

# COLUMBIA RIVER WATER USE PLAN UPDATE

MAY 2013

BC Hydro is pleased to provide highlights from the Columbia River Water Use Plan (WUP). Approved in 2007, the plan calls for a large number of monitoring programs and physical works projects to be implemented on the mainstem Columbia River from Kinbasket Reservoir in the north downstream to the Canada /United States border on the lower Columbia River over 12 years. These projects are expected to provide benefits to recreation, fisheries, wildlife, and archaeology.

## BOAT RAMP IMPROVEMENTS

BC Hydro is committed to improving summer recreational boat access in Kinbasket and Arrow Lakes reservoirs as recommended by the Columbia River Water Use Plan. For Kinbasket Reservoir, BC Hydro plans to complete the new Bush Harbour boat ramp in 2013. Remaining work includes concrete placement at the toe of the ramp and installation of the floating walkway.

On Arrow Lakes Reservoir Columbia Power Corporation continues work on behalf of BC Hydro to complete the

construction of the three remaining boat launches on Arrow Lakes Reservoir at Anderson Point, Edgewood, and Nakusp.

Construction for the new Anderson Point Boat Launch wrapped up for the 2013 season at the end of April. The public now has access to the new concrete ramp, floating walkway, widened access road and parking areas; and a pit toilet has been installed. At Nakusp, work on the ramp is nearly complete and the floating walkway will be installed this year. At Edgewood the ramp has been upgraded and the southern breakwater and floating walkway will be installed this year. Work will resume in 2014 on all ramps pending suitable water levels.

## RECREATIONAL USE STUDIES

This year is the final year of data collection for the five-year Arrow Lakes Reservoir Recreational Demand Study that began in 2009. The study is designed to understand recreational use of the reservoir and shoreline between Revelstoke and Castlegar and determine if and how this use is affected by changing water levels. The data collected includes both face-to-face and online surveys of reservoir users about their use of the reservoir and shoreline plus traffic counters installed at established reservoir recreation sites.

Started in 2010, BC Hydro is also completing a ten year Boat Ramp Use Study for Kinbasket and Arrow Lakes Reservoirs. This study will monitor trends in public use to assess whether boat ramp improvements planned and completed under the Columbia River Water Use Plan benefit recreation. Both volume of use and user satisfaction is measured through traffic counters installed at established recreation sites and user surveys; both face-to-face and online.



Bush Harbour boat ramp construction, April 2013



Eagle Bay

Help guide future reservoir recreational development. Participate in a face-to-face survey or fill out an online survey at [www.arrow-kinbasket-recreation-survey.ca](http://www.arrow-kinbasket-recreation-survey.ca) to share information about your recreational use of Kinbasket and Arrow Lakes Reservoirs

## WOODY DEBRIS REMOVAL

BC Hydro continues to remove floating woody debris from Kinbasket and Arrow Lakes Reservoir and meets with Debris Management Committees in Nakusp, Golden, and Valemount to plan and prioritize work. Since 2007, BC Hydro has funded over \$4.5 million of debris removal work on Kinbasket and Arrow Lakes Reservoirs.

On Arrow Lakes Reservoir, some shoreline debris removal work was completed in the spring of 2012. For Kinbasket Reservoir, spring work focused on disposal of about 8,000 cubic metres of woody debris collected and piled the previous year in anticipation of high water levels.



Kinbasket debris

Kinbasket Reservoir and Arrow Lakes Reservoir received unusually high inflows in 2012 due to combination of high snowpack and rainfall and water levels for both reservoirs that went above normal peak levels. This resulted in the refloating of large amounts of woody debris previously stranded on reservoir shorelines. In response BC Hydro allocated additional funding to implement a water-based program using tugs and barges to collect and corral woody debris using floating boomsticks. Over 25,000 cubic metres of debris was removed from Kinbasket Reservoir and over 20,000 cubic metres of debris was removed from Arrow Lakes Reservoir in 2012.

The provincial Comptroller of Water Rights recently completed his review of the first five years of the Arrow Lakes and Kinbasket Reservoir programs and established new budgets for the next three years under the Columbia River Water Use Plan.

