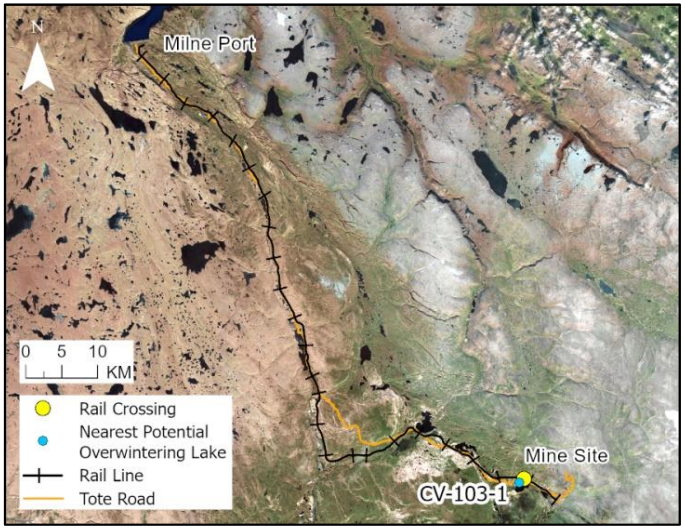
RAIL CV-103-1

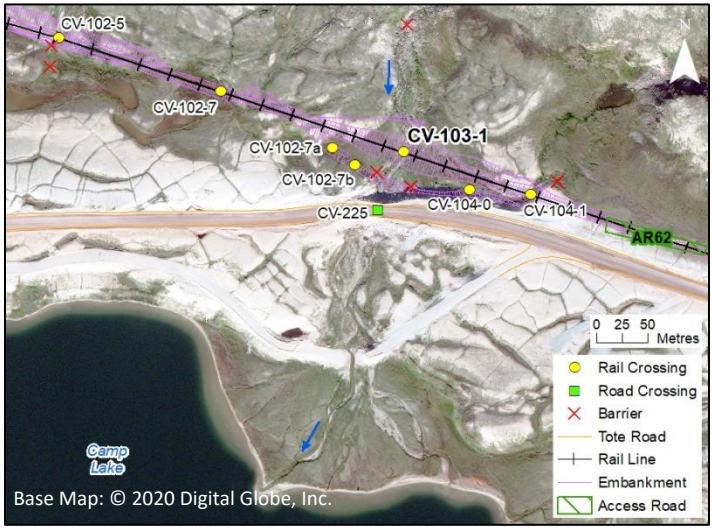
LOCATION AND CROSSING DESCRIPTION

Site ID:	CV-103-1	**Dates Surveyed:**	20-Jun-19; 22-Aug-19	**Waterbody Type:**	Stream
Project Interaction:	Rail Culvert	**Centreline UTM Coordinates:**	17W 557449 E 7915244 N	**Culvert Length (m):**	75
Number of Barrels:	4	**Culvert Diameter/Span (mm):**	1800	**Slope (%):**	4

GENERAL PHYSICAL CHARACTERISTICS

Flow Regime: Seasonal **Stream Order:** 3+ **Drainage Basin Area (km²):** 8.155





SUMMARY

The rail alignment crosses an unnamed seasonal stream at CV-103-1 that drains south to Camp Lake approximately 400 m downstream. The stream is also crossed by the Tote Road (CV-225) approximately 60 m downstream of the rail centreline. This stream had moderate depths and moderate to high velocities. Habitat is largely cascade/pool/run over cobble/boulder. It is one of the larger tributaries to Camp Lake and has been subject to considerable study since 2006.

There is a permanent barrier (set of falls) approximately 220 m upstream of the rail centreline; there is also a series of large fast-flowing cascades and vertical drops starting at approximately 130 m upstream that may limit or prevent farther upstream movements of at least the smaller juvenile char found in this stream. The main flow passes over a 0.5 m drop, but some side channels could bypass this drop with sufficient water depths. There are no natural downstream barriers to fish movement, though high velocities (>2.0 m/s) inside the Tote Road culvert have been observed during periods of high water since 2006.

