

Implementation of the Columbia River WUP –

BC Hydro's Commitment to a Balanced Approach to Water Management

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For
NTSA Public Engagement Forum
October 26-27, 2010**

Columbia River WUP - Scope

- ◆ 4-year (2000-2004) consultative process to examine ways BCH could operate the system to balance water uses for power and non-power interests
- ◆ Designed to specifically address BC Hydro facility operations (Mica, Revelstoke and Hugh Keenleyside project operations).
 - ◆ Not intended to review operations of hydroelectric facilities owned by other entities.
 - ◆ BC Hydro, through commercial agreements, manages water on lower Kootenay River. But these facilities are not owned by BC Hydro and therefore were excluded from Columbia River WUP
- ◆ Violating CRT was outside scope as it may expose the Province to possible contractual liabilities & potentially very large financial risks associated with downstream benefits

Columbia River WUP - Scope

- ◆ Beyond general guidance provided in the WUP guidelines, specific constraints put on the Columbia WUP process
- ◆ May consider operating alternatives that:
 - ◆ include incremental changes to existing operations that BC Hydro can unilaterally implement
 - ◆ flex operations –e.g., swapping water between Kinbasket and Arrow
 - ◆ constraints on reservoir maximum/minimum levels that can be accommodated within Treaty operations
 - ◆ ramping rates
 - ◆ incremental use of Non-Treaty storage.
 - ◆ recognize local and downstream flood control operations, as required by the CRT
 - ◆ affect Detailed Operating Plans and Supplemental Operating Agreements developed under the Treaty, or that affect operations under the Non-Treaty Storage Agreement but BC Hydro's ability to secure such an alternative is dependent on successful negotiations with the U.S. Entity

Columbia River WUP

Interests - Water: A Multiple Use Resource

- ◆ Fish and aquatic resources
- ◆ Flood/erosion control
- ◆ Cultural and heritage resources
- ◆ Power generation
- ◆ Recreation
- ◆ Wildlife and wildlife habitat
- ◆ Vegetation
- ◆ Navigation
- ◆ Learning



Columbia River WUP

Implementation Order

- ◆ Consensus WUP
 - ◆ no operational changes at KIN
 - ◆ year-round minimum flow at REV
 - ◆ soft operational constraints on Arrow
 - ◆ negotiated flows for WF and RBT in lower Columbia
- ◆ In January 2007, CWR approved the Columbia River WUP and issued BC Hydro with the Implementation Order
 - ◆ 62 monitoring programs & feasibility studies
 - ◆ 25 physical works
- ◆ Order includes all CC recommendations, with exception to elements of the Heritage Management Plan
 - ◆ CC recommendations related to intrusive works could not be ordered under *Water Act*

Columbia River WUP

Amendments to Order

- ◆ Order amended to include additional studies and physical works recommended by Core Committees and specified in Project Approval Certificates for REV 5 & MCA 5/6
 - ◆ Changes to existing WUP studies and physical works
 - ◆ Addition of new studies & physical works
 - ◆ MCR bank erosion control and monitoring
 - ◆ MCR long-term erosion monitoring
 - ◆ MCR juvenile fish stranding
 - ◆ MCR Effects of flow changes on incubating and early rearing sturgeon
 - ◆ REV Reservoir macrophyte overview
 - ◆ Mica TGP study
 - ◆ Nagle Creek wetland study
 - ◆ Kinbasket Reservoir wetland vegetation study
 - ◆ Mica tailrace fish indexing

Columbia River WUP

Review Periods

- 5-year interim review (2013) to review monitoring results, evaluate effectiveness of operations and efficacy of physical works in Arrow Lakes Reservoir.
- Full WUP review 13 years after implementation (2021), unless results of monitoring suggest an earlier review is appropriate or significant risks are identified
- Other interim reviews required:
 - MCR Sturgeon Phase Reviews (2011, 2014); UCRWSI
 - WF Flow Interim Analysis (2013); COFAC

Columbia River Water License Requirements (WLR)

- ◆ KIN Fish & Wildlife Information Plan
- ◆ KIN/ARR Recreation Management Plan
- ◆ KIN/ARR Revegetation Management Plan
- ◆ Revelstoke Flow Management Plan
- ◆ Columbia White Sturgeon Management Plan
- ◆ Arrow Operations Management Plan
- ◆ Arrow Wildlife Management Plan
- ◆ Lower Columbia River Fish Management Plan
- ◆ Heritage Management Plan

- ◆ Total Program Costs = ~\$120 million over 13 years

Columbia River WLR

Kinbasket Fish & Wildlife Information Plan

- ◆ Monitoring to gain better understanding of KIN Reservoir ecology and impacts of current operations to inform future operational decision making
 - ◆ TGP
 - ◆ Fish Stranding
 - ◆ Burbot, Bull Trout & Rainbow Trout Life History & Habitat Use
 - ◆ Kokanee Population Monitoring
 - ◆ Ecological Productivity
 - ◆ Valemount Peatland Monitoring
 - ◆ Revelstoke Reservoir Macrophyte Study

