



Baffinland Iron Mines Corporation Mary River Project

Freshwater and Fish Habitat Survey: Mary River and Tributary F 2023

REPORT

Prepared for Baffinland Iron Mines Corporation
By North/South Consultants Inc. • 83 Scurfield Blvd. • Winnipeg, MB • R3Y 1G4

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

FRESHWATER FISH AND FISH HABITAT SURVEY:
MARY RIVER AND TRIBUTARY F 2023

Prepared for:

Baffinland Iron Mines Corporation

Prepared by:

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EXECUTIVE SUMMARY

Baffinland Iron Mines (Baffinland) requested that North/South Consultants Inc. (NSC) undertake a fish and fish habitat survey of a small tributary adjacent to the mine (known as Tributary F) and a portion of the Mary River in the vicinity of Tributary F in the summer of 2023 (Figure 1). Electrofishing was previously conducted in Tributary F at the request of Baffinland in September 2019 to determine fish presence/absence and identify any barriers to fish movements. Two barriers to upstream fish movement (0.75-1.00 m vertical drops) were observed near the mouth of the stream in 2019. Fish were not observed or captured upstream or downstream of these barriers, though fish use was suspected in the downstream reach. The field survey conducted in September 2019 may have occurred after fish had moved out of the smaller streams to downstream overwintering habitat (e.g., Sheardown and Mary lakes). The Mary River contains an impassable set of falls, approximately 375 m upstream of the confluence with Tributary F.

The primary objective of the field program conducted in August 2023 was to confirm barriers to fish movement and examine fish presence upstream and downstream of the barriers on Tributary F and the Mary River. Aquatic habitat information was also collected from the tributary and several sites on the Mary River.

The August 2023 field survey confirmed the presence of permanent barriers on Tributary F, approximately 45-50 m upstream of the confluence with the Mary River and identified a second permanent barrier approximately 5 m farther upstream. Arctic Char were captured downstream of the barriers but no fish were captured or observed in the Tributary F mainstem or side tributaries upstream of the barriers.

No fish were captured or observed upstream of the impassable set of falls on the Mary River and no lakes were identified with sufficient depth to potentially support overwintering of Arctic Char in the upper Mary River drainage.

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ABBREVIATIONS AND ACRONYMS

ARCH	Arctic Char
B	Boulder/Boulder garden
CPUE	Catch-per-unit-effort
FEIS	Final Environmental Impact Statement
HG	High gradient
INT	Intermittent
LHB	Left hand bank
N	No
NM	Not measured
NNST	Ninespine Stickleback
NSC	North/South Consultants Inc.
P	Potential
PERM	Permanent
RHB	Right hand bank
SHALL	Shallow
SSF	Subsurface flow
UTM	Universal Transverse Mercator
VALL	Velocity barrier – all flows
VD	Vertical drop
VHIGH	Velocity barrier – high flow only
Y	Yes

1.0 INTRODUCTION

Baffinland Iron Mines (Baffinland) requested that North/South Consultants Inc. (NSC) undertake a fish and fish habitat survey of a small tributary adjacent to the mine (known as Tributary F) and a portion of the Mary River in the vicinity of Tributary F in the summer of 2023 (Figure 1). Electrofishing was previously conducted in Tributary F at the request of Baffinland in September 2019 to determine fish presence/absence and identify any barriers to fish movements. Two barriers to upstream fish movement (0.75-1.00 m vertical drops) were observed near the mouth of the stream in 2019. Fish were not observed or captured upstream or downstream of these barriers, though fish use was suspected in the downstream reach. The field survey conducted in September 2019 may have occurred after fish had moved out of the smaller streams to downstream overwintering habitat (e.g., Sheardown and Mary lakes). The Mary River contains an impassable set of falls, approximately 375 m upstream of the confluence with Tributary F.

The primary objective of the field program conducted in August 2023 was to confirm barriers to fish movement and examine fish presence upstream and downstream of the barriers on Tributary F and the Mary River. Aquatic habitat information was also collected from the tributary and several sites on the Mary River.

