



NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

April 2023

A	19 May 2023	Hendra WINASTU	Khamstone Xaysomphou	Wanidaporn RODE	Final
REV	DATE	AUTHOR	CHECKED	APPROVED	MODIFICATION DETAILS
<u>Accessibility</u>		<div>Document No.</div> <div>NNP1-O-J0904-RP-028-A</div>			
<input checked="" type="checkbox"/>	Public				
<input type="checkbox"/>	Internal				
<input type="checkbox"/>	Confidential				
This document is NNP1 property and shall not be used, reproduced, transmitted, and/or disclosed without prior permission					

TABLE OF CONTENTS

EXECUTIVE SUMMARY	5
1. ENVIRONMENTAL MANAGEMENT MONITORING	7
1.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)	7
1.2 COMPLIANCE MANAGEMENT	8
1.2.1 Site Inspection by the Environment Management Unit (EMU).....	8
1.2.2 Site Decommissioning and Rehabilitation.....	8
1.3 WATER QUALITY MONITORING	8
1.3.1 Effluent Discharge from Camps and Construction Sites.....	9
1.3.2 Ambient Surface Water and Reservoir Water Quality Monitoring	9
1.3.3 Groundwater Quality Monitoring	14
1.3.4 Gravity Fed Water Supply (GFWS) Quality Monitoring.....	15
1.3.5 Landfill Leachate Monitoring	16
1.4 DISCHARGE MONITORING.....	16
1.4.1 Main Reservoir – Water Level, Inflow and Discharge	16
1.4.2 Re-regulation Reservoir – Discharge	17
1.4.3 Nam Ngiep Downstream Water Depth Monitoring.....	18
1.5 PROJECT WASTE MANAGEMENT	18
1.5.1 Solid Waste Management.....	18
1.5.2 Hazardous Materials and Waste Management.....	19
1.6 COMMUNITY WASTE MANAGEMENT	20
1.6.1 Community Solid Waste Management and Recycling Programmes	20
2 WATERSHED AND BIODIVERSITY MANAGEMENT	20
2.1 WATERSHED MANAGEMENT	20
2.1.1 Implementation of Annual Implementation Plan (AIP).....	20
2.1.2 Preparation of Annual Implementation Plan (AIP) 2022	21
2.1.3 Preparation of Annual Implementation Plan (AIP) 2023	21
2.2 BIODIVERSITY OFFSET MANAGEMENT	21
2.2.1 Implementation of BOMP Annual Implementation Plan (AIP)	21
2.2.2 Preparation of Annual Implementation Plan (AIP) 2023	25
2.3 FISHERY MONITORING	25
3 EXTERNAL MISSIONS AND VISITS	30
ANNEX A: RESULTS OF WATER QUALITY MONITORING	32

TABLE OF TABLES

Table 1.1-1: The Details of EMPs 2023 implementation.	7
Table 1.3-1: Status of Corrective Actions for Non-Compliances at WWTs in April 2023	9
Table 1.3-2: Results of Surface Water Quality Monitoring for Dissolved Oxygen (mg/L) in the upper 0.2 m, National Water Quality Standard: >6.0 mg/L	13
Table 1.3-3: Results of Surface Water Quality Monitoring for Total Suspended Solids (mg/L)....	14
Table 1.3-4: Results of Surface Water Quality Monitoring for BOD₅ (mg/L) - Water Quality Standard: < 1.5 mg/L	14
Table 1.3-5: Groundwater Quality Monitoring Results in Phouhomxay, Somsuen, Nam Pa, ThongNoy and Pou Villages	15
Table 1.3-6: Results of the Gravity Fed Water Supply Quality Monitoring	16
Table 1.5-1: Amounts of Recyclable Waste Sold and collection in April 2023.....	18
Table 1.5-2: Record of Hazardous Material Inventory in April 2023.....	19
Table 1.5-3: Record of Hazardous Waste Inventory	19
Table 2.3-1: Fish Species dominating the Fish Catch in March 2023.....	25
Table 2.3-2: Threatened Species of March 2023 Fish Catch	25
Table 2.3-3: Main Biodiversity Indicators for March 2023	26
Table 2.3-4: Mean reported number of fishing days by fishing zone for the month of March from 2016 to 2023	27
Table 2.3-5: Mean Monthly Household Fish Catch for the month of March from 2016 to 2023..	28
Table 2.3-6: Mean Daily Fish Catch per Household for the month of March from 2016 to 2023.	29
Table 2.3-7: Proportion of the catch reported by main habitats (%) in March 2023	29
Table 2.3-8: Proportion of OAA to the total reported number of fish and OAA for the month of March from 2016 to 2023	30

TABLE OF FIGURES

Figure 1.3-1: Surface Water and Re-regulation Reservoir Water Quality Monitoring Stations ...	10
Figure 1.3-2: DO Depth Profiles Time Series in R05 (Since September 2018 to April 2023)	11
Figure 1.3-3: Concentration of Dissolved Oxygen (mg/L) in the upper 0.2 m since September 2019 to April 2023	13
Figure 1.3-4: Dissolved Oxygen (Mg/L) Long Profile in April 2023 (from Immediately Upper Main Dam to Lower Nam Ngiep River).....	13
Figure 1.4-1: Inflow for the Main Reservoir during January 2020 to April 2023.....	17
Figure 1.4-2: Water Level for the Main Reservoir during January 2020 to April 2023	17
Figure 1.4-3: Discharge Monitoring at the Re-regulation Dam in February to April 2023	18
Figure 2-1: Map of Threats Recorded by Patrolling Teams in March 2023	23
Figure 2-2: Representative photos for Monthly patrolling in March 2023	23
Figure 2-3: Representative photos of outreach implementation in Xaychamphone district from 2-7 April 2023.....	24
Figure 2.3-1: Proportion of total number of households actively fishing by fishing zone from July 2015 to March 2023	26
Figure 2.3-2: Mean of monthly fishing day from July 2015 to March 2023.....	27
Figure 2.3-3: Mean Monthly Household Fish Catch from July 2015 to March 2023	28
Figure 2.3-4: Mean Daily Fish Catch per Household from July 2015 to March 2023.....	29
Figure 2.3-5: Proportion of OAA to the total reported number of fish and OAA for a 7-day period by fishing zone from July 2015 to March 2023.....	30

EXECUTIVE SUMMARY

During April 2023, activities related to ISO14001:2015 implementation continued such as the implementation of the four (04) Environmental Management Plans (EMPs). The EMPs will be executed from April 2023 to March 2024 including 1) HSE awareness training for NNP1PC staff and contractors, 2) reducing the paper consumption in NNP1 offices, 3) minimizing the quantity of waste disposal at NNP1 project landfill, and 4) planting trees.

During this reporting period, no new document was submitted to the Environment Management Office (EMO) for review and approval.

The joint inspection involving EMO, ADM and TD was not carried out in April 2023 due to significant workloads for relevant staff over the Lao new year long holiday. However, the joint inspection will be rescheduled for May 2023 to follow up on the ongoing corrective actions from the previous findings regarding waste management, NNP1 landfill operation, hazardous material and waste management and wastewater treatment system operation and maintenance.

At R05 (in the Main Reservoir approx. 0.5 km upstream the Main Dam), the average DO concentration was 8.0 mg/L in the upper 13 m varying between 5.2 mg/L and 9.3 mg/L. Anoxic conditions (less than 0.5 mg/L) were found at depths from 34 m to the bottom during April 2023. At the water intake level, DO concentrations varied between 0.4 mg/L and 1.7 mg/L. In the Re-regulation Reservoir, the mean DO concentrations in the water column of the two monitoring stations were 2.6 mg/L and 2.7 mg/L respectively.

The DO measurements downstream the Re-regulation Dam during gate discharge was greater than 6 mg/L in all stations.

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. Water quality monitoring will be maintained, and the development of the situation in the reservoir and in the downstream area will be closely followed until a satisfactory situation has been reached. In this regard, it should be noted that since the Commercial Operation Date (COD) in September 2019 no dead fish have been observed in Nam Ngiep downstream the Re-regulation Dam.

A total of 9.04 m³ of solid waste was disposed of at the NNP1 Project Landfill, an increase of 0.4 m³ compared with March 2023. NNP1 EMO has been engaging with the Bolikhan District Environment Management Unit or EMU to discuss the process of transferring the management of the communities' solid waste and Houay Soup Landfill to the local authorities. However, the EMU later requested a postponement of the meeting and informed that an update on the matter will be provided after April 2023. It is expected that the handover will be completed in 2023.

NNP1PC transferred the funds for the first two quarters under the approved Bolikhamxay Annual Implementation Plan (AIP) 2023 to the Forest Protection Fund (FPF) office of Department of Forestry (DOF) – Ministry of Agriculture and Forestry (MAF) on 10 April 2023. FPF DOF-MAF requested the Bolikhamxay Watershed and Reservoir Protection Office (WRPO) to submit an official request for fund transfer from DOF-MAF to the Bolikhamxay WRPO account on 19 April 2023. The Bolikhamxay WRPO expects to receive the funds at the end of May 2023 after which they can start implementing their activities.

The Head of Xaysomboun WRPO was unable to organize a meeting in April 2023 to discuss the roles and responsibilities for the reservoir fishery co-management due Lao New Year holidays. A meeting was held on 27 April 2023, between the Head of Xaysomboun Province Agriculture and Forestry Office (PAFO) and the NNP1 to discuss the outstanding delays of Xaysomboun WRPO. The meeting agreed on the next steps and a timeline for the related actions. The Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS) led the Law Enforcement (LE) training that was organized from 3 to 7 April 2023 in the Xaysomboun PAFO office at Anouvong District. The NNP1 EMO team improved and shared the draft of Xaysomboun AIP2023 for BSP-WCS's review on 11 April 2023. After review, the plan will be communicated with Xaysomboun WRPO.

The Bolikhamxay Biodiversity Offset Management Unit (BOMU) informed the NNP1 EMO on 10 April 2023 that Bolikhamxay PAFO management have advised to progress with the approval of the Nam Chouane-Nam Xang (NC-NX) and its Totally Protected Zone (TPZ) boundary after completing updating the village land use plans. The NNP1 EMO requested BOMU to reconsider the advice to avoid further delays and new proposals from villagers to adjust the boundaries. BOMU conducted the outreach campaign in Xaychamphone and Viengthong District from 2 to 7 April 2023 and from 24 to 29 April 2023 respectively. BOMU could not continue with April 2023 patrolling because the budget under the approved AIP2023 is not ready yet and the remaining budget under the approved AIP2022 is not sufficient to carry out the full-scale patrolling. There is only safeguarding for the three patrol sub-stations that was scheduled from 18 April to 8 May 2023. The Head of Bolikhamxay PAFO approved the BOMU AIP2023 on 19 April 2023 and BOMU submitted it to the FPF DOF-MAF at the end of April 2023. The implementation of the activities under the approved AIP2023 will be delayed until May 2023.

NNP1 EMO submitted a brief report about the Financial Management Manual (FMM) as requested by FPF DOF-MAF on 15 March 2023 for approval. FPF DOF-MAF informed EMO on 27 April 2023 that they have submitted the FMM to the Director General of DOF-MAF for review. If there are no further comments then the FMM will be submitted to the Minister of MAF for endorsement.

The fish catch monitoring for March 2023 in Nam Ngiep Watershed was dominated by *Scaphiodonichthys acanthopterus*, *Oreochromis niloticus* and *Channa striata* and species groups of Hampala and Poropuntius. They are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species and *Oreochromis niloticus* is an exotic species. The recorded catch of threatened species includes two Vulnerable species (VU): *Scaphognathops bandanensis* and *Tor sinensis*.

1. ENVIRONMENTAL MANAGEMENT MONITORING

1.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

During April 2023, activities related to ISO14001:2015 implementation continued such as the implementation of the four (04) Environmental Management Plans (EMPs). The EMPs will be executed from April 2023 to March 2024 including 1) HSE awareness training for NNP1PC staff and contractors, 2) reducing the paper consumption in NNP1 offices, 3) minimizing the quantity of waste disposal at NNP1 project landfill, and 4) planting tree. The details of EMPs 2023 implementation are shown in **Table 1.1-1**.

