

Columbia River Project Water Use Plan Kinbasket and Arrow Recreational Management Plan Monitoring Program and Physical Works

Annual Report: 2016

Implementation Period: January 2015 to December 2015

- **CLBMON-14 Boat Ramp Use Study**
- **CLBWORKS-4 Kinbasket: Bulldog Creek New Ramp**
- **CLBWORKS-5 Kinbasket: Valemount Marina Ramp Extension**
- **CLBWORKS-6 Kinbasket: Nixon Creek Ramp**
- **CLBWORKS-7 Kinbasket: Bush Harbour Ramp Extension**
- **CLBWORKS-9 Revelstoke Ramp Extend or Build**
- **CLBWORKS-11 Arrow: Burton New Ramp**
- **CLBWORKS-12 Arrow: Edgewood Ramp Extension**
- **CLBWORKS-13 Arrow: Fauquier Ramp Extension**
- **CLBWORKS-14 Arrow: McDonald Creek Park Ramp Extension**
- **CLBWORKS-16 Kinbasket: Debris Inventory, Management Strategy and Removal**
- **CLBWORKS-17 Arrow: Debris Inventory, Management Strategy and Removal**
- **CLBWORKS-18 Kinbasket & Arrow: Feasibility of Boat Ramps**
- **CLBWORKS-19 Lower Columbia: Indian Eddy Dredging Environmental and Engineering Assessment**
- **CLBWORKS-20 Lower Columbia: Indian Eddy Dredging**
- **CLBWORKS-21 Lower Columbia: Indian Eddy Debris Removal Environmental Review**
- **CLBWORKS-22 Lower Columbia: Indian Eddy Debris Removal**
- **CLBWORKS-23 Kinbasket & Arrow: Debris Removal Environmental Review**
- **CLBWORKS-32 Arrow: Renata New Ramp**
- **CLBWORKS-33 Arrow: Syringa Ramp**
- **CLBWORKS-35 Mid-Columbia: Bank Erosion Protection and Monitoring Program**
- **CLBWORKS-36 Mid-Columbia: Long-term Erosion Monitoring Program**
- **CLBWORKS-40 Kinbasket: Site Preparation and Debris Work**
- **CLBWORKS-41 Kinbasket: Floating Debris Removal**
- **CLBWORKS-43 Nakusp Boat Ramp**
- **CLBWORKS-50 Shelter Bay Boat Ramp**

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

January 31, 2016

BC Hydro Columbia River Project Water Use Plan Kinbasket and Arrow Reservoir Recreational Management Plan Annual Report: 2016

1 Introduction

This document represents a summary of the status and the results of the Kinbasket and Arrow Reservoir Recreational Management Plan Water Use Plan (WUP) monitoring programs and physical works to December 31, 2015, as per the Columbia River Order under the *Water Act*, dated January 26, 2007. There is one monitoring program and 25 physical works.

2 Status

The following table outlines the dates that Terms of Reference (TOR) for the Kinbasket and Arrow Reservoir Recreational Management Plan WUP monitoring program and physical works were submitted to and approved by the Comptroller of Water Rights (CWR).

Table: 2-1: Dates of Kinbasket and Arrow Reservoir Recreational 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-14 Boat Ramp Use Study	Conditional, 2(b), 6(b)	Nov 13, 2009	Dec 17, 2009	Oct 19, 2012	Dec 21, 2012
CLBWORKS-4 Kinbasket: Bulldog Creek New Ramp	Conditional, 2(a)	Oct 24, 2007	Not Ordered Mar 03, 2008		
CLBWORKS-5 Kinbasket: Valemount Marina Ramp Extension	Conditional, 2(a)	Oct 24, 2007	Mar 03, 2008	May 28, 2015	Jun 09, 2015
CLBWORKS-6 Kinbasket: Nixon Creek Ramp	Conditional, 2(a)	Oct 24, 2007	Mar 03, 2008	Jun 22, 2009	Sep 18, 2009
CLBWORKS-7 Kinbasket: Bush Harbour Ramp Extension	Conditional, 2(a)	Oct 24, 2007	Mar 03, 2008	Jun 24, 2013	Jul 16, 2013
CLBWORKS-9 Revelstoke Ramp Extend or Build	Conditional, 3(a)	Oct 24, 2007	Mar 03, 2008	Cancelled	Mar 14, 2011
CLBWORKS-11 Arrow: Burton New Ramp	Clause M (ONR)	Jul 25, 2007	Aug 29, 2007	Jan 07, 2015	Feb 05, 2015
	Schedule D.4	Jul 25, 2007	Aug 29, 2007	Jan 07, 2015	Feb 05, 2015
CLBWORKS-12A Arrow: Edgewood Ramp	Clause M (ONR)	Apr 02, 2013	Apr 24, 2013	Aug 24, 2015	Aug 28, 2015
	Schedule D.4	Mar 2, 2012 Request to be relieved of obligation	Jul 26, 2012 Not granted		
CLBWORKS-13A Arrow: Fauquier Ramp Extension	Clause M (ONR)	Jul 25, 2007	Aug 29, 2007	Jan 07, 2015	Feb 04, 2015
	Schedule D.4	Jul 25, 2007	Aug 29, 2007	Mar 2, 2012 request to be relieved of obligation	Jul 26, 2012 Not granted
CLBWORKS-14 Arrow: McDonald Creek Park Ramp Extension	Clause M (ONR)	Jul 25, 2007	Aug 29, 2007	Jan 07, 2015	Feb 04, 2015
	Schedule D.4	Jul 25, 2007	Aug 29, 2007	Feb 19, 2014	May 08, 2014
CLBWORKS-16 Kinbasket: Debris Inventory, Management Strategy and Removal	(ONR) Conditional, 1(a)(b)	Nov 20, 2008	Nov 28, 2008	Sep 04, 2015	Dec 23, 2015
	Conditional, 1(a)(b)	Oct 26, 2007	Mar 05, 2008	Sep 04, 2015	Dec 23, 2015

