

Clowhom Project Water Use Plan

Monitoring Programs

Annual Report: 2019

Implementation Period: May 2018 to April 2019

- **COMMON-1 Monitor of Aquatic Wildlife in Wetlands Affected by Dam Operations**
- **COMMON-2 Role of Littoral Zone in Governing Clowhom Reservoir Productivity Capacity**
- **COMMON-3 Validation of the Effective Littoral Zone Performance Measure**
- **COMMON-4 Archaeological Sites Monitoring**

For Water Licences 120562, 120565, and Conditional Water Licence 119822

May 31, 2019

BC Hydro Clowhom Project Water Use Plan Monitoring Programs Annual Report: 2019

1 Introduction

This document represents a summary of the status and the results of the Clowhom Project Water Use Plan (WUP) monitoring programs to April 30, 2019, as per the Clowhom Order under the *Water Act*, dated April 20, 2005. There are four monitoring programs.

2 Status

The following table outlines the dates that Terms of Reference (TOR) for the Clowhom Project WUP monitoring programs were submitted to and approved by the Comptroller of Water Rights (CWR).

Leave to commence was not received for the COMMON-4 Archaeological Sites Monitoring TOR. As per the October 28, 2005 letter, this work proceeded under the *Heritage Conservation Act*.

Table: 2-1: Dates of Clowhom Project WUP TOR Submissions and Approvals by the Comptroller of Water Rights

Monitoring Program TORs	Order Clause	Original ToR Submission		Most Recent ToR Resubmission	
		Date Submitted	Date Approved	Date Submitted	Date Approved
COMMON-1 Monitor of Aquatic Wildlife in Wetlands Affected by Dam Operations	Schedule A.1.a	Sep 23, 2005	Oct 28, 2005	Feb 28, 2019	Mar 27, 2019
COMMON-2 Role of Littoral Zone in Governing Clowhom Reservoir Productivity Capacity	Schedule A.1.b	Sep 23, 2005	Oct 28, 2005	Apr 02, 2015	Apr 23, 2015
COMMON-3 Validation of the Effective Littoral Zone Performance Measure	Schedule A.1.c	Sep 23, 2005	Oct 28, 2005		
COMMON-4 Archaeological Sites Monitoring	Schedule A.2	Sep 23, 2005	Oct 28, 2005		

3 Schedule

The following table outlines the current schedule for the monitoring programs being delivered for the Clowhom Project WUP.

Table 3-1: Monitoring Programs Schedule as of April 30, 2019

Monitoring Program	Study	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
		WLR YR1	WLR YR2	WLR YR3	WLR YR4	WLR YR5	WLR YR6	WLR YR7	WLR YR8	WLR YR9	WLR YR10	WLR YR11	WLR YR12	WLR YR13	WLR YR14	WLR YR15	WLR YR16	WLR YR17	WLR YR18	WLR YR19	WLR YR20	
COMMON-1 Monitor of Aquatic Wildlife in Wetlands Affected by Dam Operations	Wildlife Census	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	■	■	■	■	■	■	■	■
	Air Photography	✓				✓	✓				X ¹	✓				■						■
COMMON-2 Role of Littoral Zone in Governing Clowhom Reservoir Productive Capacity	Fish Survey	✓		✓	✓	✓	✓				X ¹	✓				■						■
	Juvenile Habitat Use Survey		X	✓	X	✓	✓					✓F										
COMMON-3 Validation of the Effective Littoral Zone Performance Measure		✓	✓	✓	✓	✓	✓				X ¹	✓	✓			■						■
COMMON-4 Archaeological Sites Monitoring			X	✓	✓F																	

Legend: ■ = Project to be undertaken in identified year
 ✓ = Project is completed for the year
 x = Encountered operational or hydrological delays
 X¹ = Work delayed due to program review
 ✓F = All field work for this project is complete. No further field work is planned.

4 Monitoring Programs Terms of Reference

The monitoring programs being implemented under the Clowhom Project WUP are described in Terms of Reference (TOR). These TOR and the reports for work completed to date can be found here:

http://www.bchydro.com/toolbar/about/sustainability/conservation/water_use_planning/lower_mainland/clowhom.html

5 Status of Monitoring Programs

5.1 COMMON-1 Monitor of Aquatic Wildlife in Wetlands Affected by Dam Operations

The objective of this project is to determine to what extent the ecology (e.g., species diversity) in the wetland at upper end of Clowhom Falls Reservoir is linked to the operation of the reservoir. The wildlife census component of this monitoring program was initiated in 2006 and will be carried out annually over 20 years. A TOR revision to adjust the study geographic scope and refine the approach to focus on amphibians and ground nesting birds was approved in early 2019 within the already approved budget. The wildlife census field work scheduled for 2018 was completed.

