Campbell River Project Water Use Plan

Upper and Lower Campbell Lake Reservoir Amphibian Assessment

Implementation Year 1

Reference: JHTMON-09

JHTMON-9 Phase 2 Year 1 (2019) - Summary of Field Study Methods, Results and Recommendations for Year 2 Field Studies (2020)

Study Period: 2019-2020

Ecofish Research & Laich-Kwil-Tach

March 16, 2020

MEMORANDUM

TO: **Teri Neighbour and Harry van Oort, BC Hydro**

FROM: **Leah Ballin, MSFM, R.P.Bio., R.P.F., Alicia Newbury, B.Sc., R.P.Bio., Deborah Lacroix, M.Sc., R.P.Bio., Ecofish Research Ltd., and Derek LeBoeuf, R.P.Bio., and Kim Duncan, Laich-Kwil-Tach Environmental Assessment Ltd. Partnership**

DATE: **March 16, 2020**

FILE: **1230-46**

RE: JHTMON-9 Phase 2 Year 1 (2019) - Summary of Field Study Methods, Results, and Recommendations for Year 2 Field Studies (2020)

1. INTRODUCTION AND PURPOSE

The Upper and Lower Campbell Lake Reservoir Amphibian Assessment Monitoring Program (JHTMON-09) was identified by the Wildlife Technical Sub-committee during the Campbell River System Water Use Planning (WUP) process to gain an understanding of the extent of aquatic habitat suitable for obligate aquatic breeding amphibian populations and the operational effects of the Upper and Lower Campbell River facilities on these habitats[1]. As described in the program's Terms of Reference (TOR)[1], the first phase (Phase 1) is a desktop mapping and modelling exercise in which the effects of reservoir operations on potential amphibian breeding ponds in Drawdown Zone Habitats (wetlands and ponds subject to reservoir inundation) are modelled to predict hydrological effects of reservoir operations on potential amphibian breeding habitat. The second phase (Phase 2) is a field study during which a subset of potential Drawdown Zone Habitat breeding sites identified during Phase 1, as well as Reservoir Shoreline Habitats (shorelines of the reservoirs), are to be investigated to: confirm breeding habitat suitability and use by species; determine the timing of breeding by species; and evaluate breeding success (i.e., egg survival and larval growth to metamorphosis into terrestrial juveniles [considered to be exodus from wetted breeding habitat]) in relation to reservoir operations and the factors (e.g., timing of inundation) that may affect it. The management questions (BC Hydro 2018[1]) that the field study was designed to address are presented in Table 1. The field study will be implemented over two years (2019 and 2020). Following Year 2 of the field program, a final report will be provided that will contain detailed methods, results, and a discussion.

The purpose of this memorandum is to provide a summary of Year 1 field activities, provide a high-level summary of Year 1 results, and describe changes to the field study design that were implemented

[1] BC Hydro. 2018. JHTMON-9 Upper and Lower Campbell Lake Reservoir Amphibian Assessment: Monitoring Program Terms of Reference. BC Hydro. May 2018.

in Year 1, after the JHTMON-9 Upper and Lower Campbell Reservoir Amphibian Assessment Field Plan (Regehr 2019[2]) was developed, and that will be continued in Year 2.

Table 1. Overview of field methods implemented in 2019 to address management questions.

Management Question #	Question	Field Work
2 a)	Which Drawdown Zone Habitats and Reservoir Shoreline Habitats do each amphibian species utilize for laying eggs?	Pond-breeding amphibian/egg-mass surveys will be conducted at ponds in the drawdown zone and along the reservoir shoreline to assess the types of habitats and habitat characteristics used for amphibian egg-mass deposition at the site level. The maximum number of study sites will be assessed that will still allow maintenance of the survey rigour required to provide high confidence in the presence or absence of breeding.
2 b)	What attributes characterize Drawdown Zone Habitats and Reservoir Shoreline Habitats used for egg laying by each amphibian species?	Data will be recorded at each site to characterize the habitats that amphibian species do and do not use for laying eggs. This will include descriptors at the site level (e.g., elevation, size, slope, water depth, hydroperiod, temperature, connectivity, vegetation) as well as the fine scale habitat attributes associated with each egg mass or other breeding occurrence (e.g., water depth, depth and position of occurrence, water temperature, attachment/substrate). Descriptors for sites in which no breeding occurrences were detected will also be documented to allow comparison between habitat used and apparently not used by breeding amphibians.
2 c)	Based on field observations, is there evidence of reservoir operations influencing habitat suitability at amphibian breeding locations? If so, how might reservoir operations affect the success of amphibians breeding in these locations?	Study sites will be visited over two years to determine where amphibians are breeding and when they are breeding in relation to available reservoir habitats and reservoir operations. Habitats with confirmed breeding will be assessed multiple times in each breeding season so that the interaction between the reservoir environment and breeding success can be documented. Field observations will be supported by model results and a literature review. Some speculation based on professional knowledge may be required.