Table 2 cont'd

Monitoring Program & Physical Works TOR	Order Clause	Original ToR Submission		Most Recent ToR Resubmission	
		Date Submitted	Date Approved	Date Submitted	Date Approved
CLBWORKS-17 Arrow: Debris Inventory, management Strategy and Removal	(ONR) Conditional, 5(a)(b)	Oct 26, 2007	Mar 05, 2008	Sep 04, 2015	Dec 23, 2015
	Conditional, 5(a)(b)	Oct 26, 2007	Mar 05, 2008	Sep 04, 2015	Dec 23, 2015
CLBWORKS-18 Kinbasket & Arrow: Feasibility of Boat Ramps	Schedule A, 4(a) Schedule C, 3(a) Schedule D, 4(a)	Apr 20, 2007	May 03, 2007	Mar 19, 2012	Not approved per letter of Jul 30, 2012
CLBWORKS-19 Lower Columbia: Indian Eddy Dredging Environmental and Engineering Assessment	Schedule E, 4(a)	Jul 24, 2007	Aug 29, 2007	Feb 02, 2009	Mar 26, 2009
CLBWORKS-20 Lower Columbia: Indian Eddy Dredging	Conditional, 8(a)	Sep 13, 2010	Nov 10, 2010 approval to develop TOR	Aug 12, 2015	Sep 08, 2015
CLBWORKS-21 Lower Columbia: Indian Eddy Debris Removal Environmental Review	Schedule E, 1(a)	Jul 24, 2007	Aug 29, 2007		
CLBWORKS-22 Lower Columbia: Indian Eddy Debris Removal	Conditional, 8(b)	Jun 25, 2009	Jul 13, 2009	-	-
CLBWORKS-23 Kinbasket & Arrow: Debris Removal Environmental Review	Schedule E, 1(b)	Apr 27, 2007	May 03, 2007	-	-
CLBWORKS-32 Arrow: Renata New Ramp (Anderson)	Schedule D.4	Nov 13, 2009	Mar 15, 2010	Nov 17, 2015	Dec 03, 2015
CLBWORKS-33 Arrow: Syringa Ramp (New)	Clause M (ONR)	Jan 22, 2015	Feb 04, 2015	Feb 25, 2015	Feb 27, 2015
CLBWORKS-33 Arrow: Syringa New Ramp	Schedule D.4	Nov 13, 2009	Not Approved per letter of Mar 15, 2010		
CLBWORKS-35 Mid-Columbia: Bank Erosion Protection and Monitoring Program	Amended Order, 2(a)	Jul 31, 2008	Sep 11, 2008	Mar 23, 2011	May 16 2011
CLBWORKS-36 Mid-Columbia: Long-term erosion monitoring program	Amended Order, 2(d)	Jul 31, 2008	Sep 11, 2008		
CLBWORKS-40 Kinbasket: Site Preparation and Debris Work	(ONR)	Mar 12, 2008	Mar 28, 2008	Dec 12, 2008	Dec 16, 2008
		Mar 12, 2008	Mar 28, 2008	Dec 12, 2008	Dec 16, 2008
CLBWORKS-41 Kinbasket: Floating Debris Removal	Conditional, 1(c)	Mar 12, 2008	Mar 28, 2008	Dec 12, 2008	Dec 16, 2008
CLBWORKS-43 Nakusp Boat Ramp	Clause M (ONR)	Apr 02, 2013	Apr 16, 2013	Jan 12, 2015	Feb 04, 2015
CLBWORKS-50 Shelter Bay	Clause M (ONR)	Jan 22, 2015	Feb 04, 2015	Sep 24, 2015	Oct 01, 2015

3 Schedule

The following table outlines the current schedule for the monitoring programs and physical works being delivered for the Kinbasket and Arrow Reservoir Recreational Management Plan WUP.

Table 3-1: Monitoring Programs and Physical Works Schedule as of December 31, 2015.

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	WLR YR8	WLR YR9	WLR YR10	WLR YR11	WLR YR12	WLR YR13
CLBMON-14 Boat Ramp Use Study				✓	✓	✓	✓			■	■	■	■
Physical Works													
CLBWORKS-4 Kinbasket Bulldog Creek New Ramp Not Ordered													
CLBWORKS-5 Kinbasket: Valemount Marina Extend Ramp					✓	✓	✓	✓	✓	■	■*	■*	■*
CLBWORKS-6 Kinbasket: Nixon Creek Ramp Maintenance Maintenance Only; Ramp not Ordered					✓	✓	✓	✓	✓	■*	■*	■*	■*
CLBWORKS-7 Kinbasket: Bush Harbour Ramp				✓	✓	✓	✓	✓	✓	■*	■*	■*	■*
CLBWORKS-9 Revelstoke Ramp Upgrade Ramp not Ordered				✓									
CLBWORKS-11 Arrow: Burton New Ramp				✓	✓	✓	✓	✓	✓	■*	■*	■*	■*
CLBWORKS-12A Arrow: Edgewood Ramp Extension - Clause M								✓	✓	✓	■*	■*	■*
CLBWORKS-12B Arrow: Edgewood Ramp Extension - WUP WUP extension Order revised													
CLBWORKS-13A Arrow: Fauquier Ramp Extension - Clause M				✓	✓	✓	✓	✓	✓	■*	■*	■*	■*
CLBWORKS-13B Arrow: Fauquier Ramp Extension - WUP				✓									
CLBWORKS-14A Arrow: McDonald Ramp Extension - Clause M					✓	✓	✓	✓	✓	■*	■*	■*	■*
CLBWORKS-14B Arrow: McDonald Ramp Extension - WUP WUP extension Order revised				✓									
CLBWORKS-16 Kinbasket: Debris Inventory, Management Strategy and Removal		✓	✓	✓	✓	✓	✓	✓	✓	■	■	■	
CLBWORKS-17 Arrow: Debris Inventory, Management Strategy and Removal		✓	✓	✓	✓	✓	✓	✓	✓	■	■	■	
CLBWORKS-18 Feasibility of Boat Ramps	✓	✓	✓										
CLBWORKS-19 Lower Columbia: Indian Eddy Dredging Environmental and Engineering Assessment	✓	✓	✓										
CLBWORKS-20 Lower Columbia: Indian Eddy Dredging								x	✓	■			
CLBWORKS-21 Lower Columbia: Indian Eddy Debris Removal Environmental Review		✓	✓										
CLBWORKS-22 Lower Columbia: Debris Removal at Indian Eddy			x	✓	✓	✓	✓	✓	✓	■	■	■	■
CLBWORKS-23 Kin and Arrow: Debris Removal Environmental Review	✓	✓											
CLBWORKS-32 Arrow: Renata New Ramp					✓	✓	✓	✓	✓	■*	■*	■*	■*
CLBWORKS-33 Arrow: Syringa New Ramp ¹									✓	■*	■*	■*	■*
CLBWORKS-35 Mid Columbia Bank Erosion Protection and Monitoring				✓	✓	✓	✓		✓				
CLBWORKS-36 Mid Columbia Long Term Erosion Monitoring			✓	✓	✓	✓		✓		■			
CLBWORKS-40 Site Prep and Debris Work		✓	✓	✓	✓								
CLBWORKS-41 Kinbasket: Floating Debris Removal													
CLBWORKS-43 Nakusp Boat Ramp							✓	✓	✓	■	■*	■*	■*
CLBWORKS-50 Shelter Bay Boat Ramp									✓	■	■*	■*	■*

