BERNARD HARBOUR TECHNICAL MEMORANDUM

DATE 6 February 2019 **Project No.** 1787890-045-TM-Rev0

TO Matthew Pickard
Sabina Gold & Silver Corp.

CC Merle Keefe, Dionne Filiatrault, Jen Range

FROM Cam Stevens and Tiffany Hnatiuk **EMAIL tiffany_hnatiuk@golder.com**

2018 BERNARD HARBOUR OFFSETTING MEASURE INSPECTION

1.0 INTRODUCTION

The purpose of this memo is to provide Sabina Gold & Silver Corp. (Sabina) with a summary of the Bernard Harbour Offsetting Measure Site inspection and community involvement program that took place 23 July to 26 2018, at Nulahugyuk Creek (Bernard Harbour). The work was conducted as part of the implementation of the Final Fish Offsetting Plan for a *Fisheries Act* authorization for Sabina's Back River Project, and was supported through funding from Sabina, with logistical and personnel support provided by the Kugluktuk Hunters and Trappers Organization (HTO).

In 2016 and 2017, Golder Associates Ltd. (Golder) technicians and HTO staff, including local students and other community members, worked together in the field towards a common goal of improving migration conditions for Arctic Char at problem areas in Nulahugyuk Creek (Golder 2016, 2017). The remediation (i.e., habitat enhancement) approach was based, in part, on the low-flow channel concept, where a low-flow channel is the 'narrowing' or diversion of flows over an unimpeded section of the creek bed. This was done by relocating boulders from the assumed thalweg to adjacent areas as a boundary to concentrate flows within the creek bed and to create an unobstructed path for fish. Where needed, weirs above the low-flow channel were also constructed to augment flows and increase water depths in the channel (i.e., as flow deflectors), and weirs below the low-flow channel were constructed to direct fish to the channel versus adjacent boulder gardens where stranding may occur (i.e., as fish deflectors). The implementation of this habitat enhancement concept at Bernard Harbour was initially tested at five problem locations (i.e., Pilot Projects or Projects) where barriers fully or partially impeded fish passage as part of a pilot study in 2012 (Golder 2013). In 2016, habitat was enhanced for passage at an additional 13 problem areas (i.e., Remediation Sites or Sites) using low-flow channels and associated weirs as part of the Back River Project Offsetting Plan (Golder 2016).

In 2017, habitat conditions of the Sites were inspected, five of which were repaired where boulders had moved during spring flows (Golder 2017). Although the integrity of remediation structures over the long-term is unknown, the expectation is that the annual effects of spring freshet flows and ice scouring on the integrity of the remediation structures are minimal given the small size of Nulahugyuk Creek and the fact that flows on the creek are dispersed over a relatively wide streambed in late summer just prior to freeze up (reviewed in Golder 2018).

Similar to 2017, the main objectives of the 2018 study were to describe summer flow conditions (velocity and depth) and the structural integrity of the 13 Sites (low-flow channels and weirs) previously constructed in Nulahugyuk Creek. The 13 Sites constructed in 2016 (Golder 2016) and the five Pilot Projects constructed in 2012 (Golder 2013) were visually inspected for passage functionality. Creek discharge was measured as supporting fish habitat data for the Fish Offsetting Plan, and the integrity evaluations were performed by inspecting the remediation structures to determine whether boulders and cobble had been disturbed or displaced. Displaced or non-functioning structures were repaired on site. The inspections were conducted on 24 July and 25 July 2018.

This memo includes the following sections (with supplemental photos provided in Appendix A):

- Nulahugyuk Creek Flows
- Low-Flow Channel Observations
- Repairs and Improvements
- Community Involvement
- Summary

2.0 NULAHUGYUK CREEK FLOWS

Discharge measurements were collected approximately 500 m upstream from the mouth of Nulahugyuk Creek (UTM 590514 7627609) using a Swoffer velocity meter. Flows of 0.755 m^3/s were recorded on 24 July, flows of 0.578 m^3/s were recorded on July 25, and flows of 0.547 m^3/s were recorded on 26 July. Amanda Dumond (HTO Manager) noted that spring arrived late in 2018 and the field crew observed large ice flows that remained in the Dolphin and Union Strait on the travel out to Nulahugyuk Creek, in addition to snow still present throughout the study area upon arrival to Bernard Harbour. A late spring melt of snow and ice may provide an explanation for the higher flows observed in late July when compared to flows observed during previous visits in July (2015 to 2017) (Table 1). On average, the measured flow in Nulahugyuk Creek in 2018 was about nine times higher than the flow observed in 2016, about three times higher than `the flow observed in 2016 and about one and a half times higher than the flow observed in 2015 (Table 1). Throughout the field program, water levels were observed to be higher than those compared to photographs from the 2017 field memo (see comparison of Photo 1 and Photo 2). Depths within the low-flow channels at the time of the inspections were, on average, 0.19 m (±1 SD 0.07), and deemed sufficient for passage of adult Arctic Char (Table 2). Of note, the higher water levels during the 2018 field program offered an opportunity to see whether the remediation structures are effective at higher flows, specifically whether the weirs and channel boundaries required additional stabilization and height to effectively function for fish.

Table 1: Summer Flow Comparison for the Discharge Station at Nulahugyuk Creek from 2015 to 2018

Flow	July 2015[(a)]			July 2016[(b)]			July 2017[(c)]		July 2018		
	22	23	24	20	22	24	25	26	24	25	26
Wetted Width (m)	12.0	12.0	12.0	12.5	12.5	12.5	5.8	5.1	12.0	12.0	12.0
Mean Depth (m)	0.28	0.26	0.24	0.20	0.20	0.23	0.11	0.12	0.26	0.23	0.23
Discharge (m^3/s)	0.415	0.420	0.290	0.214	0.214	0.171	0.057	0.087	0.755	0.578	0.547
Mean Discharge (m^3/s)	*0.375*			*0.200*			*0.072*		*0.627*		

(a) Golder (2015)
(b) Golder (2016)
(c) Golder (2017)

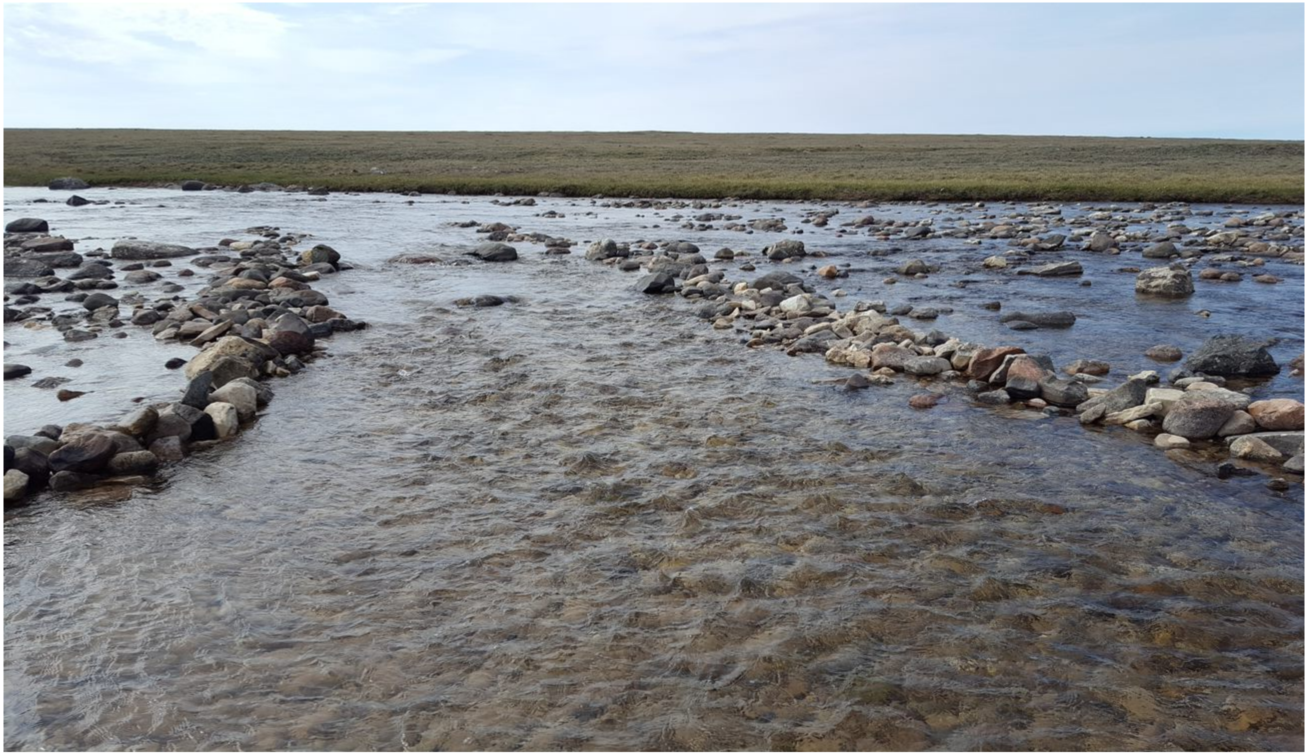

Photo 1: Upstream View of Low-flow Channel B at Site 4, 24 July 2018

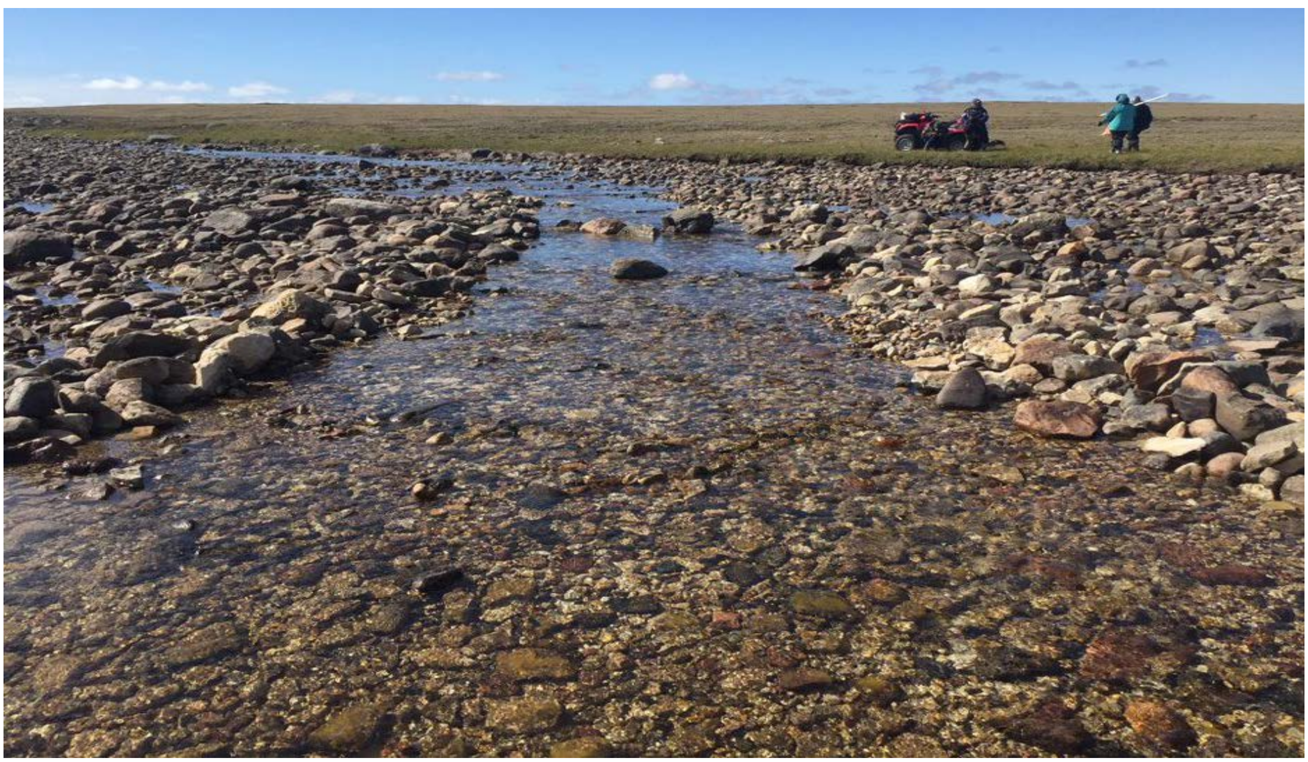

Photo 2: Upstream View of Low-flow Channel B at Site 4, 26 July 2017

Table 2: Flow Characteristics of Low-Flow Channel Structures (Sites and Projects)

ID	Structure	Date	Mean Wetted Width (m)	Mean Depth (m)	Mean Velocity (m/s)
Site 1	Low-flow Channel	25-July-18	3.0	0.15	0.71
Site 2	Low-flow Channel A	25-July-18	3.0	0.19	0.65
	Low-flow Channel B	25-July-18	3.1	0.20	0.54
Site 3	Low-flow Channel	25-July-18	3.8	0.19	0.74
Site 4	Low-flow Channel A	24-July-18	1.8	0.15	0.73
	Low-flow Channel B	24-July-18	2.2	0.18	0.60
Site 5	Low-flow Channel	24-July-18	2.2	0.24	0.39
Site 6	Low-flow Channel	24-July-18	2.9	0.23	0.70
Site 7	Low-flow Channel A	24-July-18	2.1	0.19	0.91
	Low-flow Channel B	24-July-18	1.8	0.23	0.60
Site 8	Low-flow Channel	25-July-18	1.7	0.40	0.21
Site 9	Low-flow Channel	25-July-18	1.6	0.20	0.63
Site 10	Low-flow Channel A	25-July-18	4.4	0.14	0.70
	Low-flow Channel B	25-July-18	3.5	0.13	0.70
	Low-flow Channel C	25-July-18	2.5	0.14	0.76
Site 11	Low-flow Channel	24-July-18	2.3	0.18	0.73
Site 12	Low-flow Channel A	24-July-18	2.6	0.24	0.61
	Low-flow Channel B	24-July-18	1.1	0.27	0.60
Site 13	Low-flow Channel	24-July-18	3.2	0.38	0.35
Project 1	Low-flow Channel A	25-July-18	3.5	0.15	0.99
	Low-flow Channel B	25-July-18	0.8	0.13	0.76
Project 2	Low-flow Channel A	24-July-18	2.2	0.15	0.86
	Low-flow Channel B	24-July-18	2.8	0.23	0.90
Project 3	Low-flow Channel A	24-July-18	2.2	0.14	0.63
	Low-flow Channel B	24-July-18	1.1	0.13	0.57
Project 4	Low-flow Channel	25-July-18	2.2	0.18	0.56
Project 5	Low-flow Channel A	25-July-18	1.1	0.10	0.88
	Low-flow Channel B	25-July-18	1.7	0.15	0.68
	Low-flow Channel C	25-July-18	1.5	0.15	0.67

3.0 LOW-FLOW CHANNEL INSPECTIONS

3.1 Observations

Each low-flow channel and weir constructed during the 2016 remediation program was inspected to determine if any of the structures had been disturbed or displaced, or required modifications to improve functions for fish passage. Structures requiring remediation, including those indicated as needing further remediation in the Golder (2017) report, were repaired, as needed, during the 2018 field program (see Appendix A for photos). Nineteen of the 30 structures within the 13 Sites were deemed fully intact and functional. Only 6% of the total length of remediation structures (46.3 m of 747.5 m) was visibly disturbed, where boulders and cobble were displaced, or was not functioning as intended (Table 3). Seven directional weirs and four channels within eight Sites were identified as requiring repair or improvement. For Sites 5 and 9 (Table 3), the structures were not displaced or disturbed, but were submerged due to water levels overtopping the structures. Therefore, weir structures at

Sites 5 and 9 were identified for improvement by increasing their height above the water level. Overall, the potential effects of spring flow disturbance on the function of each low-flow channel Site in providing fish passage was deemed negligible to low.

Table 3: Structure Integrity Assessment of 2016 Remediation Sites, 24 and 25 July 2018

Site	Structure	Length of Structure (m)	Percent Affected (%)	Repaired	Further Remediation Recommended	Photos (Appendix A)
1	Low-flow Channel	110	5	Yes	No	1
	Directional Weir A	15	30	Yes	No	2
	Directional Weir B	8.5	0	No	No	3
2	Low-flow Channel A	76	0	No	No	4
	Low-flow Channel B	76	0	No	No	5
	Directional Weir	8	0	No	No	N/A
	Augmentation Weir	12	50	Yes	No	6,7
3	Low-flow Channel	33	0	No	No	8
	Directional Weir	15	0	No	No	9
4	Low-flow Channel A	22	10	Yes	No	10
	Low-flow Channel B	14	0	No	No	11
	Directional Weir	10	50	Yes	No	12, 13
5	Low-flow Channel	35	0	Yes	No	14,15
	Directional Weir	5	100*	Yes	No	16, 17
6	Low-flow Channel	30	10	Yes	No	18, 19
7	Low-flow Channel A	20	0	No	No	20
	Low-flow Channel B	16	0	No	No	21
	Directional Weir	14	0	No	No	N/A
8	Low-flow Channel	18	0	No	No	22
9	Low-flow Channel	35	0	No	No	23
	Directional Weir	7	80*	Yes	No	24, 25
10	Low-flow Channel A	20	0	No	No	26
	Low-flow Channel B	20	0	No	No	27
	Low-flow Channel C	20	0	No	No	28
	Directional Weir	8	5	Yes	No	29
11	Low-flow Channel	45	0	No	No	30
12	Low-flow Channel A	30	0	No	No	31
	Low-flow Channel B	5	0	No	No	N/A
	Directional Weir	10	50	Yes	No	32, 33
13	Low-flow Channel	10	0	No	No	34

*boulders were not displaced, but were submerged due to relatively high water levels overtopping the structures; N/A = not available

The structural integrity of the 2012 Projects was also inspected to determine if any of the structures had been disturbed or displaced (see Appendix A for photos). The remediation recommendations in the Golder (2017) report were also considered, for example, 7 of the 15 structure components within the five 2012 Projects were recommended for additional repair or improvement in the 2017 report. Based on the 2018 investigation, only 12.5% of the total length of remediation structures (55 m of 440 m) was impaired or visibly disturbed, where boulders and cobble were displaced (Table 4). Four directional weirs and one channel within four Projects were identified as having been disturbed where displaced cobble and boulder ranged from 30 to 100% of a structure component. Three structure components identified as needing additional improvement or repair in 2017 were found to be fully functional during the 2018 field program. Overall, the potential effects of spring flow disturbances on the function of each low-flow channel Project in providing fish passage was deemed negligible to low.

Table 4: Structure Integrity Assessment of 2012 Pilot Projects, 24 and 25 July 2018

Project	Structure	Length of Structure (m)	Percent Affected (%)	Repairs Recommended in Golder 2017	Repaired or Improved	Photos (Appendix A)
1	Low-flow Channel B	28	0	Yes	No	35
	Low-flow Channel A	28	100	Yes	Yes	36, 37
	Directional Weir	9	50	Yes	Yes	38, 39
2	Low-flow Channel A	22	0	No	No	40
	Low-flow Channel B	22	0	Yes	No	N/A
	Directional Weir	15	90	Yes	Yes	41, 42
3	Low-flow Channel A	37	0	No	No	43
	Low-flow Channel B	37	0	No	No	N/A
	Directional Weir	5	90	Yes	Yes	44, 45
4	Low-flow Channel	27	0	No	No	46
5	Low-flow Channel A	60	0	No	No	47
	Low-flow Channel B	60	0	No	No	N/A
	Low-flow Channel C	60	0	No	No	48
	Directional Weir A	15	0	Yes	No	49
	Directional Weir B	15	30	No	Yes	50, 51

N/A = not available

3.2 Completed Repairs and Improvements

Damaged, displaced, or non-functioning weirs were repaired and improved, and low-channels were repaired and modified (e.g., boulders repositioned) (Table 5). Requiring minimal effort, the crew repaired seven directional weirs and four low-flow channels associated with the 2012 Projects and 2016 Sites. Small and large boulders displaced from high spring flows were repositioned to reinforce weir structures, increasing their effectiveness at either directing flows or fish into the low-flow channels. Adjustments to the substrate used for the banks or edges of the low-flow channels were also made. A detailed description of all repairs is summarized in Table 5. No further remediation is required for these structures. However, it is recommended that a similar field program be conducted in 2019 to maintain 100% fish passage functions of the low-flow channel structures.

Table 5: Structure Repairs and Improvements for Remediation Sites Completed on 24 and 25 July 2018

Site	Structure	Percent Affected	Repairs and Improvements	Photos (Appendix A)
1	Low-flow Channel	5	A few boulders were out of place along the length of low-flow channel. They were repositioned to ensure no gaps were present.	Pre-repair - 1
	Directional Weir A	30	A few boulders were out of place from the directional weir constructed to guide fish into the low-flow channel. They were placed back into the weir and the weir height was increased to accommodate the elevated water level.	Pre-repair – 2
2	Augmentation Weir	50	Displaced boulders in the flow augmentation weir resulted in several gaps. The boulders were repositioned, and the overall weir height increased to accommodate the elevated water level	Pre-repair – 6 Post-repair – 7
4	Low-flow Channel A	10	Several boulders were displaced in the directional weir and low-flow channel A at the confluence with low-flow channel B. The boulders were moved back into place and the overall weir and channel bank height increased to accommodate the elevated water level.	Pre-repair – 12 Post-repair – 11, 13
	Directional Weir	50		
5	Low-Flow Channel	N/A	Several large boulders installed to provide refugia for migrating fish were out of position, creating high velocities; downstream boulders were adjusted to create low-velocities paths to the channel.	Pre-repair – 14 Post-repair - 15
	Directional Weir	100	The weir was completely submerged at the time of the field program due to elevated water depths. The length of the weir was built up using boulders so it continued to be functional in blocking fish passage to shallower waters.	Pre-repair – 16 Post-repair - 17
6	Low-flow Channel	10	An approximate 5 m section of the left downstream side of the low-flow channel was displaced, leaving a gap through which fish would be able to access shallower water. Boulders were used to re-build the gap.	Pre-repair – 18 Post-repair – 19
9	Directional Weir	80	The weir was partially submerged at the time of the field program due to the elevated water depths. The length of the weir was built up using boulders and cobble, so it continued to be functional in blocking fish passage to shallower waters.	Pre-repair – 24 Post-repair – 25
10	Directional Weir	5	The weir was partially submerged at the time of the field program due to the elevated water depths. The length of the weir was built up using boulders and cobble so it continued to be functional in blocking fish passage to shallower waters.	Post-repair – 29
12	Directional Weir	50	A few boulders were out of place from the directional weir constructed to guide fish into the low-flow channel. They were placed back into the weir and the weir height was increased to accommodate the elevated water level.	Pre-repair – 32 Post-repair – 33

The below photos are examples of the pre- and post-modification efforts. At Site 5 (Photos 3 and 4; also see Photos 16 and 17 in Appendix A), the directional weir was no longer functional at current water levels, and access to shallow water would have been possible by migrating fish. Improvement efforts used additional boulders to increase the height of the directional weir structure such that the weir functions were restored as intended. An example of a low-flow channel repair includes work completed at Site 6 where boulders were displaced from one section of the low-flow channel edge (or bank) (Photos 5 and 6; also see Photos 18 and 19 in Appendix A). Repairs to the bank of a low-flow channel are expected to prevent fish from accessing adjacent shallow habitats, while augmenting flows for fish passage through the unobstructed path of the channel.

