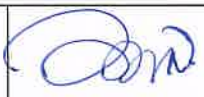
NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

September 2022

					
A	20 October 2022	Hendra WINASTU	Wanidaporn RODE	Khamlar PHONSAVAT	Final
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EXECUTIVE SUMMARY

During September 2022, activities related to ISO14001:2015 implementation continued such as conducting the annual ISO14001 Internal Audit and following up on the implementation of the Environmental Management Plan and its achievements. The internal audit completed 27 out of 31 areas/work functions and the 04 remaining areas will be completed by the middle of October 2022.

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 September 2022. The results of the effluent analyses after adding sludge indicated reduction of nitrogen and phosphorus in the effluent but still non-compliance with the standard. It is expected that the operation of the system can be adjusted to meet the effluent standards by the end of 2022.

At R05 (in the Main Reservoir approx. 0.5 km upstream the Main Dam), the average DO concentration was 8.1 mg/L in the upper 5.5 m varying between 7.0 mg/L and 8.8 mg/L, and the oxycline was generally found at the depths between 6.0 m and 9.0 m with DO concentrations decreasing from about 8 mg/L to 3 mg/L. In the Re-regulation Reservoir, the mean DO concentration in the water column of the two monitoring stations were 4.3 mg/L and 4.5 mg/L.

The DO measurements downstream the Re-regulation Dam during turbine discharges on 08 September 2022 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 September 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 9.04 m^3 of solid waste was disposed of at the NNP1 Project Landfill, an increase of 0.04 m^3 compared with August 2022. There was no trading of recyclable waste at the community recycle waste bank during the reporting period.

Xaysomboun Watershed and Reservoir Protection Office (WRPO) Annual Implementation Plan (AIP) 2022 was approved on 9 September 2022 and the WRPO is preparing the document for submission to DOF-MAF. Thus, the fund is expected to be transferred from NNP1PC to DOF-MAF in October 2022. NNP1C has already disbursed the funds to DOF-MAF under the Bolikhamxay WRPO AIP2022 for the remaining quarters of 2022 as well as under the Bolikhamxay Nam Chouane-Nam Xang (NC-

NX) Biodiversity Offset Management Unit (BOMU) AIP2022 on 15 September 2022. The documents for the fund transfer from DOF-MAF to the Bolikhamxay WRPO and BOMU account were under preparation until the end of September 2022. The fund is expected to be available in October 2022. The activities by Bolikhamxay WRPO and NC-NX BOMU will be resumed when the funds under the AIP2022 are available. The Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS) in discussion with NNP1PC EMO are preparing a list of recommended activities to be implemented by Xaysomboun and Bolikhamxay WRPO for the remaining months of 2022. NC-NX BOMU continued with safeguarding the three patrol sub-stations in September 2022 while other activities will be resumed after receiving the funds under the AIP2022.

The fish catch monitoring for August 2022 in Nam Ngiep Watershed was dominated by *Oreochromis niloticus* and species groups of Mastacembelus, Hampala, Poropuntius and *Sikukia gudgeri* and *Amblyrhynchichthys truncates*. 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 September 2022, activities related to ISO14001:2015 implementation continued such as conducting the annual ISO14001 Internal Audit and following up on the implementation of the Environmental Management Plan and its achievements. The internal audit completed 27 out of 31 areas/work functions and the 04 remaining areas will be completed by the middle of October 2022. The scope and status of the ISO Internal Audit are shown in the table below.

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

Department / Area	Auditors	Progress
Industrial Areas (Powerhouses and Dams)		
Control rooms	**Team 6**	Completed
Dams		Completed
Equipment Storage Rooms		Completed
Chemical & Hazmat Storage Areas		Completed
Reservoirs and Downstream of the Dams		Completed
Transmission Lines (230 kV and 115 kV) and 22kV DL		Completed
Emergency response and preparedness system		Completed
Wastewater treatment systems		Completed
Camps Facilities		
Wastewater treatment systems (OSOV1, OSOV2)	**Team 2**	Completed
Fuel Storage Tank/ Fuel Station		Completed
Clinic (OSOV1)		Completed
Security guard houses		Completed
Emergency response and preparedness system		Completed
Environmental Laboratory		Completed
Project Waste Management and Landfill Operation	**Team 5**	Completed
Canteen		Completed
Site decommissioned and rehabillated		Completed
Watershed and Biodiverstiy Management		Completed
Resettlement Management		Completed
Management System		
Management Represenntative (MR)	**Team 4**	Completed
Organization Contexts/Needs and Expectations of Interested Parties/Risks and Opportunities/Legal and Compliance Evaluation		Completed
Compliance Obligation and Compliance Evaluation		Completed
Communication		Completed
DCC	**Team 1**	Pending
Incident Investigation/NC/CA/PA		Pending
Internal Audit		Pending
Management Review		Pending
E Objectives, Targets and Programs	**Team 3**	Completed
Training		Completed
Procurement Management		Completed
Logistic and transportation		Completed

1.2. COMPLIANCE MANAGEMENT

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

The operation and adjustment of the constructed wastewater treatment systems in OSOV2 and the Main Powerhouse continued in September 2022. The results of the effluent analyses after adding sludge indicated reduction of nitrogen and phosphorus in the effluent but still non-compliance with the standard. It is expected that the operation of the system can be adjusted to meet the effluent standards by the end of 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 August 2022	0	1	1	0
Newly Opened in September 2022	0	0	0	0
Total in September 2022	**0**	**1**	**1**	**0**
Resolved in September 2022	0	0	0	0
Carried over to October 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 September 2022
NC No. 01/22 Issued Date: 13-02-22 (NCR Level 1)	Some effluent parameters from the wastewater treatment systems in OSOV2 and the Main Powerhouse continue to exceed the standards for more than 5 months following the completion of the improvement and modification in September 2021	• Continue to monitor the influent and effluent to check the treatment effectiveness to be adjusted as necessary.
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.	• The necessary preventive and corrective actions have been completed • The removal and hand-over of logs to Hat Gniun Village authority according to Bolikhan DAFO advice is still in process of hiring a local firm for logs removal/transportation. • This NCR could be Closed Out within October 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 September 2022.

1.2.2. Site Decommissioning and Rehabilitation

The land use handover is continue 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 September 2022. However, it can be confirmed that the vegetation covers are slightly increased compared with the previous months by general visual inspection.

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 September 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. 5) Closely monitor the Influent to compare with the effluent for the specific parameters to check the treatment effectiveness (continue in Q4 of 2022).
OSOV2	EF13	Non-compliance for total coliform (one out of two sampling), total phosphorus, total nitrogen and ammonia-nitrogen.	
Main Powerhouse	EF19	Non-compliance for COD, BOD_5, faecal coliform, total coliform, total phosphorus, total nitrogen and ammonia-nitrogen.	

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 BOD_5) during September 2022 are presented in ***Table 1.3-2***, ***Table 1.3-3*** and ***Table 1.3-4.*** The full set of data for September 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***.

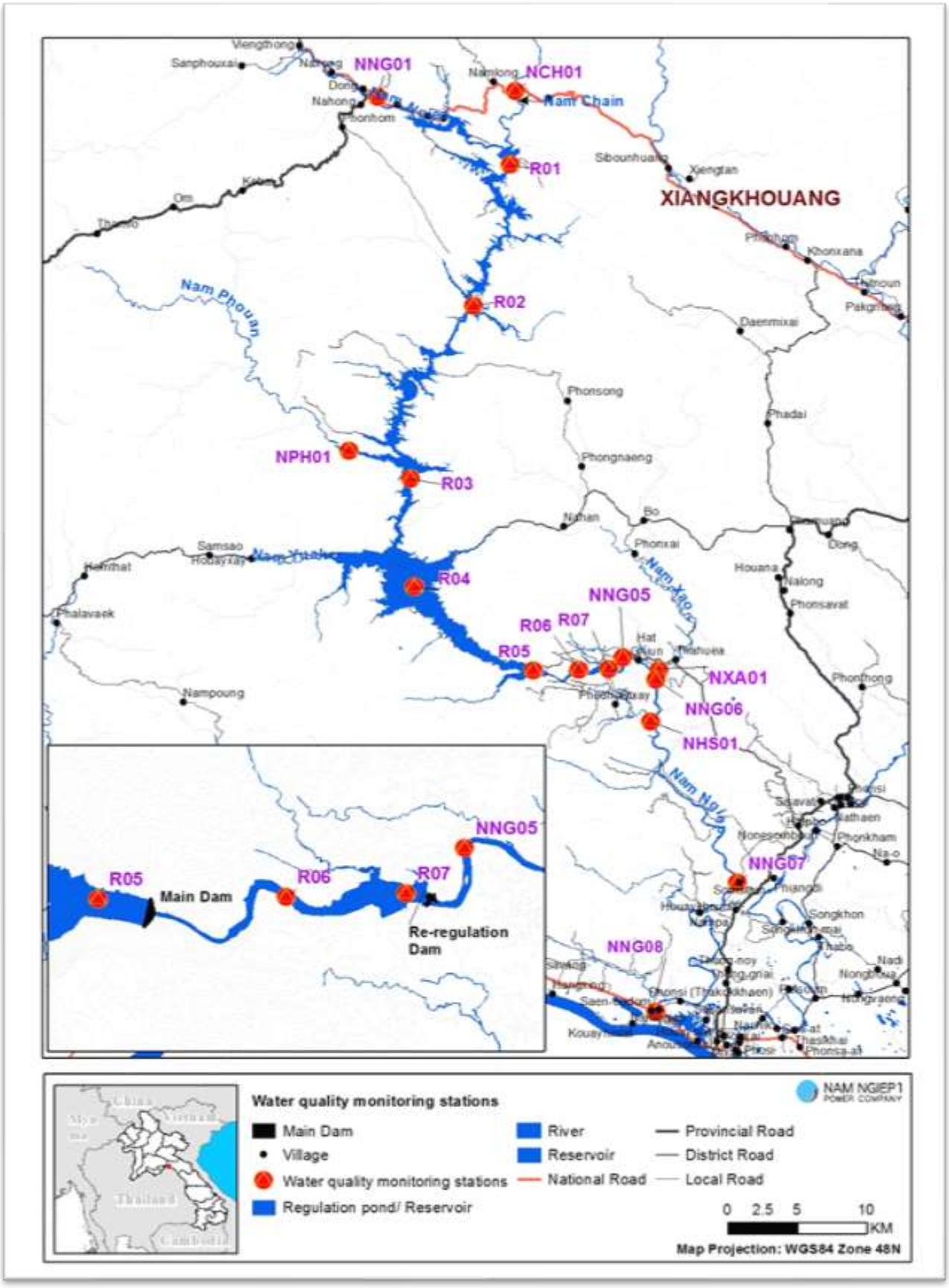

Figure 1.3-1: Surface Water and Re-regulation Reservoir Water Quality Monitoring Stations

Main Reservoir

From 01 to 30 September 2022, the water level in the main reservoir increased from El. 312.34 m asl to El. 317.55 m asl.

