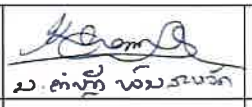
NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

August 2022

					
A	30 September 2022	Hendra WINASTU	Wanidaporn RODE	Khamlar PHONSAVAT	Final
REV	DATE	AUTHOR	CHECKED	APPROVED	MODIFICATION DETAILS

Accessibility		Document No.
☑	Public	NNP1-O-J0904-RP-020-A
☐	Internal	
☐	Confidential	

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

EXECUTIVE SUMMARY

During August 2022, activities related to ISO14001:2015 implementation continued such as following up on the implementation of the Environmental Management Plan and its achievements and on preparation of the internal audit plan for the coming session which is postponed from August 2022 to September 2022.

The Minutes of Meeting (MoM) from a quarterly monitoring mission during 31 May to 1 June 2022 on the reservoir and in Zone 2UR by the delegations from Xaysomboun Provincial Department of Natural Resources and Environment (PONRE) and the Environmental Management Unit (EMU) from Thathom and Hom Districts, Xaysomboun Province, was shared with the Company. The GOL did not raise any major comments during the mission and

During this reporting period, no new document was submitted to EMO for review and approval. EMO did not issue any Site Inspection Report of Observation of Non-Compliance (ONC) or Non-Compliance Reports (NCR) to any Contractor.

The operation and adjustment of the constructed wastewater treatment systems continued in August 2022. Approx 0.2 m^3 of sludge was collected from the biofilm septic tanks of OSOV1 and applied into the Sequencing Batch Reactor (SBR) system of OSOV2 to aid the sludge creation and micro-organic matter under the designed specification of the system. The results of the effluent analyses of the second fortnightly sampling after adding sludge indicated reduction of nitrogen and phosphorus in the effluent and due to the increase of bacteria content, the chlorine dosage was adjusted accordingly. It is expected that the operation of the system can be adjusted to meet the effluent standards by Q3 2022.

At R05 (in the Main Reservoir approx. 0.5 km upstream the Main Dam), the average DO concentration was 7.1 mg/L in the upper 5.0 m varying between 5.7 mg/L and 7.7 mg/L, and the oxycline was generally found at depths between 5.0 m and 10.0 m with DO concentrations decreasing from about 6 mg/L to 3 mg/L. In the Re-regulation Reservoir, the DO concentrations were about 2 mg/L to 3 mg/L with a mean of 2.8 mg/L.

The DO measurements downstream the Re-regulation Dam during turbine discharges were less than 6 mg/L in all downstream stations this is due to oxygen depletion in the deeper layers of the main reservoir, caused by decomposing submerged biomass which was left in the reservoir.

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.

In July 2022, the communities' solid waste management and the Houay Soup Landfill operation are still under handover process to be managed by the local authorities (Bolikhan Environment Management Unit or EMU). The report on the community consultations is still under review and

consideration by the Bolikhan District Governor. EMO expects the community solid waste management to be fully handed over to the local authority within 2022.

A total of 9.00 m^3 of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 1.71 m^3 compared with July 2022. There was no trading of recyclable waste at the community recycle waste bank during the reporting period.

Despite the follow-up by EMO team on the actions discussed and agreed at the previous monthly meetings with Xaysomboun Watershed and Reservoir Protection Office (WRPO), it is noted that there has not been much progress in August 2022. EMO Team noted that key persons of Xaysomboun WRPO were occupied with other assignments from their respective offices. Similarly, Bolikhamxay WRPO still could not organized the SMART refresher and new standard operation procedure (SOP) training for Bolikhamxay WRPO rangers in August 2022 because of unavailability of Bolikhamxay WRPO team. NC-NX BOMU continues with safeguarding the three patrol sub-stations in August 2022. The activities in NC-NX offset site will be resumed after receiving the funds under the AIP2022 that is expected to be available in September 2022.

The fish catch monitoring for July 2022 in Nam Ngiep Watershed was dominated by *Oreochromis niloticus* and *Channa striata*, and species groups of Hampala, *Sikukia gudgeri* and *Amblyrhynchichthys truncates*, and Poropuntius. They are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species, except *Sikukia gudgeri* which is classified as Data Deficient species (DD).

1. ENVIRONMENTAL MANAGEMENT MONITORING

1.1. ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

During August 2022, activities related to ISO14001:2015 implementation continued such as following up on the implementation of the Environmental Management Plan and its achievements and on preparation of the internal audit plan for the coming session which is postponed from August 2022 to September 2022. The scope of the internal audit is shown in the table below.

Table 1.1-1: The ISO14001:2015 Audit Areas and responsible Internal Auditors' Groups

Area/Department/Process/Function	G1	G2	G3	G4	G5	G6
Industrial Areas (Powerhouses and Dams)						
Control rooms						
Dams						
Equipment Storage Rooms						
Chemical & Hazmat Storage Areas						
Reservoirs and Downstream of the Dams						
Transmission Lines (230 kV and 115 kV) and 22kV DL						
Emergency response and preparedness system						
Wastewater treatment systems						
Camps Facilities						
Wastewater treatment systems (OSOV1, OSOV2)						
Environmental Laboratory						
Clinic (OSOV1)						
Security guard houses						
Emergency response and preparedness system						
Project Waste Management and Landfill Operation						
Canteen						
Site decommissioned and rehabillated						
Watershed and Biodiverstiy Management						
Resettlement Management						
Management System						
Management Represenntative (MR)						
Organization Contexts/Needs and Expectations of Interested Parties/Risks and Opportunities/Legal and Compliance Evaluation						
Compliance Obligation and Compliance Evaluation						
Communication						
DCC						
Incident Investigation/NC/CA/PA						
Internal Audit						
Management Review						
E Objectives, Targets and Programs						
Training						
Procurement Management						
Logistic and transportation						

1.2. COMPLIANCE MANAGEMENT

In August 2022, EMO did not receive any document for review and approval.

The operation and adjustment of the constructed wastewater treatment systems continued in August 2022. Approx 0.2 m^3 of sludge was collected from the biofilm septic tanks of OSOV1 and applied into the Sequencing Batch Reactor (SBR) system of OSOV2 to aid the sludge creation and micro-organic matter under the designed specification of the system. The results of the effluent analyses of the second fortnightly sampling after adding sludge indicated reduction of nitrogen and phosphorus in the effluent and due to the increase of bacteria content, the chlorine dosage was adjusted accordingly. It is expected that the operation of the system can be adjusted to meet the effluent standards by Q3 2022.

EMO did not issue any Site Inspection Report (SIR) or Non-Compliance Report (NCR) to the Contractor during the reporting period. The status of compliance reports (Observation of Non-Compliance or ONC; and Non-Compliance Report or NCR) issued by NNP1PC is summarized in ***Table 1.2-1*** and ***Table 1.2-2*** below.

Table 1.2-1: Summary of ONCs and NCRs

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from July 2022	0	1	1	0
Newly Opened in August 2022	0	0	0	0
Total in July 2022	**0**	**1**	**1**	**0**
Resolved in August 2022	0	0	0	0
Carried over to September 2022	0	**1**	**1**	0
Unsolved Exceeding Deadlines	**0**	**1**	**1**	**0**

Table 1.2-2: Summary of NCR and ONC issued to the contractor

Document Number / Date of Issue	Subject Description	Current Status at the end of August 2022
NC No. 01/22 Issued Date: 13-02-22 (NCR Level 1)	Some effluent parameters continue to exceed the standards for almost 5 months following the completion of the improvement and modification in September 2021	• Continue to conduct case studies and adjustments to identify the proper treatment condition for the SBR system at OSOV2; • Applied sludge from septic tanks into the SBR system of OSOV2 to aid sludge generation and organic matter under the designed specifications; • Continue to monitor the influent and effluent to check the treatment effectiveness.
NC No. 02/22 Issued Date: 01-07-22 (NCR Level 2)	1) The Contractor proposed "trimming of 6 trees" for preventive maintenance of the ROW for the 22 kV DL but in fact, they used the "cut" method for three trees. This change in method was implemented without prior notification and revision of SS-ESMMP submitted to NNP1PC-TD. It has resulted in significant impacts on biodiversity especially when these are protected species listed in category II and III of the Forestry Law and IUCN as endangered or vulnerable (EIA of NNP1 Project prepared by ERM dated 2014). 2) Most of these valuable trees are located outside the ROW of the 22 kV DL (5 m to each side of the centreline) so cutting shall be minimized to the extent possible. The contractor did not assess the risks nor propose any alternative options, but went ahead with cutting the trees without prior approval by EMO and the relevant GOL parties.	• Suspended the tree cutting and logs removal process; • Relevant applicable Lao Laws were shared/distributed to all NNP1NC staff by Document Controller Centre (DCC). • The removal and handing over of logs to Hat Gniun Village authority according to Bolikhan DAFO advice as well as the preventive and corrective actions are still in progress and this NCR could be Closed Out within September 2022 after the completion of logs hand-over to the GOL.

1.2.1. Site Inspection by the Environment Management Unit (EMU)

The monthly site visit by the EMU of Bolikhan District and the quarterly site visit by the EMU of Xaysomboun Province were not carried out in August 2022.

1.2.2. Site Decommissioning and Rehabilitation

The land use handover is currently being reviewed and considered by the higher government at provincial level.

The overall rehabilitation status of the construction sites and percentage of vegetation cover have not been assessed in August 2022.

1.3. WATER QUALITY MONITORING

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD_5), 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. T he 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 WWTSs in August 2022

Site	Sampling ID	Status	Corrective Actions (Expected Completion Date)
OSOV1	EF01	Non-compliance for faecal coliform and total coliform.	1) Completed proper fence installation to prevent cattle from accessing the OSOV1 wetland ponds (31 March 2022). 2) Completed additional planting of reeds in the OSOV1 wetland ponds (31 March 2022). 3) Added the proper sludge/seeds into the Aeration Tank at OSOV2 WWTS and the Biofilm Septic Tank at the Main Powerhouse System – the effluent testing results after adding will be reported in Q3 of 2022. 4) Closely monitor the residual chlorine content in the effluents of OSOV2 and the Main Powerhouse WWTS and chlorination dosage adjustment was successful by June 2022.
OSOV2	EF13	Non-compliance for total phosphorus, total nitrogen and ammonia-nitrogen.	
Main Powerhouse	EF19	Non-compliance for BOD5 (one out of two), fecal coliform, total coliform, total phosphorus, total nitrogen and ammonia-nitrogen.	

Site	Sampling ID	Status	Corrective Actions (Expected Completion Date)
			5) Closely monitor the Influent to compare with the effluent for the specific parameters to check the treatment effectiveness (continue in Q3 of 2022).

