Policy No 0200/MoF issued on 25 January 2023. Subsequently, the MoM was signed on 14 March 2023. - DOF-MAF FPF requested NNP1PC to prepare a brief report on the FMM preparation and finalization for reporting to the DOF-MAF management and approval. The report was submitted on 15 March 2023 and NNP1 EMO will continue to follow up about it. The approval is now expected to be in the second quarter of 2023.
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 Enforcement Strategy and the strategy	Q2 2022 (original) Q2 2023 (new)	Completed NC-NX offset site 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. In progress: The overall process and schedule of LES preparation:

No.	Actions	Target date	Status as of March 2023
			14 March 2023: BSP-WCS held a meeting with XSB WRPO to propose the development plan for the LE strategy in the sub-catchment. Meeting - A key message to XSB-WRPO has been to start TPZ patrolling as soon as AIP2022 disbursement is complete, and not to wait for finalization of the LE Strategy to do so - XSB WRPO agreed with the approach and to hold a technical meeting within the coming weeks - BSP-WCS notes that the Minutes of Meeting (MOM) signed by XSB WRPO on 14 March incorrectly record that BSP-WCS agreed to the meeting location (Hom) and participant list (30 persons) as such agreement cannot be reached without discussion with EMO. 2-7 April 2023: LE Training that will include a technical discussion on the LE Strategy to get input from Head of Patrols and WRPO - Apr-Jun 2023: The development of the LE strategy (with a possibility for delays in case of disagreements between parties, or slow review times) - Jun-Jul 2023: A higher-level validation workshop as part of the approval process.
b	The operation of Xaysomboun WRPO sub-office at Hom District	Jan 2022 (original) Q2 2023 (new)	The operation of Xaysomboun WRPO sub-office is expected to be cleared out after discussion with the Head of Xaysomboun WRPO on the proposed actions to deal with outstanding delays and pending issues of the AIP implementation, the approval of FMM, and the finalization of Xaysomboun AIP2023 which are now postponed to the second quarter of 2023.
c	Checkpoints in the NNP1 sub-catchment	Dec 2020 (original) Q2 2023 (new)	NNP1 EMO, Xaysomboun WRPO, and BSP-WCS re-visited the TPZ reservoir checkpoint locations on 13 February 2023 and the Head of Xaysomboun WRPO confirmed that the construction can start immediately after the survey. However, there was no progress as of the end of March 2023 with no clear explanation from the Head of Xaysomboun WRPO. NNP1 EMO will clear out this during the discussion with the Head of Xaysomboun PAFO on the proposed

No.	Actions	Target date	Status as of March 2023
			actions to deal with outstanding delays and pending issues of the AIP implementation in April 2023.
d	TPZ demarcation in the NC-NX offset site	Jan 2022 (original) Q2 2023 (new)	The meeting for the approval of the Nam Chouane-Nam Xang (NC-NX) and its Totally Protected Zone (TPZ) boundary could not be organized from January to March 2023 because of the unavailability of the Head of Bolikhamxay Province Agriculture and Forestry Office (PAFO) and the Vice Governor of Bolikhamxay Province. NNP1 EMO will continue to follow-up with NC-NX BOMU in the second quarter of 2023.
e	Reservoir fishery management	Jan 2022 (original) Q2 2023 (new)	The meeting on the roles and responsibilities of the NNP1PC reservoir fishery management could not be organized during the first quarter of 2023 because the Head of Xaysomboun WRPO was occupied with other assignments including the meeting on the FMM, the internal PAFO monthly meetings, the survey to land concession area in Thathom District, the resurvey of reservoir checkpoints and his leave. NNP1 EMO will clear out this during the discussion with the Head of Xaysomboun PAFO on the proposed actions to deal with outstanding delays and pending issues of the AIP implementation in April 2023.

4.1.2 Preparation of Annual Implementation Plan (AIP) 2022

4.1.2.1 Xaysomboun WRPO

NNP1PC EMO received the official fund disbursement request under the AIP2022 from the Forest Protection Fund (FPF) office of the Department of Forestry (DOF)-Ministry of Agriculture and Forestry (MAF) on 20 January 2023. NNP1PC transferred the fund to FPF DOF-MAF on 31 January 2023. Xaysomboun WRPO re-submitted the original document to DOF-MAF FPF on 13 February 2023 for the further fund transfer process to the Xaysomboun WRPO account. The fund transfer was not completed as of the end of March 2023 despite their close follow-up with FPF DOF-MAF.

4.1.2.2 Bolikhamxay WRPO

Bolikhamxay WRPO informed that their AIP2022 fund for the remaining quarter of 2022 was transferred by DOF-MAF on 2 November 2022.

4.1.3 Preparation of Annual Implementation Plan (AIP) 2023

4.1.3.1 Xaysomboun WRPO

The Head of Xaysomboun WRPO informed NNP1 EMO on 27 January 2023 that he is compiling the inputs from his team and reviewing the budget for their AIP2023 to be aligned with the new GOL financial policy (No. 0200/MoF). The Head of Xaysomboun WRPO submitted the draft AIP2023 to NNP1 EMO on 1 February 2023. NNP1 EMO reviewed the draft and shared it with BSP-WCS on 9 February 2023. EMO temporarily paused AIP2023 discussions during the development of the “Discussion paper on the proposed actions to XSB PAFO”. Discussions were initially planned to resume after the letter to the Head of Xaysomboun PAFO was submitted and discussed. But NNP1 management advised continuing the work while waiting for the responses or discussion with the Head of Xaysomboun PAFO. BSP-WCS reviewed the draft AIP2023 on 24 March 2023. NNP1 EMO, Xaysomboun WRPO, and BSP-WCS will discuss the revised plan after the Law Enforcement (LE) training in the first week of April 2023.

4.1.3.2 Bolikhamxay WRPO

ADB and Independent Advisory Panel (IAP) confirmed no objection for the Bolikhamxay AIP2023 on 18 and 20 January 2023 respectively. Bolikhamxay WRPO further revised the budget based on the new GOL financial policy No. 0200/MoF that was issued on 25 January 2023. NNP1 EMO agreed with the revised version on 31 January 2023. Bolikhamxay WRPO obtained approval from the Head of Bolikhamxay WRPO and submitted their AIP2023 to FPF DOF-MAF on 17 February 2023. Bolikhamxay WRPO shared an official letter of fund disbursement from the FPF DOF-MAF to NNP1 EMO on 17 March 2023. NNP1 EMO requested FPF DOF-MAF to revise the letter following the Financial Management Manual (FMM). NNP1 EMO received the revised letter on 31 March 2023. EMO will process the request and closely follow-up with FPF DOF-MAF so that the fund could reach Bolikhamxay WRPO in the last week of April 2023 as soonest. Bolikhamxay WRPO and NNP1 EMO noted the slow process from FPF DOF-MAF because the newly assigned team is not familiar with the fund disbursement processes.

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

The meeting for the approval of the Nam Chouane-Nam Xang (NC-NX) and its Totally Protected Zone (TPZ) boundary could not be organized from January to March 2023 because of the unavailability of the Head of Bolikhamxay Province Agriculture and Forestry Office (PAFO) and the Vice Governor of Bolikhamxay Province. NNP1 EMO will continue to follow-up with NC-NX BOMU in the second quarter of 2023.

b. Component 2 – Enforcement

NC-NX BOMU in collaboration with NNP1 EMO, BSP-WCS, and Lao Red Cross organized SMART refresher training, training on SOPs, and first aid training during 13-17 February 2023 in Viengthong District. A total of 46 people participated in the training including representatives from BOMU, NC-NX patrol team, snare removal team, NNP1 EMO, BSP-WCS, and Lao Red Cross.

The January 2023 patrolling was implemented from 10 to 29 January 2023 focussing on TPZ highest priority area including downstream of Nam Sone, Nam Chang, Nam San, and Nam Xi as well as TPZ higher priority area including Nam Houg, Houay Hok, Houay Kengkouang, and Houay Kasae.

The February 2023 patrolling was implemented from 20 February to 11 March 2023 focussing on the TPZ highest and high priority area including Nam Xi, Nam Chouan, Nam San and Nam Houg.

The March 2023 patrolling was scheduled from 21 March to 9 April 2023 focussing on the TPZ highest priority area including Nam Xi temporary sub-station and the nearby areas; Nam San and mountain ridges; Nam Sone; Nam Chang; as well as the TPZ high priority area including the Nam Ma and its tributaries. BOMU informed NNP1 EMO that the report will be ready and data will be shared with NNP1 EMO in the last week of April 2023 because of the Lao New Year holiday. The results of the March 2023 patrolling will be reported in the report of the second quarter of 2023.

The results of patrolling in January to February 2023 are as follow:

Team	Patrolling Area/distance	Observations/Actions Taken
1	10 - 29 January 2023 Patrolling and safeguarding the temporary sub-station at the northwest edge of the TPZ highest priority area (Nam Xi)	10 – 29 January 2023 No threats observed and recorded
	20 February - 11 March 2023 Patrolling and safeguarding the temporary sub-station at the northwest edge of the TPZ highest priority area (Nam Xi) (17 days covering a distance of 58 km on forest patrolling)	20 February - 11 March 2023 No threats observed and recorded

Team	Patrolling Area/distance	Observations/Actions Taken
2	10 - 29 January 2023 TPZ highest priority area including Nam Chouan, Nam Sone and Nam Chang (16 days covering a distance of 72 km on forest patrolling) 20 February - 11 March 2023 TPZ highest priority area including Nam Chouan and west mountain ridges of Nam Chouan (16 days covering a distance of 62 km on forest patrolling)	10 - 29 January 2023 The team found and destroyed an old hunting camp located close to the upstream of Nam Chouan. The team also encountered a group of Vangphieng villagers (2 females and 6 males) doing illegal electro fishing in Nam Chouan. The team seized the electric fish shocker, issued a warning letter, and reported to Vangphieng village authority and the village cluster police for further actions. 20 February - 11 March 2023 No threats observed and recorded.
3	10 - 29 January 2023 TPZ highest priority area including Nam San and its northern tributaries (16 days covering a distance of 61 km on forest patrolling) 20 February - 11 March 2023 TPZ highest priority area including the upstream of Nam San and mountain ridges (16 days – total distance cover is unknown because of GPS broken during the field work)	10 - 29 January 2023 No threats observed and recorded. 20 February - 11 March 2023 No threats observed and recorded.
4	10 - 29 January 2023 TPZ high priority area including Nam Tan, Nam Houng, Houay Kanang, Houay San and Houay Pahok (16 days covering a distance of 86 km on forest patrolling)	10 - 29 January 2023 The team observed two small newly improved roads for NTFP collection (one is along Nam Tan (outside TPZ) and another one is at Nam Houng (inside the TPZ high priority area). The team also found and destroyed three individual large spring snares at Houay San and heard a gunshot at Houay Vangmoun. 20 February - 11 March 2023

Team	Patrolling Area/distance	Observations/Actions Taken
	20 February - 11 March 2023 TPZ high priority area including Nam Houng, Nam Somfad, Nam Lak, Houay Bon and Houay Kasae (16 days covering a distance of 70 km on forest patrolling)	The team found and destroyed one recent fishing camp and one old fishing camp at Nam Houng, a hunting camp at Houay Kasae and observed an inactive fishing fireplace at Nam Houng.