At R05 (in the Main Reservoir approx. 0.5 km upstream the Main Dam), the average DO concentration was 8.1 mg/L in the upper 5.5 m varying between 7.0 mg/L and 8.8 mg/L, and the oxycline was generally found at depths between 6.0 m and 9.0 m corresponding to a band of low DO water (below 2 mg/L DO) roughly at depths from 6.5 m to 12 m followed by a layer of slightly higher DO levels with an average DO concentration about 3 mg/L down to depths of 40 m – 50 m from where DO concentrations below 0.5 mg/L (anoxic condition) were recorded. At the level of the intake the DO concentrations varied from about 3 mg/L to 4 mg/L.

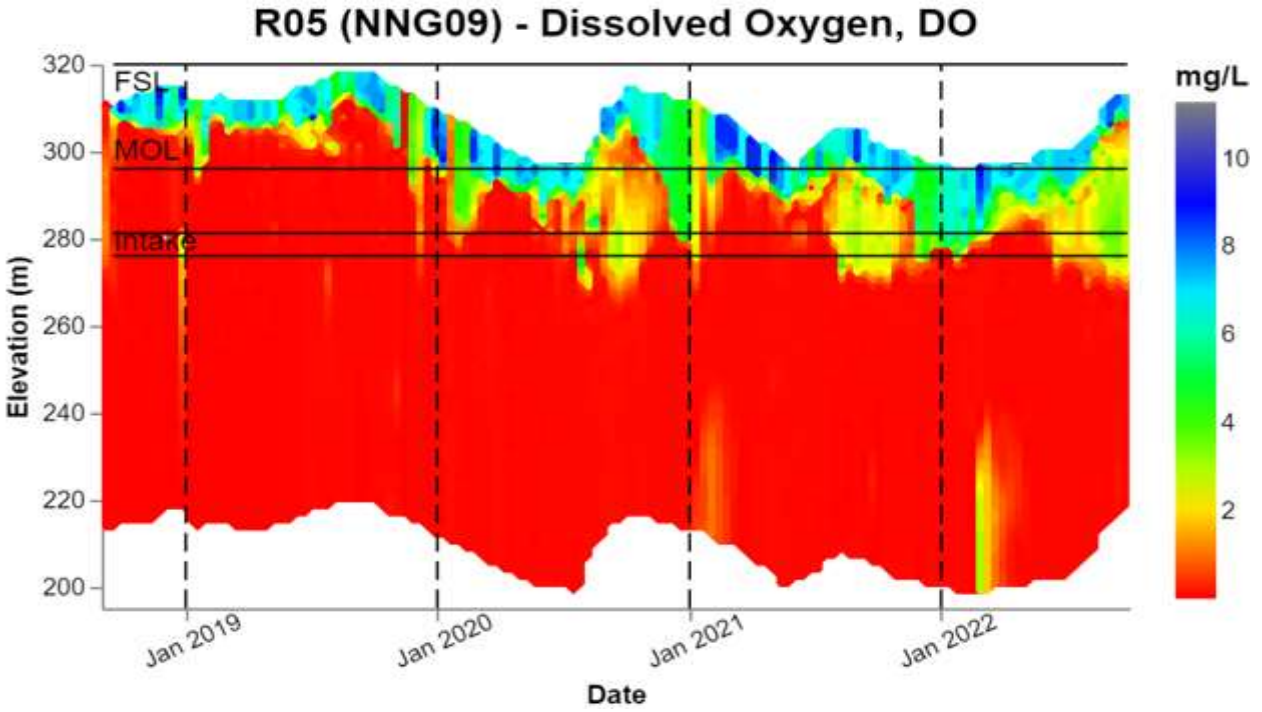

Figure 1.3-2: DO Depth Profiles Time Series in R05 (Since September 2018 to August 2022)

At R04, the DO levels in the upper 5.5 m varied between 7.4 mg/L and 8.6 mg/L. The oxycline found at depths between 6.0 and 7.0 m below surface and DO concentrations in the depth interval from 11 m to 40 m varied between 1 and 4 mg/L, and anoxic condition (0.5 mg/L) occurred at depths below 50 m.

At R03, the DO levels in the upper 4.5 m varied between 4.6 mg/L and 9.4 mg/L with an average of 7.8 mg/L. DO concentrations in the depth interval from 8.0 m to 30 m varied with a range between 1 mg/L and 5 mg/L. Anoxic condition (less than 0.5 mg/L) occurred at depths below 55 m.

At R02, the DO levels in the upper 3.0 m varied between 3.5 mg/L and 9.9 mg/L with an average of 8.5 mg/L. DO concentrations in the depth interval from 7.0 m to bottom varied with a range between 0.8 mg/L and 4.4 mg/L. Anoxic condition (less than 0.5 mg/L) occurred at depths between 4.0 m and 6.0 m during the last two weeks of the month.

At R01, the DO levels in the entire water column varied between 6.4 mg/L and 10.8 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.

The BOD_5 measurements at R01, 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, 6.5 mg/L and less than 1 mg/L respectively.

Re-regulation Reservoir

In September 2022, the turbine discharges from the Main Powerhouse varied between 12 and 240 m^3/s usually interrupted by night-time periods with no discharge.

The mean DO concentration in the water column were 4.3 mg/L and 4.5 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 September 2022, the downstream water quality monitoring was carried out during turbine discharge from the Re-regulation Dam. The DO concentrations were generally less than 6 mg/L in all stations on 08 September 2022 and at NNG05 (immediately downstream the Re-regulation Dam) on 15 September 2022, thus not complying with the surface water quality standard. However, during turbine discharges on 22 and 29 September 2022, the DO levels from NNG05 to NNG08 were 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.

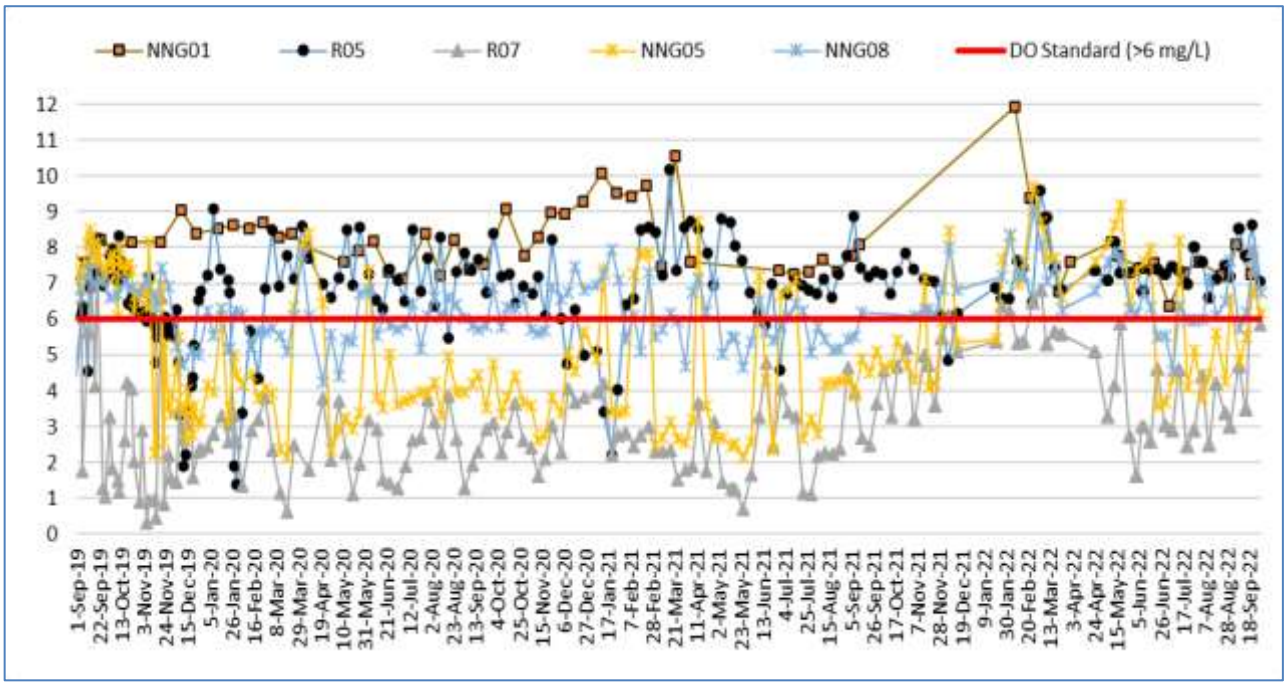

Figure 1.3-3: Concentration of Dissolved Oxygen (mg/L) in the upper 0.2 m since September 2019 on the way to September 2022

