Columbia River Water Use Plan

Arrow Lakes Reservoir Wildlife Management Plan Physical Works

Annual Report: 2019

Implementation Period: March 2018 to February 2019

- **CLBWORKS-29A Arrow Lakes Reservoir: Wildlife Physical Works Feasibility Study**
- **CLBWORKS-29B Arrow Lakes Reservoir: Study of High-Value Wildlife Habitat for Potential Enhancement and Protection**
- **CLBWORKS-30A Arrow Lakes Reservoir: Implementation of Wildlife Physical Works – Revelstoke Reach**
- **CLBWORKS-30B Arrow Lakes Reservoir: Implementation of Wildlife Physical Works –Arrow Reservoir**

Conditional Water Licences for Kinbasket storage (27068 and 39432), Mica diversion (39431), Revelstoke diversion and storage (47215), and Arrow storage (27066)

March 29, 2019

BC Hydro Columbia River Project Water Use Plan Arrow Lakes Reservoir Wildlife Management Plan Physical Works Annual Report: 2019

1 Introduction

This document represents a summary of the status and the results of the Arrow Lakes Reservoir Wildlife Management Plan Water Use Plan (WUP) physical works to February 28, 2019, as per the Columbia River WUP Order under the *Water Act*, dated January 26, 2007 and the Amended Order dated August 23, 2007. There are two studies and two physical works.

2 Status

The following table outlines the dates that Terms of Reference (TOR) for the Arrow Lakes Reservoir Wildlife Management Plan WUP studies and physical works were submitted to and approved by the CWR.

Table: 2-1: Dates of Arrow Lakes Reservoir Wildlife Management Plan WUP TOR Submissions and Approvals by the Comptroller of Water Rights

Physical Works TOR	Order Clause	Original TOR Submission		Most Recent TOR Resubmission	
		Date Submitted	Date Approved	Date Submitted	Date Approved
CLBWORKS-29A Arrow Lakes Reservoir Wildlife Physical Works Feasibility Study	Schedule C, Clause 6.a Schedule D, Clause 6.a	Jan 24, 2008	Feb 20, 2008	Apr 30, 2009	Aug 05, 2009
CLBWORKS-29B Arrow Lakes Reservoir Study of High-Value Wildlife Habitat for Potential Enhancement and Protection	Schedule C, Clause 5.h Schedule D, Clause 5.c	Jan 24, 2008	Feb 20, 2008	Apr 15, 2009	May 11, 2009
CLBWORKS-30A Arrow Lakes Reservoir Wildlife Physical Works (Revelstoke Reach)	Condition List, Clause 4.a	Jun 27, 2011	Aug 02, 2011	May 13, 2016	Jun 27, 2016
CLBWORKS-30B Arrow Lakes Reservoir Wildlife Physical Works (Arrow Reservoir)	Condition List, Clause 7.a	Jul 07, 2016	Jul 26, 2016	Nov 15, 2017	Dec 12, 2017

3 Schedule

The following table outlines the current schedule for the WUP studies and physical works being delivered for the Arrow Lakes Reservoir Wildlife Management Plan WUP.

Table 3-1: Physical Works Schedule as of February 28, 2019

Physical Works	2008 WLR YR1	2009 WLR YR2	2010 WLR YR3	2011 WLR YR4	2012 WLR YR5	2013 WLR YR6 Interim Review	2014 WLR YR7	2015 WLR YR8	2016 WLR YR9	2017 WLR YR10	2018 WLR YR11	2019 WLR YR12	2020 WLR YR13
CLBWORKS - 29A Arrow Lakes Reservoir Wildlife Physical Works Feasibility Study	✓	✓F											
CLBWORKS - 29B Arrow Lakes Reservoir Study of High-Value Wildlife Habitat for Potential Enhancement and Protection				✓					✓F				
CLBWORKS - 30A Arrow Lakes Reservoir Wildlife Physical Works-Revelstoke Reach						✓	✓	✓	✓		×	■	
CLBWORKS - 30B Arrow Lakes Reservoir Wildlife Physical Works-Arrow Reservoir									✓	✓	×	■	

Legend:
■ = Program to be undertaken/initiated in identified year
■ = Program planned pending TOR resubmission
u/w = Project is underway
✓ = Program completed for the year
✓F = All field work for this project is complete. No further field work is planned.
× = Program delayed

4 Physical Works Terms of Reference

The Physical Works being implemented under the Arrow Lakes Reservoir Wildlife Management Plan WUP are described in TOR. These TOR and the reports for work completed to date can be found here:

http://www.bchydro.com/about/sustainability/conservation/water_use_planning/southern_interior/columbia_river/arrow-wildlife.html

5 Status of Physical Works

5.1 CLBWORKS-29A Arrow Lakes Reservoir: Wildlife Physical Works Feasibility Study

This feasibility study was initiated in 2008 and completed in 2009.

