






**NAM NGIEP 1**  
POWER COMPANY

Nam Ngiep 1 Hydropower Project

# Environmental Management Monthly Monitoring Report

September 2023

					
A	26 October 2023	Hendra WINASTU	Khamstone Xaysomphou	Wanidaporn RODE	Final
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## EXECUTIVE SUMMARY

During September 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.

The annual ISO14001:2015 Internal Audit for 2023 is scheduled for mid-October 2023, covering all NNP1PC work function areas. To prepare for this audit, several tasks have been accomplished including (i) announcement of the ISO Committee and ISO Internal Auditors, (ii) online refresher training on the ISO14001:2015 Internal Audit for 17 Internal Auditors by SGS (Lao) Sole Co., Ltd, (iii) Internal meeting and coordination to prepare the detailed Internal Audit plan 2023.

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.

During this reporting period, one document was submitted to the Environment Management Office (EMO) for review and approval.

On 28 September 2023, EMO, ADM and TD conducted a joint monthly site inspection at OSOV1 (fuel storage, canteen, WWTS, and recycle waste storage), Main Powerhouse (WWTS and hazardous waste storage), NNP1 landfill, Re-regulation (WWTS and temporary waste storage). Following this joint site inspection, an observation report was submitted to ADM for implementing necessary corrective actions regarding the maintenance of the WWTS and NNP1 Landfill, and TD received recommendations for the improvement of the hazardous materials storage.

During September 2023, a monthly monitoring of the rehabilitation sites was carried out at the former RCC Plant, CVC plant, and spoil disposal no.2 and the quarry. No evidence of erosion or instability was observed at any of the inspected sites.

As of preparing this September 2023 report, the results of the water quality analyses for COD, TOC, chlorophyll-a, ammonia nitrogen, total nitrogen, total phosphorus, total dissolved phosphorus, oil & grease, TKN, total hardness, arsenic, cadmium, mercury and lead are still pending due to delays in the water sampling mission. They will be included in the next report.

At R05 (in the Main Reservoir approx. 0.5 km upstream the Main Dam), the average DO concentration was 7.2 mg/L in the upper 6.0 m varying between 3.4 mg/L and 8.2 mg/L. Anoxic conditions (less than 0.5 mg/L) were found at depths from 50 m to bottom (06 September 2023) and at depth from 55 m to bottom (15, 21 and 27 September 2023). At the water intake level, DO concentrations varied between 1.97 mg/L and 3.51 mg/L.

In the Re-regulation Reservoir, the mean DO concentrations in the water column of R06 and R07 were 2.9 mg/L and 3.2 mg/L respectively.

The DO measurements downstream the Re-regulation Dam during turbine discharge was less than 6 mg/L in some stations, except at NNG08. NNP1PC discussed the results of the ongoing water quality monitoring program with the LTA during their May 2023 visit. The LTA recommended to maintain the monitoring program, and concluded in the site visit report dated 01 September 2023

that other measures aiming at improving the water quality, such as artificial re-aeration of the water in the re-regulation pond for increasing oxygen content, are not required.

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 5.4 m<sup>3</sup> of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 1.4 m<sup>3</sup> compared with August 2023.

There is no continuation of the implementation activities under the Bolikhamxay Watershed and Reservoir Protection Office (WRPO) Annual Implementation Plan (AIP) 2023 in September 2023 because they did not receive the second two quarters funds from the Forest Protection Fund (FPF) of the Department of Forestry (DOF) of the Ministry of Agriculture and Forestry (MAF) as of the end of September 2023.

Xaysomboun WRPO conducted patrolling from 28 August to 6 September 2023. They organized a monthly meeting with the NNP1 Environment Management Office (EMO) and the Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS) on 21 September 2023. BSP-WCS reviewed the patrolling work in August 2023. The plan for the next patrolling was discussed and agreed among Xaysomboun WRPO, NNP1 EMO, and BSP-WCS. There is still no progress on the construction of two reservoir check points as of the end of September 2023. NNP1 EMO followed up with the Xaysomboun WRPO on the draft fishery regulations as per the discussion and agreement during the Fishery Co-Management Plan (FCMP) meeting in August 2023 but did not receive any update as of the end of September 2023. The meeting to discuss the project development within the NNP1 watershed Totally Protected Zone (TPZ) was organized on 22 September 2023. The meeting was chaired by Mr. Soutswad VONGPHOUMLET, Vice Governor of Xaysomboun Province, and participated by total of 43 people comprised of representatives from the Department of Energy Business (DEB) of the Ministry of Energy and Mines (MEM), Division of Policy and Planning of the MEM, Ministry of Natural Resource and Environment (MONRE), Ministry of Planning and Investment (MPI), DOF-MAF, Xaysomboun Province Energy and Mine, Xaysomboun Provincial Office of Natural Resources and Environment (PONRE), Xaysomboun Provincial Agriculture and Forestry Office (PAFO), district management and district Agriculture and Forestry Office (DAFO) of Hom, Thathom, and Anouvong districts, NNP1PC, and BSP-WCS. The Xaysomboun AIP2023 was approved by ADB and IAP on 18 and 20 September 2023, respectively. Xaysomboun WRPO will obtain approval from the Head of Xaysomboun PAFO in the first week of October 2023 and submit it to FPF DOF-MAF. NNP1 EMO expects to receive the official fund disbursement request from FPF DOF-MAF in the second week of October 2023 at the soonest.

Bolikhamxay Biodiversity Offset Management Unit (BOMU) conducted patrolling and snare removal activity during 7-26 September and 10-24 September 2023, respectively. The report on the Participatory Land Use Planning (PLUP) of Vangphieng Village was drafted by BSP-WCS and discussed among BOMU, BSP-WCS, NNP1 EMO and relevant offices at BOMU's office in Viengthong from 12-14 September 2023. The report needs major revisions, so it is expected to be ready for presentation to the Bolikhamxay PAFO and Viengthong District management in October 2023. BOMU, with support from the Bolikhamxay PAFO livestock and fishery section, submitted a report and proposal to the District Agriculture and Forestry Office (DAFO) of Viengthong and Xaychamphone for official approval of the farmer groups. After reviewing the documents, DAFO advised the team to provide supporting documents such as the farmers' regulations and the proposal from the farmer group. In this regard, BOMU and DAFO planned to conduct another field

trip to all the villages from the first week of October 2023 and will submit the supporting document to DAFO for approval. NNP1PC received the fund disbursement request from DOF-MAF on 5 September 2023 for the second six months of the BOMU AIP2023. NNP1PC transferred the fund on 18 September 2023, totalling 3,136,113,000 LAK, from which 1,830,995,000 LAK is under the GOL CA fund and 1,305,118,000 LAK is under the NNP1 No Net Loss (NNL) fund.

The fish catch monitoring for August 2023 in Nam Ngiep Watershed was dominated by *Oreochromis niloticus*, *Cyprinus carpio*, *Channa striata* and species groups of *Mastacembelus* and *Hampala*. They are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species except *Cyprinus carpio* is classified as Vulnerable species (VU) and *Cyprinus carpio* and *Oreochromis niloticus* are 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 September, 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.	Activity Description	KPI	The EMP Evaluation Schedule	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.	Sept 2023 - Feb 2024	<b>Achieved 61% as of September 2023</b> – The training is scheduled to be continued in Q4 2023. – 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.	Oct 2023 - Dec 2024	Ongoing monitoring and gathering data on monthly basis
03/2023*	Reducing the quantity of waste disposal at NNP1 Project Landfill	The quantity of waste disposed of y in the NNP1 landfill is reduced by 05% within one year compared with the previous 12 months.	Oct 2023 - Mar 2024	Ongoing monitoring and gathering data on monthly basis
04/2023#	Planting tree	Percentage of plant survival, the potential plantation fields in contributing to the environmentally sustainability objectives (refer to Tree Planting Plan).	Sept 2023 - Feb 2024	<b>Achieved 100% based on the latest assessment in September 2023</b> – The next evaluation is scheduled for February 2024



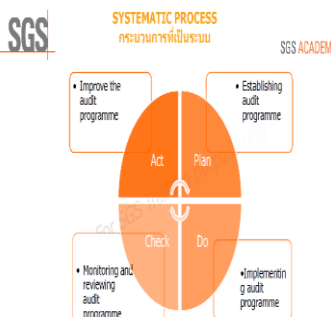

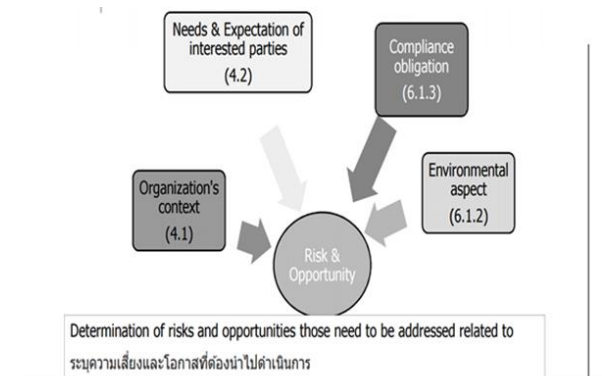
\*EMP's implemented in 2022 will continue in 2023 for further success

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



## 1.2 ANNUAL ISO14001:2015 INTERNAL AUDIT

The annual ISO14001:2015 Internal Audit for 2023 is scheduled for mid-October 2023, covering all NNP1PC work function areas. To prepare for this audit, several tasks have been accomplished including (i) announcement of the ISO Committee and ISO Internal Auditors, (ii) online refresher training on the ISO14001:2015 Internal Audit for 17 Internal Auditors by SGS (Lao) Sole Co., Ltd, (iii) Internal meeting and coordination to prepare the detailed internal audit plan 2023.

 <p>ISO14001 Internal Audit Training</p>  <p>ISO14001 Internal Audit Training</p>  <p>SYSTEMATIC PROCESS กระบวนการที่เป็นระบบ</p> <ul style="list-style-type: none"> <li>Improve the audit programme</li> <li>Establishing audit programme</li> <li>Monitoring and reviewing audit programme</li> <li>Implementing audit programme</li> </ul>	 <p>21/09/2023 09:06</p>  <p>Needs &amp; Expectation of interested parties (4.2)</p> <p>Compliance obligation (6.1.3)</p> <p>Environmental aspect (6.1.2)</p> <p>Organization's context (4.1)</p> <p>Risk &amp; Opportunity</p> <p>Determination of risks and opportunities those need to be addressed related to ระบุความเสี่ยงและโอกาสที่ต้องนำไปดำเนินการ</p> <p>© SGS SA 2018 All Rights Reserved</p>
<p>Refreshing online training on the ISO14001:2015 Internal Audit</p>	<p>Preparation for ISO14001:2015 Internal Audit 2023</p>

On 15 September 2023, NNP1PC conducted care activities of 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.



### 1.3 COMPLIANCE MANAGEMENT

In September 2023, EMO received one DWP and SS-ESMMPS from the contractor (KENBER GEOTECHNIC (THAILAND) CO., LTD) for review and approval.

#### 1.3.1 Joint Monthly Site Inspection

On 28 September 2023, EMO, ADM and TD conducted a joint monthly site inspection at OSOV1 (fuel storage, canteen, WWTS, and recycle waste storage), Main Powerhouse (WWTS and hazardous waste storage), NNP1 landfill, Re-regulation (WWTS and temporary waste storage). Following this joint site inspection, an observation report was submitted to ADM for implementing necessary corrective actions regarding the maintenance of the WWTS and NNP1 Landfill, and TD received recommendations for the improvement of the hazardous materials storage. The inspection findings are shown in **Figure 1.3-1**.