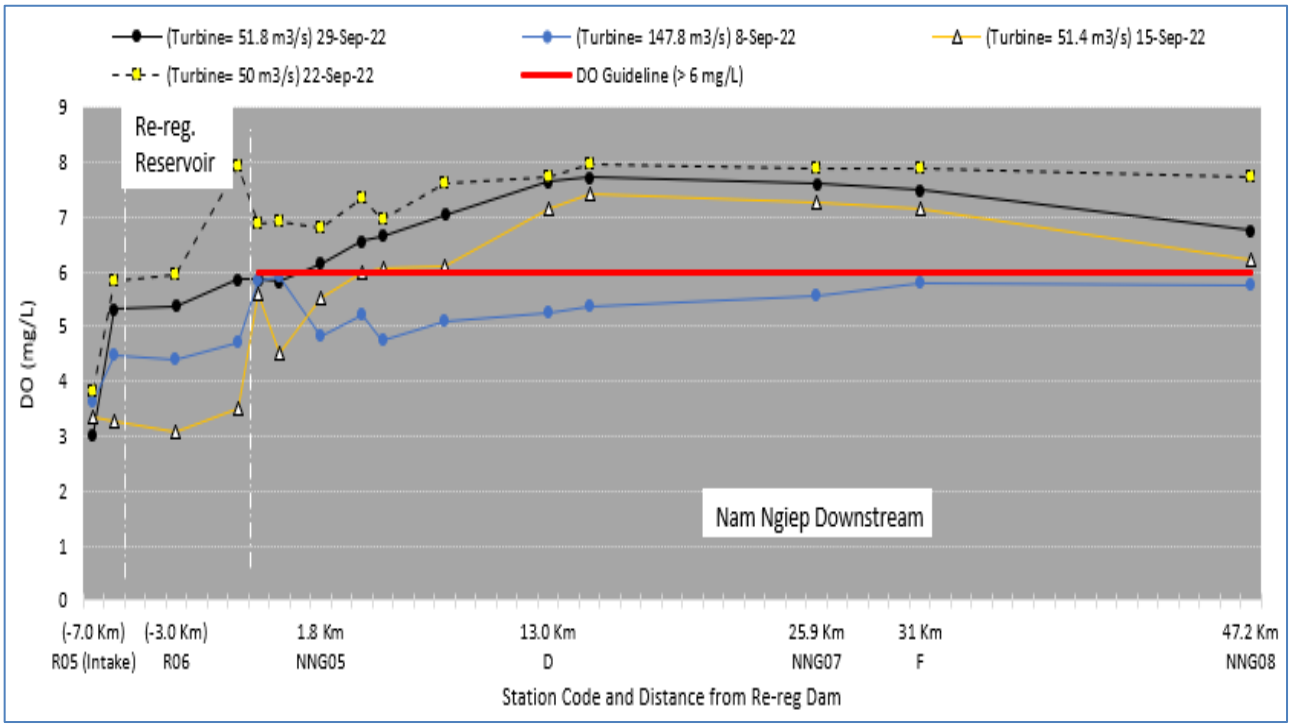

Figure 1.3-4: Dissolved Oxygen (Mg/L) Long Profile in September 2022 (from Immediately Upper Main Dam to Lower Nam Ngiep River)

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
5-Sep-22	8.07												8.49			
6-Sep-22		6.72	8.47	8.69										9.02		
7-Sep-22					8.27	8.54	4.4	4.69								
8-Sep-22									4.83	4.76	5.56	5.75			6.75	6.36
13-Sep-22		7.15	8.84	8.55										8.96		
14-Sep-22					7.82	7.76	3.07	3.49								
15-Sep-22									5.5	6.07	7.28	6.2			7.83	7.9
19-Sep-22	7.25												7.72			
20-Sep-22		6.78	8.55	7.42												
21-Sep-22					8.61	8.65	5.93	7.92								
22-Sep-22									6.8	6.95	7.89	7.72			8.27	8.42
27-Sep-22		10.44	8.05	7.4												
28-Sep-22					7.65	7.06	5.38	5.86								
29-Sep-22									6.15	6.66	7.61	6.75			7.72	8.39

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
5-Sep-22	392												14			
6-Sep-22		32		<5										29		
6-Sep-22 Bottom				22												
7-Sep-22					<5	<5	<5	<5								
7-Sep-22 Bottom					<5	<5										
8-Sep-22									<5	<5	6	13			<5	<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
5-Sep-22	<1												1.3			
6-Sep-22		<1		1.26										<1		
6-Sep-22 Bottom				<1												
7-Sep-22					<1	<1	<1	<1								
7-Sep-22 Bottom					6.5	<1										
8-Sep-22									<1	<1	<1	<1			<1	<1

1.3.3 Groundwater Quality Monitoring

During September 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	12-Sep-22	12-Sep-22	12-Sep-22	05-Sep-22	05-Sep-22
pH	6.5 - 9.2	7.05	7.35	6.82	6.02	6.81
Sat. DO (%)		72.8	84.8	43	87.2	84.8
DO (mg/l)		5.72	6.7	3.32	7.04	6.85
Conductivity (µS/cm)		379	467	318	20	324
Temperature (°C)		27.8	27.46	29.03	26.29	26.18
Turbidity (NTU)	<20	0.19	0.29	1.28	0.79	0.52
Fecal coliform (MPN/100ml)	0	0	4.5	920	240	0
E.coli Bacteria (MPN/100ml)	0	0	4.5	920	240	0
Arsenic (mg/)	<0.05	0.0013	0.0007	0.001	<0.0003	-
Cadmium (mg/l)	<0.01	<0.003	<0.003	<0.003	<0.003	-
Total Iron (mg/l)	<1	<0.01	<0.01	0.019	0.007	-
Total hardness (mg/l)	<500	177	190	141	<4	-
Selenium (mg/l)	<0.01	<0.0002	<0.0002	<0.0002	-	-
Lead (mg/l)	<0.05	<0.008	<0.008	<0.008	-	-

***Note*:** - means there is no analysis result due to the water samples were leaked during transporting to the external laboratory.

In addition, during September 2022, NNP1PC carried out landfill groundwater monitoring at NNP1 Solid Waste Landfill (only three monitoring wells due to water sampling equipment was stuck in monitoring well MW2) and at Houay Soup Solids Waste Landfill (one monitoring well). Similar to previous monitoring results, the concentration of lead in the monitoring wells MW1, MW3, MW4 and MW5 exceeded the relevant groundwater quality standard. This is most likely the (natural) background level and is not attributed to the landfill. Lead has been detected in all wells from time to time both upstream (MW1) and downstream (MW2, MW3 and MW4) the landfill. Furthermore, lead has not been detected in the leachate from landfill treatment ponds and the waste pits and all ponds of both landfills are lined with a HDPE liner protecting the groundwater against infiltration of leachate. These boreholes are more than 50 m deep and not used by staff or villagers.

Table 1.3-6: Landfill Groundwater Observation Monitoring Results

		Site Name	NNP1 Landfill				Houay Soup Landfill
		Station	MW1	MW2	MW3	MW4	MW5
Date	Parameter (Unit)	Guideline					
02-Sep-22	pH		6.03	No water sampling	6.2	5.7	5.51
02-Sep-22	Sat. DO (%)		76.9		10.3	18	48
02-Sep-22	DO (mg/L)		6.09		0.82	1.41	3.73
02-Sep-22	Conductivity (µS/cm)		193		298	181	87
02-Sep-22	Temperature (°C)		27.72		27.25	28.35	28.77
02-Sep-22	Turbidity		29.9		7.09	2.96	40.3
02-Sep-22	Lead (mg/L)	<0.01	2.37		1.04	0.315	0.406
02-Sep-22	Faecal Coliform (MPN/100ml)		920		4.5	0	1.8
02-Sep-22	E. coli (MPN/100ml)		920		4.5	0	0
02-Sep-22	NH_3-N (mg/L)		<2		<2	<2	<2
02-Sep-22	Total Nitrogen (mg/L)		0.22		0.5	0.21	0.22
02-Sep-22	Copper (mg/L)	<1	0.006		0.004	<0.003	<0.003
02-Sep-22	Total Petroleum (mg/L)		<3		<3	<3	<3
02-Sep-22	Water level (m)		21.3		19.1	16.0	5.5

1.3.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

The results of the water quality analyses are presented in ***Table 1.3-7.***

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 1.3-7: 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	12-Sep-22	12-Sep-22	12-Sep-22	12-Sep-22
pH	6.5 - 8.5	6.84	7.02	5.74	5.52
Sat. DO (%)		92.9	69.8	94.5	92.2
DO (mg/L)		7.4	5.5	7.12	
Conductivity (µS/cm)	<1,000	42	76	9	8
Temperature (°C)	<35	26.45	27.33	28.28	28.64
Turbidity (NTU)	<10	9.36	1.38	4.07	1.26
Faecal Coliform (MPN/100 mL)	0	33	7.8	350	170
E.coli Bacteria (MPN/100 mL)	0	23	4.5	170	130
Iron (mg/L)		0.243	0.023	0.14	0.167
Lead (mg/L)	<0.10	<0.01	<0.01	<0.01	<0.01
Total hardness (mg/L)	<300	23.3	41.2	5.4	5.4
Mercury (mg/L)	<0.001	<0.0002	<0.0002	<0.0002	<0.0002

1.3.5 Landfill Leachate Monitoring

During September 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 fully complied with the standards. 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 September 2022 can be found ***Table 1.3-8.***

Table 1.3-8: 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							
2-Sep-22	pH	6.0-9.0				7.99		8.08	
2-Sep-22	Sat. DO (%)					95.1		116.4	
2-Sep-22	DO (mg/L)					6.71		8.24	

		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							
2-Sep-22	Conductivity (µS/cm)					47		148	
2-Sep-22	Temperature (°C)					34.11		33.76	
2-Sep-22	Turbidity (NTU)					21.7		5.16	
2-Sep-22	BOD_5 (mg/L)	<30				11.5		11.7	
2-Sep-22	Faecal Coliform (MPN/100mL)	<400				2		13	
2-Sep-22	Total Coliform (MPN/100mL)	<400				110		240	
2-Sep-22	Total Nitrogen (mg/L)	<10				0.22		1.99	
2-Sep-22	COD (mg/L)	<125				<25		<25	
2-Sep-22	Ammonia nitrogen (mg/L)	<10				<0.2		1.9	
2-Sep-22	Oil & Grease (mg/L)	<10				<1		<1	

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 September 2022, the mean inflow to the main reservoir was 218 m^3/s. The minimum and maximum inflows were 150 m^3/s (on 28 September 2022) and 321 m^3/s (on 06 September 2022) respectively.

From 01 to 30 September 2022, the water level in the main reservoir increased from El. 312.34 m asl to El. 317.55 m asl.

In September 2022, the hourly turbine discharges from the Main Powerhouse varied between 12 m^3/s and 240 m^3/s usually interrupted by night-time periods with no discharge.

