

## **Columbia River Project Water Use Plan**

### **Kinbasket Fish and Wildlife Information Plan Annual Report: 2008**

- **CLBMON-1 – Mica Dam Total Gas Pressure Monitoring and Abatement Program**
- **CLBMON-2 – Kinbasket and Revelstoke Reservoirs Kokanee Population Monitoring**
- **CLBMON-3 – Kinbasket and Revelstoke Reservoirs Ecological Productivity Monitoring Program**
- **CLBMON-4 – Kinbasket Reservoir Fish Stranding Assessment**
- **CLBMON-5 – Kinbasket Reservoir Burbot Life History and Habitat Use Assessment**
- **CLBMON-6 – Kinbasket Reservoir Bull Trout Life History and Habitat Use Assessment**
- **CLBMON-7 – Kinbasket Reservoir Rainbow Trout Life History and Habitat Use Assessment**
- **CLBMON-8 – Kinbasket Reservoir Monitoring of the Valemount Peatland**
- **CLBMON-55 – Revelstoke Reservoir Macrophyte Overview**

**Conditional Water Licences for Kinbasket storage (27068 and 39432), Mica diversion (39431), and Revelstoke diversion and storage (47215)**

## **BC Hydro Columbia River Project Water Use Plan Kinbasket Reservoir Fish and Wildlife Information Plan Annual Report: 2008**

### **1 Introduction**

This document represents a summary of the status and the results of the Columbia River Project Water Use Plan (WUP) monitoring programs and physical works to December 2008, as per the Columbia River WUP Order under the *Water Act* (dated 26 January 2007) and the Amended Order (dated 23 August 2007). There are nine monitoring programs:

- CLBMON-1 – Mica Dam Total Gas Pressure Monitoring and Abatement Program
- CLBMON-2 – Kinbasket and Revelstoke Reservoirs Kokanee Population Monitoring
- CLBMON-3 – Kinbasket and Revelstoke Reservoirs Ecological Productivity Monitoring Program
- CLBMON-4 – Kinbasket Reservoir Fish Stranding Assessment
- CLBMON-5 – Kinbasket Reservoir Burbot Life History and Habitat Use Assessment
- CLBMON-6 – Kinbasket Reservoir Bull Trout Life History and Habitat Use Assessment
- CLBMON-7 – Kinbasket Reservoir Rainbow Trout Life History and Habitat Use Assessment
- CLBMON-8 – Kinbasket Reservoir Monitoring of the Valemount Peatland
- CLBMON 55 – Revelstoke Reservoir Macrophyte Overview

### **2 Background**

The water use planning process for BC Hydro's Columbia River project was initiated in August 2000 and completed in June 2004. The conditions proposed in the WUP for the operation of the project reflect the June 2004 consensus recommendations of the Columbia River WUP Consultative Committee.

In July 2006, the Columbia River Draft WUP was submitted to the Comptroller of Water Rights (CWR). The draft WUP was sent out to regulatory agencies, First Nations and interested stakeholders for review. In January 2007, the CWR approved the final WUP and issued an Order to BC Hydro to implement the conditions proposed in the Columbia River WUP and prepare the monitoring programs and physical works Terms of Reference (TOR).

An addendum to the Columbia River WUP was submitted to the CWR in July 2007 after an Environmental Assessment Certificate was issued for the Revelstoke Unit 5 Project. The addendum proposes additional terms and conditions for the Columbia River WUP, as recommended by the Revelstoke Unit 5 Core Committee in December 2006, to address incremental impacts of the operation of the fifth generating unit at Revelstoke Dam.

In August 2007, the CWR accepted the Columbia River Project WUP Addendum resulting from the Revelstoke Unit 5 Project, and issued amendments to the Columbia River Implementation Order to include the commitments made by BC Hydro to undertake additional monitoring programs and physical works associated with the Revelstoke Unit 5 Project.

The following table outlines the dates that the Kinbasket and Revelstoke Fish and Wildlife Information Plan TOR have been submitted to, and approved by the CWR to date.

