NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

June 2021

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

The preparation and review of the ISO 14001:2015 documentation by co-working with the ISO consultant was completed on 30 June 2021. Most of the mandatory documents were drafted and under reviewing. The ISO14001:2015 Internal Audit is expected to be conducted at all work sections by the assigned Internal Audit team in July 2021 and it is still the target to obtain certification of compliance with ISO14001:2015 by September 2021.

During June 2021, EMO received four documents (DWP and SS-ESMMPs) for review and approval. EMO did not issue any Non-Compliance reports during June 2021.

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 villages and Zone 2UR during the reporting period.

The construction of the wastewater treatment system modification and improvement at OSOV1 and OSOV2 were still on going by the Soulignet Choummanitham Construction Sole Co., Ltd. (SCC). The status of construction progress is about 70% and it is expected to be completed within the contractual timeframe of 31 July 2021.

In June 2021, water quality depth profile measurements at R01, R02 and R03 (main reservoir) and NPH01 were suspended due to security concerns. At R05, close to the dam, the Dissolved Oxygen (DO) levels at the surface were generally between 4 mg/L and 7 mg/L and the oxycline was generally found at a depth of 5.0 to 11.0 m - similar to May 2021. In the Re-regulation reservoir, the mean DO levels over the entire water column were 2.3 mg/L in R06 and 2.2 mg/L in R07.

During June 2021, the discharge from the Re-regulation dam mainly went through the turbine and occasionally through the gate or a combination of gate and turbine discharge. Only DO concentrations during gate discharge periods were greater than 6 mg/L at the stations in Nam Ngiep immediately downstream of the Re-regulation Dam. 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.

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

A total of 32.7 m^3 of solid waste was disposed of at the NNP1 Project Landfill, an increase of 17.3 m^3 compared with May 2021 due to a temporary increase in workers for construction and maintenance activities related to the NNP1 project. A total of 25.8 m^3 of solid waste from Phouhomxay, Thahuea and Hat Gniun villages was disposed of at Houay Soup Landfill, an increase of 4.1 m^3 compared with May 2021. There was no recycle waste trade activity in the Community Waste Bank during the reporting period.

Most of the activities under NNP1 WMP and NC-NX BOMP in June 2021 were postponed following the Prime Minister (PM) Order No.15/PM dated 21 April 2021, PM Order No. No. 528/PM dated 20 May 2021, PM Order No. 595/PM dated 4 June 2021, and PM Order No. 671/PM dated 19 June 2021 on the country wide lockdown as preventive measures for COVID-19. The only activities that

continue during this lockdown period include the construction of Xaysomboun WRPO sub-office at Ban Huayxay as well as patrolling and snare removal in the NC-NX offset site.

The fish catch monitoring for April and May 2021 in Nam Ngiep Watershed was dominated by *Oreochromis niloticus* and *Channa striata* respectively, while the species groups of Poropuntius, Hampala, *Sikukia gudgeri* and *Amblyrhynchichthys truncates*, and *Barbonymus gonionotus* and Hypsibarbus dominated both in April and May 2021. 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 preparation and review of the ISO 14001:2015 documentation by co-working with the ISO consultant was completed on 30 June 2021. Most of the mandatory documents were drafted and under reviewing. The ISO14001:2015 Internal Audit is expected to be conducted at all work sections by the assigned Internal Audit team in July 2021 and it is still the target to obtain certification of compliance with ISO14001:2015 by September 2021.

TABLE 1-1: ENVIRONMENTAL MANAGEMENT SYSTEM WORK PLAN-REVISED IN JUNE 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: - 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 – **1st Stage** (***remote audit*** on the documentation review)						
10	Implement the corrective actions and preventive actions according to the 1st Stage Audit						
11	ISO 14001:2015 Assessment and Certification Audit – **2nd Stage** (***on-site audit***)						
12	Implement the corrective actions and preventive actions according to the 2nd Stage Audit						
13	**Certify of ISO14001:2015 upon successful completion of the audit**						

	Completed activities
	Delayed activities and re-scheduled
	Original plan activities

1.2 COMPLIANCE MANAGEMENT

In June 2021, EMO received 04 Detail Work Programs (DWPs) and Site Specific Environmental and Social Monitoring and Management Plans (SS-ESMMPs) for review and approval. The status of documents review is presented in ***Table 1-2***.

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

Title	Date Received	Status
DWP & SS-ESMMP for Supply and Installation of Stolen Part at Main Dam Gate	30 June 2021 (3rd submission)	Under Review
Working Drawing for OSOV's WWTS improvement and Modification	15 June 2021 (2nd submission)	No objection with no further comments on 23 June 2021
DWP & SS-ESMMP for Remedial Grouting work at Main Dam	27 June 2021 (2nd submission)	Under Review
DWP & SS-ESMMP for Improvement of Irrigation System and Tractor Roads at PHX Village	17 June 2021 (1st submission)	No objection with no comments on 17 June 2021

Due to the Corvid-19 situation and the GOL's lockdown measures, the suspension of the regular joint site inspections has continued at some areas such as at villages and in Zone 2UR during the reporting period. However, the Compliance team conducted separate site inspections as well as 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. There was no significant environmental issue found during the regular inspections and bi-weekly joint site inspection.

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	WWTS IMPROVEMENT AT THE MAIN POWERHOUSE
	
WWTS IMPROVEMENT AT OSOV1	
	

EMO did not issue any Observations of Non-Compliance during June 2021. The status of compliance reports (Observation of Non-Compliance or ONC, Non-Compliance Report or NCR) issued by NNP1PC is summarized in **Table 1-3** and all ONCs and NCRs have been solved.

Table 1-3: Summary of ONCs and NCRs

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from May 2021	0	0	0	0
Newly Opened in June 2021	0	0	0	0
Total in June 2020	**0**	**0**	**0**	**0**
Resolved in June 2021	0	0	0	0
Carried over to July 2021	0	**0**	0	0
Unsolved Exceeding Deadlines	**0**	**0**	**0**	**0**

1.2.1 Site Inspection by Environment Management Unit (EMU)

The monthly site visits by the EMU of Bolikhan District and the quarterly site visit by the EMU of Xaysomboun Province were not carried out in June 2021.

1.2.2 Site Decommissioning and Rehabilitation

During the reporting period of June 2021, EMO continued to monitor the progress of rehabilitation for two sites (Phouhomxay Village's Irrigation canal rock and spoil disposal area and LILAMA10 camp). The status of the two sites as of early July 2021 compared to May 2021 is shown below.

FIGURE 1-2: PHOTOS STATUS OF FORMER LILAMA10 CAMP AND PHOUHOMXAY VILLAGE'S IRRIGATION CANAL'S ROCK AND SPOIL DISPOSAL AREA AS OF 05 JULY 2021 COMPARE TO MAY 2021.

STATUS OF FORMER LILAMA10 CAMP REHABILITATED IN MAY 2021 (45% VEGETATION COVER)	**STATUS OF FORMER LILAMA10 CAMP REHABILITATED IN EARLY JULY 2021 (50% VEGETATION COVER)**
May 2021 	
STATUS OF IRRIGATION ROCK/SPOIL DISPOSAL AREA IN MAY 2021 (15% VEGETATION COVER)	**STATUS OF IRRIGATION ROCK/SPOIL DISPOSAL AREA IN EARLY JULY 2021 (20% VEGETATION COVER)**
May 2021 	

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/

Due to the COVID-19 preventative measures imposed by the Lao Governments since 20 April 2021, the water samples were analysed at the NNP1 Project Environmental Laboratory only for TSS, BOD_5, *E.coli* bacteria, faecal coliform and total coliform and no water samples were shipped to the UAE Laboratory in Thailand. Therefore, there are no results for COD, ammonia-nitrogen, total nitrogen, TKN, TOC, phytoplankton biomass, total phosphorus, and oil and grease in this reporting month. The samples shipment will be resumed in July 2021.

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 June 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 JUNE 2021

Site	Sampling ID	Status	Corrective Actions
OSOV1	EF01	Non-compliance for BOD_5 (first fortnightly sample), faecal coliform and total coliform.	Soulignet Choummanitham Construction Sole Company Limited Co., Ltd. (SCC) commenced the wastewater treatment systems improvement work on 26 April 2021. It is expected that the works will be completed by the end of July 2021.
OSOV2	EF13	Non-compliance for faecal coliform and total coliform in the second fortnightly sampling. However, full compliance in the first fortnightly sampling.	
Main Powerhouse	EF19	Non-compliance for TSS in the second fortnightly sampling. No discharge during the first fortnightly sampling.	

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]).

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 and main reservoirs. The locations of the monitoring stations are shown in ***Figure 1-3.***

The monitoring results for key parameters (DO, TSS and BOD_5) during June 2021 are presented in ***Table 1-5, Table 1-6*** *and* ***Table 1-7*****.** The full set of data for June 2021 is attached in ***Annex A***. In addition, the results for DO are presented as line graphs in ***Figure 1-4***.

Main Reservoir

From 01 to 30 June 2021, the water level in the main reservoir increased from El. 297.45 m asl to El. 301.35 m asl.

Depth profile measurements and sampling at R01, R02 and R03 were suspended due to security concerns during June 2021.

At R05, the station closest to the main dam, as the water temperature increased, the thermocline was clearly observed at a depth interval from about 6.5 m to 9.0 m. The average DO concentration of 6.0 mg/L in the upper 5.0 m varying between 4.2 mg/L and 7.3 mg/L, and the oxycline was generally found at a depth of 5.0 – 11.0 m with DO concentrations between about 2 mg/L and 4 mg/L - similar to May 2021. The depth at which the DO concentration was at or below 2 mg/L varied from 6.5 m to 12 m. DO concentrations below 0.5 mg/L (anoxic condition) were recorded at depths below 14 m corresponding to 10 m above the centre line of the Intake in early June 2021 to 10.4 m above the centre line by the end of the month, taking into consideration the rising water level in the reservoir over the period.

At R04, the DO levels in the upper 6.5 m varied between 5.4 mg/L and 7.4 mg/L. The depth at which the DO concentration was at or below 2 mg/L varied from 8.5 m to 11 m, and the DO concentrations dropped to below 0.5 mg/L at a depth of about 22 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 BOD_5 measurements at R04 and R05 in both epilimnion and hypolimnion were less than 1.0 mg/L.

Re-regulation Reservoir

In June 2021, the turbine discharges from the main powerhouse varied between 61 and 225 m^3/s usually interrupted by night-time periods with no discharge.

