

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

September 2021




					
A	15 October 2021	Hendra WINASTU	Wanidaporn RODE	Khamlar PHONSAVAT	Final
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EXECUTIVE SUMMARY

The NNP1PC management conducted two Management Review Meetings on 01 September and 14 September 2021 respectively with the purpose of evaluating the suitability, adequacy and effectiveness of the Environmental Management System (EMS). The Stage 1 Audit of ISO14001:2015 Certification by an accreditation company, SGS (Lao) Sole Co., Ltd., was conducted remotely on 07 September 2021, no critical audit findings were raised and six non-critical audit findings were noted. The Stage 2 Certification Audit was agreed to be conducted in early December 2021.

During September 2021, EMO received two documents (One Detail Work Program or DWP; and Site Specific Environmental and Social Monitoring and Management Plan or SS-ESMMP, and One Environmental Checklist) for review and approval. EMO did not issue any Site Inspection Report (SIR) or Observation of Non-Compliance to the Contractor.

Due to the COVID-19 pandemic and the measures announced by the GOL, the regular joint site inspections were suspended at some restricted areas such as nearby villages and in Zone 2UR during the reporting period. However, the joint site inspections around the Dam sites and NNP1PC's operation sites were conducted as normal.

The construction of the wastewater treatment system modification and improvement at OSOV1, OSOV2 and the Main Powerhouse were completed by the Soulignet Choummanitham Construction Sole Co., Ltd. (SCC). The systems are still in the first stage of operation and adjustment.

In September 2021, water quality depth profile measurements at R01, R02 and R03 (main reservoir) and NPH01 were suspended due to security concerns. At R05, the average DO concentration was 7.6 mg/L in the upper 8.0 m varying between 3 mg/L and 9 mg/L, and the oxycline was generally found at a depth of 7.0 to 12.0 m – similar to levels observed in August 2021. In the Re-regulation Reservoir, the mean DO levels over the entire water column were 2.6 mg/L and 2.9 mg/L in R06 and R07 respectively.

The discharge from the Re-regulation Dam mainly went through the combination of gate and turbine discharge. At the stations in Nam Ngiep immediately downstream of the Re-regulation Dam, the DO concentrations were less than 6 mg/L for all monitoring period. No dead fish was observed in Nam Ngiep downstream in this monitoring period. NNP1PC is still in the process of collecting information to assist in developing measures to improve the DO levels downstream.

In September 2021, the local waste collection contractors continued collecting waste from the NNP1PC's operation sites and the nearby villages, and operating the NNP1 Project Landfill and Houy Soup Landfill. The work included waste segregation and disposal, waste cover, grass cutting and repairing perimeter fences.

A total of 25.3 m³ of solid waste was disposed of at the NNP1 Project Landfill, an increase of 0.5 m³ compared with August 2021. A total of 36.5 m³ of solid waste from Phouhomxay, Thahuea and Hat Gniun Villages was disposed of at Houay Soup Landfill, an increase of 3.8 m³ compared with August 2021. Due to the continuation of COVID-19 measures, many local recycling businesses and vendors have not yet resumed their recyclable waste trading. There was no trading of recyclable waste at the community recycle waste bank during the period of reporting.

Xaysomboun Watershed and Reservoir Protection Office (WRPO) planned to continue reservoir patrolling in September 2021, but the activity had to be postponed due to the new COVID-19 cases and enforcement of lockdown as part of the COVID-19 measures. The field activities by Bolikhamxay WRPO and Nam Chouane-Nam Xang Biodiversity Offset Management Unit (NC-NX BOMU) will be continued after receiving the fund under the approved AIP2021.

The fish catch monitoring for August 2021 in Nam Ngiep Watershed was dominated by *Oreochromis niloticus* and the species groups of *Mastacembelus*, *Hampala*, *Barbonymus gonionotus* and *Hypsibarbus*, and *Sikukia gudgeri* and *Amblyrhynchichthys truncates*. They are classified as Least Concern (LC) according to the IUCN Red List, except *Sikukia gudgeri* is classified as Data Deficient species (DD).

1. ENVIRONMENTAL MANAGEMENT MONITORING

1.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

The NNP1PC management conducted two Management Review Meetings on 01 September and 14 September 2021 respectively with the purpose of evaluating the suitability, adequacy and effectiveness of the Environmental Management System (EMS). The Stage 1 Audit of ISO14001:2015 Certification by an accreditation company, SGS (Lao) Sole Co., Ltd., was conducted remotely on 07 September 2021, no critical audit findings were raised and six non-critical audit findings were noted. The Stage 2 Certification Audit was agreed to be conducted remotely in early December 2021 for 4 man-days.

TABLE 1-1: ENVIRONMENTAL MANAGEMENT SYSTEM WORK PLAN-REVISED IN SEPTEMBER 2021

Item	ISO14001:2015 Work Plan	Year 2020		Year 2021			
		Q3	Q4	Q1	Q2	Q3	Q4
1	Continue to prepare EMS documents (8 Standard Operating Procedures are completed)						
2	NNP1PC Environmental Policy announcement						
3	NNP1PC ISO Committee establishment						
4	Training relevant staff on: <ul style="list-style-type: none"> - Requirement and Interpretation of ISO14001:2015 - Organization Context and Risk Management for ISO14001 - ISO14001:2015 Document Information - ISO14001:2015 Internal Audit 						
5	Implement the EMS procedures and processes						
6	ISO14001:2015 Internal Audit						
7	Implement the corrective actions and preventive actions according to the Internal Audit						
8	Management Review by NNP1PC Management						
9	ISO 14001:2015 Assessment and Certification Audit – Stage 1 (remote audit on the documentation review)						
10	Implement the corrective actions and preventive actions according to the Stage 1 Audit						
11	ISO 14001:2015 Assessment and Certification Audit – Stage 2 (remote audit, 4 man-days)						
12	Implement the corrective actions and preventive actions according to the Stage 2 Audit						

13	Certify of ISO14001:2015 upon successful completion of the audit						
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	Completed activities per the plan
	Delayed activities and postponed from the original plan
	Original plan activities

The ISO14001:2015 Audit results are:

- The **Internal Audit** by the NNP1PC Internal Auditors (10-27 August 2021) - 01 nonconformity was raised, and 56 Opportunities for Improvement (OFI) were noted.
- The **Stage 1 Certification Audit** by the accreditation company (SGS (Lao) Sole Co., Ltd.) – no critical audit findings. The following six non-critical audit findings were noted which are required to be addressed appropriately before the Stage 2 Audit:

Environmental Policy Clause 5.2

According top management has just been changed so the new environmental policy shall be reviewed by new top management.

Emergency Preparedness and Response Clause 8.2

The emergency plan has not been tested or drilled such as fire, chemical spill etc.. However, the planning has been provided.

Monitoring, measurement, analysis and evaluation Clause 9.1

No records of some emergency equipment inspection such as smoke detector, fire pump etc.

Operational Planning and Control Clause 8.1

No SOP or criteria to control wastewater treatment plant.

Environmental objectives and planning to achieve them Clause 6.2

Some environmental objective and planning such as DO reduction level to met the standard has not been approved by top management and waiting for completion of project so it shall be followed up in stage 2 audit.

Competence, Awareness Clause 7.3

Unclear training needs of the necessary of person doing work under control that affected to environmental performance including not completely provide for training records to ensure person are competent.

1.2 COMPLIANCE MANAGEMENT

In September 2021, EMO received two documents (One Detail Work Program or DWP and Site Specific Environmental and Social Monitoring and Management Plan or SS-ESMMP, and One Environmental Checklist) for review and approval. No Site Inspection Report (SIR) or Observation Non-Compliance was issued to the Contractor during September 2021. The status of the document reviews is presented in **Table 1-2**.

TABLE 1-2: SS-ESMMP AND DOCUMENT REVIEW STATUS IN SEPTEMBER 2021

Title	Date Received	Status
DWP & SS-ESMMP for Remedial Grouting work at Main Dam	13 September 2021 (3 rd submission)	No objection with no comment on 21 September 2021
Environmental Checklist for the nuts and bolts welding of 230 kV transmission line	23 September 2021 (1 st submission)	No objection with no comment on 24 September 2021

Due to the Corvid-19 situation, the GOL's lockdown measures continue to be in place in the area surrounding the project and its activities, and the suspension of the regular joint site inspections has continued at some areas such as at nearby villages and in Zone 2UR during the reporting period. However, the Compliance team conducted joint site inspections at the construction sites for the wastewater treatment system improvement and modification at OSOV1 and OSOV2, the Main Dam's grouting work and the Powerhouses maintenance. No Site Inspection Report (SIR) was issued to the contractor during the period of reporting.

On 09 September 2021, a joint site inspection was conducted for the 100% work completion of the WWTS improvement and modification works. The status and quality of construction was accepted with some minor comments by the Inspection Committee. The overall status can be seen in **Figure 1-1** below:

FIGURE 1-1: PHOTOS OF SITE INSPECTION ON THE PROGRESS OF WASTEWATER TREATMENT SYSTEM IMPROVEMENT AND MODIFICATION AT OSOV1, OSOV2 AND THE MAIN POWERHOUSE

WWTS MODIFICATION AT OSOV2 DURING THE JOINT SITE INSPECTION FOR 100% WORK COMPLETION



WWTS IMPROVEMENT AT OSOV1 DURING THE JOINT SITE INSPECTION FOR 100% WORK COMPLETION



WWTS IMPROVEMENT AT MAIN POWERHOUSE DURING THE JOINT SITE INSPECTION FOR 100% WORK COMPLETION



EMO issued no Observations of Non-Compliance (ONC) during September 2021. The status of compliance reports (Observation of Non-Compliance or ONC; and Non-Compliance Report or NCR) issued by NNP1PC is summarized in **Table 1-3**.