Monitoring Program TOR	Order Clause	Date Submitted	Date Approved
CLBMON-1 Mica Dam Total Gas Pressure Monitoring and Abatement Program	Schedule A 5(a)	24 October 2007	03 December 2007
CLBMON-2 Kinbasket and Revelstoke Reservoirs Kokanee Population Monitoring	Schedule A 5(b) and Schedule B 1(a)	24 October 2007	03 December 2007
CLBMON-3 Kinbasket and Revelstoke Reservoirs Ecological Productivity Monitoring Program	Schedule A 5(c) and Schedule B 1(b)	24 October 2007	03 December 2007
CLBMON-4 Kinbasket Reservoir Fish Stranding Assessment	Schedule A 5(d)	24 October 2007 22 October 2008	03 December 2007 10 December 2008
CLBMON-5 Kinbasket Reservoir Burbot Life History and Habitat Use Assessment	Schedule A 5(e)	24 October 2007	03 December 2007
CLBMON-6 Kinbasket Reservoir Bull Trout Life History and Habitat Use Assessment	Schedule A 5(f)	24 October 2007	03 December 2007
CLBMON-7 Kinbasket Reservoir Rainbow Trout Life History and Habitat Use Assessment	Schedule A 5(g)	24 October 2007	03 December 2007
CLBMON-8 Kinbasket Reservoir Monitoring of the Valemount Peatland	Schedule A 5(h)	24 October 2007	03 December 2007
CLBMON-55 Revelstoke Reservoir Macrophyte Overview	Clause 2(f) Amended Order	07 January 2009	Pending

As outlined in the Columbia River WUP, the Consultative Committee recommended a full review of the Columbia River Water Use Plan 13 years after implementation, unless results of the monitoring program suggest an earlier review is appropriate or significant risks are identified that could result in a recommendation to change operations.

BC Hydro will convene a multi-party panel five years after implementation of this WUP to evaluate the effectiveness of operations and physical works in meeting the stated objectives for Arrow Lakes Reservoir and the lower Columbia River. The outcomes from this process will be used to assess any potential need to review the

Arrow Lakes Reservoir component of this WUP. If a replacement Non-Treaty Storage Agreement (NTSA) is negotiated within this 5-year period, it is also recommended that agreement provisions and implications be reported out through this panel. Signing of a new NTSA is not a trigger for panel evaluation or a review of this Water Use Plan recommendation to change operations.

### **3 Status**

The following table outlines the status and schedule for the monitoring programs under the Kinbasket and Revelstoke Fish and Wildlife Information Plan.

#### **3.1 Columbia River WUP Monitoring Programs and Physical Works**

This section summarizes the status of the monitoring programs being implemented under the Kinbasket & Revelstoke Fish and Wildlife Information Plan of the Columbia River WUP, as per the Order under the *Water Act*, dated 26 January 2007.

#### **3.2 CLBMON-1 Mica Dam Total Gas Pressure Monitoring and Abatement Program**

##### **3.2.1 Overview**

Mica Generating Station currently has four generating units in operation. Units 1 and 2 were the only units historically capable of synchronous condense operation (SCO) with installation in Units 3 and 4 only recently (2007). SCO is used to provide voltage support and quick unit return to service, and can result in higher localized total dissolved gas pressure (TGP) levels below Mica Dam.

Localized dissolved gas supersaturation (DGS) in the draft tube occurs when surface water is exposed to pressurized air and through mixing of water with entrained air from wicket gate leakage. Synchronous condense operation increases DGS by injecting air (16 psi) into the draft tube to force water below the runner (to allow the runner to spin in air). Water surface turbulence from the spinning runner combined with the increased air pressure forces additional gas into the water column, creating supersaturation. Because the water in the immediate vicinity of the unit is stagnant during synchronous condense operation, supersaturation increases (volume of water supersaturated) over time. Cooling water and dam leakage in the draft tube then carries supersaturated water near the units down the draft tube and into the tailrace after 3-4 hours of synchronous condense operation. Units are operating in synchronous condense mode to some extent every month, although this operation occurs primarily during spring (March to May) and fall (October and November). Fish are able to move up into the draft tubes when units are operating in synchronous condense mode due to the limited discharge from the units, resulting in particular concern by BC Hydro staff and the fisheries regulatory agencies regarding fish mortalities in September and October when kokanee congregate at the base of the dam.

