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## **Columbia Water Use Plan**

## **Physical Works Terms of Reference**

**CLBWORKS-30B Arrow Lakes Reservoir Wildlife Enhancement Program  
(Arrow Lakes Reservoir) - Implementation**

**Addendum 1  
November 15, 2017**

## **A1.0 Addendum to CLBWORKS-30B Arrow Lakes Reservoir Wildlife Enhancement Program (Arrow Lakes Reservoir) – Physical Works Terms of Reference**

### **A1.1 Addendum Rationale**

This Terms of Reference (TOR) for CLBWORKS-30B Arrow Reservoir Wildlife Enhancement Program (Arrow Lakes Reservoir) is for the Implementation phase of the physical works project in Burton Flats originally identified in CLBWORKS-29B Arrow Lakes Reservoir: Study of High-Value Wildlife Habitat for Potential Enhancement and Protection (LGL 2012, updated 2016). Following through on the TOR dated September 20, 2016, we have completed the Feasibility Design for the Burton Creek site (see KWL 2017) which provides the basis for the next phase: Implementation.

This TOR is submitted under the schedule for Conditional Columbia Works and Effective Monitoring Studies, Clause 7 (a) of the Columbia River Project Water Use Plan implementation order (File: 76975-35/Columbia) issued January 26, 2007. Clause 7 (a) of the Order requires Terms of Reference for “*physical works to improve conditions for nesting and migratory birds and wildlife in general within the drawdown zone of Arrow Reservoir.*”

### **A1.2 Burton Flats**

The proposed works at Burton Flats are intended to create a mixture of shallow and deep wetland habitat that will primarily benefit migratory and nesting birds, pond-breeding amphibians, reptiles, and bats. The design work has focused on identifying alternatives that increase diversity and complexity of the habitat using naturalized elements and bio-technical approaches. The Design Basis is fully described in Section 3 of the Feasibility Design Report (see KWL 2017).

The Identification/Definition Phase for Burton Flats included the following tasks: project coordination; engineering technical feasibility; archaeological impact assessment; development of an environmental management plan; preparation of permit applications; engagement of First Nations and stakeholders; and development of two design alternatives.

An Archaeological Impact Assessment (AIA) was conducted in October 2016 in the Burton Flats area. Within the Burton Creek project area, the AIA produced negative results for precontact archaeological resources.

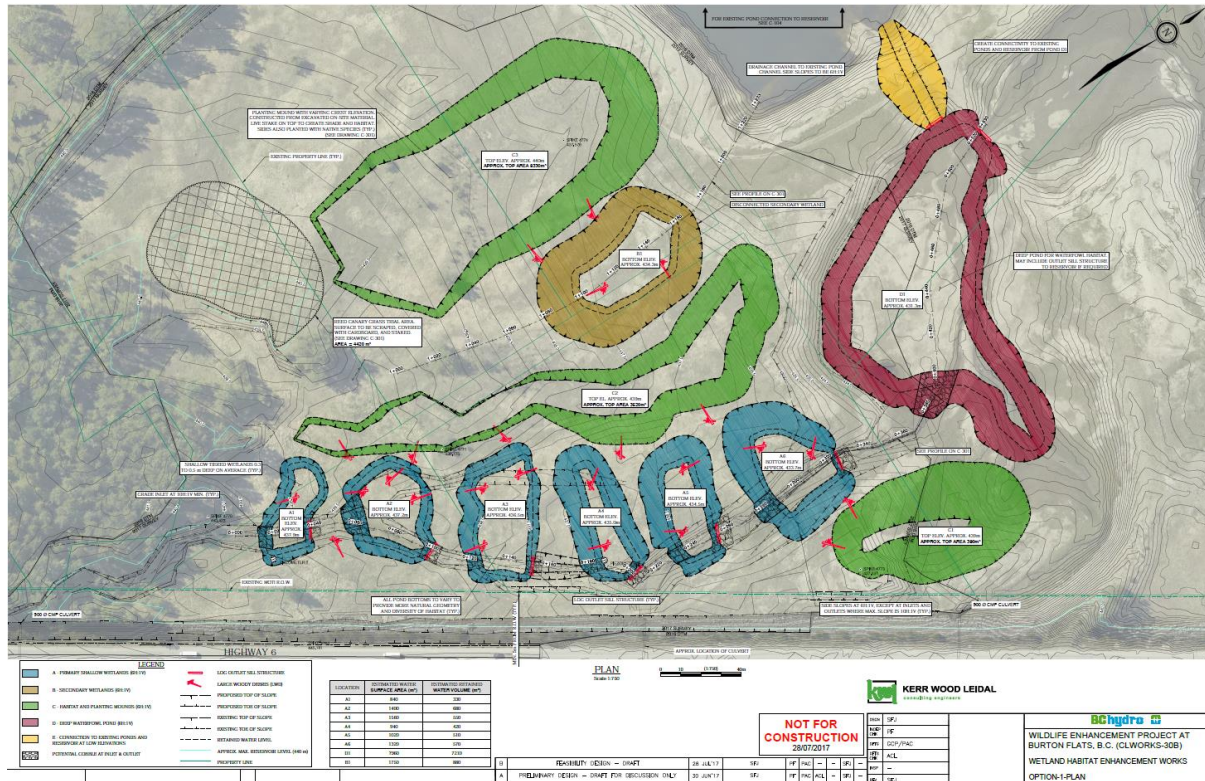
Geotechnical and hydrogeological investigation and analysis was conducted in May and June 2017 that included water level data collection, an analysis of the influence of reservoir inundation cycles, regional hydrology analysis and wave and erosion analysis. Results are fully summarized in Section 4.6 of the Feasibility Design Report (see KWL 2017). Overall surface water runoff is limited at the Burton site; therefore, the designs focus on excavation of ponds to access high groundwater levels at the site (primarily sourced through subsurface flows from Burton Creek). A fish stranding risk assessment will be conducted to determine the risk to fish at a population level of stranding within any ponds that are excavated to create the wetland complex.