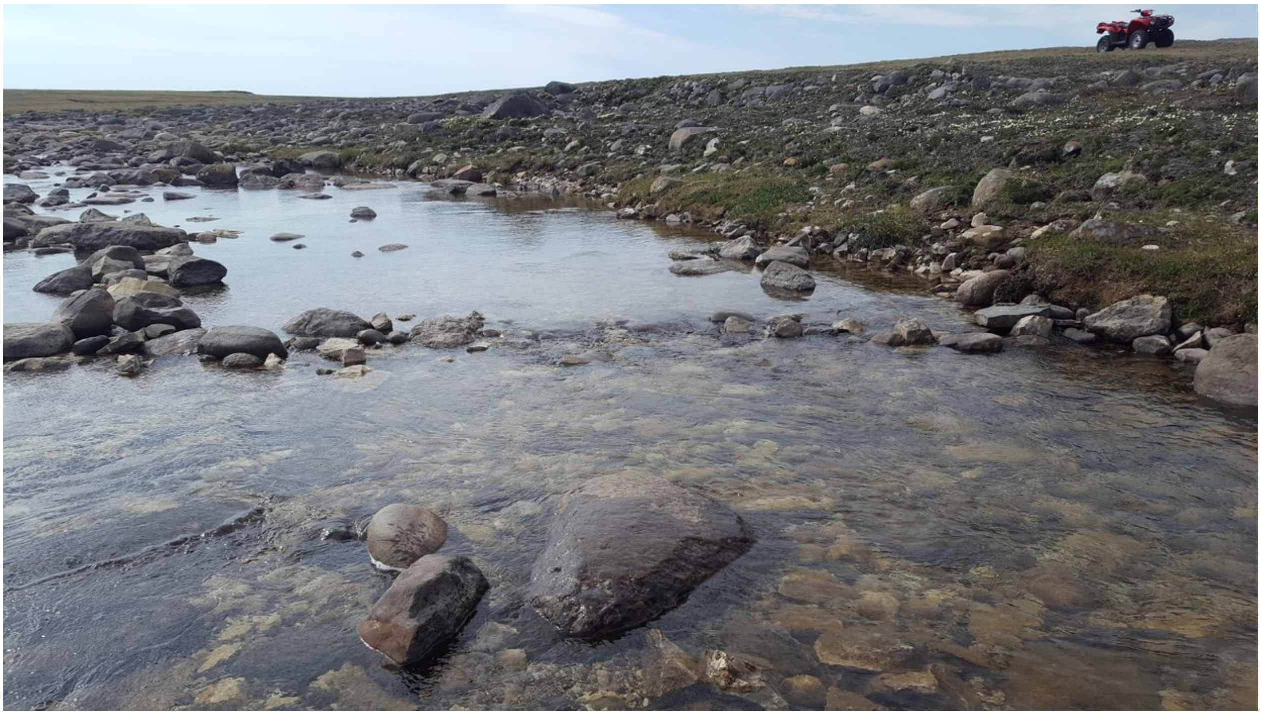

Photo 3: Upstream View of Directional Weir, Pre-Adjustment at Site 5, 24 July 2018

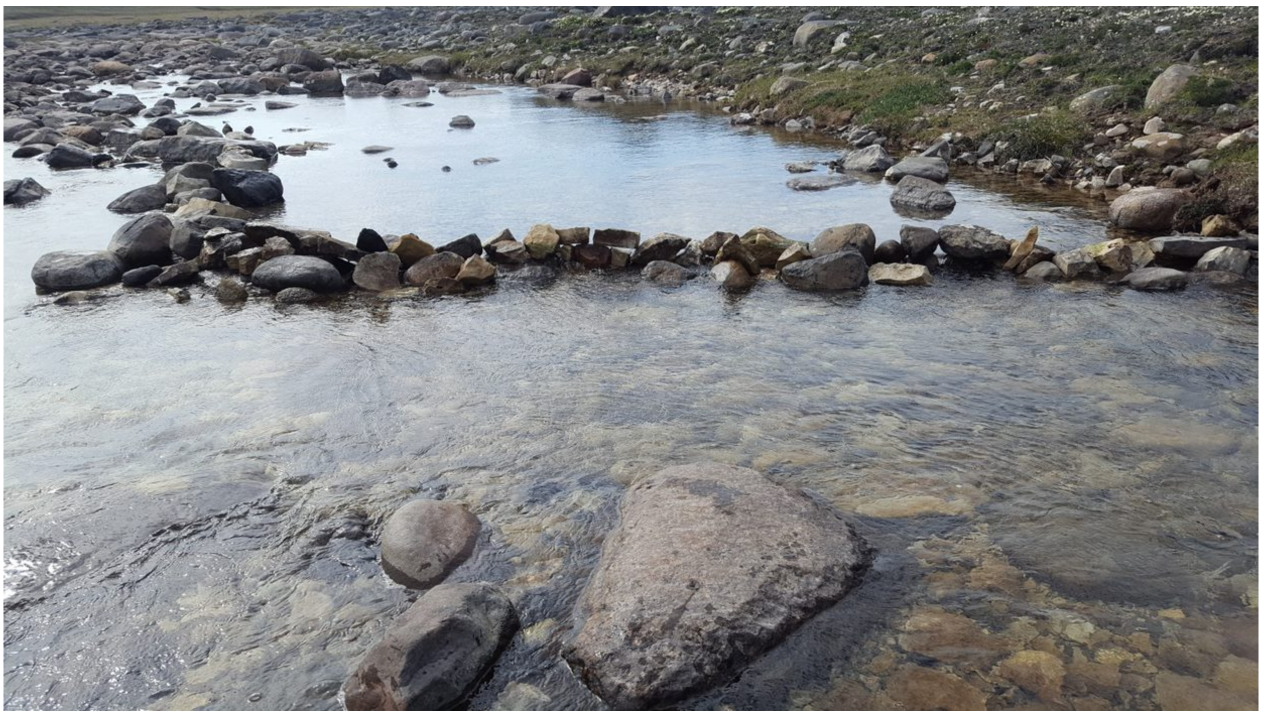

Photo 4: Upstream View of Directional Weir, Post-Adjustment, at Site 5, 24 July 2018

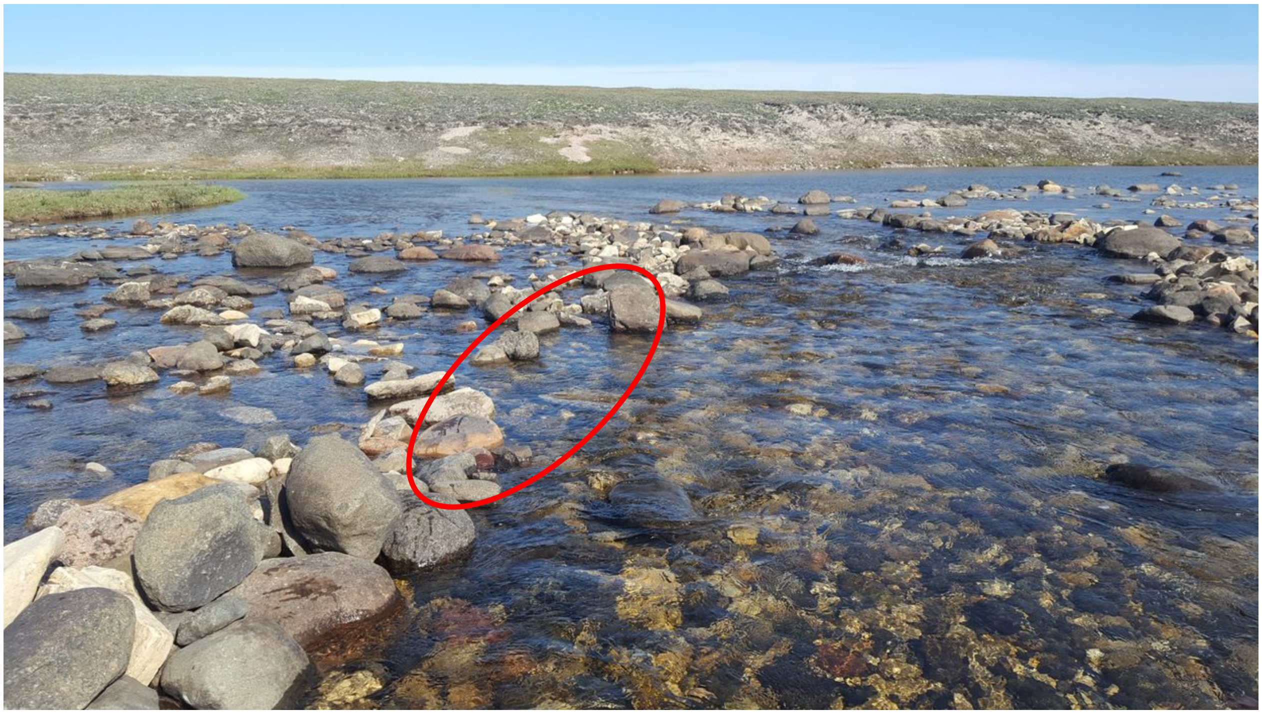

Photo 5: Downstream View of Low-flow Channel, Pre-Repair, at Site 6, 24 July 2018

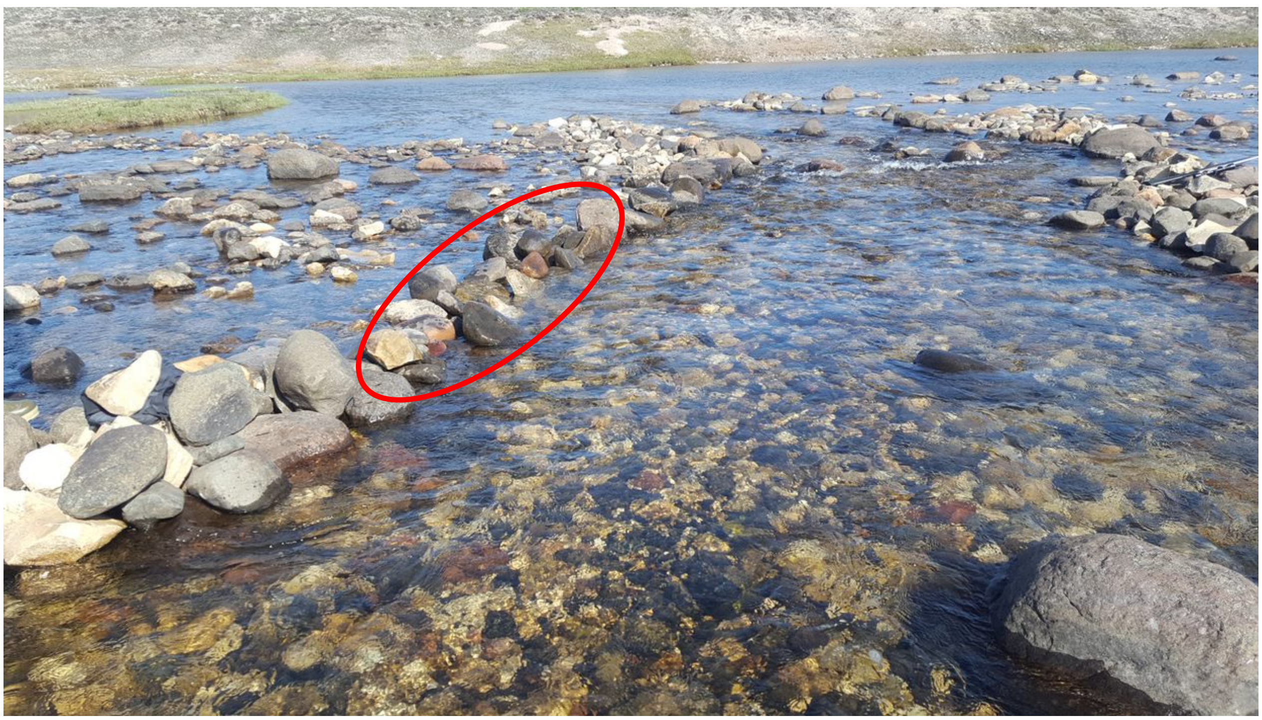

Photo 6: Downstream View of Low-flow Channel, Post-Repair, at Site 6, 24 July 2018

Repairs recommended for the 2012 Pilot Projects were all addressed. The crew completed repairs on four directional weirs and one low-flow channel (Table 6). Cobble and boulders were repositioned into the weir and low-flow channel structures to increase their effectiveness. No further remediation is required for these structures in 2018. Note that the need for additional repairs or improvements had been indicated in the 2017 report at three 2012 Pilot Projects, but based on the conditions observed during the 2018 field program, no additional repairs were necessary.

Table 6: Structure Repairs and Improvements Completed for Pilot Projects on 24 and 25 July 2018

Site	Structure	Percent (%) Displaced	Repairs and Improvements	Photos (Appendix A)
1	Low-flow Channel A	100	Boulders and cobble were placed to better define the left downstream bank of the low-flow channel.	Pre-repair – 35, 36 Post-repair - 37
	Directional Weir A	50	A large section of the directional weir was replaced and fortified with boulders and cobble, blocking fish passage to the shallow right downstream bank of the creek where stranding might have occurred.	Pre-repair – 38 Post-repair - 39
2	Directional Weir	90	Part of the weir was rebuilt to prevent access to shallower water where stranding might have occurred and to ensure utilization of the low-flow channels.	Pre-repair – 41 Post-repair – 42
3	Directional Weir	90	The directional weir was re-built and extended to the right downstream bank to prevent fish access to shallow waters where stranding might have occurred.	Pre-repair – 44 Post-repair – 45
5	Directional Weir B	30	No repairs were indicated in the 2017 report; however, a portion of the directional weir was built up and fortified to prevent access to the shallow left downstream side of the creek where stranding might have occurred.	Pre-repair – 50 Post-repair – 51

4.0 COMMUNITY INVOLVEMENT

The successful execution of the study would not be possible without the logistical support and participation from HTO staff and members of the community. Four staff provided by the HTO included Richard Akana (Boat Operator), Jonathon Niptanatiak (Wildlife Monitor and Boat Mate), Adrian Kudlak (Field Assistant) and Austin Maniyogena (Field Assistant). Local participants helped assess the low-flow channels and weirs for structural damage and collect habitat information (Photo 7 and 8). Local knowledge shared during the program contributed important information to the monitoring of Nulahugyuk Creek. The presence of a Wildlife Monitor was critical for health and safety given the grizzly bear activity in the area. Equipment imperative to the field program, including, ATV’s, boats, tents, generators, food, and supplies, were supplied by the Kugluktuk HTO.

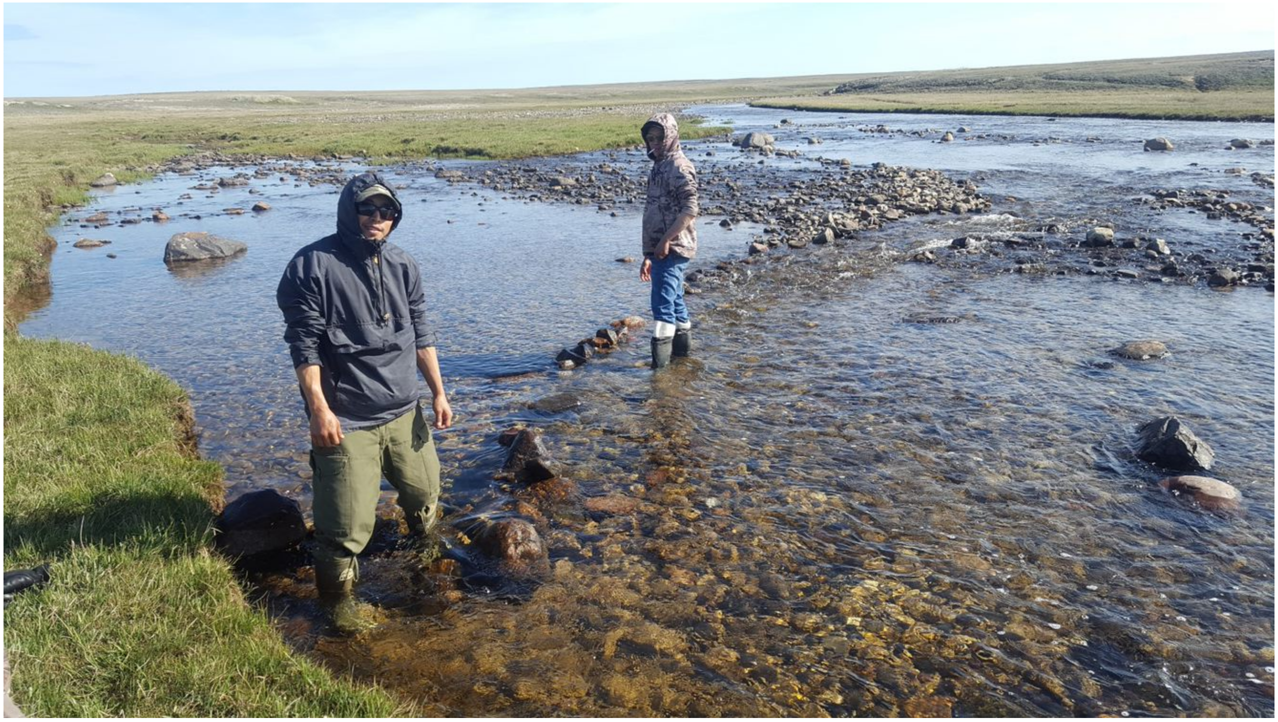

Photo 7: Local Participants Adrian Kudlak (left) and Austin Manivogena (right) Repair a Weir, 25 July 2018

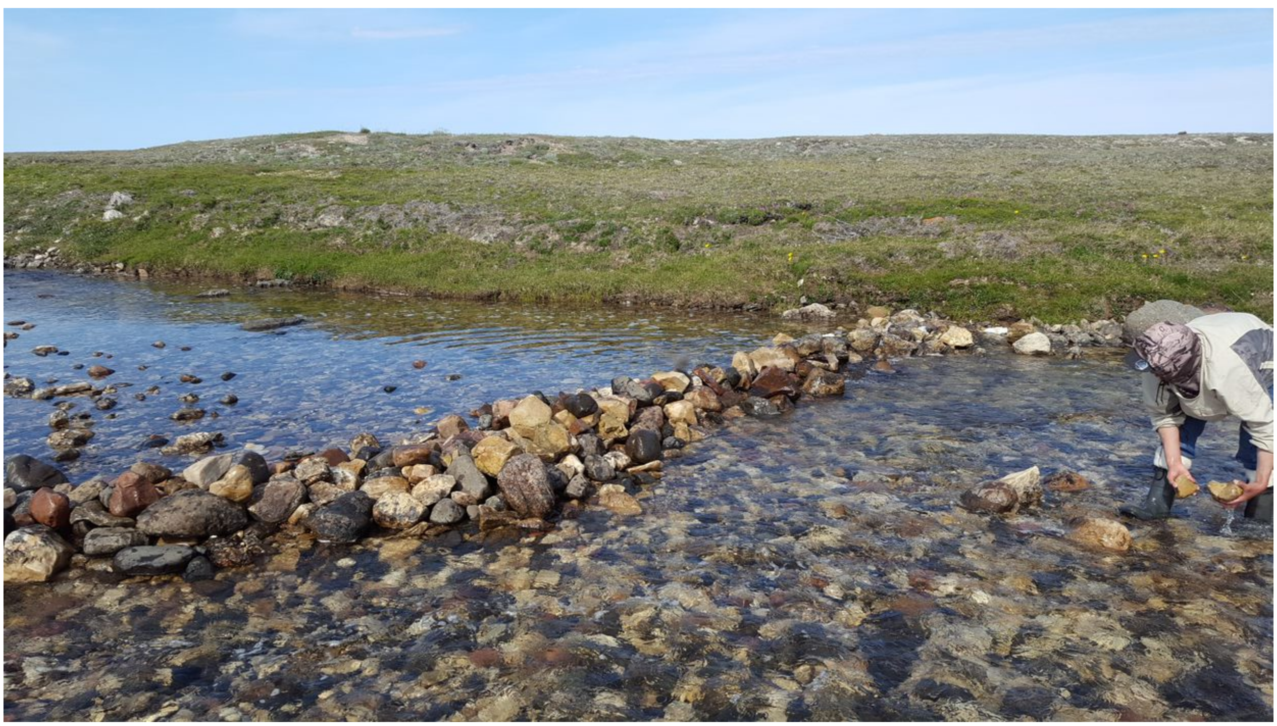

Photo 8: Local Participant Austin Manivogena Repairs a Weir, 25 July 2018

5.0 SUMMARY

The field program at Nulahugyuk Creek (Bernard Harbour) was deemed successful in meeting baseline data collection and community engagement objectives. The study confirmed that the 2016 Remediation Sites and 2012 Pilot Projects continue to provide suitable channels for fish passage. Continued follow-up is recommended to maintain the remediation structures as part of future inspection and monitoring efforts at Nulahugyuk Creek.

6.0 CLOSURE

We trust the above meets your needs, should you have any questions please do not hesitate to contact the undersigned.

GOLDER ASSOCIATES LTD.

Tiffany Hnatiuk, B.Sc., P.Biol.
Aquatic Biologist

Cam Stevens, M.Sc., Ph.D.
Associate, Fisheries Biologist

TH/CS/pls

https://golderassociates.sharepoint.com/sites/19906g/4100_fisheries/bernard harbour 2018/report/rev0/1787890_045_tm_2018 bernard harbour_rev0.docx

REFERENCES

Golder (Golder Associates Ltd.) 2013. 2012 Field Report: Stream Restoration and Community Stewardship of Arctic Char at Nulahugyuk (Bernard Harbour). Submitted to Environment Canada. Golder Project #10-1373-0075: 23 pp + appendices.

Golder. 2015. Community-Based Monitoring at Bernard Harbour, Nunavut, July 2015. Submitted to Sabina Gold & Silver Corp. Golder Project #1419666. 6 pp.

Golder. 2016. Nulahugyuk Creek Habitat Remediation Report. Report prepared for Sabina Gold & Silver Corp. Golder Project Doc 009 1545534.4000: 41 p + appendices.

Golder. 2017. 2017 Bernard Harbour Remediation Site Inspection. Technical memo prepared for Sabina Gold & Silver Corp. Golder Document Number 1776921_023_TM_Rev0: 12 p. + appendix.

Golder. 2018. Back River Project: Fish Offsetting Plan. Prepared for Sabina Gold & Silver Corp. 101 pp + appendices.

APPENDIX A

Remediation Site Photographs

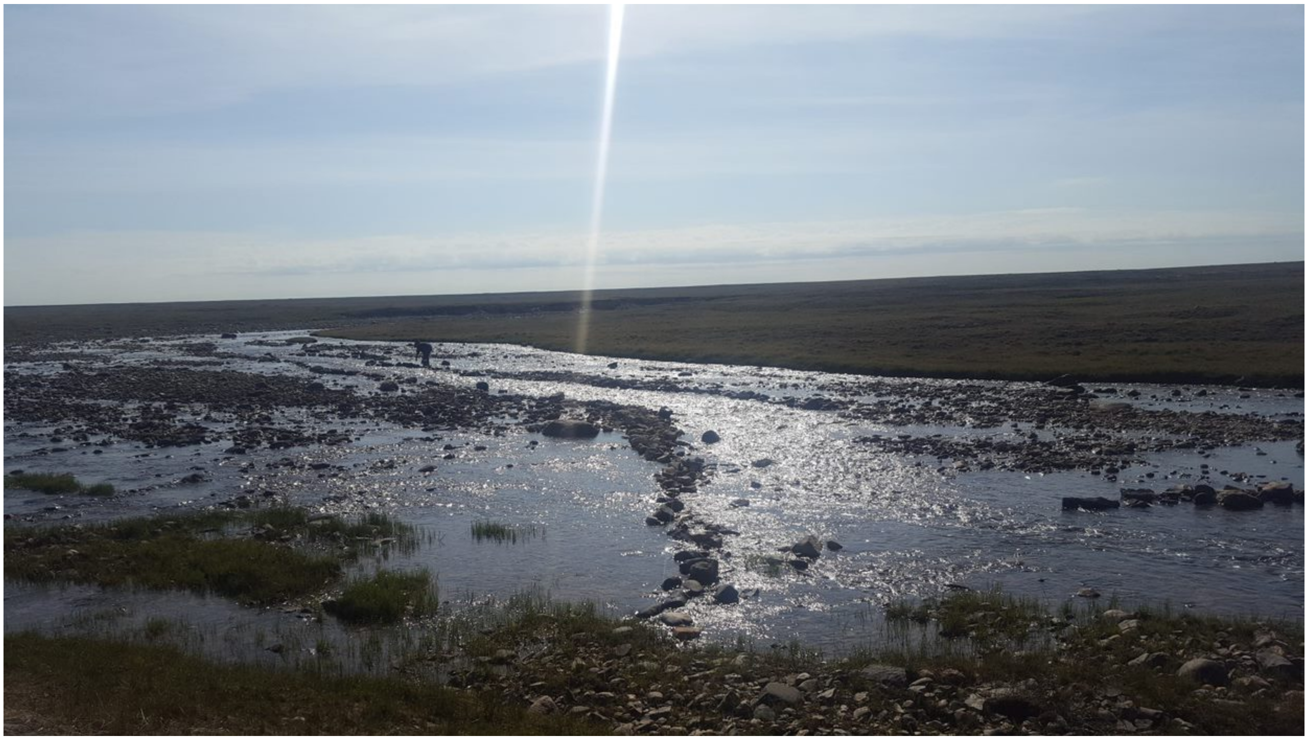

Photo A1: Upstream View of the Low-flow channel at Site 1 Pre-Repair on 25 July 2018

