

John Kelly
Water Licence Requirements Program Manager
Phone: (604) 528-7736
Fax: (604) 528-2905
Email: john.kelly@bchydro.bc.ca

8 December 2006

Mr. Pieter Bekker
Deputy Comptroller of Water Rights
Ministry of Environment
PO Box 9340 Stn Prov Govt
Victoria, BC V8W 9M1

**Re: Jordan River Project Water Use Plan
Monitoring Programs and Physical Work Annual Report**

As per your letters approving the Jordan River Project Water Use Plan monitoring programs and physical work terms of reference, dated 30 June 2005 and 18 September 2006 respectively, BC Hydro is required to submit an annual report as well as individual monitoring program reports in December each year.

Please find enclosed the 2006 Jordan River Project Water Use Plan Monitoring Programs and Physical Work Annual Report and individual reports for the *Fish Index: Lower Jordan River, Lower Jordan River Salmon Spawning Assessment and Enumeration, Diversion Reservoir Fish Indexing, and Surfing Quality below the Jordan River Generating Station* monitoring programs. An individual report for the *Lower Jordan River Inflow Monitoring program* will be submitted with the next annual report.

As the physical work for the minimum flow release at Elliott Dam was initiated in 2006, no report for this program has been completed.

Should you have any questions please do not hesitate to contact me.

Regards,



JK John Kelly

Enclosures (4)

CC Ian Dodd, BC Hydro
Alf Leake, BC Hydro
Ted Down, MOE
Ed Woo, DFO

Jordan River Water Use Plan

Monitoring Programs and Physical Works Annual Report: 2006

- **Fish Index: Lower Jordan River**
- **Lower Jordan River Inflow Monitoring**
- **Lower Jordan River Salmon Spawning Assessment and Enumeration**
- **Diversion Reservoir Fish Indexing**
- **Monitoring Surfing Quality below the Jordan River Generating Station**
- **Water Release Mechanism at Elliot Dam**

For Water Licences FL117999, FL118000, FL118001, FL118004 and FL 118005

BC Hydro Jordan River Project Water Use Plan Monitoring Programs and Physical Work Annual Report: 2006

1 Introduction

This document represents a summary of the status and the results of the Jordan River Water Use Plan (WUP) monitoring programs and physical work to 31 October 2006, as per the Jordan River Order under the *Water Act*, dated 20 July 2004. There are five monitoring programs and one physical work:

- Fish Index: Lower Jordan River
- Lower Jordan River Inflow Monitoring
- Lower Jordan River Salmon Spawning Assessment and Enumeration
- Diversion Reservoir Fish Indexing
- Monitoring Surfing Quality below the Jordan River Generating Station
- Water Release Mechanism at Elliot Dam

2 Background

The water use planning process for BC Hydro's Jordan River project was initiated in April 2000 and completed in November 2001. The conditions proposed in the WUP for the operation of the project reflect the February 2002 recommendations of the Jordan River WUP Consultative Committee.

In February 2002, the Jordan River WUP was submitted to the Comptroller of Water Rights (Comptroller).

On 20 July 2004, BC Hydro was ordered to implement the conditions proposed in the Jordan River WUP and prepare the monitoring programs and physical work terms of reference (TOR).

On 10 June 2005, the Jordan River WUP monitoring programs TOR were submitted to the Comptroller for review and approval. Revised TOR costs were submitted on 28 June 2005. On 30 June 2005, the monitoring programs TOR were accepted by the Comptroller.

On 31 May 2006, BC Hydro sent a letter to the Comptroller requesting a one year delay in the commencement of minimum flow until 30 June 2007 in order to collect two years of pre-flow release field data. On 20 July 2006, the Comptroller approved the delay.

On 31 May 2006, the Jordan River WUP physical work TOR was submitted to the Comptroller for review and approval. On 14 July 2006, the revised TOR was submitted to the Comptroller as the construction schedule would be delayed one

year until spring 2007. On 18 September 2006, the revised TOR were accepted by the Comptroller.

As outlined in the Jordan River WUP, the Jordan River Consultative Committee recommended a review of this WUP after six years of its implementation. A review may be triggered sooner if scientific data or significant new risks are identified that could result in a change to operations.

3 Status

The following table outlines the status and schedule for the Jordan River WUP monitoring programs and physical work.