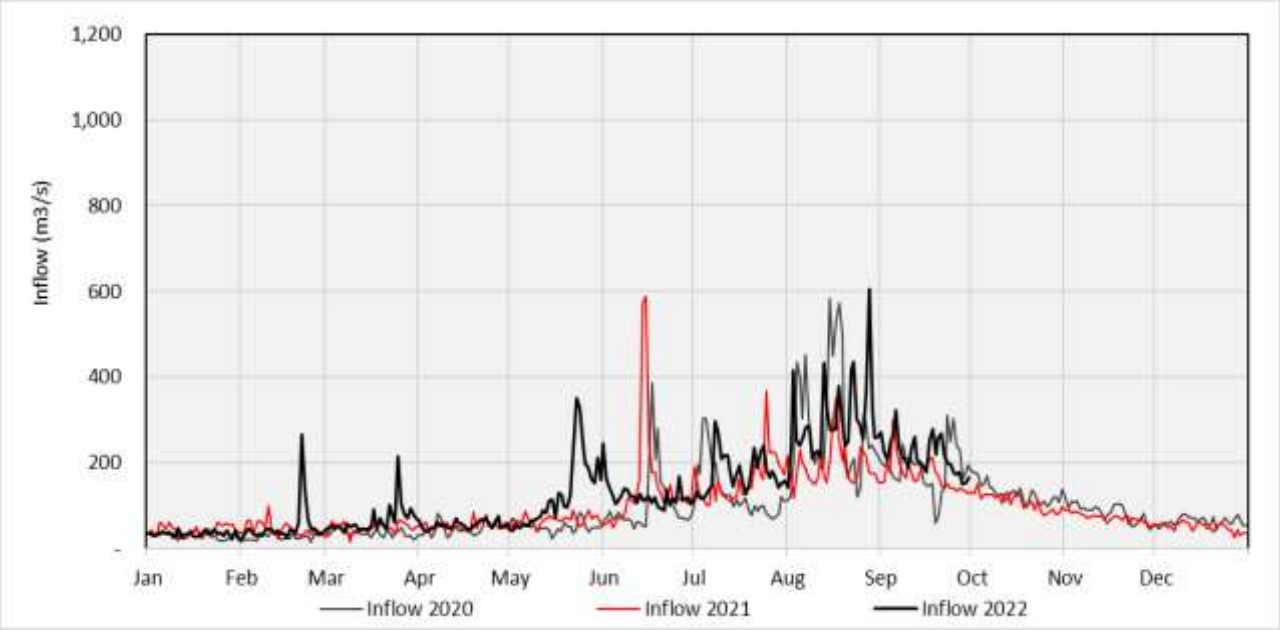

Figure 1.4-1: Inflow for the Main Reservoir during January 2020 to September 2022

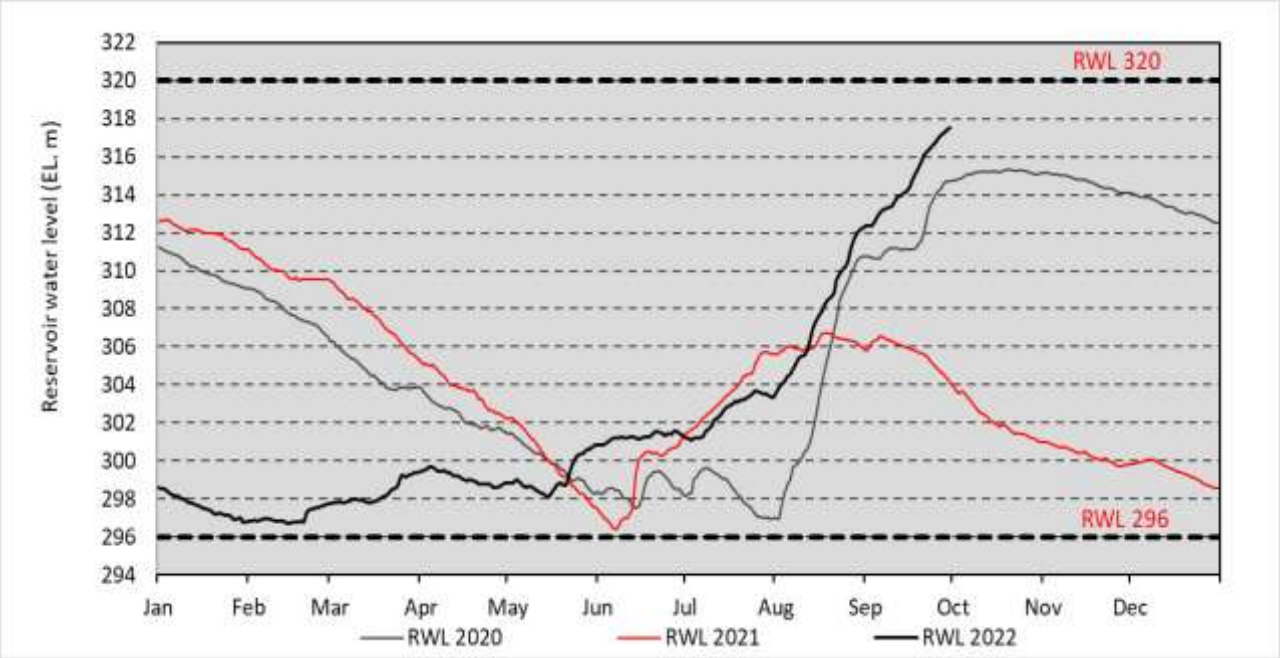

Figure 1.4-2: Water Level for the Main Reservoir during January 2020 to September 2022

1.4.2 Re-regulation Reservoir – Discharge

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

During September 2022, the mean daily discharge from the Re-regulation Dam was about 94 m^3/s, hourly gate discharge varied between 21 m^3/s and 90 m^3/s, hourly turbine discharge varied between 48 m^3/s and 161 m^3/s, and combination of gate and turbine discharge varied between 137 m^3/s and 223 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.

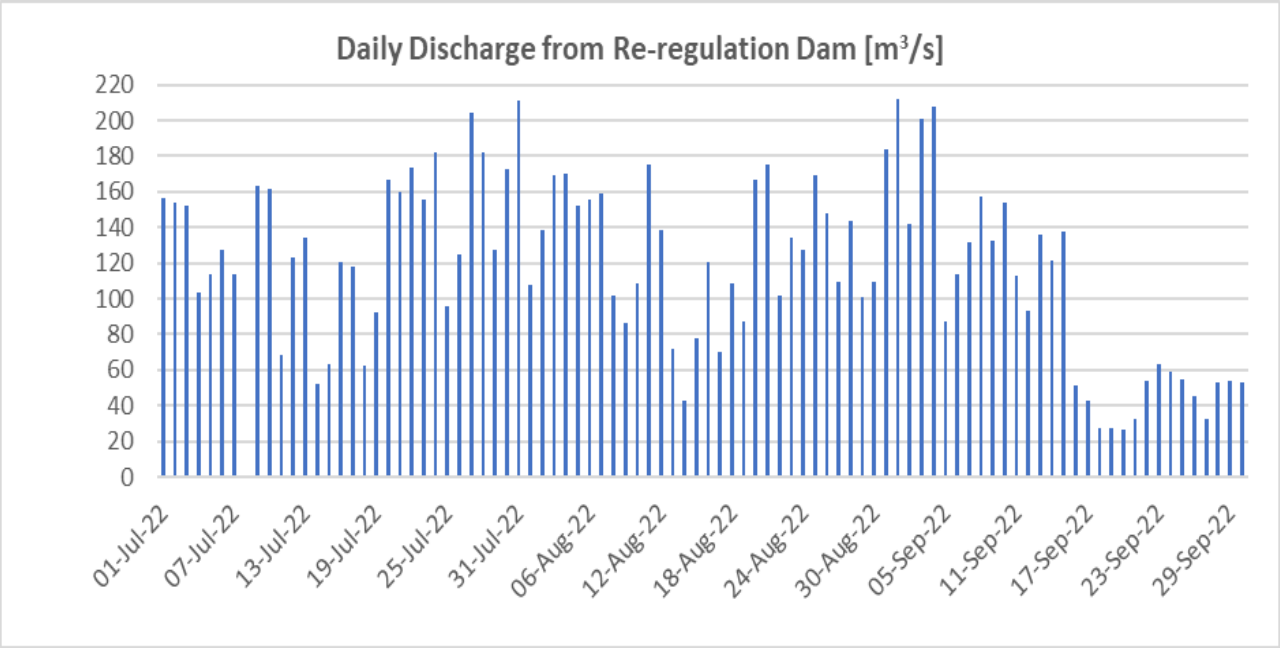

Figure 1.4-3: Discharge Monitoring at the Re-regulation Dam in July to September 2022

1.4.3 Nam Ngiep Downstream Water Depth Monitoring

In September 2022, EMO carried out four 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 9.04 m^3 of solid waste was disposed of at the NNP1 Project Landfill, an increase of 0.04 m^3 compared with August 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: Waste management activities at NNP1 landfill during September 2022

Waste segregation and Wastes Collection

Waste transportation and waste cover at landfill

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 September 2022

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by September 2022
1	Plastic bottles	kg	0	**127**
2	Aluminium can	kg	0	**0**
3	Paper/Cardboard	kg	57	**33**
4	Glass	kg	0	**140**
5	Scrap Metal	Kg	0	**10**
Total		**kg**	**57**	**310**

In September 2022, the villagers collected 235 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 September 2022 are shown in ***Table 1.5-3*** and ***Table 1.5-3*** respectively.

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

No.	Type of Hazardous Material	Unit	Total in September 2022 (A)	Used (B)	Remaining at the end of September 2022 (A – B)
1	Diesel	Litre	6,013	4,020	**1,993**
2	Gasoline	Litre	1,050	463	**587**
3	Lubricant (Turbine oil)	Litre	5,105	3	**5,102**
4	Colour Paint	Litre	299	0	**299**
5	Thinner	Litre	10	0	**10**
6	Grease Oil	Litre	150	0	**150**
7	Gear Oil	Litre	426.8	0	**427**
8	Chlorine Liquid	Litre	110	15	**95**
9	Chlorine Powder	kg	0.6	0	**0.6**
10	HA Cut AF	Litre	3,925	0	**3,925**
11	HA Cut Cat AF	Litre	372.5	0	**373**

Table 1.5-4: Record of Hazardous Waste Inventory

No.	Hazardous Waste Type	Unit	Total in September 2022 (A)	Disposed (B)	Remaining at the end of September 2022 (A - B)
1	Used Oil (Hydraulic + Engine)	Litre	355	0	**355**
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**

No.	Hazardous Waste Type	Unit	Total in September 2022 (A)	Disposed (B)	Remaining at the end of September 2022 (A - B)
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	31	0	**31**
8	Halogen/fluorescent bulbs	kg	94	0	**94**
9	Empty cartridge (Ink)	Unit	182	0	**182**
10	Clinic Waste	Kg	7.2	0	**7.2**
11	Expired Chlorine Powder	Kg	65	0	**65**

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 September 2022. There was no recycle waste trade activities in the community recycle waste bank in September 2022.