BC Hydro implemented a DGS best management practice in 1996, which was developed in consultation with fisheries regulatory agencies. The current operating criteria stipulate a 15 minute flushing operation (300 MW or 5000 cfs) for each generating unit for a cumulative 12 hours of synchronous condense.

**Table 3-1: Status and Schedule of Columbia River WUP Monitoring Programs Implementation under the Kinbasket & Revelstoke Reservoir Fish and Wildlife Information Plan**

Monitoring Programs	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	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 Final Review
CLBMON-1 Mica Dam Total Gas Pressure Monitoring and Abatement Program			■	■									
CLBMON-2 Kinbasket and Revelstoke Reservoirs Koknaee Population Monitoring	u/w	■	■	■	■	■	■	■	■	■	■	■	
CLBMON-3 Kinbasket and Revelstoke Reservoirs Ecological Productivity Monitoring Program	u/w	■	■	■	■	■	■	■	■	■	■	■	
CLBMON-4 Kinbasket Reservoir Fish Stranding Assessment					■						■	■	
CLBMON-5 Kinbasket Reservoir Burbot Life History and Habitat Use Assessment					■	■	■						
CLBMON-6 Kinbasket Reservoir Bull Trout Life History and Habitat Use Assessment								■	■	■			
CLBMON-7 Kinbasket Reservoir Rainbow Trout Life History and Habitat Use Assessment							■	■	■				
CLBMON-8 Kinbasket Reservoir Monitoring of the Valemount Peatland	√	■							■				
CLBMON-55 Revelstoke Reservoir Macrophyte Overview		■					■						
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													

Since 1998, periodic DGS data collection and observations for further fish mortalities have been conducted. Although there have been no further fish kills observed since the best management practice (BMP) was implemented, the WUP CC Fish Technical Sub-Committee recommended further study should be undertaken to determine the downstream extent of TGP impacts, and to assess whether the BMP are most effective in maintaining local TGP levels below acceptable thresholds. In 2005, BC Hydro undertook a comprehensive review of all previously collected DGS data and conducted monitoring to confirm DGS levels. This study, which characterized DGS levels and downstream extent for the two units with existing synchronous condense capability, showed that elevated DGS still exist in the draft tubes and tailrace, extending as far downstream as the Mica Blue Bridge. The question of downstream extent posed by the WUP CC was therefore addressed for existing synchronous condense operations; however, it is still uncertain whether there are benefits or additional impacts associated with installation of synchronous condense into Units 3 and 4.

The primary objective of the monitoring program is to determine dissolved gas supersaturation with synchronous condense operation of Units 3 and 4 in relation to Units 1 and 2, which have been previously monitored.

The key water use decision affected by the results of the monitoring program is whether the existing best management practice (dissolved gas supersaturation flush operation) is sufficient to minimize risks to fish health.

### **3.2.2 Status**

This monitoring program has not yet been initiated.

### **3.2.3 Interpretation of Data**

At this time, there are no data to interpret.

## **3.3 CLBMON-2 Kinbasket and Revelstoke Reservoirs Kokanee Population Monitoring**

### **3.3.1 Overview**

Key management uncertainties encountered during development of the Columbia River Water Use Plan related to how current operation of Kinbasket Reservoir impacts the productivity of pelagic fish populations, and how changes in operation would affect population levels in Kinbasket and Revelstoke Reservoirs. Concerns focused on kokanee, as this species is the key driver of the ecosystem, providing an important food source for higher trophic levels (e.g., bull trout) and a source of nutrients to the ecosystem. The most important issues to be addressed for kokanee populations in Kinbasket Reservoir were identified as: potential effects of annual water level fluctuations on the physical dynamics of the reservoir (thermal stratification, water circulation patterns and water retention time); resulting impacts on pelagic habitat and productivity. The fundamental management questions to be addressed through the monitoring program are:

- 1) What are the trends in annual distribution, abundance and biological characteristics of kokanee populations in Kinbasket and Revelstoke reservoirs?
- 2) What role does reservoir operation play in the productivity of kokanee populations?
- 3) What are the key habitat factors that contribute to changes in productivity of the Kinbasket Reservoir kokanee population?
- 4) Can modifications be made to operation of Kinbasket Reservoir to protect or enhance kokanee populations in Kinbasket or Revelstoke reservoirs?