The mean DO levels over the entire water column were 2.3 mg/L in R06 and 2.2 mg/L in R07 during June 2021.

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

Nam Ngiep Downstream

During June 2021, the discharge from the Re-regulation dam mainly went through the turbine and occasionally through the gate or as a 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 2.3 mg/L and 4.3 mg/L and gradually increased to 4.3 mg/L at a distance of 14 km from the dam and to about 5.1 mg/L at NNG07 some 25.9 km from the dam. At NNG08 close to the confluence with the Mekong River (47.2 km from the dam), the DO levels were about 5.5 mg/L.

During periods with gate discharge, the DO concentrations were above 6 mg/L for the entire reach below the dam.

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 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

No water quality monitoring for Nam Phouan during June 2021.

All monitored parameters in the Nam Xao and Nam Houaysoup complied with the standard, except DO and faecal coliform at NHS01 and NXA01.

FIGURE 1-3: SURFACE WATER AND RE-REGULATION RESERVOIR WATER QUALITY MONITORING STATIONS

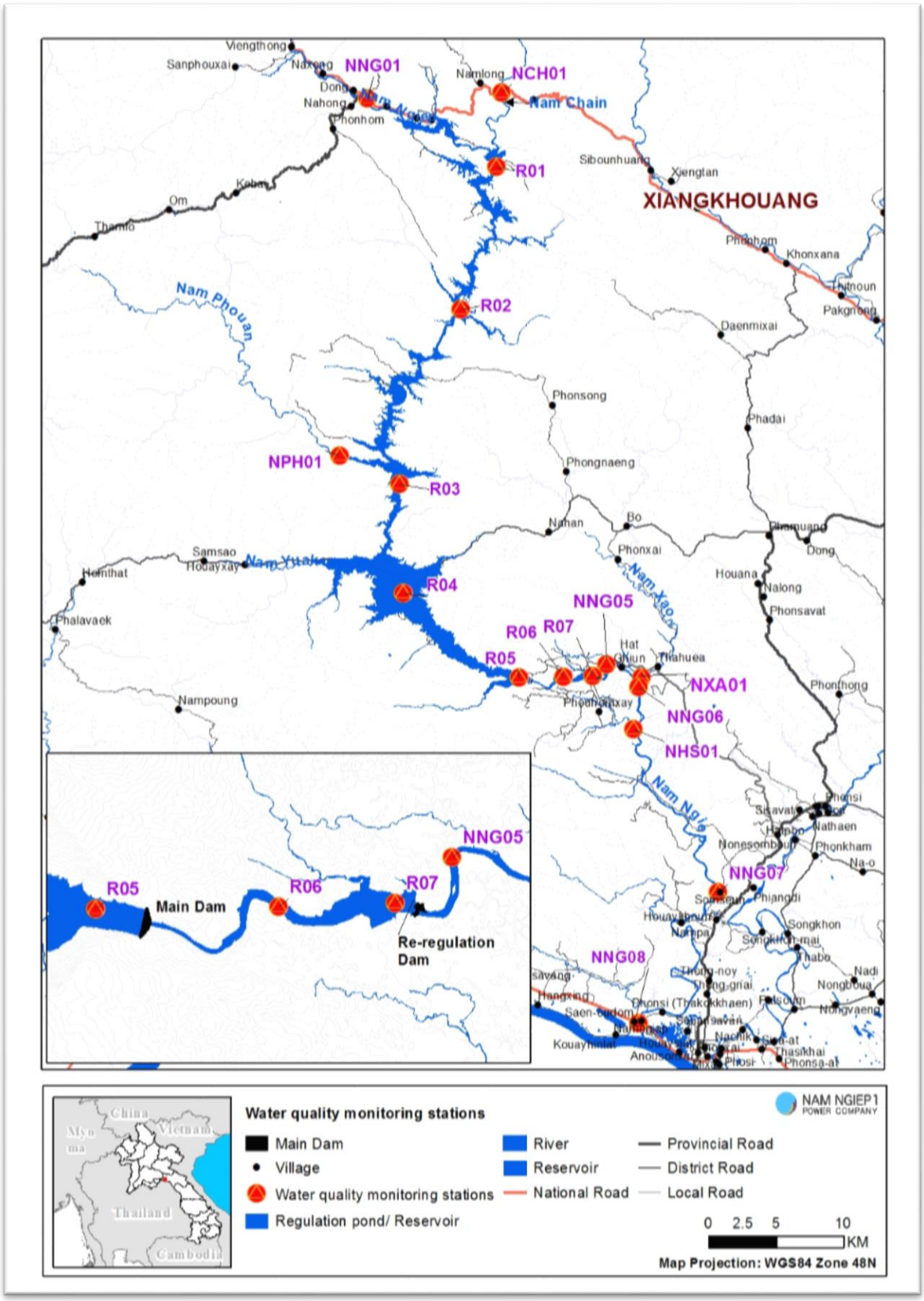


FIGURE 1-4: CONCENTRATION OF DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M SINCE SEPTEMBER 2019 TO JUNE 2021

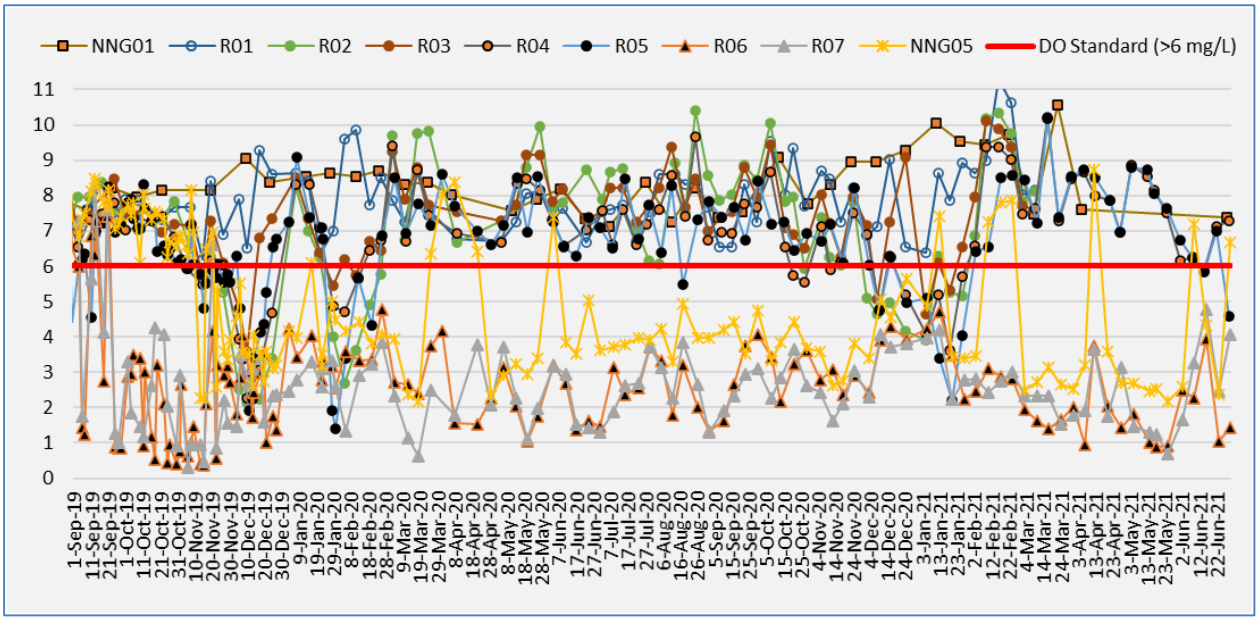


TABLE 1-5: RESULTS OF SURFACE WATER QUALITY MONITORING FOR DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M, NATIONAL WATER QUALITY STANDARD: >6.0 MG/L

DO (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
1-Jun-21					6.16	6.74										
2-Jun-21							2.51	1.67	2.58	2.89	4.85	5.36			3.36	4.82
8-Jun-21					6.26	6.21										
9-Jun-21							2.27	3.28	7.19	6.61	6.67	6.49			6.43	6.42
15-Jun-21					5.88	5.85										
16-Jun-21							3.93	4.78	4.32	4.54	5.16	5.63			6.13	6.48
22-Jun-21					7.12	6.98										
23-Jun-21							1.06	2.46	2.35	3.0	5.16	5.42			5.71	6.58
28-Jun-21	7.38												7.88			
29-Jun-21					7.29	4.59										
30-Jun-21							1.44	4.07	6.67	6.06	6.27	5.81			6.24	6.38

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
08-Jun-21					<5	<5										
08-Jun-21 Hypolimnion					<5	<5										
09-Jun-21							<5	17.4	58.14	50.25	75.14	57.67			87.9	26.84

TABLE 1-7: 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
08-Jun-21					<1	<1										
08-Jun-21 Hypolimnion					<1	<1										
09-Jun-21							<1	<1	<1	1	<1	<1			<1	<1

1.3.3 Groundwater Quality Monitoring

During June 2021, community groundwater quality analyses were carried out for five wells located in Somseun Village, Nam Pa Village, Thong Noy Village and Phouhomxay Village. The community groundwater samples were taken from household water tap, except in Phouhomxay Village where the groundwater samples were taken at sampling points before entering into the water storage tank. No groundwater sampling in Pou Village due to the GOL's Covid19 lockdown measures.

The results indicate that:

- Only one of two wells in Phouhomxay Village (GPHX01) did not comply with the groundwater quality standards for *E.coli* bacteria and pH;
- The well in Thong Noy Village, one well in Nam Pa Village and Somsuen Village did not comply with the standard for *E.coli* bacteria.

The community groundwater quality monitoring results are presented in ***Table 1-8.***

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 1-8: GROUNDWATER QUALITY MONITORING RESULTS IN SOMSUEN, NAM PA, THONG NOY AND PHOUHOMXAY VILLAGES

	Site Name	Phouhomxay Village		Somseun Village	Nampa Village	Thongnoy Village	Pou Village
Parameter (Unit)	Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01
	Guideline*						
pH	6.5 - 9.2	6.42	6.66	7.0	6.85	6.79	No Sampling due to the lockdown measures
Sat. DO (%)		47.5	44.8	12.5	92.6	83.3	
DO (mg/L)		3.87	3.52	5.67	7.2	6.44	
Conductivity (µS/cm)		223	443	362	384	392	
Temperature (°C)		26.48	28.07	28.01	28.33	28.95	
Turbidity (NTU)	<20	2.44	0.83	1.51	1.02	1.32	
Faecal coliform (MPN/100mL)		13	0	11	2	350	
E.coli Bacteria (MPN/100mL)	0	7.8	0	11	2	130	

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

1.3.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

The results of the Gravity Fed Water Supply water quality analyses are presented in ***Table 1-9***.