1.6.2 Community Solid Waste Management

In September 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 expected that the community solid waste management can 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 as well as the follow up discussion between Xaysomboun WRPO and Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS) on 23 September 2022 are summarized below:

- Xaysomboun WRPO confirmed that the inspection of mineral exploration of Boualay Mangkonthong Company in the watershed TPZ1 could not be carried out in September 2022 because the access to the site is still very difficult. An official letter from NNP1PC to the Department of Energy Business (DEB), Ministry of Energy and Mines (MEM) is still being reviewed by NNP1 ESD management.
- There will be no mobilization of the Xaysomboun WRPO/PAFO staff to the WRPO sub-office because Xaysomboun WRPO disagreed with the allowance for the assigned staff in the remote office as discussed and agreed in the draft Financial Management Manual (FMM). They have decided to take out the staff assignment under the AIP2022.
- Xaysomboun WRPO confirmed that the draft Agreement on the establishment of four TPZ Patrolling Teams and one forest patrol team is nearly finished. The comments from NNP1PC EMO and BSP-WCS have been addressed with some other minor revisions. It was also noted that the Provincial Forest Inspection (POFI) is included in the agreement but due to limited staffs then they will only contribute when available.
- The meeting on the role and responsibility of the NNP1 reservoir fishery management is still pending and Xaysomboun WRPO plans to organize the meeting in October 2022.
- EMO noted that there was still no mobilization for the construction of the two ranger stations and two reservoir checkpoints due to difficult access during the rainy season.
- Xaysomboun WRPO also requested support from BSP-WCS and NNP1PC EMO to prioritize the activities from the previous AIPs as well as under the AIP2022 for the remaining months in 2022. The initial schedule was discussed during the meeting and is expected to be finalized in the first week of October 2022 after internal discussion between BSP-WCS and NNP1PC EMO on 30 September 2022.

2.1.1.2 Bolikhamxay Watershed and Reservoir Protection Office (WRPO)

Bolikhamxay WRPO had discussion with BSP-WCS on 14 September 2022 with the following summary:

- Bolikhamxay WRPO requested NNP1PC EMO and BSP-WCS to support them in prioritizing activities for the rest of 2022 particularly relevant to No Net Loss (NNL) in biodiversity. This includes the consideration for a two-week outreach campaign that is planned in 2022. BSP-WCS was expecting it for November 2022 but it might be necessary to postpone to January 2023 because of several reasons such as: a) resource arrangement for BSP-WCS team support because the Nam Chouane-Nam Xang (NC-NX) offset site outreach campaign was also planned in November 2022; and b) December will be a short month because of harvest season and Hmong New Year festivities.
- It was noted that POFI is no longer participating in Law Enforcement patrols (both reservoir and forest patrols) because of staff availability. The two POFI staffs from each ranger team will be

replaced with two staffs from the Forest Unit of District Agriculture and Forestry Office (DAFO). This approach has been agreed to by the Head of Bolikhamxay PAFO. The agreement is being prepared by Bolikhamxay WRPO and DAFO and is expected to be finalized in the first week of October 2022.

- The SMART training that was originally planned as a refresher training will be adjusted to a full training that will be organized after the new agreement of patrol team is finalized. It is likely to be held in the second or third week of October 2022.
- Bolikhamxay WRPO also requested the support from BSP-WCS and NNP1PC EMO in prioritizing the key activities for the remaining months of 2022. A follow up discussion will be organized in the second week of October 2022.

2.1.1.3 NNP1PC EMO

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

Following a training on organic farming held on 14 August 2022 at Faculty of Agriculture, a knowledge sharing session between trained farmers and other orange and pineapple farmers was organized on 6 September 2022 at Ban PhouNgou and Houayxai of Hom District Xaysomboun Province. The knowledge sharing session organized at Ban Houayxai was attended by 29 farmers (included 8 women) and the knowledge sharing session held at Ban PhouNgou was attended by 29 farmers (included 13 women). The farmers learned how to make photosynthetic bacteria that improves plant growth and crop quality and learned how to use the wood vinegar that improves soil quality, helps elimination of pests, and assists plan growth.

Two cattle farmers at Ban PhouNgou including Mr. Teng Her and Mr. Sayher were selected as representatives cattle farming management program based on their readiness and capacity. They received some support as part of the cattle farming management training to start the cattle fattening in September 2022. Each of them received 7 zinc roof sheets, 2 kg of nails and 1 kg of molasses as feed ingredient. These two farmers are selected as representatives for cattle fattening who will be knowledge resource for other farmers. They have started the program by building the small cow shelter in the third week of September 2022.

NNP1PC EMO team was conducting post training evaluation on cattle fattening and organic farming for orange and pineapple farmers in September 2022. There were 69 questionnaire forms distributed to cattle farmers in Thathom Districts, 49 forms distributed to cattle farmers in Hom Districts, 49 forms distributed to farmers in Hom Districts, 57 forms distributed to orange and pineapple farmers in Hom District.

A database in Microsoft Excel of the farmers (cattle, orange, pineapple) engaged in the watershed sustainable livelihood opportunity program is being developed. The data will be used to analyse the capacity and behaviour of each farmer as well as the farming issues for the planning interventions.

2.1.2 Preparation of Annual Implementation Plan (AIP) 2022

2.1.2.1 Xaysomboun WRPO

Xaysomboun WRPO AIP2022 covering the implementation period from September to December 2022 with the total budget of LAK 1,544,578,000 was approved by Xaysomboun PAFO on 9 September 2022. Xaysomboun WRPO informed that they are still preparing the document for submission to Department of Forestry (DOF), Ministry of Agriculture and Forestry (MAF) until the

last week of September 2022. NNP1PC is expected to receive an official fund disbursement request from DOF-MAF in the first week of October 2022 for further fund disbursement process.

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 of 2022 fund disbursement which was concluded on 22 August 2022. NNP1PC received a fund disbursement request totalling LAK 327,005,000 from DOF-MAF on 2 September 2022. The fund was disbursed to DOF-MAF on 15 September 2022. Bolikhamxay WRPO is preparing the document for the fund transfer from DOF-MAF to their account until the last week of September 2022. The fund is expected to be available in October 2022.

2.1.3 Preparation of Annual Implementation Plan (AIP) 2023

NNP1PC EMO and BSP-WCS had discussion on 30 September 2022 on the approach for the preparation of GOL AIP2023. The preliminary draft with the recommended activities and estimated budget considering the key activities related to No Net Loss (NNL) and the actual capacity of GOL implementing units is being prepared by NNP1PC EMO in collaboration with BSP-WCS. It is expected to be finalized in the second week of October 2022 and it will be circulated to Xaysomboun and Bolikhamxay WRPO for their review. A series of small workshops and follow up discussions are expected after that to have the first draft by early November 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 September 2022 are described below:

a. Component 1 - Spatial Planning and Regulation

Nam Chouane-Nam Xang (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 was not yet organized in September 2022 but will be organized as soon as the fund under the AIP2022 is transferred from DOF-MAF to Bolikhamxay NC-NX BOMU.

b. Component 2 – Law Enforcement

The September 2022 monthly sub-station guarding is operating from 3-29 September 2022 with 3 persons for each sub-station. The SMART and first aid training agenda was finalized and shared by BSP-WCS on 12 September 2022. The trainings are tentatively scheduled to be carried out on 17-21 October 2022 in Viengthong District. BOMU and the Lao Red Cross (first aid trainers) are preparing for the training while NNP1PC EMO also support to prepare the necessary materials for the training including the maps.

c. Component 3 – Conservation Outreach

The NC-NX outreach strategy was finalized on 1 August 2022 and approved by Bolikhamxay PAFO on 6 September 2022. The outreach will be conducted after receiving the funds under the AIP2022.

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 under the AIP2022.

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. The plan was approved by Bolikhamxay PAFO on 22 August 2022 and NNP1PC received the fund disbursement request from DoF-MAF on 1 September 2022. NNP1PC transferred the fund to Ministry of Finance (MoF) on 15 September 2022. NC-NX BOMU is preparing the document for the fund transfer from DOF-MAF to their account until the last week of September 2022. The fund is expected to be available in October 2022.

2.2.3 Preparation of Annual Implementation Plan (AIP) 2023

NNP1PC EMO and BSP-WCS had discussion on 30 September 2022 on the approach for the preparation of GOL AIP2023. The preliminary draft with the recommended activities and estimated budget considering the key activities related to No Net Loss (NNL) and the actual capacity of GOL implementing units is being prepared by NNP1PC EMO in collaboration with BSP-WCS. It expected to be finalized in the second week of October 2022 and it will be circulated to NC-NX BOMU for their review. Series of small workshop and follow up discussion are expected after that to have the first draft by early November 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 August 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.

[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.

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

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Mastacembelus armatus, Mastacembelus favus	ปาหาถ	279.4	LC
Hampala dispar, Hampala macrolepidota	ปาสูถ	216.7	LC
Poropuntius normani, Poropuntius laoensis, Poropuntius carinatus	ปาจาถ	135.5	LC
Oreochromis niloticus	ปานิน	111.9	LC
Sikukia gudgeri, Amblyrhynchichthys truncatus	ปาขาวฉาย	80.1	DD, LC

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

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

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Cirrhinus cirrhosus	ปาแกง/ปามอมจัม	0.4	VU
Scaphognathops bandanensis	ปาอวมไฝ/ปาป่วม	12.2	VU
Tor sinensis	ปาแดง	45.3	VU

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

TABLE 2-3: MAIN BIODIVERSITY INDICATORS FOR AUGUST 2022

Biodiversity Indicators	Mekong	Below dam	Above dam
Total number of species and groups recorded	25	32	38
Single species	23	20	24
Species groups	2	12	14
Top 15 species (% total catch weight)	91.42%	86.06%	93.52%
Proportion for species groups	12.86%	66.42%	61.58%
Diversity index (Shannon)	2.7726	2.6995	2.5790

Figure 2-1 shows the proportion of total number of households actively fishing by fishing zone including upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK). It ranges between 45% and 70% of active fishing households for all fishing zones in August 2022.

