

## **Clowhom Project Water Use Plan**

### **Monitoring Programs Annual Report: 2007**

- **Monitor of Aquatic Wildlife in Wetlands Affected by Dam Operations**
- **Role of Littoral Zone in Governing Clowhom Reservoir Productive Capacity**
- **Validation of the Effective Littoral Zone Performance Measure**
- **Archaeological Sites Monitoring**

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

**31 May 2007**

## **BC Hydro Clowhom Project Water Use Plan Monitoring Programs Annual Report: 2007**

### **1 Introduction**

This document is a summary of the status and results of the Clowhom Project Water Use Plan (WUP) monitoring programs to April 2007, as per the Clowhom Order, dated 20 April 2005, under the *Water Act*. There are four monitoring programs including:

- a) Monitor of Aquatic Wildlife in Wetlands Affected by Dam Operations
- b) Role of Littoral Zone in Governing Clowhom Reservoir Productive Capacity
- c) Validation of the Effective Littoral Zone Performance Measure
- d) Archaeological Sites Monitoring

The terms of reference (TOR) for the monitoring programs a, b and c listed above, were accepted by the provincial Comptroller of Water Rights (Comptroller) on 28 October 2005. Attached are copies of the Year 1 individual annual reports for these monitoring studies.

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

### **2 Background**

The water use planning process for BC Hydro's Clowhom project was initiated in May 2002 and completed in May 2003. The conditions proposed in the WUP for the operation of the project reflect the March 2003 recommendations of the WUP Consultative Committee.

In April 2005, the Clowhom WUP was submitted to the Comptroller.

On 20 April 2005, BC Hydro was ordered to implement the conditions proposed in the Clowhom WUP and prepare the monitoring programs TOR.

On 23 September 2005, the Clowhom WUP monitoring programs TOR were submitted to the Comptroller for review and approval.

On 28 October 2005, the Comptroller accepted the TOR for 3 monitoring programs.

As stated in the Clowhom WUP (2003) a comprehensive evaluation report of the monitoring programs will be issued after 10 years. The Clowhom WUP will be reviewed 20 years from the date (7 April 2005) of approval of the Plan by the Comptroller.

### **3 Status**

The following table outlines the status and schedule for the Clowhom WUP monitoring programs.

**Table 3-1: Status of Clowhom WUP Monitoring Programs Implementation**

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 YR17	WLR YR20
Monitor of Aquatic Wildlife in Wetlands Affected by Dam Operations	Wildlife Census	✓	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Air Photography	✓				■					■					■					■
Role of Littoral Zone in Governing Clowhom Reservoir Productive Capacity	Fish Creel Census Analysis		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Fish Survey	✓		■		■					■					■					■
	Juvenile Habitat Survey		■																		
Validation of the Effective Littoral Zone Performance Measure		✓	■	■	■	■					■					■					■
Archaeological Sites Monitoring			■	■	■																

Legend: □ = Project timing subject to change according to maintenance schedule  
 ■ = Project to be undertaken/initiated in identified year  
 UW = Project is underway  
 ✓ = Project is complete for the year

## **4 Summary of Clowhom WUP Monitoring Programs**

This section outlines the status of the Clowhom WUP monitoring programs as per the Order under the *Water Act* dated 20 April 2005.

### **4.1 Monitor of Aquatic Wildlife in Wetlands Affected by Dam Operations**

#### **4.1.1 Overview**

The objective of this program is to measure wildlife and vegetation community diversity and abundance in the wetlands affected by dam operations.

A performance measure to track the effects of operating alternatives on aquatic wildlife in Clowhom valley could not be completed within the timeline of the water use planning process due to the complex channel hydraulics and hydrology of the upper Clowhom Lake Reservoir watershed. Rather than pursue the development of such a performance measure, the Consultative Committee recommended that monitoring be carried out to track wildlife impacts following implementation of the WUP in an adaptive management framework. Knowledge gained during the monitoring period will be used to develop an alternative operation in the future for a second treatment effect.