**Figure 1.3-1: Joint Monthly Site Inspection in September 2023**



#### OSOV1\_Wastewater Treatment System

**Issue:** It was observed that there is weed growth inside and around the edges of the wetland ponds. The weeds could potentially reduce the efficiency of wastewater treatment as they prevent sunlight from reaching the wetland and create increased competition with the wetland



reeds. Moreover, the dense vegetation also serves as a breeding ground for mosquitoes and other poisonous animals including snakes.

**Corrective Action:** The ADM was instructed to take the following actions regarding weed control:

- Remove the weeds to increase the efficiency of wastewater treatment and minimize the breeding grounds of vectors.

**Next verification:** The next monthly joint site inspection is scheduled for 18 October 2023.



#### NNP1 Landfill

**Issue:** Since the waste collection contract was completed in April 2023, maintenance activities at NNP1 Landfill, such as grass cutting, weekly waste cover, and fence maintenance, have been discontinued. Key observations 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.

**Corrective Action:** The ADM was instructed to manage landfill operation and maintenance as follows:

- Clear vegetation along the access road, around the landfill's boundaries, and within the waste cell.
- Conduct waste compaction using machinery at least twice a year, considering the current monthly waste disposal average of approximately 9 m<sup>3</sup>.

**Next verification:** The next monthly joint site inspection is scheduled on 18 October 2023.



#### LILAMA10\_Hazardous Storage Facility

**Issue:** The hazardous materials storage facility is not fully operational due to the “**absence of a control valve**” on the outlet pipe of the secondary containment. The mentioned valve is necessary for preventing accidental oil releases from the hazardous materials storage facility.

**Corrective Action:** The TD was instructed to take the following action:

- Install a control valve on the outlet pipe of the storage facility to prevent accidental oil releases from the hazardous materials storage facility.

**Next verification:** The next monthly joint site inspection is scheduled for 18 October 2023.

#### 1.3.2 Site Inspection by the Environment Management Unit (EMU)

No inspection by the EMU of Bolikhamxay province and Bolikhan, Thathom, and Hom districts in September 2023.

#### 1.3.3 Site Decommissioning and Rehabilitation

During September 2023, a monthly monitoring of the rehabilitation sites was carried out at the former RCC Plant, CVC plant, and spoil disposal no. 2 and the quarry. No evidence of erosion or instability was observed at any of the inspected sites.

#### 1.4 WATER QUALITY MONITORING

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD<sub>5</sub>), 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/>.

As of writing this September 2023 report, the results of the water quality analyses for COD, TOC, chlorophyll-a, ammonia nitrogen, total nitrogen, total phosphorus, total dissolved phosphorus, oil & grease, TKN, total hardness, arsenic, cadmium, mercury and lead are still pending due to delays in the water sampling mission. They will be included into the next report.

#### 1.4.1 Effluent Discharge from Camps and Construction Sites

Detailed monitoring results are provided in the Table A-2 (**Annex A**) 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 1.4-1**

**Table 1.4-1: Status of Corrective Actions for Non-Compliances at WWTs in September 2023**

Site	Sampling ID	Status	Corrective Actions
<b>OSOV1</b>	EF01	Fully compliance for the reported parameters.	In September 2023, EMO, ADM and TD conducted a monthly joint inspection of the operation and maintenance of the WWTs. The inspection results are outlined in the above section 1.2.1  1) Closely monitor the residual chlorine content and chlorination dosage adjustment for the effluents of OSOV2 and the Main Powerhouse WWTs.;
<b>OSOV2</b>	EF13	Fully compliance for the reported parameters.	
<b>Main Powerhouse</b>	EF19	Non-compliance for total coliform.	

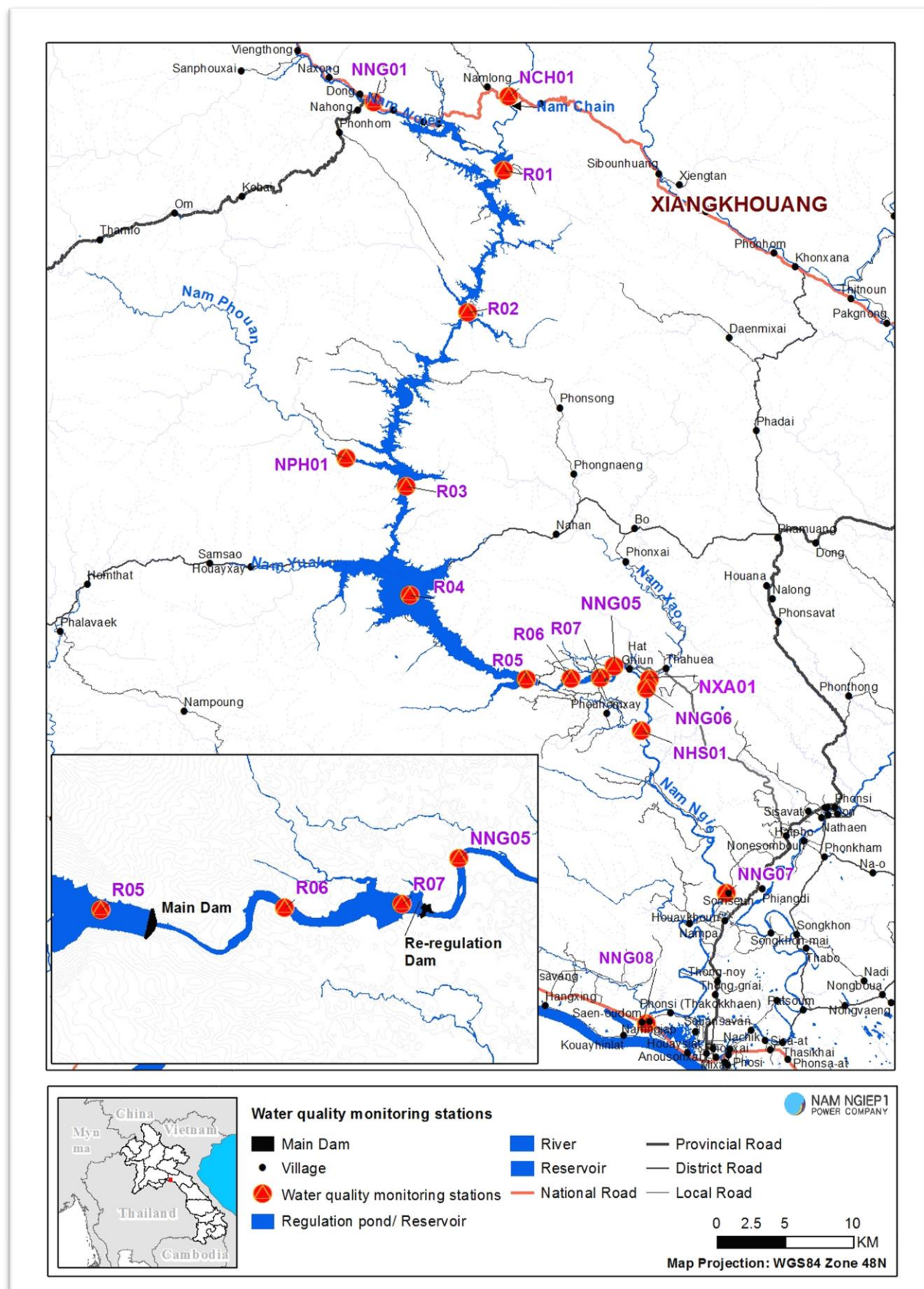
#### 1.4.2 Ambient Surface Water and Reservoir Water Quality Monitoring

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 1.4-1**.

The monitoring results for key parameters (DO, TSS and BOD<sub>5</sub>) during September 2023 are presented in **Table 1.4-2**, **Table 1.4-3** and **Table 1.4-4**. The full set of data for September 2023 is attached in Annex A. In addition, the DO depth profile timeseries for R05 are shown in **Figure 1.4-2**, and the results for DO timeseries are presented as line graphs in **Figure 1.4-3** and DO Long Profile graphs **Figure 1.4-4**.



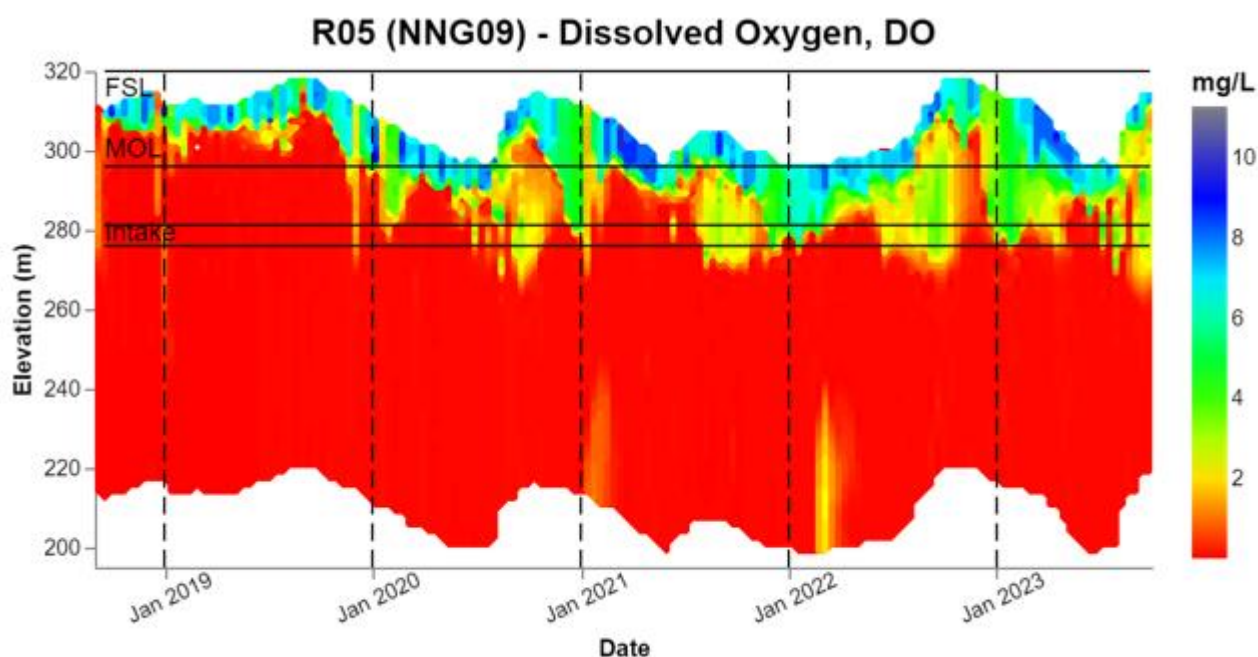


**Figure 1.4-1: Surface Water and Re-regulation Reservoir Water Quality Monitoring Stations**

## Main Reservoir

In September 2023, the water level in the main reservoir increased from El. 312.52 m asl to El. 319.49 m asl by the end of the month.