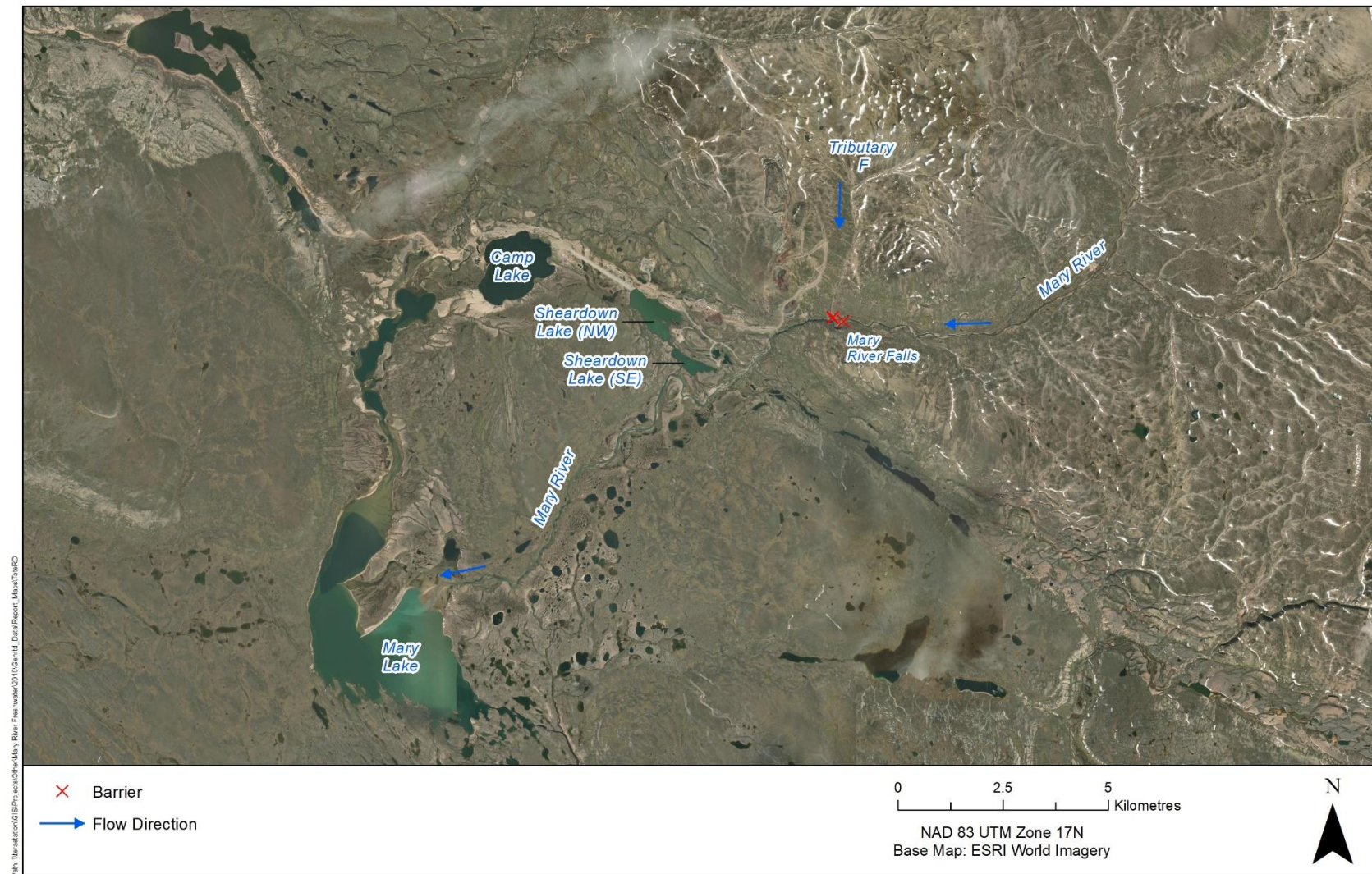


Figure 1. Mary River Mine study area.

2.0 METHODS

2.1 FIELD METHODS

The field survey was conducted August 14-21, 2023. Aquatic habitat and fish use surveys were conducted at six sites in Tributary F as follows, moving in an upstream direction (Figure 2):

- Site F1: from the mouth to the barriers;
- Site F2: 100 meters upstream of the barriers; and
- Sites F3-8: four additional upstream sites separated by at least 500 m.