1.3.2 Ambient Surface Water and Reservoir Water Quality Monitoring

The ambient surface water and reservoir 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 August 2022 are presented in ***Table 1.3-2, Table 1.3-3*** and ***Table 1.3-4***. The full set of data for August 2022 is attached in Annex A. In addition, the trends of DO depth profile timeseries measurement graph for R05 station is shown in ***Figure 1.3-2***, the results for DO timeseries are presented as line graphs in ***Figure 1.3-3*** and DO Long Profile graphs ***Figure 1.3-4.***

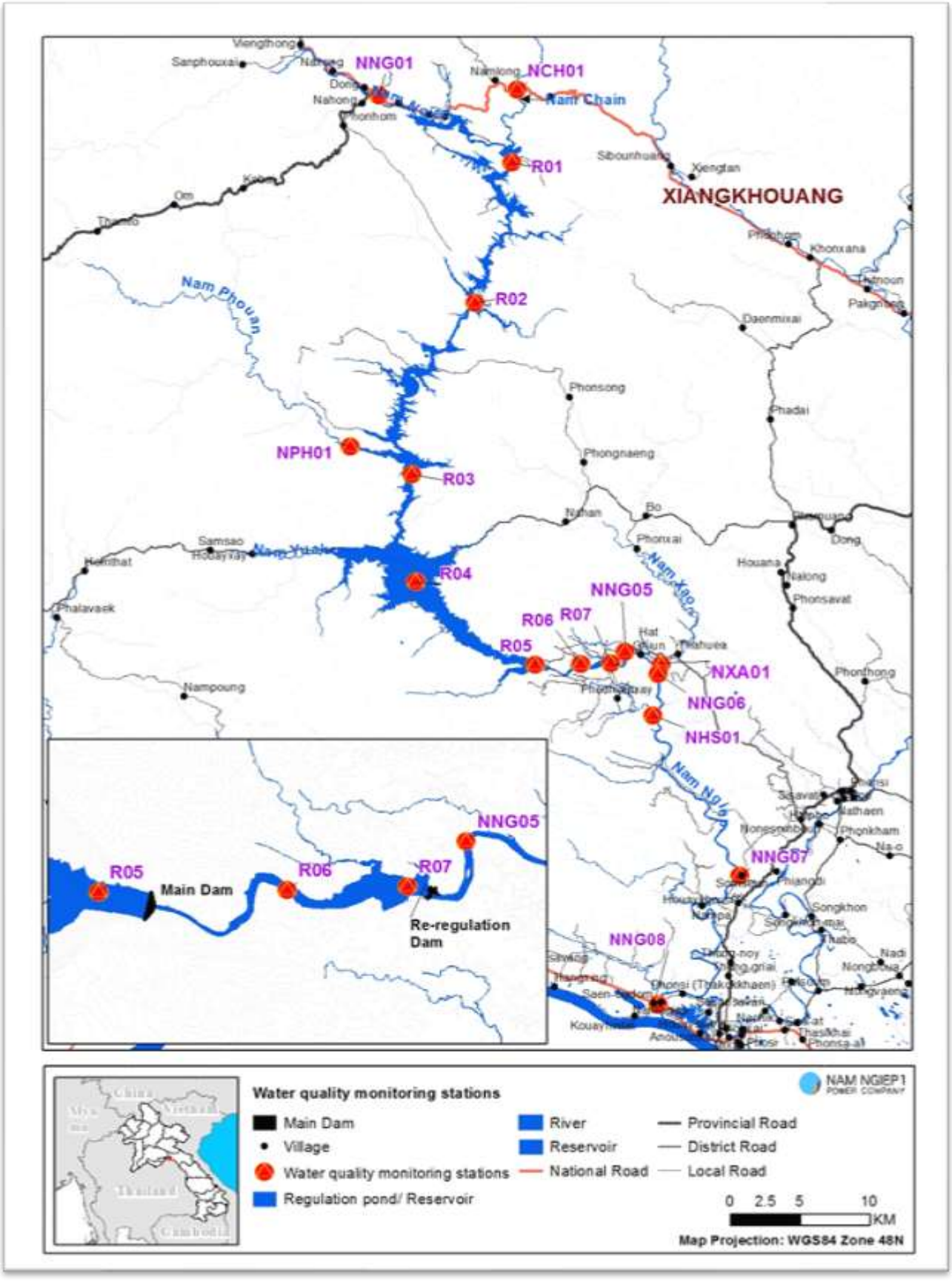


Figure 1.3-1: Surface Water and Re-regulation Reservoir Water Quality Monitoring Stations

Main Reservoir

From 01 to 31 August 2022, the water level in the main reservoir increased from El. 303.52 m asl to El. 312.24 m asl.

At R05 (in the Main Reservoir approx. 0.5 km upstream the Main Dam), the average DO concentration was 7.1 mg/L in the upper 5.0 m varying between 5.7 mg/L and 7.7 mg/L, and the oxycline was generally found at the depths between 5.0 m and 10.0 m with DO concentrations decreasing from about 6 mg/L to 3 mg/L. DO concentrations below 0.5 mg/L (anoxic condition) were recorded at depths of 36 m, 34 m, 38 m, 40 m and 45 m to the bottom which correspond to 8.0 m below the intake sill on 03 August 2022, 4.5 m below the intake sill on 10 August 2022, 6.1 m below the intake sill on 17 August 2022, 5.8 m below the intake sill on 25 August 2022 and 8.9 m below the intake sill on 30 August 2022.

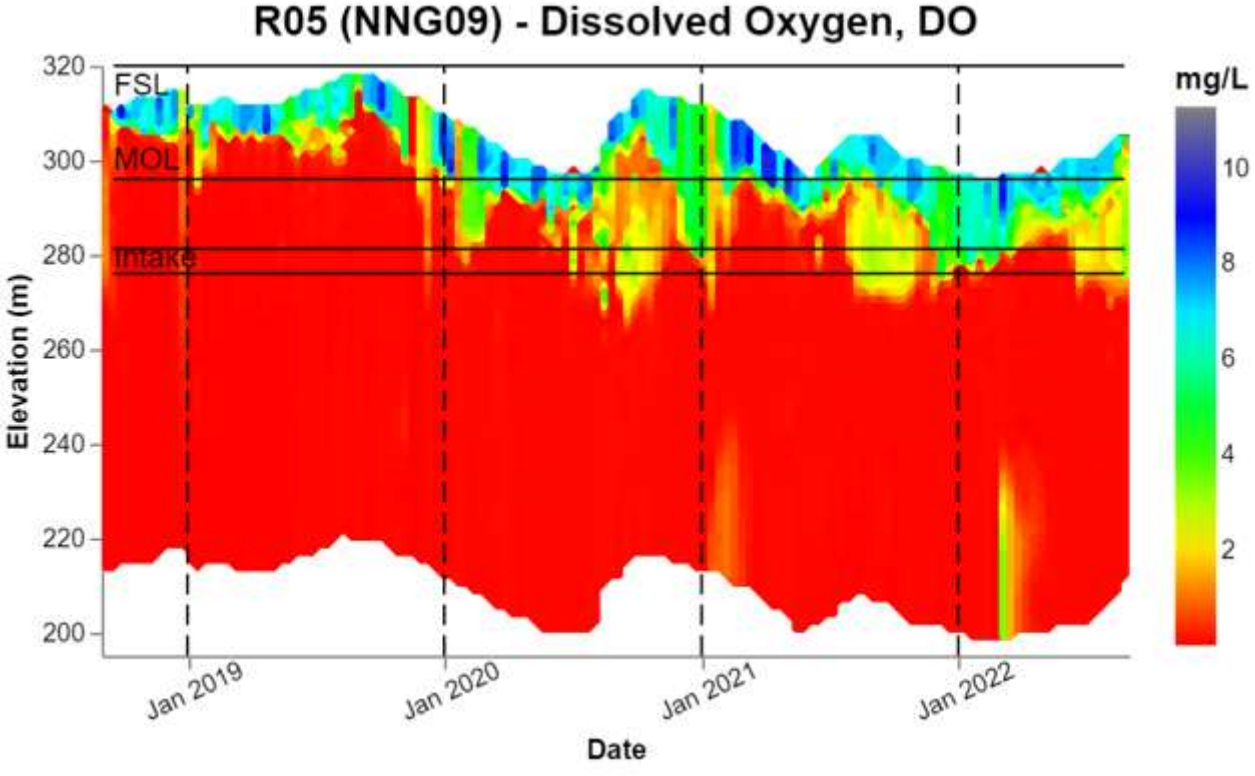


Figure 1.3-2: DO Depth Profiles Time Series in R05 (Since September 2018 to August 2022)

At R04, the DO levels in the upper 5.5 m varied between 5.5 mg/L and 7.7 mg/L with oxycline at depths between 5.0 and 7.5 m below surface, DO concentrations in the depth interval from 6 m to 28.0 varied between 1 and 7 mg/L, and anoxic condition (0.5 mg/L) occurred at depths below 30 m.

At R03, the DO levels in the upper 7.0 m varied between 3.1 mg/L and 9.1 mg/L with an average of 7.5 mg/L. DO concentrations in the depth interval from 7.5 m to 30 m varied with a range between 1 mg/L and 7 mg/L. Anoxic condition (less than 0.5 mg/L) occurred at the bottom.

At R02, the DO levels in the entire water column varied between 3.8 mg/L and 8.8 mg/L with a mean of 5.9 mg/L.

At R01, the DO levels in the entire water column varied between 6.5 mg/L and 8.1 mg/L with a mean of 7.4 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 R01.

The BOD_5 measurements at R01, R02, R03, R04 and R05 in epilimnion were less than 1.0 mg/L. The BOD5 measurements at R03, R04 and R05 in hypolimnion were less than 1 mg/L, 5.4 mg/L and 7.2 mg/L respectively.

Re-regulation Reservoir

In August 2022, the turbine discharges from the Main Powerhouse varied between 27 and 247 m^3/s usually interrupted by night-time periods with no discharge.

The mean DO concentration in the water column were 2.8 mg/L and 2.9 mg/L in R06 and R07 respectively.

The BOD_5 concentrations in both R06 and R07 were less than 1.0 mg/L.

Nam Ngiep Downstream

During August 2022, the downstream water quality monitoring was carried out during turbine discharge and combination of turbine and gate discharges from the Re-regulation Dam. When the DO measurements downstream the Re-regulation Dam were carried out during turbine and combination of turbine and gate discharge, the DO concentrations were generally less than 6 mg/L in the stations within 13 km downstream the Re-regulation Dam, thus not complying with the surface water quality standard, except on 31 August 2022 where all stations from NNG05 to NNG08 had DO levels above 6 mg/L. The low DO concentrations are due to oxygen depletion in the deeper layers of the main reservoir, caused by decomposing submerged biomass which was left in the reservoir.

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_5 in the downstream station (NNG05) was less than 1 mg/L and complied with the national surface water quality standard.