Faecal Coliform and *E.coli* exceeded the drinking water quality 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). Note here that during sampling of tap water in Phouhomxay Village, surface water from Houay Soup Stream was still supplied into the system and the samples likely represent a mixture of surface water and groundwater from the boreholes, where, as mentioned in ***Section 1.3.3*** and as shown in **Table 1-8**, *E.coli* bacteria were only detected (at a low level) in one of the two wells.

As observed in the field during water sampling, livestock are roaming around the water intake areas and feces from birds may also contribute to the presence of Faecal Coliform Bacteria and *E.coli* in GFWS samples. 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 were encouraged to boil water before drinking.

TABLE 1-9: 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*				
pH	6.5 - 8.6	6.97	7.06	7.26	7.02
Sat. DO (%)		92.9	105.8	85.5	77
DO (mg/L)		7.19	8.25	6.71	5.96
Conductivity (µS/cm)	<1,000	68	93	66	67
Temperature (°C)	<35	28.79	28.18	28.06	28.54
Turbidity (NTU)	<10	2.11	1.35	1.07	1.5
Faecal Coliform (MPN/100 mL)	0	11	130	79	49
E.coli Bacteria (MPN/100 mL)	0	8	130	79	49

*These are drinking water quality standards attached in the concession agreement.

1.3.5 Landfill Leachate Monitoring

During June 2021, the landfill leachate monitoring was not conducted at NNP1 Project Landfill and Houay Soup Solid Waste Landfill due to the ponds were dried.

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 1-5*** *and* ***Figure 1-6*** presents the values recorded since May 2018.

During June 2021, the mean inflow to the main reservoir was 148 m^3/s. The minimum and maximum inflows were 48 m^3/s (on 04 June 2021) and 188 m^3/s (on 15 June 2021) respectively.

From 01 to 30 June 2021, the water level of the main reservoir increased by 3.9 m from El. 297.45 m asl to El. 301.35 m asl.

In June 2021, the hourly turbine discharges from the Main Powerhouse varied between 61 and 225 m^3/s usually interrupted by night-time periods with no discharge.

FIGURE 1-5: INFLOW FOR THE MAIN RESERVOIR

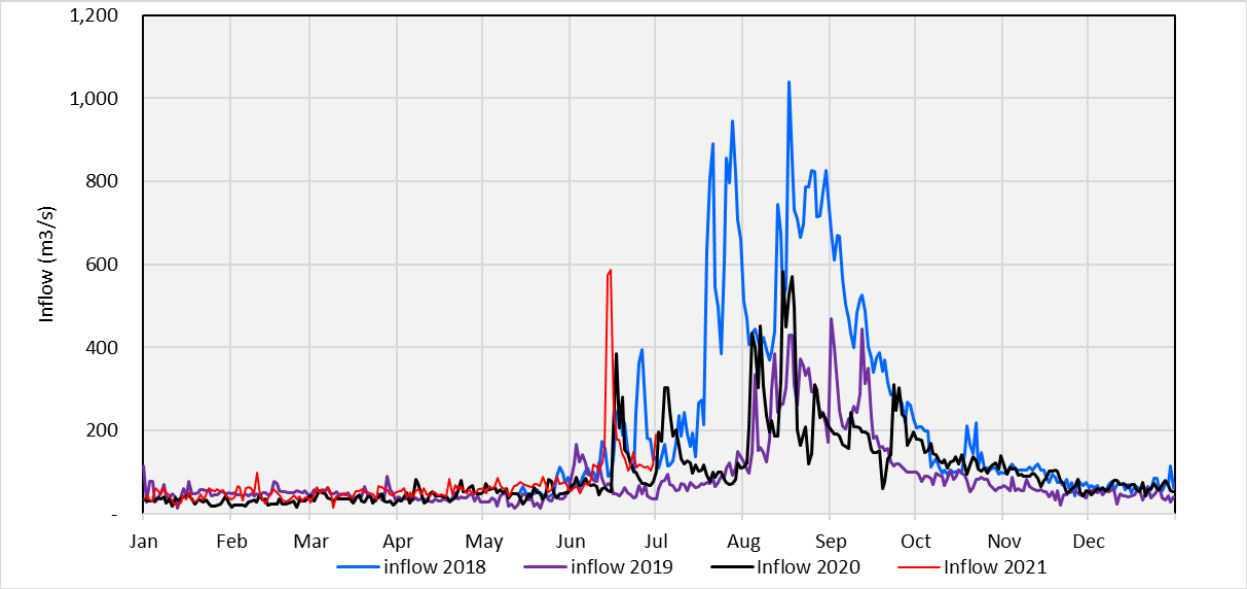
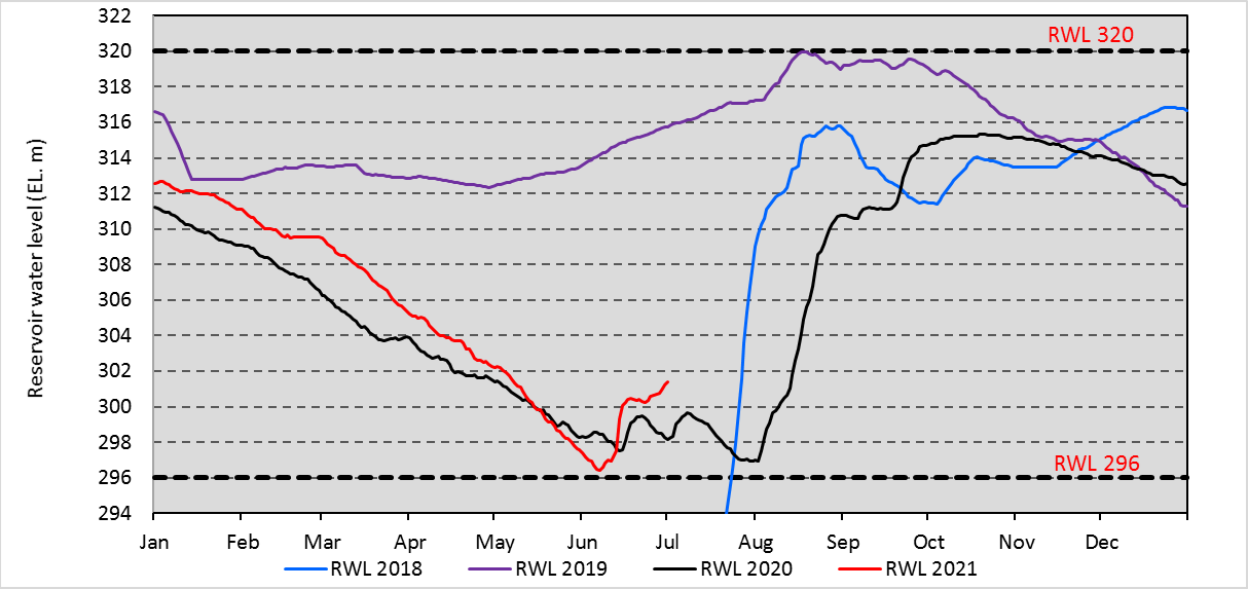


FIGURE 1-6: WATER LEVEL FOR THE MAIN RESERVOIR



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

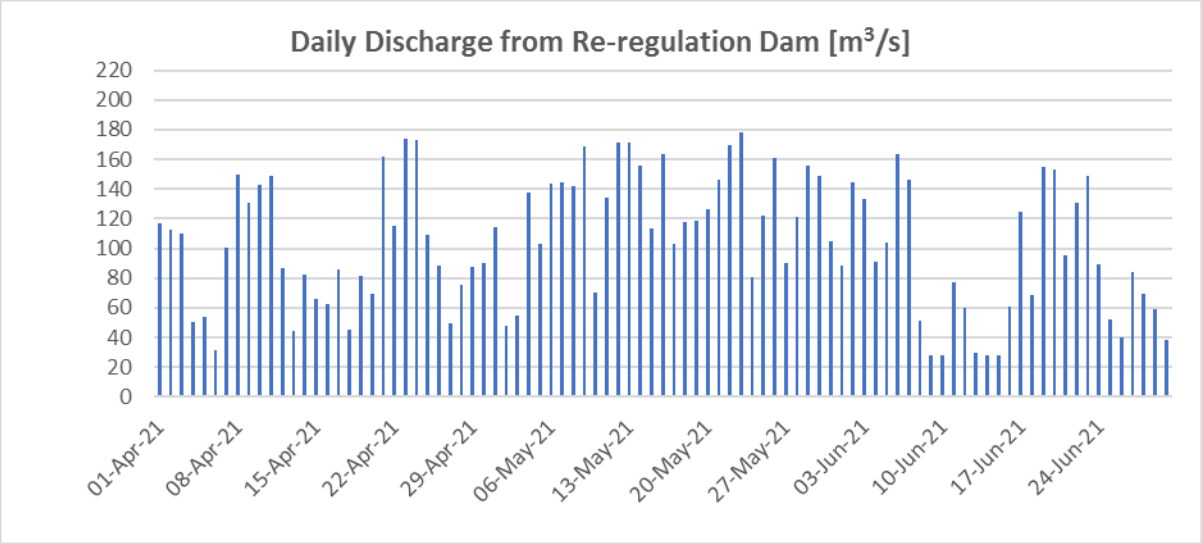
1.4.2 Re-regulation Reservoir – Discharge

The daily discharge monitoring data for the Re-regulation dam during April to June 2021 is presented in ***Figure 1-7*****.**

During June 2021, the mean hourly discharge from the Re-regulation Dam was about 83 m^3/s with hourly turbine discharges varying between 47 m^3/s and 162 m^3/s, hourly gate discharge varied between 27 m^3/s and 160 m^3/s, and hourly total discharge varying between 27 m^3/s and 207 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 1-7: DAILY DISCHARGE MONITORING AT THE RE-REGULATION DAM IN APRIL TO JUNE 2021



1.4.3 Nam Ngiep Downstream Water Depth Monitoring

In June 2021, 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 in one of the four boat missions, the talweg water depth was less than 0.5 m at:

- Three of the sites (distance between 1.5 and 5.6 km from the Re-regulation Dam) during the discharge of 27.5 m^3/s on 09 June 2021
- Two of the sites (distance between 2.4 and 5.6 km from the Re-regulation Dam) during the discharge of 27.3 m^3/s on 30 June 2021.