The intention of this monitoring study is to collect annual time series data as a foundation for further correlation analysis. Results of this monitoring program will be integrated with the Kinbasket and Revelstoke Ecological Productivity Monitoring program (refer to CLBMON-3) to enable inferences regarding the role of current operating conditions in pelagic productivity and productivity of reservoir kokanee populations.

The key water use planning decision affected by the results of this monitoring program is decision-making with respect to the need to balance storage in Kinbasket Reservoir with impacts on fish populations. Specifically, it will provide information required to support future decisions around maintaining the current operating regime or modifying operations to protect reservoir fish populations.

The overall objectives of the monitoring program are to:

- 1) monitor trends in the biological characteristics, distribution and abundance of kokanee populations in Kinbasket and Revelstoke Reservoirs; and
- 2) provide information required to link the effects of reservoir operation to population levels.

### **3.3.2 Status**

This monitoring program was initiated in 2008 under a collaborative agreement with the Ministry of Environment (MOE), Ecosystems Science Branch. MOE has been conducting hydroacoustic and trawl surveys in Kinbasket and Revelstoke reservoirs since the 1990s and thus provide long-term continuity in data collection.

Hydroacoustic and trawl surveys were conducted in both reservoirs from July 24-31, 2008. Kinbasket Reservoir was near full pool elevation creating difficulties for launching safely as good boat access is limited near the forebay area.

### **3.3.3 Interpretation of Data**

Data are currently being analysed and therefore no report is available. Progress reports are expected for interim years with a synthesis report planned for Years 4, 8 and 12 in conjunction with CLBMON-3.

### **3.4 CLBMON-3 Kinbasket and Revelstoke Reservoirs Ecological Productivity Monitoring Program**

#### **3.4.1 Overview**

During the Columbia River Water Use Plan (WUP) process, the WUP Consultative Committee found it difficult to make informed decisions regarding operational changes for Kinbasket and Revelstoke reservoirs because of the lack of data describing basic ecological processes. The WUP CC acknowledged the importance of understanding reservoir limnology and the influence of current operations on ecosystem processes for planning future water management activities. For this reason, the WUP CC recommended a monitoring program to provide long-term data on reservoir limnology and the productivity of aquatic communities, which could also be used as parameters for any experimentation and modeling of operational effects on trophic production and, ultimately, fish populations.

The objective of the monitoring program is to define the trophic web mechanisms and dynamics of Kinbasket and Revelstoke reservoirs, and to determine if changes in pelagic productivity are associated with reservoir operations. The program focuses on reservoir trophic web mechanisms and dynamics; obtaining measurements of aquatic productivity that can be used as parameters for system modeling; and determining key indicators of change in pelagic production that would ultimately affect food availability and, thus, growth of kokanee.

The key operating decision that will be affected by this monitoring program is the operation of Kinbasket Reservoir. Specifically, the program will provide information required to support future decisions around maintaining the current operating regime or modifying operations through adjusting minimum or maximum elevations to sustain reservoir fish populations.

The monitoring program is being implemented in a phased approach in conjunction with the Kinbasket/Revelstoke Reservoir Kokanee Population Monitoring program (CLBMON-2). Sampling is planned on a 4-year cycle, thereby taking advantage of information gained in each sampling period to define the data needs for future years.

#### **3.4.2 Status**

This monitoring program was initiated in 2008. A study team was assembled in April to develop a phased sampling plan as outlined in the Terms of Reference. Monthly sampling began in July and concluded in October, and is expected to run from April to October over the next few years. Index stations are sampled for water chemistry, phytoplankton, zooplankton, primary production, and basic physico-chemical parameters. A one-time sampling of all major tributaries was conducted in early August to provide initial data for the nutrient budget. This information will be used to select index tributaries for sampling in future years.

#### **3.4.3 Interpretation of Data**

Data are currently being analysed and therefore no report is available. Progress reports are expected for interim years with a synthesis report planned for Years 4, 8 and 12 in conjunction with CLBMON-2.