## REVEGETATION

The goal of the revegetation program is to increase native plant cover and diversity in the drawdown zone of Arrow Lakes and Kinbasket reservoirs to benefit wildlife, fish, archaeological site protection and shoreline stability. During the first number of years, the program focused on planting sedge, cottonwood and other native plant species in both reservoirs using a variety of planting techniques. Large scale planting in Arrow Lakes is complete; only the revegetation associated with the wildlife habitat enhancement projects remains. Planned planting of a small number of sedges in Kinbasket in 2012 was deferred to summer of 2013 due to the high water levels. In both reservoirs, the planted sites are being monitored to determine success.



sedge

## COLUMBIA RIVER FISH STUDIES

BC Hydro continues to conduct annual surveys on fish abundance, distribution and life history in the Columbia River below Revelstoke Dam and Hugh L. Keenleyside Dam to better understand the effects of dam operations on fish populations.

The Lower Columbia River large river fish indexing program completed its fourth year of monitoring in 2011. This year the program sampled new areas below the Hugh L. Keenleyside Dam to monitor fish populations. Key species monitored include rainbow trout, mountain whitefish and walleye.

BC Hydro continues work to understand how changes in discharge flows from Kootenay and Columbia River hydroelectric facilities can be implemented to benefit fish and fish habitat. Fish are at particular risk of being stranded during flow reductions during the summer period when they are typically found in shallow, warm productive inshore areas. A ground topographic survey was completed that will provide information on fish habitat available at varying flows. BC Hydro will also continue field surveys during flow changes in 2012 to assess current fish protection flow protocols.



Rainbow Trout

BC Hydro also continues to conduct yearly whitefish and rainbow trout spawning assessments in the lower Columbia River to assess whitefish and rainbow trout protection flows. Rainbow trout are a key sportfish in the mainstem Columbia River downstream of Hugh L. Keenleyside Dam, and typically spawn in March, April and May. Key spawning areas are Norn's Creek, Norn's Creek Fan, lower Kootenay River by the oxbow, the old D-Bar-D area and the Genelle Island complex. Until the fry hatch about six to eight weeks later, the eggs are vulnerable to reductions in water flows. Since 1999 BC Hydro began managing Columbia River flows to protect rainbow trout spawning locations (redds) from dewatering. Discharge flows from the facility are lowered during the peak rainbow trout spawning period to encourage the trout to spawn in deeper areas, reducing

the chance that incubating eggs will be exposed during flow changes. So far, rainbow trout spawning surveys have shown that rainbow trout protection flows have protected, on average, more than 99.5% of the total number of eggs laid each year and the numbers of rainbow trout spawners and redds found during the surveys continue to increase. The abundance of rainbow trout as predicted by spawner surveys for 2012 was 8,503 fish.

## WHITE STURGEON

BC Hydro is working in cooperation with federal and provincial Government partners to help restore Columbia River white sturgeon populations through long-term monitoring programs and physical works developed under the Water Use Plan.



White Sturgeon

BC Hydro is conducting several studies to better understand white sturgeon spawning, egg incubation, growth, and survival throughout the Columbia River. Results have shown sturgeon are spawning at multiple locations throughout the Columbia River including downstream of Revelstoke Dam, downstream of Hugh L. Keenleyside Dam and the Arrow Lakes Generating Station, near Kinnaird Rapids, downstream of Waneta Dam, and in the United States. Genetic work is ongoing to estimate numbers of adults spawning at these different locations. Flows in 2012 were higher than normal and movements of adult white sturgeon that have been implanted with acoustic transmitters will be monitored to track where they go and to determine what spawning habitats may be used in these high water years.



Examining egg mats for sturgeon eggs

BC Hydro continues to fund rearing of white sturgeon at the Wardner Fish Hatchery for release into the Columbia River. Last spring tagged hatchery juvenile white sturgeon were released near Castlegar and Revelstoke with the help of elementary school children from the communities. More juvenile sturgeon will be released in 2013. Juvenile sturgeon released near Revelstoke have been grown to larger size compared to previous years to determine if it helps them survive the first year after release into the wild. Very few juvenile sturgeon have been recovered in the Arrow Lakes to date. To help provide information on juveniles in the Arrow Lakes, an acoustic array was deployed to track juvenile sturgeon with tags to determine how they use the reservoir as it changes through the seasons. Further habitat work and flow modeling is also occurring near Revelstoke Dam and the known sturgeon spawning site.