[2] Regehr, H. L. Ballin, E. Wind, N. Wright, and D. Lacroix. 2019. JHTMON-9 Upper and Lower Campbell Reservoir Amphibian Assessment Field Plan. Consultant's report prepared for BC Hydro by Laich-Kwil-Tach Environmental Assessment Ltd. Partnership, Ecofish Research Ltd. and E. Wind Consulting, February 13, 2019.

2. METHODS

A Field Plan (Regehr *et al.* 2019[2]) was developed to direct the Year 1 field program. The two main components of the 2019 field program were amphibian breeding surveys and amphibian habitat assessments. The field program was designed to locate and characterize breeding sites and breeding success of the six obligate aquatic amphibian species that are expected to occur in the Upper and Lower Campbell Reservoirs (Table 1 in BC Hydro 2018[1]): three salamander species (Northwestern Salamander (*Ambystoma gracile*), Long-toed Salamander (*Ambystoma macrodactylum*), and Roughskin Newt (*Taricha granulosa*)), one toad species (Western Toad (*Anaxyrus boreas*)), and two frog species (Northern Red-legged Frog (*Rana aurora*) and Northern Pacific Treefrog (*Pseudacris regilla*)).

Low precipitation in the spring of 2019 resulted in unusually low water levels in the Upper Campbell Reservoir that persisted throughout the breeding season. The reservoir levels were maintained at the lower end of that allowed by the WUP (BC Hydro 2012[3]). Consequently, several of the study sites expected to provide potential aquatic amphibian breeding habitat were dry for much of the expected breeding period and it became necessary to broaden the search for additional potentially suitable amphibian breeding sites. Sites that were wetted and that were likely to contain available breeding habitat during the egg-laying season were selected. Habitat attribute data were collected at each of the selected wetted habitats. Field methods were adjusted over the first few field days from those presented in the Field Plan (Regehr *et al.* 2019[2]) to optimize data collection to account for the unusually dry conditions.

The Field Plan (Regehr *et al.* 2019[2]) included two separate types of breeding and habitat survey methods: (1) systematic and (2) rapid, to differentiate between levels of effort that would be applied to two separate sets of study sites: (1) comprehensive and (2) rapid. Comprehensive sites would have three systematic surveys conducted in the same portion of shoreline (as possible in consideration of changing water levels) throughout the breeding season, with the potential for rapid surveys, as part of follow-up surveys. Rapid study sites would have as little as one survey conducted with slightly less habitat data collected. To optimize data collection for the unusually dry conditions, the concept of differentiating between comprehensive and rapid study sites was discarded, and a new approach adopted where all wetted habitats selected for a field visit were surveyed using the systematic survey methods described in the Field Plan (Regehr *et al.* 2019[2]). Sites surveyed with systematic survey methods are referred to as survey sites hereafter. A new category of sites, reconnaissance sites, was adopted to describe sites that were either dry, overtopped, or otherwise unlikely to support amphibian breeding (e.g., cold water, wave action, bare rocky substrate), where only a brief habitat description was recorded and a georeferenced photograph was taken. If amphibian breeding habitat suitability was directly linked to the reservoir water level at the time of the site visit, reconnaissance sites may be

[3]BC Hydro. 2012. Campbell River System Water Use Plan. Available online at: https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/environment-sustainability/water-use-planning/vancouver-island/campbell-river/campbell-river-water-use-plan.pdf. Accessed on January 28, 2020.

revisited if reservoir water level is more suitable for amphibian breeding. A systematic survey would then be conducted at this time; thus, the site would be reclassified from a reconnaissance site category to the survey site category in the final report.