### **3.5 CLBMON-4 Kinbasket Reservoir Fish Stranding Assessment**

#### **3.5.1 Overview**

Although anecdotal observations of juvenile fish being stranded in isolated pools have been reported, no systematic studies have been undertaken to determine the extent of fish stranding in the drawdown zone of Kinbasket Reservoir under various discharges and drawdown conditions or on the impact of fish stranding on fish populations. While there is a heightened risk of stranding due to the magnitude of the annual drawdown, previous qualitative examination of reservoir topography and seasonal patterns of reservoir operation has suggested that stranding likely does not affect a large portion of the fish community in the reservoir, given that most of the reservoir shorelines are rocky and have steep gradients. The topography thereby limits areas prone to formation of isolated pools relative to the size of the drawdown zone.

When reviewing existing information, the WUP CC recognized that there was considerable uncertainty about these inferences on fish stranding occurrences. Based on a review of pre-impoundment topographic maps, it was noted that the majority of the upper elevations of the drawdown zone are steep sided; however, there are areas in the main arms of the reservoir (Bush Arm, Canoe Reach and the upper end of Columbia Reach) that have some potential for stranding due to their lower gradient slopes. Some high-level estimates of reservoir surface area changes at various water elevations indicated that drafting the reservoir from 754.4 m to 740 m would cause the loss of about 10 per cent of the reservoir surface area, while a drop in elevation from 740 m to 725 m could cause the loss of about 20% surface area.

The key objective of this monitoring program is to qualitatively evaluate the extent of fish stranding caused by the annual drawdown of Kinbasket Reservoir. The program will focus on assessing the risk of stranding under current reservoir operations, and verifying fish stranding through field surveys of those areas of the drawdown zone that pose the greatest risk of stranding. The program is to be conducted opportunistically over a 2-year time frame to ensure investigations are conducted in optimal conditions. The program will also incorporate a modeling component to determine fish stranding risk, which will be completed prior to the implementation of field surveys.

The key water use decision influenced by the results of this monitoring program is whether minor adjustments to the current operating regime of Kinbasket Reservoir are possible or physical works in lieu of an operational change could be implemented to mitigate stranding risk. The monitoring program will provide information needed to better understand how reservoir operations affect fish stranding and inform on the need for future changes.

#### **3.5.2 Status**

This monitoring program has not yet been initiated.

### **3.5.3 Interpretation of Data**

At this time, there are no data to interpret.

## **3.6 CLBMON-5 Kinbasket Reservoir Burbot Life History and Habitat Use Assessment**

### **3.6.1 Overview**

Burbot were identified by the WUP CC as a key fish species of concern in Kinbasket Reservoir because of their importance to the sport fishery, the potential for links between reservoir operations and burbot population productivity, and due to the dearth of information regarding burbot biology in the reservoir. The WUP CC hypothesized that the greatest potential impact of reservoir operations on burbot populations may be the dewatering effect of winter drawdown on spawning success and egg survival in sites along the shoreline and in lower sections of tributaries.

The primary objectives of this assessment are to 1) collect information on general population characteristics (distribution, growth and age structure), 2) focus on identification of spawning habitat and use within the drawdown zone; and 3) determine potential links between effects of reservoir operation and populations.

The key water use planning decision affected by the results of this monitoring program is operation of Kinbasket Reservoir. Specifically, this program will provide information to support decisions around maintaining the current operating regime or modifying operations to protect reservoir burbot populations.

Burbot life history and habitat use will be assessed using a combination of trapping and radio telemetry methods. Basic biological characteristics, such as age, size and maturity, will be assessed for trap-captured burbot. If potential burbot spawning locations are identified during the aerial surveys, boat-based surveys will be conducted to confirm the presence of burbot spawning activity. The location and habitat conditions of confirmed burbot spawning locations will be thoroughly documented.

### **3.6.2 Status**

This monitoring program has not yet been initiated.

### **3.6.3 Interpretation of Data**

At this time, there are no data to interpret.