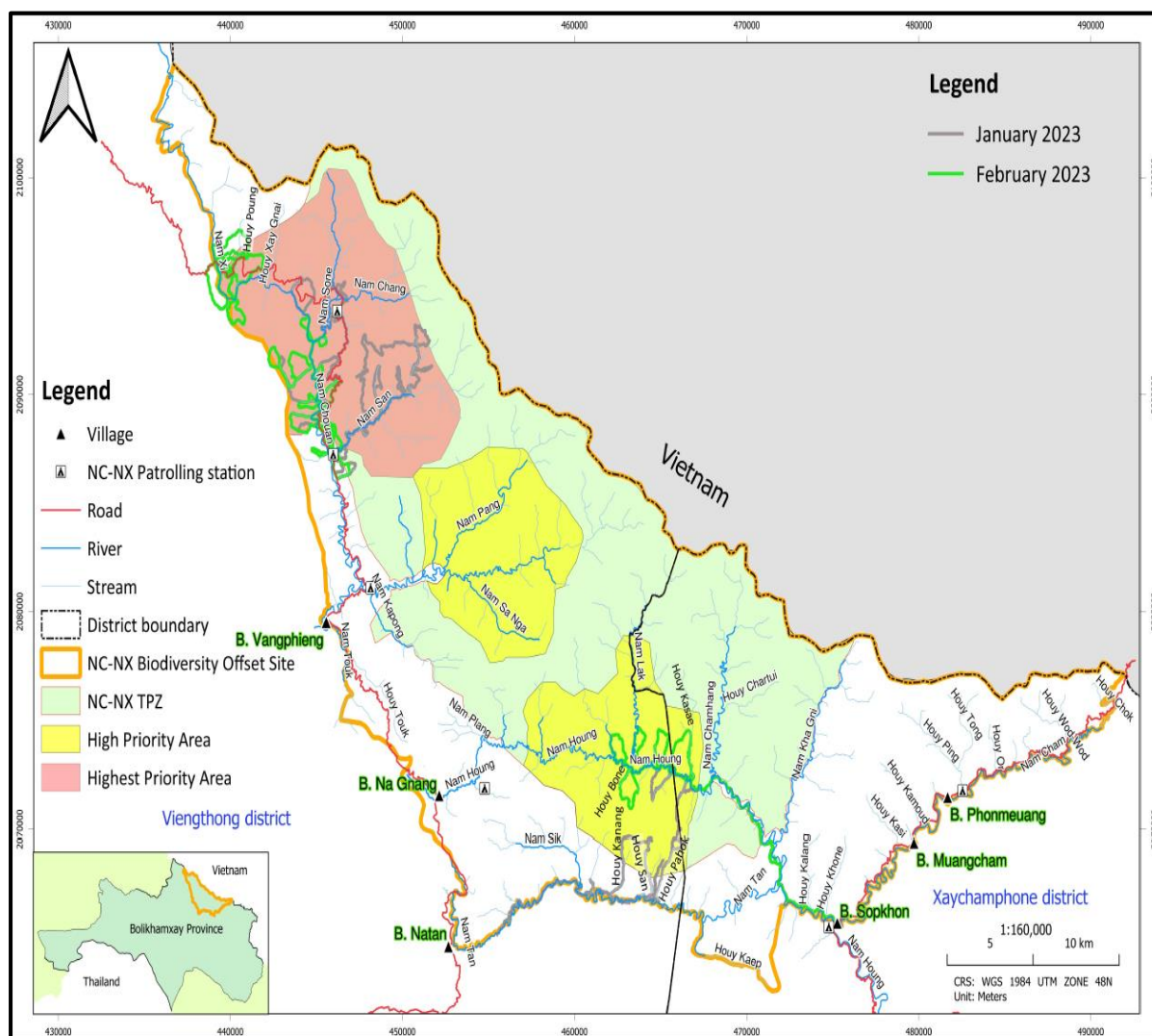
FIGURE 4-1: MAP OF PATROLLING TRACK IN JANUARY AND FEBRUARY 2023


FIGURE 4-2: MAP OF THREATS IN JANUARY AND FEBRUARY 2023

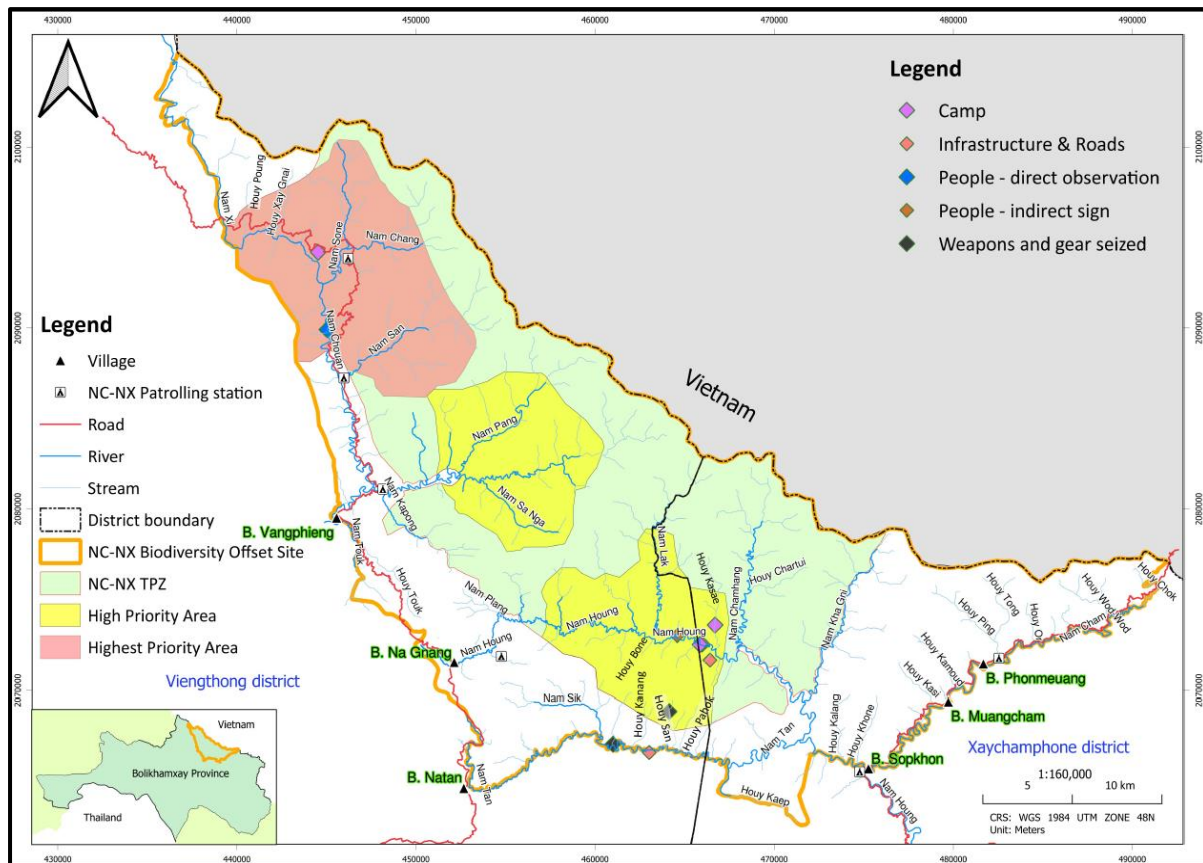


FIGURE 4-3: TEAM 2 ENCOUNTERED WITH FISHERS DOING ILLEGAL FISHING AT NAM CHOUAN IN JANUARY 2023



FIGURE 4-4: HUNTING CAMP WITH CARCASS OF MUNTJAC FOUND AND DESTROYED BY TEAM 2 AT NAM CHOUAN IN JANUARY 2023



FIGURE 4-5: LARGE SPRING SNARES FOUND AND DESTROYED BY TEAM 4 AT HOUAY SAN IN JANUARY 2023



FIGURE 4-6: RECENT HUNTING CAMP FOUND BY TEAM 4 AT HOUAY KASAE IN FEBRUARY 2023



FIGURE 4-7: FISHING FIREPLACE FOUND BY TEAM 4 AT NAM HOUNG IN FEBRUARY 2023



c. Component 3 – Conservation Outreach

Due to the delays in the procurement of some equipment, the training for the District Team was organized from 28 to 30 March 2023 in Xaychamphone District. The outreach activities in Xaychamphone and Viengthong districts are scheduled for 2-7 April and 24-17 April 2023, respectively.

FIGURE 4-8: REPRESENTATIVE PHOTOS OF OUTREACH TRAINING AT XAYCHAMPHONE DISTRICT DURING 28-30 MARCH 2023



d. Component 4 – Conservation linked livelihood

The field visit to confirm Community Development Plan (CDP) activities at three villages in Viengthong District was conducted during 9-13 January 2023 with the participation of NNP1 EMO and BSP-WCS. NNP1 EMO and BSP-WCS organized an online discussion on 17 January 2023 to wrap up the assessment including the recommended activities to be implemented under the NC-NX AIP2023. BSP-WCS shared the summary results with NC-NX BOMU on 19 January 2023. The assessment results were elaborated into the AIP2023.

The January 2023 snare removal was conducted during 15-29 January 2023 with the target area upstream of Nam Sone and mountain ridges. The February 2023 snare removal was scheduled from 24 February to 10 March 2023 with the target area at TPZ highest priority area including Nam Xi and Houay Xay Gnai. The results will be recorded in the SMART database. The March 2023 snare removal is planned to focus on TPZ highest priority area including Nam Sone and mountain ridges. However, the snare removal team submitted an official letter to BOMU on 27 March 2023 to postpone the activity to the following month because of the unavailability of the village team members related to farming activities together with their families.

e. Component 5 – coordination and collaboration

The Head of NC-NX BOMU informed NNP1 EMO that they are still working on the Memorandum of Understanding (MOU) extension between Bolikhamxay PAFO and Pu Mat

National Park and that the signing ceremony will be organized within 2023. The Head of NC-NX BOMU shared the Minutes of Meeting (MOM) of Pu Mat National Park team visit with NNP1 EMO on 2 February 2023.

4.2.2 Preparation of Annual Implementation Plan (AIP) 2023

The Head of Bolikhamxay BOMU informed NNP1 EMO in the last week of January 2023 that they are working on the budget revision of their AIP2023 following the new GOL financial policy (No. 0200/MoF). The Head of Bolikhamxay BOMU submitted the draft AIP2023 on 15 February 2023. NNP1 EMO reviewed the draft and shared it with BOMU and BSP-WCS on 21 February 2023. BSP-WCS reviewed and provided their comments and shared them with BOMU on 22 February 2023. NNP1 EMO, BOMU, and BSP-WCS organized a discussion to finalize the AIP2023 on 16 March 2023. The draft was finalized and submitted to ADB and IAP on 24 March 2023. ADB and IAP confirmed no objection on 28 March 2023. EMO has informed BOMU to process further for their internal approval by the Head of Bolikhamxay PAFO and submission to FPF DOF-MAF.

The 2-day follow-up workshop on the Financial Management Manual (FMM) with GOL was organized on 19-20 January 2023. NNP1 EMO is revising the unit rates following the new GOL financial policy (No. 0200/MoF). The MOM was signed and shared by FPF DOF-MAF on 14 March 2023 and there was no more comment from GoL partners on the revised FMM. As requested by FPF, NNP1-EMO prepared and shared a brief report on the FMM preparation process with FPF on 15 March 2023. FPF DOF-MAF is proceeding with the approval process.

5 FISHERY MONITORING

Four species groups and one species dominated the fish catch by weight in Q1 2023 as listed in **Table 5-1**. All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species² and *Oreochromis niloticus* is an exotic species.

TABLE 5-1: FISH SPECIES DOMINATING THE FISH CATCH IN Q1 2023

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Poropuntius normani</i> , <i>Poropuntius laoensis</i> , <i>Poropuntius carinatus</i>	ປາຈາດ	449.2	LC
<i>Hampala dispar</i> , <i>Hampala macrolepidota</i>	ປາສຸດ	317.6	LC
<i>Oreochromis niloticus</i>	ປານິນ	261.9	LC
<i>Scaphiodonichthys acanthopterus</i>	ປາມ້ອມ	251.7	LC
<i>Channa striata</i>	ປາຄໍ້	188.7	LC

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 recorded catch of Threatened species (IUCN Red List classification) in Q1 2023 are presented in **Table 5-2**. The list includes three species that are classified as Vulnerable species (VU).

Table 5-2: Threatened Species of Q1 2023 Fish Catch

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Cirrhinus cirrhosus</i>	ປາແກງ/ປານວນຈັນ	0.6	VU
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປ້ຽນ	48.4	VU
<i>Tor sinensis</i>	ປາແດງ	59.7	VU

The occurrence of Threatened species in the fish catch by quarter since the start of species identification in Q3 2015 is displayed in **Table 5-3**. Based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey.

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	Q4 2022	Q1 2023
<i>Bangana behri</i> (VU)	+	+	+	+	+	+	+	+	+			+	+	+		+															
<i>Cirrhinus cirrhosus</i> (VU)	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+		+	+	+		+		+	+	+	+	+	+	+
<i>Datnioides undecimradiatus</i> *																+															
<i>Epalzeorhynchos munense</i> (VU)												+																			
<i>Luciocyprinus striolatus</i> (EN)	+	+	+	+			+	+	+	+			+	+																	
<i>Pangasianodon hypophthalmus</i> (EN)	+																														
<i>Probarbus jullieni</i> (EN)	+	+	+			+		+	+	+		+		+			+	+			+	+				+					
<i>Probarbus labeamajor</i> (EN)				+	+			+																							
<i>Scaphognathops bandanensis</i> (VU)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Tor sinensis</i> (VU)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
* <i>Datnioides undecimradiatus</i> was caught in Mekong by DS households																															

Species abundance and occurrence is based on the 7-day reported catch from the DCL survey in Q1 2023. The catch is divided in 3 areas including above the main dam, below the main dam and Mekong area. Main biodiversity indicators in Q1 2023 for above dam, below dam and Mekong area are presented in **Table 5-4** 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 Q1 2023

Biodiversity Indicators	Mekong	Below dam	Above dam
Total species and groups	26	46	44
Single species	22	31	29
Species groups	4	15	15
Top 15 species (% total catch weight)	94.42%	77.15%	92.03%
Proportion for species groups	6.02%	50.75%	48.95%
Diversity index (Shannon)	2.3564	3.1484	2.6131

The mean daily fish catch per household from July 2015 to March 2023 is displayed in **Figure 5-1** and the mean fish catch per household per fishing day for Q1 from 2016 to 2023 are shown in **Table 5-5**.

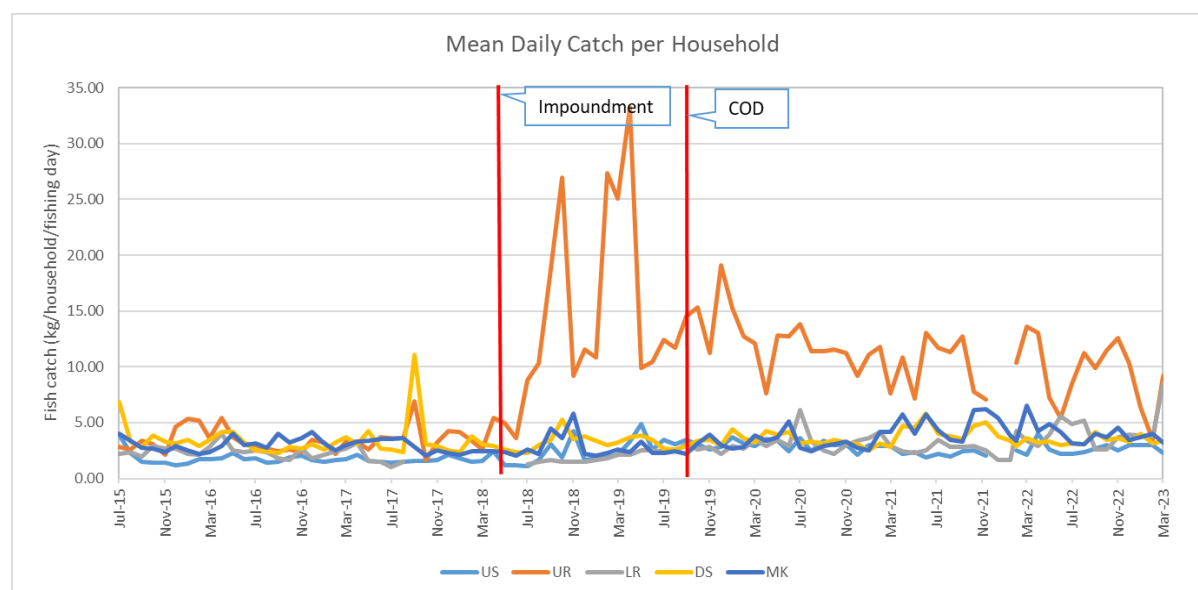


FIGURE 5-1: MEAN DAILY FISH CATCH PER HOUSEHOLD FROM JULY 2015 TO MARCH 2023

TABLE 5-5: MEAN DAILY FISH CATCH PER HOUSEHOLD FOR Q1 FROM 2016 TO 2023

Fishing Zone	Q1 2016 (kg)	Q1 2017 (kg)	Q1 2018 (kg)	Q1 2019 (kg)	Q1 2020 (kg)	Q1 2021 (kg)	Q1 2022 (kg)	Q1 2023 (kg)
Upstream	1.62	1.64	1.62	1.95	3.27	2.92	2.32	2.77
Upper reservoir	4.70	2.90	3.36	21.08	13.35	10.15	11.99	6.33

Fishing Zone	Q1 2016 (kg)	Q1 2017 (kg)	Q1 2018 (kg)	Q1 2019 (kg)	Q1 2020 (kg)	Q1 2021 (kg)	Q1 2022 (kg)	Q1 2023 (kg)
Lower reservoir	2.37	2.40	NA	1.85	3.01	3.58	3.11	5.38
Downstream	3.26	3.16	3.08	3.19	3.75	2.83	3.29	3.51
Mekong	2.36	2.86	2.32	2.30	3.11	3.63	4.57	3.66

The survey results in Q1 2023 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 Q1 2023 are displayed in **Table 5-6**.