This stream provides open-water season rearing habitat for juvenile Arctic Char from Camp Lake upstream to the barrier. The stream does not provide overwintering or spawning habitat for char due to lack of flow and sufficient depth in winter.

Ninespine Stickleback have been captured at the confluence with Camp Lake downstream, but not upstream of the Tote Road where habitat is unsuitable for this species.

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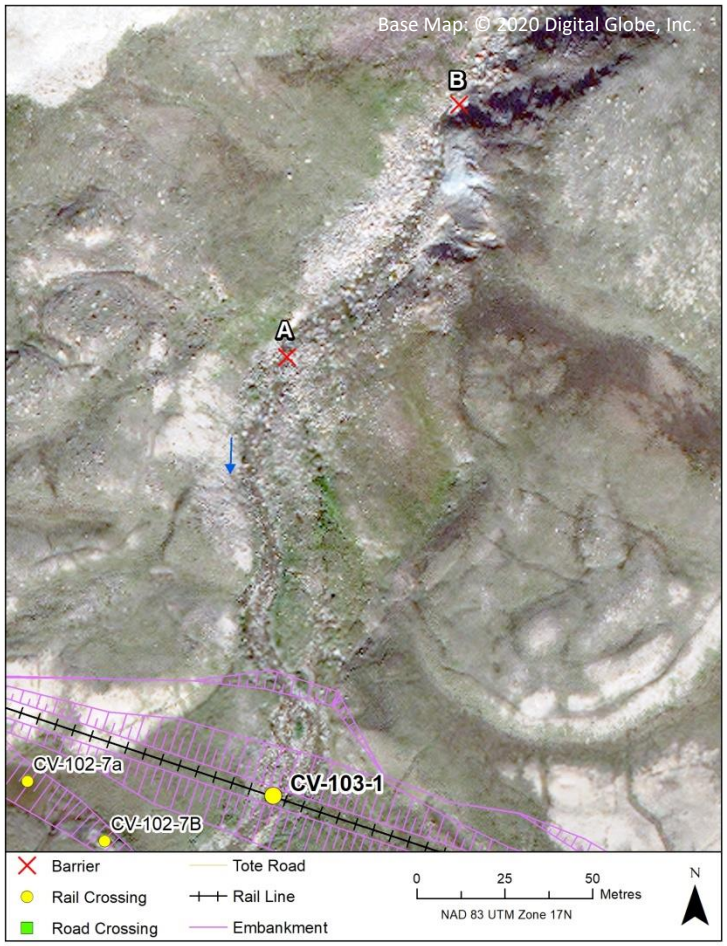
BARRIERS

Upstream/ Downstream	UTM		Barrier Type			Height (m)	Gradient (°)	Description	Site Label
	Easting	Northing	1	2	3				
Downstream	NO BARRIERS								
Upstream	557453	7915369	VD	VALL		0.3-0.5		Potential Intermittent Barrier: Located at the base of a series of large cascades/falls, some of which may be passable	A
Upstream	557502	7915441	VD			3-4m		Permanent Barrier: Large waterfall	B