The Year 12 (2017) report, dated March 31, 2018, is attached. The Year 13 report is currently being drafted and will be submitted with the 2020 annual report.

5.2 COMMON-2 Role of Littoral Zone in Governing Clowhom Reservoir Productivity Capacity

The objective of this 20-year monitoring program is to track changes in fish productivity through sampling of rearing populations. This program was developed and implemented in 2006 to measure if fish productivity has decreased.

Fish surveys occurred in alternate years from 2006 to 2010 and are scheduled to occur at five-year intervals thereafter. The last survey was completed in September 2016. The draft report for Year 10 (2016) has been reviewed by BC Hydro. We are expecting the Year 10 report to be finalized and submitted with the 2020 annual report.

5.3 COMMON-3 Validation of the Effective Littoral Zone Performance Measure

The objective of this program is to detect changes in the reservoir littoral zone (e.g. the part of the reservoir close to shore) and compare these changes to model predictions validating performance measures for the different reservoir operational alternatives.

This monitoring program was initiated in 2006 with data collection occurring every year until 2010. The sampling period was successful and provided enough data to facilitate the evaluation the Effective Littoral Zone (ELZ) Model. However, by 2015 BC Hydro began to re-evaluate the validity of the Effective Littoral Zone Model (ELZ) for Clowhom due to results on other BC Hydro reservoirs. Review and analysis of results on Clowhom Reservoir in comparison to other reservoirs

was completed in 2018 and concluded that littoral production had little effect on fish condition, in this case rainbow and cutthroat trout. Modelling was completed in 2018 and compiled in a 10-year summary report. The final monitoring report dated August 9, 2018 is attached.

The project is now complete but the TOR identified that data analysis should continue at five-year intervals after 2010. A letter will be submitted in 2019 to the CWR stating this project is now complete, and the five-year intervals of data analysis scheduled in the TOR are not required to conclude the study.

5.4 COMMON-4 Archaeological Sites Monitoring

This monitoring program was initiated in 2008, was carried out over two years. The objective of this program was to collect additional information about condition and location of sites in the drawdown zone and to monitor site specific impacts due to reservoir operations.

This project is complete.

6 Monitoring Programs Costs

The following table summarizes the Clowhom Project WUP monitoring programs costs approved by the CWR and the Actual Costs to April 30, 2019.

Table 6-1: Clowhom Project WUP Monitoring Program Costs

Monitoring Programs	Costs approved by CWR	Life to Date Actuals (LTD)	Estimated to Complete (Forecast)	Total Forecast (LTD and Forecast)	Variance Total to Approved	Explanation	Corrective Action
Clowhom WUP Annual Report	\$43,186	\$14,563	\$12,091	\$26,654	\$16,532		
COMM01A Mon Aquatic Wildlife	\$364,673	\$201,605	\$155,013	\$356,618	\$8,055	Effeciencies found during project implementation.	None
COMM01A Mon Aquatic Wildlife - ONR DM	\$174,773	\$60,644	\$39,033	\$99,678	\$75,095		
COMM01A Mon Aquatic Wildlife - ONR Imp	\$189,900	\$140,960	\$115,980	\$256,940	(\$67,040)		
COMM02A Role Littoral Zone	\$188,424	\$106,239	\$61,581	\$167,820	\$20,604	Effeciencies found during project implementation.	None
COMM02A Role Littoral Zone - ONR DM	\$85,324	\$33,274	\$25,761	\$59,035	\$26,289		
COMM02A Role Littoral Zone - ONR Imp	\$103,100	\$72,965	\$35,820	\$108,785	(\$5,685)		
COMM03A Valid Littoral Zone	\$155,909	\$125,651	\$1,680	\$127,331	\$28,578	Effeciencies found during project implementation.	None
COMM03A Valid Littoral Zone - ONR DM	\$57,909	\$19,432	\$1,680	\$21,112	\$36,797		
COMM03A Valid Littoral Zone - ONR Imp	\$98,000	\$106,219		\$106,219	(\$8,219)		
COMM04A Archaeological Sites	\$0	\$7,350		\$7,350	(\$7,350)	Project Completed.	None
COMM04A Archaeological Sites - ONR DM	\$0	\$6,681		\$6,681	(\$6,681)		
COMM04A Archaeological Sites - ONR Imp	\$0	\$669		\$669	(\$669)		

OR - Ordered Remissible
ONR - Ordered Non-Remissible

* Red values in parentheses denote overage.