TABLE 5-6: PROPORTION OF THE CATCH REPORTED BY MAIN HABITATS (%) IN Q1 2023

Habitats	US	UR	LR	DS	MK
Mekong	0.0%	0.0%	0.0%	3.0%	81.8%
Nam Ngiep	64.8%	18.1%	0.0%	44.8%	1.8%
Nam Xan	0.0%	0.0%	0.0%	0.0%	0.0%
Reservoir	0.0%	80.8%	17.9%	0.0%	0.0%
Tributary and stream	35.2%	1.1%	81.5%	40.3%	0.0%
Wetland	0.0%	0.0%	0.6%	11.3%	16.4%
Others	0.0%	0.0%	0.0%	0.6%	0.0%

Total reported fish and other aquatic animal (OAA) catch (proportion of OAA) for the same 7-day period in Q1 from 2016 to 2023 are shown in **Figure 5-2**.

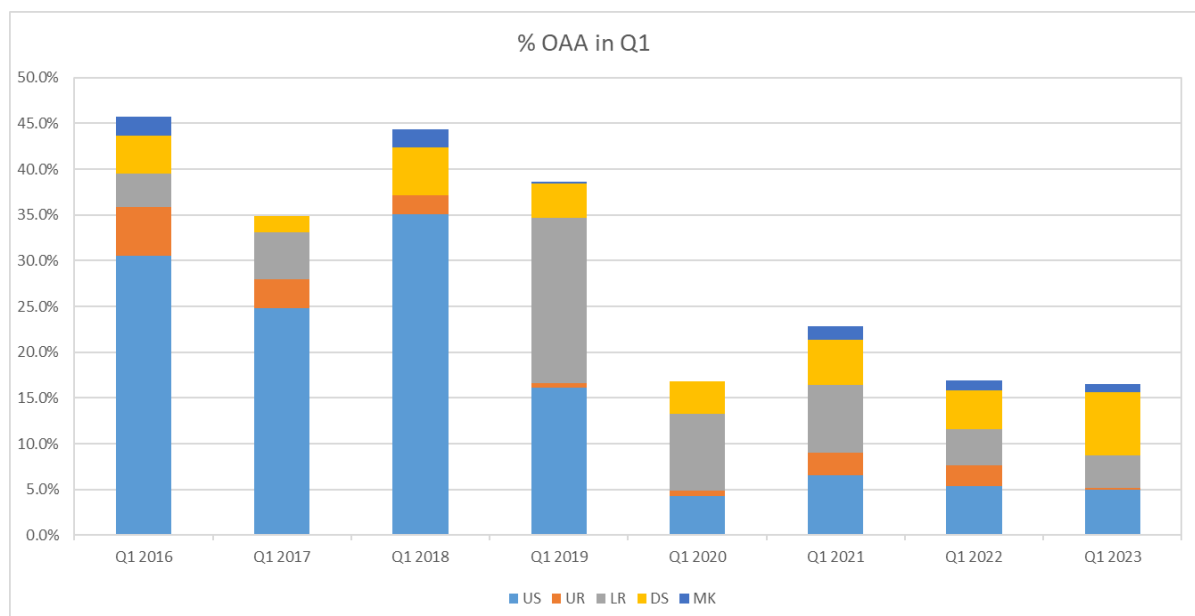


FIGURE 5-2: PROPORTION OF OAA TO THE TOTAL REPORTED KILOGRAM (KG) OF FISH AND OAA FOR A 7-DAY PERIOD BY FISHING ZONE IN Q1 FROM 2016 TO 2023

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 March 2023) are provided in **Table 6-1**.

TABLE 6-1: SAFETY INCIDENTS REPORTED DURING THE OPERATION PHASE (SEPTEMBER 2019 TO MARCH 2023)

Type of Incidents	LTI	RI	NM	PD	FI	MVI	Total
No. of Incidents in Q1, 2023	0	0	0	0	0	0	0
Cumulative Total Incidents to 31 March 2023	0	3	0	0	0	1	4

LEGEND:	LTI	-	Lost Time Incident
	RI	-	Recordable Injury ³
	NM	-	Near Miss
	PD	-	Property Damage
	FI	-	Fire Incident
	MVI	-	Motor Vehicle Incident

There were no incidents or accident reported in the first quarter 2023.

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.

³ 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

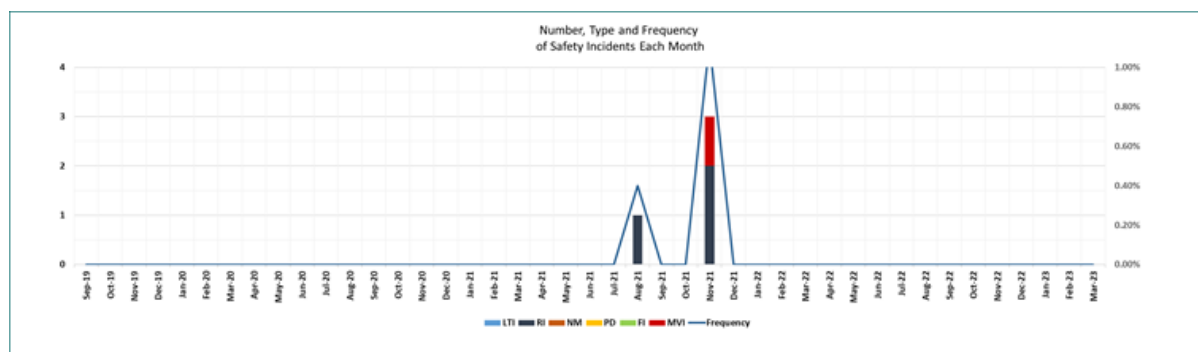


FIGURE 6-1: NUMBER, TYPE AND FREQUENCY OF SAFETY INCIDENTS SINCE SEPTEMBER 2019 TO 31 MARCH 2023

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, two cases of Recordable Injury (RI) and one case of Motor Vehicle Incident (MVI) have been recorded. 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.
- 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.

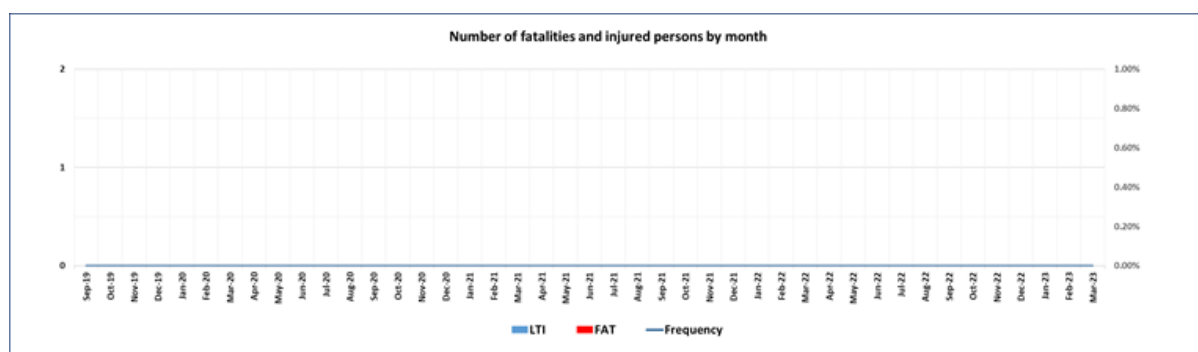


FIGURE 6-2: NUMBER OF FATALITIES AND INJURED PERSONS SINCE SEPTEMBER 2019 TO 31 MARCH 2023

Approximately:

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

6.1.1 Health and Safety Training and Emergency Drills

There was no health and safety training conducted during the past three months (January-March, 2023), only site safety induction for the newcomer of contractors.

One drill on the Canteen LPG Gas leak emergency has been conducted at the OSOV1 Canteen on 18 January 2023. The objectives of the drill are: 1) to identify any weakness in the fire fighting and evacuation strategy; 2) to familiarise the occupants with the procedures; 3) to test the arrangements for disabled people (rescue); 4) to identify weakness in emergency

communications systems; 5) to identify positive and negative reactions of staff with designated responsibilities such as Fire Evacuation to muster point; and 6) to identify weakness in Firefighting and rescue team to respond in an appropriate time and follow the right method. The drill was participated by 49 staff from NNP1 Admin, NNP1 ESD, NNP1 Technical Division, EGAT Operation and Maintenance, and NNP1 canteen service. The evaluation was carried out after the drilling and noted there is no corrective action plan required. The assessment was carried out by the Deputy Management Director (DMD) of NNP1 Technical Division and the Manager of EGAT Operation and Maintenance. Both expressed satisfaction with the drilling process and recommended to continue the drill periodically as planned.

FIGURE 6.1-3. REPRESENTATIVE PHOTOGRAPHS OF CANTEEN LPG GAS LEAK EMERGENCY DRILL



Checking gas leak point	Head count at muster point
	
Briefing at muster point by OSC-ERC	Briefing at muster point by EMD
	

6.2 RELATED TO COVID-19

The country officially opened in September 2022. However, NNP1PC still encourages COVID-19 countermeasures which include basic precautions of personal hygiene practices 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 with no record of serious case – 44 out of 90 staff members as of end of first quarter 2023.

7 External missions and visits

There was no external mission and visit carried out during the first quarter of 2023.

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 March 2023
1	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.	Ongoing - For the EEP in the fiscal year 2023, both DDMCs plan to disseminate the approved VEEP to the 13 target villages, two colleges, two banana plantations and two schools located in downstream areas for refreshment. - The EAP was under updating to be submitted to the GOL for their further review within May 2023.
2	Impacts caused by water level variations - 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.	Ongoing No change since Q4 2022 because there is no further confirmation from ADB.
3	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	Ongoing The report was shared to LTA/ADB in May 2023 and will be revised/updated accordingly. The revised report will be shared to LTA/ABD by July 2023.
8	Watershed Management Plan - Budget NN1 provides a clear approach and next steps to resolve the AIP government approvals and acceptable to ADB.	Ongoing - Financial Management Manual (FMM) was approved on 15 May 2023. - EMO with the support from BSP-WCS will closely work and follow-up with Xaysomboun WRPO to ensure that their AIP2023 will be approved in the second quarter of 2023. - EMO will closely follow up with FPF DOF-MAF to ensure the smooth process of

No	Requested/Recommended Actions	Status as of end of March 2023
		fund disbursement to WRPOs and NC-NX BOMU Additional budget need as result of increased allowance unit rate will be further discussed based on the result of NNL auditing at the end of 2023.
9	Watershed Management Plan - Law Enforcement - 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. 'Hom sub-office' – the construction was completed in September and the activity can be shared by 31 December 2021. 'checkpoints' – same response as for the WMP/BOMP budget. '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.	Ongoing - The Law Enforcement Strategy (LES) is in progress for the preparation led by BSP-WCS. - March 2023: present the LES development plan to XSB WRPO - April 2023: obtain more inputs from the Head of Xaysomboun Patrols and WRPO - April-June 2023: development of LES - June-July 2023: approval workshop - The operation of Xaysomboun WRPO sub-office is expected to be cleared out after discussion with the Head of Xaysomboun WRPO on the proposed actions to deal with outstanding delays and pending issues of the AIP implementation, the approval of FMM, and the finalization of Xaysomboun AIP2023 which now postponed to the second quarter of 2023. - Checkpoint construction: NNP1 EMO, Xaysomboun WRPO, and BSP-WCS re-visited the TPZ reservoir checkpoint locations on 13 February 2023 and the Head of Xaysomboun WRPO confirmed that the construction can start immediately after the survey. However, there was no progress until the end of March 2023 with no clear explanation from the Head of Xaysomboun WRPO. NNP1 EMO will clear out this during the discussion with the Head of Xaysomboun PAFO on the proposed actions to deal with outstanding delays and pending issues of the AIP implementation in April 2023. - TPZ demarcation The meeting for the approval of the Nam Chouane-Nam Xang (NC-NX) and its Totally Protected Zone (TPZ) boundary could not be organized from January to March 2023 because of the unavailability of the Head of Bolikhamxay Province Agriculture and

No	Requested/Recommended Actions	Status as of end of March 2023
		Forestry Office (PAFO) and the Vice Governor of Bolikhamxay Province. NNP1 EMO will continue to follow-up with NC-NX BOMU in the second quarter of 2023.
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. 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.	Ongoing 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. The meeting could not be organized during the first quarter of 2023 because the Head of Xaysomboun WRPO was occupied with other assignments including the meeting on the FMM, the internal PAFO monthly meetings, the survey to land concession area in Thathom District, the resurvey of reservoir checkpoints and his leave. NNP1 EMO will clear out this during the discussion with the Head of Xaysomboun PAFO on the proposed actions to deal with outstanding delays and pending issues of the AIP implementation in April 2023. NNP1 EMO have prepared the brief summary of livelihood activity for watershed villages as per the approved WMP that includes the plan for strengthen capacity of local producers and market linkages for Hom and Thathom Districts and an agriculture extension service plan for Thathom District. The document was shared to ADB, IAP, and LTA on 24 November 2022.

The status of the requested/recommended actions for the mission during 20-27 May 2023 will be followed up and updated in the next quarterly report.

