Clayton Falls Project Water Use Plan

Monitoring Program and Physical Work Annual Report: 2009

- **Aquatic Productivity**
- **Water Release and Measurement Device**

For Water Licences 120176 and 120177

31 July 2009

BC Hydro Clayton Falls Project Water Use Plan Monitoring Program and Physical Work Annual Report: 2009

1 Introduction

This document represents a summary of the status and the results of the Clayton Falls Water Use Plan (WUP) monitoring program and physical work to 30 June 2009, as per the Clayton Falls Order under the *Water Act,* dated 9 December 2004. There is one monitoring program and one physical work:

a) Aquatic Productivity

b) Water Release and Measurement Device

2 Background

The water use planning process for BC Hydro's Clayton Falls project was initiated in September 2002 and completed in April 2003. The conditions proposed in the WUP for the operation of the project reflect the July 2003 recommendations of the Clayton Falls WUP Consultative Committee.

In July 2003, the Clayton Falls WUP was submitted to the Comptroller of Water Rights (Comptroller).

On 9 December 2004, BC Hydro was ordered to implement the conditions proposed in the Clayton Falls WUP and prepare the monitoring program and physical works terms of reference (TOR).

On 15 August 2005, the Clayton Falls monitoring program TOR was submitted to the Comptroller for review and approval. On 16 September 2005, the TOR was accepted by the Comptroller.

On 28 October 2005, the Clayton Falls physical work TOR was submitted to the Comptroller for review and approval. On 8 December 2005, the TOR was accepted by the Comptroller.

On 6 May 2009, a Clayton Falls monitoring program TOR addendum was submitted to the Comptroller for review and approval. On 16 July 2009, the TOR addendum was accepted by the Comptroller.

As outlined in the Clayton Falls WUP, BC Hydro will review the results of the monitoring program five years after implementation of this WUP. A formal review of the WUP is recommended in ten years. A review of the WUP could be triggered sooner if significant risks are identified through the analysis of the monitoring results.

3 Status

The Physical Works has been completed and the Monitoring Program is nearing completion. BC Hydro will review the results of the monitoring program at the end of this year. Following the review BC Hydro will submit the final annual report of this

program to the Comptroller. The following table outlines the status and schedule for the Clayton Falls WUP monitoring program and physical work.

Table 3-1: Status of Clayton Falls WUP Monitoring Program and Physical Work Implementation

Monitoring Program	2005 WLR YR1	2006 WLR YR2	2007 WLR YR3	2008 WLR YR4	2009 WLR YR5 Interim Review
Aquatic Productivity	✓	✓	✓	✓	■
Physical Work					
Water Release and Measurement Device	✓				

Legend: ■ = Program to be undertaken/initiated in identified year
u/w = Project is underway
✓ = Program completed for the year

4 Clayton Falls WUP Monitoring Program

This section outlines the status of the Clayton Falls WUP monitoring program as per the Order under the *Water Act,* dated 9 December 2004.

4.1 Aquatic Productivity

4.1.1 Overview

The objective of this monitoring program is to assess the ecological benefits of the proposed flow release and to collect the information needed to help inform future decisions.

The Clayton Falls WUP Consultative Committee expressed concern that the lack of a guaranteed base flow in the mainstem channel between Clayton Falls and the confluence of the tailrace channel might affect the overwinter survival of fish and their invertebrate prey. To address this concern, the Consultative Committee recommended that the WUP include a 0.05 m^3/s minimum continuous flow release from the Clayton Falls Dam. Because of uncertainty regarding the benefits of this flow release to fish and their invertebrate prey, the Consultative Committee also recommended a monitoring program to assess the ecological response to the new flow regime.

Monitoring Indicators:
a) Invertebrate abundance.
b) Invertebrate community diversity.
c) Salmonid standing crop.

The monitoring program has three components:

1. Collect ecological information on salmonid abundance, invertebrate abundance, and invertebrate species diversity both prior to (one year) and during (three years) the flow release;

2. Assess changes in these measures pre and post flow release; and

3. Compare the salmonid abundance in reaches of Clayton Falls Creek with data from nearby, unregulated systems to assess the adequacy of changes and help to distinguish between natural variation and the effects of flow releases.

