

Columbia River Water Use Plan

Arrow Lakes Reservoir Operations Management Plan

Monitoring Program

Annual Report: 2015

Implementation Period: June 2014 – May 2015

- **CLBMON-31 Arrow Lakes Reservoir: Burbot Life History Study**
- **CLBMON-32 Arrow Lakes Reservoir: Tributary Fish Migration Study**
- **CLBMON-36 Kinbasket and Arrow Lakes Reservoir: Nest Mortality of Migratory Birds due to Reservoir Operations**
- **CLBMON-37 Kinbasket and Arrow Lakes Reservoir: Amphibian and Reptile Life History and Habitat Use Assessment**
- **CLBMON-39 Arrow Lakes Reservoir: Neotropical Migrant Use of the Drawdown Zone**
- **CLBMON-40 Arrow Lakes Reservoir: Arrow Lakes Reservoir Shorebird and Waterbird Monitoring Program**
- **CLBMON-41 Arrow Lakes Reservoir: Recreational Demand Study**
- **CLBMON-58 Monitoring of Impacts on Amphibians and Reptiles from Mica Units 5 and 6 in Kinbasket Reservoir**

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

BC Hydro Columbia River Project Water Use Plan Arrow Lakes Reservoir Operations Management Plan Monitoring Programs Annual Report: 2015

1 Introduction

This document represents a summary of the status and the results of the Arrow Lakes Reservoir Operations Management Plan Water Use Plan (WUP) monitoring programs to May 2015, as per the Columbia River Order under the *Water Act*, dated January 26, 2007. There are eight monitoring programs.

2 Status

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

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

Monitoring Program & Physical Works TOR	Order Clause	Original ToR Submission		Most Recent ToR Resubmission	
		Date Submitted	Date Approved	Date Submitted	Date Approved
CLBMON-31 Arrow Lakes Reservoir: Burbot Life History Study	Schedule D: 5.a	Oct 24, 2007	Dec 03, 2007		
CLBMON-32 Arrow Lakes Reservoir: Tributary Fish Migration Study	Schedule D: 5.b	Oct 24, 2007	Dec 03, 2007		
CLBMON-36 Kinbasket and Arrow Lakes Reservoir: Nest Mortality of Migratory Birds due to Reservoir Operations	Schedule A: 6.a Schedule C: 5.c	Jan 25, 2008	Mar 03, 2008	Dec 18, 2014	Feb 04, 2015
CLBMON-37 Kinbasket and Arrow Lakes Reservoir: Amphibian and Reptile Life History and Habitat Use Assessment	Schedule A: 6.b Schedule C: 5.d	Jan 25, 2008	Mar 03, 2008	Jan 04, 2011	Apr 12, 2011
CLBMON-39 Arrow Lakes Reservoir: Neotropical Migrant Use of the Drawdown Zone	Schedule C: 5.f	Jan 25, 2008	Mar 17, 2008		
CLBMON-40 Arrow Lakes Reservoir: Arrow Lakes Reservoir Shorebird and Waterbird Monitoring Program	Schedule C: 5.e, 5.g	Jan 25, 2008	Mar 03, 2008	Oct 22, 2008	Dec 10, 2008
CLBMON-41 Arrow Lakes Reservoir: Recreational Demand Study	Clause 6.c Ordered Jan 26, 2007 and Clause 6.c Ordered by CWR Apr 24, 2007	Jul 31, 2008	Sep 11, 2008		
CLBMON-58 Monitoring of Impacts on Amphibians and Reptiles from Mica Units 5 and 6 in Kinbasket Reservoir	Augment to Schedule A: 6.b Schedule C: 5.d	Jan 04, 2011	Apr 12, 2011		

3 Schedule

The following table outlines the current schedule for the monitoring programs being delivered for the Arrow Lakes Reservoir Operations Management Plan WUP.