Main Tributaries to Nam Ngiep

All monitored parameters in the Nam Phouan (NPH01), Nam Chiane (NCH01), Nam Xao (NXA01) and Nam Houaysoup (NHS01) complied with the standards, except COD at NSH01 and NXA01 and faecal coliform in NCH01.

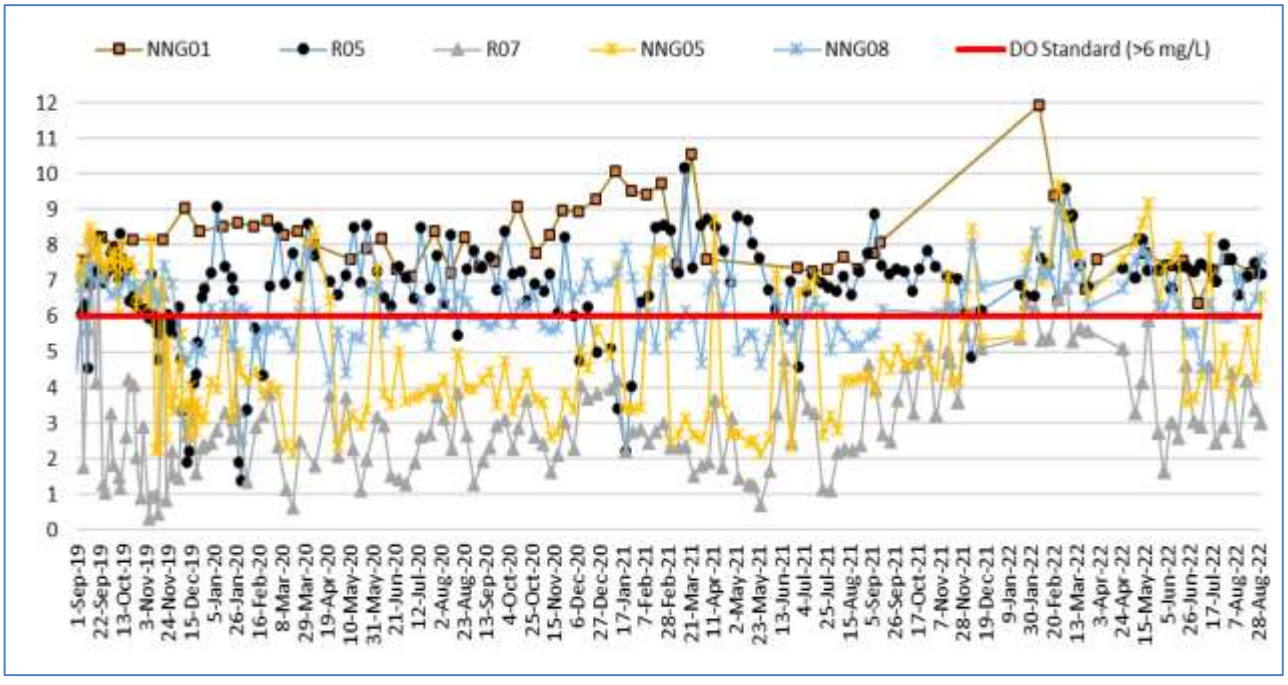


Figure 1.3-3: Concentration of Dissolved Oxygen (mg/L) in the upper 0.2 m since September 2019 on the way to August 2022

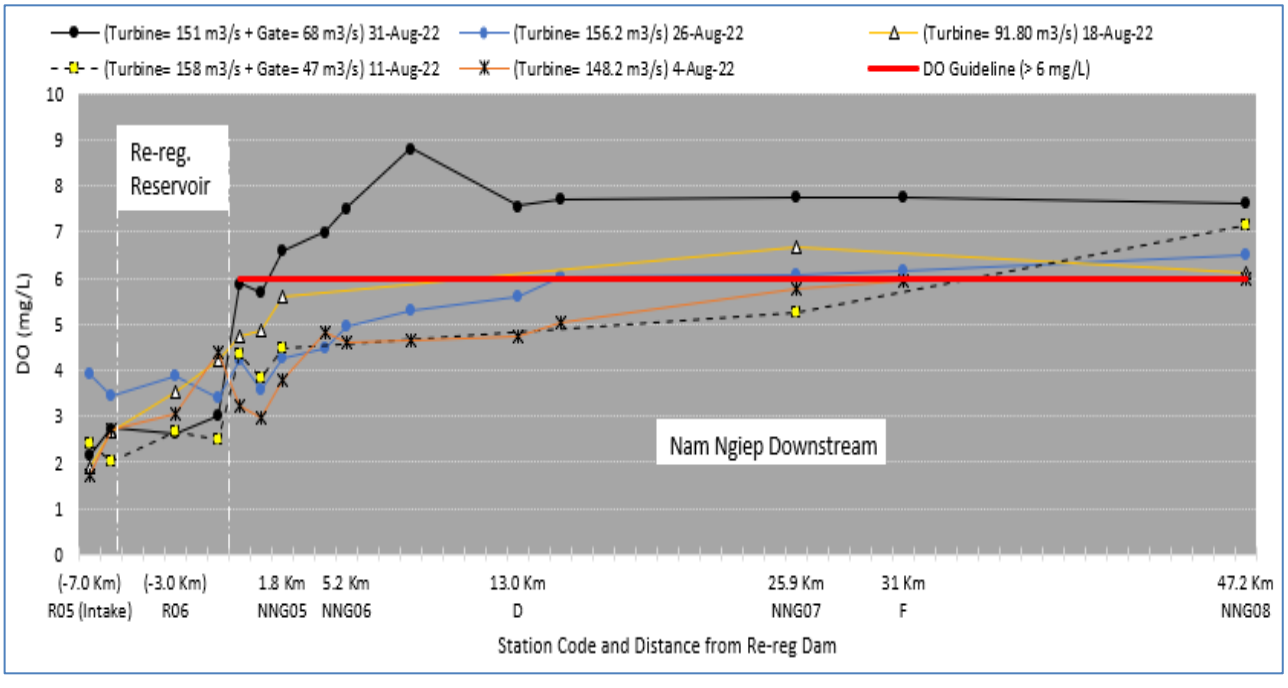


Figure 1.3-4: Dissolved Oxygen (Mg/L) Long Profile in August 2022 (from Immediately Upper Main Dam to Lower Nam Ngiep River)

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
1-Aug-22	7.61												7.01			
2-Aug-22		7.34	7.24	8.05										8.05		
3-Aug-22					7.52	7.6	3.04	4.4								
4-Aug-22									3.8	4.6	5.77	5.98			6.33	6.39
9-Aug-22		7.52	8.18	8.09												
10-Aug-22					6.6	6.6	2.65	2.48								
11-Aug-22									4.48		5.27	7.15			6.92	7.91
16-Aug-22		8.17	8.12	8.35										8.1		
17-Aug-22					7.78	7.11	3.51	4.21								
18-Aug-22									5.6		6.69	6.09			6.98	7.86
22-Aug-22	7.23												5.77			
24-Aug-22		7.98	8.43	9.08										9.34		
25-Aug-22					7.41	7.5	3.89	3.39								
26-Aug-22									4.28	4.96	6.06	6.52			7.67	6.75
29-Aug-22		6.5	7.52	7.6										8.35		
30-Aug-22					7.62	7.18	2.64	3.02								
31-Aug-22									6.59	7.53	7.76	7.63			9.54	8.78

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
1-Aug-22	116												10.42			
2-Aug-22		490		<5										110		
2-Aug-22 Bottom				18												
3-Aug-22					<5	<5	<5	<5								
3-Aug-22 Bottom					10.3	<5										
4-Aug-22									<5	6.23	10.8	14.62			42.8	<5

Table 1.3-4: Results of Surface Water Quality Monitoring for BOD_5 (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
1-Aug-22	1.05												1.5			
2-Aug-22		<1		<1										<1		
2-Aug-22 Bottom				<1												
3-Aug-22					<1	<1	<1	<1								
3-Aug-22 Bottom					5.4	7.2										
4-Aug-22									<1	<1	<1	<1			<1	<1

1.3.3 Groundwater Quality Monitoring

During August 2022, community groundwater quality analyses were carried out for only five out of seven wells located in Somseun Village, Nam Pa Village, Thong Noy Village, Pou Village and Phouhomxay Village due to the water pumps in two wells of Phouhomxay Village were broken. The community groundwater samples were taken from household water taps.

The results indicate that:

- The well in Somsuen Village complied with the National Standards.
- The well in Nam Pa Village and Thong Noy Village did not comply with the Standard for faecal coliform and *E. Coli* bacteria.
- One out of two wells (GPOU01) in Pou Village did not comply with the Standard for faecal coliform and *E.Coli* bacteria.

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 Somsuen, Nam Pa, ThongNoy and Pou Villages

Parameter (Unit)	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village	
	Station	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
	Guideline	15-Aug-22	15-Aug-22	15-Aug-22	01-Aug-22	01-Aug-22
pH	6.5 - 9.2	7.13	6.77	6.73	7.2	6.57
Sat. DO (%)		62.1	81.2	82.7	89.1	90.2
DO (mg/L)		4.88	6.42	6.53	7.06	7.18
Conductivity (µS/cm)		371	442	302	17	208
Temperature (°C)		27.99	27.39	27.44	27.5	27.02
Turbidity (NTU)	<20					
Faecal coliform (MPN/100ml)	0	0	9.3	130	240	0
E.coli Bacteria (MPN/100ml)	0	0	9.3	240	240	0

1.3.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

The results of the water quality analyses are presented ***Table 1.3-6.***

Faecal Coliform and *E.coli* exceeded the standards in the water supply of Thaheua Village (WTHH02), Hat Gniun Village (WHGN02) and Phouhomxay Village (WPHX02 – Primary School Water Tap and WPHX03 – Household Water Tap).

As observed in the field during water sampling, livestock are roaming around 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 Gniun Village	Phouhomxay Village	
	Station	WTHH02	WHGN02	WPHX02	WPHX03
Parameter (Unit)	Guideline	15-Aug-22	15-Aug-22	15-Aug-22	15-Aug-22
pH	6.5 - 8.5	7.8	7.88	8.5	8.17
Sat. DO (%)		95.4	84.7	83.5	91.1
DO (mg/L)		7.45	6.59	6.45	6.95
Conductivity (µS/cm)	<1,000	32	58	8	7
Temperature (°C)	<35	28.02	28.19	28.72	29.51
Turbidity (NTU)	<10				
Faecal Coliform (MPN/100 mL)	0	21	170	11	11
E.coli Bacteria (MPN/100 mL)	0	17	170	11	11

1.3.5 Landfill Leachate Monitoring

During August 2022, the landfill leachate monitoring was conducted at NNP1 Project Landfill (Last pond - LL4) and at Houay Soup Solid Waste Landfill (Last pond - LL6).