The purpose of this study was to identify and assess wildlife physical works opportunities in Revelstoke Reach and provide guidance towards the implementation of those works by defining treatment options, methods and schedule. Phase I started with sites originally identified by the Consultative Committee during the development of the Columbia WUP. BC Hydro established a Wildlife Physical Works Committee (WPWC) with representation from BC Hydro, Ministry of Environment, Ducks Unlimited, First Nations, and local stakeholders to assess 45 potential sites.

In Phase II, the WPWC narrowed the projects to 35 potential sites on the basis of technical feasibility and costs, then to eight on the basis of biological and operational criteria. The eight were presented at an open house in Revelstoke in December 2009, and preliminary designs were subsequently developed for five projects.

Following the review of project costs and anticipated benefits, the WPWC endorsed three of the projects:

- Site 6A at Airport Marsh: including construction of a riprap mattress to halt the erosion of the east arm of the outflow channel located near Airport Marsh and Machete Island. The work also included the installation of nest boxes in the Revelstoke Reach area;
- Site 14 at Cartier Bay: including filling in the breach in the old CP railway grade to retain water behind the grade and create seasonal shallow open water habitat; and
- Site 15A at Cartier Bay: including removal of an old collapsed wooden box culvert and reconstruction of the dike to be one metre higher than the present elevation.

The implementation of these three wildlife physical works projects is carried out under CLBWORKS-30A.

5.2 CLBWORKS-29B Arrow Lakes Reservoir: Study of High-Value Wildlife Habitat for Potential Enhancement and Protection

This feasibility study was initiated in 2011 and updated in 2016.

The purpose of this study was to conduct a preliminary feasibility assessment for wildlife physical works opportunities on the middle to lower Arrow Reservoir (outside of Revelstoke Reach). At a stakeholder meeting in 2010, the original five high-value habitat sites identified were reviewed and the following three sites were recommended for further assessment:

- Creation of new shallow wetland habitat at Burton Creek;
- Creation of new shallow wetland habitat at Edgewood South; and
- Enhancement of existing shallow wetland habitat at Lower Inonoaklin Road.

A feasibility assessment was complete in 2011 that assessed the following aspects: hydrological (including substrate, topography, and natural water sources), ecological (wildlife enhancement potential), regulatory (permitting requirements), and financial.

The 2011 feasibility assessment was updated in the summer of 2016 to incorporate the findings from several WUP monitoring studies (CLBMON-11B, 12, 33, 37) and existing conditions on site. As a result of the re-evaluation of the ecological opportunity and risks of each site, the Edgewood South site was evaluated as a highly productive wetland; therefore, modifications to Edgewood were eliminated from further consideration to protect the existing ecological functioning of the site.

Design and implementation of the physical works is carried out under CLBWORKS -30B.

5.3 CLBWORKS-30A Arrow Lakes Reservoir: Implementation of Wildlife Physical Works – Revelstoke Reach

The objective of CLBWORKS-30 is to implement the recommendations from the feasibility studies (CLBWORKS-29A and 29B). To ensure the work reflects the terms of the Order which are specific to Revelstoke Reach and Mid to Low Arrow Reservoir, CLBWORKS-30 was separated into:

- CLBWORKS-30A for Revelstoke Reach; and
- CLBWORKS-30B for Arrow Reservoir.

CLBWORKS-30A includes the detailed design, the construction, and ongoing maintenance of the three projects identified in CLBWORKS-29A:

- Site 6A at Airport Marsh;
- Site 14 at Cartier Bay; and
- Site 15A at Cartier Bay.

Site 6A was completed in October 2013. Nest boxes (wildlife enhancement structures) were installed in 2013 and 2014.

As summarized in depth in the 2015 Annual Report, an Ecological Impact Assessment (EIA) was completed in 2015 which concluded that it is very uncertain whether the proposed projects at Cartier Bay (Site 14 and 15A) would create net ecological benefits. The EIA recommended not proceeding with the original design for Site 15A, and identified very limited benefit of the works proposed for Site 14.

BC Hydro decided not to expand the Cartier Bay wetland as originally proposed in January 2013 based on public concerns, the results of the EIA, an independent review from a wetland restoration specialist, and an extensive review of wildlife monitoring in the area. These reviews indicate that Cartier Bay currently has high quality wildlife habitat that may be put at risk by altering the wetland.

BC Hydro subsequently revised the scope of the project to eliminate Site 14 and modify the design at Site 15A to reinforce the existing rail bed at the site of the wood box culvert. This would maintain and protect the existing wetland as it is currently functioning. The Cartier Bay wetland (Site 15A), approximately 26 hectares in size, was created by a filled, collapsed box culvert at the bottom of a gap in the abandoned rail bed that runs 300 metres west of the Cartier Bay peninsula and parallel to the old highway. The collapsed culvert holds back water and prevents the Cartier Bay wetland from draining as the Arrow Lakes Reservoir water levels drop. The box culvert was eroding, putting the wetland at risk from draining.