Four sites were surveyed in the Mary River as follows (Figure 2):

- Site GO-09: approximately 9.4 km upstream of Mary River Falls;
- Site EO-01A: immediately upstream of Mary River Falls;
- Site MR-A: at the confluence with Tributary F; and
- Site MR-D: downstream of the confluence with Tributary F.

2.1.1 BARRIER SURVEY

The entirety of Tributary F, including all inflowing tributaries, was surveyed for potential barriers. Barrier types were identified as described in Table 1. Barriers were classified as permanent (i.e., fish passage not possible under a range of flow conditions such as a falls) or intermittent (e.g., subsurface flow present but persistence under other flow conditions unknown).

2.1.2 ELECTROFISHING

Electrofishing was conducted at each site over a 100 meter distance, working upstream, for a minimum of 100 seconds using a Smith-Root LR-24 backpack electrofisher. Escaped fish were also enumerated.

Duration, electrofisher settings, and universal transverse mercator (UTMs) coordinates were recorded for each site. All captured fish were placed in a pail filled with source water and identified to species and measured for fork length (± 1 mm) before being released back into the source waterbody.

2.1.3 HABITAT ASSESSMENT

Stream habitat surveys extended for a minimum of 100 m at each of the surveyed reaches in Tributary F and the Mary River. Detailed habitat information was collected across transects at 20 m intervals at most sites. Habitat was surveyed at transects separated by 100-250 m at Site F6, which comprised a 2.5 km reach of relatively uniform habitat.

General habitat information collected included:

- Water temperature;
- Stream gradient;
- Stage, defined as: low = 0 – 30%; moderate = 30 – 90%; and high = >90% bankfull;
- Channel confinement: confined; frequently confined; unconfined; or not applicable (e.g., delta at mouth of stream);
- Stream morphology: straight; sinuous; meandering;

- Riparian vegetation: percentage of type (i.e., grass, willow, other, and none); and
- Floodplain: description of the substrate of the dry parts of the channel as the percentage of boulder, cobble, gravel, sand, and fines.

Additional habitat information collected at each of the survey transects included:

- Bankfull width and wetted width (at 25, 50, and 75% across the channel width);
- Water depth (at 25, 50, and 75% across the channel width);
- Velocity (at 25, 50, and 75% across the channel width); and
- Stream morphology (riffle, pool (<0.2 m depth), pool (>0.2 m depth), run, cascade, flat, and rapids; Table 2);
- Substrate composition (Table 3); and
- Percent and type of instream vegetation.

Photographs were taken upstream, downstream, and across at each of the transects.

In addition to ground-based surveys, an aerial survey of the entire Mary River watershed upstream of Mary River Falls was conducted to identify lakes or ponds of potentially sufficient depth to support fish overwintering.

2.2 DATA ANALYSIS

Catch-per-unit-effort (CPUE) was calculated for each electrofishing pass and expressed as the number of fish captured+escaped/60 seconds

Table 1. Barrier types and descriptions for Arctic Char (*Salvelinus alpinus*).

Type	Abbreviation	Description	Permanent (PERM) or Intermittent (INT)
Vertical drop/Falls	VD	Barriers with a drop of >0.5 m that could not be passed by juvenile char under all flow conditions.	PERM
High gradient	HG	Barriers where the gradient exceeds 10°. Steep gradient provides consistently high velocities that are often combined with low water levels typically over long stretches of habitat.	PERM
Boulder/Boulder garden	B	Large boulders blocking the channel such that juvenile char could not pass under all flow conditions.	PERM
Velocity barrier – all flows	VALL	Barriers formed in constrictions and/or drops in the channel where high flows (>2 m/s) prevent upstream passage of juvenile char under all flows.	PERM
Velocity barrier – high flow only	VHIGH	These barriers are formed when velocity in the stream channel is too high (>2 m/s) to permit upstream movements of all size classes of juvenile char under high flow conditions. The absence of significant constrictions or vertical drops results in reduced velocities under lower flow conditions that may permit fish passage.	INT
Insufficient depth	SHALL	Water depth of less than 0.02 m for small juvenile char and 0.2 m for adult fish.	PERM/INT
Subsurface flow	SSF	Flow is largely or entirely subterranean and surface water is lacking or of insufficient depth for fish passage.	PERM/INT
Other	Other	Headwaters, unconnected pools	PERM/INT

Table 2. Stream morphology units.