- ◆ Total Project Costs: ~\$7.3 million



Columbia River WLR

KIN, ARR and LCR Recreation Plan

- Physical works in lieu of operational changes to benefit recreational interests
 - KIN accelerated debris removal
 - KIN & ARR Reservoir debris management at recreation sites
 - Construction of new boat ramps
 - Improvements to existing boat ramps
 - Monitor boat ramp use on KIN & ARR
 - Debris removal at Indian Eddy
 - Feasibility studies and environmental reviews to enable physical works
- Total Project Costs: ~\$17 million

Columbia River WLR

KIN/ARR Revegetation Management Plan

- Planting program in Kinbasket and Arrow drawdown zones in lieu of hard constraints on reservoir operations
 - Goal to develop self-sustaining vegetation communities
- Vegetation Inventories and Effectiveness Monitoring of Revegetation Efforts
 - Monitor changes in vegetation over time to assess link to operations and evaluate long-term success of planting efforts

- Total Project Costs:
~\$16 million



Columbia River WLR

Revelstoke Flow Management Plan

- ◆ Implementation of 5 kcfs year-round min flow from REV Dam
 - ◆ Delayed to fall 2010 to synchronize with ISD of REV 5 Project
- ◆ Adaptive long-term monitoring program to help resolve data gaps on current status of aquatic communities in MCR and relative importance of mainstem large river habitats relative to reservoir and adjacent tributary habitats, and to assess effectiveness of the min flow
 - ◆ MCR physical habitat & ecological productivity
 - ◆ MCR fish population indexing
 - ◆ MCR juvenile fish habitat use
 - ◆ MCR adult fish habitat use
 - ◆ MCR juvenile fish stranding

Columbia River WLR

Sturgeon Management Plan

- ◆ Flow treatments, physical works and monitoring aimed at better understanding sturgeon habitat capabilities and causes of recruitment failure, and to support rebuilding of ARR and LCR populations
 - ◆ Experimental & conservation aquaculture in MCR (and possibly in KIN)
 - ◆ KIN Sturgeon Inventory & Recolonization Risk Assessment
 - ◆ Monitoring of all sturgeon life stages & habitat conditions in MCR & LCR
 - ◆ Seasonal spawning/incubation flow in MCR
 - ◆ Conservation aquaculture in LCR
 - ◆ Monitoring of opportunistic high flow events in LCR
 - ◆ Physical works in LCR to address recruitment failure
- ◆ Total Project Costs: ~\$ 35 million



Columbia River WLR

Arrow Operations Management Plan

- ◆ Soft operational constraints for ARR to benefits a range of social & environmental interests
- ◆ Data collection plan to evaluate performance in meeting objectives for KIN & ARR reservoirs and better understand operational impacts for future decision making
 - ◆ ARR Burbot Life History
 - ◆ ARR Tributary Access Study
 - ◆ KIN/ARR Nest Mortality of Migrating Birds
 - ◆ KIN/ARR Amphibian & Reptile Life History
 - ◆ ARR Neotropical Migrant Use of drawdown zone
 - ◆ ARR Shorebird & Waterbird Monitoring
 - ◆ ARR Recreation Demand Study



Columbia River WLR

Arrow Reservoir Wildlife Management Plan

- Wildlife Physical Works Feasibility Study to ensure projects are not conflicting with other values (e.g., recreation)
- Study of High Value Wildlife Habitat for Potential Enhancement and Protection
- Implement & Monitor Wildlife Physical Works Projects
 - Five enhancement projects selected for Phase 1
 - Additional habitat structures designed to benefit wildlife (i.e., nest boxes, loafing logs)
- Total Project Costs: ~ \$4.4 million

Columbia River WLR

Lower Columbia Fish Management Plan

- ◆ Monitoring program to evaluate effects of whitefish and rainbow trout protection flows on fish and wildlife habitat in LCR and provide a baseline for assessing future changes
 - ◆ Fish Stranding Assessment and Protocol
 - ◆ Sculpin and Dace Life History Assessment
 - ◆ Physical Habitat and Ecological Productivity Monitoring
 - ◆ Fish Population Indexing Surveys
 - ◆ Rainbow Trout Spawning Habitat Assessment
 - ◆ Whitefish Spawning Ground Topographic Survey
 - ◆ Whitefish Egg Monitoring & Life History Study
 - ◆ Lower Columbia River Effects of Whitefish Flows on Great Blue Heron and Winter Use of Waldie Island
- ◆ Total Project Costs: ~\$ 9.9 million

Columbia River WLR Heritage Management Plan

- ◆ KIN/REV Reservoirs Archaeological Overview Assessment
 - ◆ 1 year study completed
- ◆ ARR Reservoir Archaeological Overview Assessment
 - ◆ 2 year study completed
- ◆ ARR Reservoir Wind and Wave Erosion Study
 - ◆ 5 year study initiated in 2009

- ◆ Total Project Costs:
~\$ 600,000



- ◆ Arch Site Inventory and Management (i.e., intrusive works) being undertaken through BCH's Reservoir Archaeology Program