

**AS-BUILT REPORT OF FISH PASSAGE IMPROVEMENT PROJECTS
WITHIN THE WET'SUWET'EN FIRST NATION TERRITORY, 2017**



Prepared for:

**Ministry of Transportation and Infrastructure
PO Box 9850, Stn Prov Govt
4B-940 Blanshard Street
Victoria, BC V8W 9T5**

November 2017



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ACKNOWLEDGMENTS

Many people participated in the planning and implementation of this construction project. We thank Reg Ogen, YLP President/Chief Executive Officer, Shannon Haizimsque, YLP Chief Operating Officer, and Laura Van Somer, YLP Executive Assistant, who provided project oversight, administrative support, and contract management. Archie Alec and Brent Sampson, YLP Fisheries Technicians, assisted with all field activities. Roger Groot at Hatch Creek Ranch Ltd., supplied and operated an excavator and other heavy equipment at the Moan and Johnny David creek sites. Greg Cutsforth at Althor Contracting Ltd., operated the excavator at the Tchesinkut Creek site. Riffle rock and riprap material was provided by Warren Himech at Blastpro Construction Ltd. We are grateful to Joe Wong and Luke Moisey at Woodmere Nursery Ltd., for their guidance with planting willows at each of the restored sites. Doris Gummow at Mrs G's Traffic Control provided traffic-control services for the project. Funding for this project was provided by the BC Ministry of Transportation and Infrastructure and through Fisheries and Oceans Canada's Fish Habitat Restoration Initiative.

1 INTRODUCTION

Aquatic and riparian habitat restoration within the upper Bulkley and upper Fraser (Francois Lake) river watersheds is considered a pre-requisite to the long-term survival and recovery of Chinook, Coho and Sockeye salmon, as well as Steelhead, Rainbow and Bull trout. Stream and riparian habitats within Wet'suwet'en First Nation (WFN) traditional territory (Figure 1) have been impacted by past forestry activities, roads, and linear corridor developments. In 2015, through the Yinka Dene Economic Development Limited Partnership Inc. (YLP), WFN and LGL Limited developed aquatic habitat restoration designs for 16 high-priority sites the WFN traditional territory (Gaboury and Smith 2016; Figure 2, Figure 3). The objective of these restoration designs was to recover high-valued stream habitats to proper functioning condition.

The as-built report that follows describes physical works undertaken by WFN in 2017 to improve fish passage at three sites identified by Gaboury and Smith (2016), including: Johnny David Creek at Highway 16, Moan Creek at Lawson Road, and Tchesinkut Creek at Highway 34 (Table 1). Site-specific construction drawings, implementation schedules, material specifications and quantities, and estimated construction costs for these sites were reported by Gaboury and Smith (2016). Funding for these physical works was provided by the BC Ministry of Transportation and Infrastructure (MOTI) and Fisheries and Oceans Canada (DFO).

Table 1. Location of the three fish passage improvement sites completed in 2017.

Site Name	Watershed Code	UTM Zone	Easting	Northing
Johnny David Creek @ Hwy 16	460-778000	9U	670221	6044747
Moan Creek @ Lawson Rd	460-458800	9U	630665	6055720
Tchesinkut Creek @ Hwy 35	180-374000-95200-01900-3580	10U	322331	5998056

2 RESTORATION OBJECTIVES

Culverts can be barriers to fish passage if one or more of the following factors exist: excessive jump height at the culvert outlet, insufficient pool depth below the culvert, excessive water velocity inside the culvert, or insufficient water depth inside the culvert. For the three sites restored in 2017, the biological objectives were to: 1) restore fish passage at culvert crossings to historic spawning, rearing and overwintering habitats further upstream; and 2) provide improvements in the usable area and function of spawning, rearing and overwintering habitats.

3 GENERAL RESTORATION DESIGN

For all three sites, the restoration design involved the construction of rock riffles to backwater culverts and improve fish passage. Riffle crest rocks were 1.0 m in diameter with 0.7-1.0 m diameter rocks on the downstream face; and an overall D_{50} of 0.8 m as fill along with quarry tailings (< 0.3 m dia).

At sites with relatively low banks, earth-fill berms were built along the banks to ensure moderate flood flows remain confined with the channels. Berms were designed to have a 5 m base and