At R05 (in the Main Reservoir approx. 0.5 km upstream the Main Dam), the average DO concentration was 7.2 mg/L in the upper 6.0 m varying between 3.4 mg/L and 8.2 mg/L. Over the month the depth to the oxycline increased from 6.0 m on 06 September 2023 to 9.5 m on 15 September 2023 and then decreased to 5.5 m on 27 September 2023. Anoxic conditions (less than 0.5 mg/L) were found at depths from 50 m to bottom (06 September 2023) and at depth from 55 m to bottom (15, 21 and 27 September 2023). At the water intake level, DO concentrations varied between 1.97 mg/L and 3.51 mg/L.



**Figure 1.4-2: DO Depth Profiles Time Series in R05 (Since September 2018 to September 2023)**

At R04, the average DO concentration was 7.5 mg/L in the upper 6.0 m varying between 6.1 mg/L and 8.3 mg/L. From 6.5 m to the bottom, the DO concentrations varied between 0.1 mg/L and 5.9 mg/L with an average of 2.4 mg/L. Oxyclines were found at a depth of 6.5 m. Anoxic conditions (less than 0.5 mg/L) were found at depths from 50 m to the bottom (on 06 September 2023) and at depths from 55 m to bottom (on 15, 21 and 27 September 2023).

At R03, the average DO concentration was 7.8 mg/L in the upper 4.5 m varying between 5.3 mg/L and 8.5 mg/L. Oxyclines were found at depths between 4.0 m and 6.0 m. From 5.0 m to bottom, DO concentrations varied between 0.1 mg/L and 8.4 mg/L with an average of 3.6 mg/L. Anoxic conditions (less than 0.5 mg/L) were found at depths from 55 m to the bottom (14, 20 and 26 September 2023).

At R02, the average DO concentration in entire water column was 4.8 mg/L with variation between 1.9 mg/L and 9.7 mg/L. Oxyclines were found at depths between 3.5 m and 4.0 m. No anoxic conditions were detected during the month.



At R01, the DO concentrations in entire water column varied between 5.2 mg/L and 8.6 mg/L with an average of 7.2 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, except at R01 due to the large inflow with high turbidity caused by heavy rain.

The BOD<sub>5</sub> measurements in epilimnion at R01, R03, R04 and R05 were less than 1.0 mg/L and in the hypolimnion at R03, R04 and R05 were less than 1 mg/L, less than 1 mg/L and 5.8 mg/L respectively.

### **Re-regulation Reservoir**

In September 2023, the turbine discharges from the Main Powerhouse varied between 12 and 239 m<sup>3</sup>/s usually interrupted by night-time periods with no discharge.

The mean DO concentrations in the water column of R06 and R07 were 2.9 mg/L and 3.2 mg/L respectively.

The BOD<sub>5</sub> concentrations in both R06 and R07 were less than 1.0 mg/L.

### **Nam Ngiep Downstream**

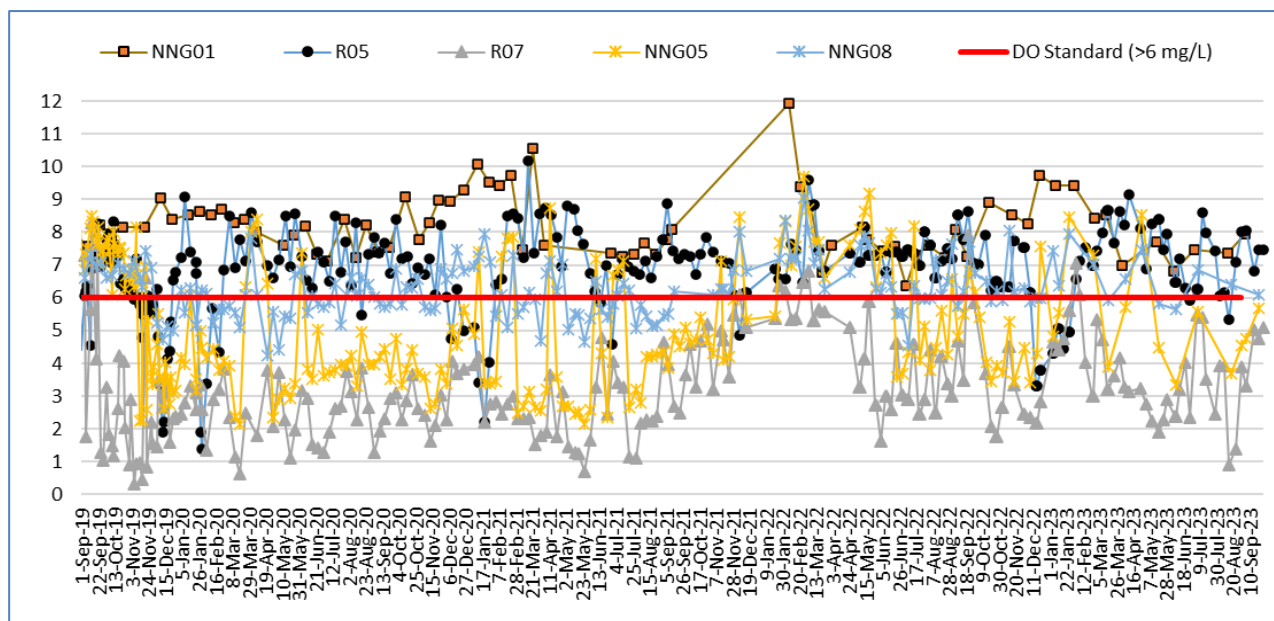
During September 2023, the monthly downstream water quality monitoring was carried out during periods of turbine discharge from the Re-regulation Dam, and the DO concentrations were less than 6 mg/L in the downstream stations, thus not complying with the surface water quality standard, except at NNG08 (47.2 Km from Re-regulation Dam).

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.

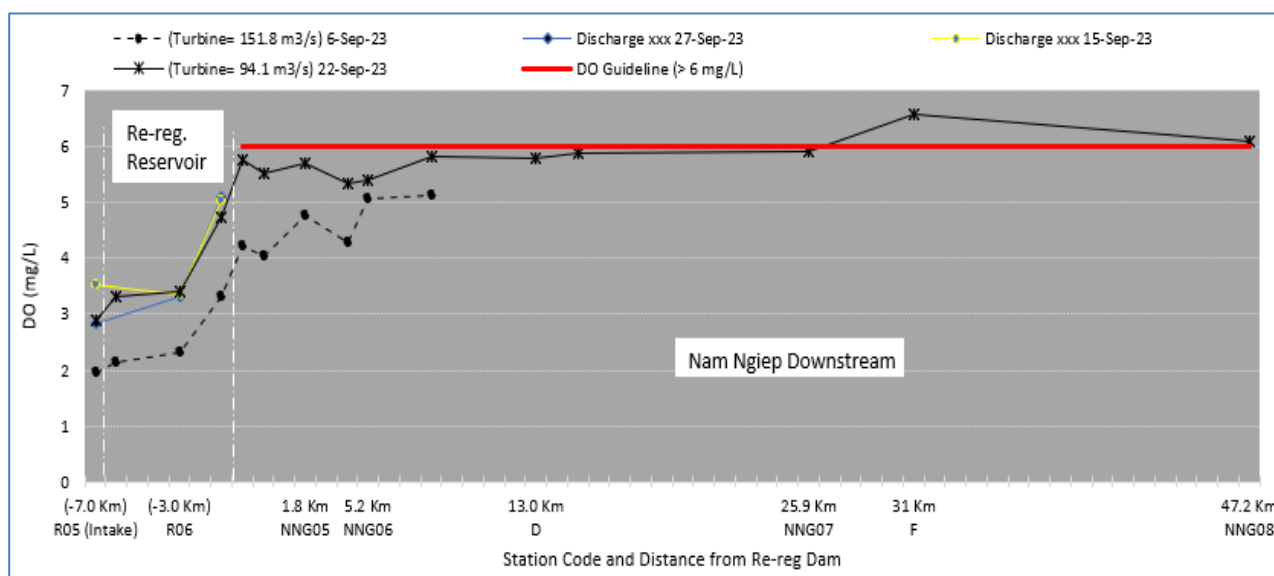
The BOD<sub>5</sub> in the downstream stations were less than 1 mg/L and complied with the national surface water quality standard.

### **Main Tributaries to Nam Ngiep**

The monitored parameters in the main tributaries (Nam Chiane, Nam Xao and Nam Houaysoup) complied with the standards. Note that there are some other chemical parameters results are pending for this report month.



**Figure 1.4-3: Concentration of Dissolved Oxygen (mg/L) in the upper 0.2 m since September 2019 to September 2023**



**Figure 1.4-4: Dissolved Oxygen (Mg/L) Long Profile in September 2023 (from Immediately Upper Main Dam to Lower Nam Ngiep River)**

**Table 1.4-2: 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
4-Sep-23	7.94												8.62			
5-Sep-23		7.18	6.82	7.44												
6-Sep-23					7.35	8.04	2.31	3.31	4.77	5.06					6.25	6.42
14-Sep-23		6.58	9.14	8.31												
15-Sep-23					8.26	6.83	3.34	5.03								
20-Sep-23		6.96	7.41	7.25												
21-Sep-23					7.42	7.45	3.4	4.74								
22-Sep-23									5.68	5.38	5.92	6.1			7.73	7.77
26-Sep-23		8.09	8.44	7.94												
27-Sep-23					7.19	7.47	3.3	5.1								

**Table 1.4-3: 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
4-Sep-23	178.7												10.63			
20-Sep-23		14.6		<5												
21-Sep-23					<5	<5	7.09	5.07								
22-Sep-23									8.8	10.14	14.05	9.16			27.4	5.61

**Table 1.4-4: Results of Surface Water Quality Monitoring for BOD<sub>5</sub> (mg/L) - Water Quality Standard: < 1.5 mg/L**

BOD <sub>5</sub> (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
4-Sep-23	<1												<1			
20-Sep-23		<1		<1												
21-Sep-23					<1	<1	<1	<1								
22-Sep-23									<1	<1	<1	<1			<1	<1

### 1.4.3 Groundwater Quality Monitoring

During September 2023, community groundwater quality analyses were carried out for all 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 in the two wells in Phouhomxay Village complied with the Standards.
- All parameters monitored for the well in NamPa Village complied with the Standards.
- The wells in Thong Noy and Somsuen Villages did not comply with the Standard for faecal coliform and *E. Coli* bacteria.
- All parameters monitored in the two wells in Pou Village complied with the Standards.

The community groundwater quality monitoring results are presented in **Table 1.4-5**.

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 1.4-5: 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	27-Sep-23	27-Sep-23	18-Sep-23	18-Sep-23	18-Sep-23	04-Sep-23	04-Sep-23
pH	6.5 - 9.2	6.51	6.6	6.6	6.55	6.5	6.74	6.85
Sat. DO (%)		63.1	62.1	86.1	98.5	69.6	89.3	100.1
DO (mg/l)		5.26	5.01	6.73	7.74	5.49	7.13	8.03
Conductivity(μS/cm)		200	519	499	458	332	28	324
Temperature (°C)		24.4	26.35	27.98	27.64	27.51	26.93	26.6
Turbidity (NTU)	<20		1.56	0.41	0.27	1.12	1.69	0.71
Faecal coliform (MPN/100ml)	0	0	0	2	0	37	0	0
<i>E.coli</i> Bacteria (MPN/100ml)	0	0	0	2	0	27	0	0

#### 1.4.4 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), Hat Gnuin Village (WHGN02) and Phouhomxay Village (WPHX02 – Primary School Water Tap and WPHX03 – Household Water Tap). In addition, non-compliance with pH was recorded for Phouhomxay's Water Supply.

