Site C Clean Energy Project

Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program (Mon-1b)

Task 2c – Site C Reservoir Tributaries Fish Population Indexing Survey

Construction Year 4 (2018)

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2018 Annual Report

Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c)

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Executive Summary

In accordance with Provincial Environmental Assessment Certificate Condition No. 7[1] and Federal Decision Statement Condition Nos. 8.4.3[2] and 8.4.4[3] for BC Hydro's Site C Clean Energy Project (the Project), BC Hydro has developed the Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP[4]). The Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program (Mon 1b) represents one component of the FAHMFP that is designed to monitor the responses, using before and after comparisons, of target Peace River fish populations to the construction and operation of the Project. Target species include Arctic Grayling (Thymallus arcticus), Bull Trout (Salvelinus confluentus), and Rainbow Trout (Oncorhynchus mykiss) because these species spend portions of their life cycle in Peace River tributaries and migrate past the Project to fulfill their life history requirements.

The Site C Reservoir Tributaries Fish Population Indexing Survey (Task 2c of Mon-1b) in an annual survey that monitors target species, and in 2018, these populations were monitored in the Moberly River (for Arctic Grayling), the Chowade River and Cypress and Fiddes creeks (for Bull Trout), and Colt, Farrell, and Kobes creeks (for Rainbow Trout) using backpack electrofishing (all streams except the Moberly River) and a combination of backpack electrofishing, small fish boat electroshocking, backpack electrofishing, beach seining, and angling (the Moberly River only). In 2018, field methods, target species, and sampled streams, were identical to those employed in 2017.

The primary objective of the study was to monitor the above three species; however, a secondary objective for sampling conducted in the Chowade River and Cypress Creek was to implant Passive Integrated Transponder (PIT) tags into Bull Trout. Tagged Bull Trout were to be monitoring by PIT detector arrays installed in the Chowade River and Cypress Creek as part of the FAHFMPs Peace River Bull Trout Spawning Assessment (Mon-1b, Task 2b). To increase the likelihood of deploying more PIT tags into Bull Trout, the upstream areas of these stream were specifically targeted as higher numbers of immature Bull Trout were recorded in these areas in 2016. Sampling in Fiddes Creek targeted areas that were readily accessible by helicopter and limiting sampling to these locations may have influenced results.

Sampling in the Halfway River watershed began on 21 July but was halted on 24 July after water levels increased substantially due to high precipitation. Sampling resumed approximately 1 week later after water levels receded.

[1] The EAC Holder must develop a Fisheries and Aquatic Habitat Monitoring and Follow-up Program to assess the effectiveness of measures to mitigate Project effects on healthy fish populations in the Peace River and tributaries, and, if recommended by a QEP or FLNR, to assess the need to adjust those measures to adequately mitigate the Project's effects.

[2] The plan shall include: an approach to monitor changes to fish and fish habitat baseline conditions in the Local Assessment Area;

[3] The plan shall include: an approach to monitor and evaluate the effectiveness of mitigation or offsetting measures and to verify the accuracy of the predictions made during the environmental assessment on fish and fish habitat.

[4] Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program available at https://www.sitecproject.com/document-library/environmental-management-plans-and-reports.

Key results from the 2018 survey are summarized as follows:

Tributaries Targeting Bull Trout (Chowade River and Cypress and Fiddes creeks)

- Comparisons between the catch rate of Bull Trout captured in the Chowade River and Cypress and Fiddes creeks in 2017 and 2018, indicated a similar CPUE for YOY fish but approximately 50% lower CPUE for immature fish. The decline is largely due to higher water levels in 2018 increasing the amount of habitat available to sample relative to 2017. Moving forward, the influence of water levels on Bull Trout catch rates may hinder interpretation of study results. Data from 2016 were not used in interannual comparisons due to differences in sampling methodologies.
- Modifications to the 2017 Chowade River and Cypress Creek study designs, which were also implemented in 2018, contributed to increased numbers of captured and tagged Bull Trout. However, focusing effort on habitats expected to yield high Bull Trout densities increased bias in CPUE estimates and increased uncertainty regarding the program's ability to test its hypothesis (i.e., Bull Trout juvenile abundance in the Halfway River will not decline relative to baseline estimates). It is unlikely that a single survey can deploy enough tags to meet the needs of other components of the FAHMFP while also gathering enough data to adequately monitor the overall immature Bull Trout populations in these two systems.
- The number of juvenile Bull Trout captured and tagged in the Chowade River and in Cypress and Fiddes creeks in 2018 were similar to 2017 results, suggesting a stable population among these years.
- Consistent with results from 2017, in 2018, Arctic Grayling were not recorded in the Chowade River or in Cypress or Fiddes creeks and Rainbow Trout were rarely recorded.

Tributaries Targeting Rainbow Trout (Colt, Farrell, and Kobes creeks)

- YOY and immature Rainbow Trout were each recorded in Colt, Farrell, and Kobes creeks. The presence of YOY Rainbow Trout in these streams during the study period (i.e., August) indicates that Rainbow Trout likely used these streams for spawning during the preceding spring spawning season. Adult Rainbow Trout were rarely recorded in these streams in 2018 and 2017, suggesting that these streams are likely used for spawning and rearing by a migratory population.
- Consistent with results from 2017, in 2018, Arctic Grayling and Bull Trout were rarely recorded in Colt, Farrell, and Kobes creeks.

Tributaries Targeting Arctic Grayling (Moberly River)

- From 2016 to 2018, Arctic Grayling catch in the Moberly River aligned with water levels, with lower catches recorded in 2017 and 2018, when water levels were low, and higher catches recorded in 2016, when water levels were high. Low water levels reduce the suitability of habitat for Arctic Grayling in the Moberly River. As such, Arctic Grayling migrate downstream to the Peace River during periods of low water. Moving forward, the influence of water levels on Arctic Grayling catch rates may hinder interpretation of study results and prevent the study from meeting its objective for this species.

Data collected from 2016 to 2018, in conjunction with data to be collected in 2019, represent the baseline, pre-Project state of select Site C reservoir tributaries. Management hypotheses cannot be statistically tested until later into the Project's construction.

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Description
EAC	Environmental Assessment Certificate
Project	Site C Clean Energy Project
FAHMFP	Fisheries and Aquatic Habitat Monitoring and Follow-up Program
Mon-1b	Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program
Task 2c	Site C Reservoir Tributaries Fish Population Indexing Survey
EIS	Environmental Impact Statement
Task 2b	Peace River Bull Trout Spawning Assessment
PIT	Passive Integrated Transponder
PCD	Peace Canyon Dam
Mon-2	Peace River Fish Community Monitoring Program
BA	Before-After study design
HDX	Half-Duplex
Task 2a	Peace River Large Fish Indexing Survey
FDX	Full-Duplex
WLR	Water License Requirements
GMSMON-2	Peace River Fish Index

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1.0 INTRODUCTION

In accordance with Provincial Environmental Assessment Certificate (EAC) Condition No. 7[5] and Federal Decision Statement Condition Nos. 8.4.3[6] and 8.4.4[7] for BC Hydro's Site C Clean Energy Project (the Project), BC Hydro developed the Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP[8]). The Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program (Mon-1b) represents one component of the FAHMFP that is designed to monitor Peace River fish populations that use tributaries in the future inundation zone of the Site C reservoir to fulfil portions of their life cycle. Most notably, these species include Arctic Grayling (*Thymallus arcticus*), Bull Trout (*Salvelinus confluentus*), and Rainbow Trout (*Oncorhynchus mykiss*). The Site C Reservoir Tributaries Fish Population Indexing Survey (Task 2c) is one component of Mon-1b that intends to monitor the populations of Arctic Grayling, Bull Trout, and Rainbow Trout that are known to spawn in Site C reservoir tributaries and how these populations are impacted by the construction and operation of the Project. This report summarizes the 2018 findings of Task 2c. As this is the third year of a multi-year study, the results from 2018 (in addition to the data from the first two years of the study) will contribute to the baseline data prior to subsequent phases of Project construction (e.g., river diversion) and reservoir formation. These data will also help identify the most effective sampling locations and methods to employ during future study years. During Year 1 (2016), surveys consisted of a broad spatial scope within each of the sampled tributaries (Golder 2017). Effort in Year 2 (Golder 2018) was focused on key areas that were identified during Year 1 surveys, while the Year 3 survey (the current year) largely repeated methods refined during Year 2 (2017).

1.1 Bull Trout

A key uncertainty identified in the Project's Environmental Impact Statement (EIS) relates to the movement of Peace River Bull Trout during and after construction of the Project, which in turn, influences the number of spawning Bull Trout expected to be present in the Halfway River[9]. The Halfway River is known to be an important watershed for spawning by Peace River Bull Trout (Braun et al. 2017; AMEC and LGL 2008a, 2008b, 2010a, 2010b; BC MELP 2000; Burrows et al. 2001; Pattenden et al. 1991). The objective of the Peace River Bull Trout Spawning Assessment (Mon-1b, Task 2b) is to monitor Bull Trout spawner and redd abundance in select tributaries of the Halfway River watershed to monitor the population's response to the construction and operation of the Project (Braun et al. 2017). The abundance of adult Bull Trout in the Halfway River watershed, as monitored under Task 2b, may be influenced by changes in the abundance of juvenile Bull Trout in the study area and by changes in the abundance of the Halfway River's resident Bull Trout population. Therefore, Task 2c is designed, in part, to monitor juvenile Bull Trout abundance in the Halfway River watershed to test Hypothesis #3 within the Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program:

H_3: Bull Trout juvenile abundance in the Halfway River will not decline relative to baseline estimates.

[5] The EAC Holder must develop a Fisheries and Aquatic Habitat Monitoring and Follow-up Program to assess the effectiveness of measures to mitigate Project effects on healthy fish populations in the Peace River and tributaries, and, if recommended by a QEP or FLNR, to assess the need to adjust those measures to adequately mitigate the Project's effects.

[6] The plan shall include: an approach to monitor changes to fish and fish habitat baseline conditions in the Local Assessment Area.

[7] The plan shall include: an approach to monitor and evaluate the effectiveness of mitigation or offsetting measures and to verify the accuracy of the predictions made during the environmental assessment on fish and fish habitat.

[8] Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program available at https://www.sitecproject.com/document-library/environmental-management-plans-and-reports.

[9] Site C Clean Energy Project Environmental Impact Statement, Volume 2, Appendix Q3.

Prior to 2016, a program dedicated to monitoring juvenile Bull Trout abundance in the Halfway River watershed had not previously been implemented, although incidental catches were noted during some studies (e.g., Mainstream 2009a, 2010a, 2011a, 2013). Therefore, for the purposes of testing the above hypothesis, data collected during initial study years (i.e., 2016 through 2019) will serve as baseline data with which to compare against future study years.

A secondary objective of the current program was to deploy Passive Integrated Transponder (PIT) tags into captured fish to allow the movements of these fish to be monitored using PIT arrays installed in the Chowade River and Cypress Creek (Figure A1) as a component of Task 2b in 2017 (Ramos-Espinoza et al. 2018) and 2018 (Ramos-Espinoza in prep.). To help meet this secondary objective, effort in the Chowade River and Cypress Creek in 2018 focused on areas of expected higher Bull Trout densities, based on the results of the surveys in 2016 and 2017.

1.2 Rainbow Trout

The Project's EIS identified uncertainties regarding the continued use of Maurice and Lynx creeks for spawning and rearing by Peace River Rainbow Trout populations. Sampling in Maurice Creek was not conducted under Task 2c during any survey year due to site access limitations associated with sampling crew safety and security. Sampling in Lynx Creek was not conducted under Task 2c during any survey year due to ongoing high turbidity levels[10] precluding fish sampling. Landslides in Lynx Creek have reduced the quality of Rainbow Trout spawning and rearing habitat through increased sediment deposition. The use of these streams as index streams for monitoring the long-term status of the Peace River Rainbow Trout population is not ideal.

In 2017 and 2018, effort in the Chowade River and Cypress Creek focused on the upstream portions of each tributary where densities of immature Bull Trout were expected to be high and densities of Rainbow Trout were expected to be low. For the Chowade River, all sampling was conducted upstream of River Km 36 (as measured upstream from the Chowade River's confluence with the Halfway River). For Cypress Creek, all sampling was conducted upstream of River Km 19 (as measured upstream from the Cypress Creek confluence).

For the above reasons, prior to the 2017 survey, Farrell, Colt, and Kobes creeks were selected, in consultation with BC Hydro[11], as alternative tributaries to monitor local Rainbow Trout populations. These streams were sampled to increase Rainbow Trout captures within the Halfway and Peace river watersheds because the other modifications to the 2017 study design were expected to reduce Rainbow Trout catches in other streams. The sites established on Farrell, Colt and Kobes creek in 2017 were replicated in 2018.

Farrell Creek is a tributary that flows into the Peace River approximately 23.5 km downstream of Peace Canyon Dam (PCD). Sampling in Farrell Creek will test the hypothesis that Rainbow Trout from Site C reservoir will continue to spawn and rear upstream of the Site C reservoir inundation zone following reservoir formation. The presence of Young-of-the-Year (YOY) Rainbow Trout in Farrell Creek during summer surveys would be taken as confirmation that Rainbow Trout spawned in the system during the preceding spring spawning season.

[10] The source of the high turbidity in Lynx Creek is not known, and may be associated with recent upstream landslide activities http://hudsonshope.ca/residents/water-services/.

[11] BC Hydro also reviewed with the Project's Fisheries and Aquatic Habitat Mitigation and Monitoring Technical Committee, the streams to sample for Rainbow Trout.

The subsequent detection of Rainbow Trout that were initially tagged as juveniles or YOY in Farrell Creek under other components of the FAHMFP will help confirm that Rainbow Trout from the Peace River spawn in Farrell Creek.

Kobes Creek is a tributary to the Halfway River, flowing into the Halfway River at River Km 76 (as measured upstream from the Halfway River's confluence with the Peace River). Colt Creek is a tributary to the Graham River, flowing into the Graham River at River Km 11.5 (as measured upstream from the Graham River's confluence with the Halfway River). The Graham River flows into the Halfway River 90 km upstream from the Halfway River's confluence with the Peace River. Over time, Rainbow Trout data from Colt and Kobes creeks will be used to provide an index of relative Rainbow Trout abundance and to gather information regarding movements between sites and study years in the Halfway River watershed.

1.3 Arctic Grayling

The Project's EIS describes key uncertainties for the Peace River Arctic Grayling population upstream of the Project[12]. These include the species' ability to overwinter in the Moberly River and its response to the Project's creation of reservoir habitat. Arctic Grayling numbers are expected to be lower when compared to baseline estimates (e.g., baseline estimates in Mainstream 2013). This program will test Hypothesis #5 from the Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program:

H_5: A self-sustained population of Arctic Grayling will remain in the Moberly River.

Sampling in the Moberly River under Task 2c in 2016, 2017 and 2018 was added to the existing pre-development baseline dataset to further describe the fish community located within and upstream of the Site C reservoir inundation zone while improving understanding of the Moberly River Arctic Grayling population.

[12] Site C Clean Energy Project Environmental Impact Statement, Volume 2, Appendix Q3.

2.0 METHODS

The Site C Reservoir Tributary Fish Population Indexing Survey represents a Before-After (BA) study design, with four years of data scheduled to be collected prior to river diversion (currently scheduled for 2020). An additional four years of data are scheduled to be collected during river diversion (2020 to 2023), with reservoir filling and operation commencing in fall 2023.

2.1 Study Area

The Task 2c study area includes tributaries that were previously identified as having key habitat for migratory Peace River Arctic Grayling, Bull Trout, and Rainbow Trout populations (Appendix A, Figures A1 to A9). Sections of each tributary that were sampled depended on sampling logistics and the species-specific hypotheses being tested. Results of the 2016 and 2017 sampling program were used to guide sample site selection to focus on reaches and habitat types with higher densities of the target fish species. Target fish species within the tributaries sampled in 2018 are summarized in Table 1.

Table 1: Summary of target species by watershed for the Site C Reservoir Tributaries Fish Population Indexing Survey, 2018

Species	Watershed						
	Chowade River	Cypress Creek	Fiddes Creek	Colt Creek	Farrell Creek	Kobes Creek	Moberly River
Arctic Grayling				o	o	o	x
Bull Trout	x[1]	x	x	o		o	
Rainbow Trout	o[2]	o		x	x	x	

[1] "X" denotes main target species for the tributary.

[2] "o" denotes secondary target species for the tributary.

River Km values presented in this report were based on the Government of Canada's CanVec series of hydrograph features[13]. For each tributary, the different line segments of the same stream were merged into a single line feature. River Km 0.0 (i.e., the tributary's confluence) was set at the lowest elevation of the line feature and 1 km intervals were established along the line feature using the Create Station Points tool (ArcGIS© extension ET GeoWizards).

2.1.1 Tributaries Targeting Bull Trout

Portions of the Halfway River watershed that were sampled in 2018 included locations where catches of Bull Trout were greatest in 2016 (Golder 2017) and 2017 (Golder 2018), and sections previously identified as important for spawning Bull Trout (Euchner and Mainstream 2013). Tributaries sampled included the Chowade River and

[13] Available for download at https://open.canada.ca/data/en/dataset/9d96e8c9-22fe-4ad2-b5e8-94a6991b744b.

Cypress and Fiddes creeks (Table 1). Sampling within the upper Halfway River mainstem, which was conducted in 2016 (Golder 2017), was not conducted in 2018 because limited access to the area reduced the feasibility of sampling it as part of a long-term index of Bull Trout population status.

For the Chowade River, sampling was conducted between River Km 36.0 and River Km 54.3 (as measured upstream from the Chowade River's confluence with the Halfway River; Appendix A, Figure A4). For Cypress Creek, sampling was conducted between River Km 19.0 and River Km 67.0 (as measured upstream from Cypress Creek's confluence with the Halfway River; Appendix A, Figure A3).

Fiddes and Turnoff creeks have been identified as containing critical spawning habitat for Bull Trout (Mainstream 2012) and results of the Peace River Bull Trout Spawning Assessment (Mon-1b, Task 2b) in 2016 indicated smaller Bull Trout spawner and redd sizes in these tributaries when compared to the Halfway River mainstem (Braun et al. 2017), which could indicate the presence of a resident Bull Trout population. Fiddes and Turnoff creeks were sampled in 2017 to gather additional information regarding Bull Trout habitat use and rearing in these two tributaries. Fiddes and Turnoff creeks flow into the Halfway River near River Km 241.5 (as measured upstream from the Halfway River's confluence with the Peace River); their confluences are within 200 m of each other (Appendix A, Figure A2). Fiddes Creek was sampled in 2018 because the catch rate of immature Bull Trout was considerably higher in this stream (7.8 fish/hour) than in Turnoff Creek (1.2 fish/hour) in 2017 (Golder 2018). In addition, limited access to sites on Turnoff Creek reduced the feasibility of including it as part of a long-term index of Bull Trout population status. All sampling within Fiddes Creek was conducted between River Km 6.0 and River Km 12.0 (as measured upstream from the Fiddes Creek's confluence with the Halfway River; Appendix A, Figure A2).

Sample sites were wadeable sections where backpack electrofishing was most effective and in habitats thought to be suitable for immature Bull Trout, including side channels, low velocity habitats near the channel margin, and areas where cover, such as woody debris or boulders, was prevalent. UTMs of all site locations are provided in Appendix A, Table A1. Individual sites were selected based on aerial surveys conducted at the start of the program, allowing crews to identify potentially suitable habitats that were within close proximity to safe landing locations.

2.1.2 Tributaries Targeting Rainbow Trout

Sample locations within Farrell Creek (Appendix A, Figure A7) were aligned with sites previously established by Mainstream (2011a) and (Golder 2018) to allow comparisons to historical data when possible. To maintain a consistent site-naming convention between tributaries within Task 2c, Mainstream Site FA03 was renamed FAC63.4, Site FA04 was renamed FAC65.7, and Site FA05 was renamed FAC102.1. UTMs of sample site locations are provided in Appendix A, Table A1.

Sample locations within Colt Creek (Appendix A, Figures A5) and Kobes Creek (Appendix A, Figure A6) were established in 2017 based on ease of access and the quality of fish habitat available (i.e., expected use by juvenile Rainbow Trout). These sample locations were replicated in 2018. UTMs of sample site locations are provided in Appendix A, Table A1.

2.1.3 Moberly River

The Moberly River study area was approximately 123 km long and was defined as the portion of the Moberly River from the outlet of Moberly Lake (River Km 123 as measured upstream from the Moberly River's confluence with the Peace River) downstream to the Moberly River confluence (River Km 0.0; Appendix A, Figures A8 and A9).

For the Moberly River, previous baseline studies had delineated river sections (Mainstream 2011b; Appendix A, Table A2) and these section breaks were implemented in 2018 to maintain consistency with these baseline datasets. The habitat classifications delineated by Mainstream (2011b) were as follows:

1) Irregular meanders; frequent riffle complexes interspersed with extended runs with some flats; and
2) Tortuous meanders dominated by low water velocities; flats with few riffle sections.

Site selection for small fish boat electroshocking and backpack electrofishing in the Moberly River in 2018 was based on access, sampling logistics, and safety protocols (similar to 2016 and 2017; Golder 2017-2018). Angling sites were selected opportunistically, targeting preferred adult Arctic Grayling habitats. UTMs of sample site locations are provided in Appendix A, Table A1.

2.2 Study Period

Overall, 27 days of sampling were conducted in 2018 (all watersheds combined; Table 2). R.L.&L. (1995) noted immature Bull Trout migrating downstream and out of the Halfway River watershed in mid-August. To facilitate catching immature Bull Trout prior to the onset of their downstream migration, sampling in the Chowade River and Cypress Creek was conducted over 10 days between 21 July to 9 August. Due to localized heavy rainfall, sampling was postponed after 25 July until 5 August while water levels receded. Overall, the Chowade River and Cypress Creek were sampled approximately one week earlier than in 2017 (Golder 2018). Fiddes Creek was sampled on 7 August.

Farrell, Kobes, and Colt creeks were sampled over 5 days between 25 July and 11 August (Table 2).

The Moberly River was sampled over an 11-day period between 13 and 23 August; an additional day of sampling was conducted on 31 August (Table 2). The timing of the 2018 Moberly River survey closely aligned with historical surveys (Mainstream 2011b; Golder 2017).

Table 2: Sampling schedule by tributary for the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Tributary	Sample Dates	Number of Sampling Days
Chowade River	21–22 July; 5–6 August	4
Cypress Creek	23–24 July; 2–9 August	6
Fiddes Creek	7 August	1
Farrell Creek	3 August	1
Colt Creek	1–2 August	2
Kobes Creek	25 July; 1 and 11 August	3
Moberly River	13–23 and 31 August	12

2.3 Discharge

Discharge data are not available for the Chowade River, or Colt, Cypress, Farrell, Fiddes, or Kobes creeks. The Water Survey of Canada's Halfway River Above Graham River station (Station Number 07FA003) [14] is located approximately 0.5 km upstream of the Graham River's confluence with the Halfway River. Data from this station were used to show discharge trends for the general region.

Discharge data for the Moberly River are from the Water Survey of Canada's Moberly River station (Station Number 07FB008)[15], which is located approximately 2.5 km upstream of the North Monias Road Bridge (Appendix A; Figure A9).

Unless stated otherwise, discharge values are daily average values presented in cubic metres per second (m^3/s).

2.4 Fish Capture

2.4.1 Halfway River Watershed and Farrell Creek

Backpack electrofishing was used to capture fish in the Chowade River, and in Colt, Cypress, Farrell, Fiddes, and Kobes creeks. All sampling consisted of a single pass in open sites. Backpack electrofishing sites ranged in length from approximately 15 to 651 m.

For the Chowade River, and Cypress and Fiddes creeks (i.e., tributaries where Bull Trout were the primary target), sites were located in areas where immature Bull Trout densities were expected to be higher. These areas were generally located in side channels or braided sections of the stream that had lots of physical cover, channel widths less than approximately 5 m, mean water depths less than approximately 0.6 m, and water velocities less than 1.0 m/s. Within each site, effort was also focused on areas where the capture of immature Bull Trout was expected to be greatest. On one occasion, two crews sampled within the same site. This multi-crew approach was used when the site had a wetted width that was too wide to effectively sample with a single backpack electrofisher. On this occasion, catches from each crew were analysed as separate sites (e.g., left bank and right bank). The multi-crew approach was employed only in Kobes Creek.

Each of the Farrell, Colt, and Kobes creeks sites sampled in 2018 were also sampled in 2017. Three of the four sites situated on Farrell Creek were previously sampled by Mainstream (2011b). All sites on Farrell, Colt, and Kobes creeks were in mainstem habitats in wadeable areas that were conducive to backpack electrofishing and thought to represent good quality Rainbow Trout habitat.

Backpack electrofishing was conducted with one person operating the electrofisher and one person netting fish. Captured fish were netted and transferred to 20 L buckets positioned on the shoreline along the length of the site. Smith-Root™ Model 12 and Model 12B backpack electrofishers (Smith-Root, Vancouver, WA, USA) were used, depending on the crew. Electrofisher settings were adjusted as needed to minimize injuries to fish while efficiently capturing the target size and species. Voltage ranged from 300 to 600 V, frequency was set at 60 Hz, and pulse width ranged from 4 to 6 ms.

Habitat variables recorded at each site (Table 3) included variables recorded during previous study years (Golder 2018) and variables recorded during similar baseline studies (e.g., Mainstream 2011b). These data were collected to provide a means of identifying differences in habitats sampled within each study year and among

[14] https://wateroffice.ec.gc.ca/report/real_time_e.html?stn=07FA003.

[15] https://wateroffice.ec.gc.ca/report/real_time_e.html?stn=07FB008.

study years. Collected data (Appendix C, Table C1) were not intended to quantify changes in habitat availability over time or imply habitat preferences.

Table 3: Habitat variables recorded at each site sampled as part of the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Variable	Description
Date	The date the site was sampled
Time	The time the site was sampled
Air Temp	Air temperature at the time of sampling (to the nearest 1°C)
Water Temp	Water temperature at the time of sampling (to the nearest 0.1°C)
Conductivity	Water conductivity at the time of sampling (to the nearest 10 µS/cm)
Secchi Bar Depth	The Secchi Bar depth recorded at the time of sampling (to the nearest 0.1 m)
Cloud Cover	A categorical ranking of cloud cover (Clear = 0-10% cloud cover; Partly Cloudy = 10-50% cloud cover; Mostly Cloudy = 50-90% cloud cover; Overcast = 90-100% cloud cover)
Weather	A general description of the weather at the time of sampling (e.g., comments regarding wind, rain, smoke, or fog)
Electrofisher Model	The model of electrofisher used during sampling
Percent	The estimated duty cycle (as a percent) used during sampling
Amperes	The average amperes used during sampling
Mode	The mode (AC or DC) and frequency (in Hz) of current used during sampling
Volts	The voltage (V) used during sampling
Length Sampled	The length of shoreline sampled (to the nearest 1 m)
Time Sampled	The duration of electrofisher operation (to the nearest 1 second)
Mean Depth	The mean water depth sampled (to the nearest 0.1 m)
Maximum Depth	The maximum water depth sampled (to the nearest 0.1 m)
Effectiveness	A categorical ranking of sampling effectiveness (1 = good; 2 = moderately good; 3 = moderately poor; 4 = poor)
Water Clarity	A categorical ranking of water clarity (High = greater than 3.0 m visibility; Medium = 1.0 to 3.0 m visibility; Low = less than 1 m visibility)
Instream Velocity	A categorical ranking of water velocity (High = greater than 1.0 m/s; Medium = 0.5 to 1.0 m/s; Low = less than 0.5 m/s)
Instream Cover	The type (i.e., Interstices; Woody Debris; Cutbank; Turbulence; Flooded Terrestrial Vegetation; Aquatic Vegetation; Shallow Water; Deep Water) and amount (as a percent) of available cover
Crew	The field crew that conducted the sample
Sample Comments	Any additional comments regarding the sample

The type and amount of instream cover for fish were qualitatively estimated at all sites. Water velocities were visually estimated and categorized at each site as low (less than 0.5 m/s), medium (0.5 to 1.0 m/s), or high (greater than 1.0 m/s). Water clarity was visually estimated and categorized at each site as low (less than 1.0 m depth), medium (1.0 to 3.0 m depth), or high (greater than 3.0 m depth). Where water depths were adequate, water clarity was also estimated using a "Secchi Bar" that was manufactured based on the description provided by Mainstream and Gazey (2014). Mean and maximum sample depths were visually estimated at each site.

A summary of effort by the number of sites surveyed, length of shoreline sampled, and seconds of backpack electrofisher operation is provided for each tributary in Table 4 and in Appendix B, Table B1.

Table 4: Summary of backpack electrofishing effort employed in Halfway River tributaries and Farrell Creek during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Tributary	Number of Sites	Electrofishing Effort (s)	Length of Survey (m)
Chowade River	33	46,424	6,286
Cypress Creek	44	62,203	9,731
Fiddes Creek	5	9,155	847
Farrell Creek	5	19,349	1,844
Colt Creek	8	14,258	1,119
Kobes Creek	6	14,260	1,206

2.4.2 Moberly River

The study plan for the Moberly River survey consisted of crews travelling by inflatable boats down the length of the Moberly River from Moberly Lake to the river's confluence with the Peace River. The six-person team worked as three separate crews; an angling crew, a small fish boat electroshocking crew, and a backpack electrofishing and beach seining crew. The survey started at the North Monias Road Bridge (Appendix A, Figure A9), which is approximately 43.5 upstream from the Moberly River's confluence. Crews travelled downstream sampling Sections 7 through 10. Once they reached the confluence (River Km 0.0), they travelled by truck to Moberly Lake Provincial Park (River Km 123.0), disembarked, and floated downstream to the North Monias Road Bridge sampling Sections 1A, 1, 2, 3, 4, 5, 6, and the upstream portion of Section 7. Water levels in the Moberly River generally decline over the late summer to fall period. As such, the lower sections, which are generally shallower and more braided (Sections 7 to 10), were sampled first while water levels were high enough to access side channel habitats. Sampling was conducted using small fish boat electroshocking, backpack electrofishing, beach seining, and angling.

Small fish boat electroshocking was conducted out of a white-water-style raft (Avon™ 13 Pathmaker; 4 m long by 1.75 m wide; AVON Marine, Port Moody, BC, Canada). Sites were located in main channel habitats where water depths were deep enough and channel widths were wide enough to allow the crew to effectively maneuver the boat. The raft was equipped with a Smith-Root 5.0 Generated Powered Pulsator (GPP 5.0) and a generator contained in a waterproof tub. The electroshocker was connected to a cathode array curtain placed on the bow of the raft and two anode pole arrays extended approximately 1.5 m in front of the raft. The anode poles were angled between 20° and 40° off either side of the bow. While sampling, a single crew member was positioned at the bow of the boat. This crew member netted stunned fish and transferred them to a water-filled holding tank positioned behind the bow but in front of the oarsman. The netter attempted to capture all stunned fish, but priority was given

to Arctic Grayling if more than one species was observed at the same time. The oarsman sat in an elevated chair behind the holding tank and maneuvered the boat with oars braced in oar locks. Electroshocker settings were adjusted at each site, depending on local conditions and the size and species of fish observed, to minimize injury to fish. The electroshocker was generally operated at 60 Hz pulsed direct current (PDC). The amperage was adjusted as needed to attain the desired response in fish, which was galvanotaxis (forced swimming) without immediate tetany. This response typically corresponded to an amperage of 2.0 to 3.0 A as measured on the GPP gauge. Habitat conditions, as summarized in Table 3, were recorded at each site. Small fish boat electroshocking sites ranged between 236 to 1242 m in length. The above methods were similar to those employed in 2016 (Golder 2017) and 2017 (Golder 2018).

Backpack electrofishing was used in locations where water depths were shallow enough and water velocities were low enough to allow safe wading and efficient fish capture using this technique. These sites were often side channel or braided areas. Two different models of backpack electrofisher were used, a Smith-Root™ Model 12 and a Smith-Root™ Model 12B. Electrofisher settings were adjusted as needed to minimize injuries to fish while allowing efficient capture of the target size and species. Voltage averaged 500 V, frequency was set at 60 Hz, and pulse width ranged from 3 to 5 ms. Backpack electrofishing was conducted with one person operating the electrofisher and one person netting fish. Captured fish were netted and transferred to 20 L buckets set along the side of the sample site. Habitat conditions, as summarized in Table 3, were recorded at each site. Backpack electrofishing sites ranged in length from 35 to 265 m. The above methods were similar to those employed in 2016 (Golder 2017) and 2017 (Golder 2018).

Beach seine sites were situated in side channels and low water velocity areas, and other habitats conducive to this capture method (i.e., smaller substrates, clear of obstructions, with low and regular slopes). The beach seine was 4.5 m (width) x 1.5 m (height) with a mesh size of 5.0 mm. One seine haul was conducted at each site along the channel margins, covering between 50 and 75 m of shoreline. The above methods were similar to those employed in 2016 (Golder 2017) and 2017 (Golder 2018).

Angling occurred at sites where fish were observed feeding on the surface of the water or in pools or other habitats that were difficult to sample using alternative capture methods. Both spin-casting and fly-fishing equipment were used, and the crew selected the equipment that they deemed most appropriate for the local conditions. The above methods were similar to those employed in 2017 (Golder 2018). Angling was not conducted in 2016.

A summary of effort[16] employed during the Moberly River survey by section is provided in Table 5 and in Appendix B, Tables B1 to B4. To potentially increase the catch of target species, angling also occurred opportunistically while the boats travelled between sites and any fish that were captured while in transit were processed. The level of effort employed during this opportunistic sampling is not included in the effort summary presented in Table 5. A total area of 95 m² was surveyed by beach seine (Appendix B, Table B2) and a total of 20 hours of angling was conducted (Appendix B, Table B3) in 2018.

[16] Angling effort and habitat characteristics were recorded at each site. To increase potential catch of target species, angling also occurred opportunistically while the boats were travelling between sites and any fish captured while in transit were processed. The level of effort in this opportunistic sampling is not included in the effort summaries below.

Table 5: Summary of sampling effort employed in the Moberly River by section during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Section	Backpack Electrofishing			Small Boat Electroshocking			Angling	Beach Seining
	Number of Sites	Effort (s)	Effort (m)	Number of Sites	Effort (s)	Effort (m)	Number of Sites	Number of Sites
MR-S1A	3	5,038	331	1	382	415	1	
MR-S1	1	1,382	57	1	542	927	2	
MR-S2	1	812	86	1	525	512	3	
MR-S3	1	1,036	158	2	835	880	1	
MR-S4	2	1,018	147	4	2,016	2,536	2	
MR-S5	4	5,172	413	5	2,272	2,758	3	
MR-S6	3	3,385	333	5	2,822	3,607	2	
MR-S7	18	16,826	1,757	3	1,726	2,098	8	
MR-S8	4	1,933	367				6	2
MR-S9	3	3,613	343	1	438	692	3	
MR-S10	1	1,472	78	4	1,428	1,791	3	
Total	**42**	**41,687**	**4,070**	**27**	**12,986**	**16,216**	**34**	**2**

2.5 Fish Processing

All captured fish were identified to species, counted, weighed to the nearest 1 g, and measured for fork length (FL) to the nearest 1 mm. Total lengths (TL) were recorded for Burbot (*Lota lota*) and sculpin species to the nearest 1 mm. When catches of species other than Arctic Grayling, Bull Trout, or Rainbow Trout exceeded 30 individuals per site, only the first 30 individuals of each species were measured; all other individuals were enumerated and released. Arctic Grayling, Burbot, Bull Trout, and Rainbow Trout in good condition following processing were implanted with half-duplex (HDX) PIT tags (ISO 11784/11785 compliant) (Oregon RFID, Portland, OR, USA). Tags were implanted within the left axial muscle below the dorsal fin origin and oriented parallel with the anteroposterior axis of the fish. Tagging criteria were established based on input from InStream Fisheries Research Inc. and are summarized as follows:

- Fish between 80 and 199 mm FL received 12 mm long HDX PIT tags (12.0 mm x 2.12 mm HDX+).
- Fish between 200 and 299 mm FL received 23 mm long HDX PIT tags (23.0 mm x 3.65 mm HDX+).
- Fish greater than 300 mm FL received 32 mm long HDX PIT tags (32.0 mm x 3.65 mm HDX+).

After processing, all fish were released at the downstream end of their capture site.

Scale samples were collected from all captured Arctic Grayling and Rainbow Trout. Scales were collected from above the lateral line and posterior to the dorsal fin. The first leading fin ray of the left pectoral fin was collected from all Bull Trout longer than 120 mm FL. Scales were collected from select Bull Trout less than 120 mm FL. Scale and fin ray samples were stored in appropriately labelled coin envelopes.