4.1.2 Status

This monitoring program was initiated in September 2005 and was carried out over four years. The first program report was received in December 2006, the second in June 2007 and the third in October 2008.

Status updates from the field sampling implementers highlighted that two of the monitoring program's three components, the physical measurements and fish sampling were implemented effectively in 2005, 2006, 2007 and 2008. However, challenges occurred under the invertebrate sampling component, given the frequent high flows in this steep creek during September 2005, typical of this period. As a result, and in consultation with the Ministry of Environment, invertebrate sampling was repeated during low flows in February 2006 in an effort to collect data prior to implementation of the minimum flow release in April 2006. Further sampling challenges were encountered in February 2006. As a result, the invertebrate sampling component of the monitoring program was re-evaluated in September 2006, in consultation with the Ministry of Environment. The recommended sampling refinements were incorporated into a TOR addendum that was submitted in May 2009.

4.1.3 Interpretation of Data

The Year 4 report outlines in detail the interpretation of the monitoring data. This section summarizes key components to address the Management Question and Ecological Hypotheses outlined in the TOR.

It was uncertain whether flows in the mainstem channel between Clayton Falls and the confluence of the tailrace channel dropped to very low levels during periods of low inflow to the headpond during the winter, as well as when the headpond was drained for maintenance. The relative contribution to stream flow that would be provided by the 0.05 m^3/s minimum flow during these periods was also uncertain. To address these uncertainties, crews observed stream flow and recorded stage during these critical periods. Discharge measurements were not attempted due to the challenging channel morphology and gradient. These observations of stream flow consistently showed that the stream channel remained wetted and flows appeared to be well in excess of that provided by the minimum flow from the pipe. Therefore, the program concluded that low, and discontinuous flows were likely not as great a concern as was hypothesized by the CC, and that discharge was not greatly affected by the minimum flow provided by the pipe.

Given the limited change in stream flows provided by the minimum flow 'treatment', the Before-After Control-Impact component of the sampling design could not be used

for the ecological interpretation. Interpretation therefore relied on the component of the sampling design that compares fish size and abundance in Clayton Falls Creek to that in nearby, unregulated streams. The rationale for this design is that if low flows impair ecological productivity, this impairment would be reflected in fish size and abundance during late summer. Results showed that observed fish size and densities of juvenile coho salmon are within the natural range of coho densities found in unregulated streams of similar low productivity or within the EcoSection. As well, the qualitative description of the invertebrate species and life stages present showed a relatively diverse benthic community structure which was comparable to other streams of the region.

The program concluded:

> **Management Question #1**: "How does the minimum flow alter the physical conditions of habitats in Reach 2 and, in turn, influence the community composition and productivity of invertebrates and fish?"
>
> Flows remain well in excess of 0.5 m^3/s even in the absence of the provision of the minimum flow. Therefore, the minimum flow has little effect on the physical conditions of habitats in Reach 2, and in turn did not influence the community composition and productivity of invertebrates and fish.
>
> **Hypothesis[1] 1**: "Pre-WUP flows in Reach 2 (dam leakage and local inflows) are *not* sufficient to sustain over-wintering fish and invertebrates."
>
> Pre-WUP flows in Reach 2 are sufficient to sustain over-wintering fish and invertebrates. Reject the null hypothesis.
>
> **Hypothesis 2**: The provision of a year round minimum base flow of 0.1 $m^3 \bullet s^{-1}$ to Reach 2 (0.05 $m^3 \bullet s^{-1}$ from the dam release and an anticipated 0.05 $m^3 \bullet s^{-1}$ from dam leakage and natural inflow) will *not* partially restore the productive capacity of lower Clayton Falls Creek. Productive capacity will primarily be measured as the standing crop biomass of salmonids sampled during the fall.
>
> The data suggested that the productive capacity of lower Clayton Falls Creek was not impaired, and, therefore, could not be 'partially restored'. Hence, the hypothesis is not relevant as originally stated.