A

B

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FISH HABITAT POTENTIAL

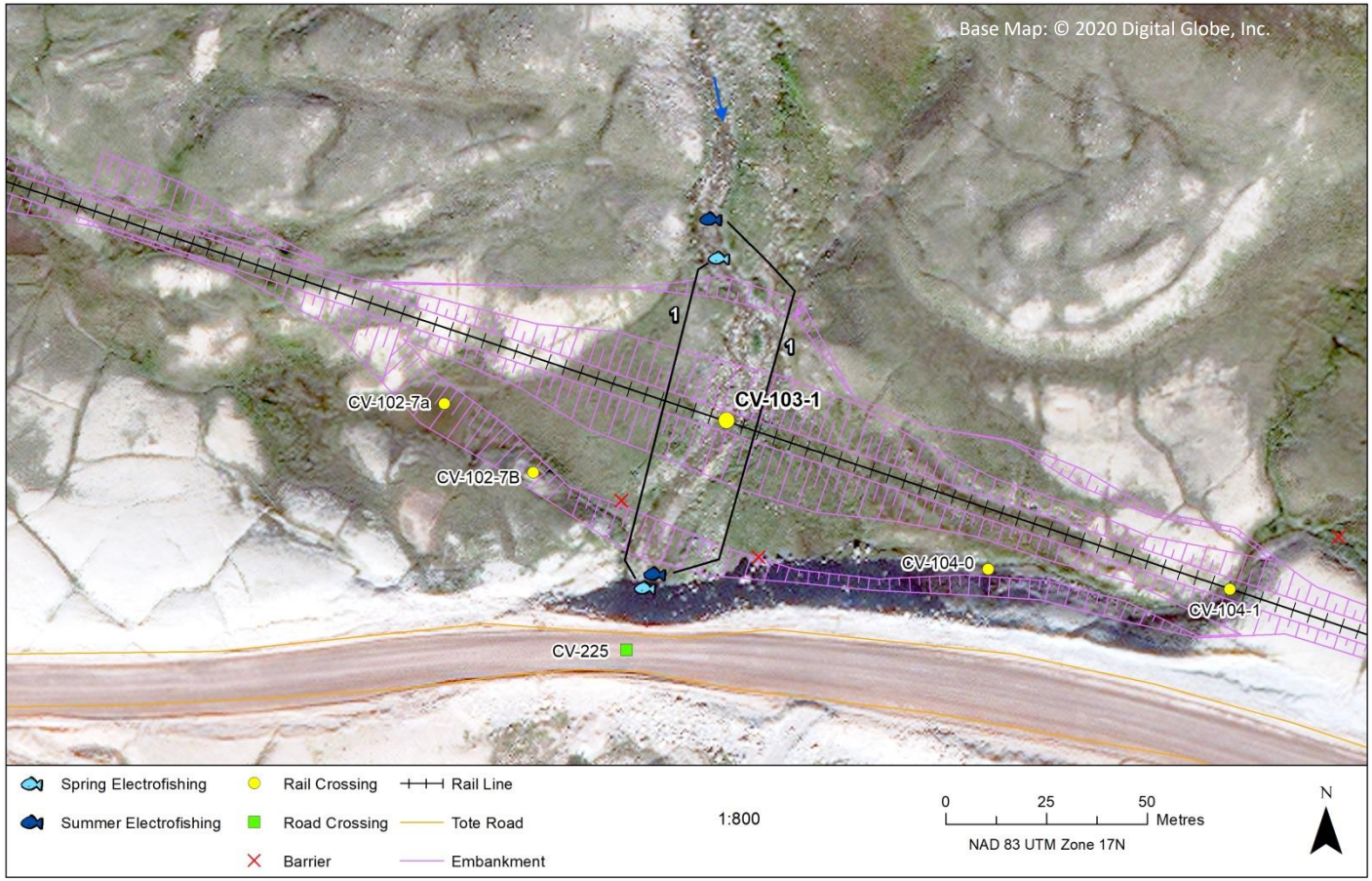
Nearest Potential Overwintering Habitat - ARCH: Camp Lake

Distance to Nearest Potential Overwintering Habitat - ARCH (km): ~0.40

Overwintering Habitat Upstream of Site - ARCH (Y/N): No

Species	Spawning	Overwintering	Rearing	Adults Present
ARCH	N	N	Y	N
NNST	N	N	N	N

FISHING SITES



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FISHERIES DATA

Date: 20-Jun-19 **Temperature (°C):** 9.0 **Gear Used:** Backpack Electrofisher/Visual

Distance Fished (m): 100 **Duration Fished (seconds):** 280

Species	Season	Pass	Effort (Seconds)	Fish Captured	Fish Observed	CPUE (No. Fish/60 Seconds)	Length Range (mm)
ARCH	Spring	1	280	7	0	1.50	132 – 201 (measured)
NNST	Spring	1	280	0	0	-	-

Date: 22-Aug-19 **Temperature (°C):** 8.0 **Gear Used:** Backpack Electrofisher/Visual