1.5 PROJECT WASTE MANAGEMENT

1.5.1 Solid Waste Management

In June 2021, a total of 32.7 m^3 of solid waste was disposed of at the NNP1 Project Landfill, an increase of 17.3 m^3 compared with May 2021 due to the temporary increase in workers for construction as well as powerhouse maintenance activities. However, EMO plans to check the waste generation at the various NNP1PC operation sites to identify the reasons for the high increase in waste and develop measure to reduce waste generation.

During this reporting period, the contractor conducted regular waste collection from the NNP1PC's operation sites and operated the project landfill for 3 days per week. The work included waste segregation and disposal, waste cover, grass cutting and repairing of perimeter fence. In addition, the contractor conducted a quarterly spot check of the landfill waste disposal and waste covering as well as providing training on health, safety and environment for the local workers.

FIGURE 1-8: WASTE MANAGEMENT ACTIVITIES AT NNP1 LANDFILL DURING JUNE 2021

CLEAN-UP SEDIMENT FROM THE OPEN DITCH	*QUARTERLY HEALTH SAFETY &ENVIRONMENTAL TOOLBOX FOR LOCAL WORKERS AND WASTE COVER SPOT CHECK*
	 

The total amount of recyclable waste collected this month is 612 kg– see ***Table 1-10.***

TABLE 1-10: AMOUNTS OF RECYCLABLE WASTE SOLD

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by June 2021
1	Plastic bottles	kg	0	93
2	Aluminium	kg	0	50
3	Paper/Cardboard	kg	0	108
4	Glass	kg	0	205
5	Scrap Metal	Kg	0	156
Total		**kg**	**0**	**612**

Due to the extension of OSOV1 Lockdown until 04 July 2021 which restricts access to the site, collection of food waste from the OSOV1 canteen by the villagers from Phouhomxay Village continued to be suspended in June 2021. EMO tried to contact the villagers for alternative options to pick up the food waste for feeding their animals and proposed that they could pick up the food waste from the Community Landfill. However, the villagers could not be reached. EMO plans to meet the villagers after 04 July 2021 to solve the issue.

1.5.2 Hazardous Materials and Waste Management

The types and amounts of hazardous materials and hazardous waste stored on site in June 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 June 2021 (A)	Used (B)	Remaining at the end of June 2021 (A – B)
1	Diesel	Litre	5,124	3,400	**1,724**
2	Gasoline	Litre	770	400	**370**
3	Lubricant (Turbine oil)	Litre	7,830	4	**7,826**
4	Colour Paint	Litre	245	3	**242**
5	Thinner	Litre	8	0	**8**
6	Grease Oil	Litre	160	0	**160**
7	Gear Oil	Litre	470	0	**470**
8	Chlorine Liquid	Litre	103	100	**3**
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 June 2021 (A)	Disposed (B)	Remaining at the end of June 2021 (A - B)
1	Used Oil (Hydraulic and Engine)	Litre	4,467.7	0	**4,467.7**
2	Used oil mixed with water	Litre	150	0	**150**
3	Empty 200L drum of used oil	Unit	21	0	**21**
4	Contaminated soil, sawdust and textile material	M^3	2.49	0	**2.49**
5	Used tires	Piece	18	0	**18**
6	Empty 20L chemical drum	Drum	10	0	**10**
7	Lead battery	Unit	5	0	**5**
8	Empty paint and spray cans	Can	139	0	**139**
9	Halogen/fluorescent bulbs	Unit	280	0	**280**
10	Empty cartridge (Ink)	Unit	195	0	**195**
11	Clinic Waste	kg	3.5	0	**3.5**

1.6 COMMUNITY WASTE MANAGEMENT

1.6.1 Community Recycling Programme

In June 2021, there was no trading of recyclable waste at the community waste bank. Due to the continuation of COVID-19 measures, many local recycling businesses and vendors have not yet resumed their recyclable waste trading. EMO contacted the local recycling company to come and collect the recyclables. It is expected that the company will come in early July 2021.

The total amount of recyclable waste in the waste bank is 2,519 kg - same as the amount recorded in April 2021.

TABLE 1-13: TYPES AND AMOUNTS OF RECYCLABLE WASTE TRADED AT THE COMMUNITY RECYCLE WASTE BANK

Types of Waste	Unit	Remaining in May 2021	Additional in June 2021	Sold/ dispose	Remaining in June 2021
Glass bottles	kg	2,358	0	0	**2,358**
Paper/ cardboard	kg	126	0	0	**126**
Plastic bottles	kg	35	0	0	**35**
Aluminium cans	kg	0	0	0	**0**
Scrap metal	kg	0	0	0	**0**
Total	**kg**	**2,519**	**0**	**0**	**2,519**

1.6.2 Community Solid Waste Management

In June 2021, approximately 25.8 m^3 of solid waste was collected from Phouhomxay Village and the host villages for disposal at the Houay Soup Landfill, an increase of 4.1 m^3 compared with May 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 of perimeter fence. In addition, the local contractor also conducted a quarterly site inspection and provided training on health, safety and environmental as well as waste covering and segregation for the local workers.

FIGURE 1-9: WASTE MANAGEMENT ACTIVITIES DURING JUNE 2021

WASTE SEGREGATION AT HSL	*HEALTH, SAFETY &ENVIRONMENTAL TOOLBOX FOR THE 03 TEAMS OF LOCAL WORKERS FROM 03 VILLAGES*
	

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 WRPO at Ban Huayxay, Hom District under the approved AIP2020 continued to progress in June 2021. EMO conducted field inspection on 18 June 2021.

There were no field activities during the country-wide lockdown as preventive measures for COVID-19 in June 2021. The camera-trap installation within NNP1 watershed TPZ is postponed to the last quarter of 2021.

The procurement of a local consultant to support implementing the Action Plan of Sustainable Livelihood Opportunities was concluded in the third week of June 2021 and the Consultant will start the work in July 2021.

2.1.2 Preparation of Annual Implementation Plan (AIP) 2021

An online meeting on the WMP's 5-year budget plan 2021-2025 was organized on 09 June 2021. The meeting was attended by 24 people including representatives from DoF, Xaysomboun PAFO/WRPO, Bolikhamxay PAFO/WRPO, EMO and BSP-WCS. Some of the key discussion points are summarized as follow:

- The participants agreed on the budget allocation referring to the WMP's 5-year budget plan 2021-2025 totalling USD 6,713,733 comprised of USD 1,600,839 from CA budget, USD 3,433,966 from NNP1PC's NNL budget, and USD 1,678,928 from ADB's NNL budget.
- The allowance of 150,000 kip/day/person will be provided for patrolling work, field survey or any field works in the area where accommodation service is not available until the Financial Management Manual (FMM) is ready. The FMM is expected to be ready and implemented in last quarter of 2021.
- WRPOs of BLX and XSB in coordination with relevant agencies can develop a short-term action plan as necessary for reservoir fishery management while waiting for the agreement of roles and responsibilities of different parties at the provincial, district and village levels and finalization of the FCMP.
- DOF-MAF, Xaysomboun and Bolikhamxay WRPO to prepare the AIP 2021 for the remaining period (July-December 2021) and submit the plan to NNP1PC. The AIP 2021 should be realistic and implementable. WRPOs will review and improve the recommended plans that were sent to WRPOs for developing the AIP 2021 in order to shorten the time for preparation.
- Any budget allocation and revision of the approved plan shall be consulted and acknowledged by NNP1PC in writing.
- Bolikhamxay PAFO to submit official letter requesting advance procurement of one vehicle for WRPO in 2021 and submit it together with the AIP 2021 to NNP1PC for review and further consultation with ADB.
- BSP-WCS confirmed their availability to support WRPOs in preparing the annual implementation plan under Biodiversity Protection Component prior to submission of the plan to NNP1PC and ADB.

Bolikhamxay WRPO submitted the revised plan to EMO on 14 Jun 2021 and EMO reviewed the plan and provided their comments at the end of June 2021. Xaysomboun WRPO will submit the revised plan in July 2021.

2.2 BIODIVERSITY OFFSET MANAGEMENT

2.2.1 Implementation of BOMP Annual Implementation Plan (AIP) 2019 and 2020

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

a. Component 1 - Spatial Planning and Regulation

The site visits to settle the issue on the TPZ boundary demarcation in the remaining village, Ban Vangphieng of Viengthong district was still postponed until further confirmation of the availability of representatives of NC-NX BOMC and BOMU.

b. Component 2 – Law Enforcement

The four patrol teams continue the patrolling work that was scheduled between 14 June to 10 July 2021 in which three teams focus on TPZ Highest priority area and one team focuses on TPZ Nam Houng high priority area including Nam Houng, Nam Lak and Nam Somfard. The results of patrolling in June 2021 will be presented and discussed in July 2021 Monthly Report.

The results of patrolling activity in May 2021 are as follows:

Team	Patrolling Area/distance	Observations/Actions Taken
1	Nam Ma TPZ high priority area including Nam Ma, Nam Pang, Nam Mong and mountain ridges (15 days covering a 62.9 km distance of forest patrol)	The team encountered and destroyed two old fishing camps located at Nam Ma and an old hunting camp located at Nam Mong.
2	Nam Ma TPZ high priority area including Nam Ma, Na Sagna and Nam Kapong. (16 days covering a 74.77 km distance of forest patrol)	• The team observed three separate plots of Marijuana plantations with three old huts located at the upstream of Nam Kapong (inside TPZ higher priority area). • The team also found ammunition and heard gunshot (Gap Gun) at the upstream of Nam Kapong (near three plots of Marijuana plantations). • The team encountered and destroyed a fresh hunting camp at Nam Kapong and a small fresh fishing camp at Nam Ma.
3	TPZ highest priority area including Nam Xi, Nam Chouan and mountain ridges. (15 days covering a 69.3 km distance of forest patrol and 6.5 km distance of road patrol)	The team encountered and destroyed two old hunting camps located close to Nam Chouan.
4	TPZ highest priority area including Nam San and south of Nam San Mountain ridges. (15 days covering a 49 km distance of forest patrol)	The team encountered and destroyed a fresh fishing camp at Nam San.

