



Nam Ngiep 1 Hydropower Project

Quarterly Environment Monitoring Report Fourth Quarter of 2023

October to December 2023

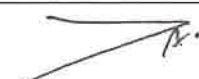
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Table of Contents

EXECUTIVE SUMMARY	9
1 INTRODUCTION	12
2 ENVIRONMENTAL MANAGEMENT AND MONITORING	12
2.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)	12
2.1.1 <i>Environmental Management Plan (EMP)</i>	13
2.2 CONTRACTOR SS-ESMMPs.....	15
2.3 RESULTS OF COMPLIANCE INSPECTIONS AT CONSTRUCTION SITES.....	15
2.4 SITE DECOMMISSIONING AND REHABILITATION	16
2.5 WASTE MANAGEMENT AT THE OPERATION SITES	16
2.5.1 <i>Waste Management at NNP1 Project Sites</i>	16
2.5.2 <i>Hazardous Waste Management</i>	17
2.5.3 <i>Animal Fodder (Pig Feed) Collection Programme</i>	18
2.5.4 <i>Community Solid Waste Management and Recycling Programme</i>	18
2.5.5 <i>Houay Soup Landfill</i>	18
2.6 RESERVOIR OPERATIONS	19
2.6.1 <i>Main Reservoir</i>	19
2.6.2 <i>Environmental Flow Requirements (EFRs) for the Operation Phase</i>	20
2.7 WATER QUALITY MONITORING	27
2.7.1 <i>Surface Water (River) and Depth Profile Water Quality</i>	27
2.7.2 <i>Compliance Monitoring of Effluents from Camps</i>	41
2.7.3 <i>Groundwater Quality Monitoring</i>	45
2.7.4 <i>Gravity Fed Water Supply (GFWS) Monitoring</i>	48
2.7.5 <i>Landfill Leachate Monitoring</i>	49
2.7.6 <i>Water Quality Compliance Monitoring</i>	50
3 WATERSHED AND BIODIVERSITY MANAGEMENT	53
3.1 WATERSHED MANAGEMENT	53
3.1.1 <i>Implementation of Watershed Management Plan</i>	53
3.1.2 <i>Preparation of Annual Implementation Plan (AIP) 2023</i>	59
3.2 BIODIVERSITY OFFSET MANAGEMENT.....	59
3.2.1 <i>Implementation of Biodiversity Offset Management Plan</i>	59
3.2.2 <i>Preparation of Annual Implementation Plan (AIP) 2023</i>	64
3.2.3 <i>Preparation of Annual Implementation Plan (AIP) 2024</i>	64

4	FISHERY MONITORING	65
5	HEALTH AND SAFETY	69
5.1	RELATED TO NNP1PC HEALTH AND SAFETY	69
5.1.1	<i>Health and Safety Training and Emergency Drills in the Project site</i>	70
5.2	RELATED TO COVID-19	71
5.2.1	<i>NNP1PC COVID-19 Measures</i>	71
5.2.2	<i>General situation of COVID-19 in NNP1PC</i>	72
6	EXTERNAL MISSIONS AND VISITS	72
	APPENDICES	73
	APPENDIX 1: THE SITE INSPECTION RESULTS DURING Q4 2023	74
	APPENDIX 2: ENVIRONMENTAL MONITORING CORRECTIVE ACTIONS Q4 2023	77
	APPENDIX 3: SITE CODES, LOCATIONS, MONITORING PARAMETERS AND ITS MAP OF THE SURFACE WATER QUALITY MONITORING	84
	APPENDIX 4: KEY TRENDS OF WATER QUALITY MONITORING FROM JANUARY 2020 TO END OF DECEMBER 2023 (ONLY PARAMETERS THAT EXCEEDED THE STANDARDS)	87
	APPENDIX 5: WATER QUALITY MONITORING DATA	91
	APPENDIX 5-1: SURFACE WATER QUALITY MONITORING – Q4 2023	91
	APPENDIX 5-2: EFFLUENT CAMP MONITORING RESULTS – Q4 2023	105
	APPENDIX 5-3: COMMUNITY GROUNDWATER QUALITY MONITORING RESULTS – Q4 2023	106
	APPENDIX 5-4: GRAVITY FED WATER SUPPLY QUALITY MONITORING RESULTS – Q4 2023	108
	APPENDIX 5-5: LANDFILL LEACHATE MONITORING RESULTS – Q4 2023	109

Table of Tables

Table 2-1: <i>The Details of EMPs 2023 Implementation</i>	13
Table 2-2: <i>The Details of EMPs 2023 Implementation</i>	14
Table 2-3: <i>The Internal Audit Activity Photos</i>	14
Table 2-4: <i>STATUS OF ONCs REPORT DURING Q4 2023</i>	16
Table 2-5: <i>Amounts of Recyclable Waste during Q4 2023</i>	17
Table 2-6: <i>Hazardous material and hazardous waste recorded during Q4 2023</i>	17
Table 2-7: <i>Summary of EFRs Compliance Monitoring in Q4 2023</i>	20
Table 2-8: <i>River depth measurements in Nam Ngiep downstream the re-regulation dam</i>	23
Table 2-9: <i>DO (mg/L) Results of Surface Water in Main Reservoir, DO (mg/l) results of R05 at intake depth, Re-regulation Reservoir, Nam Ngiep and its Main Tributaries Monitored in Q4 2023</i>	36
Table 2-10: <i>Ammonia Nitrogen (mg/L) results for the surface water in Nam Ngiep and its main tributaries monitored in Q4 2023</i>	38
Table 2-11: <i>BOD₅ (mg/L) results for the surface water in Nam Ngiep and its main tributaries monitored in Q4 2023</i>	39
Table 2-12: <i>COD (mg/L) results for the surface water in Nam Ngiep and its main tributaries in Q4 2023</i>	40
Table 2-13: <i>Faecal coliforms (MPN/100 mL) results in Nam Ngiep and its main tributaries in Q4 2023</i>	40
Table 2-14: <i>Total coliform (MPN/100 mL) results in Nam Ngiep and its main tributaries in Q4 2023</i>	40
Table 2-15: <i>Results of the Effluent Water Quality Monitoring of the Camps in Q4 2023 (Non-compliance Parameters Only)</i>	42
Table 2-16: <i>Compliance Status of Effluent Discharge from the Camps in Q4-2023</i>	43
Table 2-17: <i>The GFWS Monitoring Result in Q4 2023</i>	48
Table 2-18: <i>Non-compliances relating to water quality monitoring in Q4 2023</i>	50
Table 3-1: <i>The Action Taken under the NNP1 watershed and biodiversity program</i>	57
Table 4-1: <i>Fish Species dominating the Fish Catch in Q4 2023</i>	65
Table 4-2: <i>Threatened Species of Q4 2023 Fish Catch</i>	65
Table 4-3: <i>Occurrence of Threatened Species in the Fish Catch</i>	66
Table 4-4: <i>Main Biodiversity Indicators for Q4 2023</i>	67
Table 4-5: <i>Mean Daily Fish Catch per Household for Q4 from 2015 to 2023</i>	68
Table 4-6: <i>Proportion of the catch reported by main habitats (%) in Q4 2023</i>	68
TABLE 5-1: <i>SAFETY INCIDENTS REPORTED DURING THE OPERATION PHASE (SEPTEMBER 2019 TO DECEMBER 2023)</i>	69

Table of Figures

Figure 2-1: <i>STATUS OF ONCs DURING Q4 2023</i>	16
Figure 2-2: <i>Inflow to the Main Reservoir</i>	19
Figure 2-3: <i>Water Level of the Main Reservoir</i>	19
Figure 2-4: <i>Discharge from the Re-regulation Dam during Q4 2023</i>	21
Figure 2-5: <i>Location map of river depth monitoring points</i>	24
Figure 2-6: <i>Hourly Stage Height Fluctuations During Q4 2023</i>	26
Figure 2-7: <i>24-Hour Stage Height Difference (M) during Q4 2023</i>	26
Figure 2-8: <i>7-day Stage Height Difference (M) during Q4 2023</i>	27
Figure 2-9: <i>Dissolved Oxygen immediately upstream and downstream of the Main Dam</i>	28
Figure 2-10: <i>Dissolved Oxygen Long Profile Measurement from Immediately Upper Main Dam to Lower Nam Ngiep (Q3 2023 and Q4 2023)</i>	28
Figure 2-11: <i>Monthly mean concentrations of dissolved oxygen in R05</i>	30
Figure 2-12: <i>Main reservoir Dissolved Oxygen at the End of Q4 2023</i>	32
Figure 2-13: <i>Water Temperature and Dissolved Oxygen – depth profiles in the Main Reservoir immediately upstream of the main dam (R05)</i>	33
Figure 2-14: <i>Water Temperature and DO Depth Profiles in the Main Reservoir (R04 - R05), with Position of Intake at the Actual Water Level During September 2018 – December 2023</i>	34
Figure 2-15: <i>The STRAIGHT-LINE graph of Monthly Averaged DO and Water Temperature at R04 and R05</i>	35
Figure 2-16: <i>Location of effluent monitoring points</i>	41
Figure 2-17: <i>Groundwater Sampling Locations</i>	46
Figure 2-18: <i>Overview of Gravity fed water supply</i>	48
Figure 2-19: <i>Landfill Leachate Monitoring Location</i>	50
Figure 3-1: <i>Map of patrolling track in October and December 2023</i>	61
Figure 3-2: <i>Map of threats in October and December 2023</i>	62
Figure 3-3: <i>REPRESENTATIVE PHOTOS FOR MONTHLY PATROLLING IN OCTOBER AND DECEMBER 2023</i>	63
FIGURE 4-1: <i>FISH DIVERSITY INDEX (SHANNON) BY FISHING ZONE FROM JULY 2015 TO DECEMBER 2023</i>	67
Figure 4-2: <i>Mean Daily Fish Catch per Household from July 2015 to December 2023</i>	68
Figure 4-3: <i>Proportion of OAA to the total reported kilogram (kg) of fish and OAA for a 7-day period by fishing zone in Q4 from 2015 to 2023</i>	69
Figure 5-1: <i>Number, Type and Frequency of Safety Incidents since September 2019 to 30 September 2023</i>	70
Figure 5-2: <i>Representative photos of the safety induction during Q4 2023</i>	71

ABBREVIATIONS / ACRONYMS

AIP	Annual Implementation Plan
ADB	Asian Development Bank
ADM	Administration Division
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
DCC	Document Control
DD	Data Deficient of IUCN conservation status
DEB	Department of Energy and Business of the Ministry of Energy and Mine
DEMO	District Energy and Mines Office
DOF	Department of Forestry of Ministry of Agriculture and Forestry
DWP	Detailed Work Program
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
H&S	Health and Safety
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
KGS	Khammany General Service
KPI	Key performance Indicator
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
MPI	Ministry of Planning and Investment
NC-NX	Nam Chouane-Nam Xang
NCR	Non-Compliance Report
NNP1PC	Nam Ngiep 1 Power Company Limited
OAA	Other aquatic animals
OC	Obayashi Corporation
OFIs	Opportunity for Improvement
O&M	Operation & Maintenance
ONC	Observation of Non-Compliance
OSOV	Owners' Site Office and Village
PAFO	Provincial Department of Agriculture and Forestry

PCD	Procurement Division
PEMO	Province Energy and Mine Office
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
TD	Technical Division
TOR	Terms of Reference
TPZ	Totally Protected Zone
TSS	Total Suspended Solids
UAE	United Analysis and Engineering Consultant Company Ltd.
UR	Upper Reservoir
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

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 Q4 2023, activities related to the implementation of ISO14001:2015 continued such as the implementation of the four (04) Environmental Management Plans (EMPs).

The annual ISO14001:2015 Internal Audit was conducted from 18 October 2023 to 24 November 2023, covering all 31 work function areas (Industrial areas, camp facilities, and management systems). The internal audit did not identify any non-conformities (NCs), however, the audit identified 33 of Opportunities for Improvements (OFIs) and 10 recommendations for continual improvement. A management review meeting has been scheduled for 11 January 2024, aiming to provide detailed directives for maintaining and enhancing the performance of the Environmental Management System (EMS).

During Q4 2023, EMO received one DWP and SS-EMMP for the remaining work of the 2UR Suspension Bridge Construction for review and approval.

Three joint monthly site inspections were carried out among EMO, ADM and Technical Division (TD) to follow up on the progress of corrective actions from the previous findings related to waste management, NNP1 landfill operation, hazardous material and waste management and wastewater treatment system operation and maintenance. Three Site Inspection Reports (SIRs) were submitted to TD and ADM containing necessary corrective actions including soil filling of the underground holes at the former RCC plant, as well as maintenance of the wastewater treatment systems and waste management improvements at OSOV1 and OSOV2. All 31 rehabilitated areas were inspected, no evidence of erosion or instability were observed at any of the inspected sites.

A total of 19.51 m³ solid waste from NNP1 project sites and camps was disposed of at the NNP1 Project Landfill, an increase of 0.31 m³ compared with Q3 2023.

The environmental flow requirements have been monitored in accordance with the ESMMP-OP and the results show that the rate of water level increase due to dam operations (ramping-up) in a few cases did not comply 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 5.4 mg/L and 9.3 mg/L. The monthly mean DO concentration at the intake level decreased from 3.0 mg/L in October 2023, to 2.0 mg/L in November 2023 and 1.0 mg/L in December 2023. The DO concentrations in Nam Chian was above 6 mg/L.

The DO concentrations at the surface level in the Re-regulation Reservoir (R07) were between 2.0 and 7.6 mg/L.

During turbine discharge, the DO levels in Nam Ngiep downstream the Re-regulation Dam were less than 6 mg/L. However, during combined turbine and gate discharges, the DO concentration in Nam Ngiep downstream were greater than 6 mg/L at the stations located at 5.2 km to 47.2 km from the Re-regulation Dam.

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

Bolikhamxay Watershed and Reservoir Protection Office (WRPO) received the second two-quarter funds under the approved Bolikhamxay Annual Implementation Plan (AIP) 2023 from the Forest Protection Fund (FPF) office of the Department of Forestry (DOF) – Ministry of Agriculture and Forestry (MAF) on 20 October 2023. Bolikhamxay WRPO conducted the forest and reservoir patrol in November 2023 but did not continue in December 2023 because the members were occupied with internal meetings and annual performance evaluations until the end of December 2023. Bolikhamxay WRPO submitted the first draft of their AIP2024 to NNP1 EMO on 1 December 2023. NNP1 EMO and Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS) reviewed the draft and reverted to Bolikhamxay WRPO on 19 December 2023. The revised draft was shared with NNP1 EMO and BSP-WCS on 26 December 2023 and is expected to be finalized in early January 2024 for further submission and review by ADB and the Independent Advisory Panel (IAP).

Xaysomboun WRPO conducted the Total Protected Zone (TPZ) and reservoir patrolling in October and November 2023. Xaysomboun WRPO did not continue with TPZ and reservoir patrolling in December 2023 because the results of patrolling have not been discussed and reported yet to the Head of Xaysomboun PAFO since October 2023, and the members were also occupied with internal meetings and annual performance evaluations until the end of December 2023. NNP1 EMO obtained the updates from the contractor for the two reservoir checkpoints in the middle of November 2023 and noted that they are procuring the materials and recruiting local labour for the construction. The contractor proposed to visit the checkpoint location together with NNP1 EMO and Xaysomboun WRPO before starting the construction, and due to the internal activities of Xaysomboun WRPO, the visit was scheduled to take place in January 2024. NNP1 EMO followed up with the Xaysomboun WRPO on the draft fishery regulation as per the discussion and agreement during the Fishery Co-Management Plan (FCMP) meeting in August 2023, and NNP1 EMO noted that it would be further delayed because the Deputy Head of Xaysomboun WRPO responsible for it is resigning from Xaysomboun PAFO. The Xaysomboun WRPO AIP2023 has been delayed and was finally completed and approved by the Head of Xaysomboun PAFO in November 2023. The plan was submitted to FPF DOF-MAF on 12 December 2023. NNP1 EMO expects to receive the official fund disbursement request from FPF DOF-MAF in the first week of January 2024.

Bolikhamxay Biodiversity Offset Management Unit (BOMU) conducted patrolling and snare removal activity on 6-25 October and 11-23 October 2023, respectively. BOMU did not continue patrolling and snare removal activity in November 2023 because they did not receive the second two-quarters of AIP 2023 funds from the FPF DOF-MAF until the end of November 2023. They continued patrolling and snare removal activity on 3-22 December 2023 and 11-23 December 2023, respectively. BSP-WCS finalized the report of the Participatory Land Use Planning (PLUP) at the end of October 2023. BSP-WCS revised the report in November 2023 per review from NNP1 EMO and BOMU. NNP1 EMO, BOMU, and BSP-WCS discussed the revised report in the third week of December 2023. The meeting to present the results to the PAFO and Viengthong District

authorities is expected to be organized in January 2024. Under the agreed Community Development Plan (CDP) for 2023, BOMU conducted fieldwork to obtain additional information on the farmers' regulations and proposals from the farmer group for the farmer group approval process in the second week of November 2023. The livestock-raising groups in all six NC-NX target villages were established and approved by Viengthong and Xaychamphone DAFOs in December 2023. NNP1 EMO, BSP-WCS, and BOMU started the gibbon survey on 8 December 2023, including a total of 20 targeted listening posts. These listening posts are being surveyed and the data is being analyzed by BSP-WCS, the EMO Team observed that gibbon calls were detected across all listening posts surveyed. The survey is expected to be completed on 3 January 2024. BOMU received the second two-quarter fund disbursement request under their approved AIP2023 from FPF DOF-MAF on 27 November 2023. BSP-WCS drafted the list of activities for the BOMU AIP2024 on 8 November 2023. NNP1 EMO reviewed it on 14 November 2023. BSP-WCS revised the list and shared it with BOMU on 14 November 2023. BOMU is still preparing the detailed budget of their AIP2024 as of the end of December 2023.

In Q4 2023, dominant fish species by weight included *Oreochromis niloticus* and four species group of *Poropuntius*, *Sikukia gudgeri* and *Amblyrhynchichthys truncatus*, *Hampala* and *Mastacembelus*, all classified as Least Concern (LC) on the IUCN Red List of Threatened Species, except *Sikukia gudgeri* which is classified as Data Deficient (DD) and *Oreochromis niloticus* is an exotic species. Notably, *Channa striata*, a dominant species in Q3, was absent in Q4, while *Sikukia gudgeri* and *Amblyrhynchichthys truncatus*, also dominant species in Q4, were not observed in Q3.

The recorded catch of threatened species includes four species classified as Vulnerable species (VU): *Bangana behri*, *Cirrhinus cirrhosus*, *Scaphognathops bandanensis*, and *Tor sinensis*.

INTRODUCTION

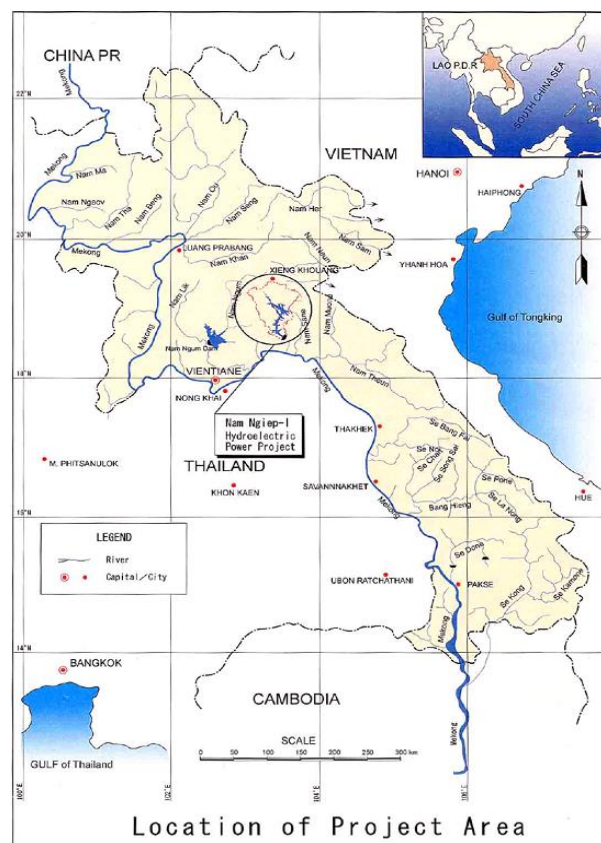
The Nam Ngiep originates in the mountains of Xiengkhouang Province, flowing through Khoun District into Thathom District of Xaysomboun Province, through Hom District and into Bolikhamxay Province. The Nam Ngiep meets the Mekong River just upstream from Pakxan in Bolikhamxay Province.

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.



2 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 Q4 2023.

2.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

During Q4 2023, activities related to the implementation of ISO14001:2015 continued such as the implementation of the four (04) Environmental Management Plans (EMPs). The activities under the EMPs included 1) HSE awareness training for NNP1PC staff and contractors, 2) reducing the paper consumption in NNP1 offices, 3) minimising waste generation and maximising waste separation at sources to reduce the quantity of waste disposal at NNP1 project landfill, and 4) planting trees.

The details of EMPs 2023 implementation are shown in **Table 2-1**.

TABLE 2-1: THE DETAILS OF EMPs 2023 IMPLEMENTATION

EMP No.	Activity Description	KPI	Evaluation Date	Implementation Progress
01/2023*	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.	Dec 2023	Achieved 49 % – The training is scheduled to be continued in Q1 2024. – The next evaluation is planned for February 2024
02/2023*	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.	Dec 2023	Achieved 8.5 % The next evaluation is scheduled for February 2024
03/2023*	Reducing the quantity of waste disposal at NNP1 Project Landfill	The total quantity of waste disposed of in the NNP1 landfill in 2023 is reduced by 5% compared with 2022.	Dec 2023	Achieved 27.4% The next evaluation is scheduled for February 2024
04/2023 [#]	Planting tree	50% of plant survival, the potential plantation fields in contributing to the environmentally sustainability objectives (refer to Tree Planting Plan).	Dec 2023	Achieved 83% The next evaluation is scheduled for February 2024

*EMP_s were implemented in 2022 and continued in 2023 for further success

[#] New EMP 2023 suggested by the external ISO Auditor (SGS)

2.1.1 Environmental Management Plan (EMP)

The annual **ISO14001:2015** Internal Audit was conducted from 18 October 2023 to 24 November 2023, covering all 31 work functions in three areas: Industrial areas, camp facilities, and management systems. The internal audit identified 33 Opportunities for Improvements (OFIs). The audit did not identify any non-conformities. A management review meeting has been scheduled for 11 January 2024, aiming to provide detailed observations and directives for maintaining and enhancing the performance of the Environmental Management System (EMS). The internal audit results are shown in **Table 2-2**. And the audit activities photos are shown in **Table 2-3**.

TABLE 2-2: THE DETAILS OF EMPs 2023 IMPLEMENTATION

No	OFI description	Number of Observation	Area of Responsibility
1	Documentation works – DCC registered, updating procedures, records, and distribution	9	TD, ADM, HR, PCD, DCC, H&S, EMO
2	Emergency Preparedness - training, drill, records, equipment/kits	6	TD, ADM, H&S, PCD
3	Training needs, records	6	TD, EMO, ADM, H&S
4	Communication on NNP1 Policies, SOPs, and relevant EMS documents to Staff, Contractors, GOL, villagers	5	ADM, TD
5	Effluent discharge	2	ADM, EMO
6	Waste management , Environmental aspect	5	EMO, TD

TABLE 2-3: THE INTERNAL AUDIT ACTIVITY PHOTOS

	
	
<i>Internal Training on Environmental Risk and Opportunities (04 October 2023)</i>	<i>ISO14001:2015 Internal Audit of 2023</i>

On 15 September 2023, NNP1PC conducted care activities for the planted trees under the Environmental Management Plan (EMP04-2023) to achieve at least 50% survival by April 2024, including replacing dead and unhealthy trees and applying natural fertilizer to enhance growth.

In November 2023, NNP1PC completed the installation of a water piping system to supply water for the planted trees during dry seasons, under the Environmental Management Plan (EMP04-2023) to ensure these trees survive.



2.2 CONTRACTOR SS-ESMMPs

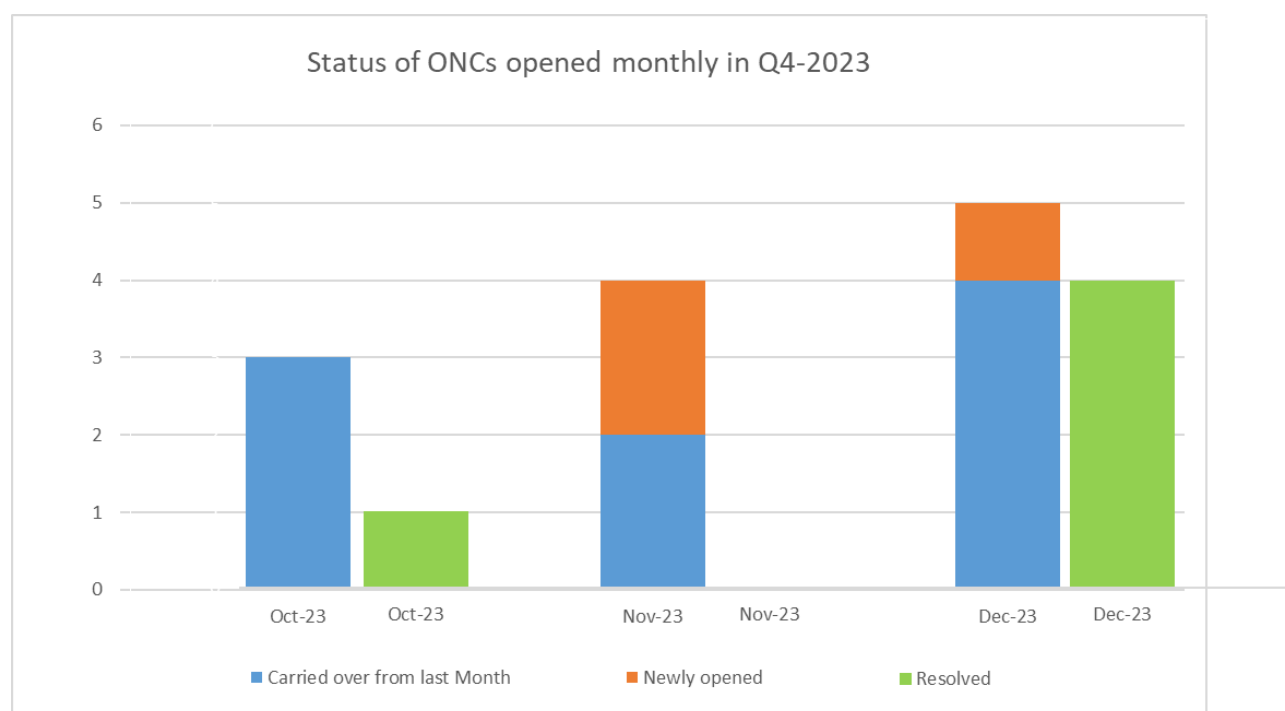
During Q4 2023, EMO received one DWP and SS-EMMP for the remaining work of the 2UR Suspension Bridge Construction. Following a site inspection, EMO found that the document lacked important details regarding riverbank erosion protection, gabion installation, and waste management. Additionally, some of the information in the document was found to be irrelevant to the actual scope of work and site conditions. The contractor was instructed to revise and resubmit the document for EMO's review and approval within 10 business days. Later, on 20 November 2023, TD held a kick-off meeting with the contractor to discuss additional technical information and convey EMO's environmental feedback. The contractor acknowledged technical and environmental requirements and will address all comments in the revised DWP and SS-EMMP to NNP1PC (TD currency follows up the submission of the revised document). TD and EMO conduct daily and monthly inspection to ensure the contractor performance.

2.3 RESULTS OF COMPLIANCE INSPECTIONS AT CONSTRUCTION SITES

During Q4 2023, three joint monthly site inspections were carried out among EMO, ADM and Technical Division (TD) to follow up on the progress of corrective actions from the previous findings related to waste management, NNP1 landfill operation, hazardous material and waste management and wastewater treatment system operation and maintenance. Three Site Inspection Reports (SIRs) were submitted to TD and ADM recommending necessary corrective actions including soil filling of the underground holes at the former RCC plant, as well as maintenance of the WWTS and waste management improvements at OSOV1 and OSOV2. All 31 rehabilitated areas were inspected, no evidence of erosion or instability were observed at any of the inspected sites. The status of ONCs report is summarized in **Table 2-4** and **Figure 2-1**. The Site Inspection Results During Q4 2023 is presented in **Appendix 1**.

TABLE 2-4: STATUS OF ONCs REPORT DURING Q4 2023

Status	ONC	NCR-Level 1	NCR-Level 2	NCR-Level 3	Incident Report
Carried over ONC/NCR from the previous quarter	3	0	0	0	0
Newly opened ONC/NCR	3	0	0	0	0
Total No. of ONC/NCR	6	0	0	0	0
Resolved ONC/NCR	5	0	0	0	0
Unresolved ONC/NCR carried forward to the next quarter	1	0	0	0	0

FIGURE 2-1: STATUS OF ONCs DURING Q4 2023

2.4 SITE DECOMMISSIONING AND REHABILITATION

All 31 rehabilitated areas were inspected. No evidence of erosion or instability were observed at any of the inspected sites. However, additional continued soil filling of small holes is required at the former RCC plant to ensure stability.

2.5 WASTE MANAGEMENT AT THE OPERATION SITES

2.5.1 Waste Management at NNP1 Project Sites

A total of 19.51 m³ solid waste from NNP1 project sites and camps was disposed of at the NNP1 Project Landfill, an increase of 0.31 m³ compared with Q3 2023. The project waste collection and

NNP1 landfill management by the contractor was resumed in mid of November 2023, and has continued routinely.

The amount of recyclable waste managed on site during Q4 2023 is shown in **Table 2-5**.