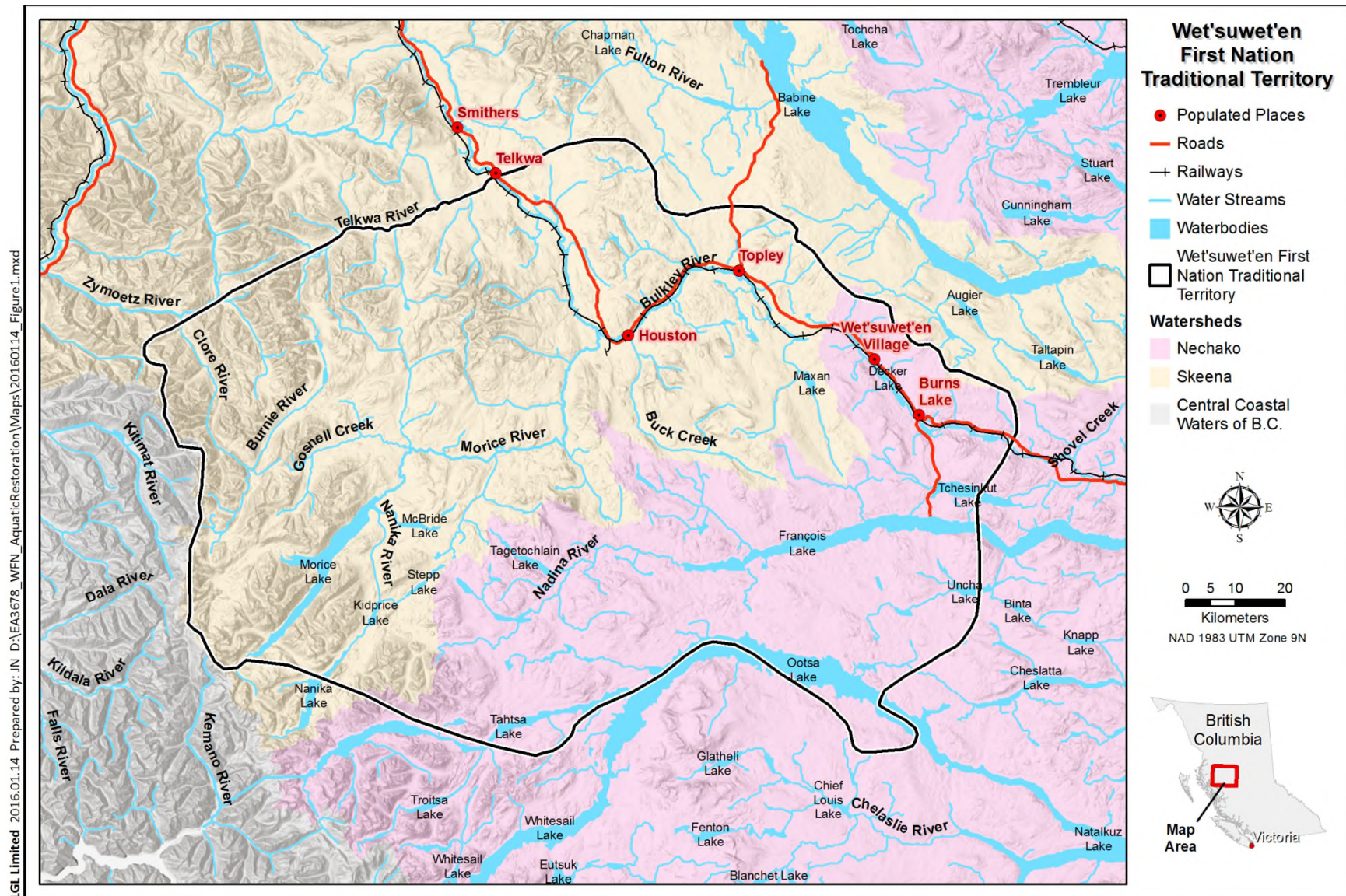


Figure 1. Map of the Wet'suwet'en First Nation (WFN) traditional territory which includes portions of the upper Bulkley and upper Fraser river watersheds.