### A1.2.1 Feasibility Design Alternatives

For Burton Flats, there were two options that were proposed as alternatives during the Feasibility Design phase:

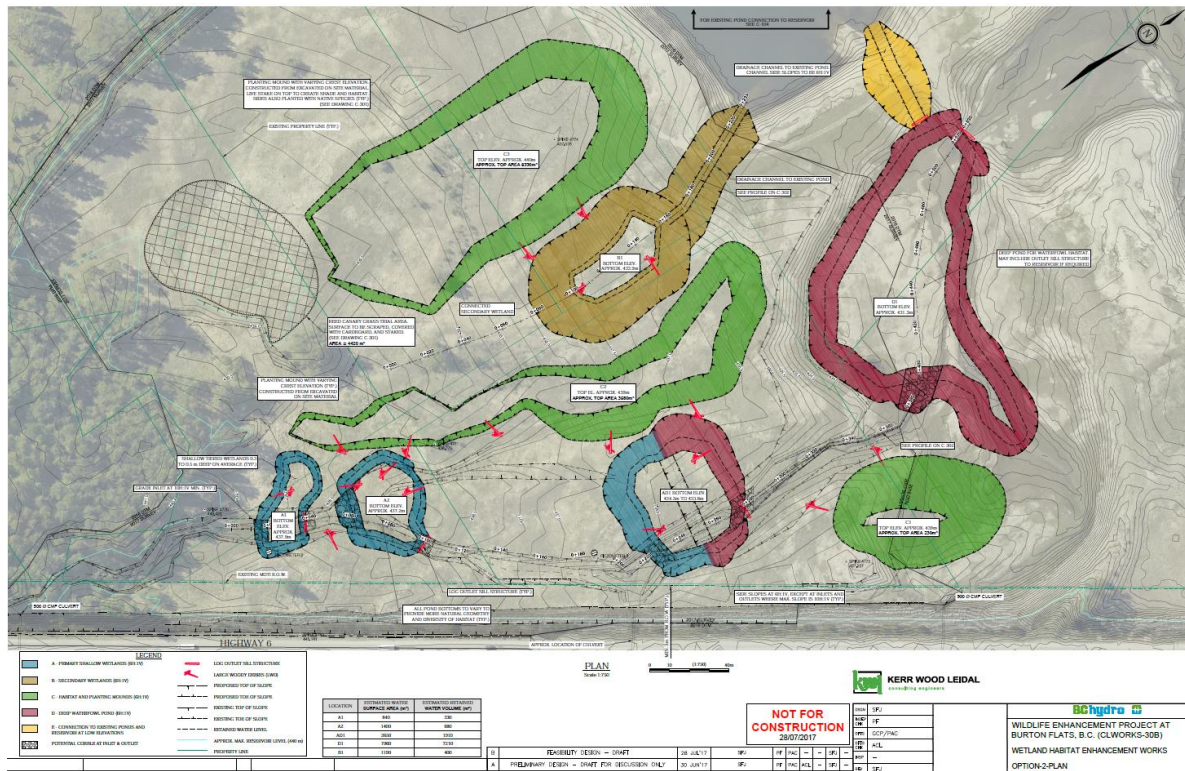
- Option 1 includes six shallow contiguous wetland pools, one deep waterfowl pond, planting mounds, and one disconnected shallow wetland creating a wetland complex of 6.1 ha (Figure 1). Option 1 is fully described in Section 5.1 of the Feasibility Design Report (see KWL 2017).