TABLE 2-5: AMOUNTS OF RECYCLABLE WASTE DURING Q4 2023

Source and Type of Recyclables		Unit	Total in Q4 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	106	0	106
3	Aluminium Can	kg	0	0	0
4	Paper/Cardboard	kg	93	0	93
5	Glass	kg	267	0	267
6	Scrap metal	Kg	0	0	0
Sub-Total 2		kg	466.0	0	466.0
Grand Total (Sub-Total 1+2)		kg	466.0	0	466.0

2.5.2 Hazardous Waste Management

The amounts of hazardous waste and hazardous materials that were collected, stored and disposed of during Q4 2023 are shown in **TABLE 2-6**.

TABLE 2-6: HAZARDOUS MATERIAL AND HAZARDOUS WASTE RECORDED DURING Q4 2023

No.	Type of Hazardous Material	Unit	Total in Q4 2023	Used/ Disposed	Remaining
1	Diesel	Litre	12,987	12,577	410
2	Gasoline	Litre	1,975	1,414	561
3	Lubricant (Turbine oil)	Litre	85	13	72
4	Colour paint	Litre	39	0	39
5	Thinner	Litre	1	0	1
6	Grease oil	Litre	785	0	785
7	Gear Oil	Litre	16.5	0	16.5
8	Chlorine Liquid	Litre	240	240	0
9	HA Cut AF	Litre	3,925	0	3,925
10	HA Cut Cat AF	Litre	373	0	373
Type of Hazardous Waste					
11	Used Oil (Hydraulic + Engine)	Litre	355	0	355
12	Used oil mixed with water	Litre	0	0	0
13	Empty used oil drum/container (drum 200L)	Unit	53	0	53
14	Use Oil Filter	Unit	27	0	27
15	Contaminated soil, sawdust and textile material	M3	1.2	0	1.2

No.	Type of Hazardous Material	Unit	Total in Q4 2023	Used/ Disposed	Remaining
16	Used tyre	Drum	5	0	5
17	Empty used chemical drum/container (drum 20L)	Unit	66	0	66
18	Lead acid batteries	Unit	6	0	6
19	Empty paint and spray cans	Can	100	0	100
20	Halogen/fluorescent bulbs	Unit	439	0	439
21	Empty cartridge (Ink)	Piece	108	0	108
22	Clinic Waste	Kg	12.8	8.6	4.2
23	Expired Chlorine Powder	Kg	65	0	65

2.5.3 Animal Fodder (Pig Feed) Collection Programme

During Q4 2023, local villagers collected 1,749.1 kg of food waste from the Owner's Site Office and Village (OSOV) for feeding their animals. During the previous ISO14001 Internal Audit in January 2023, the canteen operator was instructed to minimise food waste in the food preparation process (use all parts of fruits and vegetables as much as possible) and perform proper waste segregation. This has been monitored regularly to ensure that instructions are adequately implemented. During the recent ISO14001:2015 Internal Audit in November 2023, the NNP1-ADM, canteen operator (SGS), and internal auditors engaged in a discussion about the current food preparation practices at the canteen. This discussion led to an improvement recommendation in investing in a new refrigerator for better on-site food storage preservation. Additionally, continuous monitoring of food waste management is being conducted.

2.5.4 Community Solid Waste Management and Recycling Programme

There was no update since NNP1 EMO coordinated with the Bolikhan District Environment Management Unit in Q3 2023 on transferring the management of the communities' solid waste, recycle waste bank and Houay Soup Landfill to the local authorities.

2.5.5 Houay Soup Landfill

There was no waste collection from communities to dispose of at Houay Soup Landfill during the reporting period since the waste collection services by the contractor hired by NNP1PC's ended in April 2022. Proper waste management is awaiting formal handover of the communities' solid waste management as noted above. In the meantime, the Bolikhan District EMU and villagers have managed solid waste. Some self-disposed solid waste was observed at the landfill. EMO reported to the EMU and the Special Taskforce team in Phouhomxay and the host villages for further investigation on an incident regarding the theft of a significant portion of HDPE lining from Houay Soup Landfill (HSL). The issue has been ongoing since NNP1PC-ESD officially informed EMU in March 2022 about the transfer of responsibility for community solid waste management and HSL. EMO has requested the EMU to speed up the handover process and a discussion meeting is expected to be within quarter 2 of 2024.

2.6 RESERVOIR OPERATIONS

2.6.1 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 2-2** and **Figure 2-3**.

During Q4 2023, the mean daily inflow to the main reservoir was 147 m³/s. The minimum daily inflow was 47 m³/s, maximum daily inflow was recorded at 560 m³/s, and 25th percentile of 84 m³/s and 75th percentile of 169 m³/s. As indicated in **Figure 2-2**, the inflow during Q4 2023 was higher compared to the same period in 2022.

The water level in the main reservoir decreased with 3.16 m from El. 319.92 m asl (15 October 2023) to 316.76 m asl by the end of Q4 2023.

FIGURE 2-2: INFLOW TO THE MAIN RESERVOIR

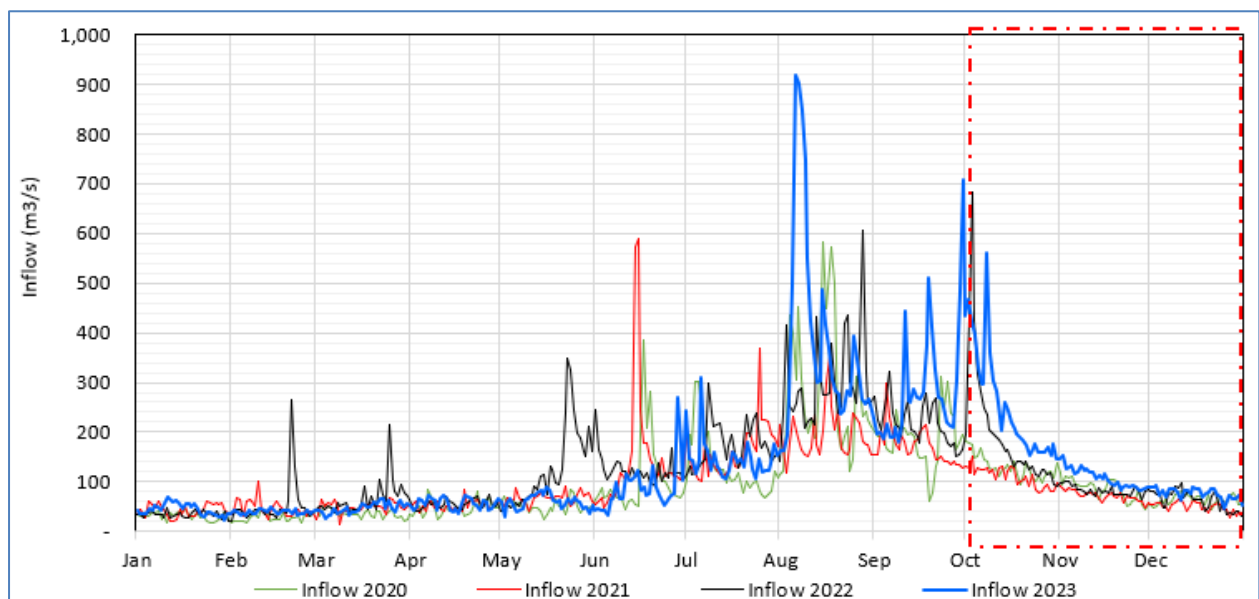
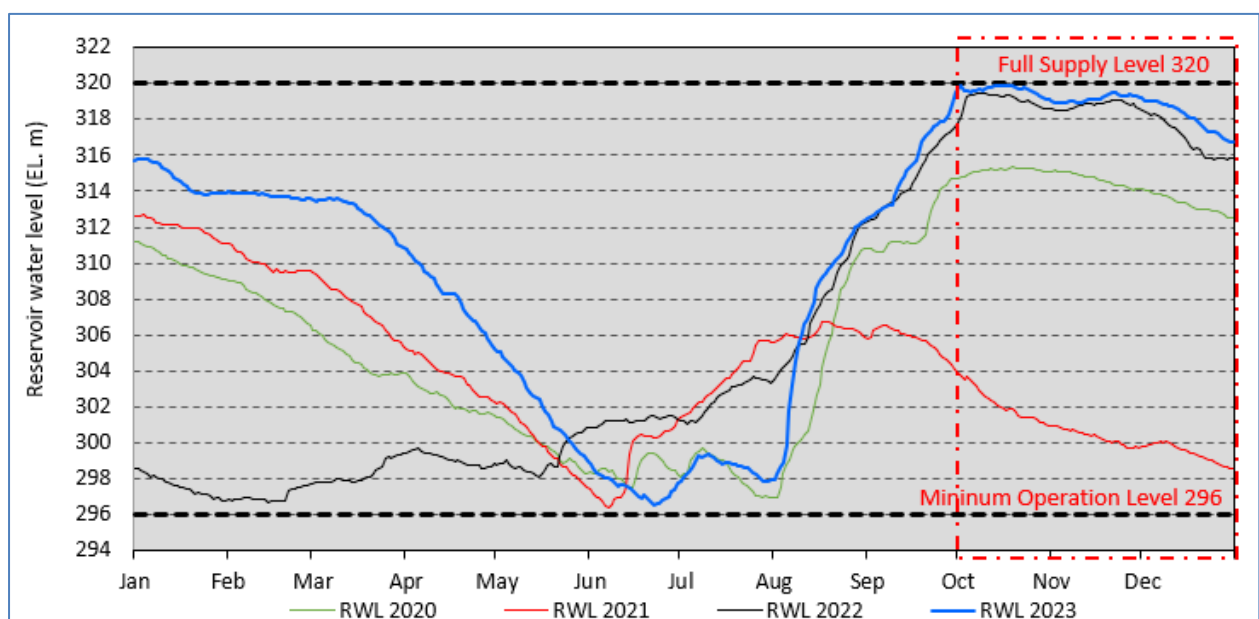


FIGURE 2-3: WATER LEVEL OF THE MAIN RESERVOIR



2.6.2 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), except with respect to thalweg water depth monitoring.

The results of the EFR compliance monitoring during Q4 2023 are summarized in **Table 2-7**.

TABLE 2-7: SUMMARY OF EFRs COMPLIANCE MONITORING IN Q4 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 Q4 2023 monthly thalweg monitoring missions only included monitoring of navigation difficulties and not water depth measurements, because the discharge from the re-regulation dam exceeded 90 m³/s at the time of the missions. The results of previous monitoring missions, as also confirmed by the LTA, have documented that when the discharge is 30 m³/s or greater, the water depth requirements are met and there are no problems with navigating the river. However, in Q4 2023, at the beginning of the dry season, NNP1PC conducted interviews with inhabitants who use boats to gather and assess any complaints about boat navigation difficulties. Based on the feedback from the boat users, NNP1PC will consider officially proposing revisions to the monitoring programme in Q2 2024
3	Maximum rate of change (both rise and fall, separately) in stage of 0.6 m per hour	99% of hourly fluctuations comply (2205 out of 2206 data recorded)
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)	99% of 24-hour fluctuations comply (2205 out of 2206 data recorded)

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)	99% of 7-day fluctuations comply (2204 out of 2206 data recorded)

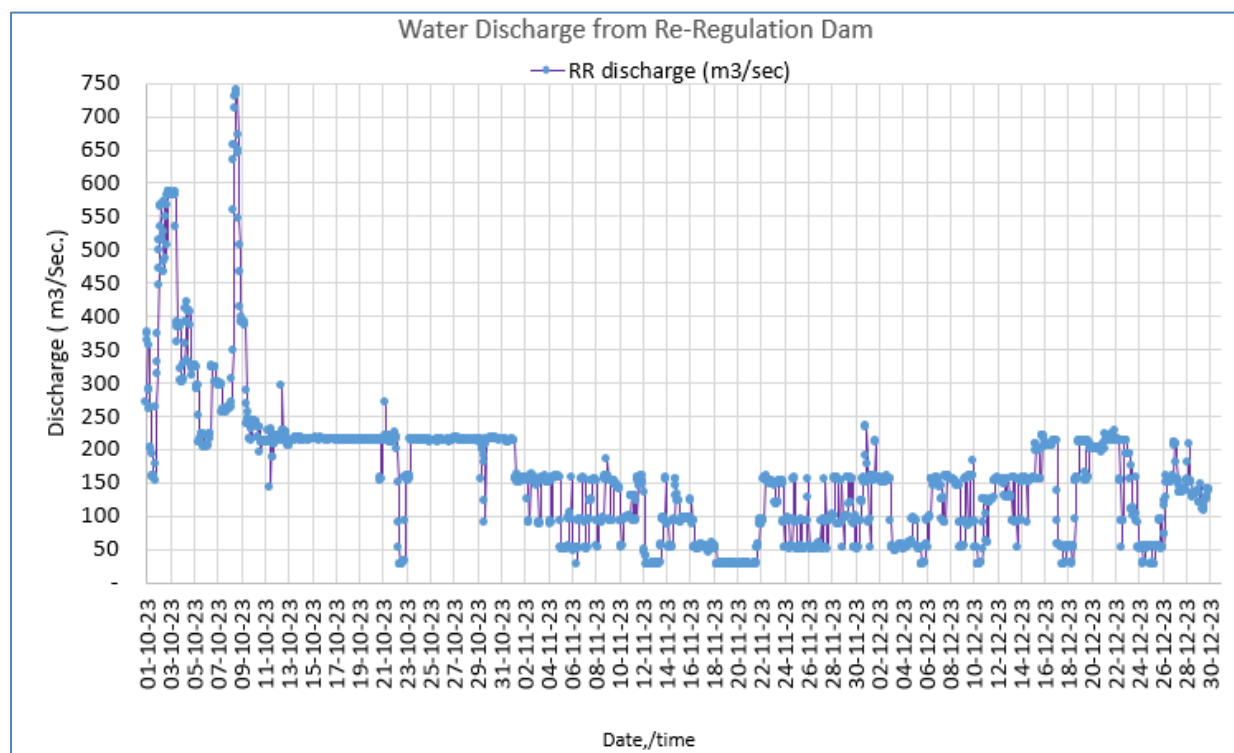
2.6.2.1 Minimum Flow Requirements

The discharge monitoring data for the re-regulation dam during Q4 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 2-4**.

During Q4 2023, the mean discharge from the re-regulation dam was about 249 m³/s in October 2023 and about 96 m³/s and 123 m³/s in November and December 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 2-4: DISCHARGE FROM THE RE-REGULATION DAM DURING Q4 2023



2.6.2.2 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 2-5**. 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.

According to the recommendations by the Lenders' Technical Advisor (LTA) during the virtual site visit on 21 to 26 November 2021, NNP1PC has continued to monitor the situation at the critical sites under conditions with discharge of less than 30 m³/s for detecting any navigation problems and also monitor whether any complaints have been raised to consider how to solve the problems, if any. The results of these monitoring missions have documented that when the discharge is 30 m³/s or greater, the water depth requirements are met and there are no problems with navigating the river.

NNP1PC carried out three boat monitoring missions in Q4 2023 (see **Table 2-8**), however, as the discharge exceeded 90 m³/s on all three missions, the thalweg water depths were not measured. There were no boat navigation difficulties during the missions.

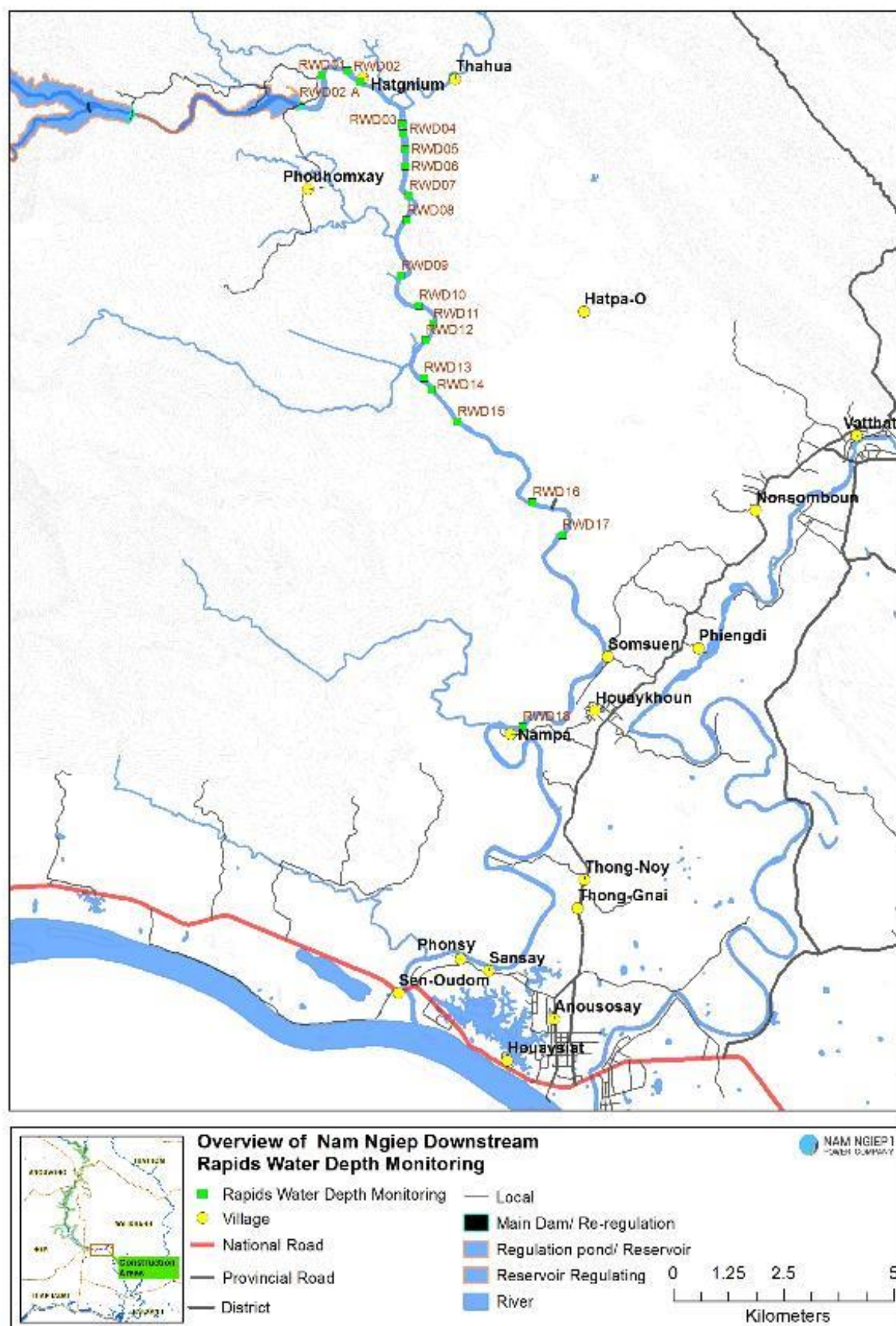
In Q4 2023, at the beginning of the dry season, NNP1PC conducted interviews with inhabitants who use boats to gather and assess any complaints about boat navigation difficulties.

Based on the feedback from the boat users, NNP1PC will consider officially proposing revisions to the monitoring programme in Q2 2024.

TABLE 2-8: RIVER DEPTH MEASUREMENTS IN NAM NGIEP DOWNSTREAM THE RE-REGULATION DAM

Station ID		RWD 01	RWD 02	RWD 02.a	RWD 03	RWD 04	RWD 05	RWD 06	RWD 07	RWD 08	RWD 09	RWD 10	RWD 11	RWD 12	RWD 13	RWD 14	RWD 15	RWD 16	RWD 17	RWD 18
Distance from Re-regulation Dam (km)		1.55	2.43	2.97	4.9	5.2	5.7	6.16	7.13	8.01	9.97	11.31	12.08	12.62	14.1	14.49	15.77	19.76	21.58	30.09
Date	Discharge (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)
13-Oct-23	211	- 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. - NNP1PC (EMO and TD) closely monitors the Nam Ngiep River downstream the re-regulation dam to check boat navigation difficulties due to thalweg water depths below 0.5 m.																		
30-Nov-23	91																			
08-Dec-23	153																			

FIGURE 2-5: LOCATION MAP OF RIVER DEPTH MONITORING POINTS



2.6.2.3 Stage Height Fluctuations

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

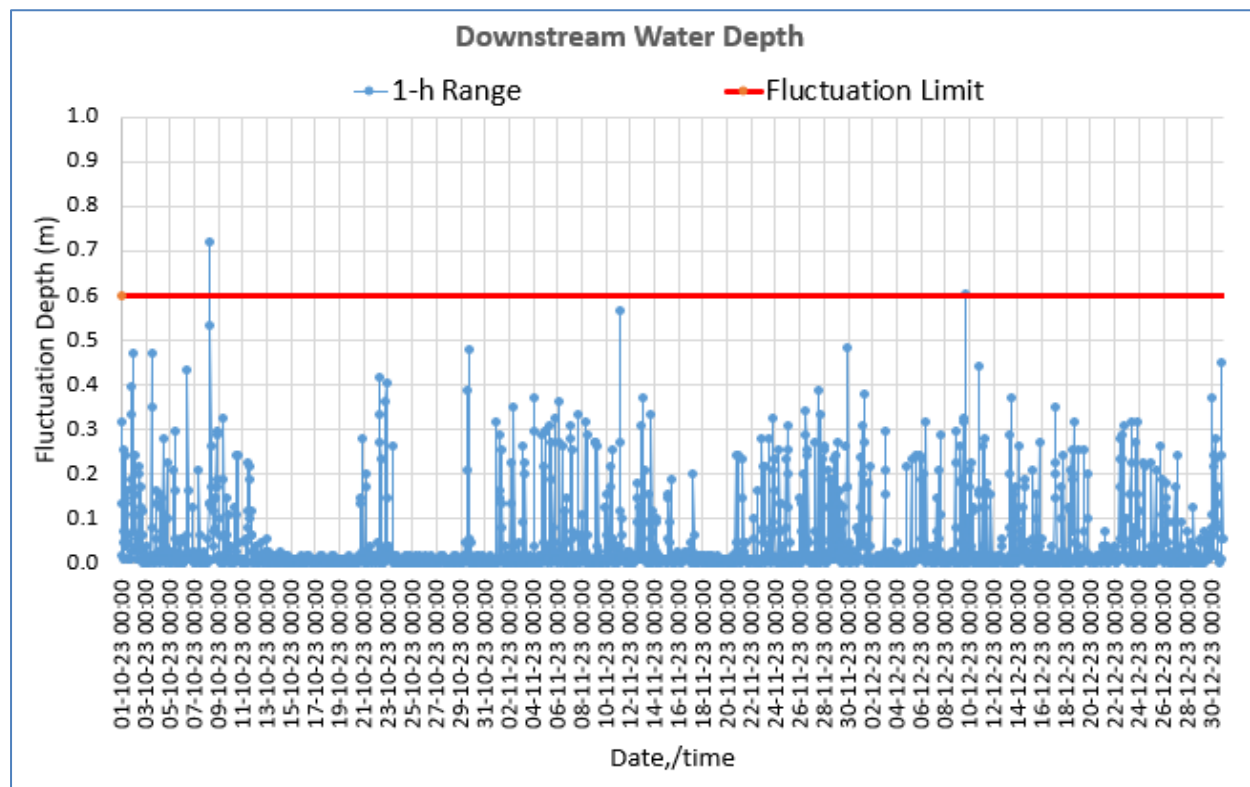
1. A requirement on the rate of change which is set at a maximum of 0.6 m per hour.
2. Requirements on the range in fluctuations over 24-hour periods and 7-day periods respectively, which is set at a maximum of 1.7 m for both periods. In other words, the range requirements determine the maximum difference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

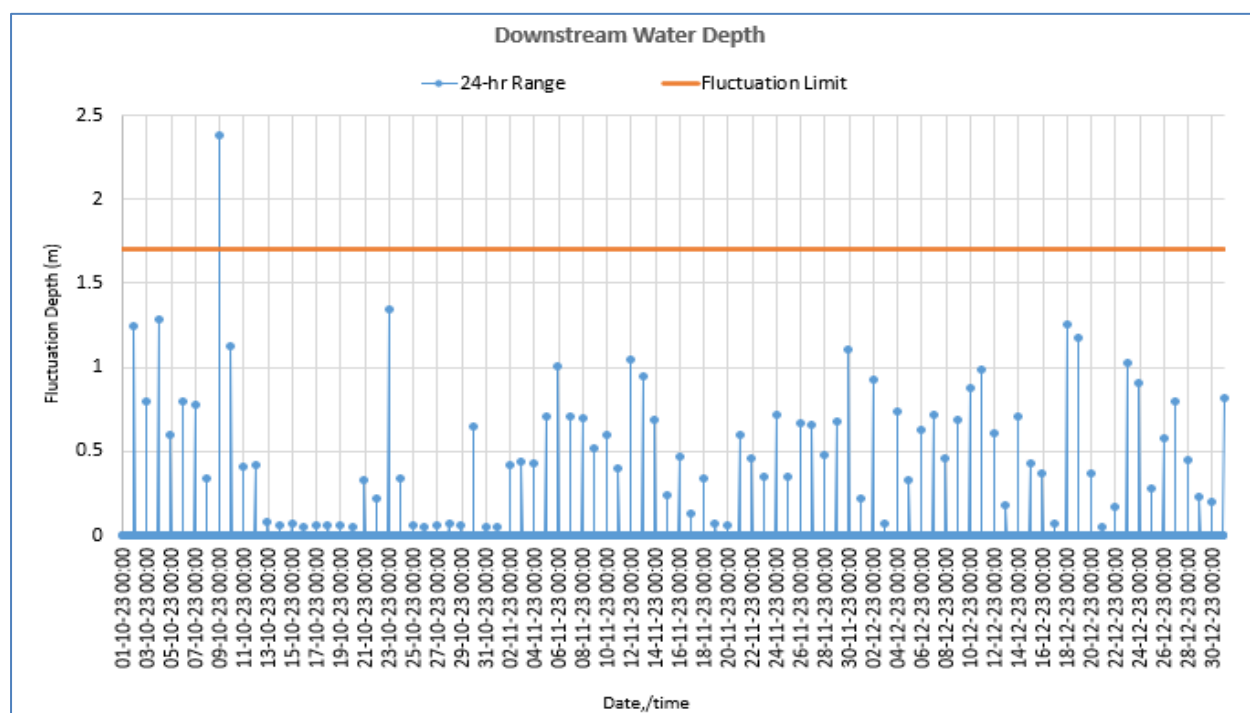
In practice, meeting stage height fluctuation EFRs are managed through controlling the rate of change in discharge from the re-regulation dam/powerhouse. This is done using established rating relationships between stage height and discharge, as set out in the Re-regulation dam operation manual. These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

During Q4 2023, the maximum allowed rate of change of 0.6 m over 1-hour was complied with, except in one instance on 08 October 2023 (at 7:00). The results are presented in **Figure 2-6**.

FIGURE 2-6: HOURLY STAGE HEIGHT FLUCTUATIONS DURING Q4 2023

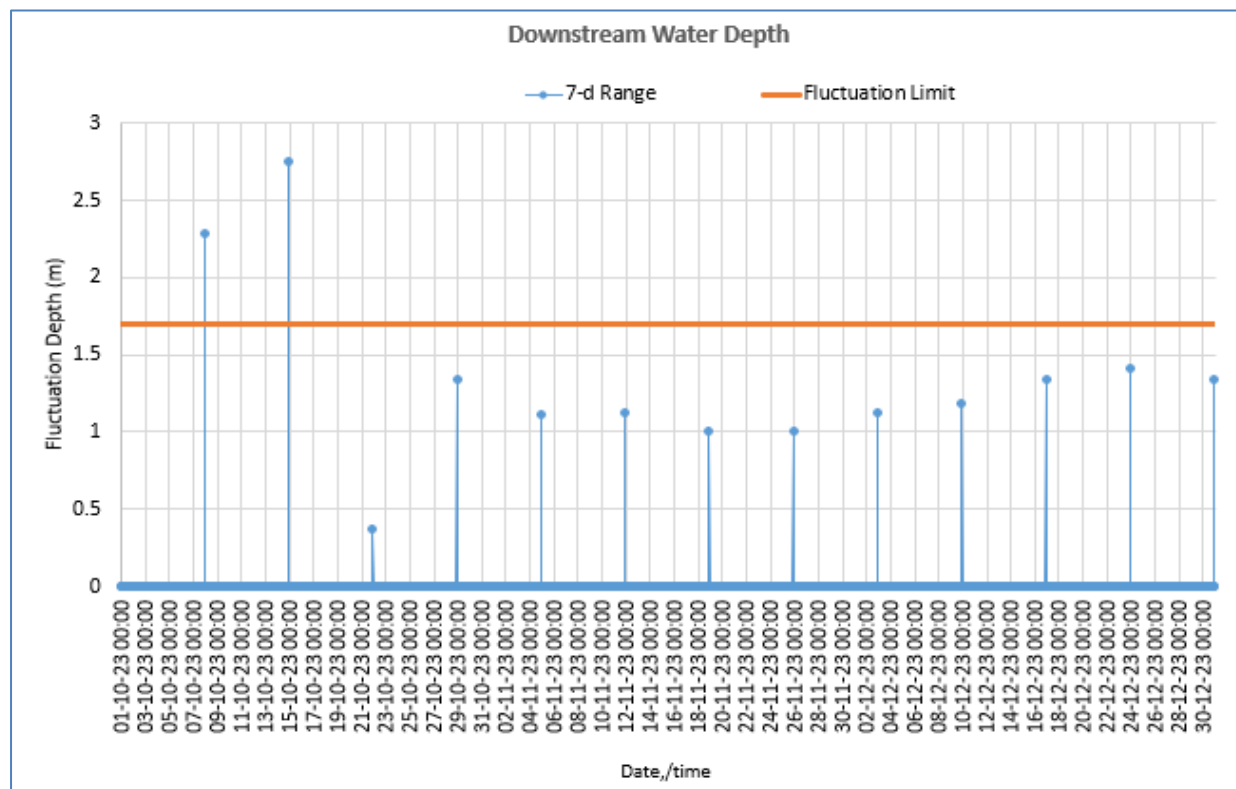
During Q4 2023, the maximum allowed difference in stage height of 1.7 m over 24-hour was complied with for all 24-hour periods (00:00 – 23:59), except in one instance on 08 October 2023 (at 23:00).