Distance Fished (m): 100 **Duration Fished (seconds):** 308

Species	Season	Pass	Effort (Seconds)	Fish Captured	Fish Observed	CPUE (No. Fish/60 Seconds)	Length Range (mm)
ARCH	Summer/Fall	1	308	20	2	3.90	82 – 160 (measured)
NNST	Summer/Fall	1	308	0	0	-	-

COMMENTS

Char were observed throughout the surveyed reach up to the intermittent vertical barrier in spring and upstream to the permanent barrier in summer/fall. Most char were relatively large (i.e., >120 mm in length) which likely reflects the relatively high velocities found upstream of the Tote Road. Similar observations have been made during Tote Road monitoring and Mine Area baseline surveys conducted since 2006. Stickleback have never been captured in this reach of the stream.

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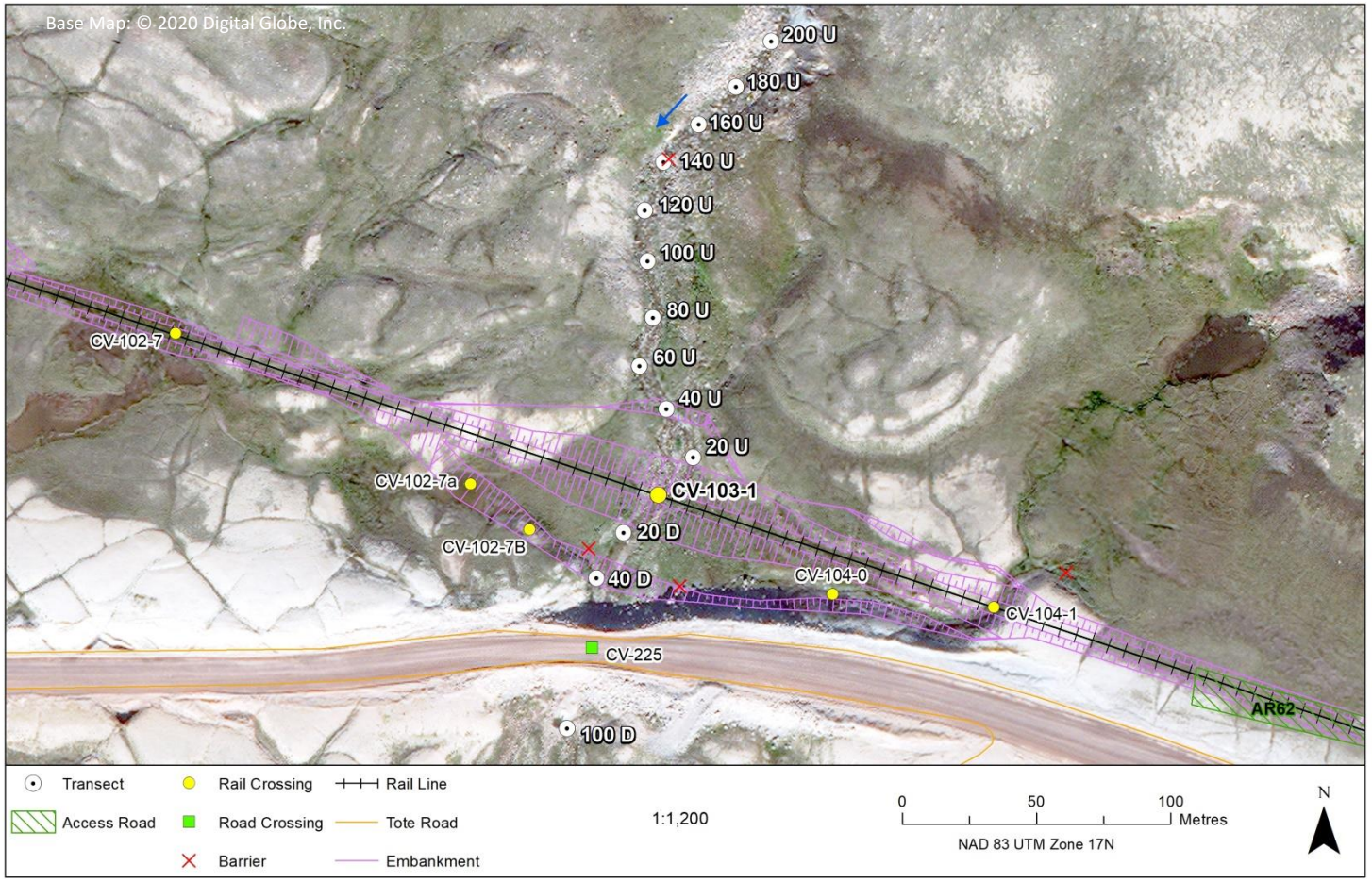
GENERAL HABITAT CHARACTERISTICS