Type	Description
Riffle	High velocity/gradient (vs. run), surface broken; shallow (<0.5 m)
Rapids	High velocity, deeper than riffle, coarse substrate
Cascade	High gradient and velocity, extremely turbulent, armoured substrate
Run (Glide)	Moderate to high velocity, surface mostly unbroken, deeper than riffle
Flat	Low velocity, near-uniform flow, differential from a pool by high channel uniformity
Pool	>0.2 m
	<0.2 m

Table 3. Substrate classes.

Substrate	Size (mm)
Fines	<2
Gravel	2-16
Small cobble	17-64
Large cobble	65-256
Boulder	>256

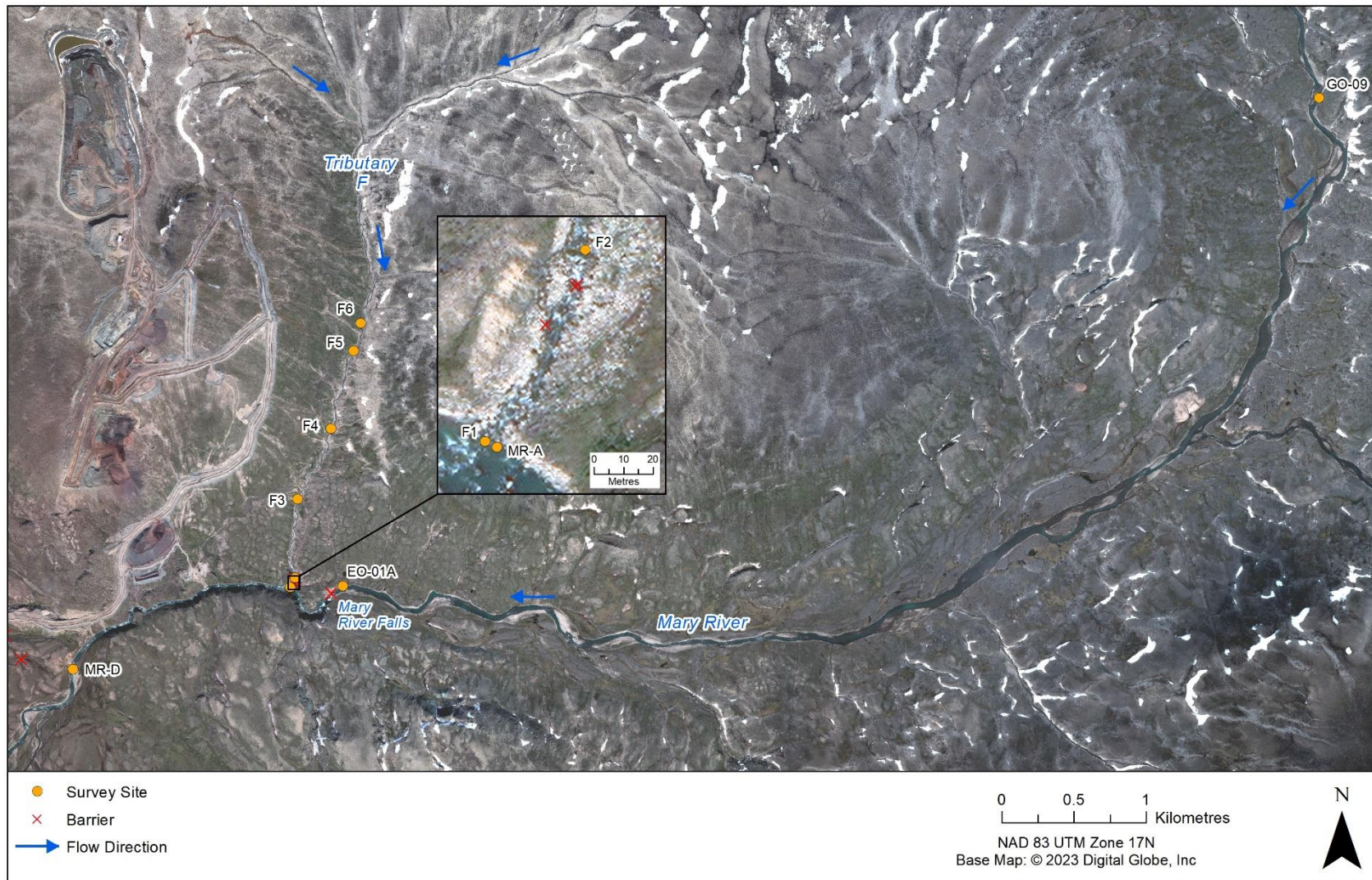


Figure 2. Aquatic habitat and fish survey locations in Tributary F and the Mary River: August 2023.