The results of the monitoring are presented in **Figure 2-7**.

FIGURE 2-7: 24-HOUR STAGE HEIGHT DIFFERENCE (M) DURING Q4 2023

During Q4 2023, the maximum difference in stage height of 1.7 m over 7-days was complied with for all 7-day periods, except on 07 October 2023 (at 22:00) and 14 October 2023 (at 22:00). The results are presented in **Figure 2-8**.

FIGURE 2-8: 7-DAY STAGE HEIGHT DIFFERENCE (M) DURING Q4 2023



2.7 WATER QUALITY MONITORING

2.7.1 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 Q4 2023 are listed in **Appendix 5.1**. In addition, there is no water quality monitoring carried out at NPH01 (Nam Phouan) during the reported quarter due to floating debris blocked the access.

Dissolved Oxygen (DO)

The results of DO measurements for the station immediately upstream of the main dam (R05 – intake at 276 m asl.) and immediately downstream of the re-regulation dam (NNG05) are presented in **Figure 2-9**, the DO long profile measurement as timeseries are presented in **Figure 2-10**, and the full set of DO surface water quality data are shown in **Table 2-9**.

The water temperature and DO depth profiles in the main reservoir at R05 during Q4 2022, Q3 2023 and Q4 2023 are presented in **Figure 2-12** to **Figure 2-14**.

FIGURE 2-9: DISSOLVED OXYGEN IMMEDIATELY UPSTREAM AND DOWNSTREAM OF THE MAIN DAM

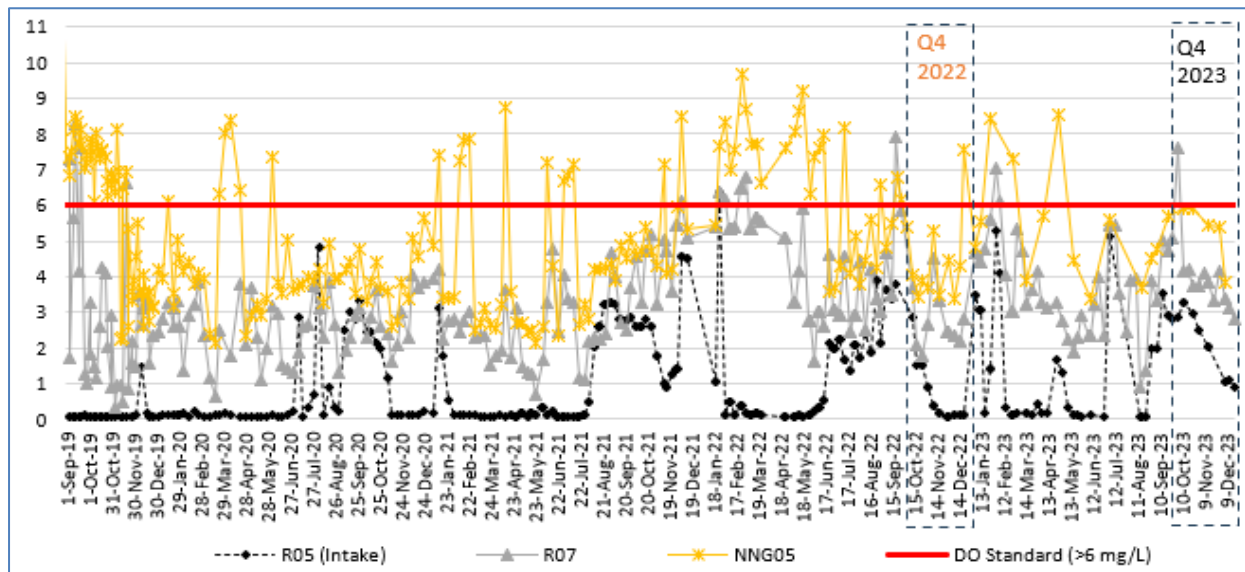
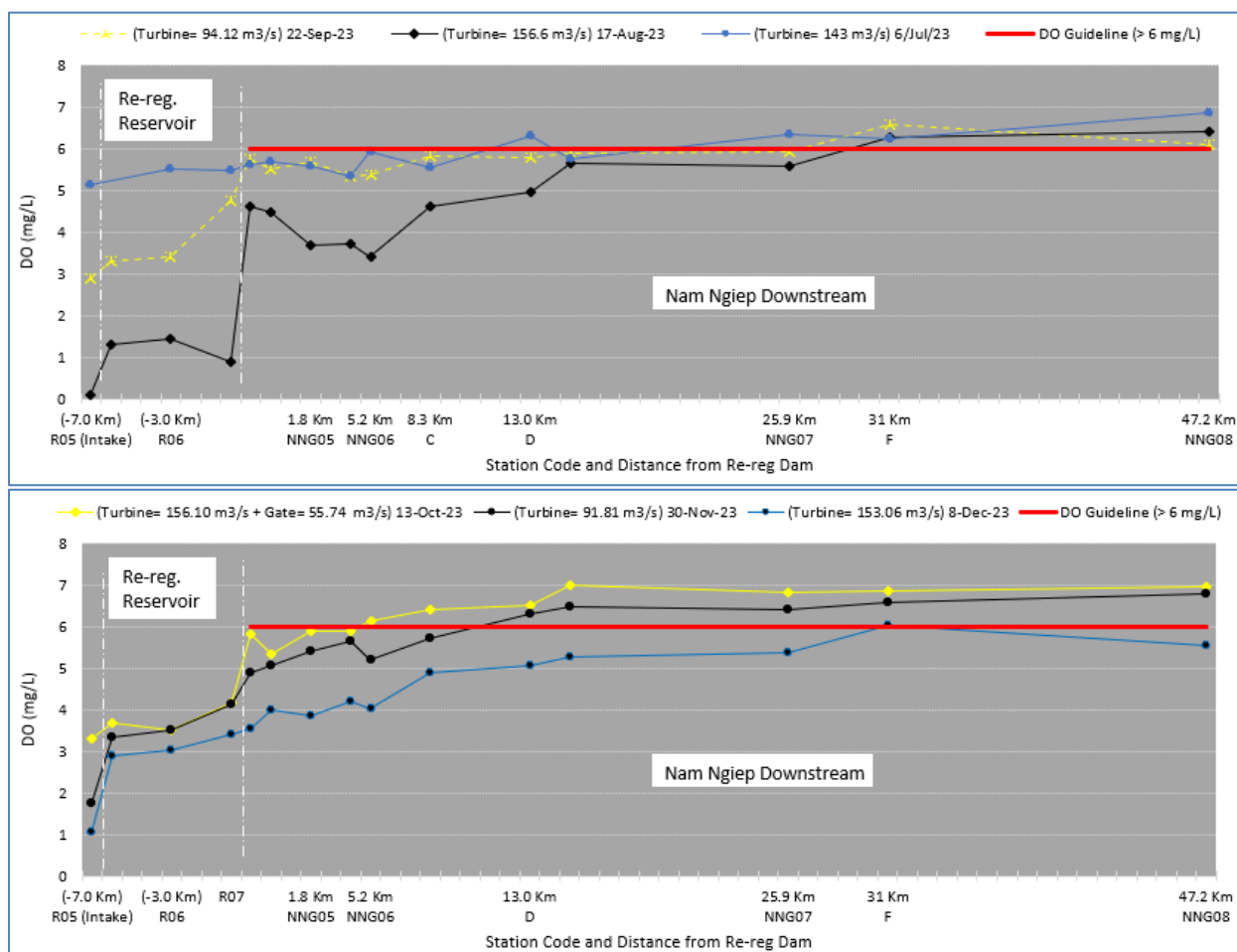


FIGURE 2-10: DISSOLVED OXYGEN LONG PROFILE MEASUREMENT FROM IMMEDIATELY UPPER MAIN DAM TO LOWER NAM NGIEP (Q3 2023 AND Q4 2023)



Main Reservoir

Figure 2-14 and **Figure 2-15** present the DO and water temperature depth profile timeseries in the Main Reservoir (R04 and R05) from September 2018 to September 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 Q4 2023 indicates formation of thermoclines and oxyclines in the main reservoir at the monitored stations at different depths.

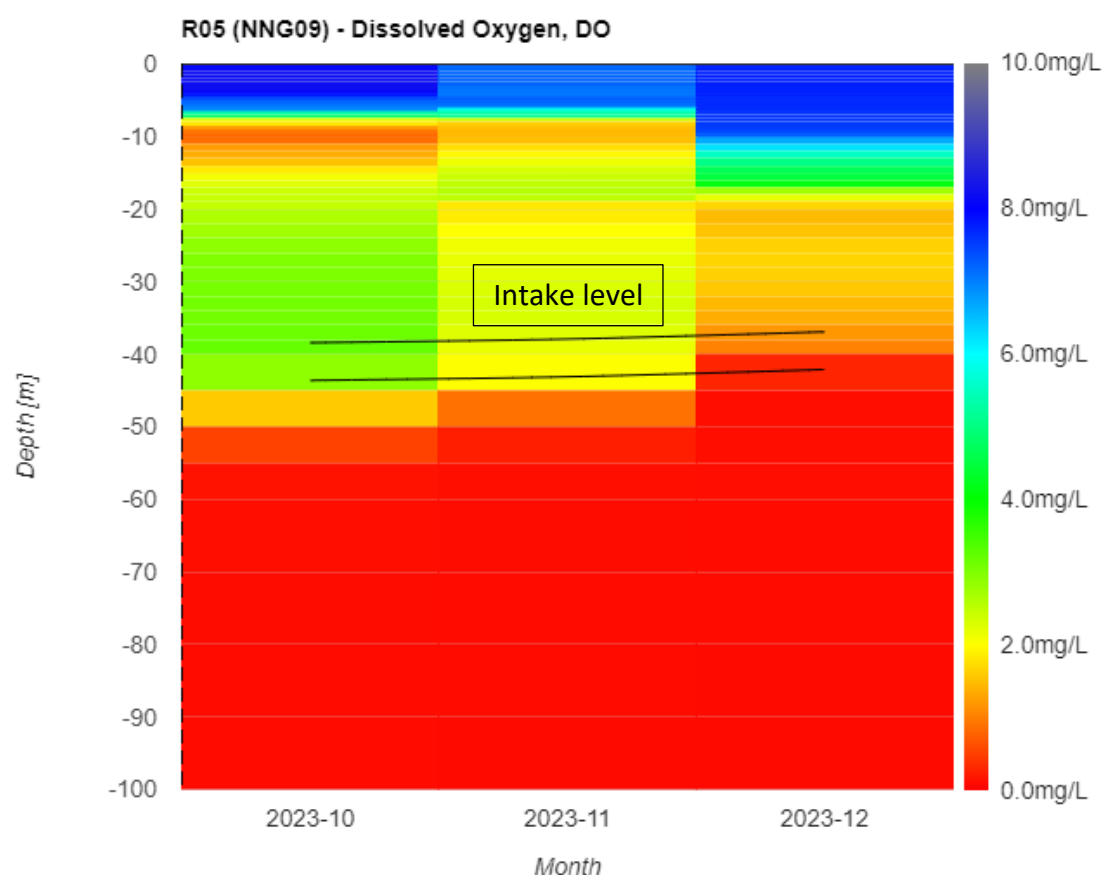
At R05, when comparing Q4 2023 with Q4 2022, overall, the thermocline and oxycline show similar patterns.

Figure 2-13 shows the average DO concentrations observed during Q4 2023. It reveals a minor improvement in the DO level near the water surface and no significant improvement at the intake level compared to the same period in Q4 2022.

At R05 (the station closest to the main dam), during Q4 2023, the thermocline and the oxycline occurred at about 4.5 m - 24 m depths with DO concentrations dropping from about 8 mg/L - 9 mg/L in the epilimnion down to 1 mg/L – 2 mg/L below the thermocline (see **Figure 2-11**).

The monthly mean DO concentration at the intake level decreased from about 3.0 mg/L in October 2023, to 1.0 mg/L in December 2023. Anoxic levels were found at decreasing depths from about 60 m in October 2023 (about 20 m below the intake sill) to 45 m in December 2023 (about 5 m below the intake sill) (see **Figure 2-11**).

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

FIGURE 2-11 MONTHLY MEAN CONCENTRATIONS OF DISSOLVED OXYGEN IN R05

At R02, during Q4 2023, DO concentrations varied between 2.0 mg/L and 11.3 mg/L with an average of 7.2 mg/L in the upper 4 m and DO fluctuated between 0.1 mg/L and 5.3 mg/L with a mean of 2.5 mg/L in the depths below 4 m to the bottom.

At R01, the mean DO concentration throughout the quarter was about 7.1 mg/L over the entire water column with no measurements below 4.4 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 3.5 mg/L in October, 3.4 mg/L in November to 2.40 mg/L in December 2023. A similar pattern was found at R07. The decreasing DO concentrations in R06 and R07 are likely linked to the decreasing DO concentrations at the intake level in the main reservoir. 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, and the station in Nam Chian (NCH01) a left bank tributary at the upper part of the reservoir had DO concentrations above 6 mg/L during Q4 2023.

Downstream Stations

During Q4 2023, a total of three monitoring missions were conducted. All these three monitoring missions were undertaken during turbine discharges greater than 90 m³/s (greater than minimum environmental flow requirement).

As indicated in **Figure 2-10**, periods with turbine discharge and combined discharges of turbine and gate have resulted in DO concentrations in the range of 4 mg/L to 6 mg/L over the first 5 km downstream the re-regulation dam and then gradually increasing to close to 6 mg/L (the National Surface Water Quality Standard) near the confluence with the Mekong River. **Figure 2-10** also indicates that during periods with combined turbine and gate discharges, the DO concentrations reach 6 mg/L within the first 1-2 kilometers downstream of the re-regulation dam.

No dead fish was observed in Nam Ngiep downstream during Q4 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 2-12: MAIN RESERVOIR DISSOLVED OXYGEN AT THE END OF Q4 2023

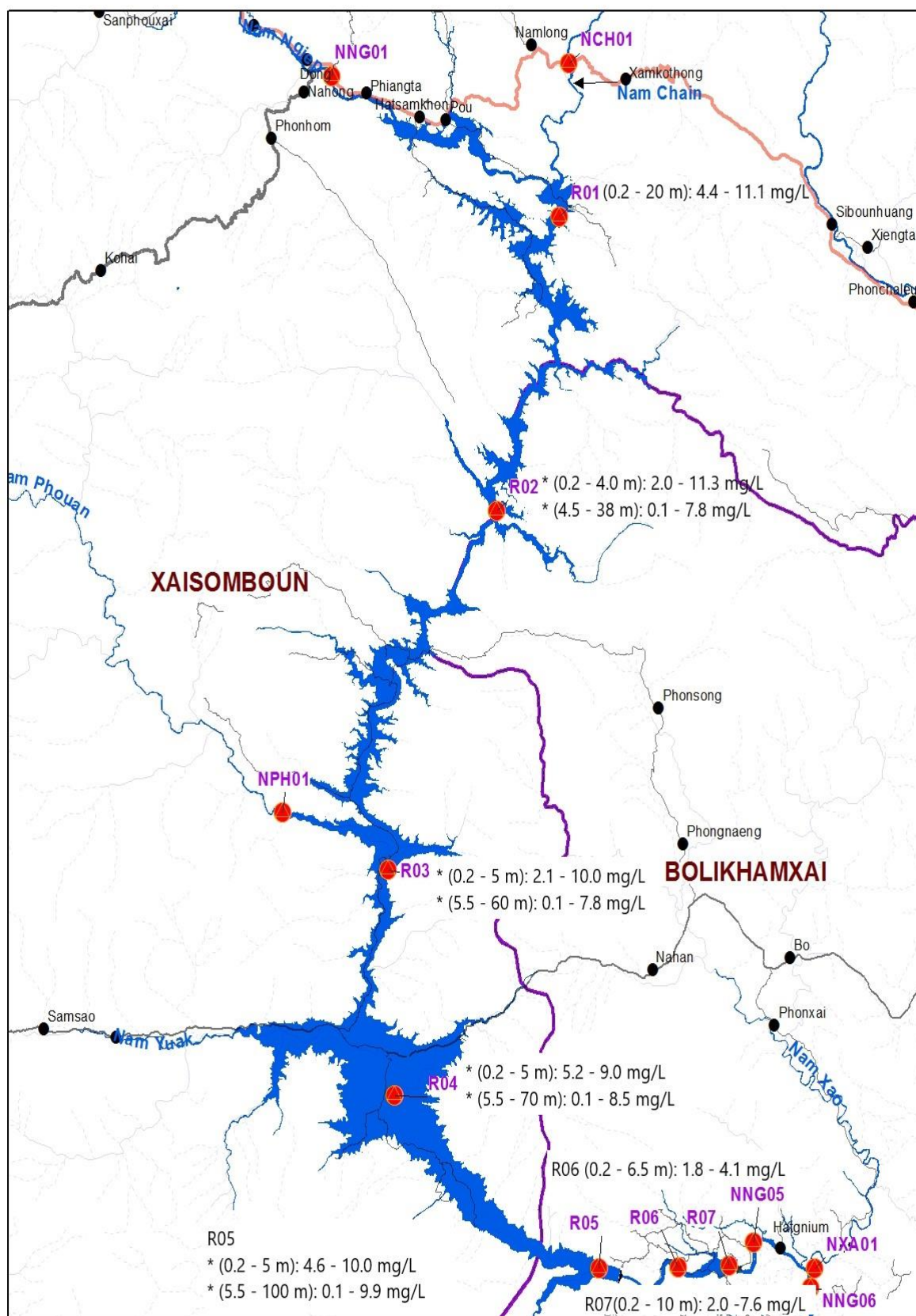


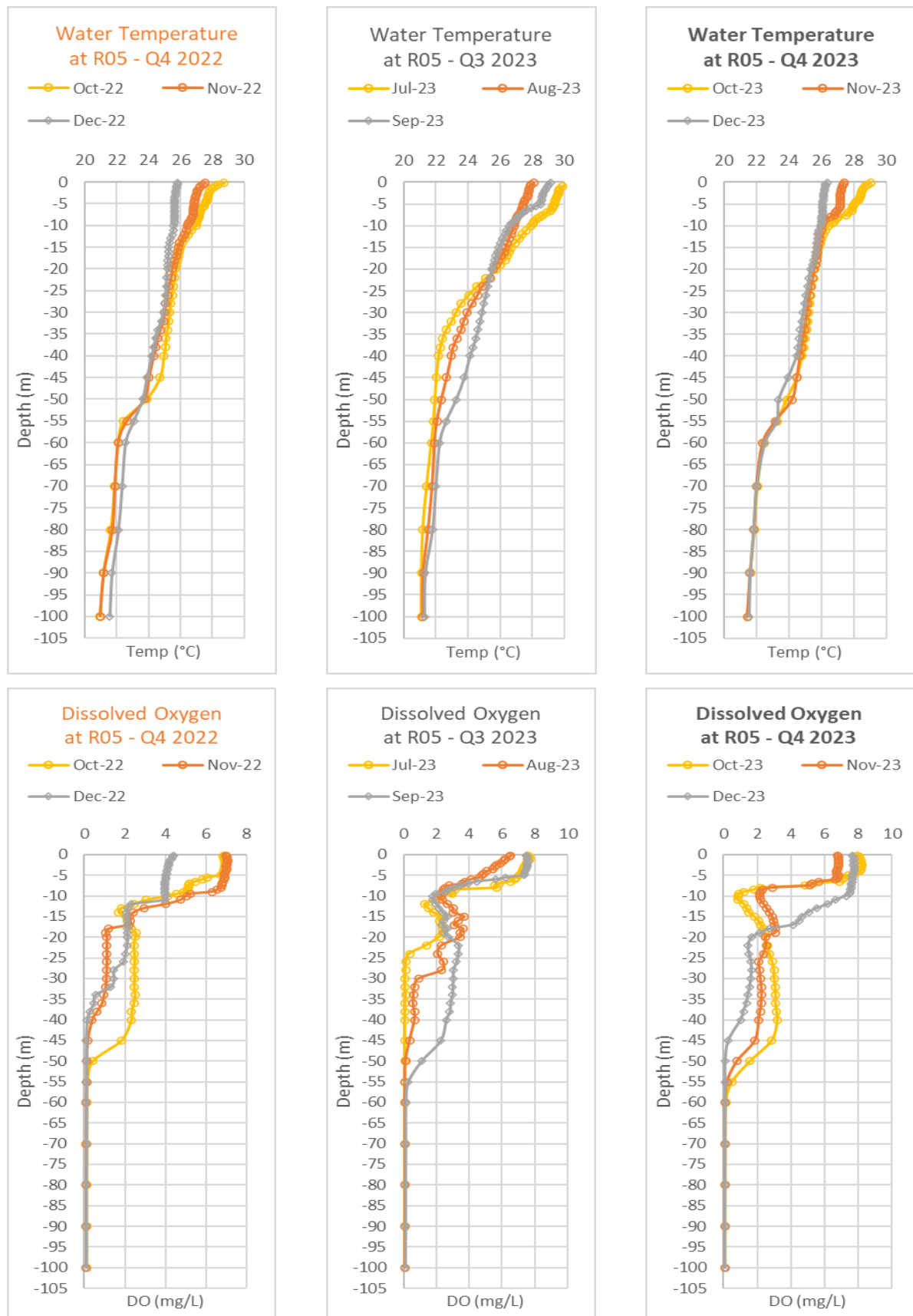
FIGURE 2-13: WATER TEMPERATURE AND DISSOLVED OXYGEN – DEPTH PROFILES IN THE MAIN RESERVOIR IMMEDIATELY UPSTREAM OF THE MAIN DAM (R05)

FIGURE 2-14: WATER TEMPERATURE AND DO DEPTH PROFILES IN THE MAIN RESERVOIR (R04 - R05), WITH POSITION OF INTAKE AT THE ACTUAL WATER LEVEL DURING SEPTEMBER 2018 – DECEMBER 2023

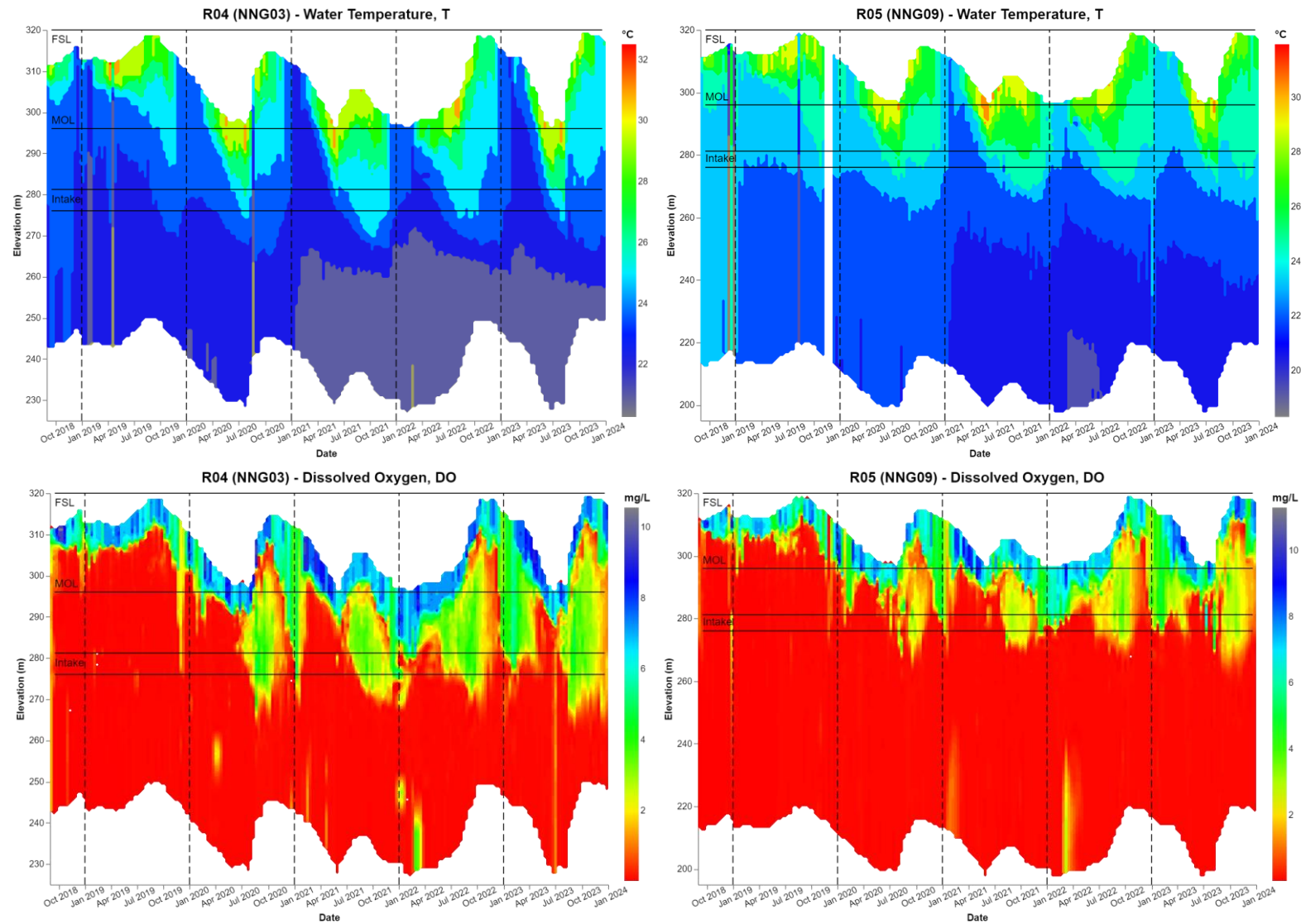


FIGURE 2-15: THE STRAIGHT-LINE GRAPH OF MONTHLY AVERAGED DO AND WATER TEMPERATURE AT R04 AND R05

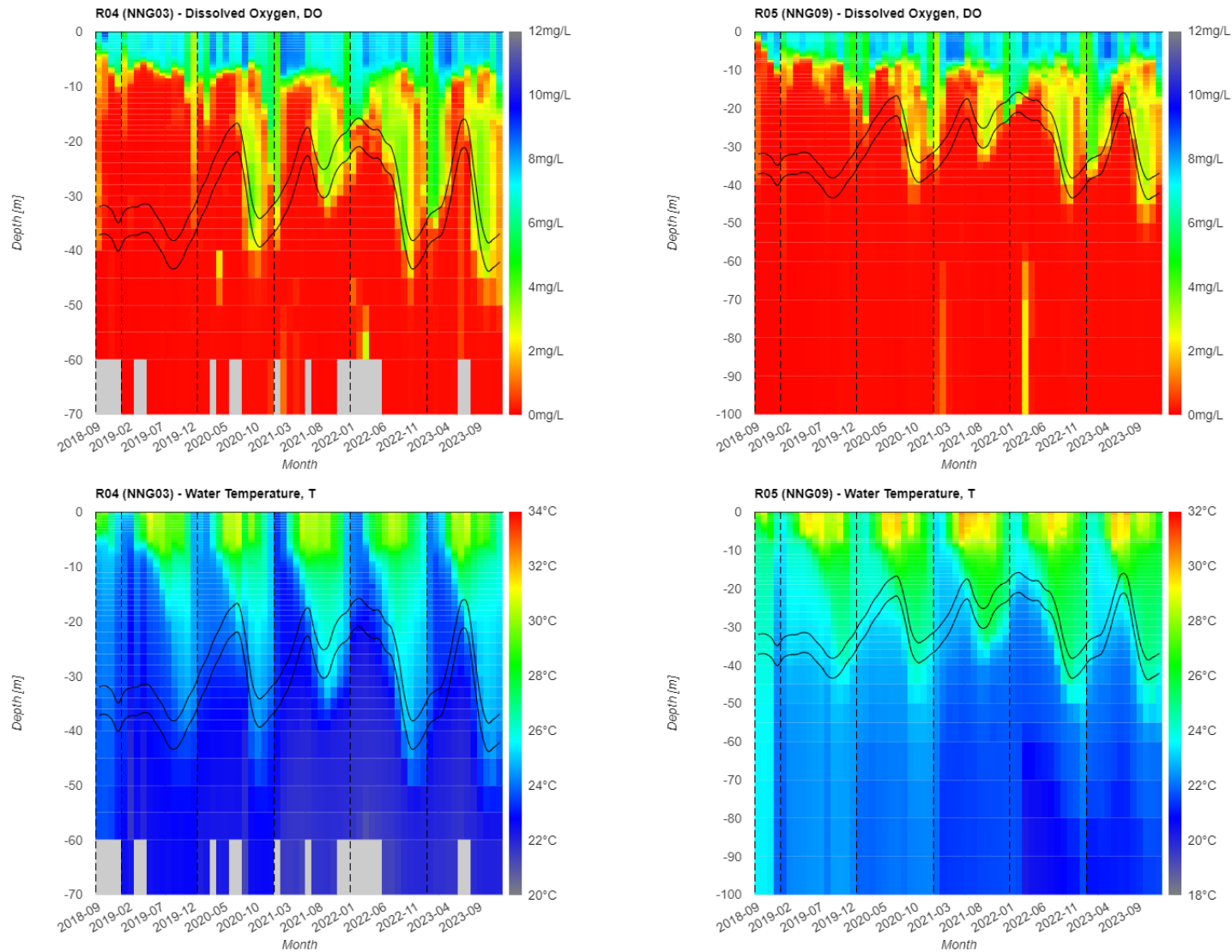


TABLE 2-9: DO (MG/L) RESULTS OF SURFACE WATER IN MAIN RESERVOIR, DO (MG/L) RESULTS OF R05 AT INTAKE DEPTH, RE-REGULATION RESERVOIR, NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q4 2023**(NATIONAL SURFACE WATER QUALITY STANDARD FOR DISSOLVED OXYGEN: ≥ 6 MG/L)**

Station Code	NNG01	R01	R02	R03	R04	R05 Intake	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
4-Oct-23	8.08													8.73			
5-Oct-23				7.46	7.36	2.87	7.35	3.4	7.62								
11-Oct-23		8.03	8.28	7.4													
12-Oct-23					6.99	3.29	6.84	3.51	4.16								
13-Oct-23										5.9	6.14	6.82	6.95			7.78	7.64
18-Oct-23		9.37	8.79	8.61													
19-Oct-23					8.91		9.3	4.11	4.23								
25-Oct-23		8.13	8.08	7.95													
26-Oct-23					7.73	2.97	8.29	3.4	3.73							7.84	7.62
1-Nov-23		7.6	7.86	7.77													
2-Nov-23					6.83	2.5	7.82	3.31	3.72								
8-Nov-23		8.71	8.96	8.56													
9-Nov-23					7.28		7.76	3.4	4.11								
13-Nov-23	8.34													8.89			
14-Nov-23		6.96	6.52	7.54	6.53												
15-Nov-23						2.05	7.45	3.68	3.85								
16-Nov-23																7.59	7.05
22-Nov-23		5.98	5.14	5.17	5.54												
23-Nov-23							5.59	3.43	3.34								
28-Nov-23					6.57	1.77	5.37										
29-Nov-23		7.72	5.26	6.78				3.52	4.14								

Station Code	NNG01	R01	R02	R03	R04	R05 Intake	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
30-Nov-23										5.39	5.19	6.39	6.77			7.62	6.48
5-Dec-23	8.53													8.62			
6-Dec-23		9.14	8.35	8.6													
7-Dec-23					7.07	1.08	6.15	3.03	3.4								
8-Dec-23										3.86	4.04	5.37	5.56			6.7	5.95
13-Dec-23		10.51	10.05	9.78													
14-Dec-23					8.84	1.1	8.75	2.51	3.11								
19-Dec-23		7	7.82	7.55													
20-Dec-23					8.2	0.9	8.1	2.17	2.83								

Ammonia Nitrogen

In Q4 2023, Ammonia Nitrogen complied with the National Surface Water Quality Standard (<0.2 mg/L) in all monitored stations.