Juvenile sturgeon

## RESERVOIR PRODUCTIVITY

BC Hydro is continuing with programs to investigate links between reservoir productivity and our operation of Kinbasket and Revelstoke Reservoirs. These programs are focusing on learning how the aquatic food webs work and whether we could make changes to our reservoir operations to improve biological production. The food webs start with how nutrients such as phosphorus and nitrogen are made available to phytoplankton (algae) and then on up the food chain to zooplankton and kokanee populations. Field sampling for water and plankton is conducted from May to October and kokanee populations are assessed in late summer and fall. Moored temperature monitoring stations were installed in the reservoirs in 2012 to provide more continuous data on how water, and thus nutrients, move through the system.



Spawning Kokanee

While low in productivity, both Kinbasket and Revelstoke Reservoirs support short, efficient food chains that have resulted in relatively good kokanee populations. Kokanee numbers can vary widely by year as they are dominated by fry (up to 75%-86%). Numbers of all other ages have remained relatively consistent over the years, averaging about 2 million in Kinbasket Reservoir and 200,000 in Revelstoke Reservoir.

## REVELSTOKE DAM MINIMUM FLOW

BC Hydro is continuing a suite of aquatic studies in the mid Columbia River to determine whether minimum flows at Revelstoke Dam will provide expected fisheries benefits. BC Hydro began operating Revelstoke Dam to provide a minimum flow of 142 cubic metres per second in December 2010. Discharge flows over the last two years have varied widely throughout the day and typically been maintained well above the minimum flow level. As a result, the data collected so far has not shown any changes in fish distribution or diversity.



Revelstoke Minimum flow sampling equipment

# UNDERSTANDING EFFECTS OF RESERVOIR OPERATIONS

A key component of the Columbia River Water Use Plan is to better understand how BC Hydro's Arrow Lakes Reservoir operations affect fish, wildlife, vegetation, recreation and archaeology. A number of studies are underway to gather this information that will be used to better inform future decision making at the next Water Use Plan review.

## BURBOT

BC Hydro will complete fieldwork for a five year Arrow Lakes burbot life history study in 2013. The study was designed to better understand how Arrow Reservoir and Revelstoke Dam operations affect burbot spawning. Fieldwork for the study involves capturing and tagging adult burbot with acoustic and radio transmitters and tracking their movements during the winter spawning season to identify spawning areas. Boat tracking surveys conducted during the burbot's winter spawning season between November and February indicate that burbot may spawn near the bottom of the Beaton Arm section of the Arrow Lakes Reservoir. More spawning investigations are planned in 2013 to confirm these results.

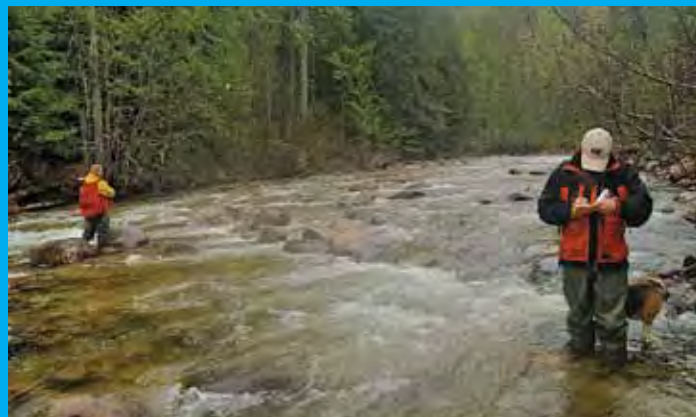


Deploying burbot trap

## TRIBUTARY ACCESS FOR SPAWNING FISH

Data collection also continues in 2013 for a seven-year study to determine whether Arrow Lakes Reservoir levels restrict kokanee, bull trout and rainbow trout access to spawning areas in tributary streams.

A total of 23 streams with potential for spawning and known or potential impediments to fish passage were assessed by the study. Of these, 19 streams with moderate to high spawning habitat are surveyed on a regular basis every year during summer and fall spawning periods to assess spawning fish use and access. Results are used to determine whether access is affected by reservoir levels and stream flows. The Akolkolex River falls prevent fish access at any time of year. However the river is monitored by the study due to the potential for spawning sites within the drawdown zone of the reservoir.