Table 3-1: Status and Schedule of Jordan River WUP Monitoring Programs and Physical Work Implementation

Monitoring Programs	2005	2006	2007	2008	2009	2010	2011
	WLR YR1	WLR YR2	WLR YR3 Interim Review	WLR YR4	WLR YR5	WLR YR6	WLR YR7
Fish Index: Lower Jordan River	✓	u/w	■	■	■	■	
Lower Jordan River Inflow Monitoring	✓	u/w	■	■	■	■	
Lower Jordan River Slamon Spawning Assessment and Enumeration	✓	u/w	■	■	■	■	
Diversion Reservoir Fish Indexing	✓	u/w	■	■	■	■	
Monitoring Surfing Quality below the Jordan River Generating Station		✓	■	■	■	■	■
Physical Works							
Water Release Mechanism	✓	u/w	■				

- Legend:
- = Program to be undertaken/initiated in identified year
 - u/w = Project is underway
 - ✓ = Program completed for the year
 - x = Program started, but encountered operational or hydrological delays

4 Summary of Monitoring Program

The following section outlines the status of the Jordan River WUP monitoring programs as per the Jordan River order under the *Water Act*, dated 20 July 2005. The following table summarizes the monitoring program results according to the key monitoring indicators for each program.

Table 4-1: Summary of Jordan River WUP Monitoring Programs Results

Study	Monitoring Indicator	Bio-Standard or Base-Line	2005	2006	2007	2008	2009	2010	2011
			WLR YR1	WLR YR2	WLR YR3	WLR YR4	WLR YR5	WLR YR6	WLR YR7
Fish Index: Lower Jordan River	Rainbow Fry Density (fish/100m ²)	N/A	10.2						
	Rainbow Parr Density (fish/100m ²)	N/A	1.9						
	Rainbow Trout Condition Factor	1.05 ²	1.07						
Lower Jordan River Inflow Monitoring	% Diff from WUP MAD (1.51cms) ³	0	Incomplete Data						
Lower Jordan River Salmon Spawning Assessment and Enumeration	Salmon (coho and/or chum) escapement	N/A	4 CO						
	Egg to fry survival (%)	80% ¹	76%						
Diversion Reservoir Fish Indexing	Rainbow CPUE (Floating + Sinking)	N/A	9.6						
	Rainbow Trout Condition Factor	1.05 ²	1.10						
Monitoring Surfing Quality Below the Jordan River Generating Station	% Surfers Not Affected by Operations	< 50% ⁴	Not studied	82%					

1. Salmonid Enhancement Program biostandards for Vancouver Island (Quinsam River) transplanted eggs (March 1997)
2. Personal communication: Ptolemy, Ron. Fish biologist, Aquatic Ecosystems Science Section, BC Ministry of Environment, Victoria, BC.
3. Water Use Plan hydrology summary - see Taylor, 2001
4. Drafted as a threshold below which it may be determined that further operational constraints are required.

Jordan River WUP Monitoring Programs

This section outlines the status of the Jordan River WUP monitoring program as per the Order under the *Water Act*, dated 20 July 2004.

4.1 Fish Index: Lower Jordan River

4.1.1 Overview

The objective of this monitoring program is to assess the biological benefits of the key WUP decision to increase flows in the lower Jordan River from leakage/local inflows to $\geq 0.25 \text{ m}^3\text{s}^{-1}$ using stock abundance and fish condition as performance measures.

The Jordan River WUP Consultative Committee recommendation to release a $0.25 \text{ m}^3\text{s}^{-1}$ flow was based, in part, on estimates of increased weighted usable area for rearing rainbow trout. To address this decision, the Jordan River Consultative Committee recommended a monitoring program to detect an increase in the standing stock of rainbow trout.

Monitoring Indicators a): Rainbow trout (juvenile) density.

b): Rainbow trout (juvenile) condition factor.

This monitoring program involves three components:

- Establish sampling protocol expected to provide statistical power to detect changes in standing stock (expected change $\geq 100\%$);
- Collect initial estimates of standing stock, physical habitat changes and fish size and condition for rainbow trout, and;
- Analyse data to compare increases in size, condition and standing stock between pre and post $0.25 \text{ m}^3\text{s}^{-1}$ flow release.

4.1.2 Status

This monitoring program was initiated in September 2005 and will be carried out over two years. The first program report was received in March 2006.

4.1.3 Interpretation of Data

Results of the program will be compared between years to determine the level of response as defined by monitoring indicators above. It is anticipated that all six years of data collection will be required to make this determination; however rainbow trout fish condition observed in Year 1 is comparable to Vancouver Island biostandards (Ptolemy, pers. comm.¹)

To date, there is insufficient data to determine whether instream flow provisions are a driver in Lower Jordan River fish productivity.

¹ Ptolemy, Ron. Fish biologist, Aquatic Ecosystems Science Section, BC Ministry of Environment, Victoria, BC.

4.2 Lower Jordan River Inflow Monitoring

4.2.1 Overview

The objective of this monitoring program is to assess the performance of the key WUP decision to increase flows in the lower Jordan River from leakage/local inflows to $\geq 0.25 \text{ m}^3\text{s}^{-1}$ using instream flow measurements as the performance measure.