¹ Project formerly labelled as CLBWORKS-33 Syringa referred to a WUP project that was never ordered. The name and number was reused for the clause (m) required project at Syringa Park.

Legend:	■	=	Program to be undertaken/initiated in identified year
	■*	=	Boat Ramp Maintenance
	■	=	Pending
	✓	=	Program completed for the year
	x	=	Program started, but encountered operational or hydrological delays

4 Monitoring Programs and Physical Works Terms of Reference

The monitoring programs and physical works being implemented under the Kinbasket and Arrow Reservoir Recreational 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/kinbasket-recreation.html

5 Status of Monitoring Programs

5.1 CLBMON-14 Boat Ramp Use Study

This monitoring program was initiated in 2010. The Mid-term report which covers study Years 1 through 4 was submitted with the 2015 Annual Report.

6 Status of Physical Works

6.1 CLBWORKS-4 Kinbasket: Bulldog Creek New Ramp – (Not Ordered)

Bulldog Creek is an undeveloped site located 7 km southeast of Valemount Marina.

In the feasibility study dated October 5, 2007, (CLBWORKS-18)¹, the Bulldog Creek site was not considered feasible for a low water ramp due to cost, safety, and environmental issues. Additionally, the community preferred further scope to be included at Valemount (see Section 6.2 below) rather than upgrade work at Bulldog Creek.

Consequently, in the letter dated March 3, 2008, the CWR cancelled any further boat ramp development at Bull Dog Creek.

No further work is required.

6.2 CLBWORKS-5 Kinbasket: Valemount Marina Ramp Extension

Under Clause (m) of Conditional Water Licence 27068, BC Hydro is required to provide reservoir access at Valemount. The Valemount Marina site is located on the eastern shore of the northern-most end of the Kinbasket Reservoir. It is located approximately 24 km off Highway 5.

Following the feasibility study dated October 5, 2007 (CLBWORKS-18)¹, the CWR approved the initial design at Valemount to extend the ramp from the existing toe at El. 732.7 m (2403.9 ft.) to El. 730.0 m (2395 ft.) which would require dredging. On September 18, 2009, following further community input, the CWR approved an alternative two-stage ramp with no dredging to provide access to El. 727 m (2385 ft. lower ramp) and El. 734 m (2408 ft. upper ramp) with a concrete turnaround.

The majority of the construction was completed in 2011 following delays due to high water. The CWR approved cost increases on February 25, 2013, and the remaining low water construction was completed in 2013.

¹ Submitted to the CWR January, 2008.

On June 9, 2015, the CWR approved the replacement of the boarding floats (walkway). The work is expected to be undertaken prior to the 2016 recreation season.

BC Hydro will continue to provide annual maintenance. A long-term maintenance plan is currently being developed.

6.3 CLBWORKS-6 Kinbasket: Nixon Creek Ramp

The Nixon Creek boat launch is located approximately 93 km from the turn-off to Donald which is a westbound exit off Highway 1 when headed towards Revelstoke from Golden. It is a gravel ramp with a natural slope of 7% that provides water level access to the reservoir to approximately El. 713.5 m (2340.8 ft.).

In the letter dated March 3, 2008, the CWR did not approve any upgrades/extension at the Nixon Creek ramp. On October 19, 2009, the CWR approved annual maintenance of the existing ramp.

BC Hydro will continue to provide annual maintenance. A long-term maintenance plan is currently being developed.

6.4 CLBWORKS-7 Kinbasket: Bush Harbour Ramp Extension

Under Clause (m) of Conditional Water Licence 27068, BC Hydro is required to provide reservoir access at Bush Harbour. The Bush Harbour site is located approximately 42 km from the exit to Donald – a westbound exit off Highway 1 when headed towards Revelstoke from Golden. In 2007, the elevation of the boat ramp was at El. 734.6m (2410.1 ft.).

The feasibility design was included in the October 5, 2007, report (CLBWORKS-18)² and design phase work was approved March 3, 2008. On September 18, 2009, the CWR approved the design and construction on the Bush Harbour launch which included extension of the concrete ramp to El. 724.6 m (2377.3 ft.), concrete turnaround, floating walkway, breakwaters, parking lot, and toilet.

Construction for these works occurred between 2011 and May 2013. The ramp was built to 724.6 m (to be confirmed by survey in 2016).

BC Hydro will continue to provide annual maintenance. A long-term maintenance plan is currently being developed.