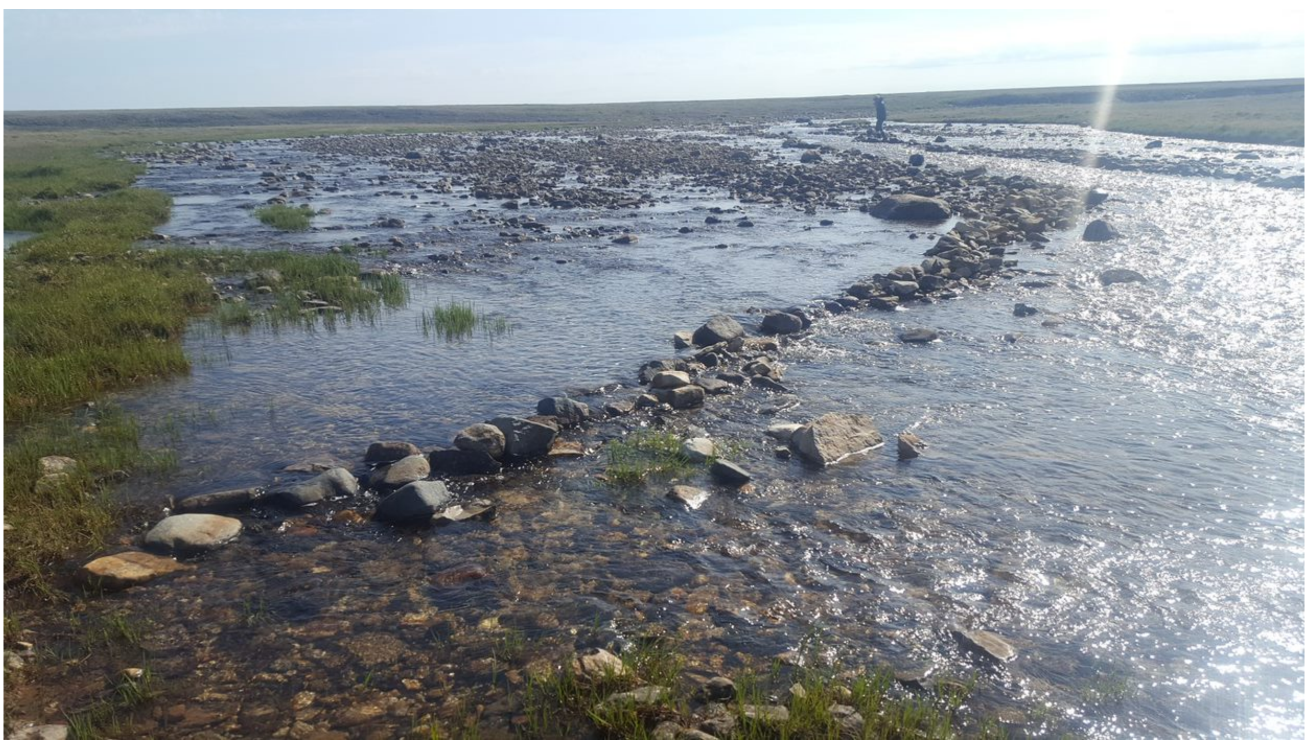

Photo A2: Upstream View of Directional Weir A Pre-Repair at Site 1 on 25 July 2018

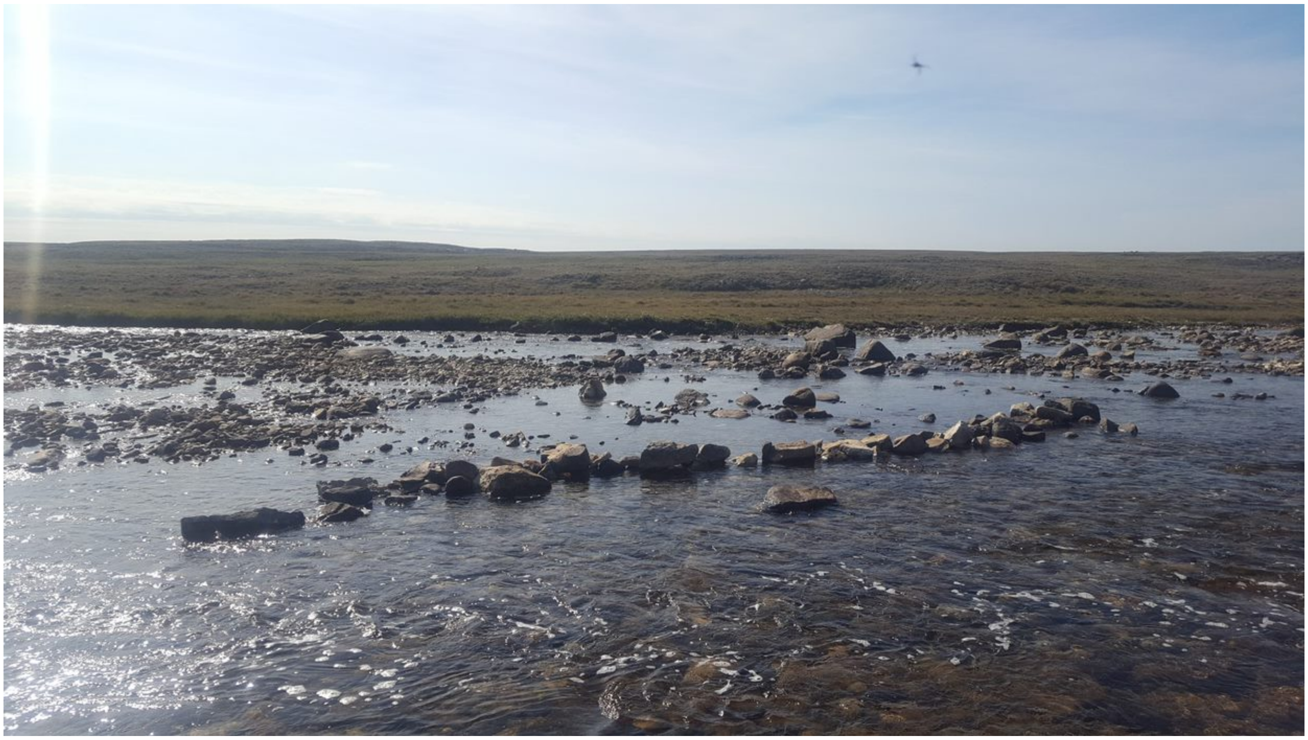

Photo A3: View from Right Downstream Bank of Directional Weir B at Site 1 on 25 July 2018

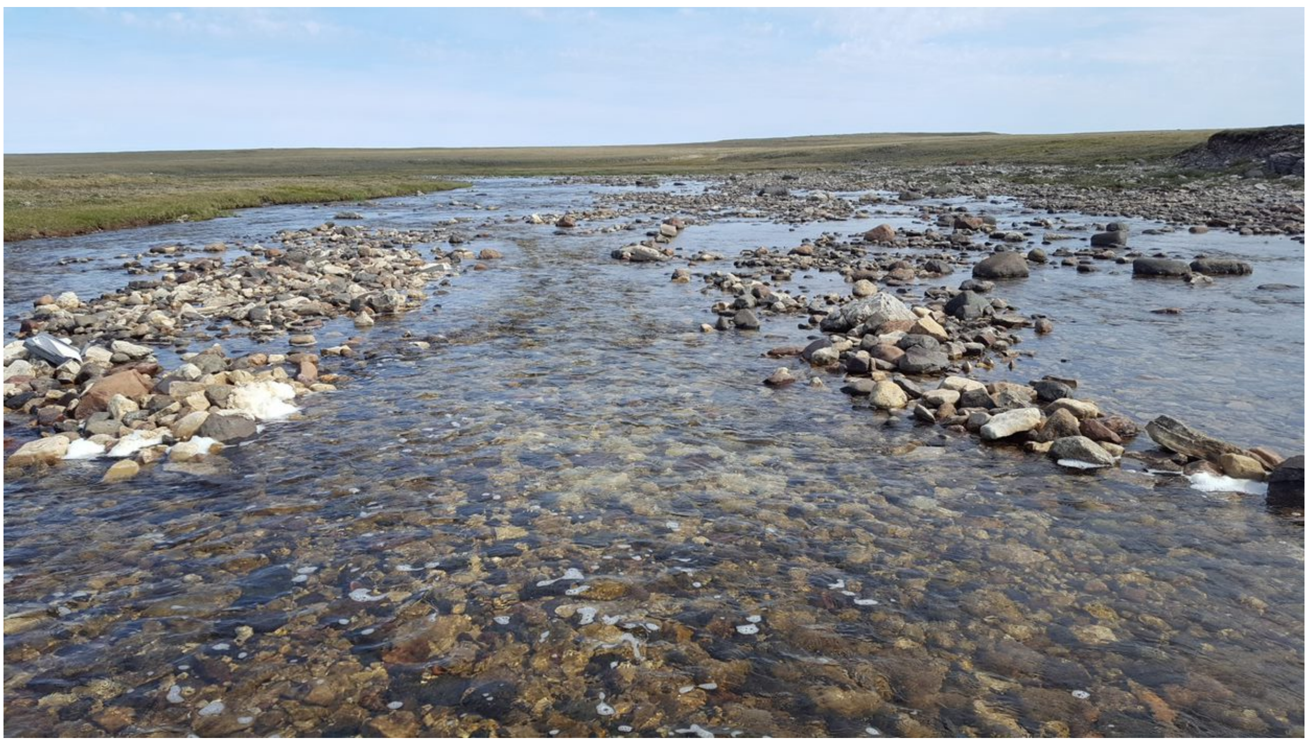

Photo A4: Downstream View of Low-flow Channel A at Site 2 on 25 July 2018

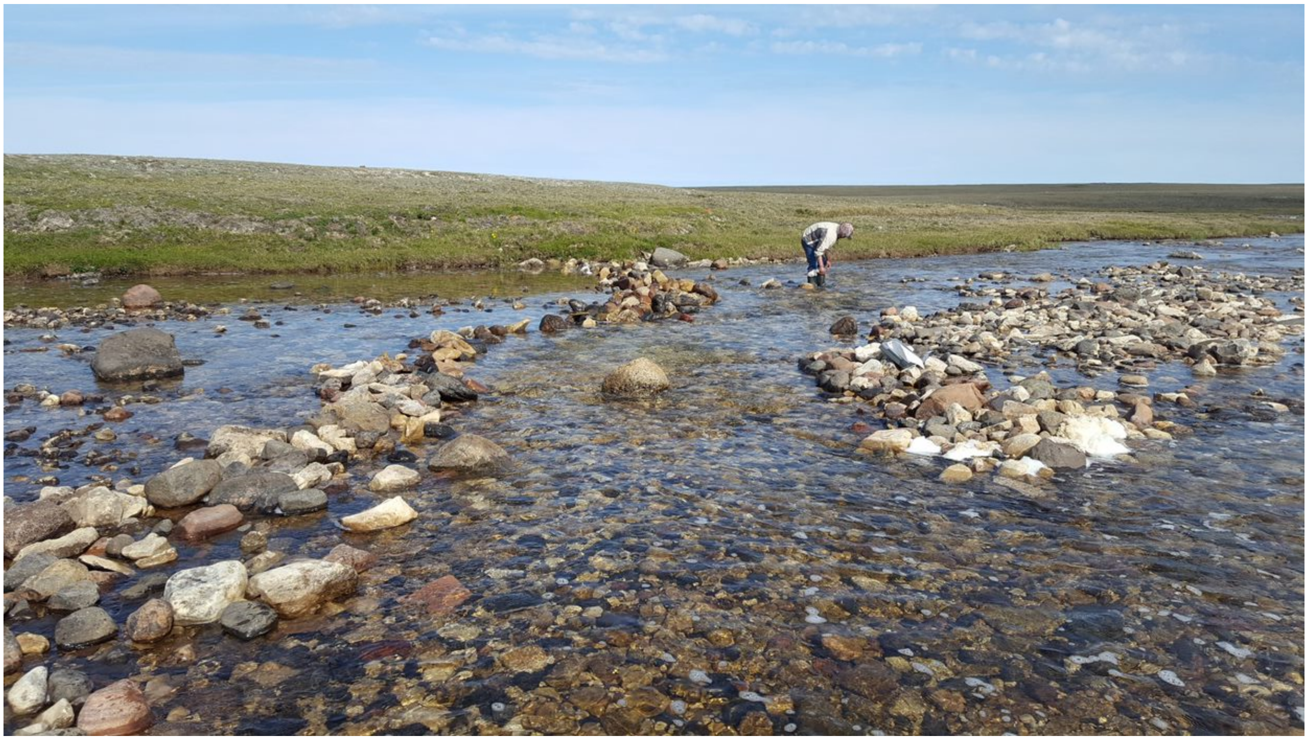

Photo A5: Downstream View of Low-flow Channel B at Site 2 on 25 July 2018

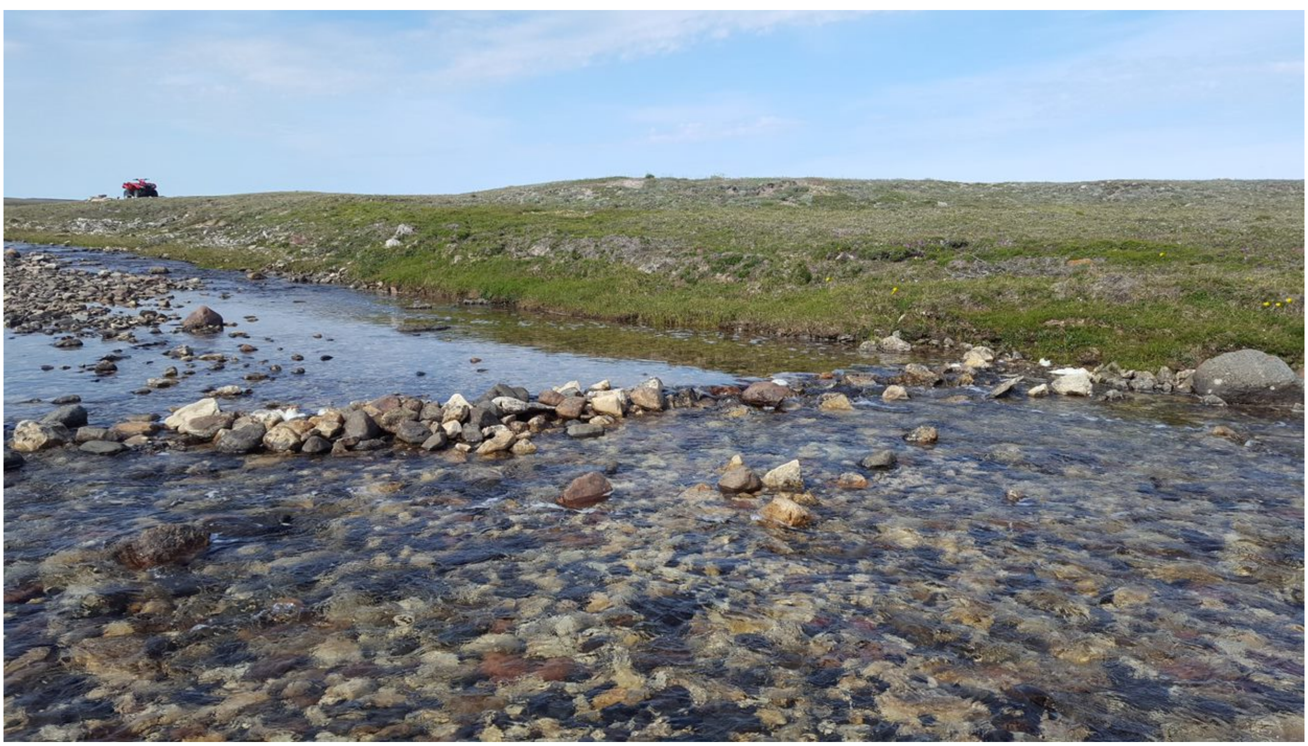

Photo A6: Downstream View of Augmentation Weir, Pre-Repair, at Site 2 on 25 July 2018

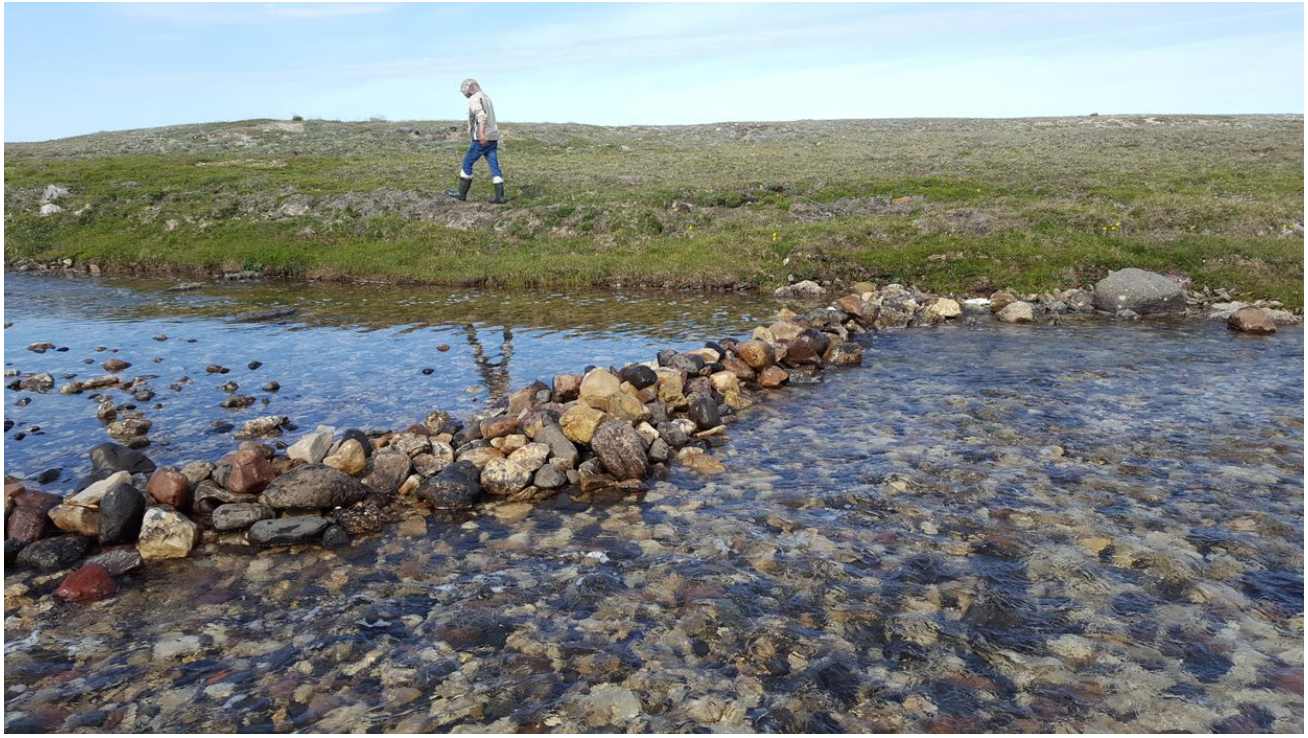

Photo A7: Downstream View of Augmentation Weir, Post-Repair, at Site 2 on 25 July 2018

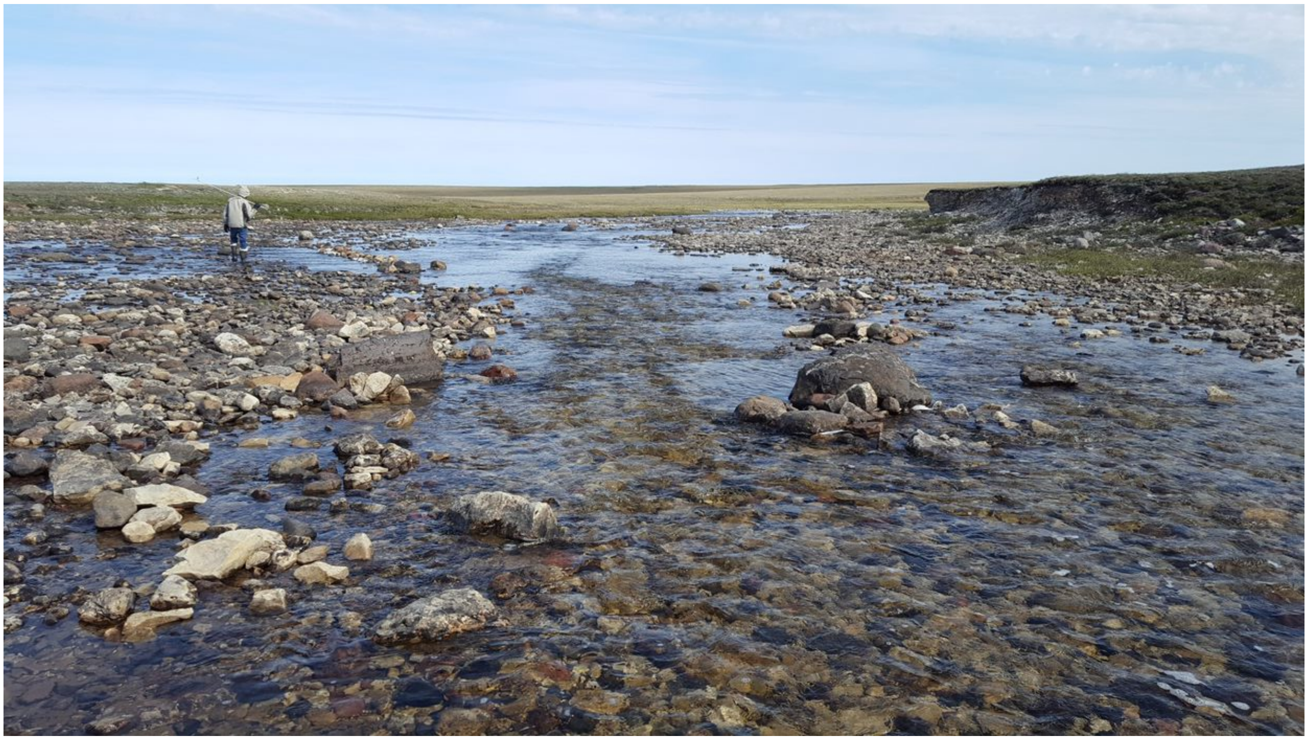

Photo A8: Downstream View of Low-flow Channel at Site 3 on 25 July 2018

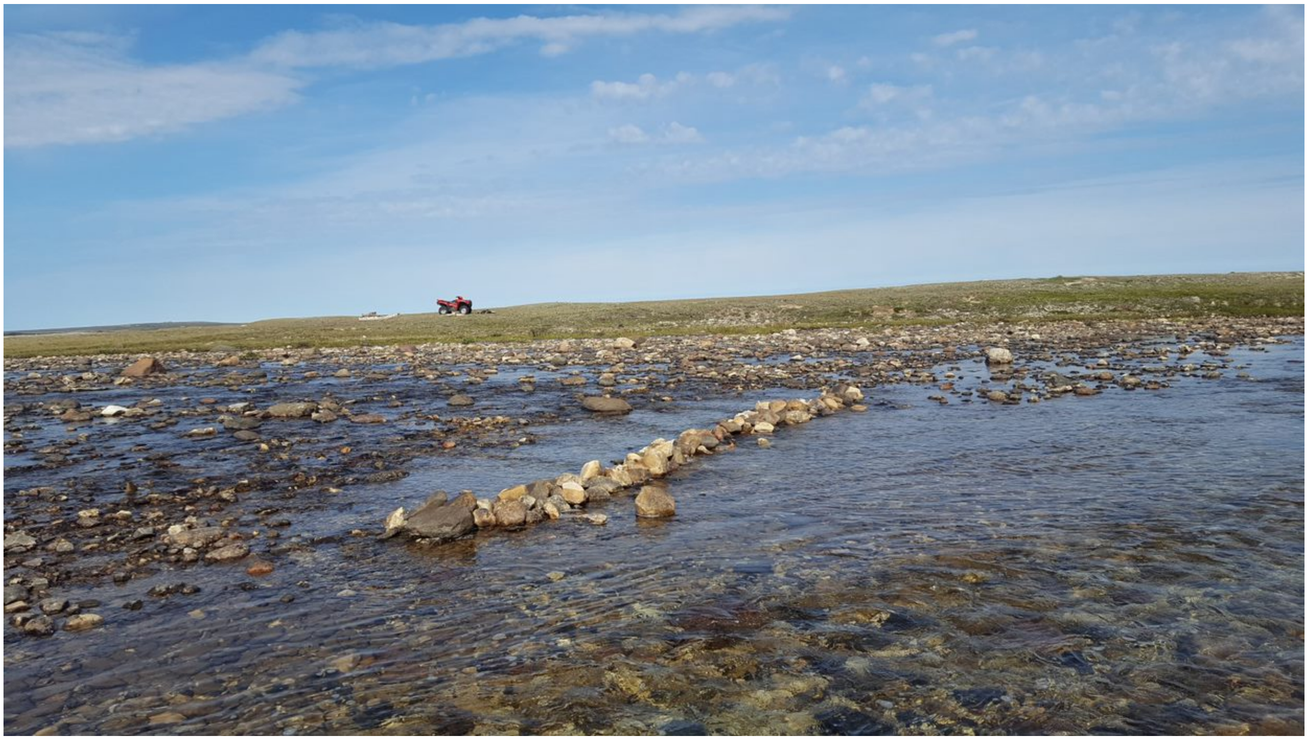

Photo A9: Downstream View of Directional Weir at Site 3 on 25 July 2018

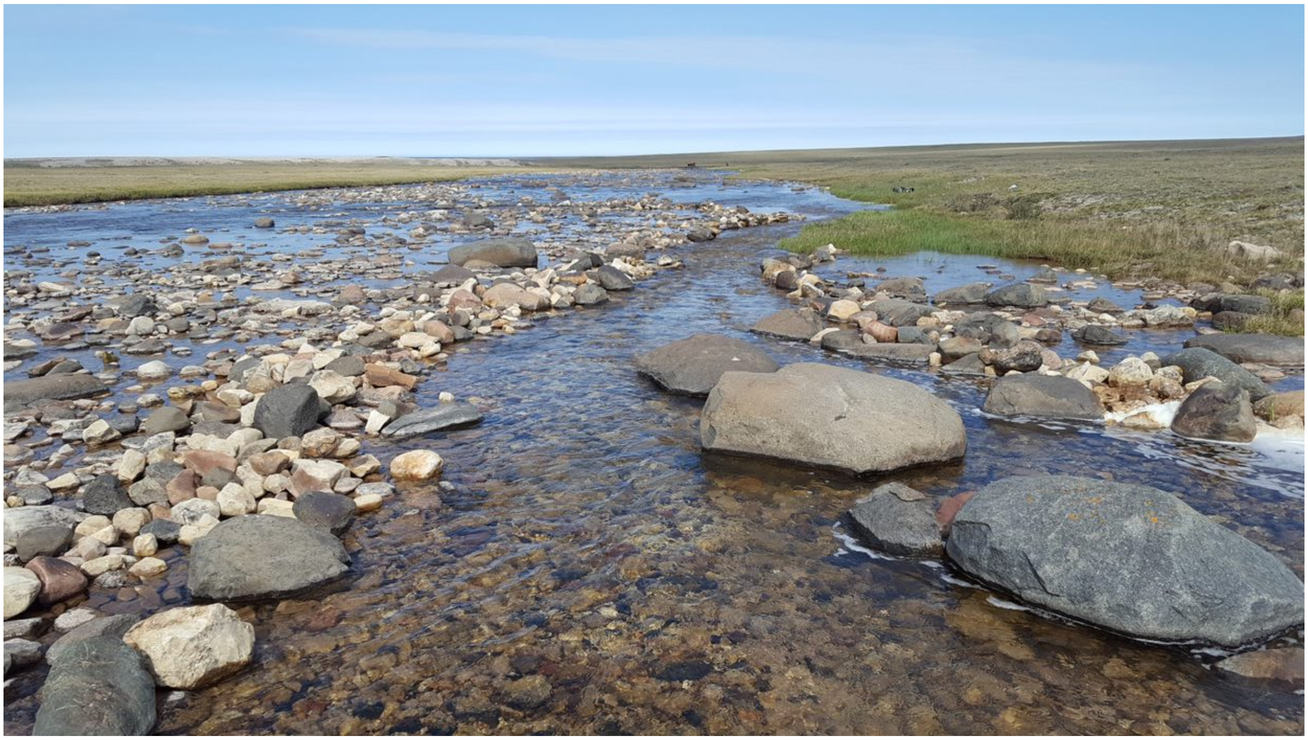

Photo A10: Downstream View of Low-flow Channel A, Pre-Repair, at Site 4 on 24 July 2018