Table 1.1-1: The Details of EMPs 2023 implementation.

EMP No.	Description	KPI	Implementation Period	Implementation Result
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	May 2023 – March 2024	The EMP evaluation is scheduled for Oct 2023 and 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	April 2023 – March 2024	The EMP evaluation is scheduled for Oct and December 2023 and March 2024
03/2023*	Reducing the quantity of waste disposal at NNP1 Project Landfill	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	April 2023 – March 2024	The EMP evaluation is scheduled for September 2023 and March 2024
04/2023#	Planting tree	Percentage of plant survival, the potential plantation fields in contributing to the environmentally sustainability objectives (refer to Tree Planting Plan)	June 2023 – March 2024	The EMP evaluation is scheduled for February 2024

*EMP implemented in 2022 will continue in 2023 for further success

New EMP suggested by the external ISO Auditor (SGS)

1.2 COMPLIANCE MANAGEMENT

The joint inspection involving EMO, ADM and TD was not carried out in April 2023 due to significant workloads for relevant staff over the Lao new year long holiday. However, the joint inspection will be rescheduled for May 2023 to follow up on the ongoing corrective actions from the previous findings regarding waste management, NNP1 landfill operation, hazardous material and waste management and wastewater treatment system operation and maintenance.

1.2.1 Site Inspection by the Environment Management Unit (EMU)

On 04 April 2023, EMO received the final site visit report for December 2022 from the EMUs of Hom and Thathom district, Xaysomboun Province. The report documented findings and provided recommendations as follows:

- A livelihood development program is being carried out in Vanghai Village, Thathom District and Homthad and Houayxay villages, which includes livestock raising, vegetable gardening, technical training and support for other livelihood development activities. However, some villagers in Hom District and outsiders have encroached on land within the NNP1 watershed. Xaysomboun PONRE will report the incident to the Xaysomboun provincial administration and management for their consideration and advice on law enforcement actions to be taken. The report also recommends that NNP1PC should arrange a meeting with the relevant parties from two provinces and four districts to discuss watershed management.
- NNP1PC should provide the survey reports on aquatic species, wildlife and the fishery management plan to the EMUs of Xaysomboun PONRE, Hom and Thathom districts.
- NNP1PC should evaluate the livelihood restoration results for self-resettlers to determine if their livelihoods have improved.
- MONRE, as the key government counterpart for NNP1 project management, should request NNP1PC to disburse monitoring funds to the EMUs in a timely manner.
- NNP1PC's Social Management Team should continue evaluating the livelihood development of villagers in Thathom District to ensure long-term effectiveness and sustainability.
- NNP1PC's Social Management Team should increase their efforts on the provision of technical support in conjunction with the livelihood development program.

The report has been circulated to relevant NNP1 divisions for them to take action according to the recommendations. The next EMU mission is scheduled for Q3 2023. There was no site visit by the EMU of Bolikhan District, Bolikhamxay Province, it is expected that their site visit will be in Q4 2023 after receiving the monitoring funds from MONRE.

1.2.2 Site Decommissioning and Rehabilitation

During April 2023, all 31 rehabilitated areas were inspected, and no site disturbances were identified. The assessment of the vegetation cover will continue during the rainy season of 2023.

1.3 WATER QUALITY MONITORING

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD₅), Faecal Coliform Bacteria, Total Coliform Bacteria and *E.coli* have been carried out by NNP1PC's environmental laboratory since August 2017.

All data are reported to the Ministry of Natural Resources and Environment (MONRE) monthly, and quarterly to the ADB. The reports are also published on the Company's website at <https://namngiep1.com/resources/monitoring-reports/>.

1.3.1 Effluent Discharge from Camps and Construction Sites

Detailed monitoring results are provided in the *Error! Reference source not found.* of this Report. The status of implementation of the corrective actions addressing non-compliances at the camps and key project facilities are summarized in **Table 1.3-1**

Table 1.3-1: Status of Corrective Actions for Non-Compliances at WWTs in April 2023

Site	Sampling ID	Status	Corrective Actions
OSOV1	EF01	Non-compliance for total coliform and fecal coliform (1 out of 2 samplings).	EMO, ADM and TD did not conduct a monthly joint inspection in April. However, the previous inspection in March covered the operation and maintenance of the WWTs: 1) Closely monitor the residual chlorine content and chlorination dosage adjustment for the effluents of OSOV2 and the Main Powerhouse WWTs.; 2) Closely monitor the Influent to compare with the effluent for the specific parameters to check the treatment effectiveness (stopped in Q4 of 2022). 3) The maintenance work for the constructed wetland system of OSOV1 is currently underway, including 1) weeding and replacing plants in wetland ponds and 2) fixing perimeter fence to prevent cattle intrusion. The next monthly joint inspection is scheduled in middle of May 2023.
OSOV2	EF13	Non-compliance for total coliform and fecal coliform (1 out of 2 samplings), total nitrogen and ammonia-nitrogen.	
Main Powerhouse	EF19	Non-compliance for total coliform (1 out of 2 samplings), total nitrogen, total phosphorus and ammonia-nitrogen.	

1.3.2 Ambient Surface Water and Reservoir Water Quality Monitoring

The ambient surface water quality monitoring programme comprises five monitoring stations in the main reservoir (R01-R05), two stations in the Re-regulation Reservoir (R06 and R07), five stations in the mainstream Nam Ngiep (NNG01 and NNG05 to NNG08) and four stations in the main tributaries to Nam Ngiep (Nam Chiane [NCH01], Nam Phouan [NPH01], Nam Xao [NXA01] and Nam Houay Soup [NHS01]).

Weekly depth profile monitoring (pH, DO, conductivity and temperature) has been undertaken since 18 September 2018 for stations located in the Re-regulation reservoir and the main reservoir. The locations of the monitoring stations are shown in **Figure 1.3-1**.

The monitoring results for key parameters (DO, TSS and BOD₅) during April 2023 are presented in **Table 1.3-2**, **Table 1.3-3** and **Table 1.3-4**. The full set of data for April 2023 is attached in Annex A. In addition, the DO depth profile timeseries for R05 are shown in **Figure 1.3-2**, and the results for DO timeseries are presented as line graphs in **Figure 1.3-3** and DO Long Profile graphs **Figure 1.3-4**.

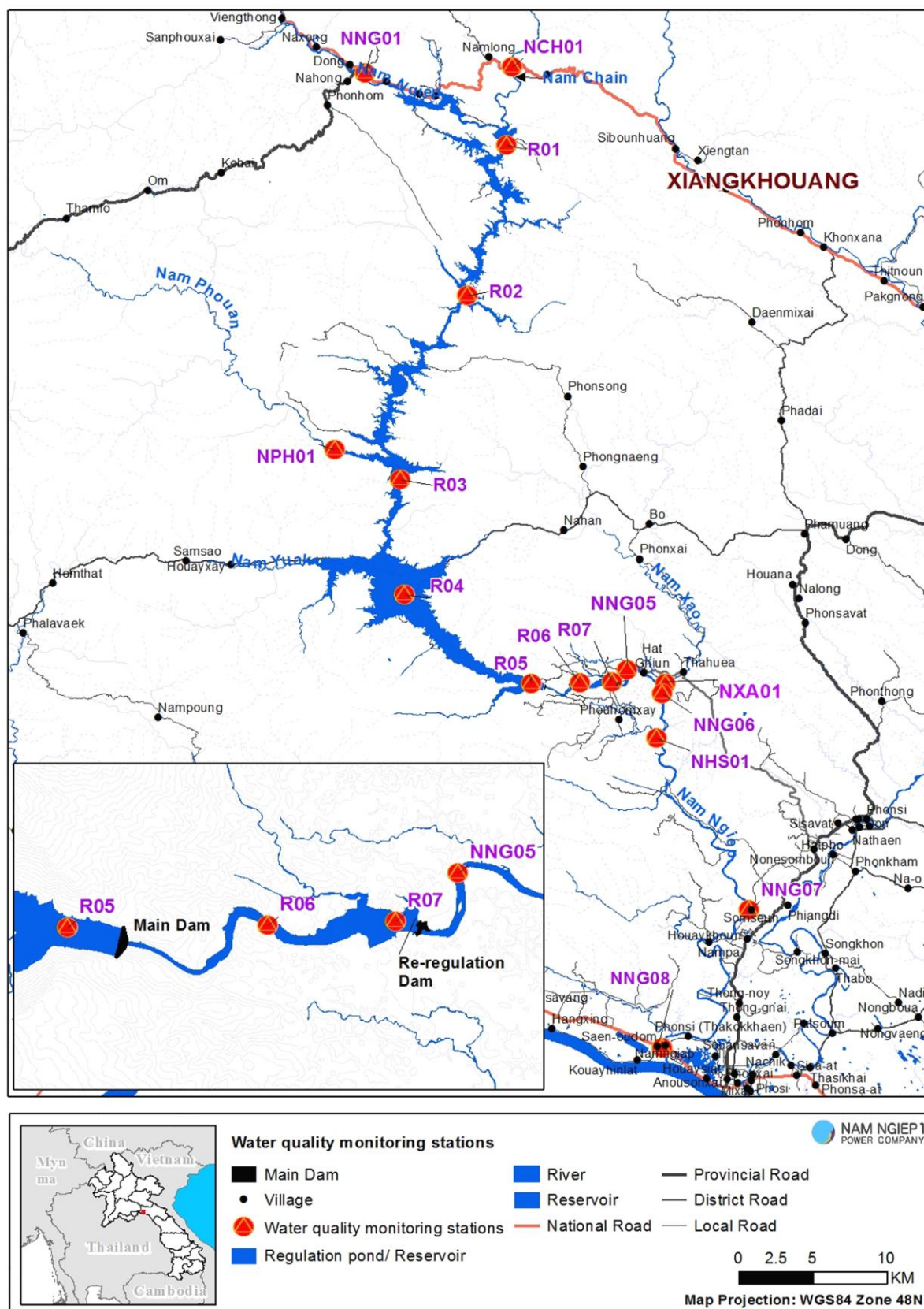


Figure 1.3-1: Surface Water and Re-regulation Reservoir Water Quality Monitoring Stations

Main Reservoir

During April 2023, the water level in the main reservoir decreased from El. 310.76 m asl to El. 305.26 m asl.

At R05 (in the Main Reservoir approx. 0.5 km upstream the Main Dam), the average DO concentration was 8.0 mg/L in the upper 13 m varying between 5.2 mg/L and 9.3 mg/L. Over the month the depth to the oxycline gradually decreased from a depth of 18 m on 05 April 2023 to 7.5 m on 26 April 2023. Anoxic conditions (less than 0.5 mg/L) were found at depths from 34 m to the bottom during April 2023. At the water intake level, DO concentrations varied between 0.4 mg/L and 1.7 mg/L.