APPENDICES

APPENDIX 1: ENVIRONMENTAL MONITORING CORRECTIVE ACTIONS Q1 2023

No	Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
1	NC No. 01/23 (NCR Level 1)	17-02-23	OSOV1	On 17 February 2023, the SGS auditor and the NNP1-ISO secretariate observed leachate leaking from food waste storage bins, contaminating soil, attracting flies, and posing hygiene risks to camp staff.	The corrective actions were carried out as follows: - Applied lime powder on the contaminated ground to neutralize the leachate and eliminate odour; - Collected contaminated soil and disposed at designated spoil disposal no. 6 by following the Standard Operating Procedure (SOP) on sewage and black water disposal; The preventive actions were carried out as follows: - Ensure complete separation of water from food waste before storing in the bins; - Conduct weekly routine inspections by EMO staff; - Perform random checks to prevent inadequate practices and; - Incorporate this nonconformity as a lesson learned for the waste management training in 2023.	24.02.2023	24.02.2020	Resolved <i>(The corrective actions were completed)</i>

APPENDIX 2: SITE CODES, LOCATIONS, MONITORING PARAMETERS AND ITS MAP OF THE SURFACE WATER QUALITY MONITORING

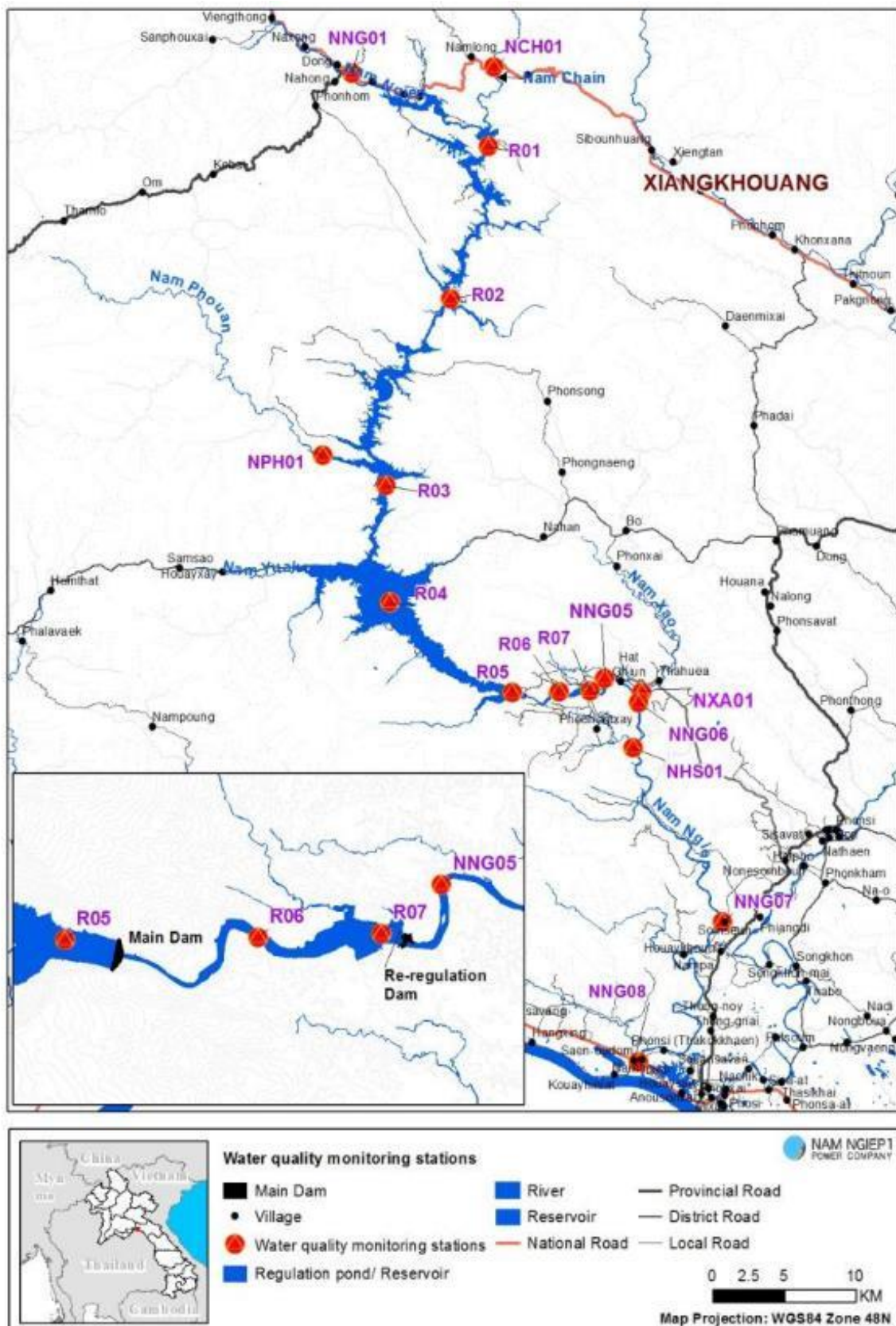
SITE CODES AND LOCATION STATION FOR SURFACE WATER QUALITY MONITORING

Site Code	Location station	Zone
NNG01	Nam Ngiep Upstream of Phientga 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

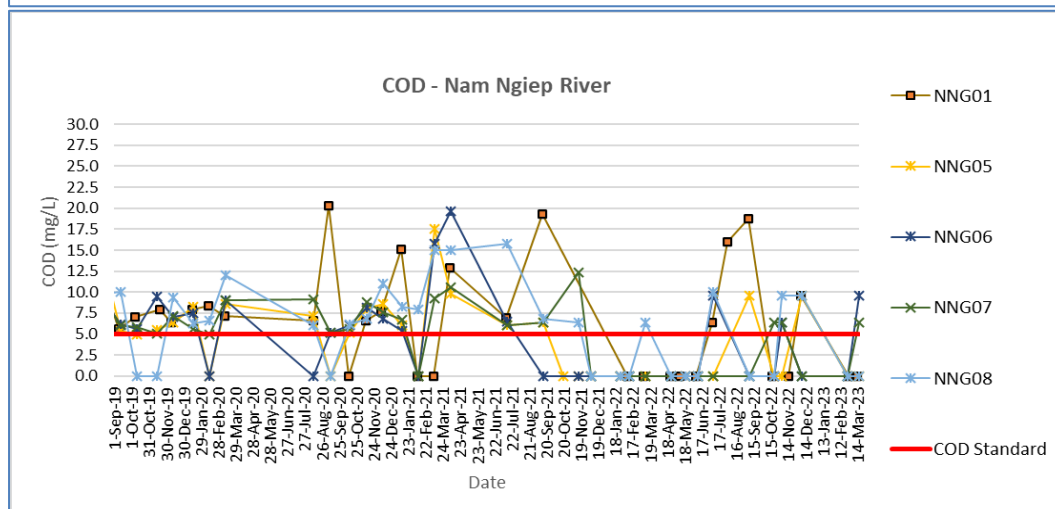
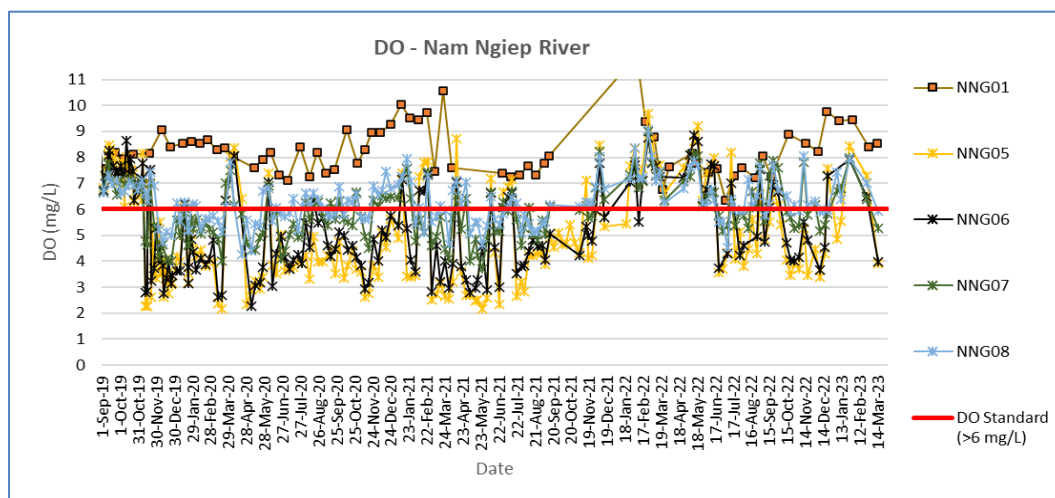
Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Weekly	pH, DO (%), DO (mg/L), Conductivity (µs/cm), Temperature (°C), Turbidity (NTU).	- Main Reservoir: R01, R02, R03, R04, R05; - Re-regulation Reservoir: R06 and R07.
Monthly	pH, DO (%), DO (mg/L), Conductivity (µs/cm), Temperature (°C), Turbidity (NTU).	- NNG01, NCH01, NPH01, NNG05, NNG06, NNG07, NNG08, NXA01 and NHS01
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. Noted: Hydrogen sulphide and Phytoplankton biomass remained in the analysis program for Q1 2023, but they were no longer monitored starting from Q2 2023.

SURFACE WATER QUALITY MONITORING LOCATIONS

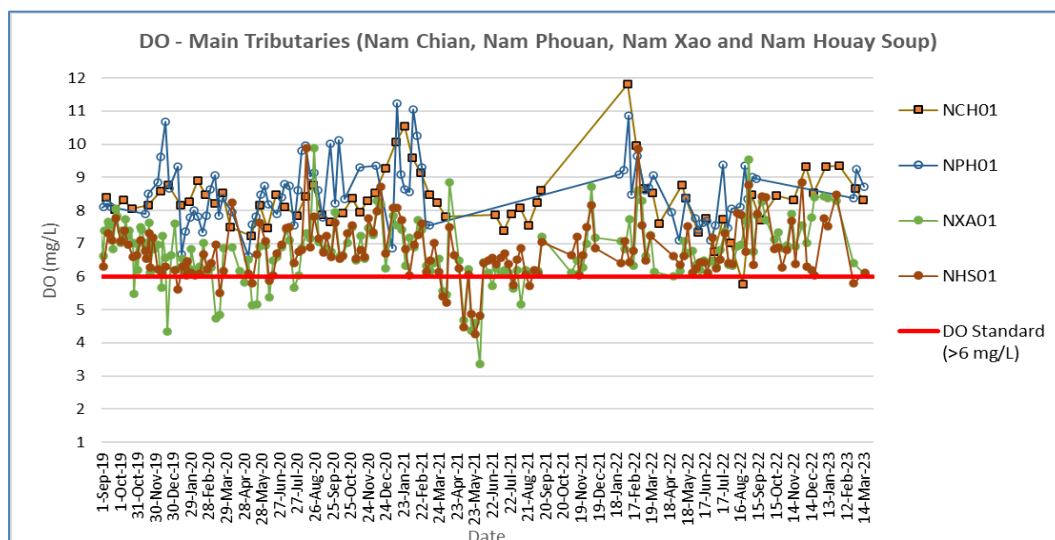


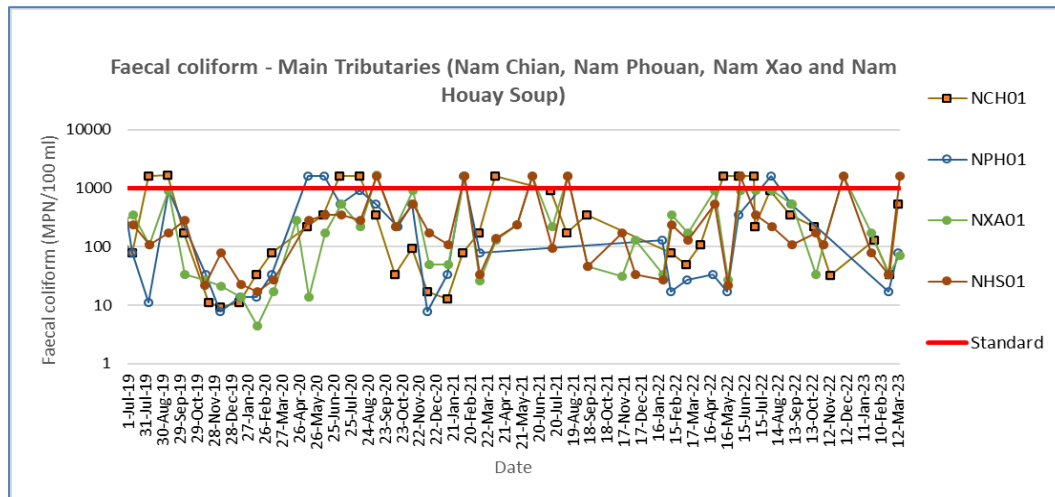
APPENDIX 3: KEY TRENDS OF WATER QUALITY MONITORING FROM JANUARY 2020 TO END OF MARCH 2023 (ONLY PARAMETERS THAT EXCEEDED THE STANDARDS)

Nam Ngiep Surface Water

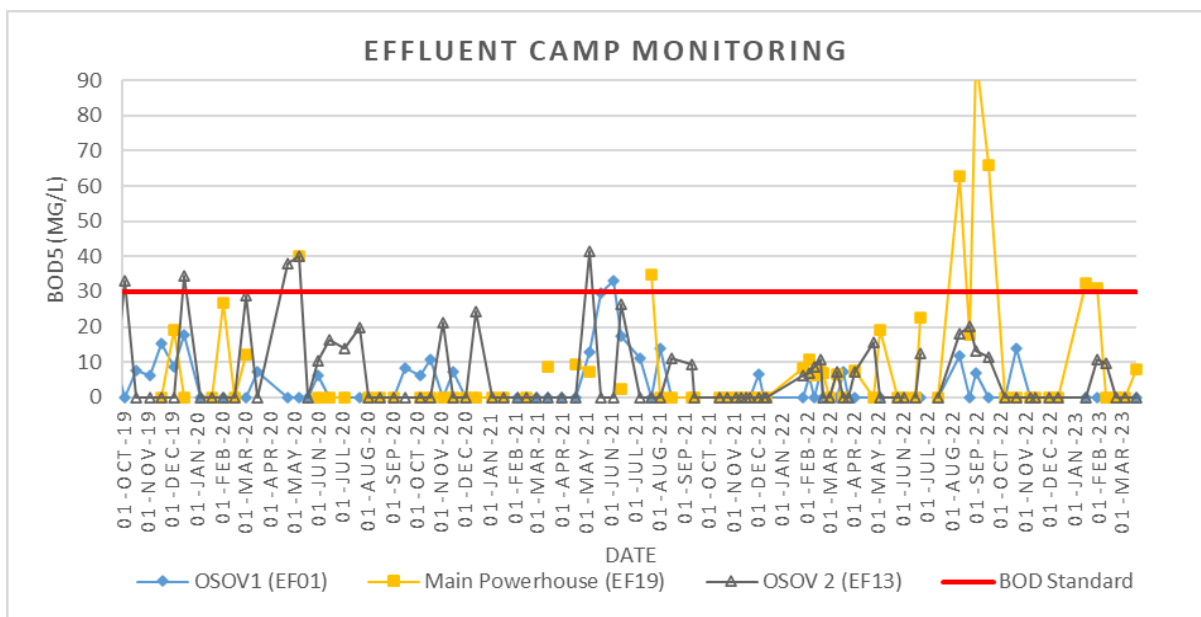
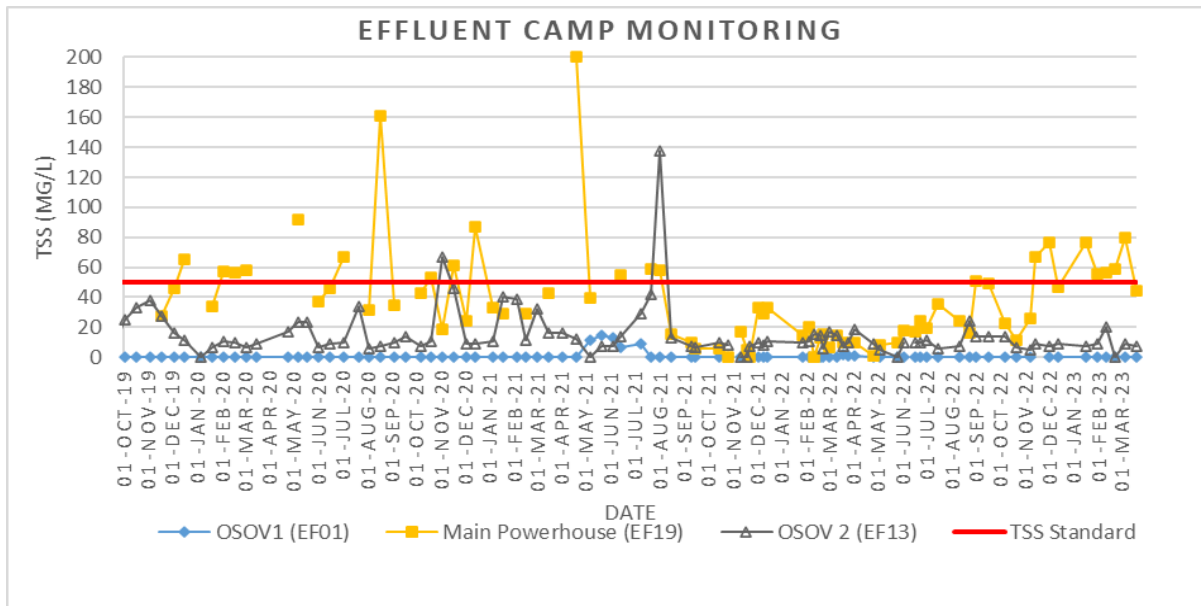