FIGURE 2-1: MAP OF THREATS RECORDED BY PATROLLING TEAMS IN MAY 2021

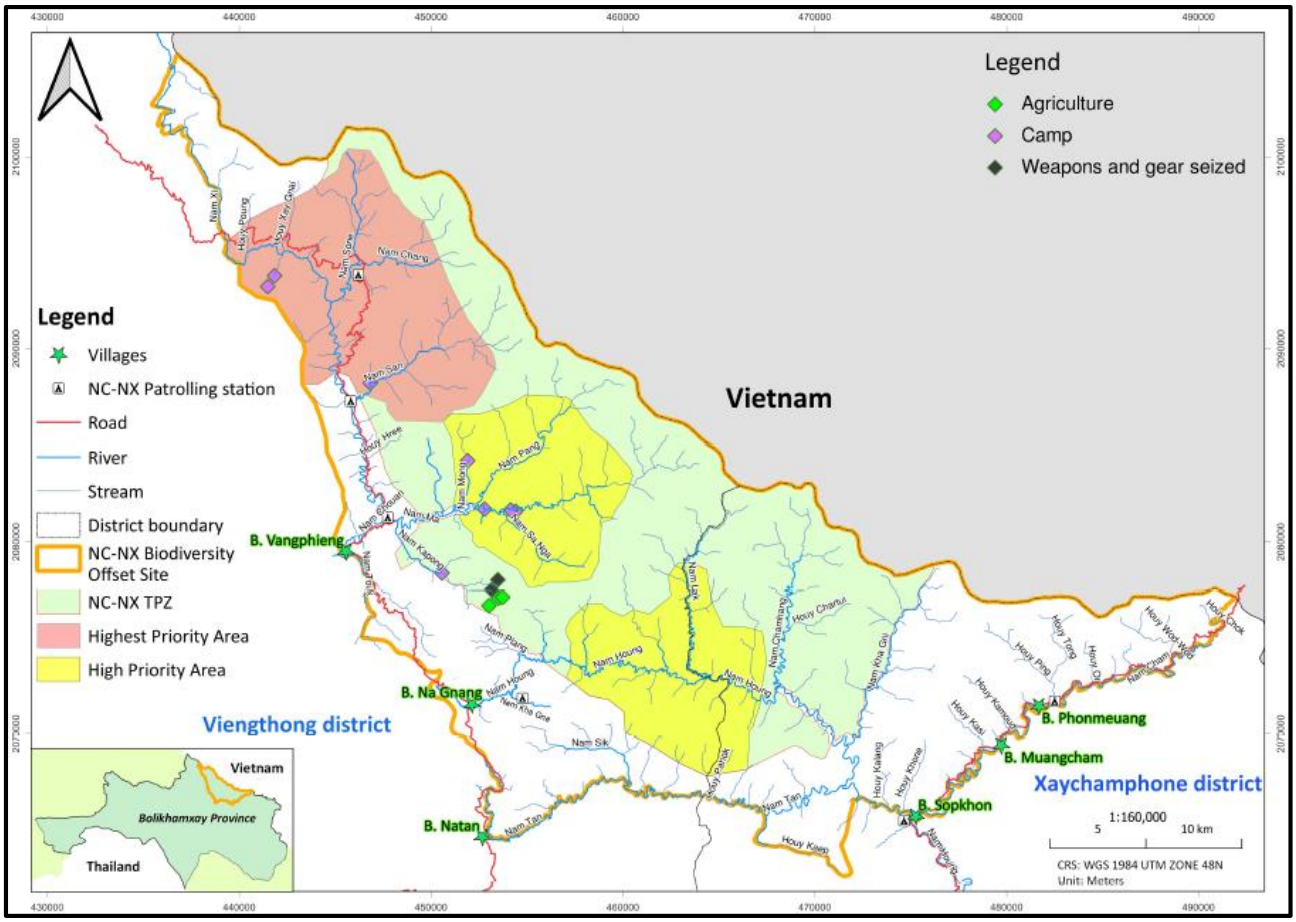


FIGURE 2-2: FISHING CAMPS FOUND BY TEAM 1 LOCATED AT NAM MA	*FIGURE 2-3: OLD HUNTING CAMP FOUND BY TEAM 1 LOCATED AT NAM MONG*
	
FIGURE 2-4: FRESH HUNTING CAMP FOUND BY TEAM 2 LOCATED AT NAM KAPONG	*FIGURE 2-5: OLD HUNTING CAMP FOUND BY TEAM 3 LOCATED AT NAM CHOUAN*
	

c. Component 3 – Conservation Outreach

Due to the COVID-19 preventive and control measures, the outreach activity will be further postponed to after the rainy season.

d. Component 4 – Conservation linked livelihood development

NC-NX BOMU informed that the review of Lao version of CDP was completed in the second week of June 2021. NC-NX BOMU requested EMO to explain the comments from relevant agencies to Bolikhamxay PAFO.

The second snare removal for June 2021 was started on 20 June 2021 and is expected to be completed in July 2021. The team was led by a Viengthong DAFO staff and implemented by 6 village team members focusing on the TPZ highest priority area including Nam Chouan, Houy Xai Gnai, Nam Sone Mountain ridges and Pak Namchang.

e. Component 6 – Biological Monitoring

EMO and BSP developed the TOR for specific surveys between Feb-Mar 2021. The TORs were discussed and reviewed by ADB and IAP between April-May 2021. The TOR is being reviewed by NNP1 ESD management.

The draft TOR of NNL auditor was shared by ADB on 17 May 2021 noting that it has been reviewed by IAP Biodiversity Expert. EMO provided comments and notes for ESD management consideration on 24 May 2021. The draft TOR is being reviewed by NNP1 ESD management.

2.2.2 Preparation of Annual Implementation Plan (AIP) 2021

EMO, NC-NX BOMU, and BSP-WCS organized an online discussion to finalize the BOM AIP2021 on 3 June 2021 focussing on the activities, budget, and timeline that will only cover the implementation period from July to December 2021.

BOMU informed on 5 June 2021 that they still do not agree with allowance of 150,000 LAK/day/person for any field works until there is an official notification from DOF-MAF and an official letter from NNP1PC management and ADB.

NNP1PC Management is requesting for a meeting with Director General of DOF-MAF and BLX Provincial Vice Governor to seek the guidance on the allowance issue. In case that it could not be settled easily and to avoid further delays then NNP1PC will recommend GOL for separating the budget/activities that can be agreeable by NNP1PC, ADB, BSP and BOMU for the approval and fund disbursement to continue with the activities while non-agreeable items can be proposed after it is settled.

3. FISHERY MONITORING

Four species groups and one species dominated the fish catch by weight in April 2021 as well as in May 2021 as listed in **Table 3-1** and **Table 3-2** 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).

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

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Poropuntius normani, Poropuntius laoensis,Poropuntius carinatus	ปาจาด	129.9	LC
Hampala dispar, Hampala macrolepidota	ปาสูด	112.6	LC
Sikukia gudgeri, Amblyrhynchichthys truncatus	ปาขาวชาย	107.8	DD, LC
Barbonymus gonionotus, Hypsibarbus malcomi, Hypsibarbus vernayi, Hypsibarbus wetmorei	ปาปาฆา	89.3	LC
Oreochromis niloticus	ปานิน	76.8	LC

[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: Fish Species dominating the Fish Catch in May 2021

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Barbonymus gonionotus, Hypsibarbus malcomi, Hypsibarbus vernayi, Hypsibarbus wetmorei	ปาปาฆา	241.1	LC
Hampala dispar, Hampala macrolepidota	ปาสูด	91.8	LC
Poropuntius normani, Poropuntius laoensis,Poropuntius carinatus	ปาจาด	70.4	LC
Sikukia gudgeri, Amblyrhynchichthys truncatus	ปาขาวซาย	72.4	DD, LC
Channa striata	ปาถ่ำ	40.7	LC

The recorded catch of Threatened species (IUCN Red List classification) in April and May 2021 are presented in **Table 3-3** and **Table 3-4** The list includes two species that are classified as Vulnerable species (VU) in April and three Vulnerable species in May 2021.

Table 3-3: Threatened Species of April 2021 Fish Catch

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Scaphognathops bandanensis	ปาอวนไฝ/ปาป่วน	12.5	VU
Tor sinensis	ปาแดง	13.3	VU

Table 3-4: Threatened Species of May 2021 Fish Catch

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Cyprinus carpio	ปาไน	2	VU
Scaphognathops bandanensis	ปาอวนไฝ/ปาป่วน	12.6	VU
Tor sinensis	ปาแดง	22.6	VU

Species abundance and occurrence is based on the 7-day reported catch from the DCL survey in April and May 2021. The catch is divided in 3 areas including above the main dam, below the main dam and Mekong area. Main biodiversity indicators in April and May 2021 for above dam, below dam and Mekong area are presented in **Table 3-5** and **Table 3-6.**

Table 3-5: Main Biodiversity Indicators for April 2021

Biodiversity Indicators	Mekong	Below dam	Above dam
Total species and groups	29	39	35
Single species	23	26	23
Species groups	6	13	12
Top 15 species (% total catch weight)	92.89%	85.23%	91.15%