TABLE 2-10: AMMONIA NITROGEN (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q4 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
4-Oct-23	<0.2												<0.2			
11-Oct-23		<0.2		<0.2												
12-Oct-23					<0.2	<0.2										
13-Nov-23	<0.2												<0.2			
14-Nov-23		<0.2		<0.2	<0.2											
15-Nov-23						<0.2										
5-Dec-23	<0.2												<0.2			
6-Dec-23		<0.2		<2												
7-Dec-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 Q4 2023 indicate that the BOD₅ levels are in compliance with the standard at all stations.

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 2-11: BOD_5 (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q4 2023**(NATIONAL SURFACE WATER QUALITY STANDARD FOR BOD_5 : <1.5 MG/L)**

Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
4-Oct-23	<1												<1			
11-Oct-23		1.19		<1												
11-Oct-23 Bottom				<1												
12-Oct-23					<1	1.63	<1	<1								
12-Oct-23 Bottom					7.7	7.4										
13-Oct-23									<1	<1	<1	<1			<1	<1
13-Nov-23	<1												<1			
14-Nov-23		<1		<1	<1											
14-Nov-23 Bottom				<1	4.7											
15-Nov-23						<1	<1	<1								
15-Nov-23 Bottom						4.9										
16-Nov-23									<1	<1	<1	<1			<1	<1
5-Dec-23	<1												<1			
6-Dec-23		<1		<1												
6-Dec-23 Bottom				<1												
7-Dec-23					<1	<1	<1	<1								
7-Dec-23 Bottom					4.0	<1										
8-Dec-23									<1	<1	<1	<1			<1	<1

Chemical Oxygen Demand (COD)

The COD measurements in Q4 2023 are presented in **Table 2-12**.

TABLE 2-12: COD (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q4 2023**(NATIONAL SURFACE WATER QUALITY STANDARD FOR COD: < 5 MG/L)**

Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG0 6	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
4-Oct-23	<5												<5			
12-Oct-23							12.8	6.4								
13-Oct-23									<5	6.4	6.4	9.6			16	9.6
13-Nov-23	<5												<5			
15-Nov-23							<5	<5								
16-Nov-23									6.4	<5	<5	9.6			<5	<5
5-Dec-23	12.8												<5			
7-Dec-23							9.6	6.4								
8-Dec-23									9.6	9.6	12.8	19.2			6.4	<5

Faecal Coliform Bacteria

The results of the faecal coliform analyses in Q4 2023 are presented in **Table 2-13**.

Faecal coliform complied with the standard in all stations, except NNG01 (December 2023).

TABLE 2-13: FAECAL COLIFORMS (MPN/100 ML) RESULTS IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q4 2023**(NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <1,000 MPN/100 ML)**

Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG0 5	NNG 06	NNG 07	NNG0 8	NC H01	NP H01	NXA0 1	NHS0 1
4-Oct-23	79												17			
13-Oct-23									33	49	79	130			170	170
13-Nov-23	220												540			
16-Nov-23									17	170	40	94			220	280
5-Dec-23	1,600												34			
8-Dec-23									34	11	17	34			11	350

Total Coliform Bacteria

The results of measurements for total coliform bacteria are presented in **Table 2-14**. The results indicate a similar pattern and same tendency as for faecal coliform bacteria. There were no exceedances of the National Surface Water Quality Standard (<5,000 MPN/100 mL) for total coliform bacteria.

TABLE 2-14: TOTAL COLIFORM (MPN/100 ML) RESULTS IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q4 2023**(NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <5,000 MPN/100 ML)**

Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG0 7	NNG0 8	NCH 01	NPH 01	NXA0 1	NHS 01
4-Oct-23	170												22			
13-Oct-23									540	540	1,600	1,600			1,600	920
13-Nov-23	350												920			
16-Nov-23									22	220	47	220			350	920
5-Dec-23	1,600												240			
8-Dec-23									220	110	350	70			1,600	1,600

2.7.2 Compliance Monitoring of Effluents from Camps

A total of 03 sites discharged effluents in Q4 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 2-16**.

The results are described in **Table 2-15** and the full data set is in **Appendix 5.2**.

The status of compliance as of 31 December 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 OSOV1 (EF01) and OSOV2 (EF13).

FIGURE 2-16: LOCATION OF EFFLUENT MONITORING POINTS

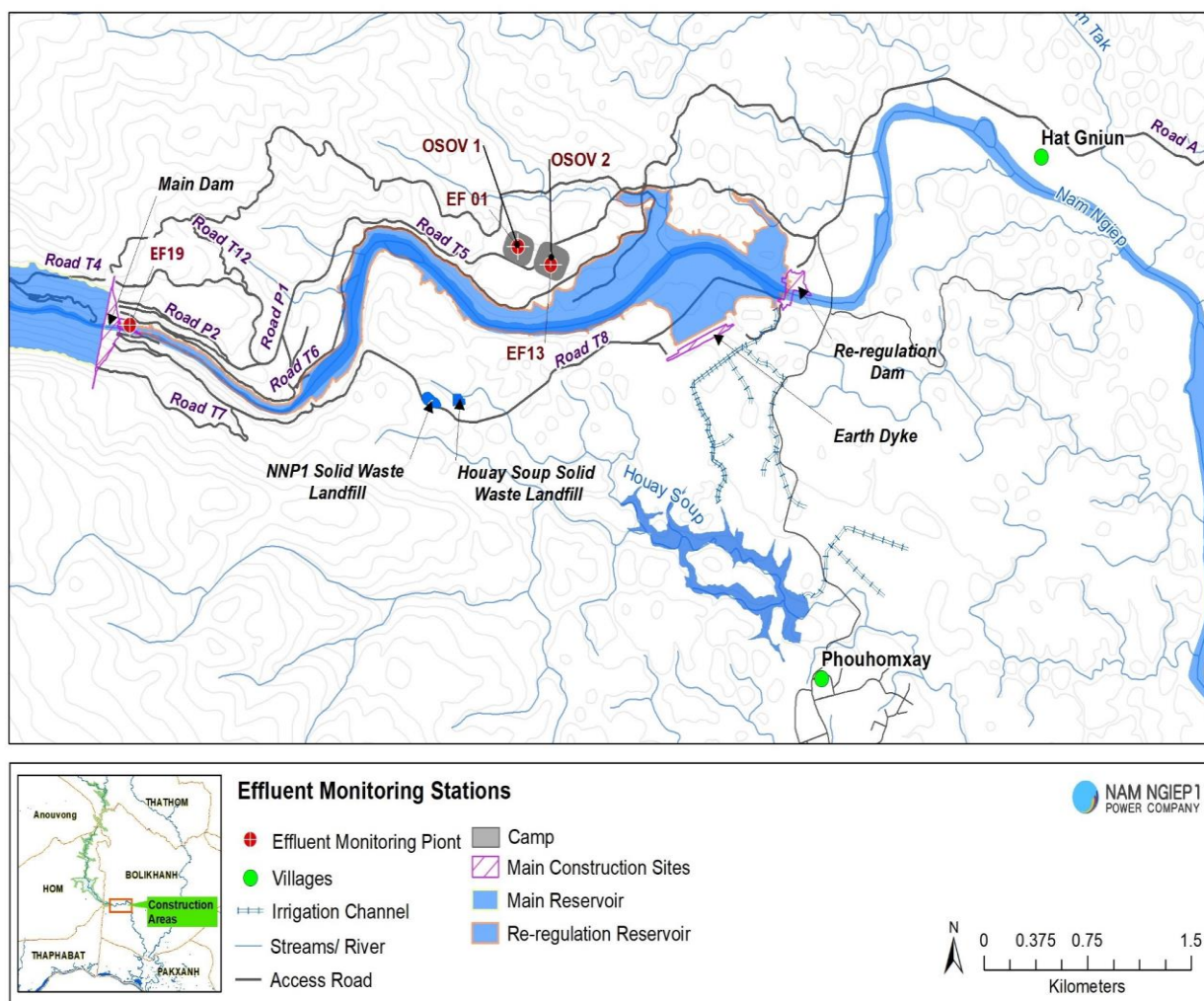


TABLE 2-15: RESULTS OF THE EFFLUENT WATER QUALITY MONITORING OF THE CAMPS IN Q4 2023 (NON-COMPLIANCE PARAMETERS ONLY)

		Site Name	OSOV1	OSOV 2	Main Powerhouse
Date	Parameter (Unit)	Station Code	EF01	EF13	EF19
		Guideline in the CA			
09-Oct-23	NH ₃ -N (mg/L)	<10.0	<2	11.4	9.0
23-Oct-23	NH ₃ -N (mg/L)	<10.0	<2	15.3	32.8
07-Nov-23	NH ₃ -N (mg/L)	<10.0	<2	15.2	23.6
11-Dec-23	NH ₃ -N (mg/L)	<10.0	<2	12.2	5.8
09-Oct-23	Total Nitrogen (mg/L)	<10.0	2.1	12.5	10.7
23-Oct-23	Total Nitrogen (mg/L)	<10.0	0.8	18.3	36.8
07-Nov-23	Total Nitrogen (mg/L)	<10.0	0.7	16.3	25.1
11-Dec-23	Total Nitrogen (mg/L)	<10.0	0.9	15.6	7.4
09-Oct-23	Total Phosphorus (mg/L)	<2	1.3	1.2	5.3
23-Oct-23	Total Phosphorus (mg/L)	<2	1.07	1.6	3.2
07-Nov-23	Total Phosphorus (mg/L)	<2	2.56	1.2	7.4
11-Dec-23	Total Phosphorus (mg/L)	<2	1.61	1.3	5.3
09-Oct-23	Faecal Coliform (MPN/100 mL)	<400	1,600	0	0
23-Oct-23	Faecal Coliform (MPN/100 mL)	<400	540	0	0
07-Nov-23	Faecal Coliform (MPN/100 mL)	<400	2,200	3,500	23
11-Dec-23	Faecal Coliform (MPN/100 mL)	<400	49	0	0
09-Oct-23	Total coliform (MPN/100 mL)	<400	1,600	0	0
23-Oct-23	Total coliform (MPN/100 mL)	<400	1,700	0	0
07-Nov-23	Total coliform (MPN/100 mL)	<400	54,000	16,000	49
11-Dec-23	Total coliform (MPN/100 mL)	<400	540	0	0

TABLE 2-16: COMPLIANCE STATUS OF EFFLUENT DISCHARGE FROM THE CAMPS IN Q4-2023

Site	ID	WWTS	Key Non-Compliance Issues ¹ in Q4-2023	Corrective Actions
OSOV 1 (Owner's Site Office and Village)	EF01	- Septic tanks (kitchen and black water) and wetland (grey water), discharge: 70 m³/day. - The effluent from this site flows into the Re-regulation Reservoir.	- Faecal coliform (<400 MPN/100 mL): Non-compliance in 3 out of 4 samplings. Q4 mean 1,097 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in all 4 samplings. Q4 mean 2,310 MPN/100 mL.	Carried out routine maintenance of the Wastewater Treatment System including cleaning all 17 septic tanks, inspecting the air blowers to ensure they are functioning properly and maintaining wetland system.
OSOV 2 (ESD Camp)	EF13	- Septic tanks (kitchen and black water) and SBR with chlorination system. - The effluent from this site is led into a ditch connected to the Re-regulation	- Ammonia-nitrogen (<10 mg/L): Non-compliance in all 4 samplings. Q4 mean 13.5 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in all 4 samplings. Q4 mean 15.7 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 1 out of 4 samplings. Q4 mean 875 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 1 out of 4 samplings. Q4 mean 4,000 MPN/100 mL.	The installed WWTS does not eliminate nitrogen or phosphorus. However, there is no concern given the low discharge effluent quantity, which is completely absorbed in the soil within a distance of less

¹ The values in brackets indicate the applicable standard

Site	ID	WWTS	Key Non-Compliance Issues ¹ in Q4-2023	Corrective Actions
		reservoir, however, due to low quantities of effluent, the liquid is absorbed in the soil before reaching the reservoir.		than 300 m before reaching the re-regulation pond. Cleaning all 17 septic tanks and inspecting the air blowers and closely monitoring the residual chlorine content and chlorination dosage adjustment to ensure they are functioning properly
Main Powerhouse	EF19	- Septic tanks (grey and black water), biofilm tank and chlorination tank. - The effluent from this site flows into the tailrace of the Main Powerhouse and then into the Re-regulation Reservoir.	- Ammonia-nitrogen (<10 mg/L): Non-compliance in 2 out of 4 samplings. Q4 mean 17.8 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 3 out of 4 samplings. Q4 mean 20.0 mg/L. - Total Phosphorus (<2 mg/L): Non-compliance in all 4 samplings. Q4 mean 5.3 mg/L.	As above

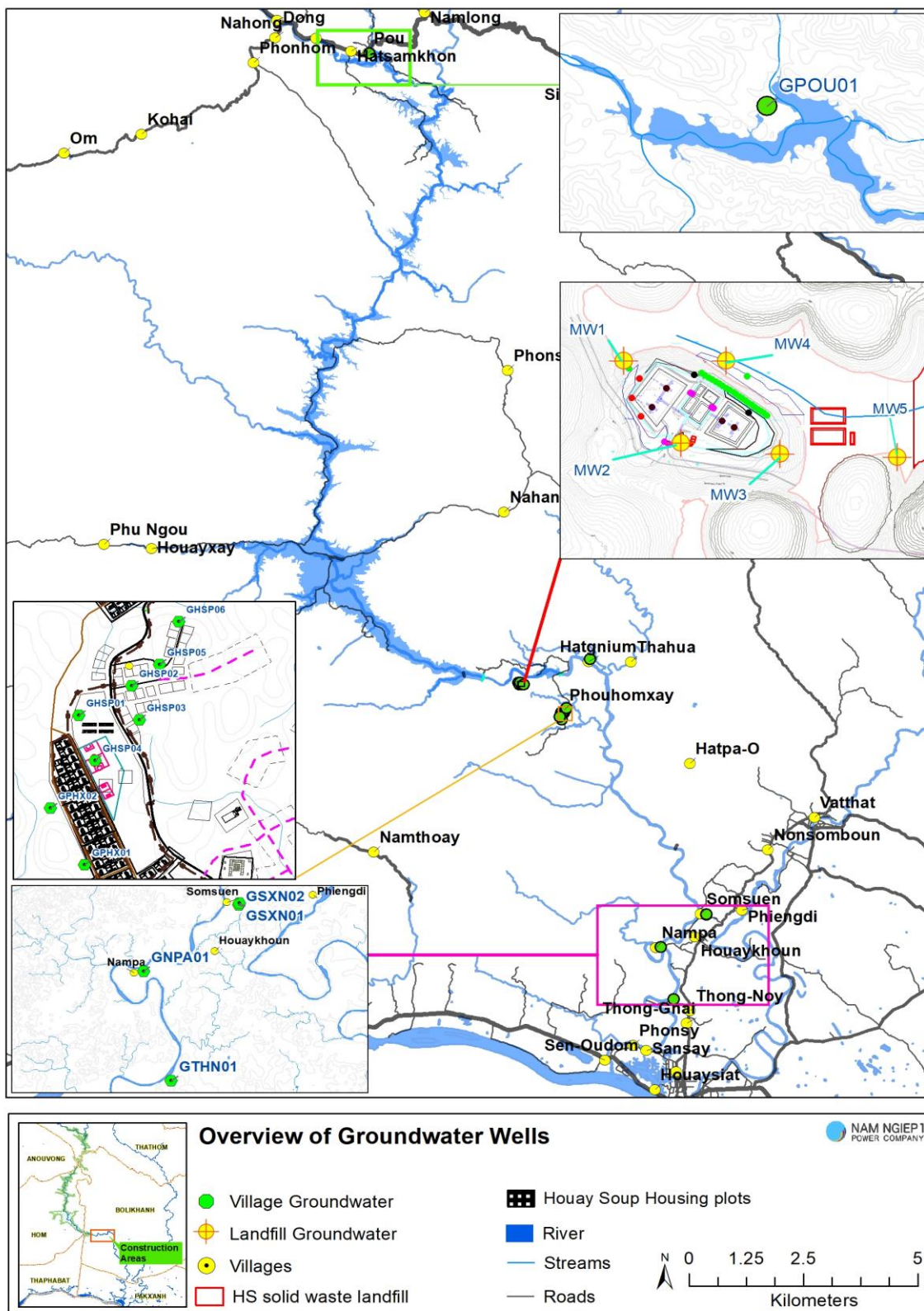
2.7.3 Groundwater Quality Monitoring

During Q4 2023, a total of seven boreholes at Somseun, Nam Pa, Thong Noy, (one borehole in each village) and Phouhomxay and Pou Villages (two boreholes in each village) 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 (Not for This Quarter)*: Arsenic (mg/L), Total Iron (mg/L), Magnesium (mg/L), Fluoride (mg/L), Total Hardness (mg/L), Nitrate (mg/L), Nitrite (mg/L) and Lead (mg/L).

The groundwater sampling locations are displayed in **Figure 2-17** and the groundwater monitoring data is presented in **Appendix 5.3**.

FIGURE 2-17: GROUNDWATER SAMPLING LOCATIONS



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

Phouhomxay Village: all monitored parameters complied with the standard, except pH (October 2023) and faecal coliform (November 2023) in water supply well GPHX02.

Thong Noy Village: all monitored parameters complied with the standard, except pH (December 2023), faecal coliform and E. coli bacteria.

Somsuen Village: all monitored parameters complied with the standard, except faecal coliform and E. coli bacteria in October 2023.

NamPa Village: all monitored parameters complied with the standard, except pH in December 2023.

Pou Village: all monitored parameters complied with the standard, except faecal coliform (November 2023) in GPOU01 and faecal coliform (December 2023) and pH (October and November 2023) in GPOU02.

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.

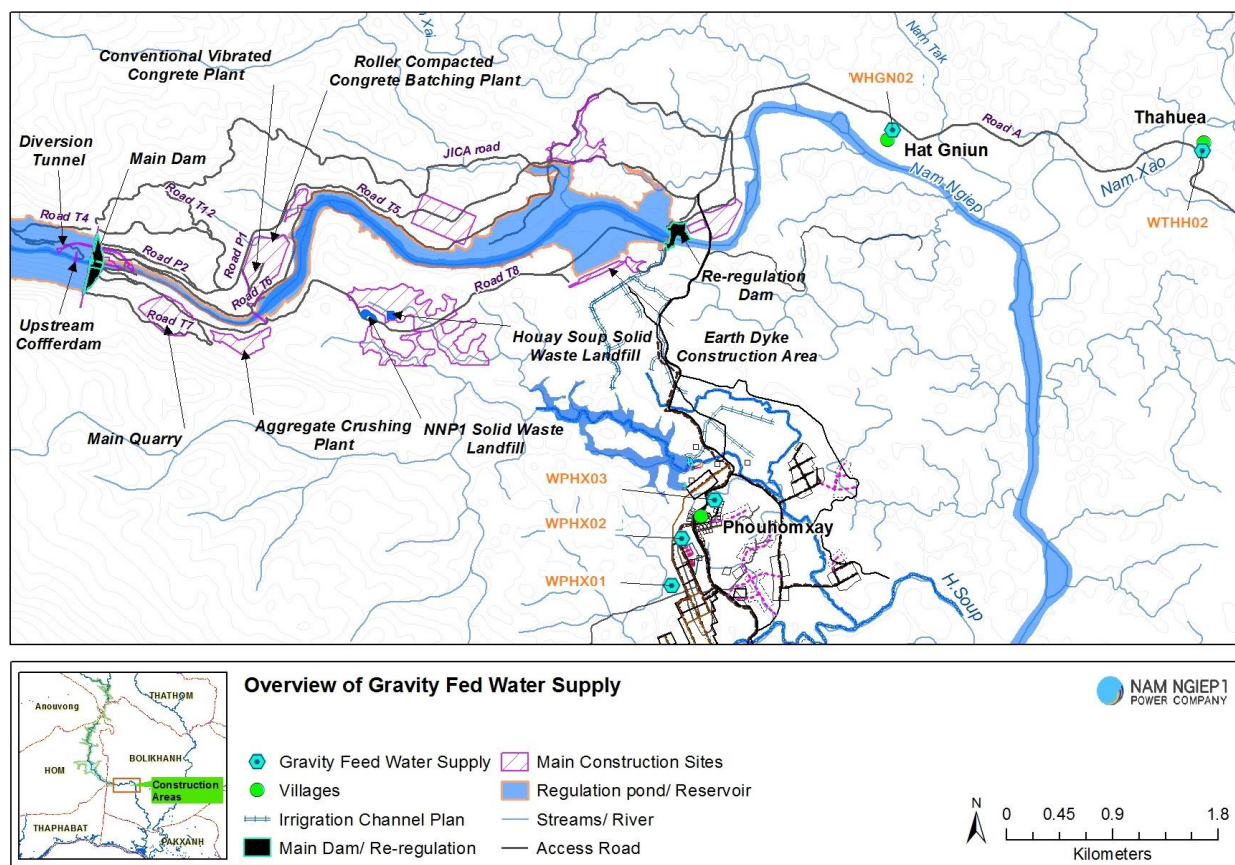
The community water supply systems related to the NNP1 hydropower project are under Nam Saat system with the monitoring requirements identify in the Minister's Decision on the Water Quality Standard Management for Drinking and Domestic Use, No. 561/MoH dated 27 February 2014.

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.

2.7.4 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 2-18: 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 2-17**. The full set of data is presented in **Appendix 5.4**.

TABLE 2-17: THE GFWS MONITORING RESULT IN Q4 2023

Date	Parameter (Unit)	Site Name	Tha Heua Village	Hat Gnuin Village	Phouhomxay Village	
		Station	WTHH02	WHGN02	WPHX02	WPHX03
		Guideline				
23-Oct-23	Faecal Coliform (MPN/100 mL)	0	350	170	110	49
20-Nov-23		0	8	14	130	79
15-Dec-23		0	2		540	70
23-Oct-23	E.Coli Bacteria (MPN/100 mL)	0	130	110	27	22
20-Nov-23		0	2	4	22	17
15-Dec-23		0	0		110	17

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

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

Phouhomxay Village (WPHX02-tap water at primary school; and **WPHX03**-tap water at the villager's house): all parameters complied with the standard, except faecal coliform and *E.coli* in Q4 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.

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 2.7.3, 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.

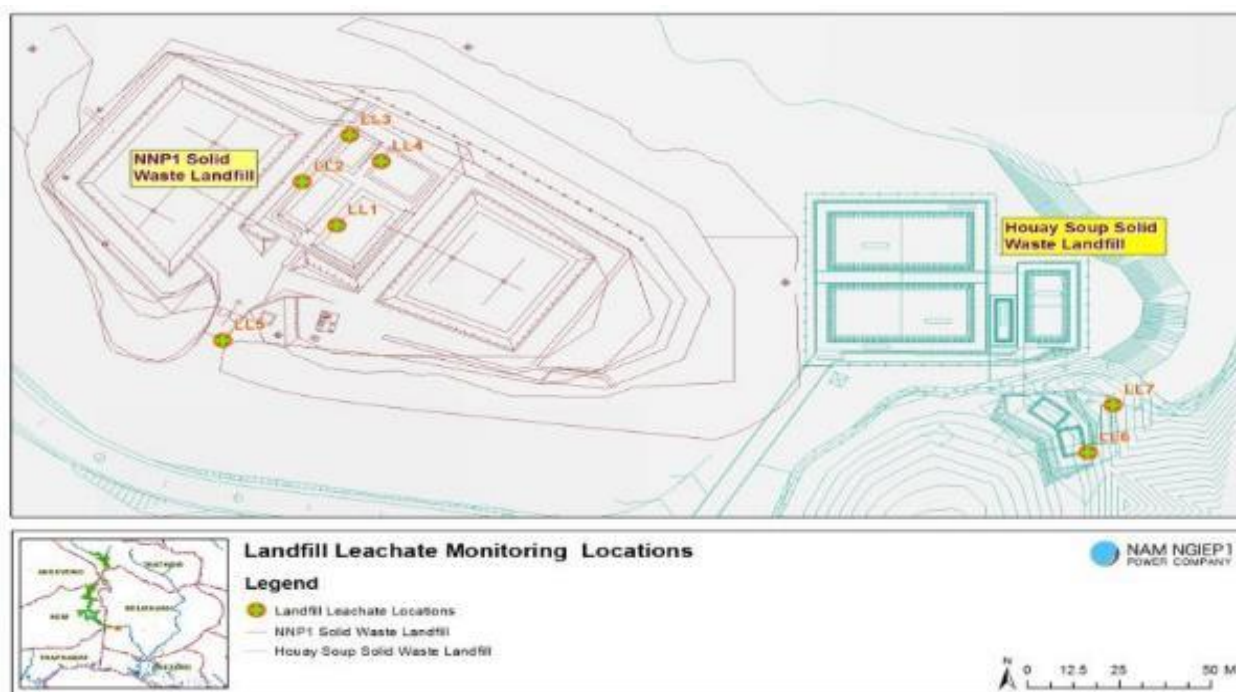
In addition, to ensure sufficient water quantity, the ESD will work with the District Water Supply Office to improve the water intake of the GFS under NNP1PC's Corporate Social Responsibility (CSR). For the presence of bacteria, the community confirmed that they will boil water before drinking. It is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

2.7.5 Landfill Leachate Monitoring

The landfill leachate treatment systems at NNP1 Project landfill and Houay Soup landfill are monitored to control the functioning of the treatment process and ensure compliance with effluent standards. However, due to the low rainfall in December 2023, the leachate flow into the treatment system of NNP1 Project landfill did not reach the last treatment pond and sampling

of effluent could therefore not be carried out for December 2023. The monitoring locations are presented in the **Figure 2-19**.

FIGURE 2-19: LANDFILL LEACHATE MONITORING LOCATION



The monitoring results in Q4 2023 indicate compliance with the applicable standards for all monitored parameters, except for total coliform for NNP1 Landfill Leachate (October and November 2023) and for faecal coliform and total coliform for Houay Soup Landfill Leachate (October 2023). The monitoring data can be found in **Appendix 5.5**.

2.7.6 Water Quality Compliance Monitoring

The water quality non-compliance issues in Q4 2023 are summarized in **Table 2-18**.

TABLE 2-18: NON-COMPLIANCES RELATING TO WATER QUALITY MONITORING IN Q4 2023

No	Non-compliance Issues	Corrective Actions	Status
1	During turbine discharge (Q4 2023), Dissolved Oxygen (DO) in the Nam Ngiep River downstream the Re-regulation Dam was lower than the National Surface	- NNP1PC is ongoing implementing the water quality monitoring program and discussed the results with the LTA during the May 2023 visit; - LTA recommended to maintain the monitoring program, and concluded that other measures aiming at an improvement, like e.g. the possibility of artificial re-aeration of the water in	- Closely monitoring

No	Non-compliance Issues	Corrective Actions	Status
	Water Quality Standard (6 mg/L)	the re-regulation pond for increasing oxygen content, are not required.	
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	In October, November and December 2023, EMO, ADM and TD conducted a monthly joint inspection for the operation and maintenance of the WWTS: - All 17 tanks and air blowers at OSOV1 were randomly checked by the ADM staff and they are functioning properly. - Wetland maintenance at OSOV1 including weeding and replacing dead reeds and fixing the fence have been completed. - Closely monitor the residual chlorine content and chlorination dosage adjustment for the effluents of OSOV2 and the Main Powerhouse WWTS.	- Closely monitoring the system operation and maintenance.
3	Groundwater quality monitored for the communities (Pou, Phouhomxay, Thong Noy and Som Seun Villages) were not in compliance with the National Groundwater Quality Standard for drinking purpose on Faecal Coliform and <i>E.coli</i> parameters	- A full inspection of the water supply systems in Som Seun, Nam Pa and Thong Noy Village was conducted in September 2020 by NNP1PC team including consultations with the Village Water Use Committee (VWUC) and also interviews with some consumers (detailed in Q4 2020 Report). - Potential contamination sources of coliform were identified and 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	- The villagers were advised/encouraged to boil water before drinking. - Continue to monitor.