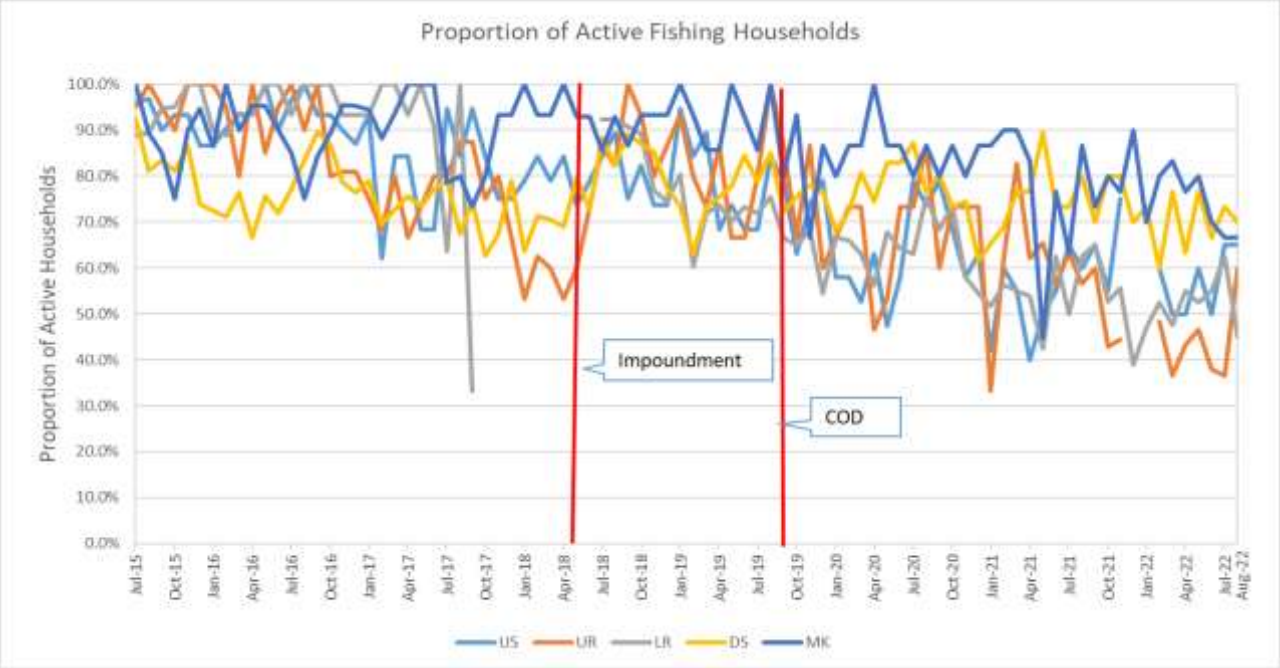

FIGURE 2-1: PROPORTION OF TOTAL NUMBER OF HOUSEHOLDS ACTIVELY FISHING BY FISHING ZONE FROM JULY 2015 TO AUGUST 2022

Note:

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

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

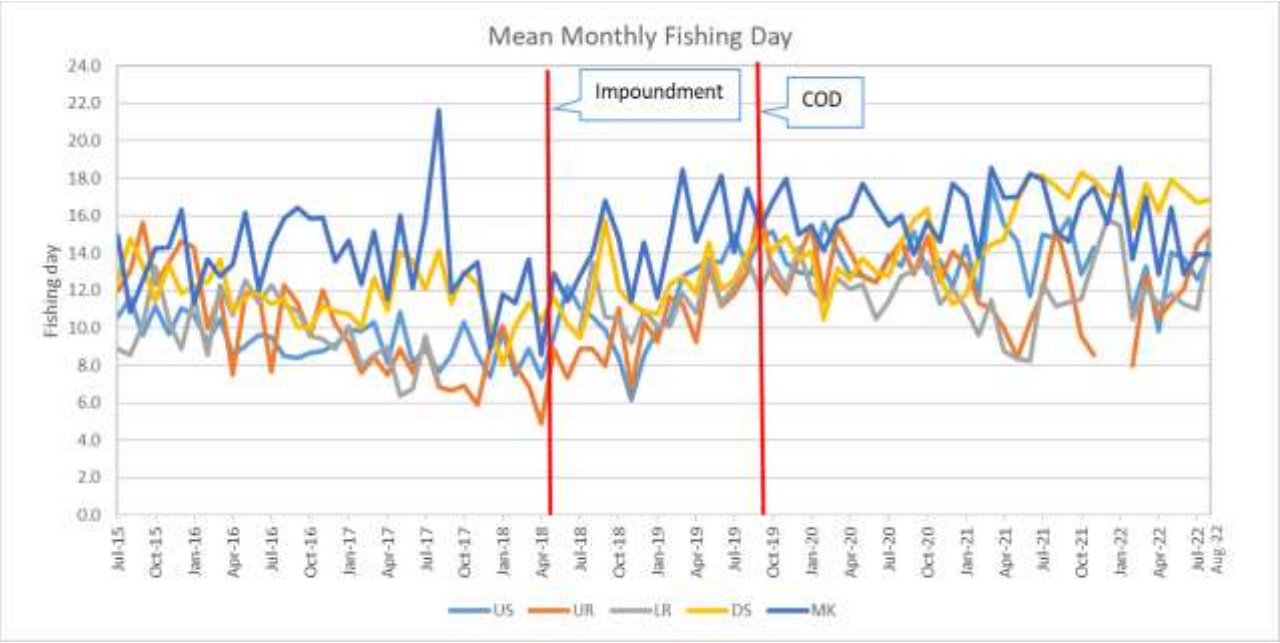

FIGURE 2-2: MEAN OF MONTHLY HOUSEHOLD FISHING DAY FROM JULY 2015 TO AUGUST2022

The mean monthly number of fishing days for the month of August 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 AUGUST FROM 2015 TO 2022

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)
Upstream	11.60	8.49	7.68	10.56	13.29	13.29	14.76	13.97
Upper reservoir	13.05	12.26	6.84	8.86	12.99	14.65	15.37	15.25
Lower reservoir	8.56	11.24	7.09	13.52	13.70	12.77	11.16	15.01
Downstream	14.80	11.57	14.13	11.81	14.06	14.64	17.53	16.87
Mekong	10.87	15.87	21.65	14.02	17.42	16.01	15.16	13.95

The mean monthly household fish catch from July 2015 to August 2022 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area are presented in ***Figure 2-3.***

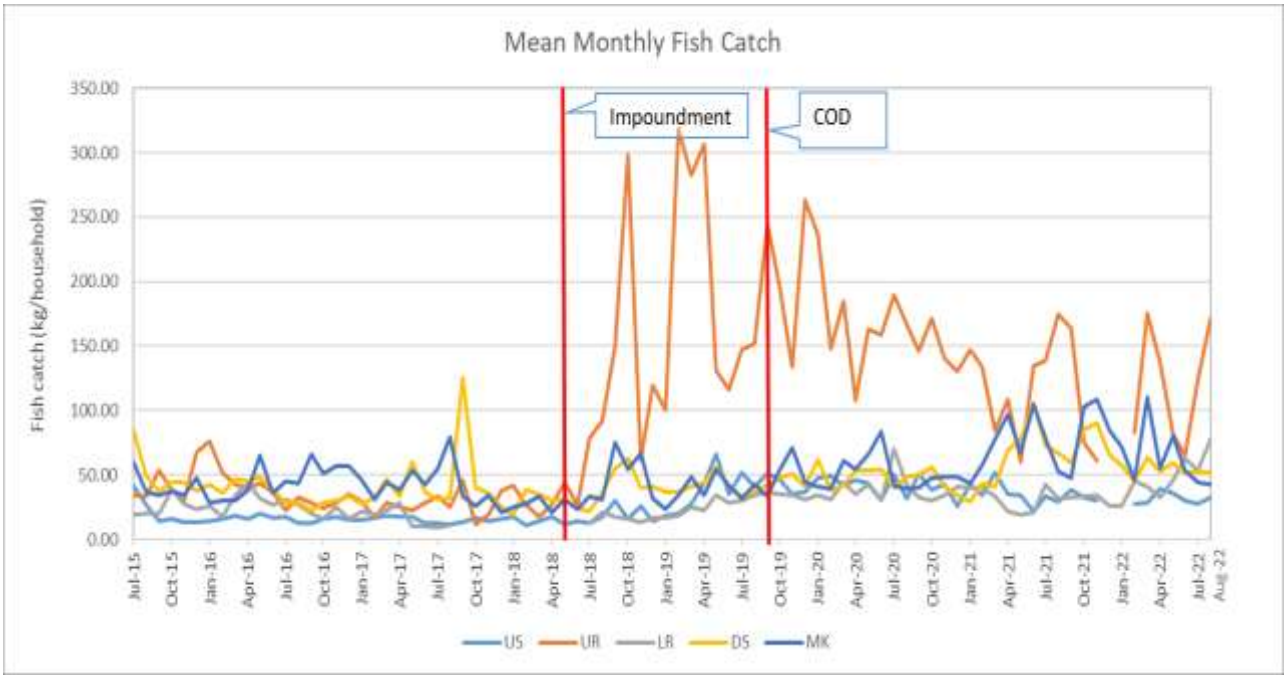

FIGURE 2-3: MEAN MONTHLY HOUSEHOLD FISH CATCH FROM JULY 2015 TO AUGUST 2022

The mean household fish catch for the month of August 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 AUGUST FROM 2015 TO 2022

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)
Upstream	26.66	12.10	11.34	17.68	40.55	32.14	28.82	32.81
Upper reservoir	33.75	32.64	25.00	91.49	151.78	166.58	174.30	171.48
Lower reservoir	20.22	26.78	10.54	20.55	33.90	41.69	31.76	77.75
Downstream	49.30	28.12	32.88	35.65	36.87	48.44	66.78	52.19
Mekong	36.80	43.66	79.12	30.48	42.75	38.84	52.61	42.49

The mean daily fish catch per household from July 2015 to August 2022 are displayed in ***Figure 2-4*** and the mean fish catch per household per fishing day for the month of August from 2015 to 2022 are shown in ***Table 2-6.***