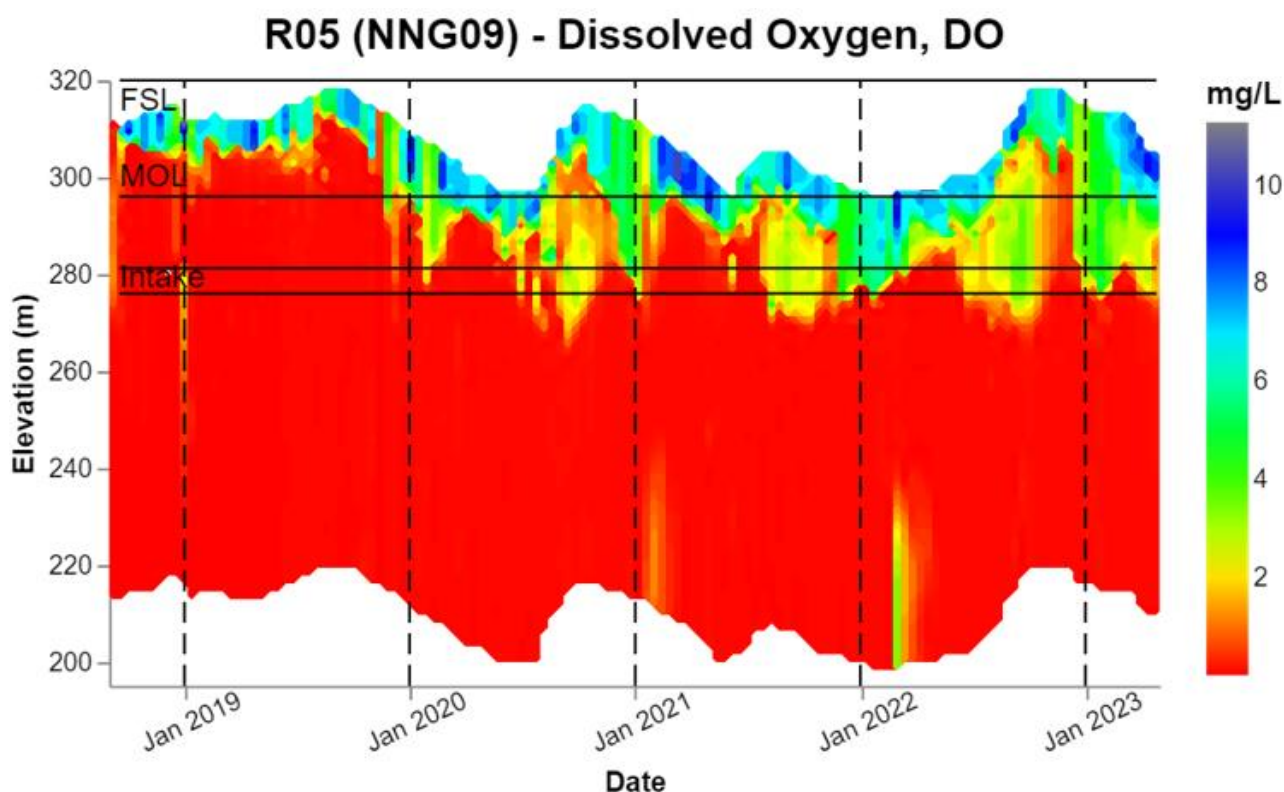


Figure 1.3-2: DO Depth Profiles Time Series in R05 (Since September 2018 to April 2023)

At R04, the average DO concentration was 8.3 mg/L in the upper 8.5 m varying between 5.0 mg/L and 9.3 mg/L. From 9.0 m to 32 m, DO concentration varied between 0.13 mg/L and 7.1 mg/L with an average of 2.2 mg/L. The oxycline were found at depths of 6.5 m (05 April 2023), 11 m (11 April 2023) and 7.0 m (26 April 2023). Anoxic conditions (less than 0.5 mg/L) were found at depths between 12 m – 22 m (on 26 April 2023) and at depths from 32 m - 34 m to the bottom during April 2023.

At R03, the average DO concentration was 7.8 mg/L in the upper 7.0 m varying between 5.7 mg/L and 8.8 mg/L. An oxycline was found at depths between 6.0 m and 7.0 m. From 7.5 m to bottom, DO concentration varied between 0.1 mg/L and 4.78 mg/L with an average of 0.85 mg/L. Anoxic conditions (less than 0.5 mg/L) were found at depths between 12 m – 19 m and at depths from 26 m – 30 m to the bottom during April 2023.

At R02, the average DO concentration was 8.1 mg/L in the upper 4.0 m varying between 6.1 mg/L and 9.0 mg/L. Oxycines were found at depths between 3.5 m and 4.0 m. The anoxic condition occurred at the bottom on 04 April 2023. From 4.5 m to the bottom, DO concentrations varied between 0.1 mg/L and 5.1 mg/L with an average of 2.4 mg/L.

At R01, the DO levels in the water column varied between 6.4 mg/L and 7.6 mg/L with an average of 6.9 mg/L.

As expected, the TSS concentrations in the main reservoir have been consistently low since the start of impounding with a mean of 5 mg/L compared with the high flow season means of about 100 – 250 mg/L and low flow season means of 20 mg/L - 50 mg/L prior to impounding.

The BOD₅ measurements in both epilimnion and hypolimnion at R01, R03, R04 and R05 were less than 1.0 mg/L.

Re-regulation Reservoir

In April 2023, the turbine discharges from the Main Powerhouse varied between 67 and 249 m³/s usually interrupted by night-time periods with no discharge.

The mean DO concentrations in the water column of the two monitoring stations were 2.6 mg/L and 2.7 mg/L in R06 and R07 respectively.

The BOD₅ concentrations in both R06 and R07 were less than 1.0 mg/L.

Nam Ngiep Downstream

During April 2023, the monthly downstream water quality monitoring was carried out during a period with gate discharge from the Re-regulation Dam. Due to the reaeration generated by the gate discharge, the DO concentrations were greater than 6 mg/L in all stations, thus, complying with the surface water quality standard.

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. Water quality monitoring will be maintained, and the development of the situation in the reservoir and in the downstream area will be closely followed. In this regard, it should be noted that since the Commercial Operation Date (COD) in September 2019 no dead fish have been observed in Nam Ngiep downstream the re-regulation dam.

The BOD₅ in the downstream stations were less than 1 mg/L and complied with the national surface water quality standard.

Main Tributaries to Nam Ngiep

The monitored parameters in the Nam Chiane (NCH01), Nam Xao (NXA01), Nam Phouan (NPH01) and Nam Houaysoup (NHS01) complied with the standards, except ammonia-nitrogen in Nam Phouan (NPH01).

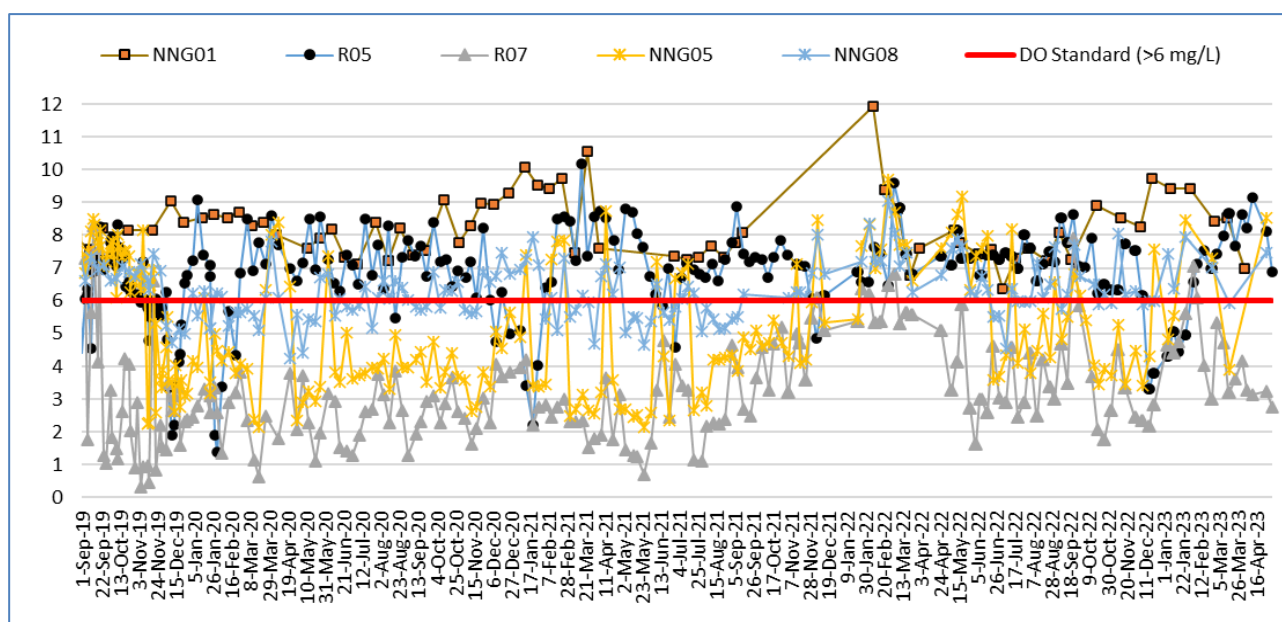


Figure 1.3-3: Concentration of Dissolved Oxygen (mg/L) in the upper 0.2 m since September 2019 to April 2023

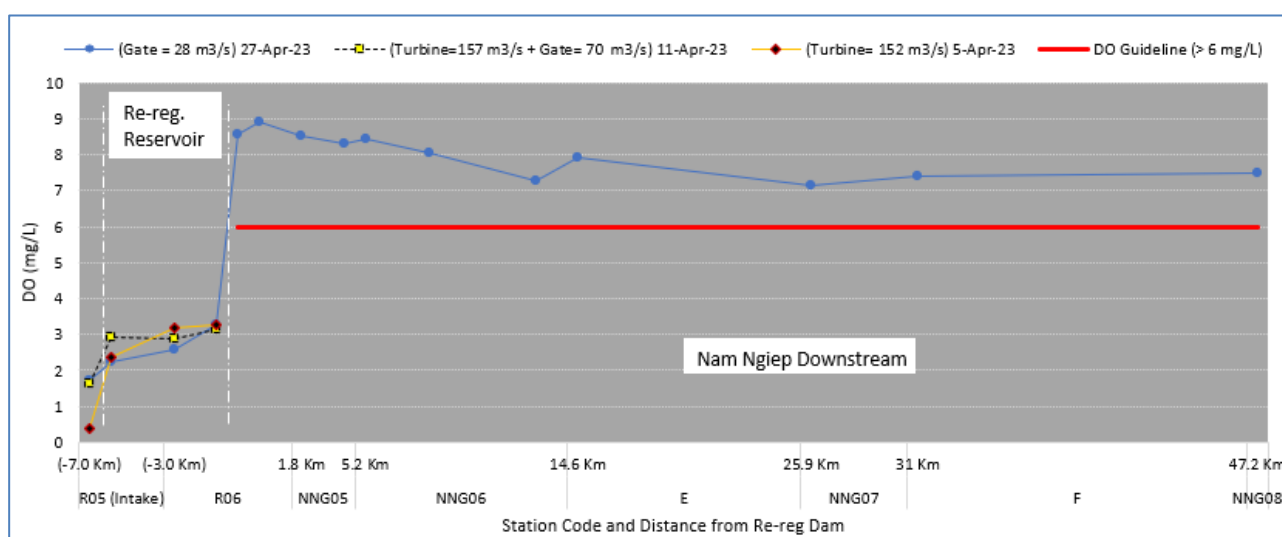


Figure 1.3-4: Dissolved Oxygen (Mg/L) Long Profile in April 2023 (from Immediately Upper Main Dam to Lower Nam Ngiep River)

Table 1.3-2: Results of Surface Water Quality Monitoring for Dissolved Oxygen (mg/L) in the upper 0.2 m, National Water Quality Standard: >6.0 mg/L

DO (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
2-Apr-23	6.97												9.22			
4-Apr-23		7.14	8	7.59										7.47		
5-Apr-23					8.32	8.22	3.2	3.27								
10-Apr-23		7.46	8.88	8.76												

DO (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
11-Apr-23					9.1	9.14	2.9	3.13								
26-Apr-23					7.94	8.11	2.57	3.26								
27-Apr-23									8.53	8.42	7.14	7.47			6.1	6.05

Table 1.3-3: Results of Surface Water Quality Monitoring for Total Suspended Solids (mg/L)

Total Suspended Solids (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
2-Apr-23	<5												<5			
4-Apr-23		9.8		<5										37.45		
5-Apr-23					<5	<5	<5	<5								
7-Apr-23									<5	<5	<5	8.93			<5	9.6

Table 1.3-4: Results of Surface Water Quality Monitoring for BOD₅ (mg/L) - Water Quality Standard: < 1.5 mg/L

BOD ₅ (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
2-Apr-23	<1												<1			
4-Apr-23		<1		<1										<1		
5-Apr-23					<1	<1	<1	<1								
7-Apr-23									<1	<1	<1	<1			<1	<1

1.3.3 Groundwater Quality Monitoring

During April 2023, community groundwater quality analyses were carried out for seven wells located in Somseun Village, Nam Pa Village, Thong Noy Village, Pou Village and Phouhomxay Village. The community groundwater samples were taken from household water taps.