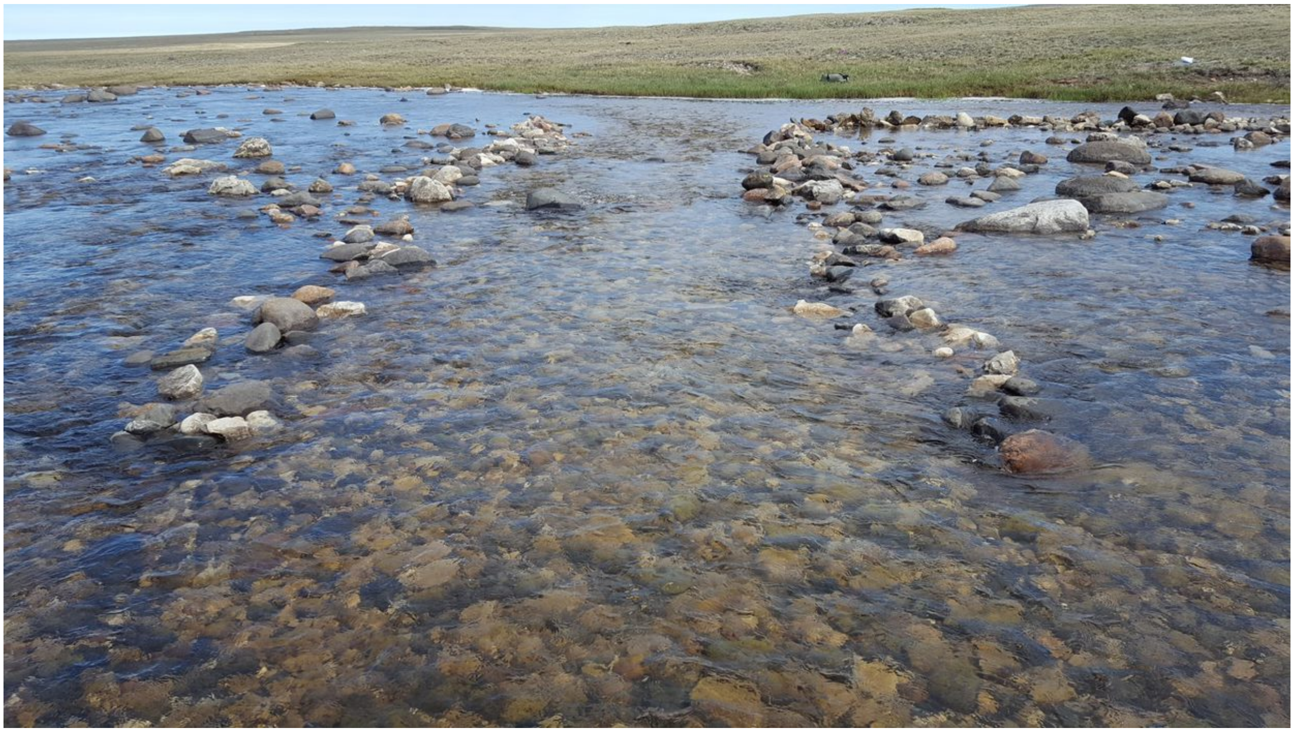

Photo A11: Downstream View of Low-flow Channel B at Site 4 on 24 July 2018

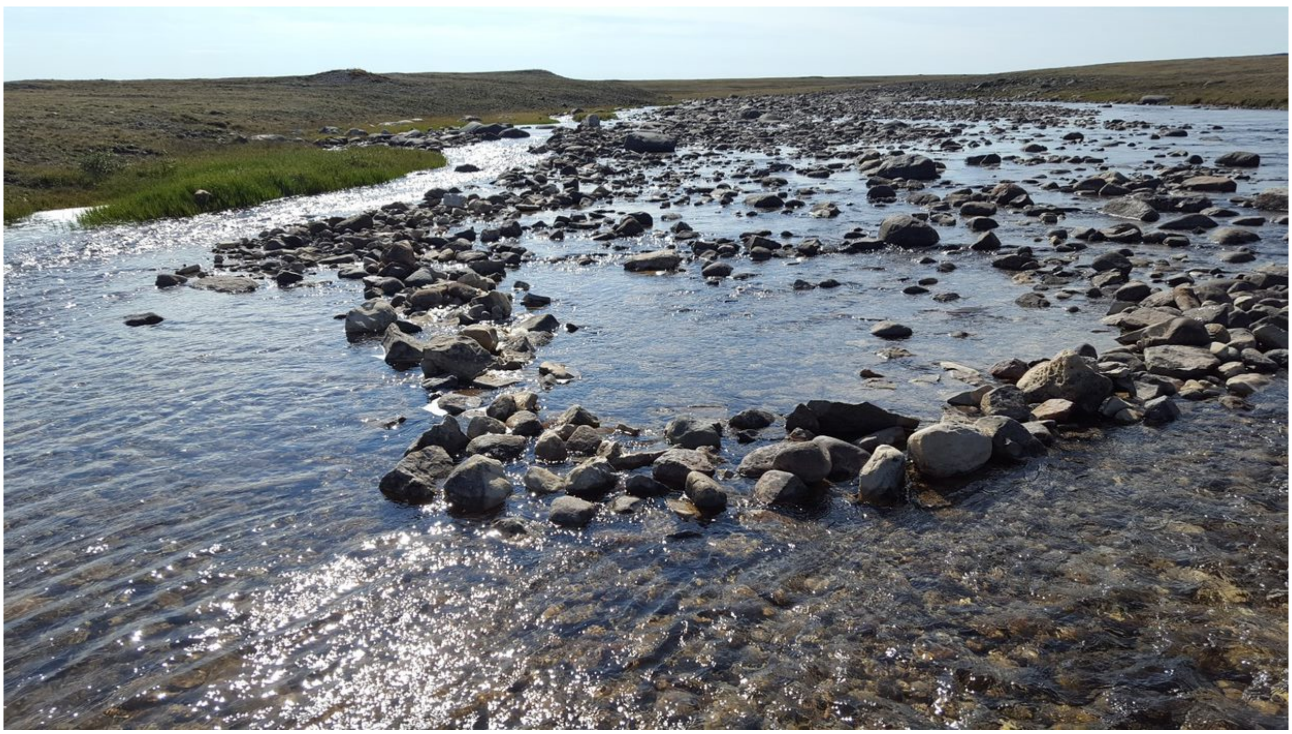

Photo A12: Upstream View of Directional Weir at the confluence of Low-flow Channel A and Low-flow Channel B, Pre-Repair, at Site 4 on 24 July 2018

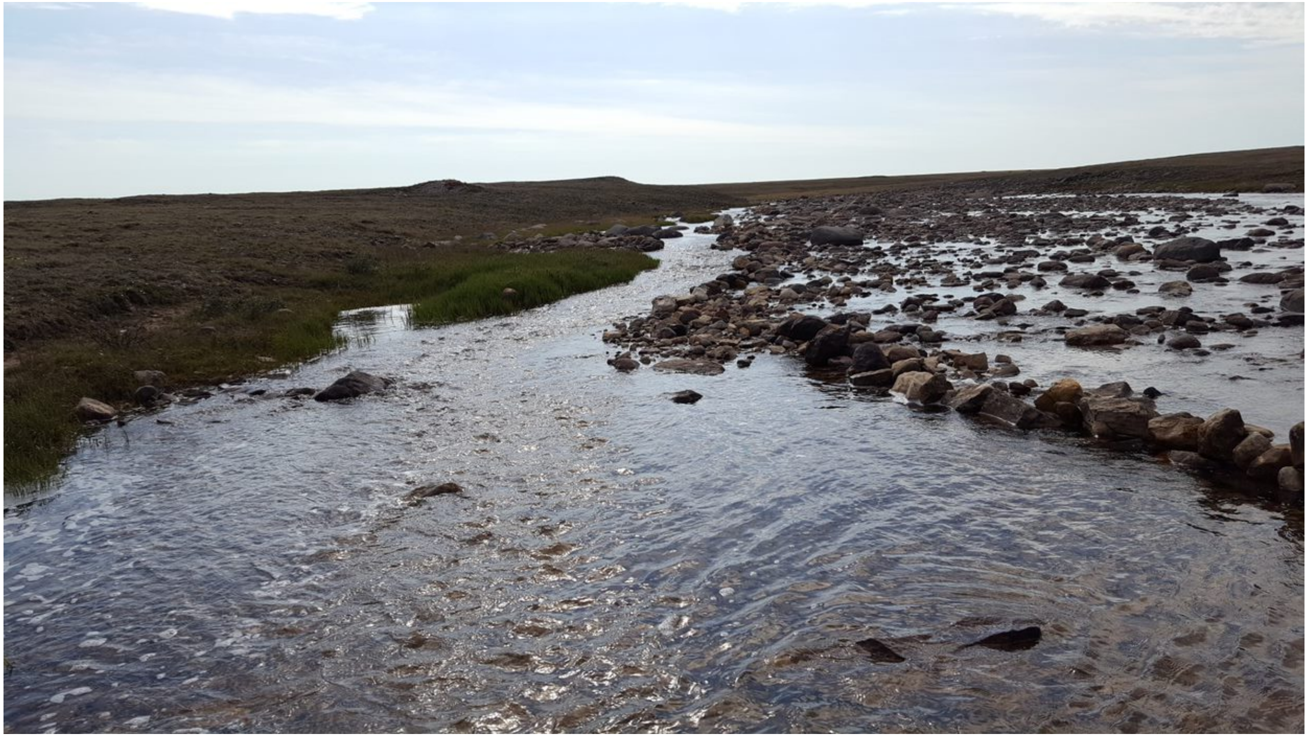

Photo A13: Upstream View of Low-flow Channel A and Directional Weir, Post-Repair, at Site 4 on 24 July 2018

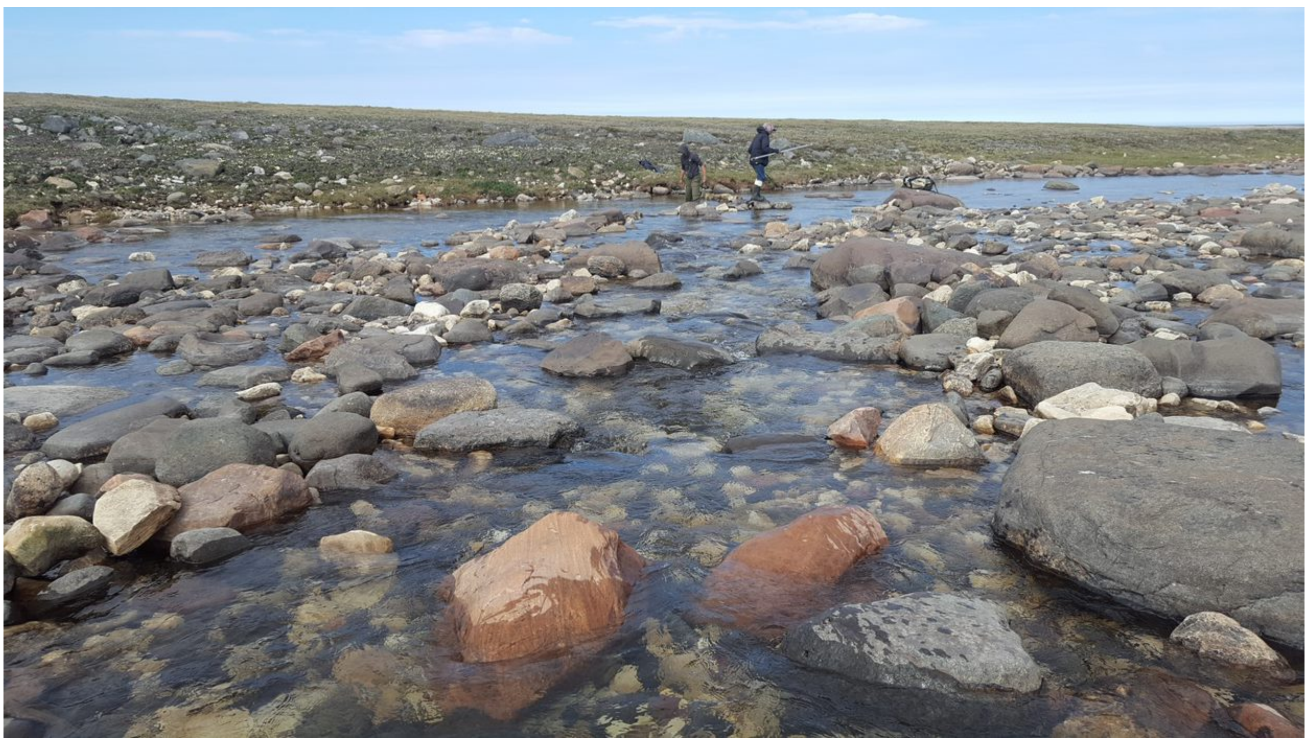

Photo A14: Downstream View of Low-flow Channel at Site 5 on 24 July 2018

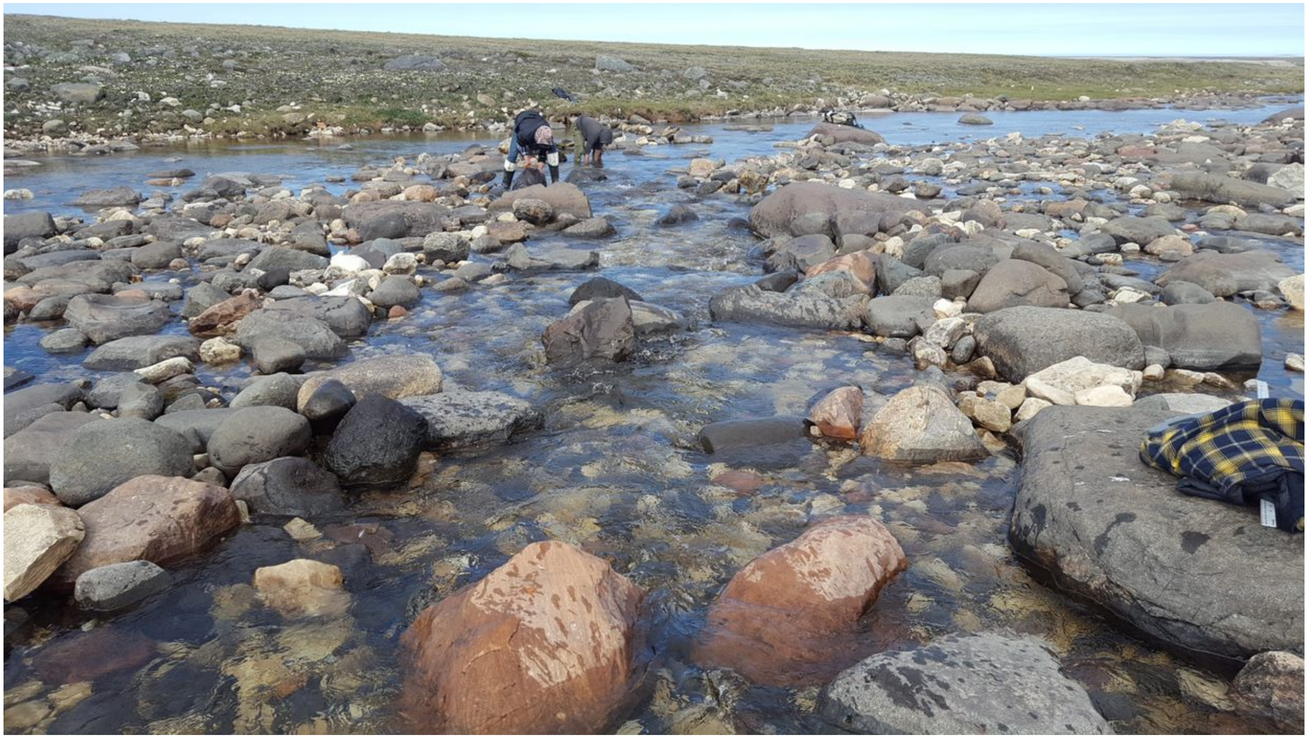

Photo A15: Downstream View of Low-flow Channel at Site 5 on 24 July 2018

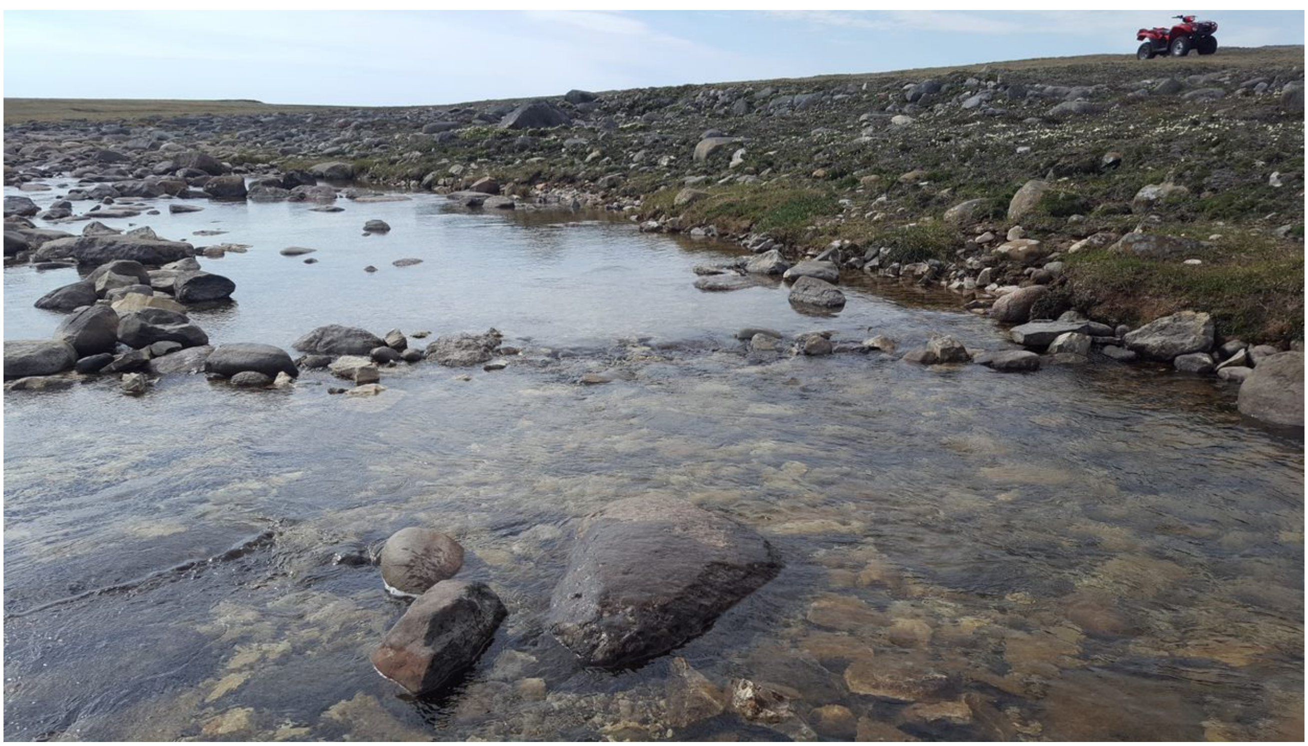

Photo A16: Upstream View of Directional Weir, Pre-Improvement, at Site 5 on 24 July 2018

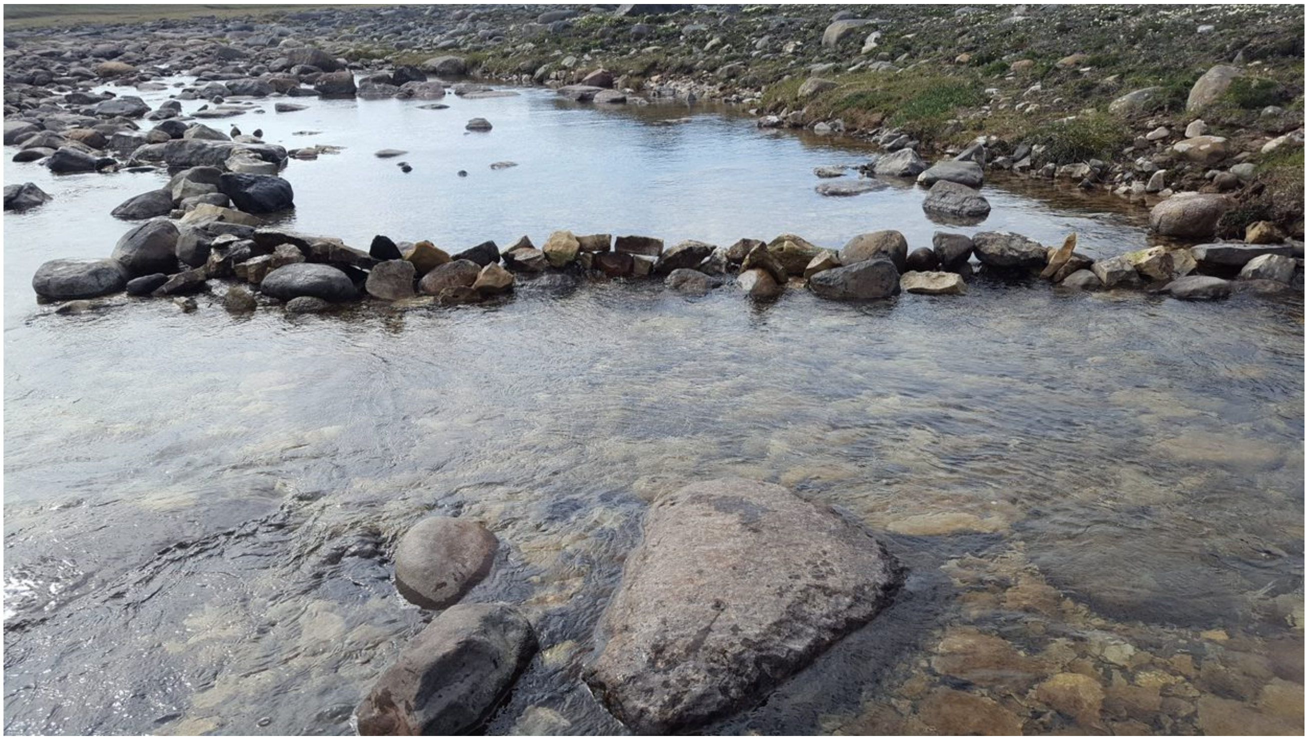

Photo A17: Upstream View of Directional Weir, Pre-Improvement, at Site 5 on 24 July 2018