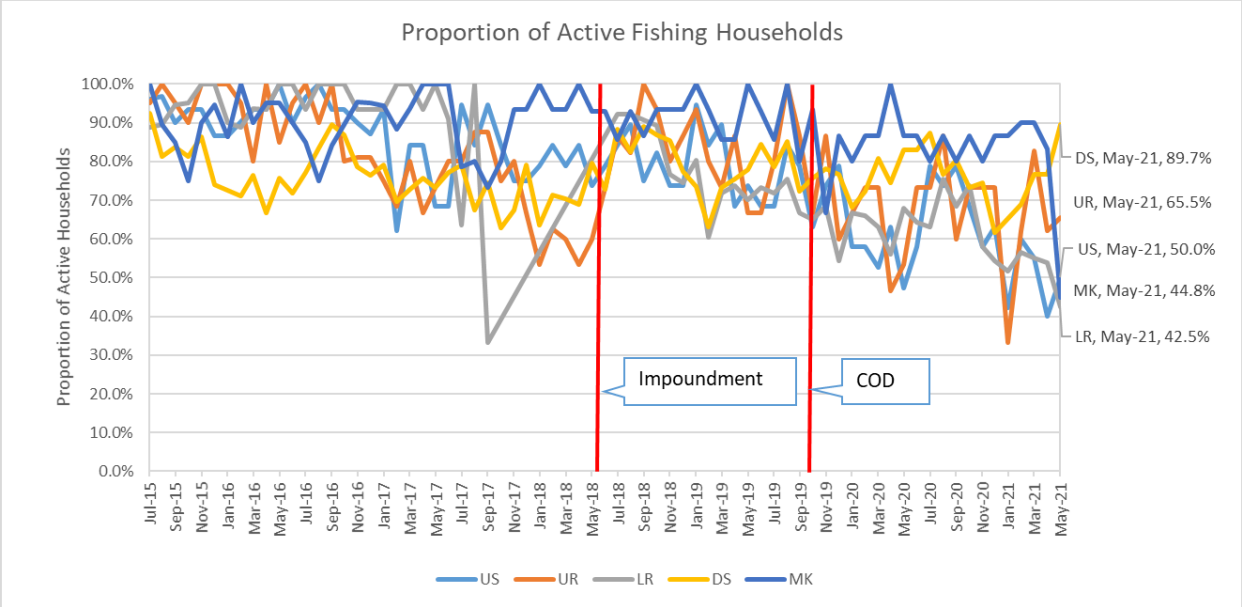
Biodiversity Indicators	Mekong	Below dam	Above dam
Proportion for species groups	23.40%	50.84%	54.58%
Diversity index (Shannon)	2.7413	2.9194	2.7307

Table 3-6: Main Biodiversity Indicators for May 2021

Biodiversity Indicators	Mekong	Below dam	Above dam
Total species and groups	22	30	31
Single species	17	17	18
Species groups	5	13	13
Top 15 species (% total catch weight)	96.44%	93.52%	92.50%
Proportion for species groups	15.31%	80.90%	58.23%
Diversity index (Shannon)	2.4120	2.1394	2.7508

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 40% and 83% of active fishing households for all fishing zones in April 2021, and 40-90% in May 2021.

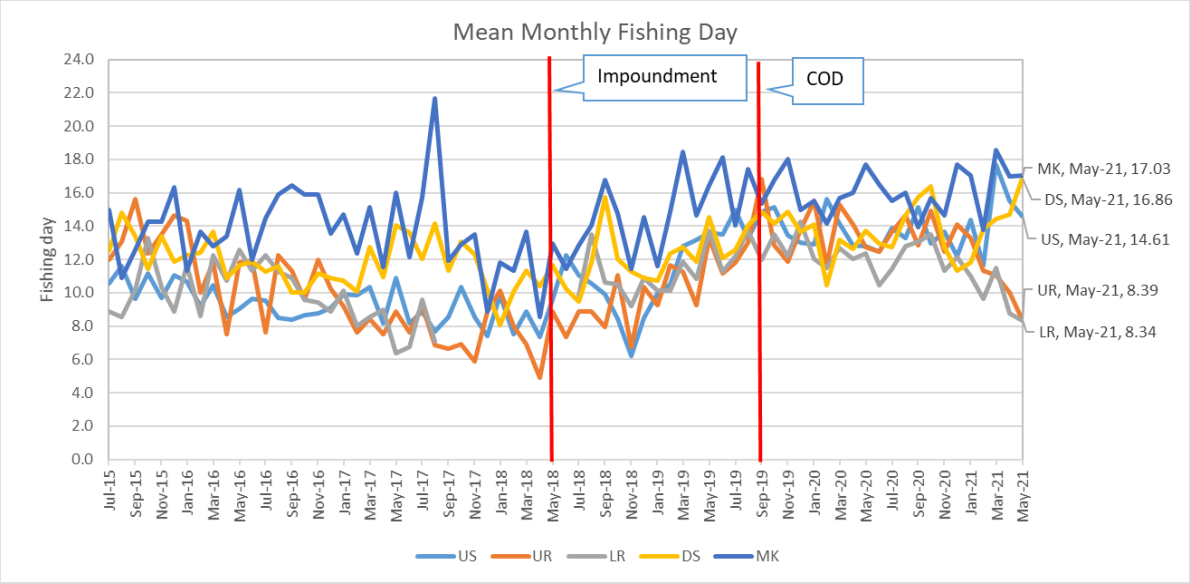
FIGURE 3-1: Proportion of total number of households actively fishing by fishing zone from July 2015 to May 2021



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 May 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 May 2021



The mean monthly number of fishing day in April and May from 2016 to 2021 for the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in ***Table 3-7*** and ***Table 3-8*** respectively.

Table 3-7: Mean reported number of fishing days by fishing zone in April

Fishing Zone	April 2016 (day)	April 2017 (day)	April 2018 (day)	April 2019 (day)	April 2020 (day)	April 2021 (day)
Upstream	8.57	8.14	7.35	13.19	12.86	15.54
Upper reservoir	7.50	7.50	4.90	9.23	14.08	10.00
Lower reservoir	10.71	9.00	0.00	10.82	12.05	8.78
Downstream	10.90	10.95	10.38	11.85	12.61	14.72
Mekong	13.39	11.54	8.57	14.64	16.00	16.97

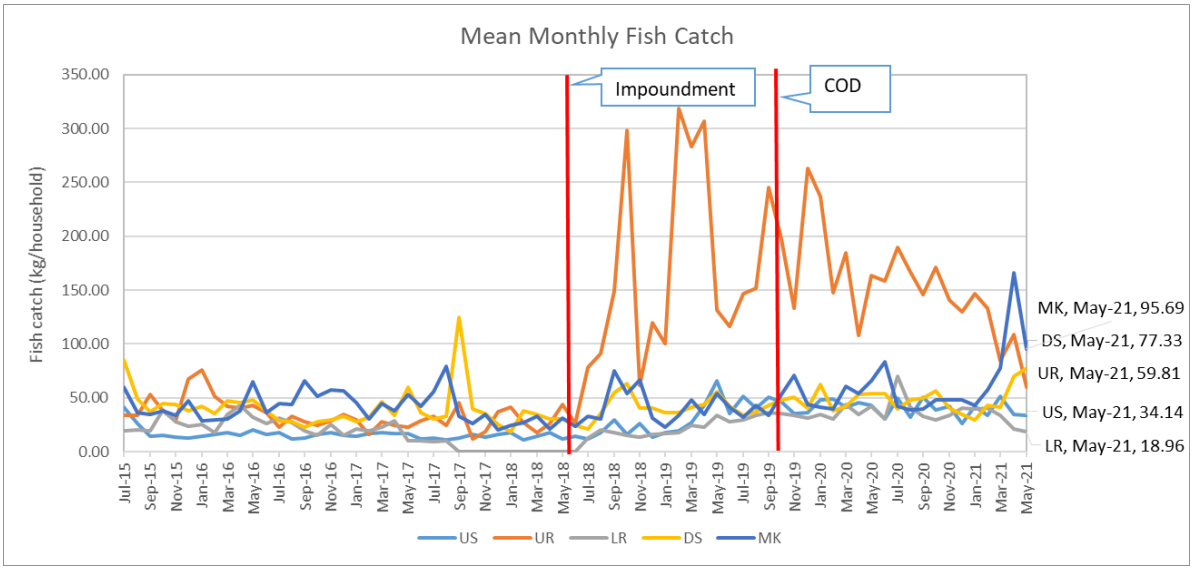
Table 3-8: Mean reported number of fishing days by fishing zone in May

Fishing Zone	May 2016 (day)	May 2017 (day)	May 2018 (day)	May 2019 (day)	May 2020 (day)	May 2021 (day)
Upstream	9.03	10.87	9.60	13.60	12.79	14.61
Upper reservoir	11.81	8.86	8.86	13.29	12.73	8.39
Lower reservoir	12.55	6.40	NA	13.73	12.35	8.34
Downstream	11.65	14.02	11.65	14.55	13.74	16.86

Fishing Zone	May 2016 (day)	May 2017 (day)	May 2018 (day)	May 2019 (day)	May 2020 (day)	May 2021 (day)
Mekong	16.15	16.01	12.95	16.45	17.71	17.03

The mean monthly household fish catch from July 2015 to May 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 May 2021



The mean household fish catch for the month of April and May from 2016 to 2021 in the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in ***Table 3-9*** and ***Table 3-10.***

Table 3-9: Mean Monthly Household Fish Catch for the month of April from 2016 to 2021

Fishing Zone	April 2016 (kg)	April 2017 (kg)	April 2018 (kg)	April 2019 (kg)	April 2020 (kg)	April 2021 (kg)
Upstream	15.46	17.14	17.82	43.15	45.57	34.77
Upper reservoir	40.46	24.96	26.51	306.73	107.69	108.57
Lower reservoir	43.11	28.76	NA	22.68	34.89	21.49
Downstream	45.50	33.67	30.36	43.85	53.38	69.75
Mekong	38.49	38.31	21.10	34.46	54.20	165.96

Table 3-10: Mean Monthly Household Fish Catch for the month of May from 2016 to 2021

Fishing Zone	May 2016 (kg)	May 2017 (kg)	May 2018 (kg)	May 2019 (kg)	May 2020 (kg)	May 2021 (kg)
Upstream	20.35	17.11	11.66	66.14	43.55	34.14
Upper reservoir	43.36	22.81	43.93	131.31	163.25	59.81
Lower reservoir	32.00	10.04	NA	34.12	42.62	18.96
Downstream	48.41	59.99	30.64	55.57	53.70	77.33
Mekong	65.23	53.65	30.93	54.44	66.12	95.69

The mean daily fish catch per household from July 2015 to May 2021 are displayed in ***Figure 3-4*** and the mean fish catch per household per fishing day for the month of April and May from 2016 to 2021 are shown in ***Table 3-11*** and ***Table 3-12.***