The results indicate that:

- All parameters monitored from the two wells in Phouhomxay Village complied with the Standards, except for pH in GPHX01.
- The well in Nam Pa Village fully complied with the Standards.
- The well in Thong Noy and Somsuen Villages did not comply with the Standard for faecal coliform and *E. Coli* bacteria (however, at very low concentrations)
- All monitored parameters from the two wells in Pou Village complied with the Standards.

The community groundwater quality monitoring results are presented in **Table 1.3-5**.

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. The villagers generally use tap water for washing and cleaning. They were informed about the monitoring results and recommended to carry out the operation and maintenance improvement as well as were encouraged to boil water before drinking.

Table 1.3-5: Groundwater Quality Monitoring Results in Phouhomxay, Somsuen, Nam Pa, ThongNoy and Pou Villages

	Site Name	Phouhomxay		Somseun Village	NamPa Village	ThongNoy Village	Pou Village	
Parameter (Unit)	Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
	Guideline	26-Apr-23	26-Apr-23	25-Apr-23	25-Apr-23	25-Apr-23	02-Apr-23	02-Apr-23
pH	6.5 - 9.2	6.48	6.52	6.6	6.77	6.89	6.62	6.77
Sat. DO (%)		48.5	24.5	90.8	98	79.6	82.6	89.5
DO (mg/l)		3.95	2	7.02	7.65	6.1	6.56	7.34
Conductivity (µS/cm)		361	503	419	460	468	31	430
Temperature (°C)		26.29	25.93	28.4	27.94	29.31	27.23	25.2
Turbidity (NTU)	<20	0.59	1	2.2	0.36	1.21	4.98	0.6
Faecal coliform (MPN/100ml)	0	0	0	2	0	79	0	0
<i>E.coli</i> Bacteria (MPN/100ml)	0	0	0	2	0	14	0	0

1.3.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

The concentration of Faecal Coliform and *E.coli* did not comply with the standards in the water supply of Thaheua Village (WTHH02) and Hat Gnuin Village (WHGN02). There is no water sampling carried out for Phouhomxay Village (WPHX02 – Primary School Water Tap and WPHX03 – Household Water Tap) due to the system maintenance performed during the mission.

As observed in the field during water sampling, livestock are roaming around in the water intake areas which may contribute to the presence of Faecal Coliform Bacteria and *E.coli* in GFWS samples. The villagers were advised to boil water before drinking in accordance with the Law as mentioned in **1.3.3** as well as recommended to carry out the operation and maintenance improvement.

Table 1.3-6: Results of the Gravity Fed Water Supply Quality Monitoring

	Site Name	Thaheua Village	Hat Gnuin Village	Phouhomxay Village	
	Station	WTHH02	WHGN02	WPHX02	WPHX03
Parameter (Unit)	Guideline	25-Apr-23	25-Apr-23	26-Apr-23	26-Apr-23
pH	6.5 - 8.5	6.81	6.58	The water supply system was under maintenance during the sampling date. Therefore, no sampling was carried out.	
Sat. DO (%)		97.2	95.3		
DO (mg/L)		7.45	7.12		
Conductivity ($\mu\text{S}/\text{cm}$)	<1,000	86	148		
Temperature ($^{\circ}\text{C}$)	<35	28.9	30.57		
Turbidity (NTU)	<10	7.68	1.68		
Faecal Coliform (MPN/100 mL)	0	27	240		
<i>E.coli</i> Bacteria (MPN/100 mL)	0	79	350		

1.3.5 Landfill Leachate Monitoring

During April 2023, the landfill leachate monitoring was not conducted at NNP1 Project Landfill (Last pond - LL4) and at Houay Soup Solid Waste Landfill (Last pond - LL6) because the leachate in the treatment ponds became disconnected from each other in the dry season.

1.4 DISCHARGE MONITORING

1.4.1 Main Reservoir – Water Level, Inflow and Discharge

The water level in the main reservoir, inflow to the reservoir and discharge from the reservoir have been monitored since the start of the impounding on 15 May 2018. The graph in **Figure 1.4-1** and **Figure 1.4-2** presents the values recorded since January 2020.

During April 2023, the mean inflow to the main reservoir was $56 \text{ m}^3/\text{s}$. The minimum and maximum inflows were $37 \text{ m}^3/\text{s}$ (on 17 April 2023) and $72 \text{ m}^3/\text{s}$ (on 19 April 2023) respectively.

In April 2023, the water level in the main reservoir decreased from El. 310.76 m asl to El. 305.26 m asl.

During April 2023, the hourly turbine discharges from the Main Powerhouse varied between $67 \text{ m}^3/\text{s}$ and $249 \text{ m}^3/\text{s}$ usually interrupted by night-time periods with no discharge.

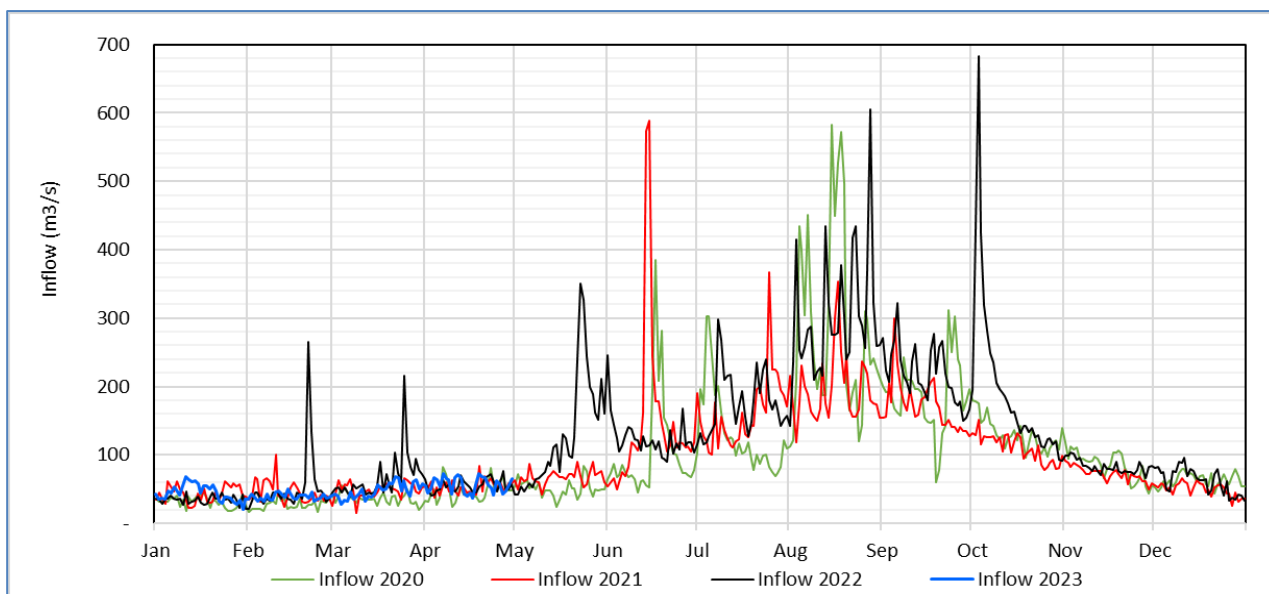


Figure 1.4-1: Inflow for the Main Reservoir during January 2020 to April 2023

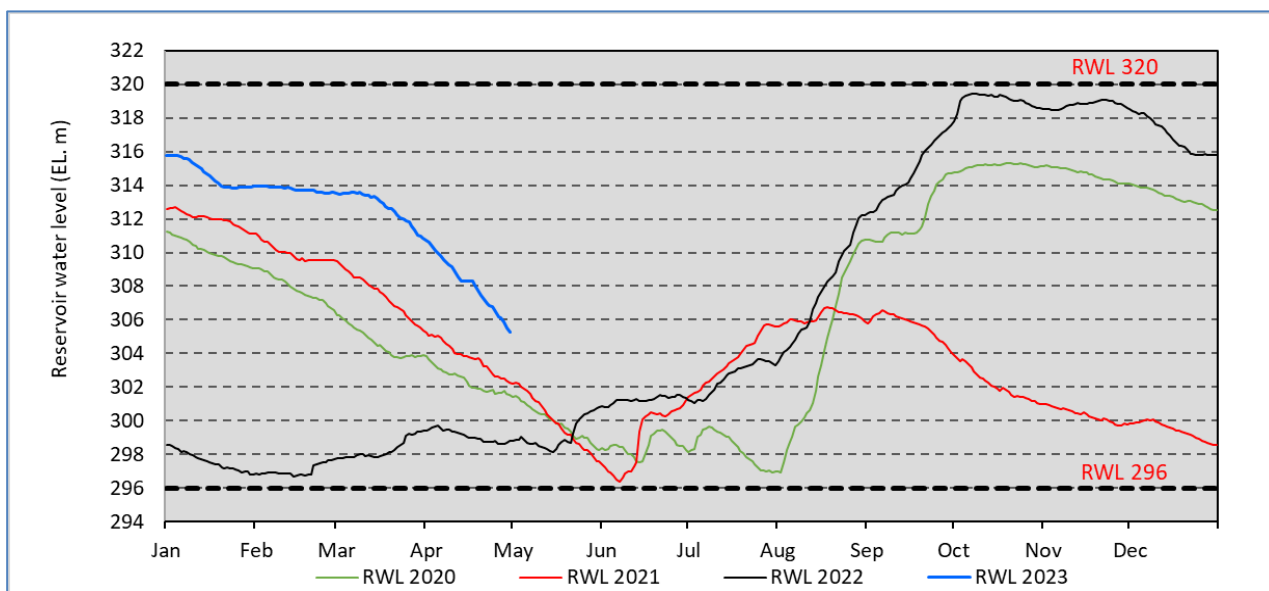


Figure 1.4-2: Water Level for the Main Reservoir during January 2020 to April 2023

1.4.2 Re-regulation Reservoir – Discharge

The daily discharge monitoring data for the Re-regulation Dam during February to April 2023 is presented in **Figure 1.4-3**.

During April 2023, the mean daily discharge from the Re-regulation Dam was about 149 m³/s, with hourly gate discharge varying between 27 m³/s and 160 m³/s, and hourly turbine discharge varying between 48 m³/s and 162 m³/s. The total discharges (combined gate and turbine discharge) varied between 81 m³/s and 245 m³/s. The hourly discharge was kept above the minimum flow requirement of 27 m³/s at all times.

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.

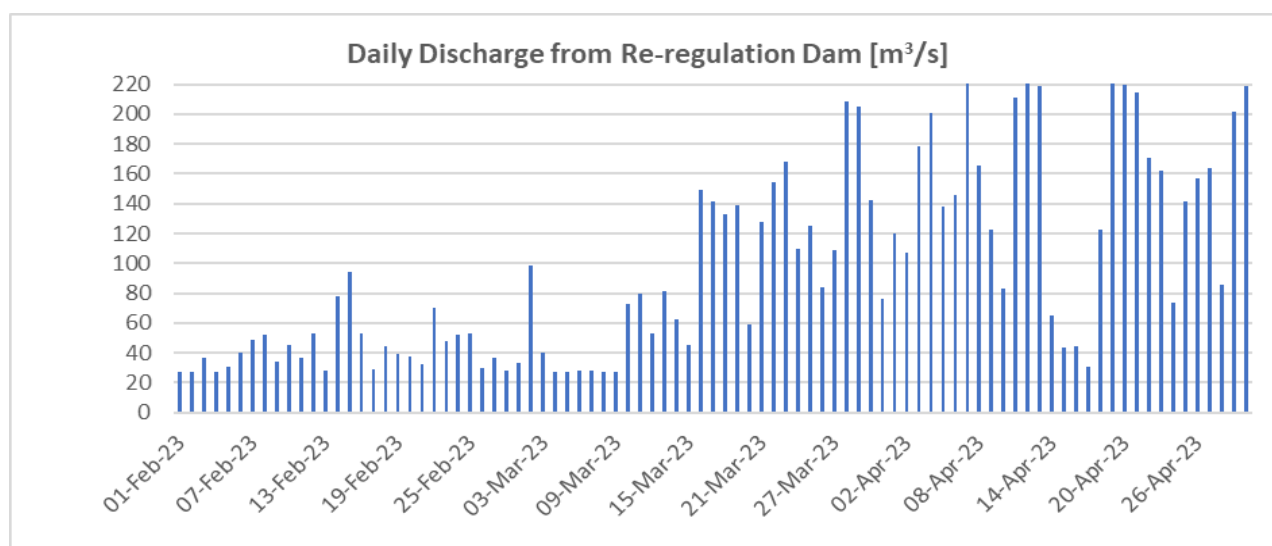


Figure 1.4-3: Discharge Monitoring at the Re-regulation Dam in February to April 2023

1.4.3 Nam Ngiep Downstream Water Depth Monitoring

In April 2023, EMO carried out a monthly boat mission to monitor the water depth in the Nam Ngiep downstream of the Re-regulation Dam. A total of 19 sites have been identified with potential shallow water depths. The thalweg water depth was less than 0.5 m at three sites (located 1.5 Km and 5.6 Km from the Re-regulation Dam) during the discharge of 28 m³/s on 27 April 2023, but the team encounter no difficulties with boat navigation.