### **3.7 CLBMON-6 Kinbasket Reservoir Bull Trout Life History and Habitat Use Assessment**

#### **3.7.1 Overview**

The WUP CC hypothesized that the greatest potential impact of reservoir operations on the productivity of bull trout populations is entrainment of immature bull trout through Mica Dam. While juvenile bull trout have not been recorded or noted in fish salvage operations at Mica Dam, and entrainment will be addressed separately by BC Hydro's Fish Entrainment Strategy, there is a data gap with respect to stream emigration and reservoir habitat use by juvenile bull trout. To address this data gap, the WUP CC recommended that a bull trout life history and habitat use assessment be undertaken in Kinbasket Reservoir.

The primary objectives of this monitoring program are to obtain baseline data on the life history and habitat characteristics of juvenile bull trout in Kinbasket Reservoir and to provide preliminary information to determine if reservoir operations could have an effect on bull trout populations. The study aims to determine timing and duration of juvenile bull trout emigration to the reservoir and to collect data on habitat use of out migrants within the reservoir to determine if nearshore habitats are used by juveniles.

The key water use planning decision affected by the results of this monitoring program is the operation of Kinbasket Reservoir. Specifically, it will provide information to support future decisions on maintaining the current operating regime or modifying operations through adjusting the drawdown schedule or minimum elevation to protect juvenile bull trout populations.

#### **3.7.2 Status**

This monitoring program has not yet been initiated.

#### **3.7.3 Interpretation of Data**

At this time, there are no data to interpret.

### **3.8 CLBMON-7 Kinbasket Reservoir Rainbow Trout Life History and Habitat Use Assessment**

#### **3.8.1 Overview**

Two primary issues of concern identified by the WUP CC related to potential effects of low reservoir elevations on rainbow trout access to spawning tributaries, as well as potential effects of reservoir refill on inundation of stream spawning habitats within the drawdown zone and subsequent effects on egg and fry survival. At present, there are no available data regarding potential barriers to fish passage caused by low water conditions during rainbow trout spawning, because past tributary access studies have been undertaken at higher reservoir levels. Further, there is no information related to presence of rainbow trout spawning in the drawdown zone of the reservoir. To address these concerns, the WUP CC recommended that a rainbow trout life history and habitat use assessment be undertaken in Kinbasket Reservoir.

The objectives of the monitoring program will be to determine: a) biological characteristics, focusing specifically on the timing and location of rainbow trout spawning; b) upstream access of spawners to tributary streams in relation to reservoir water levels; and c) timing and extent of inundation of rainbow trout spawning habitat within the drawdown zone. The results of this study will allow a better assessment of the potential impacts of the current operating regime of Kinbasket Reservoir on the productivity of rainbow trout populations.

The key water use planning decision affected by the results of this monitoring program is the operation of Kinbasket Reservoir. Specifically, it will provide information to support future decisions on maintaining the current operating regime or modifying operations through adjusting seasonal minimum or maximum elevations to protect adfluvial rainbow trout populations.

### **3.8.2 Status**

This monitoring program has not yet been initiated.

### **3.8.3 Interpretation of Data**

At this time, there are no data to interpret.

## **3.9 CLBMON-8 Kinbasket Reservoir Monitoring of the Valemount Peatland**

### **3.9.1 Overview**

During the Columbia River Water Use Planning process, a remnant peatland was identified near Valemount at the north end of the Kinbasket Reservoir. The Consultative Committee expressed concern regarding the potential impacts of the current operating regime of the Kinbasket Reservoir on the peatland; specifically, concerns focused on whether water level fluctuations were causing significant erosion of the peatland and, if so, whether this erosion was affecting the long-term viability of the wetland. In order to better understand the potential impacts of reservoir operations on this wetland, the Consultative Committee recommended a monitoring program to determine whether: a) erosion is caused by current operations, b) this erosion is affecting the long-term viability of the site and c) control measures are required to stabilize the area against erosion caused by reservoir operations. The objectives of this monitoring program are:

- Address key uncertainties regarding the relative contribution and importance of the current reservoir operating regime to the erosion processes affecting the wetland;
- Obtain an inventory of plant species that have been successfully surviving long-term inundation;
- Obtain an inventory of wildlife species that utilize this habitat; and

- Determine whether the long-term viability of the wetland, and associated plant and animal species, are being affected by erosion processes related to reservoir operations, and how these effects may be mitigated.