Channel Confinement: PC **Stream Morphology:** Sinuous **Riparian Vegetation Type (%):** Grass 60, Willow 20, Other 20

Centreline	Height (m)	Stability	Materials (%)	Shape
LHB	0.40	Moderate	Boulder 20, Cobble 40, Organic 40	Sloping
RHB	0.30	Moderate	Boulder 20, Cobble 40, Organic 40	Sloping

HABITAT SURVEY SITES



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HYDROLOGY & HABITAT CHARACTERISTICS: 20-JUN-19

Wetted/Dry/Shallow (<0.02 m)/Unconnected Pools: Wetted **Stage:** Moderate

Site	Channel Width (m)		Water Depth (m)				Water Velocity (m/s)			
	Bankfull	Wetted	25%	50%	75%	Max	25%	50%	75%	Max
100D	TRANSECTS OVERLAP WITH TOTE ROAD									
80D										
60D										
40D	9.4	9.4	0.09	0.04	0.05	0.09	0.55	0.28	0.32	0.55
20D	5.1	4.1	0.15	0.17	0.10	0.18	0.52	0.55	0.35	0.55
0 (Centreline)	8.1	7.7	0.14	0.13	0.07	0.14	0.40	0.26	0.22	0.40
20U	11.8	11.3	0.11	0.04	0.12	0.12	0.26	0.38	0.42	0.42
40U	7.3	7.3	0.20	0.10	0.06	0.20	0.36	0.40	0.25	0.40
60U	5.9	6.0	0.11	0.08	0.10	0.11	0.30	0.40	0.50	0.50
80U	4.5	3.9	0.17	0.28	0.10	0.30	0.30	0.35	0.10	0.45
100U	5.9	5.5	0.10	0.05	0.08	0.15	0.35	0.35	0.35	0.35

Site	Stream Morphology Composition (%)							Substrate Composition (%)				
	Riffle	Pool (<0.2 m)	Pool (>0.2 m)	Run	Cascade	Flat	Rapids	Fines	Gravel	Small Cobble	Large Cobble	Boulders
100D	TRANSECTS OVERLAP WITH TOTE ROAD											
80D												
60D												
40D	60	20	10	5	5	-	-	5	20	45	25	5
20D	70	15	-	10	5	-	-	10	20	30	30	10
0 (Centreline)	40	15	-	5	40	-	-	5	15	30	35	15
20U	20	30	-	-	50	-	-	10	10	45	20	15
40U	20	20	-	-	60	-	-	5	20	40	20	15
60U	20	20	-	10	50	-	-	-	20	40	30	10
80U	10	-	30	10	50	-	-	20	10	20	30	20
100U	25	20	5	-	50	-	-	5	5	15	45	30

OTHER NOTES / OBSERVATIONS

The stream is characterized by riffle/cascade/pool habitat over cobble/boulder substrate, with moderate to high velocities.