TABLE 1-3: SUMMARY OF ONCs AND NCRs

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from August 2021	4	0	0	0
Newly Opened in September 2021	0	0	0	0
Total in September 2021	4	0	0	0
Resolved in September 2021	0	0	0	0
Carried over to October 2021	4	0	0	0
Unsolved Exceeding Deadlines	4	0	0	0

1.2.1 Site Inspection by 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 2021 due to the COVID-19 lockdown measures.

1.2.2 Site Decommissioning and Rehabilitation

During the reporting period of September 2021, the progress of site rehabilitation for the two sites (Phouhomxay Village's Irrigation canal rock and spoil disposal area and the former LILAMA10 camp) have not been conducted due to the relevant staffs were in quarantine and worked from home in accordance with NNP1PC's COVID-19 prevention measures.

1.3 WATER QUALITY MONITORING

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

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

Due to the rapid increase in COVID-19 infection cases in the project related communities during September 2021, the GOL imposed additional COVID-19 preventative measures, which meant that the community water supply (groundwater and gravity fed) monitoring had to be suspended.

In addition, there is still no turbidity measurement data reported in September 2021 due to the Turbidity Meter was broken.

1.3.1 Effluent Discharge from Camps and Construction Sites

Detailed monitoring results are provided in the **Annex B** of this Report. The effluent camp monitoring results in September 2021 indicated non-compliances for some parameters in OSOV1 (EF01), OSOV2 (EF13) and the Main Powerhouse (EF19).

The status of implementation of the corrective actions addressing non-compliances at the camps and key project facilities are summarized in **Table 1-4**.

TABLE 1-4: STATUS OF CORRECTIVE ACTIONS FOR NON-COMPLIANCES AT WWTSS IN SEPTEMBER 2021

Site	Sampling ID	Status	Corrective Actions
OSOV1	EF01	Non-compliance for faecal coliform (first fortnightly) and total coliform.	The wastewater treatment systems modification and improvements were completed, under test run and treatment condition adjustment in this reporting period. The improved/modified wastewater treatment systems would be fully operated by October 2021.
OSOV2	EF13	Non-compliance for faecal coliform and total coliform in the first fortnightly sample, ammonia-nitrogen and total nitrogen in both fortnightly samples.	
Main Powerhouse	EF19	Non-compliance for faecal coliform and total coliform in the first fortnightly sample, ammonia-nitrogen, total nitrogen and total phosphorus in both fortnightly samples.	

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]). However, water quality monitoring at three stations in the main reservoir (R01-03) and Nam Phouan (NPH01) were suspended due to the security concerns.

In addition, 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 1-2**.

The monitoring results for key parameters (DO, TSS and BOD₅) during September 2021 are presented in **Table 1-5, Table 1-6 and Table 1-7**. The full set of data for September 2021 is attached in **Annex A**. In addition, the results for DO are presented as line graphs in **Figure 1-3**.

Main Reservoir

From 01 to 06 September 2021, the water level in the main reservoir increased with 0.76 m from El. 305.79 m asl to El. 306.55 m, and from 07 to 30 September 2021, the main reservoir water level decreased with 2.41 m from El. 306.51 m asl to El. 304.10 m.

Depth profile measurements and sampling at R01, R02 and R03 continue to be suspended due to security concerns during September 2021.

At R05, the average DO concentration was 7.6 mg/L in the upper 8.0 m varying between 3.2 mg/L and 8.9 mg/L, and the oxycline was generally found at a depth of 7.0 – 12.0 m with DO concentrations between about 2 mg/L and 6 mg/L – slightly higher than August 2021. At the intake level (approximately 25 m below surface), the mean DO concentration was 3 mg/L during September 2021. DO concentrations below 0.5 mg/L (anoxic condition) were recorded at depths below 36 m corresponding to 6.2 m below the centre line of the Intake in early September 2021 to 7.5 m below the centre line by the end of the month, taking into consideration the fluctuated water level in the reservoir over the period.

At R04, the DO levels in the upper 7.0 m varied between 4.3 mg/L and 8.6 mg/L. The DO concentrations dropped to below 0.5 mg/L at a depth of about 36 m.

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.

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

Re-regulation Reservoir

In September 2021, the turbine discharges from the main powerhouse varied between 30 and 262 m³/s usually interrupted by night-time periods with no discharge.

The mean DO levels over the entire water column were 2.6 mg/L and 2.9 mg/L in R06 and R07 respectively during September 2021.

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

Nam Ngiep Downstream

During September 2021, the discharge from the Re-regulation Dam mainly went through the combination of gate and turbine discharge.

During periods with turbine discharge, the DO concentrations at NNG05 about 1.8 km downstream of the Re-regulation Dam varied between 3.8 mg/L and 5.1 mg/L with an average of 4.5 mg/L and gradually increased to about 5.6 mg/L at NNG07 (25.9 km distance from the dam). At NNG08 close to the confluence with the Mekong River (47.2 km from the dam), the DO levels varied between 5.4 mg/L and 6.2 mg/L with an average of 5.7 mg/L.

No dead fish was observed in Nam Ngiep downstream during this monitoring period. NNP1PC is still in the process of collecting information to assist in developing measures to improve the DO levels downstream.

The BOD₅ 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

No water quality monitoring for Nam Phouan during September 2021.

All monitored parameters in the Nam Chian (NCH01), Nam Xao (NXA01) and Nam Houaysoup (NHS01) complied with the standards, except COD.

FIGURE 1-2: SURFACE WATER AND RE-REGULATION RESERVOIR WATER QUALITY MONITORING STATIONS

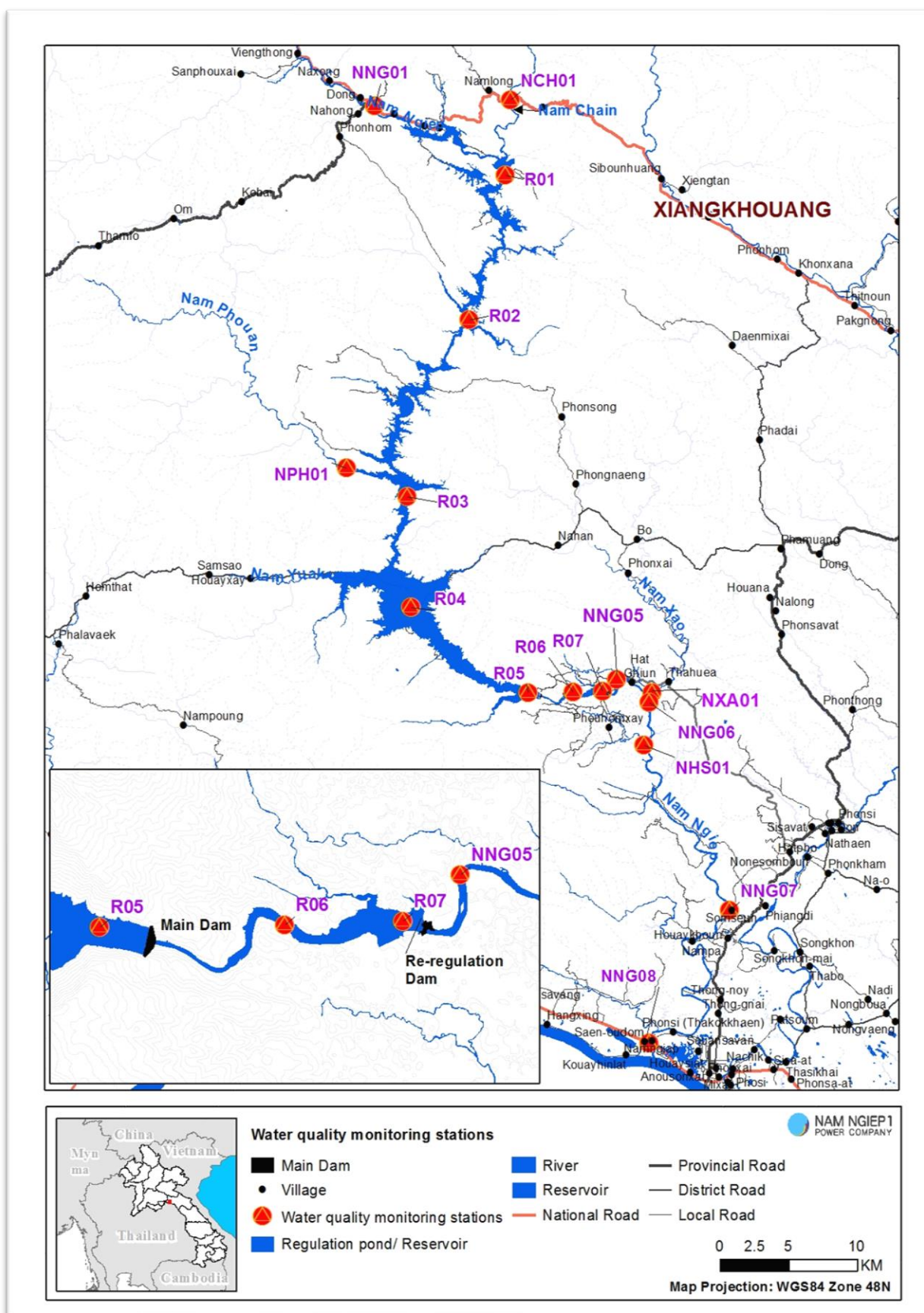
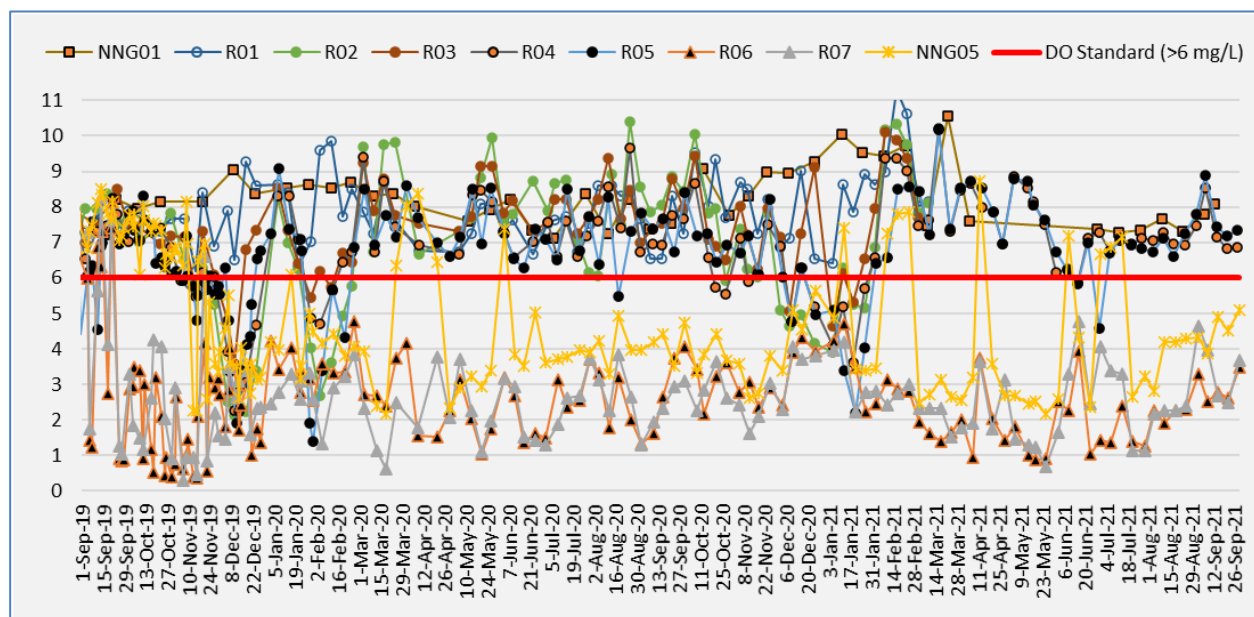