FIGURE 3-4: Mean Daily Fish Catch per Household from July 2015 to May 2021

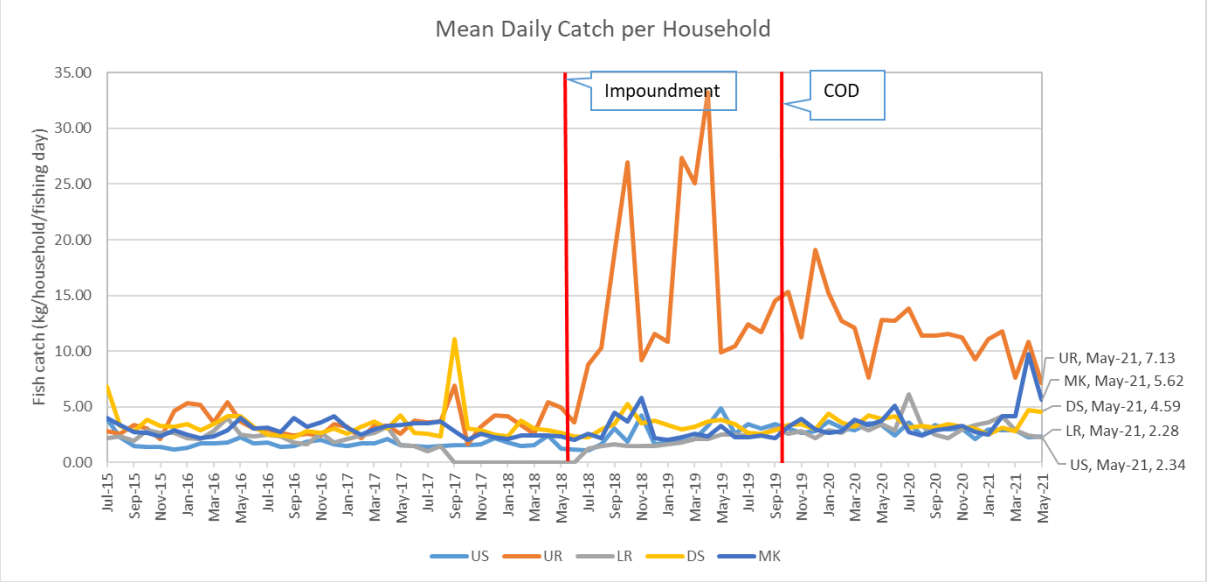


Table 3-11: Mean Daily Fish Catch per Household for the month of April from 2016 to 2021

Fishing Zone	April 2016 (kg)	April 2017 (kg)	April 2018 (kg)	April 2019 (kg)	April 2020 (kg)	April 2021 (kg)
Upstream	1.80	2.11	2.43	3.27	3.54	2.24
Upper reservoir	5.40	3.33	5.41	33.23	7.65	10.86
Lower reservoir	4.02	3.20	NA	2.10	2.89	2.45

Fishing Zone	April 2016 (kg)	April 2017 (kg)	April 2018 (kg)	April 2019 (kg)	April 2020 (kg)	April 2021 (kg)
Downstream	4.18	3.07	2.93	3.70	4.23	4.74
Mekong	2.87	3.32	2.46	2.35	3.39	9.78

Table 3-12: Mean Daily Fish Catch per Household for the month of May from 2016 to 2021

Fishing Zone	May 2016 (kg)	May 2017 (kg)	May 2018 (kg)	May 2019 (kg)	May 2020 (kg)	May 2021 (kg)
Upstream	2.25	1.57	1.22	4.86	3.40	2.34
Upper reservoir	3.67	2.58	4.96	9.88	12.82	7.13
Lower reservoir	2.55	1.57	NA	2.49	3.45	2.28
Downstream	4.15	4.28	2.63	3.82	3.91	4.59
Mekong	4.04	3.35	2.39	3.31	3.73	5.62

The survey results in April 2021 found Nam Ngiep is the main fishing habitat for upstream and downstream zone, while the main fishing habitat in upper reservoir, lower reservoir and Mekong zones are reservoir, tributaries and streams and Mekong respectively. In May 2021, the proportion of fish catch in Mekong decreased moderately for downstream and Mekong zones, then it shifted to Nam Ngiep and wetland due to fishing with boat in Mekong was restricted according to the measures of Prevention, Control and Preparedness for the COVID-19. While the main habitat of upper reservoir and lower reservoir zones are reservoir and tributaries and streams respectively. On the other hand, tributaries and streams become slightly more important than Nam Ngiep for upstream zone. The proportion of fishing habitats in April and May 2021 are displayed in ***Table 3-13*** and ***Table 3-14***.

Table 3-13: Proportion of the catch reported by main habitats (%) in April 2021

Habitats	US	UR	LR	DS	MK
Mekong	0.00%	0.00%	0.00%	18.59%	92.85%
Nam Ngiep	62.10%	6.27%	0.00%	45.44%	0.00%
Nam Xan	0.00%	0.00%	0.00%	0.00%	0.00%
Reservoir	0.00%	89.52%	20.04%	0.00%	0.00%
Tributary and stream	34.05%	4.21%	67.14%	22.60%	0.00%
Wetland	3.85%	0.00%	12.82%	2.14%	7.15%
Others	0.00%	0.00%	0.00%	11.22%	0.00%

Table 3-14: Proportion of the catch reported by main habitats (%) in May 2021

Habitats	US	UR	LR	DS	MK
Mekong	0.00%	0.00%	0.00%	0.00%	53.33%
Nam Ngiep	44.49%	22.29%	0.00%	73.37%	15.45%
Nam Xan	0.00%	0.00%	0.00%	0.00%	0.00%
Reservoir	0.00%	66.87%	19.23%	0.00%	0.00%
Tributary and stream	55.51%	10.83%	63.19%	24.87%	0.00%
Wetland	0.00%	0.00%	17.58%	1.76%	31.22%
Others	0.00%	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 May 2021 are presented in ***Figure 3-5*** and the proportion of OAA catch for the month of April and May from 2016 to 2021 are shown in ***Table 3-15*** and ***Table 3-16.***

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 May 2021

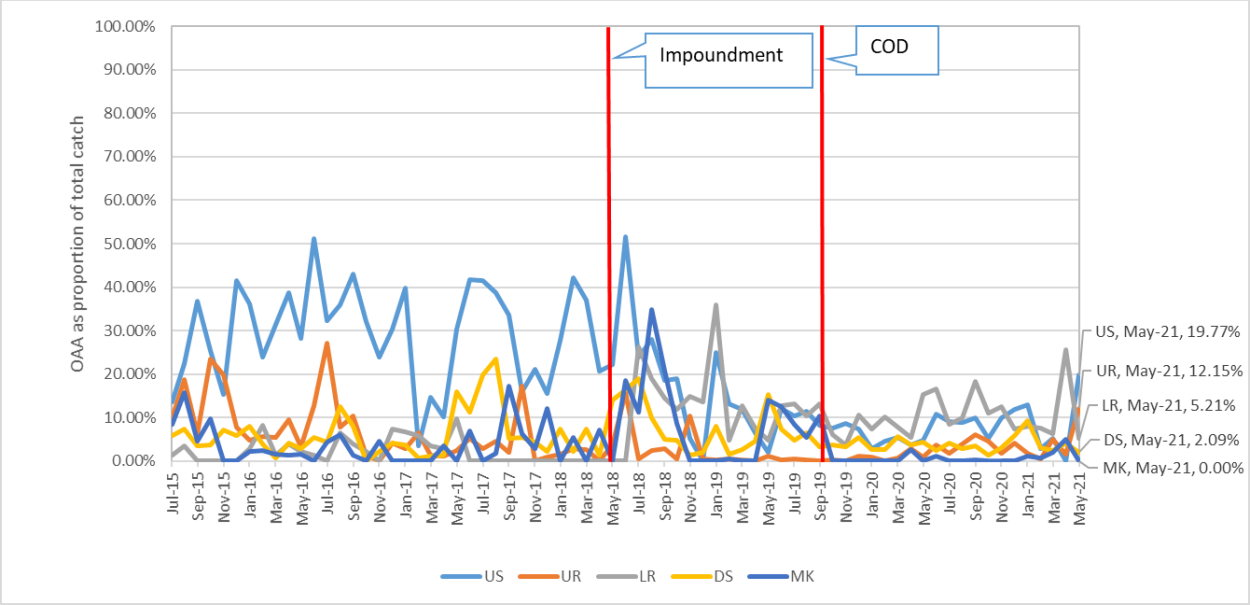


Table 3-15: Proportion of OAA to the total reported number of fish and OAA for the month of April from 2016 to 2021

Fishing Zone	April 2016 (kg)	April 2017 (kg)	April 2018 (kg)	April 2019 (kg)	April 2020 (kg)	April 2021 (kg)
Upstream	38.71%	10.11%	20.71%	6.43%	3.77%	0.00%
Upper reservoir	9.58%	1.06%	0.00%	0.16%	2.92%	1.49%
Lower reservoir	3.98%	2.89%	0.00%	7.68%	5.51%	25.69%
Downstream	4.23%	1.39%	1.32%	4.61%	3.65%	4.07%
Mekong	1.30%	3.57%	7.11%	0.00%	2.57%	5.10%

Table 3-16: Proportion of OAA to the total reported number of fish and OAA for the month of May from 2016 to 2021

Fishing Zone	May 2016 (kg)	May 2017 (kg)	May 2018 (kg)	May 2019 (kg)	May 2020 (kg)	May 2021 (kg)
Upstream	28.14%	30.33%	22.17%	2.11%	4.84%	19.77%
Upper reservoir	3.21%	2.37%	3.69%	1.23%	1.04%	12.15%
Lower reservoir	2.14%	9.73%	0.00%	4.73%	15.23%	5.21%
Downstream	2.83%	15.89%	13.96%	15.41%	4.39%	2.09%
Mekong	1.61%	0.00%	0.00%	13.99%	0.00%	0.00%