Habitat data collection followed that described in the Field Plan (Regehr *et al.* 2019[2]), with the addition of beaver activity descriptions, and with the exception that water quality data (other than temperature and turbidity) were not collected at any sites. In addition, the Project team and BC Hydro came to the agreement that installing hydrological monitoring equipment, as described in the original Field Plan (Regehr 2019[2]), would not provide as meaningful data to the study as previously believed prior to the 2019 field season, when less was known about study site conditions (Neighbour, pers. comm. 2020[4]).

3. PRELIMINARY RESULTS

In Year 1, surveys were conducted between March 13 and August 9, 2019 (Table 2). A total of 53 sites were surveyed in 2019 (Table 3). Of these sites, 42 were ponds and 11 were shoreline sites. Thirty-nine were in the Upper Campbell Reservoir (comprised of Buttle Lake and Upper Campbell Lake) and 14 were in the Lower Campbell Reservoir. Systematic surveys were conducted and detailed habitat data collected at 38 survey sites, and minimal habitat data were collected at 15 reconnaissance sites (Map 1, Map 2, Map 3; note that shoreline sites have an 'S' at the end of their site name, e.g., JHT-PBA43S). A total of 64 hours of person time was applied to searching for breeding amphibians in Year 1.

Within the 53 sites, amphibian breeding was confirmed at a total of 20 sites (egg masses, tadpoles, metamorphs or amplexed adults observed), comprised of 19 ponds and one shoreline site (Table 5, Table 4, Figure 1, Map 1, Map 2, Map 3). Western Toads were observed to be breeding at the highest number of sites (13 sites), followed by Northern Pacific Treefrogs (11 sites), Northwestern Salamanders (6 sites) and Northern Red-legged Frogs (2 sites). In addition, adult Roughskin Newt adults were thought to be observed (quick view only); however, no individuals were captured and no signs of breeding were detected.

Based on field observations, the egg-laying period in 2019 for all amphibians combined was estimated to be from March 26 to July 15th (Table 4, Figure 1) and the time required for eggs to develop into tadpoles was estimated to range from 7-50 days depending on the species (Table 4).

Breeding times were highly staggered within and between species (Figure 1). Much of the variation between egg laying timing within species between ponds appeared to be associated with reservoir levels and associated wetting of ponds. Such that later in the season, breeding activities were observed within days of ponds becoming newly wetted.

[4] Neighbour, T. BC Hydro, Water Licence Requirements, Environment. Email communication to K. Duncan, A-Tlegay Fisheries Society, on January 6, 2020.

The time from egg laying to when amphibians left the breeding pond was relatively easy to detect for some species and very challenging to detect for others. Western Toads develop fast and the tadpoles often form large schools and then metamorphose into terrestrial juveniles/metamorphs synchronously and leave the pond in large conglomerations. Contrarily, Northern Red-legged Frog and Northwestern Salamander take longer to develop, and often disperse themselves around a pond. In addition, the ponds in which Northwestern Salamander egg masses were observed became covered in algae later in the season, making larvae challenging to detect during future visits. Only three Northern Red-legged Frog tadpoles were observed in 2019, and the only tadpole observed in June was in poor condition.

The presence of beaver activity was observed to be positively correlated to amphibian breeding activity in Year 1, as sites that were managed by beaver dams often had inflow sources (e.g., small streams) and were impounded, thus holding water within the breeding site in the drawdown zone while adjacent sites at similar elevations were dry.

Table 2. Year 1 field assessment dates and activities.

Field Visit	Month	Date	# of Days in Field	# of Study Sites Visited	Activities	Preliminary Observations
1	March	13	1	14	Reconnaissance assessments at a subset of sites to determine if egg deposition had started.	No sign of breeding.
2	March	28	1	5	Reconnaissance assessments. Systematic breeding surveys conducted where breeding confirmed.	First Western Toad breeding occurrence confirmed.
3	April	2-3	2	18	Reconnaissance assessments. Systematic breeding surveys conducted and habitat data collected where breeding confirmed.	First Northern Red-legged Frog and Northwestern Salamander breeding occurrences
4	April	23-25	3	15	Reconnaissance assessments. Systematic breeding surveys conducted and habitat data collected where breeding confirmed.	First Northern Pacific Treefrog breeding occurrence confirmed.
5	May	14-15	2	21	Reconnaissance assessments. Systematic breeding surveys conducted and habitat data collected where breeding confirmed.	
6	June	11	1	21	Verification of amphibian larvae development and breeding success at previously confirmed breeding occurrences. Additional reconaissance assessments at newly wetted sites.	Western Toad and Pacific Treefrog breeding confirmed at newly wetted sites.
7	July	7	1	14	Verification of amphibian larvae development and breeding success at previously confirmed breeding occurrences.	
8	August	9	1	7	Verification of amphibian larvae development and breeding success at previously confirmed breeding occurrences. BC Hydro site visit.	
Total			*12*			