[1] To facilitate hypothesis testing, the alternate hypotheses listed in the TOR were re-stated as null hypotheses, as shown by italicized text.

Hypothesis 3:The flow release will *not* increase invertebrate abundance.

As per hypotheses #1 and 2, fail to reject the null hypothesis.

Hypothesis 4: The flow release will *not* increase the diversity of the invertebrate community.

As per hypotheses #1 and 2, fail to reject the null hypothesis.

Hypothesis 5:The flow release will *not* increase salmonid standing crop.

5a: The flow release will *not* increase salmonid density.

5b: The flow release will *not* increase salmonid size.

5c: The flow release will *not* increase salmonid condition.

As per hypotheses #1 and 2, fail to reject the null hypothesis.

5 Clayton Falls WUP Physical Work

This section outlines the status of the Clayton Falls WUP physical work as per the Order under the *Water Act,* dated 9 December 2004.

5.1 Water Release and Measurement Device

5.1.1 Overview

The objective of this physical work includes the design and construction of a water release and measurement device to be installed in Clayton Falls Dam in order to ensure a minimum flow of 0.05 m^3/s from the dam.

The Clayton Falls WUP Consultative Committee expressed concern that the lack of a guaranteed base flow in the mainstem channel between the Clayton Falls and the confluence of the tailrace channel might impact the over-winter survival of fish and their invertebrate prey. To address this concern, the Consultative Committee recommended that the WUP include a 0.05 m^3/s minimum continuous flow release from Clayton Falls Dam. The 0.05 m^3/s release will be provided via an engineered structure that will be designed to ensure passage of the minimum flow requirement.

5.1.2 Status

The water release and measurement device was installed on 8 March 2006 during the annual maintenance period. The Clayton Falls Water Release and Measurement Device Construction completion Report was submitted to your office in August 2006.

5.1.3 Interpretation of Data

Flow through the device is uncontrolled and dependent on reservoir level. The device has been designed to deliver the required minimum flow under normal operating conditions. During the annual maintenance period, the reservoir is drawn down below the crest of the spillway and the minimum flow release pipe will be dewatered. During this period of time, the sluice gate is opened to pass the project inflow while the unit is out of service thus sustaining the minimum flow to the downstream channel. At the end of the maintenance period when the sluice gate is closed to allow the headpond to refill, there will be a short period of time (one to three hours) when there will be no minimum flow release until the headpond fills to the elevation of the flow release pipe. This exception was noted in the TOR submitted to the Comptroller and was considered to be acceptable variance.

6 Clayton Falls WUP Monitoring Program and Physical Work Costs

The following table summarizes the Clayton Falls WUP monitoring program and physical work costs approved by the Comptroller and actual costs to 30 June 2009.

Table 6-1: Clayton Falls WUP Monitoring Program and Physical Work Costs

Monitoring Programs	Costs approved by CWR	Total Forecast (Actuals and Forecast) Life to Date	Variance Total to Approved($)	Explanation	Corrective Action
CLAWLR ANNUAL REPORT	$8,820.45	$4,343.39	$4,477.06	Original forecast overestimated. Report writing streamlined.	Resubmit to CWR
CLAMON#1 AQUATIC PRODUCTIVITY MONITORING	**$82,989.38**	**$56,039.10**	**$26,949.90**		
CLAMON#1 Direct Management 001	$39,089.00	$33,218.10	$5,870.90	Result of efficiencies implemented over life of project.	Resubmitted 2009
CLAMON#1 Implementation 002	$43,900.00	$22,821.00	$21,079.00	Number of study tasks reduced due to difficult sampling conditions.	Resubmitted 2009
CLAWORKS#1 WATER RELEASE MEASUREMENT DEVICE	**$9,717.68**	**$11,825.00**	**($2,107.00)**		
CLAWORKS#1 Direct Management 001	$4,693.00	$3,643.00	$1,050.00	Reference September 11, 2007 letter from CWR capping remissions at approved amount.	None
CLAWORK#1 Implementation 002	$5,025.00	$8,182.00	($3,157.00)	Reference September 11, 2007 letter from CWR capping remissions at approved amount.	None