No	Non-compliance Issues	Corrective Actions	Status
		accordance with the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, which states that domestic water supply for daily use is not required to be readily drinkable but would normally have to be boiled or otherwise treated before it would be suitable for drinking.	
4	Gravity Fed Water Supply monitored for the communities (Tha Heua, Hat Gnuin, and Phouhomxay Village) were not complied with the National Drinking Water Quality Standard on Faecal Coliform and <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 total coliform parameter in NNP1 Project and Houay Soup Landfills leachated.	- The leachate is still contained in the leachate ponds without being discharged to the environment. - Continue monitoring.	- Continue monitoring.

3 WATERSHED AND BIODIVERSITY MANAGEMENT

3.1 WATERSHED MANAGEMENT

3.1.1 Implementation of Watershed Management Plan

3.1.1.1 Xaysomboun Watershed and Reservoir Protection Office (WRPO)

A meeting was held on 26 April 2023 between the Head of Xaysomboun Province Agriculture and Forestry Office (PAFO) and NNP1PC to address the outstanding delays of Xaysomboun WRPO. The meeting agreed on the next steps and a timeline for the related actions. The progress of the actions as of December 2023 is summarized below:

- The Xaysomboun PAFO agreed to update the NNP1 EMO team 15 working days after the meeting. Xaysomboun WRPO shared the Minutes of Meeting (MOM) from the FCMP meeting in Thathom and Hom District with the NNP1 EMO on 7 September 2023. NNP1 EMO keeps following up with the Xaysomboun WRPO on the draft fishery regulation and noted in the middle of December 2023 that the work would be further delayed because the Deputy Head of Xaysomboun WRPO responsible for it is resigning from Xaysomboun PAFO.
- Xaysomboun WRPO patrolled the Total Protected Zone (TPZ) and reservoir in October 2023. The TPZ patrol team started the work at different time schedules because some patrolling team members had to complete assignments from their respective offices first. The reservoir patrolling team could not complete the full patrolling because of an accident during boating, but the Head of Xaysomboun WRPO did not provide any further clarification to the NNP1 EMO and Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS) team as of the end of December 2023. Since October 2023, there have been no patrols because the result of patrolling work in October 2023 was not discussed among XSB WRPO, NNP1 EMO and BSP-WCS and reported to the Head of Xaysomboun PAFO.
- The Head of Xaysomboun WRPO shared the budget plan to fix the Xaysomboun WRPO sub-office on 21 August 2022. NNP1 EMO requested Xaysomboun WRPO to issue the official assignment for the staff to be based in the sub-office in September 2023 as a condition to fix the sub-office and its operation. Despite the continuous follow-up by NNP1 EMO, the Head of Xaysomboun WRPO only shared the revised budget plan on 1 November 2023 and still could not finalize it as of the end of November 2023 because he was occupied with other assignments, and the local contractor to work on it proposed a higher budget. The local contractor proposed rechecking the sub-office with Xaysomboun WRPO in December 2023 before signing the contract and commencing the work. However, Xaysomboun WRPO was unavailable because of other assignments, internal meetings, and annual performance evaluations in December 2023. The survey to recheck the sub-office was rescheduled to January 2024. The Head of Xaysomboun PAFO also did not issue the official assignment for the staff based in the sub-office as of 31 December 2023.
- The Head of Xaysomboun WRPO requested the NNP1 EMO to organize another field visit with the local contractor to confirm the reservoir checkpoint location. NNP1 EMO noted that it is not the same contractor that the Head of Xaysomboun WRPO mentioned during the ADB-IAP-LTA mission in May 2023. The local contractor informed NNP1 EMO that they are procuring the materials and recruiting the local laborers. The field visit was rescheduled to

January 2024 because of the unavailability of Xaysomboun WRPO until the end of December 2023.

3.1.1.2 Bolikhamxay Watershed and Reservoir Protection Office (WRPO)

Bolikhamxay WRPO received the second two-quarter funds of AIP 2023 from the Forest Protection Fund (FPF) of the Department of Forestry (DOF) of the Ministry of Agriculture and Forestry (MAF), on 20 October 2023.

Bolikhamxay WRPO organized the monthly meeting on 6 November 2023, participated by a total of 12 people from NNP1 EMO, BSP-WCS, Bolikhamxay WRPO, Bolikan District Agriculture and Forestry Office (DAFO), and Bolikhan District Office for Forest Inspection (DOFI). Some of the key discussions:

- Bolikhamxay WRPO proposed a joint reservoir patrolling with Xaysomboun WRPO in December 2023 and requested support from NNP1 EMO and BSP-WCS to communicate it with Xaysomboun WRPO.
- Bolikhamxay WRPO agreed to continue forest and reservoir patrolling in the recommended area by NNP1 EMO and BSP-WCS with the schedule in the second week of November 2023.
- Bolikhamxay WRPO and BSP-WCS agreed to conduct outreach activity at the end of November 2023

Bolikhamxay WRPO conducted forest and reservoir patrols from 8-18 November 2023 as planned. Bolikhamxay WRPO did not conduct the forest and reservoir patrols in December 2023 because the result of patrolling work in November 2023 had not yet been reported and discussed among NNP1 EMO, Bolikhamxay WRPO, and BSP-WCS.

Bolikhamxay WRPO and BSP-WCS discussed the schedule and detailed materials for the outreach activity on 28 November 2023. Bolikhamxay WRPO and BSP-WCS are still preparing the materials for the outreach campaign as of the end of December 2023. The outreach activity is expected to be conducted in January 2024.

3.1.1.3 NNP1PC EMO

Hom District Agriculture and Forestry Office (DAFO) and NNP1 EMO continued to discuss the regulations for orange, pineapple, and cattle groups during the second week of October 2023. The meeting to discuss the draft regulations with the farmer groups was organized on 18-20 October 2023. The production groups agreed with the draft regulations, and Hom DAFO submitted the final regulations to the Head of Hom DAFO at the end of October 2023. The Head of the Hom District Agriculture and Forestry Office (DAFO) received the regulations for orange, pineapple, and cattle groups from the Hom DAFO key focal point in the second week of November 2023. The Head of the Hom District Agriculture and Forestry Office (DAFO) approved the regulations for orange, pineapple, and cattle groups from the Hom DAFO on 1 December 2023. Hom DAFO conducted regulation dissemination in the third week of December 2023.

Thathom DAFO revisited the greenhouse vegetable gardens that need to be repaired and met with two new households in Phonhom Village for the new greenhouse vegetable gardens in the first week of October 2023. Thathom DAFO is fixing the greenhouse vegetable gardens at the end of October 2023. Thathom DAFO started the construction of two new greenhouse vegetable

gardens with the villagers in the last week of November 2023 and an additional two new greenhouse vegetable gardens in the last week of December 2023.

The NNP1PC team and management discussed with ADB on 24 October 2023 the messages to be communicated by ADB to the relevant minister's offices on the results of the meeting on 22 September 2023. ADB will not accept any negotiation to amend NNP1PC's legal obligations under the Concession Agreement (CA) and the ADB loan Facility Agreement (FA), and NNP1PC and ADB will request full cooperation from the GOL. Further actions related to the NNP1 NNL program will be discussed at separate sessions and follow-ups among NNP1PC, ADB, Independent Advisory Panel (IAP), and the BSP-WCS. ADB discussed with relevant GOL ministry offices, including the Ministry of Energy and Mines (MEM), Ministry of Natural Resource and Environment (MONRE), and MAF, on 25 and 26 Oct 2023. The NNP1PC team and management discussed with ADB on 13 November 2023 the results of the ADB meeting with the relevant minister offices on 25-26 October 2023. Some key notes from the discussions:

- The Ministry of Energy and Mines (MEM), the Ministry of Agriculture and Forestry (MAF), the Ministry of Natural Resource and Environment (MONRE), and the Ministry of Planning and Investment (MPI) stated awareness of the CA and the NNP1 No Net Loss (NNL) concerns. The decision for mining and hydro has not been made because there are no final Environmental and Social Impact Assessment (ESIA) reports. The minister-level has the authority to decide about the province's project development. Once the ESIA reports are submitted to the GOL, they will be shared with NNP1PC and ADB.
- MPI recommended that NNP1PC and ADB directly raise the issue of NNP1 NNL with MPI for MPI to communicate further with the Prime Minister Office (PMO) and other relevant offices.
- The DOF-MAF requested the official MOM from a meeting held on 22 Sep 2023 as a reference to support speeding up the Xaysomboun WRPO restructuring. DOF-MAF also informed that there is a new Prime Minister (PM) order No. 11 on 21 July 2023 on the control of the slash-and-burn countrywide, and they have communicated it with the Xaysomboun Province.
- NNP1PC and ADB will write a letter to MPI in which NNP1PC will focus on the safeguards requirements and non-commercial issues, and the ADB will focus on the GOL's non-compliance to the legal obligations.
- The Head of ADB's Private Sector Operation Department (PSOD) plans to meet with the NNP1PC and the Ministry of Finance (MOF) on 6 December 2023. If proper responses are not received after NNP1PC and ADB issue the letters and meet with MOF in December 2023, ADB will escalate the matter to the National Assembly (NA) of Lao PDR.

The NNP1PC management discussed with ADB about the NNP1 No Net Loss (NNL) concerns on 6 December 2023 with keynotes:

- ADB encourages combined efforts among NNP1PC, shareholders, and lenders to continue mediation and discussions with the relevant parties to solve the current concerns.
- ADB is also aware that the current concerns involve several ministry offices, and recommended escalation actions as initially shared and discussed with NNP1PC in November 2023: 1) ADB and NNP1PC to write the letter to the Ministry of Planning and Investment (MPI) for the MPI to escalate the matter to the Prime Minister Office (PMO); and 2) if there is no

satisfactory result, then NNP1, ADB, and shareholders to escalate it to the National Assembly (NA) of Lao PDR.

The FPF DOF-MAF, with financial support from the NNP1PC, will organize training for the key staff of the Watershed and Reservoir Protection Office (WRPO) and Biodiversity Offset Management Unit (BOMU) on the NNP1 Financial Management Manual (FMM) on 1-3 November 2023. However, the FPF DOF-MAF later requested NNP1 to provide the training instead of FPF DOF-MAF in collaboration with the Ministry of Finance (MOF). It is not aligned with the agreement of the approved FMM, and after a series of discussions, FPF DOF-MAF agreed with NNP1 to drop the training.

The progress of actions to deal with the pending issues under the NNP1 Watershed and Biodiversity Program is summarized in Table 3-1.

TABLE 3-1: THE ACTION TAKEN UNDER THE NNP1 WATERSHED AND BIODIVERSITY PROGRAM

No.	Actions	Target date	Status as of December 2023
1	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 for the NC-NX offset site Delayed for the NNP1 watershed: There was no further discussion on the Law Enforcement Strategy (LES) document in the fourth quarter of 2023 because the Head of Xaysomboun WRPO was occupied with other assignments and unavailability of relevant key officers in December 2023 related to their internal activity from the internal meeting and annual performance evaluation.
b	The operation of Xaysomboun WRPO sub-office at Hom District	Jan 2022 (original) Q2 2023 (new)	Delayed Despite the continued follow-up by NNP1 EMO, the Head of Xaysomboun WRPO only shared the revised budget plan on 1 November 2023 and still could not finalize it as of the end of November 2023 because he was occupied with other assignments, and the local contractor to work on it proposed a higher budget. The local contractor proposed rechecking the sub-office with Xaysomboun WRPO in December 2023 before signing the contract and commencing the work. However, Xaysomboun WRPO was unavailable because of other assignments, internal meetings, and annual performance evaluations until December 2023. The survey to recheck the sub-office was rescheduled to January 2024. The Head of Xaysomboun PAFO also did not issue the official assignment for the staff based in the sub-office as of December 2023.
c	Checkpoints in the NNP1 sub-catchment	Dec 2020 (original) Q2 2023 (new)	Delayed The Head of Xaysomboun WRPO requested the NNP1 EMO to organize another field visit with the local contractor to confirm the reservoir checkpoint location. NNP1 EMO noted that it is not the contractor that the Head of Xaysomboun WRPO mentioned during the ADB-IAP-LTA mission in May 2023. The local contractor informed NNP1 EMO that

			they are procuring the materials and recruiting the local laborers as of the end of November 2023, but the field visit was rescheduled to January 2024 because of the unavailability of Xaysomboun WRPO until the end of December 2023.
d	TPZ demarcation in the NNP1 watershed	Jan 2022 (original) Q2 2023 (new)	Delayed - The Head of Xaysomboun WRPO informed NNP1 EMO during the AIP2022 preparation that he would submit the report to the Head of Xaysomboun PAFO. The Xaysomboun WRPO will organize a meeting with relevant offices for final confirmation. The Head of Xaysomboun PAFO will submit the report, and the meeting results to the Xaysomboun Provincial Vice Governor to issue the approval letter for the TPZ boundary. However, the Head of Xaysomboun WRPO has not yet submitted the report to the Head of Xaysomboun PAFO as of 12 January 2024 and did not have any plan to organize the meeting with the relevant offices despite the continuous follow-up by NNP1 EMO. In addition, the result of the meeting on 22 September 2023 allowing the mining and hydropower projects to continue in the NNP1 watershed TPZ1 might impact the TPZ boundary, and there was no discussion yet about this. - Bolikhamxay WRPO informed EMO on 28 November 2023 during the discussion of AIP 2024 preparation that DoF-MAF should approve the TPZ boundary instead.
e	Reservoir fishery management	Jan 2022 (original) Q2 2023 (new)	Delayed Xaysomboun WRPO did not share the detailed meeting agenda with NNP1 EMO and organized the meeting with Thathom and Hom District on 22 and 29 August 2023, respectively. Xaysomboun WRPO shared the MOM with the NNP1 EMO on 7 September 2023. NNP1 EMO keeps following up with the Xaysomboun WRPO on the draft fishery regulation and noted in the middle of December 2023 that the work would be further delayed because the Deputy Head of Xaysomboun WRPO responsible for it is resigning from Xaysomboun PAFO.

3.1.2 Preparation of Annual Implementation Plan (AIP) 2023

3.1.2.1 Xaysomboun WRPO

The Head of XSB WRPO submitted the plan to the Head of Xaysomboun PAFO at the end of November 2023. The approved plan was submitted to FPF DOF-MAF on 12 December 2023. NNP1PC received the fund disbursement request from FPF DOF-MAF on 4 Jan 2024. NNP1PC is processing the fund disbursement as of 12 January 2024. However, it was noted that the remaining budgets under the AIP 2020 and 2022 have not yet been fully utilized, as per the financial record shared with NNP1 EMO as of October 2023.

3.1.2.2 Bolikhamxay WRPO

Bolikhamxay WRPO received the second two-quarter funds under the approved Bolikhamxay Annual Implementation Plan (AIP) 2023 from the FPF DOF-MAF on 20 October 2023, a total of 583,688,000 LAK, of which 163,490,000 LAK is from the NNP1 NNL source and 420,198,000 is from the GOL CA source.

3.2 BIODIVERSITY OFFSET MANAGEMENT

3.2.1 Implementation of Biodiversity Offset Management Plan

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

a. Component 1 - Spatial Planning and Regulation

BSP-WCS drafted the report on Participatory Land Use Planning (PLUP) of Vangphieng Village. The draft report was discussed among the Biodiversity Offset Management Unit (BOMU), BSP-WCS, NNP1-EMO and relevant offices at BOMU's office in Viengthong from 12-14 September 2023. BSP-WCS updated the report at the end of October 2023. After another NNP1 EMO and BOMU review, BSP-WCS resubmitted the revised report on 10 November 2023. NNP1 EMO and BOMU still had more comments on the revised report on 14 November 2023. BSP-WCS shared the revised report to NNP1 EMO and BOMU on 29 November 2023. NNP1 EMO, BOMU, and BSP-WCS discussed the revised report in the third week of December 2023. The meeting to present the results to the PAFO and Viengthong district authorities is expected to be organized in January 2024.

b. Component 2 – Enforcement

The October 2023 patrolling was conducted on 6-25 October 2023, focusing on the TPZ highest and high priority area. BOMU did not continue patrolling in November 2023 because they still have not received the second two-quarters of funds of AIP 2023 from the FPF DOF-MAF until the end of November 2023. BOMU continued patrolling in December 2023 from 3-22 December 2023.

The results of patrolling in October and December 2023 are as follows:

Team	Patrolling Area/Distance	Observations/Actions Taken
1	6-25 October 2023 TPZ highest area covering Nam San, some tributaries, and northern ridges of Nam San.	6-25 October 2023 The team observed a fresh fireplace for hunting at a tributary of Nam San. However, the team did not observe any offenders.

	(13 days covering a distance of 36 Km on distance forest patrolling) 3-22 December 2023 TPZ highest area covering Nam Sone, tributaries and mountain ridges nearby (16 days and was able to cover 113 Km on distance forest patrolling)	3-22 December 2023 The team did not observe any threats during the patrolling.
2	6-25 October 2023 TPZ highest priority area covering Houay Payang, Houay Poug (Nam Sone tributary), and Nam Chang. (13 days covering a distance of 51 Km on distance forest patrolling) 3-22 December 2023 TPZ highest priority area covering Nam Xi, Houay Xai Gnai, Houay Xai noy and Houay Poug. (16 days covering a distance of 63 Km on distance forest patrolling)	6-25 October 2023 The team encountered three hunters with guns close to Houay Payang, but the hunters ran away, and the patrol team could not arrest them. 3-22 December 2023 An inactive camp for NTFP collection was observed and destroyed at Nam Sone
3	6-25 October 2023 TPZ high priority area covering Nam Sone and its eastern mountain ridges. (13 days covering a distance of 102 Km on distance forest patrolling and 35 Km for road patrol) 3-22 December 2023 TPZ highest priority area covering Nam Chouan and the western ridges. (16 days covering a distance of 70 Km on distance forest patrolling)	6-25 October 2023 The team observed and destroyed an old hunting camp and a small wire snare near Nam Sone. 3-22 December 2023 The team did not observe any threats during the patrolling.
4	6-25 October 2023 TPZ high priority area covering Nam Houg, Nam Somfard, and Nam Kapa. (12 days covering a distance of 61 Km on distance forest patrolling) 3-22 December 2023 TPZ highest priority area including Nam San and some tributaries.	6-25 October 2023 The team observed and destroyed two old hunting camps at Nam Somfard, two old hunting camps at Nam Kapa, a hunting camp at Nam Tong, and six old fishing camps at Nam Houg. 3-22 December 2023 The team has observed a recently used fire place for fishing at Nam San.

(16 days covering a distance of 50 Km
on distance forest patrolling)

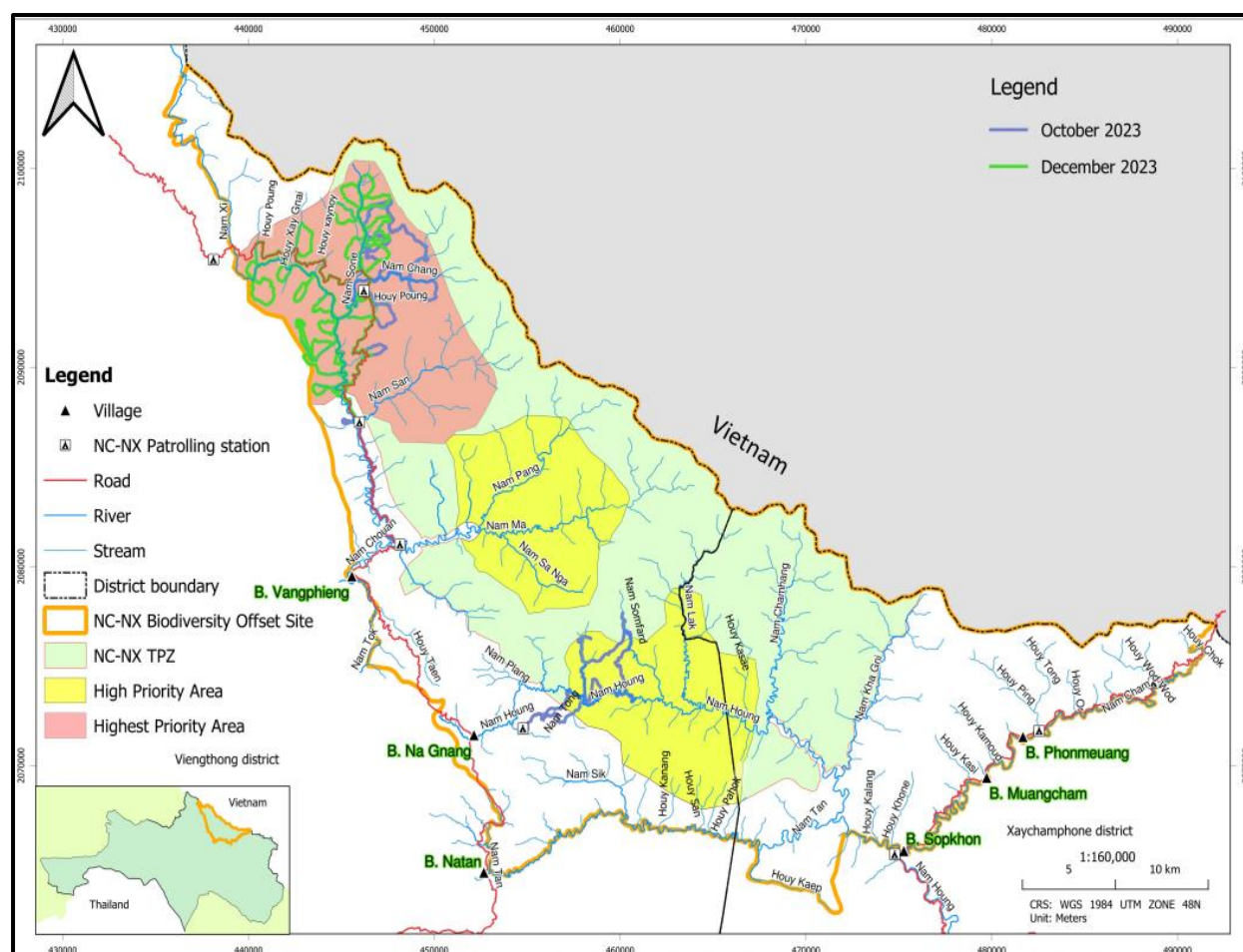
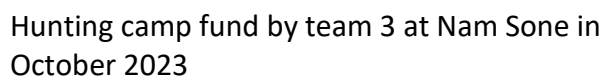
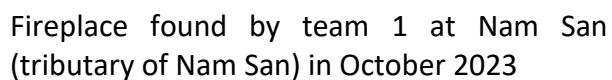
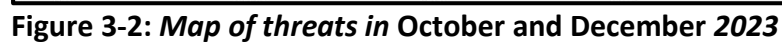


FIGURE 3-1: MAP OF PATROLLING TRACK IN OCTOBER AND DECEMBER 2023



	
Wire snare found by team 3 at Nam Sone in October 2023	Ammunitions and spent cartridges found by team 4 at Nam Somfard in October 2023
	
Camp for NTFP collection observed by Team 2 at Nam Sone in December 2023	A recent used fire place for fishing observed by Team 4 at Nam San in December 2023

Figure 3-3: REPRESENTATIVE PHOTOS FOR MONTHLY PATROLLING IN OCTOBER AND DECEMBER 2023

c. Component 3 – Conservation Outreach

BSP-WCS shared the report for the outreach activity conducted in April 2023 on 2 October 2023. NNP1-EMO has reviewed, provided comments, and reverted to BSP on 6 October 2023. BSP-WCS was still revising the report until end of November 2023. BSP-WCS presented the method and topics for the school outreach program on 29 November 2023. The materials will also be presented to Viengthong and Xaychamphone District Education and Sports Offices in the first week of January 2024. The activities are expected to start in January 2024. It was also agreed among NNP1 EMO, BOMU, and BSP-WCS that the 2023 radio-based outreach will be further postponed to the first quarter of 2024 due to the delay of AIP2023 fund disbursement from the Ministry of Finance (MOF) to BOMU and the BSP-WCS still need to develop additional scripts for this.

Viengthong DAFO disseminated relevant laws and regulations in three NC-NX target villages (Vangphieng, Na Gngang, and Natan) in the last week of December 2023 with financial support from BOMU's AIP2023 budget. The disseminated legislations included the PM's Order No.11,

dated 21 Jul 2023, on enhancing intensity on the management, protection, development, and use of forest and forest land, resisting and preventing forest and forest land destruction, encroachment and Forest fires; the Law on Forestry; and NC-NX regulation.

d. Component 4 – Conservation linked livelihood

BOMU and DAFO of Viengthong and Xaychamphone are scheduled to conduct the fieldwork in the six NC-NX villages to obtain the farmers' regulations and proposal from the farmer group for the farmer group approval process on 23-31 October 2023. BOMU and DAFO of Viengthong and Xaychamphone conducted fieldwork in the six NC-NX villages to obtain the farmers' regulations and proposal from the farmer group for the farmer group approval process on 1-9 November 2023. The livestock-raising groups in all six NC-NX target villages were established and approved by Viengthong and Xaychamphone DAFOs in December 2023, but the training has not started yet because of the unavailability of the trainers (Livestock and Fishery Section of Bolikhamxay PAFO), and it is expected to start in January 2024.

The snare removal activity was conducted from 11 to 23 October 2023, focusing on the TPZ's highest priority area. The results will be discussed during the monthly meeting in November 2023. BOMU did not continue the snare removal activity in November 2023 because they still have not received the second two-quarters of funds of AIP 2023 from the FPF DOF-MAF until the end of November 2023. The snare removal activity was conducted from 11-23 December 2023.

e. Component 6 – Monitoring and reporting

BOMU, DAFO of Viengthong and Xaychamphone, NNP1-EMO and BSP conducted the camera trap installation in NC-NX from 6-27 November 2023 following the same survey method and location of the first monitoring in 2020. The removal of the camera trap is scheduled from 17 January to 4 February 2024.

NNP1 EMO, BOMU, and BSP-WCS conducted the gibbon survey in December 2023. The training was organized on 9 December 2023 at the BOMU Viengthong office. The field survey started on 11 December 2023 and is expected to be completed on 8 January 2024.

3.2.2 Preparation of Annual Implementation Plan (AIP) 2023

BOMU received the second two-quarter funds under the approved BOMU Annual Implementation Plan (AIP) 2023 from the FPF DOF-MAF on 30 November 2023, a total of 3,136,113,000 LAK, of which 1,305,118,000 LAK is from the NNP1 NNL source and 1,830,995,000 is from the GOL CA source.

3.2.3 Preparation of Annual Implementation Plan (AIP) 2024

BSP-WCS drafted the list of activities for the BOMU AIP2024 on 8 November 2023. NNP1 EMO reviewed it on 14 November 2023. BSP-WCS revised the list and shared it with BOMU on 14 November 2023. BOMU is still preparing the detailed budget of their AIP2024 as of the end of December 2023.

4 FISHERY MONITORING

Three species groups and two species dominated the fish catch by weight in Q4 2023 as listed in **Table 4-1**. All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species², except *Sikukia gudgeri* is classified as Data Deficient (DD) and *Oreochromis niloticus* is an exotic species.

TABLE 4-1: FISH SPECIES DOMINATING THE FISH CATCH IN Q4 2023

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Oreochromis niloticus</i>	ປານິນ	484.5	LC
<i>Poropuntius normani</i> , <i>Poropuntius laoensis</i> , <i>Poropuntius carinatus</i>	ປາຈາດ	348.2	LC
<i>Sikukia gudgeri</i> , <i>Amblyrhynchichthys truncatus</i>	ປາຂາວຊາຍ	277	DD, LC
<i>Hampala dispar</i> , <i>Hampala macrolepidota</i>	ປາສຸດ	226.6	LC
<i>Mastacembelus armatus</i> , <i>Mastacembelus favus</i>	ປາຫຼາດ	192.7	LC

The recorded catch of Threatened species (IUCN Red List classification) in Q4 2023 are presented in **Table 4-2**. The list includes four species are classified as Vulnerable species (VU).

Table 4-2: Threatened Species of Q4 2023 Fish Catch

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Bangana behri</i>	ປາຫວ້າ	2	VU
<i>Cirrhinus cirrhosus</i>	ປາແກງ/ປານວນຈັນ	0.5	VU
<i>Scaphognathops bandanensis</i>	ປາປ່ຽນ/ປາວຽນໄຟ	76.6	VU
<i>Tor sinensis</i>	ປາແດງ	44.4	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 4-3 based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey.

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

TABLE 4-3: 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	Q2 2023	Q3 2023	Q4 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																																			

**Datnioides undecimradiatus* was caught in Mekong by DS households

Species abundance and occurrence is based on the 7-day reported catch from the DCL survey in Q4 2023. The catch is divided in 3 areas including above the main dam, below the main dam and Mekong area. Main biodiversity indicators in Q4 2023 for above dam, below dam and Mekong area are presented in **Table 4-4** and the Shannon biodiversity index has been calculated (the higher the value, the higher the diversity of species).

TABLE 4-4: MAIN BIODIVERSITY INDICATORS FOR Q4 2023

Biodiversity Indicators	Mekong	Below dam	Above dam
Total species and groups	29	50	42
Single species	25	35	29
Species groups	4	15	13
Top 15 species (% total catch weight)	85.15%	82.58%	91.02%
Proportion for species groups	19.22%	57.00%	40.80%
Diversity index (Shannon)	2.5135	3.0023	2.5756

FIGURE 4-1 shows fish diversity index (Shannon) for above dam, below dam and Mekong area from July 2015 to December 2023.