Table 3. Number of sites surveyed in Year 1 by reservoir, survey type, and habitat type.

Location	Site Type	Habitat Type	# Sites
Upper Campbell Reservoir	Survey	Pond	22
		Shoreline	5
	Reconnaissance	Pond	10
		Shoreline	2
subtotal			*37*
Lower Campbell Reservoir	Survey	Pond	8
		Shoreline	3
	Reconnaissance	Pond	2
		Shoreline	1
subtotal			*16*
Total			**53**

Table 4. Number of sites where amphibians were observed, and breeding was confirmed in Year 1, by species. Expected egg laying and development time is based on data collected at these sites, by species.

Species	# of Sites with Amphibians Detected (any age class)	# of Sites with Egg Masses or Tadpoles Detected	Expected Egg Laying Period[1]	Expected Egg Development Time[1]
Northern Red-legged Frog	4	2	March 26 - April 10	20 days
Northern Pacific Treefrog	17	11	April 10 - July 15	7 days
Northwestern Salamander	6	6	April 1 - April 25	30-50 days
Roughskin Newt	2	0	-	-
Western Toad	16	13	March 28 - June 15	~10 days

[1]Based on breeding observations made in Year 1 in the Upper and Lower Campbell Reservoirs.

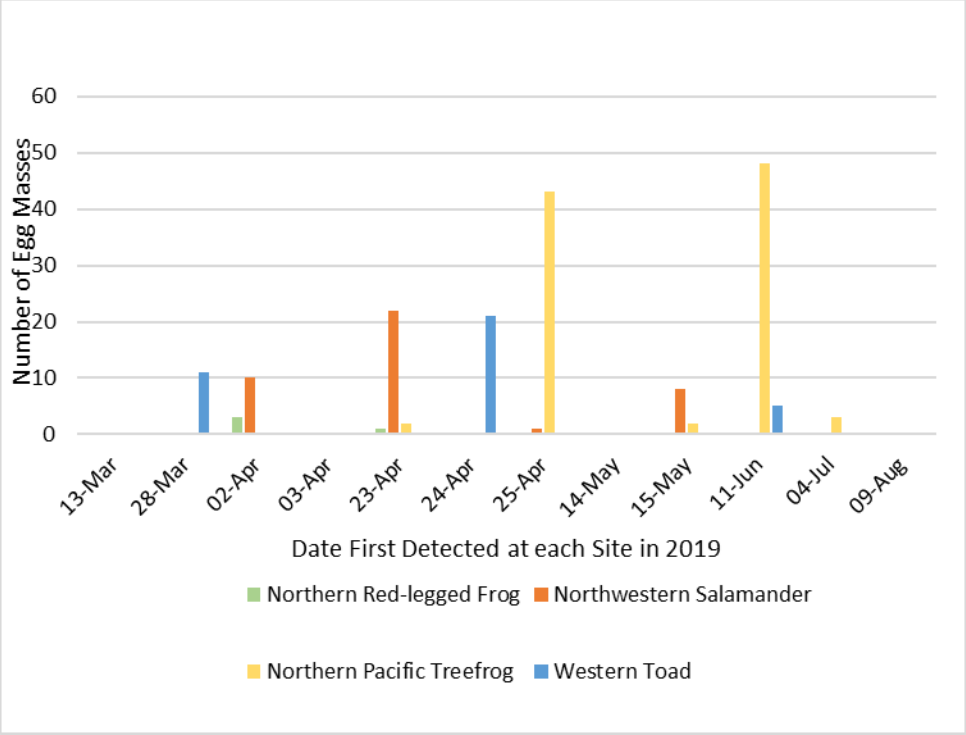
Table 5. Number of detections by age class per species in Year 1, at first detection only.