The results indicate that NNP1 Project Landfill leachate and Houay Soup Landfill Leachate did not comply with the standard for total coliform parameter. However, the concentrations of faecal coliform bacteria were rather low. The leachate is still contained in the leachate ponds without being discharged to the environment. EMO will continue to monitor the leachate and report the results in the next monthly progress report. The landfill leachate monitoring results for August 2022 can be found ***Table 1.3-7.***

Table 1.3-7: 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	Discharged Point
		Station	LL1	LL2	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline							
12-Aug-22	pH	6.0-9.0				7.23		7.09	
12-Aug-22	Sat. DO (%)					98		97.5	
12-Aug-22	DO (mg/L)					7.7		7.73	
12-Aug-22	Conductivity (µS/cm)					52		121	
12-Aug-22	Temperature (°C)					27.75		27.3	

		Site Name	NNP1 Landfill Leachate					Houay Soup Landfill	
		Location	Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point	Last pond	Discharged Point
		Station	LL1	LL2	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline							
12-Aug-22	BOD5 (mg/L)	<30				14.97		10.23	
12-Aug-22	COD (mg/L)	<125				41.2		<25	
12-Aug-22	Faecal Coliform (MPN/100mL)	<400				350		220	
12-Aug-22	Total Coliform (MPN/100mL)	<400				1,600		1,600	
12-Aug-22	Total Nitrogen (mg/L)	<10				0.74		1.91	
12-Aug-22	Lead (mg/L)	<0.2				<0.01		<0.01	
12-Aug-22	Copper (mg/L)					<0.005		<0.006	
12-Aug-22	Iron (mg/L)					0.62		0.753	
12-Aug-22	Ammonia Nitrogen (mg/L)	<10				<2		<2	
12-Aug-22	Oil & Grease (mg/L)	<10				<1		1.8	

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 August 2022, the mean inflow to the main reservoir was 298 m^3/s. The minimum and maximum inflows were 142 m^3/s (on 01 August 2022) and 605 m^3/s (on 28 August 2022) respectively.

From 01 to 31 August 2022, the water level in the main reservoir increased from El. 303.52 m asl to El. 312.24 m asl.

In August 2022, the hourly turbine discharges from the Main Powerhouse varied between 27 m^3/s and 247 m^3/s usually interrupted by night-time periods with no discharge.

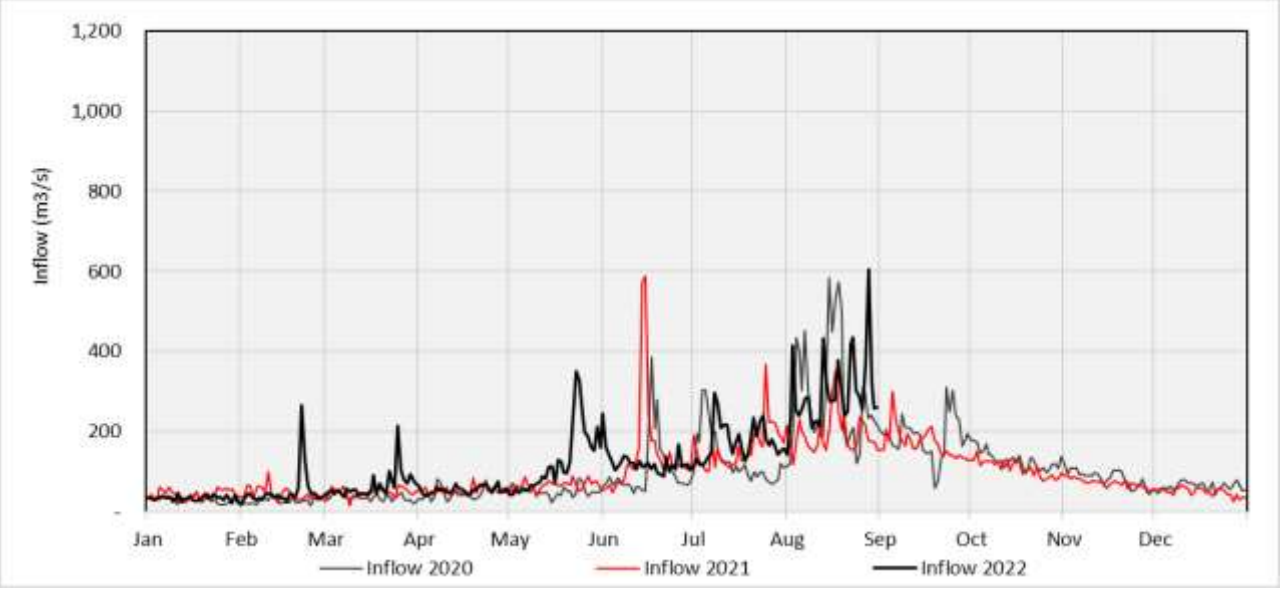


Figure 1.4-1: Inflow for the Main Reservoir during January 2020 to August 2022

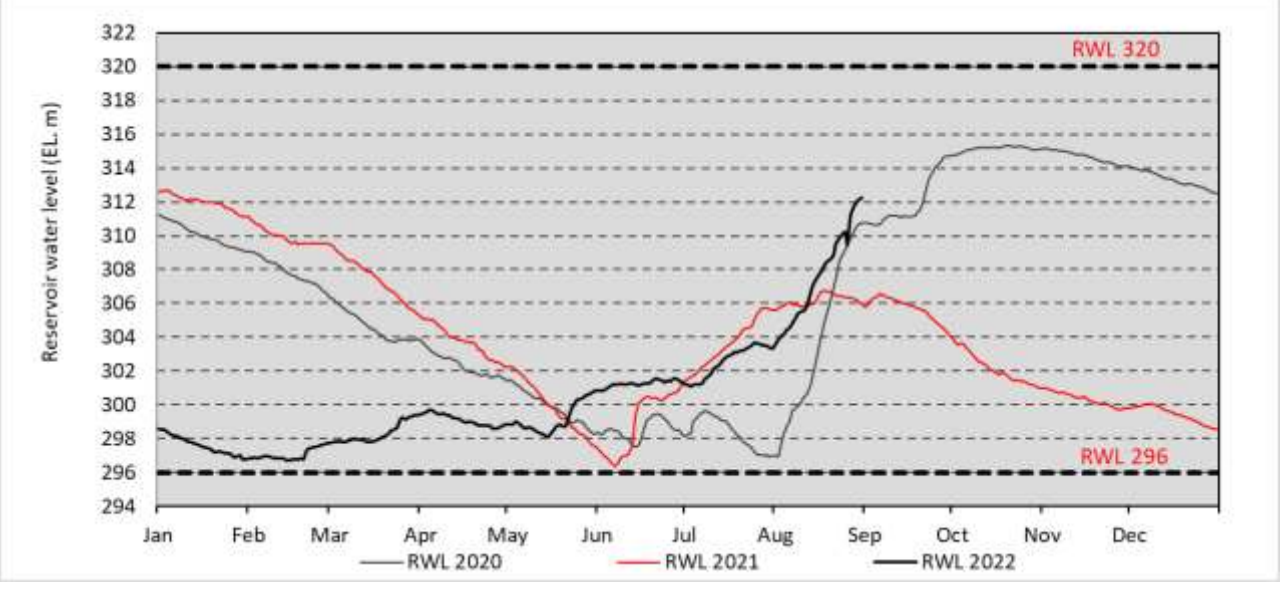


Figure 1.4-2: Water Level for the Main Reservoir during January 2020 to August 2022

1.4.2 Re-regulation Reservoir – Discharge

The daily discharge monitoring data for the Re-regulation Dam during June to August 2022 is presented in ***Figure 1.4-3***.

During August 2022, the mean daily discharge from the Re-regulation Dam was about 126 m^3/s, hourly gate discharge varied between 10 m^3/s and 94 m^3/s, and hourly turbine discharge varied between 47 m^3/s and 165 m^3/s. The hourly discharge was kept above the minimum flow requirement of 27 m^3/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.

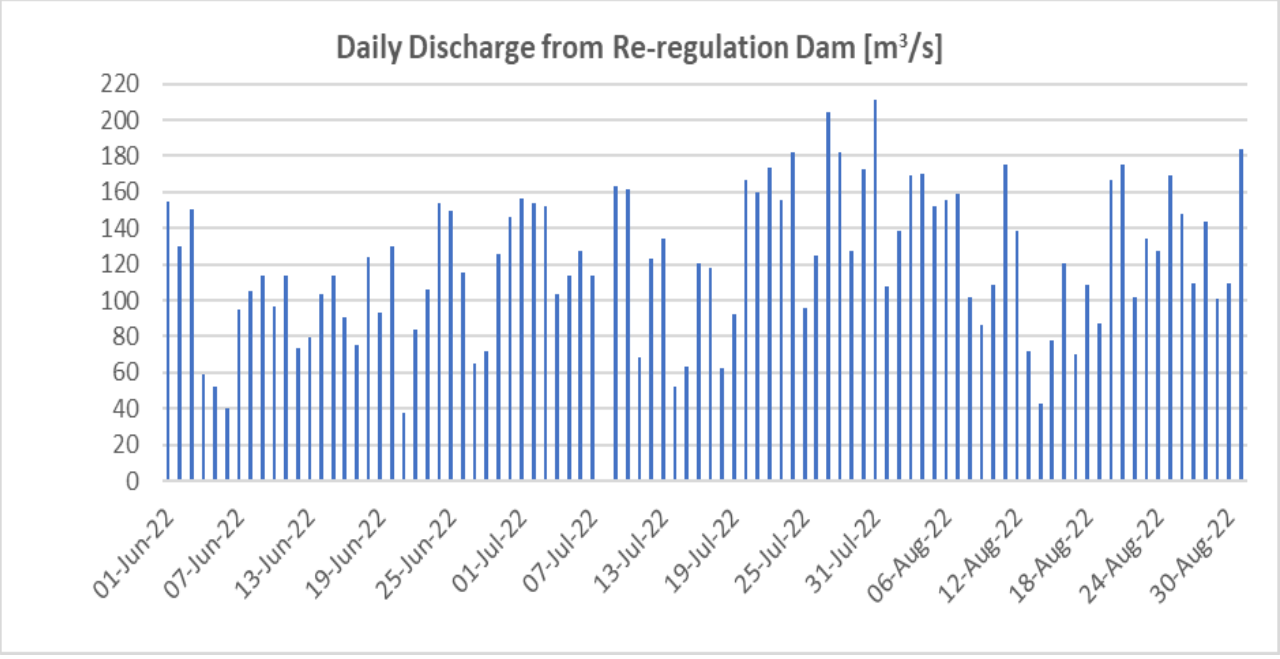


Figure 1.4-3: Discharge Monitoring at the Re-regulation Dam in June to August 2022

1.4.3 Nam Ngiep Downstream Water Depth Monitoring

In August 2022, EMO carried out five boat missions 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 and during the boat missions, the thalweg water depth was greater than 0.5 m and the team did not have any difficulties with boat navigation.