FIGURE 1-3: CONCENTRATION OF DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M SINCE SEPTEMBER 2019 TO SEPTEMBER 2021**TABLE 1-5: RESULTS OF SURFACE WATER QUALITY MONITORING FOR DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M, NATIONAL WATER QUALITY STANDARD: >6.0 MG/L**

DO (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
1-Sep-21					7.46	7.79										
2-Sep-21							3.29	4.66	4.34	4.59	5.59	5.43			6.14	6.2
6-Sep-21	7.79												8.24			
7-Sep-21					8.53	8.89										
8-Sep-21							2.51	3.98	3.87	4.06	5.03	5.52			6.17	6.08
13-Sep-21	8.07												8.61			
14-Sep-21					7.14	7.43										
15-Sep-21							2.79	2.7	4.9	5.06	6.1	6.18			7.2	7.04
21-Sep-21					6.83	7.18										
22-Sep-21							2.61	2.5	4.53							
28-Sep-21					6.85	7.34										
29-Sep-21							3.48	3.67	5.1							

TABLE 1-6: 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
13-Sep-21	54.8 3												5.28			
14-Sep-21					<5	<5										
14-Sep-21 Bottom					13.5	<5										
15-Sep-21							<5	<5	<5	<5	<5	6.09			16.46	5.6

TABLE 1-7: RESULTS OF SURFACE WATER QUALITY MONITORING FOR BOD₅ (MG/L) - WATER QUALITY STANDARD: < 1.5 MG/L

BOD ₅ (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
13-Sep-21	<1												<1			
14-Sep-21					<1	<1										
14-Sep-21 Bottom					<1	<1										
15-Sep-21							<1	<1	<1	1	<1	<1			<1	<1

1.3.3 Groundwater Quality Monitoring

During September 2021, due to the rapid increase in COVID-19 infection cases in the project related communities, the GOL imposed additional COVID-19 measures, which meant that NNP1PC could not access the villages for water sampling, and therefore had to suspend the community groundwater quality monitoring for five wells located in Phouhomxay Village, Somseun Village, Nam Pa Village, Thong Noy Village and Pou Village.

During the reporting period, EMO carried out landfill groundwater monitoring at NNP1 Project Landfill (only 03 monitoring wells were monitored due to the water sampling equipment was stuck inside the monitoring well no. MW2) and at Houay Soup Landfill (01 monitoring well). Similar to previous monitoring results, the concentration of Lead in the monitoring wells no. 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 and downstream 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 1-8: LANDFILL GROUNDWATER QUALITY MONITORING RESULTS IN NNP1 AND HOUAY SOUP LANDFILLS

		Site Name	NNP1 Landfill				Houay Soup Landfill
		Station	MW1	MW2	MW3	MW4	MW5
Date	Parameter (Unit)	Guideline					
17-Sep-21	pH		6.1		6.23	5.47	6.02
17-Sep-21	Sat. DO (%)		40.3		13.5	17.4	22.5
17-Sep-21	DO (mg/l)		3.31		1.13	1.42	1.86
17-Sep-21	Conductivity (µS/cm)		163		199	62	86
17-Sep-21	Temperature (°C)		25.35		25.43	25.92	25.62
17-Sep-21	Total Nitrogen (mg/l)		0.38		2.95	1.37	1.12
17-Sep-21	Lead (mg/l)	<0.01	0.03		1.07	0.346	0.178
17-Sep-21	Faecal Coliform (MPN/100ml)		540		17	920	0
17-Sep-21	Total Coliform (MPN/100ml)		540		11	920	0
17-Sep-21	NH ₃ -N (mg/l)		<2		0.83	<2	0.24
17-Sep-21	Copper (mg/l)	<1	0.004		0.008	0.007	0.003
17-Sep-21	Total Petroleum (mg/l)		<3		<3	<3	<3
17-Sep-21	Water level (m)		29.05		26.40	25.04	15.45

*These are groundwater quality standards for drinking purposes attached in the concession agreement.

1.3.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

During September 2021, due to the rapid increase in COVID-19 infection cases in the project related communities, the GOL imposed additional COVID-19 measures, which meant that NNP1PC could not access the villages and therefore had to suspend the water quality monitoring of the community gravity fed water supply in Phouhomxay, Hat Gniun and Thahuea Villages.

1.3.5 Landfill Leachate Monitoring

During September 2021, 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 did not comply with the total coliform standard and Houay Soup Landfill leachate did not comply with the standard for faecal coliform and total coliform. However, the leachate is still contained in the leachate ponds without discharging 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 2021 can be found in **Table 1-9**.

TABLE 1-9: 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							
10-Sep-21	pH	6.0-9.0				7.23		7.06	
10-Sep-21	Sat. DO (%)					91.5		111.6	
10-Sep-21	DO (mg/L)					6.93		8.42	
10-Sep-21	Conductivity (μS/cm)					81		156	
10-Sep-21	Temperature (°C)					29.87		29.9	
10-Sep-21	BOD ₅ (mg/L)	<30				<6		<6	
10-Sep-21	Faecal Coliform (MPN/100mL)	<400				49		13	
10-Sep-21	Total Coliform (MPN/100mL)	<400				920		1,600	
10-Sep-21	NH ₃ -N (mg/L)	2				<2		<2	
10-Sep-21	COD (mg/L)	25				53.9		<25	
10-Sep-21	Total Nitrogen (mg/L)	0.1				0.94		0.85	
10-Sep-21	FAT, Oil & Grease (mg/L)	1				2		<1	