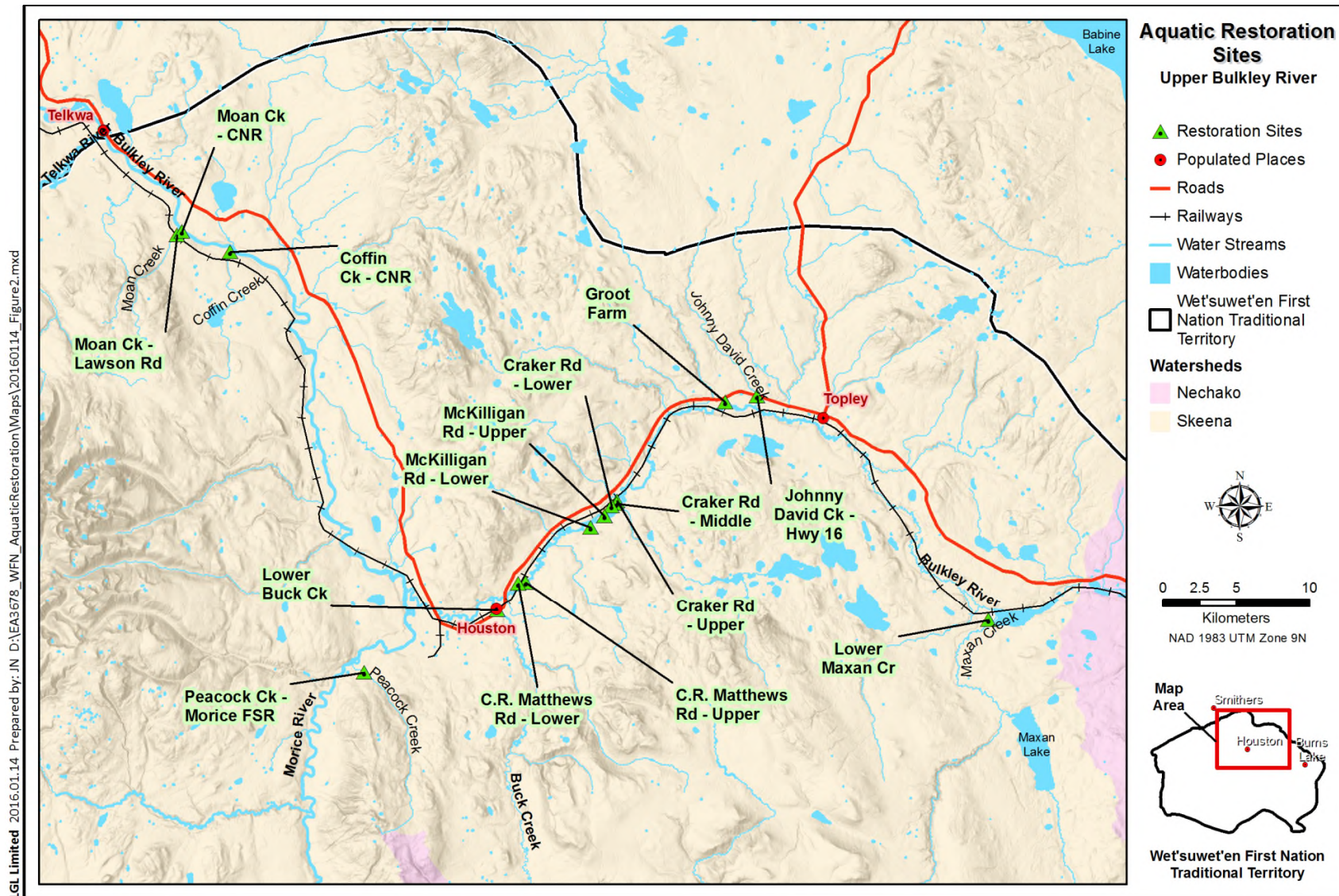


Figure 2. Map of the upper Bulkley and Morice watersheds showing the location of 15 potential restoration sites within the Wet'suwet'en First Nation traditional territory that were identified by Gaboury and Smith (2016) in the fall of 2015.

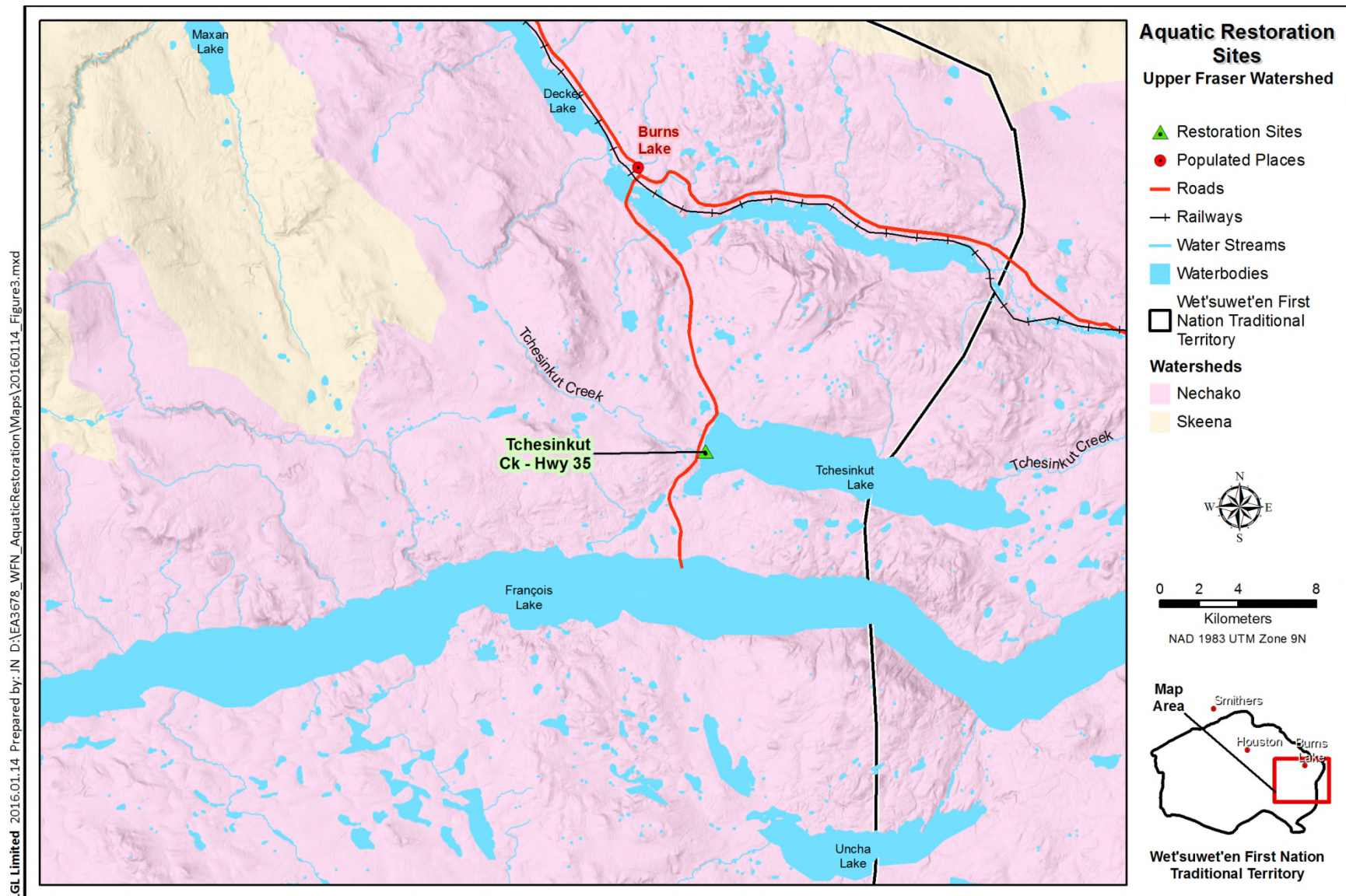


Figure 3. Map of the upper Fraser watershed showing the location of a potential restoration site on Tchesinkut Creek within the Wet'suwet'en First Nation traditional territory that was identified by Gaboury and Smith (2016) in the fall of 2015.