1.5. PROJECT WASTE MANAGEMENT

1.5.1 Solid Waste Management

A total of 9.00 m^3 of solid waste was disposed of at the NNP1 Project Landfill, an increase of 1.71 m^3 compared with July 2022.

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

Table 1.5-1: Photos of Waste management activities at NNP1 landfill during August 2022

Waste spot check and Wastes Collection	
	
Waste Segregation at Landfill	*Waste dump and waste cover*
	

The total amount of recyclable waste selling and collection this month is summarized in ***Table 1.5-2.***

Table 1.5-2: Amounts of Recyclable Waste Sold and collection in August 2022

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by August 2022
1	Plastic bottles	kg	0	**116**
2	Aluminium can	kg	0	**0**
3	Paper/Cardboard	kg	0	**45**
4	Glass	kg	0	**118**
5	Scrap Metal	Kg	0	**10**
Total		**kg**	**0**	**289**

In August 2022, the villagers collected 255 kg food wastes 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 August 2022 are shown in ***Table 1.5-3*** and ***Table 1.5-3*** respectively.

Table 1.5-3: Record of Hazardous Material Inventory in August 2022

No.	Type of Hazardous Material	Unit	Total in August 2022 (A)	Used (B)	Remaining at the end of August 2022 (A – B)
1	Diesel	Litre	10,882	4,869	**6,013**
2	Gasoline	Litre	1,585	535	**1,050**
3	Lubricant (Turbine oil)	Litre	5,080	15	**5,065**
4	Colour Paint	Litre	299	0	**299**
5	Thinner	Litre	10	0	**10**
6	Grease Oil	Litre	150	0	**150**
7	Gear Oil	Litre	434.8	8	**427**
8	Chlorine Liquid	Litre	120	10	**110**
9	Chlorine Powder	kg	3	2	**1**
10	HA Cut AF	Litre	3,925	0	**0**
11	HA Cut Cat AF	Litre	372.5	0	**0**

Table 1.5-4: Record of Hazardous Waste Inventory

No.	Hazardous Waste Type	Unit	Total in August 2022 (A)	Disposed (B)	Remaining at the end of August 2022 (A - B)
1	Used Oil (Hydraulic + Engine)	Litre	331	0	**331**
2	Empty used oil drum/container (drum 200L)	Unit	50	0	**50**
3	Contaminated soil, sawdust and textile material	m^3	0.5	0	**0.5**
4	Used tyre	Drum	14	0	**14**
5	Empty used chemical drum/container (drum 20L)	Unit	31	0	**31**
6	Lead acid batteries	Unit	6	0	**6**
7	Empty paint and spray cans	Unit	28	0	**28**
8	Halogen/fluorescent bulbs	kg	91	0	**91**
9	Empty cartridge (Ink)	Unit	182	0	**182**
10	Clinic Waste	Kg	3	0	**3**
11	Expired Chlorine Powder	Kg	65	0	**0**

1.6. COMMUNITY WASTE MANAGEMENT

1.6.1 Community Recycling Programme

The process of handing over the community waste bank to the Bolikhan District EMU has continued in August 2022. There was no recycle waste trade activities in the community recycle waste bank in August 2022.

1.6.2 Community Solid Waste Management

In August 2022, the communities' general waste collection and the Houay Soup Landfill operation are still under handover process to be managed by the local authorities (Bolikhan Environment Management Unit or EMU). There was no waste collection from communities to dispose of at Houay Soup Landfill during the reporting period. The report on the community consultations is still under review and consideration by the Bolikhan District Governor. EMO expects the community solid waste management to be fully handed over to the local authority within 2022.

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 are summarized below:

- Xaysomboun WRPO was still working on drafting the Agreement on establishing a provincial task force for addressing the forest encroachment and occupation in the watershed Total Protected Zones (TPZs).
- EMO team followed up with Xaysomboun WRPO on the inspection of mineral exploration of Boualay Mangkonthong Company in the watershed TPZ1 and noted that they could not confirm the inspection schedule because the access to the site is very difficult with the continuous rain starting from the first week of August 2022. EMO Management also followed up with DOF-MAF and noted that their discussion with the Minister of MAF has not yet been held. NNP1 management advices to communicate further with Department of Energy Business (DEB), Ministry of Energy and Mines (MEM) and an official letter was prepared and is expected to be submitted to MEM office in September 2022.
- EMO noted that Xaysomboun WRPO did not follow up with the Hom DAFO on the EMO enquiries about the staff assignment for the WRPO sub-office at Hom District. EMO team also noted that as of 31 August 2022, there was no mobilization of Xaysomboun WRPO into the WRPO sub-office due to their disagreement on the allowance for the sub-office operation.
- EMO provided comments to Xaysomboun WRPO on the draft Agreement on the establishment of four TPZ Patrolling Teams and one forest patrol team in the second week of August 2022.
- EMO team also noted that Xaysomboun WRPO did not yet have discussion and agreement with the fishermen about managing their boats as of 31 August 2022, but the Xaysomboun WRPO sub-office is still in operation to park the fishermen's boat.
- EMO team did not receive any update from Xaysomboun WRPO on the progress of work of building the two ranger stations and two reservoir checkpoints and noted that there was still no mobilization yet due to difficult access during the rainy season.

2.1.1.2 Bolikhamxay Watershed and Reservoir Protection Office (WRPO)

Bolikhamxay WRPO did not yet organize the SMART refresher training and training on new standard operation procedures (SOP) for Bolikhamxay rangers because of the unavailability of Bolikhamxay WRPO team. There was no also patrolling in August 2022 because the patrol team members are not available due to assignments from their respective offices.

2.1.1.3 NNP1PC EMO

Implementation of the agriculture extension service plan for improving home gardening and Kai Noi rice production continued in August 2022. Thathom DAFO continued monitoring Kai Noi rice farming in August 2022.

A training on organic farming took place on 14 August 2022 at the Faculty of Agriculture of the National University of Laos (NUOL). The training was chaired by Professor Somsanouk Phonepadith,

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

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

EMO had a meeting with Thathom DAFO on 21 July 2022 for the work arrangements in connection with establishing the local producer groups at Nahong and Phonhome Village. The kick off meeting was further postponed because of non-availability of assigned DAFO staffs.

Figure 2.1-1: Representative photos of the organic farming training on 14 August 2022 at Faculty of Agriculture, National University of Laos

PhouNgou Village, Hom District

Houayxay Village, Hom District

Ban Nahong, Thathom District

Figure 2.1-2: Representative photos of the cattle management farming training on 15-18 August 2022 in Hom and Thathom Districts

2.1.2 Preparation of Annual Implementation Plan (AIP) 2022

2.1.2.1 Xaysomboun WRPO

Xaysomboun WRPO submitted the revised AIP2022 on 10 August 2022 and EMO has further reviewed and revised the AIP2022 to cover the remaining months of 2022. The final AIP2022 was concluded on 22 August 2022 and EMO advised Xaysomboun WRPO to proceed further with the fund disbursement. However, Xaysomboun WRPO still return back to EMO on 30 August 2022 with some disagreement on the allowances for the staff to be assigned at the Hom District sub-office and admin operation cost. EMO has prepared an official response letter on 31 August 2022. The funds are expected to be disbursed within September 2022.

2.1.2.2 Bolikhamxay WRPO

Bolikhamxay WRPO AIP2022 was finalized in February 2022 and the WRPO received their quarterly funds (Q1 and Q2) under their approved AIP 2022 in the first week of May 2022. Bolikhamxay WRPO submitted the budget plan for the Q3 and Q4 fund disbursement which was concluded on 22 August 2022. The funds are expected to be disbursed within September 2022.

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 August 2022 are described below:

a. Component 1 - Spatial Planning and Regulation

Nam Chouane-Nam Xan (NC-NX) Biodiversity Offset Management Unit (BOMU), EMO and BSP-WCS organized a technical discussion/meeting on 30 June 2022 to clarify and agree on data and mapping for the recognition of NC-NX and TPZ boundary. EMO noted that per further discussion and recommendation from Bolikhamxay PAFO management then a meeting with relevant provincial, district and village authorities will be organized to present the final boundaries to be officially recognized. The presentation material and relevant documents were prepared by NC-NX BOMU with the support from EMO in the third week of July 2022. The meeting will be organized after the confirmation of availability of participants and the fund available under the AIP2022 which was finalized on 18 August 2022.

b. Component 2 – Law Enforcement

The sub-stations have been guarded from 5-31 August 2022. The patrolling will be resumed after receiving the funds under the AIP2022 which was finalized on 18 August 2022.

c. Component 3 – Conservation Outreach

The NC-NX outreach strategy was finalized on 1 August 2022 and it is being processed by NC-NX BOMU for the approval by Bolikhamxay PAFO.

d. Component 4 – Conservation linked livelihood development

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

The snare removal activity will be resumed after receiving the funds from under the AIP2022 which was finalized on 18 August 2022.

2.2.2 Preparation of Annual Implementation Plan (AIP) 2022

NC-NX AIP2022 that will cover the implementation period from September to December 2022 was finalized on 18 August 2022 after a series of review by BOMU, NNP1 and BSP. BOMU is processing the plan approval from Bolikhamxay PAFO and further submission to DoF-MAF afterwards. The funds are expected to be disbursed within September 2022.

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 July 2022 as listed in ***Table 2-1.*** All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species[1], except *Sikukia gudgeri* is classified as Data Deficient species (DD) and *Oreochromis niloticus* is an exotic species.

TABLE 2-1: FISH SPECIES DOMINATING THE FISH CATCH IN JULY 2022

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Hampala dispar, Hampala macrolepidota	ปาสูด	137.6	LC
Sikukia gudgeri, Amblyrhynchichthys truncatus	ปาຂາວຊາຍ	110.6	DD, LC
Oreochromis niloticus	ปานิน	87.3	LC
Channa striata	ปาຄໍ່	77	LC
Poropuntius normani, Poropuntius laoensis, Poropuntius carinatus	ปาจาด	83.9	LC

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

TABLE 2-2: THREATENED SPECIES OF JULY 2022 FISH CATCH

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Scaphognathops bandanensis	ปาอຽมไฝ/ปาป่ຽม	10.2	VU
Tor sinensis	ปาแดง	51.2	VU

[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.

Species abundance and occurrence is based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey in July 2022. The catch is divided in three areas including above the main dam, below the main dam and Mekong area. Main biodiversity indicators in July 2022 for above dam, below dam and Mekong area are presented in ***Table 2-3.***

TABLE 2-3: MAIN BIODIVERSITY INDICATORS FOR JULY 2022

Biodiversity Indicators	Mekong	Below dam	Above dam
Total number of species and groups recorded	22	30	35
Single species	17	19	27
Species groups	5	11	8
Top 15 species (% total catch weight)	92.94%	80.07%	93.08%
Proportion for species groups	18.57%	66.63%	40.21%
Diversity index (Shannon)	2.5675	2.5549	2.6872

Figure 2-3 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 36% and 73% of active fishing households for all fishing zones in July 2022.