6.5 CLBWORKS-9 Revelstoke Ramp Extend or Build

The Revelstoke boat launch is also known as Centennial Park boat launch. The Centennial Park boat launch is located in the City of Revelstoke near the ball park fields of Centennial Park and is located on property owned by the City. The launch is approximately 8 km downstream of the Revelstoke Dam.

The feasibility study for the Centennial Park launch upgrade was included in the October 5, 2007, feasibility report (CLBWORKS-18)². The preliminary designs explored the possibility of extending the ramp, and improving safety by realigning the ramp to reduce its exposure to river currents. In a letter dated September 18, 2009, the CWR approved the preliminary designs and preliminary construction.

² Submitted to the CWR January, 2008.

As the landowner, the City of Revelstoke continued to have concerns about safety of the ramp usage even with the revised design. By letter dated January 21, 2011, the City of Revelstoke requested the CWR re-evaluate its decision regarding improvements at Centennial Boat Ramp due to ongoing safety concerns. Subsequently, by letter dated March 14, 2011, the CWR relieved BC Hydro of the obligation to refurbish the Centennial Park ramp. No further work is expected to be undertaken.

6.6 CLBWORKS-11 Arrow: Burton New Ramp

Under Clause (m) of Conditional Water Licence 27066, BC Hydro is required to provide reservoir access at Burton. The original Burton launch was located within the Burton Historic Park in the community of Burton, 32 km south of Nakusp. The ramp, with a toe elevation of El. 431 m (1414 ft.), is located on the northern end of the park, with a turnaround and parking.

The feasibility report dated July 13, 2007, (CLBWORKS-18)³ explored two alternative sites in addition to the extension and upgrade of existing ramp within Burton Historic Park, and recommended a greenfield site located approximately 5 km south of Burton. The alternative site was suitable due to the natural slope of the foreshore, access to deeper lake bed elevations, and minimal environmental impacts. On September 18, 2009, the CWR approved the design and implementation phase for the Burton (South) alternative.

The CWR confirmed the budget and final design requirements on February 5, 2015. The site design includes a ramp of El. 425.5 m (1396 ft.), with an access road from the highway, parking lot, turnaround, walkway and breakwater.

Construction took place between 2010 and 2015 and was completed in April 2015 with the ramp toe elevation of El. 425.4 m (1395.7 ft.).

BC Hydro will continue to provide annual maintenance. A long-term maintenance plan is currently being developed.

6.7 CLBWORKS-12 Arrow: Edgewood Ramp Extension

Under Clause (m) of Conditional Water Licence 27066, BC Hydro is required to provide reservoir access at Edgewood. The boat launch at Edgewood is located in the Provincial Park in the community of Edgewood.

The feasibility designs for the Edgewood boat launch improvements are included in the report dated July 13, 2007 (CLBWORKS-18)³. In subsequent years, discussions with the community were undertaken related to concerns about any possible impacts of Eagle Creek on the ramp. No impacts were identified.

On April 23, 2013, the CWR approved the agreed conceptual design and cost estimates for Edgewood including breakwaters, replacement of the floating walkway, and ramp improvements.

Columbia Power Corporation completed the installation of the walkway and floating breakwaters in 2013. Work was postponed in 2014 due to high water.

³ Submitted to the CWR January, 2008.

In late 2014, the community expressed a safety concern: the anchor blocks for the southern floating breakwater become a hazard when exposed at low water. Following community meetings and redesign work in late 2014 and early 2015, BC Hydro received approval from the CWR on August 28, 2015, for an agreed design to relocate the southern breakwater.

The concrete ramp and walkway work was completed in spring 2015 to an elevation of 425.7 m (1396.7 ft.), with gravel transition to El. 423.7m (1390.1 ft.). The southern breakwater was moved to a new location between the ramp and the spit in October 2015.

BC Hydro will continue to provide annual maintenance. A long-term maintenance plan is currently being developed.

6.8 CLBWORKS-13 Arrow: Fauquier Ramp Extension

Under Clause (m) of Conditional Water Licence 27066, BC Hydro is required to provide reservoir access at Fauquier. The Fauquier boat launch is located in Fauquier Provincial Park, off Highway 6 just north of Fauquier Creek and a 45-minute drive to Nakusp.

The feasibility report for Fauquier dated July 13, 2007, under CLBWORKS-18⁴ identified a low water option which would require regular dredging to provide continued low water access to the reservoir. On September 8, 2009, the CWR approved the design.

In 2010 and 2011, BC Hydro installed floating walkway, two breakwaters and an access ramp for the floating walkway.

The ramp is currently constructed down to El. 424.66 m (1396.5 ft.). On February 4, 2015, the CWR confirmed the existing elevation meets the water licence requirement.

With low water in early 2015, BC Hydro adjusted the breakwater chains to prevent the pontoons from overlapping near the shore and installed signs on Highway 6 to direct the public to the boat launch.

BC Hydro will continue to provide annual maintenance. A long-term maintenance plan is currently being developed.

6.9 CLBWORKS-14 Arrow: McDonald Creek Park Ramp Extension

Under Clause (m) of Conditional Water Licence 27066, BC Hydro is required to provide reservoir access at McDonald Creek. McDonald Creek boat launch is located in McDonald Creek Provincial Park, located approximately 12 km south of Nakusp. The end of the ramp at McDonald Creek was at El. 429.2 m (1408.1 ft.) at the time of the July 13, 2007, feasibility report (CLBWORKS-18)⁵.

On September 18, 2009, (and February 4, 2015) BC Hydro received approval on the design and installation of the floating walkway and breakwaters, as well as approval for ramp extension and turnaround.

⁴ Submitted to the CWR January, 2008.

⁵ Submitted to the CWR January, 2008. The level was surveyed in February 2014.

In 2010, BC Hydro installed the piles for the floating walkway. In spring 2014, the scour protection on the existing ramp and floating walkway were installed as well as the turnaround.

With low water in 2015, the extension of the ramp to El. 426 m (1397.6 ft.) was completed, with the installation of a creek diversion on the north side of the ramp, and two floating breakwaters.