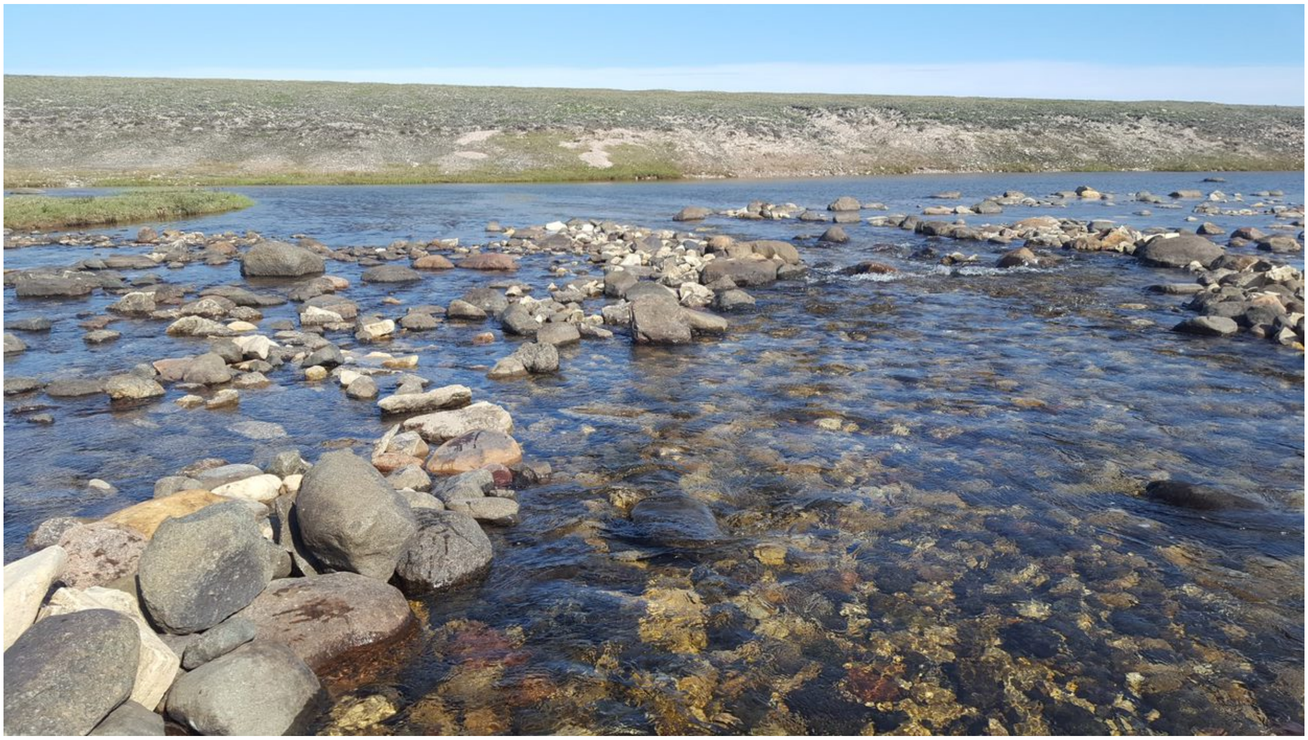

Photo A18: Downstream View of Low-flow Channel, Pre-Repair, at Site 6 on 24 July 2018

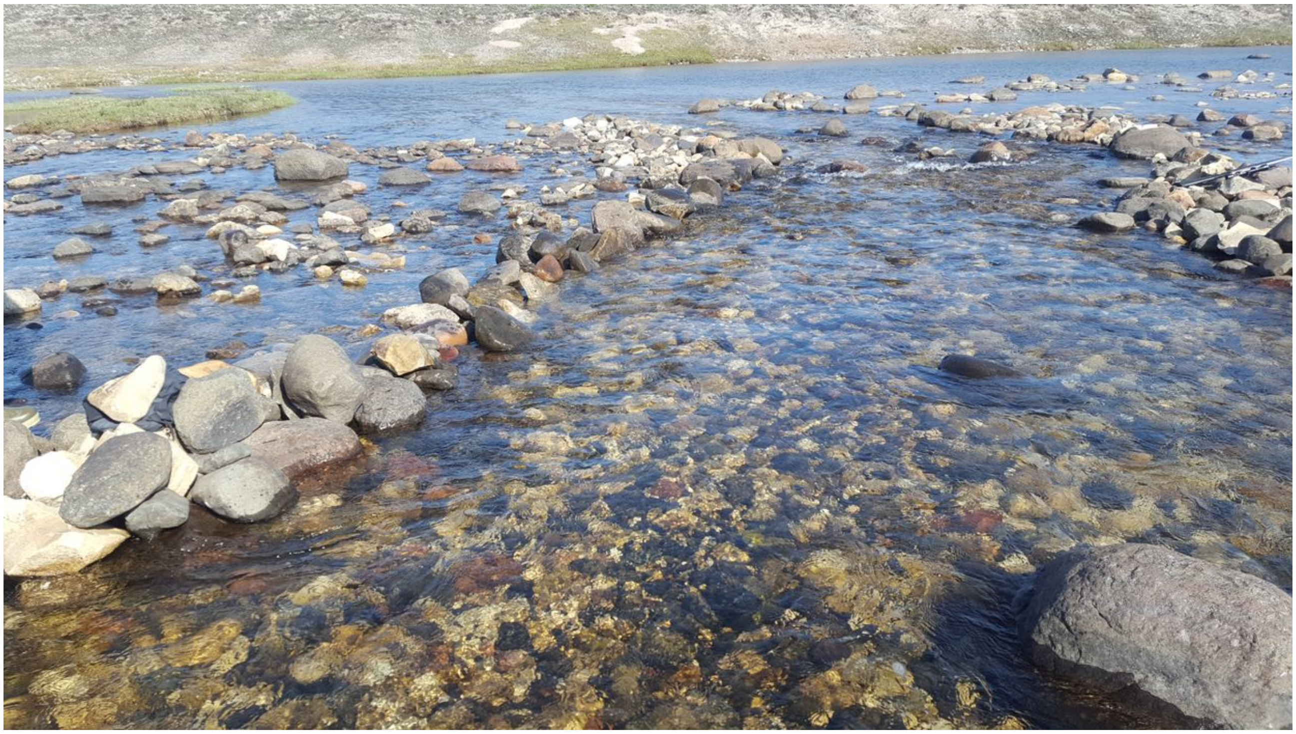

Photo A19: Downstream View of Low-flow Channel, Post-Repair, at Site 6 on 24 July 2018

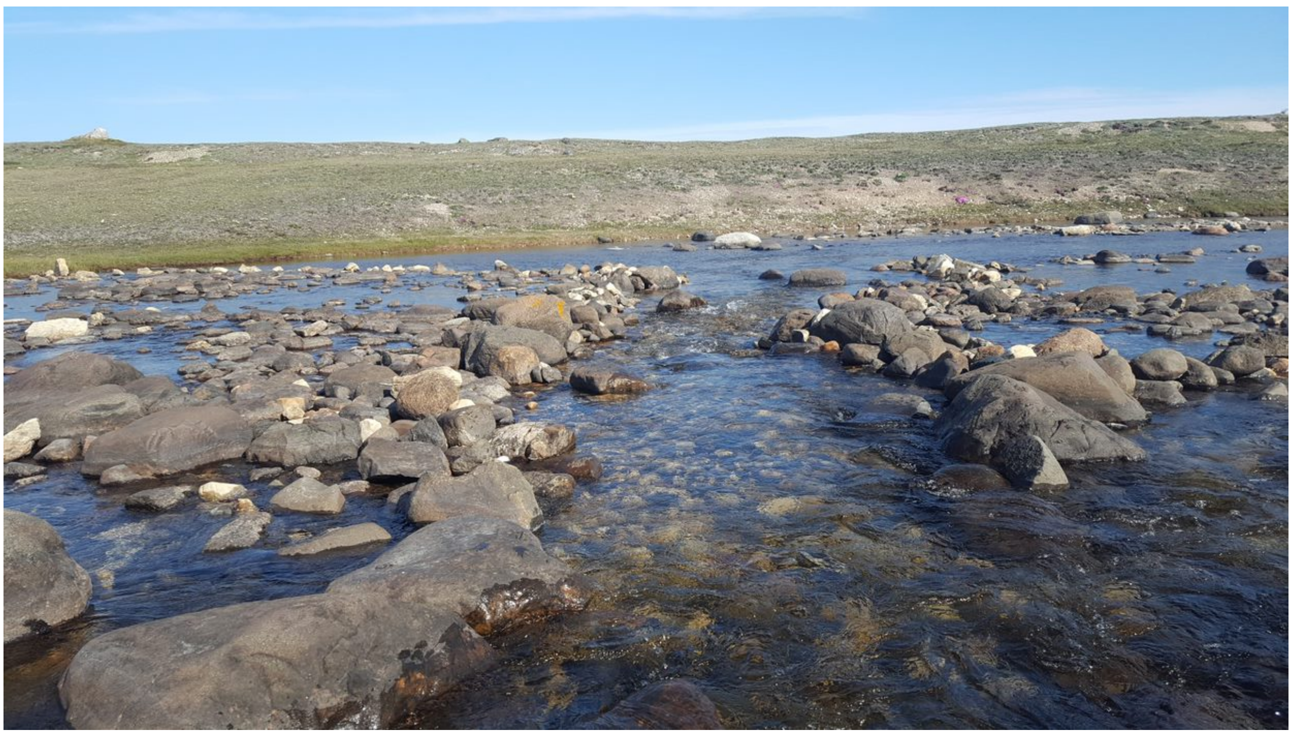

Photo A20: Downstream View of Low-flow Channel A and Directional Weir (seen at top left of photo) at Site 7 on 24 July 2018

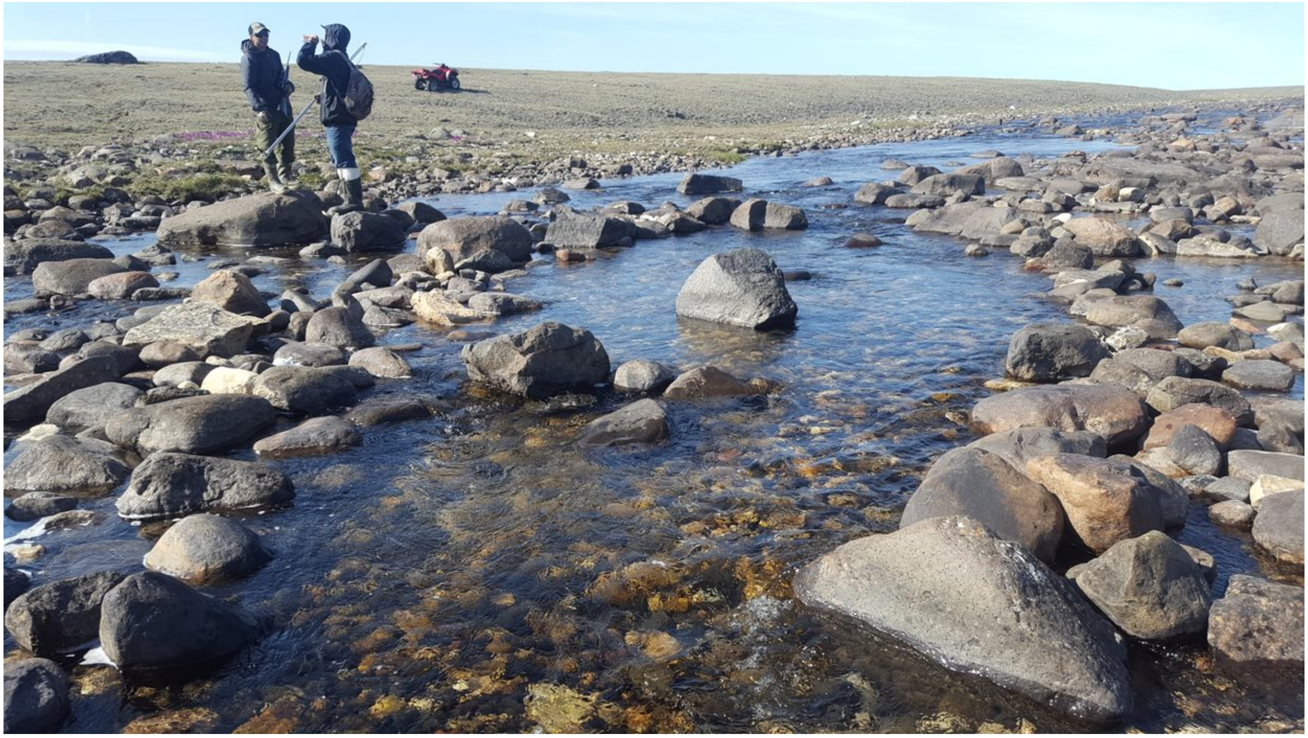

Photo A21: Upstream View of Low-flow Channel B at Site 7 on 24 July 2018

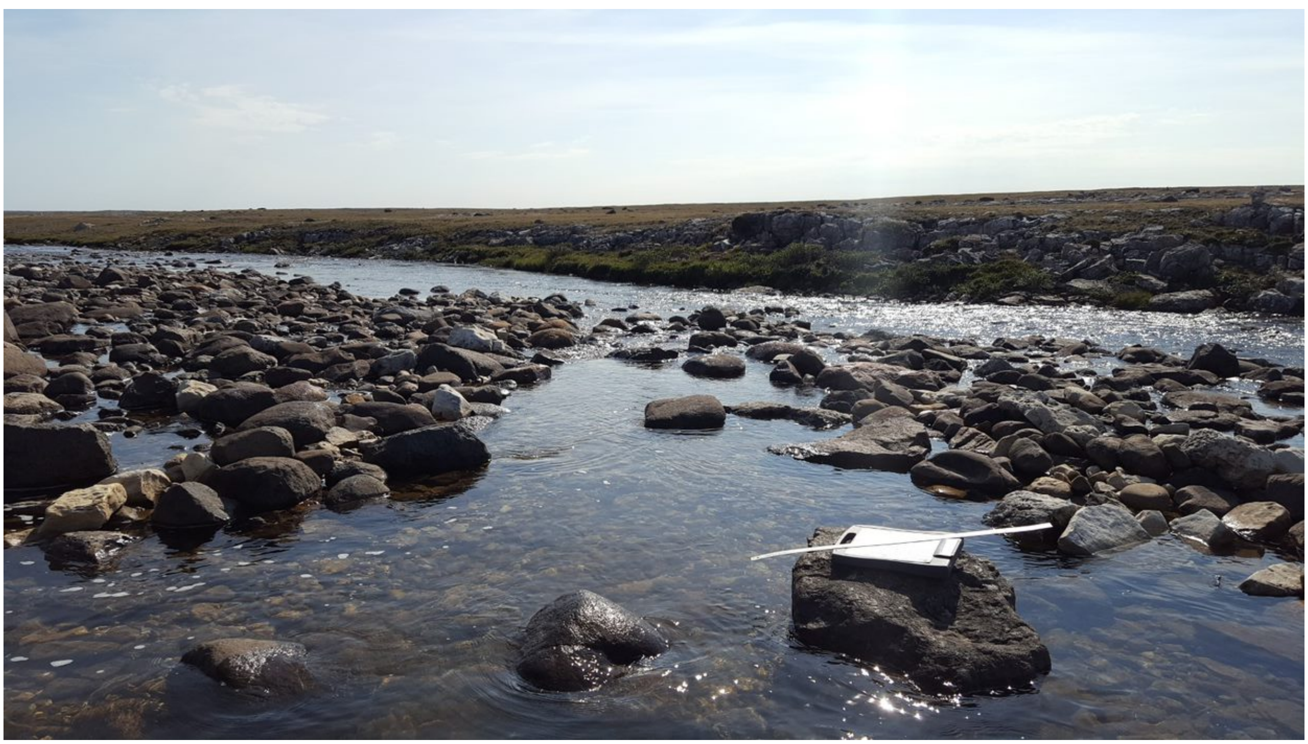

Photo A22: Downstream View of Low-flow Channel at Site 8 on 24 July 2018

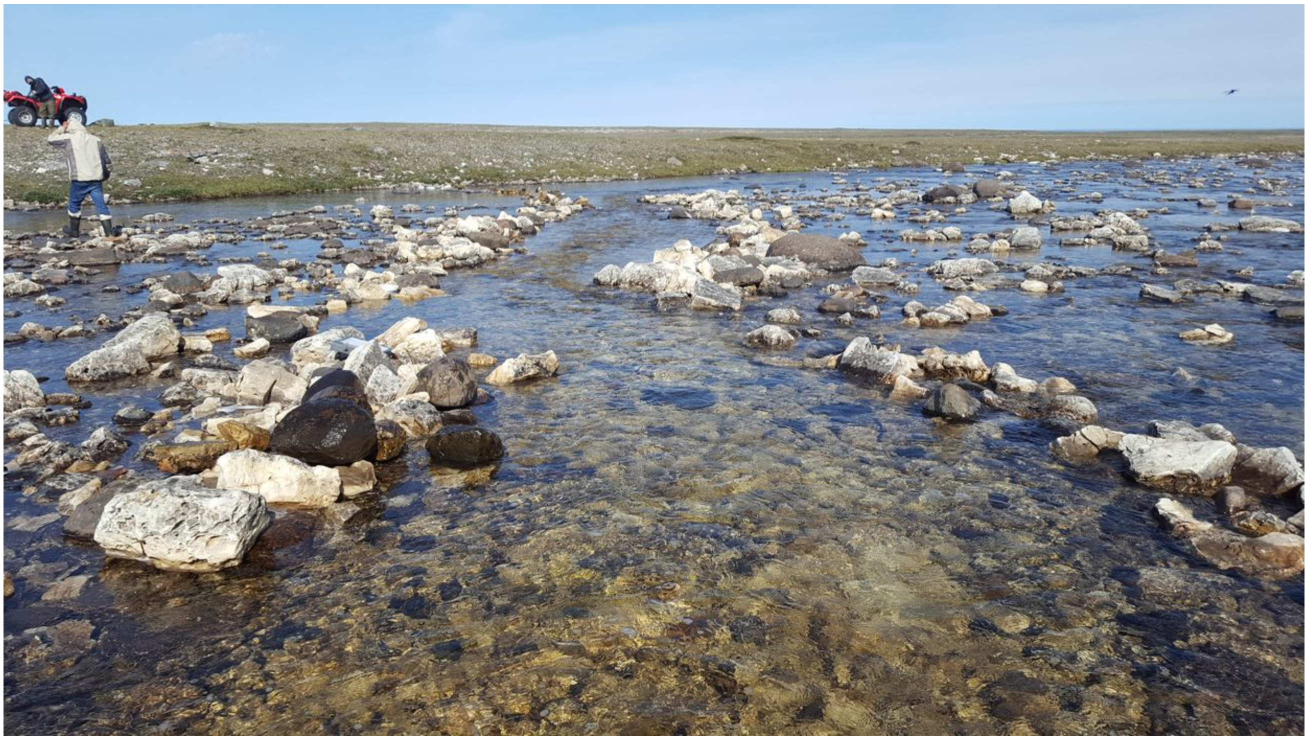

Photo A23: Downstream View of Low-flow Channel at Site 9 on 25 July 2018

Photo A24: View from Left Downstream Bank of Directional Weir, Pre-Improvement, at Site 9 on 25 July 2018

Photo A25: View from Left Downstream Bank of Directional Weir, Post-Improvement, at Site 9 on 25 July 2018