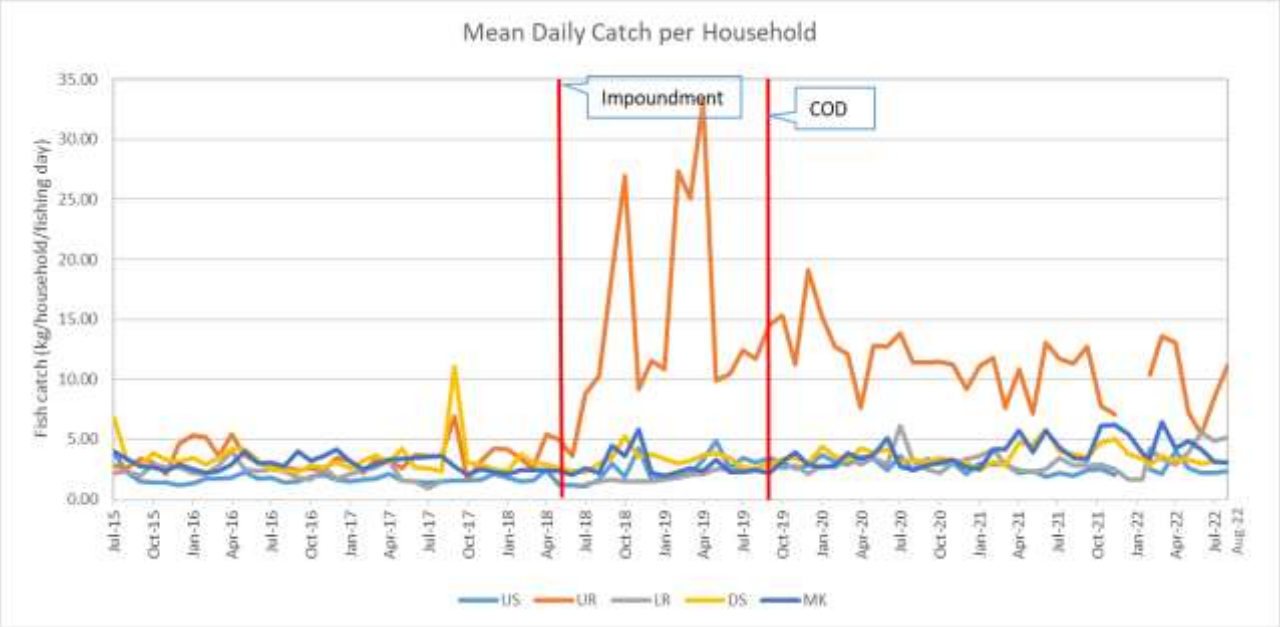

FIGURE 2-4: MEAN DAILY FISH CATCH PER HOUSEHOLD FROM JULY 2015 TO AUGUST 2022

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

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)
Upstream	2.30	1.43	1.48	1.67	3.05	2.42	1.95	2.35
Upper reservoir	2.59	2.66	3.65	10.33	11.68	11.37	11.34	11.24
Lower reservoir	2.36	2.38	1.49	1.52	2.48	3.26	2.85	5.18

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)
Downstream	3.33	2.43	2.33	3.02	2.62	3.31	3.81	3.09
Mekong	3.39	2.75	3.65	2.17	2.45	2.43	3.47	3.05

The survey results in August 2022 indicate that Nam Ngiep is the main fishing habitat for the upstream and downstream zone, the main fishing habitat for the lower reservoir zone is reservoir and tributaries and streams, while the main fishing habitat for the upper reservoir and Mekong zones are reservoir and Mekong respectively. The proportion of fishing habitats in August 2022 are displayed in ***Table 2-7.***

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

Habitats	US	UR	LR	DS	MK
Mekong	0.0%	0.0%	0.0%	0.0%	57.2%
Nam Ngiep	55.3%	4.1%	0.0%	63.7%	2.6%
Nam Xan	0.0%	0.0%	0.0%	0.0%	0.0%
Reservoir	0.0%	91.7%	48.5%	0.0%	0.0%
Tributaries and streams	40.5%	3.4%	47.7%	31.8%	0.3%
Wetlands	4.2%	0.9%	3.7%	4.4%	39.9%
Others	0.0%	0.0%	0.0%	0.0%	0.0%

The 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 2022 are presented in ***Figure 2-5*** and the proportion of OAA catch for the month of August from 2015 to 2022 are shown in ***Table 2-8.***

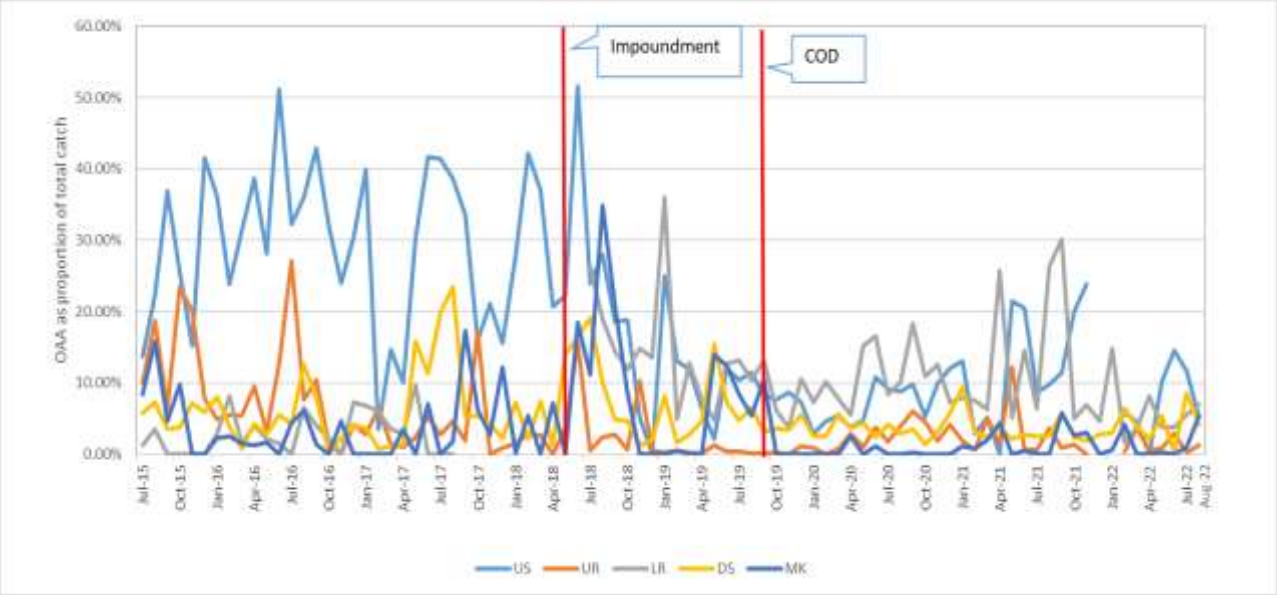

FIGURE 2-5: PROPORTION OF OAA TO THE TOTAL REPORTED NUMBER OF FISH AND OAA FOR A 7-DAY PERIOD BY FISHING ZONE FROM JULY 2015 TO AUGUST 2022

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

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

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																
5-Sep-22	pH	5.0 - 9.0	6.79												6.56			
6-Sep-22	pH	5.0 - 9.0		6.93	7.95	8.55										7.84		
7-Sep-22	pH	5.0 - 9.0					7.85	7.75	6.86	6.93								
8-Sep-22	pH	5.0 - 9.0									6.86	7.12	7.06	7.13			7.09	6.28
13-Sep-22	pH	5.0 - 9.0		7.15	8.04	7.8										7.88		
14-Sep-22	pH	5.0 - 9.0					7.96	7.18	6.84	7								
15-Sep-22	pH	5.0 - 9.0									6.89	7.12	7.04	6.88			7.31	6.68
19-Sep-22	pH	5.0 - 9.0	7.18												6.99			
20-Sep-22	pH	5.0 - 9.0		7.25	8.34	7.92												
21-Sep-22	pH	5.0 - 9.0					7.27	7.49	6.87	7.05								
22-Sep-22	pH	5.0 - 9.0									7.05	7.11	7.14	7			7.2	6.99
27-Sep-22	pH	5.0 - 9.0		8.32	7.08	7.05												
28-Sep-22	pH	5.0 - 9.0					7.14	7.03	6.75	6.75								
29-Sep-22	pH	5.0 - 9.0									6.82	7.13	7.07	6.87			7.13	7.07
5-Sep-22	Sat. DO (%)		99.1												102.1			
6-Sep-22	Sat. DO (%)			82.5	119.7	119.5										108.7		
7-Sep-22	Sat. DO (%)						110.3	112.8	53.9	59.2								
8-Sep-22	Sat. DO (%)										58.7	58	68.4	70.6			85.5	79.1
13-Sep-22	Sat. DO (%)			91.2	121.6	114.2										106.8		
14-Sep-22	Sat. DO (%)						103	102.8	37.5	43.3								
15-Sep-22	Sat. DO (%)										67.5	75	89.4	82.1			99.1	98.4
19-Sep-22	Sat. DO (%)		89.6												93.1			

		River Name	Nam Ngiep								Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites								Location Refer to Construction Sites			
			Upstream/Main Reservoir					Within/Re-regulation Reservoir		Downstream			Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
20-Sep-22	Sat. DO (%)			85.9	118.3	102.1												
21-Sep-22	Sat. DO (%)						112.9	112.8	72.7	105.3								
22-Sep-22	Sat. DO (%)										83.7	85.9	98.4	97.7			103.6	103.5
27-Sep-22	Sat. DO (%)			139.1	109.8	100.3												
28-Sep-22	Sat. DO (%)						99.6	91.6	65.5	71.7								
29-Sep-22	Sat. DO (%)										75.1	81.4	93.4	82.3			95.6	102.7
5-Sep-22	DO (mg/L)	>6.0	8.07												8.49			
6-Sep-22	DO (mg/L)	>6.0		6.72	8.47	8.69										9.02		
7-Sep-22	DO (mg/L)	>6.0					8.27	8.54	4.4	4.69								
8-Sep-22	DO (mg/L)	>6.0									4.83	4.76	5.56	5.75			6.75	6.36
13-Sep-22	DO (mg/L)	>6.0		7.15	8.84	8.55										8.96		
14-Sep-22	DO (mg/L)	>6.0					7.82	7.76	3.07	3.49								
15-Sep-22	DO (mg/L)	>6.0									5.5	6.07	7.28	6.2			7.83	7.9
19-Sep-22	DO (mg/L)	>6.0	7.25												7.72			
20-Sep-22	DO (mg/L)	>6.0		6.78	8.55	7.42												
21-Sep-22	DO (mg/L)	>6.0					8.61	8.65	5.93	7.92								
22-Sep-22	DO (mg/L)	>6.0									6.8	6.95	7.89	7.72			8.27	8.42
27-Sep-22	DO (mg/L)	>6.0		10.44	8.05	7.4												
28-Sep-22	DO (mg/L)	>6.0					7.65	7.06	5.38	5.86								
29-Sep-22	DO (mg/L)	>6.0									6.15	6.66	7.61	6.75			7.72	8.39
5-Sep-22	Conductivity (µs/cm)		91												32			
6-Sep-22	Conductivity (µs/cm)			78	74	67										88		
7-Sep-22	Conductivity (µs/cm)						67	65	80	79								
8-Sep-22	Conductivity (µs/cm)										79	79	78	74			96	22
13-Sep-22	Conductivity (µs/cm)			96	72	63										81		
14-Sep-22	Conductivity (µs/cm)						64	61	75	74								
15-Sep-22	Conductivity (µs/cm)										73	75	70	63			95	17