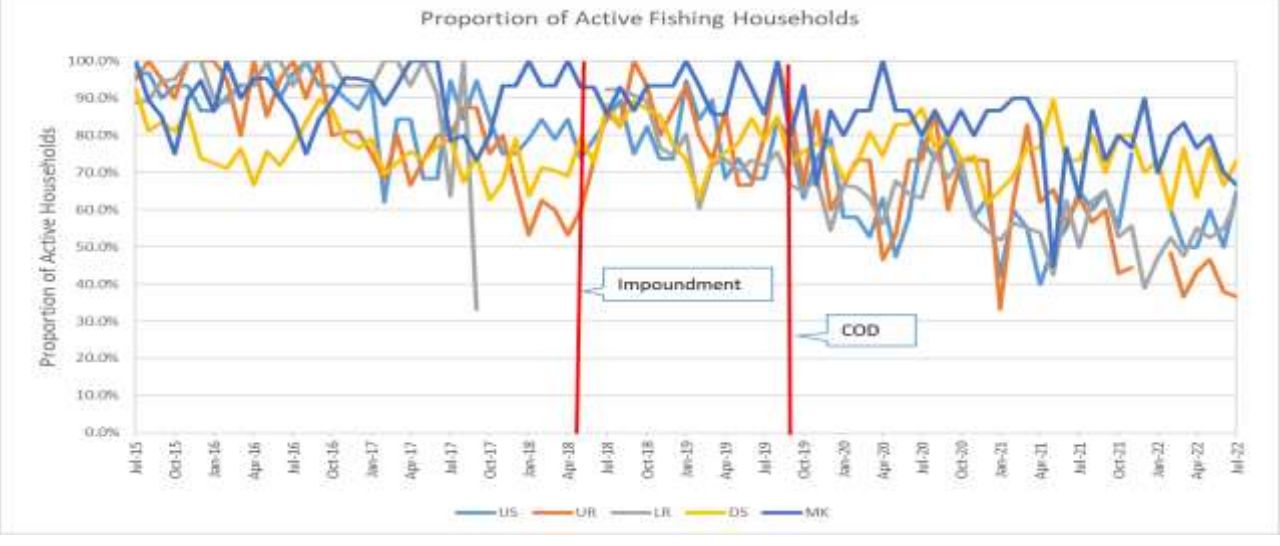


FIGURE 2-3: PROPORTION OF TOTAL NUMBER OF HOUSEHOLDS ACTIVELY FISHING BY FISHING ZONE FROM JULY 2015 TO JULY 2022

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

Figure 2-4 shows the average (mean) of monthly household fishing days from July 2015 to July 2022 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area.

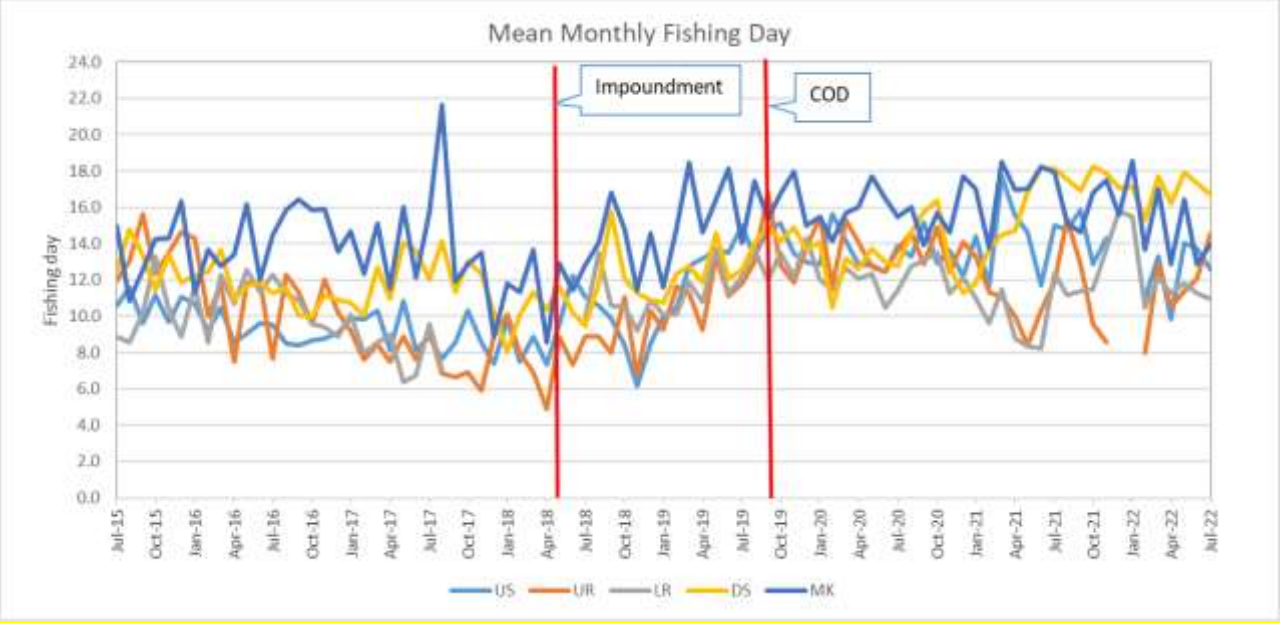


FIGURE 2-4: MEAN OF MONTHLY HOUSEHOLD FISHING DAY FROM JULY 2015 TO JULY 2022

The mean monthly number of fishing days for the month of July from 2015 to 2022 for the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in ***Table 2-4***.

TABLE 2-4: MEAN REPORTED NUMBER OF FISHING DAYS BY FISHING ZONE FOR THE MONTH OF JULY FROM 2015 TO 2022

Fishing Zone	July 2015 (day)	July 2016 (day)	July 2017 (day)	July 2018 (day)	July 2019 (day)	July 2020 (day)	July 2021 (day)	July 2022 (day)
Upstream	10.56	9.52	8.86	11.07	14.99	13.88	14.99	12.60
Upper reservoir	11.98	7.65	9.26	8.86	11.81	13.69	11.89	14.49
Lower reservoir	8.86	12.26	9.60	9.88	12.21	11.44	12.40	10.98
Downstream	12.50	11.29	12.05	9.46	12.57	12.75	18.12	16.71
Mekong	14.95	14.47	15.75	12.84	14.02	15.50	17.95	13.95

The mean monthly household fish catch from July 2015 to July 2022 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area are presented in ***Figure 2-5.***

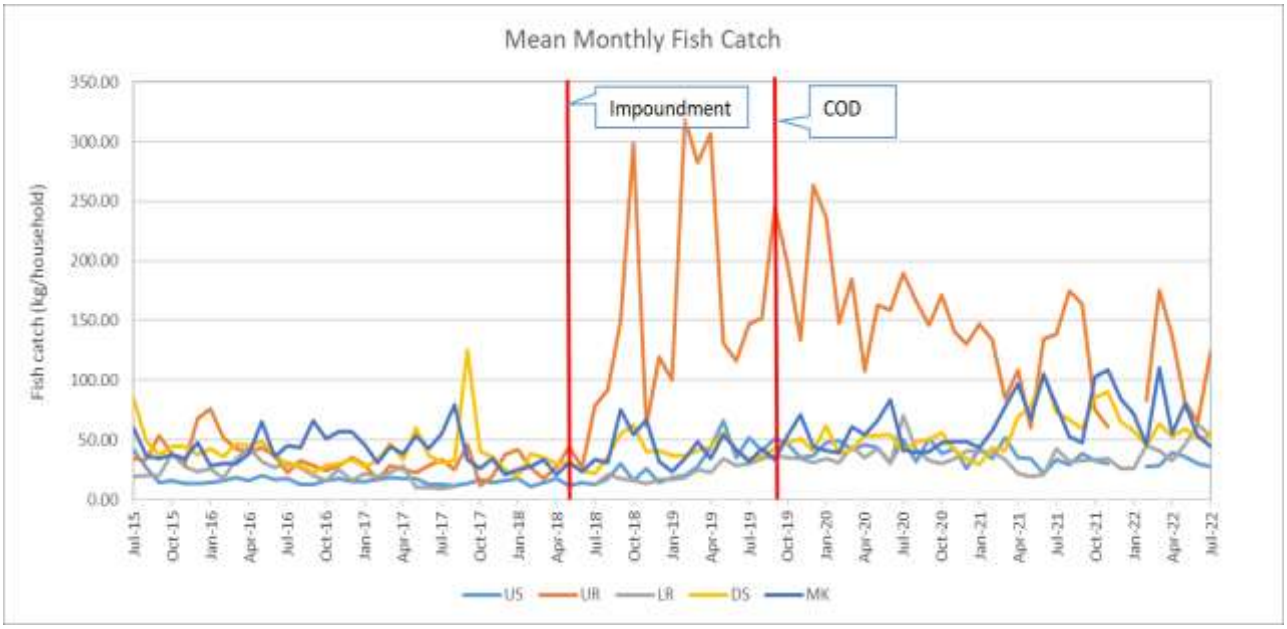


FIGURE 2-5: MEAN MONTHLY HOUSEHOLD FISH CATCH FROM JULY 2015 TO JULY 2022

The mean household fish catch for the month of July from 2015 to 2022 in the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in ***Table 2 5.***

TABLE 2-5: MEAN MONTHLY HOUSEHOLD FISH CATCH FOR THE MONTH OF JULY FROM 2015 TO 2022

Fishing Zone	July 2015 (kg)	July 2016 (kg)	July 2017 (kg)	July 2018 (kg)	July 2019 (kg)	July 2020 (kg)	July 2021 (kg)	July 2022 (kg)
Upstream	41.36	17.49	12.74	12.29	51.71	49.81	33.55	27.70
Upper reservoir	33.97	22.91	33.17	78.19	146.88	189.46	139.10	123.28
Lower reservoir	19.19	31.00	9.45	12.58	30.00	70.40	42.98	53.21
Downstream	85.46	28.76	30.88	21.66	33.66	39.85	72.95	52.42
Mekong	59.95	44.96	55.36	33.39	31.85	42.11	78.15	43.89

The mean daily fish catch per household from July 2015 to July 2022 are displayed in ***Figure 2-6*** and the mean fish catch per household per fishing day for the month of July from 2015 to 2022 are shown in ***Table 2-6.***