Small sections of fin tissue were collected from Arctic Grayling, Bull Trout, and Rainbow Trout that the crew deemed large enough to not be adversely affected by the collection procedure (Table 6). Samples were preserved in 95% anhydrous ethanol and provided to BC Hydro for long-term storage and future consideration. The samples were not analyzed as part of the current study.

Table 6: Summary of genetic samples collected as part of the Site C Reservoir Tributary Fish Population Indexing Survey, 2018.

Location	Arctic Grayling	Bull Trout	Rainbow Trout
Chowade River		216	7
Cypress Creek		145	15
Fiddes Creek		134	
Colt Creek		6	32
Kobes Creek			42
Moberly River	8	2	
Total	**8**	**503**	**96**

2.6 Moberly River Habitat Assessment

In the Moberly River, the same habitat variables listed in Table 3 were recorded at all sample sites. At select backpack electrofisher and beach seine sites, more detailed habitat data were collected following a modified version of the Level 1 assessment procedure described in BC's Watershed Restoration Technical Circular No. 8 (Johnston and Slaney 1996) and Fish and Fish Habitat Inventory: Standards and Procedures (RISC 2001).
At each of the selected sites, mesohabitat types (pool, riffle, run, or glide) were identified and the GPS location of the upstream and downstream end of each habitat unit was recorded. Each backpack electrofishing or beach seine site was located within one mesohabitat unit. Within each site, various physical attributes were measured and recorded on standardized data forms. Information recorded included date and time, photograph number, UTM location, habitat type, wetted width, bankfull width and height, channel gradient (%), mean water depth and velocity (based on ¼, ½, and ¾ wetted channel width), maximum water depth in pools, and substrate composition (% fines, gravels, cobbles, boulders, bedrock). Percent substrate composition was visually estimated using a classification system based on the modified Wentworth Scale (Cummins 1962). In addition, each transect included a visual assessment of substrate characteristics compatible with baseline datasets (Mainstream 2009a, 2011b, Golder 2017, 2018). These included the following: 90th percentile particle size (D90); embeddedness (sand, silt, and clay) present within the substrate; and compaction, to evaluate the density or looseness of the substrate within the channel. Compaction and embeddedness were evaluated as low, moderate, or high.
The presence or absence of large organic debris or large woody debris (%), defined as having a diameter greater than 10 cm and a length greater than 1 m, was recorded. The percent of overhead cover, off-channel habitat, and riparian vegetation were also recorded.

The modified Level 1 habitat assessment data collected in the Moberly River are provided in the Site C Reservoir Tributary Fish Population Indexing Survey database (see Section 4.7) and in Appendix C, Table C2, but are not discussed in detail in this report.

2.7 Fish Ageing

All Arctic Grayling and Rainbow Trout were aged by scale analysis. Scales were aged by counting the number of growth annuli present on the fish scale following methods outlined in Mackay et al. (1990) and RISC (1997). Scales were temporarily mounted between two slides and examined using a trinocular microscope equipped with a digital camera. If needed, several scales were examined and the highest quality scale was photographed using the integrated 3.1-megapixel digital macro camera and saved as a JPEG-type picture file. All scales were examined independently by two experienced individuals and ages assigned. For each scale sample, the agers had access to the species and the date of capture but no other information about the sampled fish (e.g., fork length or capture history). If the two assigned ages did not agree, a third ager assigned an age. If two out of three agers agreed on the age, then this age was used for analysis. If two out of three agers did not agree on an age, then the sample was not used for analysis purposes.

Bull Trout fin rays were aged by counting the number of growth annuli present on the sample following methods outlined in Mackay et al. (1990). Fin rays were coated in epoxy and allowed to dry. Once the epoxy dried, a rotary sectioning saw with a diamond blade (Buehler IsoMet Low Speed Saw; Lake Bluff, Illinois) was used to create multiple cross-sections of each fin ray sample. The rotary sectioning saw allowed the thickness of cross-sections to be set to specific widths, resulting in cross-sections of uniform thickness with more polished surfaces (which reduced sanding and preparation time), when compared to the jeweler's saw used prior to 2017 (Gesswein Canada, Toronto, Canada). The cross-sections were permanently mounted on a microscope slide using a clear coat nail polish and examined using a digital microscope. If needed, several fin ray cross-sections were examined and the cross-section with the most visible annuli was used. All fin rays were examined independently by two experienced individuals using the same approach as detailed above for scales.
Initial analyses of Bull Trout ageing structures suggested that the first annuli was not evident on fin rays, resulting in assigned ages that were one year younger than the true age of the fish. This result was further supported by comparing length-at-age data to modes in length-frequency histograms. Based on these data, one year was added to each assigned Bull Trout age.

Scale samples collected from select small Bull Trout (i.e., fish less than 120 mm FL) were analyzed.
Ages assigned to these small scales proved inconsistent and are not presented in this report.

Ages were assigned to Bull Trout less than 114 mm FL and Rainbow Trout less than 112 mm FL based on their fork lengths and the separation of modes in length-frequency histograms for each species and stream (Table 7). Overlapping length distributions of individual age classes prevented the use of this method to assign ages to fish larger than approximately 115 mm FL.

Table 7: Range of fork lengths (in mm) used to assigned age classes to Bull Trout and Rainbow Trout captured during the Site C Reservoir Tributary Fish Population Indexing Survey, 2018.

Stream	Bull Trout		Rainbow Trout	
	Age-0	Age-1	Age-0	Age-1
Chowade River	33 – 63	72 – 114		
Colt Creek			31 – 36	86 – 89
Cypress Creek	29 – 53	62 – 113		
Farrell Creek			35 – 44	89 – 112
Fiddes Creek	36 – 46	69 – 113		
Kobes Creek			26 – 51	

2.8 Data Analysis

All data collected during field surveys were entered and stored in a custom MS-Access© database that conforms to BC Hydro's established Site C data standards. Data on field sheets were entered into an MS-Excel© spreadsheet, which were then verified by a second person before being uploaded to the database. Before data analysis, Quality Control / Quality Assurance (QA/QC) included checks of the range and format of all variables and graphical methods to check for possible errors including histograms and bivariate plots.

Catch was summarized by sample method, species, life stage, watercourse, and section (where applicable) and presented in tabular format. Catch-per-unit-effort (CPUE) for electrofishing was calculated by dividing the summed total number of fish in a tributary captured at all sites by the sum of effort at all sites. Sampling effort was measured in seconds of electrofisher operation and CPUE was expressed as the number of fish per hour. Length of site was not used to represent sampling effort for CPUE because sampling in the Chowade River and Cypress Creek focused only on optimal habitats and the entire site length was not always sampled (as described in Section 2.1.1).

Length-frequency histograms were plotted for the three target species (Bull Trout, Rainbow Trout, and Arctic Grayling) by tributary. Length-frequency histograms were also plotted for Burbot and Mountain Whitefish (*Prosopium williamsoni*) for the Moberly River. Age-frequency histograms were plotted for Bull Trout (three tributaries pooled) and Rainbow Trout (three tributaries pooled). Length-at-age data were used to plot three-parameter von Bertalanffy growth curves for the Arctic Grayling, Bull Trout, and Rainbow Trout (Pardo et al. 2013).

Fish were assigned a life stage of YOY, immature, or adult based on their body length (fork or total length). The maximum size of YOY was determined for each species based on breaks between the first and second modes in the species' length-frequency histogram. Fish larger than 250 mm were classified as adult for all species. Although some individuals larger than 250 mm for some species are likely not mature adults, 250 mm was used as a consistent cut-off to summarize data by length-class. Backpack electrofishing was the only capture method used in the Halfway River watershed and Farrell Creek and is an ineffective method of capturing large-bodied fish such as adult Bull Trout. Catch data from 2018 should not be considered a reliable indicator of adult Bull Trout abundance in these streams.

3.0 RESULTS

3.1 Discharge and Temperature

An aerial survey of the study area in the Halfway River watershed and Farrell Creek was conducted on 18 July 2018. At that time, water levels in the Chowade River and Cypress Creek were similar to or slightly higher than water levels observed in 2017. Between the conclusion of the aerial survey and the initiation of sampling three days later, Halfway River discharge increased from 36 m^3/s to 96 m^3/s and peaked at 131 m^3/s (Figure 1). The increase was due to excessive rain in the area[17]. As a result of the high water levels, sampling ceased on 25 July and was reinitiated on 1 August after water levels in the Halfway River declined to below 75 m^3/s. Based on historical data[18], Halfway River discharges generally declines between mid-July and mid-August and average approximately 58 m^3/s.

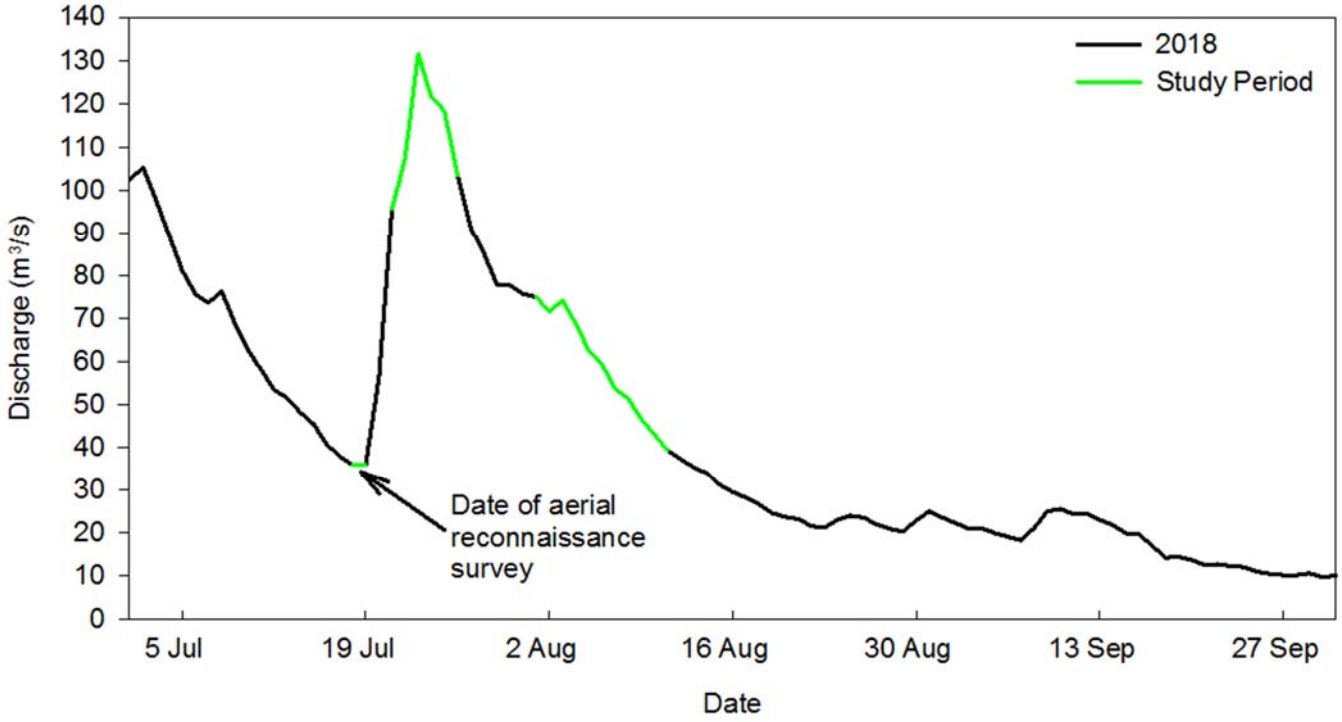

Figure 1: Mean daily discharge for the Halfway River at Water Survey of Canada gauging station 07FA003, 1 July to 31 August 2018.

Average water temperatures at the time of sampling where lower in the Chowade River (7.2°C), Cypress Creek (9.5°C), and Fiddes Creek (8.4°C) (i.e., tributaries targeting Bull Trout) when compared to Colt (9.7°C), Farrell (16.7°C), and Kobes (14.8°C) creeks (i.e., tributaries targeting Rainbow Trout) (Appendix C, Table C1).

[17] http://climate.weather.gc.ca/climate_data/daily_data_e.html?StationID=50837&timeframe=2&StartYear=1840&EndYear=2019&Day=25&Year=2018&Month=7

[18] https://wateroffice.ec.gc.ca/report/historical_e.html?mode=Graph&type=&stn=07FA003&dataType=Daily&parameterType=Flow&year=2014&y1Max=1&y1Min=1&y1Mean=1&scale=normal

3.2 Tributaries Targeting Bull Trout

3.2.1 Catch and Life History

Of the 671 Bull Trout captured in the Chowade River and Cypress and Fiddes creeks combined, 475 (71%) were implanted with PIT tags; two were subsequently recaptured at different sites (Table 8; Appendix B, Table B5). All remaining Bull Trout were not tagged because they were either unhealthy (i.e., unlikely to survive the tagging process; *n* = 2) or too small to receive a PIT tag (i.e., less than 80 mm FL; *n* = 194).

Table 8: Number of fish caught and tagged in the Chowade River and Cypress and Fiddes creeks during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Species[a]	Life Stage[b]	Chowade River			Cypress Creek			Fiddes Creek			Total		
		# Caught	# Tagged	CPUE (#/hour)	# Caught	# Tagged	CPUE (#/hour)	# Caught	# Tagged	CPUE (#/hour)	# Caught	# Tagged	CPUE (#/hour)
Bull Trout	Adult	3	3	0.23	5	5	0.29				8	8	0.24
	Imm.[c]	203	202	15.74	139	138	8.16	127	127	49.94	469	467	14.40
	YOY	130		10.08	50		2.90	14		5.51	194		5.93
Rainbow Trout	Adult	6	6	0.47	2	2	0.12				8	8	0.24
	Imm.				13	12	0.75				13	12	0.40
	YOY	1		0.08							1		0.03
Mountain Whitefish	Adult	1		0.08	3		0.17				4		0.12
	Imm.				1		0.06				1		0.03
	YOY				1		0.06				1		0.03

[a] Table excludes 37 Slimy Sculpin (*Cottus cognatus*) captured in the Chowade River and 109 Slimy Sculpin captured in Cypress Creek.
[b] Life stage was assigned based on fork length. Fish were classified as adult when longer than 249 mm FL and immature when less than 250 mm FL. The maximum size of YOY fish varied by species and was selected based on modes observed in length-frequency histograms and corroborated with length-at-age data when possible.
[c] Two immature Bull Trout that were captured and tagged in Cypress Creek were subsequently recaptured in other sites in Cypress Creek.

Adult Bull Trout captured in 2018 ranged between 396 and 685 mm FL in length and were recorded in the Chowade River (*n* = 3) and Cypress Creek (*n* = 5). Adult Bull Trout were not recorded in Fiddes Creek.

Total effort expended in Cypress Creek (17.3 hours) was greater than effort expended in the Chowade River (12.9 hours). The approximately 34% higher effort in Cypress Creeks relative to the Chowade River resulted in immature and YOY Bull Trout catch values that were similar despite substantially higher CPUE values in the Chowade River (Table 8). In total, 85% less effort was expended in Fiddes Creek (2.5 hours) relative to Cypress Creek (17.3 hours); however, total immature Bull Trout catch was similar in both streams (Table 8).

Bull Trout YOY were recorded in all three of the tributaries sampled, with higher CPUEs occurring in the Chowade River (10.08 fish/hour) and lower CPUE occurring in Cypress Creek (2.90 fish/hour) and Fiddes Creek (5.51 fish/hour; Table 8). Bull Trout YOY ranged in length between 29 and 63 mm FL. None of the Bull Trout YOY captured in 2018 were tagged.

Length-frequency histograms for Bull Trout (Figure 2) show a mode between approximately 20 and 60 mm FL and between approximately 70 and 110 mm FL, corresponding to the age-0 (YOY) and age-1 cohorts, respectively. These two modes were evident in all three of the sampled tributaries. A third mode from approximately 120 to 200 mm FL likely corresponds to age-2 and older fish. As a proportion of the total catch, Bull Trout larger than 120 mm FL were more common in Fiddes Creek and less common in the Chowade River and Cypress Creek.

Overall (all three streams combined), 98.4% of the Bull Trout captured in 2018 were less than 200 mm FL and when tagged, were implanted with a 12 mm PIT tag (*n* = 462). Four Bull Trout were implanted with 23 mm PIT tags and nine were implanted with 32 mm PIT tags. Larger PIT tags have a wider read-range. As such, larger tags are more likely to be detected by the Chowade River or Cypress Creek PIT arrays when compared to smaller PIT tags.

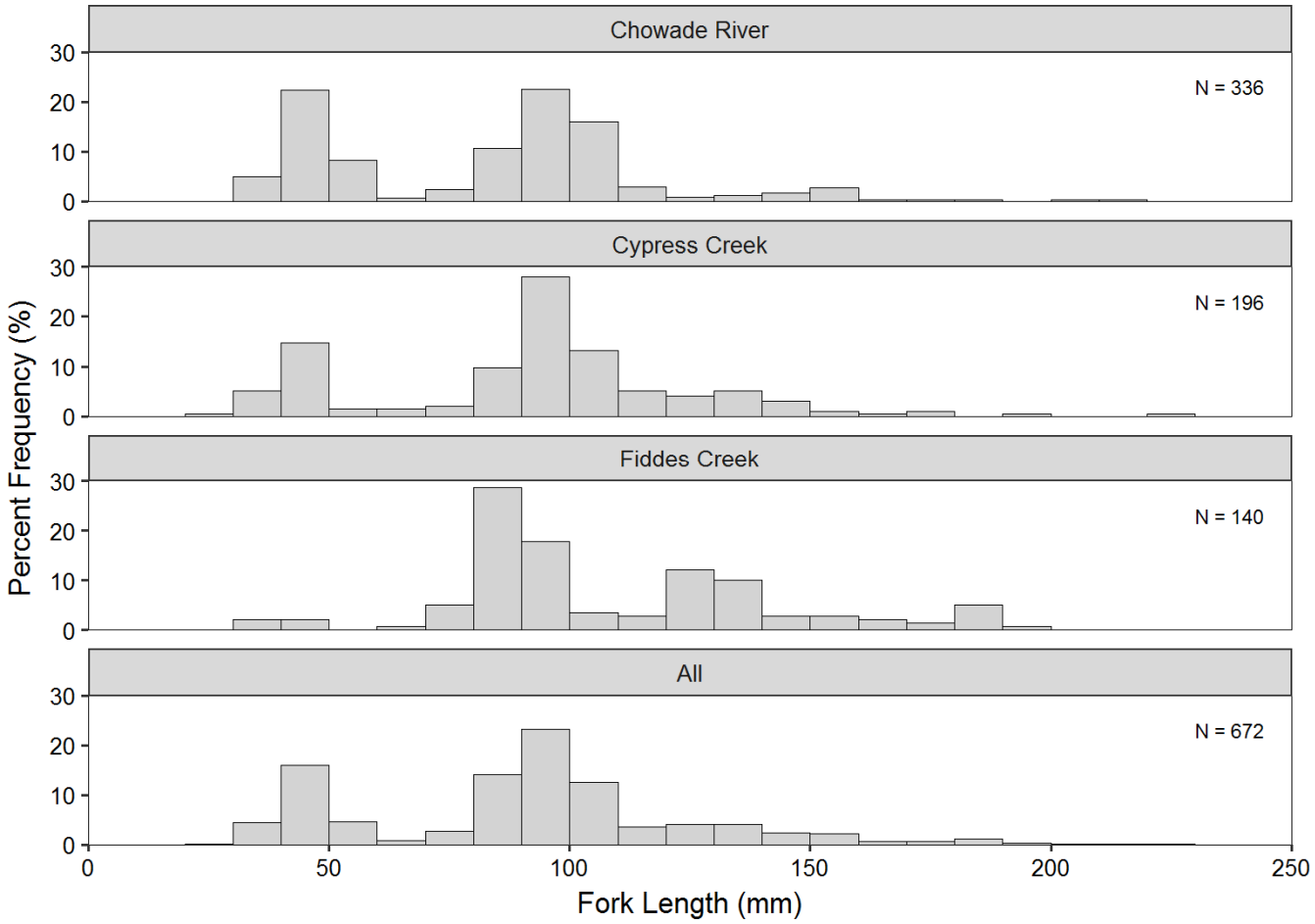

Figure 2: Length-frequency distribution for Bull Trout captured by backpack electrofishing in the Chowade River and Cypress and Fiddes creeks during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018. The total numbers included the eight adult Bull Trout captured in the Chowade River and Cypress Creek but the figure shows fish with FL <250 mm to better represent the distribution of smaller fish.

In 2018, fin rays were collected from 106 Bull Trout with fork lengths greater than 120 mm; ages were assigned to 77 of these samples (Table 9). Ages ranged from age-0 to age-9; however, the bulk of the catch were age-1 (60%) and age-0 (27%) (Figure 3). Most (82%) of the Bull Trout encountered in 2018 were less than 120 mm FL and were assigned age-0 or age-1 based on their length (Table 7). The low number of older Bull Trout in the catch was expected and can be attributed to two main reasons: 1) the study specifically targeted immature life stages through backpack electrofishing; and 2) most individuals migrate downstream and out of the study area by age-2 to age-3. Low numbers of older Bull Trout reduced the accuracy of growth estimates (Figure 4). Length-at-age data indicate overlapping length distributions beginning at age-2 (Figure 5), a result supported by length-frequency histograms (Figure 2).

Table 9: Descriptive statistics of fork lengths by age for Bull Trout captured in the Chowade River and Cypress and Fiddes creeks during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018. Age-0 and age-1 fish were assigned ages based only on their fork lengths.

Age	Chowade River			Cypress Creek			Fiddes Creek		
	Average FL ± SD	Range	*n*	Average FL ± SD	Range	*n*	Average FL ± SD	Range	*n*
0[a]	45 ± 6	33 – 63	122	42 ± 4	29 – 53	43	40 ± 4	36 – 46	6
1[a]	95 ± 9	72 – 114	184	95 ± 10	62 – 126	113	89 ± 9	69 – 129	80
2	141 ± 11	127 – 155	11	135 ± 5	125 – 140	9	135 ± 12	121 – 166	25
3	195 ± 17	175 – 215	4	155 ± 12	142 – 175	8	177 ± 13	154 – 195	13
7	–	–	–	534	534 – 534	1	–	–	–
8	585	585 – 585	1	490 ± 134	396 – 585	2	–	–	–
9	446	446 – 446	1	604 ± 115	523 – 685	2	–	–	–

[a] Age assigned based on the fork length categories detailed in Table 7; ages were not validated using scale or fin ray samples.

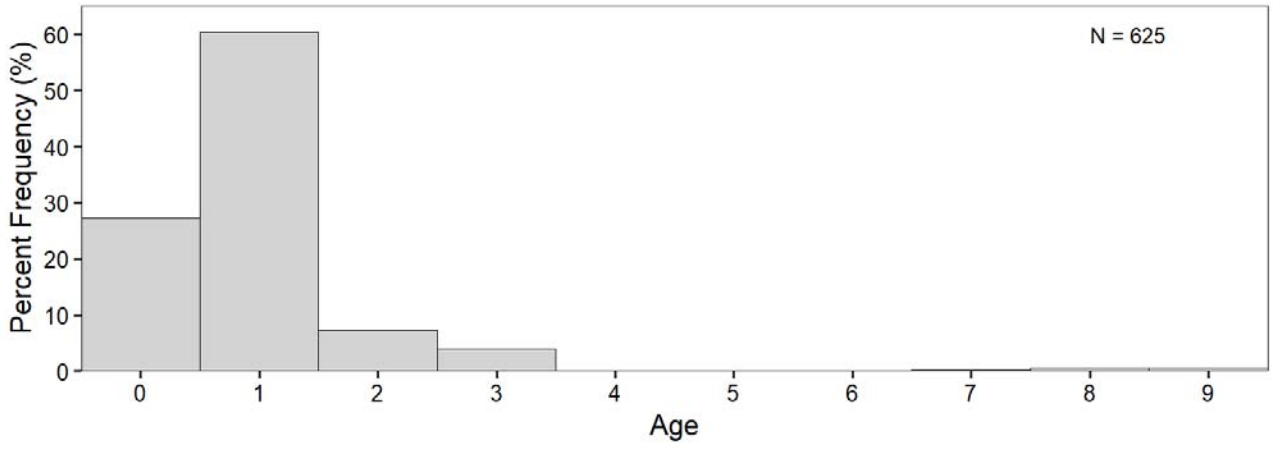

Figure 3: Age-frequency distribution for Bull Trout captured in the Chowade River and Cypress and Fiddes creeks combined, during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018. Age-0 and age-1 fish were assigned ages based on their fork lengths.

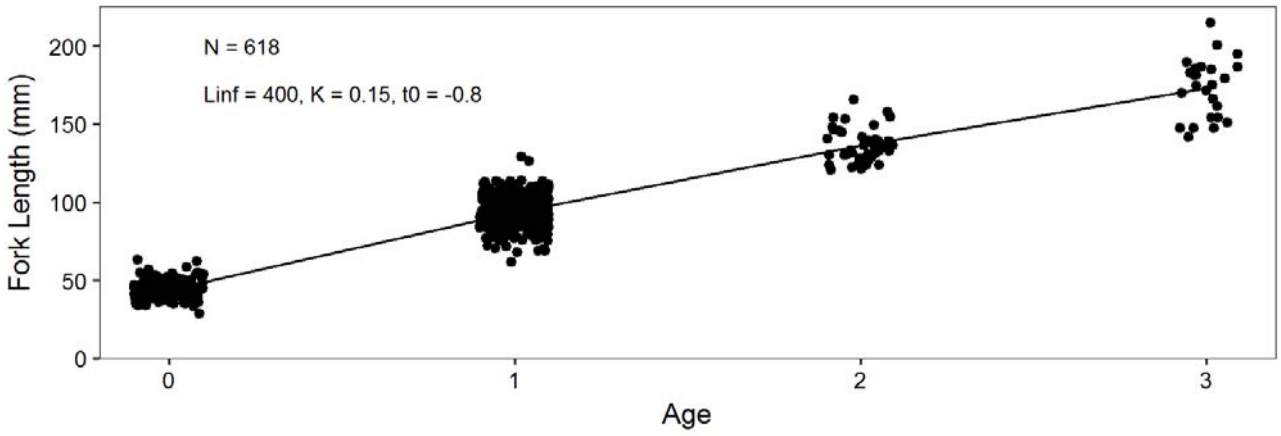

Figure 4: von Bertalanffy growth curve for Bull Trout captured in the Chowade River and Cypress and Fiddes creeks combined, during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018. Bull Trout larger than 250 mm FL were excluded from the analysis due to the low number of captured individuals. Age-0 and age-1 fish were assigned ages based on their fork lengths.

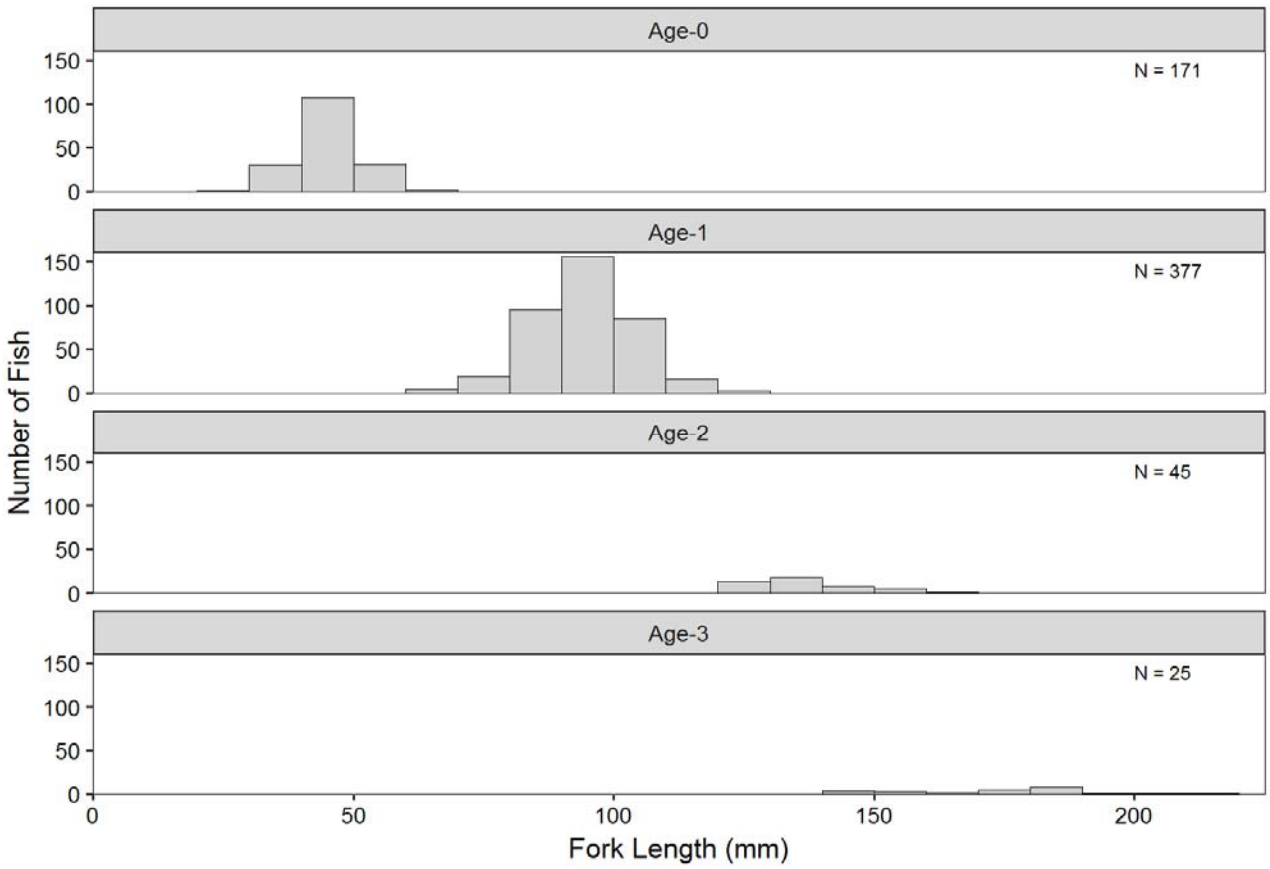

Figure 5: Length-frequency distribution by age-class for Bull Trout captured in the Chowade River, and Cypress and Fiddes creeks during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018. Bars show the number of fish in each 20 mm bin. Age-0 and age-1 fish were assigned ages based on their fork lengths.

Seven Rainbow Trout were captured in the Chowade River in 2018. Of these seven, six were classified as adults with fork lengths ranging between 276 and 416 mm. PIT tags were implanted into all adult Rainbow Trout encountered. The remaining Rainbow Trout was 65 mm FL and likely an age-0; this individual did not receive a PIT tag. Scales were used to assign ages to six of the seven Rainbow Trout; ages ranged from age-3 to age-5.

Of the 15 Rainbow Trout captured in Cypress Creek in 2018, two were classified as adults. One was 256 mm FL and was classified as age-3 and the other was 366 mm FL and classified as age-5. The remaining 13 Rainbow Trout were classified as immature and ranged between 74 to 233 mm FL, with ages between age-0 and age-3. Of the 15 Rainbow Trout captured in Cypress Creek, 14 received PIT tags. One Rainbow Trout was too small (74 mm FL) to receive a tag.

Rainbow Trout were not captured in Fiddes Creek.

Non-target species caught incidentally in 2018 included six Mountain Whitefish and 146 Slimy Sculpin (Table 8). Mountain Whitefish were captured in the Chowade River (*n* = 1) and Cypress Creek (*n* = 5) but were not captured in Fiddes Creek. Slimy Sculpin were captured in the Chowade River (*n* = 37) and Cypress Creek (*n* = 109) but were not captured in Fiddes Creek.

3.2.2 Interannual Comparison

A comparison of Bull Trout CPUE in 2017 and 2018 indicated a consistent trend across all three streams. Specifically, catch rates for the YOY cohort were consistent between 2017 and 2018, but approximately 50% lower for the immature cohort in 2018 relative to 2017 (Figure 6). In 2018, immature Bull Trout CPUE in the Chowade River was 15.7 fish/hour, compared to 26.1 fish/hour in 2017. Similarly, in Cypress Creek, immature Bull Trout CPUE was 8.6 fish/hour in 2018, but 16.9 fish/hour in 2017. For Fiddes Creek, immature Bull Trout CPUE was 110.5 and 49.9 fish/hour in 2017 and 2018, respectively.

Data from 2016 were not included in the analysis because differences in capture methods and site selection processes were not compatible with data from 2017 and 2018.

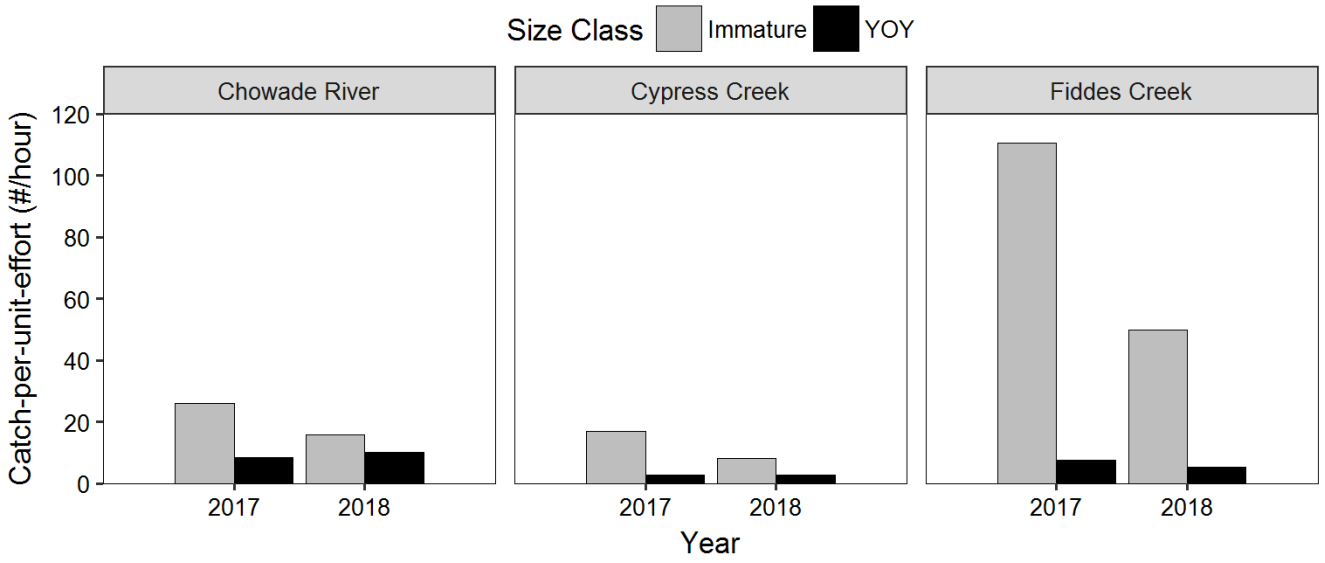

Figure 6: Interannual comparison of Catch-Per-Unit-Effort rates (fish/hour) for Bull Trout captured by backpack electrofishing in the Chowade River and Cypress and Fiddes creeks, during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017 and 2018.

3.2.3 Summary of Movement Data

A key uncertainty identified in the Project's EIS relates to the movement of Peace River Bull Trout during and after construction of the Project, which in turn, influences the number of spawning Bull Trout expected to be present in the Halfway River[19]. The abundance of adult Bull Trout in the Halfway River watershed could be further influenced by changes in the abundance of juvenile Bull Trout in the study area and by changes in the abundance of the Halfway River's resident Bull Trout population. Having a thorough understanding of the movement patterns of both adult and juvenile Bull Trout in the study area will provide insight into this species life history characteristics and help address the above uncertainty. Most notably, movement data will help confirm the presence or absence of resident populations, the timing of both pre- and post-spawn movements by adults, the residence time of juveniles, the timing of downstream juvenile dispersal, and the extent of skip-spawning by adults.

Fish implanted with PIT tags as part of the current program (Mon-1b, Task 2c) could be detected by the Chowade River and Cypress Creek PIT arrays installed as part of Mon-1b, Task 2b (e.g., Ramos-Espinoza in prep.). The arrays could also detect fish implanted with tags during boat electroshocking surveys conducted as part of the Peace River Large Fish Indexing Survey (Mon-2, Task 2a; e.g., Golder and Gazey 2018). The summary below represents a compilation of movement data collected for fish initially tagged as part of Mon-2, Task 2a or Mon-1b, Task 2c and detected by either the Chowade River or Cypress Creek PIT arrays in 2018.