Species	Number Detected per Age Class[1]				
	Egg Masses	Tadpoles	Metamorphs	Juveniles	Adults
Northern Red-legged Frog	4	3		1	7
Northern Pacific Treefrog	98	2,743		3	14
Northwestern Salamander	41				4
Roughskin Newt					2 [2]
Western Toad	37	58,253	11,000	25,001	82

[1] Numbers reflect the occurrences observed the first time the occurrence was detected (e.g., if egg masses were detected during a survey, then tadpoles were observed in place of egg masses during a later survey of the same area, the occurrence was documented but is not included in the above totals.)

[2] Species not confirmed as individual not captured or photographed.

Figure 1. Number of egg masses by first detection date at each site by species in Year 1.



4. YEAR 2 SAMPLING PLAN

In Year 2, study sites where amphibians have been detected will continue to be the focus of the field program and will be visited multiple times throughout the field season to monitor amphibian activity and habitat changes. To increase site replication across elevation bands, surveys in Year 2 will also include any additional pond and shoreline sites expected to provide amphibian breeding habitat if Year 2 water levels are suitable. Survey methodology adjustments made in Year 1 (Section 2) to the Field Plan (Regehr *et al.* 2019[2]) will also be applied in Year 2, with similar levels of field effort (i.e., 12 field days). Water quality data collected in Year 1 included temperature and turbidity only. In Year 2, dissolved oxygen, pH and specific conductivity will also be collected at sites where amphibians are observed. In addition, similar to Year 1, reconnaissance sites that are deemed to have low amphibian habitat suitability at the time of first visit or follow up visits (e.g., dry) will be documented by photographing them and briefly describing habitat status rather than completing a full habitat survey, focusing the field program on collecting data to address the management questions.

Yours truly,

Ecofish Research Ltd.

Prepared by:

Signed

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Signed

Alicia Newbury, B.Sc., R.P.Bio.

Wildlife Biologist, Project Manager

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Disclaimer:

PROJECT MAPS

315000 320000 325000 330000

5545000

5540000

Merrill Lake
Gosling Lake
Boot Lake
Lawson Lake
Lower Campbell Lake
Campbell River
Reginald Lake
Beavertail Creek
Beavertail Lake
Echo Lake
Mirror Lake
Miller Creek
Snakehead Lake

JHT-PBA20
PSRE, ANBO,
AMGR, RAAU

JHT-PBA22
RAAU, AMGR

JHT-PBA23

JHT-PBA25

JHT-PBA47S

JHT-PBA26

JHT-PBA48S

JHT-PBA08
AMGR, ANBO

JHT-PBA16
PSRE

JHT-PBA07

JHT-PBA57

JHT-PBA58

JHT-PBA59

JHT-PBA46S
PSRE, AMGR

JHT-PBA31

JHT-PBA30

JHT-PBA55

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JHTMON CAMPBELL RIVER WATER USE PLAN
JHTMON-9 2019 Amphibian Breeding Locations and Survey Sites

Legend

Survey Sites

- Survey Site
- Reconnaissance
- Breeding Observed
- Amphibians
- Pond
- Stream

Species	Code
Northern Red-legged Frog	RAAU
Northern Pacific Treefrog	PSRE
Northwestern Salamander	AMGR
Roughskin Newt	TAGR
Western Toad	AMBO

MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES

0 1 2 km

Scale: 1:52,000

NO.	DATE	REVISION	BY
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3			
4			
5			