BC Hydro will continue to provide annual maintenance. A long-term maintenance plan is currently being developed.

6.10 CLBWORKS-16 Kinbasket: Debris Inventory, Management Strategy and Removal

Debris removal estimates for the Kinbasket Reservoir over the past few years include:

- 2013 – 50,000 m³
- 2014 – 35,000 m³
- 2015 – 38,540 m³

Following completion of the debris removal session for 2015, an estimated 447,126 m³ of woody debris remains in the Kinbasket system.

An updated debris removal strategy was developed in 2015 in consultation with the Golden and Valemount Debris Committees, and submitted to the CWR in September 2015. The third phase of the debris program was approved in December 2015 for implementation in 2016, 2017 and 2018.

6.11 CLBWORKS-17 Arrow: Debris Inventory, Management Strategy and Removal

Debris removal estimates for the Arrow Reservoir over the past few years include:

- 2013 – 23,319 m³
- 2014 – 9,900 m³
- 2015 – 4,100 m³

Following completion of the debris removal session for 2015, an estimated 134,702 m³ of woody debris remains in the Arrow Lakes system.

An updated debris removal strategy was developed in 2015 in consultation with the Arrow Lakes Debris Committees, and submitted to the CWR in September 2015. The second phase of the debris program was approved in December 2015 for implementation in 2016, 2017 and 2018.

6.12 CLBWORKS-18 Kinbasket and Arrow: Feasibility of Boat Ramps

This project was completed in December 2009.

6.13 CLBWORKS-19 Lower Columbia: Indian Eddy Dredging Environmental and Engineering Assessment

This project was completed in September 2009.

6.14 CLBWORKS-20 Lower Columbia: Indian Eddy Dredging

In 2010, the CWR approved the development of a Terms of Reference for a two-phased approach, in which the first phase was to develop a detailed dredging and

material disposal plan including more extensive sampling of the sediment and an assessment of risk. If the risks were deemed acceptable, BC Hydro would submit a second phase Terms of Reference for approval for the actual dredging works. BC Hydro began drafting the Terms of Reference in 2011/2012 and was not completed due to a reorganization and resource constraints.

When BC Hydro restarted the work on the TOR submission in 2014, BC Hydro became aware of groundwater contamination emptying into the site and temporary physical works put in place by Teck Resources Ltd. that will remain until a permanent solution is in place.

The Definition Phase Terms of Reference for the Lower Columbia Indian Eddy Dredging was approved on September 8, 2015. Task One (the bathymetric survey) has been completed and the draft report has been submitted to BC Hydro for review. Task Two (stakeholder engagement) is scheduled for the spring of 2016. The final report for the Definition Phase will be submitted in the next Annual Report.

6.15 CLBWORKS-21 Lower Columbia: Indian Eddy Debris Removal Environmental Review

Project was completed in 2008.

6.16 CLBWORKS-22 Lower Columbia: Indian Eddy Debris Removal

Debris removal started in 2010 will continue annually until 2020.

6.17 CLBWORKS-23 Kinbasket and Arrow: Debris Removal Environmental Review

Project was completed in 2007.

6.18 CLBWORKS-32 Arrow: Renata New Ramp (Anderson Point)

Under the Columbia WUP Order, Schedule D, Clause 4.v, BC Hydro was required to recommend an option for up to two boat launch sites between Renata and Syringa Creek Park. The feasibility report dated October 23, 2009⁶ for two ramps between Renata and Syringa on the lower Arrow Reservoir was undertaken as part of CLBWORKS-18. During public meetings in 2009 and 2010, BC Hydro received a consensus recommendation for only one site at Anderson Point (Renata).

On October 12, 2012, the CWR approved the final design and budget.

Access roads were completed in 2012. In 2013, Columbia Power Corporation (CPC) constructed the ramp to 431.6 m (1414 ft.) with turnarounds, walkway and parking lot. In June 2014, the breakwater was installed. After navigational issues arose with the location of the breakwater, the breakwater was relocated in early 2015. In 2015, CPC completed the ramp to El. 425.0 m (1394.4 ft.).

BC Hydro will continue to provide annual maintenance. A long-term maintenance plan is currently being developed.

⁶ Submitted to the CWR January, 2010.

6.19 CLBWORKS-33 Arrow: Syringa Ramp

Under Clause (m) of Conditional Water Licence 27066, BC Hydro is required to provide reservoir access at Syringa Provincial Park. A survey in 2015 confirmed that the current ramp at Syringa reached El. 421.87 m (1384.1 ft.). The Syringa boat launch was the second of two projects identified in the October 23, 2009, feasibility study (CLBWORKS-18)⁷ for reservoir access between Syringa Creek Park and Renata, as ordered under the Water Use Plan. During public meetings in 2009 and 2010, BC Hydro received a consensus recommendation for only one site at Anderson Point (Renata), and did not proceed with an alternative at Syringa.

In 2014, BC Hydro assessed the condition of the Syringa boat launch. The ramp was in generally good condition but repairs to the concrete ribs, and upland improvements were recommended. On February 25, 2015, the CWR approved these improvements.

In spring 2015, taking advantage of low water, BC Hydro undertook repairs to the ramp and walkway. BC Hydro repaired damaged concrete ribs, and added infill between the ribs, and between the ramp and floating walkway.

In 2015, following an engineering assessment of the wind, wave, and vessel wake conditions, it was determined that breakwaters were not required to ensure safe boat launching. In October 2015, BC Hydro expanded the upland turnaround area to provide for safer and quicker access to the ramp.

BC Hydro will continue to provide annual maintenance. A long-term maintenance plan is currently being developed.

6.20 CLBWORKS-35 Mid-Columbia: Bank Erosion Protection and Monitoring Program

This physical works was initiated in 2010, with monitoring implemented in 2011, 2012, 2013 and 2015. The Year 5 (2015) report is in draft format and will be submitted with next year's Annual Report.