RAIL CV-103-1

HYDROLOGY & HABITAT CHARACTERISTICS: 22-AUG-19

Wetted/Dry/Shallow (<0.02 m)/Unconnected Pools: Wetted **Stage:** Moderate

Site	Channel Width (m)		Water Depth (m)				Water Velocity (m/s)			
	Bankfull	Wetted	25%	50%	75%	Max	25%	50%	75%	Max
100D	13.5	11.4	0.10	0.14	0.10	>2.0	0.13	0.47	0.44	0.91
80D	TRANSECTS OVERLAP WITH TOTE ROAD									
60D										
40D	10.5	9.3	0.10	0.11	0.10	0.15	0.53	1.03	0.43	1.03
20D	5.6	4.5	0.09	0.19	0.12	0.24	0.24	0.47	0.11	1.01
0 (Centreline)	8.4	6.5	0.09	0.21	0.12	0.30	0.21	0.60	0.32	1.05
20U	15.5	14.7	0.08	0.03	0.11	0.98	0.98	0.21	0.22	0.29
40U	5.2	3.3	0.14	0.16	0.03	0.24	0.40	0.84	0.05	0.98
60U	8.1	7.9	0.18	0.08	0.17	0.42	0.47	0.04	0.20	1.02
80U	6.0	4.8	0.07	0.10	0.09	0.22	0.48	0.59	0.63	1.33
100U	5.0	4.1	0.03	0.17	0.18	0.33	0.26	1.02	0.91	1.02

Site	Stream Morphology Composition (%)							Substrate Composition (%)				
	Riffle	Pool (<0.2 m)	Pool (>0.2 m)	Run	Cascade	Flat	Rapids	Fines	Gravel	Small Cobble	Large Cobble	Boulders
100D	40	40	20						15	20	60	5
80D	TRANSECTS OVERLAP WITH TOTE ROAD											
60D												
40D	30	-	-	60	10	-	-	-	20	30	50	-
20D	20	5	20	35	20	-	-	-	35	20	40	5
0 (Centreline)	-	25	5	20	50	-	-	-	5	40	45	10
20U	-	5	10	5	80	-	-	-	10	10	60	20
40U	-	10	-	80	10	-	-	-	20	30	20	30
60U	-	10	-	10	80	-	-	-	20	30	40	10
80U	-	40	-	20	40	-	-	-	-	20	60	20
100U	-	50	-	20	30	-	-	-	10	10	30	50

OTHER NOTES / OBSERVATIONS

Water levels and velocities were higher in summer/fall than spring.

RAIL CV-103-1

20-JUN-19

A

B

C

D

E

F

Photos 1. Photos taken at the crossing centreline (top) and 20 m downstream (bottom) in spring: (A,D) facing upstream; (B,E) facing downstream; and (C,F) across (right bank looking at left bank).

RAIL CV-103-1

20-JUN-19

A

B

C

Photos 2. Photos taken 40 m downstream in spring: (A) facing upstream; (B) facing downstream; and (C) across (right bank looking at left bank).

RAIL CV-103-1

20-JUN-19

A

B

C

D

E

F

Photos 3. Photos taken 20 m upstream (top) and 40 m upstream (bottom) in spring: (A,D) facing upstream; (B,E) facing downstream; and (C,F) across (right bank looking at left bank).

RAIL CV-103-1

20-JUN-19

A

B

C

D

E

F

Photos 4. Photos taken 60 m upstream (top) and 80 m upstream (bottom) in spring: (A) facing upstream; (B) facing downstream; and (C) across (right bank looking at left bank).

RAIL CV-103-1

20-JUN-19

A

B

C

Photos 5. Photos taken 100 m upstream (top) in spring: (A) facing upstream; (B) facing downstream; and (C) across (right bank looking at left bank).

RAIL CV-103-1

22-AUG-19

A

B

C

D

E

F

Photos 6. Photos taken at the crossing centerline in summer/fall: (A) facing upstream; (B) facing downstream; (C) across (right bank looking at left bank); (D) diagonal from left bank above the centreline looking downstream; (E) across (left bank looking at right bank); and (F) diagonal from left bank below the centreline looking upstream.

RAIL CV-103-1

22-AUG-19

A

B

C

D

E

F

Photos 7. Photos taken 20 m downstream (top) and 40 downstream (bottom) in summer/fall: (A,D) facing upstream; (B,E) facing downstream; and (C,F) across (left bank looking at right bank).