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 **1.4.3** as well as recommended to carry out the operation and maintenance improvement.

**Table 1.4-6: Results of the Gravity Fed Water Supply Quality Monitoring**

	Site Name	Thaheua Village	Hat Gnuin Village	Phouhomxay	
	Station	WTHH02	WHGN02	WPHX02	WPHX03
Parameter (Unit)	Guideline	19-Sep-23	19-Sep-23	19-Sep-23	19-Sep-23
pH	6.5 - 8.5	6.88	6.95	6.86	6.92
Sat. DO (%)		84.6	86.9	88.8	87.9
DO (mg/L)		6.63	6.71	6.89	6.83
Conductivity (µS/cm)	<1,000	33	65	12	11
Temperature (°C)	<35	29.2	28.7	28.9	29.1
Turbidity (NTU)	<10	13.8	3.84	3.69	2.51
Faecal Coliform (MPN/100 mL)	0	49	79	49	27
<i>E.coli</i> Bacteria (MPN/100 mL)	0	49	79	22	27

#### 1.4.5 Landfill Leachate Monitoring

During September 2023, the landfill leachate monitoring was conducted at NNP1 Project Landfill (Last pond - LL4) and Houay Soup Solid Waste Landfill (Last pond - LL6).

The results indicate that NNP1 Project and Houay Soup Landfills complied with the relevant standard. The landfill leachate monitoring results for September 2023 can be found **Table 1.4-7**.

**Table 1.4-7: Results of the Landfill Leachate Monitoring**

		Site Name	NNP1 Landfill Leachate					Houay Soup Landfill	
		Location	Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point	Last pond	Discharge Point
		Station	LL1	LL2	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline							
28-Sep-23	pH	6.0 - 9.0				7.11		7.2	
28-Sep-23	Sat. DO (%)					95		95.5	
28-Sep-23	DO (mg/L)					7.29		7.37	
28-Sep-23	Conductivity (µS/cm)					72		133	
28-Sep-23	Temperature (°C)					28.98		28.74	
28-Sep-23	Turbidity (NTU)					12.6		16.8	
28-Sep-23	BOD <sub>5</sub> (mg/L)	<30				<6		<6	
28-Sep-23	COD (mg/L)	<125							

			Site Name	NNP1 Landfill Leachate					Houay Soup Landfill
			Location	Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point	Last pond Discharge Point
			Station	LL1	LL2	LL3	LL4	LL5	LL6 LL7
Date	Parameter (Unit)	Guideline							
28-Sep-23	Faecal Coliform (MPN/100mL)	<400					33		8
28-Sep-23	Total Coliform (MPN/100mL)	<400					280		33
28-Sep-23	Total Nitrogen (mg/L)	<10							
28-Sep-23	Ammonia nitrogen (mg/L)	<10							
28-Sep-23	Oil & Grease (mg/L)	<10							

## 1.5 DISCHARGE MONITORING

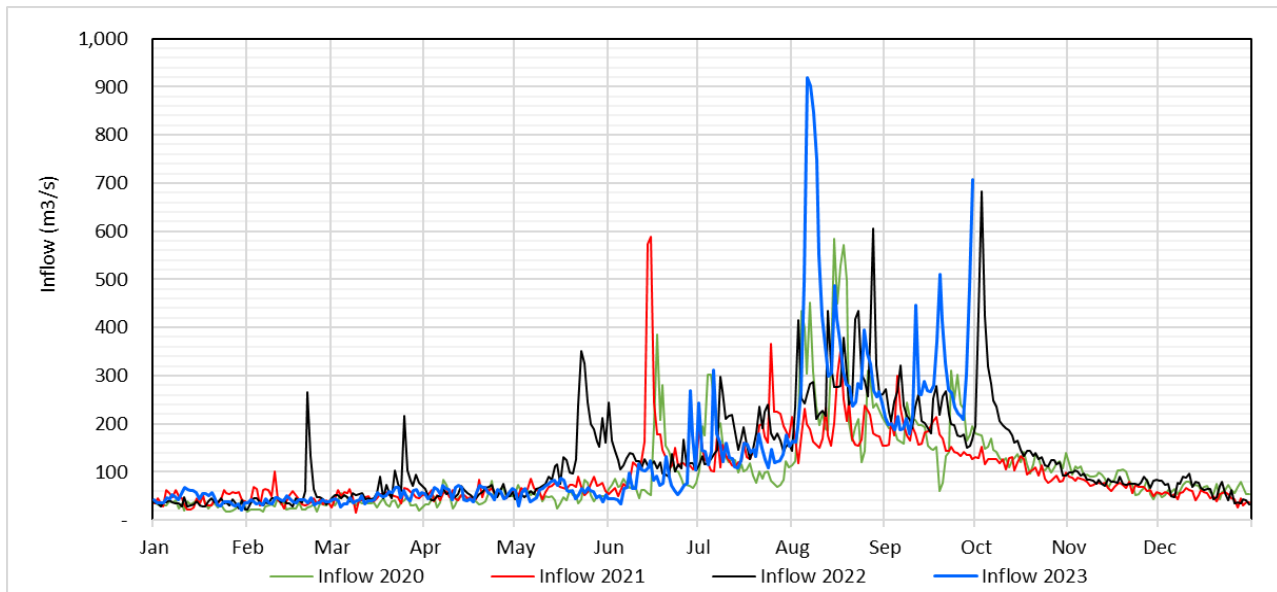
### 1.5.1 Main Reservoir – Water Level, Inflow and Discharge

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 1.5-1** and **Figure 1.5-2** presents the values recorded since January 2020.

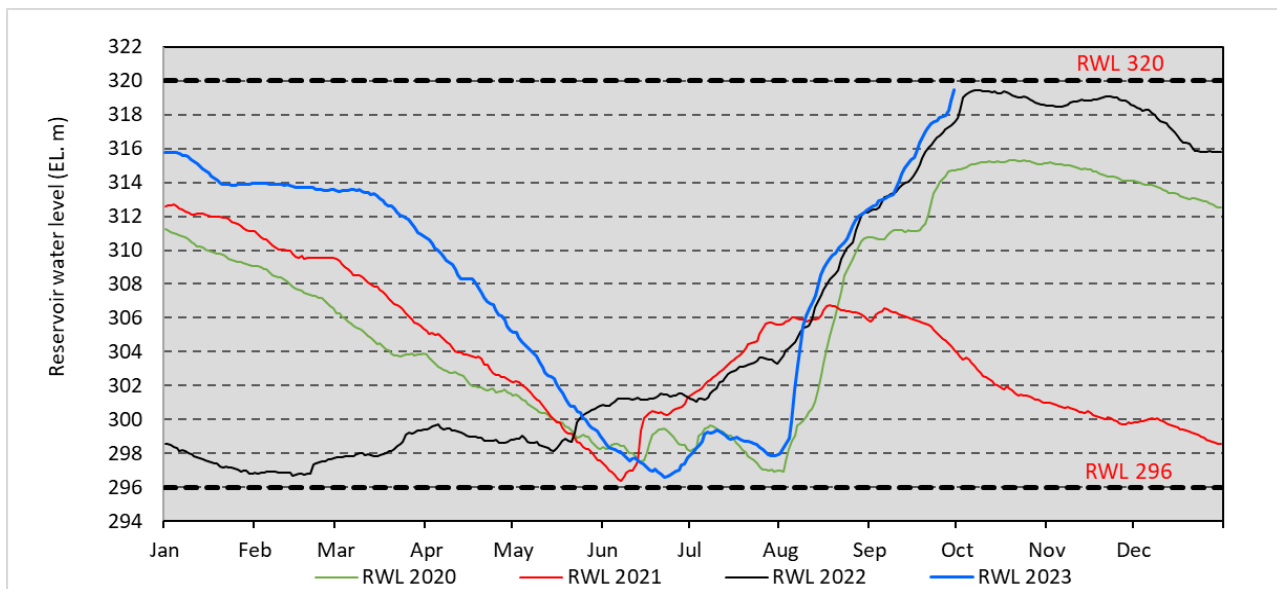
During September 2023, the mean inflow to the main reservoir was 286 m<sup>3</sup>/s. The minimum and maximum inflows were 178 m<sup>3</sup>/s (on 09 September 2023) and 707 m<sup>3</sup>/s (on 30 September 2023) respectively.

In September 2023, the water level in the main reservoir increased from El. 312.52 m asl to El. 319.49 m asl by the end of the month.

During September 2023, the hourly turbine discharges from the Main Powerhouse varied between 12 m<sup>3</sup>/s and 239 m<sup>3</sup>/s usually interrupted by night-time periods with no discharge.



**Figure 1.5-1: Inflow for the Main Reservoir during January 2020 to September 2023**



**Figure 1.5-2: Water Level for the Main Reservoir during January 2020 to September 2023**

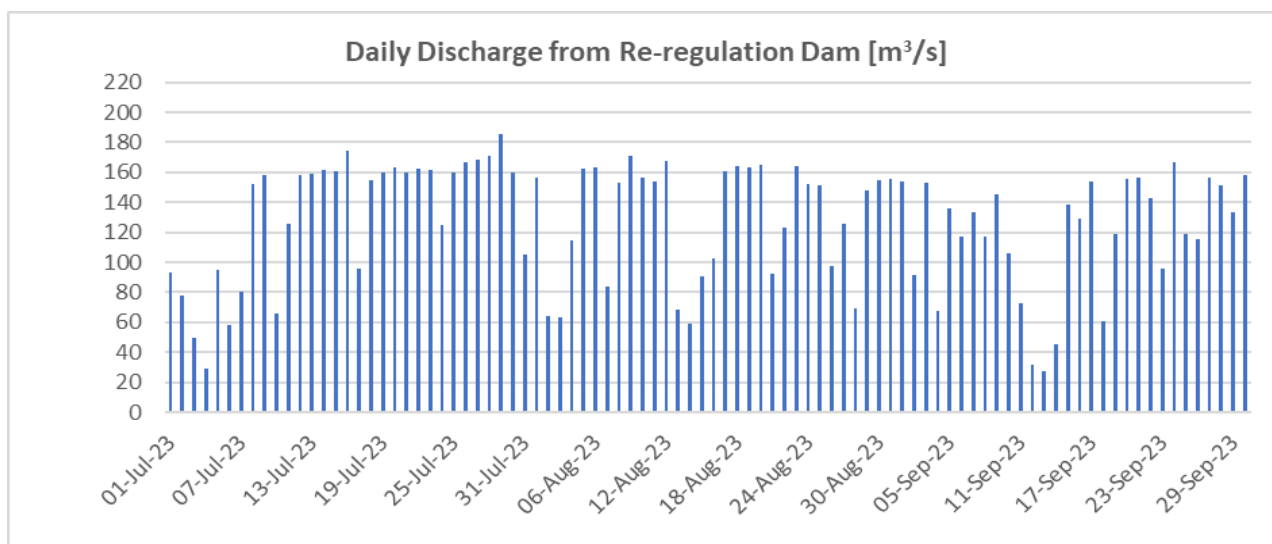
### 1.5.2 Re-regulation Reservoir – Discharge

The daily discharge monitoring data for the Re-regulation Dam during July to September 2023 is presented in **Figure 1.5-3**.