1.4 DISCHARGE MONITORING

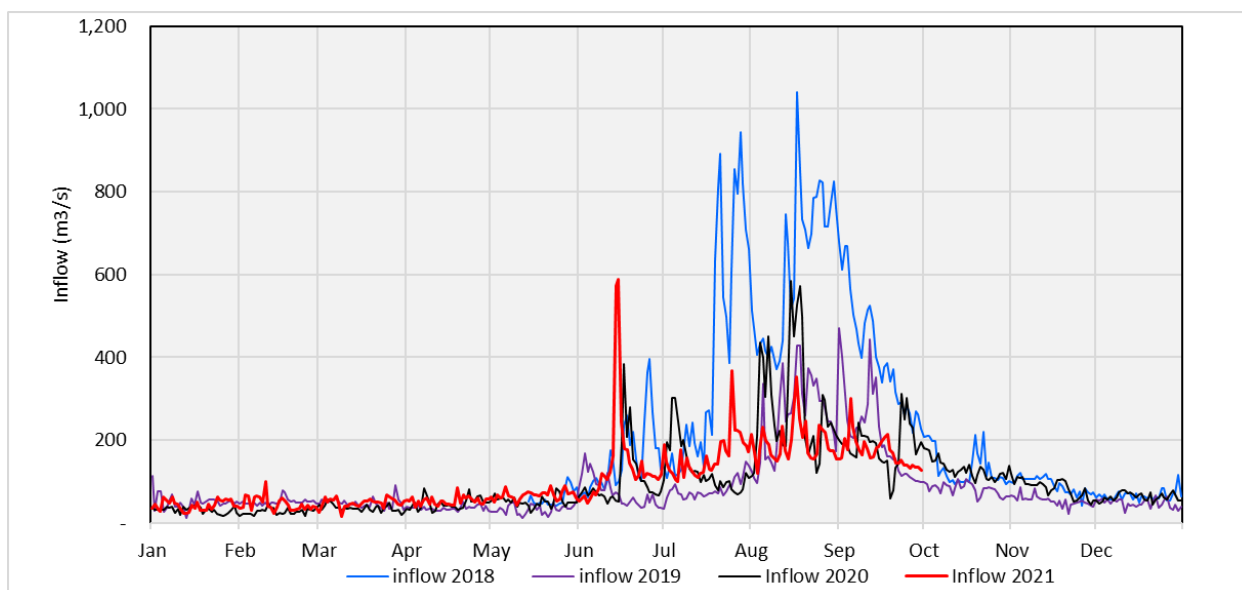
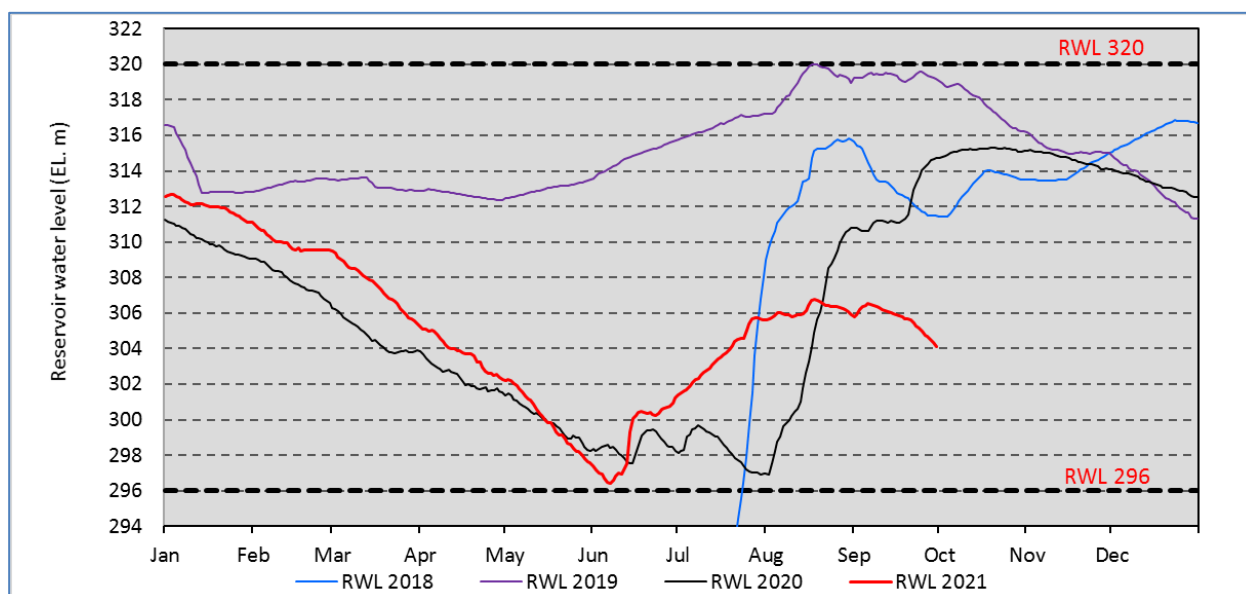
1.4.1 Main Reservoir – Water Level, Inflow and Discharge

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** and **Figure 1-5** presents the values recorded since May 2018.

During September 2021, the mean inflow to the main reservoir was 172 m³/s. The minimum and maximum inflows were 127 m³/s (on 30 September 2021) and 299 m³/s (on 05 September 2021) respectively.

From 01 to 06 September 2021, the water level in the main reservoir increased from El. 305.79 m asl to El. 306.55 m, and from 07 to 30 September 2021, the main reservoir water level decreased from El. 306.51 m asl to 304.10 m.

In September 2021, the hourly turbine discharges from the Main Powerhouse varied between 30 and 262 m³/s usually interrupted by night-time periods with no discharge.

FIGURE 1-4: INFLOW TO THE MAIN RESERVOIR**FIGURE 1-5: WATER LEVEL FOR THE MAIN RESERVOIR**

Note: The 2018 and 2019 Reservoir Water Level represent the reservoir before the COD (05 September 2019)

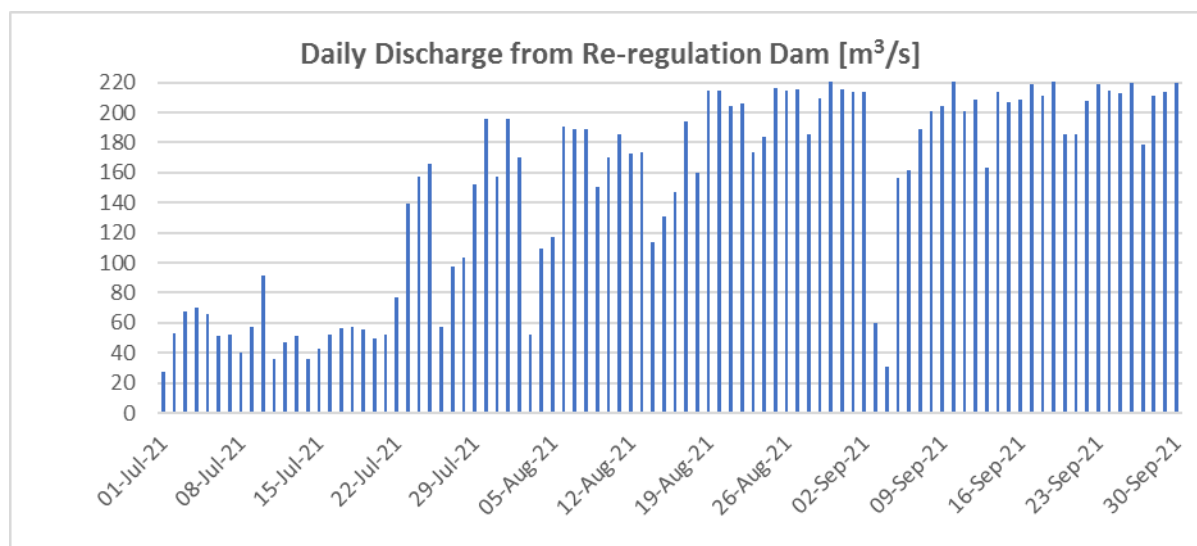
1.4.2 Re-regulation Reservoir – Discharge

The daily discharge monitoring data for the Re-regulation Dam during July to September 2021 is presented in **Figure 1-6**.

During September 2021, the mean hourly discharge from the Re-regulation Dam was about 191 m^3/s with hourly turbine discharges varying between 48 m^3/s and 160 m^3/s , hourly gate discharge varied between 27 m^3/s and 170 m^3/s , and hourly total discharge varying between 27 m^3/s and 268 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 1-6: DAILY DISCHARGE MONITORING AT THE RE-REGULATION DAM IN JULY TO SEPTEMBER 2021



1.4.3 Nam Ngiep Downstream Water Depth Monitoring

In September 2021, EMO carried out three 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 the thalweg water depth monitoring results showed full compliance with the CA requirement (greater than 0.5 m) and no difficulty on boat navigation.

1.5 PROJECT WASTE MANAGEMENT

1.5.1 Solid Waste Management

In September 2021, a total of 25.3 m³ of solid waste was disposed of at the NNP1 Project Landfill, an increase of 0.5 m³ compared with August 2021.

During this reporting period, 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, grass cutting and repairing of perimeter fences.

FIGURE 1-7: WASTE MANAGEMENT ACTIVITIES AT NNP1 LANDFILL DURING SEPTEMBER 2021

WASTE COLLECTION AND WASTE BAGS SPOT CHECK	WEEKLY LANDFILL MAINTENANCE (GRASS CUTTING)
	
DAILY WASTE DUMP AND WASTE COVER AT LANDFILL	
	

The total amount of recyclable waste selling and collection this month is summarized in **Table 1-10**.

TABLE 1-10: AMOUNTS OF RECYCLABLE WASTE SOLD AND COLLECTION

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by September 2021
1	Plastic bottles	kg	0	18
2	Aluminium	kg	0	13
3	Paper/Cardboard	kg	0	4
4	Glass	kg	0	14
5	Scrap Metal	Kg	0	0
Total		kg	0	49

In September 2021, the villagers from Phouhomxay Village and host villages collected 545 kg of food waste from the OSOV1 canteen for feeding their animals.

1.5.2 Hazardous Materials and Waste Management

The types and amounts of hazardous materials and hazardous waste stored on site in September 2021 are shown in **Table 1-11** and **Table 1-12**.

TABLE 1-11: RECORD OF HAZARDOUS MATERIAL INVENTORY

No.	Type of Hazardous Material	Unit	Total in September 2021 (A)	Used (B)	Remaining at the end of September 2021 (A – B)
1	Diesel	Litre	4,448	3,450	998
2	Gasoline	Litre	665	320	345
3	Lubricant (Turbine oil)	Litre	7,332	5	7,327
4	Colour Paint	Litre	242	0	242
5	Thinner	Litre	9	1	8
6	Grease Oil	Litre	220	0	220
7	Gear Oil	Litre	468	0	468
8	Chlorine Liquid	Litre	200	60	140
9	Chlorine Powder	kg	65	0	65
10	SIKA	Litre	7	0	7

TABLE 1-12: RECORD OF HAZARDOUS WASTE INVENTORY

No.	Hazardous Waste Type	Unit	Total in September 2021 (A)	Disposed (B)	Remaining at the end of September 2021 (A - B)
1	Used Oil (Hydraulic and Engine)	Litre	220	0	220
2	Used oil mixed with water	Litre	4,800	0	4,800
3	Empty 200L drum of used oil	Unit	6	0	6
4	Contaminated soil, sawdust and textile material	m ³	0.72	0	0.72
5	Empty 20L chemical drum	Drum	18	0	18
6	Lead battery	Unit	7	0	7
7	Halogen/fluorescent bulbs	Unit	351	0	351
8	Empty cartridge (Ink)	Unit	10	0	10
9	Clinic Waste	kg	5.5	4.5	1

1.6 COMMUNITY WASTE MANAGEMENT

1.6.1 Community Recycling Programme

Due to the continuation of COVID-19 measures, many local recycling businesses and vendors have not yet resumed their recyclable waste trading. No recycle waste trade activities in the community recycle waste bank in September 2021.