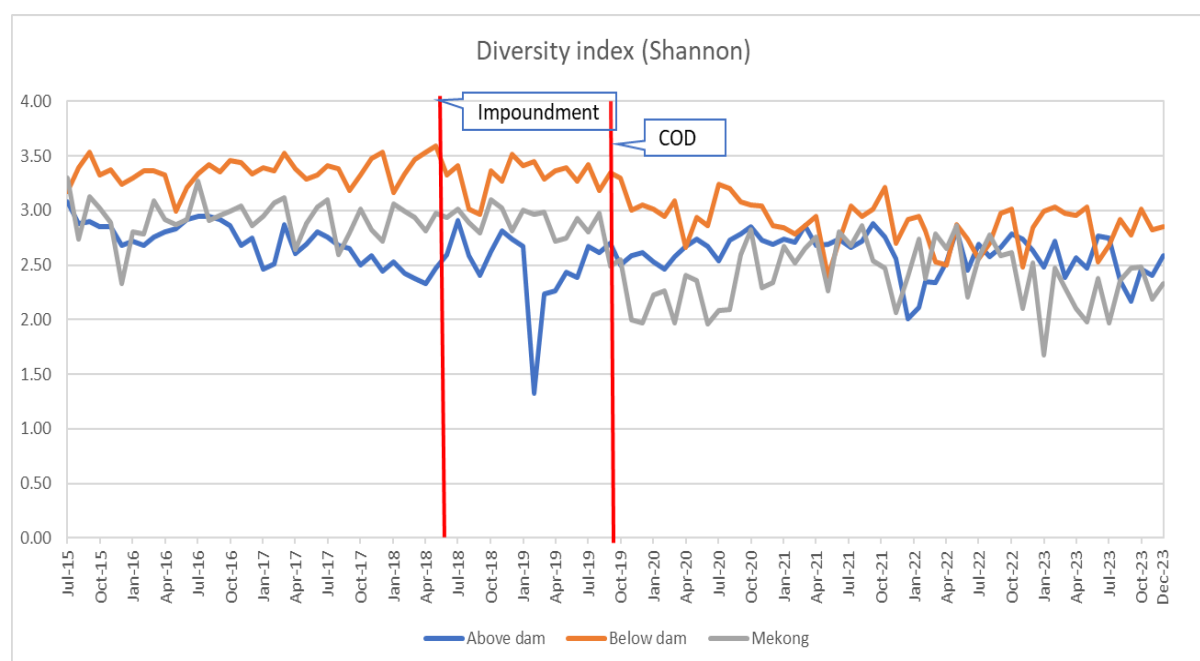


FIGURE 4-1: FISH DIVERSITY INDEX (SHANNON) BY FISHING ZONE FROM JULY 2015 TO DECEMBER 2023

The mean daily fish catch per household from July 2015 to December 2023 is displayed in **Figure 4-2** and the mean fish catch per household per fishing day for Q4 from 2015 to 2023 are shown in **Table 4-5**.

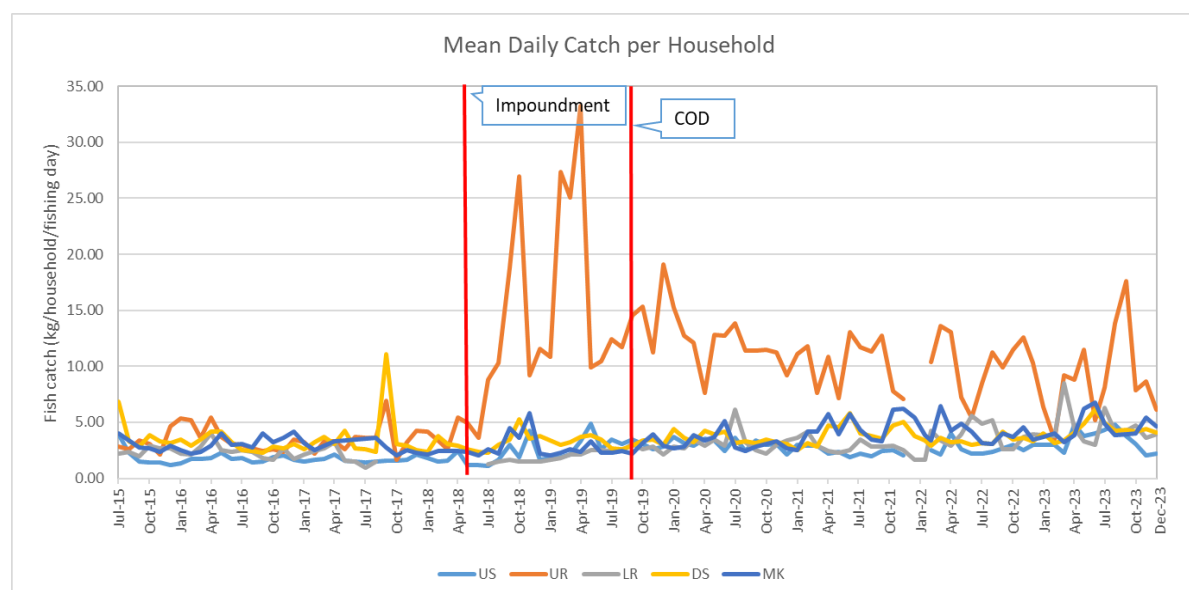


FIGURE 4-2: MEAN DAILY FISH CATCH PER HOUSEHOLD FROM JULY 2015 TO DECEMBER 2023

TABLE 4-5: MEAN DAILY FISH CATCH PER HOUSEHOLD FOR Q4 FROM 2015 TO 2023

Fishing Zone	Q4 2015 (kg)	Q4 2016 (kg)	Q4 2017 (kg)	Q4 2018 (kg)	Q4 2019 (kg)	Q4 2020 (kg)	Q4 2021 (kg)	Q4 2022 (kg)	Q4 2023 (kg)
Upstream	1.32	1.86	1.79	2.60	2.85	2.74	2.29	2.83	2.45
Upper reservoir	3.29	2.80	3.03	15.90	15.23	10.67	7.46	11.42	7.56
Lower reservoir	2.75	2.03	NA	1.48	2.52	2.85	2.34	3.42	4.06
Downstream	3.45	2.85	2.82	4.18	3.27	3.23	4.51	3.44	4.23
Mekong	2.65	3.67	2.29	3.89	3.36	3.03	5.91	3.89	4.68

The survey results in Q4 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 Q4 2023 are displayed in **Table 4-6**.

Table 4-6: Proportion of the catch reported by main habitats (%) in Q4 2023

Habitats	US	UR	LR	DS	MK
Mekong	0.0%	0.0%	0.0%	6.8%	85.5%
Nam Ngiep	59.1%	17.5%	0.0%	63.6%	0.2%
Nam Xan	0.0%	0.0%	0.0%	0.0%	0.0%
Reservoir	0.0%	74.9%	25.8%	0.0%	0.0%
Tributary and stream	40.9%	6.4%	73.5%	28.3%	7.5%
Wetland	0.0%	1.3%	0.7%	0.7%	6.7%
Others	0.0%	0.0%	0.0%	0.5%	0.0%

Total reported fish and other aquatic animal (OAA) catch (proportion of OAA) for the same 7-day period in Q4 from 2015 to 2023 are shown in **Figure 4-3**.

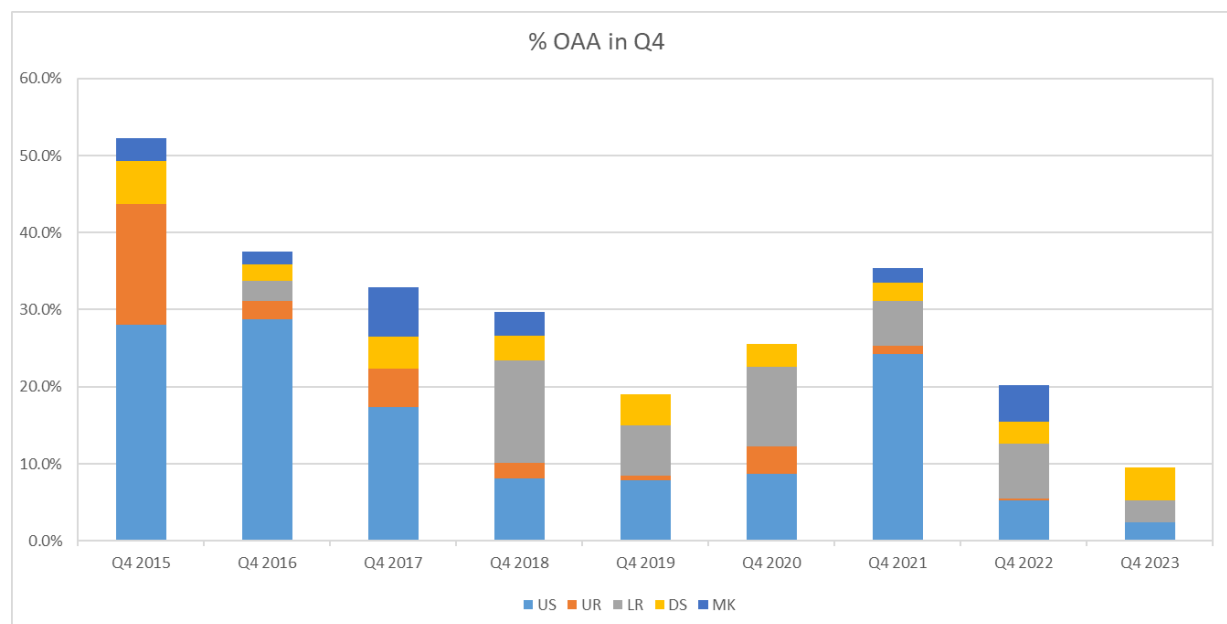


FIGURE 4-3: PROPORTION OF OAA TO THE TOTAL REPORTED KILOGRAM (KG) OF FISH AND OAA FOR A 7-DAY PERIOD BY FISHING ZONE IN Q4 FROM 2015 TO 2023

5 Health and Safety

5.1 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 December 2023) are provided in **TABLE 5-1**.

TABLE 5-1: SAFETY INCIDENTS REPORTED DURING THE OPERATION PHASE (SEPTEMBER 2019 TO DECEMBER 2023)

Type of Incidents	LTI	RI	NM	PD	FI	MVI	Total
No. of Incidents in Q4, 2023	0	0	0	0	0	0	0
Cumulative Total Incidents to 31 December 2023	0	3	0	0	0	1	4

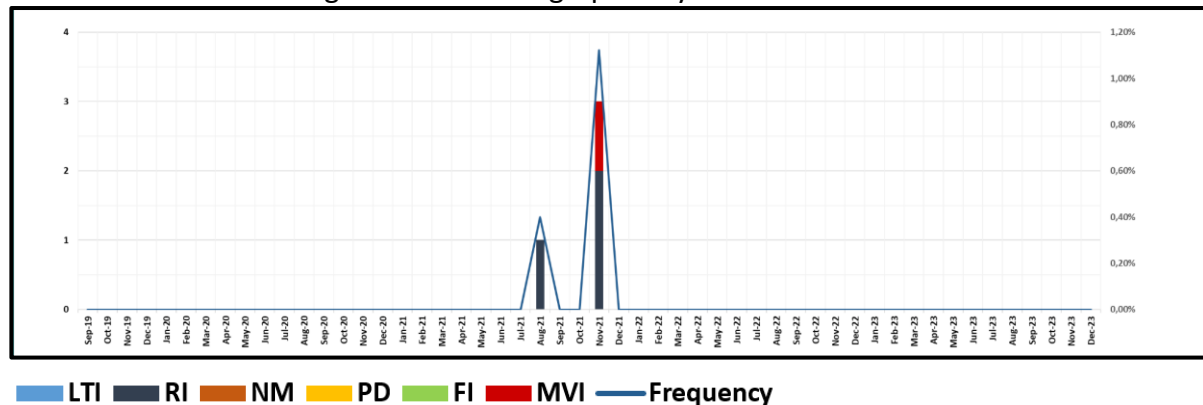
LTI: Lost Time Incident; RI: Recordable Injury; NM: Near Miss; PD: Property Damage; FI: Fire Incident; MVI: Motor Vehicle Incident

There were no incidents or accident reported in Q4 2023.

The histogram below in Figure 5-1 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.



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

FIGURE 5-1: NUMBER, TYPE AND FREQUENCY OF SAFETY INCIDENTS SINCE SEPTEMBER 2019 TO 30 SEPTEMBER 2023

The second histogram in Figure 5-1 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.

There were no health and safety incidents in Q4 2023.

5.1.1 Health and Safety Training and Emergency Drills in the Project site

Safety inductions were conducted for the 25 contractor staff of Daothong Company for trimming work along the NNP1PC 230 kV transmission line on 13 and 24 November 2023, as well as for the 15 local labours hired for trimming works along the NNP1PC 22 kV transmission line on 19 November and 6 December 2023.

The main objectives of the safety induction are to let the contractor and local labours understand the general measures for safety and assistance, including awareness of high slopes, sharp bamboo or trees, dangers from snakes, bees and wasps, dehydration while working in heat weather, safe condition of hand tools, communication each other while working in difference level of ground while doing the work.

No emergency drill was conducted in Q4 2023.



FIGURE 5-2: REPRESENTATIVE PHOTOS OF THE SAFETY INDUCTION DURING Q4 2023

5.2 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 workplace as well as avoiding mass gathering.

5.2.1 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.

5.2.2 General situation of COVID-19 in NNP1PC

There was no case COVID-19 infection in the third quarter 2023.

6 External missions and visits

There were no external missions during the Q4 2023.

The action priorities recommended by ADB, IAP, and LTA during the mission in May 2023 are listed for further follow-up as shown in the appendix 1.

APPENDICES

APPENDIX 1: THE SITE INSPECTION RESULTS DURING Q4 2023

No	Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
1	ON-ADM-0001	28/09/2023	OSOV1 (WWTS)	It was observed that there is weed growth inside and around the edges of the wetland ponds.	The ADM was instructed to remove the presence of weeds to increase the efficiency of wastewater treatment and minimize the breeding grounds of vectors.	12/10/2023	21/12/2024	Resolved (The corrective action was verified and accepted)
2	ON-ADM-0002	28/09/2023	NNP1 Landfill (Waste cell)	The key observation from this joint inspection are as follows: 1. The growth of vegetation inside the waste cell could potentially block the flow of leachate from the waste cell to the treatment ponds, compromising leachate treatment efficiency. 2. Dense vegetation has developed along the access road and the perimeter of the landfill. This could pose a fire hazard during dry seasons, and potentially leading to landfill fires.	The ADM was instructed to clear vegetation along the access road, around the landfill's boundaries, and within the waste cell and conduct waste compaction using machinery at least twice a year, considering the current monthly waste disposal average of approximately 9 m3.	12/10/2023	21/12/2024	Resolved (The corrective action was verified and accepted)

No	Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
3	ON-TD-0003	28/09/2023	LILAMA10 Hazardous Storage facility	The hazardous storage facility is not fully operational as the secondary protection system as it is intended to. This is due to the “absence of a control valve” on the outlet pipe of the storage facility. The mentioned valve is necessary for preventing accidental oil releases from the hazardous storage facility.	The TD was instructed install a control valve on the outlet pipe of the storage facility to prevent accidental oil releases from the hazardous storage facility.	05/10/2023	19/10/2023	Resolved (outlet pipe was blocked) (The corrective action was verified and accepted)
4	ON-ADM-0004	23/11/2023	OSOV1 (Recycle waste storage)	Improper housekeeping and arrangement at recycle waste storage area	The ADM was instructed to perform good housekeeping around the recycle waste storage area, re-arrange and tidy up the recycle waste for each partition to keep more space.	08/12/2023	21/12/2023	Pending issue with some progress
5	ON-ADM-0005	23/11/2023	OSOV2 (WWTS)	The wastewater collection tank has cracked allowing leakage of some small portion of wastewater.	The ADM was instructed to repair the cracks to avoid wastewater leakage to the environment, and closely monitor and maintain the WWTS.	08/12/2023	21/12/2023	Resolved (The corrective action was verified and accepted)

No	Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
6	ON-TD-0006	21/12/2023	RCC Plant	The holes at the former RCC Plant which were identified by the LTA during their mission in May 2023 have not yet been completely filled.	TD was instructed to continue inspecting soil filling of the underground holes (approximately 3 holes) at the former RCC Plant. More soil needs to be filled before the upcoming ADB-IAP-LTA mission which was scheduled by 22-27 January 2024.	Within December 2023	21/12/2023	Resolved (The corrective action was verified and accepted)

APPENDIX 2: ENVIRONMENTAL MONITORING CORRECTIVE ACTIONS Q4 2023

No	Aspect	Issue Description	Corrective Action Requests	Requested Timeline	Corrective Actions by NNP1PC (As of December 2023)
1	EAP	HatGnuin: Muster point cannot be reached (private property), too far from village, access road flood-prone, may not be passable during rainy season: no realistic EAP for this village.	Identify realistic muster point (check suitability of two hills identified during May 2023 site visit). Conditions: sufficient elevation, as close as possible to village, accessible. Make muster point accessible (clear vegetation if required, no fences).	Q3 2023	<u>In progress:</u> - The drill was carried out in Hat Gniun village on 27 September 2023. - The muster point at Hat Gniun need to be rediscussed again between the Bolikhan District Disaster Management Committee, Hat Gniun local authorities and the private landowners to allow access in case of an emergency - the conclusion of the meeting will be used for the drill in 2024 - In addition, the elevation of the hill must be checked. -
		Thaheua: suitable muster point identified, but not accessible due to dense vegetation.	Make accessible (clear overgrown path, keep open by regular cutting).	30 June 2023	<u>In progress:</u> - The paths was cleared during December 2023 to make it accessible The villagers are also persuaded to carry out routine clearing of overgrown paths and maintain convenient access at least two times per annum. In particular before and after the rainy season. - The drill was carried out in Thaheua on 26 September 2023
			Both villages: carry out drill under realistic conditions (i.e.,	Q3 2023	<u>Completed:</u>

No	Aspect	Issue Description	Corrective Action Requests	Requested Timeline	Corrective Actions by NNP1PC (As of December 2023)
			people actually reaching identified muster point.		- As mentioned above, NNP1PC agreed to conduct the drill in mid-August 2023. - The drill was carried out in Phouhomxay on 28 September 2023.
		Houay Soup Noy dam (irrigation reservoir): spillway sufficient for evacuating even exceptional flood. Village not threatened in case of a dam break, however, people in the demonstration farm or working in the fields would be at risk.	Confirm statements about spillway and exposure of village; check with Technical LTA. Include warning system and evacuation plan for farm and fields in EAP.	Q3 2023	<u>In progress:</u> - The inundation map in case of the irrigation dam break was created and is being studied. - The statement of evacuation plan in the EAP in case of the Dyke Break will be confirmed as the potential flood is in the same area in case of the irrigation dam break. - This matter will be discussed with the Technical LTA on their next visit in January 2024.
2	Critical water depth	In Nam Ngiep downstream of the dam minimum water depth of 0.5 m cannot be kept during conditions of minimum flow. Identified as “not a problem”.	Confirm: if users of respective sites agree that there is no such problem, make official statement and stop monitoring. If there is a problem, take measures (deepening of passage, removal of barrier) and confirm effectiveness.	Q3 2023	<u>In progress:</u> In accordance with the LTA’ recommendation, NNP1PC (EMO and TD) has closely monitored water depth in the thalweg of the Nam Ngiep River downstream the reregulation dam when the discharge is approx. 27 m³/s to: - Monthly interviews were conducted with the downstream residents, who use boats. The interviews, from October to December 2023, were randomly conducted to gather and

No	Aspect	Issue Description	Corrective Action Requests	Requested Timeline	Corrective Actions by NNP1PC (As of December 2023)
					assess any complaints about boat navigation difficulties. - During the interviews in October to December 2023, two villagers from Hat Gniun village and one person from Thahuea village, who use the boat navigation path through identified shallow water depth locations, reported no concerns about boat navigation. The monthly interviews will be continued until Q2 2024. Based on an evaluation of the monitoring results and the effectiveness of any mitigation measures, NNP1PC will consider officially proposing revisions to the monitoring programme after Q2 2024.
3	Fisheries Management Plan	Still no Fisheries Management Plan. Main issue seems to be lack of commitment from Xaysomboun Province	Undertake every effort required for solving this issue.	Q3 2023	Follow-up: See Table 3-1 point 1 (e) on the FCMP progress
4	Watershed Management Plan	Excessive slash-and-burn activity around reservoir. Critical issue for biodiversity (NNL), but also leading to massive sheet erosion.	Reinforce activities for protecting the watershed area (land use, fishing) according to contractual requirements.	Q3 2023	Follow-up: See section 3.1.1.3 on the progress of meeting to address the risks and challenges for achieving the No Net Loss with relevant GOL offices from central, provincial, and district level.
5	Irrigation system	Section with Category A damage.	Make reinforcement as soon as possible, before collapse of the section.	-	In progress: - NNP1PC discussed and plans to repair it in 2023.

No	Aspect	Issue Description	Corrective Action Requests	Requested Timeline	Corrective Actions by NNP1PC (As of December 2023)
		Pump for providing irrigation water; installation work started.	Confirm operation of pump	30 June 2023	<u>In progress:</u> - NNP1PC plans to complete the installation of the pump in early August 2023. It was delayed because the operation condition resulted in the low water level of the re-regulation dam. - The installation of the pump was completed in July then tested its full operation in August 2023. - NNP1PC plans to handover the irrigation system to the local authorities/water user group in April 2024.
6	Site rehabilitation	Site of former batching plant: two access holes to underground structure remain, not secured sufficiently.	Eliminate risk, best is to remove the entire structure, but at least fill the cavity and securely close access holes. Clearly mention in handover document.	30 June 2023	<u>In progress:</u> - NNP1PC closed the two holes by filling the earth material in December 2023. - This will be clearly stated in the handover materials
7	Groundwater supply	Two boreholes "broken".	Clearly state whether replacement is required or not (alternative solution?), if required replace them.	Q3 2023	<u>Completed:</u> - The two broken boreholes were repaired and put back into operation in April 2023. - NNP1PC resumed its monthly water quality monitoring as scheduled.
		E. coli contamination of drinking water due to cattle around intake sites.	Clarify whether measures (fencing) can be taken to reduce risk, and if yes do it.	Q3 2023	<u>Completed:</u> - According to the 2019 site condition survey, fencing off the upstream water course is not

No	Aspect	Issue Description	Corrective Action Requests	Requested Timeline	Corrective Actions by NNP1PC (As of December 2023)
					feasible due to cattle having access from all directions along the stream. - The villagers were informed about the monitoring results and advised to boil water before drinking. - This clarification will be identified in the Monthly and Quarterly Monitoring Reports.
8	Financial Management Manual (FMM)	Inform ADB and IAP of Mr. Vansy's decision on the financial manual by June 15, 2023		-	Completed The Head of Xaysomboun WRPO agreed to finalize their AIP2023 with the NNP1 EMO and BSP-WCS after the Xaysomboun PAFO received the response letter from FPF DOF-MAF on 21 July 2023 for them to follow up with the MOM of the FMM finalization workshop in January 2023 as well as the approved FMM in May 2023.
9	IAP Contracts	NN1PC to extend the IAP contracts.		-	Completed: - The 2 IAP contracts for Biodiversity Management Offset Expert (Dr Will Duckworth) and Involuntary Resettlement Expert (Dr Tony Zola) are extended until 31 August 2024. One onsite mission is included.
10	NNL Audit	NN1PC to share NNL audit technical proposals with ADB and agree on the selection process		-	Completed: - NNP1PC conducted the bidding committee meeting on 11 Jul 2023. NNP1 EMO completed the technical review on 12 Jul 2023 and shared

No	Aspect	Issue Description	Corrective Action Requests	Requested Timeline	Corrective Actions by NNP1PC (As of December 2023)
					the proposals to ADB, IAP, LTA, and BSP-WCS on 18 Jul 2023. - The review by IAP, LTA, and BSP-WCS was discussed during the 5th MOU of NNP1-ADB-WCS on 27 Jul 2023. RINA Consulting was recommended by IAP and BSP-WCS over LCG because they have better technical qualification. - NNP1PC bidding committee meeting was organized on 18 Aug 2023 with the conclusion that RINA has better qualification but recommended for financial price negotiation. After further inquiry, EMO noted that the only way to negotiate the price down is by reducing the scope of work which is impractical. - NNP1 EMO requested further view from ADB, IAP, LTA, and BSP-WCS for further selection process on 30 Aug 2023. - After the meeting with Xaysomboun Provincial Management and relevant GOL offices related to the NNL on 22 Sep 2022, IAP recommended cancelling the NNL audit assignment and using the budget for reviewing the Biodiversity Impact Mitigation and Offset Framework (BIMOF). NNP1PC agreed with the recommendation from IAP. ADB also confirmed their agreement with the IAP recommendation on 24 Oct 2023.

No	Aspect	Issue Description	Corrective Action Requests	Requested Timeline	Corrective Actions by NNP1PC (As of December 2023)
11	MoU Meeting	Set a date for the next MoU meeting (ADB-NN1-WCS)		-	<u>In progress:</u> The 5 th MOU meeting between NNP1PC, ADB, and BSP-WCS was organized on 27 Jul 2023.
12	Next joint ADB-LTA-IAP mission	Agree on the dates for the next mission.		-	<u>In progress:</u> ADB, IAP, and LTA confirmed for the ENV joint mission in Jan 2024. ADB, IAP, and LTA confirmed for the social mission to be held in 20-25 May 2024. A virtual pre mission will be held on 3 rd April 2024.

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

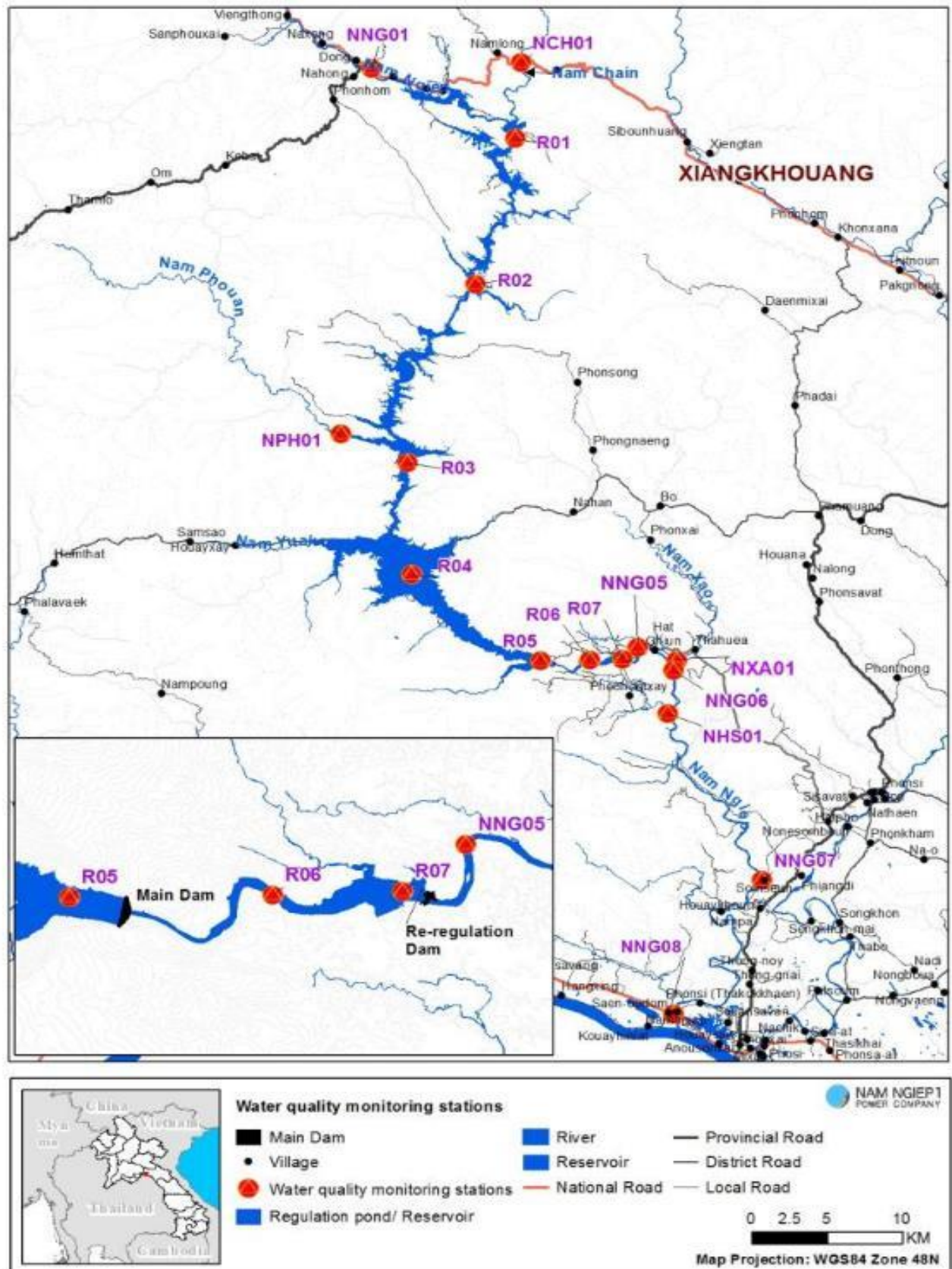
SITE CODES AND LOCATION STATION FOR SURFACE WATER QUALITY MONITORING

Site Code	Location station	Zone
NNG01	Nam Ngiep Upstream of Phiengta Village	Upstream Project Construction Site
R01	Main reservoir upstream main dam approx. 50 Km.	
R02	Main reservoir upstream main dam approx. 35 Km.	
NNG02/R03	Nam Ngiep Upstream of Nam Phouan Confluence / Main reservoir upstream main dam approx. 21 Km.	
NNG03/R04	Nam Ngiep Downstream of Sopyouak Village/ Main reservoir upstream main dam approx. 13 Km.	
NNG09/R05	Nam Ngiep Upstream Main Dam / Main reservoir upstream main dam approx. 0.5 Km	Within Project Construction Site
NNG04 / R06	Nam Ngiep Downstream RT Camp (Middle Re-regulation Reservoir)	
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