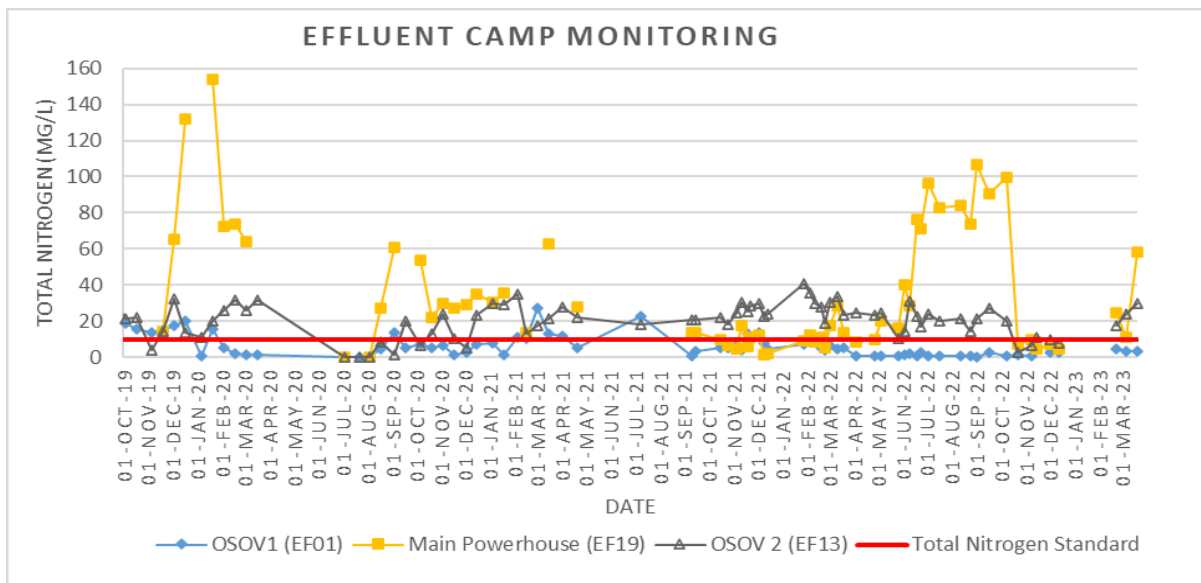
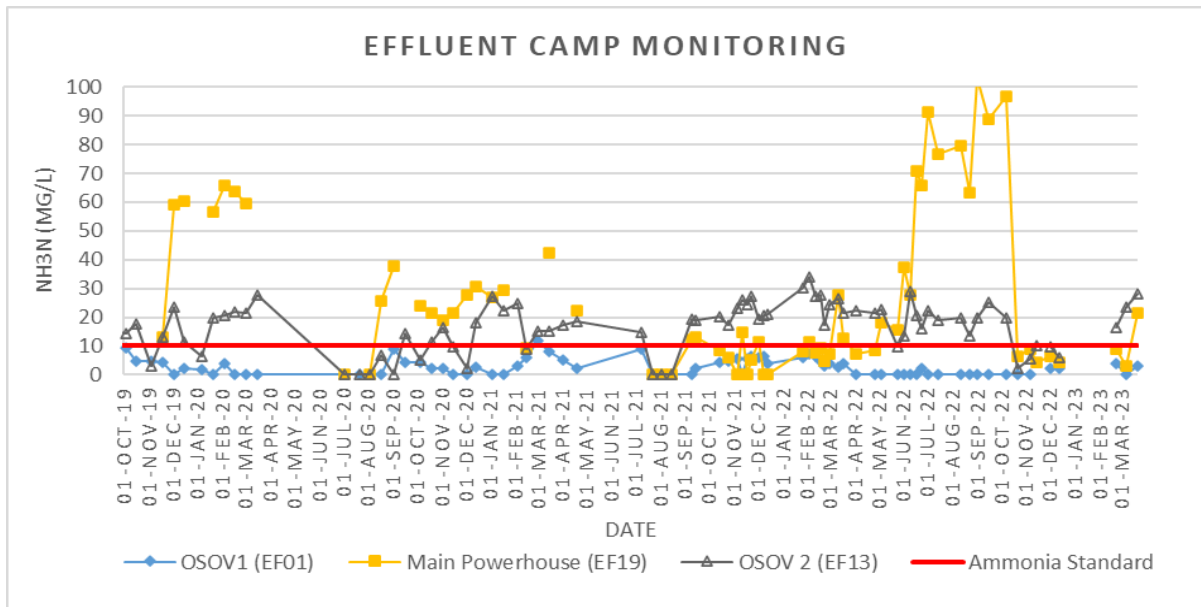
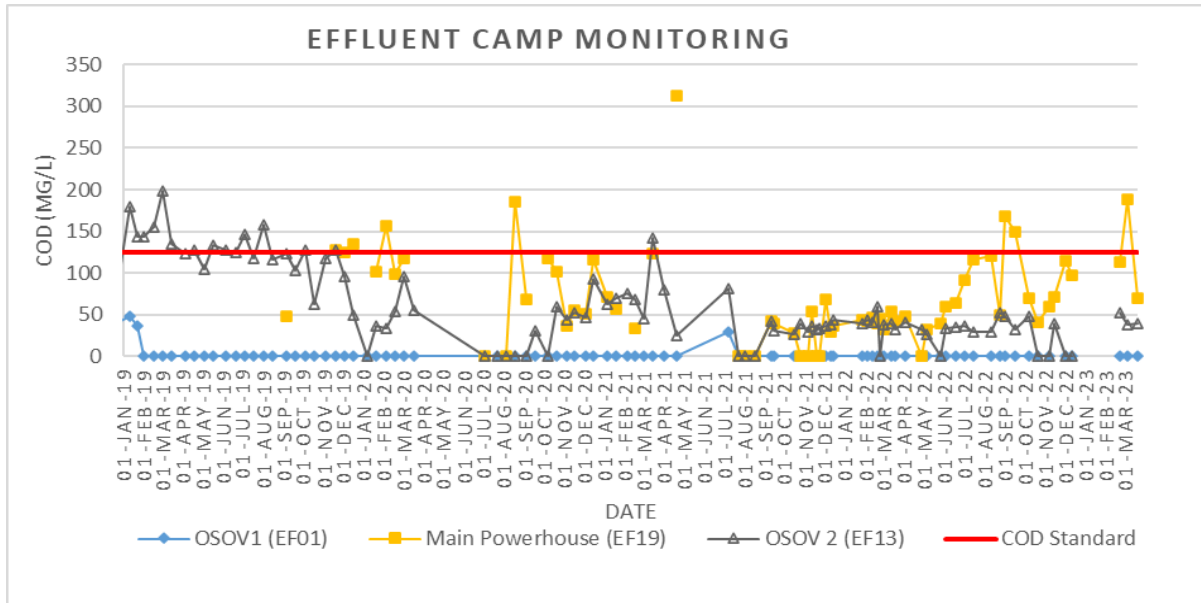
Key Water Quality Parameters for the Nam Ngiep Tributaries: Nam Chian, Nam Phouan, Nam Xao, Nam Houay Soup

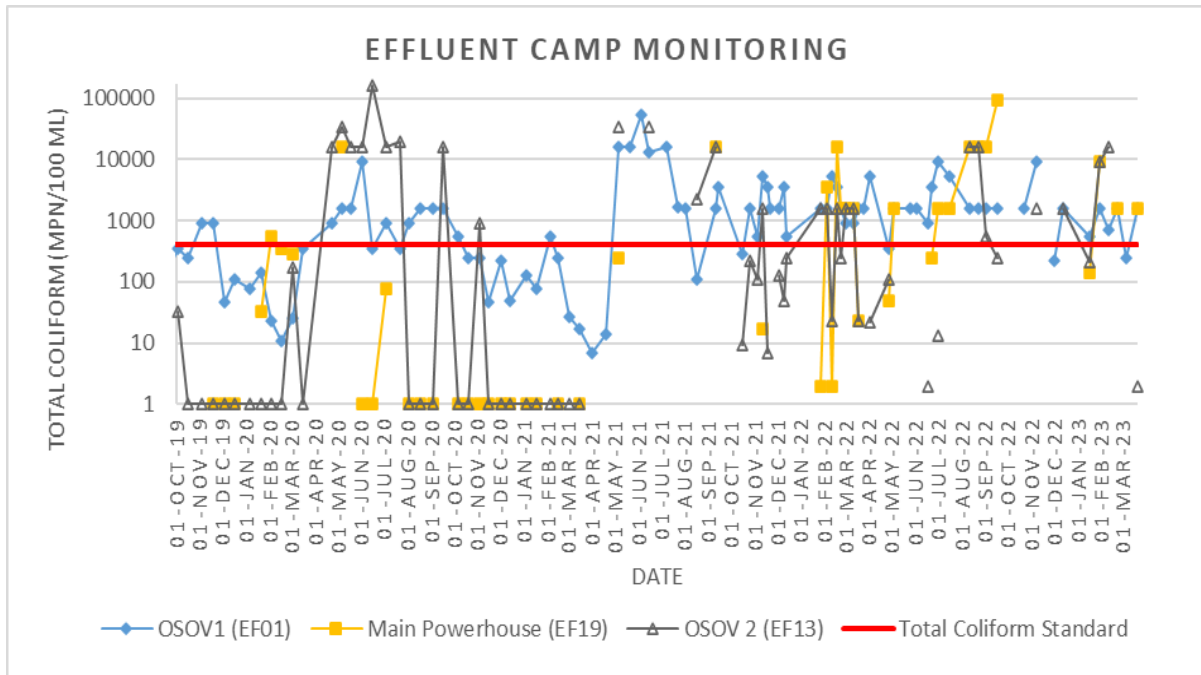
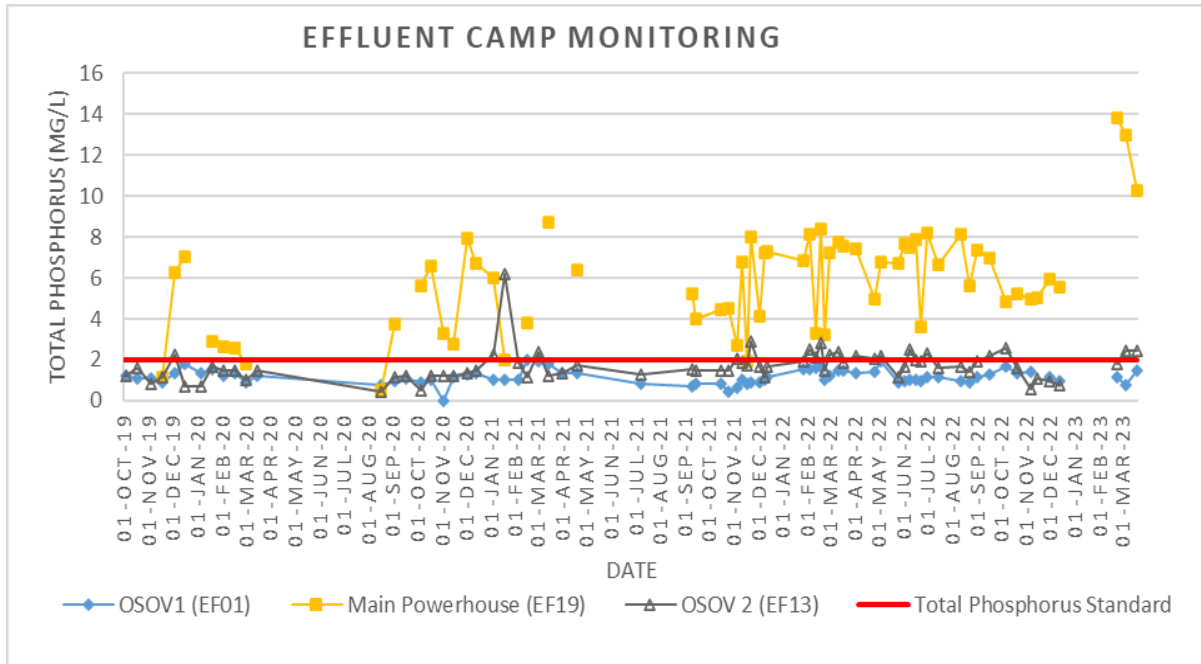




Camps' Effluent Water Quality Trends (Since October 2019 – March 2023)