1.6.2 Community Solid Waste Management

In September 2021, a total of 36.5 m³ of solid waste from Phouhomxay, Thahuea and Hat Gniun Villages was disposed of at Houay Soup Landfill, an increase of 3.8 m³ compared with August 2021.

During this reporting period, the local waste collection contractor conducted regular waste collection from the three villages and operated the Houy Soup landfill for two days per week. The work included waste collection, segregation and disposal, waste cover, grass cutting and repairing the perimeter fences.

FIGURE 1-8: WASTE MANAGEMENT ACTIVITIES DURING SEPTEMBER 2021

DAILY WASTE DUMP AT HSL	
	
DAILY WASTE COVER	DAILY LANDFILL MAINTENANCE (GRASS CUTTING)
	

2. WATERSHED AND BIODIVERSITY MANAGEMENT

2.1 WATERSHED MANAGEMENT

2.1.1 Implementation of Annual Implementation Plan (AIP) 2020

The construction of the sub-office for Xaysomboun Watershed and Reservoir Protection Office (WRPO) at Houay Xay Village, Hom District under the approved AIP2020 was completed in early September 2021 except the installation of the solar power system. However, Xaysomboun WRPO has not yet informed about their staff assignments to the sub-office.

Xaysomboun WRPO planned to continue reservoir patrolling in September 2021 but the activity had to be postponed due to the new COVID-19 cases and enforcement of lockdown as part as the COVID-19 measures.

NNP1 Environmental Management Office (EMO) Team advised Bolikhamxay WRPO to use the remaining funds under the AIP2020 to execute activities planned under AIP2021 while waiting for the fund disbursement from Department of Forestry (DOF) of Ministry of Agriculture and Forestry (MAF). However, Bolikhamxay WRPO confirmed that they have no plan to execute any activities during September 2021.

NNP1 Environment and Social Division (ESD) management planned to organize a discussion with Xaysomboun Provincial Governor to follow up on the actions recommended during the meeting in March 2021 including the issue about fishery co-management. An official letter to request an appointment with Xaysomboun Provincial Governor was submitted to Provincial Governor Secretary on 23 September 2021. The meeting is likely to be organized after the ease of COVID-19 lockdown in Xaysomboun Province.

A meeting on the action plan to strengthen local production and market access for local producers in Thathom District was postponed until after the ease of the COVID-19 lockdown. EMO Team also reviewed the draft plan of extension service of Thathom District Agriculture and Forestry Office (DAFO). A follow-up discussion will be made during the meeting on action plan to strengthen local production and market access for local producers in Thathom District.

2.1.2 Preparation of Annual Implementation Plan (AIP) 2021

NNP1PC disbursed the funds under the approved Bolikhamxay Watershed Management (WM) AIP2021 for the period July-September 2021 on 13 September 2021. DOF-MAF is processing the fund transfer to Bolikhamxay WRPO bank in accordance with the requirements of the National Treasury Department (NTD), Ministry of Finance (MOF).

Xaysomboun WRPO submitted their final plan to EMO on 30 August 2021. The plan was reviewed by EMO and the revised version was sent back to Xaysomboun WRPO. However, EMO has not yet received the official comments from Xaysomboun WRPO. The revised version of the plan was submitted to Asian Development Bank (ADB), Independent Advisory Panel (IAP), and Biodiversity Service Provider (BSP)- Wildlife Conservation Society (WCS) on 27 September 2021 while waiting for the official confirmation from Xaysomboun WRPO.

2.2 BIODIVERSITY OFFSET MANAGEMENT

2.2.1 Implementation of BOMP Annual Implementation Plan (AIP) 2020

The progress on the implementation of key activities by Component in September 2021 are described below:

a. Component 1 - Spatial Planning and Regulation

The site visit by the representatives of Nam Chouane-Nam Xang Biodiversity Offset Management Committee (NC-NX BOMC) and Biodiversity Offset Management Unit (BOMU) to settle the issue on the Totally Protection Zone (TPZ) boundary demarcation in the remaining village, Vangphieng Village of Viengthong district was organized from 29-31 August 2021. NC-NX BOMU is preparing the report and will share it with the EMO team when completed.

The plan for reviewing and updating the land use plans of three NC-NX villages (Na Tan, Na Ghang, Vangphieng Villages) in Viengthong District under the AIP2021 is still being reviewed by NC-NX BOMU in September 2021. NC-NX BOMC and BOMU insisted to conduct detailed land use down to household level. EMO team clarified that the primary objective of the activity is to review and update the land use categories classified by GOL only. However, if the allocated budget under AIP2021 is sufficient then the detailed land use planning at household level could be considered.

b. Component 2 – Law Enforcement

The fund disbursement from DOF-MAF to Bolikhamxay NC-NX BOMU for the approved AIP2021 is still being processed in September 2021 which means that the patrolling work could not be carried out. Some of the patrol team members were assigned in the patrol sub-station to safeguard the facility and make observations nearby the sub-station.

c. Component 3 – Conservation Outreach

BSP-WCS continued to finalize the outreach strategy document in September 2021. The outreach activity will be implemented according to the schedule after receiving the fund under the approved AIP2021.

d. Component 4 – Conservation linked livelihood development

A further discussion with Bolikhamxay Province Agriculture and Forestry Office (PAFO) on the NC-NX Community Development Plan (CDP) was organized on 02 September 2021. The Minutes of Meeting (MOM) is being finalized for CDP approval. The MOM notes that the CDP activities have already been incorporated into the NC-NX Biodiversity Offset Management (BOM) AIP2021.

BSP-WCS provided a snare removal SMART training to NC-NX BOMU and NNP1 EMO staffs at NC-NX BOMU office in Viengthong District on 01 September 2021. The SMART database was further revised by BSP. The snare removal activity was postponed until NC-NX BOMU receives the funds under the approved AIP2021.

e. Component 6 – Biological Monitoring

NNP1, ADB, and BSP-WCS had further discussion about the Terms of References (TORs) and expert engagement during the 2nd Memorandum of Understanding (MOU) meeting on 08 September 2021. Further technical discussions were also organized between EMO and BSP-WCS on 14 September 2021. The TORs for the survey were finalized. There will only be three surveys in the last quarter of 2021 in the NNP1 watershed area which are camera-trap, acoustic, and Lao Newt and

Bent-toed gecko survey. NNP1 was processing the procurement of expert to support the Lao Newt and Bent-toed gecko survey.

2.2.2 Preparation of Annual Implementation Plan (AIP) 2021

NNP1PC transferred the funds for Q3 2021 to DOF-MAF account on 26 August 2021. NC-NX BOMU informed EMO Team on 23 September 2021 that the Q3 AIP2021 fund was still being processed at National Treasure Department (NTD) of Ministry of Finance (MOF). DOF-MAF further clarified on 24 September 2021 that NTD implements a strict process on the fund disbursement to the projects related to the decrease in GOL Tax revenue. NTD requested the projects to manage the funds only for the implementation activities while the funds for procurement of equipment/service will be managed by NTD. DOF-MAF have informed the relevant committees to communicate with their provincial management to obtain the acknowledgement from the Province Treasury Department on the procurement practices managed by the project. This acknowledgement will be used as reference to request NTD consideration so that the procurement can be continuously managed by the project at provincial level. If NTD accepts the acknowledgement/explanation from the Province Treasury Department then the funds could be fully transferred to BOMU.

3. FISHERY MONITORING

Four species groups and one species dominated the fish catch by weight in August 2021 as listed in **Table 3-1**. All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species¹, except *Sikukia gudgeri* is classified as Data Deficient species (DD).

Table 3-1: Fish Species dominating the Fish Catch in August 2021

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Mastacembelus armatus</i> , <i>Mastacembelus favus</i>	ປາຫຼາດ	175.2	LC
<i>Oreochromis niloticus</i>	ປານິນ	130.9	LC
<i>Hampala dispar</i> , <i>Hampala macrolepidota</i>	ປາສຸດ	106.4	LC
<i>Barbonymus gonionotus</i> , <i>Hypsibarbus malcomi</i> , <i>Hypsibarbus vernayi</i> , <i>Hypsibarbus wetmorei</i>	ປາປາກ	78.8	LC
<i>Sikukia gudgeri</i> , <i>Amblyrhynchichthys truncatus</i>	ປາຂາວຊາຍ	63.2	DD, LC

The recorded catch of Threatened species (IUCN Red List classification) in August 2021 are presented in **Table 3-2**. The list includes three species that are classified as Vulnerable species (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.