1 m top width, and be constructed with 2H:1V side slopes to a height of ~1 m above the existing top of bank. Berm cores were constructed with soils having a high clay content to prevent leakage. Pit-run gravel was used over the clay core and rock riprap was added to the upstream and downstream side slopes of the berm to increase stability and avoid washout. A 50 kg Class of riprap (Northwest Hydraulic Consultants Ltd. 2000) with a rock gradation of 85% larger than 5 kg (~10 cm diameter), 50% larger than 50 kg (~35 cm diameter) and 15% larger than 150 kg (~48 cm diameter) was used.

Rooted willows and grass seed were planted along the banks at each of the restored sites once construction was complete.

4 CONSTRUCTED WORKS

4.1 Johnny David Creek at Highway 16

Johnny David Creek is a 2nd order stream that flows southward before draining into the upper Bulkley River along its right bank. Johnny David Creek crosses Highway 16 about 25 km northeast of Houston, and the Hwy 16 crossing is located approximately 1 rkm upstream from the Bulkley River. Fish species present in Johnny David Creek include Chinook and Coho salmon, Steelhead, Cutthroat and Rainbow trout, and Dolly Varden (FISS 2015). At the Hwy 16 crossing, Johnny David Creek passes through a round, multi-plate culvert (2 m dia x 20 m long). The slope of the culvert is 3.96% and the height of the outfall drop was 0.19 m on 10 October 2015.

From 14-20 July 2017, rock material was delivered to the Johnny David site and three riffles were constructed approximately 16, 38, and 50 m downstream of the Highway 16 culvert outlet (Figure 4, Figure 5; Photo 1 to Photo 6). Post-construction, the culvert was backwatered 9.5 m (31% of the 30-m length) and water depth at the invert of the culvert outlet was 0.38 m on July 20. Berms were constructed on both banks, extending from the culvert outlet downstream to the first riffle. In total, approximately 224 m³ of riffle rock and gravel, 16 m³ of spawning gravel, and 120 m³ of berm material were used.

4.2 Moan Creek at Lawson Road

Moan Creek is a 2nd order stream that flows northwest before draining into the upper Bulkley River along its left bank, approximately 9.5 km upstream of the Telkwa River mouth. Fish species present in Moan Creek include Cutthroat, Rainbow and Bull trout, as well as Dolly Varden (FISS 2015). Wilson and Rabnett (2007) indicated that Chinook and Coho salmon have been observed in the lower 500 m reach of the creek. At the Lawson Road crossing located approximately 500 m from its mouth, Moan Creek passes through a concrete, baffled culvert. The culvert is 1.5 m wide, 1.5 m high and approximately 22 m long. Fifteen v-shaped baffles (0.33 m in height at the center notch) create a series of step pools through the entire length of the culvert. The culvert is steeply sloped at 10% and there was an outfall drop of 0.27 m on 10 October 2015.

Rock material for the Moan Creek site was delivered from 13-14 July and 21-24 July 2017. From 21-24 July, three riffles were constructed approximately 6, 17, and 27 m downstream of

the Lawson Road culvert outlet (Figure 6, Figure 7; Photo 7 to Photo 12). Post-construction, the first step pool was backwatered with a water depth of 0.08 m flowing over the notch in the lowermost v-shaped baffle on 24 July. A berm was constructed along the right bank, extending from the culvert outlet downstream to the crest of the third riffle. Approximately 102 m³ of riffle rock and gravel and 61 m³ of berm material were used.

4.3 Tchesinkut Creek at Highway 35

The upper portion of Tchesinkut Creek flows eastward and empties into the west side of Tchesinkut Lake. The lower portion of Tchesinkut Creek flows northeast from the outlet of Tchesinkut Lake (at the east end) and empties into the Endako River. The Endako River feeds into the Nechako River, and the Nechako River drains into the Fraser River at Prince George. Rainbow Trout are present in Tchesinkut Creek, while Kokanee, Rainbow Trout, Lake Trout, Lake Whitefish, and Burbot are among the fish species observed in Tchesinkut Lake (FISS 2015). At the Highway 35 crossing located approximately 75 m upstream from Tchesinkut Lake, Tchesinkut Creek passes through two, elliptical, multi-plate culverts. Each culvert is 2.2 m wide, 1.65 m high and 21 m in length. The culvert closer to the north (left) side of the creek had a slope of 1.49% with an outfall drop of 0.19 m on 12 October 2015.

From 28-29 August 2017, rock material was delivered to the Tchesinkut Creek site and one riffle was constructed approximately 35 m downstream of the Highway 35 culvert outlets (Figure 8, Figure 9; Photo 13 to Photo 16). Post-construction, the culvert was backwatered 16.8 m (81% of the 20.8 m length) and water depth at the invert of the culvert outlet was 0.29 m on 29 August 2017. Approximately 24 m³ of riffle rock was used.

5 CONSTRUCTION MONITORING

An environmental monitor was on site daily throughout construction to ensure that the works had minimal or no impact on fish habitat, as per the environmental protocol outlined in Appendices A and B in Gaboury and Smith (2016). All land-based equipment operated from the upland when possible so as not to enter the watercourses. Visual observations at all sites showed no significant increases in turbidity as a result of construction. No fuel or oil spills occurred during construction, and all construction equipment was fueled at least 30 m from the river.

6 REFERENCES

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Wilson, T., and K. Rabnett. 2007. Fish passage assessment of Highway 16 and CN Rail in the Bulkley Watershed. Skeena Fisheries Commission, Kispiox, BC.