6.21 CLBWORKS-36 Mid-Columbia: Long-term Erosion Monitoring Program

Site selection occurred in 2009, and monitoring has occurred in 2010, 2011, 2012, 2014 and scheduled for 2016. Attached is the 2014 (Year 4) (Phase 2) report dated March 2015.

6.22 CLBWORKS-40 Kinbasket: Site Preparation and Debris Work

Project was completed in 2011.

6.23 CLBWORKS-41 Kinbasket: Floating Debris Removal

In a letter to the CWR (dated December 12, 2008), BC Hydro requested reallocation of funds for boomstick fabrication and mobilization/demobilization of tugboats to barged-based debris removal activities under CLBWORKS-40. This request was made to seek significant efficiencies that could be realized by barging equipment directly to the work area and by reducing the need for remediation of access roads and ground disturbance. In response, the CWR approved the reallocation of these

⁷ Submitted to the CWR November 2009.

funds as well as the funds from the Floating Debris Program to land-based removal activities under CLBWORKS-40, which was completed in 2011.

6.24 CLBWORKS-43 Nakusp Boat Ramp

Under Clause (m) of Conditional Water Licence 27066, BC Hydro is required to provide reservoir access in the Village of Nakusp.

The feasibility study dated August 8, 2008, for Nakusp identified options for reservoir access to address safety concerns and high maintenance costs associated with the wooden trestle ramp that existed at the location.

In summer 2008, BC Hydro agreed with the community on the option to dismantle the wood trestle ramp and replace it with a concrete ramp, with turnaround and walkway.

The detailed design was completed in 2011. The CWR approved the budget and design and implementation for the first phase on April 16, 2013. By fall 2013, Columbia Power Corporation had demolished the timber trestle, constructed the concrete ramp at grade to El. 430.1 m (1411.2 ft.), upgraded the parking lot, upgraded and installed the walkway. On August 8, 2014, the CWR approved additional budget and confirmed the requirement to the elevation of El. 420.5 m (1379.6 ft.), including construction using under-water methods.

In spring 2015, CPC constructed the ramp to El. 423.6 m (1390.8 ft.). In December 2015, work resumed in Nakusp to complete to the final elevation using under-water construction methods and is expected to be in-service before the 2016 recreation season.

BC Hydro will continue to provide annual maintenance. A long-term maintenance plan is currently being developed.

6.25 CLBWORKS-50 Shelter Bay Boat Ramp

Under Clause (m) of Conditional Water Licence 27066, BC Hydro is required to provide reservoir access at Shelter Bay Provincial Park to an elevation of 423.7 m (1390.1 ft.). Shelter Bay Provincial Park is located approximately 55 km south of Revelstoke on the eastern side of Highway 23. A survey of the ramp in 2015 concluded that the ramp reaches El. 422.9 m (1387.5 ft.).

The feasibility assessment for Shelter Bay was completed December 24, 2009, (CLBWORKS-18)⁸ and concluded the ramp was in reasonable condition requiring minor repairs and recommended upgrades to the upland parking area, turnaround, and replacement of the gabion walkway.

On February 4, 2015, the CWR approved design development and implementation for these changes and for a feasibility assessment of breakwaters. Following public feedback in 2015, the CWR approved a revised design including the breakwaters on October 1, 2015.

Work commenced in the fall of 2015 and is expected to be in-service before the 2016 recreation season.

⁸ Submitted to the CWR January, 2010.

BC Hydro will continue to provide annual maintenance. A long-term maintenance plan is currently being developed.

7 Monitoring Programs and Physical Works Costs

The following table summarizes the Kinbasket and Arrow Recreational Management Plan WUP monitoring programs and physical works costs approved by the Comptroller and the Actual Costs to December 31, 2015.