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-Jun-21	pH	5.0 - 9.0					6.85	6.67						
2-Jun-21	pH	5.0 - 9.0							6.98	7.17	7.52	6.86	6.86	7.12
8-Jun-21	pH	5.0 - 9.0					6.67	6.65						
9-Jun-21	pH	5.0 - 9.0							6.75	6.81	6.88	6.97	7.09	6.85
15-Jun-21	pH	5.0 - 9.0					6.74	6.5						
16-Jun-21	pH	5.0 - 9.0							6.52	6.4	7.02	6.98	6.7	6.63
22-Jun-21	pH	5.0 - 9.0					6.86	7.02						
23-Jun-21	pH	5.0 - 9.0							7.79	6.97	6.65	6.65	6.95	6.78
28-Jun-21	pH	5.0 - 9.0	6.64											
29-Jun-21	pH	5.0 - 9.0					6.95	7						
30-Jun-21	pH	5.0 - 9.0							6.62	6.71	6.96	6.94	7.25	6.99
1-Jun-21	Sat. DO (%)						83.9	91.5						
2-Jun-21	Sat. DO (%)								30.7	20.5	31.7	35.9	61	67.7
8-Jun-21	Sat. DO (%)						84	82.4						
9-Jun-21	Sat. DO (%)								32.8	39.7	87.5	81.6	82.1	80.2
15-Jun-21	Sat. DO (%)						76	75.6						
16-Jun-21	Sat. DO (%)								47.6	58.2	52.6	55.3	63.3	69.5
22-Jun-21	Sat. DO (%)						96.1	93.8						
23-Jun-21	Sat. DO (%)								12.7	29.8	28.2	36.7	63.5	67.2
28-Jun-21	Sat. DO (%)		88.9											
29-Jun-21	Sat. DO (%)						96.4	59.3						
30-Jun-21	Sat. DO (%)								17.3	50.5	81.2	74.4	78.2	71.9
1-Jun-21	DO (mg/L)	>6.0					6.16	6.74						
2-Jun-21	DO (mg/L)	>6.0							2.51	1.67	2.58	2.89	4.85	5.36
8-Jun-21	DO (mg/L)	>6.0					6.26	6.21						
9-Jun-21	DO (mg/L)	>6.0							2.27	3.28	7.19	6.61	6.67	6.49
15-Jun-21	DO (mg/L)	>6.0					5.88	5.85						
16-Jun-21	DO (mg/L)	>6.0							3.93	4.78	4.32	4.54	5.16	5.63
22-Jun-21	DO (mg/L)	>6.0					7.12	6.98						
23-Jun-21	DO (mg/L)	>6.0							1.06	2.46	2.35	3	5.16	5.42
28-Jun-21	DO (mg/L)	>6.0	7.38											
29-Jun-21	DO (mg/L)	>6.0					7.29	4.59						
30-Jun-21	DO (mg/L)	>6.0							1.44	4.07	6.67	6.06	6.27	5.81
1-Jun-21	Conductivity (µs/cm)						71	71						
2-Jun-21	Conductivity (µs/cm)								82	81	81	81	80	79
8-Jun-21	Conductivity (µs/cm)						69	68						
9-Jun-21	Conductivity (µs/cm)								83	81	81	78	60	55
15-Jun-21	Conductivity (µs/cm)						71	69						
16-Jun-21	Conductivity (µs/cm)								67	65	67	68	71	65
22-Jun-21	Conductivity (µs/cm)						71	70						
23-Jun-21	Conductivity (µs/cm)								82	80	83	86	80	79
28-Jun-21	Conductivity (µs/cm)		83											

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		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												
29-Jun-21	Conductivity (µs/cm)						71	71						
30-Jun-21	Conductivity (µs/cm)								85	75	81	89	63	52
1-Jun-21	Temperature (°C)						31.74	31.66						
2-Jun-21	Temperature (°C)								25.58	25.88	25.94	26.15	27.3	27.6
8-Jun-21	Temperature (°C)						30.77	30.17						
9-Jun-21	Temperature (°C)								25.36	25.43	25.61	25.95	25.94	26.05
15-Jun-21	Temperature (°C)						28.81	28.78						
16-Jun-21	Temperature (°C)								25.12	25.3	25.31	25.49	25.68	26.45
22-Jun-21	Temperature (°C)						31.02	30.89						
23-Jun-21	Temperature (°C)								25.07	25.67	25.3	25.77	26.06	26.38
28-Jun-21	Temperature (°C)		24.73											
29-Jun-21	Temperature (°C)						29.69	28.67						
30-Jun-21	Temperature (°C)								24.74	65.65	25.4	25.71	26.62	26.81
1-Jun-21	Turbidity (NTU)						1.04	0.92						
2-Jun-21	Turbidity (NTU)								0.93	1.97	1.83	1.06	1.36	2.54
8-Jun-21	Turbidity (NTU)						1.18	1.08						
9-Jun-21	Turbidity (NTU)								1.85	11.9	22.9	32.2	26.2	27.3
15-Jun-21	Turbidity (NTU)						1.35	1.19						
16-Jun-21	Turbidity (NTU)								1.24	1.32	1.84	2.98	4.08	3.3
22-Jun-21	Turbidity (NTU)						0.79	0.68						
23-Jun-21	Turbidity (NTU)								1.12	1.4	1.16	1.44	1.57	2.01
28-Jun-21	Turbidity (NTU)		18.9											
29-Jun-21	Turbidity (NTU)						1.02	0.88						
30-Jun-21	Turbidity (NTU)								6.03	4.55	2.7	5.58	5.66	10.03
8-Jun-21	TSS (mg/L)						<5	<5						
9-Jun-21	TSS (mg/L)								<5	17.4	58.14	50.25	75.14	57.67
8-Jun-21	BOD_5 (mg/L)	<1.5					<1	<1						
9-Jun-21	BOD_5 (mg/L)	<1.5							<1	<1	<1	<1	<1	<1
8-Jun-21	Faecal coliform (MPN/100 mL)	<1,000					4	0						
9-Jun-21	Faecal coliform (MPN/100 mL)	<1,000							0	8	540	920	1,600	1,600
8-Jun-21	Total Coliform (MPN/100 mL)	<5,000					4	13						
9-Jun-21	Total Coliform (MPN/100 mL)	<5,000							23	23	920	1,600	1,600	1,600
8-Jun-21	Turbidity (NTU)-bottom						0.96	1.06						
8-Jun-21	TSS (mg/L)-bottom						<5	<5						
8-Jun-21	BOD_5 (mg/L)-bottom						<1	<1						
8-Jun-21	Total Coliform (MPN/100 mL)-bottom						2	0						
8-Jun-21	Faecal coliform (MPN/100 mL)-bottom						0	0						

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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-Jun-21	pH	5.0 - 9.0			6.98	6.96
9-Jun-21	pH	5.0 - 9.0			7.14	7.24
16-Jun-21	pH	5.0 - 9.0			7.21	7.1
23-Jun-21	pH	5.0 - 9.0			7.11	7.08
28-Jun-21	pH	5.0 - 9.0	7.56			
29-Jun-21	pH	5.0 - 9.0				
30-Jun-21	pH	5.0 - 9.0			7.07	7.21
2-Jun-21	Sat. DO (%)				42.6	64.4
9-Jun-21	Sat. DO (%)				81.1	79
16-Jun-21	Sat. DO (%)				77.3	80.7
23-Jun-21	Sat. DO (%)				77.2	84.4
28-Jun-21	Sat. DO (%)		93.5			
29-Jun-21	Sat. DO (%)					
30-Jun-21	Sat. DO (%)				75.8	78.6
2-Jun-21	DO (mg/L)	>6.0			3.36	4.82
9-Jun-21	DO (mg/L)	>6.0			6.43	6.42
16-Jun-21	DO (mg/L)	>6.0			6.13	6.48
23-Jun-21	DO (mg/L)	>6.0			5.71	6.58
28-Jun-21	DO (mg/L)	>6.0	7.88			
29-Jun-21	DO (mg/L)	>6.0				
30-Jun-21	DO (mg/L)	>6.0			6.24	6.38
2-Jun-21	Conductivity (µs/cm)				99	46
9-Jun-21	Conductivity (µs/cm)				102	25
16-Jun-21	Conductivity (µs/cm)				103	32
23-Jun-21	Conductivity (µs/cm)				153	37
28-Jun-21	Conductivity (µs/cm)		31			
29-Jun-21	Conductivity (µs/cm)					
30-Jun-21	Conductivity (µs/cm)				140	16
2-Jun-21	Temperature (°C)				28.18	30.08
9-Jun-21	Temperature (°C)				27.2	25.74
16-Jun-21	Temperature (°C)				27.25	27.12
23-Jun-21	Temperature (°C)				31.22	28.22
28-Jun-21	Temperature (°C)		24.03			
29-Jun-21	Temperature (°C)					
30-Jun-21	Temperature (°C)				27.66	24.68
2-Jun-21	Turbidity (NTU)				2.38	4.46
9-Jun-21	Turbidity (NTU)				54.1	23.9
16-Jun-21	Turbidity (NTU)				14	2.54
23-Jun-21	Turbidity (NTU)				4.34	3.29
28-Jun-21	Turbidity (NTU)		12.8			
29-Jun-21	Turbidity (NTU)					
30-Jun-21	Turbidity (NTU)				9.6	23.15
9-Jun-21	TSS (mg/L)				87.9	26.84
9-Jun-21	BOD_5 (mg/L)	<1.5			<1	<1
9-Jun-21	Faecal coliform (MPN/100 mL)	<1,000			1,600	1,600
9-Jun-21	Total Coliform (MPN/100 mL)	<5,000			1,600	1,600

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

	Site Name	OSOV1 (Owner's Site Office and Village)		OSOV2 (ESD Camp)		Main Powerhouse	
	Station Code	EF01		EF13		EF19	
	Date	04-Jun-21	14-Jun-21	04-Jun-21	14-Jun-21	04-Jun-21	17-Jun-21
Parameters (Unit)	**Guideline**						
pH	6.0 - 9.0	6.76	6.87	7.82	6.74		6.85
Sat. DO (%)		28.7	44.3	6.21	19.2		79.4
DO (mg/L)		1.89	3.5	1.22	1.51		6.01
Conductivity (µs/cm)		492	297	630	383		1,113
TDS (mg/L)		246	148.5	315	191.5		556.5
Temperature (°C)		29.02	27.06	27.22	28.14	No	29.72
Turbidity (NTU)		11.2	2.13	9.01	4.4	Discharge	14.7
TSS (mg/L)	<50	12.66	6.4	7.4	13.7		54.9
BOD_5 (mg/L)	<30	32.99	17.23	<6	26.4		<6
COD (mg/L)	<125	n/a	n/a	n/a	n/a		n/a
NH_3-N (mg/L)	<10.0	n/a	n/a	n/a	n/a		n/a
Total Nitrogen (mg/L)	<10.0	n/a	n/a	n/a	n/a		n/a
Total Phosphorus (mg/L)	<2	n/a	n/a	n/a	n/a		n/a
Oil & Grease (mg/L)	<10.0	n/a	n/a	n/a	n/a		n/a
Total coliform (MPN/100 mL)	<400	54,000	13,000	0	35,000		0
Faecal Coliform (MPN/100 mL)	<400	54,000	7,900	0	24,000		0
Effluent Discharge Volume (L/mn)		20	6	6	5		1650
Chlorination Dosing Rate (mL/mn)		n/a	n/a	7.00			410
Residual Chlorine (mg/L)	<1.0	n/a	n/a	0.95	0.06		0.82