Date Saved: 2020-02-18
Coordinate System: NAD 1983 UTM Zone 10N

ECOFISH RESEARCH

Map 1

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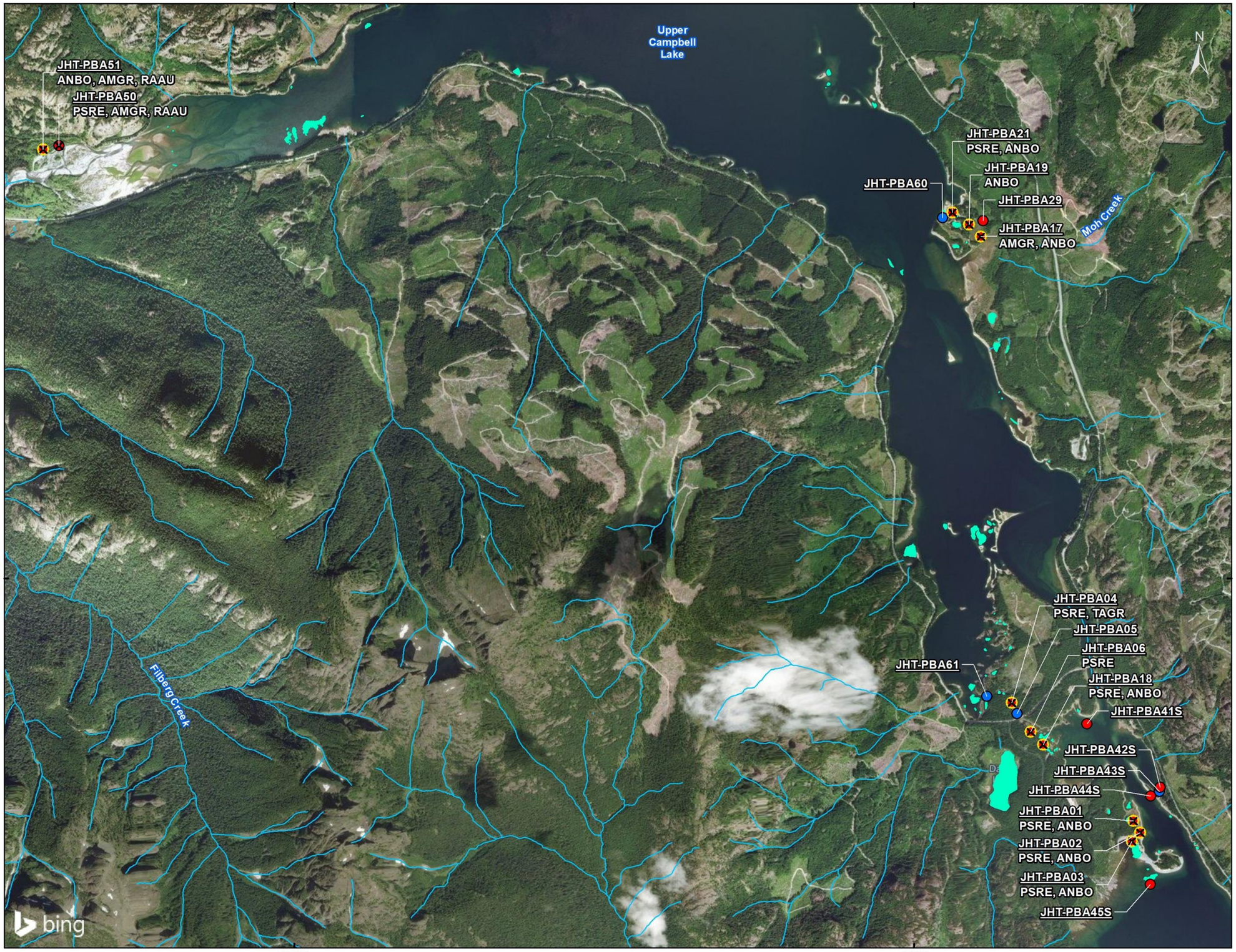

JHTMON CAMPBELL RIVER WATER USE PLAN

JHTMON-9 2019 Amphibian Breeding Locations and Survey Sites

Legend

Survey Sites

- Survey Site
- Reconnaissance Site
- Breeding Observed
- Amphibians Observed
- Pond
- Stream

Species	Code
Northern Red-legged Frog	RAAU
Northern Pacific Treefrog	PSRE
Northwestern Salamander	AMGR
Roughskin Newt	TAGR
Western Toad	AMBO

MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES

0 0.75 1.5 km

Scale: 1:30,000

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3			
4			
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Date Saved: 2020-01-30
Coordinate System: NAD 1983 UTM Zone 10N