Table 7-1: Kinbasket and Arrow Recreational Management Plan WUP Monitoring Programs and 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 MP3 Kin & Arrow Rec Annual Report	\$47,328	\$5,336	\$25,605	\$30,941	\$16,387	Efficiencies found during project implementation.	
C03M14A Boat Ramp Use Study	\$600,475	\$384,426	\$160,555	\$544,980	\$55,495	Efficiencies found during project implementation.	
C03M14A Boat Ramp Use Study - OR DM	\$90,000	\$43,370	\$24,362	\$67,732	\$22,268		
C03M14A Boat Ramp Use Study - OR Imp	\$510,475	\$341,055	\$136,193	\$477,248	\$33,227		
C03W05A KIN Valemount Ramp	\$1,125,882	\$997,358	\$70,701	\$1,068,060	\$57,822	Efficiencies found during project implementation. Final reporting outstanding.	
C03W05A KIN Valemount Ramp - ONR DM	\$31,595	\$33,580	\$12,051	\$45,631	(\$14,036)		
C03W05A KIN Valemount Ramp - ONR Imp	\$1,094,287	\$963,778	\$58,650	\$1,022,428	\$71,859		
C03W06A KIN Nixon Ramp	\$78,880	\$5,192	\$57,471	\$62,663	\$16,217	Efficiencies found during project implementation.	
C03W06A KIN Nixon Ramp - ONR DM	\$18,036	\$3,152	\$10,471	\$13,623	\$4,413		
C03W06A KIN Nixon Ramp - ONR Imp	\$60,844	\$2,040	\$47,000	\$49,040	\$11,804		
C03W07A KIN Bush Harbr Ramp	\$1,983,480	\$1,808,602	\$73,042	\$1,881,644	\$101,836	Efficiencies found during project implementation. Final reporting outstanding.	
C03W07A KIN Bush Harbr Ramp - ONR DM	\$49,993	\$36,116	\$10,393	\$46,509	\$3,484		
C03W07A KIN Bush Harbr Ramp - ONR Imp	\$1,933,487	\$1,772,486	\$62,649	\$1,835,135	\$98,352		
C03W09A REV Extend Or Build	\$28,791	\$28,791		\$28,791	(\$0)	Project cancelled.	
C03W09A REV Extend Or Build - OR DM	\$10,108	\$10,108		\$10,108	(\$0)		
C03W09A REV Extend Or Build - OR Imp	\$18,683	\$18,683		\$18,683	(\$0)		
C03W11A ARR Burton Newramp - OR	\$3,518,210	\$779,445		\$779,445	\$2,738,765	Construction complete. Favourable water levels reduced construction cost compared to forecast. Final reporting outstanding.	
C03W11A ARR Burton Newramp - OR DM	\$76,517	\$18,154		\$18,154	\$58,363		
C03W11A ARR Burton Newramp - OR Imp	\$3,441,693	\$761,291		\$761,291	\$2,680,402		
C03W11A ARR Burton Newramp - ONR	\$1,769,409	\$1,710,988	\$53,896	\$1,764,884	\$4,525	Construction complete. Remaining forecast for ongoing ramp maintenance. Final reporting outstanding.	
C03W11A ARR Burton Newramp - ONR DM	\$68,262	\$41,786	\$5,396	\$47,182	\$21,080		
C03W11A ARR Burton Newramp - ONR Imp	\$1,701,147	\$1,669,202	\$48,500	\$1,717,702	(\$16,555)		
C03W12A ARR Edgewood Ramp - ONR	\$2,795,035	\$2,602,714	\$60,511	\$2,663,225	\$131,810	Construction complete. Remaining forecast for ongoing ramp maintenance. Final reporting outstanding.	
C03W12A ARR Edgewood Ramp - ONR DM	\$91,604	\$73,166	\$7,976	\$81,142	\$10,462		
C03W12A ARR Edgewood Ramp - ONR Imp	\$2,703,431	\$2,529,548	\$52,535	\$2,582,083	\$121,348		
C03W13A ARR Fauquier Ramp - ONR	\$780,909	\$628,927	\$32,695	\$661,622	\$119,287	Efficiencies found during project implementation. Final reporting outstanding.	
C03W13A ARR Fauquier Ramp - ONR DM	\$31,352	\$21,166	\$3,185	\$24,351	\$7,001		
C03W13A ARR Fauquier Ramp - ONR Imp	\$749,557	\$607,761	\$29,510	\$637,271	\$112,286		
C03W13A ARR Fauquier Ramp - OR	\$452,081	\$80,300		\$80,300	\$371,781	No further OR work is planned.	
C03W13A ARR Fauquier Ramp - OR DM	\$17,310	\$10,255		\$10,255	\$7,055		
C03W13A ARR Fauquier Ramp - OR Imp	\$434,771	\$70,045		\$70,045	\$364,726		
C03W14A ARR McDonald Ramp - ONR	\$3,934,795	\$1,098,426	\$57,372	\$1,155,798	\$2,778,997	Construction complete. Favourable water levels reduced construction cost compared to forecast. Final reporting outstanding.	
C03W14A ARR McDonald Ramp - ONR DM	\$147,035	\$47,413	\$5,432	\$52,845	\$94,190		
C03W14A ARR McDonald Ramp - ONR Imp	\$3,787,760	\$1,051,012	\$51,940	\$1,102,952	\$2,684,808		
C03W14A ARR McDonald Ramp - OR	\$261,344	\$21,671		\$21,671	\$239,673	No further OR work is planned.	
C03W14A ARR McDonald Ramp - OR DM	\$16,065	\$10,065		\$10,065	\$6,000		
C03W14A ARR McDonald Ramp - OR Imp	\$245,279	\$11,606		\$11,606	\$233,673		
C03W16A KIN Debris Mgmt. - OR	\$2,070,756	\$1,009,774	\$1,020,320	\$2,030,094	\$40,662	Efficiencies found during project implementation.	
C03W16A KIN Debris Mgmt. - OR DM	\$253,542	\$153,201	\$112,670	\$265,871	(\$12,329)		
C03W16A KIN Debris Mgmt. - OR Imp	\$1,817,214	\$856,573	\$907,650	\$1,764,223	\$52,991		
C03W16B KIN Debris - ONR	\$1,648,074	\$763,257	\$640,000	\$1,403,257	\$244,817	Approved amount includes \$245,000 for high water contingency, which is not included in our forecast as it is conditional.	
C03W16B KIN Debris - ONR Imp	\$1,648,074	\$763,257	\$640,000	\$1,403,257	\$244,817		
C03W17A ARROW Debris Mgmt. - OR	\$800,444	\$399,369	\$392,367	\$791,735	\$8,709	Efficiencies found during project implementation.	
C03W17A ARROW Debris Mgmt. - OR DM	\$107,220	\$57,545	\$51,967	\$109,512	(\$2,292)		
C03W17A ARROW Debris Mgmt. - OR Imp	\$693,224	\$341,824	\$340,400	\$682,224	\$11,000		