### ARROW LAKES RESERVOIR STREAMS MONITORED BY THE TRIBUTARY ACCESS STUDY

UPPER ARROW LAKES RESERVOIR	LOWER ARROW LAKES RESERVOIR
Akolkolex River	Burton Creek
Bannock Creek	Caribou Creek
Blanket Creek	Deer Creek
Cranberry Creek	Dog Creek
Crawford Creek	Eagle Creek
Drimmie Creek	Johnston Creek
Mackenzie Creek	Little Cayuse Creek
Nacillewaet Creek	Octopus Creek
Payne Creek	Renata Creek
	Taite Creek

The data collected so far indicate that reservoir levels have been sufficiently high to allow fish to access tributaries during spring and fall spawning. Stream surveys have shown that high spring stream runoff can move substrate and woody debris, possibly impeding fish passage.



Common yellowthroat

#### MIGRATORY SONGBIRDS

In 2008, BC Hydro implemented CLBMON 39, a ten year monitoring program designed to determine the effects of reservoir operations on neotropical migrant songbirds in Revelstoke Reach during fall migration. In the first three years of this study, research focused on the migration monitoring station at Machete Island. In 2011, monitoring in other habitats in Revelstoke Reach was implemented to assess the impacts of reservoir operations across the diversity of habitats throughout the Reach.

In spring of 2012, 123 random plots were surveyed and 285 migrants (30 species) were recorded on plot, with an average density of 2.32 migrants per plot. In fall of 2012, 98 permanent plots both in and outside of the drawdown zone were monitored. In total 881 surveys were conducted and 2,375 neotropical migrant songbirds of 51 species were recorded. The most frequently recorded migrant species on plot were Pine Siskin (209 records) and Common Yellowthroat (203 records).

#### NESTING BIRDS

BC Hydro continues to locate and monitor nests in the upper reaches of Arrow Lakes Reservoir (Revelstoke Reach) and Kinbasket Reservoir (Canoe Reach and Columbia Reach) under a ten-year study to better understand how nesting birds are affected by reservoir operations.

In 2012, field crews located and monitored a total of 284 nests in Revelstoke Reach and Canoe Reach. The primary cause of nest failure was predators (36 per cent) and rising reservoir levels (29 per cent). In 2012 reservoir operations were responsible for more failed nests than previous years. From 2009 to 2011, less than 10 per cent of nest failures were related to reservoir levels.



#### SHOREBIRDS AND WATERBIRDS

BC Hydro is continuing a ten-year study in the Revelstoke Reach stretch of Arrow Lakes Reservoir to document how reservoir operations affect waterbirds and shorebirds using area wetlands. Last year was the fifth year of regular spring and fall surveys under the study.

During the 2012 spring migration that peaked in about mid-April, eight land-based waterbird surveys were conducted that counted sightings of 5,221 waterfowl (25 species). The most common species were Canada Goose, American Wigeon, and Mallard. Most waterfowl were observed at Cartier Bay (46%), followed by Airport Marsh (25%) and Downie Marsh (9%). Aerial surveys provided estimates of the number of birds that could be using the study area during the migration period. Mallards were highest (about 503), followed by Canada Goose (about 212) and American Wigeon (about 152).

During the 2012 fall migration, 5,025 waterfowl (21 species) were counted during eight land-based waterbird surveys. Canada Goose, American Wigeon and Mallard were the most common species. Most waterfowl were observed at Cartier Bay (32%), followed by Airport Marsh (28%) and Locks Creek Outflow (17%). Canada Goose was also the leading species recorded during fall aerial surveys (about 1,462), followed by Mallard (about 303) and American Coot (about 110). The 2012 autumn migration peaked in the third week of October.

#### REVELSTOKE WILDLIFE ENHANCEMENT PROJECTS

BC Hydro is planning a suite of wildlife habitat enhancement projects south of Revelstoke to benefit waterfowl, birds, turtles, and other wetland wildlife species affected by BC Hydro's Arrow Lakes Reservoir operations. Work to rip-rap a bank of the

Airport Slough outflow channel to test if the rip-rap can halt further erosion and protect the wetland into the Columbia River was recently postponed to fall 2013 due to unsuitable spring conditions. Nest boxes will be installed this summer to provide additional habitat. In spring 2014 pending suitable reservoir conditions, BC Hydro plans to fill in two gaps in an abandoned railbed west of the Cartier Bay wetland with engineered dykes to protect the wetland and double its size. An artificial nesting island will also be installed in Carter Bay to see whether the structure can withstand reservoir operations and provide additional habitat.