Monitoring Indicators (a): Index of wildlife diversity and abundance

(b): Index of vegetation community diversity and abundance

The program is comprised of annual field reconnaissance surveys and aerial photography.

#### **4.1.2 Status**

This monitoring program was initiated in June 2006 and will be carried out over 20 years. The first year program report is attached.

#### **4.1.3 Interpretation of Data**

The first year of the monitoring program resulted in the identification of transects through out the wet land area and the installation of recording instrumentation. Wildlife surveys were carried out in June and October where wildlife use data were collected. No analysis was done as there were too little data to draw meaningful conclusions (i.e., only 2 months on an entire yearly cycle have been sampled). Diversity and abundance indices cannot be calculated until at least one full season (or yearly cycle) of data has been collected.

Ortho-rectified air photos of the wetland complex were collected in July 2006 for comparison to the 1998 air photo series. Vegetation polygons were identified using the Ministry of Forests vegetation typing procedure in both air photo sets. Though there is insufficient data for statistical analysis at this time, a subjective comparison of the two air photo sets and corresponding vegetation polygons show clear evidence of successional growth since 1998. The 2006 polygon data will serve as the baseline for comparison in future years. An index of vegetation community diversity and abundance was not calculated at the time of the report.

## 4.2 Role of Littoral Zone in Governing Clowhom Reservoir Productive Capacity

### 4.2.1 Overview

The objective of this program is to test the validity of the premise that a decrease in reservoir fish productivity is the result of an operations-related loss of littoral habitat, by tracking changes in relative fish abundance and simple health metrics through time.

During the Clowhom Project water use planning process, a decrease in reservoir fish productivity was noted since the impoundment of Clowhom Lake Reservoir for power generation (Bruce, 2003)<sup>1</sup>. For the purposes of the WUP, it was assumed that the loss was the result of an operations-related loss of littoral habitat and that restoring the littoral zone would lead to improved fish productivity. Evidence supporting this assumption however is weak. In addition, there is a competing hypothesis that suggests a loss of marine derived nutrients brought in by a historic run of sockeye salmon may be the dominant causal factor. The Consultative Committee recommended that a monitoring program be carried out to test the littoral zone hypothesis as part of a larger study to assess the role of each hypothesis.

Monitoring Indicators (a): Relative abundance of salmonid species

(b): Size at age

(c): Fish condition

The program is comprised of three parts:

- a) An annual Creel census of all Clowhom Lodge guests and others who regularly visit or fish the Clowhom Lake Reservoir to track fishing effort and success.
- b) A bi-annual fish survey for the first five years that uses the same methodology as the Fish Studies (Bruce, 2003c)<sup>2</sup> to quantify relative changes in fish condition, abundance, and diversity.
- c) A juvenile habitat use survey of Clowhom Lake Reservoir and Clowhom River habitats to determine where juvenile salmonids rear in the system, and hence assess impacts of operations.

### 4.2.2 Status

This program was initiated in June 2006 and will be carried out over 20 years. The first program report is attached.

### 4.2.3 Interpretation of Data

Species composition of fish caught in 2006 was identical to that observed by Bruce (2004), as was the pattern of catch which identified cutthroat trout as being primarily

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<sup>1</sup> Bruce, J.A. 2003. Habitat use characteristics of obligate and facultative aquatic wildlife in the Campbell River project area. Technical Note to Campbell River WUP Wildlife Technical Committee. 8 February, 2002, BC Hydro, Water Use Plans, Burnaby, BC [File No. WUP-JHT-TN-W03].

<sup>2</sup> Bruce, J.A. 2003c. Results of Fish Studies. Technical Prepared for Clowhom WUP Fish Technical Committee. B.C. Hydro Report No. COM-TN-002. 17 pp.

deepwater piscivores, rainbow trout as shoreline predators, and kokanee as open-water planktivores. Prickly sculpin and three-spined sticklebacks were the other two species captured. Of all the species sculpins were the most abundant. The abundance of salmonids caught in 2006 was considerably less than that reported by Bruce (2004). Whether this is by chance alone, or represents a pattern of decline cannot be determined at this time. Additional data will have to be collected.