During September 2023, the mean daily discharge from the Re-regulation Dam was about 118 m<sup>3</sup>/s, with hourly gate discharge varying between 27 m<sup>3</sup>/s and 185 m<sup>3</sup>/s, and hourly turbine discharge varying between 48 m<sup>3</sup>/s and 162 m<sup>3</sup>/s. The hourly combined gate, labyrinth and turbine discharges varied between 150 m<sup>3</sup>/s and 226 m<sup>3</sup>/s. The hourly discharge was kept above the minimum flow requirement of 27 m<sup>3</sup>/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 1.5-3: Discharge Monitoring at the Re-regulation Dam in July to September 2023**

### 1.5.3 Nam Ngiep Downstream Water Depth Monitoring

In September 2023, due to the discharge from Re-regulation Dam was greater than 30 m<sup>3</sup>/s, EMO did not carry out any boat missions to monitor the water depth in the Nam Ngiep downstream of the Re-regulation Dam.

## 1.6 PROJECT WASTE MANAGEMENT

### 1.6.1 Solid Waste Management

A total of 5.4 m<sup>3</sup> of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 1.4 m<sup>3</sup> compared with August 2023. Since the waste collection contract was completed in April 2023, the general waste collection and disposal and NNP1 landfill operation have temporarily been carried out by the ADM staff while awaiting the new recruitment of a contractor. However, maintenance activities at NNP1 Landfill, such as grass cutting, weekly waste cover, and fence maintenance, have been discontinued. In addition, the waste compaction at NNP1 landfill is still on hold, waiting for ADM to finalize an arrangement for waste compaction (refer to the joint site inspection result in section 1.3.1). The total amount of recyclable waste sold and collected this month is summarized in **Table 1.6-1**.

**Table 1.6-1: Amounts of Recyclable Waste Sold and collection in September 2023**

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total By September 2023
1	Plastic bottles	kg	0	73
2	Aluminium can	kg	0	0
3	Paper/Cardboard	kg	0	83
4	Glass	kg	0	<b>192</b>
5	Scrap Metal	Kg	0	0
<b>Total</b>		<b>kg</b>	<b>57</b>	<b>348</b>

In September 2023, the villagers from Phouhomxay Village collected a total of 242.9 kg of food waste from the OSOV1 canteen for feeding their animals.

### 1.6.2 Hazardous Materials and Waste Management

The types and amounts of hazardous materials and hazardous waste stored on site in September 2023 are shown in **Table 1.6-2** and **Table 1.6-3** respectively.

**Table 1.6-2: Record of Hazardous Material Inventory in September 2023**

No.	Type of Hazardous Material	Unit	Total in September 2023(A)	Used (B)	Remaining at the end of September 2023 (A – B)
1	Diesel	Litre	430	0	430
2	Gasoline	Litre	631	530	101
3	Lubricant (Turbine oil)	Litre	72	0	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	0	0	0
09	HA Cut AF	Litre	3,925	0	3,925.0
10	HA Cut Cat AF	Litre	372.5	0	372.5

**Table 1.6-3: Record of Hazardous Waste Inventory**

No.	Hazardous Waste Type	Unit	Total in September 2023 (A)	Disposed (B)	Remaining at the end of September 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 <sup>3</sup>	1.2	0	1.2
4	Used tyre	Drum	5	0	5
5	Empty used chemical drum/container (drum 20L)	Unit	44	0	44
6	Lead acid batteries	Unit	6	0	6
7	Empty paint and spray cans	Unit	96	0	96
8	Halogen/fluorescent bulbs	kg	414	0	414
9	Empty cartridge (Ink)	Unit	108	0	108

No.	Hazardous Waste Type	Unit	Total in September 2023 (A)	Disposed (B)	Remaining at the end of September 2023 (A - B)
10	Clinic Waste	Kg	4.2	0	4.2
11	Expired Chlorine Powder	Kg	65	0	65

## 1.7 COMMUNITY WASTE MANAGEMENT

### 1.7.1 Community Solid Waste Management and Recycling Programmes

NNP1 EMO is waiting for the EMU to initiate discussions on the transfer of the management of the communities' solid waste and Houay Soup Landfill to the local authorities.

## 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 upon during the meeting with the Head of Xaysomboun Province Agriculture and Forestry Office (PAFO) on 26 April 2023 are summarized below:

- The meeting to discuss the project development within the NNP1 watershed Totally Protected Zone (TPZ) was organized on 22 September 2023. See section 2.1.1.3 for further details.
- The Xaysomboun PAFO agreed to update the NNP1 EMO team 15 working days after the meeting about the Fishery Co-Management Plan (FCMP). 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. After a series of follow up, including during a monthly meeting on 21 September 2023, NNP1 EMO did not receive the draft fishery regulation from Xaysomboun WRPO as of the end of September 2023.
- NNP1 EMO, Xaysomboun WRPO, and BSP-WCS organized a monthly meeting on 21 September 2023. NNP1 EMO and BSP-WCS noted that there was a lack of clarification provided by both patrol members and the XSB WRPO regarding the team not following patrolling plan including: patrolling outside the target area, fewer days for the field work, and poor recording. A plan for the next patrolling was agreed among NNP1 EMO, Xaysomboun WRPO patrol team, and BSP-WCS with condition for improvement as discussed during the meeting.
- The Head of Xaysomboun WRPO shared the budget plan to fix the Xaysomboun WRPO sub-office on 21 August 2022. NNP1 EMO reviewed the plan and communicated it with Xaysomboun WRPO for improvement on 22 August 2023. NNP1 EMO also 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. However, there was no further update from Xaysomboun WRPO despite a series of follow-ups including during the monthly meeting on 22 September 2023. NNP1 EMO noted that the Head of Xaysomboun WRPO was occupied with another project.
- The Head of Xaysomboun WRPO informed NNP1 EMO during the meeting on 21 September 2023 that the Contractor engaged to construct two reservoir check points still could not be

contacted. He consulted with the Head of Xaysomboun PAFO and they planned to call the contractor in October 2023. The start of the construction work will therefore be delayed until then.

#### **2.1.1.2 Bolikhamxay Watershed and Reservoir Protection Office (WRPO)**

Bolikhamxay WRPO will resume patrolling and implementing other activities during the remaining months of 2023 after receiving the second two quarters funds of AIP 2023 from FPF DOF-MAF. Please refer to section 2.1.2.2 on the fund disbursement of Bolikhamxay AIP2023.

#### **2.1.1.3 NNP1PC EMO**

Hom District Agriculture and Forestry Office (DAFO) and NNP1 EMO agreed and finalized the work plan and budget for the activities to strengthen the capacity of local producers and market linkages during September to December 2023. The first activity which is drafting the farmer group regulations was conducted on 27-29 September 2023.

Thathom DAFO and NNP1 EMO also agreed and finalized the work plan and budget for the agriculture extension service in Phonhom and Nahong Village. The first activity which is to revisit the greenhouse vegetable garden was scheduled for the first week of October 2023.

NNP1 EMO has distributed hard copies of the approved NNP1 Financial Management Manual (FMM) to the relevant offices in Bolikhamxay Province in the second week of September 2023.

The meeting with relevant GOL parties on the risks and challenges in achieving the No Net Loss (NNL) was organized on 22 September 2023. The meeting was chaired by Mr. Soutswad VONGPHOUMLET, Vice Governor of Xaysomboun Province, and participated by a total of 43 people comprised of representatives from the Department of Energy Business (DEB) of the Ministry of Energy and Mines (MEM), Division of Policy and Planning of the MEM, Ministry of Natural Resources and Environment (MONRE), Ministry of Planning and Investment (MPI), DOF-MAF, Xaysomboun Province Energy and Mine, Xaysomboun Province Office of Natural Resource and Environment (PONRE), Xaysomboun Province Agriculture and Forestry Office (PAFO), district management and district Agriculture and Forestry Office (DAFO) of Hom, Thathom, and Anouvong, NNP1PC, and BSP-WCS.

NNP1 EMO noted the following key points concluded by the chairman.

1. It is recommended that the Xaysomboun PAFO, Xaysomboun PONRE, Xaysomboun Provincial Energy and Mine (PEMO) and 3 relevant districts (Hom, Thathom, and Anouvong), as per the XSB Provincial Governor Agreement on the establishment of Xaysomboun WRPC and Xaysomboun WRPO, No.0286/XSB.PG, dated 29 Mar 2022, have further internal discussion to develop an action plan that shall be discussed and implemented at provincial and district levels to solve the issues raised during the meeting. The additional comments and notes for this meeting will be incorporated in the next monthly progress report once the official MOM prepared by the MEM-DEB becomes available.
2. It is recommended that DEB-MEM and NNP1PC review the fund disbursement to ensure a faster process from the central to the provincial level. In addition, it is also recommended that DEB-MEM and NNP1PC review the CA among GOL and NNP1PC to be in line with Decree No. 414 issued by the Prime Minister dated 10/12/2019 NNP1PC noted that this decree defines the principles, regulations and measures regarding the special policy to encourage domestic and foreign investors and entrepreneurs to invest and develop Xaysomboun Province to have a level

of social–economic development comparable with other provinces in Lao PDR. It includes the promotion of hydropower plant and mining development as long as it is aligned with the National Strategy and the Provincial Electricity Energy and Mineral Exploration Development Plan. So, it is a valid legal reference for the Boulay Mangkone Thong Company and Nam Phouan HPP to be operated within the NNP1 watershed TPZ.

3. It is recommended that Xaysomboun WRPO reviews the roles and responsibilities for implementing the activities within the NNP1 watershed as per comments from the district governors according to which the activities shall be implemented by the district level of WRPC and WRPO instead, and the province Xaysomboun WRPC and WRPO shall act as secretary in coordinating and monitoring the activities. In addition, it is also recommended that Xaysomboun WRPO (Xaysomboun PAFO) reviews and revises the structure and working arrangement to ensure that decision-making and implementation of activities are carried out in time by Xaysomboun WRPO at provincial and district levels.
4. It is recommended that the XSB Provincial Military implement the Xaysomboun Provincial Agreement to monitor and remove the offenders or villagers at the Xam Lieam Area within the NNP1 watershed as per the Ministry of Defense recommendation.
5. It is recommended that the Xaysomboun PEMO regularly monitors and provides support for the mining exploration of Boulay Mangkone Thong Company as well as the development of Nam Phouan HPP that they shall follow the agreed work plan in line with Decree No. 414. In addition, Xaysomboun PEMO should monitor the progress of the mining exploration of Boulay Mangkone Thong Company within the NNP1 watershed, and the area should be returned to NNP1PC if no minerals are found.
6. It is recommended that NNP1 updates the figures of funds transferred to the Xaysomboun WRPO from 2015 to 2023 to distinguish between the former XSB WRPO under POPNRE and the current XSB WRPO under PAFO, then submit the updated information to the provincial management for acknowledgment and reference.

## **2.1.2 Preparation of Annual Implementation Plan (AIP) 2023**

### **2.1.1.4 Xaysomboun WRPO**

The draft of AIP2023 was finalized after the 8<sup>th</sup> revision by NNP1 EMO, Xaysomboun WRPO, and BSP-WCS and it was submitted to ADB and IAP for review and approval on 16 August 2023. ADB and IAP approved the plan on 18 and 20 September 2023, respectively. Xaysomboun WRPO will obtain approval from the Head of Xaysomboun PAFO in the first week of October 2023 and submit it to FPF DOF-MAF afterward. NNP1 EMO expects to receive the official fund disbursement request from FPF DOF-MAF in the second week of October 2023 at the soonest.