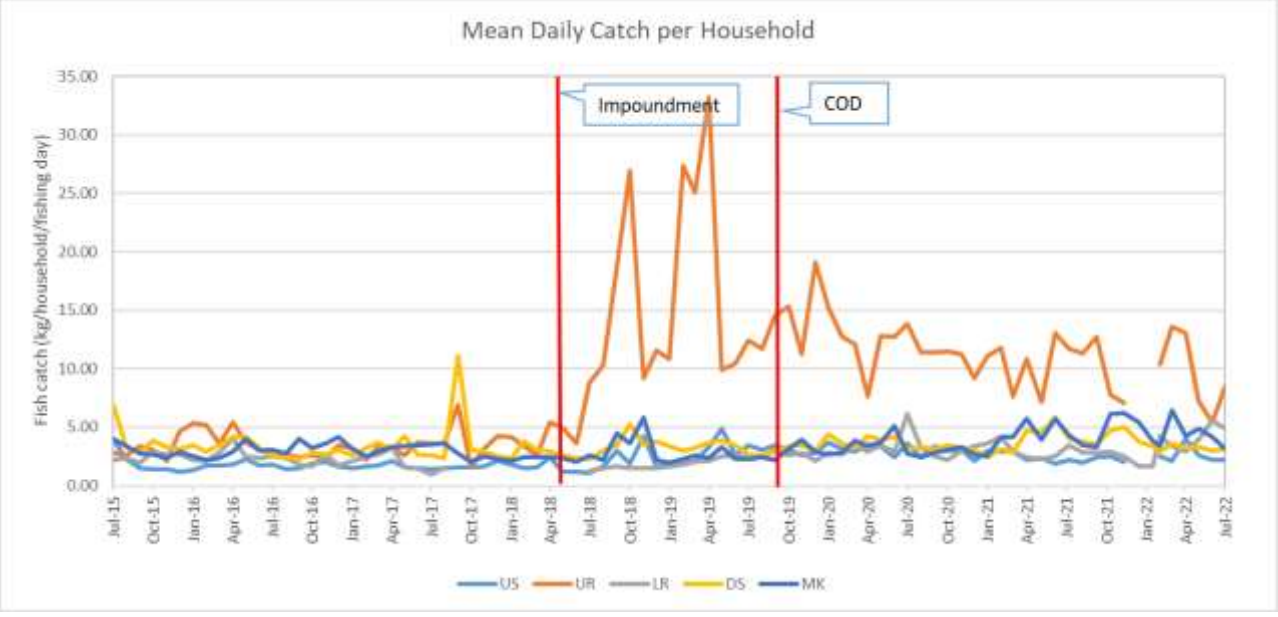


FIGURE 2-6: MEAN DAILY FISH CATCH PER HOUSEHOLD FROM JULY 2015 TO JULY 2022

TABLE 2-6: MEAN DAILY FISH CATCH PER HOUSEHOLD FOR THE MONTH OF JULY FROM 2015 TO 2022

Fishing Zone	July 2015 (kg)	July 2016 (kg)	July 2017 (kg)	July 2018 (kg)	July 2019 (kg)	July 2020 (kg)	July 2021 (kg)	July 2022 (kg)
Upstream	3.92	1.84	1.44	1.11	3.45	3.59	2.24	2.20
Upper reservoir	2.83	2.99	3.58	8.83	12.44	13.84	11.70	8.51
Lower reservoir	2.17	2.53	0.98	1.27	2.46	6.15	3.47	4.85
Downstream	6.83	2.55	2.56	2.29	2.68	3.13	4.03	3.14
Mekong	4.01	3.11	3.52	2.60	2.27	2.72	4.35	3.15

The survey results in July 2022 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 July 2022 are displayed in ***Table 2-7.***

TABLE 2-7: PROPORTION OF THE CATCH REPORTED BY MAIN HABITATS (%) IN JULY 2022

Habitats	US	UR	LR	DS	MK
Mekong	0.0%	0.0%	0.0%	2.1%	83.8%
Nam Ngiep	47.6%	7.2%	0.0%	62.6%	0.0%
Nam Xan	0.0%	0.0%	0.0%	0.0%	0.0%
Reservoir	0.0%	87.9%	39.8%	0.0%	0.0%
Tributaries and streams	40.8%	3.4%	57.2%	32.6%	0.0%

Habitats	US	UR	LR	DS	MK
Wetlands	11.6%	1.5%	3.0%	2.7%	16.2%
Others	0.0%	0.0%	0.0%	0.0%	0.0%

Total reported fish and OAA (other aquatic animals) catch (proportion of OAA) for the same 7-day period from July 2015 to July 2022 are presented in ***Figure 2-7*** and the proportion of OAA catch for the month of July from 2015 to 2022 are shown in ***Table 2 8.***

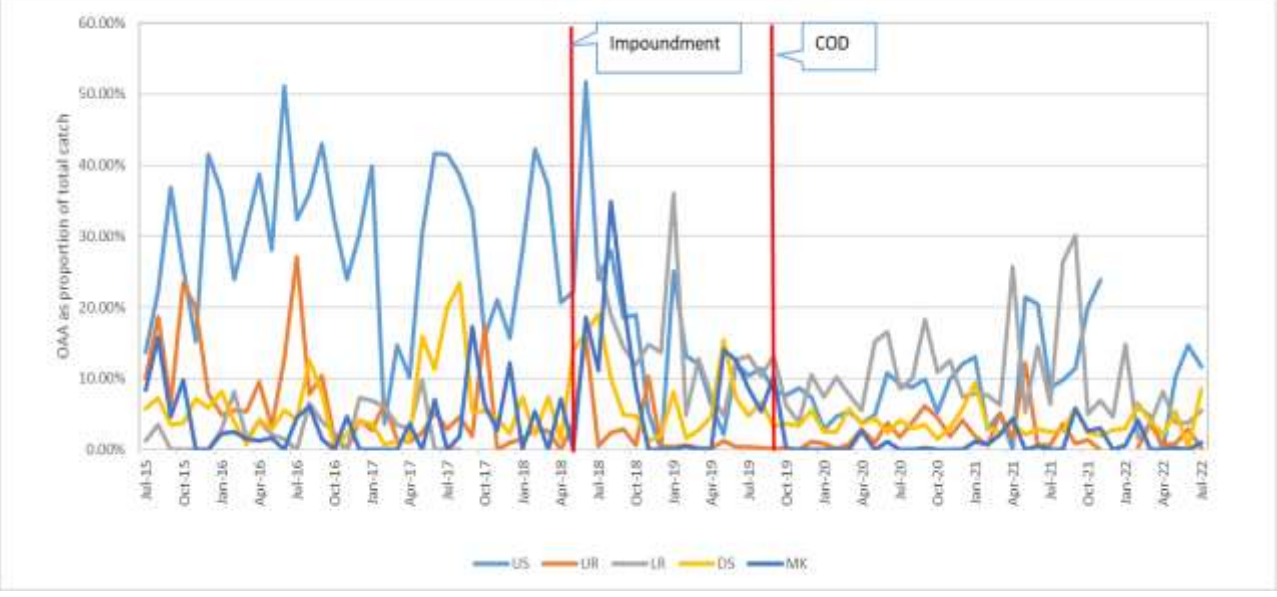


FIGURE 2-7: PROPORTION OF OAA TO THE TOTAL REPORTED NUMBER OF FISH AND OAA FOR A 7-DAY PERIOD BY FISHING ZONE FROM JULY 2015 TO JULY 2022

TABLE 2-8: PROPORTION OF OAA TO THE TOTAL REPORTED NUMBER OF FISH AND OAA FOR THE MONTH OF JULY FROM 2015 TO 2022

Fishing Zone	July 2015	July 2016	July 2017	July 2018	July 2019	July 2020	July 2021	July 2022
Upstream	13.66%	32.31%	41.47%	23.97%	10.44%	9.20%	8.63%	11.63%
Upper reservoir	10.07%	27.05%	2.83%	0.50%	0.43%	1.73%	0.67%	0.29%
Lower reservoir	1.27%	0.00%	0.00%	26.23%	13.14%	8.48%	6.41%	5.50%
Downstream	5.81%	4.27%	19.90%	19.04%	4.74%	4.18%	2.50%	8.54%
Mekong	8.38%	4.45%	0.00%	11.19%	8.48%	0.00%	0.00%	1.00%

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																
1-Aug-22	pH	5.0 - 9.0	7.46												8.49			
2-Aug-22	pH	5.0 - 9.0		7.3	7.69	7.98										7.73		
3-Aug-22	pH	5.0 - 9.0					7.43	7.88	7.46	7.43								
4-Aug-22	pH	5.0 - 9.0									7.64	7.95	8.21	8.3			7.4	8.14
9-Aug-22	pH	5.0 - 9.0		7.96	7.03	6.79												
10-Aug-22	pH	5.0 - 9.0					6.61	6.87	6.64	6.84								
11-Aug-22	pH	5.0 - 9.0									6.77		6.81	7.45			7.27	7.11
16-Aug-22	pH	5.0 - 9.0		7.74	8.29	8.5										8.03		
17-Aug-22	pH	5.0 - 9.0					8.04	7.8	8.09	7.98								
18-Aug-22	pH	5.0 - 9.0									8.16		8.67	7.32			8.01	8.45
22-Aug-22	pH	5.0 - 9.0	6.67												7.72			
24-Aug-22	pH	5.0 - 9.0		7.15	7.56	8.52										7.76		
25-Aug-22	pH	5.0 - 9.0					7.66	7.33	6.89	6.9								
26-Aug-22	pH	5.0 - 9.0									6.85	6.95	6.95	6.73			7.1	6.09
29-Aug-22	pH	5.0 - 9.0		7.37	7.6	8.24										7.87		
30-Aug-22	pH	5.0 - 9.0					8.02	7.58	6.8	6.83								
31-Aug-22	pH	5.0 - 9.0									6.73	6.95	7	6.87			7.09	6.52
1-Aug-22	Sat. DO (%)		94.4												83.7			
2-Aug-22	Sat. DO (%)			89.4	98.7	110.5										96.4		
3-Aug-22	Sat. DO (%)						101.6	101.5	37.4	55.2								
4-Aug-22	Sat. DO (%)										46.6	56.9	72.7	75.2			81.9	82.5
9-Aug-22	Sat. DO (%)			90.4	109.9	109.1												
10-Aug-22	Sat. DO (%)						87.6	86.4	32.8	30.8								