Figure 1: Burton Flats Wetland Enhancement Feasibility Design Option 1



- Option 2 contains two shallow wetland pools, one variable depth pond, one deep waterfowl pond and a shallow wetland connected to the existing excavated pond, and planting mounds creating a wetland complex of 5.7 ha (Figure 2). Option 2 is fully described in Section 5.2 of the Feasibility Design Report (see KWL 2017).

Figure 2 Burton Flats Wetland Enhancement Feasibility Design Option 2



Uncertainties and risks associated with these alternatives will be fully explored in the detailed design report to arrive at a recommended design.

There are three phases recommended for implementation of the full design, with a short monitoring period between each phase that may include design modifications. This adaptive approach ensures prudent use of resources and provides opportunities to apply learnings and engage with First Nations and stakeholders throughout Implementation.

### A1.2.2 Implementation Phase 1

As Phase 1 for both alternatives is the same, BC Hydro plans to proceed with construction of Phase 1 in 2018 (assuming all permits and authorizations are obtained). Planning for future phases will also occur. In addition, educational and engagement opportunities will commence.

### Task 12<sup>1</sup>: Educational Engagement Opportunities

BC Hydro will explore a range of opportunities to engage and educate recreational users of the drawdown zone to be more aware of First Nation and local stakeholder concerns for the protection of cultural and ecological values within this area. This may include wetland restoration workshops, engagement of youth, wetland educational interpretative signage, and designated walking trails.

<sup>1</sup> Tasks 1-11 of the TOR are fully described in the original September 20, 2016 CLBWORKS 30B Arrow Lakes Reservoir Wildlife Enhancement Program (Arrow Lakes Reservoir) Terms of Reference.

### **Task 13: Construction Phase 1 - 2018**

The Feasibility Design recommends that Phase 1 includes two of the upper primary shallow wetlands (labeled A1 and A2 in Figures 1 and 2), one mound (C2), and a small trial of Reed Canary Grass removal. There may be some modification of the timing of the construction of these features once we are closer to implementation depending on the conditions of the reservoir and results of permitting.

### **Task 15: Construction Phase 2 - 2019**

The Feasibility Design recommends that Phase 2 includes the disconnected secondary shallow wetland (B1), the remaining primary shallow wetlands, several mounds, and expansion of reed canary grass trials. The outcomes of Phase 1 may result in some modification to the detailed designs.

### **Task 16: Construction Phase 3 - 2020**

Finally, the Feasibility Design recommends that Phase 3 include the deep waterfowl pond (D1), any remaining mounds that would provide additional complexity and integrity of function to the wetland complex and potentially connection of disconnected features. The outcomes of Phase 1 and Phase 2 may result in some modification to the detailed designs. The fish stranding assessment will be critical to informing the design of deeper structures closer to the migration route of Kokanee, Bull Trout, and Rainbow Trout.

### **A1.3 Schedule**

The approach recommended by KWL (2017) is to adopt a phased approach to construction, such that wetland features of lowest ecological and financial risk are constructed first, followed by some post monitoring under CLBMON-11B1 to inform any subsequent construction (Figure 3). Currently, it is recommended that construction occur in the fall as this is a better time for vegetation salvage on site, avoids the nesting birds, and has proved to yield a higher rate of success for the planting of live-stakes. Phasing is described further in Section 5.6 of the Feasibility Design Final Report (KWL, 2017).

**Figure 3 Burton Wildlife Enhancement Program Schedule**

Task/Milestone	2017	2018	2019	2020
Detailed Design	* (fall)			
Constructability Review	* (fall)			
Procurement		* (spring)		
Permitting obtained		* (summer)		
Construction - Phase 1 <sup>2</sup>		* (fall)		
Construction – Phase 2 <sup>3</sup>			* (fall)	
Construction - Phase 3 <sup>3</sup>				* (fall)

**A1.4 Budget**

Total Revised Program Cost: \$1,686,998.

**A2.0 References**

BC Hydro, 2016. CLBWORKS-30B Arrow Lakes Reservoir Wildlife Enhancement Program (Arrow Lakes Reservoir) Physical Works Terms of Reference, Burnaby, BC.

Kerr Wood Leidal (KWL) Consulting Engineers. 2017. CLBWORKS-30B Feasibility Design Final Report: Wildlife Enhancement Program at Burton Flats. KWL File No. 0478.203-300 for BC Hydro, Water License Requirements, Burnaby, BC.

Tipi Mountain Eco-cultural Services. 2017. CLBWORKS-30B Archaeology Impact Assessment Report of the Burton Creek and Lower Inonoaklin Road Project Areas, Interim Report under Heritage Conservation Act Inspection Permit 2014-0098 for BC Hydro, Water License Requirements, Burnaby, BC.

<sup>2</sup> This schedule assumes that all permitting is obtained and that appropriate reservoir levels are available to permit construction in the dry. If conditions are not met, then the timeline for construction could shift out.

<sup>3</sup> The later construction phases may be pushed out or combined if permit delays are incurred.