Each PIT array has an upstream and downstream antenna. If a fish was first detected by the upstream antenna and then by the downstream antenna, it was assumed that the fish was travelling in a downstream direction. Similarly, if a fish was first detected by the downstream antenna and then detected by the upstream antenna, it was assumed that the fish was travelling upstream.

[19] Site C Clean Energy Project Environmental Impact Statement, Volume 2, Appendix Q3.

High water levels prevented the installation and operation of the array prior to 13 August. As such, early stages of the upstream migration by pre-spawning fish and the downstream dispersal of juvenile fish may have been missed in 2018. Between 13 August and 29 September 2018, 57 unique PIT tags were detected by the arrays (Ramos-Espinoza in prep.). No tags initially released in the Chowade River were detected in Cypress Creek but one adult Rainbow Trout initially tagged and released in Cypress Creek in 2016 was detected by the Chowade River array in 2018.

HDX PIT tags were deployed in the Peace River from 2016 to 2018. However, some fish encountered during Mon-2, Task 2a surveys were implanted with Full Duplex (FDX) tags prior to 2016 and implanted with HDX tags during subsequent encounters. For these fish, their historical encounters based on their FDX tag are also included in the summaries.

3.2.3.1 Chowade River Array Summary

One tag that was detected by the Chowade River array did not have any corresponding release data; its origin is unknown. Of the 21 Bull Trout (Table 10) and 12 Rainbow Trout detected by the Chowade River array in 2018, all but one adult Rainbow Trout (Table 11) were initially tagged and released in either the Chowade River (*n* = 20) or the Peace River (*n* = 14). Tags that were initially deployed in 2016, 2017, and 2018 as part of Mon-1b, Task 2c were all detected by the Chowade River array in 2018. All of the Bull Trout that were detected by the Chowade River array in 2018 that were initially tagged and released in the Peace River were from sampling programs conducted between 2014 and 2018. One adult Rainbow Trout detected by the Chowade River array in 2018 was tagged and released at River Km 33.8 in Cypress Creek in 2016.

None of the 202 immature Bull Trout tagged in the Chowade River in 2018 (Table 8) were recorded on the Chowade River array in 2018. Two of the three adult Bull Trout tagged in the Chowade River in 2018 were recorded on the Chowade River array in 2018.

In 2018, 14 Bull Trout (Table 10) detected by the Chowade River array were initially tagged in the Peace River as part of the Peace River Large Fish Indexing Survey (Mon-2, Task 2a). Of those 14 fish, 1 was initially tagged in 2014, 2 were initially tagged in 2015, 8 were initially tagged in 2016, and 3 were initially tagged in 2017. The three fish tagged in 2014 or 2015 were initially implanted with FDX PIT tags and subsequently recaptured and implanted with HDX PIT tags.

Four adult Bull Trout detected by the Chowade River array in 2018 were also detected by the Chowade River array in 2017. Of these four Bull Trout, one was tagged and released in the Chowade River in 2016 and the other three were tagged and released in the Peace River in 2015 or 2016.

The direction that Bull Trout were travelling when they were detected by the Chowade River array was determined for 19 of 21 individuals (90%); 43% were recorded travelling downstream and 14% were recorded traveling upstream. The remaining five Bull Trout were recorded multiple times on the Chowade River array in 2018 traveling in both directions.

In 2016, 7 immature Bull Trout from the Chowade River were implanted with PIT tags, and in 2017, 206 immature Bull Trout from the Chowade River were implanted with PIT tags. Of these 213 tagged fish, two were detected by the Chowade River array in 2018 (Table 10). Both were initially tagged in 2017.

In 2016, 10 adult Bull Trout from the Chowade River were implanted with PIT tags, and in 2017, 2 adult Bull Trout from the Chowade River were implanted with PIT tags. Of these 12 tagged fish, two were detected by the Chowade River array in 2018 (Table 10). Both were initially tagged in 2016.

Of the 14 Bull Trout initially tagged and released in the Peace River and detected by the Chowade River array in 2018, 4 (29%) were tagged and released in the Peace River upstream of the Halfway River's confluence with the Peace River (i.e., Section 1; Golder and Gazey 2018) and 5 (36%) were tagged and released in the Peace River downstream of the Halfway River's confluence with the Peace River, but upstream of the Project (i.e., Section 3; Golder and Gazey 2018). The remaining 5 fish (36%) were initially tagged and released in the Peace River downstream of the Project. One Bull Trout that was detected by the Chowade River array in 2018 was initially tagged and released in the Peace River near Many Islands, Alberta and travelled over 300 km upstream to the Chowade River array.

Table 10: Encounter history summary for Bull Trout detected by the Chowade River PIT array (Mon-1b, Task 2b) between 13 August and 29 September 2018. PIT array data summarized from Ramos-Espinoza (in prep.).

Tag Number	Encounter Date	Program – Study Year	Fork Length (mm)	Stream	River km[a]	Direction of Travel
900230000124018	20-Aug-2016 20-Sep-2018	Mon-1b, Task 2c - 2016 Mon-1b, Task 2b - 2018	592	Chowade River Chowade River	46.5	n/a Downstream
900230000125263[b]	24-Aug-2016 20-Sep-2017 09-Sep-2018	Mon-1b, Task 2c - 2016 Mon-1b, Task 2b - 2017 Mon-1b, Task 2b - 2018	463	Chowade River Chowade River Chowade River	34.0 21.0 21.0	n/a Downstream Downstream
900226000173013	29-Jul-2017 22-Aug-2018	Mon-1b, Task 2c - 2017 Mon-1b, Task 2b - 2018	93	Chowade River Chowade River	49.2 21.0	n/a Unknown[c]
900226000248478	29-Jul-2017 17-Sep-2018	Mon-1b, Task 2c - 2017 Mon-1b, Task 2b - 2018	90	Chowade River Chowade River	48.2 21.0	n/a Unknown[c]
900230000074247	21-Jul-2018 02-Sep-2018	Mon-1b, Task 2c - 2018 Mon-1b, Task 2b - 2018	444	Chowade River Chowade River	37.2 21.0	n/a Upstream
900230000074858	21-Jul-2018 24-Sep-2018 24-Sep-2018 24-Sep-2018	Mon-1b, Task 2c - 2018 Mon-1b, Task 2b - 2018 Mon-1b, Task 2b - 2018 Mon-1b, Task 2b - 2018	585	Chowade River Chowade River Chowade River Chowade River	37.2 21.0 21.0 21.0	n/a Downstream Upstream Downstream
900230000124427	23-Aug-2016 29-Aug-2018	Mon-1b, Task 2c - 2016 Mon-1b, Task 2b - 2018	450	Chowade River Chowade River	24.3 21.0	n/a Downstream
900230000030350	09-Sep-2016 26-Aug-2018 26-Aug-2018 27-Aug-2018 24-Sep-2018	Mon-2, Task 2a - 2016 Mon-1b, Task 2b - 2018 Mon-1b, Task 2b - 2018 Mon-1b, Task 2b - 2018 Mon-1b, Task 2b - 2018	365	Peace River Chowade River Chowade River Chowade River Chowade River	31.3 21.0 21.0 21.0 21.0	n/a Upstream Downstream Upstream Downstream
900230000127421	09-Sep-2016 04-Sep-2018	Mon-2, Task 2a - 2016 Mon-1b, Task 2b - 2018	414	Peace River Chowade River	115.5 21.0	n/a Upstream

Tag Number	Encounter Date	Program – Study Year	Fork Length (mm)	Stream	River km[a]	Direction of Travel
900230000031672	11-Sep-2016	Mon-2, Task 2a - 2016	390	Peace River	77.9	n/a
	19-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.7	Upstream
	01-Oct-2018	Mon-2, Task 2a - 2018	483	Peace River	77.9	n/a
900230000123766	14-Sep-2016	Mon-2, Task 2a - 2016	451	Peace River	115.5	n/a
	24-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Upstream
900228000587382	31-Aug-2017	Mon-2, Task 2a - 2017	588	Peace River	77.9	n/a
	22-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
900230000032412	25-Aug-2017	Mon-2, Task 2a - 2017	593	Peace River	78.6	n/a
	22-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
900230000033213	24-Sep-2016	Mon-2, Task 2a - 2016	458	Peace River	126.5	n/a
	17-Aug-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Unknown[c]
	16-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
	25-Sep-2018	Mon-2, Task 2a - 2018	598	Peace River	126.5	n/a
900230000055260	09-Sep-2017	Mon-2, Task 2a - 2017	614	Peace River	73.1	n/a
	21-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
900230000124726	23-Sep-2016	Mon-2, Task 2a - 2016	619	Peace River	27.0	n/a
	25-Aug-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
	26-Aug-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Upstream
	29-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
900230000125313[b]	23-Sep-2016	Mon-2, Task 2a - 2016	549	Peace River	30.6	n/a
	19-Aug-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Downstream
	20-Aug-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Unknown[c]
	21-Aug-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Unknown[c]
	22-Aug-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Upstream
	05-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Downstream
	06-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Unknown[c]
	07-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Upstream
	22-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Downstream
	24-Aug-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Upstream
	18-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
900230000125735[b]	24-Sep-2016	Mon-2, Task 2a - 2016	571	Peace River	73.1	n/a
	15-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Downstream
	12-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
981098104791874[d]	24-Sep-2014	Mon-2, Task 2a - 2014	362	Peace River	106.0	n/a
900230000057135	17-Sep-2017	Mon-2, Task 2a - 2017	525	Peace River	107.7	n/a
	07-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Upstream
	15-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
	15-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Upstream
	19-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream

Tag Number	Encounter Date	Program – Study Year	Fork Length (mm)	Stream	River km[a]	Direction of Travel
	19-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Upstream
	28-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
981098104937812[d]	04-Oct-2015	Mon-2, Task 2a - 2015	650	Peace River	219.4	n/a
900230000125710[b]	21-Sep-2016	Mon-2, Task 2a - 2016	690	Peace River	217.6	n/a
	09-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Upstream
	09-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
981098104936426[d]	11-Sep-2015	Mon-2, Task 2a - 2015	278	Peace River	29.3	n/a
900230000054851	05-Sep-2017	Mon-2, Task 2a - 2017	466	Peace River	27.0	n/a
	20-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Upstream
	20-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream

[a] River km values for the Chowade River are measured upstream from the Chowade River's confluence with the Halfway River. The Chowade River enters the Halfway River approximately 127 km upstream from the Halfway River's confluence with the Peace River. River Km values for the Peace River are measured downstream from WAC Bennett Dam (River Km 0.0).
[b] This fish was detected by the Chowade River array in both 2017 and 2018.
[c] This fish was detected by a single antenna and its direction of travel could not be confirmed using video data.
[d] This fish was implanted with an FDX tag when it was initially encountered and implanted with an HDX tag during a subsequent encounter.

Between 2016 and 2018, 75 Rainbow Trout were tagged in the Chowade River as part of Mon-1b, Task 2c. Of those 75 fish, 13 were detected by the Chowade River array in 2018 (Table 11). Additionally, 1 of 47 Rainbow Trout initially tagged in Cypress Creek between 2016 and 2018 was recorded on the Chowade River array in 2018. This fish was initially tagged in Cypress Creek in late August 2016 and was detected by the Chowade River array in mid-September 2018, travelling approximately 71 km between its initial capture location and the Chowade River array. Of the 14 Rainbow Trout detected by the Chowade River array in 2018, nine were recorded travelling downstream, two were recorded travelling upstream, and the remaining three Rainbow Trout were recorded multiple times traveling in both directions by the array in 2018.

Ten of the 14 Rainbow Trout detected by the Chowade River array in 2018 were also detected by the Chowade River array in 2017 (Table 11).

Between 2016 and 2018, 430 Rainbow Trout were implanted with HDX PIT tags in the Peace River as part of Mon-2, Task 2a. None of these fish were detected by the Chowade River array in 2018.

Table 11: Encounter history summary for Rainbow Trout detected by the Chowade River PIT array (Mon-1b, Task 2b) between 13 August and 29 August 2018. PIT array data summarized from Ramos-Espinoza (in prep.).

Tag Number	Encounter Date	Program	Fork Length (mm)	Stream	River km[a]	Direction of Travel
900230000125867[b]	18-Aug-2016	Mon-1b, Task 2c - 2016	397	Chowade River	51.9	n/a
	11-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Downstream
	07-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
900230000125778[b]	19-Aug-2016	Mon-1b, Task 2c - 2016	353	Chowade River	49.8	n/a
	20-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Downstream
	21-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream

Tag Number	Encounter Date	Program	Fork Length (mm)	Stream	River km[a]	Direction of Travel
900230000124122[b]	19-Aug-2016	Mon-1b, Task 2c - 2016	376	Chowade River	48.9	n/a
	23-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Downstream
	14-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
900230000124295	19-Aug-2016	Mon-1b, Task 2c - 2016	324	Chowade River	48.9	n/a
	19-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
	19-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Upstream
	19-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
	19-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Upstream
900230000124457[b]	24-Aug-2016	Mon-1b, Task 2c - 2016	338	Chowade River	35.2	n/a
	23-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Downstream
	21-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
900230000125273[b]	24-Aug-2016	Mon-1b, Task 2c - 2016	316	Chowade River	34.0	n/a
	23-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Downstream
	05-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Upstream
900230000124312[b]	22-Aug-2016	Mon-1b, Task 2c - 2016	393	Chowade River	42.4	n/a
	24-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Downstream
	19-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
	19-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Upstream
	19-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
900228000541400[b]	23-Aug-2016	Mon-1b, Task 2c - 2016	280	Chowade River	38.7	n/a
	23-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Downstream
	06-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Upstream
900228000541890[b]	23-Aug-2016	Mon-1b, Task 2c - 2016	295	Chowade River	38.7	n/a
	21-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Downstream
	18-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Upstream
	18-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
	18-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Upstream
900228000541567[b]	23-Aug-2016	Mon-1b, Task 2c - 2016	247	Chowade River	36.5	n/a
	11-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Downstream
	23-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
900230000031276	25-Aug-2016	Mon-1b, Task 2c - 2016	352	Cypress Creek	33.8	n/a
	10-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
900228000348221	05-Aug-2018	Mon-1b, Task 2c - 2018	276	Chowade River	40.0	n/a
	16-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream
900228000348182	06-Aug-2018	Mon-1b, Task 2c - 2018	325	Chowade River	46.2	n/a
	27-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream

Tag Number	Encounter Date	Program	Fork Length (mm)	Stream	River km[a]	Direction of Travel
900228000541227[b]	20-Aug-2016	Mon-1b, Task 2c - 2016	310	Chowade River	47.4	n/a
	20-Sep-2017	Mon-1b, Task 2b - 2017		Chowade River	21.0	Downstream
	30-Sep-2018	Mon-1b, Task 2b - 2018		Chowade River	21.0	Downstream

[a] River Km values for the Chowade River are measured upstream from the Chowade River's confluence with the Halfway River. The Chowade River enters the Halfway River approximately 127 km upstream from the Halfway River's confluence with the Peace River.
[b] This fish was detected by the Chowade River array in 2017 and in 2018.

3.2.3.2 Cypress Creek Array Summary

During the 2018 study period, 22 tags were detected by the Cypress Creek array; these included 18 Bull Trout (Table 12) and 3 Rainbow Trout (Table 13) (Ramos-Espinoza in prep.).

None of the 138 immature Bull Trout implanted with PIT tags and released in Cypress Creek during the 2018 Mon-1b, Task 2c field program (Table 8) were recorded by the Cypress Creek array in 2018. Two of the three adult Bull Trout implanted with PIT tags and released in Cypress Creek during the 2018 Mon-1b, Task 2c field program were detected by the Cypress Creek array in 2018 (Table 12).

In total, 11 adult Bull Trout tagged and released in the Peace River during Mon-2, Task 2a surveys, or its predecessor (i.e., Water License Requirement [WLR] survey GMSMON-2; e.g., Golder and Gazey 2014), were detected by the Cypress Creek array in 2018 (Table 12).

The direction of travel was determined for 14 of the 18 (78%) Bull Trout that were detected by the Cypress Creek array in 2018. All 14 of those fish were travelling downstream; three of those fish were also detected by the array earlier in 2018 when their direction of travel could not be determined.

In 2016 and 2017, 232 immature Bull Trout from Cypress Creek were implanted with PIT tags as part of Mon-1b, Task 2c. Of these 232 fish, 4 were detected by the Cypress Creek array in 2018 (Table 12). All 4 were initially tagged in 2017.

In 2016 and 2017, 17 adult Bull Trout from Cypress Creek were implanted with PIT tags as part of Mon-1b, Task 2c. None of these 17 fish were detected by the Cypress Creek array in 2018.

Table 12: Encounter history summary for Bull Trout detected by the Cypress Creek PIT array (Mon-1b, Task 2b) between 13 August and 29 September 2018. PIT array data summarized from Ramos-Espinoza (in prep.).

Tag Number	Encounter Date	Program	Fork Length (mm)	Stream	River km[a]	Direction of Travel
900226000980315	02-Aug-2017	Mon-1b, Task 2c - 2017	145	Cypress Creek	33.8	n/a
	24-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Downstream
900226000980290	02-Aug-2017	Mon-1b, Task 2c - 2017	127	Cypress Creek	33.4	n/a
	26-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Downstream
900226000980477	02-Aug-2017	Mon-1b, Task 2c - 2017	103	Cypress Creek	33.4	n/a
	07-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Downstream
900226000980484	02-Sep-2017	Mon-1b, Task 2c - 2017	111	Cypress Creek	30.9	n/a
	19-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Downstream

Tag Number	Encounter Date	Program	Fork Length (mm)	Stream	River km[a]	Direction of Travel
900230000074910	04-Aug-2018	Mon-1b, Task 2c - 2018	396	Cypress Creek	19.0	n/a
	13-Aug-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Unknown[b]
	14-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Downstream
900230000075233	09-Aug-2018	Mon-1b, Task 2c - 2018	585	Cypress Creek	24.9	n/a
	20-Aug-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Unknown[b]
900230000074424	23-Jul-2018	Mon-1b, Task 2c - 2018	534	Cypress Creek	31.0	n/a
	21-Aug-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Unknown[b]
	10-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Downstream
900230000054202	02-Sep-2017	Mon-2, Task 2a - 2017	490	Peace River	153.2	n/a
	24-Jul-2018	Mon-1b, Task 2c - 2018	523	Cypress Creek	37.6	n/a
	22-Aug-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Unknown[b]
900230000126634	13-Sep-2014	Mon-2, Task 2a - 2014	381	Peace River	107.7	n/a
	08-Sep-2016	Mon-2, Task 2a - 2016	489	Peace River	110.5	n/a
	12-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Downstream
900230000057676	18-Sep-2014	Mon-2, Task 2a - 2014	346	Peace River	73.1	n/a
	30-Sep-2017	Mon-2, Task 2a - 2017	560	Peace River	71.3	n/a
	16-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Unknown[b]
900230000124782	19-Sep-2016	Mon-2, Task 2a - 2016	446	Peace River	77.9	n/a
	26-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Downstream
900230000124217	23-Sep-2016	Mon-2, Task 2a - 2016	346	Peace River	28.5	n/a
	22-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Downstream
900230000033165	30-Sep-2016	Mon-2, Task 2a - 2016	539	Peace River	226.6	n/a
	08-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Downstream
900228000294727	29-Aug-2017	Mon-2, Task 2a - 2017	484	Peace River	25.3	n/a
	20-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Downstream
900228000585936	01-Sep-2017	Mon-2, Task 2a - 2017	519	Peace River	71.3	n/a
	22-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Downstream
900230000056650	13-Sep-2018	Mon-2, Task 2a - 2017	450	Peace River	123.3	n/a
	17-Aug-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Unknown[b]
900230000055713	16-Sep-2017	Mon-2, Task 2a - 2017	634	Peace River	73.1	n/a
	19-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Downstream
900228000349604	01-Oct-2017	Mon-2, Task 2a - 2017	620	Peace River	141.8	n/a
	20-Aug-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Unknown[b]
	20-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Downstream

[a] River Km values for Cypress Creek are measured upstream from the Cypress Creek's confluence with the Halfway River. Cypress Creek enters the Halfway River approximately 144 km upstream from the Halfway River's confluence with the Peace River. River Km values for the Peace River are measured downstream from WAC Bennett Dam (River Km 0.0).

[b] This fish was detected by a single antenna and its direction of travel could not be confirmed using video data.

Three adult Rainbow Trout were detected by the Cypress Creek array in 2018 (Table 13). Two of these three fish were initially tagged and released in Cypress Creek in 2018. The remaining fish was tagged and released in the upper Halfway River (River Km 241.1) in late August 2016. It was also detected by the Cypress Creek array in mid-September 2017. All three Rainbow Trout detected by the Cypress Creek array in 2018 were detected travelling upstream.

Table 13: Encounter history summary for Rainbow Trout detected by the Cypress Creek PIT array (Mon-1b, Task 2b) between 13 August and 29 September 2018. PIT array data summarized from Ramos-Espinoza (in prep.).

Tag Number	Encounter Date	Program	Fork Length (mm)	Stream	River km[a]	Direction of Travel
900230000125822	28-Aug-2016	Mon-1b, Task 2c - 2016	347	Halfway River	241.1	n/a
	14-Sep-2017	Mon-1b, Task 2b - 2017		Cypress Creek	18.0	Downstream
	30-Aug-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Upstream
900230000074947	09-Aug-2018	Mon-1b, Task 2c - 2018	366	Cypress Creek	33.0	n/a
	29-Aug-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Upstream
900230000053786	23-Jul-2018	Mon-1b, Task 2c - 2018	256	Cypress Creek	29.2	n/a
	01-Sep-2018	Mon-1b, Task 2b - 2018		Cypress Creek	18.0	Upstream

[a] River Km values for Cypress Creek are measured upstream from the Cypress Creek's confluence with the Halfway River. Cypress Creek enters the Halfway River approximately 144 km upstream from the Halfway River's confluence with the Peace River.

3.3 Tributaries Targeting Rainbow Trout

3.3.1 Catch and Life History

Rainbow Trout were the primary target species for sampling conducted in Colt, Farrell, and Kobes creeks in 2018. The Rainbow Trout populations in Colt and Kobes creeks are suspected resident populations, while Farrell Creek is a suspected recruitment source for the Peace River Rainbow Trout population (Mainstream 2012). Overall, Rainbow Trout catch-rates were similar across tributaries and life stages with the exception of the catch-rate for YOY Rainbow Trout in Kobes Creek, which was nearly 3 times higher than both Farrell and Colt creeks (Table 14 and Appendix B, Table B6). Of the 137 Rainbow Trout captured in all three streams combined, 108 were implanted with PIT tags. Rainbow Trout that were not tagged were either unhealthy (i.e., unlikely to survive the tagging process; n = 3) or too small to receive a PIT tag (i.e., less than 80 mm FL; n = 26).

Table 14: Number of fish caught and tagged in Colt, Farrell, and Kobes creeks during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Species	Life Stage[a]	Colt Creek			Farrell Creek			Kobes Creek			Total		
		# Captured	# Tagged	CPUE (#/hour)	# Captured	# Tagged	CPUE (#/hour)	# Captured	# Tagged	CPUE (#/hour)	# Captured	# Tagged	CPUE (#/hour)
Target Species													
Arctic Grayling	Adult												
	Imm.												
	YOY	1		0.25							1		0.8
Bull Trout	Adult												
	Imm.	6	6	1.51							6	6	0.45
	YOY												
Rainbow Trout	Adult				1	1	0.19				1	1	0.08
	Imm.	33	31	8.33	44	37	8.19	42	39	10.60	119	107	8.95
	YOY	3		0.76	4		0.74	10		2.52	17		1.28
Non-Target Species													
Lake Chub	All				57		10.61	34		8.58	91		6.84
Largescale Sucker	All				35		6.51	26		6.56	61		4.59
Longnose Dace	All	5		1.26	65		12.09	32		8.08	102		7.67
Longnose Sucker	All	19		4.80	36		6.70	13		3.28	68		5.11
Mountain Whitefish	All	13		3.28				1		0.25	14		1.05
Northern Pikeminnow	All				12		2.23				12		0.90
Redside Shiner	All				87		16.19	23		5.81	110		8.27
Slimy Sculpin	All	65		16.41	61		11.35	106		26.76	232		17.45
Sucker Species	All							1		0.25	1		0.08
Trout-perch	All				17		3.16				17		1.28

[a] Life stage was assigned based on fork length. Fish were classified as adult when longer than 249 mm FL and immature when less than 250 mm FL. The maximum size of YOY fish varied by species and was selected based on modes observed in length-frequency histograms and corroborated with length-at-age data when possible.

Backpack electrofishing is effective at capturing smaller-bodied fish but less effective at capturing larger-bodied fish. The lack of adult Rainbow Trout encountered in 2017 and 2018 is largely due to the capture methods employed and should not be considered as evidence that these tributaries were not used by adult Rainbow Trout during either study period.

CPUE of immature Rainbow Trout was similar in Colt Creek (8.33 fish/hour) and Farrell Creek (8.19 fish/hour) and higher in Kobes Creek (10.60 fish/hour; Table 14). YOY Rainbow Trout CPUE in Colt and Farrell creeks were similar at 0.76 and 0.74 fish/hour, respectively and higher (2.52 fish/hour) in Kobes Creek. YOY Rainbow Trout ranged in length between 26 and 51 mm FL and were not tagged due to their small size.

Length-frequency histograms for Rainbow Trout (Figure 7) show a mode between approximately 30 and 60 mm FL and between approximately 70 and 110 mm FL, corresponding to the age-0 (YOY) and age-1 cohorts, respectively. Based on length-frequency data, the length distributions of age-1 and age-2 Rainbow Trout overlapped (Figure 7). The average fork length of YOY Rainbow Trout (i.e., Rainbow Trout less than 51 mm FL) was slightly larger in Farrell Creek (average = 41 mm FL) when compared to Colt Creek (average = 34 mm FL) and Kobes Creek (average = 37 mm FL); however, the differences were not statistically significant and were based on small sample sizes (e.g., only 3 YOY Rainbow Trout were recorded in Colt Creek in 2018). A similar finding was also noted in 2017 (Golder 2018). Most (78%) of the Rainbow Trout encountered in 2018 were less than 120 mm FL and largely represent the age-0 and age-1 cohorts.

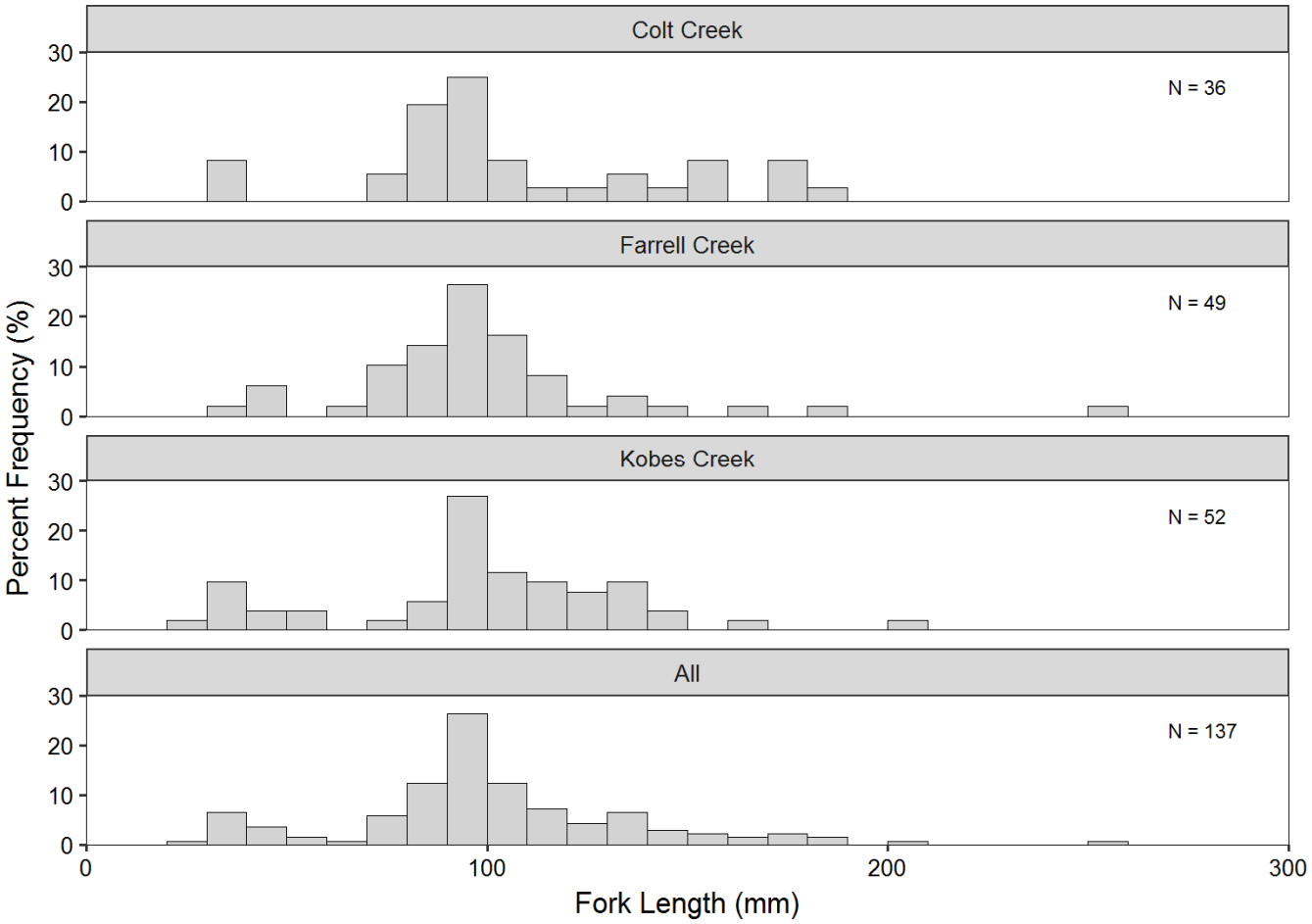

Figure 7: Length-frequency distribution for Rainbow Trout captured by backpack electrofishing in Colt, Farrell, and Kobes creeks during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Ages were assigned to 111 of the Rainbow Trout captured in 2018 (Table 15) and ranged from age-1 to age-4. An additional 17 Rainbow Trout less than 51 mm FL were assumed to be age-0 (YOY) based on length alone and an additional 10 fish between 86 and 112 mm FL were assumed to be age-1 based on length alone. These 137 fish were included in age-related analyses (Figure 8). The von Bertalanffy growth curve suggests that Rainbow Trout encountered in 2018 had not yet reached their asymptotic length (Figure 9). Length distributions overlapped for most of the individual age-classes (Figure 10) beginning at age-1. This result is supported by modes in Rainbow Trout length-frequency histograms (Figure 7).

Table 15: Descriptive statistics of fork length by age for Rainbow Trout captured in Colt, Farrell, and Kobes creeks during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Age[a]	Colt Creek			Farrell Creek			Kobes Creek		
	Average FL ± SD	Range	*n*	Average FL ± SD	Range	*n*	Average FL ± SD	Range	*n*
0	34 ± 3	31 – 36	3	41 ± 4	35 – 44	4	37 ± 8	26 – 51	10
1	92 ± 8	78 – 110	22	95 ± 13	66 – 125	39	94 ± 9	71 – 107	21
2	151 ± 19	128 – 176	8	137 ± 7	133 – 145	3	126 ± 14	105 – 161	15
3				167	167 – 167	1	204	204 – 204	1
4				251	251 – 251	1			

[a] Age-0 and age-1 fish were assigned ages based on fork lengths alone; ages were not validated using scale samples.

One Arctic Grayling, measuring 59 mm FL, was captured in Colt Creek. This fish was age-0 based on its scale sample. Arctic Grayling were not captured in Farrell or Kobes creeks.

Six Bull Trout were captured in Colt Creek. One Bull Trout measured 144 mm FL and was age-2. The remaining five Bull Trout were between 81 and 96 mm FL and likely age-1 based on their size. All six of the Bull Trout captured in Colt Creek were implanted with PIT tags. Bull Trout were not captured in Farrell or Kobes creeks.

Non-target fish species captured in Colt, Farrell, and Kobes creeks in 2018, in declining order of abundance, included Slimy Sculpin (*n* = 232), Redside Shiner (*Richardsonius balteatus*; *n* = 110), Longnose Dace (*Rhinichthys cataractae*; *n* = 102), Lake Chub (*Couesius plumbeus*; *n* = 91), Longnose Sucker (*Catostomus catostomus*; *n* = 68), Largescale Sucker (*Catostomus macrocheilus*; *n* = 61), Trout-perch (*Percopsis omiscomaycus*, *n* = 17), Mountain Whitefish (*n* = 14) Northern Pikeminnow (*Ptychocheilus oregonensis*; *n* = 12), and unidentified sucker species (*n* = 1) (Table 14). Mountain Whitefish were the only non-target salmonid species encountered and were recorded in Colt and Kobes creeks. Lengths of captured Mountain Whitefish ranged between 59 and 262 mm FL.