Nest box



Western Painted Turtle

#### AMPHIBIANS AND REPTILES

BC Hydro is conducting an amphibian and reptile monitoring program in the drawdown zones of Kinbasket and Arrow Lakes reservoirs with surveys every two years. For Kinbasket Reservoir the survey schedule was changed to odd years starting in 2011 until 2017 to accommodate potential impacts from the new generating units being installed at Mica Generating Station; surveys will be conducted this year. Arrow Lakes Reservoir surveys are planned for even years with the next survey scheduled for 2014.

Work continues on a study to understand the life history of painted turtles living in the Upper Arrow Lakes Reservoir near Revelstoke. Visual surveys and radio telemetry of tagged turtles along with environmental monitoring will continue to understand the turtle's distribution, habitat use, abundance, productivity, and population demographics.

## ARROW LAKES RESERVOIR SOFT CONSTRAINTS

Under the Columbia Water Use Plan, the Consultative Committee developed a set of soft constraints for Arrow Lakes Reservoir to help guide operational decisions each year. It is recognized there are a number of conflicting objectives and the degree to which they are met depends on weather and runoff conditions, Treaty and Non-Treaty obligations and system requirements.

#### FIVE YEAR REVIEW

The Columbia River Water Use Plan recommends a multi-party review to evaluate how well the various non-power interests and objectives in Arrow Lakes Reservoir were met during the first five years of implementation (2008 to 2012). BC Hydro is currently in the planning process for this review.

# ARROW SOFT CONSTRAINTS PERFORMANCE 2012



## RECREATION

### TARGET

Reservoir water levels between 1435 feet and 1440 feet from May 24 to September 30, 2012.

### PERFORMANCE

The reservoir was above 1435 feet about 53 per cent of the time between May 24 and September 30, 2012.



## WILDLIFE

### TARGET

Ensure inundation of nesting bird habitat by rising reservoir levels and availability of fall migratory bird habitat is no worse than recent average (1984 – 1999). Target a reservoir level of 1438 feet or lower by August 7, 2012.

### PERFORMANCE

Arrow Lakes Reservoir was below 1424 feet for about 46 per cent of the time between April 30, and July 16, 2012 for nesting birds.

The reservoir was below 1438 feet for 80 per cent of the time between August 7 and October 31, 2012.



## FISH

### TARGET

Reservoir levels above 434 metres (1424 feet) to ensure tributary access during kokanee spawning period from late August to early November.

### PERFORMANCE

Reservoir was above 1424 feet about 93 per cent of the time between August 25 and Nov 15, 2012.



## VEGETATION

### TARGET

Maintain current (2004) level of vegetation in the drawdown zone by maintaining lower reservoir water levels during the growing season.

### PERFORMANCE

Reservoir was below 1424 feet for about 22 per cent of the time between May 1 and October 31, 2012.



## CULTURAL AND HERITAGE

### TARGET

Reservoir levels at or below 1430 feet for as long as possible to limit impacts to archaeological sites.

### PERFORMANCE

Reservoir was below 1430 feet for about 73 per cent of the year.



## EROSION

### TARGET

Minimize duration of full pool events and avoid sudden drawdown once full pool has been reached to avoid shoreline slumping. Reservoir water level of 1440 feet is ideal.

### PERFORMANCE

Due to exceptionally high inflows, the reservoir filled to above normal full pool to peak at 1445.3 feet on July 11, 2012 for flood management purposes on the Columbia river. As soon as the high flows abated in the Columbia river, the reservoir drafted as quickly as possible to reach normal full pool, 1444 feet by the end of July and below 1440 feet by August 18, 2012.

## HOW TO GET MORE INFORMATION

Copies of the Columbia River Water Use Plan, study terms of reference, reports, performance measures and the Columbia River WUP Consultative Committee report are available at [bchydro.com/planning\\_regulatory/water\\_use\\_planning.html](http://bchydro.com/planning_regulatory/water_use_planning.html).



FOR GENERATIONS

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