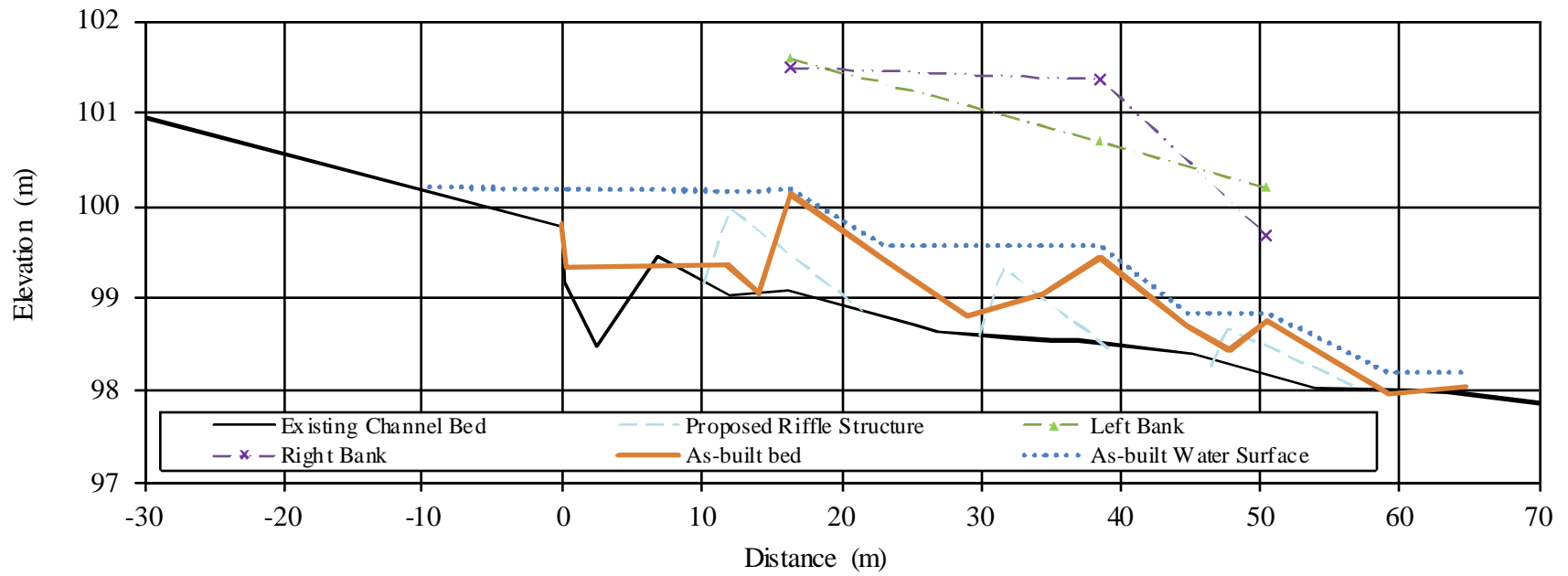


Figure 4. Longitudinal profile of the restored site on Johnny David Creek at Highway 16, 20 July 2017.