Table 3-2: Threatened Species of August 2021 Fish Catch

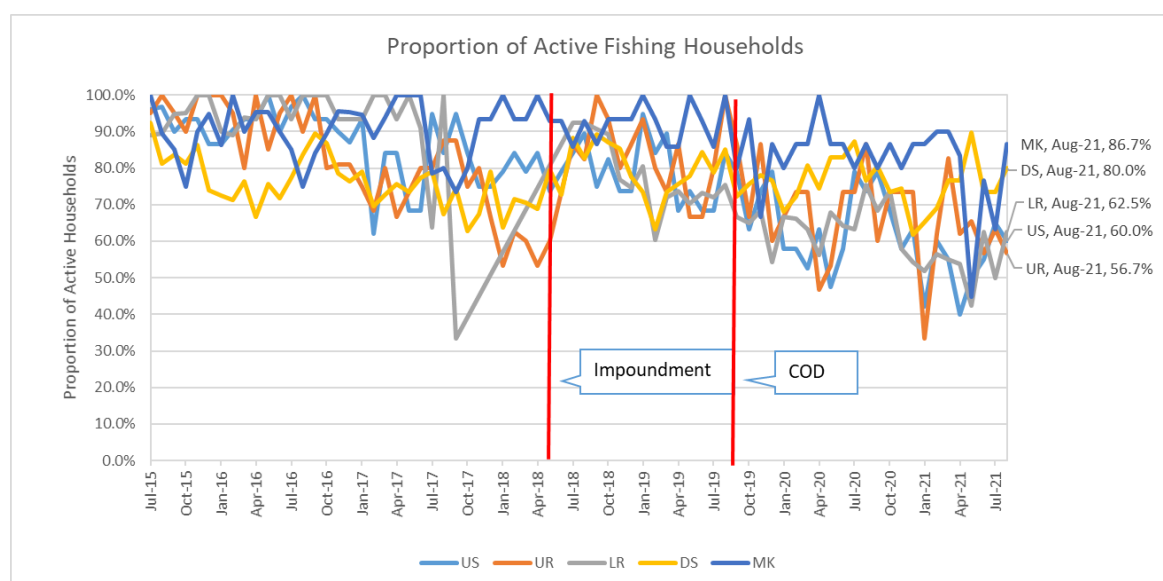
Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Cyprinus carpio</i>	ປາໄນ	54	VU
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາບຽນ	9	VU
<i>Tor sinensis</i>	ປາແດງ	41.8	VU

Species abundance and occurrence is based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey in August 2021. The catch is divided in three areas including above the main dam, below the main dam and Mekong area. Main biodiversity indicators in August 2021 for above dam, below dam and Mekong area are presented in **Table 3-3**.

Table 3-3: Main Biodiversity Indicators for August 2021

Biodiversity Indicators	Mekong	Below dam	Above dam
Total species and groups	34	32	31
Single species	28	22	19
Species groups	6	10	12
Top 15 species (% total catch weight)	87.47%	83.88%	94.77%
Proportion for species groups	9.28%	53.96%	48.22%
Diversity index (Shannon)	2.8537	2.8673	2.5880

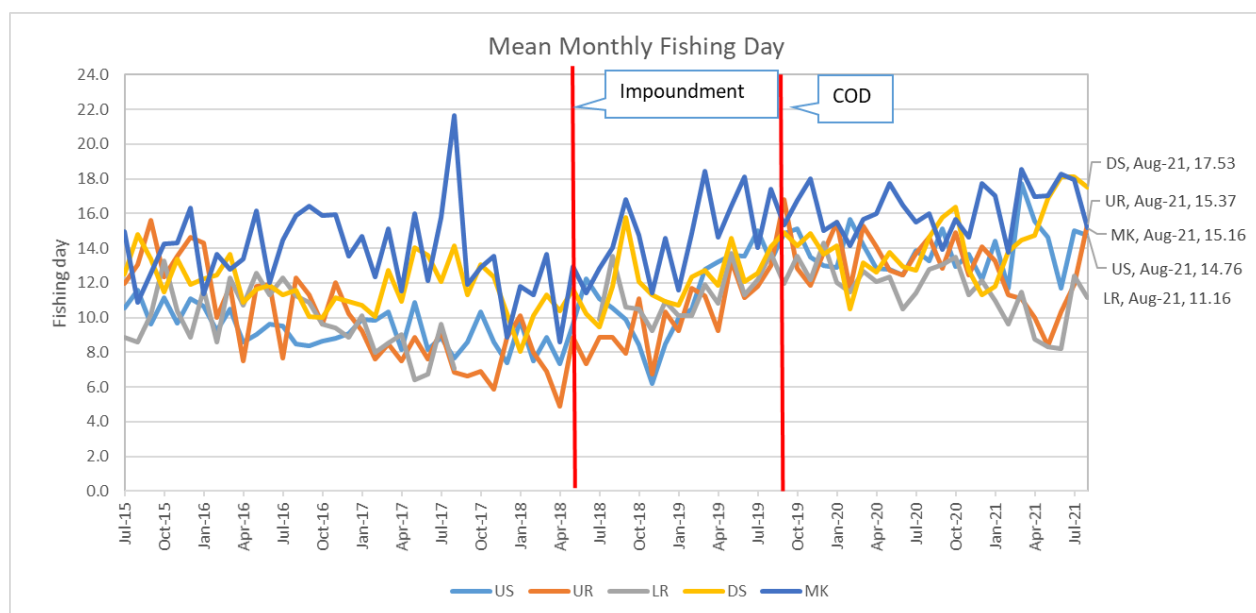
Figure 3-1 shows the proportion of total number of households actively fishing by fishing zone including upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK). It ranges between 56% and 86% of active fishing households for all fishing zones in August 2021.

FIGURE 3-1: Proportion of total number of households actively fishing by fishing zone from July 2015 to August 2021**Note:**

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

Figure 3-2 shows the average (mean) of monthly fishing day from July 2015 to August 2021 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area.

FIGURE 3-2: Mean of monthly fishing day from July 2015 to August 2021

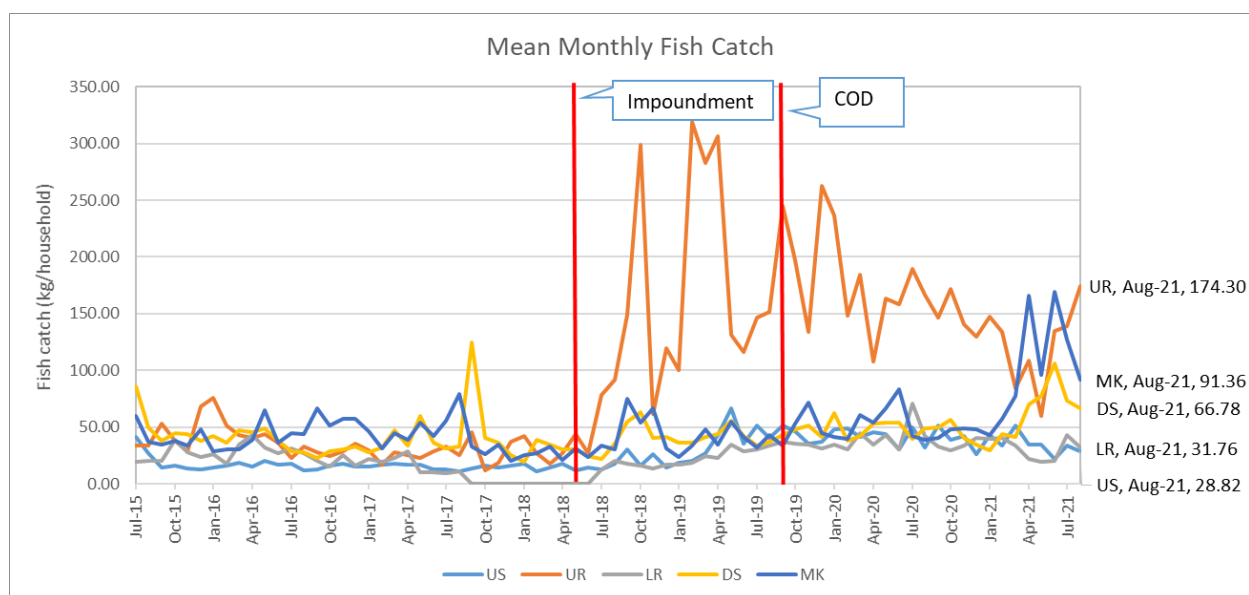


The mean monthly number of fishing day for the month of August from 2015 to 2021 for the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in **Table 3-4**.

Table 3-4: Mean reported number of fishing days by fishing zone for the month of August from 2015 to 2021

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

The mean monthly household fish catch from July 2015 to August 2021 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area are presented in **Figure 3-3**

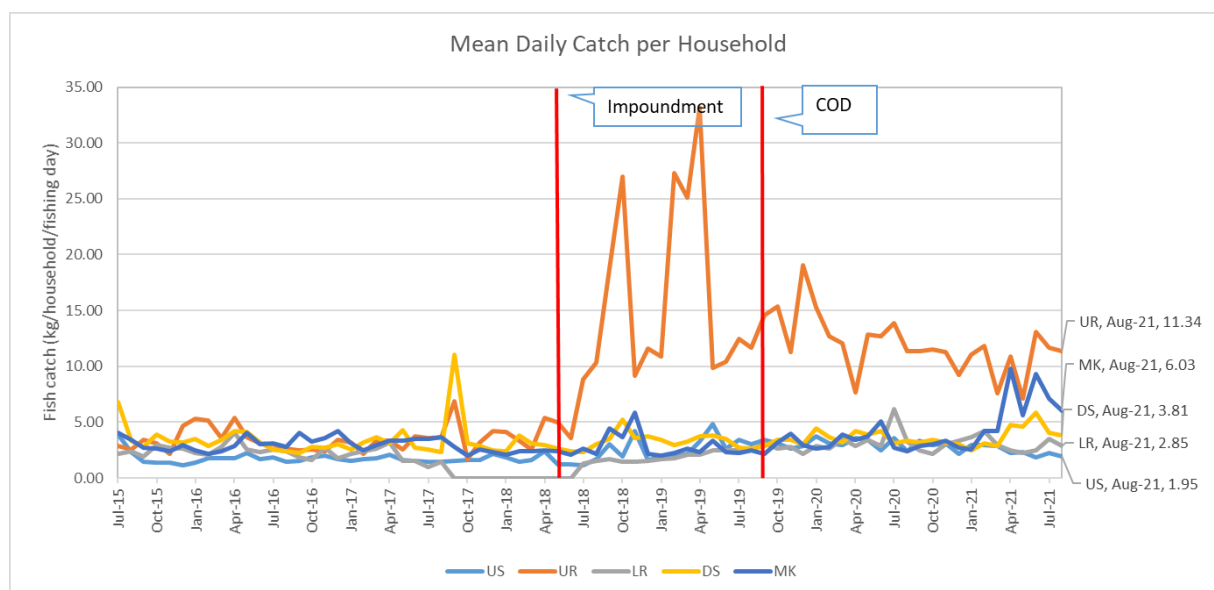
FIGURE 3-3: Mean Monthly Household Fish Catch from July 2015 to August 2021

The mean household fish catch for the month of August from 2015 to 2021 in the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in **Table 3-5**.