APPENDIX 4: WATER QUALITY MONITORING DATA**APPENDIX 4-1: SURFACE WATER QUALITY MONITORING – Q1 2023**

		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/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01
Date	Parameters (Unit)	Guideline															
5-Jan-23	pH	5.0 - 9.0				6.5	6.62	6.7	6.81	6.88							
6-Jan-23	pH	5.0 - 9.0									6.73		6.65	7.05		7.1	6.91
9-Jan-23	pH	5.0 - 9.0	6.91											7.02			
10-Jan-23	pH	5.0 - 9.0		6.94	6.65	6.49											
11-Jan-23	pH	5.0 - 9.0					6.72	6.84	6.91	6.96							
12-Jan-23	pH	5.0 - 9.0									6.48		6.2	6.3		6.7	6.5
17-Jan-23	pH	5.0 - 9.0		6.5	6.54	6.55											
18-Jan-23	pH	5.0 - 9.0					6.45	6.53	6.81	6.93							
24-Jan-23	pH	5.0 - 9.0		6.92	6.7	6.65											
25-Jan-23	pH	5.0 - 9.0					6.81	6.76	6.56	6.5							
26-Jan-23	pH	5.0 - 9.0									6.91	6.97	6.79	6.62		7.1	7.05
31-Jan-23	pH	5.0 - 9.0	6.76											7.05			
2-Feb-23	pH	5.0 - 9.0		6.66	6.72	6.78											
3-Feb-23	pH	5.0 - 9.0					6.8	6.74	6.77	6.9							
7-Feb-23	pH	5.0 - 9.0		6.55	6.59	6.7											
8-Feb-23	pH	5.0 - 9.0					6.77	6.83	6.91	6.96							
14-Feb-23	pH	5.0 - 9.0		6.7	6.6	6.5											
15-Feb-23	pH	5.0 - 9.0					6.5	6.4	6.89	6.91							
23-Feb-23	pH	5.0 - 9.0					6.8	6.9	6.7	6.62							
24-Feb-23	pH	5.0 - 9.0		6.87	6.74	6.66									6.92		
25-Feb-23	pH	5.0 - 9.0									6.5	6.8	6.86	7.05		7	6.3
27-Feb-23	pH	5.0 - 9.0	7											6			
1-Mar-23	pH	5.0 - 9.0		6.58	6.83	6.75									6.9		
2-Mar-23	pH	5.0 - 9.0					6.59	6.77	6.91	6.98							
8-Mar-23	pH	5.0 - 9.0		6.9	6.7	6.5											
9-Mar-23	pH	5.0 - 9.0					6.79	6.84	6.78	6.91							

		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/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
13-Mar-23	pH	5.0 - 9.0	6.7											6.96				
14-Mar-23	pH	5.0 - 9.0		6.47	6.56	6.74									6.9			
15-Mar-23	pH	5.0 - 9.0					6.62	6.85	6.69	6.83								
16-Mar-23	pH	5.0 - 9.0									6.71	6.85	6.99	7.1		7.14	7.04	
22-Mar-23	pH	5.0 - 9.0		6.8	6.5	6.88												
23-Mar-23	pH	5.0 - 9.0					6.56	6.6	6.91	6.95								
29-Mar-23	pH	5.0 - 9.0		6.86	6.74	6.59												
30-Mar-23	pH	5.0 - 9.0					6.55	6.6	6.77	6.81								
5-Jan-23	Sat. DO (%)					56.9	55.9	52.6	45.9	57								
6-Jan-23	Sat. DO (%)										57		79.1	88.3		94.8	83.8	
9-Jan-23	Sat. DO (%)		103.8											99.4				
10-Jan-23	Sat. DO (%)			84.8	58.4	58.1												
11-Jan-23	Sat. DO (%)						61.1	60.7	60	51.9								
12-Jan-23	Sat. DO (%)										66.2		82	76.8		100.2	86.6	
17-Jan-23	Sat. DO (%)			86.3	45.8	67.9												
18-Jan-23	Sat. DO (%)						53.7	53.3	43.4	57.6								
24-Jan-23	Sat. DO (%)			85.3	52.3	59.4												
25-Jan-23	Sat. DO (%)						57	59.3	56.5	68.1								
26-Jan-23	Sat. DO (%)										98.7	91.1	91.9	91.6		96.8	88.8	
31-Jan-23	Sat. DO (%)		100.9											97.2				
2-Feb-23	Sat. DO (%)			76	51.4	67.5												
3-Feb-23	Sat. DO (%)						86.1	77.1	82.6	84.5								
7-Feb-23	Sat. DO (%)			97.5	79.5	87.6												
8-Feb-23	Sat. DO (%)						88.1	85.4	59.1	76.2								
14-Feb-23	Sat. DO (%)			79.6	89.1	81.1												
15-Feb-23	Sat. DO (%)						96.4	91.1	53.3	48.4								
23-Feb-23	Sat. DO (%)						100.5	85.8	35.1	39.8								
24-Feb-23	Sat. DO (%)			93.3	107.4	102.6									97.7			
25-Feb-23	Sat. DO (%)										86	76	75.5	84.5		76.9	67.2	

		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/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
27-Feb-23	Sat. DO (%)		94.1											93.6				
1-Mar-23	Sat. DO (%)			95.2	87.8	99									102.8			
2-Mar-23	Sat. DO (%)						90.9	89	49.9	66.4								
8-Mar-23	Sat. DO (%)			97	94.8	119.6												
9-Mar-23	Sat. DO (%)						98.6	95.6	29.5	58.5								
13-Mar-23	Sat. DO (%)		97.2											93.8				
14-Mar-23	Sat. DO (%)			97.2	102.6	107.3									100.3			
15-Mar-23	Sat. DO (%)						103.9	103.2	31.7	38.1								
16-Mar-23	Sat. DO (%)										45.5	46.3	62	70.4		73.1	74.2	
22-Mar-23	Sat. DO (%)			101.7	105.3	113.2												
23-Mar-23	Sat. DO (%)						96.6	98	31.9	44								
29-Mar-23	Sat. DO (%)			106.1	117.5	120.4												
30-Mar-23	Sat. DO (%)						109.8	107.1	38.9	50.7								
5-Jan-23	DO (mg/L)	>6.0				4.73	4.66	4.31	3.84	4.66								
6-Jan-23	DO (mg/L)	>6.0														8.42	7.76	
9-Jan-23	DO (mg/L)	>6.0	9.41											9.32				
10-Jan-23	DO (mg/L)	>6.0		7.05	4.82	4.87												
11-Jan-23	DO (mg/L)	>6.0					5.12	5.07	5.06	4.4								
12-Jan-23	DO (mg/L)	>6.0														8.36	7.52	
17-Jan-23	DO (mg/L)	>6.0		7.2	3.83	5.7												
18-Jan-23	DO (mg/L)	>6.0					4.53	4.43	3.62	4.77								
24-Jan-23	DO (mg/L)	>6.0		7.14	4.29	4.98												
25-Jan-23	DO (mg/L)	>6.0					4.82	4.96	4.7	5.6								
26-Jan-23	DO (mg/L)	>6.0									8.45	7.92	7.98	7.95		8.3	8.49	
31-Jan-23	DO (mg/L)	>6.0	9.44											9.34				
2-Feb-23	DO (mg/L)	>6.0		6.57	4.29	5.55												
3-Feb-23	DO (mg/L)	>6.0					7.3	6.57	6.8	7.05								
7-Feb-23	DO (mg/L)	>6.0		8.08	6.57	7.21												
8-Feb-23	DO (mg/L)	>6.0					7.32	7.13	4.79	6.11								

		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/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
14-Feb-23	DO (mg/L)	>6.0		6.41	7.21	6.66												
15-Feb-23	DO (mg/L)	>6.0					7.93	7.52	4.52	4.03								
23-Feb-23	DO (mg/L)	>6.0					8.22	7	3.41	3.02								
24-Feb-23	DO (mg/L)	>6.0		7.53	8.65	8.21									8.37			
25-Feb-23	DO (mg/L)	>6.0						7	3.41	3.02	7.29	6.48	6.37	7.02		6.4	5.8	
27-Feb-23	DO (mg/L)	>6.0	8.42											8.67				
1-Mar-23	DO (mg/L)	>6.0		7.76	7.22	8.23									9.24			
2-Mar-23	DO (mg/L)	>6.0					7.54	7.42	4.16	5.35								
8-Mar-23	DO (mg/L)	>6.0		7.8	7.83	9.92												
9-Mar-23	DO (mg/L)	>6.0					8.16	7.99	2.52	4.72								
13-Mar-23	DO (mg/L)	>6.0	8.54											8.32				
14-Mar-23	DO (mg/L)	>6.0		7.91	8.42	8.68									8.72			
15-Mar-23	DO (mg/L)	>6.0					8.63	8.68	2.7	3.2								
16-Mar-23	DO (mg/L)	>6.0									3.9	3.98	5.27	5.92		6.07	6.13	
22-Mar-23	DO (mg/L)	>6.0		7.91	8.31	8.93												
23-Mar-23	DO (mg/L)	>6.0					7.67	7.69	2.73	3.62								
29-Mar-23	DO (mg/L)	>6.0		8.42	9.34	9.55												
30-Mar-23	DO (mg/L)	>6.0					8.82	8.62	3.32	4.17								
5-Jan-23	Conductivity (µs/cm)					75	72	71	78	78								
6-Jan-23	Conductivity (µs/cm)										77		78	79		146	57	
9-Jan-23	Conductivity (µs/cm)		130											36				
10-Jan-23	Conductivity (µs/cm)			81	83	74												
11-Jan-23	Conductivity (µs/cm)						72	72	78	76								
12-Jan-23	Conductivity (us/cm)										77		81	79		149	60	

		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/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
17-Jan-23	Conductivity (µs/cm)			80	82	75												
18-Jan-23	Conductivity (µs/cm)						72	72	79	79								
24-Jan-23	Conductivity (µs/cm)			81	83	74												
25-Jan-23	Conductivity (µs/cm)						73	73	80	77								
26-Jan-23	Conductivity (µs/cm)										77	81	81	80			152	55
31-Jan-23	Conductivity (µs/cm)		109												36			
2-Feb-23	Conductivity (µs/cm)			83	82	76												
3-Feb-23	Conductivity (µs/cm)						74	74	78	77								
7-Feb-23	Conductivity (µs/cm)			82	82	75												
8-Feb-23	Conductivity (µs/cm)						73	74	79	77								
14-Feb-23	Conductivity (µs/cm)			84	82	75												
15-Feb-23	Conductivity (µs/cm)						73	73	83	80								
23-Feb-23	Conductivity (µs/cm)						74	74	85	82								
24-Feb-23	Conductivity (µs/cm)			85	81	75										71		
25-Feb-23	Conductivity (µs/cm)										81	83	83	82			168	68
27-Feb-23	Conductivity (µs/cm)		99												37			
1-Mar-23	Conductivity (µs/cm)			87	82	75										71		

		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/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
2-Mar-23	Conductivity (µs/cm)						74	74	83	82								
8-Mar-23	Conductivity (µs/cm)			85	83	75												
9-Mar-23	Conductivity (µs/cm)						74	73	86	82								
13-Mar-23	Conductivity (µs/cm)		88											35				
14-Mar-23	Conductivity (µs/cm)			78	75	68									67			
15-Mar-23	Conductivity (µs/cm)						67	67	77	75								
16-Mar-23	Conductivity (µs/cm)										76	77	74	73			132	62
22-Mar-23	Conductivity (µs/cm)			78	78	69												
23-Mar-23	Conductivity (µs/cm)						68	67	77	74								
29-Mar-23	Conductivity (µs/cm)			95	95	84												
30-Mar-23	Conductivity (µs/cm)						82	81	88	88								
5-Jan-23	Temperature (°C)					24.84	24.4	25.41	24.33	25.6								
6-Jan-23	Temperature (°C)										23.59		23.45			21.19	19.13	
9-Jan-23	Temperature (°C)		20.45											18.46				
10-Jan-23	Temperature (°C)			24.6	25.02	24.42												
11-Jan-23	Temperature (°C)						24.19	24.27	24.09	24								
12-Jan-23	Temperature (°C)										24.05		25	24.81		24.44	22.31	
17-Jan-23	Temperature (°C)			24.32	24.34	24.25												
18-Jan-23	Temperature (°C)						24.03	24.17	24.39	24.9								
24-Jan-23	Temperature (°C)			24.38	25.26	24.24												
25-Jan-23	Temperature (°C)						23.84	24.41	24.69	25.25								

		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/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
26-Jan-23	Temperature (°C)									23.16	22.35	22.39	22.52			20.07	17.57	
31-Jan-23	Temperature (°C)		18.52											17.21				
2-Feb-23	Temperature (°C)			22.68	24.69	25.18												
3-Feb-23	Temperature (°C)						23.44	23.47	25.15	24.6								
7-Feb-23	Temperature (°C)			24.81	25.01	25.25												
8-Feb-23	Temperature (°C)						24.65	24.4	26.52	26.75								
14-Feb-23	Temperature (°C)			26.57	26.03	25.39												
15-Feb-23	Temperature (°C)						25.61	25.02	23.65	23.98								
23-Feb-23	Temperature (°C)						25.75	25.73	23.09	23.03								
24-Feb-23	Temperature (°C)			26.18	26.38	26.67									23.01			
25-Feb-23	Temperature (°C)										23.58	23.52	23.66	24.38		24.74	22.51	
27-Feb-23	Temperature (°C)		20.89												19.11			
1-Mar-23	Temperature (°C)			25.77	25.21	24.7										20.46		
2-Mar-23	Temperature (°C)						24.73	24.52	24.43	26.53								
8-Mar-23	Temperature (°C)			26.5	25.16	24.82												
9-Mar-23	Temperature (°C)						24.87	24.38	23.29	26.29								
13-Mar-23	Temperature (°C)		21.77												21.22			
14-Mar-23	Temperature (°C)			25.76	25.42	25.99										22.21		
15-Mar-23	Temperature (°C)						24.77	24.07	23.21	23.86								
16-Mar-23	Temperature (°C)										23.17	23.11	23.39	23.88		24.66	23.36	
22-Mar-23	Temperature (°C)			28.26	27.54	27.45												
23-Mar-23	Temperature (°C)						27.42	27.79	23.29	25.46								
29-Mar-23	Temperature (°C)			26.95	27.25	27.17												
30-Mar-23	Temperature (°C)						26.53	26.45	23.59	25.57								
5-Jan-23	Turbidity (NTU)					1.06	1.12	0.9	2.41	1.57								
6-Jan-23	Turbidity (NTU)										2		2.17	7.03		4.41	2.45	
9-Jan-23	Turbidity (NTU)		5.25												2.79			
10-Jan-23	Turbidity (NTU)			2.07	1.12	0.92												
11-Jan-23	Turbidity (NTU)						1	0.87	1.5	2.33								