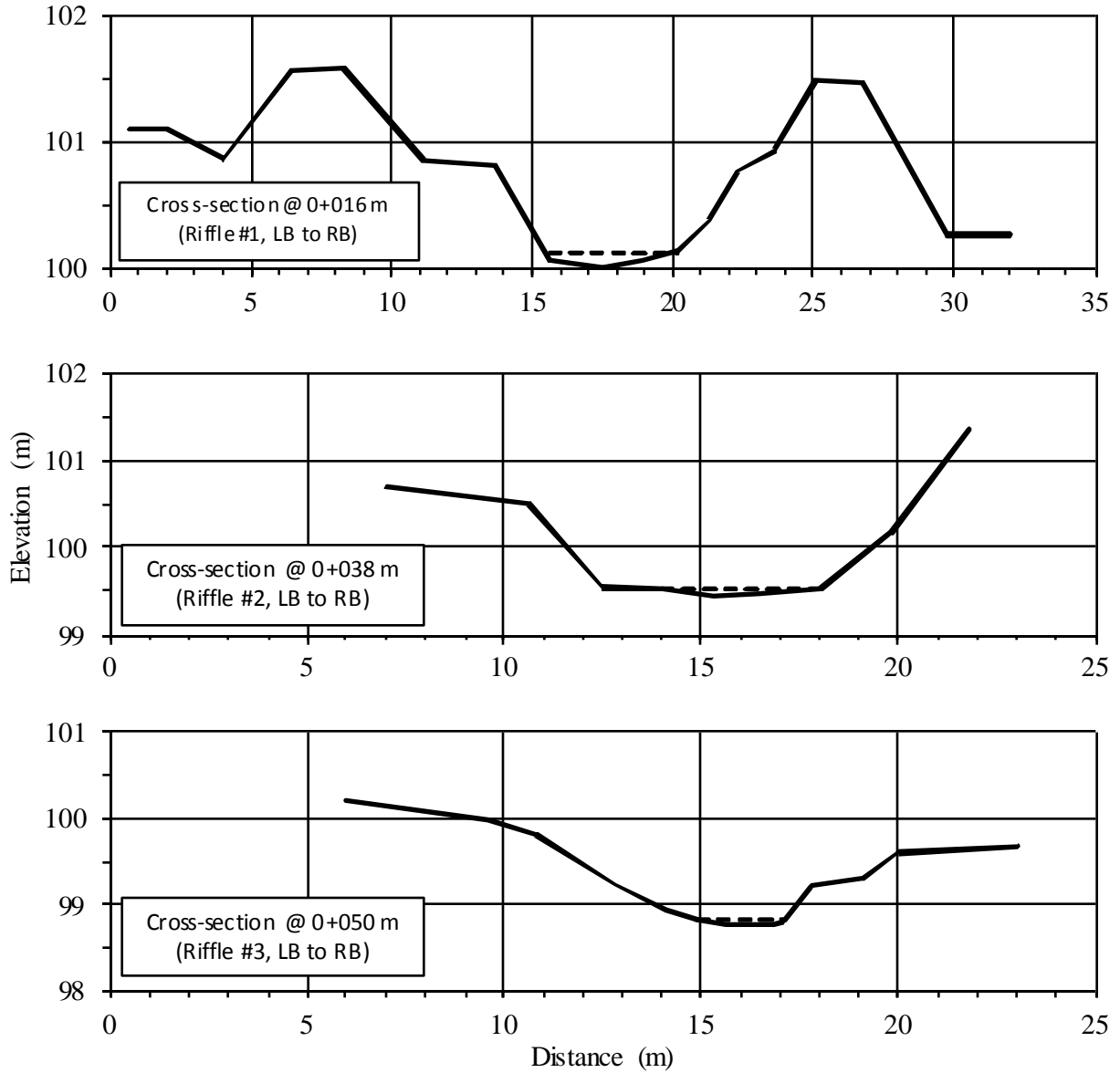


Figure 5. Cross sections at the riffles of the restored site on Johnny David Creek at Highway 16, 20 July 2017.

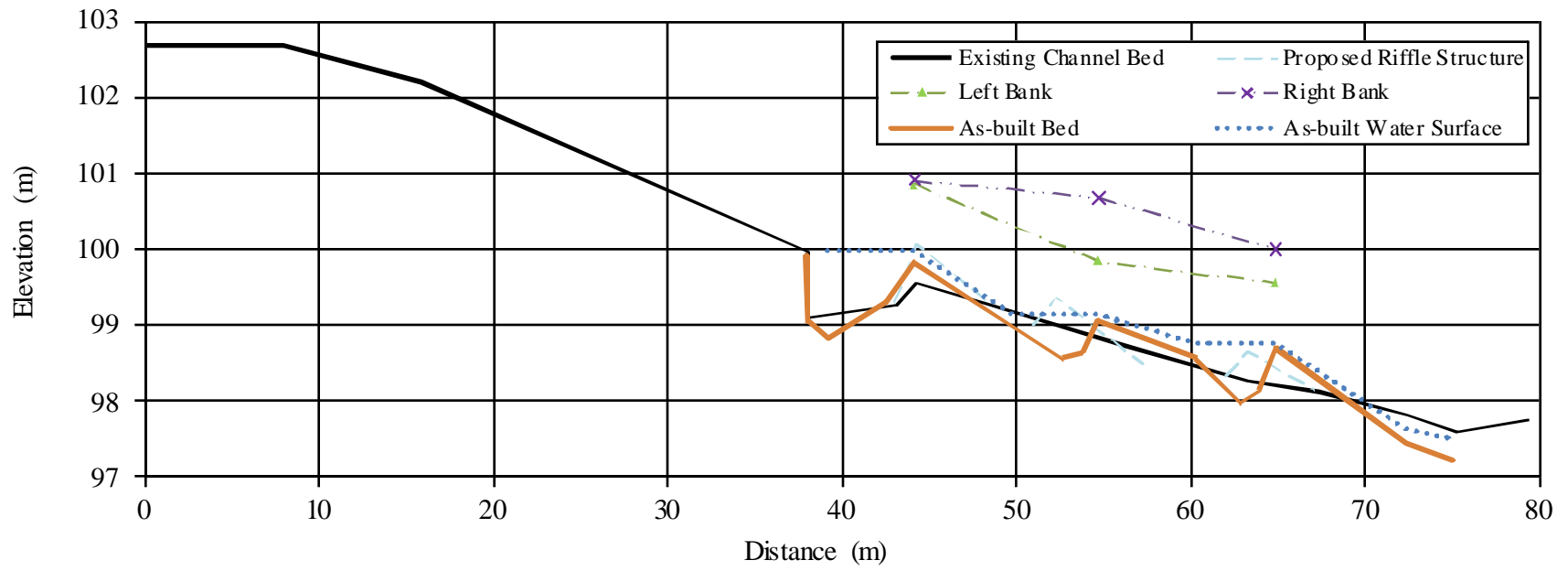


Figure 6. Longitudinal profile of the restored site on Moan Creek at Lawson Road, 24 July 2017.