The key water use planning decision affected by the results of this monitoring program is the current operating regime of Kinbasket Reservoir. Implementation of the monitoring program will provide information to determine if current reservoir operations are contributing to or establishing conditions for erosion processes affecting of the Valemount Peatland, and to support future recommendations to mitigate erosion-related impacts on the wetland, if on-going operations of the reservoir are creating or contributing to the observed erosional processes.

This program involves the following monitoring approach:

- a) Determine the processes and rates of erosion of the wetland, and determine if current reservoir operations are contributing to or establishing conditions for the observed erosion processes;
- b) Conduct an inventory of wetland vegetation and wildlife to determine the riparian vegetation species that have been surviving long-term inundation successfully, and the wildlife species that utilize the habitat provided by the wetland;
- c) Make recommendations for mitigative measures that may be required to retain the wetland's long-term viability, if reservoir operations are contributing to the observed erosional processes.

### **3.9.2 Status**

This monitoring program was initiated in 2008. The first program report was submitted to BC Hydro in December 2008. The next program report is expected in December 2009.

### **3.9.3 Interpretation of Data**

There are a wide variety of erosional processes that are currently affecting the Valemount Peatland. Small scour features, recreational (ATV) users, wildlife, wind erosion, and distributary flow channels and creeks all disrupt the surface and likely prevent the establishment and growth of vegetation. However, these processes are relatively restricted in space, and are most commonly observed only at the north end of the peatland. Additional processes of lateral erosion of the peatland by the Canoe River and denudation of the entire peatland surface by surface runoff and wave attack are fairly ubiquitous, and appear to dominate the erosional processes that have been observed. Lateral erosion rates by Canoe River have actually declined 20% since inundation, the result of a reduction in the frequency and duration of high flows due to the attenuating effects of the reservoir at higher pool levels. However, vertical denudation of the peatland surface appears to be the main factor limiting vegetation growth. Despite the fact that there has been clear erosion of the peatland since inundation, the results of this monitoring program are not yet sufficiently developed to conclude that current operations of Kinbasket Reservoir are contributing to or creating conditions for erosion processes that threaten the

long-term viability of the peatland or the vegetation and wildlife species that it supports. Additional work carried out in 2009 and 2016 will seek to address this key question.

#### 4 Kinbasket Reservoir Fish and Wildlife Information Plan - Monitoring Programs Costs

The following table summarizes the approved costs of the monitoring programs under the Kinbasket Reservoir Fish and Wildlife Information Plan of Columbia River WUP, as well as the Actual costs to 31 December 2008.

**Table 4-1: Kinbasket Reservoir Fish and Wildlife Information Plan Monitoring Program Costs**

Description		Costs Approved by Comptroller of Water Rights	Actual Costs to 31 Dec 2008
<b>Monitoring Programs</b>			
CLBMON#1 Mica Dam TGP Monitoring & Abatement Program	Direct Management	\$18,681	\$2,159
	Implementation	\$74,984	\$0
CLBMON#2 Kin & Rev Kokanee Population Monitoring	Direct Management	\$76,308	\$1,470
	Implementation	\$1,007,744	\$0
CLBMON#3 Kin & Rev Ecological Productivity Monitoring	Direct Management	\$157,106	\$17,712
	Implementation	\$4,156,723	\$256,244
CLBMON#4 Kin Fish Stranding Assessment	Direct Management	\$21,287	\$4,560
	Implementation	\$188,480	\$0
CLBMON#5 Kin Burbot Life History & Habitat Use Assessment	Direct Management	\$42,685	\$6,891
	Implementation	\$530,412	\$0
CLBMON#6 Kin Bull Trout Life History & Habitat Use Assessment	Direct Management	\$38,207	\$5,923
	Implementation	\$474,389	\$0
CLBMON#7 Kin Rainbow Trout Life History & Habitat Use Assessment	Direct Management	\$36,694	\$6,118
	Implementation	\$435,062	\$0
CLBMON#8 Kin Monitoring Of Valemount Peatland	Direct Management	\$34,593	\$19,740
	Implementation	\$108,953	\$51,096
CLBMON-55 Revelstoke Reservoir Macrophyte Overview	Direct Management	\$0	\$0
	Implementation	\$0	\$0