Table 3-5: Mean Monthly Household Fish Catch for the month of August from 2015 to 2021

Fishing Zone	August 2015 (kg)	August 2016 (kg)	August 2017 (kg)	August 2018 (kg)	August 2019 (kg)	August 2020 (kg)	August 2021 (kg)
Upstream	26.66	12.10	11.34	17.68	40.55	32.14	28.82
Upper reservoir	33.75	32.64	25.00	91.49	151.78	166.58	174.30
Lower reservoir	20.22	26.78	10.54	20.55	33.90	41.69	31.76
Downstream	49.30	28.12	32.88	35.65	36.87	48.44	66.78
Mekong	36.80	43.66	79.12	30.48	42.75	38.84	91.36

The mean daily fish catch per household from July 2015 to August 2021 are displayed in **Figure 3-4** and the mean fish catch per household per fishing day for the month of August from 2015 to 2021 are shown in **Table 3-6**.

FIGURE 3-4: Mean Daily Fish Catch per Household from July 2015 to August 2021**Table 3-6: Mean Daily Fish Catch per Household for the month of August from 2015 to 2021**

Fishing Zone	August 2015 (kg)	August 2016 (kg)	August 2017 (kg)	August 2018 (kg)	August 2019 (kg)	August 2020 (kg)	August 2021 (kg)
Upstream	2.30	1.43	1.48	1.67	3.05	2.42	1.95
Upper reservoir	2.59	2.66	3.65	10.33	11.68	11.37	11.34
Lower reservoir	2.36	2.38	1.49	1.52	2.48	3.26	2.85
Downstream	3.33	2.43	2.33	3.02	2.62	3.31	3.81
Mekong	3.39	2.75	3.65	2.17	2.45	2.43	6.03

The survey results in August 2021 indicate that Nam Ngiep is the main fishing habitat for the upstream and downstream zones, while the main fishing habitat for the upper reservoir, lower reservoir and Mekong zones are the reservoir, tributaries and streams, and Mekong respectively. The proportion of fishing habitats in August 2021 are displayed in **Table 3-7**.

Table 3-7: Proportion of the catch reported by main habitats (%) in August 2021

Habitats	US	UR	LR	DS	MK
Mekong	0.0%	0.00%	0.00%	11.05%	65.87%
Nam Ngiep	66.3%	2.85%	0.00%	54.55%	11.00%
Nam Xan	0.0%	0.00%	0.00%	0.00%	0.00%
Reservoir	0.8%	92.86%	0.00%	0.00%	0.00%
Tributary and stream	22.8%	1.64%	78.58%	32.74%	0.00%
Wetland	10.1%	2.65%	21.42%	1.66%	23.14%
Others	0.0%	0.00%	0.00%	0.00%	0.00%

Total reported fish and OAA catch (proportion of OAA) for the same 7-day period from July 2015 to August 2021 are presented in **Figure 3-4** and the proportion of OAA catch for the month of August from 2015 to 2021 are shown in **Table 3-8**.

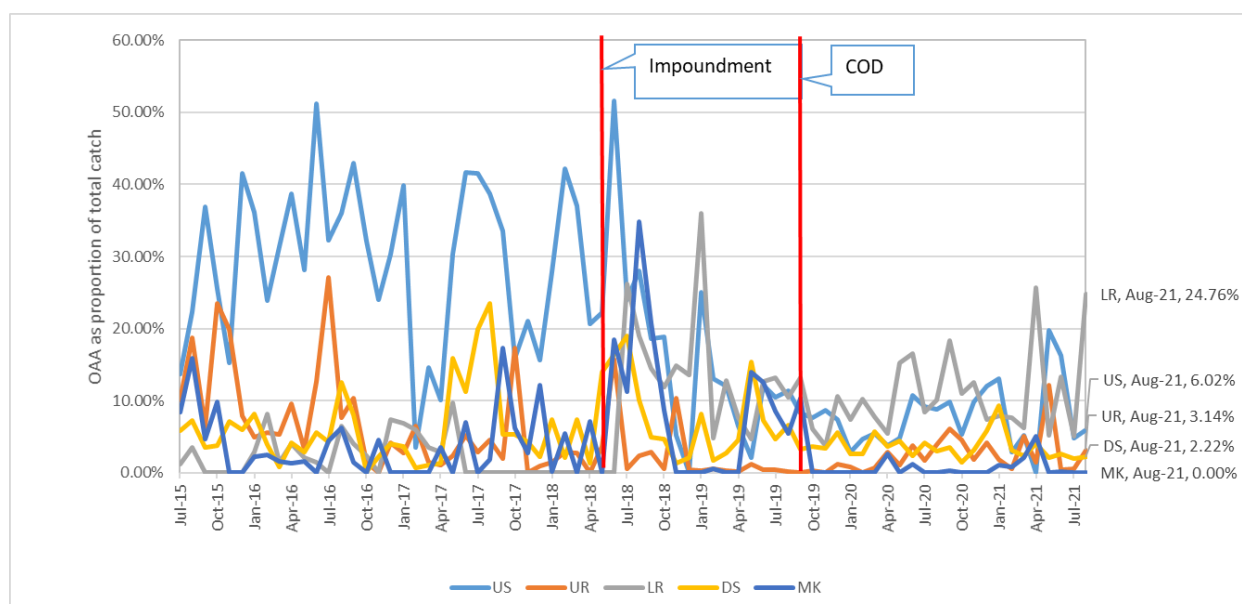
FIGURE 3-5: Proportion of OAA to the total reported number of fish and OAA for a 7-day period by fishing zone from July 2015 to August 2021

Table 3-8: Proportion of OAA to the total reported number of fish and OAA for the month of August from 2015 to 2021

Fishing Zone	August 2015	August 2016	August 2017	August 2018	August 2019	August 2020	August 2021
Upstream	22.31%	36.00%	38.66%	28.02%	11.37%	8.80%	6.02%
Upper reservoir	18.74%	7.71%	4.61%	2.36%	0.19%	3.93%	3.14%
Lower reservoir	3.52%	6.54%	0.00%	18.98%	10.45%	10.06%	24.76%
Downstream	7.28%	12.58%	23.50%	10.06%	6.59%	2.96%	2.22%
Mekong	15.84%	6.19%	1.83%	34.86%	5.42%	0.00%	0.00%

4. EXTERNAL MISSIONS AND VISITS

There was no external mission and visit during the month.

ANNEXES

ANNEX A: RESULTS OF WATER QUALITY MONITORING

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

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
1-Sep-21	pH	5.0 - 9.0					6.52	6.07						
2-Sep-21	pH	5.0 - 9.0							6.09	6.29	6.27	6.47	6.44	6.42
6-Sep-21	pH	5.0 - 9.0	6.14											
7-Sep-21	pH	5.0 - 9.0					6.85	6.85						
8-Sep-21	pH	5.0 - 9.0							6.29	6.36	6.42	6.56	6.52	6.63
13-Sep-21	pH	5.0 - 9.0	6.19											
14-Sep-21	pH	5.0 - 9.0					6.41	6.68						
15-Sep-21	pH	5.0 - 9.0							6.07	6.08	6.16	6.32	6.28	6.23
21-Sep-21	pH	5.0 - 9.0					6.57	6.72						
22-Sep-21	pH	5.0 - 9.0							6.59	6.64	6.6			
28-Sep-21	pH	5.0 - 9.0					6.57	6.51						
29-Sep-21	pH	5.0 - 9.0							6.63	6.62	6.78			
1-Sep-21	Sat. DO (%)						100.3	104.2						
2-Sep-21	Sat. DO (%)								41.2	58.5	53.8	58.7	70.7	68.7
6-Sep-21	Sat. DO (%)		97.4											
7-Sep-21	Sat. DO (%)						114.4	117.2						
8-Sep-21	Sat. DO (%)								30.9	41.2	47.3	49.7	61.9	68.1
13-Sep-21	Sat. DO (%)		98.5											
14-Sep-21	Sat. DO (%)						94.3	97.1						
15-Sep-21	Sat. DO (%)								34.3	33.1	59.9	62	76.2	77.2
21-Sep-21	Sat. DO (%)						90.3	96						
22-Sep-21	Sat. DO (%)								32.1	30.8	46.5			
28-Sep-21	Sat. DO (%)						90.6	97.1						
29-Sep-21	Sat. DO (%)								42.7	46.1	68.6			
1-Sep-21	DO (mg/L)	>6.0					7.46	7.79						
2-Sep-21	DO (mg/L)	>6.0							3.29	4.66	4.34	4.59	5.59	5.43
6-Sep-21	DO (mg/L)	>6.0	7.79											
7-Sep-21	DO (mg/L)	>6.0					8.53	8.89						
8-Sep-21	DO (mg/L)	>6.0							2.51	3.98	3.87	4.06	5.03	5.52
13-Sep-21	DO (mg/L)	>6.0	8.07											
14-Sep-21	DO (mg/L)	>6.0					7.14	7.43						
15-Sep-21	DO (mg/L)	>6.0							2.79	2.7	4.9	5.06	6.1	6.18
21-Sep-21	DO (mg/L)	>6.0					6.83	7.18						
22-Sep-21	DO (mg/L)	>6.0							2.61	2.5	4.53			
28-Sep-21	DO (mg/L)	>6.0					6.85	7.34						
29-Sep-21	DO (mg/L)	>6.0							3.48	3.67	5.1			
1-Sep-21	Conductivity (µs/cm)						69	68						
2-Sep-21	Conductivity (µs/cm)								72	54	67	77	70	56
6-Sep-21	Conductivity (µs/cm)		98											