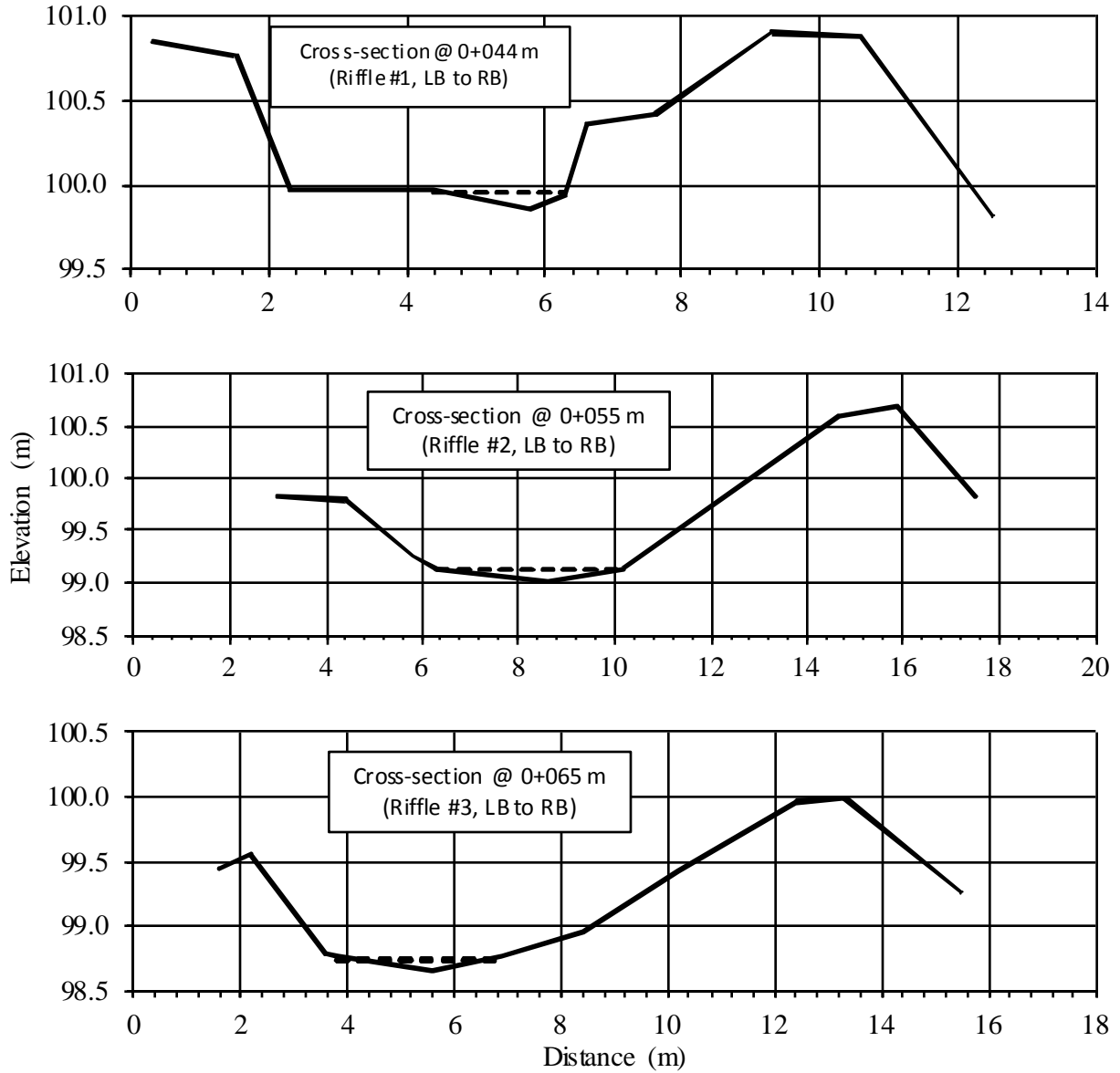


Figure 7. Cross sections at the riffles of the restored site on Moan Creek at Lawson Road, 24 July 2017.

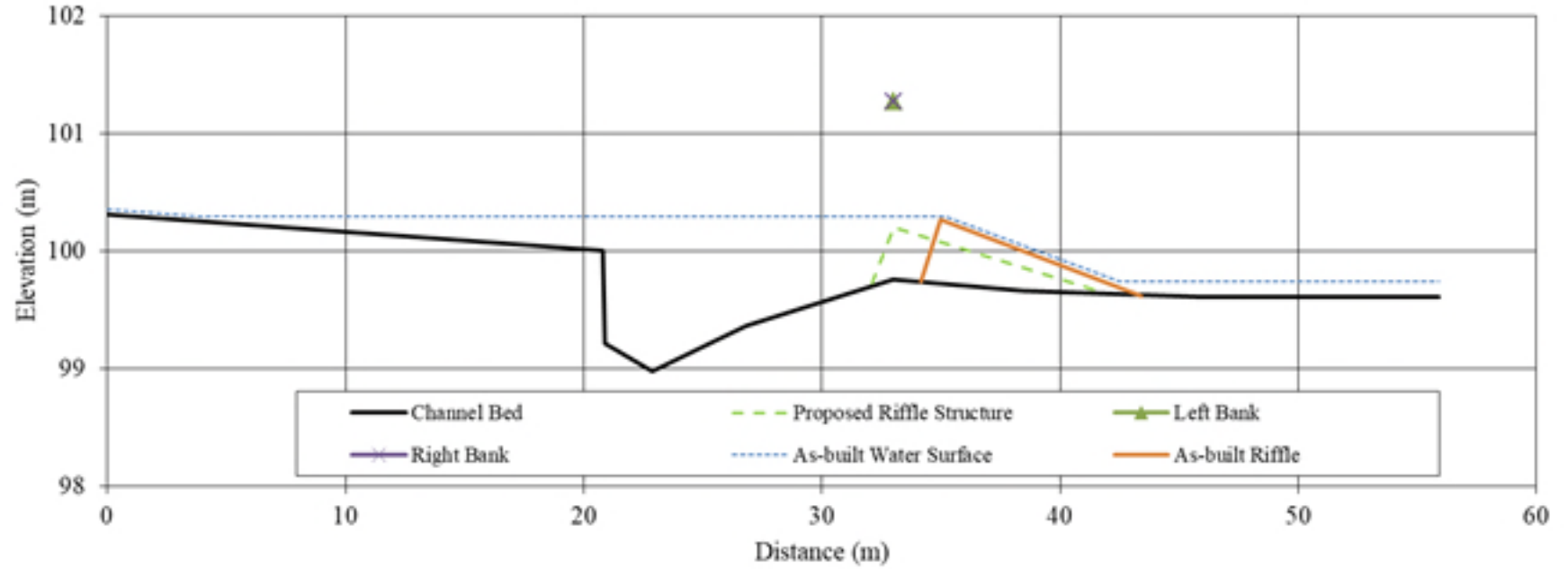


Figure 8. Longitudinal profile of the restored site on Tchesinkut Creek at Highway 35, 29 August 2017.