		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/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
12-Jan-23	Turbidity (NTU)									1.86		2.42	7.67			4.35	2.76	
17-Jan-23	Turbidity (NTU)			2.78	1	1.01												
18-Jan-23	Turbidity (NTU)						1.19	0.76	1.88	1.96								
24-Jan-23	Turbidity (NTU)			2.92	0.76	0.81												
25-Jan-23	Turbidity (NTU)						1.76	0.81	2.43	1.62								
26-Jan-23	Turbidity (NTU)									1.64	1.62	2.37	4.59			4.55	4.3	
31-Jan-23	Turbidity (NTU)		4.05											4.06				
2-Feb-23	Turbidity (NTU)			2.55	1.14	0.84												
3-Feb-23	Turbidity (NTU)						1.57	1.44	2.67	2.34								
7-Feb-23	Turbidity (NTU)			2.46	1.3	0.86												
8-Feb-23	Turbidity (NTU)						1.03	1.07	2.04	1.75								
14-Feb-23	Turbidity (NTU)			2.78	1.47	1.29												
15-Feb-23	Turbidity (NTU)						1.49	0.9	1.06	1.97								
23-Feb-23	Turbidity (NTU)						1.57	1	1	1.72								
24-Feb-23	Turbidity (NTU)			3.8	1.59	1.94									3.21			
25-Feb-23	Turbidity (NTU)										1.48	1.6	2.23	4.67		3.15	3.75	
27-Feb-23	Turbidity (NTU)		3.78											3.18				
1-Mar-23	Turbidity (NTU)			3.17	1.45	1.38									2.42			
2-Mar-23	Turbidity (NTU)						1.31	1.21	1.83	2.21								
8-Mar-23	Turbidity (NTU)			2.17	1.66	1.59												
9-Mar-23	Turbidity (NTU)						1.16	1.34	0.98	2.62								
13-Mar-23	Turbidity (NTU)		4.95											3.06				
14-Mar-23	Turbidity (NTU)			4.72	1.85	1.43									4.44			
15-Mar-23	Turbidity (NTU)						1.36	1.14	0.9	2.34								
16-Mar-23	Turbidity (NTU)										1.73	1.94	3.1	9.21		3.16	2.74	
22-Mar-23	Turbidity (NTU)			9.01	1.79	2.03												
23-Mar-23	Turbidity (NTU)						1.84	1.81	4.08	3								
29-Mar-23	Turbidity (NTU)			13.1	2.98	2.83												
30-Mar-23	Turbidity (NTU)						1.9	1.82	2.42	2.65								

		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/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01
Date	Parameters (Unit)	Guideline															
24-Jan-23	TSS (mg/L)			<5		<5											
25-Jan-23	TSS (mg/L)						<5	<5	<5								
26-Jan-23	TSS (mg/L)									<5	<5	<5	<5			<5	<5
31-Jan-23	TSS (mg/L)		<5											<5			
23-Feb-23	TSS (mg/L)						<5	<5	<5								
24-Feb-23	TSS (mg/L)			<5		<5									<5		
25-Feb-23	TSS (mg/L)									<5	<5	<5	<5			<5	<5
27-Feb-23	TSS (mg/L)		<5											<5			
13-Mar-23	TSS (mg/L)		<5											<5			
14-Mar-23	TSS (mg/L)			<5		<5									<5		
15-Mar-23	TSS (mg/L)						<5	<5									
16-Mar-23	TSS (mg/L)								<5	<5		<5	11.05			<5	<5
24-Jan-23	BOD ₅ (mg/L)	<1.5		<1		<1											
25-Jan-23	BOD ₅ (mg/L)	<1.5					<1	<1	<1	<1							
26-Jan-23	BOD ₅ (mg/L)	<1.5								<1	<1	<1	<1			<1	<1
31-Jan-23	BOD ₅ (mg/L)	<1.5	<1											<1			
23-Feb-23	BOD ₅ (mg/L)	<1.5					<1	<1	<1	<1							
24-Feb-23	BOD ₅ (mg/L)	<1.5		<1		<1									<1		
25-Feb-23	BOD ₅ (mg/L)	<1.5								<1	<1	1.01	1			1.34	1.22
27-Feb-23	BOD ₅ (mg/L)	<1.5	<1											<1			
13-Mar-23	BOD ₅ (mg/L)	<1.5	<1											<1			
14-Mar-23	BOD ₅ (mg/L)	<1.5		<1		<1									<1		
15-Mar-23	BOD ₅ (mg/L)	<1.5					<1	<1	<1	<1							
16-Mar-23	BOD ₅ (mg/L)	<1.5								<1	<1	<1	<1			<1	<1
23-Feb-23	COD (mg/L)	<5.0							<5	6.4							
24-Feb-23	COD (mg/L)	<5.0														<5	
25-Feb-23	COD (mg/L)	<5.0								<5	<5	<5	<5			6.4	<5
27-Feb-23	COD (mg/L)	<5.0	<5											<5			
13-Mar-23	COD (mg/L)	<5.0	<5											<5			

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
14-Mar-23	COD (mg/L)	<5.0													<5			
15-Mar-23	COD (mg/L)	<5.0						<5	6.4									
16-Mar-23	COD (mg/L)	<5.0								<5	9.6	6.4	<5			13.8	6.4	
23-Feb-23	NH ₃ -N (mg/L)	<0.2					<0.2	<0.2										
24-Feb-23	NH ₃ -N (mg/L)	<0.2		0.3		0.2								<0.2				
27-Feb-23	NH ₃ -N (mg/L)	<0.2	<0.2											<0.2				
13-Mar-23	NH ₃ -N (mg/L)	<0.2	<0.2											<0.2				
14-Mar-23	NH ₃ -N (mg/L)	<0.2		<0.2		<0.2									<0.2			
15-Mar-23	NH ₃ -N (mg/L)	<0.2					<0.2	<0.2										
23-Feb-23	NO ₃ -N (mg/L)	<5.0					0.07	0.06										
24-Feb-23	NO ₃ -N (mg/L)	<5.0		<0.02		0.07									0.08			
27-Feb-23	NO ₃ -N (mg/L)	<5.0	0.09											0.08				
13-Mar-23	NO ₃ -N (mg/L)	<5.0	<0.02											<0.02				
14-Mar-23	NO ₃ -N (mg/L)	<5.0		<0.02		<0.02									<0.02			
15-Mar-23	NO ₃ -N (mg/L)	<5.0					<0.02	<0.02										
26-Jan-23	Faecal coliform (MPN/100 mL)	<1,000								11	17	4	27			170	79	
31-Jan-23	Faecal coliform (MPN/100 mL)	<1,000	240											130				
24-Feb-23	Faecal coliform (MPN/100 mL)	<1,000													17			
25-Feb-23	Faecal coliform (MPN/100 mL)	<1,000								7	8	11	14			34	33	
27-Feb-23	Faecal coliform (MPN/100 mL)	<1,000	21											33				
13-Mar-23	Faecal coliform (MPN/100 mL)	<1,000	170											540				
14-Mar-23	Faecal coliform (MPN/100 mL)	<1,000													79			
16-Mar-23	Faecal coliform (MPN/100 mL)	<1,000								49	39	130	79			70	1,600	

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
26-Jan-23	Total Coliform (MPN/100 mL)	<5,000									27	170	27	240			920	110
31-Jan-23	Total Coliform (MPN/100 mL)	<5,000	1,600												350			
24-Feb-23	Total Coliform (MPN/100 mL)	<5,000														920		
25-Feb-23	Total Coliform (MPN/100 mL)	<5,000									240	110	350	540			920	920
27-Feb-23	Total Coliform (MPN/100 mL)	<5,000	540												240			
13-Mar-23	Total Coliform (MPN/100 mL)	<5,000	540												350			
14-Mar-23	Total Coliform (MPN/100 mL)	<5,000														920		
16-Mar-23	Total Coliform (MPN/100 mL)	<5,000									49	39	170	110			70	1,600
23-Feb-23	TKN						<1.5	<1.5										
24-Feb-23	TKN			<1.5		<1.5										<1.5		
27-Feb-23	TKN		<1.5												<1.5			
13-Mar-23	TKN		<1.5												<1.5			
14-Mar-23	TKN			<1.5		<1.5										<1.5		
15-Mar-23	TKN						<1.5	<1.5										
5-Jan-23	Secchi Disk (m)					4	4.5	4.6										
10-Jan-23	Secchi Disk (m)			2.8	3.25	4.25												
11-Jan-23	Secchi Disk (m)						4	4.5										
17-Jan-23	Secchi Disk (m)			2	2.8	4.3												
18-Jan-23	Secchi Disk (m)						4.3	4.5										
24-Jan-23	Secchi Disk (m)			2	4.2	4.3												
25-Jan-23	Secchi Disk (m)						4.35	4.2	3	3.2								
2-Feb-23	Secchi Disk (m)			2.8	3.2	3												
3-Feb-23	Secchi Disk (m)						3	3.2	2.8	2.5								

		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/Within		Downstream				Tributaries Upstream		Tributaries Downstream		
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
7-Feb-23	Secchi Disk (m)			2.5	3.2	3.5												
8-Feb-23	Secchi Disk (m)						3.8	3.9	3	3.1								
14-Feb-23	Secchi Disk (m)			2.2	3.2	3.5												
15-Feb-23	Secchi Disk (m)						3.7	4	4.1	3.2								
23-Feb-23	TOC (mg/L)								1.08	1.12								
24-Feb-23	TOC (mg/L)															0.87		
25-Feb-23	TOC (mg/L)										1.01	1.2	1.17	1.16			2.82	2.06
27-Feb-23	TOC (mg/L)		0.96												<0.5			
13-Mar-23	TOC (mg/L)		1.26												1.2			
14-Mar-23	TOC (mg/L)															1.47		
15-Mar-23	TOC (mg/L)								1.32	1.26					<0.5			
16-Mar-23	TOC (mg/L)										2.05	1.55	1.33	1.19			2.81	2.47
23-Feb-23	Phytoplankton Biomass (g dry wt/m³)						1.8	0										
24-Feb-23	Phytoplankton Biomass (g dry wt/m³)			0.4		2.2												
14-Mar-23	Phytoplankton Biomass (g dry wt/m³)			3.4		2.2												
15-Mar-23	Phytoplankton Biomass (g dry wt/m³)						1	2										
23-Feb-23	Total Phosphorus (mg/L)						0.01	<0.01										
24-Feb-23	Total Phosphorus (mg/L)			0.01		0.01												
27-Feb-23	Total Phosphorus (mg/L)		<0.01												<0.01			
13-Mar-23	Total Phosphorus (mg/L)		0.01												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/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
14-Mar-23	Total Phosphorus (mg/L)			0.02		0.01									0.02			
15-Mar-23	Total Phosphorus (mg/L)						<0.01	0.01										
23-Feb-23	Total Dissolved Phosphorus (mg/L)						<0.01	<0.01										
24-Feb-23	Total Dissolved Phosphorus (mg/L)			<0.01		<0.01												
27-Feb-23	Total Dissolved Phosphorus (mg/L)																	
13-Mar-23	Total Dissolved Phosphorus (mg/L)		<0.01											0.01				
14-Mar-23	Total Dissolved Phosphorus (mg/L)			0.01		<0.01									0.01			
15-Mar-23	Total Dissolved Phosphorus (mg/L)		<0.01				<0.01	<0.01						<0.01				
23-Feb-23	Hydrogen Sulfide (mg/L)						<0.02	<0.02										
24-Feb-23	Hydrogen Sulfide (mg/L)			<0.02		<0.02												
14-Mar-23	Hydrogen Sulfide (mg/L)			<0.02		<0.02												
15-Mar-23	Hydrogen Sulfide (mg/L)						<0.02	<0.02										
24-Jan-23	Turbidity (NTU)-bottom					2.8												
25-Jan-23	Turbidity (NTU)-bottom						4.12	1.9										

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
23-Feb-23	Turbidity (NTU)-bottom						1.63	0.86										
24-Feb-23	Turbidity (NTU)-bottom					1.29												
14-Mar-23	Turbidity (NTU)-bottom					3.03												
15-Mar-23	Turbidity (NTU)-bottom						8											
24-Jan-23	TSS (mg/L)-bottom				<5													
25-Jan-23	TSS (mg/L)-bottom					18.44	<5											
23-Feb-23	TSS (mg/L)-bottom					<5	<5											
24-Feb-23	TSS (mg/L)-bottom				<5													
14-Mar-23	TSS (mg/L)-bottom			<5	<5													
15-Mar-23	TSS (mg/L)-bottom					<5	<5											
24-Jan-23	BOD _s (mg/L)-bottom				<1													
25-Jan-23	BOD _s (mg/L)-bottom					11.06	5.3											
14-Mar-23	BOD _s (mg/L)-bottom				<1													
15-Mar-23	BOD _s (mg/L)-bottom					<1	5.6											
23-Feb-23	NH ₃ -N (mg/L)-bottom					<0.2	<0.2											
24-Feb-23	NH ₃ -N (mg/L)-bottom				0.3													
14-Mar-23	NH ₃ -N (mg/L)-bottom				<0.2													

		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/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
15-Mar-23	NH ₃ -N (mg/L)-bottom						<0.2	<0.2										
23-Feb-23	NO ₃ -N (mg/L)-bottom						0.06	0.08										
24-Feb-23	NO ₃ -N (mg/L)-bottom					0.06												
14-Mar-23	NO ₃ -N (mg/L)-bottom					<0.02												
15-Mar-23	NO ₃ -N (mg/L)-bottom						<0.02	<0.02										
23-Feb-23	TKN-bottom						<1.5	<1.5										
24-Feb-23	TKN-bottom					<1.5												
14-Mar-23	TKN-bottom					<1.5												
15-Mar-23	TKN-bottom						<1.5	<1.5										
23-Feb-23	Total Dissolved Phosphorus (mg/L)-bottom						<0.01	0.02										
24-Feb-23	Total Dissolved Phosphorus (mg/L)-bottom					<0.01												
14-Mar-23	Total Dissolved Phosphorus (mg/L)-bottom					<0.01												
15-Mar-23	Total Dissolved Phosphorus (mg/L)-bottom						<0.01	0.03										
23-Feb-23	Total Phosphorus (mg/L)-bottom						<0.02	0.03										
24-Feb-23	Total Phosphorus (mg/L)-bottom					<0.02												
14-Mar-23	Total Phosphorus (mg/L)-bottom					<0.01												
15-Mar-23	Total Phosphorus (mg/L)-bottom						0.01	0.05										

		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/Within		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
23-Feb-23	Hydrogen Sulfide (mg/L)-bottom					<0.02	<0.02											
24-Feb-23	Hydrogen Sulfide (mg/L)-bottom					<0.02												
14-Mar-23	Hydrogen Sulfide (mg/L)-bottom					<0.02												
15-Mar-23	Hydrogen Sulfide (mg/L)-bottom						<0.02	0.02										
23-Feb-23	Phytoplankton Biomass (g dry wt/m³)-bottom						0.6	1.8										
24-Feb-23	Phytoplankton Biomass (g dry wt/m³)-bottom																	
14-Mar-23	Phytoplankton Biomass (g dry wt/m³)-bottom					1.2												
15-Mar-23	Phytoplankton Biomass (g dry wt/m³)-bottom						2	1.2										