3.0 RESULTS

Detailed habitat assessment sheets for each site are presented in Appendix 1.

3.1 TRIBUTARY F

The two vertical drop barriers identified near the mouth of Tributary F in a survey conducted in 2019 were confirmed as permanent barriers to fish passage in 2023 (Figure 3; Photographs 1 and 2). A third vertical drop barrier was also identified in 2023, 5 m farther upstream (Figure 3; Photograph 2). Due to the presence of permanent barriers, accessible habitat within Tributary F is restricted to the lowermost 45-50 m of the stream in the lefthand channel and lowermost 60-65 m of the stream in the righthand (main) channel (Site F1). There is no overwintering habitat in the Tributary F drainage.

At Site F1 (the farthest downstream site), water velocities were moderate to high, with predominantly riffle and run morphology. Substrates were composed primarily of cobble, with some boulders and gravel. Habitat was similar at all other reaches surveyed in Tributary F (F2-F6). Small inflow streams, some with intermittent flows, drain steep hills on either side of Tributary F. Habitat in these streams was typically riffle/cascade over gravel/cobble substrate, and they were shallower with lower velocities than the mainstem of Tributary F.

Six juvenile char, with fork lengths ranging from 92-130 mm, were captured in Tributary F downstream of the barriers. Electrofishing was conducted at four reaches upstream of the barriers for a total of 687 seconds and no fish were captured or observed. Ninespine Stickleback (*Pungitius pungitius*) were not captured or observed in Tributary F but could potentially access habitat downstream of the barriers for feeding in the open-water season.

3.2 MARY RIVER

Stream morphology and substrate composition were generally uniform across the sites surveyed in the Mary River (MR-D, MR-A, EO-01A and GO-09). The surveyed reaches of the Mary River were dominated by riffles and rapids with large cobble and boulder substrate, relatively high velocities, and moderate depths.

The set of falls on the Mary River (Mary River Falls) upstream of the Tributary F confluence represents a permanent barrier to fish passage on the Mary River (Photograph 3). No fish were captured or observed upstream of the falls and no lakes were identified with sufficient depth to potentially support overwintering of Arctic Char in the upper Mary River drainage. One site upstream of the Mary River Falls (GO-09) was fished on seven separate site visits in 2006 and 2007 during the Final Environmental Impact Statement (FEIS) baseline field studies, and fish were never captured or observed (Baffinland 2012).

Nine juvenile Arctic Char were captured/observed at the farthest downstream site surveyed on the Mary River (MR-D) in August 2023; no fish were captured or observed in the Mary River in the vicinity of the confluence with Tributary F. Arctic Char were frequently captured/observed downstream of the falls during FEIS baseline field studies conducted at locations near the MR-D and MR-A sites (2006-2010). Juvenile and adult char can use habitat downstream of the falls for feeding/rearing. Depths are insufficient for overwintering or char spawning.

Ninespine Stickleback have not been captured near the falls, likely due to the relatively high velocities present throughout the open-water period. However, stickleback have been captured in slower-flowing areas of the river farther downstream that were not surveyed in 2023.