Table 3-1: Table of WUP Schedule

Monitoring Programs	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
	WLR YR1	WLR YR2	WLR YR3	WLR YR4	WLR YR5	WLR YR6	WLR YR7 Interim Review	WLR YR8	WLR YR9	WLR YR10	WLR YR11	WLR YR12	WLR YR13
CLBMON-31 Arrow Lakes Reservoir: Burbot Life History Study		✓	✓	✓	✓	✓							
CLBMON-32 Arrow Lakes Reservoir: Tributary Fish Migration Study		✓	✓	✓	✓	✓	✓						
CLBMON-36 Kinbasket and Arrow Lakes Reservoir: Nest Mortality of Migratory Birds due to Reservoir Operations		✓	✓	✓	✓	✓	✓	✓	u/w	■	■		
CLBMON-37 Kinbasket and Arrow Lakes Reservoir: Amphibian and Reptile Life History and Habitat Use Assessment		✓	✓	✓		✓		✓		■		■	
CLBMON-39 Arrow Lakes Reservoir: Neotropical Migrant Use of the Drawdown Zone		✓	✓	✓	✓	✓	✓	✓	■	■	■		
CLBMON-40 Arrow Lakes Reservoir: Arrow Lakes Reservoir Shorebird and Waterbird Monitoring Program		✓	✓	✓	✓	✓	✓	✓	u/w	■	■		
CLBMON-41 Arrow Lakes Reservoir: Recreational Demand Study			✓	✓	✓	✓	✓						
CLBMON-58 Mica Addendum to CLBMON 37 Amphibians and Reptiles					✓		✓		u/w		■		
Legend: <ul style="list-style-type: none"> ■ = 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 													

4 Monitoring Programs Terms of Reference

The monitoring programs being implemented under the Arrow Lakes Reservoir Operations Management Plan WUP are described in Terms of Reference. These Terms of Reference 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-operations.html

5 Status of Monitoring Programs

5.1 CLBMON-31 Arrow Lakes Reservoir: Burbot Life History Study

This monitoring program was initiated in 2008 and was completed in 2013. All reports have been submitted.

5.2 CLBMON-32 Arrow Lakes Reservoir: Tributary Fish Migration Study

This monitoring program was initiated in 2008 and will be carried out over six years. Attached is the report for Year 6, dated November 2014.

5.3 CLBMON-36 Kinbasket and Arrow Lakes Reservoir: Nest Mortality of Migratory Birds due to Reservoir Operations

This monitoring program was initiated in 2008 and will be carried out over ten years. Attached is the report for Year 7 dated March 2015.

5.4 CLBMON-37 Kinbasket and Arrow Lakes Reservoir: Amphibian and Reptile Life History and Habitat Use Assessment

This monitoring program was initiated in 2008 and will be carried out every other year for eleven years. Attached is the report for Year 5 dated February 13, 2015.

5.5 CLBMON-39 Arrow Lakes Reservoir: Neotropical Migrant Use of the Drawdown Zone

This monitoring program was initiated in 2008 and will be carried out over ten years. Attached is the report for Year 7 dated June 15, 2015.

5.6 CLBMON-40 Arrow Lakes Reservoir: Arrow Lakes Reservoir Shorebird and Waterbird Monitoring Program

This monitoring program was initiated in 2008 and will be carried out over ten years. Attached is the report for Year 7 dated June 15, 2015.

5.7 CLBMON-41 Arrow Lakes Reservoir: Recreational Demand Study

This monitoring program was initiated in 2009 and was carried out over five years. Attached is the report for Year 5 (final year of the study) dated February 6, 2015.

5.8 CLBMON-58 Monitoring of Impacts on Amphibians and Reptiles from Mica Units 5 and 6 in Kinbasket Reservoir

This monitoring program was initiated in 2011 and will be carried out every other year over seven years. Implementation did not occur in 2014.

6 Monitoring Programs Costs

The following table summarizes the Arrow Lakes Reservoir Operations Management Plan WUP monitoring programs approved by the Comptroller and the Actual Costs to May 31, 2015.