Size at age and fish condition data were not compared to that reported by Bruce, the authors deciding to postpone that analysis until following the lake sampling session.

There was no recorded recreational fishing in the reservoir in 2006.

### **4.3 Validation of the Effective Littoral Zone Performance Measure**

#### **4.3.1 Overview**

The objective of this program is to track changes in littoral zone productivity through time, and compare them to Effective Littoral Zone model predictions as a method to validate the performance measures.

An effective littoral zone model was developed to predict changes in potential littoral productivity around the shoreline of Clowhom Lake Reservoir for a given reservoir-operating alternative. The model is conceptually new and has not been validated, but was one of the key performance measures used to evaluate the benefits of various operating alternatives.

Monitoring Indicator (a): Depth-integrated periphyton productivity

The program is comprised of field sampling of periphyton from three sites in the reservoir, laboratory work to estimate productivity and annual program reporting and a final report at the conclusion of the monitor.

#### **4.3.2 Status**

This program was initiated in June 2006 and will be carried out over five years. The first year program report is attached.

#### **4.3.3 Interpretation of Data**

The crew experienced a number of difficulties in developing, fabricating and installing the periphyton sampling plates. A functional apparatus was not completed until the end of the periphyton growing season (Nov/Dec). Severe storms and ice damage occurred over the dormant winter period, causing delay in data collection in spring. As a result, no data was collected in the first year of sampling. However, all sampling plates have been seeded over the winter period and a full year of periphyton biomass data is expected for next year.

### **4.4 Archaeological Site Monitoring**

#### **4.4.1 Overview**

The objective of this program is to:

- Test the broad assumptions made in developing the performance measures used in the assessment of trade-offs during the Clowhom water use planning process. For archaeology sites these assumptions include a hypothesis that Clowhom Lake Reservoir fluctuations damaged archaeological sites and that it is preferable for archaeological sites to remain inundated to protect them from erosion and theft. Archaeological sites have been recorded as impacted in the reservoir drawdown zone.
- Provide a more accurate assessment of the impacts of BC Hydro operations on known and potential sites.
- Assess the relative importance of potentially impacted sites.
- Assist in the development of proposals to mitigate impacts.

The monitoring study will be implemented in three phases; erosion monitoring system installation and archaeological site significance determination, erosion monitoring and reporting, and mitigation options assessment.

#### **4.4.2 Status**

A contract has been awarded for this program and it was expected that Phase 1 would commence in March 2007 during a scheduled draw-down; however, heavy precipitation in early March forced a re-scheduling of the draw-down and Phase 1 has not been implemented at this time. This program is scheduled to be initiated in August 2007 and the first program report is expected in April 2008.

This study is being conducted in accordance with a heritage inspection permit under Section 14 of the Heritage Conservation Act (*HCA*).

#### **4.4.3 Interpretation of Results**

At this time there is no data to interpret for this monitoring program.

### **5 Clowhom WUP Monitoring Programs Costs**

The following table summarizes the Clowhom WUP monitoring programs costs approved by the Comptroller on 28 October 2005 and the actual costs to 30 April 2007.

**Table 5-1: Clowhom WUP Monitoring Programs Costs**

Description		Costs Approved by Comptroller of Water Rights	Actual Costs to 30 April 2007
<b>Monitoring Programs</b>			
Monitor of Aquatic Wildlife in Wetlands Affected by Dam Operations	Direct Management	\$174,773	\$4,067
	Implementation	\$189,900	\$12,957
Role of Littoral Zone in Governing Clowhom Reservoir Productive Capacity	Direct Management	\$85,324	\$8,840
	Implementation	\$103,100	\$7,300
Validation of the Effective Littoral Zone Performance Measure	Direct Management	\$57,909	\$3,836
	Implementation	\$98,000	\$1,280
Archaeological Sites Monitoring	Direct Management		
	Implementation		