1.5 PROJECT WASTE MANAGEMENT

1.5.1 Solid Waste Management

A total of 9.04 m³ of solid waste was disposed of at the NNP1 Project Landfill, an increase of 0.4 m³ compared with February 2023. The Contractor continued the regular waste collection from the NNP1PC's operation sites and operated the project landfill for three days per week. The work includes waste segregation and disposal, grass cutting and repairing of the perimeter fences. ADM has made an arrangement with the local contractor (PKCC) for waste compaction. However, the contractor's machinery is currently being maintained and is planned to be carried out in May 2023 shortly before the start of the wet season.

The total amount of recyclable waste sold and collected this month is summarized in **Table 1.5-1**.

Table 1.5-1: Amounts of Recyclable Waste Sold and collection in April 2023

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by April 2023
1	Plastic bottles	kg	45	24
2	Aluminium can	kg	0	0
3	Paper/Cardboard	kg	23	64
4	Glass	kg	57	30
5	Scrap Metal	Kg	0	0
Total		kg	125	118

In April 2023, the villagers from Phouhomxay Village collected a total of 499 kg of food waste from the OSOV1 canteen for feeding their animals.

1.5.2 Hazardous Materials and Waste Management

The types and amounts of hazardous materials and hazardous waste stored on site in April 2023 are shown in **Table 1.5-2** and **Table 1.5-3** respectively.

Table 1.5-2: Record of Hazardous Material Inventory in April 2023

No.	Type of Hazardous Material	Unit	Total in April 2023(A)	Used (B)	Remaining at the end of April 2023 (A – B)
1	Diesel	Litre	6,987	4,567	2420
2	Gasoline	Litre	1,075	386	689
3	Lubricant (Turbine oil)	Litre	91	0	91
4	Colour Paint	Litre	39	0	39
5	Thinner	Litre	1	0	1
6	Grease Oil	Litre	785	0	785
7	Gear Oil	Litre	17,25	0	17,25
8	Chlorine Liquid	Litre	18	0	18
09	HA Cut AF	Litre	3,925	0	3,925.0
10	HA Cut Cat AF	Litre	372.5	0	372.5

Table 1.5-3: Record of Hazardous Waste Inventory

No.	Hazardous Waste Type	Unit	Total in April 2023 (A)	Disposed (B)	Remaining at the end of April 2023 (A - B)
1	Used Oil (Hydraulic + Engine)	Litre	335.3	0	335.3
2	Empty used oil drum/container (drum 200L)	Unit	53	0	53
3	Contaminated soil, sawdust and textile material	m ³	0.8	0	0.8
4	Used tyre	Drum	5	0	5
5	Empty used chemical drum/container (drum 20L)	Unit	6	0	6
6	Lead acid batteries	Unit	6	0	6
7	Empty paint and spray cans	Unit	33	0	33
8	Halogen/fluorescent bulbs	kg	338	0	338
9	Empty cartridge (Ink)	Unit	91	0	91
10	Clinic Waste	Kg	0	0	0
11	Expired Chlorine Powder	Kg	65	0	65

1.6 COMMUNITY WASTE MANAGEMENT

1.6.1 Community Solid Waste Management and Recycling Programmes

NNP1 EMO has recently contacted the Bolikhan District Environment Management Unit or EMU in April 2023 to initiate discussion regarding the transfer of the communities' general waste collection and the Houay Soup Landfill operation to the local authorities. The has EMU confirmed that they will be available for a discussion meeting in a near future.

2 WATERSHED AND BIODIVERSITY MANAGEMENT

2.1 WATERSHED MANAGEMENT

2.1.1 Implementation of Annual Implementation Plan (AIP)

2.1.1.1 Xaysomboun Watershed and Reservoir Protection Office (WRPO)

The progress of the actions that were discussed and agreed in the previous monthly meetings as well as the follow up discussions are summarized below:

- From 3 to 6 April 2023, the training of SMART and new Standard Operating Procedures for Xaysomboun Patrolling Teams was held, attended by 10 representatives from Xaysomboun WRPO/Provincial Agriculture and Forestry Office (PAFO), 4 representatives from Thathom District Agriculture and Forestry Office (DAFO), 4 representatives from Hom DAFO, 1 provincial military and 2 district military staff, 4 people from BSP-WCS, and 1 person from NNP1 EMO. EMO observed the involvement of Hom District military staffs in the training, who were not part of the designated patrol team. The EMO team plans to discuss this matter with the Head of Xaysomboun PAFO.
- During the training, the member of Xaysomboun WRPO informed the NNP1 EMO team that three companies are exploring quartz at Ban Nam Pong which is situated in the vicinity and within the NNP1 Totally Protected Zone 2 (TPZ2). One member of XSB WRPO visited the exploration activity in February 2023 and one staff of Xaysomboun PAFO participated in the installation of the signages along the exploration area on 6 April 2023. As of the end of April 2023, there are no further updates on the mining activities. The NNP1 EMO will continue to follow-up with the Hom District Energy and Mines office about the situation as well as any updates related with Nam Phouan HPP.
- The Head of Xaysomboun WRPO informed NNP1 EMO that a meeting on the roles and responsibilities of the NNP1 reservoir fishery management still could not be organized due to Lao New Year holiday and his leave.
- A meeting was held on 27 April 2023, between the Head of Xaysomboun Province Agriculture and Forestry Office (PAFO) and the NNP1 to address the outstanding delays of Xaysomboun WRPO. The meeting agreed on the next steps and a timeline for the related actions.

2.1.1.2 Bolikhamxay Watershed and Reservoir Protection Office (WRPO)

In April 2023, the forest and reservoir patrolling were not conducted due to delays in fund transfer from the Forest Protection Fund (FPF) office of Department of Forestry (DOF) - Ministry of Agriculture and Forestry (MAF) to Bolikhamxay WRPO under the approved AIP2023. In addition, the Bolikhamxay WRPO still could not fix the broken boat engine. The monthly meeting was also cancelled due to the Lao New Year holiday, the unavailability of the Head of Bolikhamxay WRPO and some of the patrol members.

NNP1PC EMO

There was no activity implemented under the NNP1 EMO watershed livelihood program this month because of the Lao New Year holiday and the team's engagement with other assignments including the Law Enforcement (LE) training for Xaysomboun WRPO, the review of Xaysomboun AIP2023, follow-up on the outstanding issues with the Xaysomboun WRPO, follow-up on mining and hydropower project development in the NNP1 TPZ area, and the fishery survey in the NNP1 watershed.

NNP1 EMO, the NNP1 fishery monitoring expert (Dr. Kotelat), the NNP1 fishery survey consultant (FISHBIO), and BSP-WCS collaborated on the NNP1 No Net Loss (NNL) biological monitoring program, conducting the fishery survey in the NNP1 watershed and NC-NX offset site. The survey included a total of 15 sampling sites in the NNP1 watershed and 10 sampling sites in NC-NX. The survey was carried out from 24 April to 3 May 2023 in the NNP1 watershed.

2.1.2 Preparation of Annual Implementation Plan (AIP) 2022

2.1.2.1 Xaysomboun WRPO

The fund transfer for the approved AIP2022 is delayed despite close follow-up with FPF DOF-MAF.

2.1.3 Preparation of Annual Implementation Plan (AIP) 2023

2.1.3.1 Xaysomboun WRPO

NNP1 EMO, Xaysomboun WRPO, and BSP-WCS planned to discuss the revised plan after the Law Enforcement (LE) training in the first week of April 2023, but the Head of Xaysomboun WRPO was on leave. EMO finalized the plan based on the 2023 timeline, future utilization of the AIP2022 fund, and the pending activities since 2020. The activity budget will be further revised if there are no actions until May 2023. The NNP1 EMO shared the revised version of the plan with BSP-WCS for review and confirmation on 11 April 2023. The BSP-WCS team provided their review on 21 April 2023 and proposed an immediate follow-up with the Xaysomboun WRPO. The discussion is expected to be organized in the first week of May 2023.

2.1.3.2 Bolikhamxay WRPO

NNP1PC transferred the fund for the two quarters of 2023 of the approved Bolikhamxay AIP2023 totalling 529,527,000 LAK to FPF DOF-MAF on 10 April 2023. The Bolikhamxay WRPO expects to receive the funds at the end of May 2023 after which they can start implementing their activities.

2.2 BIODIVERSITY OFFSET MANAGEMENT

2.2.1 Implementation of BOMP Annual Implementation Plan (AIP)

The progress on the implementation of key activities by Component in April 2023 is described below:

a. Component 1 - Spatial Planning and Regulation

The Bolikhamxay Biodiversity Offset Management Unit (BOMU) informed the NNP1 EMO on 10 April 2023 that Bolikhamxay PAFO management have advised to progress with the approval of the Nam Chouane-Nam Xang (NC-NX) and its Totally Protected Zone (TPZ) boundary after completing updating the village land use plans. The NNP1 EMO requested BOMU to reconsider the advice to avoid further delays and possible new proposals from villagers to adjust the boundaries. The

training for the Participatory Land Use Planning (PLUP) updating was organized from 24-16 April 2023. The PLUP updating started on 27 April 2023 and it is expected to be completed in May 2023.

b. Component 2 – Law Enforcement

BOMU could not continue with April 2023 patrolling because the budget under the approved AIP2023 is not ready yet and the remaining budget under the approved AIP2022 is not sufficient to carry out the full-scale patrolling. There is only safeguarding of the three patrol sub-stations as scheduled from 18 April to 8 May 2023.

The results of patrolling activity in March 2023 are as follows:

Team	Patrolling Area/distance	Observations/Actions Taken
1	Safeguarding at Nam Xi temporary sub-station and carried out the forest patrolling in the nearby areas (Nam Xi, Houay Pong and Houay Xay Gnai) (14 days covering a distance of 158 km on forest patrolling)	The team discovered and destroyed an old hunting camp at a southern tributary of Nam Xi.
2	TPZ highest priority area including Nam San and some of its tributaries (16 days covering a distance of 64 km on forest patrolling)	No threats observed and recorded.
3	TPZ high priority area including Nam Ma, Nam Pang, Nam Sa Nga and some mountain ridges (15 days covering a distance of 70 km on forest patrolling)	The team discovered and destroyed a total of 5 fishing camps along Nam Ma. Three camps are old camps, one camp is new, and one camp is very recent.
4	TPZ highest priority area including Nam Sone, Nam Chang and some mountain ridges (16 days covering a distance of 78 km on forest patrolling)	The team discovered and destroyed an old fishing camp at Nam Chouan.