### **2.1.1.5 Bolikhamxay WRPO**

NNP1PC received the official request for the second two-quarter funds disbursement under the approved Bolikhamxay Annual Implementation Plan (AIP) 2023 from the Forest Protection Fund (FPF) of the Department of Forestry (DOF), Ministry of Agriculture and Forestry (MAF) on 28 July 2023. NNP1PC transferred the funds to FPF DOF-MAF on 17 August 2023, totalling 583,688,000 LAK, from which 163,490,000 LAK is under NNP1 NNL and 420,198,000 is under GOL CA. Bolikhamxay did not receive the fund yet from FPF DOF-MAF as of the end of September 2023.

## **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 September 2023 is described below:

#### **a. Component 1 - Spatial Planning and Regulation**

BSP-WCS drafted the report on Participatory Land Use Planning (PLUP) in Vangphieng Village. The draft report was discussed among BOMU, BSP-WCS, NNP1-EMO and relevant offices at BOMU's office in Viengthong from 12-14 September 2023. The report needed major revisions, and is expected to be ready for presentation to the Bolikhamxay PAFO and Viengthong District management in October 2023.

#### **b. Component 2 – Law Enforcement**

Bolikhamxay BOMU conducted patrolling 7-26 September 2023, focusing on the TPZ highest and high priority area. The results will be reported in October 2023.

#### **c. Component 3 – Conservation Outreach**

BSP-WCS is preparing the report for the outreach activity conducted in April 2023.

The outreach activities under the approved AIP2023 are scheduled from September to December 2023. BSP-WCS is now preparing the contents and methods of the school outreach program and will present the program during the monthly meeting in October 2023 for comment and further revision. The materials will be discussed with the Viengthong and Xaychamphone District Education and Sports Offices before the implementation.

#### **d. Component 4 – Conservation linked livelihood development**

BOMU, with support from the Bolikhamxay PAFO livestock and fishery section, submitted the report and proposal to the District Agriculture and Forestry Office (DAFO) of Viengthong and Xaychamphone for the official approval of the farmer groups. After reviewing the documents, DAFO advised the team to provide supporting documents such as the farmers' regulations and the proposal from the farmer group. In this regard, BOMU and DAFO planned to conduct another field trip to all the villages from the first week of October 2023 and will then submit the supporting document to DAFO for approval.

The snare removal activity was conducted from 10 to 24 September 2023, focusing on the TPZ highest priority area. The results will be discussed during the monthly meeting in October 2023.

### **2.2.2 Preparation of Annual Implementation Plan (AIP) 2023**

Bolikhamxay BOMU submitted the request for the second two-quarter fund disbursement under their approved AIP2023 to FPF DOF-MAF on 18 August 2023. NNP1PC received the fund disbursement request from DOF-MAF on 5 September 2023 for the second six months of the BOMU AIP2023. NNP1PC transferred the fund on 18 September 2023, totalling 3,136,113,000 LAK, from which 1,830,995,000 LAK is under the GOL CA fund and 1,305,118,000 LAK is under the NNP1 No Net Loss (NNL) fund.



## 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, covering the upstream, upper reservoir, lower reservoir, downstream and Mekong areas.

The fish species dominating the fish catch by weight in August 2023 as listed in **Table 2.3-1**. All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species<sup>1</sup>, except *Sikukia gudgeri* is classified as Data deficient (DD) and *Cyprinus carpio* and *Oreochromis niloticus* are an exotic species.

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

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Oreochromis niloticus</i>	ປານິນ	340.6	LC
<i>Mastacembelus armatus</i> , <i>Mastacembelus favus</i>	ປາຫຼາດ	259.3	LC
<i>Hampala dispar</i> , <i>Hampala macrolepidota</i>	ປາສຸດ	131.4	LC
<i>Cyprinus carpio</i>	ປາໃນ	85.1	VU
<i>Channa striata</i>	ປາຄໍ້າ	90.4	LC

The recorded catch of Threatened species (IUCN Red List classification) in August 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 August 2023 Fish Catch**

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Scaphognathops bandanensis</i>	ປາປ່ຽນ/ປາວຽນໄຟ	33.7	VU
<i>Tor sinensis</i>	ປາແດງ	18.7	VU

Species abundance and occurrence is based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey in August 2023. The catch is divided in three areas including above the main dam, below the main dam and Mekong area. The main biodiversity indicators in August 2023 for above dam, below dam and Mekong area are presented in **Table 2.3-3**.

**Table 2.3-3: Main Biodiversity Indicators for August 2023**

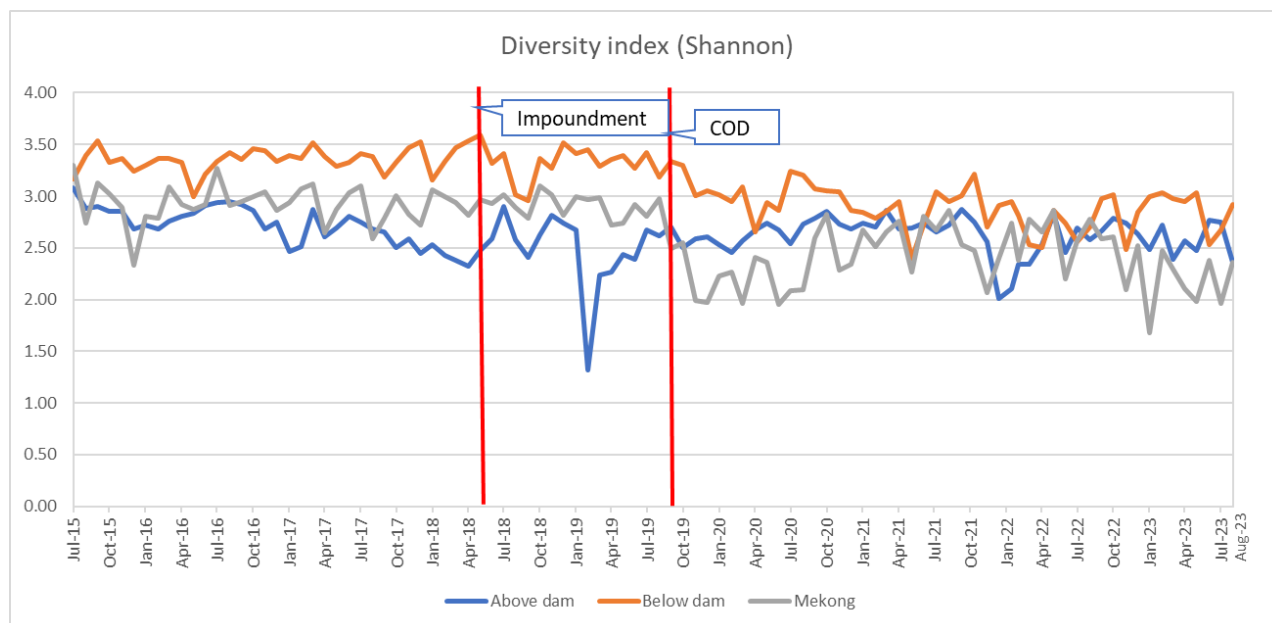
Biodiversity Indicators	Mekong	Below dam	Above dam
Total number of species and groups recorded	25	29	33
Single species	21	20	21

<sup>1</sup> 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.



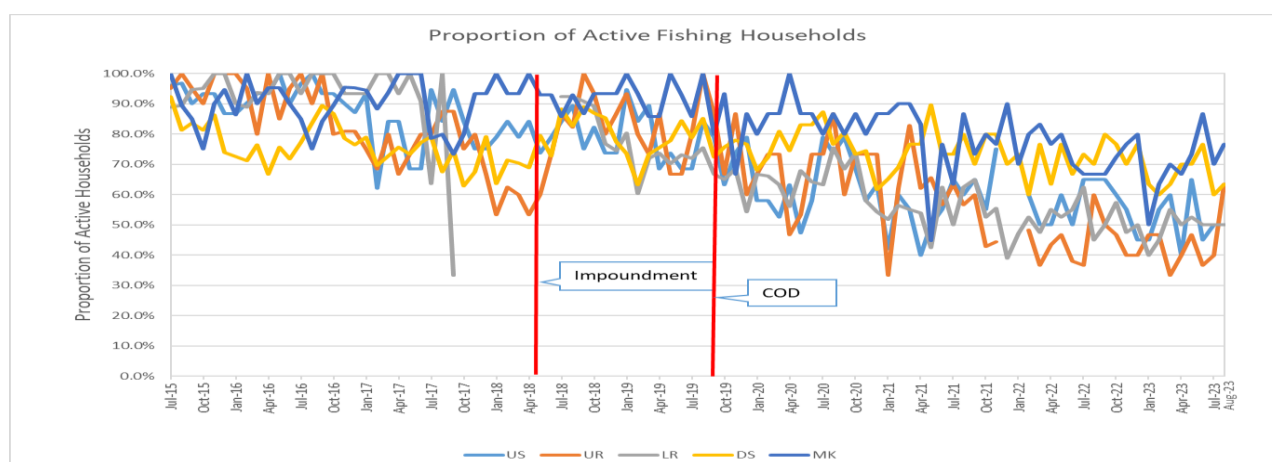
Biodiversity Indicators	Mekong	Below dam	Above dam
Species groups	4	9	12
Top 15 species (% total catch weight)	76.15%	83.23%	93.75%
Proportion for species groups	6.86%	54.30%	43.54%
Diversity index (Shannon)	2.3604	2.9186	2.3591

**Figure 2.3-1** shows fish diversity index (Shannon) for above dam, below dam and Mekong area from July 2015 to August 2023. Note that high values in the index (Shannon) mean high biodiversity.