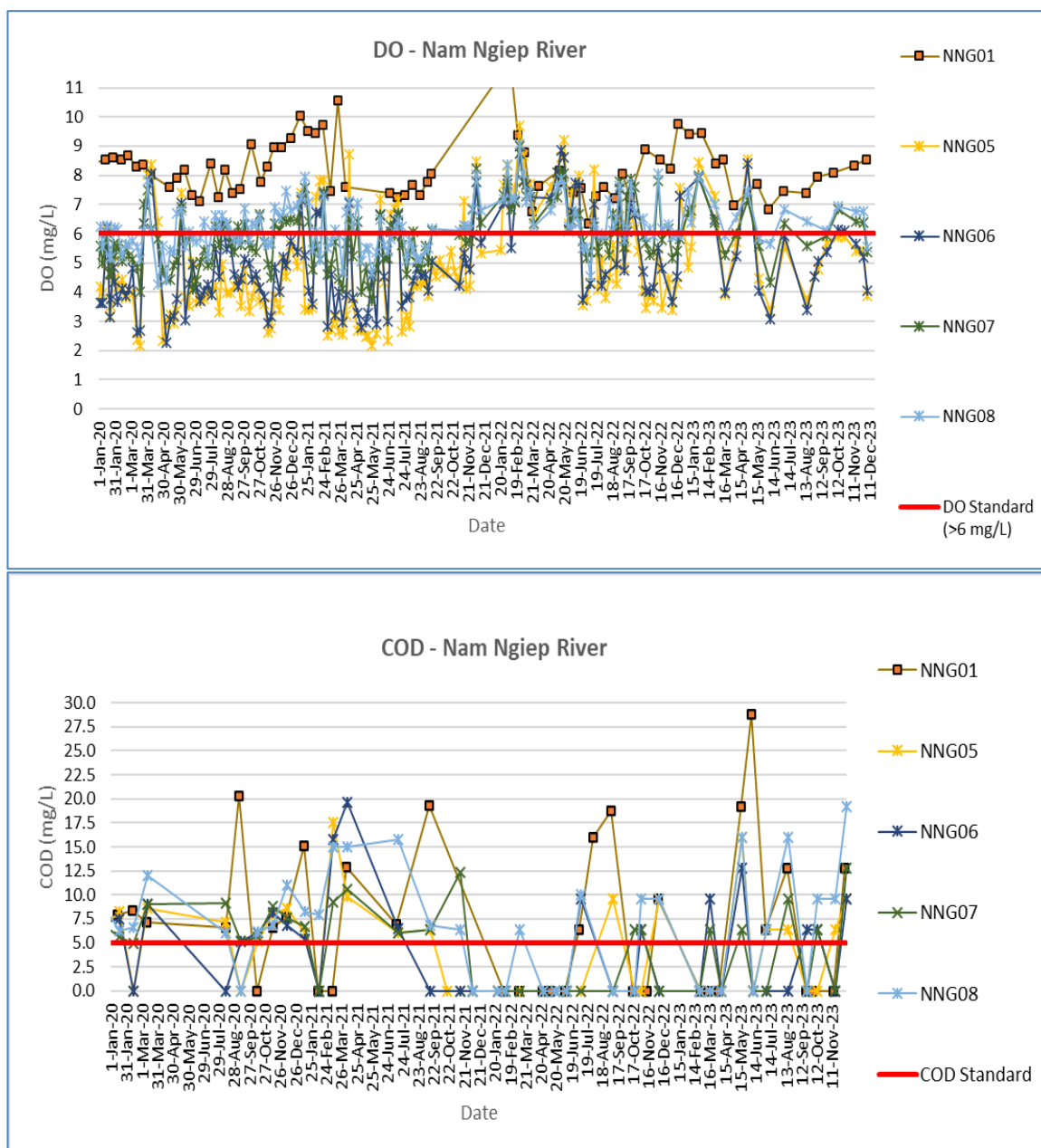
Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Weekly	pH, DO (%), DO (mg/L), Conductivity ($\mu\text{s}/\text{cm}$), Temperature ($^{\circ}\text{C}$), Turbidity (NTU).	- Main Reservoir: R01, R02, R03, R04, R05; - Re-regulation Reservoir: R06 and R07.
Monthly	pH, DO (%), DO (mg/L), Conductivity ($\mu\text{s}/\text{cm}$), Temperature ($^{\circ}\text{C}$), 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), Chlorophyll a, 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

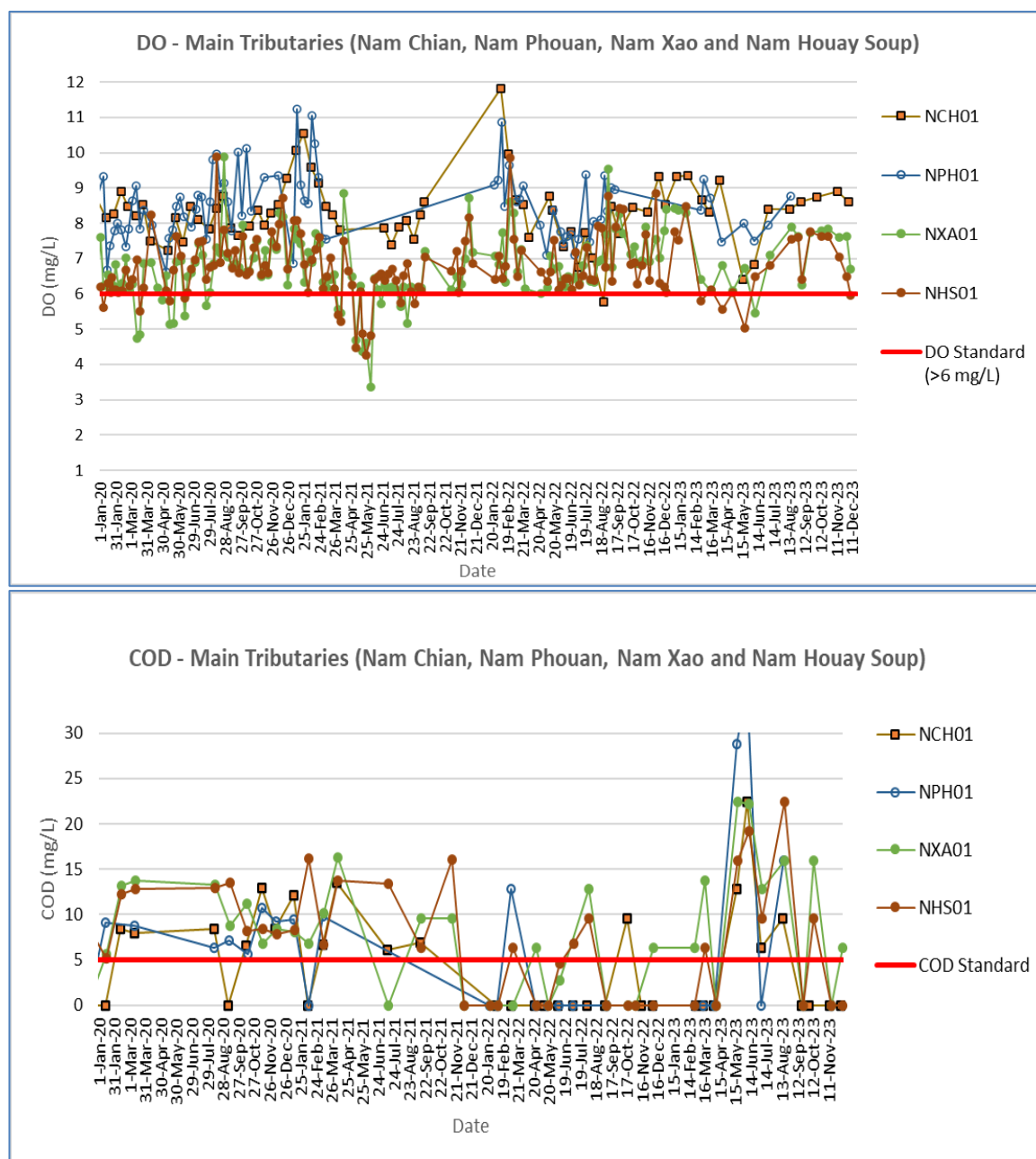


**APPENDIX 4: KEY TRENDS OF WATER QUALITY MONITORING FROM JANUARY 2020 TO END OF DECEMBER 2023
(ONLY PARAMETERS THAT EXCEEDED THE STANDARDS)**

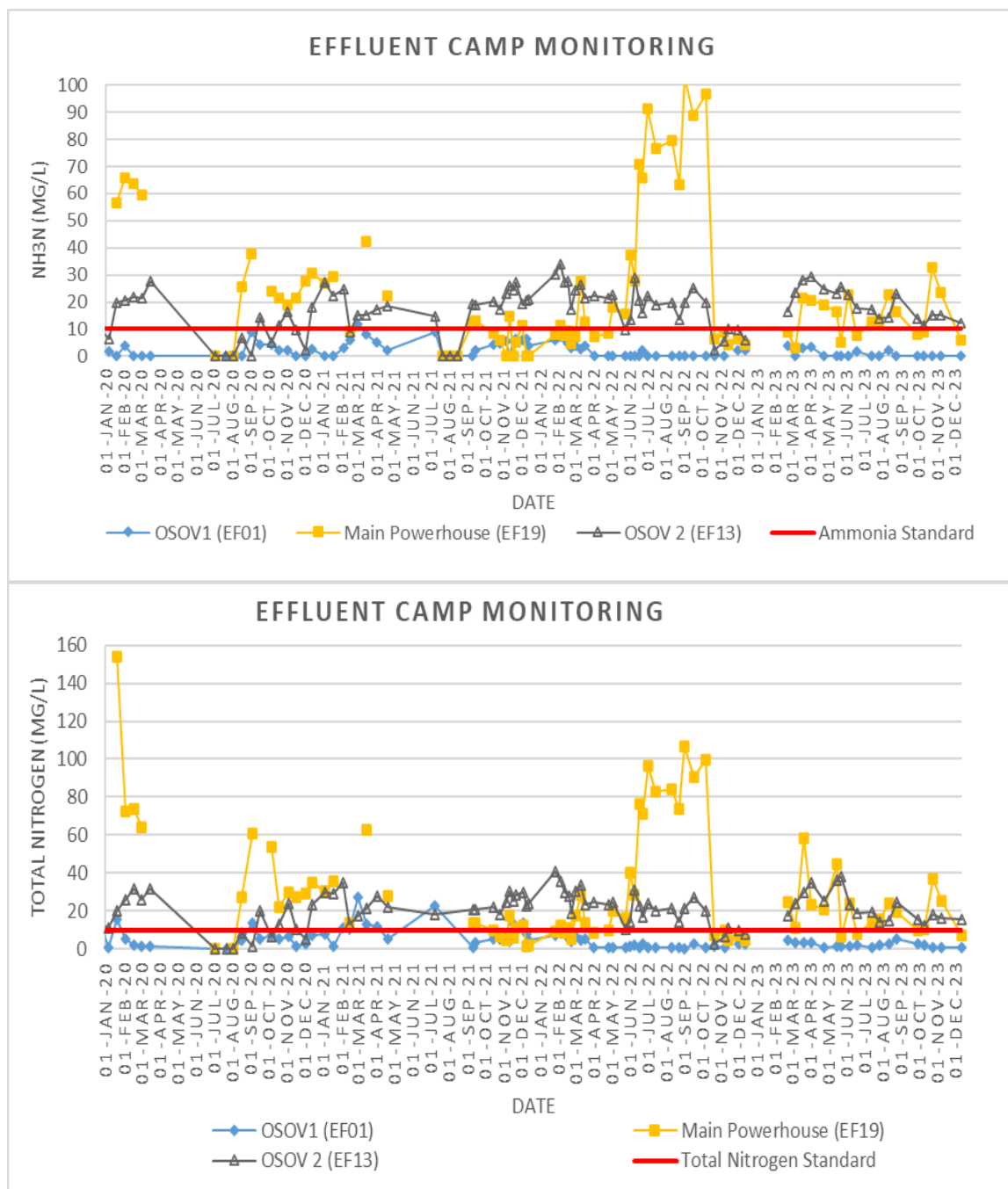
Nam Ngiep Surface Water

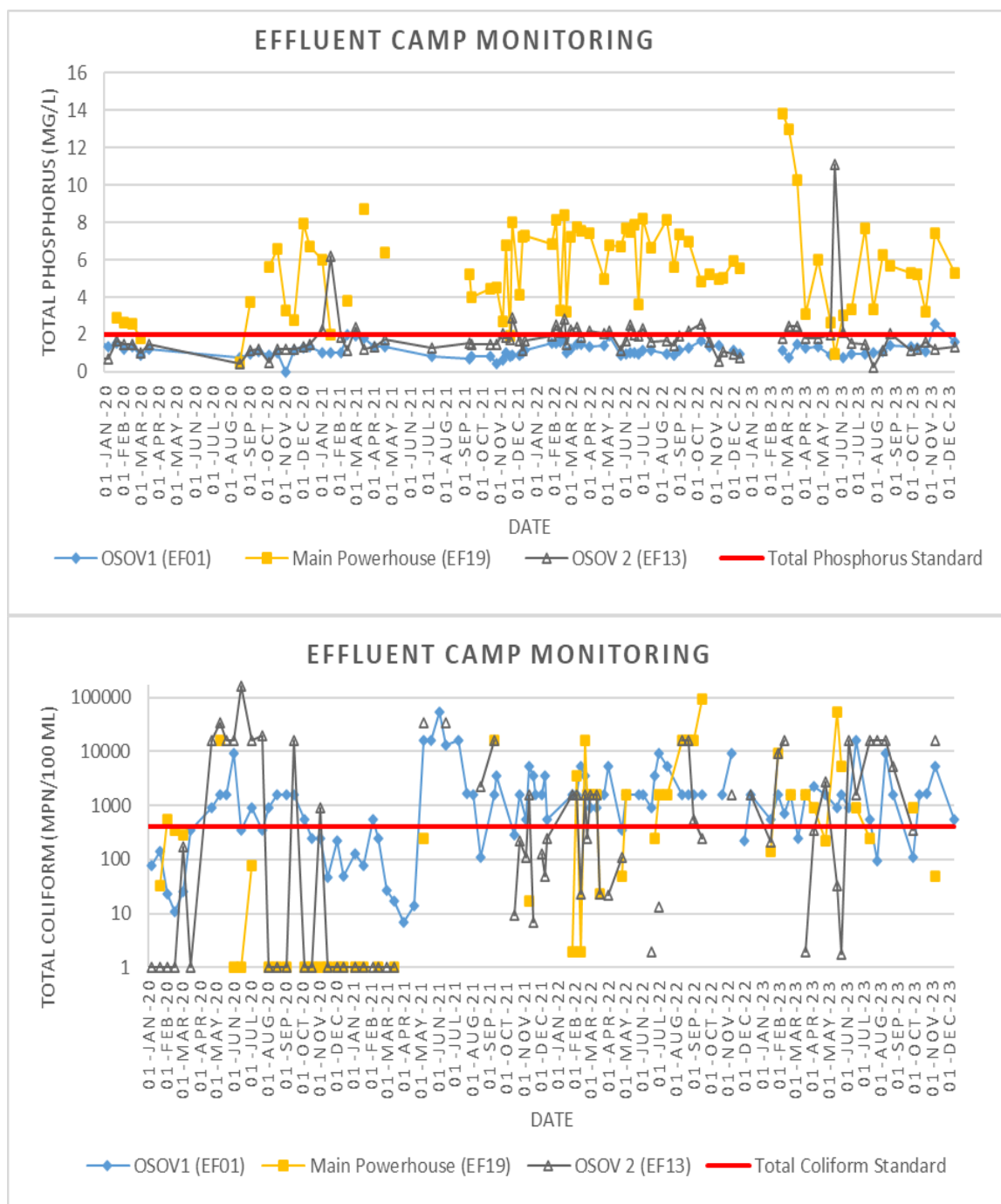


Key Water Quality Parameters for the Nam Ngiep Tributaries: Nam Chian, Nam Phouan, Nam Xao, Nam Houay Soup



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





APPENDIX 5: WATER QUALITY MONITORING DATA**APPENDIX 5-1: SURFACE WATER QUALITY MONITORING – Q4 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	NHS01
Date	Parameters (Unit)	Guideline																
4-Oct-23	pH	5.0 - 9.0	6.81												6.52			
5-Oct-23	pH	5.0 - 9.0				6.7	6.65	6.54	6.81	6.89								
11-Oct-23	pH	5.0 - 9.0		6.88	6.69	6.62												
12-Oct-23	pH	5.0 - 9.0					6.56	6.66	6.79	6.85								
13-Oct-23	pH	5.0 - 9.0									6.64	6.75	6.89	6.98			7.1	7.03
18-Oct-23	pH	5.0 - 9.0		6.66	6.58	6.5												
19-Oct-23	pH	5.0 - 9.0					6.69	6.76	6.86	6.79								
25-Oct-23	pH	5.0 - 9.0		6.65	6.62	6.75												
26-Oct-23	pH	5.0 - 9.0					6.62	6.69	6.58	6.55	6.54	6.62					7.14	7.06
1-Nov-23	pH	5.0 - 9.0		6.48	6.52	6.78												
2-Nov-23	pH	5.0 - 9.0					6.66	6.74	6.77	6.83								
8-Nov-23	pH	5.0 - 9.0		6.47	6.52	6.69												
9-Nov-23	pH	5.0 - 9.0					6.6	6.69	6.77	6.85								
13-Nov-23	pH	5.0 - 9.0	6.77												6.92			
14-Nov-23	pH	5.0 - 9.0		6.84	6.71	6.63	6.56											
15-Nov-23	pH	5.0 - 9.0						6.48	6.68	6.74								
16-Nov-23	pH	5.0 - 9.0									6.64	6.73	6.81	6.9			7.02	6.95
22-Nov-23	pH	5.0 - 9.0		6.48	6.42	6.51	6.64											
23-Nov-23	pH	5.0 - 9.0						6.63	6.75	6.76								
28-Nov-23	pH	5.0 - 9.0					6.75	6.78										
29-Nov-23	pH	5.0 - 9.0		6.48	6.55	6.59			6.71	6.77								
30-Nov-23	pH	5.0 - 9.0									6.79	6.85	6.96	6.8			7.03	6.51
5-Dec-23	pH	5.0 - 9.0	6.51												6.88			

		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																
6-Dec-23	pH	5.0 - 9.0		6.8	6.75	6.69												
7-Dec-23	pH	5.0 - 9.0					6.6	6.75	6.79	6.87								
8-Dec-23	pH	5.0 - 9.0									6.75	6.8	6.65	6.72			7.16	7.26
13-Dec-23	pH	5.0 - 9.0		6.48	6.55	6.6												
14-Dec-23	pH	5.0 - 9.0					6.66	6.69	6.81	6.89								
19-Dec-23	pH	5.0 - 9.0		6.87	6.83	6.85												
20-Dec-23	pH	5.0 - 9.0					6.78	6.76	6.74	6.79								
4-Oct-23	Sat. DO (%)		99.2												106.2			
5-Oct-23	Sat. DO (%)					100.6	99.4	98	41.1	96.3								
11-Oct-23	Sat. DO (%)			104.7	110.3	97.7												
12-Oct-23	Sat. DO (%)						91.6	88.1	42.5	51.3								
13-Oct-23	Sat. DO (%)										72.2	75.3	83	84.6			96.8	94
18-Oct-23	Sat. DO (%)			123.6	116.1	112.7												
19-Oct-23	Sat. DO (%)						115.3	120.6	49.8	51.8								
25-Oct-23	Sat. DO (%)			108.1	109.3	104.5												
26-Oct-23	Sat. DO (%)						100.3	106.9	41.2	46.1	72.7	74.6					97.2	93.6
1-Nov-23	Sat. DO (%)			99.2	105.8	100.8												
2-Nov-23	Sat. DO (%)						88.2	100.6	40.2	45.7								
8-Nov-23	Sat. DO (%)			115.2	118.1	112.5												
9-Nov-23	Sat. DO (%)						94.9	100.4	41.3	50.6								
13-Nov-23	Sat. DO (%)		98.8												102.6			
14-Nov-23	Sat. DO (%)			92.3	85.1	98.1	84.4											
15-Nov-23	Sat. DO (%)							95.1	44.4	46.8								
16-Nov-23	Sat. DO (%)										66.3	69.6	78.6	83.3			93.1	85.2
22-Nov-23	Sat. DO (%)			75	64.2	64.6	68.7											
23-Nov-23	Sat. DO (%)							68.9	41.4	40.3								
28-Nov-23	Sat. DO (%)						81.3	66.1										

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/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																
29-Nov-23	Sat. DO (%)			95.1	65.2	83.6			42.5	50.8								
30-Nov-23	Sat. DO (%)										64.9	62.3	76.9	81.6			88.9	77.5
5-Dec-23	Sat. DO (%)		102												96.2			
6-Dec-23	Sat. DO (%)			115.6	105.3	107.5												
7-Dec-23	Sat. DO (%)						87.3	75.8	36.7	41.5								
8-Dec-23	Sat. DO (%)										46.5	48.4	64.6	66.8			80.5	71.3
13-Dec-23	Sat. DO (%)			133.9	127.1	123.7												
14-Dec-23	Sat. DO (%)						110.2	109	30.2	37.9								
19-Dec-23	Sat. DO (%)			88	99.4	94.1												
20-Dec-23	Sat. DO (%)						102.7	101	26	34.3								
4-Oct-23	DO (mg/L)	>6.0	8.08												8.73			
5-Oct-23	DO (mg/L)	>6.0				7.46	7.36	7.35	3.4	7.62								
11-Oct-23	DO (mg/L)	>6.0		8.03	8.28	7.4												
12-Oct-23	DO (mg/L)	>6.0					6.99	6.84	3.51	4.16								
13-Oct-23	DO (mg/L)	>6.0									5.9	6.14	6.82	6.95			7.78	7.64
18-Oct-23	DO (mg/L)	>6.0		9.37	8.79	8.61												
19-Oct-23	DO (mg/L)	>6.0					8.91	9.3	4.11	4.23								
25-Oct-23	DO (mg/L)	>6.0		8.13	8.08	7.95												
26-Oct-23	DO (mg/L)	>6.0					7.73	8.29	3.4	3.73	5.91	6.1					7.84	7.62
1-Nov-23	DO (mg/L)	>6.0		7.6	7.86	7.77												
2-Nov-23	DO (mg/L)	>6.0					6.83	7.82	3.31	3.72								
8-Nov-23	DO (mg/L)	>6.0		8.71	8.96	8.56												
9-Nov-23	DO (mg/L)	>6.0					7.28	7.76	3.4	4.11								
13-Nov-23	DO (mg/L)	>6.0	8.34												8.89			
14-Nov-23	DO (mg/L)	>6.0		6.96	6.52	7.54	6.53											
15-Nov-23	DO (mg/L)	>6.0						7.45	3.68	3.85								
16-Nov-23	DO (mg/L)	>6.0									5.42	5.64	6.42	6.76			7.59	7.05

		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																
22-Nov-23	DO (mg/L)	>6.0		5.98	5.14	5.17	5.54											
23-Nov-23	DO (mg/L)	>6.0						5.59	3.43	3.34								
28-Nov-23	DO (mg/L)	>6.0					6.57	5.37										
29-Nov-23	DO (mg/L)	>6.0		7.72	5.26	6.78			3.52	4.14								
30-Nov-23	DO (mg/L)	>6.0									5.39	5.19	6.39	6.77			7.62	6.48
5-Dec-23	DO (mg/L)	>6.0	8.53												8.62			
6-Dec-23	DO (mg/L)	>6.0		9.14	8.35	8.6												
7-Dec-23	DO (mg/L)	>6.0					7.07	6.15	3.03	3.4								
8-Dec-23	DO (mg/L)	>6.0									3.86	4.04	5.37	5.56			6.7	5.95
13-Dec-23	DO (mg/L)	>6.0		10.51	10.05	9.78												
14-Dec-23	DO (mg/L)	>6.0					8.84	8.75	2.51	3.11								
19-Dec-23	DO (mg/L)	>6.0		7	7.82	7.55												
20-Dec-23	DO (mg/L)	>6.0					8.2	8.1	2.17	2.83								
4-Oct-23	Conductivity (µs/cm)		108												33			
5-Oct-23	Conductivity (µs/cm)					72	72	70	76	74								
11-Oct-23	Conductivity (µs/cm)			85	76	72												
12-Oct-23	Conductivity (µs/cm)						70	71	77	75								
13-Oct-23	Conductivity (µs/cm)										77	79	76	73			101	21
18-Oct-23	Conductivity (µs/cm)			84	82	71												
19-Oct-23	Conductivity (µs/cm)						71	71	79	74								
25-Oct-23	Conductivity (µs/cm)			81	83	72												
26-Oct-23	Conductivity (µs/cm)						72	70	79	79	80	78					104	20
1-Nov-23	Conductivity (µs/cm)			82	82	73												
2-Nov-23	Conductivity (µs/cm)						73	71	81	80								
8-Nov-23	Conductivity (µs/cm)			82	83	73												
9-Nov-23	Conductivity (µs/cm)						73	71	82	82								
13-Nov-23	Conductivity (µs/cm)		108												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																
14-Nov-23	Conductivity (µs/cm)			82	81	72	73											
15-Nov-23	Conductivity (µs/cm)							71	83	83								
16-Nov-23	Conductivity (µs/cm)										83	84	87	91			172	32
22-Nov-23	Conductivity (µs/cm)			88	88	75	75											
23-Nov-23	Conductivity (µs/cm)							72	84	84								
28-Nov-23	Conductivity (µs/cm)						75	72										
29-Nov-23	Conductivity (µs/cm)			89	88	76			84	84								
30-Nov-23	Conductivity (µs/cm)										85	87	88	90			198	38
5-Dec-23	Conductivity (µs/cm)		111												36			
6-Dec-23	Conductivity (µs/cm)			89	86	77												
7-Dec-23	Conductivity (µs/cm)						74	73	85	85								
8-Dec-23	Conductivity (µs/cm)										86	86	87	87			188	58
13-Dec-23	Conductivity (µs/cm)			88	86	77												
14-Dec-23	Conductivity (µs/cm)						75	75	86	86								
19-Dec-23	Conductivity (µs/cm)			88	85	76												
20-Dec-23	Conductivity (µs/cm)						75	75	86	86								
4-Oct-23	Temperature (°C)		25.77												25.13			
5-Oct-23	Temperature (°C)					31.01	31.16	1.27	25.01	26.82								
11-Oct-23	Temperature (°C)			28.99	30.23	29.87												
12-Oct-23	Temperature (°C)						29.39	28.37	25.05	26.1								
13-Oct-23	Temperature (°C)										24.97	25.12	25.37	25.28			26.41	25.81
18-Oct-23	Temperature (°C)			29.82	29.72	29.53												
19-Oct-23	Temperature (°C)						28.7	28.8	25.1	25.61								
25-Oct-23	Temperature (°C)			30.31	31.31	29.54												
26-Oct-23	Temperature (°C)						28.96	28.53	25.17	26.48	25.86	25.84					26.37	25.9
1-Nov-23	Temperature (°C)			29.11	29.99	28.8												
2-Nov-23	Temperature (°C)						28.53	28.41	25.18	25.82								