Figure 2-1: Map of Threats Recorded by Patrolling Teams in March 2023

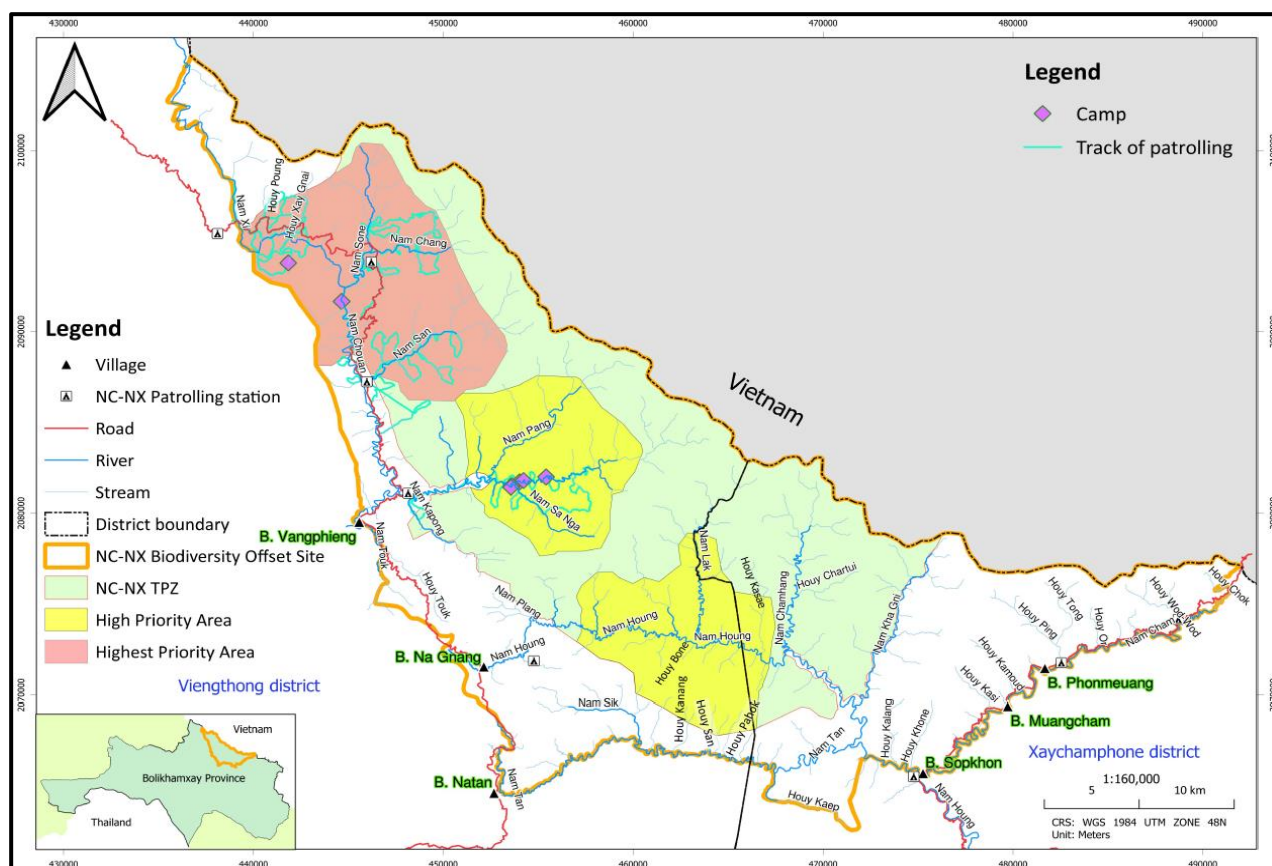


Figure 2-2: Representative photos for Monthly patrolling in March 2023



c. Component 3 – Conservation Outreach

BOMU conducted the outreach campaign for the community, schools, and military in Xaychamphone and Viengthong District from 2 to 7 April 2023 and from 24 to 29 April 2023 respectively.

Figure 2-3: Representative photos of outreach implementation in Xaychamphone district from 2-7 April 2023



d. Component 4 – Conservation linked livelihood development

The April 2023 monthly snare removal was scheduled from 25 April - 9 May 2023. The target areas are Nam Chang and Nam Sone. However, BOMU informed NNP1 EMO on 27 April 2023 that the activity is postponed to the first week of May 2023 because some of the snare removal team members are not ready yet.

2.2.2 Preparation of Annual Implementation Plan (AIP) 2023

The Head of Bolikhamxay PAFO approved the BOMU AIP2023 on 19 April 2023 and BOMU submitted it to the PPF DOF-MAF at the end of April 2023. All the activities under the approved AIP2023 will be delayed until May 2023.

PPF DOF-MAF informed EMO on 27 April 2023 that they have submitted the FMM to the Director General of DOF-MAF for review. If there are no further comments then the FMM will be submitted to the Minister of MAF for endorsement.

2.3 FISHERY MONITORING

The fishery monitoring is based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey of the month by covering the upstream, upper reservoir, lower reservoir, downstream and Mekong areas.

The fish species dominating the fish catch by weight in March 2023 as listed in **Table 2.3-1**. All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species¹.

Table 2.3-1: Fish Species dominating the Fish Catch in March 2023

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Hampala dispar</i> , <i>Hampala macrolepidota</i>	ປາສຸດ	240.5	LC
<i>Poropuntius normani</i> , <i>Poropuntius laoensis</i> , <i>Poropuntius carinatus</i>	ປາຈາດ	216.6	LC
<i>Scaphiodonichthys acanthopterus</i>	ປາມ້ອມ	136.9	LC
<i>Oreochromis niloticus</i>	ປານິນ	118.7	LC
<i>Channa striata</i>	ປາຄໍ້	62.5	LC

The recorded catch of Threatened species (IUCN Red List classification) in March 2023 are presented in **Table 2.3-2**. The list includes two species that are classified as Vulnerable species (VU).

Table 2.3-2: Threatened Species of March 2023 Fish Catch

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປຽນ	21.8	VU
<i>Tor sinensis</i>	ປາແດງ	35.3	VU

Species abundance and occurrence is based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey in March 2023. The catch is divided in three areas including above the main

¹ 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.

dam, below the main dam and Mekong area. Main biodiversity indicators in March 2023 for above dam, below dam and Mekong area are presented in **Table 2.3-3**.

Table 2.3-3: Main Biodiversity Indicators for March 2023

Biodiversity Indicators	Mekong	Below dam	Above dam
Total number of species and groups recorded	19	35	36
Single species	15	24	22
Species groups	4	11	14
Top 15 species (% total catch weight)	97.27%	82.37%	91.18%
Proportion for species groups	10.92%	47.22%	53.91%
Diversity index (Shannon)	2.2947	2.9754	2.3900

Figure 2.3-1 shows the proportion of total number of households actively fishing by fishing zone including upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK). It ranges between 33% and 70% of active fishing households for all fishing zones in March 2023.

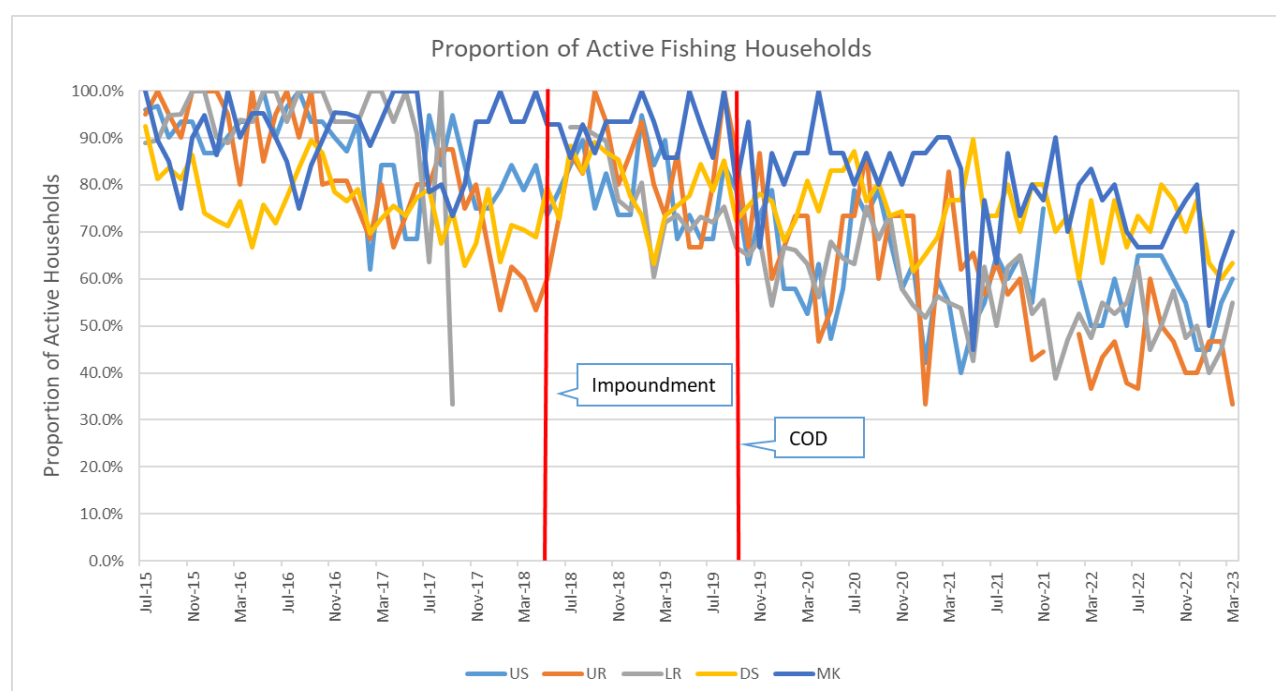


Figure 2.3-1: Proportion of total number of households actively fishing by fishing zone from July 2015 to March 2023

Note: Proportion of Active Fishing Households = (Active Fishing Households/Total Interviewed Households) x 100%.

Figure 2.3-2 shows the average (mean) of monthly household fishing days from July 2015 to March 2023 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area.

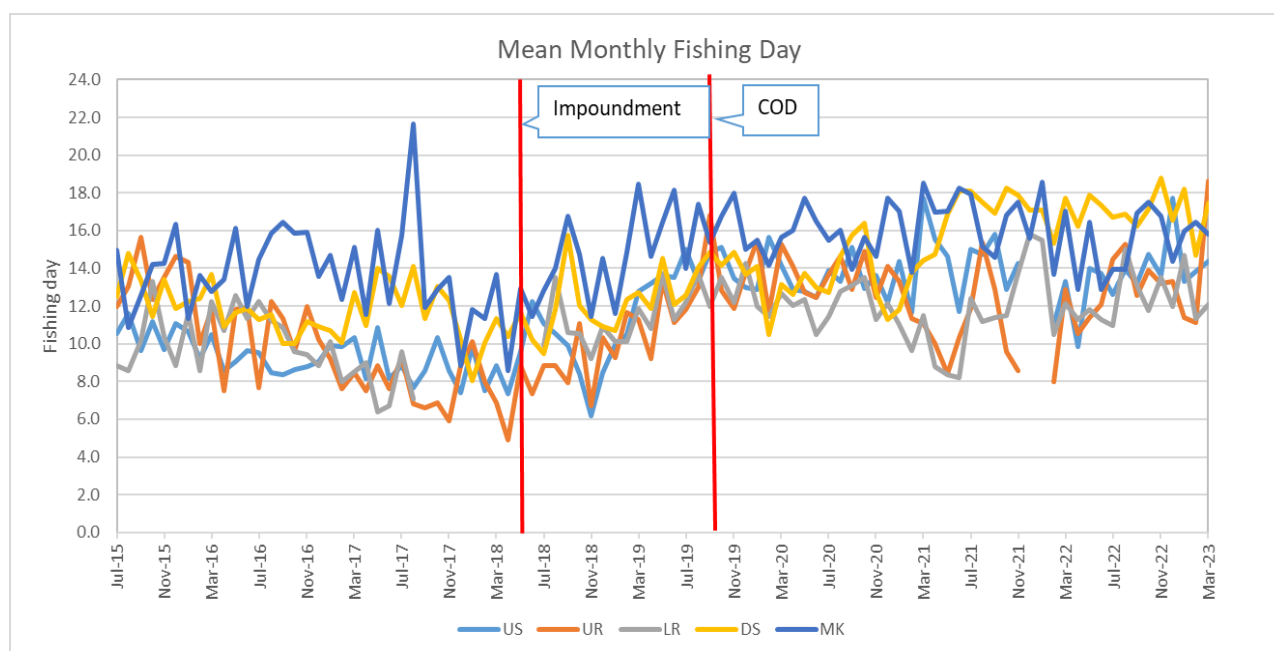


Figure 2.3-2: Mean of monthly fishing day from July 2015 to March 2023

The mean monthly number of fishing days for the month of March from 2016 to 2023 for the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in **Table 2.3-4**.

