

## **Columbia River Water Use Plan**

### **Arrow Lakes Reservoir Wildlife Management Plan Physical Works**

**Annual Report: 2023**

**Implementation Period: March 2022 to February 2023**

- **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 31, 2023**

## **BC Hydro Columbia River Project Water Use Plan Arrow Lakes Reservoir Wildlife Management Plan Physical Works Annual Report: 2023**

### **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, 2023, 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 25, 2008	Feb 26, 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 25, 2008	Feb 26, 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	Feb 04, 2022	Feb 15, 2022
CLBWORKS-30B Arrow Lakes Reservoir Wildlife Physical Works (Arrow Reservoir)	Condition List, Clause 7.a	Jul 07, 2016	Jul 26, 2016	Jan 29, 2020	Feb 19, 2020

### **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, 2023**

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	2021 WLR YR14	2022 WLR YR15	2023 WLR YR16	2024 WLR YR17	2025 WLR YR18	2026 WLR YR19
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						✓	✓	✓	✓		x	✓	✓	✓	x	■	■	■	■
CLBWORKS - 30B Arrow Lakes Reservoir Wildlife Physical Works-Arrow Reservoir									✓	✓	x	✓	x	✓F					

Legend: ■ = Program to be undertaken/initiated in identified year  
 ✓ = Program completed for the year  
 ✓F = All field work for this project is complete. No further field work is planned.  
 x = 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:

[https://www.bchydro.com/toolbar/about/sustainability/environmental\\_responsibility/water-use-plans/southern-interior/columbia-river/arrow-wildlife.html](https://www.bchydro.com/toolbar/about/sustainability/environmental_responsibility/water-use-plans/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. This project is complete.

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) including detailed design, construction, and ongoing maintenance of projects. 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 elaborates on the feasibility of the three projects identified in CLBWORKS-29A:

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

In subsequent analysis included in the 2015 Annual Report, Site 14 was dropped from further consideration as it was expected to have very limited ecological benefit.

The east eroding arm of Site 6A was completed in October 2013 and continues to provide erosion protection. However, in 2020 and again in 2022, erosion to the west arm of Site 6A was observed. Conceptual design of options to prevent further erosion has commenced with an aim to construct the preferred alternative in 2024.

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 held back water and prevented 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.

The 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.

During an inspection in May 2020 a new outflow channel was observed to be forming on the north side of the wetland. Emergency repairs were completed in October 2020 to stabilize the channel with sandbags to prevent further erosion.

Detailed design for the erosion repair at the northern edge of the wetland was completed in 2022. The current plan is to conduct the works in late April 2023 when the site is snow free and reservoir elevations conditions allow. The Detailed design report dated May 13, 2022 is attached.

The remaining wildlife enhancement structures (i.e., bat boxes) were delayed incorporating emerging design considerations by the BC Bat Network and were planned for installation in 2019. Two BrandenBark bat poles were installed in fall 2019 at one location (Montana 3). One mini-Condo, Rocket Box, back-to-back maternity box and one BrandenBark bat pole was installed in November 2020 at one location (Hayfield). Three remaining structures were installed at the Burton Wetland (CLBWORKS-30B) in April 2021.

Attached is the summary of bat roost habitat enhancement installations at Revelstoke Reach and Burton Wetland dated May 25, 2022.

#### **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 Burton Creek project identified in the 2016 update to CLBWORKS-29B. As mentioned in previous annual reports, the Lower Inonoaklin and Edgewood south sites were not feasible and did not proceed to detailed design.

Burton Creek is located south of Nakusp, on the east side of Arrow Lakes Reservoir. The detailed design was completed in October 2018. Phase 1 of the work was completed in 2019.

Engineering inspections were conducted in Spring 2020 and Fall 2020 on the Phase 1 constructed works. The engineering inspections identified significant cost savings without compromising the design and or scope of work for the Phase 2 construction works. Phase 2 of the work was completed in Spring 2021. A rocket Box, one back-to-back maternity box and one BrandenBark bat pole were installed on the mounds during the spring 2021 construction. In 2022, two project information signs were installed, and maintenance (weeding) was conducted to provide a better opportunity for the native plants to establish at the site. A TOR will be submitted for the inspections and maintenance phase of the project in 2023.

Attached is the summary of bat roost habitat enhancement installations at Revelstoke Reach and Burton Wetland dated May 25, 2022.

## **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, 2023

**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
<b>CLB MP7 Arrow Res WL Annual Report</b>	\$10,302	\$7,587	\$1,259	\$8,846	\$1,456		
<b>C07W29A Arrow Feas - ONR</b>		\$1,031		\$1,031	(\$1,031)	Overspend on 29A without approval from the CWR, coverage was absorbed through ONR funds.	
C07W29A Arrow Feas - ONR DM OS		\$1,031		\$1,031	(\$1,031)		
<b>C07W29A Arrow Feas - OR</b>	\$242,054	\$242,054		\$242,054	(\$0)	Project Completed	
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		
<b>C07W29B ARR High Value</b>	\$81,045	\$80,517	\$528	\$81,045	\$0	Project Completed	
C07W29B ARR High Value - OR DM	\$15,387	\$8,517	\$528	\$9,045	\$6,342		
C07W29B ARR High Value - OR Imp	\$65,658	\$72,000		\$72,000	(\$6,342)		
<b>C07W30A ARR Wildlife Pw</b>	\$2,801,798	\$1,661,914	\$1,120,609	\$2,782,523	\$19,275		
C07W30A ARR Wildlife Pw - OR DM	\$638,093	\$437,406	\$266,769	\$704,174	(\$66,081)		
C07W30A ARR Wildlife Pw - OR Imp	\$2,163,705	\$1,224,508	\$853,840	\$2,078,348	\$85,357		
<b>C07W30B ARR Wildlife Lower</b>	\$4,989,028	\$3,017,822	\$76,198	\$3,094,020	\$1,895,008	Project Completed. Efficiencies found in the project.	TOR for Maintenance and Inspection of the works to be submitted in 2023.
C07W30B ARR Wildlife Lower - OR DM	\$636,972	\$570,208	\$4,108	\$574,316	\$62,656		
C07W30B ARR Wildlife Lower - OR Imp	\$4,352,056	\$2,447,614	\$72,090	\$2,519,704	\$1,832,352		

OR - Ordered Remissible  
 ONR - Ordered Non-Remissible

\* Red values in parentheses denote overage.