**Figure 2.3-1: Fish diversity index (Shannon) by fishing zone from July 2015 to August 2023**

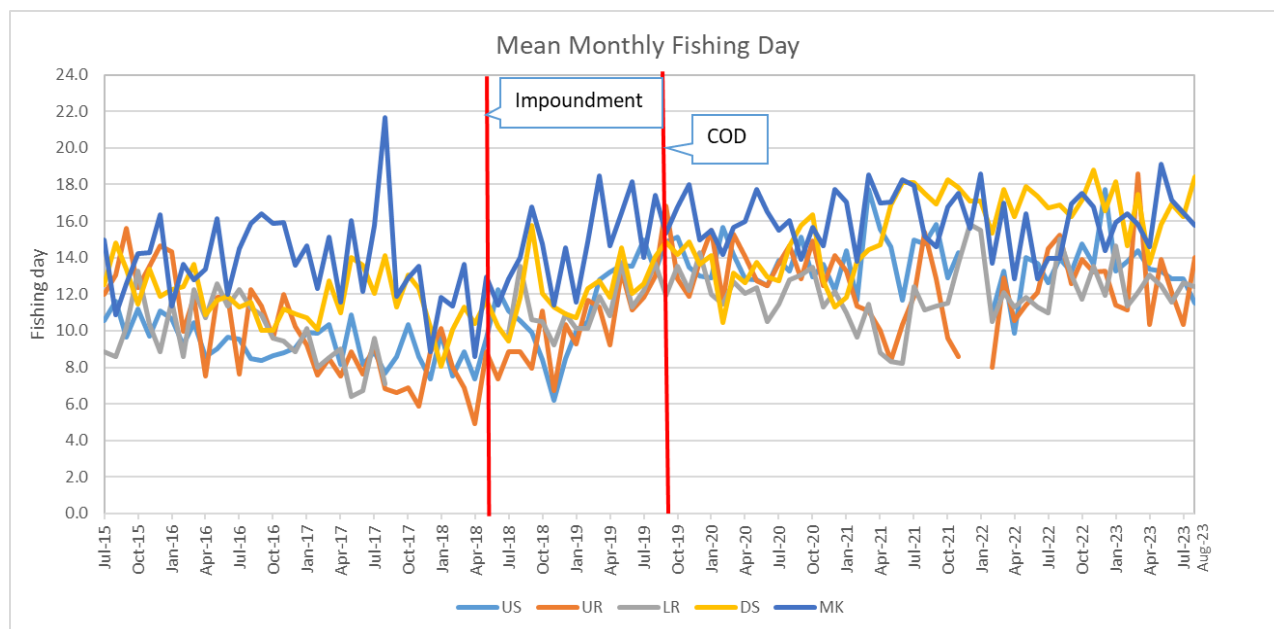
**Figure 2.3-2** shows the proportion of total number of households actively fishing by fishing zone including upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK). It ranges between 50% and 76% of active fishing households for all fishing zones in August 2023.



**Figure 2.3-2: Proportion of total number of households actively fishing by fishing zone from July 2015 to August 2023**

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

**Figure 2.3-3** shows the average (mean) of monthly household fishing days from July 2015 to August 2023 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area.



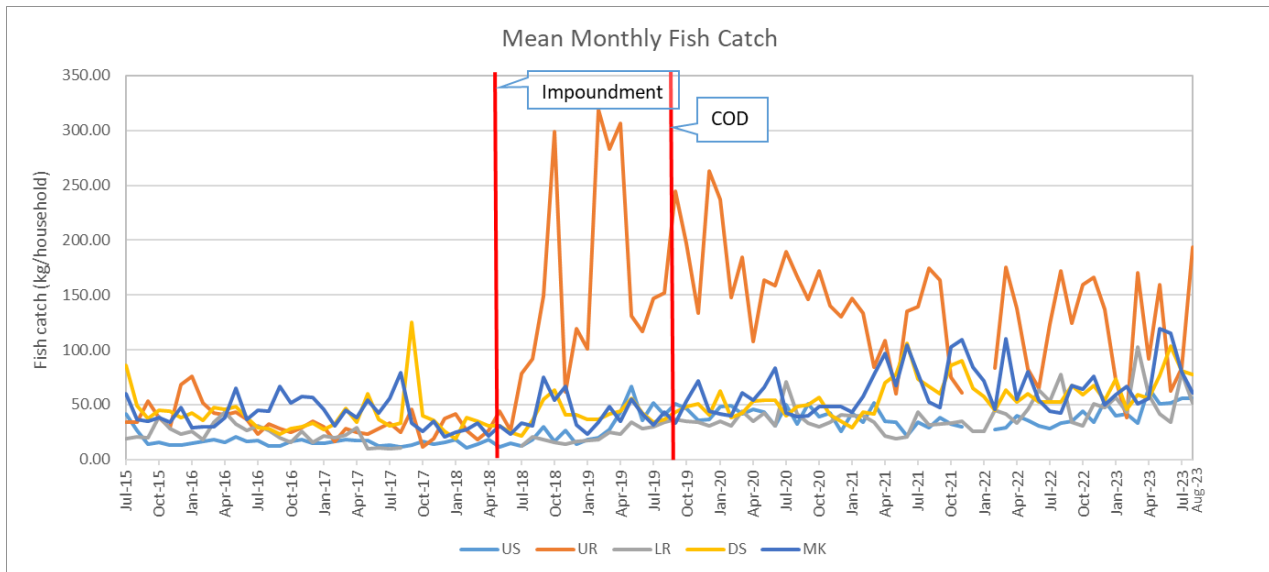
**Figure 2.3-3: Mean of monthly fishing day from July 2015 to August 2023**

The mean monthly number of fishing days for the month of August from 2015 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 August from 2015 to 2023**

Fishing Zone	August 2015 (day)	August 2016 (day)	August 2017 (day)	August 2018 (day)	August 2019 (day)	August 2020 (day)	August 2021 (day)	August 2022 (day)	August 2023 (day)
Upstream	11.60	8.49	7.68	10.56	13.29	13.29	14.76	13.97	11.51
Upper reservoir	13.05	12.26	6.84	8.86	12.99	14.65	15.37	15.25	13.98
Lower reservoir	8.56	11.24	7.09	13.52	13.70	12.77	11.16	15.01	12.40
Downstream	14.80	11.57	14.13	11.81	14.06	14.64	17.53	16.87	18.41
Mekong	10.87	15.87	21.65	14.02	17.42	16.01	15.16	13.95	15.79

The mean monthly household fish catch from July 2015 to August 2023 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area are presented in **Figure 2.3-4**.



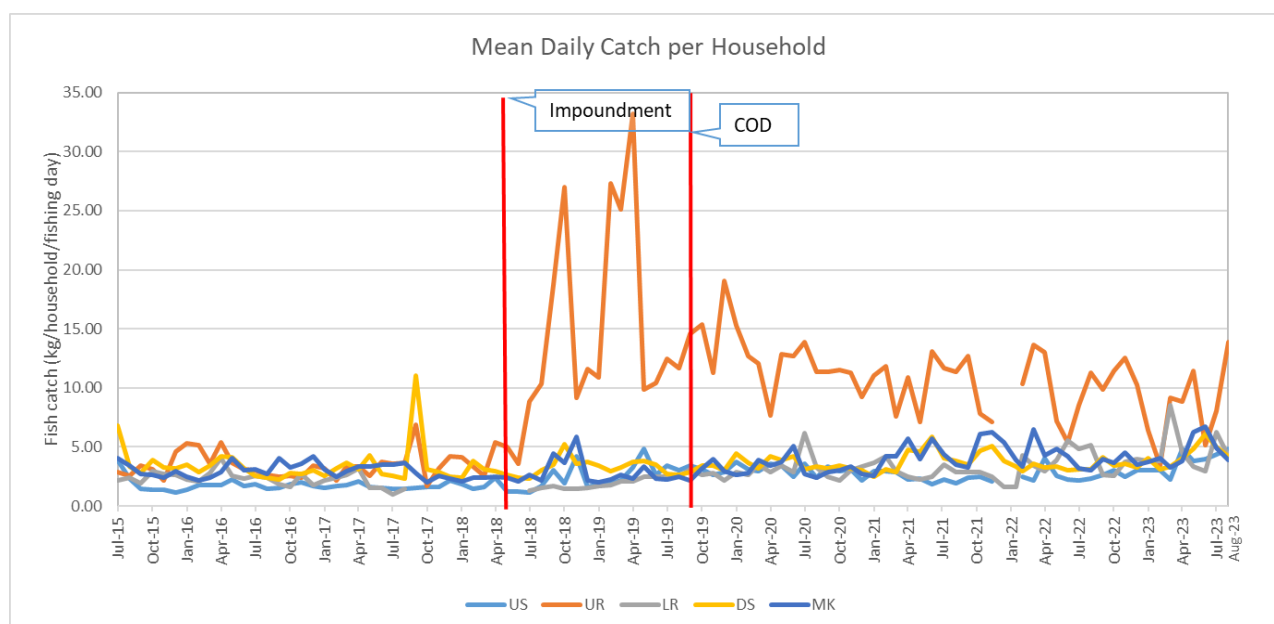
**Figure 2.3-4: Mean Monthly Household Fish Catch from July 2015 to August 2023**

The mean household fish catch for the month of August from 2015 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 August from 2015 to 2023**

Fishing Zone	August 2015 (kg)	August 2016 (kg)	August 2017 (kg)	August 2018 (kg)	August 2019 (kg)	August 2020 (kg)	August 2021 (kg)	August 2022 (kg)	August 2023 (kg)
Upstream	26.66	12.10	11.34	17.68	40.55	32.14	28.82	32.81	55.49
Upper reservoir	33.75	32.64	25.00	91.49	151.78	166.58	174.30	171.48	193.58
Lower reservoir	20.22	26.78	10.54	20.55	33.90	41.69	31.76	77.75	51.84
Downstream	49.30	28.12	32.88	35.65	36.87	48.44	66.78	52.19	77.57
Mekong	36.80	43.66	79.12	30.48	42.75	38.84	52.61	42.49	61.02

The mean daily fish catch per household from July 2015 to August 2023 are displayed in **Figure 2.3-5** and the mean fish catch per household per fishing day for the month of August from 2015 to 2023 are shown in **Table 2.3-6**.



**Figure 2.3-5: Mean Daily Fish Catch per Household from July 2015 to August 2023**

**Table 2.3-6: Mean Daily Fish Catch per Household for the month of August from 2015 to 2023**

Fishing Zone	August 2015 (kg)	August 2016 (kg)	August 2017 (kg)	August 2018 (kg)	August 2019 (kg)	August 2020 (kg)	August 2021 (kg)	August 2022 (kg)	August 2023 (kg)
Upstream	2.30	1.43	1.48	1.67	3.05	2.42	1.95	2.35	4.82
Upper reservoir	2.59	2.66	3.65	10.33	11.68	11.37	11.34	11.24	13.84
Lower reservoir	2.36	2.38	1.49	1.52	2.48	3.26	2.85	5.18	4.18
Downstream	3.33	2.43	2.33	3.02	2.62	3.31	3.81	3.09	4.21
Mekong	3.39	2.75	3.65	2.17	2.45	2.43	3.47	3.05	3.86

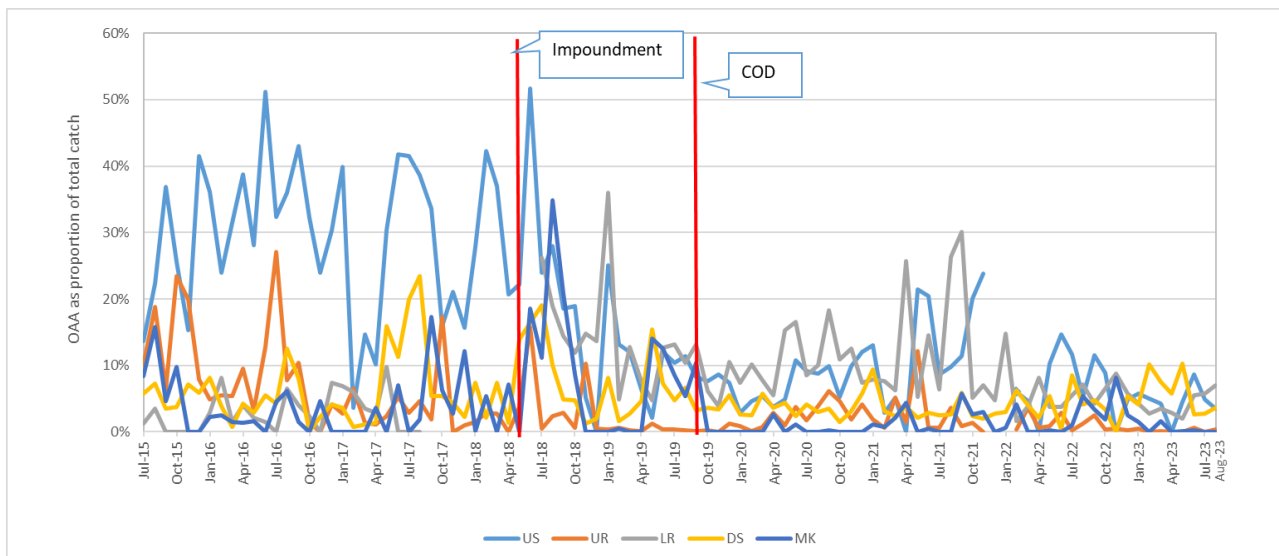
The survey results in August 2023 indicate that Nam Ngiep is the main fishing habitat for the upstream and downstream zone, while the main fishing habitat for the upper reservoir and lower reservoir zone is reservoir and the main habitat in the Mekong zone is Mekong. The proportion of fishing habitats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