		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																
11-Aug-22	Sat. DO (%)										54.9		64.9	88.5			87.2	94.7
16-Aug-22	Sat. DO (%)			97.5	108.7	112.8												
17-Aug-22	Sat. DO (%)						102.7	92.2	43.1	53.1								
18-Aug-22	Sat. DO (%)										68.7		81.7	76.6			85.9	93.9
22-Aug-22	Sat. DO (%)		86.5												68.1			
24-Aug-22	Sat. DO (%)			96.8	113.6	121.9										113.1		
25-Aug-22	Sat. DO (%)						97.8	96.9	47.4	41.4								
26-Aug-22	Sat. DO (%)										52.2	60.5	74.8	79.7			94.5	82.2
29-Aug-22	Sat. DO (%)			80.7	101.2	105.2										99.9		
30-Aug-22	Sat. DO (%)						101.2	94.6	32.4	37.6								
31-Aug-22	Sat. DO (%)										80.8	93	96.8	95.4			121.1	109.7
1-Aug-22	DO (mg/L)	>6.0	7.61												7.01			
2-Aug-22	DO (mg/L)	>6.0		7.34	7.24	8.05										8.05		
3-Aug-22	DO (mg/L)	>6.0					7.52	7.6	3.04	4.4								
4-Aug-22	DO (mg/L)	>6.0									3.8	4.6	5.77	5.98			6.33	6.39
9-Aug-22	DO (mg/L)	>6.0		7.52	8.18	8.09												
10-Aug-22	DO (mg/L)	>6.0					6.6	6.6	2.65	2.48								
11-Aug-22	DO (mg/L)	>6.0									4.48		5.27	7.15			6.92	7.91
16-Aug-22	DO (mg/L)	>6.0		8.17	8.12	8.35										8.1		
17-Aug-22	DO (mg/L)	>6.0					7.78	7.11	3.51	4.21								
18-Aug-22	DO (mg/L)	>6.0									5.6		6.69	6.09			6.98	7.86
22-Aug-22	DO (mg/L)	>6.0	7.23												5.77			
24-Aug-22	DO (mg/L)	>6.0		7.98	8.43	9.08										9.34		
25-Aug-22	DO (mg/L)	>6.0					7.41	7.5	3.89	3.39								
26-Aug-22	DO (mg/L)	>6.0									4.28	4.96	6.06	6.52			7.67	6.75
29-Aug-22	DO (mg/L)	>6.0		6.5	7.52	7.6										8.35		
30-Aug-22	DO (mg/L)	>6.0					7.62	7.18	2.64	3.02								
31-Aug-22	DO (mg/L)	>6.0									6.59	7.53	7.76	7.63			9.54	8.78

	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															
1-Aug-22	Conductivity (µs/cm)		84											28			
2-Aug-22	Conductivity (µs/cm)			78	70	68									63		
3-Aug-22	Conductivity (µs/cm)						63	61	70	69							
4-Aug-22	Conductivity (µs/cm)										69	70	65	58			97	15
9-Aug-22	Conductivity (µs/cm)			78	76	68											
10-Aug-22	Conductivity (µs/cm)						66	63	78	77							
11-Aug-22	Conductivity (µs/cm)										78		73			87	11
16-Aug-22	Conductivity (µs/cm)			85	76	67									68		
17-Aug-22	Conductivity (µs/cm)						65	63	74	72							
18-Aug-22	Conductivity (µs/cm)										55		30	62			42	11
22-Aug-22	Conductivity (µs/cm)		113											28			
24-Aug-22	Conductivity (µs/cm)			92	78	68									77		
25-Aug-22	Conductivity (µs/cm)						67	66	77	78							
26-Aug-22	Conductivity (µs/cm)										78	78	65	49			110	16
29-Aug-22	Conductivity (µs/cm)			105	77	68									86		
30-Aug-22	Conductivity (µs/cm)						67	65	77	76							
31-Aug-22	Conductivity (µs/cm)										77	78	77	65			93	21
1-Aug-22	Temperature (°C)		26.3											24.87			
2-Aug-22	Temperature (°C)			25.4	31.65	32.17									24.55		
3-Aug-22	Temperature (°C)						31.19	30.58	26.12	27.26							
4-Aug-22	Temperature (°C)										25.76	26.23	27.02	27.33			28.69	27.2
9-Aug-22	Temperature (°C)			24.65	30.95	30.74											
10-Aug-22	Temperature (°C)						30.22	29.33	26.25	27.05							
11-Aug-22	Temperature (°C)										25.7		25.9	26.2			27.21	24.39
16-Aug-22	Temperature (°C)			24.29	30.71	31.06									30.72		
17-Aug-22	Temperature (°C)						29.75	28.87	26.07	26.99							
18-Aug-22	Temperature (°C)										25.74		25.51	27.29			25.89	24.36
22-Aug-22	Temperature (°C)		24.37											23.9			

		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																
24-Aug-22	Temperature (°C)			24.89	31.2	30.87										24.6		
25-Aug-22	Temperature (°C)						29.81	28.67	25.74	26.4								
26-Aug-22	Temperature (°C)										25.38	25.5	25.49	25.54			26	25.35
29-Aug-22	Temperature (°C)			26.34	30.96	30.99										24.38		
30-Aug-22	Temperature (°C)						30.12	29.73	25.65	26.66								
31-Aug-22	Temperature (°C)										25.67	26.09	26.57	26.7			27.64	26.82
16-Aug-22	Turbidity (NTU)			101	2.13	1.34										4.17		
17-Aug-22	Turbidity (NTU)						1.42	1.39	2.78	2.69								
18-Aug-22	Turbidity (NTU)										68.4		245	17.7			304	34.7
22-Aug-22	Turbidity (NTU)		151												13.5			
24-Aug-22	Turbidity (NTU)			30	1.8	1.31										27.5		
25-Aug-22	Turbidity (NTU)						1.6	1.14	3.35	3								
26-Aug-22	Turbidity (NTU)										5.36	15.4	22.4	35			51.7	46.8
29-Aug-22	Turbidity (NTU)			19.1	1.96	2										34.6		
30-Aug-22	Turbidity (NTU)						1.52	2.21	4.81	3.85								
31-Aug-22	Turbidity (NTU)										4.49	6.33	9.65	7.49			25.4	5.22
1-Aug-22	TSS (mg/L)		116												10.42			
2-Aug-22	TSS (mg/L)			490		<5										110		
3-Aug-22	TSS (mg/L)						<5	<5	<5	<5								
4-Aug-22	TSS (mg/L)										<5	6.23	10.8	14.62			42.8	<5
1-Aug-22	BOD_5 (mg/L)	<1.5	1.05												1.5			
2-Aug-22	BOD_5 (mg/L)	<1.5		<1		<1										<1		
3-Aug-22	BOD_5 (mg/L)	<1.5					<1	<1	<1	<1								
4-Aug-22	BOD_5 (mg/L)	<1.5									<1	<1	<1	<1			<1	<1
1-Aug-22	COD (mg/L)	<5.0	16												<5			
3-Aug-22	COD (mg/L)	<5.0							<5	6.4								
4-Aug-22	COD (mg/L)	<5.0															12.8	9.6
1-Aug-22	NH_3-N (mg/L)	<0.2	<0.2												<0.2			

		River Name	Nam Ngiep								Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites								Location Refer to Construction Sites			
			Upstream/Main Reservoir						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-Aug-22	NH_3-N (mg/L)	<0.2		<0.2														
1-Aug-22	NO_3-N (mg/L)	<5.0	0.13												0.1			
4-Aug-22	NO_3-N (mg/L)	<5.0		0.14														
1-Aug-22	Faecal coliform (MPN/100 mL)	<1,000	1,600												920			
2-Aug-22	Faecal coliform (MPN/100 mL)	<1,000														1,600		
3-Aug-22	Faecal coliform (MPN/100 mL)	<1,000							920	79								
4-Aug-22	Faecal coliform (MPN/100 mL)	<1,000									70	350	140	220			920	220
1-Aug-22	Total Coliform (MPN/100 mL)	<5,000	1,600												1,600			
2-Aug-22	Total Coliform (MPN/100 mL)	<5,000														1,600		
3-Aug-22	Total Coliform (MPN/100 mL)	<5,000							1,600	110								
4-Aug-22	Total Coliform (MPN/100 mL)	<5,000									110	350	280	920			1,600	280
1-Aug-22	TKN		<1.5												<1.5			
2-Aug-22	TKN			<1.5														
1-Aug-22	TOC (mg/L)		4.16												6.88			
3-Aug-22	TOC (mg/L)								2.89	2.72								
4-Aug-22	TOC (mg/L)																3.34	2.37
1-Aug-22	Phytoplankton Biomass (g dry wt/m^3)			489														
1-Aug-22	Total Phosphorus (mg/L)		0.11												0.02			
2-Aug-22	Total Phosphorus (mg/L)			0.16														
1-Aug-22	Total Dissolved Phosphorus (mg/L)		0.07												0.01			

		River Name	Nam Ngiep								Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites								Location Refer to Construction Sites			
			Upstream/Main Reservoir					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-Aug-22	Total Dissolved Phosphorus (mg/L)			0.06														
1-Aug-22	Hydrogen Sulfide (mg/L)			0.02														
2-Aug-22	TSS (mg/L)-bottom					18.02												
3-Aug-22	TSS (mg/L)-bottom						10.33	<5										
2-Aug-22	BOD_5 (mg/L)-bottom					<1												
3-Aug-22	BOD_5 (mg/L)-bottom						5.4	7.28										

TABLE A-2: RESULTS OF CAMP EFFLUENTS IN AUGUST 2022

	Site Name	OSOV1 (Owner's Site Office and Village)		OSOV2 (ESD Camp)		Main Powerhouse	
	Station Code	EF01		EF13		EF19	
	Date	11-Aug-22	23-Aug-22	11-Aug-22	23-Aug-22	11-Aug-22	23-Aug-22
Parameters (Unit)	**Guideline**						
pH	6.0 - 9.0	7.05	6.53	6.73	7.06	7.09	7.84
Sat. DO (%)		82.5	76.3	91.2	64	43.5	50.2
DO (mg/L)		6.54	5.86	7.14	4.82	3.35	3.81
Conductivity (µs/cm)		228	270	509	454	1,550	1,136
Temperature (°C)		27.23	29.03	27.88	30.17	28.54	29.41
Turbidity (NTU)			1.16		17		13.6
TSS (mg/L)	<50	<5	<5	7.3	24.4	24.0	16.3
BOD_5 (mg/L)	<30	11.91	<6	18	20.34	62.7	17.7
COD (mg/L)	<125	<25	<25	30	53	121	50
NH_3-N (mg/L)	<10.0	<2	<2	19.8	13.5	79.7	63.1
Total Nitrogen (mg/L)	<10.0	0.38	0.58	21.2	14.4	84.2	73.9
Total Phosphorus (mg/L)	<2	0.97	0.89	1.70	1.39	8.2	5.6
Oil & Grease (mg/L)	<10.0	<1		<1		2	
Total coliform (MPN/100 mL)	<400	1,600	1,600	16,000	16,000	16,000	16,000
Faecal Coliform (MPN/100 mL)	<400	1,600	920	9,200	5,400	16,000	3,500
Residual Chlorine (mg/L)	<1.0			0.17	0.08	0.02	0.08