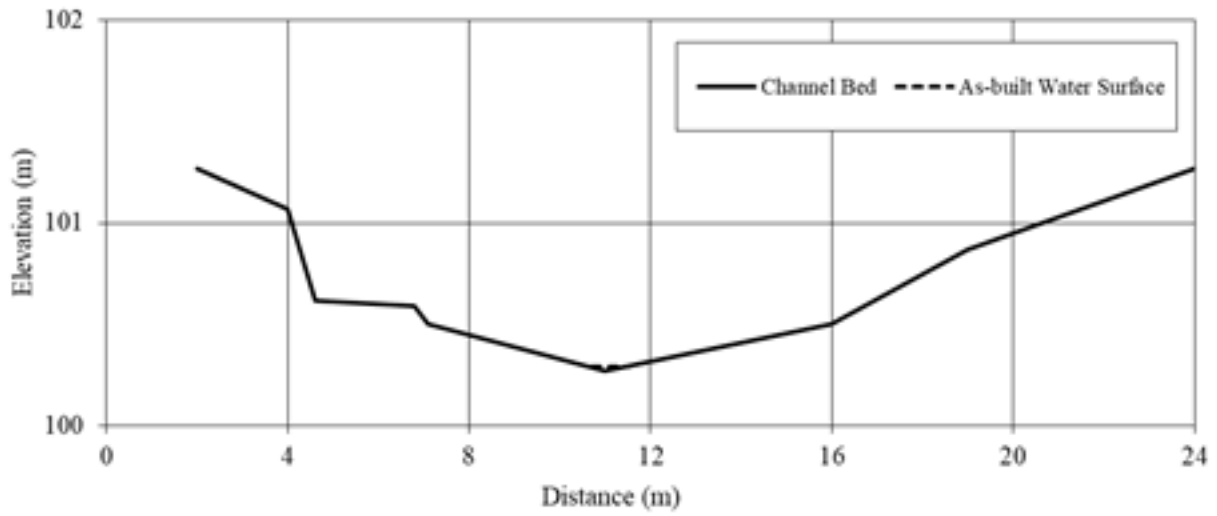


Figure 9. Cross section at the riffle crest of the restored site on Tchesinkut Creek at Highway 35, 29 August 2017.

7 PHOTOS



Photo 1. Johnny David Creek at Highway 16 – Upstream view of the culvert outlet prior to construction (15 July 2017).



Photo 2. Johnny David Creek at Highway 16 – Upstream view of the culvert outlet after construction (20 July 2017).



Photo 3. Johnny David Creek at Highway 16 – View from the right bank of riffle 1 (12 m d/s culvert outlet) during construction (17 July 2017).



Photo 4. Johnny David Creek at Highway 16 – View from the right bank of riffle 1 (0+012 m) after construction (20 July 2017).

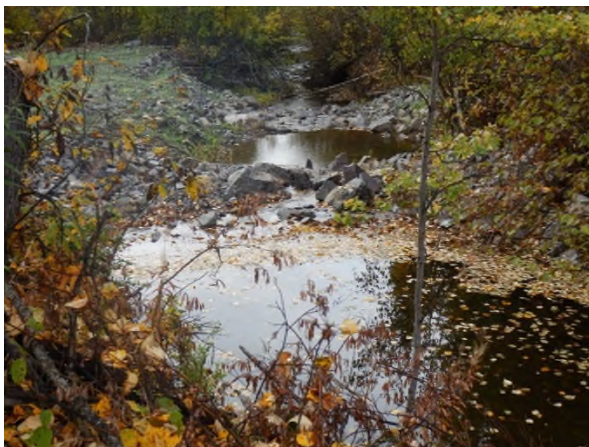


Photo 5. Johnny David Creek at Highway 16 – Downstream view of riffles 2 and 3 after construction (30 September 2017).



Photo 6. Johnny David Creek at Highway 16 – Downstream view of the left-bank berm after construction (20 July 2017).



Photo 7. Moan Creek at Lawson Road – Upstream view of the culvert outlet prior to construction (21 July 2017).



Photo 8. Moan Creek at Lawson Road – Upstream view of the culvert outlet after construction (24 July 2017).



Photo 9. Moan Creek at Lawson Road – Upstream view of riffle 1 (6 m d/s culvert outlet) during construction (24 July 2017).



Photo 10. Moan Creek at Lawson Road – Upstream view of riffle 1 (6 m d/s culvert outlet) after construction (29 September 2017).



Photo 11. Moan Creek at Lawson Road – Upstream view of the pool between riffles 2 and 3 after construction (29 September 2017).



Photo 12. Moan Creek at Lawson Road – View of the right-bank berm and creek from Lawson Rd. The creek flows from left to right (29 September 2017).



Photo 13. Tchesinkut Creek at Highway 35 – Upstream view of the culvert outlets and outlet pool prior to construction (23 July 2017).



Photo 14. Tchesinkut Creek at Highway 35 – Upstream view of the culvert outlets and outlet pool after construction (30 September 2017).



Photo 15. Tchesinkut Creek at Highway 35 – Downstream view of the proposed riffle 1 site prior to construction (23 July 2017).



Photo 16. Tchesinkut Creek at Highway 35 – Downstream view of riffle 1 after construction (30 September 2017).