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

Habitats	US	UR	LR	DS	MK
Mekong	0.0%	0.0%	0.0%	0.0%	70.7%
Nam Ngiep	42.6%	11.6%	0.0%	64.5%	6.3%
Nam Xan	0.0%	0.0%	0.0%	0.0%	0.0%
Reservoir	32.7%	85.8%	41.9%	0.0%	0.0%

Habitats	US	UR	LR	DS	MK
Tributaries and streams	21.3%	2.0%	54.9%	35.5%	6.1%
Wetlands	3.4%	0.7%	3.2%	0.0%	16.9%
Others	0.0%	0.0%	0.0%	0.0%	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 August 2023 are presented in **Figure 2.3-6** and the proportion of OAA catch for the month of August from 2015 to 2023 are shown in **Table 2.3-8**.



**Figure 2.3-6: Proportion of OAA to the total reported number of fish and OAA for a 7-day period by fishing zone from July 2015 to August 2023**

**Table 2.3-8: Proportion of OAA to the total reported number of fish and OAA for the month of August from 2015 to 2023**

Fishing Zone	August 2015	August 2016	August 2017	August 2018	August 2019	August 2020	August 2021	August 2022	August 2023
Upstream	22.31%	36.00%	38.66%	28.02%	11.37%	8.80%	9.82%	5.22%	3.47%
Upper reservoir	18.74%	7.71%	4.61%	2.36%	0.19%	3.93%	3.60%	1.27%	0.36%
Lower reservoir	3.52%	6.54%	0.00%	18.98%	10.45%	10.06%	26.37%	7.09%	7.07%
Downstream	7.28%	12.58%	23.50%	10.06%	6.59%	2.96%	2.61%	4.11%	3.68%
Mekong	15.84%	6.19%	1.83%	34.86%	5.42%	0.00%	0.00%	5.42%	0.00%

### **3 External missions and visits**

There are no external missions and visits in September 2023.

# 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																
4-Sep-23	pH	5.0 - 9.0	6.52											7.05			7.02	
5-Sep-23	pH	5.0 - 9.0		6.75	6.58	6.55												
6-Sep-23	pH	5.0 - 9.0					6.58	6.64	6.59	6.7	6.85	6.91				7.1	7.02	
14-Sep-23	pH	5.0 - 9.0		6.91	6.73	6.66												
15-Sep-23	pH	5.0 - 9.0					6.5	6.59	6.45	6.55								
20-Sep-23	pH	5.0 - 9.0		6.88	6.7	6.64												
21-Sep-23	pH	5.0 - 9.0					6.59	6.71	6.56	6.8								
22-Sep-23	pH	5.0 - 9.0									6.74	6.86	6.92	7.06		7.1	6.98	
26-Sep-23	pH	5.0 - 9.0		6.84	6.72	6.6												
27-Sep-23	pH	5.0 - 9.0					6.55	6.66	6.75	6.83								
4-Sep-23	Sat. DO (%)		96.7											103.1				
5-Sep-23	Sat. DO (%)			88.2	91.2	100.4												
6-Sep-23	Sat. DO (%)						96.9	105.8	28.1	40.2	57.7	61.4				81.2	82.8	
14-Sep-23	Sat. DO (%)			80.7	123.5	109.7												
15-Sep-23	Sat. DO (%)						107.6	87.3	40.4	64.3								
20-Sep-23	Sat. DO (%)			87.5	99.2	96.9												
21-Sep-23	Sat. DO (%)						98.8	98.2	41.6	59.4								
22-Sep-23	Sat. DO (%)										69	65.4	74.5	76.6		98.9	97.9	
26-Sep-23	Sat. DO (%)			105.6	112.3	105.7												
27-Sep-23	Sat. DO (%)						94.4	97.3	40.3	61.9								
4-Sep-23	DO (mg/L)	>6.0	7.94											8.62				
5-Sep-23	DO (mg/L)	>6.0		7.18	6.82	7.44												
6-Sep-23	DO (mg/L)	>6.0					7.35	8.04	2.31	3.31	4.77	5.06				6.25	6.42	
14-Sep-23	DO (mg/L)	>6.0		6.58	9.14	8.31												

		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																
15-Sep-23	DO (mg/L)	>6.0					8.26	6.83	3.34	5.03								
20-Sep-23	DO (mg/L)	>6.0		6.96	7.41	7.25												
21-Sep-23	DO (mg/L)	>6.0					7.42	7.45	3.4	4.74								
22-Sep-23	DO (mg/L)	>6.0									5.68	5.38	5.92	6.1		7.73	7.77	
26-Sep-23	DO (mg/L)	>6.0		8.09	8.44	7.94												
27-Sep-23	DO (mg/L)	>6.0					7.19	7.47	3.3	5.1								
4-Sep-23	Conductivity (µs/cm)		103											34				
5-Sep-23	Conductivity (µs/cm)			98	81	78												
6-Sep-23	Conductivity (µs/cm)						79	78	80	78	78	79				97	24	
14-Sep-23	Conductivity (µs/cm)			77	82	76												
15-Sep-23	Conductivity (µs/cm)						76	74	77	56								
20-Sep-23	Conductivity (µs/cm)			57	78	75												
21-Sep-23	Conductivity (µs/cm)						74	73	74	62								
22-Sep-23	Conductivity (µs/cm)										72	75	72	61		96	19	
26-Sep-23	Conductivity (µs/cm)			82	78	74												
27-Sep-23	Conductivity (µs/cm)						73	72	74	56								
4-Sep-23	Temperature (°C)		25.44											24.64				
5-Sep-23	Temperature (°C)			25.67	30.61	31.53												
6-Sep-23	Temperature (°C)						29.86	29.74	25.19	24.98	24.96	25.43				28.72	28.69	
14-Sep-23	Temperature (°C)			35.3	2.37	2.15												
15-Sep-23	Temperature (°C)						29.12	28.01	25.08	27.51								
20-Sep-23	Temperature (°C)			27.33	30.64	30.52												
21-Sep-23	Temperature (°C)						30.22	29.81	25.7	27.15								
22-Sep-23	Temperature (°C)										25.13	25.44	26.71	26.53		28.06	27.09	
26-Sep-23	Temperature (°C)			29.24	30.56	30.33												
27-Sep-23	Temperature (°C)						29.45	29.03	24.88	25.81								
4-Sep-23	Turbidity (NTU)		310											15.7				
5-Sep-23	Turbidity (NTU)			42.9	2.65	1.33												

		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						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																
6-Sep-23	Turbidity (NTU)						1.45	1.03	17.8	16.1	21	26.8				99.1	5.76	
14-Sep-23	Turbidity (NTU)			35.3	2.37	2.15												
15-Sep-23	Turbidity (NTU)						1.69	1.96	18.8	12.3								
20-Sep-23	Turbidity (NTU)			28.3	2.58	1.12												
21-Sep-23	Turbidity (NTU)						1.3	1.22	20.5	14.5								
22-Sep-23	Turbidity (NTU)										19.9	22.7	22.3	17.6		30.3	5.7	
26-Sep-23	Turbidity (NTU)			4.41	3.78	1.44												
27-Sep-23	Turbidity (NTU)						1.36	1.69	19.8	18.6								
4-Sep-23	TSS (mg/L)		178.7											10.63				
20-Sep-23	TSS (mg/L)			14.6		<5												
21-Sep-23	TSS (mg/L)						<5	<5	7.09	5.07								
22-Sep-23	TSS (mg/L)										8.8	10.14	14.05	9.16		27.4	5.61	
4-Sep-23	BOD <sub>5</sub> (mg/L)	<1.5	<1											<1				
20-Sep-23	BOD <sub>5</sub> (mg/L)	<1.5		<1		<1												
21-Sep-23	BOD <sub>5</sub> (mg/L)	<1.5					<1	<1	<1	<1								
22-Sep-23	BOD <sub>5</sub> (mg/L)	<1.5									<1	<1	<1	<1		<1	<1	
4-Sep-23	Faecal coliform (MPN/100 mL)	<1,000	920											920				
4-Sep-23	Total Coliform (MPN/100 mL)	<5,000	1,600											1,600				
14-Sep-23	Total Phosphorus (mg/L)		0.57											0.04				
15-Sep-23	Total Phosphorus (mg/L)						0.01	<0.01										
16-Sep-23	Total Phosphorus (mg/L)			0.05		0.03									0.1			
20-Sep-23	Turbidity (NTU)-bottom					48.6												
21-Sep-23	Turbidity (NTU)-bottom						4.46	1.97										
20-Sep-23	TSS (mg/L)-bottom					21.71												
21-Sep-23	TSS (mg/L)-bottom						20.8	11.38										
20-Sep-23	BOD <sub>5</sub> (mg/L)-bottom					<1												
21-Sep-23	BOD <sub>5</sub> (mg/L)-bottom						<1	5.78										

**TABLE A-2: RESULTS OF CAMP EFFLUENTS IN SEPTEMBER 2023**

	Site Name	OSOV1 (Owner's Site Office and Village)		OSOV2 (ESD Camp)		Main Powerhouse	
	Station Code	EF01		EF13		EF19	
	Date	28-Sep-23		28-Sep-23		28-Sep-23	
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	6.6		6.79		6.8	
Sat. DO (%)		28.5		49.5		47.4	
DO (mg/L)		2.25		3.8		3.6	
Conductivity (µs/cm)		271		425		873	
Temperature (°C)		27.47		29.04		29.48	
Turbidity (NTU)		1.32		4.67		6.8	
TSS (mg/L)	<50	<5		5.94		10.9	
BOD <sub>5</sub> (mg/L)	<30	<6		7.35		11.64	
COD (mg/L)	<125	Pending		Pending		Pending	
NH <sub>3</sub> -N (mg/L)	<10.0	Pending		Pending		Pending	
Total Nitrogen (mg/L)	<10.0	Pending		Pending		Pending	
Total Phosphorus (mg/L)	<2	Pending		Pending		Pending	
Oil & Grease (mg/L)	<10.0	Pending		Pending		Pending	
Total coliform (MPN/100 mL)	<400	110		350		920	
Faecal Coliform (MPN/100 mL)	<400	79		280		220	
Residual Chlorine (mg/L)	<1.0	N/A		0.06		0.06	