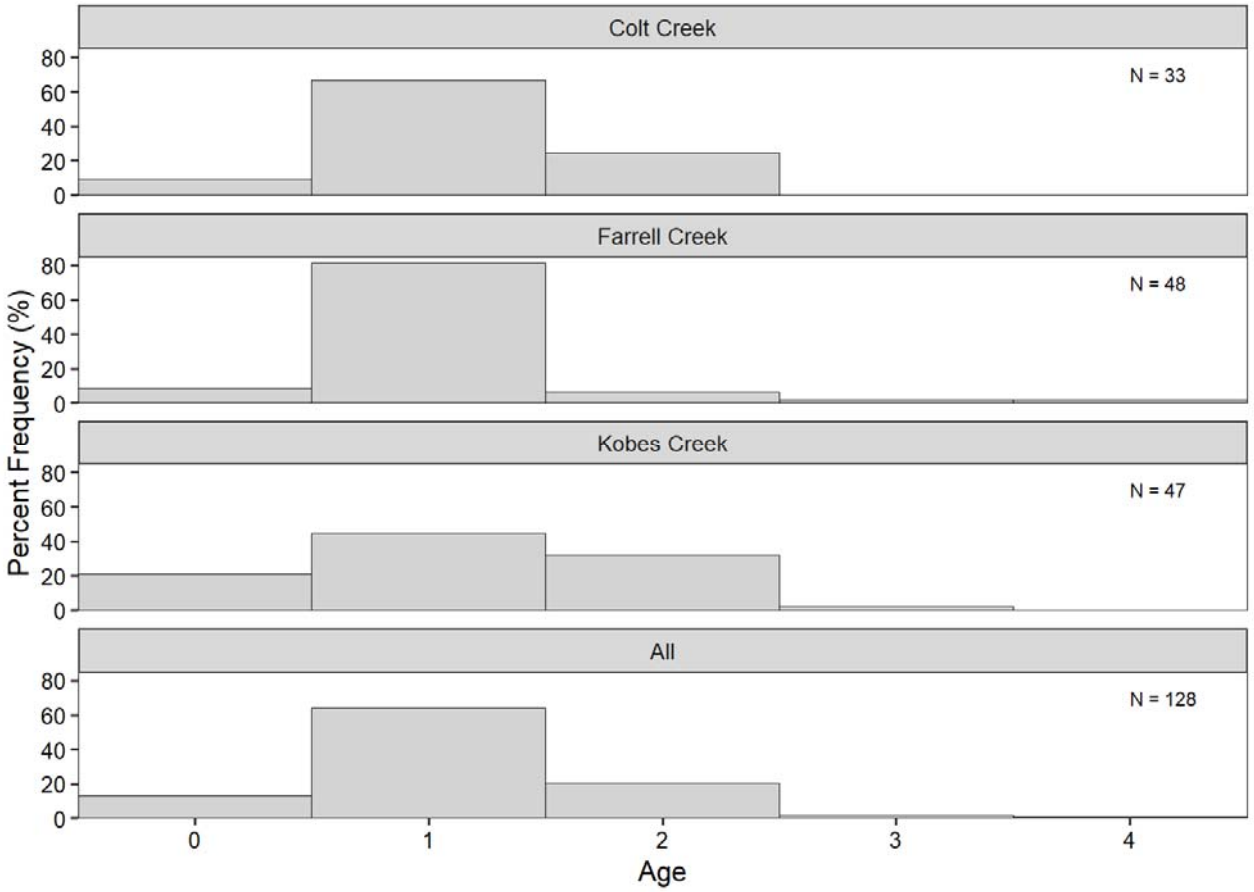

Figure 8: Age-frequency distribution for Rainbow Trout captured in Colt, Farrell, and Kobes creeks combined during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

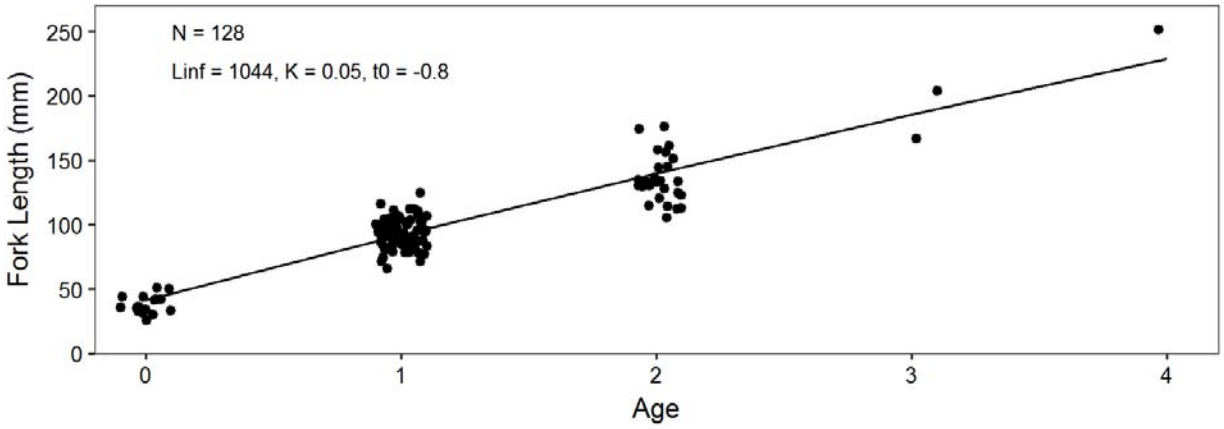

Figure 9: von Bertalanffy growth curve for Rainbow Trout captured in Colt, Farrell, and Kobes creeks combined during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

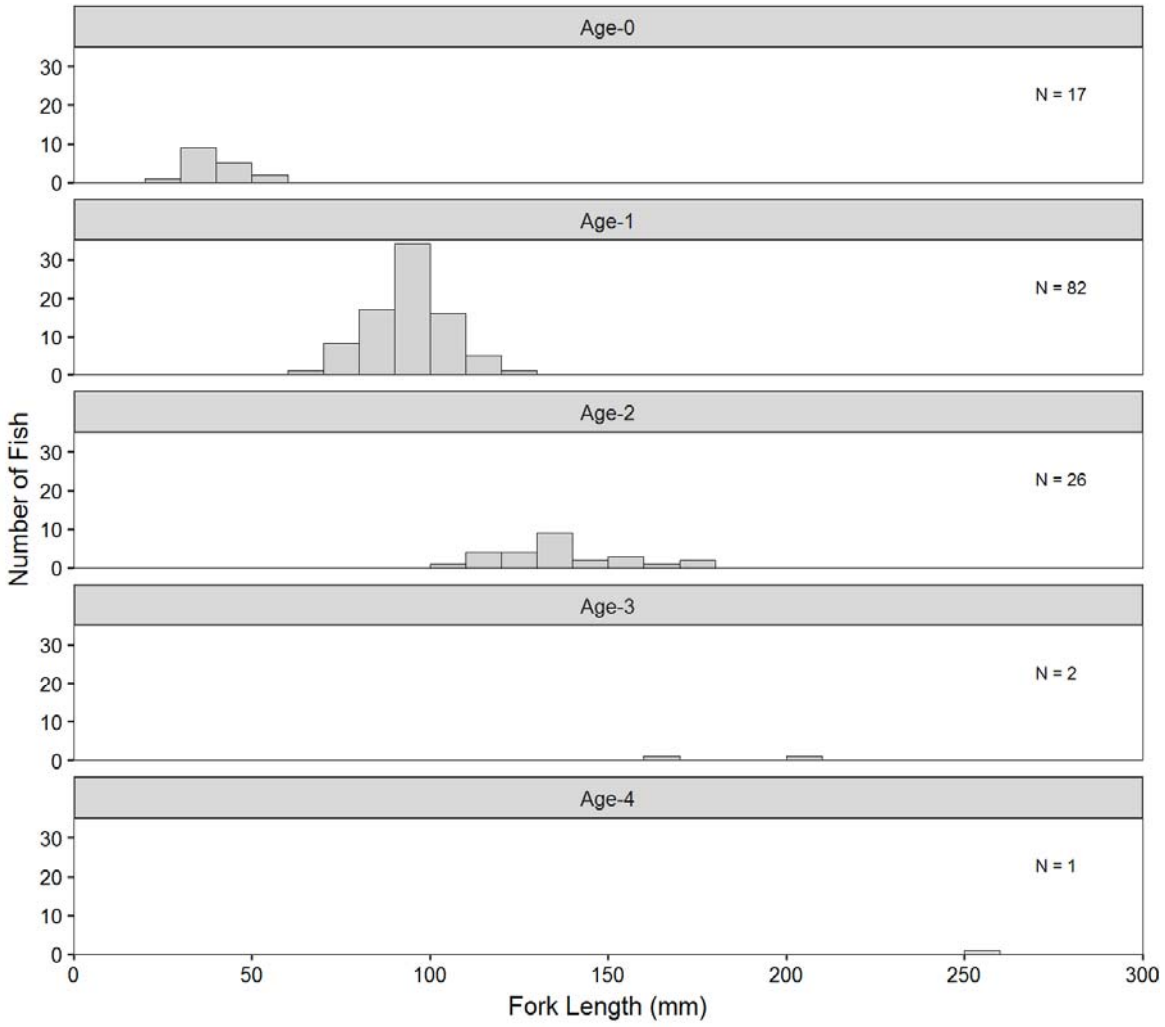

Figure 10: Length-frequency by age-class for Rainbow Trout captured in Colt, Farrell, and Kobes creeks combined during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018. Bars show the number of fish in each 20 mm bin.

3.3.2 Interannual Comparison

A comparison of Rainbow Trout CPUE in 2017 and 2018 indicated similar catch rates for the YOY cohort in Colt and Kobes creeks, but approximately 60% lower catch rates in 2018 relative to 2017 for the immature cohort (Figure 11). In Farrell Creek, a comparison of Rainbow Trout CPUE in 2017 and 2018 indicated similar catch rates for the immature cohort but significantly lower (89% lower) catch rates in 2018 relative to 2017 for the YOY cohort (Figure 11). In 2018, immature Rainbow Trout CPUE in Colt Creek was 8.3 fish/hour, compared to 29.1 fish/hour in 2017. Similarly, in Kobes Creek, immature Rainbow Trout CPUE was 10.6 fish/hour in 2018, but 25.9 fish/hour in 2017. In Farrell Creek, immature Bull Trout CPUE was 8.2 fish/hour in 2018 and 9.6 fish/hour in 2017.

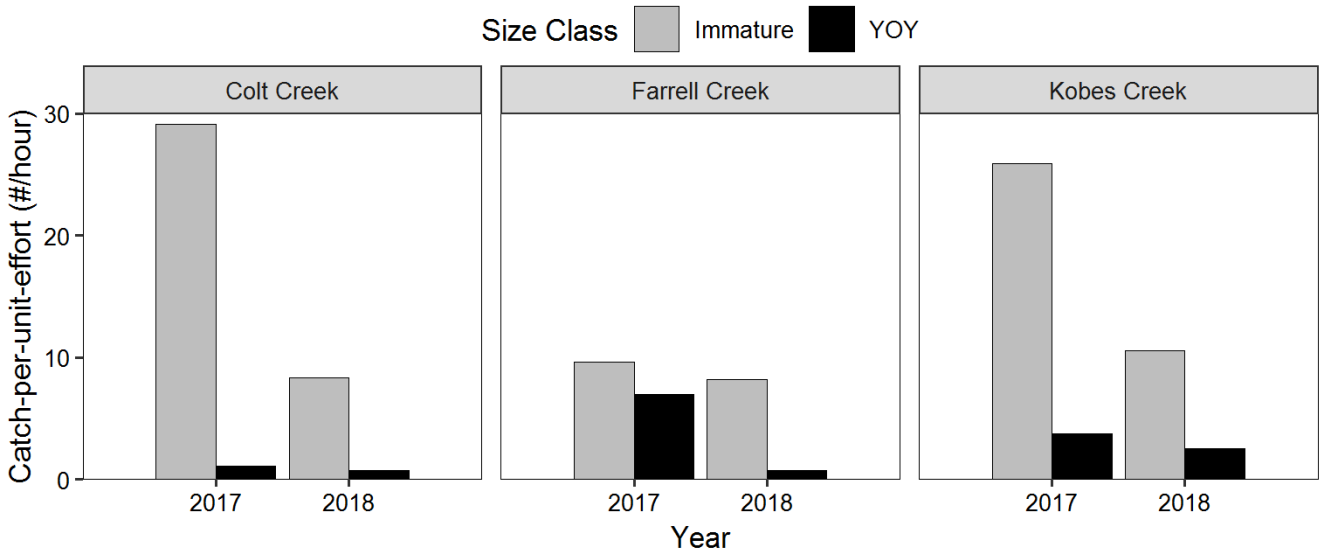

Figure 11: Interannual comparison of Catch-Per-Unit-Effort rates (fish/hour) for Rainbow Trout captured by backpack electrofishing in the Colt, Farrell and Kobes creeks, during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017 and 2018.

3.4 Moberly River

3.4.1 Discharge and Temperature

In 2018, Moberly River discharge gradually declined over the course of the study period (Figure 12). The discharges recorded in 2017 were lower and the discharges recorded in 2016 and higher than the discharges recorded in 2018 (Figure 12). Between 2001 and 2015, Moberly River discharge from late August to mid-September averaged 4.6 m^3/s. During this same seasonal time period, discharge averaged 37.3 m^3/s in 2016, 1.1 m^3/s in 2017, and 11.0 m^3/s in 2018 (Figure 12).

During the 2018 study period, water temperatures in the Moberly River ranged between 12.7°C and 20.4°C (average = 17.9°C) and generally declined over the study period (Appendix C, Table C2).

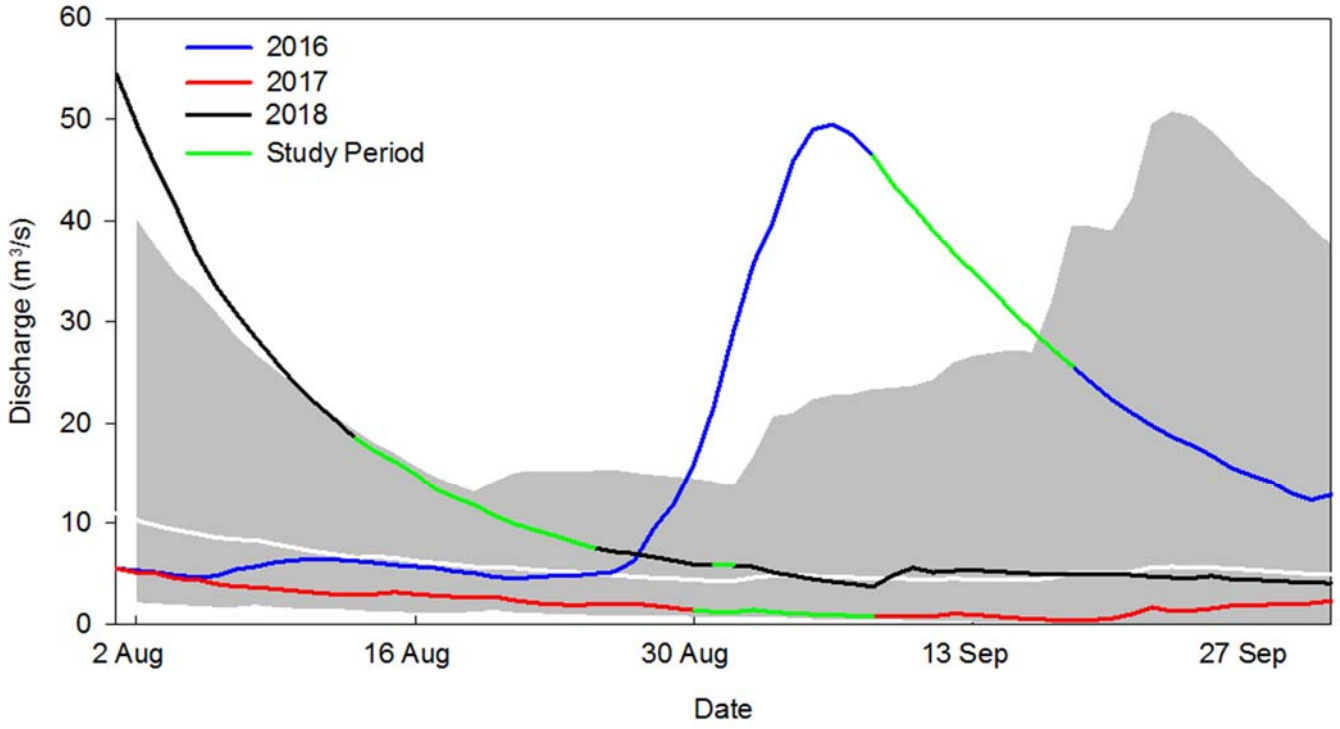

Figure 12: Mean daily discharge for the Moberly River at Water Survey of Canada gauging station 07FB008, 2 August to 30 September, 2016–2018. The shaded area represents minimum and maximum mean daily discharge values recorded at the station from 2001 to 2015. The white line represents average mean daily discharge values over the same time period.

3.4.2 Catch and Life History

Arctic Grayling were the primary target species for sampling conducted in the Moberly River. Eight Arctic Grayling were captured in 2018 (Table 16). One was captured by angling (spin casting) in Section 7 and the remaining seven Arctic Grayling were captured by backpack electrofishing in Section 7 and Section 1A (Table 16). Arctic Grayling were not captured by beach seining or small fish boat electroshocking.

Two Bull Trout were captured in the Moberly River. One individual (420 mm FL, 621 g) was captured by angling (spin casting) in Section 7 on 15 August near River Km 37.7. The second Bull Trout (327 mm FL, 343 g) was captured by backpack electrofishing in Section 10 on 18 August near River Km 3.4. Both fish were implanted with PIT tags. Bull Trout were not captured by beach seining or small fish boat electroshocking in 2018. Rainbow Trout were not recorded in the Moberly River in 2018.

Non-target species comprised the majority of the Moberly River catch (all methods combined) and included, in declining order of abundance, Redside Shiner (*n* = 405), Longnose Sucker (*n* = 391), Longnose Dace (*n* = 368), Mountain Whitefish (*n* = 306), Slimy Sculpin (*n* = 84), Burbot (*n* = 79), Lake Chub (*n* = 77), unidentified sucker species (*n* = 54), White Sucker (*Catostomus commersonii*; *n* = 25), Northern Pikeminnow (*n* = 22), Northern Pike (*n* = 10), Largescale Sucker (*n* = 7), and Trout-Perch (*n* = 3). Species composition by section is presented in Appendix B, Table B7. CPUE was not calculated for the Moberly River because of the various capture methods used and the low catch of target species. A summary of catch by capture method for sportfish species is provided in Table 17.

Table 16: Capture and life history information for Arctic Grayling caught in Moberly River during Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Capture Date	Method	Section	River km[a]	Fork Length (mm)	Weight (g)	Age	Tagged
15-Aug-18	Angling	7	37.7	235	143	2	Yes
13-Aug-18	Backpack Electrofishing	7	43.6	66	3	0	No
15-Aug-18	Backpack Electrofishing	7	40.5	49	1	0	No
19-Aug-18	Backpack Electrofishing	1A	114.5	165	56	1	Yes
19-Aug-18	Backpack Electrofishing	1A	114.5	256	173	3	Yes
31-Aug-18	Backpack Electrofishing	7	39.4	80	5	0	Yes
31-Aug-18	Backpack Electrofishing	1A	114.5	101	13	0	Yes
31-Aug-18	Backpack Electrofishing	1A	114.5	170	55	1	Yes

[a] River Km values for the Moberly River are measured upstream from the Moberly River's confluence with the Peace River.

Table 17: Number of sportfish caught and tagged in the Moberly River during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Species	Life Stage[a]	Angling		Backpack Electrofishing		Small Boat Electroshocking		Total	
		Number Caught	Number Tagged	Number Caught	Number Tagged	Number Caught	Number Tagged	**Number Caught**	**Number Tagged**
Arctic Grayling	Adult			1	1			**1**	**1**
	Immature	1	1	2	2			**3**	**3**
	YOY			4	2			**4**	**2**
Bull Trout	Adult	1	1	1	1			**2**	**2**
Burbot	Adult			2	2	2	2	**4**	**4**
	Immature			33	10			**33**	**10**
	YOY			42				**42**	
Mountain Whitefish	Adult					55		**55**	
	Immature			18		155		**173**	
	YOY			68		9		**77**	
Northern Pike	Adult			1	1			**1**	**1**
	Immature			7		2		**9**	**9**

[a] Life stage was assigned based on fork length. Fish were classified as adult when longer than 249 mm FL and immature when less than 250 mm FL. The maximum size of YOY fish varied by species and was selected based on modes observed in length-frequency histograms and corroborated with length-at-age data when possible.

Backpack electrofishing caught more fish than all other methods for most species and life stages. The exception was adult and immature Mountain Whitefish, which were mostly (72%) captured by small fish boat electroshocking. Although angling caught very few fish in total, one of the eight Arctic Grayling and one of the two Bull Trout were captured using this method.

Length-frequency data for Arctic Grayling demonstrate that a range of size classes use the Moberly River, but in low numbers during the study period (Figure 13). The length-frequency histogram suggested a mode representing YOY Arctic Grayling from 50 to 110 mm FL and a mode representing the age-1 fish from 160 to 180 mm FL.

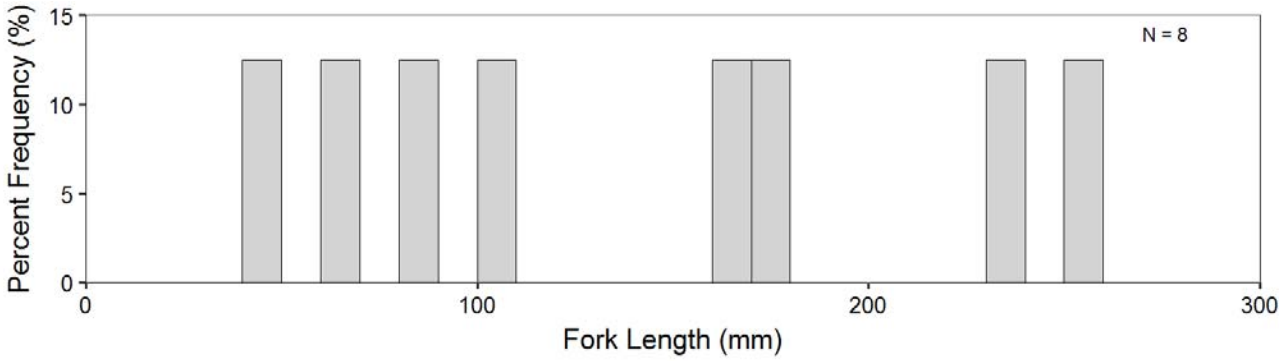

Figure 13: Length-frequency distribution for Arctic Grayling captured in the Moberly River (all capture methods combined) during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Ages were assigned to the eight Arctic Grayling captured in 2018 and ranged from age-0 to age-3.
The von Bertalanffy growth curve suggests that the Arctic Grayling encountered in 2018 had not yet reached their asymptotic length (Figure 14).

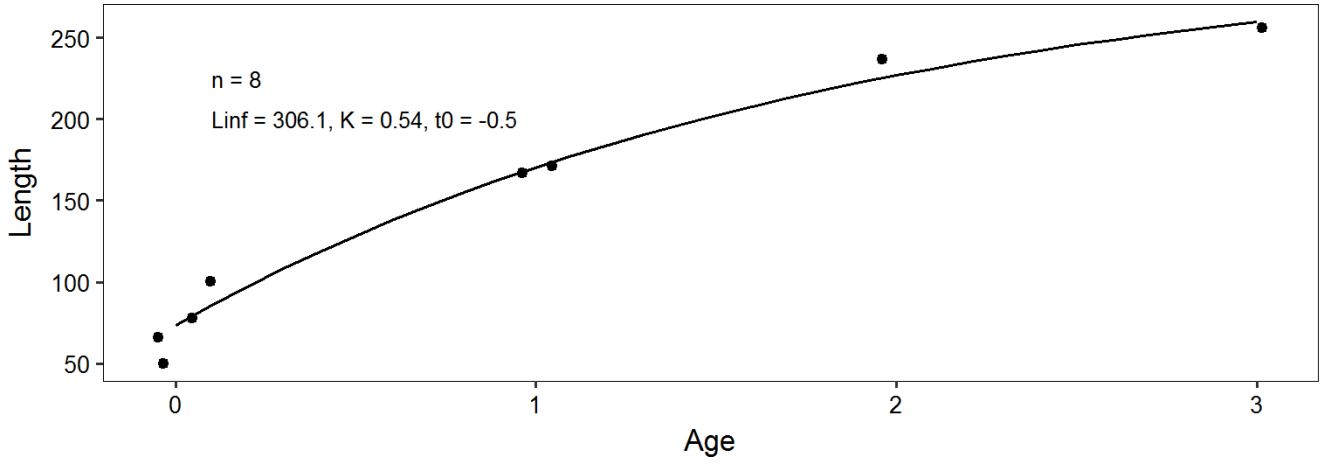

Figure 14: von Bertalanffy for Arctic Grayling captured in the Moberly River (all capture methods combined) during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Length-frequencies are provided for Burbot and Mountain Whitefish because there were sufficient sample sizes for these species and they are key indicator species for other components of the Site C FAHMFP.
The length-frequency histogram for Burbot suggests a mode representing age-0 fish from 50 to 100 mm TL (Figure 15). Burbot larger than 100 mm TL ranged in length from 125 to 375 mm TL. The length-frequency histogram for Mountain Whitefish suggested a mode representing age-0 fish from 40 to 100 mm FL, and a mode representing age-1 fish from 110 to 160 mm FL (Figure 16). The remaining Mountain Whitefish ranged between 160 and 344 mm FL in length with no clear modes in the histogram, likely due to overlapping length distributions for the individual age classes and the small sample size.

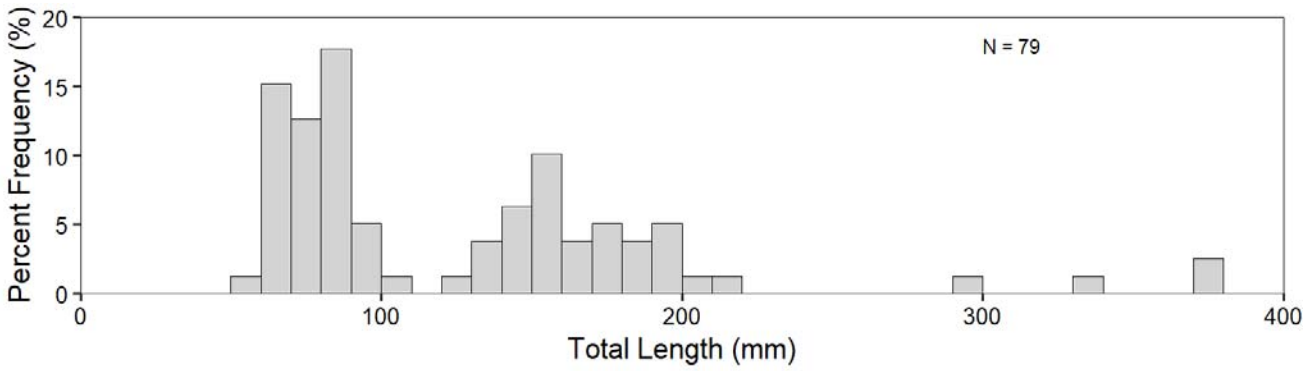

Figure 15: Length-frequency distribution for Burbot captured in the Moberly River (all capture methods combined) during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

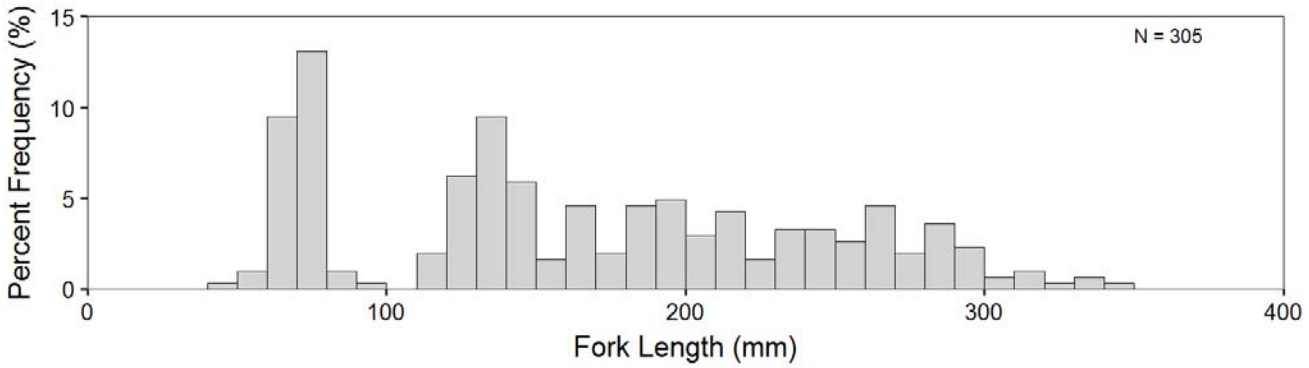

Figure 16: Length-frequency distribution for Mountain Whitefish captured in the Moberly River (all capture methods combined) during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Data from the habitat assessments conducted at select backpack electrofishing and beach seine sites are presented in Appendix C, Table C2.

4.0 DISCUSSION

The current program represented the third year of a multi-year monitoring program. The primary objective of the program is to collect data from Peace River fish populations that use tributaries situated within the future inundation zone of the Site C reservoir to fulfil portions of their life cycles. These data will be used to monitor population-level responses to the construction and operation of the Project. A secondary objective of the survey in 2018 was to deploy PIT tags into fish to allow their movements to be monitored by other components of the Site C FAHMFP.

4.1 Tributaries Targeting Bull Trout

To accomplish the secondary objective mentioned above, the results from 2016 were reviewed by the Site C Fisheries and Aquatic Habitat Mitigation and Monitoring Technical Committee (BC Hydro 2017). Based on this review, changes to the study design were implemented for the Chowade River and Cypress Creek in 2017 and repeated in 2018. These changes are as follows:

1) Sampling effort focused on sections of these tributaries that were identified in 2016 (Golder 2017) as having higher densities of immature Bull Trout.

2) Only backpack electrofishing was employed as this method had the highest catch rates of immature Bull Trout in 2016 (Golder 2017).

3) Surveys were conducted approximately three weeks earlier than in 2016 to increase the likelihood of capturing immature Bull Trout before they migrate downstream (see R.L.&L. 1995 for outmigration timing).

4) The minimum fork length required to implant a PIT tag was reduced from 120 mm FL to 80 mm FL following discussions with InStream Fisheries Research Inc.

The above modifications increased the catch rates of immature Bull Trout and increased the number of PIT tags deployed in both 2017 and 2018 relative to 2016. As described in the Site C FAHMFP, tagged fish that subsequently migrate downstream past the PIT arrays in the Chowade River and Cypress Creek will be considered offspring of a migratory Bull Trout population. Further, if these same tagged fish are recaptured in the Peace River mainstem as part of the Peace River Large Fish Indexing Survey (Mon-2, Task 2a) or are detected in the temporary and permanent upstream fish passage facilities, they will be considered offspring of the Peace River Bull Trout population. Combined, this information will further our understanding of resident and migrant Bull Trout populations in Halfway River tributaries. PIT arrays will also monitor the upstream migrations of these same fish in subsequent years when they return to the Halfway River watershed as adults to spawn. As such, these data could potentially be used to estimate annual transition probabilities between life stages (i.e., juvenile to subadult, subadult to adult) and adult survival rates.

The above modifications also helped reduce the number of adult Bull Trout encountered during the survey. In 2016, 25 adult Bull Trout were captured in the Chowade River and Cypress Creek combined (Golder 2017). In 2017, five adult Bull Trout were captured (Golder 2018), and in 2018, eight adult Bull Trout were captured in these two tributaries. Any modifications to the study design that reduce interactions with adult Bull Trout during their spawning or migration periods immediately prior to spawning will reduce the potential for effects of electrofishing on these fish.

The modifications to the sampling design (BC Hydro 2017) acknowledged that sampling habitats farther upstream in the tributaries to target Bull Trout would likely result in reduced catches of Arctic Grayling and Rainbow Trout (e.g., habitats with lower water temperatures that favour Bull Trout; BC Hydro 2017). Arctic Grayling were not recorded in the Chowade River or Cypress Creek in 2017 or 2018. This result is likely an artefact of the modified study design and not an indication of population decline. Rainbow Trout catch in the Chowade River and Cypress Creek was lower in 2018 (n = 22) and 2017 (n = 10) relative to 2016 (n = 96). All of the Rainbow Trout captured in 2016 were captured using a small fish boat electroshocker; therefore, the low numbers of Rainbow Trout recorded in 2017 and 2018 are also likely due to the modified study design.

The number of immature Bull Trout captured in the Chowade River and Cypress and Fiddes creeks in 2018 was similar to the number captured in 2017; however, immature Bull Trout CPUE was substantially lower in 2018 when compared to 2017 for all three streams. This decline in CPUE was largely due to increased effort expended in 2018. Overall, an additional 1884 m of shoreline habitat was sampled by electrofishing in 2018 compared to 2017, an increase of 13%; however, an additional 9.7 hours of electrofishing effort was expended in 2018 relative to 2017, an increase of 42%. Further, substantially higher water levels in 2018 reduced the efficiency of backpack electrofishing because there was more water and therefore more habitat to sample within each study site (i.e., additional time was needed within each site to ensure all preferred habitats were properly assessed).

Temporal comparisons of life history metrics within individual tributaries will be more feasible in future study years if repetitive and consistent sampling protocols are established. Changes to the capture methodologies between 2016 and 2017 hindered the comparison of life history data between the first two study years for the Chowade River and Cypress Creek.

4.1.1 Movement Data

Movement data from recaptured fish, the PIT tag detector arrays, and radio telemetry surveys (scheduled to commence in 2019) will ultimately be used to monitor the timing and extent of fish movements in response to river diversion, Project operation, and the operation of the temporary and permanent upstream fish passage facilities. Depending on the species, these data will provide insight into spawning frequency (i.e., the prevalence of skip-spawning), the timing and duration of pre-spawning migrations and kelting, travel extent, age of first maturity, the timing and duration of downstream dispersal patterns of juvenile fishes, as well as the age of downstream dispersal, and juvenile to adult survival rates.

Based on length and age data, juvenile Bull Trout in the Chowade River and Cypress Creek likely migrate downstream to the Peace River at age-2 or age-3. In 2018, two immature Bull Trout were detected by the Chowade River array; however, their direction of travel could not be determined. These two fish were initially tagged as age-1 individuals in 2017 and were 90 and 93 mm FL in length at the time of their capture. In 2018, four immature Bull Trout were detected by the Cypress Creek array; all four were detected travelling downstream between 7 and 26 September. These four fish were initially tagged in 2017. Two were age-1 (103 and 111 mm FL) and two were age-2 (127 and 145 mm FL). Between 2016 and 2018, 415 immature Bull Trout were implanted with PIT tags in the Chowade River and 372 immature Bull Trout were implanted with PIT tags in Cypress Creek. More detections on the PIT arrays are anticipated during future study years as these fish mature and migrate downstream to the Peace River.

In 2018, the 14 Bull Trout that were detected by the Chowade River array and 11 Bull Trout that were detected by the Cypress Creek array were initially captured as adults or subadults in the Peace River as part of the Peace River Large Fish Index (Mon-2, Task 2a). The initial capture locations of these fish ranged from the PCD area and the Many Islands area in Alberta, covering the geographic scope of Mon-2, Task 2a. Of these 25 fish, 10 were initially captured downstream of the Project and would have migrated through the Project area to reach the Chowade or Cypress Creek array. Two Bull Trout that were detected by the Chowade River array in 2018 were subsequently captured in the Peace River by Mon-2, Task 2a. One fish was detected by the array on 19 September, travelling upstream, and was captured in the Peace River approximately 4 km upstream of the Cache Creek confluence on 1 October, covering at minimum 160 km in less than 12 days. The other fish was detected by the array on 17 August (direction of travel was unknown) and again on 16 September (travelling downstream) before being captured in the Peace River approximately 3 km downstream of the Highway #97 bridge near Taylor, BC on 25 September. Between its last detection on the array and its recapture in the Peace River, this fish travelled over 208 km in 9 days. To date, adult Bull Trout movement data collected under the FAHMFP support the findings of telemetry studies conducted during Site C baseline studies (e.g., AMEC and LGL 2010b) and the findings of telemetry studies conducted in the 1990s (AMEC and LGL 2010b).

Four adult Bull Trout were detected by the Chowade River array in both 2017 and 2018, while no Bull Trout were detected in both 2017 and 2018 by the Cypress Creek array.

Ten Rainbow Trout were detected by the Chowade River array in both 2017 and 2018. These upstream and downstream movements occurred between 6 and 30 September of each study year.

The adult Rainbow Trout that was initially tagged in the upper Halfway River in late August of 2016 (tag number 900230000125822) and detected in Cypress Creek in mid-September 2017 was also detected by the Cypress Creek array in mid-September 2018. This fish was one of only nine Rainbow Trout tagged in the upper Halfway River as part of the current study and was the only Rainbow Trout that was detected by the Cypress Creek array in both 2017 and 2018. The Halfway River is a recruitment source for the Peace River Rainbow Trout population (Mainstream 2012); however, the Halfway River also has a resident Rainbow Trout population. Meka et al. (2003) noted both highly migratory and non-migratory movement behaviours in riverine-based Rainbow Trout populations. It is possible that the Rainbow Trout sampled as part of the current program represent a combination of three different ecotypes: a migratory Peace River population; a migratory Halfway River resident population, and a non-migratory Halfway River resident population. None of Rainbow Trout tagged in the Halfway River watershed have been subsequently captured in the Peace River mainstem and none of the Rainbow Trout tagged in the Peace River have been subsequently captured in the Halfway River watershed or detected by the Chowade or Cypress PIT arrays. These data suggest that the populations sampled in the Halfway and Peace rivers are distinct; however, adult Rainbow Trout from the Peace River are most likely to be present in the Halfway system during the spring spawning season. Under the FAHMFP, fish have not been collected from the Halfway River during the spring season and arrays have not been installed early enough in the year to detect spawning movements by adult Rainbow Trout. Microchemistry or genetic data could provide insight on the origin and movement patterns of Rainbow Trout. High flows reduce the feasibility of sampling in the Halfway River during the spring spawning season.

4.2 Tributaries Targeting Rainbow Trout

Sampling in Farrell Creek was intended to replace sampling in Maurice and Lynx creeks for the reasons detailed in Section 1.2. Data from Farrell Creek will be used to test the Mon-1b hypothesis regarding Peace River Rainbow Trout continuing to spawn and rear in Site C reservoir tributaries upstream of the reservoir's inundation zone. YOY Rainbow Trout (i.e., fish less than 50 mm FL) were recorded at two of the four sites during both study years (i.e., 2017 and 2018), while immature Rainbow Trout (i.e., fish between 51 and 250 mm FL) were recorded in all sites during both study years. These data indicate that Rainbow Trout use Farrell Creek for spawning and rearing; however, uncertainty remains as to whether these fish are part of a local resident population or are part of a migratory Peace River population. In 2017 and 2018 combined, 78 Rainbow Trout were tagged in Farrell Creek. None of these have been recaptured in the Peace River mainstem under other components of the Site C FAHMFP. Conversely, none of the 777 Rainbow Trout that were tagged in the Peace River between 2009 and 2018 were recaptured in Farrell Creek. Recapturing a Rainbow Trout in the Peace River that originated in Farrell Creek or recapturing a Rainbow Trout that was initially tagged in the Peace River would provide insight into life history patterns of this species in the region. Continued sampling in Farrell Creek using methods similar to those used in 2017 and 2018 is expected to yield results capable of testing the Mon-1b hypothesis.

Sampling was conducted in Colt and Kobes creeks in 2017 and 2018 to collect additional baseline data for Rainbow Trout within the Halfway River watershed. Data collected as part of these surveys will not be used to specifically test any hypotheses under the Site C FAHMFP, but will contribute to the regional Rainbow Trout dataset and contribute to our understanding of any potential changes to Rainbow Trout populations in tributaries and the Site C reservoir. YOY and immature Rainbow Trout were recorded in both tributaries in 2017 and 2018, indicating that both systems are used for spawning and rearing by this species. Adult Rainbow Trout were not recorded in either system, however the presence of YOY Rainbow Trout in early August could be viewed as evidence that mature spawning adults were present in the system the previous spring. The lack of adult Rainbow Trout in the catch in 2017 and 2018 could partially be due to the capture method used (backpack electrofishing only).