A revised approach for Site 15A was approved by the CWR on November 18, 2015. Delays associated with obtaining Provincial Dam Safety's approval of the new design and related water conservation licence deferred the project construction until the fall of 2016.

In October 2016, BC Hydro installed rock rip rap on the river side of the old rail line at the box culvert to protect the wetland and reinforce the box culvert of Site 15A.

The remaining wildlife enhancement structures (i.e., bat boxes) were delayed to incorporate emerging design considerations by the BC Bat Network and are planned for installation in 2019.

5.4 CLBWORKS-30B Arrow Lakes Reservoir: Implementation of Wildlife Physical Works – Arrow Reservoir

CLBWORKS-30B includes the detailed design, the construction, and ongoing maintenance of the three projects identified in the 2016 update to CLBWORKS-29B:

- Burton Creek;
- Edgewood South; and
- Lower Inonoaklin Road.

Burton Creek is located south of Nakusp, on the east side of Arrow Lakes Reservoir. The Lower Inonoaklin site is located south of the Fauquier ferry on the west side of Arrow Lakes Reservoir. Edgewood South is located immediately south of the confluence of Eagle Creek on the west side of Arrow Lakes Reservoir. As the Edgewood site is already a highly productive wetland, it was eliminated from further consideration as it carries the most risk that the existing functional wetland could be negatively impacted by any further modification.

Preliminary designs were completed in 2017 for Lower Inonoaklin Road. Hydrologic modelling concluded that the proposed berms would result in a delay of spring inundation of only one to two weeks which is not biologically significant. In addition, the construction cost estimate was significantly higher than the conceptual design estimate. As a result, BC Hydro has not proceeded with implementation of the designs at Lower Inonoaklin Road.

Preliminary designs were completed in July 2017 for Burton Creek. BC Hydro shared them with First Nations, regulatory agencies, and the public in August 2017 prior to submitting the TOR for the Implementation Phase of this project in November 2017.

Implementation did not proceed in 2018 due to delays in acquiring crown tenure for portions of the wetland footprint. Implementation will require suitable conditions in terms of water levels, ground conditions, etc. Assuming all regulatory requirements are met, the earliest date of wetland construction at Burton Creek would be in the fall of 2019.

6 Physical Works Costs

The following table summarizes the Arrow Lakes Reservoir Wildlife Management Plan WUP physical works costs approved by the Comptroller and the Actual Costs to February 28, 2019.

Table 6-1: Arrow Lakes Reservoir Wildlife Management Plan WUP Physical Works Costs

Monitoring Programs	Costs approved by CWR	Life to Date Actuals (LTD)	Estimated to Complete (Forecast)	Total Forecast (LTD and Forecast)	Variance Total to Approved	Explanation	Corrective Action
CLB MP7 Arrow Res WL Annual Report	$9,514	$5,594	$893	$6,486	$3,028		
C07W29A Arrow Feas - OR	$242,054	$242,054		$242,054	($0)	Project Complete	
C07W29A Arrow Feas - OR DM	$34,038	$35,586		$35,586	($1,548)		
C07W29A Arrow Feas - OR Imp	$208,016	$206,468		$206,468	$1,548		
C07W29A Arrow Feas - ONR		$1,031		$1,031	($1,031)	CLBWORKS 29A was overspent without approval from the CWR, overage was absorbed through ONR funds.	
C07W29A Arrow Feas - ONR DM OS		$1,031		$1,031	($1,031)		
C07W29B ARR High Value	$81,045	$80,517		$80,517	$528	Project Complete	
C07W29B ARR High Value - OR DM	$15,387	$8,517		$8,517	$6,870		
C07W29B ARR High Value - OR Imp	$65,658	$72,000		$72,000	($6,342)		
C07W30A ARR Wildlife Pw	$1,348,643	$1,212,964	$57,954	$1,270,918	$77,725	Efficiencies found during project implementation	
C07W30A ARR Wildlife Pw - OR DM	$214,376	$222,330	$5,454	$227,784	($13,408)		
C07W30A ARR Wildlife Pw - OR Imp	$1,134,267	$990,633	$52,500	$1,043,133	$91,134		
C07W30B ARR Wildlife Lower	$2,282,821	$635,977	$1,503,694	$2,139,670	$143,151	Efficiencies found during project implementation	
C07W30B ARR Wildlife Lower - OR DM	$266,820	$245,981	$95,009	$340,990	($74,170)		
C07W30B ARR Wildlife Lower - OR Imp	$2,016,001	$389,996	$1,408,684	$1,798,680	$217,321		

OR - Ordered Remissible
ONR - Ordered Non-Remissible

* Red values in parentheses denote overage.