		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																
8-Nov-23	Temperature (°C)			29.91	29.71	29.49												
9-Nov-23	Temperature (°C)						29.1	28.7	25.27	26.06								
13-Nov-23	Temperature (°C)		23.86												22.46			
14-Nov-23	Temperature (°C)			29.7	29.14	28.97	28.68											
15-Nov-23	Temperature (°C)							27.92	25.01	25.22								
16-Nov-23	Temperature (°C)										25.58	25.96	25.58	25.95			25.73	24.96
22-Nov-23	Temperature (°C)			26.82	26.79	26.72	26.3											
23-Nov-23	Temperature (°C)							26.01	24.9	24.73								
28-Nov-23	Temperature (°C)						26.19	25.97										
29-Nov-23	Temperature (°C)			25.98	26.28	26.12			24.92	25.63								
30-Nov-23	Temperature (°C)										24.58	24.54	24.99	24.81			22.83	23.36
5-Dec-23	Temperature (°C)		18.3												20.85			
6-Dec-23	Temperature (°C)			27.45	27.19	26.69												
7-Dec-23	Temperature (°C)						26.12	25.94	25.15	25.61								
8-Dec-23	Temperature (°C)										24.68	24.55	24.63	24.63			24.59	24.55
13-Dec-23	Temperature (°C)			27.85	27.44	27.3												
14-Dec-23	Temperature (°C)						26.61	26.55	24.85	25.25								
19-Dec-23	Temperature (°C)			26.98	27.64	26.62												
20-Dec-23	Temperature (°C)						26.57	26.61	24.59	25.06								
4-Oct-23	Turbidity (NTU)		126												25.8			
5-Oct-23	Turbidity (NTU)					1.33	1.73	1.27	26.6	14.2								
11-Oct-23	Turbidity (NTU)			6.46	4.93	1.44												
12-Oct-23	Turbidity (NTU)						1.72	1.41	12.7	13.6								
13-Oct-23	Turbidity (NTU)										15.1	16.4	19.2	21.2			33.1	6.22
18-Oct-23	Turbidity (NTU)			4.16	4.18	1.64												
19-Oct-23	Turbidity (NTU)						1.62	1.6	9.46									
25-Oct-23	Turbidity (NTU)			4.68	3.86	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																
26-Oct-23	Turbidity (NTU)						1.76	1.3	7.29	6.88	8.66	9.12					23.4	5.18
1-Nov-23	Turbidity (NTU)			4.94	4.27	1.85												
2-Nov-23	Turbidity (NTU)						1.65	1.42	5.58	6.15								
8-Nov-23	Turbidity (NTU)			3.91	3.85	2.01												
9-Nov-23	Turbidity (NTU)						1.21	1.32	4.36	4.41								
13-Nov-23	Turbidity (NTU)		18.9												6.84			
14-Nov-23	Turbidity (NTU)			4.87	3.04	1.49	1.43											
15-Nov-23	Turbidity (NTU)							1.36	3.22	3.52								
16-Nov-23	Turbidity (NTU)										3.73	3.94	4.2	10.8			6.74	4.15
22-Nov-23	Turbidity (NTU)			2.78	1.88	1.25	1.05											
23-Nov-23	Turbidity (NTU)							1.28	2.56	3.04								
28-Nov-23	Turbidity (NTU)						1.01	0.93										
29-Nov-23	Turbidity (NTU)			3.14	1.36	1.17			2.07	2.1								
30-Nov-23	Turbidity (NTU)										2.43	2.32	4.7	4.52			6.05	2.22
5-Dec-23	Turbidity (NTU)		18.3												6.51			
6-Dec-23	Turbidity (NTU)			2.36	1.47	1.29												
7-Dec-23	Turbidity (NTU)						1.28	1.26	2.55	2.21								
8-Dec-23	Turbidity (NTU)										2.62	2.44	3.55	4.35			4.98	3.46
13-Dec-23	Turbidity (NTU)			3.19	2	1.79												
14-Dec-23	Turbidity (NTU)						1.44	1.12	2.09	2.67								
19-Dec-23	Turbidity (NTU)			2.5	1.72	1.71												
20-Dec-23	Turbidity (NTU)						1.35	0.96	1.6	1.7								
4-Oct-23	TSS (mg/L)		106.52												24			
11-Oct-23	TSS (mg/L)			<5		<5												
12-Oct-23	TSS (mg/L)						<5	<5	<5	<5								
13-Oct-23	TSS (mg/L)										7	6.02	9.8	13.1			27.35	16.2
13-Nov-23	TSS (mg/L)		26.21												<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-Nov-23	TSS (mg/L)			<5		<5	<5											
15-Nov-23	TSS (mg/L)							<5	<5	<5								
16-Nov-23	TSS (mg/L)										<5	<5	<5	11.3			<5	<5
5-Dec-23	TSS (mg/L)		15.12												<5			
6-Dec-23	TSS (mg/L)			<5		<5												
7-Dec-23	TSS (mg/L)						<5	<5	<5	<5								
8-Dec-23	TSS (mg/L)										<5	<5	<5	5.6			<5	<5
4-Oct-23	BOD _s (mg/L)	<1.5	<1												<1			
11-Oct-23	BOD _s (mg/L)	<1.5		1.19		<1												
12-Oct-23	BOD _s (mg/L)	<1.5					<1	1.63	<1	<1								
13-Oct-23	BOD _s (mg/L)	<1.5									<1	<1	<1	<1			<1	<1
13-Nov-23	BOD _s (mg/L)	<1.5	<1												<1			
14-Nov-23	BOD _s (mg/L)	<1.5		<1		<1	<1											
15-Nov-23	BOD _s (mg/L)	<1.5						<1	<1	<1								
16-Nov-23	BOD _s (mg/L)	<1.5									<1	<1	<1	<1			<1	<1
5-Dec-23	BOD _s (mg/L)	<1.5	<1												<1			
6-Dec-23	BOD _s (mg/L)	<1.5		<1		<1												
7-Dec-23	BOD _s (mg/L)	<1.5					<1	<1	<1	<1								
8-Dec-23	BOD _s (mg/L)	<1.5									<1	<1	<1	<1			<1	<1
4-Oct-23	COD (mg/L)	<5.0	<5												<5			
12-Oct-23	COD (mg/L)	<5.0							12.8	6.4								
13-Oct-23	COD (mg/L)	<5.0									<5	6.4	6.4	9.6			16	9.6
13-Nov-23	COD (mg/L)	<5.0	<5												<5			
15-Nov-23	COD (mg/L)	<5.0							<5	<5								
16-Nov-23	COD (mg/L)	<5.0									6.4	<5	<5	9.6			<5	<5
5-Dec-23	COD (mg/L)	<5.0	12.8												<5			
7-Dec-23	COD (mg/L)	<5.0							9.6	6.4								

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/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																
8-Dec-23	COD (mg/L)	<5.0									9.6	9.6	12.8	19.2			6.4	<5
4-Oct-23	NH ₃ -N (mg/L)	<0.2	<0.2												<0.2			
11-Oct-23	NH ₃ -N (mg/L)	<0.2		<0.2		<0.2												
12-Oct-23	NH ₃ -N (mg/L)	<0.2					<0.2	<0.2										
13-Nov-23	NH ₃ -N (mg/L)	<0.2	<0.2												<0.2			
14-Nov-23	NH ₃ -N (mg/L)	<0.2		<0.2		<0.2	<0.2											
15-Nov-23	NH ₃ -N (mg/L)	<0.2						<0.2										
5-Dec-23	NH ₃ -N (mg/L)	<0.2	<0.2												<0.2			
6-Dec-23	NH ₃ -N (mg/L)	<0.2		<0.2		<2												
7-Dec-23	NH ₃ -N (mg/L)	<0.2					<0.2	<0.2										
4-Oct-23	NO ₃ -N (mg/L)	<5.0	0.1												0.08			
11-Oct-23	NO ₃ -N (mg/L)	<5.0		0.15		<0.02												
12-Oct-23	NO ₃ -N (mg/L)	<5.0					0.11	0.13										
13-Nov-23	NO ₃ -N (mg/L)	<5.0	0.12												0.12			
14-Nov-23	NO ₃ -N (mg/L)	<5.0		0.11		0.11	0.11											
15-Nov-23	NO ₃ -N (mg/L)	<5.0						0.11										
5-Dec-23	NO ₃ -N (mg/L)	<5.0	0.1												0.07			
6-Dec-23	NO ₃ -N (mg/L)	<5.0		0.09		0.07												
7-Dec-23	NO ₃ -N (mg/L)	<5.0					0.1	0.07										
4-Oct-23	Faecal coliform (MPN/100 mL)	<1,000	79												17			
13-Oct-23	Faecal coliform (MPN/100 mL)	<1,000									33	49	79	130			170	170
13-Nov-23	Faecal coliform (MPN/100 mL)	<1,000	220												540			
16-Nov-23	Faecal coliform (MPN/100 mL)	<1,000									17	170	40	94			220	280
5-Dec-23	Faecal coliform (MPN/100 mL)	<1,000	1,600												34			
8-Dec-23	Faecal coliform (MPN/100 mL)	<1,000									34	11	17	34			11	350
4-Oct-23	Total Coliform (MPN/100 mL)	<5,000	170												22			
13-Oct-23	Total Coliform (MPN/100 mL)	<5,000									540	540	1,600	1,600			1,600	920

		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-Nov-23	Total Coliform (MPN/100 mL)	<5,000	350												920			
16-Nov-23	Total Coliform (MPN/100 mL)	<5,000									22	220	47	220			350	920
5-Dec-23	Total Coliform (MPN/100 mL)	<5,000	1,600												240			
8-Dec-23	Total Coliform (MPN/100 mL)	<5,000									220	110	350	70			1,600	1,600
4-Oct-23	TKN		<1.5												<1.5			
11-Oct-23	TKN			<1.5		<1.5												
12-Oct-23	TKN						<1.5	<1.5										
13-Nov-23	TKN		<1.5												<1.5			
14-Nov-23	TKN			<1.5		<1.5	<1.5											
15-Nov-23	TKN							<1.5										
5-Dec-23	TKN		<1.5												<1.5			
6-Dec-23	TKN			<1.5		<1.5												
7-Dec-23	TKN						<1.5	<1.5										
5-Oct-23	Secchi Disk (m)					3.5	3	3.6	1									
25-Oct-23	Secchi Disk (m)			1.75	1.5	2.75												
26-Oct-23	Secchi Disk (m)						3.4	3.5	1.75	1.8								
1-Nov-23	Secchi Disk (m)			1.5	1.6	2.6												
2-Nov-23	Secchi Disk (m)						2.8	3	2	1.8								
22-Nov-23	Secchi Disk (m)			1	1.5	2.5	2.75											
23-Nov-23	Secchi Disk (m)							2.6	2	1.8								
28-Nov-23	Secchi Disk (m)						3	3.5										
29-Nov-23	Secchi Disk (m)			1.5	2.5	2.7			2	1.9								
6-Dec-23	Secchi Disk (m)			2.4	3.2	3.4												
7-Dec-23	Secchi Disk (m)						3.8	3.5	3.2	3.4								
13-Dec-23	Secchi Disk (m)			3	3.4	3												
14-Dec-23	Secchi Disk (m)						3.5	3.7	3	2.8								
4-Oct-23	TOC (mg/L)		1.77												1.7			

		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-Oct-23	TOC (mg/L)								0.9	0.7								
13-Oct-23	TOC (mg/L)										0.68	0.68	0.87	0.95			1.22	1.51
13-Nov-23	TOC (mg/L)		1.18												0.79			
15-Nov-23	TOC (mg/L)								0.92	0.76								
16-Nov-23	TOC (mg/L)										0.84	0.78	0.71	0.83			0.99	2.05
5-Dec-23	TOC (mg/L)		5.77												1.15			
7-Dec-23	TOC (mg/L)								1.16	1.03								
8-Dec-23	TOC (mg/L)										0.96	0.97	1.01	1.07			1.33	1.81
4-Oct-23	Total Phosphorus (mg/L)		0.04												0.03			
11-Oct-23	Total Phosphorus (mg/L)			0.02		0.01												
12-Oct-23	Total Phosphorus (mg/L)						<0.01	0.02										
13-Nov-23	Total Phosphorus (mg/L)		0.11												0.02			
14-Nov-23	Total Phosphorus (mg/L)			0.02		0.02	0.02											
15-Nov-23	Total Phosphorus (mg/L)							0.02										
5-Dec-23	Total Phosphorus (mg/L)		0.02												0.02			
6-Dec-23	Total Phosphorus (mg/L)			0.02		0.02												
7-Dec-23	Total Phosphorus (mg/L)						0.01	0.02										
4-Oct-23	Total Dissolved Phosphorus (mg/L)		0.03												0.01			
11-Oct-23	Total Dissolved Phosphorus (mg/L)			0.01		<0.01												
12-Oct-23	Total Dissolved Phosphorus (mg/L)						<0.01	0.01										
13-Nov-23	Total Dissolved Phosphorus (mg/L)		0.06												0.01			
14-Nov-23	Total Dissolved Phosphorus (mg/L)			0.01		<0.01	<0.01											

				River Name	Nam Ngiep											Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup	
				Zone	Location Refer to Construction Sites											Location Refer to Construction Sites				
					Upstream/Main Reservoir					Re-Regulation Reservoir/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-Nov-23	Total	Dissolved	Phosphorus (mg/L)							<0.01										
5-Dec-23	Total	Dissolved	Phosphorus (mg/L)		0.01											0.01				
6-Dec-23	Total	Dissolved	Phosphorus (mg/L)			0.01		<0.01												
7-Dec-23	Total	Dissolved	Phosphorus (mg/L)						<0.01	<0.01										
11-Oct-23	Hydrogen Sulfide (mg/L)					<0.02		<0.02												
12-Oct-23	Hydrogen Sulfide (mg/L)								<0.02	<0.02										
14-Nov-23	Hydrogen Sulfide (mg/L)					<0.02		<0.02	<0.02											
15-Nov-23	Hydrogen Sulfide (mg/L)									<0.02										
6-Dec-23	Hydrogen Sulfide (mg/L)					<0.02		3.06												
7-Dec-23	Hydrogen Sulfide (mg/L)								<0.02	<0.02										
11-Oct-23	Turbidity (NTU)-bottom							24.5												
12-Oct-23	Turbidity (NTU)-bottom								3.58	1.82										
14-Nov-23	Turbidity (NTU)-bottom							29.4	15											
15-Nov-23	Turbidity (NTU)-bottom									1.7										
6-Dec-23	Turbidity (NTU)-bottom							2.9												
7-Dec-23	Turbidity (NTU)-bottom								3.42	2.16										
11-Oct-23	TSS (mg/L)-bottom							22.48												
12-Oct-23	TSS (mg/L)-bottom								17.98	<5										
14-Nov-23	TSS (mg/L)-bottom							26	11.25											
15-Nov-23	TSS (mg/L)-bottom									7.02										
6-Dec-23	TSS (mg/L)-bottom							<5												
7-Dec-23	TSS (mg/L)-bottom								19.15	<5										
11-Oct-23	BOD ₅ (mg/L)-bottom							<1												

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-Regulation Reservoir/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-Oct-23	BOD ₅ (mg/L)-bottom						7.66	7.44										
14-Nov-23	BOD ₅ (mg/L)-bottom					<1	4.66											
15-Nov-23	BOD ₅ (mg/L)-bottom							4.86										
6-Dec-23	BOD ₅ (mg/L)-bottom					<1												
7-Dec-23	BOD ₅ (mg/L)-bottom						4.02	<1										
11-Oct-23	NH ₃ -N (mg/L)-bottom					0.88												
12-Oct-23	NH ₃ -N (mg/L)-bottom						0.88	<0.2										
6-Dec-23	NH ₃ -N (mg/L)-bottom					<0.2												
7-Dec-23	NH ₃ -N (mg/L)-bottom						0.74	<0.2										
11-Oct-23	NO ₃ -N (mg/L)-bottom					0.08												
12-Oct-23	NO ₃ -N (mg/L)-bottom						0.09	0.11										
6-Dec-23	NO ₃ -N (mg/L)-bottom					0.11												
7-Dec-23	NO ₃ -N (mg/L)-bottom						0.08	0.08										
11-Oct-23	TKN-bottom					<1.5												
12-Oct-23	TKN-bottom						<1.5	<1.5										
6-Dec-23	TKN-bottom					<1.5												
7-Dec-23	TKN-bottom						<1.5	<1.5										
11-Oct-23	Total Dissolved Phosphorus (mg/L)-bottom					<0.01												
12-Oct-23	Total Dissolved Phosphorus (mg/L)-bottom						<0.01	0.03										
6-Dec-23	Total Dissolved Phosphorus (mg/L)-bottom					<0.01												
7-Dec-23	Total Dissolved Phosphorus (mg/L)-bottom						<0.01	0.03										
11-Oct-23	Total Phosphorus (mg/L)-bottom					<0.01												
12-Oct-23	Total Phosphorus (mg/L)-bottom						<0.01	0.05										
6-Dec-23	Total Phosphorus (mg/L)-bottom					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																
7-Dec-23	Total Phosphorus (mg/L)-bottom						0.02	0.08										
11-Oct-23	Hydrogen Sulfide (mg/L)-bottom					0.02												
12-Oct-23	Hydrogen Sulfide (mg/L)-bottom						<0.02	0.06										
6-Dec-23	Hydrogen Sulfide (mg/L)-bottom					<0.02												
7-Dec-23	Hydrogen Sulfide (mg/L)-bottom						0.08	0.16										
11-Oct-23	Chlorophyll-A-bottom					3												
12-Oct-23	Chlorophyll-A-bottom						2.59	3.19										
14-Nov-23	Chlorophyll-A-bottom					2.18	1.77											
15-Nov-23	Chlorophyll-A-bottom							2.18										
6-Dec-23	Chlorophyll-A-bottom					1.71												
7-Dec-23	Chlorophyll-A-bottom						1.77	3										
11-Oct-23	Chlorophyll-A			2.18		1.77												
12-Oct-23	Chlorophyll-A						1.77	3.6										
14-Nov-23	Chlorophyll-A			11.82		4.01	2.24											
15-Nov-23	Chlorophyll-A							5.37										

APPENDIX 5-2: EFFLUENT CAMP MONITORING RESULTS – Q4 2023

		Site Name	OSOV1	OSOV 2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameter (Unit)	Guideline in the CA			
09-Oct-23	pH	6.0 - 9.0	6.9	7.6	7.7
23-Oct-23	pH	6.0 - 9.0	7.1	7.55	7.4
07-Nov-23	pH	6.0 - 9.0	6.9	6.63	6.94
11-Dec-23	pH	6.0 - 9.0	6.62	6.9	6.8
09-Oct-23	Sat. DO (%)		33.4	82.3	67.1
23-Oct-23	Sat. DO (%)		20.8	81	40.2
07-Nov-23	Sat. DO (%)		32.6	51.1	27.7
11-Dec-23	Sat. DO (%)		31.1	7.2	43.5
09-Oct-23	DO (mg/L)		2.65	6.38	5.28
23-Oct-23	DO (mg/L)		1.68	6.3	3.07
07-Nov-23	DO (mg/L)		2.54	3.93	2.1
11-Dec-23	DO (mg/L)		2.48	0.57	3.32
09-Oct-23	Conductivity (µs/cm)		217	485	707
23-Oct-23	Conductivity (µs/cm)		331	520	1325
07-Nov-23	Conductivity (µs/cm)		373	529	1391
11-Dec-23	Conductivity (µs/cm)		314	419	1073
09-Oct-23	Temperature (°C)		27.28	28.43	27.6
23-Oct-23	Temperature (°C)		26.18	28.33	29.3
07-Nov-23	Temperature (°C)		28.64	29.07	30.04
11-Dec-23	Temperature (°C)		27.07	27.68	29.22
09-Oct-23	Turbidity (NTU)		0.81	5.36	11
23-Oct-23	Turbidity (NTU)		1.06	7.08	17.6
07-Nov-23	Turbidity (NTU)		2.76	7.31	14.9
11-Dec-23	Turbidity (NTU)		1.97	6.91	9.07
09-Oct-23	TSS (mg/L)	<50	<5	5.6	21.61
23-Oct-23	TSS (mg/L)	<50	<5	7.83	22.33
07-Nov-23	TSS (mg/L)	<50	12.63	10.2	16.48
11-Dec-23	TSS (mg/L)	<50	<5	<5	8.23
09-Oct-23	BOD ₅ (mg/L)	<30	<6	<6	<6
23-Oct-23	BOD ₅ (mg/L)	<30	<6	<6	<6
07-Nov-23	BOD ₅ (mg/L)	<30	6.96	11.22	<6
11-Dec-23	BOD ₅ (mg/L)	<30	6.54	6.24	6.54
09-Oct-23	COD (mg/L)	<125	<25	<25	42
23-Oct-23	COD (mg/L)	<125	<25	<25	53
07-Nov-23	COD (mg/L)	<125	<25	34.5	48
11-Dec-23	COD (mg/L)	<125	<25	<25	31
09-Oct-23	NH ₃ -N (mg/L)	<10.0	<2	11.4	9.0
23-Oct-23	NH ₃ -N (mg/L)	<10.0	<2	15.3	32.8
07-Nov-23	NH ₃ -N (mg/L)	<10.0	<2	15.2	23.6
11-Dec-23	NH ₃ -N (mg/L)	<10.0	<2	12.2	5.8
09-Oct-23	Total Nitrogen (mg/L)	<10.0	2.1	12.5	10.7
23-Oct-23	Total Nitrogen (mg/L)	<10.0	0.8	18.3	36.8

		Site Name	OSOV1	OSOV 2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameter (Unit)	Guideline in the CA			
07-Nov-23	Total Nitrogen (mg/L)	<10.0	0.7	16.3	25.1
11-Dec-23	Total Nitrogen (mg/L)	<10.0	0.9	15.6	7.4
09-Oct-23	Total Phosphorus (mg/L)	<2	1.3	1.2	5.3
23-Oct-23	Total Phosphorus (mg/L)	<2	1.07	1.6	3.2
07-Nov-23	Total Phosphorus (mg/L)	<2	2.56	1.2	7.4
11-Dec-23	Total Phosphorus (mg/L)	<2	1.61	1.3	5.3
09-Oct-23	Faecal Coliform (MPN/100 mL)	<400	1,600	0	0
23-Oct-23	Faecal Coliform (MPN/100 mL)	<400	540	0	0
07-Nov-23	Faecal Coliform (MPN/100 mL)	<400	2,200	3,500	23
11-Dec-23	Faecal Coliform (MPN/100 mL)	<400	49	0	0
09-Oct-23	Total coliform (MPN/100 mL)	<400	1,600	0	0
23-Oct-23	Total coliform (MPN/100 mL)	<400	1,700	0	0
07-Nov-23	Total coliform (MPN/100 mL)	<400	5,400	16,000	49
11-Dec-23	Total coliform (MPN/100 mL)	<400	540	0	0
09-Oct-23	Oil & Grease (mg/L)	<10.0	<1		
23-Oct-23	Oil & Grease (mg/L)	<10.0			
07-Nov-23	Oil & Grease (mg/L)	<10.0	<1	<1	<1
11-Dec-23	Oil & Grease (mg/L)	<10.0	<1	<1	<1
09-Oct-23	Residual Chlorine (mg/L)	<1.0	N/A	1.38	1.34
23-Oct-23	Residual Chlorine (mg/L)	<1.0	N/A	1.47	1.17
07-Nov-23	Residual Chlorine (mg/L)	<1.0		0.04	1.45
11-Dec-23	Residual Chlorine (mg/L)	<1.0	N/A	0.35	1.61

APPENDIX 5-3: COMMUNITY GROUNDWATER QUALITY MONITORING RESULTS – Q4 2023

Month Year	Parameter (Unit)	Site Name	Phouhomxay		Somseun	NamPa	ThongNoy	Pou Village	
		Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
		Guideline							
04-Oct-23	pH	6.5 - 9.2						6.65	6.46
23-Oct-23	pH	6.5 - 9.2	6.51	6.45	6.55		6.61		
13-Nov-23	pH	6.5 - 9.2						6.52	6.45
20-Nov-23	pH	6.5 - 9.2	6.56	6.55	6.46	6.59	6.77		
05-Dec-23	pH	6.5 - 9.2						6.6	6.68
15-Dec-23	pH	6.5 - 9.2	6.6	6.65	6.51	6.45	6.4		
04-Oct-23	Sat. DO (%)							90	89.8
23-Oct-23	Sat. DO (%)		57.6	31.7	91.2		77.5		
13-Nov-23	Sat. DO (%)							89.6	78.9
20-Nov-23	Sat. DO (%)		46	38.2	80.6	94.8	70.1		
05-Dec-23	Sat. DO (%)							81.9	82.5
15-Dec-23	Sat. DO (%)		36.7	25.3	56.8	50.1	63.4		
04-Oct-23	DO (mg/l)							7.09	7.13

Month Year	Parameter (Unit)	Site Name	Phouhomxay		Somseun	NamPa	ThongNoy	Pou Village	
		Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
		Guideline							
23-Oct-23	DO (mg/l)		4.65	2.58	7.18		6.14		
13-Nov-23	DO (mg/l)							7.31	6.34
20-Nov-23	DO (mg/l)		3.74	3.13	6.68	7.75	5.73		
05-Dec-23	DO (mg/l)							6.67	6.73
15-Dec-23	DO (mg/l)		2.99	4.27	4.56	4.03	5.04		
04-Oct-23	Conductivity (μ S/cm)							22	364
23-Oct-23	Conductivity (μ S/cm)		244	509	502		360		
13-Nov-23	Conductivity (μ S/cm)							23	282
20-Nov-23	Conductivity (μ S/cm)		259	512	501	492	401		
05-Dec-23	Conductivity (μ S/cm)							21	226
15-Dec-23	Conductivity (μ S/cm)		255	508	504	508	438		
04-Oct-23	Temperature (°C)							27.6	27.31
23-Oct-23	Temperature (°C)		26.47	25.9	27.62		27.38		
13-Nov-23	Temperature (°C)							25.82	26.46
20-Nov-23	Temperature (°C)		25.88	25.38	24.73	25.55	25.56		
05-Dec-23	Temperature (°C)							25.82	25.41
15-Dec-23	Temperature (°C)		25.93	25.62	26.91	26.19	27.02		
04-Oct-23	Turbidity (NTU)	<20						3.73	0.98
23-Oct-23	Turbidity (NTU)	<20	37.7	8.85	0.33		1.81		
13-Nov-23	Turbidity (NTU)	<20						3.77	0.61
20-Nov-23	Turbidity (NTU)	<20	8.45	9.9	0.37	0.48	0.97		
05-Dec-23	Turbidity (NTU)	<20						2.44	0.88
15-Dec-23	Turbidity (NTU)	<20	14.3	6.37	1.21	0.83	2.02		
04-Oct-23	Fecal coliform (MPN/100ml)	0						0	0
23-Oct-23	Fecal coliform (MPN/100ml)	0	0	0	4.5		13		
13-Nov-23	Fecal coliform (MPN/100ml)	0						7.8	0

Month Year	Parameter (Unit)	Site Name	Phouhomxay		Somseun	NamPa	ThongNoy	Pou Village	
		Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
		Guideline							
20-Nov-23	Fecal coliform (MPN/100ml)	0	0	4.5	0	0	240		
05-Dec-23	Fecal coliform (MPN/100ml)	0						0	2
15-Dec-23	Fecal coliform (MPN/100ml)	0	0	0	0	0	920		
04-Oct-23	E.coli Bacteria (MPN/100ml)	0						0	0
23-Oct-23	E.coli Bacteria (MPN/100ml)	0	0	0	2		4.5		
13-Nov-23	E.coli Bacteria (MPN/100ml)	0						0	0
20-Nov-23	E.coli Bacteria (MPN/100ml)	0	0	0	0	0	22		
05-Dec-23	E.coli Bacteria (MPN/100ml)	0						0	0
15-Dec-23	E.coli Bacteria (MPN/100ml)	0	0	0	0	0	130		

APPENDIX 5-4: GRAVITY FED WATER SUPPLY QUALITY MONITORING RESULTS – Q4 2023

		Site Name	Thaheua Village	Hat Gnuin Village	Phouhomxay Village	
		Station	WTHH02	WHGN02	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline				
23-Oct-23	pH	6.5 - 8.5	6.95	6.76	6.82	6.88
20-Nov-23	pH	6.5 - 8.5	7.01	6.81	6.6	6.68
15-Dec-23	pH	6.5 - 8.5	6.81		6.68	6.71
23-Oct-23	Sat. DO (%)		91.9	79.9	97.2	78
20-Nov-23	Sat. DO (%)		90.7	101.6	94.3	93.6
15-Dec-23	Sat. DO (%)		85.6		92.5	78
23-Oct-23	DO (mg/L)		7.24	6.34	7.51	6.05
20-Nov-23	DO (mg/L)		7.59	8.56	7.73	7.56
15-Dec-23	DO (mg/L)		7.06		7.58	6.48
23-Oct-23	Conductivity (µS/cm)	<1,000	47	91	10	10
20-Nov-23	Conductivity (µS/cm)	<1,000	55	76	10	10
15-Dec-23	Conductivity (µS/cm)	<1,000	61		13	14
23-Oct-23	Temperature (°C)	<35	27.56	27.35	28.75	29.07
20-Nov-23	Temperature (°C)	<35	24.3	24.01	25.51	26.23
15-Dec-23	Temperature (°C)	<35	25.1		25.4	24.72
23-Oct-23	Turbidity (NTU)	<10	4.52	2.91	1.18	2.65
20-Nov-23	Turbidity (NTU)	<10	2.64	2.16	1.42	1.32

		Site Name	Thaheua Village	Hat Gnuin Village	Phouhomxay Village	
			Station	WTHH02	WHGN02	WPHX02 WPHX03
Date	Parameter (Unit)	Guideline				
15-Dec-23	Turbidity (NTU)	<10		6.6		1.33 0.91
23-Oct-23	Faecal Coliform (MPN/100 mL)	0		350	170	110 49
20-Nov-23	Faecal Coliform (MPN/100 mL)	0		8	14	130 79
15-Dec-23	Faecal Coliform (MPN/100 mL)	0		2		540 70
23-Oct-23	E.coli Bacteria (MPN/100 mL)	0		130	110	27 22
20-Nov-23	E.coli Bacteria (MPN/100 mL)	0		2	4	22 17
15-Dec-23	E.coli Bacteria (MPN/100 mL)	0		0		110 17

APPENDIX 5-5: LANDFILL LEACHATE MONITORING RESULTS – Q4 2023

		Site Name	NNP1 Landfill Leachate			Houay Soup Landfill	
			Location	Pond No.03	Pond No.04	Discharge Point	Last pond Discharged Point
			Station	LL3	LL4	LL5	LL6 LL7
Date	Parameter (Unit)	Guideline					
9-Oct-23	pH	6.0-9.0			6.4		6.56
7-Nov-23	pH	6.0-9.0			7.11		7.05
9-Oct-23	Sat. DO (%)				115.9		132.4
7-Nov-23	Sat. DO (%)				113.9		122.7
9-Oct-23	DO (mg/L)				8.4		9.93
7-Nov-23	DO (mg/L)				8.09		8.85
9-Oct-23	Conductivity (µS/cm)				58		94
7-Nov-23	Conductivity (µS/cm)				80		109
9-Oct-23	Temperature (°C)				32.4		30.42
7-Nov-23	Temperature (°C)				33.71		32.93
9-Oct-23	Turbidity (NTU)				15.2		28.8
7-Nov-23	Turbidity (NTU)				14.8		15.3
9-Oct-23	BOD5 (mg/L)	<30			<6		<6
7-Nov-23	BOD5 (mg/L)	<30			10.39		10.54
9-Oct-23	COD (mg/L)	<125			<25		<25
7-Nov-23	COD (mg/L)	<125			43.5		26.2
9-Oct-23	Faecal Coliform (MPN/100mL)	<400			40		920

		Site Name	NNP1 Landfill Leachate			Houay Soup Landfill	
		Location	Pond No.03	Pond No.04	Discharge Point	Last pond	Discharged Point
		Station	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline					
7-Nov-23	Faecal Coliform (MPN/100mL)	<400		220		170	
9-Oct-23	Total Coliform (MPN/100mL)	<400		1,600		1,600	
7-Nov-23	Total Coliform (MPN/100mL)	<400		1,600		350	
9-Oct-23	Total Nitrogen (mg/L)	<10		0.84		0.75	
7-Nov-23	Total Nitrogen (mg/L)	<10		0.49		0.36	
9-Oct-23	Lead (mg/L)	<0.2		<0.01		<0.01	
7-Nov-23	Lead (mg/L)	<0.2		<0.01		<0.01	
9-Oct-23	Copper (mg/L)			<0.005		<0.005	
7-Nov-23	Copper (mg/L)			<0.005		<0.005	
9-Oct-23	Iron (mg/L)			0.453		1.35	
7-Nov-23	Iron (mg/L)			0.146		0.6	
9-Oct-23	Ammonia nitrogen (mg/L)	<10		<2		<2	
7-Nov-23	Ammonia nitrogen (mg/L)	<10		<2		<2	
9-Oct-23	Oil & Grease (mg/L)	<10		<1		<1	
7-Nov-23	Oil & Grease (mg/L)	<10		<1		<1	