The Jordan River Consultative Committee's recommendation to release a base flow was based, in part, on estimates of weighted usable rearing area. The Jordan River Consultative Committee has recommended that more accurate river discharge and local inflow contributions be assessed.

Monitoring Indicator a): Percentage difference from assumed (Jordan River WUP, Taylor, 2001²) mean annual discharge.

This monitoring program involves monitoring instream flow at three locations in Lower Jordan River through the combination of water level monitoring and rating curve (flow-water surface elevation relationship) development.

4.2.2 Status

This monitoring program was initiated in November 2005, and will be carried out over two years. The first program report is expected in November 2006.

4.2.3 Interpretation of Data

At the time of reporting, there was inadequate data to report on the monitoring indicator above. It is anticipated that this information will be provided prior to the Elliott Dam fish-water release July 2007.

The monitoring indicator will provide both the context of the Jordan River Water Use Plan recommendations and the flow response of the water release, for consideration in future planning processes.

4.3 Lower Jordan River Salmon Spawning Assessment and Enumeration

4.3.1 Overview

The objective of this monitoring program is to assess the performance of the key WUP decision to increase flows in the lower Jordan River from leakage/local inflows to $\geq 0.25 \text{ m}^3\text{s}^{-1}$ using spawning success (number of returns to outmigrants) as the performance measure. Effective spawning and incubation habitat will also be measured.

Spawning success in lower Jordan River is limited by the cumulative impacts of flow reductions, mine operations, and log sort operations in the Lower Jordan River. Fisheries and Ocean Canada and some members of the Consultative Committee, however, hypothesised that improvements to the base flow in the lower reaches may

² Taylor, Lara, 2001. Inter-office memo: Jordan River Projects – basin hydrology. Prepared for Eric Wiess, BC Hydro Operations, Burnaby, BC.

be adequate to A) improve effective incubation habitat and B) dilute dissolved metal levels (Cu) sufficiently to reduce chronic toxicity. To address this hypothesis the Jordan River Consultative Committee recommended a program to monitor for successful signs of spawning and rearing in the Lower Jordan River following the base flow release.

Monitoring Indicators a): Salmon escapement (coho + chum).
b): Spawning success (egg to fry survival).

This monitoring program involves repeated snorkel surveys, incubation tests where observations of significant spawning warrant follow-up and analysis of flow information.

4.3.2 Status

This monitoring program was initiated in October 2005 and will be carried out over six years. The first program report was received in August 2006.

4.3.3 Interpretation of Data

As observed in 2001 (Benvar³), salmon escapement to the Lower Jordan River is very low, with a total of 4 adult coho and no steelhead adults observed over their respective spawning periods. Results from incubation assessments conducted in 2006-2007 were similar to those conducted in 2003 (Wright and Guimond⁴), with the exception of results from one incubation site located near a historic copper mine tailings outflow.

To date, there is insufficient data at this time to determine whether increasing instream flows will influence escapement or spawning success.

4.4 Diversion Reservoir Fish Indexing

4.4.1 Overview

The objective of this monitoring program is to evaluate the effects of extensive drawdown on Diversion Reservoir, using rainbow trout fish condition as the performance measure.

The Jordan River WUP Consultative Committee recommended an operational change that was hypothesised to elicit biologically significant measurable responses in the resident fish populations in Diversion Reservoir. It was hypothesised that the decrease in seasonal and daily reservoir fluctuation and bulk decrease in pelagic

³ Benvar Holdings, 2001. Jordan River salmonid swim survey. Prepared for BC Hydro's Jordan River Water Use Plan Project, Burnaby, BC.

⁴ Wright, M. C. and E. Guimond, 2003. Jordan River pink salmon incubation study. Prepared for the Bridge-Coastal Restoration Program, Burnaby, BC.

volume would increase both the establishment of an effective littoral zone and mitigate against reducing rainbow trout condition factors.

Monitoring Indicators a): Rainbow trout catch per unit effort (CPUE; sinking + floating gillnet).

b): Rainbow trout condition factor.

This monitoring program involves repeated gill-net and gee-trap surveys set at index sites in the reservoir in late-August/early-September every year, coinciding with typical low-reservoir operations.

4.4.2 Status

This monitoring program was initiated in September 2005, and will be carried out over six years. The first program report was received in January 2006.

4.4.3 Interpretation of Data

The 2005 study results were comparable with historic assessments in 1994 (Griffith 1996)⁵ and 2002 (Stewart et. al.)⁶ except that 1994 CPUE estimates were biased higher presumably due to lower reservoir elevations than in 2002 and 2005. These data will be compiled with annual results collected during the monitoring program and a final assessment of whether constrained Diversion Reservoir drawdown conditions will improve fish productivity and health as defined by the monitoring indicators above.