For Farrell Creek, the number of immature Rainbow Trout encountered and their catch rates in 2018 were similar to 2017; however, the number and catch rates for YOY Rainbow Trout were substantially lower in 2018 when compared to 2017. The lower catch rates of YOY Rainbow Trout in Farrell Creek may have been due to the higher water levels at the time of sampling (i.e., this size class of fish may have been closer to shore or in shallower water and therefore were not captured in the same habitat preferred by the immature Rainbow Trout). Both total numbers and catch rates for immature Rainbow Trout in Colt and Kobes creeks were lower in 2018 when compared to 2017. Approximately the same amount of shoreline habitat was sampled in both years but an additional 2.8 hours of electrofishing effort was expended in 2018, an increase of 20% between 2017 and 2018. Sampling conducted in July 2018, before the flows had subsided, reduced the efficiency of backpack electrofishing because there was more water and therefore more habitat to sample within each study site (i.e., additional time was needed within each site to ensure all preferred habitats were properly assessed).

None of the three tributaries sampled for Rainbow Trout in 2017 and 2018 (i.e., Farrell, Colt, and Kobes creeks) were sampled in 2016; therefore, comparisons to 2016 data (Golder 2017) were not possible. Length-frequency distributions and catch rates for Rainbow Trout in Farrell Creek in both 2017 and 2018 were similar to those recorded by Mainstream in 2010 (Mainstream 2011a). Length-frequency data indicate that most of the YOY Rainbow Trout recorded in 2010 were between 60 and 70 mm FL. Data from 2017 and 2018 indicate that most of the YOY Rainbow Trout were between 30 and 40 mm FL. The difference in size is likely due to the differences in

the two survey periods: mid-September in 2010 and early August in 2017 and 2018. These data may indicate that YOY Rainbow Trout grow substantially during the first growing season. Maintaining consistent study periods across study years will be important to monitor changes to annual growth and length-at-age.

4.3 Moberly River

Sampling for Arctic Grayling in the Moberly River in 2018 supplemented pre-Project baseline data collected from 2008 to 2011 (Mainstream 2009a, 2009b, 2010a, 2011b, 2013) and 2016 and 2017 (Golder 2017, 2018). In 2018, Arctic Grayling catch was low; one adult, three immature, and four YOY. The low Arctic Grayling catch may, in part, be due to Moberly River discharge levels at the time of sampling. To date, three years of sampling have been conducted in the Moberly River under the FAHMFP, with each being conducted under substantially different environmental conditions. Sampling was conducted at historically high water levels in mid-September in 2016, at historically low water levels in early September in 2017, and at more typical water levels in mid-August in 2018. Over these three study years, higher Arctic Grayling catches have aligned with higher water levels. This result is supported by Mainstream (2012) who hypothesized that Arctic Grayling migrate downstream and out of the Moberly River over the summer as water levels decline. Sampling the Moberly River prior to the decline in freshet flows would increase the likelihood of encountering Arctic Grayling; however, the timing of freshet flows in the Moberly River is variable. Furthermore, the Moberly River valley is susceptible to rain events that can result in quick and substantial changes in Moberly River water levels. As an example, water levels in the Moberly River increased from 12 to 91 m^3/s over a 3-day period between 20 and 23 July 2018 and data from the Water Survey of Canada indicate that variable flows like these, whether from freshet or rain events, can occur in the Moberly River anytime between early May and late August (a four month period)[20]. The Moberly River's incised channel, high bank instability, large volume of woody debris, and high water turbidity levels reduces the feasibility of safely and effectively sampling this river at high water levels; therefore, sampling cannot commence until after water levels begin to decline. Due to the dynamic nature of the Moberly River's hydrograph between May and August, it is difficult to consistently align sampling to ideal conditions or to consistent conditions across study years. As a result, drawing conclusions across study years is more difficult. Moving forward, the Moberly River survey will likely continue to be conducted under variable water levels with the study period shifting temporally in response to these variable water levels.

Under the FAHFMP, the number of Arctic Grayling encountered in the Moberly River has ranged between a low of 2 fish in 2017 and a high of 108 fish in 2016. The number of Arctic Grayling encountered in the Moberly River during baseline studies was also variable, ranging from a low of 6 fish in both 2008 and 2011 (Mainstream 2009a, 2013) to a high of 106 fish in 2009 (Mainstream 2010a). The sample methods and the level of effort employed varied between all studies. The inconsistent and irregular timing of Moberly River water levels will continue to influence Arctic Grayling catch rates and present logistical sampling challenges.

Two adult Bull Trout were recorded in the Moberly River in 2018. One of these fish was captured in Section 10 approximately 3.4 km upstream of the Moberly River's confluence with the Peace River and within the inundation zone of the Site C reservoir. The second Bull Trout was captured in Section 7 approximately 38 km upstream of the confluence. At the time of capture, the water temperature of the Moberly River was 19.8°C. Bull Trout are a

[20] https://wateroffice.ec.gc.ca/report/real_time_e.html?stn=07FB008.

cold-water species (Mainstream 2012) and typically prefer water temperatures below 15°C (McPhail 2007). A preliminary review of available data did not identify any other Bull Trout encounters this far upstream in the Moberly River. Historically, Bull Trout have been recorded in Moberly Lake[21].

Non-target fish species recorded in the Moberly River in 2018 were similar to those recorded in 2016 and 2017. Prickly Sculpin (*Cottus asper*) and Walleye (*Sander vitreus*) were not recorded in the Moberly River in 2018 or 2016 but were recorded in 2017. Finescale Dace (*Chrosomus neogaeus*), Flathead Chub (*Platygobio gracilis*), and Kokanee (*Oncorhynchus nerka*) were recorded in the Moberly River in 2016 but were not recorded in 2017 or 2018. All six of these species were captured in low numbers during the years they were recorded. Their absence in the catch in a particular study year is not likely indicative of a true change in species richness or diversity.

[21] http://a100.gov.bc.ca/pub/reports/rwservlet?habitat_wizard_lakes_report&p_title=%22Ministry%20of%20Environment%22&P_LAKE_ID=125439

5.0 CLOSURE

We trust the information contained in this report is sufficiently detailed for your review purposes. Please do not hesitate to contact us should you have any questions or require clarification.

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APPENDIX A

Maps and UTM Locations

Table A1 Locations of sites sampled during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

River	Upstream River Km[a]	Site Name	Sample Method	Upstream UTM[b]			Downstream UTM[b]		
				Zone	Easting	Northing	Zone	Easting	Northing
Chowade River	54.3	CHR-EF54.3-2018-07-22	Backpack Electrofishing	10V	490644	6284881	10V	490602	6284906
	54.2	CHR-EF54.2-2018-07-22	Backpack Electrofishing	10V	490420	6285114	10V	490492	6285149
	54.1	CHR-EF54.1-2018-07-22	Backpack Electrofishing	10V	490639	6285018	10V	490739	6285014
	51.0	CHR-EF51.0-2018-07-22	Backpack Electrofishing	10V	492742	6284633	10V	492869	6284701
	50.9	CHR-EF50.9-2018-07-22	Backpack Electrofishing	10V	492821	6284413	10V	492965	6284456
	48.1	CHR-EF48.1-2018-07-22	Backpack Electrofishing	10V	495274	6283893	10V	495372	6283829
	47.9	CHR-EF47.9-2018-07-22	Backpack Electrofishing	10V	495348	6283670	10V	495464	6283623
	47.0	CHR-EF46.7-2018-08-06	Backpack Electrofishing	10V	496371	6283564	10V	496720	6283559
	46.3	CHR-EF46.3-2018-08-06	Backpack Electrofishing	10V	496714	6283468	10V	496895	6283446
	45.8	CHR-EF45.8-2018-07-22	Backpack Electrofishing	10V	497157	6283479	10V	497221	6283492
	45.7	CHR-EF45.7-2018-07-22	Backpack Electrofishing	10V	497274	6283512	10V	497474	6283614
	45.6	CHR-EF45.6-2018-07-22	Backpack Electrofishing	10V	497197	6283601	10V	497177	6283723
	45.0	CHR-EF44.2-2018-08-06	Backpack Electrofishing	10V	498503	6283918	10V	498708	6283781
	44.5	CHR-EF44.5-2018-07-22	Backpack Electrofishing	10V	498318	6283907	10V	498411	6283885
	44.3	CHR-EF44.3-2018-07-22	Backpack Electrofishing	10V	498517	6283665	10V	498638	6283711
	44.0	CHR-EF43.8-2018-08-06	Backpack Electrofishing	10V	498792	6283552	10V	498816	6283466
	44.0	CHR-EF44.0-2018-08-06	Backpack Electrofishing	10V	498763	6283767	10V	498867	6283548
	43.9	CHR-EF43.9-2018-08-06	Backpack Electrofishing	10V	498723	6283623	10V	498794	6283553
	43.4	CHR-EF43.4-2018-07-21	Backpack Electrofishing	10V	498985	6283390	10V	499127	6283387
	43.0	CHR-EF43.0-2018-07-21	Backpack Electrofishing	10V	499109	6283128	10V	499202	6283122
	41.5	CHR-EF41.5-2018-07-21	Backpack Electrofishing	10V	499967	6282748	10V	500033	6282666
	41.2	CHR-EF41.2-2018-07-21	Backpack Electrofishing	10V	500148	6282541	10V	500125	6282456
	40.0	CHR-EF39.8-2018-08-05	Backpack Electrofishing	10V	501114	6282407	10V	501381	6282435
	40.0	CHR-EF40.0-2018-08-05	Backpack Electrofishing	10V	501013	6282328	10V	501339	6282417
	40.0	CHR-EF39.7-2018-08-05	Backpack Electrofishing	10V	501499	6282384	10V	501803	6282190
	40.0	CHR-EF39.3-2018-08-05	Backpack Electrofishing	10V	501810	6282180	10V	501959	6282403
	39.5	CHR-EF39.5-2018-08-06	Backpack Electrofishing	10V	501449	6282429	10V	501661	6282413
	39.0	CHR-EF38.8-2018-08-05	Backpack Electrofishing	10V	501978	6282412	10V	502197	6282400
	39.0	CHR-EF39.0-2018-08-05	Backpack Electrofishing	10V	501912	6282488	10V	502181	6282477
	37.2	CHR-EF37.2-2018-07-21	Backpack Electrofishing	10V	503254	6281875	10V	503344	6281828
	37.1	CHR-EF37.1-2018-07-21	Backpack Electrofishing	10V	503268	6281617	10V	503128	6281759
	36.6	CHR-EF36.6-2018-07-21	Backpack Electrofishing	10V	503502	6282109	10V	503502	6282109
	36.5	CHR-EF36.5-2018-07-21	Backpack Electrofishing	10V	503628	6281976	10V	503674	6282027
Colt Creek	31.0	COC-EF30.4-2018-08-02	Backpack Electrofishing	10V	521235	6258388	10V	521277	6258457
	30.5	COC-EF30.5-2018-08-02	Backpack Electrofishing	10V	521162	6258312	10V	521282	6258423
	29.0	COC-EF28.8-2018-08-02	Backpack Electrofishing	10V	522343	6259127	10V	522427	6259122
	28.9	COC-EF28.9-2018-08-02	Backpack Electrofishing	10V	522305	6259042	10V	522418	6259120
	14.1	COC-EF14.1-2018-08-02	Backpack Electrofishing	10V	531684	6260266	10V	531904	6260368
	14.0	COC-EF14.0-2018-08-02	Backpack Electrofishing	10V	531803	6260338	10V	531912	6260367
	4.0	COC-EF3.6-2018-08-01	Backpack Electrofishing	10V	538060	6258666	10V	538257	6258624
	4.0	COC-EF3.0-2018-08-01	Backpack Electrofishing	10V	538252	6258617	10V	538350	6258640
Cypress Creek	67.0	CYC-EF66.9-2018-08-08	Backpack Electrofishing	10V	482092	6297021	10V	482133	6296992
	41.0	CYC-EF40.3-2018-08-09	Backpack Electrofishing	10V	495911	6302934	10V	496152	6303045

[a] Upstream River Km of each site as measured upstream from the stream's confluence.

[b] NAD83.

continued…

Table A1 Continued.

River	Upstream River Km[a]	Site Name	Sample Method	Upstream UTM[b]			Downstream UTM[b]		
				Zone	Easting	Northing	Zone	Easting	Northing
Cypress Creek	40.1	CYC-EF40.1-2018-08-09	Backpack Electrofishing	10V	496012	6302968	10V	496168	6303043
	39.0	CYC-EF38.8-2018-08-04	Backpack Electrofishing	10V	497111	6303400	10V	497248	6303498
	39.0	CYC-EF38.7-2018-08-02	Backpack Electrofishing	10V	497256	6303434	10V	497176	6303494
	38.2	CYC-EF38.2-2018-08-04	Backpack Electrofishing	10V	497218	6303486	10V	497308	6303826
	38.0	CYC-EF37.6-2018-07-24	Backpack Electrofishing	10V	497676	6303649	10V	497744	6303724
	37.5	CYC-EF37.5-2018-07-24	Backpack Electrofishing	10V	497806	6303513	10V	497862	6303575
	37.4	CYC-EF37.4-2018-07-24	Backpack Electrofishing	10V	497905	6303575	10V	497879	6303670
	35.8	CYC-EF35.8-2018-07-24	Backpack Electrofishing	10V	498807	6303523	10V	498857	6303566
	35.7	CYC-EF35.7-2018-07-24	Backpack Electrofishing	10V	498839	6303517	10V	499095	6303634
	35.1	CYC-EF35.1-2018-07-24	Backpack Electrofishing	10V	499095	6303634	10V	499182	6303665
	35.0	CYC-EF34.7-2018-08-08	Backpack Electrofishing	10V	499424	6303922	10V	499584	6304055
	35.0	CYC-EF35.0-2018-07-24	Backpack Electrofishing	10V	499117	6304008	10V	499246	6303942
	35.0	CYC-EF35.0-2018-07-24	Backpack Electrofishing	10V	499139	6304159	10V	499195	6303973
	35.0	CYC-EF34.7-2018-07-24	Backpack Electrofishing	10V	499410	6303926	10V	499587	6304056
	34.9	CYC-EF34.9-2018-07-24	Backpack Electrofishing	10V	499341	6303721	10V	499699	6303787
	34.7	CYC-EF34.7-2018-08-08	Backpack Electrofishing	10V	499384	6303834	10V	499590	6304058
	33.0	CYC-EF32.6-2018-07-23	Backpack Electrofishing	10V	500522	6304899	10V	500568	6304957
	33.0	CYC-EF32.3-2018-08-09	Backpack Electrofishing	10V	500615	6305056	10V	500761	6305403
	33.0	CYC-EF32.55-2018-07-23	Backpack Electrofishing	10V	500498	6304880	10V	500528	6304936
	32.8	CYC-EF32.8-2018-07-23	Backpack Electrofishing	10V	500482	6304648	10V	500624	6304735
	31.8	CYC-EF31.8-2018-08-09	Backpack Electrofishing	10V	500855	6305442	10V	501006	6305349
	31.0	CYC-EF30.1-2018-07-23	Backpack Electrofishing	10V	502136	6305490	10V	502226	6305504
	31.0	CYC-EF30.88-2018-07-23	Backpack Electrofishing	10V	501594	6305719	10V	501646	6305594
	31.0	CYC-EF30.9-2015-07-23	Backpack Electrofishing	10V	501508	6305719	10V	501565	6305726
	31.0	CYC-EF30.8-2018-07-23	Backpack Electrofishing	10V	501659	6305595	10V	501723	6305558
	30.7	CYC-EF30.7-2018-07-23	Backpack Electrofishing	10V	501753	6305388	10V	501925	6305634
	30.4	CYC-EF30.4-2018-07-23	Backpack Electrofishing	10V	502026	6305395	10V	502248	6305393
	29.2	CYC-EF29.2-2018-07-23	Backpack Electrofishing	10V	503000	6305330	10V	503194	6305363
	29.0	CYC-EF28.1-2018-08-08	Backpack Electrofishing	10V	503878	6305228	10V	503848	6305309
	29.0	CYC-EF28.9-2018-07-23	Backpack Electrofishing	10V	502963	6305434	10V	503130	6305426
	28.3	CYC-EF28.3-2018-08-08	Backpack Electrofishing	10V	503784	6305426	10V	503907	6305127
	27.0	CYC-EF26.5-2018-08-04	Backpack Electrofishing	10V	505183	6304467	10V	505323	6304394
	26.2	CYC-EF26.2-2018-08-04	Backpack Electrofishing	10V	505323	6304410	10V	505434	6304568
	26.0	CYC-EF25.25-2018-08-09	Backpack Electrofishing	10V	506056	6304472	10V	506461	6304390
	26.0	CYC-EF25.3-2018-08-09	Backpack Electrofishing	10V	506043	6304468	10V	506013	6304371
	24.9	CYC-EF24.9-2018-08-09	Backpack Electrofishing	10V	506134	6304267	10V	506413	6304237
	22.0	CYC-EF21.2-2018-08-08	Backpack Electrofishing	10V	508574	6302850	10V	508662	6302735
	22.0	CYC-EF21.3-2018-08-08	Backpack Electrofishing	10V	508434	6302789	10V	508553	6302804
	21.7	CYC-EF21.7-2018-08-08	Backpack Electrofishing	10V	508282	6302871	10V	508549	6302834
	21.6	CYC-EF21.6-2018-08-08	Backpack Electrofishing	10V	508282	6302871	10V	508448	6302779
	19.0	CYC-EF18.9-2018-08-04	Backpack Electrofishing	10V	510004	6301866	10V	510312	6301893
	19.0	CYC-EF18.8-2018-08-04	Backpack Electrofishing	10V	510070	6301801	10V	510314	6301878
Farrell Creek	103.0	FAC-EF102.5-2018-08-03	Backpack Electrofishing	10V	561018	6238338	10V	561046	6238132
	102.0	FAC-EF102.1-2018-08-03	Backpack Electrofishing	10V	560892	6238244	10V	561010	6238340

[a] Upstream River Km of each site as measured upstream from the stream's confluence.

[b] NAD83.

continued…

Table A1 Continued.

River	Upstream River Km[a]	Site Name	Sample Method	Upstream UTM[b]			Downstream UTM[b]		
				Zone	Easting	Northing	Zone	Easting	Northing
Farrell Creek	66.0	FAC-EF65.7-2018-08-03	Backpack Electrofishing	10V	573210	6238256	10V	573010	6238446
	64.0	FAC-EF63.2-2018-08-03	Backpack Electrofishing	10V	572194	6239744	10V	572502	6240088
	63.3	FAC-EF63.3-2018-08-03	Backpack Electrofishing	10V	572204	6239746	10V	572498	6240098
Fiddes Creek	11.7	FIC-EF11.7-2018-08-07	Backpack Electrofishing	10V	478295	6306901	10V	478281	6307124
	7.0	FIC-EF7.0-2018-08-07	Backpack Electrofishing	10V	479589	6310835	10V	479684	6310884
	6.8	FIC-EF6.8-2018-08-07	Backpack Electrofishing	10V	479624	6310882	10V	479836	6311013
	4.8	FIC-EF4.8-2018-08-07	Backpack Electrofishing	10V	480388	6312456	10V	480324	6312544
	4.6	FIC-EF4.6-2018-08-07	Backpack Electrofishing	10V	480318	6312564	10V	480291	6312622
Kobes Creek	56.0	KOC-EF55.3-2018-08-11	Backpack Electrofishing	10V	544250	6243194	10V	544132	6243355
	46.7	KOC-EF46.7-2018-08-11	Backpack Electrofishing	10V	543215	6248252	10V	543405	6248365
	41.0	KOC-EF40.2-2018-07-25	Backpack Electrofishing	10V	544124	6252323	10V	544067	6252515
	40.5	KOC-EF40.5-2018-07-25	Backpack Electrofishing	10V	544122	6252301	10V	544002	6252160
	12.0	KOC-EF11.5-RDB-2018-08-01	Backpack Electrofishing	10V	555155	6256356	10V	555230	6256202
	12.0	KOC-EF11.5-LDB-2018-08-01	Backpack Electrofishing	10V	555148	6256341	10V	555230	6256202
Moberly River	116.8	MOB-EF-116.8-2018-08-31	Backpack Electrofishing	10U	588553	6191199	10U	588641	6191250
	115.5	MOB-ES-115.5-2018-08-19	Small Fish Boat Electroshocking	10U	589412	6191939	10U	589448	6192324
	114.5	MOB-AN-114.5-2018-08-19	Angling	10U	589240	6192770	10U	589223	6192807
	114.5	MOB-EF-114.5-2018-08-19	Backpack Electrofishing	10U	589240	6192791	10U	589247	6192920
	114.5	MOB-EF-114.5-2018 -08-31	Backpack Electrofishing	10U	589230	6192782	10U	589241	6192921
	101.5	MOB-AN-101.5-2018-08-20	Angling	10U	591223	6199728	10U	591280	6200210
	101.5	MOB-AN-101.5-2018-08-20	Angling	10U	591223	6199728	10U	591280	6200210
	101.5	MOB-EF-101.5-2018-08-20	Backpack Electrofishing	10U	591250	6199690	10U	591274	6199714
	101.4	MOB-ES-101.4-2018-08-20	Small Fish Boat Electroshocking	10U	591281	6199735	10U	591433	6200138
	98.3	MOB-AN-98.3-2018-08-20	Angling	10U	590696	6201119	10U	590287	6200613
	91.5	MOB-AN-91.5-2018-08-20	Angling	10U	587345	6202627	10U	587179	6204045
	87.3	MOB-ES-87.3-2018-08-20	Small Fish Boat Electroshocking	10U	587228	6203881	10U	587424	6204205
	86.9	MOB-AN-86.9-2018-08-20	Angling	10U	587371	6204255	10U	587371	6204255
	86.6	MOB-EF-86.6-2018-08-20	Backpack Electrofishing	10U	587439	6204051	10U	587419	6204129
	73.7	MOB-ES-73.7-2018-08-21	Small Fish Boat Electroshocking	10V	590363	6210903	10V	590593	6211136
	72.8	MOB-AN-72.8-2018-08-21	Angling	10V	590717	6211090	10V	590769	6211056
	72.6	MOB-EF-72.6-2018-08-21	Backpack Electrofishing	10V	590827	6210959	10V	590827	6210818
	72.2	MOB-ES-72.2-2018-08-21	Small Fish Boat Electroshocking	10V	590593	6211137	10V	590987	6210776
	69.8	MOB-ES-69.8-2018-08-21	Small Fish Boat Electroshocking	10V	592530	6211387	10V	593422	6211557
	69.3	MOB-EF-69.3-2018-08-21	Backpack Electrofishing	10V	593285	6211595	10V	593384	6211584
	67.9	MOB-ES-67.9-2018-08-21	Small Fish Boat Electroshocking	10U	594045	6211031	10U	594464	6211107
	67.6	MOB-AN-67.6-2018-08-21	Angling	10V	594496	6211162	10V	594487	6211199
	65.5	MOB-ES-65.5-2018-08-21	Small Fish Boat Electroshocking	10V	594432	6211997	10V	594426	6211800
	65.2	MOB-EF-65.2-2018-08-21	Backpack Electrofishing	10V	594363	6211912	10V	594310	6211879
	64.4	MOB-AN-64.4-2018-08-21	Angling	10V	594804	6211640	10V	594817	6211655
	60.1	MOB-ES-60.1-2018-08-21	Small Fish Boat Electroshocking	10V	595674	6213953	10V	596068	6214515
	58.0	MOB-ES-58.0-2018-08-22	Small Fish Boat Electroshocking	10V	596373	6215610	10V	596591	6215550
	57.6	MOB-AN-57.6-2018-08-22	Angling	10V	596741	6215483	10V	596691	6215540
	57.5	MOB-ES-57.5-2018-08-22	Small Fish Boat Electroshocking	10V	596775	6215477	10V	597485	6215111
	57.4	MOB-EF-57.4-2018-08-22	Backpack Electrofishing	10V	596640	6215526	10V	596721	6215492

[a] Upstream River Km of each site as measured upstream from the stream's confluence.

[b] NAD83.

continued…

Table A1 Continued.

River	Upstream River Km[a]	Site Name	Sample Method	Upstream UTM[b]			Downstream UTM[b]		
				Zone	Easting	Northing	Zone	Easting	Northing
Moberly River	56.9	MOB-EF-56.9-2018-08-22	Backpack Electrofishing	10V	597169	6215411	10V	597160	6215323
	56.3	MOB-AN-56.3-2018-08-22	Angling	10V	597632	6215125	10V	597697	6215143
	55.8	MOB-EF-55.8-2018-08-22	Backpack Electrofishing	10V	598248	6215447	10V	598316	6215539
	55.7	MOB-ES-55.7-2018-08-22	Small Fish Boat Electroshocking	10V	598214	6215381	10V	598364	6215554
	54.7	MOB-ES-54.7-2018-08-22	Small Fish Boat Electroshocking	10V	598781	6215132	10V	598474	6214643
	53.5	MOB-AN-53.5-2018-08-22	Angling	10V	598484	6214298	10V	598452	6214178
	53.1	MOB-EF-53.1-2018-08-22	Backpack Electrofishing	10V	598485	6214292	10V	598450	6214169
	51.6	MOB-ES-51.6-2018-08-22	Small Fish Boat Electroshocking	10V	599485	6215065	10V	599252	6215425
	50.9	MOB-ES-50.9-2018-08-22	Small Fish Boat Electroshocking	10V	599259	6215565	10V	599194	6215836
	50.7	MOB-AN-50.7-2018-08-22	Angling	10V	599251	6215712	10V	599221	6215743
	50.4	MOB-ES-50.4-2018-08-22	Small Fish Boat Electroshocking	10V	599195	6215981	10V	599903	6216449
	49.8	MOB-EF-49.8-2018-08-22	Backpack Electrofishing	10V	599375	6216485	10V	599439	6216546
	49.2	MOB-ES-49.2-2018-08-22	Small Fish Boat Electroshocking	10V	599903	6216449	10V	600412	6216773
	48.1	MOB-EF-48.1-2018-08-31	Backpack Electrofishing	10V	600581	6217104	10V	600628	6217219
	47.5	MOB-ES-47.5-2018-08-23	Small Fish Boat Electroshocking	10V	601039	6217189	10V	601319	6217211
	47.2	MOB-EF-47.2-2018-08-23	Backpack Electrofishing	10V	601317	6217401	10V	601317	6217537
	47.1	MOB-AN-47.1-2018-08-23	Angling	10V	601333	6217447	10V	601333	6217477
	46.8	MOB-ES-46.8-2018-08-23	Small Fish Boat Electroshocking	10V	601287	6217621	10V	601951	6217785
	45.4	MOB-EF-45.4-2018-08-23	Backpack Electrofishing	10V	602220	6217907	10V	602267	6217918
	45.3	MOB-ES-45.3-2018-08-23	Small Fish Boat Electroshocking	10V	602328	6217941	10V	602875	6217786
	45.2	MOB-AN-45.2-2018-08-23	Angling	10V	602427	6217686			
	44.7	MOB-ES-44.7-2018-08-23	Small Fish Boat Electroshocking	10V	602875	6217783	10V	603423	6217901
	44.4	MOB-EF-44.4-2018-08-23	Backpack Electrofishing	10V	602732	6217777	10V	602864	6217750
	43.6	MOB-EF-43.6-2018-08-13	Backpack Electrofishing	10V	603493	6217946	10V	603612	6218008
	43.5	MOB-AN-43.5-2018-08-13	Angling	10V	603618	6218007			
	43.5	MOB-ES-43.5-2018-08-13	Small Fish Boat Electroshocking	10V	603543	6217933	10V	603906	6217967
	43.0	MOB-EF-43.0-2018-08-14	Backpack Electrofishing	10V	604018	6218075	10V	604115	6218151
	42.5	MOB-EF-42.5-2018-08-14	Backpack Electrofishing	10V	604229	6218461	10V	604224	6218467
	42.0	MOB-EF-42.0-2018-08-14	Backpack Electrofishing	10V	604438	6218656	10V	604563	6218748
	42.0	MOB-AN-42.0-2018-08-14	Angling	10V	604518	6218723			
	41.6	MOB-AN-41.6-2018-08-14	Angling	10V	604840	6218953	10V	604841	6218892
	41.4	MOB-EF-41.4-2018-08-14	Backpack Electrofishing	10V	604703	6218874	10V	604832	6218851
	41.3	MOB-EF-41.3-2018-08-14	Backpack Electrofishing	10V	604696	6218875	10V	604840	6218874
	41.0	MOB-EF-41.0-2018-08-14	Backpack Electrofishing	10V	605181	6218859	10V	605206	6218923
	41.0	MOB-EF-41.0-2018-08-15	Backpack Electrofishing	10V	605181	6218859	10V	605206	6218923
	40.5	MOB-EF-40.5-2018-08-15	Backpack Electrofishing	10V	605440	6219174	10V	605558	6219184
	40.4	MOB-AN-40.4-2018-08-15	Angling	10V	605536	6219131	10V	605206	6218923
	40.2	MOB-EF-40.2-2018-08-15	Backpack Electrofishing	10V	605694	6219290	10V	605811	6219316
	40.2	MOB-AN-40.2-2018-08-15	Angling	10V	605713	6219315	10V	606171	6219758
	39.5	MOB-EF-39.5-2018-08-15	Backpack Electrofishing	10V	606172	6219757	10V	606238	6219731
	39.4	MOB-EF-39.4-2018-08-31	Backpack Electrofishing	10V	606348	6219897	10V	606251	6220055
	39.1	MOB-AN-39.1-2018-08-15	Angling	10V	606256	6220231	10V	606580	6220776
	38.3	MOB-EF-38.3-2018-08-15	Backpack Electrofishing	10V	606576	6220774	10V	606547	6220837
	37.7	MOB-EF-37.7-2018-08-15	Backpack Electrofishing	10V	606598	6221153	10V	606781	6221359

[a] Upstream River Km of each site as measured upstream from the stream's confluence.

[b] NAD83.

continued…

Table A1 Concluded.

River	Upstream River Km[a]	Site Name	Sample Method	Upstream UTM[b]			Downstream UTM[b]		
				Zone	Easting	Northing	Zone	Easting	Northing
Moberly River	37.7	MOB-AN-37.7-2018-08-15	Angling	10V	606600	6221155	10V	606512	6221179
	28.7	MOB-EF-28.7-2018-08-31[c]	Backpack Electrofishing						
	28.5	MOB-EF-28.5-2018-08-16	Backpack Electrofishing	10V	610114	6225018	10V	610053	6224967
	28.5	MOB-BS-28.5-2018-08-16	Beach Seining	10V	610019	6224984	10V		
	27.5	MOB- AN-27.5-2018-08-16	Angling	10V	610275	6224969	10V	610275	6224969
	26.5	MOB-AN-26.5-2018-08-16	Angling	10V	610505	6225772	10V	610505	6225772
	26.3	MOB-EF-26.3-2018-08-16	Backpack Electrofishing	10V	610488	6225807	10V	610527	6225838
	26.2	MOB-BS-26.2-2018-08-16	Beach Seining	10V	610526	6225852			
	24.2	MOB-AN-24.2-2018-08-16	Angling	10V	612068	6227276	10V	612096	6227258
	23.7	MOB-AN-23.7-2018-08-16	Angling	10V	612168	6227242			
	22.7	MOB-AN-22.7-2018-08-16	Angling	10V	613051	6227392	10V	613051	6227392
	22.6	MOB-EF-22.6-2018-08-16	Backpack Electrofishing	10V	613111	6227413	10V	613157	6227444
	21.4	MOB-AN-21.4-2018-08-16	Angling	10V	614079	6227838	10V	614162	6227909
	21.2	MOB-EF-21.2-2018-08-16	Backpack Electrofishing	10V	614006	6227934	10V	614062	6227911
	18.7	MOB-EF-18.7-2018-08-31[c]	Backpack Electrofishing						
	16.5	MOB-EF-16.5-2018-08-17	Backpack Electrofishing	10V	617063	6228927	10V	617068	6228826
	16.3	MOB-AN-16.3-2018-08-17	Angling	10V	617058	6228940	10V	617102	6228768
	15.6	MOB-EF-15.6-2018-08-17	Backpack Electrofishing	10V	617645	6228788	10V	617740	6228782
	15.3	MOB-AN-15.3-2018-08-17	Angling	10V	617616	6228767	10V	617707	6228844
	14.4	MOB-ES-14.4-2018-08-17	Small Fish Boat Electroshocking	10V	618546	6228842	10V	619195	6228650
	13.8	MOB-EF-13.8-2018-08-17	Backpack Electrofishing	10V	619165	6228622	10V	619293	6228662
	13.5	MOB-AN-13.5-2018-08-17	Angling	10V	619190	6228628	10V	619366	6228730
	13.5	MOB-EF-13.5-2018-08-31[c]	Backpack Electrofishing						
	8.2	MOB-AN-8.2-2018-08-17	Angling	10V	623414	6227293	10V	623438	6227293
	8.2	MOB-ES-8.2-2018-08-17	Small Fish Boat Electroshocking	10V	623419	6227304	10V	623870	6227469
	5.9	MOB-ES-5.9-2018-08-17	Small Fish Boat Electroshocking	10V	625171	6227722	10V	625569	6227864
	3.7	MOB-AN-3.7-2018-08-18	Angling	10V	626192	6228451	10V	626171	6228501
	3.7	MOB-ES-3.7-2018-08-18	Small Fish Boat Electroshocking	10V	626226	6228560	10V	626490	6228515
	3.4	MOB-EF-3.4-2018-08-18	Backpack Electrofishing	10V	626370	6228637	10V	626438	6228458
	2.1	MOB-ES-2.1-2018-08-18	Small Fish Boat Electroshocking	10V	627049	6229255	10V	627485	6229394
	1.4	MOB-AN-1.4-2018-08-18	Angling	10V	627686	6229447	10V	627686	6229447

[a] Upstream River Km of each site as measured upstream from the stream's confluence.

Concluded.

[b] NAD83.

[c] Synoptic sampling only to collect genetic samples from small-bodied fish. Location, habitat and effort data were not recorded.