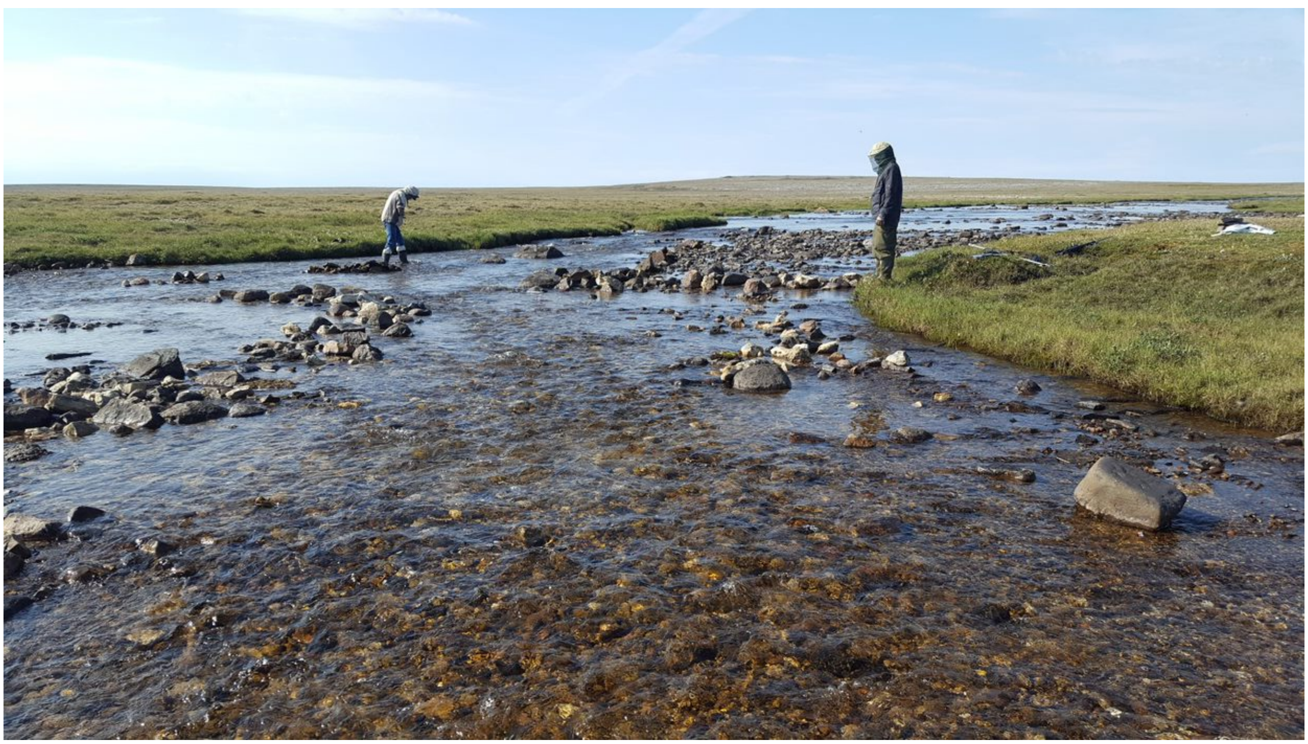

Photo A26: Upstream View of Low-flow Channel A at Site 10 on 25 July 2018

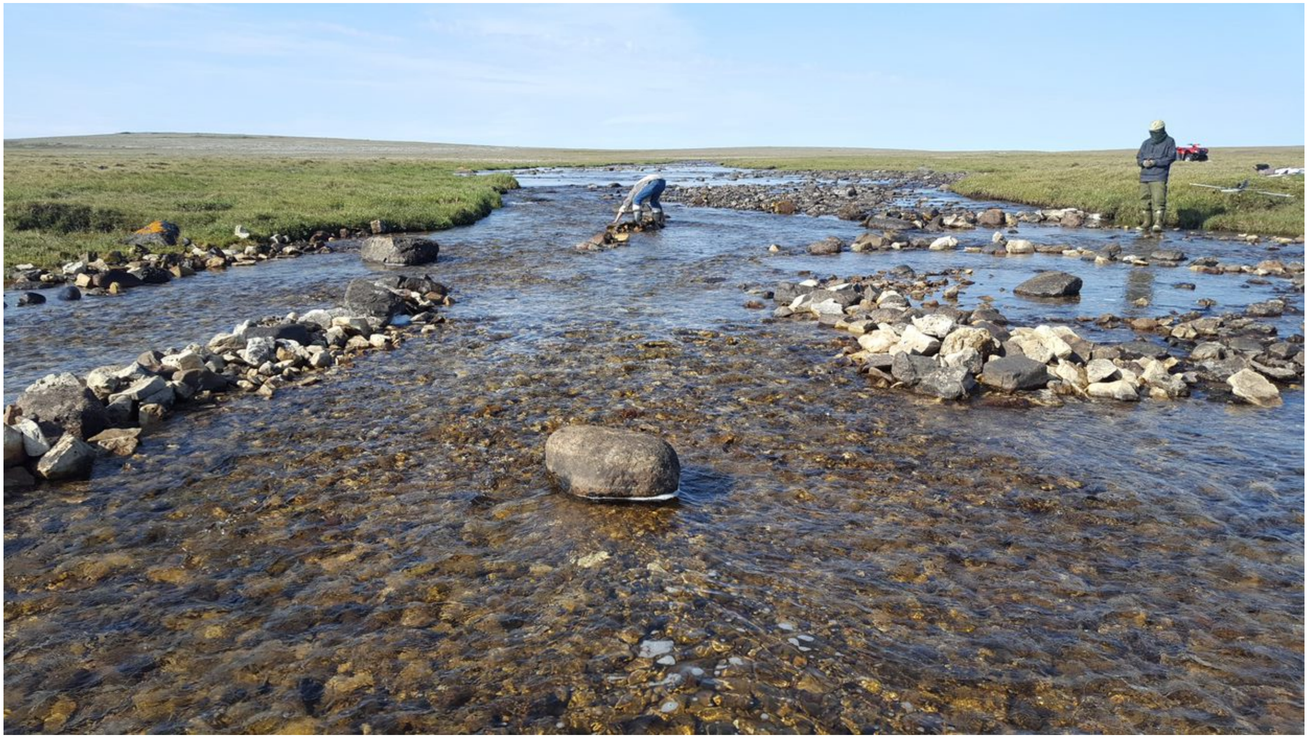

Photo A27: Upstream View of Low-flow Channel B at Site 10 on 25 July 2018

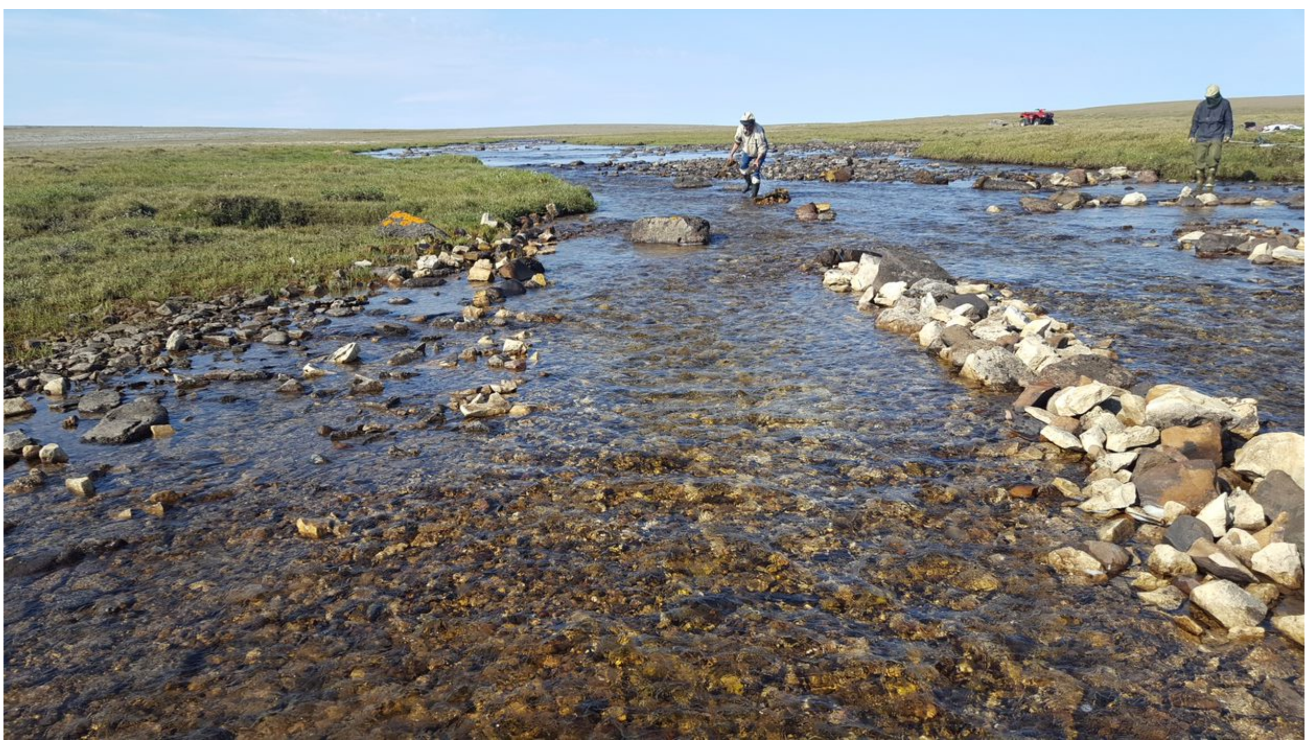

Photo A28: Upstream View of Low-flow Channel C at Site 10 on 25 July 2018

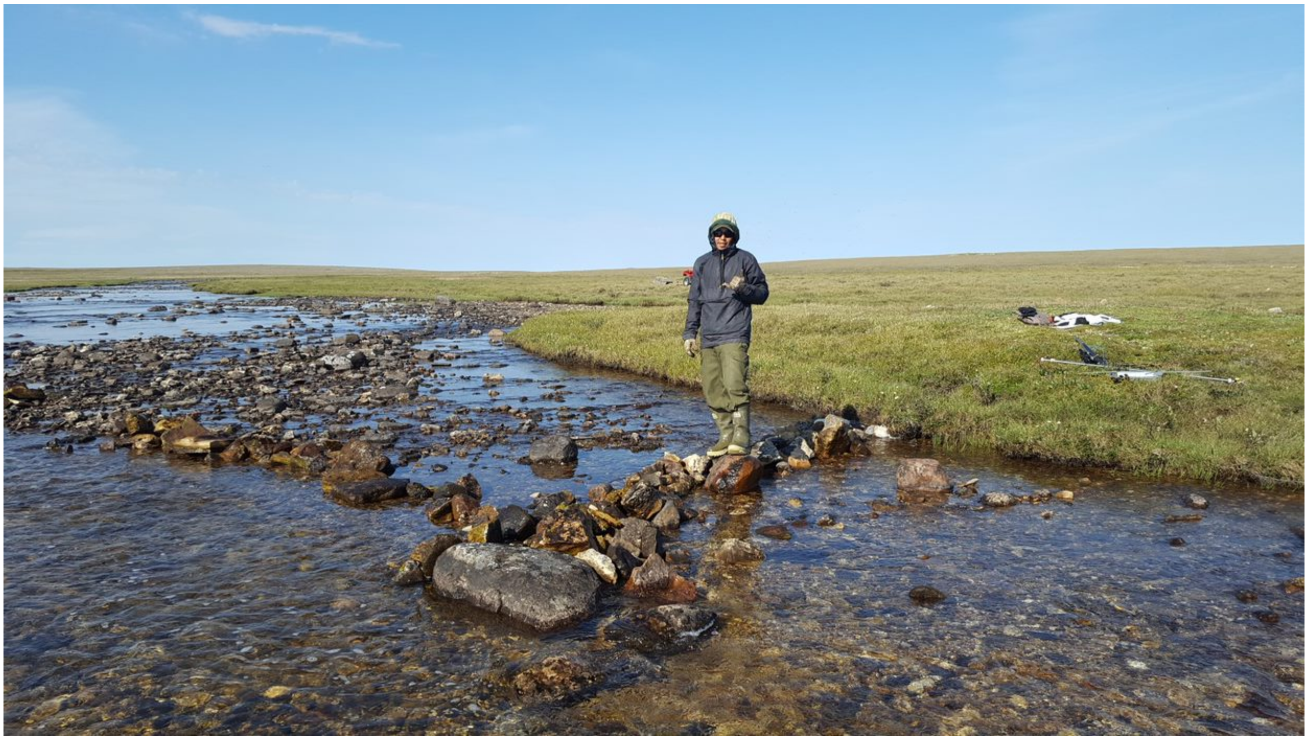

Photo A29: Upstream View of Directional Weir, Post-Repair, with assistant Adrian at Site 10 on 25 July 2018

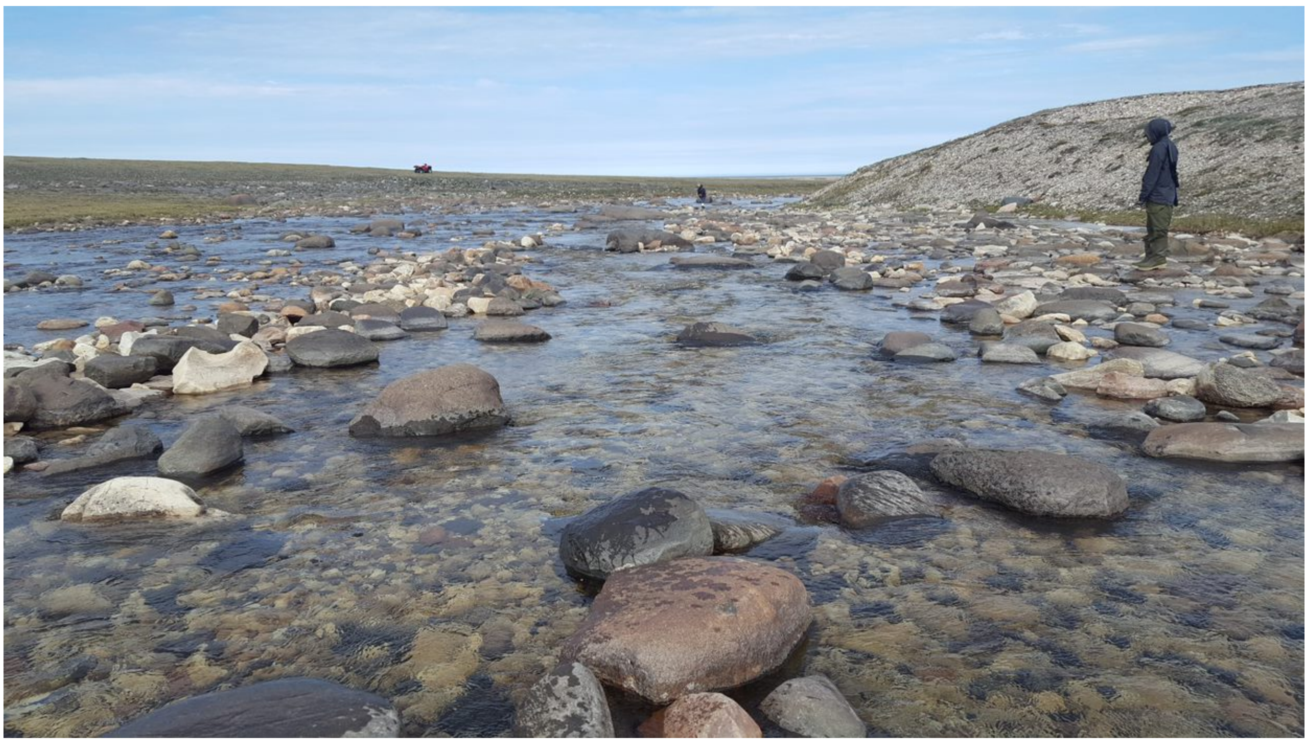

Photo A30: Downstream View of Low-flow Channel at Site 11 on 24 July 2018

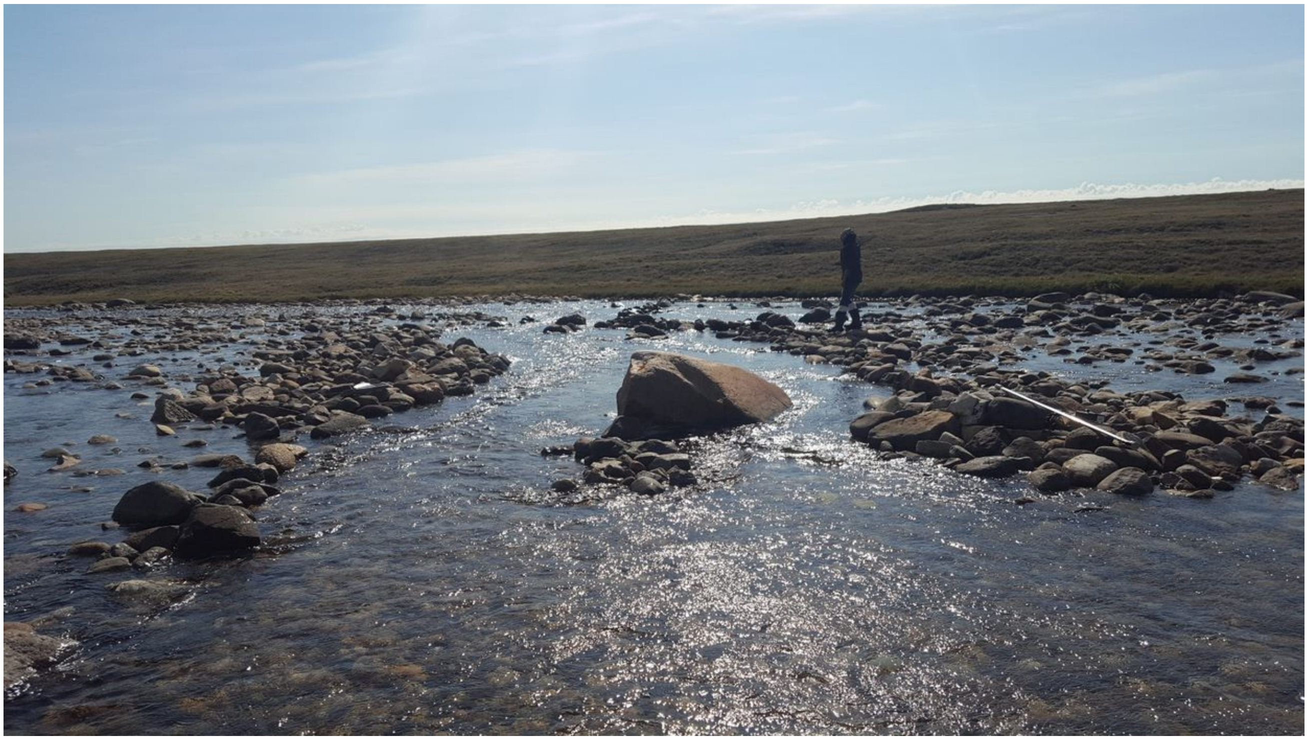

Photo A31: Downstream View of Low-flow Channels A and B at Site 12 on 24 July 2018

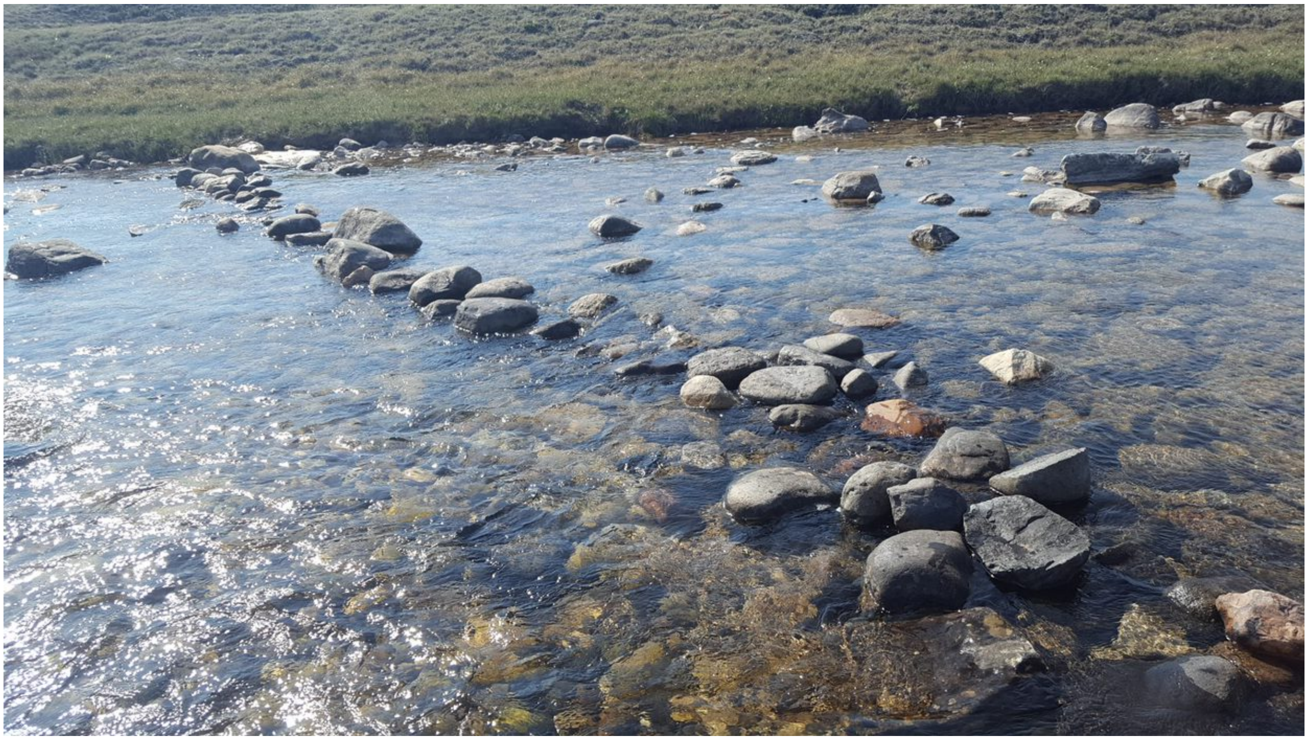

Photo A32: Downstream View of Directional Weir, Pre-Repair/Improvement, at Site 12 on 24 July 2018

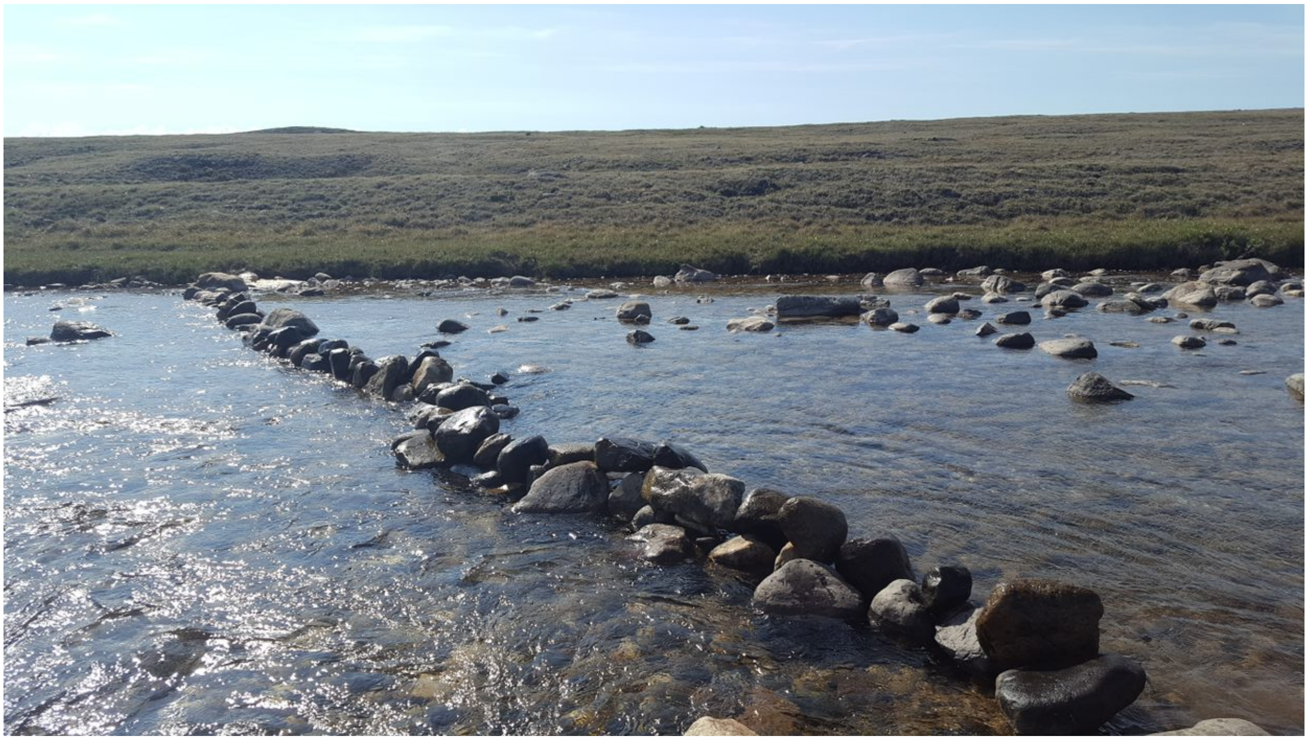

Photo A33: Downstream View of Directional Weir, Post-Repair/Improvement, at Site 12 on 24 July 2018

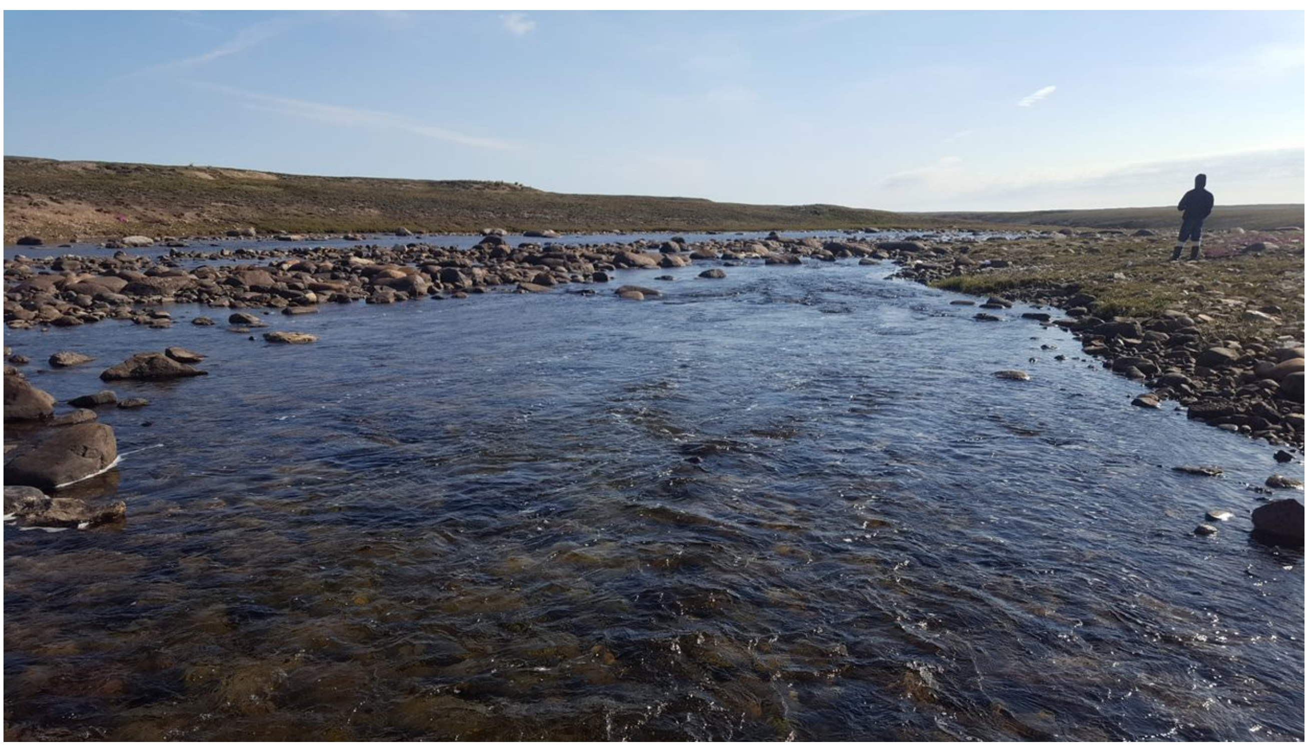

Photo A34: Downstream View of Low-flow Channel at Site 13. 24 July 2018.