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
7-Sep-21	Conductivity (µs/cm)					68	66							
8-Sep-21	Conductivity (µs/cm)							72	87	70	72	69	66	
13-Sep-21	Conductivity (µs/cm)		99											
14-Sep-21	Conductivity (µs/cm)					67	65							
15-Sep-21	Conductivity (µs/cm)							73	72	72	73	71	67	
21-Sep-21	Conductivity (µs/cm)					66	63							
22-Sep-21	Conductivity (µs/cm)							71	71	72				
28-Sep-21	Conductivity (µs/cm)					67	64							
29-Sep-21	Conductivity (µs/cm)							72	72	72				
1-Sep-21	Temperature (°C)					30.99	30.5							
2-Sep-21	Temperature (°C)							26.8	27.22	26.45	27.05	27.33	27.44	
6-Sep-21	Temperature (°C)		26.72											
7-Sep-21	Temperature (°C)					30.79	29.71							
8-Sep-21	Temperature (°C)							25.8	25.22	25.62	25.75	25.88	26.1	
13-Sep-21	Temperature (°C)		25.42											
14-Sep-21	Temperature (°C)					29.89	29.24							
15-Sep-21	Temperature (°C)							25.93	25.95	26.01	26.31	26.69	26.74	
21-Sep-21	Temperature (°C)					29.86	30.55							
22-Sep-21	Temperature (°C)							26.04	26.1	26.53				
28-Sep-21	Temperature (°C)					30	29.98							
29-Sep-21	Temperature (°C)							26.56	27.17	26.42				
13-Sep-21	TSS (mg/L)		54.83											
14-Sep-21	TSS (mg/L)					3	3.01							
15-Sep-21	TSS (mg/L)							0.76	1.29	1.94	1.71	3.49	6.09	
14-Sep-21	BOD _s (mg/L)	<1.5				<1	<1							
15-Sep-21	BOD _s (mg/L)	<1.5						<1	<1	<1	<1	<1	<1	
13-Sep-21	COD (mg/L)	<5.0	19.3											
15-Sep-21	COD (mg/L)	<5.0						16.1	12.9	6.4	<5	6.4	6.8	
13-Sep-21	NH ₃ -N (mg/L)	<0.2	<0.2											
14-Sep-21	NH ₃ -N (mg/L)	<0.2				<0.2								
13-Sep-21	NO ₃ -N (mg/L)	<5.0	0.13											
14-Sep-21	NO ₃ -N (mg/L)	<5.0				<0.02	<0.02							
13-Sep-21	Faecal coliform (MPN/100 mL)	<1,000	540											
14-Sep-21	Faecal coliform (MPN/100 mL)	<1,000				0	2							
15-Sep-21	Faecal coliform (MPN/100 mL)	<1,000						27	22	8	27	49	33	
13-Sep-21	Total Coliform (MPN/100 mL)	<5,000	1,600											
14-Sep-21	Total Coliform (MPN/100 mL)	<5,000				0	5							
15-Sep-21	Total Coliform (MPN/100 mL)	<5,000						110	140	23	130	540	540	
13-Sep-21	TKN (mg/L)		<1.5											
14-Sep-21	TKN (mg/L)					<1.5	<1.5							

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
13-Sep-21	TOC (mg/L)		2.42											
15-Sep-21	TOC (mg/L)							1.1	1.19	1.19	1.09	1.14	1.3	
14-Sep-21	Phytoplankton Biomass (g dry wt/m³)						2.4	1.2						
13-Sep-21	Total Phosphorus (mg/L)		0.02											
14-Sep-21	Total Phosphorus (mg/L)						<0.01	<0.01						
13-Sep-21	Total Dissolved Phosphorus (mg/L)			0.02										
14-Sep-21	Total Dissolved Phosphorus (mg/L)						<0.01	<0.01						
14-Sep-21	Hydrogen Sulfide (mg/L)						<0.02	<0.02						
14-Sep-21	TSS (mg/L)-bottom						13.5	0.64						
14-Sep-21	BOD ₅ (mg/L)-bottom						<1	<1						
14-Sep-21	Total Coliform (MPN/100 mL)-bottom						7.8	2						
14-Sep-21	Faecal coliform (MPN/100 mL)-bottom						2	2						
14-Sep-21	NH ₃ -N (mg/L)-bottom						<0.2	<0.2						
14-Sep-21	NO ₃ -N (mg/L)-bottom						<0.02	0.16						
14-Sep-21	TKN-bottom						<1.5	<1.5						
14-Sep-21	Total Dissolved Phosphorus (mg/L)-bottom						0.06	0.02						
14-Sep-21	Total Phosphorus (mg/L)-bottom						0.07	0.03						
14-Sep-21	Hydrogen Sulfide (mg/L)-bottom						0.16	0.47						
14-Sep-21	Phytoplankton Biomass (g dry wt/m³)-bottom						1.2	12.2						

TABLE A-2: RESULTS OF SURFACE WATER QUALITY MONITORING IN NAM CHIAN, NAM PHOUAN, NAM XAO AND NAM HOUAY SOUP

		River Name	Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites			
			Tributaries Upstream		Tributaries Downstream	
		Station Code	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline				
2-Sep-21	pH	5.0 - 9.0			6.4	6.63
6-Sep-21	pH	5.0 - 9.0	6.22			
8-Sep-21	pH	5.0 - 9.0			6.5	6.68
13-Sep-21	pH	5.0 - 9.0	6.06			
15-Sep-21	pH	5.0 - 9.0			6.28	
2-Sep-21	Sat. DO (%)				80.4	77.8
6-Sep-21	Sat. DO (%)		98.3			
8-Sep-21	Sat. DO (%)				78.1	75.4
13-Sep-21	Sat. DO (%)		102.9			
15-Sep-21	Sat. DO (%)				87	
2-Sep-21	DO (mg/L)	>6.0			6.14	6.2
6-Sep-21	DO (mg/L)	>6.0	8.24			
8-Sep-21	DO (mg/L)	>6.0			6.17	6.08
13-Sep-21	DO (mg/L)	>6.0	8.61			
15-Sep-21	DO (mg/L)	>6.0			7.2	7.04
2-Sep-21	Conductivity (µs/cm)				113	22
6-Sep-21	Conductivity (µs/cm)		30			
8-Sep-21	Conductivity (µs/cm)				93	19
13-Sep-21	Conductivity (µs/cm)		31			
15-Sep-21	Conductivity (µs/cm)				100	17
2-Sep-21	Temperature (°C)				29.2	27.02
6-Sep-21	Temperature (°C)		24.21			
8-Sep-21	Temperature (°C)				27.44	26.28
13-Sep-21	Temperature (°C)		24.46			
15-Sep-21	Temperature (°C)				27.24	26.15
13-Sep-21	TSS (mg/L)		5.28			
15-Sep-21	TSS (mg/L)				16.46	5.6
15-Sep-21	BOD ₅ (mg/L)	<1.5			<1	<1
13-Sep-21	COD (mg/L)	<5.0	6.9			
15-Sep-21	COD (mg/L)	<5.0			9.6	6.4
13-Sep-21	NH ₃ -N (mg/L)	<0.2	<0.2			
13-Sep-21	NO ₃ -N (mg/L)	<5.0	0.13			
13-Sep-21	Faecal coliform (MPN/100 mL)	<1,000	350			
15-Sep-21	Faecal coliform (MPN/100 mL)	<1,000			47	47
13-Sep-21	Total Coliform (MPN/100 mL)	<5,000	1,600			
15-Sep-21	Total Coliform (MPN/100 mL)	<5,000			920	920
13-Sep-21	TKN (mg/L)		<1.5			
13-Sep-21	TOC (mg/L)		1.13			
15-Sep-21	TOC (mg/L)				2.03	4.39
13-Sep-21	Total Phosphorus (mg/L)		<0.01			
13-Sep-21	Total Dissolved Phosphorus (mg/L)		<0.01			

TABLE A-3: RESULTS OF CAMP EFFLUENTS IN SEPTEMBER 2021

	Site Name	OSOV1 (Owner's Site Office and Village)		OSOV2 (ESD Camp)		Main Powerhouse	
	Station Code	EF01		EF13		EF19	
	Date	10-Sep-21	14-Sep-21	10-Sep-21	14-Sep-21	10-Sep-21	14-Sep-21
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	6.25	6.17	6.94	6.85	7.05	6.82
Sat. DO (%)		75.6	77.3	86.8	97.5	19.9	62.9
DO (mg/L)		5.84	5.91	6.72	7.53	1.51	4.76
Conductivity (µs/cm)		402	468	490	472	753	850
TDS (mg/L)		201	234	245.5	236	376.5	425
Temperature (°C)		28.65	29.49	28.54	28.68	29.71	29.91
TSS (mg/L)	<50	<5	<5	7.6	6.8	10.0	6.0
BOD ₅ (mg/L)	<30	<6	<6	9.21	<6	<6	<6
COD (mg/L)	<125	<25	<25	43	32	42	39
NH ₃ -N (mg/L)	<10.0	<2	2	19.3	19	12.2	13
Total Nitrogen (mg/L)	<10.0	0.91	3.21	20.6	20.9	13.3	13.9
Total Phosphorus (mg/L)	<2	1	1	1.56	1.51	5.23	4.02
Oil & Grease (mg/L)	<10.0	1	1	1	1	<1	<1
Total coliform (MPN/100 mL)	<400	1,600	3,500	16,000	0	16,000	0
Faecal Coliform (MPN/100 mL)	<400	920	210	9,200	0	9,200	0
Residual Chlorine (mg/L)	<1.0			0.24	0.31	0.06	0.16