ECOFISH RESEARCH

Map 2

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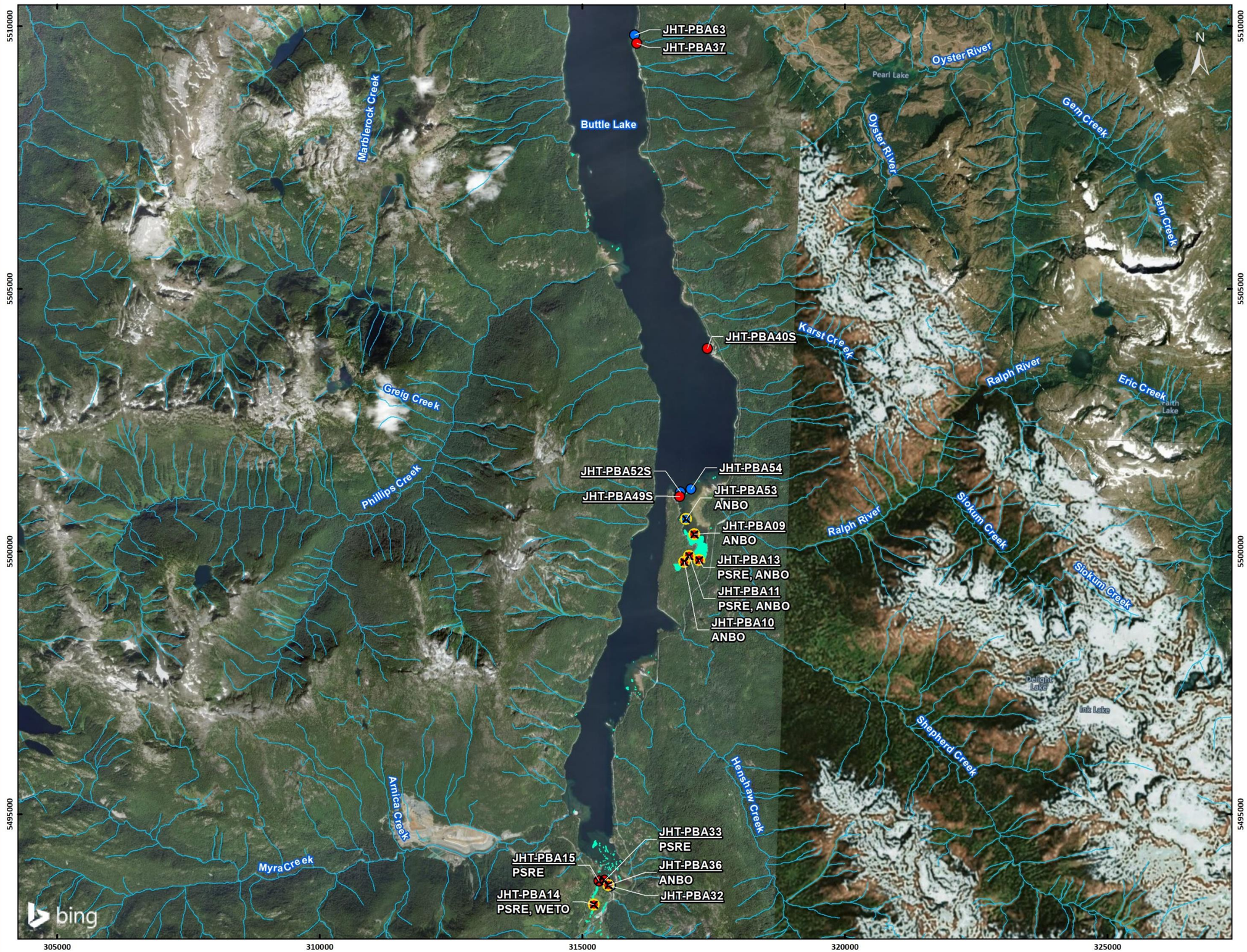
JHTMON CAMPBELL RIVER WATER USE PLAN

JHTMON-9 2019 Amphibian Breeding Locations and Survey Sites



Legend

Survey Sites

- Survey Site
- Reconnaissance Site
- Breeding Observed
- Amphibians Observed
- Pond
- Stream

Species	Code
Northern Red-legged Frog	RAAU
Northern Pacific Treefrog	PSRE
Northwestern Salamander	AMGR
Roughskin Newt	TAGR
Western Toad	AMBO

MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES

0 1 2 km

Scale: 1:70,000

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3			
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Coordinate System: NAD 1983 UTM Zone 10N

ECOFISH RESEARCH

Map 3

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