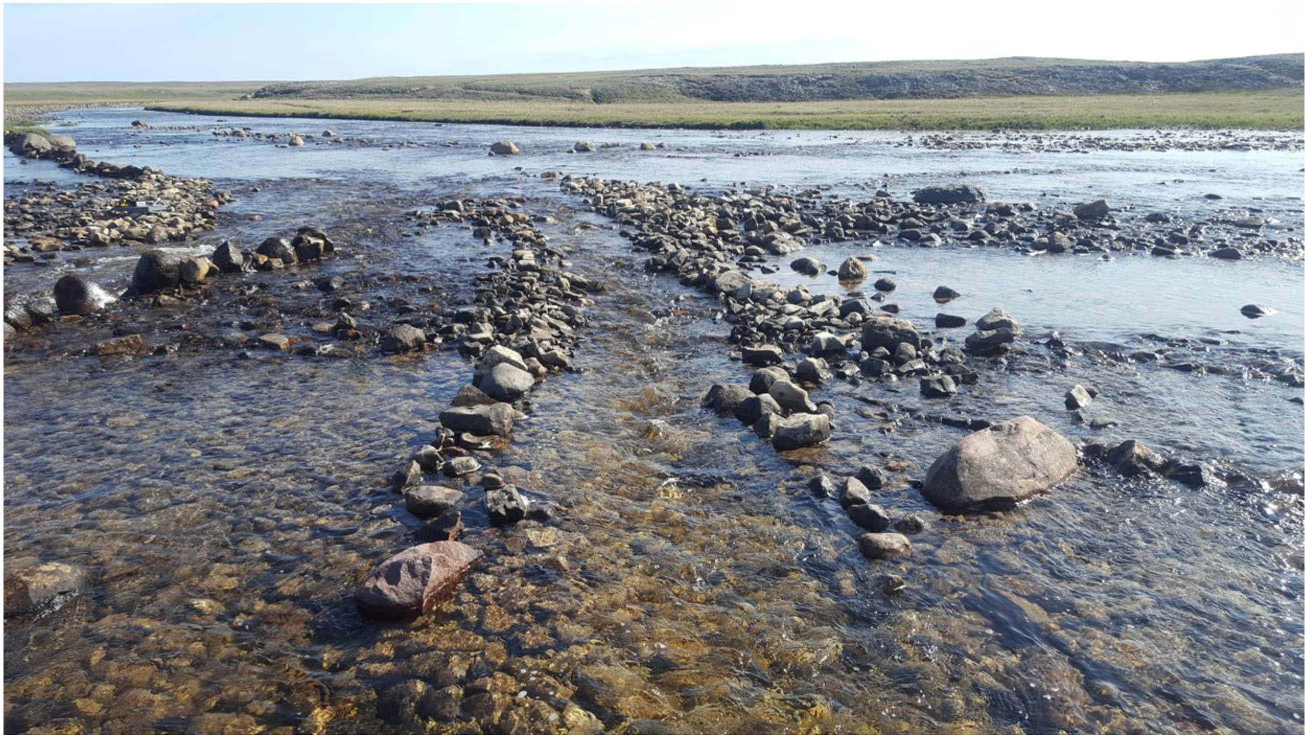

Photo A35: Upstream View of Low-flow Channel B at 2012 Project 1, Depths Allows for Fish Passage, 25 July 2018

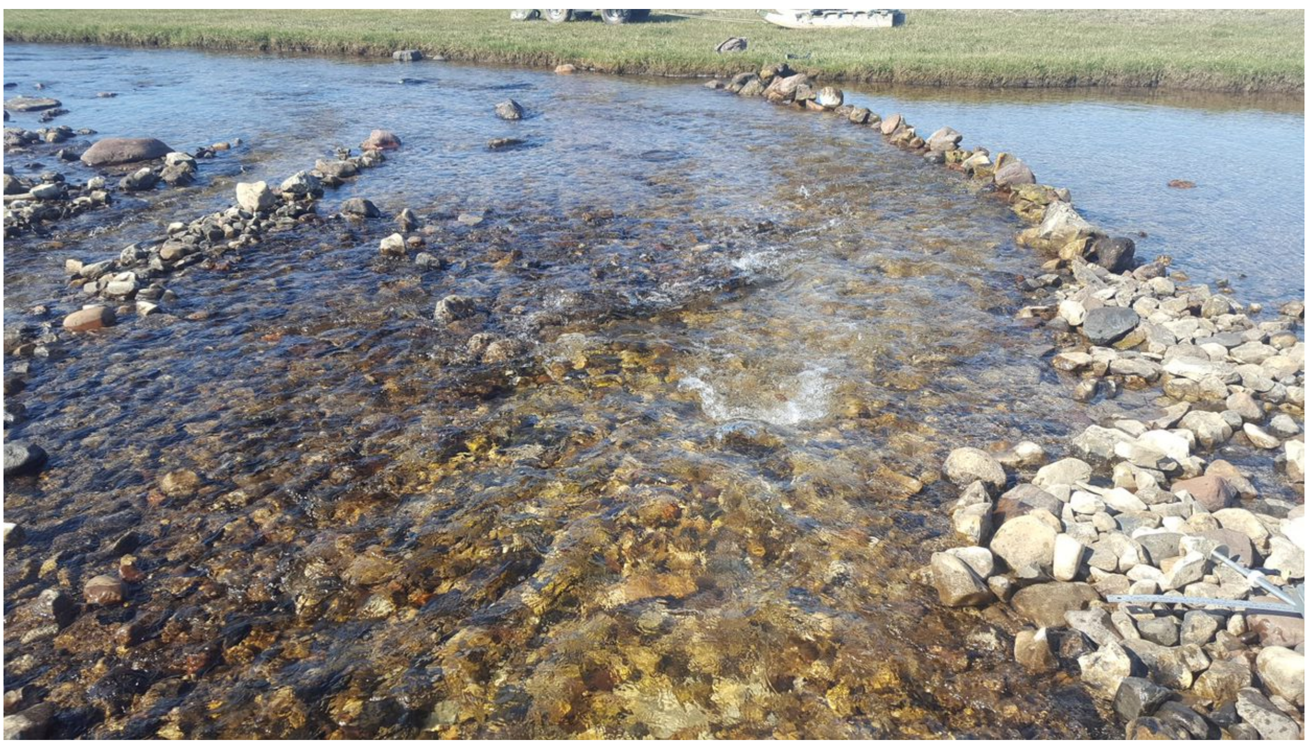

Photo A36: Downstream View of Low-flow Channel A, Pre-Repair, at 2012 Project 1, 25 July 2018

Photo A37: Downstream View of Low-flow Channel A, Post-Repair, at 2012 Project 1, 25 July 2018

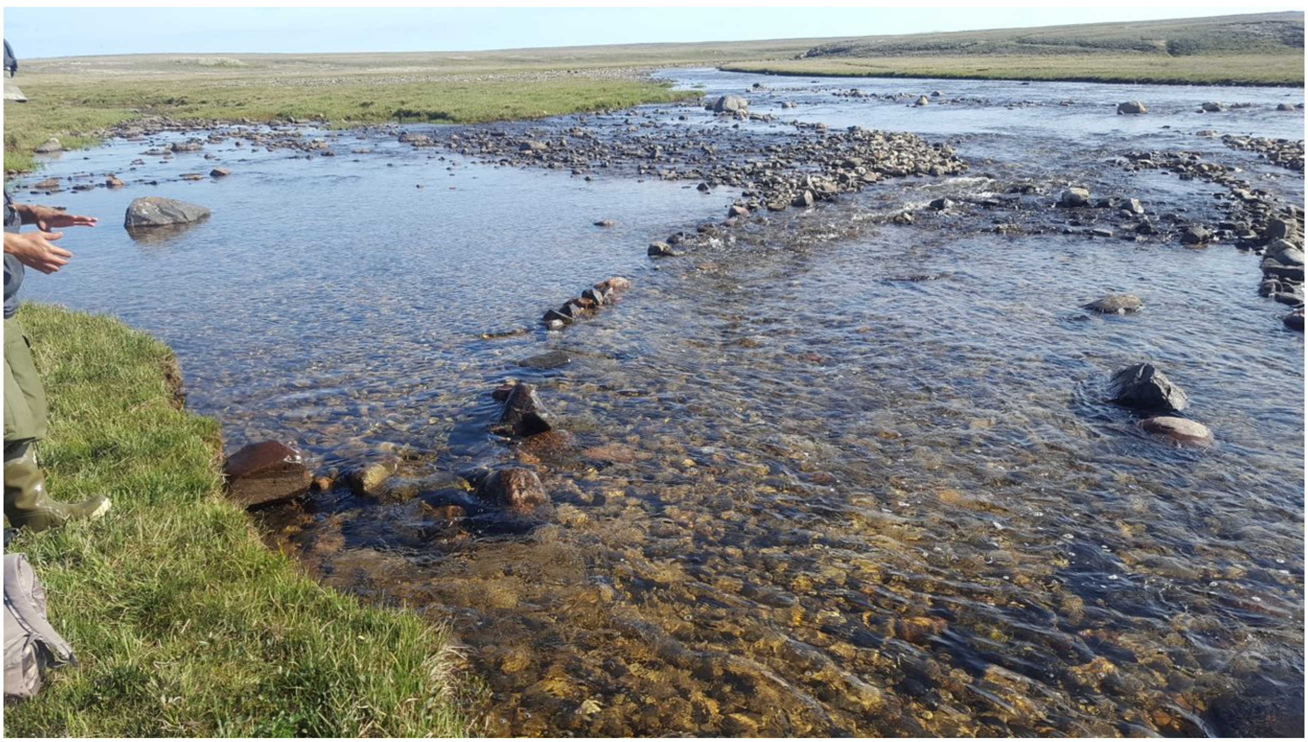

Photo A38: View from Right Downstream Bank of Directional Weir, Pre-Repair, at 2012 Project 1, 25 July 2018

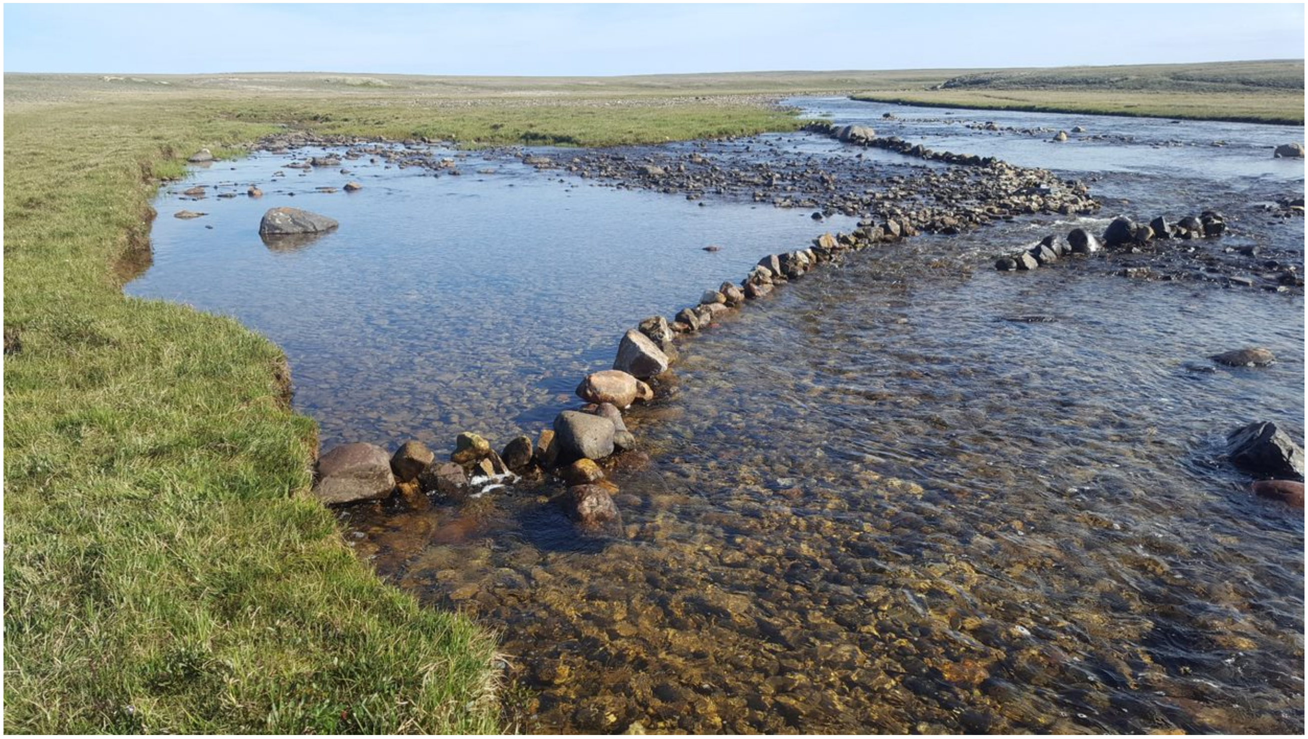

Photo A39: View from Right Downstream Bank of Directional Weir, Post-Repair, at 2012 Project 1, 25 July 2018

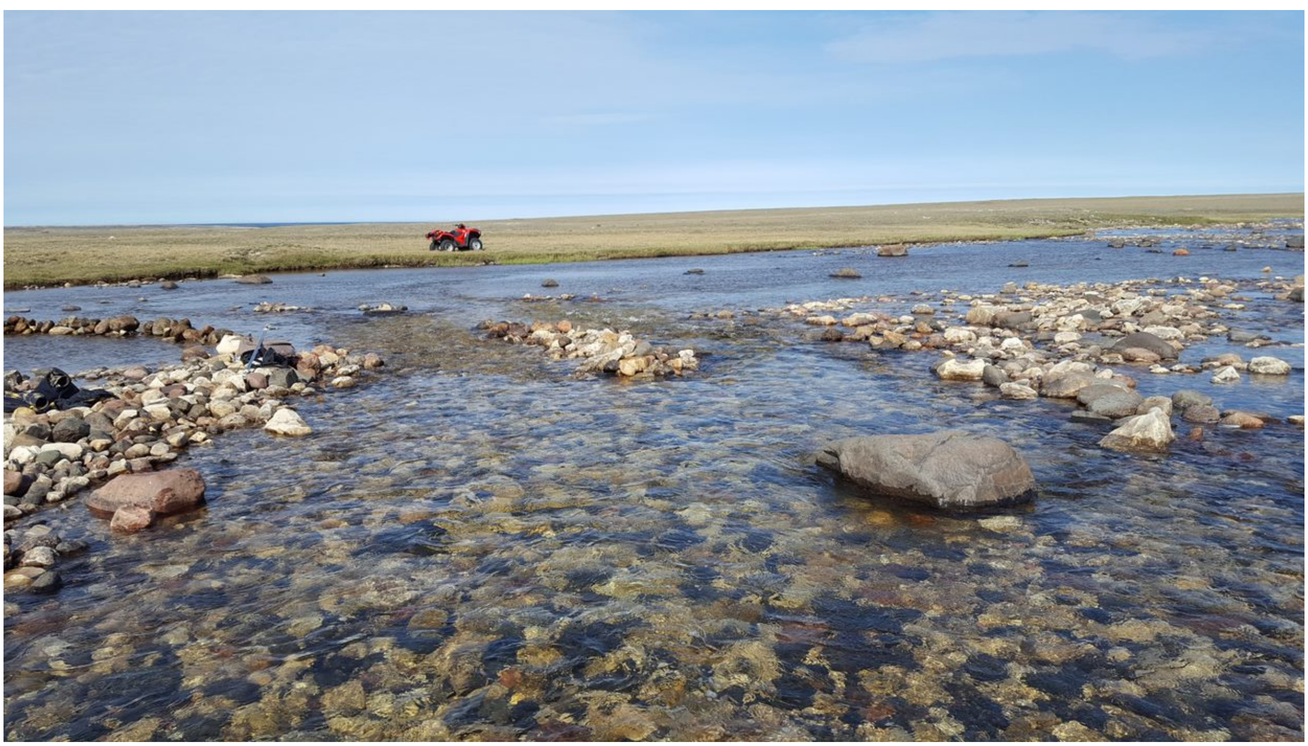

Photo A40: Downstream View of Low-flow Channel A and Low-flow Channel B at 2012 Project 2, 24 July 2018

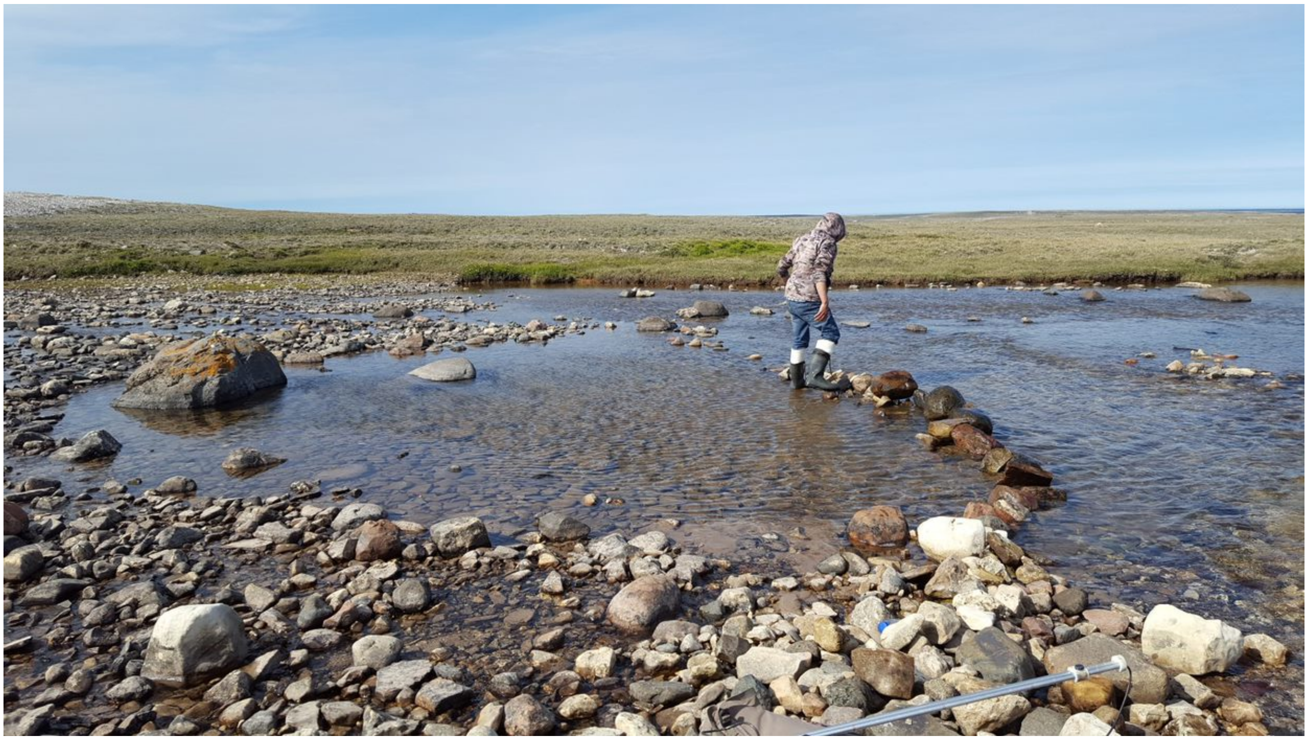

Photo A41: Downstream View of Directional Weir, Pre-Repair, at 2012 Project 2, 24 July 2018

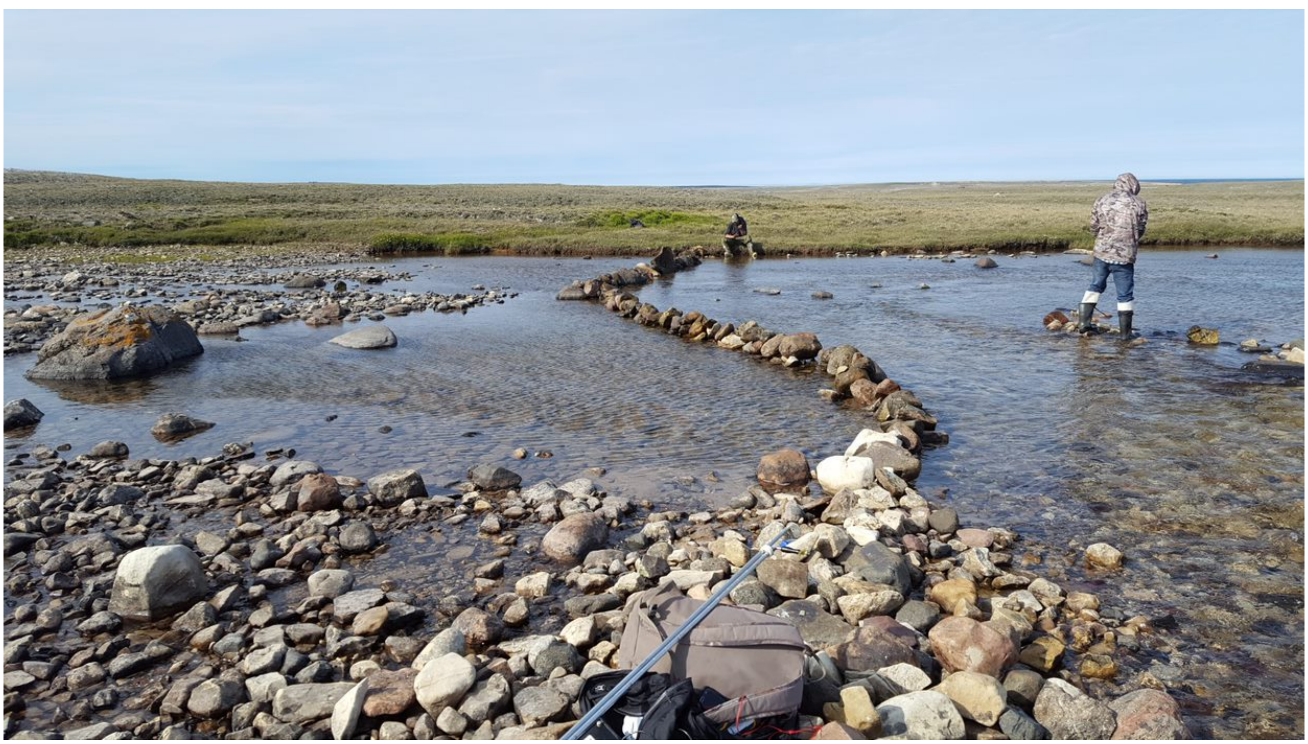

Photo A42: Downstream View of Directional Weir, Post-Repair, at 2012 Project 2, 24 July 2018

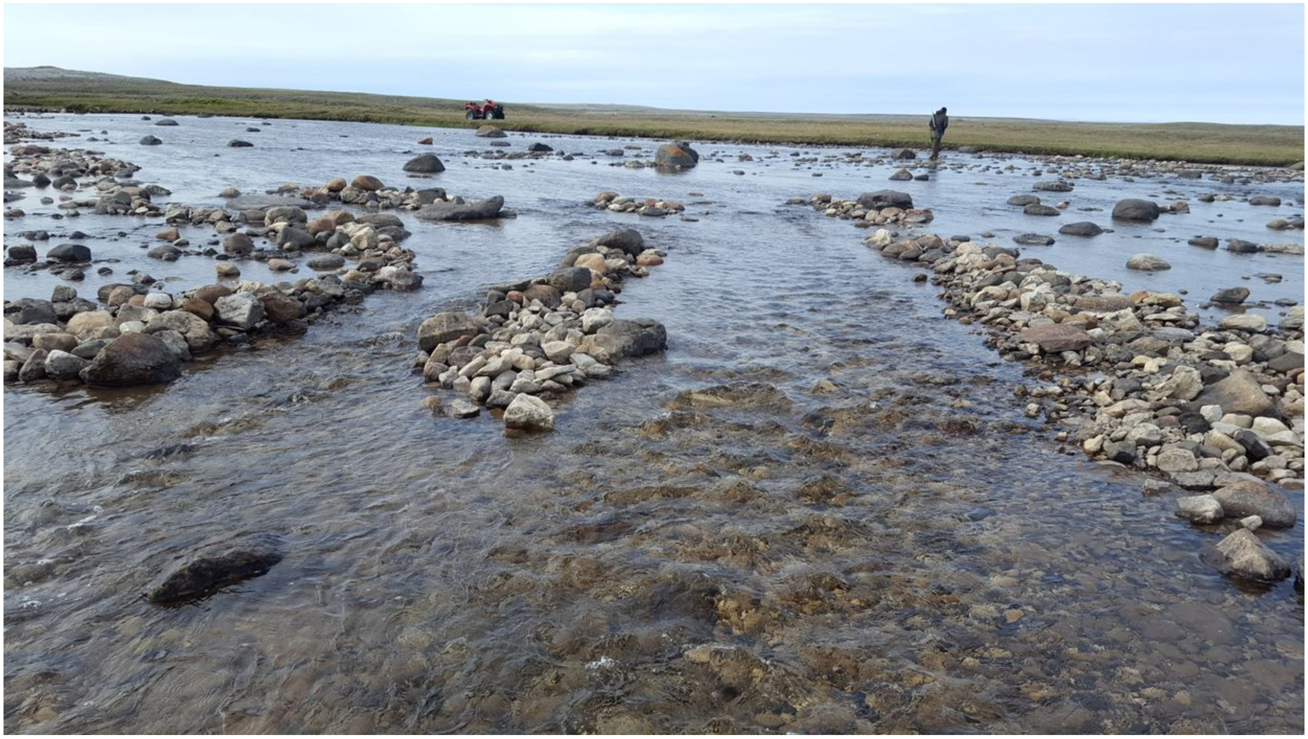

Photo A43: Upstream View of Low-flow Channels A and B at 2012 Project 3, 24 July 2018