Table 2.3-4: Mean reported number of fishing days by fishing zone for the month of March from 2016 to 2023

Fishing Zone	March 2016 (day)	March 2017 (day)	March 2018 (day)	March 2019 (day)	March 2020 (day)	March 2021 (day)	March 2022 (day)	March 2023 (day)
Upstream	10.47	10.33	8.86	12.76	14.17	17.71	13.29	14.39
Upper reservoir	11.81	8.45	6.89	11.27	15.30	11.07	12.88	18.60
Lower reservoir	12.26	8.54	0.00	11.88	12.67	11.47	12.12	12.08
Downstream	13.65	12.73	11.32	12.75	13.17	14.44	17.71	17.48
Mekong	12.76	15.13	13.65	18.45	15.67	18.53	17.01	15.82

The mean monthly household fish catch from July 2015 to March 2023 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area are presented in **Figure 2.3-3**.

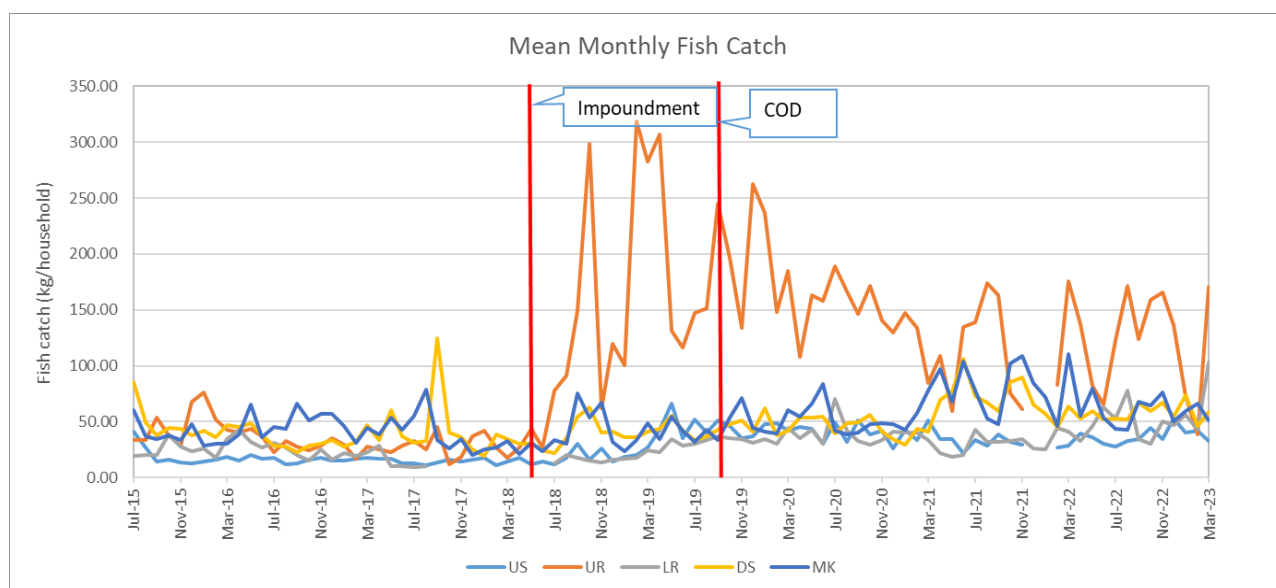


Figure 2.3-3: Mean Monthly Household Fish Catch from July 2015 to March 2023

The mean household fish catch for the month of March from 2016 to 2023 in the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in **Table 2.3-5**.

Table 2.3-5: Mean Monthly Household Fish Catch for the month of March from 2016 to 2023

Fishing Zone	March 2016 (kg)	March 2017 (kg)	March 2018 (kg)	March 2019 (kg)	March 2020 (kg)	March 2021 (kg)	March 2022 (kg)	March 2023 (kg)
Upstream	18.20	18.05	14.17	27.17	41.63	51.45	28.65	32.81
Upper reservoir	42.54	28.02	17.81	282.74	184.63	84.20	175.41	170.37
Lower reservoir	34.37	22.55	0.00	24.80	44.25	33.60	41.14	102.60
Downstream	47.07	46.91	34.84	41.23	42.11	41.30	63.52	58.69
Mekong	30.17	44.62	33.14	48.27	60.67	77.68	110.29	50.99

The mean daily fish catch per household from July 2015 to March 2023 are displayed in **Figure 2.3-4** and the mean fish catch per household per fishing day for the month of March from 2016 to 2023 are shown in **Table 2.3-6**.

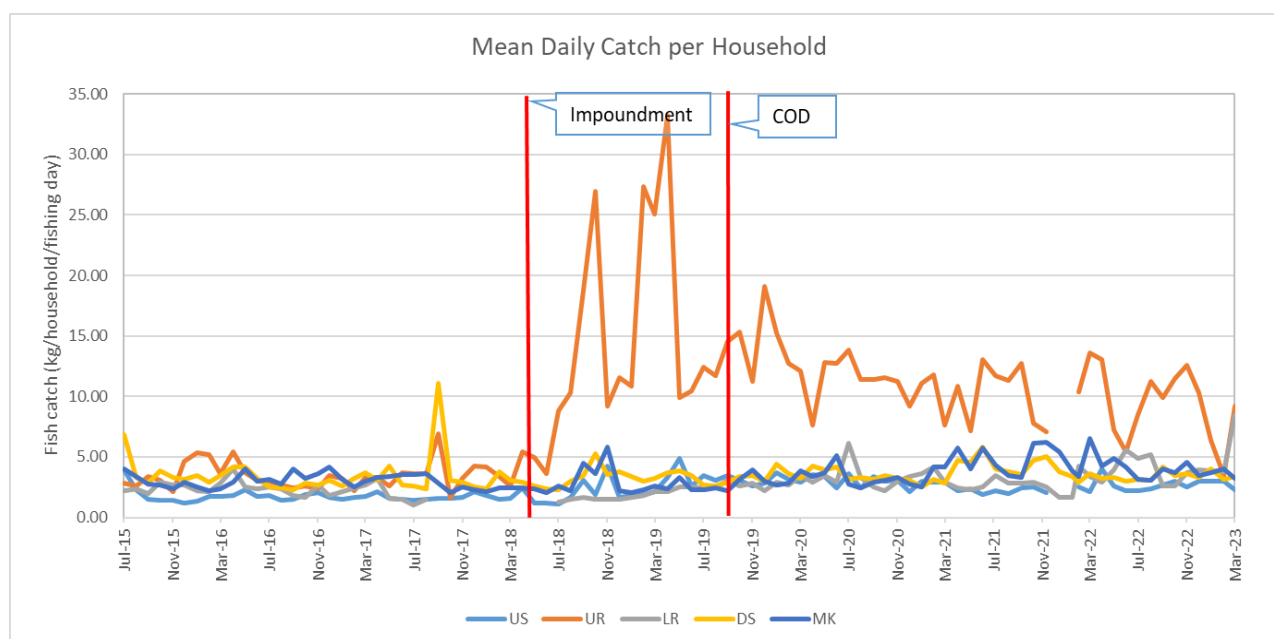


Figure 2.3-4: Mean Daily Fish Catch per Household from July 2015 to March 2023

Table 2.3-6: Mean Daily Fish Catch per Household for the month of March from 2016 to 2023

Fishing Zone	March 2016 (kg)	March 2017 (kg)	March 2018 (kg)	March 2019 (kg)	March 2020 (kg)	March 2021 (kg)	March 2022 (kg)	March 2023 (kg)
Upstream	1.74	1.75	1.60	2.13	2.94	2.90	2.16	2.28
Upper reservoir	3.60	3.31	2.59	25.08	12.07	7.61	13.62	9.16
Lower reservoir	2.80	2.64	0.00	2.09	3.49	2.93	3.39	8.50
Downstream	3.45	3.68	3.08	3.23	3.20	2.86	3.59	3.36
Mekong	2.36	2.95	2.43	2.62	3.87	4.19	6.49	3.22

The survey results in March 2023 indicate that Nam Ngiep is the main fishing habitat for the upstream and downstream zone, while the main fishing habitat for the upper reservoir, lower reservoir and Mekong zones are reservoir, tributaries and streams and Mekong respectively. The proportion of fishing habitats in March 2023 are displayed in **Table 2.3-7**.

Table 2.3-7: Proportion of the catch reported by main habitats (%) in March 2023

Habitats	US	UR	LR	DS	MK
Mekong	0.0%	0.0%	0.0%	0.8%	90.9%
Nam Ngiep	68.7%	14.3%	0.0%	55.6%	1.2%
Nam Xan	0.0%	0.0%	0.0%	0.0%	0.0%
Reservoir	0.0%	85.7%	19.0%	0.0%	0.0%

Habitats	US	UR	LR	DS	MK
Tributaries and streams	31.3%	0.0%	80.3%	41.8%	0.0%
Wetlands	0.0%	0.0%	0.6%	0.0%	7.9%
Others	0.0%	0.0%	0.0%	1.8%	0.0%

Total proportion of other aquatic animals (OAA) in the total reported catch of fish and OAA for the same 7-day period from July 2015 to March 2023 are presented in **Figure 2.3-5** and the proportion of OAA catch for the month of March from 2016 to 2023 are shown in **Table 2.3-8**.

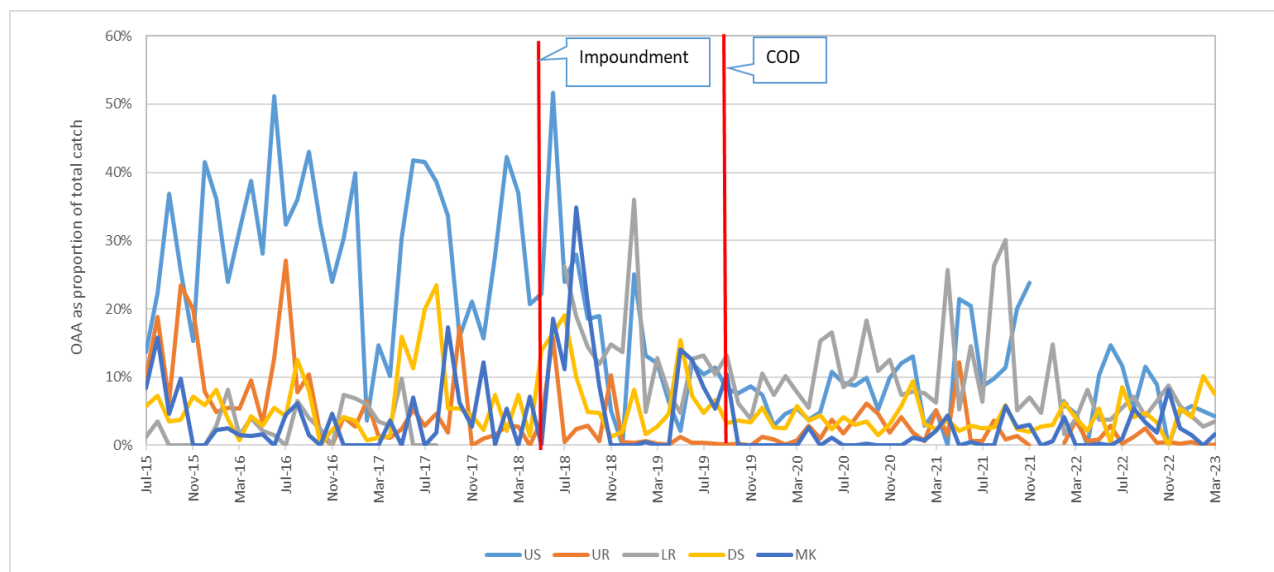


Figure 2.3-5: Proportion of OAA to the total reported number of fish and OAA for a 7-day period by fishing zone from July 2015 to March 2023

Table 2.3-8: Proportion of OAA to the total reported number of fish and OAA for the month of March from 2016 to 2023

Fishing Zone	March 2016	March 2017	March 2018	March 2019	March 2020	March 2021	March 2022	March 2023
Upstream	31.41%	14.66%	36.98%	11.98%	5.43%	5.19%	4.57%	4.31%
Upper reservoir	5.38%	1.42%	2.69%	0.28%	0.74%	5.08%	3.68%	0.13%
Lower reservoir	1.46%	3.52%	0.00%	12.80%	7.77%	6.29%	3.81%	3.50%
Downstream	0.78%	1.13%	7.37%	2.72%	5.72%	2.37%	3.96%	7.56%
Mekong	1.53%	0.00%	0.00%	0.00%	0.00%	2.07%	0.00%	1.63%

3 EXTERNAL MISSIONS AND VISITS

There was no external mission and visit during the month of reporting.