Table 6-1: Arrow Lakes Reservoir Operations Management Plan WUP Monitoring Programs 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 MP6 Arrow Res Ops Annual Report	\$13,457	\$7,552	\$5,675	\$13,227	\$230		No Corrective Action
C06M31A ARROW: Burbot Life - ONR	\$114,277	\$116,683		\$116,683	(\$2,406)	Project is completed.	No Corrective Action
C06M31A ARROW: Burbot Life - ONR DM	\$0	\$73		\$73	(\$73)		
C06M31A ARROW: Burbot Life - ONR Imp	\$114,277	\$116,610		\$116,610	(\$2,333)		
C06M31A ARROW: Burbot Life - OR	\$970,525	\$857,802		\$857,802	\$112,723	Project is completed.	No Corrective Action
C06M31A ARROW: Burbot Life - OR DM	\$67,022	\$56,092		\$56,092	\$10,930		
C06M31A ARROW: Burbot Life - OR Imp	\$903,503	\$801,710		\$801,710	\$101,793		
C06M32A ARROW:Tributary Fish	\$439,574	\$368,344		\$368,344	\$71,230	Efficiencies found during project implementation	No Corrective Action
C06M32A ARROW:Tributary Fish - OR DM	\$81,842	\$45,132		\$45,132	\$36,710		
C06M32A ARROW:Tributary Fish - OR Imp	\$357,732	\$323,212		\$323,212	\$34,520		
C06M36A ARROW & KIN: Nest	\$4,256,071	\$2,722,888	\$1,213,298	\$3,936,186	\$319,885	Efficiencies found during project implementation	No Corrective Action
C06M36A ARROW & KIN: Nest - OR DM	\$204,722	\$106,376	\$30,127	\$136,503	\$68,219		
C06M36A ARROW & KIN: Nest - OR Imp	\$4,051,349	\$2,616,512	\$1,183,171	\$3,799,683	\$251,666		
C06M37A ARROW & KIN: Amphib	\$1,166,608	\$769,928	\$342,888	\$1,112,817	\$53,792	Efficiencies found during project implementation	No Corrective Action
C06M37A ARROW & KIN: Amphib - OR DM	\$127,889	\$65,929	\$31,691	\$97,621	\$30,268		
C06M37A ARROW & KIN: Amphib - OR Imp	\$1,038,719	\$703,999	\$311,197	\$1,015,196	\$23,523		
C06M39A ARROW: Neotropical	\$2,150,992	\$1,348,239	\$657,951	\$2,006,190	\$144,802	Efficiencies found during project implementation	No Corrective Action
C06M39A ARROW: Neotropical - OR DM	\$189,932	\$111,917	\$27,005	\$138,922	\$51,010		
C06M39A ARROW: Neotropical - OR Imp	\$1,961,060	\$1,236,321	\$630,946	\$1,867,267	\$93,793		
C06M40A ARROW: Shore&Wat	\$2,890,326	\$1,765,726	\$845,927	\$2,611,653	\$278,673	Efficiencies found during project implementation	No Corrective Action
C06M40A ARROW: Shore&Wat - OR DM	\$189,388	\$117,257	\$30,305	\$147,563	\$41,825		
C06M40A ARROW: Shore&Wat - OR Imp	\$2,700,938	\$1,648,469	\$815,621	\$2,464,090	\$236,848		
C06M41A ARROW: Recreation	\$755,561	\$697,964	\$1	\$697,965	\$57,596	Efficiencies found during project implementation	No Corrective Action
C06M41A ARROW: Recreation - OR DM	\$71,661	\$43,734		\$43,734	\$27,927		
C06M41A ARROW: Recreation - OR Imp	\$683,900	\$654,230	\$1	\$654,231	\$29,669		
C06M58A ARROW Amphibs & Rep	\$497,676	\$199,100	\$246,185	\$445,285	\$52,391	Efficiencies found during project implementation	No Corrective Action
C06M58A ARROW Amphibs & Rep - ONR DM	\$68,894	\$13,069	\$23,803	\$36,872	\$32,022		
C06M58A ARROW Amphibs & Rep - ONR Imp	\$428,782	\$186,031	\$222,382	\$408,413	\$20,369		

OR - Ordered Remissible
ONR - Ordered Non-Remissible

* Red values in parentheses denote overage.