At this time there is insufficient data to determine whether reservoir operations are limiting rainbow productivity in Diversion Reservoir.

4.5 Monitoring Surfing Quality below the Jordan River Generating Station

4.5.1 Overview

The objective of this monitoring program is to assess the performance of the WUP decision to constrain maximum discharge opportunistically during the surfing season, using surf quality as the performance measure.

Jordan River is one of the most popular surf locations on Vancouver Island. A surfing survey conducted over the WUP indicated that surf conditions are also affected by Jordan River Generating Station discharge. In some conditions high discharges may flatten waves and make it more difficult for surfers to catch waves against the current.

⁵ Griffith, R.P. 1996. Biophysical Assessment of fish production within the Jordan River drainage 1994. Final Report. R.P. Griffith and Associates, Sidney, BC for BC Hydro and Power Authority, Burnaby, BC.

⁶ Stewart, S.M., R. McHale, A. Francis (Three Rivers Consulting), 2002. Limnological assessment of two Jordan River reservoirs (Phase II). Prepared for Royal Roads University, Sooke, BC.

Monitoring Indicators a): Surfers not affected by operations.

This monitoring program involves on-site observations of surfing use proximal to the mouth of the Jordan River under constrained and unconstrained conditions, and a surfing survey of Jordan River recreationalists under constrained and unconstrained conditions.

4.5.2 Status

This monitoring program was initiated in March 2006 and will be carried out over six years. The first program report was received in July 2006.

4.5.3 Interpretation of Data

The 2006 study applied similar methods to those utilized in 2001 (RRL),⁷ with results varying from that year presumably due to less than optimal surf conditions over the 2006 survey (in spite of constrained operations at Jordan River Generating Station). In terms of monitoring indicators, 82% of surfers were not affected by operations, compared to 57% in 2001.

Due to the fact that a compilation of comparable observations of surfing during both constrained and unconstrained operations will not be collected until 2007 (and again in 2009 and 2011), there is insufficient data to determine whether WUP recommendations have improved surf quality at Jordan River.

5 Summary of Jordan River WUP Physical Work

This section outlines the status of the Jordan River WUP physical works as per the Jordan River Order under the *Water Act*, dated 20 July 2004.

5.1 Water Release Mechanism at Elliott Dam

5.1.1 Overview

The objective of this physical work includes the design and construction of a water release mechanism at Elliott Dam in order to ensure a minimum base flow of 0.25 m³s⁻¹ from the dam.

During the Consultative Committee process the committee agreed to an objective to maximize fish populations in the Lower Jordan River below Elliott Dam. Currently no base flows are provided below the dam and therefore the committee considered a number of alternatives for releasing base flows. It was agreed to release a base target flow of 0.25 m³s⁻¹ year-round through the dam. It is expected that the increased base flow will result in improved ecosystem condition and an increase in habitat for fish from the mouth of the river, up to and including the river 300 m below Elliott Dam.

⁷ RRL (Recreation Resources Limited), 2001. Jordan River surf users. Prepared for BC Hydro's Jordan River Water Use Plan Project, Burnaby, BC.

5.1.2 Status

The implementation phase of the physical works was initiated in October 2006 and will be carried out over ten months. The physical works report is expected in December 2007.

Phase I of the Water Release Mechanism was completed in 2004, prior to the receipt of the Order. Phase II of this physical work is currently underway. The construction of Phase II is scheduled for completion in July 2007 prior to the 0.25 m³s⁻¹ minimum flow release from Elliott Dam which is ordered to commence 20 July 2007.

6 Jordan River WUP Monitoring Programs and Physical Work Costs

The following table summarizes the Jordan River WUP monitoring programs and physical works costs approved by the Comptroller on 30 June 2005 and 18 September 2006, respectively, and the actual costs to 31 October 2006.

Table 6-1: Jordan River WUP Monitoring Programs and Physical Work Costs

Description		Costs Approved by Comptroller of Water Rights	Actual Costs to 31 October 2006
Monitoring Programs			
Fish Index: Lower Jordan River	Direct Management	\$51,935	\$4,700
	Implementation	\$123,988	\$40,051
Lower Jordan River Inflow Monitoring	Direct Management	\$61,620	\$9,482
	Implementation	\$49,885	\$16,272
Lower Jordan River Salmon Spawning Assessment and Enumeration	Direct Management	\$57,454	\$5,365
	Implementation	\$87,440	\$14,114
Diversion Reservoir Fish Indexing	Direct Management	\$60,028	\$2,237
	Implementation	\$61,515	\$19,430
Monitoring Surfing Quality below the Jordan River Generating Station	Direct Management	\$45,734	\$2,896
	Implementation	\$19,628	\$0
Physical Work			
Water Release Mechanism	Direct Management	\$20,461	\$8,381
	Implementation	\$592,500	\$79,530