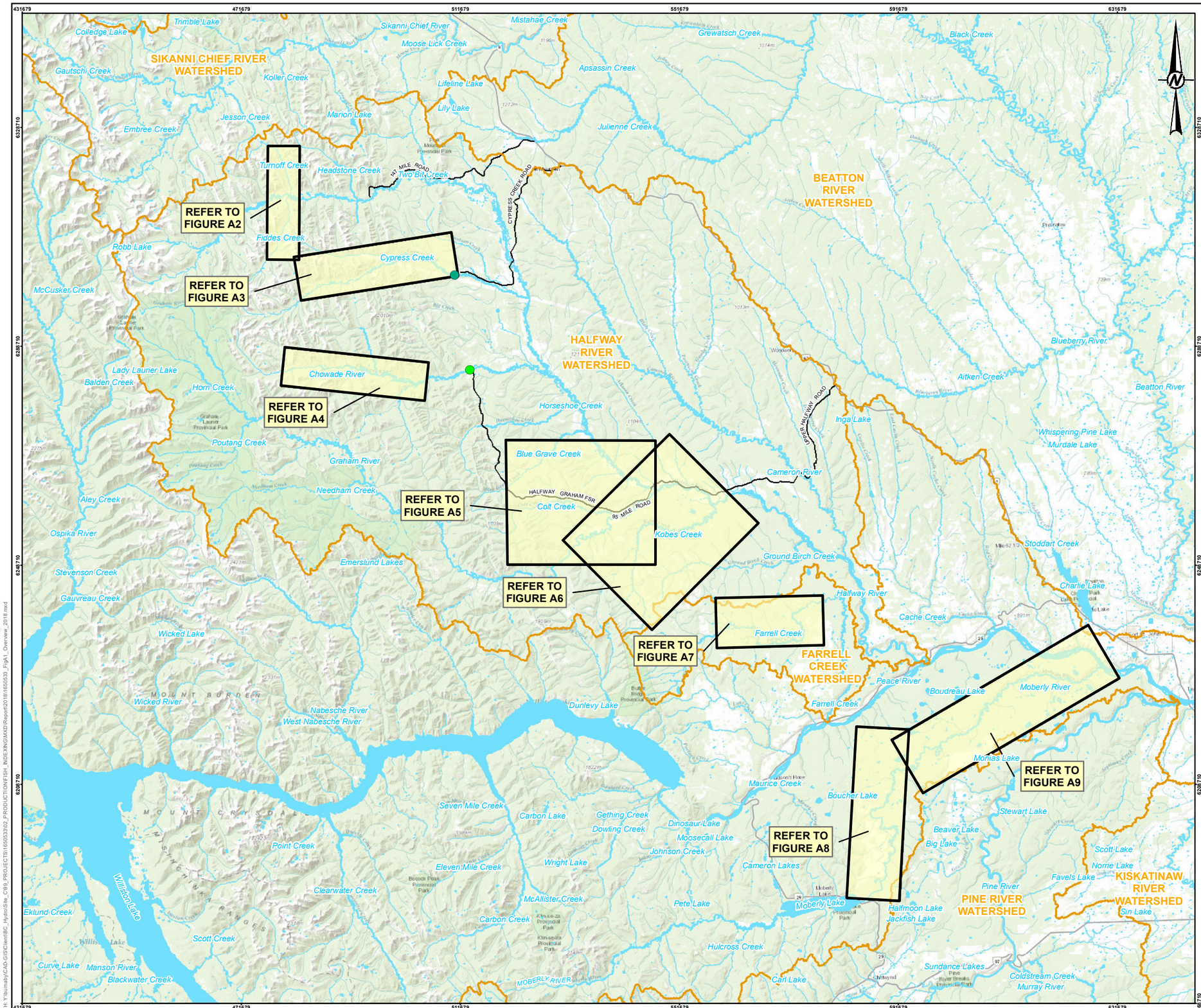
Table A2 Location information for Moberly River sections sampled during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

River	Section	Habitat Type	Length (km)	River Km[a]	Upstream UTM[b]			River Km[a]	Downstream UTM[b]		
					Zone	Easting	Northing		Zone	Easting	Northing
Moberly River	MR-S1A	Irregular Meanders[a]	5.9	119.6	10V	587890	6189345	113.8	10V	589439	6193416
	MR-S1	Tortuous Meanders	4.5	105.1	10V	590194	6198180	100.6	10V	591248	6200259
	MR-S2	Tortuous Meanders	15.8	100.6	10V	591248	6200259	84.8	10V	589031	6204822
	MR-S3	Tortuous Meanders	12.0	84.1	10V	589407	6205349	72.2	10V	591076	6210858
	MR-S4	Tortuous Meanders	11.3	72.2	10V	591076	6210858	60.9	10V	595402	6213268
	MR-S5	Tortuous Meanders	9.0	60.9	10V	595402	6213268	51.9	10V	599325	6214944
	MR-S6	Tortuous Meanders	4.3	51.9	10V	599325	6214944	47.6	10V	600924	6217136
	MR-S7	Irregular meandering; Braided; Frequently Confined	18.2	47.6	10V	600924	6217136	29.5	10V	609657	6224625
	MR-S8	Irregular meandering; Braided; Frequently Confined	11.4	29.5	10V	609657	6224625	18.0	10V	616182	6228657
	MR-S9	Irregular meandering; Braided; Frequently Confined	5.4	18.0	10V	616182	6228657	12.6	10V	619999	6228240
	MR-S10	Irregular meandering; Braided; Frequently Confined	12.6	12.6	10V	619999	6228240	0.0	10V	628556	6230023

[a] River Km as measured upstream from the Moberly River confluence.

[b] NAD83.

[c] Habitat types and section breaks for the Moberly River were established by Mainstream Aquatics Ltd. (2011).



LEGEND

- CHOWADE RIVER PIT TAG DETECTOR STATION
- CYPRESS CREEK PIT TAG DETECTOR STATION
- MAJOR WATERSHED

BASE MAP FEATURES

- HIGHWAY
- ROAD
- WATERCOURSE
- WATERBODY

KEY PLAN

0 15 30

1:700,000 KILOMETRES

REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. WATERSHED DATA OBTAINED FROM THE GOVERNMENT OF BRITISH COLUMBIA
3. BASEDATA SOURCES: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESR I JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY (Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY (Mon-1b, Task 2c) STUDY AREA, 2018

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DB
PREPARED	MH
REVIEWED	DF
APPROVED	SR

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2018/5001	0	**A1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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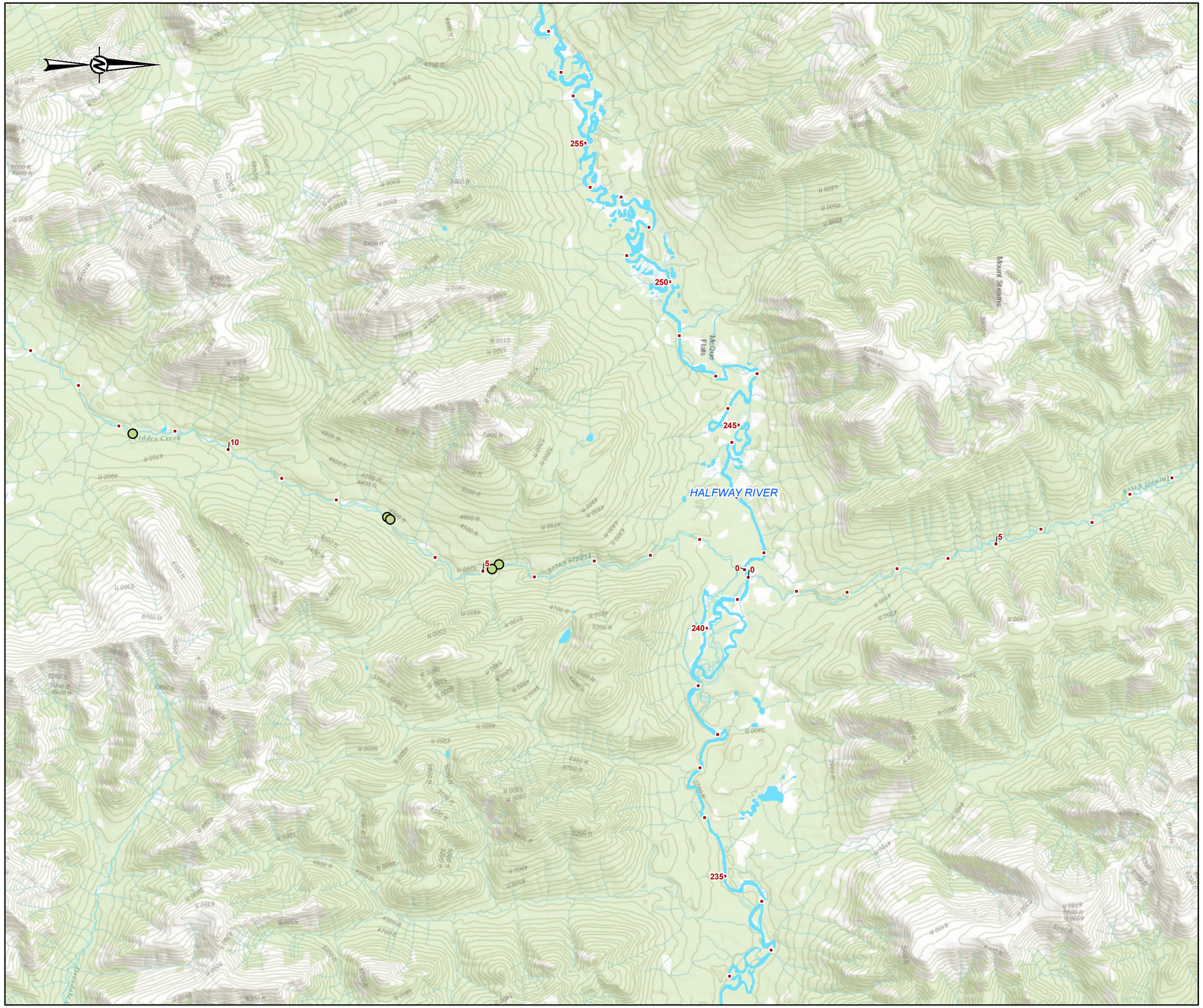


LEGEND

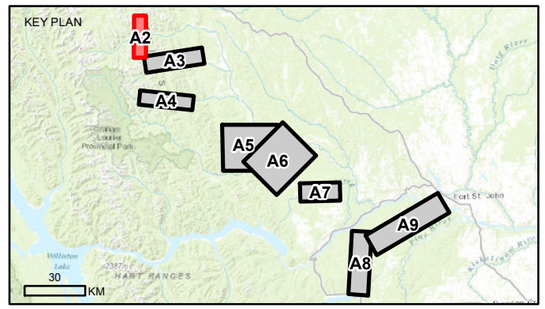
- RIVER KILOMETRE POSTS

UPSTREAM EXTENT OF EACH SAMPLE SITE

- BACKPACK ELECTROFISHING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



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REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY (Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) FIDDES CREEK STUDY AREA, 2018.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DB
PREPARED	MH
REVIEWED	DF
APPROVED	SR

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2018/5001	0	**A2**

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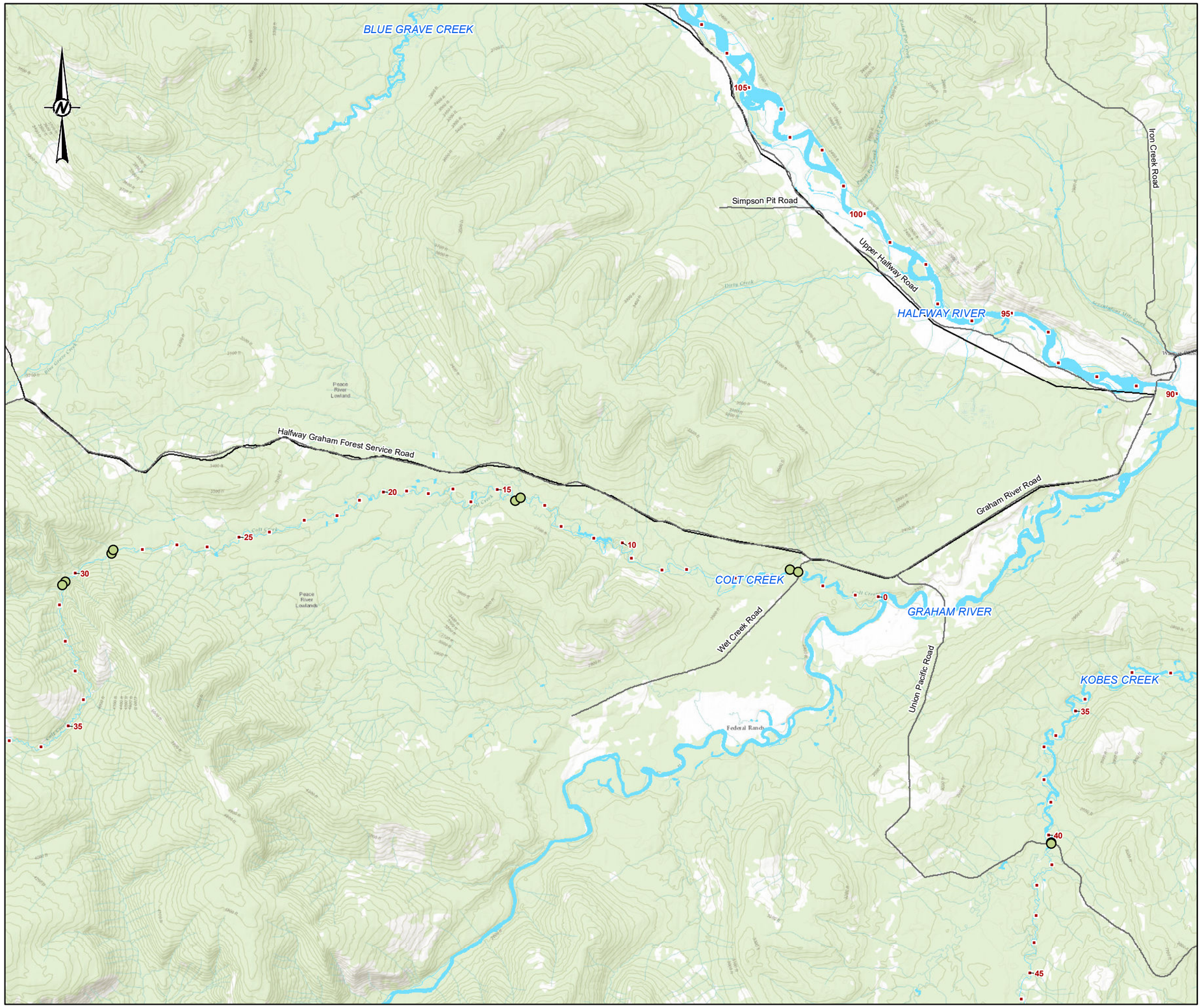


LEGEND

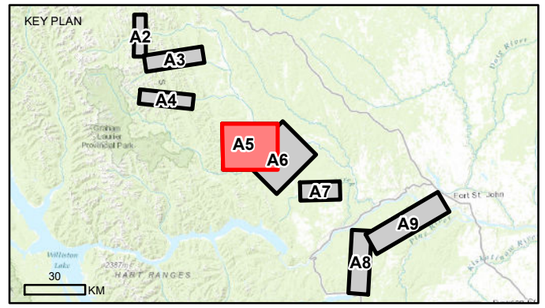
- RIVER KILOMETRE POSTS

UPSTREAM EXTENT OF EACH SAMPLE SITE

- BACKPACK ELECTROFISHING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



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REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY (Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) COLT CREEK STUDY AREA, 2018.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DB
PREPARED	MH
REVIEWED	DF
APPROVED	SR

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2018/5001	0	**A5**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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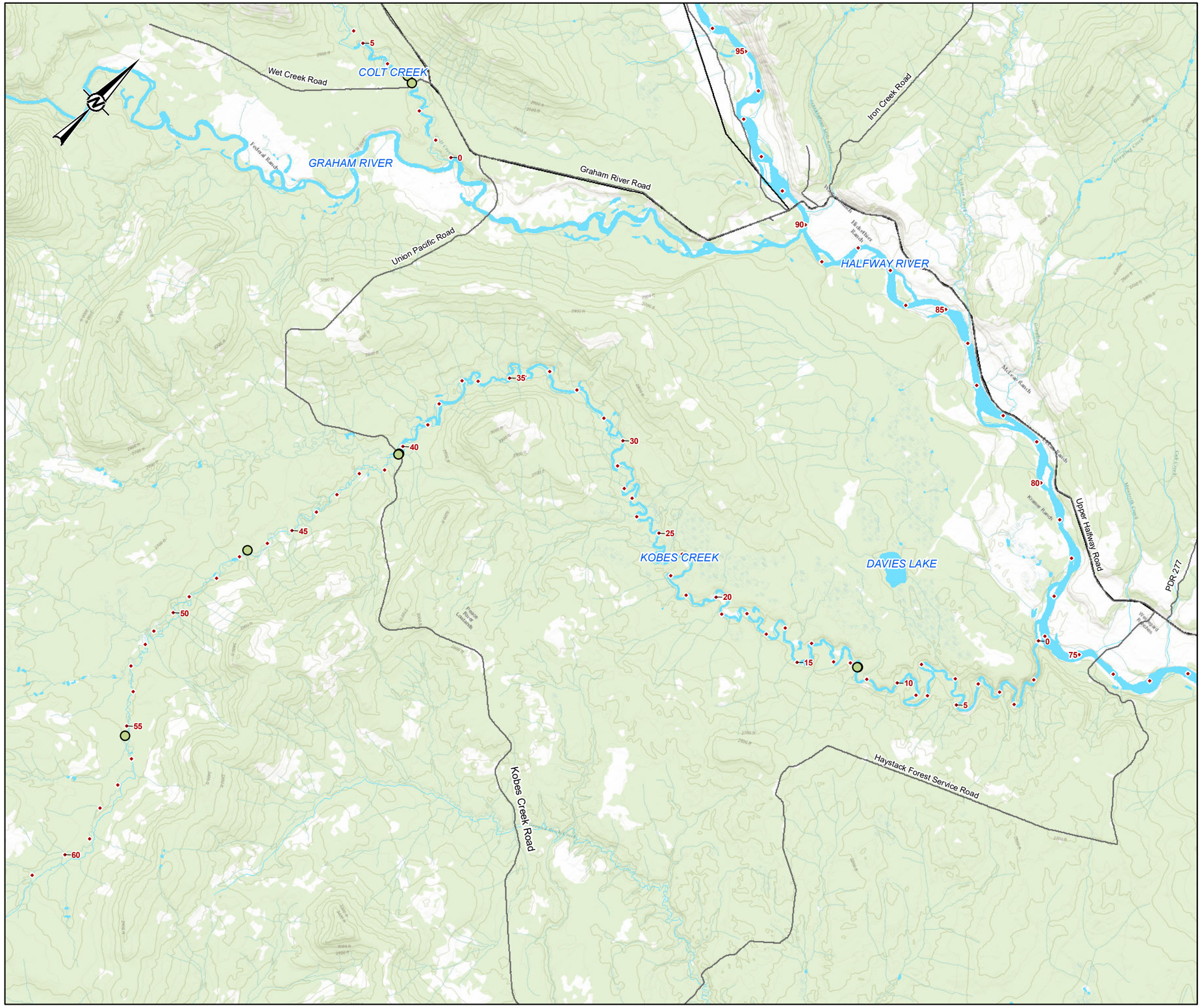


LEGEND

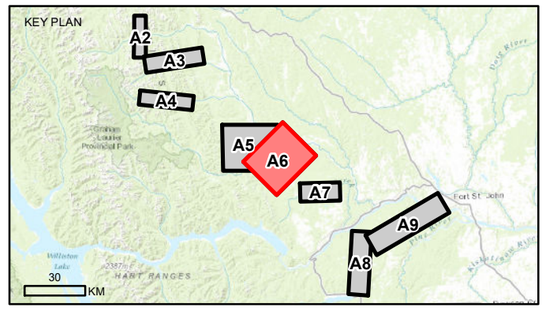
- RIVER KILOMETRE POSTS

UPSTREAM EXTENT OF EACH SAMPLE SITE

- BACKPACK ELECTROFISHING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



0 1,750 3,500

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REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY
(Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) KOBES CREEK STUDY AREA, 2018.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DB
PREPARED	MH
REVIEWED	DF
APPROVED	SR

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2018/5001	0	**A6**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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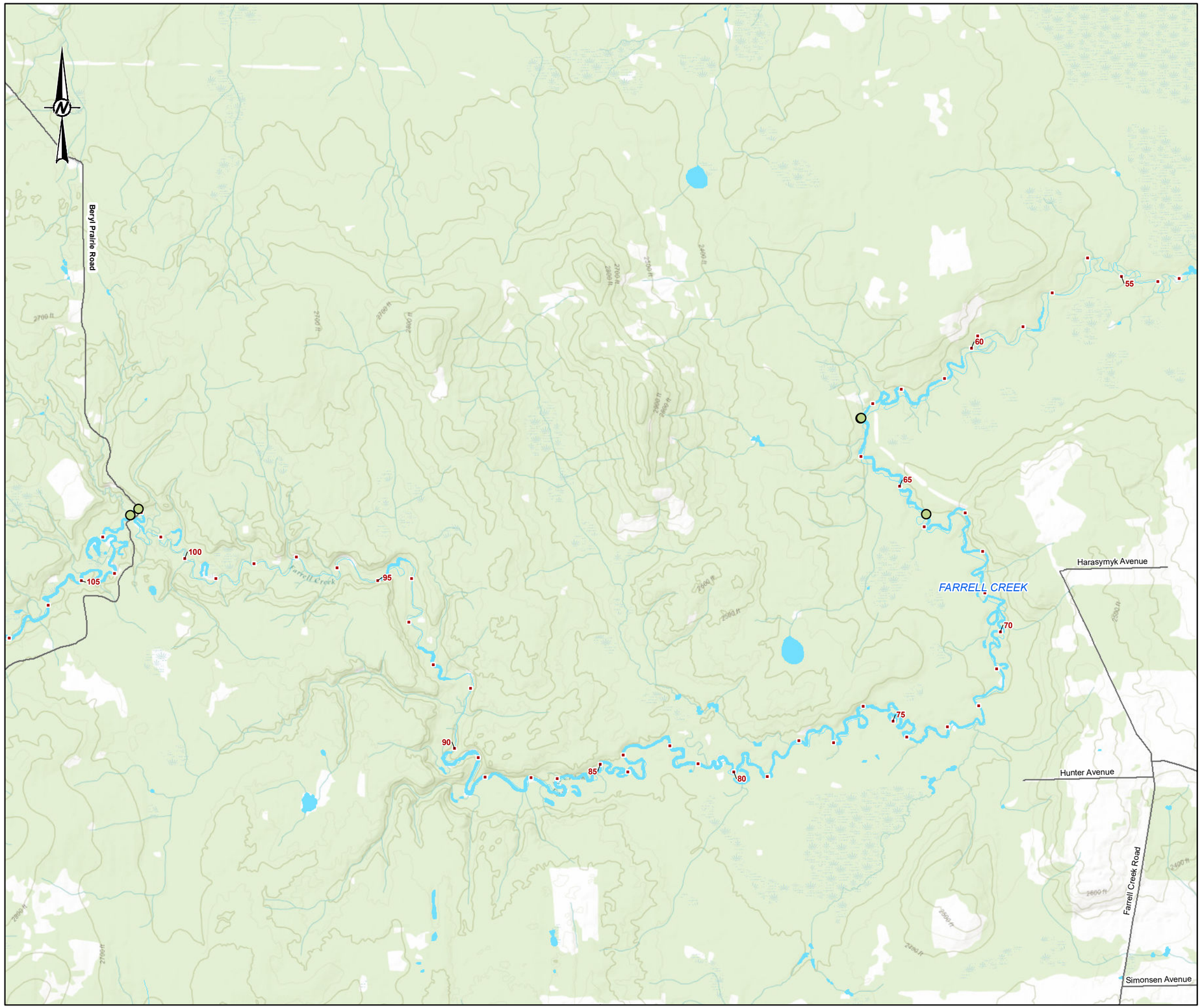


LEGEND

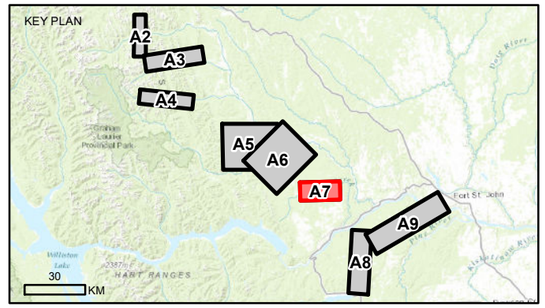
- RIVER KILOMETRE POSTS

UPSTREAM EXTENT OF EACH SAMPLE SITE

- BACKPACK ELECTROFISHING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



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REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY (Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) FARRELL CREEK STUDY AREA, 2018.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DB
PREPARED	MH
REVIEWED	DF
APPROVED	SR

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2018/5001	0	**A7**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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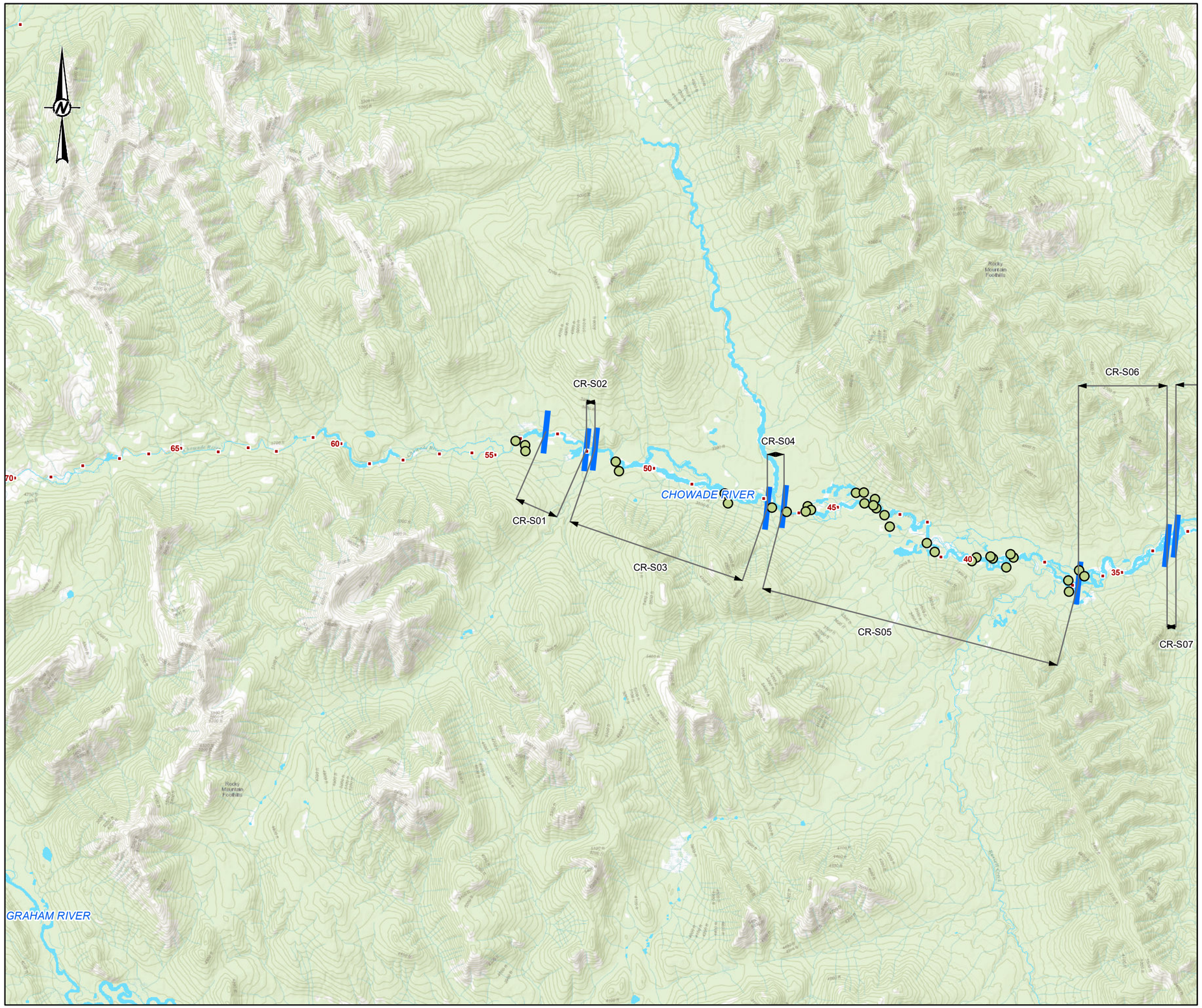


LEGEND

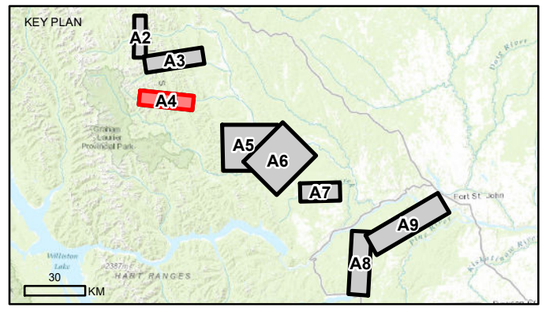
- RIVER KILOMETRE POSTS
- SECTION BREAK

UPSTREAM EXTENT OF EACH SAMPLE SITE

- BACKPACK ELECTROFISHING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



0 1,750 3,500

1:90,000 METRES

REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY (Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) CHOWADE RIVER STUDY AREA, 2018.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DB
PREPARED	MH
REVIEWED	DF
APPROVED	SR

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2018/5001	0	**A4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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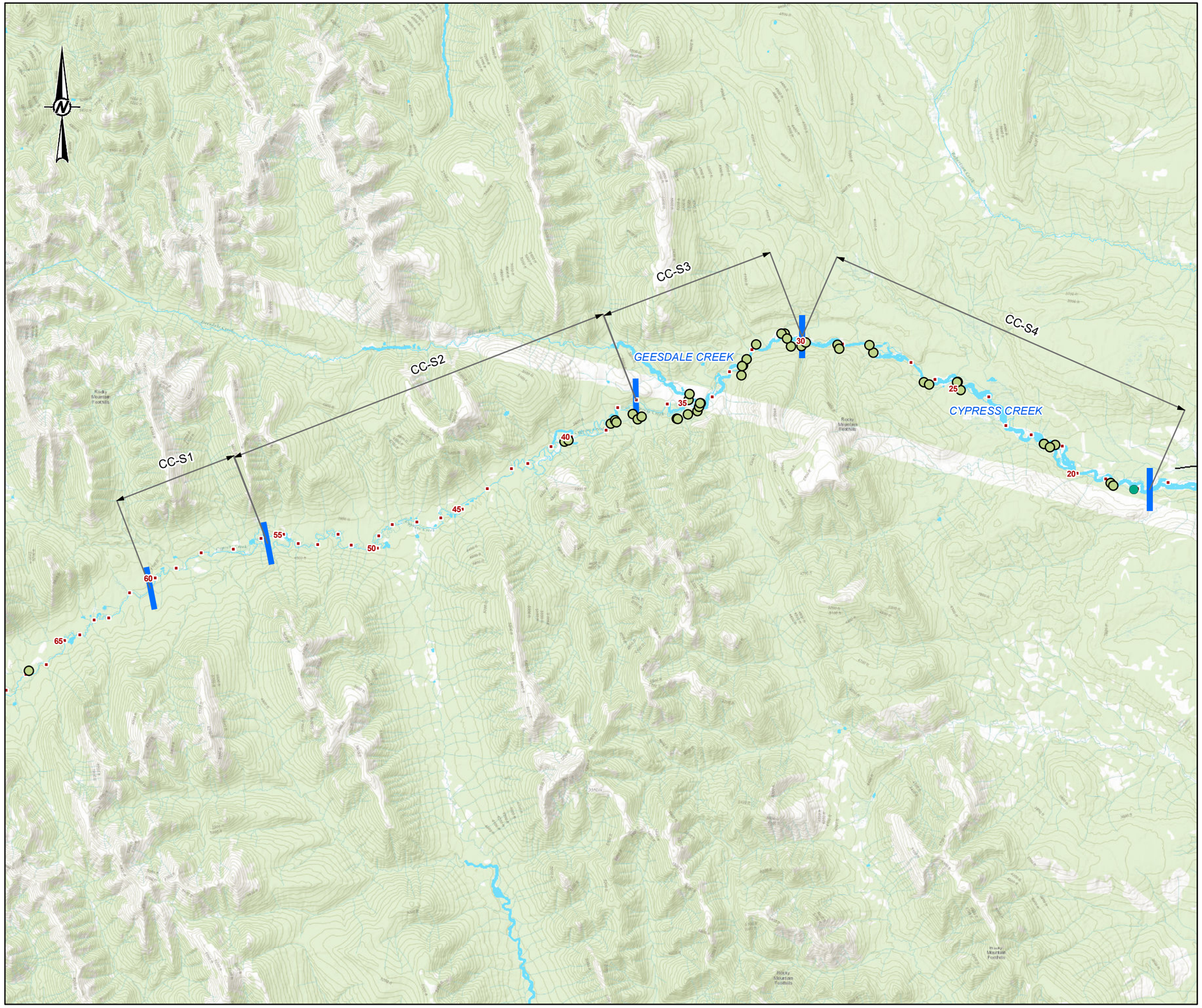


LEGEND

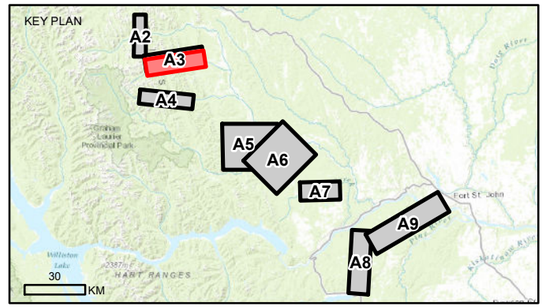
- RIVER KILOMETRE POSTS
- SECTION BREAK

UPSTREAM EXTENT OF EACH SAMPLE SITE

- BACKPACK ELECTROFISHING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



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REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY
(Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) CYPRESS CREEK STUDY AREA, 2018.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DB
PREPARED	MH
REVIEWED	DF
APPROVED	SR

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2018/5001	0	**A3**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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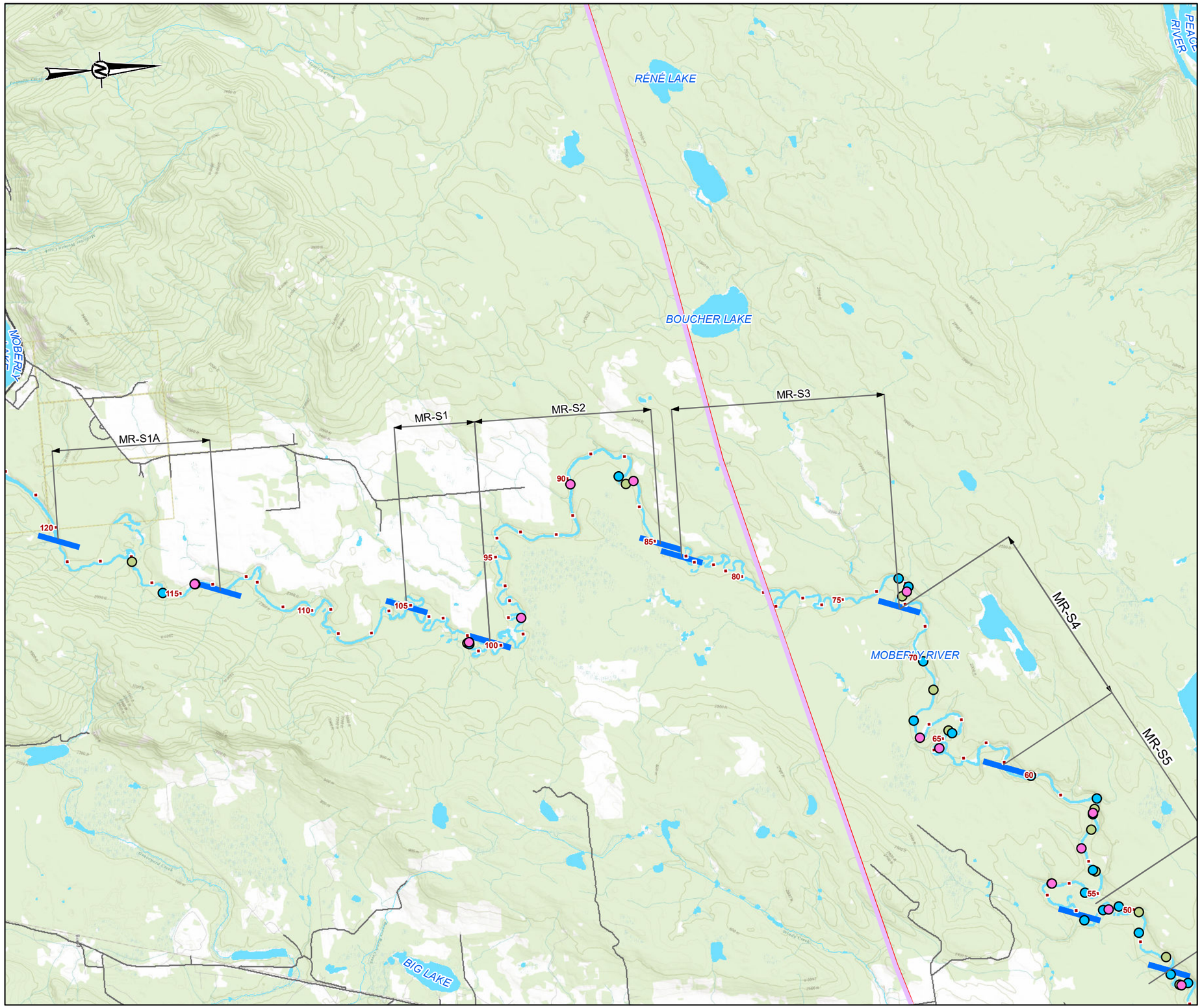


LEGEND

- RIVER KILOMETRE POSTS
- SECTION BREAK

UPSTREAM EXTENT OF EACH SAMPLE SITE

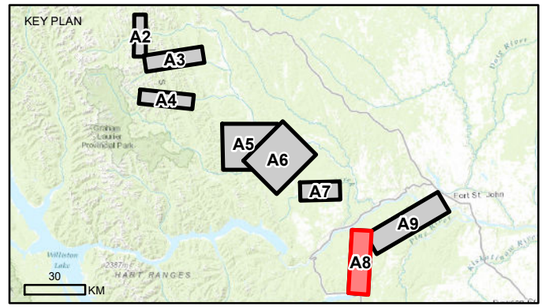
- ANGLING
- BACKPACK ELECTROFISHING
- BEACH SEINING
- SMALL FISH BOAT ELECTROSHOCKING

TRANSMISSION LINE RIGHT OF WAY (ROW)

- BCH EXISTING ROW
- ONE-TIME CLEARING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



0 2,000 4,000

1:100,000 METRES

REFERENCES

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4. ROW PROVIDED BY BCHYDRO, DATED 2017-07-13.

COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY
(Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) MOBERLY RIVER STUDY AREA, 2018.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DB
PREPARED	MH
REVIEWED	DF
APPROVED	SR

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2018/5001	0	**A8**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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HALFWAY RIVER
PEACE RIVER
CACHE CREEK
BOUDREAU LAKE
MOBERLY RIVER
NORTH MONIAS ROAD BRIDGE
MONIAS LAKE
PINE RIVER
BEAVER LAKE
GRAVEYARD LAKE
STEWART LAKE

MR-S4
MR-S5
MR-S6
MR-S7
MR-S8
MR-S9
MR-S10

Predicted Inundation Level

LEGEND

- RIVER KILOMETRE POSTS
- SECTION BREAK

UPSTREAM EXTENT OF EACH SAMPLE SITE

- ANGLING
- BACKPACK ELECTROFISHING
- BEACH SEINING
- SMALL FISH BOAT ELECTROSHOCKING

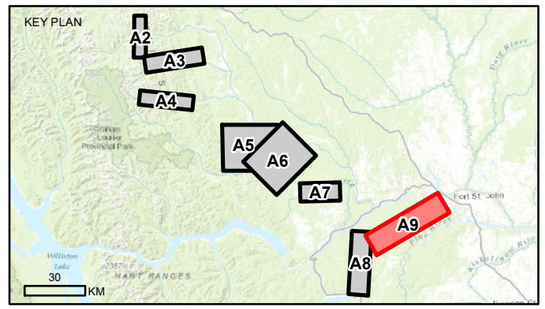
TRANSMISSION LINE RIGHT OF WAY (ROW)

- BCH EXISTING ROW
- LOO - PERMANENT SUBSTATION
- ONE-TIME CLEARING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY

KEY PLAN



0 2,750 5,500
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REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. WATERSHED DATA OBTAINED FROM THE GOVERNMENT OF BRITISH COLUMBIA
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CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY (Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) MOBERLY RIVER STUDY AREA, 2018.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DB
PREPARED	MH
REVIEWED	DF
APPROVED	SR

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2018/5001	0	**A9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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APPENDIX B

Catch and Effort Data

Table B1 Summary of backpack electrofishing sites sampled during the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

River	Section[a]	River Km[b]	Site Name	Sample Date	Sample Length (m)	Sample Time (s)
Chowade River		54.3	CHR-EF54.3-2018-07-22	22-Jul-2018	50	200
		54.2	CHR-EF54.2-2018-07-22	22-Jul-2018	223	563
		54.1	CHR-EF54.1-2018-07-22	22-Jul-2018	100	681
		51.0	CHR-EF51.0-2018-07-22	22-Jul-2018	135	1055
		50.9	CHR-EF50.9-2018-07-22	22-Jul-2018	61	581
		48.1	CHR-EF48.1-2018-07-22	22-Jul-2018	120	682
		47.9	CHR-EF47.9-2018-07-22	22-Jul-2018	238	639
		47.0	CHR-EF46.7-2018-08-06	6-Aug-2018	539	2763
		46.3	CHR-EF46.3-2018-08-06	6-Aug-2018	183	1641
		45.8	CHR-EF45.8-2018-07-22	22-Jul-2018	16	514
		45.7	CHR-EF45.7-2018-07-22	22-Jul-2018	454	845
		45.6	CHR-EF45.6-2018-07-22	22-Jul-2018	56	311
		45.0	CHR-EF44.2-2018-08-06	6-Aug-2018	98	2746
		44.5	CHR-EF44.5-2018-07-22	22-Jul-2018	52	1002
		44.3	CHR-EF44.3-2018-07-22	22-Jul-2018	158	1309
		44.0	CHR-EF43.8-2018-08-06	6-Aug-2018	115	2275
		44.0	CHR-EF44.0-2018-08-06	6-Aug-2018	252	1150
		43.9	CHR-EF43.9-2018-08-06	6-Aug-2018	88	2749
		43.4	CHR-EF43.4-2018-07-21	21-Jul-2018	57	828
		43.0	CHR-EF43.0-2018-07-21	21-Jul-2018	370	1184
		41.5	CHR-EF41.5-2018-07-21	21-Jul-2018	23	784
		41.2	CHR-EF41.2-2018-07-21	21-Jul-2018	49	967
		40.0	CHR-EF39.8-2018-08-05	5-Aug-2018	246	2113
		40.0	CHR-EF40.0-2018-08-05	5-Aug-2018	217	2112
		40.0	CHR-EF39.7-2018-08-05	5-Aug-2018	339	3957
		40.0	CHR-EF39.3-2018-08-05	5-Aug-2018	400	2939
		39.5	CHR-EF39.5-2018-08-06	6-Aug-2018	506	2358
		39.0	CHR-EF38.8-2018-08-05	5-Aug-2018	258	3011
		39.0	CHR-EF39.0-2018-08-05	5-Aug-2018	268	2193
		37.2	CHR-EF37.2-2018-07-21	21-Jul-2018	15	636
		37.1	CHR-EF37.1-2018-07-21	21-Jul-2018	130	426
		36.6	CHR-EF36.6-2018-07-21	21-Jul-2018	200	607
		36.5	CHR-EF36.5-2018-07-21	21-Jul-2018	270	603
Chowade River Total					**6,286**	**46,424**
Cypress Creek		67.0	CYC-EF66.9-2018-08-08	8-Aug-2018	35	296
		40.3	CYC-EF40.3-2018-08-09	9-Aug-2018	290	1518
		40.1	CYC-EF40.1-2018-08-09	9-Aug-2018	184	1207
		39.0	CYC-EF38.8-2018-08-04	4-Aug-2018	266	1723
		39.0	CYC-EF38.7-2018-08-02	2-Aug-2018	76	499
		38.2	CYC-EF38.2-2018-08-04	4-Aug-2018	480	2333
		38.0	CYC-EF37.6-2018-07-24	24-Jul-2018	117	1232
		37.5	CYC-EF37.5-2018-07-24	24-Jul-2018	65	240
		37.4	CYC-EF37.4-2018-07-24	24-Jul-2018	120	992

[a] only applicable to Moberly River sites.

continued…

[b] as measured upstream from the stream's confluence.

Table B1 Continued.

River	Section[a]	River Km[b]	Site Name	Sample Date	Sample Length (m)	Sample Time (s)
Cypress Creek		35.8	CYC-EF35.8-2018-07-24	24-Jul-2018	30	393
		35.7	CYC-EF35.7-2018-07-24	24-Jul-2018	140	1465
		35.1	CYC-EF35.1-2018-07-24	24-Jul-2018	91	171
		35.0	CYC-EF35.05-2018-07-24	24-Jul-2018	154	1258
		35.0	CYC-EF35.0-2018-07-24	24-Jul-2018	200	962
		34.9	CYC-EF34.9-2018-07-24	24-Jul-2018	434	3313
		34.7	CYC-EF34.7-2018-07-24	24-Jul-2018	584	1937
		34.7	CYC-EF34.7-2018-08-08	8-Aug-2018	484	1915
		34.7	CYC-EF34.69-2018-08-08	8-Aug-2018	507	2116
		32.8	CYC-EF32.8-2018-07-23	23-Jul-2018	128	1799
		32.6	CYC-EF32.6-2018-07-23	23-Jul-2018	55	1378
		32.6	CYC-EF32.55-2018-07-23	23-Jul-2018	50	426
		32.3	CYC-EF32.3-2018-08-09	9-Aug-2018	345	2133
		32.0	CYC-EF31.8-2018-08-09	9-Aug-2018	195	2879
		31.0	CYC-EF30.9-2015-07-23	23-Jul-2018	64	256
		31.0	CYC-EF30.88-2018-07-23	23-Jul-2018	154	721
		31.0	CYC-EF30.8-2018-07-23	23-Jul-2018	73	619
		30.7	CYC-EF30.7-2018-07-23	23-Jul-2018	199	2761
		30.4	CYC-EF30.4-2018-07-23	23-Jul-2018	206	1414
		30.1	CYC-EF30.1-2018-07-23	23-Jul-2018	97	547
		29.2	CYC-EF29.2-2018-07-23	23-Jul-2018	171	1139
		29.0	CYC-EF28.9-2018-07-23	23-Jul-2018	160	1007
		28.3	CYC-EF28.3-2018-08-08	8-Aug-2018	312	2045
		28.1	CYC-EF28.1-2018-08-08	8-Aug-2018	86	1541
		26.5	CYC-EF26.5-2018-08-04	4-Aug-2018	231	1863
		26.2	CYC-EF26.2-2018-08-04	4-Aug-2018	229	2603
		25.3	CYC-EF25.3-2018-08-09	2-Aug-2017	83	903
		25.3	CYC-EF25.25-2018-08-09	9-Aug-2018	651	2152
		24.9	CYC-EF24.9-2018-08-09	9-Aug-2018	548	2454
		21.7	CYC-EF21.7-2018-08-08	8-Aug-2018	269	666
		21.6	CYC-EF21.6-2018-08-08	8-Aug-2018	207	865
		21.3	CYC-EF21.3-2018-08-08	8-Aug-2018	126	586
		21.2	CYC-EF21.2-2018-08-08	8-Aug-2018	200	1080
		19.0	CYC-EF18.9-2018-08-04	4-Aug-2018	350	2199
		19.0	CYC-EF18.8-2018-08-04	4-Aug-2018	285	2597
Cypress Creek Total					**9,731**	**62,203**
Fiddes Creek		11.7	FIC-EF11.7-2018-08-07	7-Aug-2018	232	1742
		7.0	FIC-EF7.0-2018-08-07	7-Aug-2018	108	2387
		6.8	FIC-EF6.8-2018-08-07	7-Aug-2018	254	1860
		4.8	FIC-EF4.8-2018-08-07	7-Aug-2018	141	1803
		4.6	FIC-EF4.6-2018-08-07	7-Aug-2018	49	1363
Fiddes Creek Total					**784**	**9,155**

[a] only applicable to Moberly River sites.

[b] as measured upstream from the stream's confluence.

continued...

Table B1 Continued.

River	Section[a]	River Km[b]	Site Name	Sample Date	Sample Length (m)	Sample Time (s)
Colt Creek		31.0	COC-EF30.4-2018-08-02	2-Aug-2018	93	814
		30.5	COC-EF30.5-2018-08-02	2-Aug-2018	140	840
		29.0	COC-EF28.8-2018-08-02	2-Aug-2018	65	1303
		28.9	COC-EF28.9-2018-08-02	2-Aug-2018	194	1086
		14.1	COC-EF14.1-2018-08-02	2-Aug-2018	221	1889
		14.0	COC-EF14.0-2018-08-02	2-Aug-2018	92	2044
		4.0	COC-EF3.6-2018-08-01	1-Aug-2018	225	2981
		4.0	COC-EF3.0-2018-08-01	1-Aug-2018	89	3301
Colt Creek Total					**1,119**	**14,258**
Farrell Creek		103.0	FAC-EF102.5-2018-08-03	3-Aug-2018	373	3186
		102.0	FAC-EF102.1-2018-08-03	3-Aug-2018	187	3200
		66.0	FAC-EF65.7-2018-08-03	3-Aug-2018	402	5100
		64.0	FAC-EF63.2-2018-08-03	3-Aug-2018	442	3676
		63.3	FAC-EF63.3-2018-08-03	3-Aug-2018	440	4187
Farrell Creek Total					**1,844**	**19,349**
Kobes Creek		56.0	KOC-EF55.3-2018-08-11	11-Aug-2018	169	3036
		46.7	KOC-EF46.7-2018-08-11	11-Aug-2018	163	3344
		41.0	KOC-EF40.2-2018-07-25	25-Jul-2018	367	2479
		40.5	KOC-EF40.5-2018-07-25	25-Jul-2018	174	2202
		12.0	KOC-EF11.5-RDB-2018-08-01	1-Aug-2018	173	1516
		12.0	KOC-EF11.5-LDB-2018-08-01	1-Aug-2018	160	1683
Kobes Creek Total					**1,206**	**14,260**
Moberly River	MR-S1A	116.8	MOB-EF-116.8-2018-08-31	31-Aug-2018	97	1218
	MR-S1A	114.5	MOB-EF-114.5-2018-08-19	19-Aug-2018	117	2211
	MR-S1A	114.5	MOB-EF-114.5-2018-08-31	31-Aug-2018	117	1609
	MR-S1	101.5	MOB-EF-101.5-2018-08-20	20-Aug-2018	57	1382
	MR-S2	86.6	MOB-EF-86.6-2018-08-20	20-Aug-2018	86	812
	MR-S3	72.6	MOB-EF-72.6-2018-08-21	21-Aug-2018	158	1036
	MR-S4	69.3	MOB-EF-69.3-2018-08-21	21-Aug-2018	102	632
	MR-S4	65.2	MOB-EF-65.2-2018-08-21	21-Aug-2018	45	386
	MR-S5	57.4	MOB-EF-57.4-2018-08-22	22-Aug-2018	86	1412
	MR-S5	56.9	MOB-EF-56.9-2018-08-22	22-Aug-2018	81	1228
	MR-S5	55.8	MOB-EF-55.8-2018-08-22	22-Aug-2018	121	922
	MR-S5	53.1	MOB-EF-53.1-2018-08-22	22-Aug-2018	125	1610
	MR-S6	49.8	MOB-EF-49.8-2018-08-22	22-Aug-2018	83	1036
	MR-S6	48.1	MOB-EF-48.1-2018-08-31	31-Aug-2018	122	1119
	MR-S6	47.2	MOB-EF-47.2-2018-08-23	23-Aug-2018	128	1230
	MR-S7	45.4	MOB-EF-45.4-2018-08-23	23-Aug-2018	41	616
	MR-S7	44.4	MOB-EF-44.4-2018-08-23	23-Aug-2018	207	1422
	MR-S7	43.6	MOB-EF-43.6-2018-08-13	13-Aug-2018	112	927
	MR-S7	43.0	MOB-EF-43.0-2018-08-14	14-Aug-2018	108	1178
	MR-S7	42.5	MOB-EF-42.5-2018-08-14	14-Aug-2018	60	503
	MR-S7	42.0	MOB-EF-42.0-2018-08-14	14-Aug-2018	155	1406

[a] only applicable to Moberly River sites.

[b] as measured upstream from the stream's confluence.

continued…

Table B1 Concluded.

River	Section[a]	River Km[b]	Site Name	Sample Date	Sample Length (m)	Sample Time (s)
Moberly River	MR-S7	41.4	MOB-EF-41.4-2018-08-14	14-Aug-2018	121	433
	MR-S7	41.3	MOB-EF-41.3-2018-08-14	14-Aug-2018	138	1121
	MR-S7	41.0	MOB-EF-41.0-2018-08-14	14-Aug-2018	47	769
	MR-S7	41.0	MOB-EF-41.0-2018-08-15	15-Aug-2018	47	575
	MR-S7	40.5	MOB-EF-40.5-2018-08-15	15-Aug-2018	35	830
	MR-S7	40.2	MOB-EF-40.2-2018-08-15	15-Aug-2018	52	1627
	MR-S7	39.5	MOB-EF-39.5-2018-08-15	15-Aug-2018	40	1210
	MR-S7	39.4	MOB-EF-39.4-2018-08-31	31-Aug-2018	NR[c]	1762
	MR-S7	38.3	MOB-EF-38.3-2018-08-15	15-Aug-2018	154	420
	MR-S7	37.7	MOB-EF-37.7-2018-08-15	15-Aug-2018	248	1484
	MR-S7	28.7	MOB-EF-28.7-2018-08-31	31-Aug-2018	NR[c]	NR[c]
	MR-S7	28.5	MOB-EF-28.5-2018-08-16	16-Aug-2018	55	543
	MR-S8	26.3	MOB-EF-26.3-2018-08-16	16-Aug-2018	51	593
	MR-S8	22.6	MOB-EF-22.6-2018-08-16	16-Aug-2018	51	333
	MR-S8	21.2	MOB-EF-21.2-2018-08-16	16-Aug-2018	265	1007
	MR-S8	18.7	MOB-EF-18.7-2018-08-31	31-Aug-2018	NR[c]	NR[c]
	MR-S9	16.5	MOB-EF-16.5-2018-08-17	17-Aug-2018	100	789
	MR-S9	15.6	MOB-EF-15.6-2018-08-17	17-Aug-2018	98	664
	MR-S9	13.8	MOB-EF-13.8-2018-08-17	17-Aug-2018	145	2160
	MR-S9	13.5	MOB-EF-13.5-2018-08-31	31-Aug-2018	NR[c]	NR[c]
	MR-S10	3.4	MOB-EF-3.4-2018-08-18	18-Aug-2018	78	1472
Moberly River Total					**3,933**	**41,687**
Grand Total					**24,903**	**167,198**

[a] Only applicable to Moberly River sites.

[b] As measured upstream from the stream's confluence.

[c] Synoptic sites which was only sampled to collect genetic samples from small-bodied fish. Habitat and effort data were not recorded.

Table B2 Summary of beach seine sites sampled in the Moberly River during the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

River	Section	River Km[a]	Site Name	Sample Date	Length Sampled (m)	Width Sampled (m)	Area Sampled (m^2)
Moberly River	MR-S7	28.5	MOB-BS-28.5-2018-08-16	16-Aug-18	50	5.0	250
	MR-S8	26.2	MOB-BS-26.2-2018-08-16	16-Aug-18	75	5.0	375
Total							**625**

[a] As measured upstream from the Moberly River's confluence with the Peace River.

Table B3 Summary of angling sites sampled in the Moberly River during the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

River	Section	River Km[a]	Site Name	Sample Date	Number of Rods	Time (min)	Angler-Minutes
Moberly River	MR-S1A	114.5	MOB-AN-114.5-2018-08-19	19-Aug-2018	2	45	90
	MR-S1	101.5	MOB-AN-101.5-2018-08-20	20-Aug-2018	1	13	13
	MR-S1	101.5	MOB-AN-101.5-2018-08-20	20-Aug-2018	2	23	46
	MR-S2	98.3	MOB-AN-98.3-2018-08-20	20-Aug-2018	1	28	28
	MR-S2	91.5	MOB-AN-91.5-2018-08-20	20-Aug-2018	1	37	37
	MR-S2	86.9	MOB-AN-86.9-2018-08-20	20-Aug-2018	2	18	36
	MR-S3	72.8	MOB-AN-72.8-2018-08-21	21-Aug-2018	2	20	40
	MR-S4	67.6	MOB-AN-67.6-2018-08-21	21-Aug-2018	2	20	40
	MR-S4	64.4	MOB-AN-64.4-2018-08-21	21-Aug-2018	2	15	30
	MR-S5	57.6	MOB-AN-57.6-2018-08-22	22-Aug-2018	2	25	50
	MR-S5	56.3	MOB-AN-56.3-2018-08-22	22-Aug-2018	2	20	40
	MR-S5	53.5	MOB-AN-53.5-2018-08-22	22-Aug-2018	2	30	60
	MR-S6	50.7	MOB-AN-50.7-2018-08-22	22-Aug-2018	2	15	30
	MR-S6	47.1	MOB-AN-47.1-2018-08-23	23-Aug-2018	2	15	30
	MR-S7	45.2	MOB-AN-45.2-2018-08-23	23-Aug-2018	2	30	60
	MR-S7	43.5	MOB-AN-43.5-2018-08-13	13-Aug-2018	2	17	34
	MR-S7	42.0	MOB-AN-42.0-2018-08-14	14-Aug-2018	2	13	26
	MR-S7	41.6	MOB-AN-41.6-2018-08-14	14-Aug-2018	2	23	46
	MR-S7	40.4	MOB-AN-40.4-2018-08-15	15-Aug-2018	1	13	13
	MR-S7	40.2	MOB-AN-40.2-2018-08-15	15-Aug-2018	1	24	24
	MR-S7	39.1	MOB-AN-39.1-2018-08-15	15-Aug-2018	1	14	14
	MR-S7	37.7	MOB-AN-37.7-2018-08-15	15-Aug-2018	2	1	2
	MR-S8	27.5	MOB- AN-27.5-2018-08-16	16-Aug-2018	2	22	44
	MR-S8	26.5	MOB-AN-26.5-2018-08-16	16-Aug-2018	2	32	64
	MR-S8	24.2	MOB-AN-24.2-2018-08-16	16-Aug-2018	2	15	30
	MR-S8	23.7	MOB-AN-23.7-2018-08-16	16-Aug-2018	2	16	32
	MR-S8	22.7	MOB-AN-22.7-2018-08-16	16-Aug-2018	4	18	72
	MR-S8	21.4	MOB-AN-21.4-2018-08-16	16-Aug-2018	3	44	132
	MR-S9	16.3	MOB-AN-16.3-2018-08-17	17-Aug-2018	4	45	180
	MR-S9	15.3	MOB-AN-15.3-2018-08-17	17-Aug-2018	4	20	80
	MR-S9	13.5	MOB-AN-13.5-2018-08-17	17-Aug-2018	2	52	104
	MR-S10	8.2	MOB-AN-8.2-2018-08-17	17-Aug-2018	3	16	48
	MR-S10	3.7	MOB-AN-3.7-2018-08-18	18-Aug-2018	2	33	66
	MR-S10	1.4	MOB-AN-1.4-2018-08-18	18-Aug-2018	1	13	13
Total							**1,654**

[a] As measured upstream from the Moberly River's confluence with the Peace River.

Table B4 Summary of small fish boat electroshocking sites sampled during the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

River	Section	River Km[a]	Site Name	Sample Date	Sample Length (m)	Sample Time (s)
Moberly River	MR-S1A	115.5	MOB-ES-115.5-2018-08-19	19-Aug-2018	415	382
	MR-S1	101.4	MOB-ES-101.4-2018-08-20	20-Aug-2018	927	542
	MR-S2	87.3	MOB-ES-87.3-2018-08-20	20-Aug-2018	512	525
	MR-S3	73.7	MOB-ES-73.7-2018-08-21	21-Aug-2018	310	389
	MR-S3	72.2	MOB-ES-72.2-2018-08-21	21-Aug-2018	570	446
	MR-S4	69.8	MOB-ES-69.8-2018-08-21	21-Aug-2018	968	641
	MR-S4	67.9	MOB-ES-67.9-2018-08-21	21-Aug-2018	410	350
	MR-S4	65.5	MOB-ES-65.5-2018-08-21	21-Aug-2018	279	323
	MR-S4	60.1	MOB-ES-60.1-2018-08-21	21-Aug-2018	879	702
	MR-S5	58.0	MOB-ES-58.0-2018-08-22	22-Aug-2018	236	211
	MR-S5	57.5	MOB-ES-57.5-2018-08-22	22-Aug-2018	1023	853
	MR-S5	55.7	MOB-ES-55.7-2018-08-22	22-Aug-2018	246	195
	MR-S5	54.7	MOB-ES-54.7-2018-08-22	22-Aug-2018	662	510
	MR-S5	51.6	MOB-ES-51.6-2018-08-22	22-Aug-2018	591	503
	MR-S6	50.9	MOB-ES-50.9-2018-08-22	22-Aug-2018	332	327
	MR-S6	50.4	MOB-ES-50.4-2018-08-22	22-Aug-2018	1242	947
	MR-S6	49.2	MOB-ES-49.2-2018-08-22	22-Aug-2018	746	535
	MR-S6	47.5	MOB-ES-47.5-2018-08-23	23-Aug-2018	318	301
	MR-S6	46.8	MOB-ES-46.8-2018-08-23	23-Aug-2018	969	712
	MR-S7	45.3	MOB-ES-45.3-2018-08-23	23-Aug-2018	742	671
	MR-S7	44.7	MOB-ES-44.7-2018-08-23	23-Aug-2018	978	830
	MR-S7	43.5	MOB-ES-43.5-2018-08-13	13-Aug-2018	378	225
	MR-S9	14.4	MOB-ES-14.4-2018-08-17	17-Aug-2018	692	438
	MR-S10	8.2	MOB-ES-8.2-2018-08-17	17-Aug-2018	520	331
	MR-S10	5.9	MOB-ES-5.9-2018-08-17	17-Aug-2018	403	347
	MR-S10	3.7	MOB-ES-3.7-2018-08-17	18-Aug-2018	363	360
	MR-S10	2.1	MOB-ES-2.1-2018-08-17	18-Aug-2018	505	390
Moberly River Total					**16216**	**12,986**

[a] As measured upstream from the Moberly River's confluence with the Peace River.

Table B5 Number of fish caught and observed by backpack electrofishing and their frequency of occurrence in the Chowade River and Cypress and Fiddes creeks during the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Species	Life Stage	River						All Rivers	
		Chowade River		Cypress Creek		Fiddes Creek			
		n	%[b]	n	%[b]	n	%[b]	n	%[b]
Target Species									
Arctic Grayling	Adult								
	Immature								
	YOY								
All Arctic Grayling		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Bull Trout	Adult	3	1	5	2			8	1
	Immature	215	56	148	46	134	95	497	59
	YOY	118	31	43	13	7	5	168	20
All Bull Trout		**336**	**88**	**196**	**61**	**141**	**100**	**673**	**80**
Rainbow Trout	Adult	6	2	2	1			8	1
	Immature	1	<1	13	4			14	2
	YOY							0	0
All Rainbow Trout		**7**	**2**	**15**	**5**	**0**	**0**	**22**	**3**
Target Species Subtotal		**343**	**90**	**211**	**65**	**141**	**100**	**695**	**82**
Non-Target Species									
Mountain Whitefish	All	1	<1	3	1			4	<1
Slimy Sculpin	All	37	10	109	34			146	17
Non-Target Species Subtotal		**38**	**10**	**112**	**35**	**0**	**0**	**150**	**18**
All species		**381**	**100**	**323**	**100**	**141**	**100**	**845**	**100**

[a] Percent composition of the total catch.

Table B6 Number of fish caught and observed by backpack electrofishing and their frequency of occurrence in Colt, Farrell, and Kobes creeks creeks during the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Species	Life Stage	River						All Rivers	
		Colt Creek		Farrell Creek		Kobes Creek			
		n	%[b]	n	%[b]	n	%[b]	n	%[b]
Target Species									
Arctic Grayling	Adult								
	Immature								
	YOY	1	1					1	<1
All Arctic Grayling		**1**	**1**	**0**	**0**	**0**	**0**	**1**	**<1**
Bull Trout	Adult								
	Immature	6	4					6	1
	YOY								
All Bull Trout		**6**	**4**	**0**	**0**	**0**	**0**	**6**	**1**
Rainbow Trout	Adult								
	Immature	33	23	45	11	42	15	120	14
	YOY	3	2	4	1	10	3	17	2
All Rainbow Trout		**36**	**25**	**49**	**12**	**52**	**18**	**137**	**16**
Target Species Subtotal		**43**	**30**	**49**	**12**	**52**	**18**	**144**	**17**
Non-Target Species									
Lake Chub	All			57	14	34	12	91	11
Largescale Sucker	All			35	8	26	9	61	7
Longnose Dace	All	5	3	65	16	32	11	102	12
Longnose Sucker	All	19	13	36	9	13	5	68	8
Mountain Whitefish	All	13	9			1	<1	14	2
Northern Pikeminnow	All			12	3			12	1
Redside Shiner	All			87	21	23	8	110	13
Slimy Sculpin	All	65	45	61	15	106	37	232	27
Sucker Unidentified	All					1	<1	1	<1
Trout-perch	All			17	4			17	2
Non-Target Species Subtotal		**102**	**70**	**370**	**88**	**236**	**82**	**708**	**83**
All species		**145**	**100**	**419**	**100**	**288**	**100**	**852**	**100**

[a] Percent composition of the total catch.

Table B7 Number of fish caught and observed and their frequency of occurrence for all sample methods combined in sampled sections of the Moberly River during the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

Species	Section																				All Sections	
	1A		1		2		3		4		5		6		7		8		9		10			
	n	%[a]	n	%[a]	n	%[a]	n	%[a]	n	%[a]	n	%[a]	n	%[a]	n	%[a]	n	%[a]	n	%[a]	n	%[a]	n	%[a]
Arctic Grayling	4	4													4	1							8	<1
Bull Trout															1	<1					1	1	2	<1
Burbot	14	14	4	13	1	5	2	4	2	2	19	9	4	2	29	4	3	2	1	1			79	4
Lake Chub															31	4	23	12	18	21	5	6	77	4
Largescale Sucker											1	<1			6	1							7	<1
Longnose Dace	5	5					8	16	8	8	29	14	32	18	195	25	65	33	18	21	8	9	368	20
Longnose Sucker	10	10	5	16	3	15	6	12	34	33	28	13	35	20	176	22	56	29	15	18	23	26	391	21
Mountain Whitefish	37	37	10	32	9	45	12	24	39	38	33	16	62	36	96	12	4	2			4	4	306	17
Northern Pike	1	1					4	8							3	<1	2	1					10	1
Northern Pikeminnow			2	6							1	<1			1	<1	2	1	2	2	14	16	22	1
Redside Shiner	17	17	4	13	5	25	6	12	16	16	78	38	21	12	155	20	38	19	30	36	35	39	405	22
Slimy Sculpin	4	4			1	5	7	14	2	2	15	7	18	10	35	4	2	1					84	5
Sucker Unidentified							1	2							53	7							54	3
Trout-perch							1	2			1	<1			1	<1							3	<1
White Sucker	7	7	6	19	1	5	3	6	2	2	3	1	1	1	2	<1							25	1
All species	**99**	**5**	**31**	**2**	**20**	**1**	**50**	**3**	**103**	**6**	**208**	**11**	**173**	**9**	**788**	**43**	**195**	**11**	**84**	**5**	**90**	**5**	**1841**	**100**

[a] Percent composition of the total catch.

APPENDIX C

Habitat Data

Table C1 Habitat variables measured during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2018.

River	River Km	Site Name	Sample Date	Water Temp. (°C)	Water Cond. (µS/cm)	Secchi Depth (m)	Instream Velocity[a]	Substrate		Cover Type - Percent of Available Cover (%)								
								Dominant	Sub-dominant	Interstices	Large Woody Debris	Small Woody Debris	Cutbank	Turbulence	Terrestrial Vegetation	Aquatic Vegetation	Shallow Water	Deep Water
Chowade River	54.3	CHR-EF54.3-2018-07-22	22-Jul-2018	5.0	390	1.50	High	Silt	Boulder		15		20	5	50			10
	54.2	CHR-EF54.2-2018-07-22	22-Jul-2018	5.0	410	0.50	Medium	Sand	Gravel	10	25	15	15		10	5	5	15
	54.1	CHR-EF54.1-2018-07-22	22-Jul-2018	6.1	390	Bottom	Low	Cobble	Silt	60	1	2	2		5	5	25	
	51.0	CHR-EF51.0-2018-07-22	22-Jul-2018	5.0	410	>0.8	Medium	Cobble	Boulder	30	10	10	10	10	5	15		10
	50.9	CHR-EF50.9-2018-07-22	22-Jul-2018	6.2	380	Bottom	Low	Cobble	Gravel	60	5	5	5		10		15	
	48.1	CHR-EF48.1-2018-07-22	22-Jul-2018	6.2	370		Medium	Cobble	Gravel	35	20	15	10		10			10
	47.9	CHR-EF47.9-2018-07-22	22-Jul-2018	6.2	370	Bottom		Cobble	Gravel	20	5	10	3		2		59	1
	47.0	CHR-EF46.7-2018-08-06	6-Aug-2018	7.1	410	>1.5	High	Boulder	Sand	20	20	10	5	5	10	5	10	15
	46.3	CHR-EF46.3-2018-08-06	6-Aug-2018	7.1	410	Bottom	High	Cobble	Boulder	50	10	15	1	3			20	1
	45.8	CHR-EF45.8-2018-07-22	22-Jul-2018	5.5	420	>0.5	High	Cobble	Gravel	100								
	45.7	CHR-EF45.7-2018-07-22	22-Jul-2018	5.4	380	Bottom	Low	Cobble	Sand	30	10	10	10				35	5
	45.6	CHR-EF45.6-2018-07-22	22-Jul-2018	5.9	420	>0.5	Low	Sand	Organics		20	10	10		10	35		5
	45.0	CHR-EF44.2-2018-08-06	6-Aug-2018	8.1	400	>1.5	Medium	Cobble	Sand	15	15	15	15	5	5	5	5	15
	44.5	CHR-EF44.5-2018-07-22	22-Jul-2018	6.2	430	>1.0	Low	Organics	Cobble	30	20	10	10			10		20
	44.3	CHR-EF44.3-2018-07-22	22-Jul-2018	5.4	410	Bottom	Medium	Cobble	Boulder	80	10	5				5		
	44.0	CHR-EF43.8-2018-08-06	6-Aug-2018	8.1	410	>1.0	Medium	Sand	Gravel	25	20	20	5		10	5	5	10
	44.0	CHR-EF44.0-2018-08-06	6-Aug-2018	9.1	400	Bottom	High	Cobble	Sand	65	16	10	2		2		10	10
	43.9	CHR-EF43.9-2018-08-06	6-Aug-2018	8.1	400	Bottom	Medium	Silt;Sand	Gravel	45	15	15	2		1		20	2
	43.4	CHR-EF43.4-2018-07-21	21-Jul-2018	8.2	380	>1.0	Medium	Cobble	Gravel	30	15	10	15		5	5	10	10
	43.0	CHR-EF43.0-2018-07-21	21-Jul-2018	8.2	380	Bottom	Medium	Organics	Silt		50	30	10		5		2	3
	41.5	CHR-EF41.5-2018-07-21	21-Jul-2018	8.0	360	0.75	High			20	30	15	5	5	5	5	5	10
	41.2	CHR-EF41.2-2018-07-21	21-Jul-2018	8.3	360	Bottom	Medium	Organics;Silt	Sand	10	35	30	10		5			10
	40.0	CHR-EF39.8-2018-08-05	5-Aug-2018	7.0	410	>1.0	Medium	Sand	Gravel	5	25	15	10	10	10	5		20
	40.0	CHR-EF40.0-2018-08-05	5-Aug-2018	7.0	410	Bottom	Medium	Silt;Sand	Gravel;Cobble	40	10	15	3		2		25	5
	40.0	CHR-EF39.7-2018-08-05	5-Aug-2018	9.1	410	Bottom	Medium	Cobble	Gravel	40	10	10	3		2		30	5
	40.0	CHR-EF39.3-2018-08-05	5-Aug-2018	9.1	410	>1.0	Low	Sand	Gravel	10	20	20	10	5	10	5	5	15
	39.5	CHR-EF39.5-2018-08-06	6-Aug-2018	9.2	410	Bottom	Medium	Sand	Gravel	35	15	10	1		1		35	3
	39.0	CHR-EF38.8-2018-08-05	5-Aug-2018	9.1	410	>1.0	Low	Sand	Gravel	15	20	20	10		10		5	20
	39.0	CHR-EF39.0-2018-08-05	5-Aug-2018	10.4	410	Bottom	Medium	Sand	Silt	15	15	10	10		5		40	5
	37.2	CHR-EF37.2-2018-07-21	21-Jul-2018	7.0		>2	High	Gravel	Cobble	5	25	10	10		5		15	20
	37.1	CHR-EF37.1-2018-07-21	21-Jul-2018	7.0	360	0.80	Low	Silt	Cobble		10		30		50			10
	36.6	CHR-EF36.6-2018-07-21	21-Jul-2018	7.8	400	Bottom	High	Cobble	Silt	20	30	10	20		10			10
	36.5	CHR-EF36.5-2018-07-21	21-Jul-2018	7.0	360	0.80	Low	Gravel	Cobble	30	15	15	5		15	10	5	5
Cypress Creek	67.0	CYC-EF66.9-2018-08-08	8-Aug-2018	5.7	490	Bottom	Medium	Gravel	Sand	25	5	5	5	15	20	5	10	10
	41.0	CYC-EF40.3-2018-08-09	9-Aug-2018	10.1	450	>1.0	Medium	Cobble	Sand	20	15	10	5	10	10	10	10	10
	40.1	CYC-EF40.1-2018-08-09	9-Aug-2018	10.1	450	Bottom	Medium	Cobble	Gravel	38	5	3	1	1		1	60	1
	39.0	CYC-EF38.8-2018-08-04	4-Aug-2018	8.1	430	>1.0	Medium	sand	Organics	5	10	10	5	5	5	5	5	50
	35.8	CYC-EF35.8-2018-07-24	2-Aug-2018	10.4	440	Bottom		Sand	Cobble	25	15	10	25		15	5		10
	35.7	CYC-EF35.7-2018-07-24	4-Aug-2018	8.1	430	Bottom	High	Cobble	Gravel	65	5	3	2	5			20	5
	35.1	CYC-EF35.1-2018-07-24	24-Jul-2018	8.7	420	0.65	Medium	Sand	Cobble	40	15	10	5			10		20
	35.0	CYC-EF34.7-2018-08-08	24-Jul-2018	11.6	420	Bottom	Low	Cobble	Boulder	10	10	10	5		5		60	
	35.0	CYC-EF35.0-2018-07-24	24-Jul-2018	8.5	420	Bottom	Medium	Sand	Cobble	30	15	15	15		5		10	10
	35.0	CYC-EF35.0-2018-07-24	24-Jul-2018	9.3	430	Bottom	Low	Cobble	Sand;Boulder	75	1	1			1		22	
	35.0	CYC-EF34.7-2018-07-24	24-Jul-2018	7.8	430	Bottom	High	Gravel	Cobble	40	5	1	10	5	4		25	10
	34.9	CYC-EF34.9-2018-07-24	24-Jul-2018	5.5	460	Bottom	Low	Organics	Sand		50	10	30		5		5	
	34.7	CYC-EF34.7-2018-08-08	8-Aug-2018	10.4	310	>0.4	Medium	Gravel	Sand	15	10	10	10	15	15	5	10	10
	33.0	CYC-EF32.6-2018-07-23	24-Jul-2018	8.9	360	0.80	Medium	Cobble	Gravel	30	5	5	2	5	3	10	10	30
	33.0	CYC-EF32.3-2018-08-09	24-Jul-2018	8.8	270	0.80	High	Cobble	Boulder	50	10	10	5	10	5			10
	33.0	CYC-EF32.55-2018-07-23	24-Jul-2018	6.0	270	0.70	High	Cobble	Gravel	25	10	10	5	15	30			5
	32.8	CYC-EF32.8-2018-07-23	24-Jul-2018	6.6	420	Bottom	High	Boulder	Cobble	70	2	1	1	10			15	1
	31.8	CYC-EF31.8-2018-08-09	8-Aug-2018	8.1	460	Bottom	High	Cobble	Gravel	40	3	2	2	10			42	1
	31.0	CYC-EF30.1-2018-07-23	23-Jul-2018	8.7	380	0.75	Medium	Cobble	Bedrock	55	10	5	5	10		5		10
	31.0	CYC-EF30.88-2018-07-23	9-Aug-2018	12.1	420	>0.8	Medium	Cobble	Sand	20	10	20	5	5	15	10	10	5
	31.0	CYC-EF30.9-2015-07-23	23-Jul-2018	8.7	380	0.75	High	Cobble	Boulder	80	5			5		5		5
	31.0	CYC-EF30.8-2018-07-23	23-Jul-2018	9.1	380	Bottom	High	Cobble	Boulder	70	10		10		5			5
	30.7	CYC-EF30.7-2018-07-23	9-Aug-2018	12.1	420	Bottom	Medium	Sand;Gravel	Cobble	25	5	4	1	1	1	1	60	2
	30.4	CYC-EF30.4-2018-07-23	23-Jul-2018	6.9	330	>0.6	Low	Cobble	Sand	20	10	10	10		40	5		5
	29.2	CYC-EF29.2-2018-07-23	23-Jul-2018	8.8	380	0.70	Medium	Boulder	Cobble	60	5	5	5	5	10			10
	29.0	CYC-EF28.1-2018-08-08	23-Jul-2018	8.5	370	0.65	Low	Boulder	Cobble	30	10	10	5		25		10	10

[a] A categorical ranking of water velocity (high = greater than 1.0 m/s; medium = 0.5 to 1.0 m/s; low = less than 0.5 m/s)

…continued.