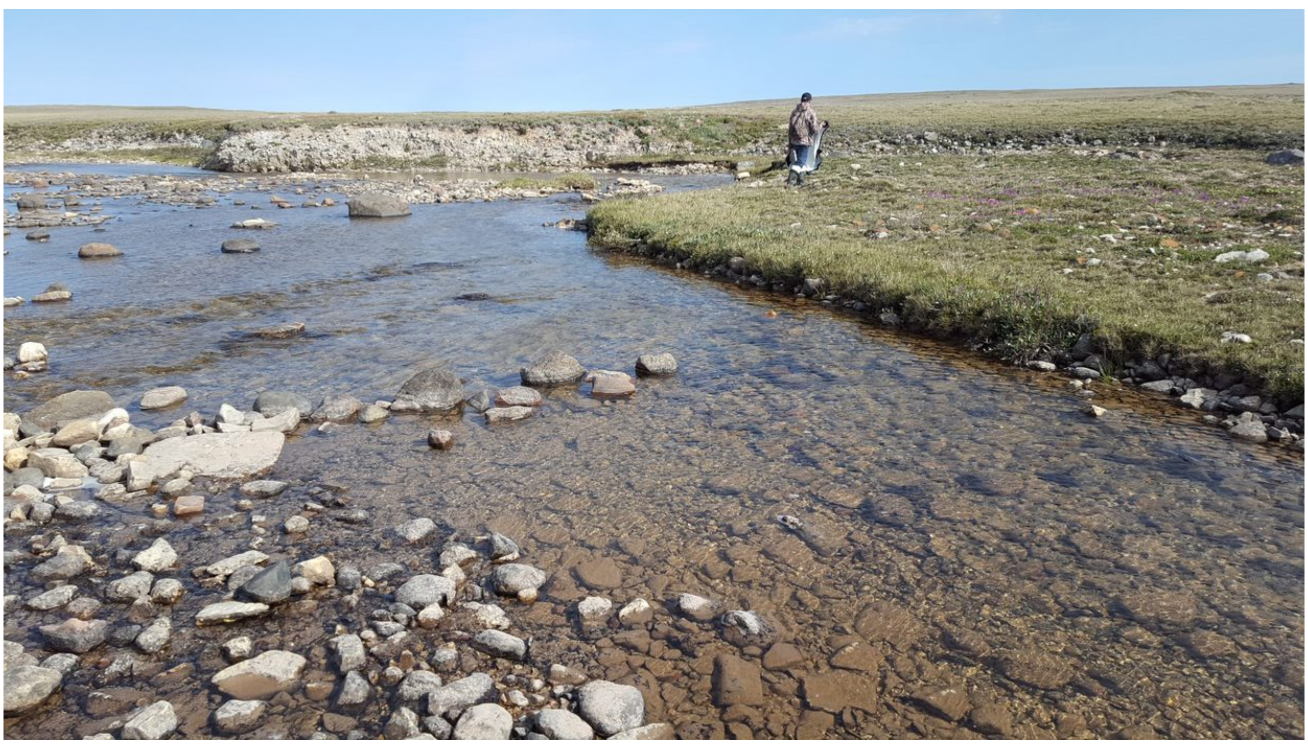

Photo A44: Downstream View of Directional Weir, Pre-Repair, at 2012 Project 3, 24 July 2018

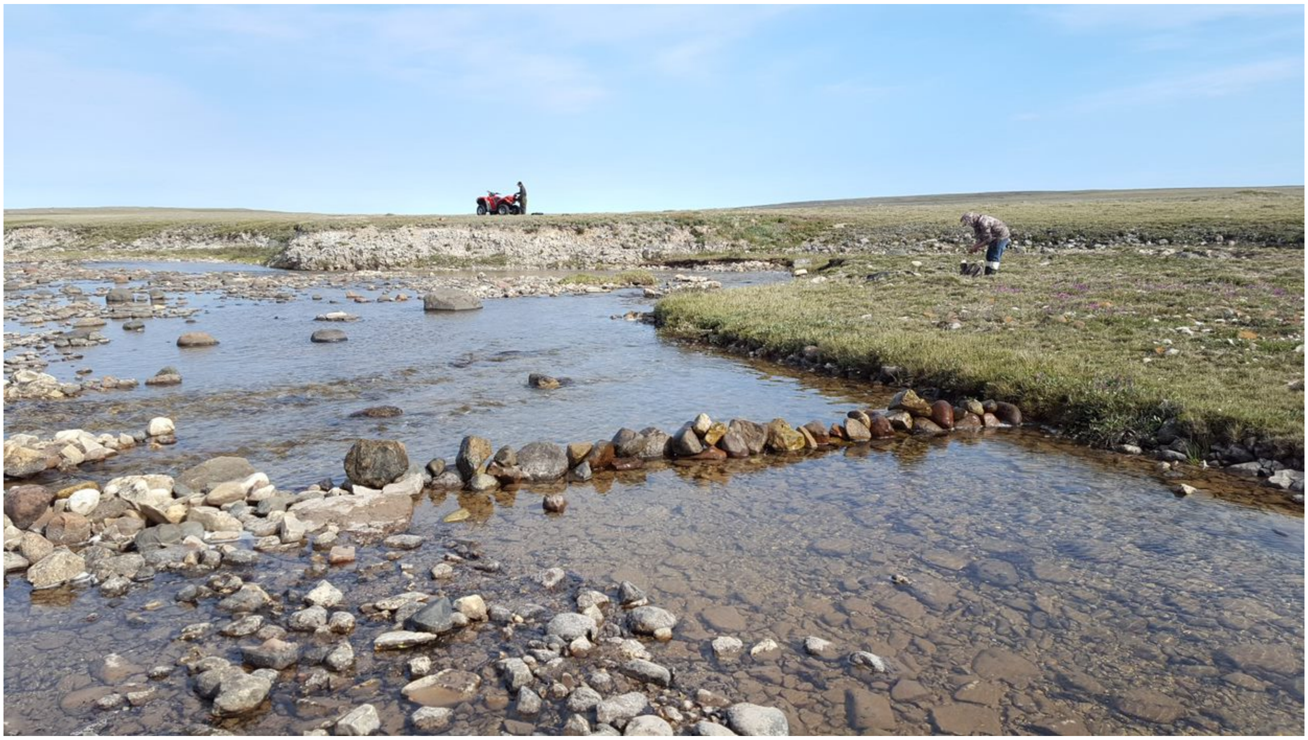

Photo A45: Downstream View of Directional Weir, Post-Repair, at 2012 Project 3, 24 July 2018

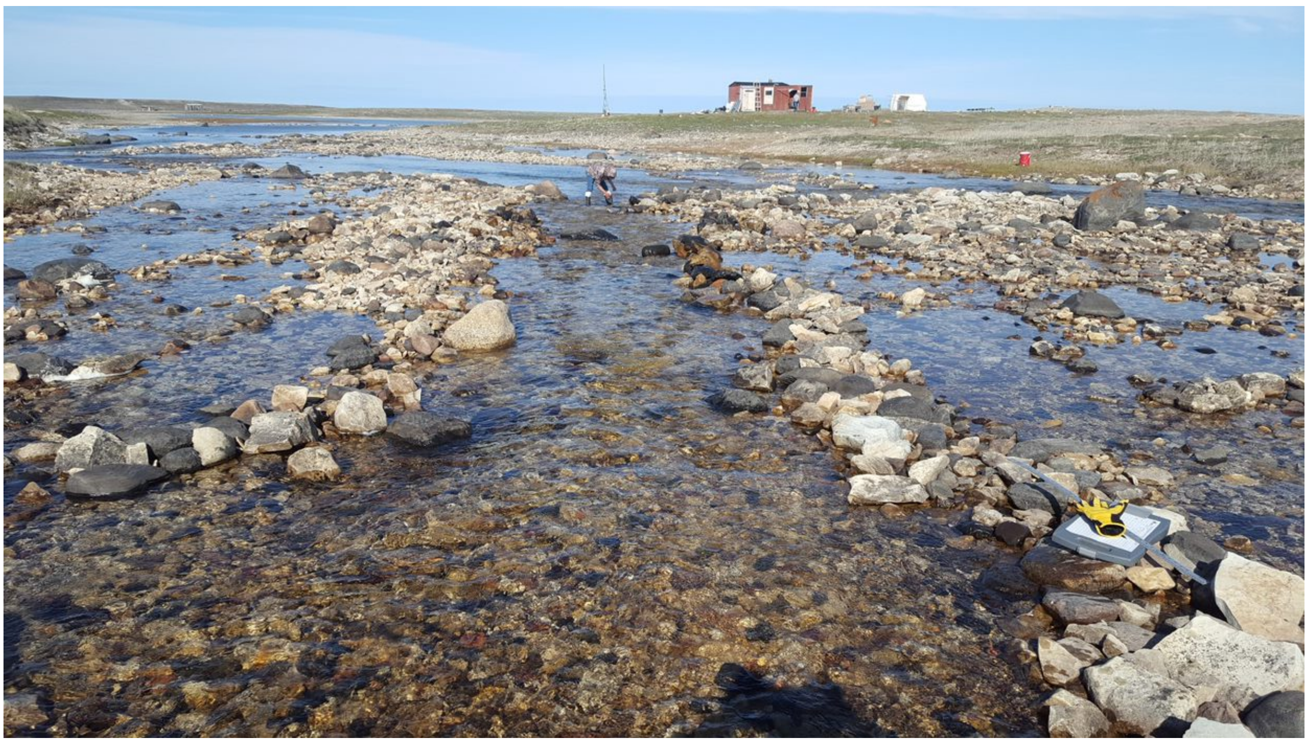

Photo A46: Downstream View of Low-flow Channel at 2012 Project 4, 25 July 2018

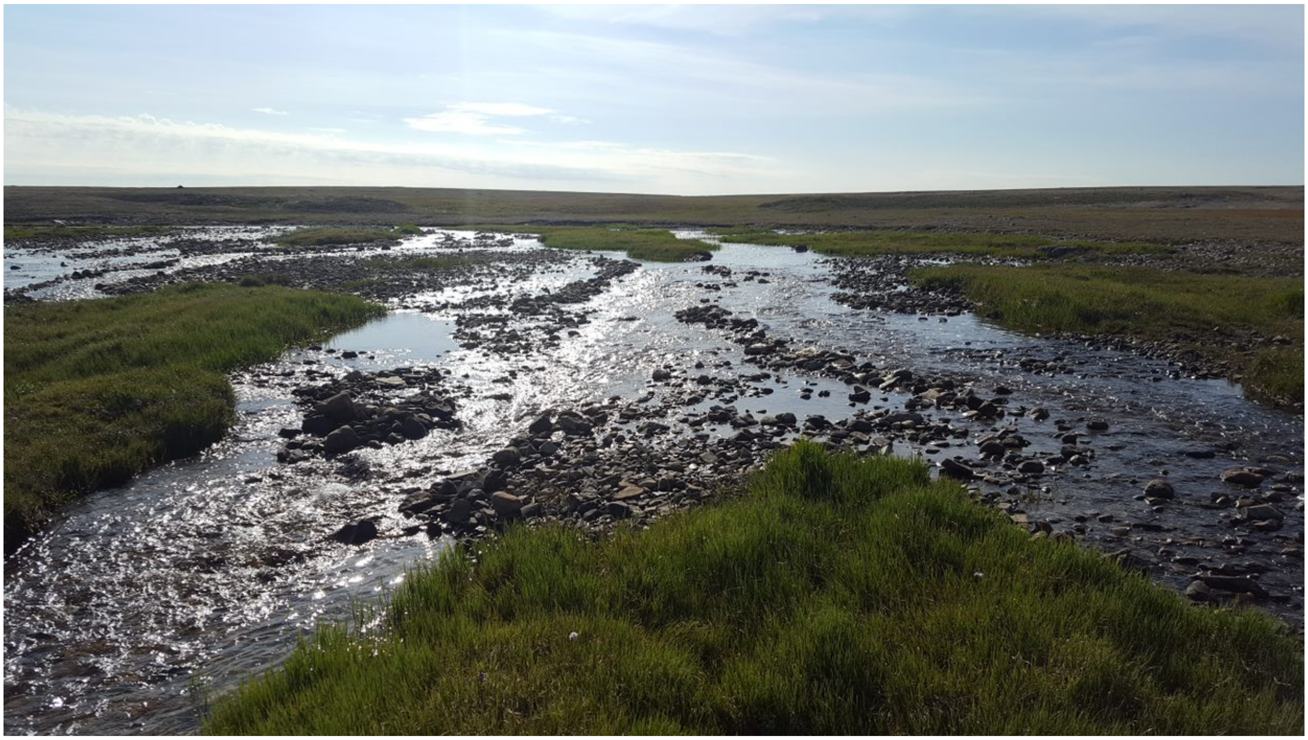

Photo A47: Upstream View of Low-flow Channels A and B at 2012 Project 5, 25 July 2018

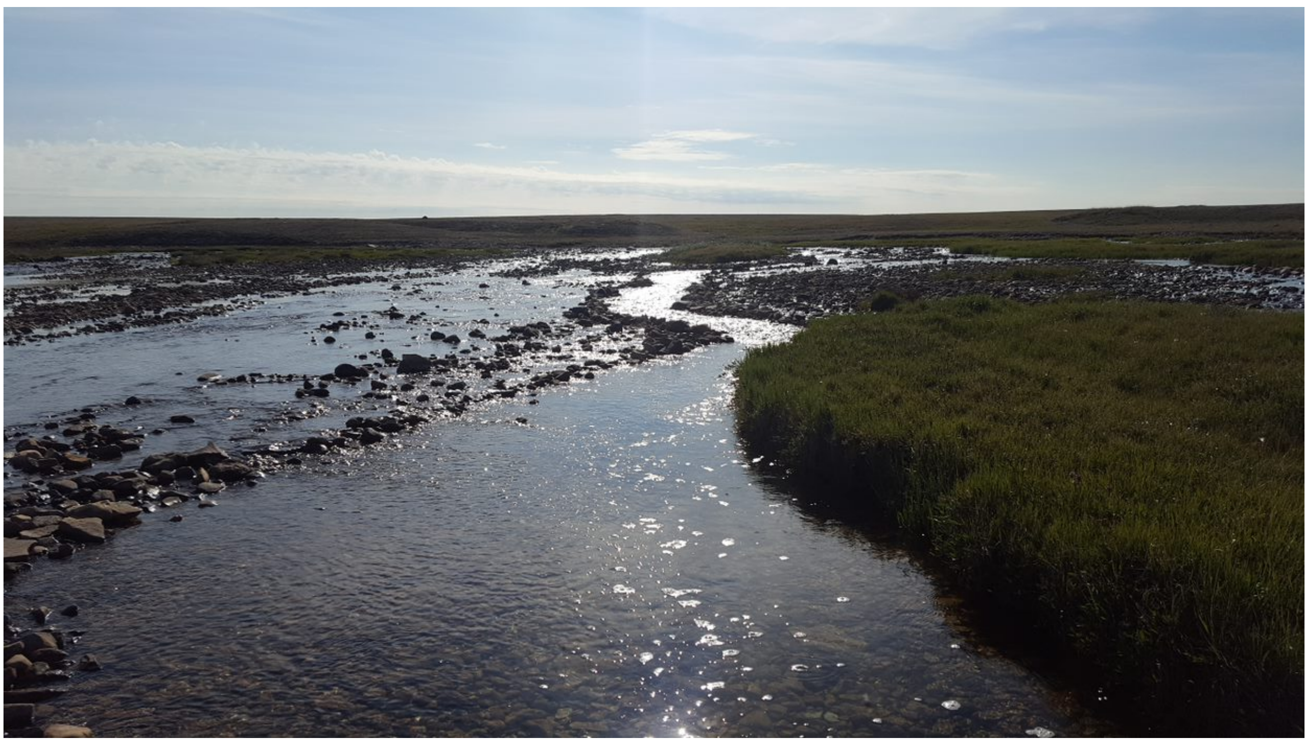

Photo A48: Upstream View of Low-flow Channel C at 2012 Project 5, 25 July 2018

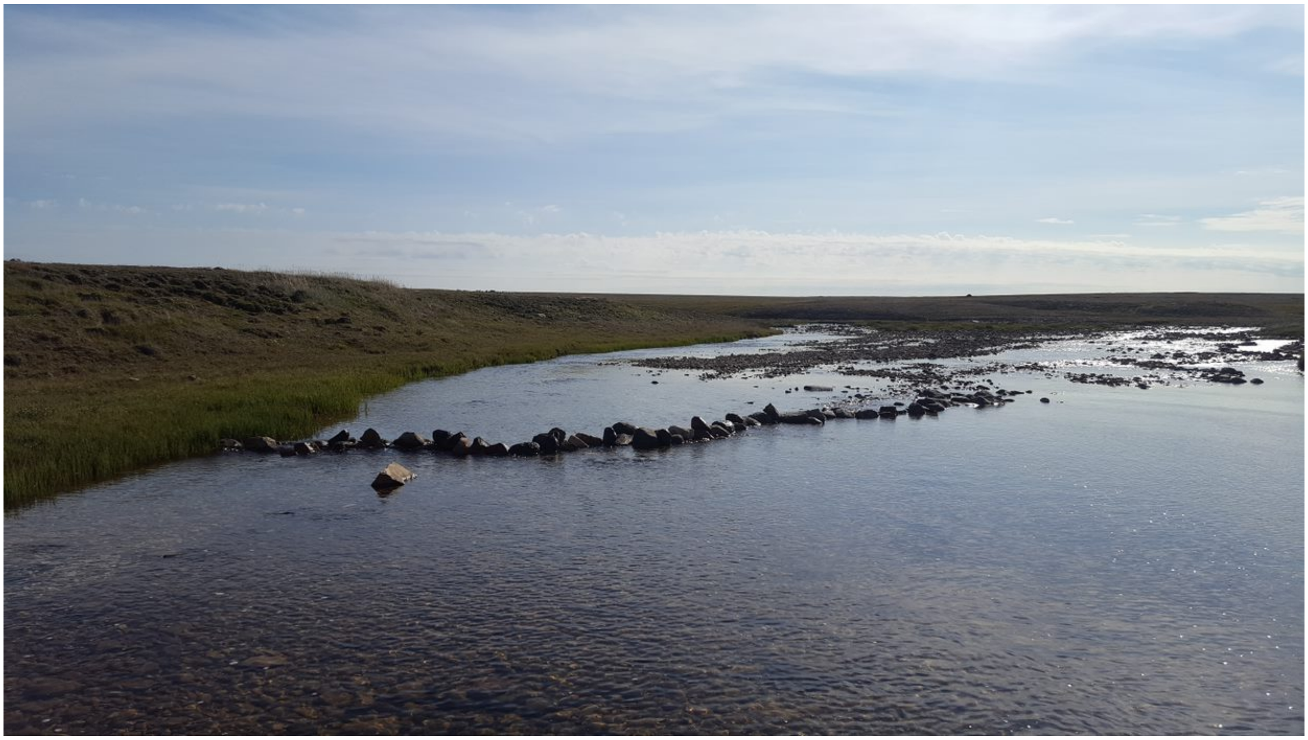

Photo A49: Upstream View of Directional Weir A at 2012 Project 5, 25 July 2018

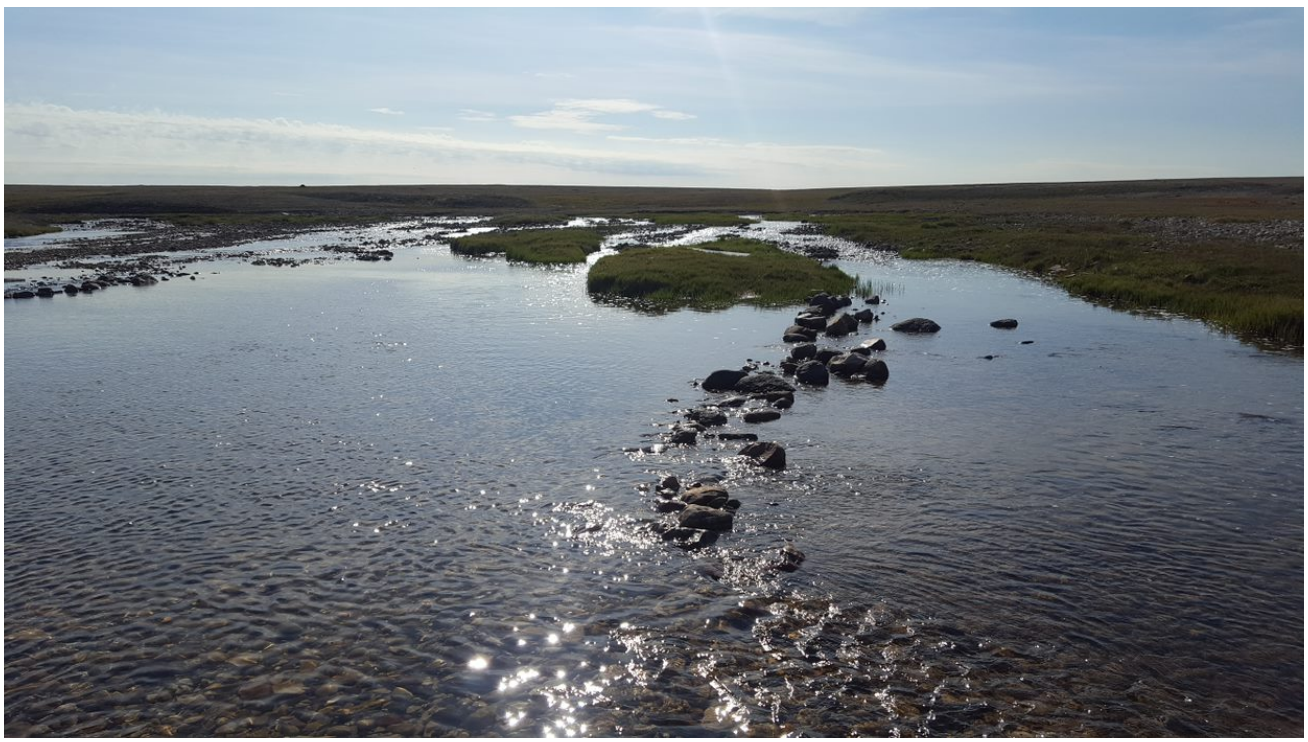

Photo A50: Upstream View of Directional Weir B, Pre-Repair, at 2012 Project 5, 25 July 2018

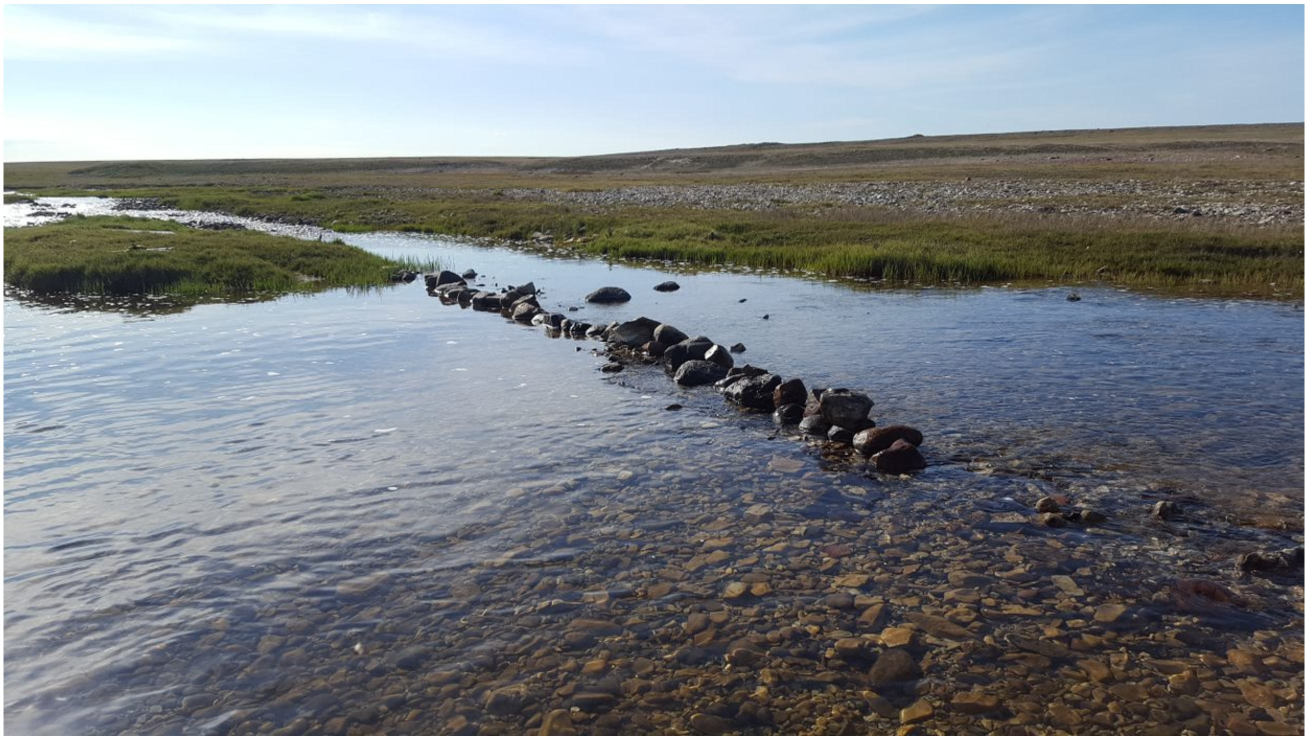

Photo A51: Upstream View of Directional Weir B, Pre-Repair, at 2012 Project 5, 25 July 2018