		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																
19-Sep-22	Conductivity (µs/cm)		92												32			
20-Sep-22	Conductivity (µs/cm)			92	71	64												
21-Sep-22	Conductivity (µs/cm)						64	61	74	68								
22-Sep-22	Conductivity (µs/cm)										72	74	69	55			87	16
27-Sep-22	Conductivity (µs/cm)			69	68	60												
28-Sep-22	Conductivity (µs/cm)						61	58	71	68								
29-Sep-22	Conductivity (µs/cm)										69	72	69	62			92	19
5-Sep-22	Temperature (°C)		25.8												24.53			
6-Sep-22	Temperature (°C)			26.02	34.1	32.03										24.66		
7-Sep-22	Temperature (°C)						30.43	29.83	25.7	27.44								
8-Sep-22	Temperature (°C)										25.4	25.62	25.85	26.35			27.46	26.53
13-Sep-22	Temperature (°C)			27.58	32.46	30.48										24.13		
14-Sep-22	Temperature (°C)						29.76	29.93	25.56	26.34								
15-Sep-22	Temperature (°C)										25.74	26.05	26.34	26.52			27.46	26.56
19-Sep-22	Temperature (°C)		26.19												24.75			
20-Sep-22	Temperature (°C)			27.7	32.48	32.2												
21-Sep-22	Temperature (°C)						29.78	29.08	25.88	30.33								
22-Sep-22	Temperature (°C)										25.91	26.12	26.63	27.99			27.24	26.22
27-Sep-22	Temperature (°C)			30.45	31.7	31.29												
28-Sep-22	Temperature (°C)						29.04	28.78	25.46	25.58								
29-Sep-22	Temperature (°C)										25.44	25.47	25.94	26.77			26.21	25.67
5-Sep-22	Turbidity (NTU)		214												14.9			
6-Sep-22	Turbidity (NTU)			70.4	2.09	1.96										29.1		
7-Sep-22	Turbidity (NTU)						2.38	1.64	3.58	3.37								
8-Sep-22	Turbidity (NTU)										4.53	4.95	7.16	6.53			19.9	3.72
13-Sep-22	Turbidity (NTU)			25.2	4.36	2.1										20.7		
14-Sep-22	Turbidity (NTU)						1.45	1.41	3.56	3.62								

		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-22	Turbidity (NTU)										3.01	5.78	8.55	9.13			20.6	3.96
19-Sep-22	Turbidity (NTU)		81												12.8			
20-Sep-22	Turbidity (NTU)			41.7	3.58	2.29												
21-Sep-22	Turbidity (NTU)						2.07	1.75	3	8.92								
22-Sep-22	Turbidity (NTU)										3.33	6.62	13.5	11.6			22.7	4.41
27-Sep-22	Turbidity (NTU)			9.31	43.4	1.7												
28-Sep-22	Turbidity (NTU)						1.73	1.62	2.71	3.22								
29-Sep-22	Turbidity (NTU)										3.1	4.4	6.52	5.69			11	4.11
5-Sep-22	TSS (mg/L)		392.5												14.46			
6-Sep-22	TSS (mg/L)			32.02		<5										29.23		
7-Sep-22	TSS (mg/L)						<5	<5	<5	<5								
8-Sep-22	TSS (mg/L)										<5	<5	5.8	13.36			<5	<5
5-Sep-22	BOD_5 (mg/L)	<1.5	<1												1.3			
6-Sep-22	BOD_5 (mg/L)	<1.5		<1		1.26										<1		
7-Sep-22	BOD_5 (mg/L)	<1.5					<1	<1	<1	<1								
8-Sep-22	BOD_5 (mg/L)	<1.5									<1	<1	<1	<1			<1	<1
5-Sep-22	COD (mg/L)	<5.0	18.8												<5			
6-Sep-22	COD (mg/L)	<5.0																
7-Sep-22	COD (mg/L)	<5.0							<5	<5						<5		
8-Sep-22	COD (mg/L)	<5.0									9.6	<5	<5	<5			<5	<5
5-Sep-22	NH_3-N (mg/L)	<0.2	<0.2												<0.2			
6-Sep-22	NH_3-N (mg/L)	<0.2		<0.2		<0.2										<0.2		
7-Sep-22	NH_3-N (mg/L)	<0.2					<0.2	<0.2										
5-Sep-22	NO_3-N (mg/L)	<5.0	0.09												0.05			
6-Sep-22	NO_3-N (mg/L)	<5.0		0.08		0.05										0.04		
7-Sep-22	NO_3-N (mg/L)	<5.0					0.05	0.05										
5-Sep-22	Faecal coliform (MPN/100 mL)	<1,000	1,600												350			

		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-22	Faecal coliform (MPN/100 mL)	<1,000														540		
7-Sep-22	Faecal coliform (MPN/100 mL)	<1,000							11	22								
8-Sep-22	Faecal coliform (MPN/100 mL)	<1,000									49	70	110	220			540	110
5-Sep-22	Total Coliform (MPN/100 mL)	<5,000	1,600												930			
6-Sep-22	Total Coliform (MPN/100 mL)	<5,000														1,600		
7-Sep-22	Total Coliform (MPN/100 mL)	<5,000							17	27								
8-Sep-22	Total Coliform (MPN/100 mL)	<5,000									130	170	280	280			920	140
5-Sep-22	TKN		<1.5												<1.5			
6-Sep-22	TKN			<1.5		<1.5										<1.5		
7-Sep-22	TKN						<1.5	<1.5										
6-Sep-22	Secchi Disk (m)			0.15	2	3.2												
7-Sep-22	Secchi Disk (m)						3.1	2.9	2.1	2.75								
13-Sep-22	Secchi Disk (m)			0.5	1.5	3												
14-Sep-22	Secchi Disk (m)						3	2.75	2.25	2.2								
5-Sep-22	TOC (mg/L)		3.32												2			
6-Sep-22	TOC (mg/L)															0.62		
7-Sep-22	TOC (mg/L)								1.89	1.63								
8-Sep-22	TOC (mg/L)										2.18	1.65	1.6	1.72			1.62	3.54
5-Sep-22	Total Phosphorus (mg/L)		0.06												0.02			
6-Sep-22	Total Phosphorus (mg/L)			0.05		0.02										0.05		
7-Sep-22	Total Phosphorus (mg/L)						0.02	0.02										
5-Sep-22	Total Dissolved Phosphorus (mg/L)		0.03												0.01			
6-Sep-22	Total Dissolved Phosphorus (mg/L)			0.03		0.01										0.01		
7-Sep-22	Total Dissolved Phosphorus (mg/L)						<0.01	<0.01										
6-Sep-22	Hydrogen Sulfide (mg/L)			<0.02		<0.02												

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						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																
7-Sep-22	Hydrogen Sulfide (mg/L)						<0.02	<0.02										
6-Sep-22	Turbidity (NTU)-bottom					1.96												
7-Sep-22	Turbidity (NTU)-bottom						2.38	1.64										
6-Sep-22	TSS (mg/L)-bottom					21.83												
7-Sep-22	TSS (mg/L)-bottom						<5	<5										
6-Sep-22	BOD_5 (mg/L)-bottom					<1												
7-Sep-22	BOD_5 (mg/L)-bottom						6.54	<1										
6-Sep-22	NH_3-N (mg/L)-bottom					0.77												
7-Sep-22	NH_3-N (mg/L)-bottom						0.4	0.5										
6-Sep-22	NO_3-N (mg/L)-bottom					0.05												
7-Sep-22	NO_3-N (mg/L)-bottom						0.05	0.05										
6-Sep-22	TKN-bottom					<1.5												
7-Sep-22	TKN-bottom						<1.5	<1.5										
6-Sep-22	Total Dissolved Phosphorus (mg/L)-bottom					0.02												
7-Sep-22	Total Dissolved Phosphorus (mg/L)-bottom						0.03	0.02										
6-Sep-22	Total Phosphorus (mg/L)-bottom					0.03												
7-Sep-22	Total Phosphorus (mg/L)-bottom						0.05	0.04										
6-Sep-22	Hydrogen Sulfide (mg/L)-bottom					0.02												
7-Sep-22	Hydrogen Sulfide (mg/L)-bottom						0.02	<0.02										

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

	Site Name	OSOV1 (Owner's Site Office and Village)		OSOV2 (ESD Camp)		Main Powerhouse	
	Station Code	EF01		EF13		EF19	
	Date	01-Sep-22	16-Sep-22	02-Sep-22	15-Sep-22	02-Sep-22	19-Sep-22
Parameters (Unit)	**Guideline**						
pH	6.0 - 9.0	6.4	6.32	7.6	7.74	7.77	8.03
Sat. DO (%)		61.9	77.4	71.4	89.4	49.8	43.3
DO (mg/L)		4.72	6.15	5.36	7.42	3.7	3.29
Conductivity (µs/cm)		402	322	591	531	1,700	1,560
Temperature (°C)		29.36	27.09	30.24	24.59	30.66	29.58
Turbidity (NTU)		1.57	0.48	12.5	11	74.1	66.5
TSS (mg/L)	<50	<5	<5	14	13.56	51.0	48.8
BOD_5 (mg/L)	<30	6.78	<6	13.07	11.37	97.05	66.0
COD (mg/L)	<125	<25	<25	48	32	168	150
NH_3-N (mg/L)	<10.0	<2	<2	19.8	25.4	103.0	88.7
Total Nitrogen (mg/L)	<10.0	0.21	2.38	21.2	26.9	107.0	90.7
Total Phosphorus (mg/L)	<2	1.16	1.26	1.95	2.20	7.4	7.0
Oil & Grease (mg/L)	<10.0	<1		<1		1	
Total coliform (MPN/100 mL)	<400	1,600	1,600	540	250	16,000	92,000
Faecal Coliform (MPN/100 mL)	<400	1,600	1,600	31	130	16,000	92,000
Residual Chlorine (mg/L)	<1.0			0.27	0.27	0.02	0.00