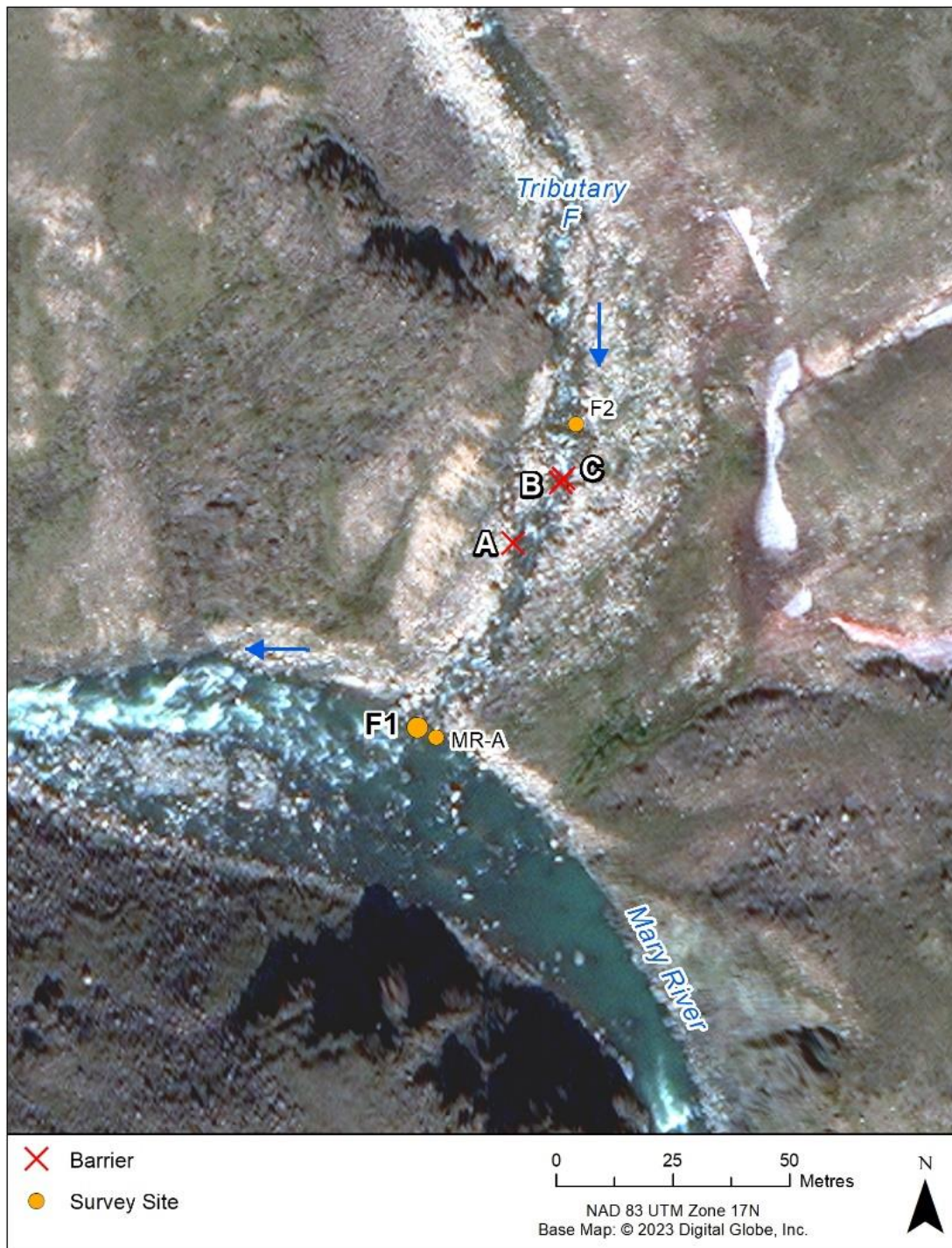


Figure 3. Locations of barriers on Tributary F.



Photograph 1. Farthest downstream barrier on Tributary F: lefthand channel drop of 0.75 m (site depicted as “A” on Figure 3). Photos from September 2019 (left) and August 2023 (right).



Photograph 2. Barriers on Tributary F: main channel drops of > 1 m (top photos) and 0.75 m (bottom photo; sites depicted as “B” and “C” on Figure 3). Photos from September 2019 (top left) and August 2023 (top right and bottom left).



Photograph 3. Mary River Falls. Photo from August 2022.

4.0 LITERATURE CITED

Baffinland. 2012. Mary River Project – Final Environmental Impact Statement. Volume 7: Freshwater Environment. February 2012.

APPENDIX 1. AQUATIC HABITAT ASSESSMENT SHEETS FOR THE MARY RIVER AND TRIBUTARY F: AUGUST 2023