Table C1 Continued.

River	River Km	Site Name	Sample Date	Water Temp. (°C)	Water Cond. (µS/cm)	Secchi Depth (m)	Instream Velocity[a]	Substrate		Cover Type - Percent of Available Cover (%)								
								Dominant	Sub-dominant	Interstices	Large Woody Debris	Small Woody Debris	Cutbank	Turbulence	Terrestrial Vegetation	Aquatic Vegetation	Shallow Water	Deep Water
Cypress Creek	29.0	CYC-EF28.9-2018-07-23	23-Jul-2018	8.5	380	>0.6				50	15	10		10		5		10
	28.3	CYC-EF28.3-2018-08-08	23-Jul-2018	9.0	360	Bottom	Low	Cobble	Boulder	80	2	1	1		1		15	
	27.0	CYC-EF26.5-2018-08-04	23-Jul-2018	6.5	380	Bottom		Cobble	Boulder	80	5	2	1	2	1		10	
	26.2	CYC-EF26.2-2018-08-04	23-Jul-2018	6.5	340	Bottom	High	Cobble	Boulder	70	2	1		4	1		22	
	26.0	CYC-EF25.25-2018-08-09	8-Aug-2018	12.1	420	>1.0	Medium	Cobble	Gravel	30	10	10	5	20	5	5	10	5
	26.0	CYC-EF25.3-2018-08-09	23-Jul-2018	7.3	420	>0.3	Low	Sand	Boulder	10	10	10	10		40	10		10
	24.9	CYC-EF24.9-2018-08-09	8-Aug-2018	12.1	420	Bottom	High	Cobble	Gravel	50	5	5					30	10
	22.0	CYC-EF21.2-2018-08-08	4-Aug-2018	10.2	410	Bottom	High	Cobble	Gravel	15	15	10	5	10	10	5	15	15
	22.0	CYC-EF21.3-2018-08-08	4-Aug-2018	10.2	410	Bottom	High	Cobble	Gravel	40	6	5	1	1	2		40	5
	21.7	CYC-EF21.7-2018-08-08	9-Aug-2018	9.6	410	>1.0	High	Cobble	Gravel	25	15	10	5	15	10	5	5	10
	21.6	CYC-EF21.6-2018-08-08	2-Aug-2017	9.6	410	>1.0	Medium	Cobble	Boulder	35	5	5	5	10	10	5	25	
	19.0	CYC-EF18.9-2018-08-04	9-Aug-2018	9.6	410	Bottom	Medium	Cobble	Gravel	25	7	3		1		1	58	5
	19.0	CYC-EF18.8-2018-08-04	8-Aug-2018	15.6	420	Bottom	Low	Sand	Gravel	40	10	10		5	5	5	20	5
	22.0	CYC-EF21.3-2018-08-08	8-Aug-2018	13.5	420	>1.0	Medium	Cobble	Gravel	45	5	5		30	5	5		
	21.7	CYC-EF21.7-2018-08-08	8-Aug-2018	15.6	420	Bottom	Low	Gravel	Sand	45	3	2	2		1	1	45	1
	21.6	CYC-EF21.6-2018-08-08	8-Aug-2018	13.5	420	Bottom	High	Cobble	Gravel	55	2	3	1	5	1	1	30	2
	19.0	CYC-EF18.9-2018-08-04	4-Aug-2018	11.0	400	1.00		Cobble	Gravel	15	15	15	5	15	5	5	10	15
	19.0	CYC-EF18.8-2018-08-04	4-Aug-2018	11.0	400	Bottom	Medium	Cobble	Silt	48	10	10	5		2		10	5
Fiddes Creek	11.7	FIC-EF11.7-2018-08-07	7-Aug-2018	8.4	460	Bottom	Medium	Cobble	Boulder	45	5		5	10	10	5	10	10
	7.0	FIC-EF7.0-2018-08-07	7-Aug-2018	7.4	450	>1.0	High	Cobble	Boulder	20	20	10	5	20	5	5	5	10
	6.8	FIC-EF6.8-2018-08-07	7-Aug-2018	7.4	450	Bottom	High	Cobble	Sand;Gravel; Boulder	45	1	1	2	20			30	1
	4.8	FIC-EF4.8-2018-08-07	7-Aug-2018	9.4	450	Bottom	High	Cobble	Boulder	40				20			40	
	4.6	FIC-EF4.6-2018-08-07	7-Aug-2018	9.4	450	0.80	High	Cobble	Boulder	30	15	10	5	10	5	5	10	10
Colt Creek	31.0	COC-EF30.4-2018-08-02	2-Aug-2018	8.1	290	>1.0	High	Boulder	Cobble	10	15	10	15	15	10		5	15
	30.5	COC-EF30.5-2018-08-02	2-Aug-2018	8.1	290	Bottom	High	Boulder	Cobble	78	2	2	10	1	2		4	1
	29.0	COC-EF28.8-2018-08-02	2-Aug-2018	8.0	260	>1.0	High	Boulder	Cobble	20	15	10	10	20	15			10
	28.9	COC-EF28.9-2018-08-02	2-Aug-2018	8.0	290	Bottom	High	Boulder	Cobble	65	2	1	5	2			20	5
	14.1	COC-EF14.1-2018-08-02	2-Aug-2018	10.1	260	Bottom	Medium	Cobble	Gravel	40	5	5			5		40	5
	14.0	COC-EF14.0-2018-08-02	2-Aug-2018	10.1	260	0.80	Medium	Cobble	Gravel	20	10	10	10	10	15		5	20
	4.0	COC-EF3.6-2018-08-01	1-Aug-2018	12.5	260	0.35	Medium	Cobble	Gravel	20	10	15	15	5	10	5	10	10
	4.0	COC-EF3.0-2018-08-01	1-Aug-2018	12.5	260		Medium	Cobble	Gravel	60	3	2	2		1		30	2
Farrell Creek	103.0	FAC-EF102.5-2018-08-03	3-Aug-2018	15.0	240	0.45	Medium	Sand	Cobble	5	20	10	5	5	10	10	5	30
	102.0	FAC-EF102.1-2018-08-03	3-Aug-2018	15.0	240	0.45		Sand	Gravel	1	2	2	3		2		60	30
	66.0	FAC-EF65.7-2018-08-03	3-Aug-2018	16.5	390	0.80	Low	Sand	Gravel	10	20	25	5	5	5	5	5	20
	64.0	FAC-EF63.2-2018-08-03	3-Aug-2018	18.5	330	0.65	Medium	Sand	Cobble	5	15	10	5	10	15	5	10	25
	63.3	FAC-EF63.3-2018-08-03	3-Aug-2018	18.5	330	0.65	Medium	Cobble	Gravel	65	1	1	1	1	1		25	5
Kobes Creek	56	KOC-EF55.3-2018-08-11	11-Aug-2018	14.7	80	>0.4	Low	Gravel	Cobble	93			2				5	
	46.7	KOC-EF46.7-2018-08-11	11-Aug-2018	16.2	120	Bottom	Low	Cobble	Gravel	40	5	5	2		1		45	2
	41	KOC-EF40.2-2018-07-25	25-Jul-2018	10.2	90	0.45	Medium	Cobble	Gravel	55	5	10			20	10		
	40.5	KOC-EF40.5-2018-07-25	25-Jul-2018	10.8	90	0.45	High	Cobble	Gravel	10	5	5	30		30		10	10
	12	KOC-EF11.5-RDB-2018-08-01	1-Aug-2018	18.5	170	0.25	Medium	Sand	Cobble	30	10	10	5	10	15	5	5	15
	12	KOC-EF11.5-LDB-2018-08-01	1-Aug-2018	18.5	170	0.25	Medium	Gravel	Sand	25		1		10	1		58	5
Moberly	116.8	MOB-EF-116.8-2018-08-31	31-Aug-2018	13.0	190	0.65	Medium	Gravel	Sand	10	5	5		10			60	10
	115.5	MOB-ES-115.5-2018-08-19	31-Aug-2018	18.8	190	0.40	Medium	Gravel	Cobble	40	10	15		5			20	10
	114.5	MOB-EF-114.5-2018-08-19	19-Aug-2018	13.1	190	0.70	Medium	Gravel	Sand	10	5	10	5	15			50	5
	114.5	MOB-EF-114.5-2018-08-31	31-Aug-2018	18.8	180	0.31	Medium	Gravel	Sand	30	5	10		25	10		5	15
	114.5	MOB-AN-114.5-2018-08-19	19-Aug-2018	16.7	180	0.31	Low	Gravel	Cobble	10	10						80	
	101.5	MOB-EF-101.5-2018-08-20	20-Aug-2018	16.8	190	0.45	Medium	Sand	Gravel	30	5	20		20				15
	101.5	MOB-AN-101.5-2018-08-20	20-Aug-2018	16.8	190	0.45	Low	Gravel	Sand			10	5	10	10		65	
	101.4	MOB-ES-101.4-2018-08-20	20-Aug-2018	16.9	190		Low	Gravel	Sand	20	10	30					15	25
	98.3	MOB-AN-98.3-2018-08-20	20-Aug-2018				Low	Silt	Sand		10	30			10		10	40
	91.5	MOB-AN-91.5-2018-08-20	20-Aug-2018	17.6	200	0.45	Low	Silt	Gravel	15	10		40	5				30
	87.3	MOB-ES-87.3-2018-08-20	20-Aug-2018	17.9	200	0.40	Medium	Cobble	Gravel	40	5	10		5			25	15
	86.9	MOB-AN-86.9-2018-08-20	20-Aug-2018	17.9	180	0.45		Gravel	Sand		30	20		20			30	
	86.6	MOB-EF-86.6-2018-08-20	30-Aug-2017	17.9	180	0.40	Low	Boulder	Cobble	65	10	5		20				
	73.7	MOB-ES-73.7-2018-08-21	21-Aug-2018	16.9	210	0.52	Low	Cobble	Silt	50			50					
	72.8	MOB-AN-72.8-2018-08-21	21-Aug-2018	17.4	200	0.50	Low	Sand	Gravel	10		5					50	35
	72.6	MOB-EF-72.6-2018-08-21	21-Aug-2018	17.4	200	0.50	Medium	Gravel	Sand	50	10	5		30				10
	72.2	MOB-ES-72.2-2018-08-21	21-Aug-2018	16.9	210	0.26	Medium	Cobble	Boulder	50				30				20
	69.8	MOB-ES-69.8-2018-08-21	21-Aug-2018	17.6	210	0.40	Medium	Boulder	Cobble	45	10		15	20				10
	69.3	MOB-EF-69.3-2018-08-21	21-Aug-2018	18.8	200	0.50		Cobble	Gravel	60				40				

[a] A categorical ranking of water velocity (high = greater than 1.0 m/s; medium = 0.5 to 1.0 m/s; low = less than 0.5 m/s)

…continued.

Table C1 Continued.

River	River Km	Site Name	Sample Date	Water Temp. (°C)	Water Cond. (µS/cm)	Secchi Depth (m)	Instream Velocity[a]	Substrate		Cover Type - Percent of Available Cover (%)								
								Dominant	Sub-dominant	Interstices	Large Woody Debris	Small Woody Debris	Cutbank	Turbulence	Terrestrial Vegetation	Aquatic Vegetation	Shallow Water	Deep Water
Moberly	67.9	MOB-ES-67.9-2018-08-21	21-Aug-2018	17.9	210	0.40	Medium	Boulder	Cobble	50	10		10	20				
	67.9	MOB-AN-67.6-2018-08-21	21-Aug-2018	19.0	200	0.50	Low	Silt	Sand		10	25				5	20	40
	65.5	MOB-ES-65.5-2018-08-21	21-Aug-2018	18.5	200	0.39	Medium	Boulder	Sand	20	30			30	10		10	
	65.2	MOB-EF-65.2-2018-08-21	21-Aug-2018	19.0	200	0.55	Medium	Gravel	Sand	80				20				
	64.4	MOB-AN-64.4-2018-08-21	21-Aug-2018	19.0	200	0.55	Low	Silt	Sand		15	25					15	45
	60.1	MOB-ES-60.1-2018-08-21	21-Aug-2018	18.5	200	0.39	Medium	Boulder	Sand	20	30			30	10		10	
	58.0	MOB-ES-58.0-2018-08-22	22-Aug-2018	19.0	200	0.55	Medium	Gravel	Sand	80				20				
	57.6	MOB-AN-57.6-2018-08-22	22-Aug-2018	19.0	200	0.55	Low	Silt	Sand		15	25					15	45
	57.5	MOB-ES-57.5-2018-08-22	22-Aug-2018	18.6	200	0.40	Medium	Boulder	Cobble	50				20	10		20	
	57.4	MOB-EF-57.4-2018-08-22	22-Aug-2018	16.7	210	0.35	Medium	Gravel	Cobble	70								30
	56.9	MOB-EF-56.9-2018-08-22	22-Aug-2018	17.3	200	0.55		Gravel	Cobble	30				10			30	30
	56.3	MOB-AN-56.3-2018-08-22	22-Aug-2018	17.1	210	0.41	Medium	Cobble	Gravel	45	10			30			10	5
	55.8	MOB-EF-55.8-2018-08-22	22-Aug-2018	17.3	200	0.55	Medium	Gravel	Cobble	50	5	10		25	5			5
	55.7	MOB-ES-55.7-2018-08-22	22-Aug-2018	18.1	200	0.60	Medium	Cobble	Gravel	25	15	10		20				30
	54.7	MOB-ES-54.7-2018-08-22	22-Aug-2018	18.1	200	0.55	Medium	Cobble	Gravel	25	2	3		10			45	15
	53.5	MOB-AN-53.5-2018-08-22	22-Aug-2018	19.0	200	0.55	Medium	Cobble	Gravel	40	10	5		38	2			5
	53.1	MOB-EF-53.1-2018-08-22	22-Aug-2018	17.4	210	0.46	Medium	Cobble	Gravel	30	30		20	20				
	51.6	MOB-ES-51.6-2018-08-22	22-Aug-2018	18.4	210	0.46	Medium	Cobble	Gravel	60	10			20				10
	50.9	MOB-ES-50.9-2018-08-22	22-Aug-2018	18.7	200	0.55	Medium	Sand	Gravel	15	5	10		10			50	10
	50.7	MOB-AN-50.7-2018-08-22	22-Aug-2018	18.7	200	0.55	Medium	Gravel	Cobble	25	15	10		30	5			15
	50.4	MOB-ES-50.4-2018-08-22	22-Aug-2018	18.9	200	0.40	Low	Gravel	Sand		20	10		10			30	30
	49.8	MOB-EF-49.8-2018-08-22	22-Aug-2018	18.7	210	0.40	Low	Gravel	Sand	10	20	10		10			25	25
	49.2	MOB-ES-49.2-2018-08-22	22-Aug-2018	18.7	200	0.55	Low	Silt	Sand	10		5					45	40
	48.1	MOB-EF-48.1-2018-08-31	31-Aug-2017	18.9	210	0.40	Medium	Boulder	Cobble	30	20	20		20			10	
	47.5	MOB-ES-47.5-2018-08-23	23-Aug-2018	19.2	200	0.50	Medium	Cobble	Gravel	55				40	5			
	47.2	MOB-EF-47.2-2018-08-23	31-Aug-2017	18.9	210	0.40	Medium	Boulder	Cobble	20	20	10		40			10	
	47.1	MOB-AN-47.1-2018-08-23	23-Aug-2018	12.7	210	-	Medium	Gravel	Cobble	40	1	4		25			30	
	46.8	MOB-ES-46.8-2018-08-23	23-Aug-2018	16.2	210	0.40	Medium	Cobble	Gravel	65	5			30				
	45.4	MOB-EF-45.4-2018-08-23	23-Aug-2018	16.6	200	0.45	Medium	Cobble	Gravel	60	2			33				5
	45.3	MOB-ES-45.3-2018-08-23	23-Aug-2018	16.6	200	45.00	Medium	Cobble	Gravel	50	1	4		20			20	5
	45.2	MOB-AN-45.2-2018-08-23	23-Aug-2018	16.3	210	0.40	Medium	Cobble	Gravel	70	5		5	20				
	44.7	MOB-ES-44.7-2018-08-23	23-Aug-2018	16.3	200	0.45		Gravel	Sand	20	30	20		15				15
	44.4	MOB-EF-44.4-2018-08-23	23-Aug-2018	16.3	210	0.40	Medium	Cobble	Gravel	40	10			50				
	43.6	MOB-EF-43.6-2018-08-13	13-Aug-2018	16.1	200	0.45	Medium	Cobble	Sand	10	20	20					40	10
	43.5	MOB-ES-43.5-2018-08-13	13-Aug-2018	16.3	210	0.40	Medium	Cobble	Gravel	50	15		5	30				
	43.5	MOB-AN-43.5-2018-08-13	13-Aug-2018	15.6	210	0.45	Medium	Gravel	Sand	50	5	5		30				10
	43.0	MOB-EF-43.0-2018-08-14	14-Aug-2018	20.0	190	0.18	Medium	Gravel	Cobble	68		10	2	10	5			5
	42.5	MOB-EF-42.5-2018-08-14	14-Aug-2018	20.0	190	0.18	Medium	Cobble	Gravel	25	5			10			10	50
	42.0	MOB-EF-42.0-2018-08-14	14-Aug-2018	20.1	200	0.05	Medium	Cobble	Gravel	20				30				
	42.0	MOB-AN-42.0-2018-08-14	14-Aug-2018	18.9	190	0.24	Medium	Gravel	Cobble	10	2	2		20				
	41.6	MOB-AN-41.6-2018-08-14	14-Aug-2018	20.1	190	0.23	High	Cobble	Gravel	75				20				5
	41.4	MOB-EF-41.4-2018-08-14	14-Aug-2018	20.1	190	0.23	Medium	Gravel	Sand	45	10	15		10	5			5
	41.3	MOB-EF-41.3-2018-08-14	14-Aug-2018	20.4	190	0.30	Medium	Cobble	Gravel							60		40
	41.0	MOB-EF-41.0-2018-08-15	15-Aug-2018	20.3	180	0.21	Medium	Cobble	Gravel					20				50
	41.0	MOB-EF-41.0-2018-08-14	14-Aug-2018	20.2	190	0.21	Medium	Cobble	Silt	20	10		10	40				20
	40.5	MOB-EF-40.5-2018-08-15	15-Aug-2018	20.0	190	0.21	Medium	Cobble	Gravel	40	10			40				10
	40.4	MOB-AN-40.4-2018-08-15	15-Aug-2018	17.5	200	0.25		Cobble	Gravel	50		5					35	10
	40.2	MOB-EF-40.2-2018-08-15	15-Aug-2018	19.6	210	0.25	Low	Cobble	Gravel	50		5					35	10
	40.2	MOB-AN-40.2-2018-08-15	15-Aug-2018	18.3	200	Bottom	Medium	Gravel	Cobble	50		10		30			10	
	39.5	MOB-EF-39.5-2018-08-15	15-Aug-2018				Medium	Cobble	Gravel	40	20			20				20
	39.4	MOB-EF-39.4-2018-08-31	31-Aug-2018	18.1	210	0.40	Low	Gravel	Cobble	30		5		10			45	10
	39.1	MOB-AN-39.1-2018-08-15	15-Aug-2018	18.1	210	0.40	High	Cobble	Gravel	5	10		10	30			5	40
	38.3	MOB-EF-38.3-2018-08-15	15-Aug-2018	18.9	210	0.28	Medium	Gravel	Cobble	30	5	10		15	10		20	10
	37.7	MOB-EF-37.7-2018-08-15	15-Aug-2018	12.7	210	0.55	Medium	Gravel	Cobble	20	3	7		10			50	10
	37.7	MOB-AN-37.7-2018-08-15	15-Aug-2018	18.1	210	0.40	Medium	Cobble	Gravel	40	10			30				20
	28.7	MOB-EF-28.7-2018-08-31	31-Aug-2018	19.7	210	0.40	Medium	Gravel	Cobble	50		2		25			23	
	28.5	MOB-EF-28.5-2018-08-16	16-Aug-2018	15.8	200	0.22	Medium	Cobble	Gravel	40		5		25			20	10
	28.5	MOB-BS-28.5-2018-08-16	16-Aug-2018	19.8	200	0.40	Medium	Gravel	Cobble	20				10			10	60
	27.5	MOB- AN-27.5-2018-08-16	16-Aug-2018															
	26.5	MOB-AN-26.5-2018-08-16	16-Aug-2018	16.8	220	0.45	Medium	Cobble	Gravel	75				15			10	
	26.3	MOB-EF-26.3-2018-08-16	16-Aug-2018	17.4	210	0.46	Medium	Gravel	Cobble	60				20			20	
	26.2	MOB-BS-26.2-2018-08-16	16-Aug-2018	17.4	210	0.45	High	Gravel	Cobble	5	10	5	5	30			5	40

[a] A categorical ranking of water velocity (high = greater than 1.0 m/s; medium = 0.5 to 1.0 m/s; low = less than 0.5 m/s)

…continued.

Table C1 Concluded.

River	River Km	Site Name	Sample Date	Water Temp. (°C)	Water Cond. (µS/cm)	Secchi Depth (m)	Instream Velocity[a]	Substrate		Cover Type - Percent of Available Cover (%)								
								Dominant	Sub-dominant	Interstices	Large Woody	Small Woody	Cutbank	Turbulence	Terrestrial Vegetation	Aquatic Vegetation	Shallow Water	Deep Water
	24.2	MOB-AN-24.2-2018-08-16	16-Aug-2018	19.5	230	0.26	Medium	Cobble	Gravel	10	20	10			10			50
	23.7	MOB-AN-23.7-2018-08-16	16-Aug-2018	17.4	210	0.40	Medium	Cobble	Sand		80			10				10
	22.7	MOB-AN-22.7-2018-08-16	16-Aug-2018	17.4	210	0.45	Medium	Cobble	Gravel	65	30							5
	22.6	MOB-EF-22.6-2018-08-16	16-Aug-2018	19.9	220	0.28		Gravel	Cobble	60		5		20			15	
	21.4	MOB-AN-21.4-2018-08-16	16-Aug-2018	20.0	230	0.45	Medium	Cobble	Gravel	20	30	20		10			30	
	21.2	MOB-EF-21.2-2018-08-16	16-Aug-2018	20.0	230	0.45	Medium	Gravel	Sand	40		10	2	10			28	10
	18.7	MOB-EF-18.7-2018-08-31	31-Aug-2018															
	16.5	MOB-EF-16.5-2018-08-17	17-Aug-2018	16.5	230	0.27	Medium	Gravel	Sand	20	5	15	5	5			25	25
	16.3	MOB-AN-16.3-2018-08-17	17-Aug-2018	16.3	230	0.27	Medium	Gravel	Cobble	15	30	20	5	10	5		15	
	15.6	MOB-EF-15.6-2018-08-17	17-Aug-2018	17.9	230	0.35	Medium	Gravel	Cobble	40	2	8		30			15	5
	15.3	MOB-AN-15.3-2018-08-17	17-Aug-2018	17.9	220	0.35	Medium	Gravel	Cobble	10					5		15	70
	14.4	MOB-ES-14.4-2018-08-17	17-Aug-2018	19.1	230	0.40	Medium	Cobble	Gravel	25	5	10		25			10	25
	13.8	MOB-EF-13.8-2018-08-17	5-Sep-2017	19.5	220	0.19	Medium	Gravel	Sand	30	25	10		10	5			20
	13.5	MOB-EF-13.5-2018-08-31	5-Sep-2017															
	13.5	MOB-AN-13.5-2018-08-17	17-Aug-2018	19.5	220	0.19	Medium	Cobble	Sand	30	20			20			30	
	8.2	MOB-ES-8.2-2018-08-17	17-Aug-2018	19.9	230	0.40	High	Cobble	Gravel	20	10	20		25	5		15	5
	8.2	MOB-AN-8.2-2018-08-17	17-Aug-2018	19.3	230	0.19	Low	Gravel	Cobble	10	10							80
	5.9	MOB-ES-5.9-2018-08-17	17-Aug-2018	19.3	240	0.40	Medium	Gravel	Cobble	15	5	5		10			30	35
	3.7	MOB-ES-3.7-2018-08-18	18-Aug-2018	16.1	240	0.40	Medium	Gravel	Cobble	10	5	10		15			30	30
	3.7	MOB-AN-3.7-2018-08-18	18-Aug-2018	16.5	230	0.25	Low	Gravel	Sand		30	10		10				50
	3.4	MOB-EF-3.4-2018-08-18	18-Aug-2018	16.7	230	0.27	Medium	Gravel	Sand	40	5	10		20			15	10
	2.1	MOB-ES-2.1-2018-08-18	18-Aug-2018	16.9	240	0.40	Medium	Gravel	Cobble	40	2	3		5			30	20
	1.4	MOB-AN-1.4-2018-08-18	18-Aug-2018	17.0	230	0.20	Low	Cobble	Sand	10		10		10			10	60

…concluded.

Table C2 Habitat variables recorded at backpack electrofishing and beach seining sites on the Moberly River during the Site C Reservoir Tributaries Fish Population Index Survey (Mon-1b, Task 2c), 2018.

River Section	Site Name	Sample Date	Water Temp. (°C)	Water Cond. (µS/cm)	Secchi Depth (m)	D90	Embeddedness (L/M/H)	Compaction (L/M/H)	Depth (m)			Velocity (m/s)			Bank Sampled (LDB/RDB/MID)[a]	Bank Habitat	Instream Habitat
									Near	Mid	Far	Near	Mid	Far			
1A	MOB-EF-116.8-2018-08-31	31-Aug-18	13.0	190	0.65	0.07	M	L	0.27	0.59	0.46	0.57	0.63	0.46	ILDB	Glide	Run
1A	MOB-EF-114.5-2018-08-19	19-Aug-18	13.1	190	0.7	0.09	M	L	0.24	0.30	0.51	0.24	0.30	0.10	RDB	Side Channel	Riffle
1A	MOB-EF-114.5-2018-08-31	31-Aug-18	18.8	180	0.31	0.09	M	L	0.22	0.34	0.46	0.28	0.48	0.21	IRDB	Side Channel	Riffle, Run
1	MOB-EF-101.5-2018-08-20	20-Aug-18	16.8	190	0.45	0.02	M	L	0.32	0.15	0.45	1.17	0.37	0.57	RDB	Side Channel	Run
2	MOB-EF-86.6-2018-08-20	30-Aug-17	17.9	180	0.4	0.22	L	H	0.22	0.26	0.46	0.24	0.43	0.32	LDB	Glide	Run
3	MOB-EF-72.6-2018-08-21	21-Aug-18	17.4	200	0.5	0.1	M	L	0.13	0.16	0.21	0.25	0.30	0.54	RDB	Side Channel	Riffle
4	MOB-EF-69.3-2018-08-21	21-Aug-18	18.8	200	0.5	0.12	M	M	0.19	0.24	0.34	0.35	0.37	0.66	LDB	Glide	Riffle
4	MOB-EF-65.2-2018-08-21	21-Aug-18	19.0	200	0.55	0.08	M	L	0.20	0.38	0.58	0.03	0.43	0.51	RDB	Glide	Run
5	MOB-EF-57.4-2018-08-22	22-Aug-18	16.7	210	0.35	0.12	M	M	0.42	0.55	0.44	0.36	0.73	0.45	RDB	Glide	Run
5	MOB-EF-56.9-2018-08-22	22-Aug-18	17.3	200	0.55	0.14	L	H	0.34	0.44	0.63	0.09	0.12	0.18	LDB	Glide	Riffle
5	MOB-EF-55.8-2018-08-22	22-Aug-18	17.3	200	0.55	0.18	M	H	0.32	0.47	0.52	0.35	0.30	0.13	RDB	Riffle	Run
5	MOB-EF-53.1-2018-08-22	22-Aug-18	17.4	210	0.46	0.07	M	L	0.14	0.32	0.35	0.65	0.93	0.76	RDB	Riffle	Riffle
6	MOB-EF-49.8-2018-08-22	22-Aug-18	18.7	210	0.4	0.18	L	M	0.25	0.22	0.23	0.35	0.43	0.35	RDB	Riffle	Riffle
6	MOB-EF-48.1-2018-08-31	31-Aug-17	18.9	210	0.4	0.1	M	M	0.17	0.23	0.35	0.29	0.63	0.84	ILDB	Riffle	Riffle
6	MOB-EF-47.2-2018-08-23	31-Aug-17	18.9	210	0.4	0.18	L	M	0.21	0.21	0.30	0.18	0.38	0.31	RDB	Riffle	Riffle
7	MOB-EF-45.4-2018-08-23	23-Aug-18	16.6	200	0.45	0.16	M	M	0.22	0.30	0.29	0.03	0.06	0.12	LDB	Side Channel	Riffle
7	MOB-EF-44.4-2018-08-23	23-Aug-18	16.3	210	0.4	0.12	L	L	0.21	0.25	0.08	0.87	0.87	0.33	RDB	Side Channel	Riffle
7	MOB-EF-43.6-2018-08-13	13-Aug-18	16.1	200	0.45	0.11	L	M	0.18	0.33	0.33	0.22	0.42	0.44	LDB	Side Channel	Riffle
7	MOB-EF-43.0-2018-08-14	14-Aug-18	20.0	190	0.18	0.11	L	L	0.25	0.22	0.60	0.51	0.70	1.05	RDB	Side Channel	Riffle, Run
7	MOB-EF-42.5-2018-08-14	14-Aug-18	20.0	190	0.18	0.12	L	L	0.15	0.29	0.46	0.00	0.50	0.56	RDB	Eddy, Riffle	Riffle
7	MOB-EF-42.0-2018-08-14	14-Aug-18	20.1	200	0.05	0.2	L	L	0.10	0.20	0.19	0.16	0.58	0.19	RDB	Side Channel	Riffle
7	MOB-EF-41.4-2018-08-14	14-Aug-18	20.1	190	0.23	0.08	H	L	0.30	0.70	0.85	0.00	0.08	0.06	RDB	Side Channel	Riffle
7	MOB-EF-41.3-2018-08-14	14-Aug-18	20.4	190	0.3	0.08	H	L	0.25	0.30	0.20	0.42	0.58	0.38	RDB	Side Channel	Riffle
7	MOB-EF-41.0-2018-08-15	15-Aug-18	20.3	180	0.21	0.15	M	M	0.20	0.27	0.42	0.25	0.48	0.58	LDB	Glide	Run
7	MOB-EF-41.0-2018-08-14	14-Aug-18	20.2	190	0.21	0.15	M	M	0.20	0.27	0.42	0.25	0.48	0.58	LDB	Glide	Run
7	MOB-EF-40.5-2018-08-15	15-Aug-18	20.0	190	0.21	0.12	L	L	0.13	0.15	0.10	0.20	0.40	0.29	LDB	Side Channel	Riffle
7	MOB-EF-39.5-2018-08-15	15-Aug-18				0.1	L	L	0.47	0.47	0.40	0.21	0.24	0.30	RDB	Side Channel	Riffle
7	MOB-EF-39.4-2018-08-31	31-Aug-18	18.1	210	0.4	0.14	M	M	0.39	0.41	0.28	0.28	0.58	0.27	IRDB	Side Channel	Run
7	MOB-EF-38.3-2018-08-15	15-Aug-18	18.9	210	0.28	0.12	M	L	0.27	0.59	0.52	0.12	1.01	0.71	ILDB		
7	MOB-EF-37.7-2018-08-15	15-Aug-18	12.7	210	0.55	0.14	L	L	0.17	0.16	0.19	0.34	0.50	0.47	RDB	Side Channel	Riffle
7	MOB-BS-28.5-2018-08-16	16-Aug-18	19.8	200	0.4	0.17	L	M	0.11	0.20	0.18	0.42	0.37	0.54	RDB	Riffle	Riffle
8	MOB-EF-26.3-2018-08-16	16-Aug-18	17.4	210	0.46	0.4	M	M	0.15	0.27	0.35	0.74	0.69	0.51	LDB	Riffle	Riffle
8	MOB-EF-22.6-2018-08-16	16-Aug-18	19.9	220	0.28	0.14	M	L	0.14	0.20	0.27	0.00	0.65	0.75	RDB	Riffle	Riffle
8	MOB-EF-21.2-2018-08-16	16-Aug-18	20.0	230	0.45	0.12	L	M	0.18	0.13	0.19	0.23	0.64	0.55	LDB	Side Channel	Riffle
9	MOB-EF-16.5-2018-08-17	17-Aug-18	16.5	230	0.27	0.13	M	M	0.25	0.30	0.28	0.43	0.79	0.72	LDB	Side Channel	Run
9	MOB-EF-15.6-2018-08-17	17-Aug-18	17.9	230	0.35	0.12	M	L	0.20	0.25	0.15	0.37	0.55	0.32	IRDB	Riffle	Riffle
9	MOB-EF-13.8-2018-08-17	5-Sep-17	19.5	220	0.19		L	L	0.13	0.25	0.27	0.68	0.97	0.88	RDB	Side Channel, Glide	Run
10	MOB-EF-3.4-2018-08-18	18-Aug-18	16.7	230	0.27	0.08	M	L	0.30	0.16	0.35	0.07	0.43	0.11	RDB	Side Channel	Run

[a]LDB = Left bank as viewed facing downstream; RDB = Right bank as viewed facing downstream; MID = Mid Channel; ILDB = Island left bank viewed facing downstream; IRDB = Island right bank viewed facing downstream.

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