ANNEXES

ANNEX A: RESULTS OF WATER QUALITY MONITORING

TABLE A-1: RESULTS OF MAIN RESERVOIR, RE-REGULATION RESERVOIR AND SURFACE WATER (NAM NGIEP RIVER, NAM PHOUAN, NAM CHIAN AND NAM XAO) QUALITY MONITORING

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
2-Apr-23	pH	5.0 - 9.0	6.92											7.1				
4-Apr-23	pH	5.0 - 9.0		6.72	6.64	6.55									6.95			
5-Apr-23	pH	5.0 - 9.0					6.6	6.73	6.6	6.5								
7-Apr-23	pH	5.0 - 9.0									6.63	6.69	6.78	6.89		7.05	6.5	
10-Apr-23	pH	5.0 - 9.0		7.02	6.8	6.6												
11-Apr-23	pH	5.0 - 9.0					6.68	6.75	6.85	8.94								
26-Apr-23	pH	5.0 - 9.0					6.76	6.8	6.8	6.93								
27-Apr-23	pH	5.0 - 9.0									6.83	6.9	7.08	7.16		7.26	7.1	
2-Apr-23	Sat. DO (%)		82.4											112.2				
4-Apr-23	Sat. DO (%)			92.9	103.7	97.7									93.1			
5-Apr-23	Sat. DO (%)						105.6	103.4	37.5	39								
7-Apr-23	Sat. DO (%)										68.3	62.1	71.5	79		87.3	66.9	
10-Apr-23	Sat. DO (%)			96	115.9	113.1												
11-Apr-23	Sat. DO (%)						117	116.9	34.1	36.9								
26-Apr-23	Sat. DO (%)						103.9	104.7	29.8	39.1								
27-Apr-23	Sat. DO (%)										102.1	101.2	86.4	91.3		79.7	74.8	
2-Apr-23	DO (mg/L)	>6.0	6.97											9.22				
4-Apr-23	DO (mg/L)	>6.0		7.14	8	7.59									7.47			
5-Apr-23	DO (mg/L)	>6.0					8.32	8.22	3.2	3.27								
10-Apr-23	DO (mg/L)	>6.0		7.46	8.88	8.76												
11-Apr-23	DO (mg/L)	>6.0					9.1	9.14	2.9	3.13								
26-Apr-23	DO (mg/L)	>6.0					7.94	8.11	2.57	3.26								
27-Apr-23	DO (mg/L)	>6.0									8.53	8.42	7.14	7.47		6.1	6.05	

		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					Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA01
Date	Parameters (Unit)	Guideline															
2-Apr-23	Conductivity (µs/cm)		108											77			
4-Apr-23	Conductivity (µs/cm)			98	98	83									82		
5-Apr-23	Conductivity (µs/cm)						82	81	88	89							
7-Apr-23	Conductivity (µs/cm)									89	90	89	88			208	29
10-Apr-23	Conductivity (µs/cm)			95	95	84											
11-Apr-23	Conductivity (µs/cm)						82	81	87	88							
26-Apr-23	Conductivity (µs/cm)						82	81	88	87							
27-Apr-23	Conductivity (µs/cm)									86	89	89	87			198	80
2-Apr-23	Temperature (°C)		24.22											25.28			
4-Apr-23	Temperature (°C)			28.98	28.77	28.45									26.44		
5-Apr-23	Temperature (°C)						27.65	27.14	23.39	24.25							
7-Apr-23	Temperature (°C)										24.24	23.99	24.04	24.63		28.23	25.19
10-Apr-23	Temperature (°C)			28.95	29.27	28.62											
11-Apr-23	Temperature (°C)						28.28	28.1	23.46	23.89							
26-Apr-23	Temperature (°C)						29.27	28.52	23.58	24.24							
27-Apr-23	Temperature (°C)										24.2	24.52	24.98	25.53		29.27	26.4
2-Apr-23	Turbidity (NTU)		2.52											1.77			
4-Apr-23	Turbidity (NTU)			8.67	2.59	2.97									4.67		
5-Apr-23	Turbidity (NTU)						2.98	1.07	2.08	1.96							
7-Apr-23	Turbidity (NTU)										2	2.24	3.09	8.12		4.49	9.61
10-Apr-23	Turbidity (NTU)			5.7	3.47	1.85											
11-Apr-23	Turbidity (NTU)						1.78	1.32	1.59	1.84							
26-Apr-23	Turbidity (NTU)						2.64	1.42	1.21	1.31							
27-Apr-23	Turbidity (NTU)										1.6	1.8	2.18	5.59		3.13	3.95
2-Apr-23	TSS (mg/L)		<5											<5			
4-Apr-23	TSS (mg/L)			9.8		<5									37.45		
5-Apr-23	TSS (mg/L)						<5	<5	<5	<5							

Date	Parameters (Unit)	River Name	Nam Ngiep											Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites											Location Refer to Construction Sites			
			Upstream/Main Reservoir					Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
Station Code		NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA01	NHS01
Guideline																	
7-Apr-23	TSS (mg/L)									<5	<5	<5	8.93			<5	9.6
2-Apr-23	BOD ₅ (mg/L)	<1.5	<1											<1			
4-Apr-23	BOD ₅ (mg/L)	<1.5		<1	<1										<1		
5-Apr-23	BOD ₅ (mg/L)	<1.5				<1	<1	<1	<1								
7-Apr-23	BOD ₅ (mg/L)	<1.5								<1	<1	<1	<1			<1	<1
2-Apr-23	COD (mg/L)	<5.0	<5											<5			
4-Apr-23	COD (mg/L)	<5.0													<5		
5-Apr-23	COD (mg/L)	<5.0						<5	<5								
7-Apr-23	COD (mg/L)	<5.0								<5	<5	<5	<5			<5	<5
2-Apr-23	NH ₃ -N (mg/L)	<0.2	<0.2											<0.2			
4-Apr-23	NH ₃ -N (mg/L)	<0.2		0.2	<0.2										0.2		
5-Apr-23	NH ₃ -N (mg/L)	<0.2				<0.2	<0.2										
2-Apr-23	NO ₃ -N (mg/L)	<5.0	<0.02											<0.02			
4-Apr-23	NO ₃ -N (mg/L)	<5.0		<0.02	<0.02										<0.02		
5-Apr-23	NO ₃ -N (mg/L)	<5.0				<0.02	<0.02										
2-Apr-23	Faecal coliform (MPN/100 mL)	<1,000	33											22			
4-Apr-23	Faecal coliform (MPN/100 mL)	<1,000													5		
7-Apr-23	Faecal coliform (MPN/100 mL)	<1,000								11	8	79	130			110	33
2-Apr-23	Total Coliform (MPN/100 mL)	<5,000	170											79			
4-Apr-23	Total Coliform (MPN/100 mL)	<5,000													14		
7-Apr-23	Total Coliform (MPN/100 mL)	<5,000								27	14	170	220			170	39
2-Apr-23	TKN		<1.5											<1.5			
4-Apr-23	TKN			<1.5	<1.5										<1.5		

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
5-Apr-23	TKN					<1.5	<1.5											
2-Apr-23	TOC (mg/L)		1.43											1.02				
4-Apr-23	TOC (mg/L)														2.04			
5-Apr-23	TOC (mg/L)							1.35	1.4									
7-Apr-23	TOC (mg/L)									1.35	1.19	1.52	1.26			2.94	4.35	
4-Apr-23	Phytoplankton Biomass (g dry wt/m³)			4.2		0.4												
5-Apr-23	Phytoplankton Biomass (g dry wt/m³)					0.2	2											
2-Apr-23	Total Phosphorus (mg/L)		0.01											0.01				
4-Apr-23	Total Phosphorus (mg/L)			0.02		0.01									0.02			
5-Apr-23	Total Phosphorus (mg/L)						0.01	0.01										
2-Apr-23	Total Dissolved Phosphorus (mg/L)		0.01											0.01				
4-Apr-23	Total Dissolved Phosphorus (mg/L)			0.01		<0.01									0.01			
5-Apr-23	Total Dissolved Phosphorus (mg/L)						<0.01	<0.01										
4-Apr-23	Hydrogen Sulfide (mg/L)			<0.02		<0.02												
5-Apr-23	Hydrogen Sulfide (mg/L)						<0.02	<0.02										
4-Apr-23	Turbidity (NTU)-bottom					15.6												
5-Apr-23	Turbidity (NTU)-bottom						0.97	0.83										
4-Apr-23	TSS (mg/L)-bottom					11.09												
5-Apr-23	TSS (mg/L)-bottom						<5	<5										
4-Apr-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						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
5-Apr-23	BOD ₅ (mg/L)-bottom					<1	<1											
4-Apr-23	NH ₃ -N (mg/L)-bottom				0.4													
5-Apr-23	NH ₃ -N (mg/L)-bottom					0.4	0.4											
4-Apr-23	NO ₃ -N (mg/L)-bottom				<0.02													
5-Apr-23	NO ₃ -N (mg/L)-bottom					<0.02	<0.02											
4-Apr-23	TKN-bottom				<1.5													
5-Apr-23	TKN-bottom					<1.5	<1.5											
4-Apr-23	Total Dissolved Phosphorus (mg/L)-bottom				<0.01													
5-Apr-23	Total Dissolved Phosphorus (mg/L)-bottom					0.03	0.01											
4-Apr-23	Total Phosphorus (mg/L)-bottom				0.01													
5-Apr-23	Total Phosphorus (mg/L)-bottom					0.04	0.01											
4-Apr-23	Hydrogen Sulfide (mg/L)-bottom				<0.02													
5-Apr-23	Hydrogen Sulfide (mg/L)-bottom					<0.02	<0.02											
4-Apr-23	Phytoplankton Biomass (g dry wt/m ³)-bottom				2.6													
5-Apr-23	Phytoplankton Biomass (g dry wt/m ³)-bottom					3.2	0.6											

TABLE A-2: RESULTS OF CAMP EFFLUENTS IN APRIL 2023

	Site Name	OSOV1 (Owner's Site Office and Village)		OSOV2 (ESD Camp)		Main Powerhouse	
	Station Code	EF01		EF13		EF19	
	Date	03-Apr-23	24-Apr-23	03-Apr-23	24-Apr-23	03-Apr-23	24-Apr-23
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	7.5	6.68	7.12	6.86	6.87	6.74
Sat. DO (%)		53	65.3	87.7	49.9	66.5	47.6
DO (mg/L)		4.13	4.91	6.83	3.91	4.96	3.52
Conductivity (µs/cm)		361	309	646	579	1,564	1,123
Temperature (°C)		28.15	30.39	28.14	27.86	30.32	31.25
Turbidity (NTU)		2.08	1.23	10.7	7.61	22.8	28.6
TSS (mg/L)	<50	6.2	<5	10.86	6.8	25.9	45.6
BOD ₅ (mg/L)	<30	<6	<6	<6	8.82	<6	<6
COD (mg/L)	<125	<25	<25	41	36	65	90
NH ₃ -N (mg/L)	<10.0	3.3	<2	29.4	24.7	20.8	19.1
Total Nitrogen (mg/L)	<10.0	3.57		34.8		23.6	
Total Phosphorus (mg/L)	<2	1.28	1.38	1.81	1.80	3.1	6.0
Oil & Grease (mg/L)	<10.0	1.1		<1		1	
Total coliform (MPN/100 mL)	<400	2,200	1,600	350	2,800	920	220
Faecal Coliform (MPN/100 mL)	<400	320	920	140	1,700	220	170
Residual Chlorine (mg/L)	<1.0	N/A	N/A	0.30	0.02	0.54	0.39