C03W17B ARR Debris - ONR	\$784,739	\$324,239	\$238,500	\$562,739	\$222,000	Approved amount includes \$222,000 for high water contingency, which is not included in our forecast as it is conditional.	
C03W17B ARR Debris - ONR Imp	\$784,739	\$324,239	\$238,500	\$562,739	\$222,000		
C03W18A Feasibility Boat Ramp - OR	\$238,120	\$238,120		\$238,120	\$0	Project complete	
C03W18A Feasibility Boat Ramp - OR DM	\$53,942	\$53,942		\$53,942	\$0		
C03W18A Feasibility Boat Ramp - OR Imp	\$184,178	\$184,178		\$184,178	\$0		
C03W19A LC Indian Env	\$181,019	\$157,488	\$1,814	\$159,302	\$21,717	Project complete. Final reporting outstanding.	
C03W19A LC Indian Env - OR DM	\$53,892	\$31,564	\$1,814	\$33,379	\$20,513		
C03W19A LC Indian Env - OR Imp	\$127,127	\$125,924		\$125,924	\$1,203		
C03W20A LC Indian Dred	\$114,002	\$41,392	\$72,610	\$114,002	\$0		
C03W20A LC Indian Dred - OR DM	\$45,722	\$22,817	\$24,075	\$46,891	(\$1,169)		
C03W20A LC Indian Dred - OR Imp	\$68,280	\$18,575	\$48,535	\$67,111	\$1,169		
C03W21A LC Debris Env	\$53,601	\$45,886	\$1,206	\$47,092	\$6,509	Project complete. Final reporting outstanding.	
C03W21A LC Debris Env - OR DM	\$15,367	\$15,259	\$1,206	\$16,466	(\$1,099)		
C03W21A LC Debris Env - OR Imp	\$38,234	\$30,627		\$30,627	\$7,607		
C03W22A LC In Ed Debris	\$44,726	\$17,253	\$13,568	\$30,821	\$13,905	Project complete. Final reporting outstanding.	
C03W22A LC In Ed Debris - OR DM	\$16,512	\$3,507	\$1,568	\$5,075	\$11,437		
C03W22A LC In Ed Debris - OR Imp	\$28,214	\$13,746	\$12,000	\$25,746	\$2,468		
C03W23A KIN & ARR Debris Env	\$126,716	\$68,960	\$1,339	\$70,299	\$56,417	Project complete. Final reporting outstanding.	
C03W23A KIN & ARR Debris Env - OR DM	\$34,233	\$15,326	\$1,339	\$16,666	\$17,567		
C03W23A KIN & ARR Debris Env - OR Imp	\$92,483	\$53,633		\$53,633	\$38,850		
C03W32A ARR Anderson New ramp - OR	\$6,301,782	\$3,589,476	\$2,447	\$3,591,923	\$2,709,859	Construction complete. Favourable water levels reduced construction cost compared to forecast. Final reporting outstanding.	
C03W32A ARR Anderson New ramp - OR DM	\$64,653	\$78,133	\$2,447	\$80,580	(\$15,927)		
C03W32A ARR Anderson New ramp - OR Imp	\$6,237,129	\$3,511,343		\$3,511,343	\$2,725,786		
C03W32A ARR Anderson New ramp- ONR	\$91,500	\$43,217		\$43,217	\$48,283	Project complete. Breakwater removal cheaper than forecast.	
C03W32A ARR Anderson New ramp - ONR DM		\$720		\$720	(\$720)		
C03W32A ARR Anderson New ramp - ONR IMP	\$91,500	\$42,497		\$42,497	\$49,003		
C03W33A ARR Syringa Ramp ONR	\$2,527,085	\$338,084	\$61,234	\$399,318	\$2,127,767	Scope reduced as breakwater determined not required. Final reporting outstanding.	
C03W33A ARR Syringa Ramp - ONR DM	\$189,085	\$54,964	\$9,234	\$64,198	\$124,887		
C03W33A ARR Syringa Ramp - ONR Imp	\$2,338,000	\$283,120	\$52,000	\$335,120	\$2,002,880		
C03W35A MCR Bank Erosion	\$712,739	\$669,788	\$22,240	\$692,028	\$20,711	Efficiencies found during project implementation. Final reporting outstanding.	
C03W35A MCR Bank Erosion - ONR DM	\$72,964	\$53,528	\$14,240	\$67,768	\$5,196		
C03W35A MCR Bank Erosion - ONR Imp	\$639,775	\$616,260	\$8,000	\$624,260	\$15,515		
C03W36A MCR Erosion Mon	\$311,993	\$257,761	\$41,163	\$298,924	\$13,069	Efficiencies found during project implementation.	
C03W36A MCR Erosion Mon - ONR DM	\$70,240	\$41,184	\$22,163	\$63,346	\$6,894		
C03W36A MCR Erosion Mon - ONR Imp	\$241,753	\$216,578	\$19,000	\$235,578	\$6,175		
C03W40A KIN Dbrs Site Prep - OR	\$785,000	\$783,522	\$1,586	\$785,108	(\$108)	Project complete. Final reporting outstanding.	
C03W40A KIN Dbrs Site Prep - OR DM	\$78,000	\$52,470	\$1,586	\$54,057	\$23,943		
C03W40A KIN Dbrs Site Prep - OR Imp	\$707,000	\$731,051		\$731,051	(\$24,051)		
C03W40B KIN Debris Rmvl - ONR	\$1,800,000	\$1,995,488		\$1,995,488	(\$195,488)	Project complete	
C03W40B KIN Debris Rmvl - ONR Imp	\$1,800,000	\$1,995,488		\$1,995,488	(\$195,488)		
C03W41A KIN Flt Dbrs Rmvl	\$42,026	\$1,498	\$1,586	\$3,084	\$38,942	Project complete. Final reporting outstanding.	
C03W41A KIN Flt Dbrs Rmvl - ONR DM	\$29,784	\$1,455	\$1,586	\$3,042	\$26,742		
C03W41A KIN Flt Dbrs Rmvl - ONR Imp	\$12,242	\$43		\$43	\$12,199		
C03W43A Nakusp Boat Launch	\$9,497,731	\$4,491,374	\$1,151,797	\$5,643,172	\$3,854,559	Favourable water levels reduced construction cost compared to forecast.	
C03W43A Nakusp Boat Launch - ONR DM	\$69,038	\$79,352	\$11,585	\$90,937	(\$21,899)		
C03W43A Nakusp Boat Launch - ONR Imp	\$9,428,693	\$4,412,022	\$1,140,212	\$5,552,234	\$3,876,459		
C03W50A Shelter Bay	\$3,065,308	\$891,910	\$1,137,551	\$2,029,461	\$1,035,847	Favourable water levels reduced construction cost compared to forecast.	
C03W50A Shelter Bay - ONR DM	\$209,308	\$77,570	\$49,410	\$126,980	\$82,328		
C03W50A Shelter Bay - ONR Imp	\$2,856,000	\$814,340	\$1,088,141	\$1,902,481	\$953,519		

OR - Ordered Remissible
ONR - Ordered Non-Remissible

* Red values in parentheses denote overage.