APPENDIX 4-2: EFFLUENT CAMP MONITORING RESULTS – Q1 2023

		Site Name	OSOV1	OSOV 2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameter (Unit)	Guideline in the CA			
16-Jan-23	pH	6.0 - 9.0	6.87	6.6	7.1
30-Jan-23	pH	6.0 - 9.0	6.7	6.85	6.89
10-Feb-23	pH	6.0 - 9.0	6.7	6.9	6.9
22-Feb-23	pH	6.0 - 9.0	6.9	6.82	7.04
06-Mar-23	pH	6.0 - 9.0	7.0	7.25	7.2
20-Mar-23	pH	6.0 - 9.0	6.85	7.5	7.05
16-Jan-23	Sat. DO (%)		43.9	46.9	55.4
30-Jan-23	Sat. DO (%)		47.1	91.1	64.3
10-Feb-23	Sat. DO (%)		44.5	68.6	38.8
22-Feb-23	Sat. DO (%)		51.5	79.2	32
06-Mar-23	Sat. DO (%)		44.6	82.2	50.5
20-Mar-23	Sat. DO (%)		55.1	105.4	52.9
16-Jan-23	DO (mg/L)		3.67	4.39	4.38
30-Jan-23	DO (mg/L)		4.08	8.04	5.25
10-Feb-23	DO (mg/L)		3.63	5.56	3.08
22-Feb-23	DO (mg/L)		4.27	6.48	2.53
06-Mar-23	DO (mg/L)		3.71	6.94	3.98
20-Mar-23	DO (mg/L)		4.3	8.27	4.2
16-Jan-23	Conductivity (µs/cm)		332	420	1100
30-Jan-23	Conductivity (µs/cm)		354	385	1102
10-Feb-23	Conductivity (µs/cm)		390	484	1171
22-Feb-23	Conductivity (µs/cm)		378	475	1490
06-Mar-23	Conductivity (µs/cm)		364	613	2002
20-Mar-23	Conductivity (µs/cm)		310	590	1463
16-Jan-23	Temperature (°C)		24.42	19.67	26.95
30-Jan-23	Temperature (°C)		22.39	21.39	25.49
10-Feb-23	Temperature (°C)		25.61	26.07	27.06
22-Feb-23	Temperature (°C)		24.75	25.55	27.13
06-Mar-23	Temperature (°C)		24.65	23.68	27.1
20-Mar-23	Temperature (°C)		27.17	27.73	28.96
16-Jan-23	Turbidity (NTU)		1.4	8.22	41.8
30-Jan-23	Turbidity (NTU)		1.69	7.42	43.5
10-Feb-23	Turbidity (NTU)		0.89	14.7	42.4
22-Feb-23	Turbidity (NTU)		1.57	17.1	51.7
06-Mar-23	Turbidity (NTU)		1.08	11.4	66.4
20-Mar-23	Turbidity (NTU)		1.52	10.7	33.7
16-Jan-23	TSS (mg/L)	<50	<5	7.6	76.25
30-Jan-23	TSS (mg/L)	<50	<5	9.05	56.03
10-Feb-23	TSS (mg/L)	<50	<5	20.33	56.47
22-Feb-23	TSS (mg/L)	<50	<5	<5	59.13
06-Mar-23	TSS (mg/L)	<50	<5	9.4	80
20-Mar-23	TSS (mg/L)	<50	<5	7.63	44.58
16-Jan-23	BOD ₅ (mg/L)	<30	<6	<6	32.34
30-Jan-23	BOD ₅ (mg/L)	<30	<6	10.65	31.02
10-Feb-23	BOD ₅ (mg/L)	<30	<6	9.57	<6
22-Feb-23	BOD ₅ (mg/L)	<30	<6	<6	<6

		Site Name	OSOV1	OSOV 2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameter (Unit)	Guideline in the CA			
06-Mar-23	BOD ₅ (mg/L)	<30	<6	<6	<6
20-Mar-23	BOD ₅ (mg/L)	<30	<6	<6	8
22-Feb-23	COD (mg/L)	<125	<25	52.5	113
06-Mar-23	COD (mg/L)	<125	<25	37.8	188
20-Mar-23	COD (mg/L)	<125	<25	40.2	70
22-Feb-23	NH ₃ -N (mg/L)	<10.0	4.1	16.4	8.9
06-Mar-23	NH ₃ -N (mg/L)	<10.0	<2	23.5	3.1
20-Mar-23	NH ₃ -N (mg/L)	<10.0	3	28.1	21.3
22-Feb-23	Total Nitrogen (mg/L)	<10.0	4.5	17.6	24.8
06-Mar-23	Total Nitrogen (mg/L)	<10.0	3.1	23.8	10.8
20-Mar-23	Total Nitrogen (mg/L)	<10.0	3.1	29.5	58.0
22-Feb-23	Total Phosphorus (mg/L)	<2	1.13	1.8	13.8
06-Mar-23	Total Phosphorus (mg/L)	<2	0.76	2.5	13.0
20-Mar-23	Total Phosphorus (mg/L)	<2	1.48	2.4	10.3
16-Jan-23	Faecal Coliform (MPN/100 mL)	<400	540	170	79
30-Jan-23	Faecal Coliform (MPN/100 mL)	<400	540	5,400	5,400
10-Feb-23	Faecal Coliform (MPN/100 mL)	<400	460	9,200	0
22-Feb-23	Faecal Coliform (MPN/100 mL)	<400	5	0	1,600
06-Mar-23	Faecal Coliform (MPN/100 mL)	<400	79	0	0
20-Mar-23	Faecal Coliform (MPN/100 mL)	<400	140	0	920
16-Jan-23	Total coliform (MPN/100 mL)	<400	540	210	140
30-Jan-23	Total coliform (MPN/100 mL)	<400	1,600	9,200	9,200
10-Feb-23	Total coliform (MPN/100 mL)	<400	700	16,000	0
22-Feb-23	Total coliform (MPN/100 mL)	<400	1,600	0	1,600
06-Mar-23	Total coliform (MPN/100 mL)	<400	240	0	0
20-Mar-23	Total coliform (MPN/100 mL)	<400	1,600	2	1,600
22-Feb-23	Oil & Grease (mg/L)	<10.0	<1	<1	<1
06-Mar-23	Oil & Grease (mg/L)	<10.0	<1	1.2	2.1

APPENDIX 4-3: COMMUNITY GROUNDWATER QUALITY MONITORING RESULTS – Q1 2023

Month Year	Parameter (Unit)	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village	
		Station	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
		Guideline					
12-Jan-23	pH	6.5 - 9.2	7.0	7.2	7.5		
31-Jan-23	pH	6.5 - 9.2				6.48	6.52
13-Feb-23	pH	6.5 - 9.2	6.5	6.8	7.05		
20-Feb-23	pH	6.5 - 9.2				6.6	6.51
13-Mar-23	pH	6.5 - 9.2				6.6	6.52
21-Mar-23	pH	6.5 - 9.2	6.8	6.77	6.56		
24-Mar-23	pH	6.5 - 9.2					
12-Jan-23	Sat. DO (%)		65	84.3	64.1		
31-Jan-23	Sat. DO (%)					68.9	68
13-Feb-23	Sat. DO (%)		80	93.1	72.2		
20-Feb-23	Sat. DO (%)					81	95.4

Month Year	Parameter (Unit)	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village	
		Station	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
		Guideline					
13-Mar-23	Sat. DO (%)					76.8	75.2
21-Mar-23	Sat. DO (%)		98.5	109.5	99.6		
24-Mar-23	Sat. DO (%)						
12-Jan-23	DO (mg/l)		5.19	6.83	5.3		
31-Jan-23	DO (mg/l)					6.42	6.36
13-Feb-23	DO (mg/l)		6.09	7.38	5.74		
20-Feb-23	DO (mg/l)					6.93	7.79
13-Mar-23	DO (mg/l)					6.3	6.17
21-Mar-23	DO (mg/l)		7.67	8.63	7.79		
24-Mar-23	DO (mg/l)						
12-Jan-23	Conductivity (μS/cm)		396	423	413		
31-Jan-23	Conductivity (μS/cm)					22	227
13-Feb-23	Conductivity (μS/cm)		360	423	425		
20-Feb-23	Conductivity (μS/cm)					28	239
13-Mar-23	Conductivity (μS/cm)					25	227
21-Mar-23	Conductivity (μS/cm)		339	396	390		
24-Mar-23	Conductivity (μS/cm)						
12-Jan-23	Temperature (°C)		26.71	25.99	25.13		
31-Jan-23	Temperature (°C)					18.77	22.29
13-Feb-23	Temperature (°C)		29.54	27.3	27.07		
20-Feb-23	Temperature (°C)					23.2	25.52
13-Mar-23	Temperature (°C)					25.51	25.23
21-Mar-23	Temperature (°C)		28.22	27.63	27.93		
24-Mar-23	Temperature (°C)						
12-Jan-23	Turbidity (NTU)	<20	1.1	0.31	0.69		
31-Jan-23	Turbidity (NTU)	<20					
13-Feb-23	Turbidity (NTU)	<20	1.25	0.91	0.71		
20-Feb-23	Turbidity (NTU)	<20				2.65	1.27
13-Mar-23	Turbidity (NTU)	<20				3.89	0.76
21-Mar-23	Turbidity (NTU)	<20	0.44	0.28	0.91		
24-Mar-23	Turbidity (NTU)	<20					
12-Jan-23	Fecal coliform (MPN/100ml)	0	0	7.8	70		

Month Year	Parameter (Unit)	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village	
		Station	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
		Guideline					
31-Jan-23	Fecal coliform (MPN/100ml)	0					
13-Feb-23	Fecal coliform (MPN/100ml)	0	0	22	130		
20-Feb-23	Fecal coliform (MPN/100ml)	0				0	0
13-Mar-23	Fecal coliform (MPN/100ml)	0				0	2
21-Mar-23	Fecal coliform (MPN/100ml)	0	1.8	2	49		
24-Mar-23	Fecal coliform (MPN/100ml)	0					
12-Jan-23	E.coli Bacteria (MPN/100ml)	0					
31-Jan-23	E.coli Bacteria (MPN/100ml)	0	0	2	26		
13-Feb-23	E.coli Bacteria (MPN/100ml)	0	0	22	79		
20-Feb-23	E.coli Bacteria (MPN/100ml)	0				0	0
13-Mar-23	E.coli Bacteria (MPN/100ml)	0				0	2
21-Mar-23	E.coli Bacteria (MPN/100ml)	0	1.8	2	49		
24-Mar-23	E.coli Bacteria (MPN/100ml)	0					
13-Feb-23	Arsenic (mg/)	<0.05	0.0008	0.0008	0.0024		
20-Feb-23	Arsenic (mg/)	<0.05				<0.0003	0.0017
13-Feb-23	Cadmium (mg/l)	<0.01	<0.003	<0.003	<0.003		
20-Feb-23	Cadmium (mg/l)	<0.01				0.002	0.002
13-Feb-23	Total Iron (mg/l)	<1	0.006	0.008	0.013		
20-Feb-23	Total Iron (mg/l)	<1				0.038	0.013
20-Feb-23	Total hardness (mg/l)	<500				8	115
13-Feb-23	Mercury (mg/l)	<0.01	<0.0002	<0.0002	<0.0002		
20-Feb-23	Mercury (mg/l)	<0.01				<0.0002	<0.0002
13-Feb-23	Lead (mg/l)	<0.05	<0.003	<0.003	<0.003		
20-Feb-23	Lead (mg/l)	<0.05				<0.003	<0.003

APPENDIX 4-4: GRAVITY FED WATER SUPPLY QUALITY MONITORING RESULTS – Q1 2023

		Site Name	Thaheua Village	Hat Gnuin Village	Phouhomxay Village	
		Station	WTHH02	WHGN02	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline				
12-Jan-23	pH	6.5 - 8.5	6.5	7.0	6.1	6
26-Feb-23	pH	6.5 - 8.5	6.51	6.6	5.56	5.5
21-Mar-23	pH	6.5 - 8.5	6.63	6.94		
24-Mar-23	pH	6.5 - 8.5			6.2	6.1
12-Jan-23	Sat. DO (%)		93.3	85.5	72.8	68.7
26-Feb-23	Sat. DO (%)		87.8	81.4	81.7	75
21-Mar-23	Sat. DO (%)		114.9	109.8		
24-Mar-23	Sat. DO (%)				90.8	85
12-Jan-23	DO (mg/L)		7.87	7.24	6.38	5.83
26-Feb-23	DO (mg/L)		7.38	7.1	7.09	6.58
21-Mar-23	DO (mg/L)		9.1	8.38		
24-Mar-23	DO (mg/L)				7.45	6.92
12-Jan-23	Conductivity (µS/cm)	<1,000	67	111	28	16
26-Feb-23	Conductivity (µS/cm)	<1,000	73	129	23	21
21-Mar-23	Conductivity (µS/cm)	<1,000	390	109		
24-Mar-23	Conductivity (µS/cm)	<1,000			22	22
12-Jan-23	Temperature (°C)	<35	23.83	23.84	23.99	23.54
26-Feb-23	Temperature (°C)	<35	24.52	22.1	22.69	21.64
21-Mar-23	Temperature (°C)	<35	27.3	29.41		
24-Mar-23	Temperature (°C)	<35			25.3	25.83
12-Jan-23	Turbidity (NTU)	<10	4.94	3.66	1.22	0.72
26-Feb-23	Turbidity (NTU)	<10	1.15	1.11	0.83	0.7
21-Mar-23	Turbidity (NTU)	<10	2.01	1.7		
24-Mar-23	Turbidity (NTU)	<10			1.9	1.37
12-Jan-23	Faecal Coliform (MPN/100 mL)	0	79	49	130	170
26-Feb-23	Faecal Coliform (MPN/100 mL)	0	8	49	33	40
21-Mar-23	Faecal Coliform (MPN/100 mL)	0	17	21		
24-Mar-23	Faecal Coliform (MPN/100 mL)	0			130	70
12-Jan-23	E.coli Bacteria (MPN/100 mL)	0	79	22	130	170
26-Feb-23	E.coli Bacteria (MPN/100 mL)	0	5	49	49	33
21-Mar-23	E.coli Bacteria (MPN/100 mL)	0	13	17		
24-Mar-23	E.coli Bacteria (MPN/100 mL)	0			79	49

		Site Name	Thaheua Village	Hat Gnuin Village	Phouhomxay Village	
		Station	WTHH02	WHGN02	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline				
26-Feb-23	Arsenic (mg/L)	<0.05	<0.0003	<0.0003	<0.0003	<0.0003
26-Feb-23	Cadmium (mg/L)	<0.003	<0.002	<0.002	<0.002	<0.002
26-Feb-23	Iron (mg/L)		<0.05	<0.05	0.117	0.129
26-Feb-23	Lead (mg/L)	<0.10	<0.01	<0.01	0.003	0.008
26-Feb-23	Total hardness (mg/L)	<300	32.7	62.1	14.3	11.9
26-Feb-23	Mercury (mg/L)	<0.001	<0.0002	<0.0002	<0.0002	<0.0002