RAIL CV-103-1

22-AUG-19

A

B

C

Photos 8. Photos taken 100 m downstream in summer/fall: (A) facing upstream; (B) facing downstream; and (C) across (left bank looking at right bank).

RAIL CV-103-1

22-AUG-19

A

B

C

D

E

F

Photos 9. Photos taken 20 m upstream (top) and 40 m upstream (bottom) in summer/fall: (A,D) facing upstream; (B,E) facing downstream; and (C,F) across (left bank looking at right bank).

RAIL CV-103-1

22-AUG-19

A

B

C

D

E

F

Photos 10. Photos taken 60 m upstream (top) and 80 m upstream (bottom) in summer/fall: (A,D) facing upstream; (B,E) facing downstream; and (C,F) across (left bank looking at right bank).

RAIL CV-103-1

22-AUG-19

A

B

C

Photos 11. Photos taken 100 m upstream in summer/fall: (A) facing upstream; (B) facing downstream; and (C) across (left bank looking at right bank).

RAIL CV-103-1

HYDROLOGY & HABITAT CHARACTERISTICS: UPSTREAM SURVEY

Date: 22-Aug-19

Site	Channel Width (m)		Water Depth (m)				Water Velocity (m/s)			
	Bankfull	Wetted	25%	50%	75%	Max	25%	50%	75%	Max
120U	6.8	5.4	0.21	0.09	0.12	0.38	0.35	0.50	0.24	1.46
140U	6.1	3.2	0.06	0.13	0.09	0.20	0.14	1.06	0.55	1.06
160U	7.8	6.3	0.15	0.07	0.09	0.23	0.42	0.47	0.44	1.08
180U	6.7	4.3	0.08	0.30	0.20	0.30	0.05	0.45	0.19	1.32
200U	6.0	4.5	0.08	0.15	0.05	0.35	0.15	0.69	0.74	1.51

Site	Stream Morphology Composition (%)							Substrate Composition (%)				
	Riffle	Pool (<0.2 m)	Pool (>0.2 m)	Run	Cascade	Flat	Rapids	Fines	Gravel	Small Cobble	Large Cobble	Boulders
120U	-	20	10	30	30	-	10	-	-	10	30	60
140U	-	20	10	30	30	-	10	-	-	10	25	65
160U	-	20	10	30	30	-	10	-	-	10	40	50
180U	-	-	-	60	10	-	30	-	-	10	40	50
200U	-	40	-	20	-	-	40	-	15	5	20	60

OTHER NOTES / OBSERVATIONS

A detailed habitat survey was conducted from 100-200 m upstream in summer/fall. Average velocities and substrate sizes increased upstream of the 100 m upstream transect. The first upstream barrier includes a relatively large drop, but there are side cascades with smaller drops on either side of the 0.5 m drop that may allow the larger juveniles observed in this stream (>150 mm) to access additional upstream habitat depending on water levels (there was minimal water in the side cascades during the summer/fall survey). The permanent barrier (falls) is an additional 20 m upstream from this reach.

RAIL CV-103-1

22-AUG-19: UPSTREAM SURVEY

A

B

C

D

E

F

Photos 12. Photos taken 120 m upstream (top) and 140 m upstream (bottom) in summer/fall: (A,D) facing upstream; (B,E) facing downstream; and (C,F) across (left bank looking at right bank). Note: all photos taken while standing at the transect centreline.

RAIL CV-103-1

22-AUG-19: UPSTREAM SURVEY

A

B

C

D

E

F

Photos 13. Photos taken 160 m upstream (top) and 180 m upstream (bottom) in summer/fall: (A,D) facing upstream; (B,E) facing downstream; and (C,F) across (left bank looking at right bank). Note: all photos taken while standing at the transect centreline.

RAIL CV-103-1

22-AUG-19: UPSTREAM SURVEY

A

B

C

Photos 14. Photos taken 200 m upstream in summer/fall: (A) facing upstream; (B) facing downstream; and (C) across (right bank looking at left bank). Note: all photos taken while standing at the transect centreline.