4.0 HYDROLOGICAL ASSESSMENT

4.1 OVERVIEW

Withdrawal of water will affect quantity by reducing the volume of the waterbody as well as the downstream flow.

Volume reduction is of particular importance during winter when lake surfaces are frozen and water levels are below the outlet; withdrawal will lower the surface elevation, potentially causing dewatering and stranding of fish. In lakes used by Arctic char for spawning, there is a potential for ice to freeze or smother eggs in shallow spawning beds.

In spring, outflow will not occur until the lake has refilled and the water surface rises above the outlet. This refilling will delay outflows from the lake. Once it starts, outflow will continue as it would naturally, reduced only by the rate of any summer withdrawals.

Reduction in summer outflow may also affect downstream fish biota, including a reduction in fish habitat, through changes to substrate conditions and stranding of previous habitat, a reduction in benthic invertebrate transport, or the prevention of fish passage.

4.2 WATERBODY CATCHMENTS

Geographical Information System (GIS) was used to delineate catchments for both lakes and streams that were identified as potential sources of water for the Project. The catchment boundaries for those waterbodies identified for use in this plan are presented on figures in Appendix B.

4.3 AVAILABLE STREAMFLOW DATA

The hydrological assessment relies on streamflow data collected by Baffinland and the Water Survey of Canada (WSC) since 2006. The Project's hydrometric stations and regional stations are listed in Table 4.1 and are shown on Figure 4.1.

A hydrology baseline analysis for the Mary River Project was completed previously (KP, 2012). The analysis used the Project streamflow data collected over the period of 2006 to 2011, which included data from up to 16 stations on smaller river/creek systems and from four stations on larger systems. The 16 stations on smaller river/creek systems were operated by Baffinland during the open water season. Four stations on larger systems were operated year-round for four years (2006-2009) by WSC. Since 2012, Baffinland has continued to operate seven hydrometric stations. The hydrology at these seven stations (H01, H02, H04, H05, H06, H07 and H11) was reviewed and updated based on data available to the end of 2021.

Table 4.1 Project Hydrometric Stations

Station No.	Waterbody	Catchment Area	Years of Operation	Mean Annual Unit Runoff
		(km^2)		($L/s/km^2$)
H01	Phillips Creek northern tributary	250	2006-08, 2011-23	10.1
H02	Tom River	210	2006-08, 2010-23	17.5
H04	Camp Lake tributary 2 (CLT-2)	8.3	2006-08, 2010-23	10.7
H05	Camp Lake tributary CLT-1, branch L1	5.3	2006-08, 2010-23	10.6
H06	Mary River mainstem	240	2006-08, 2010-23	17.3
H07	Mary River Tributary F	14.7	2006-08, 2010-11, 2017-23	15.3
H08	Upper Mary River	208	2006-2008	2.1
H09	Southern Access Route	158	2006-2008	5.0
H11	Sheardown Lake Tributary SDLT-1	3.6	2011-23	6.3
Mary River	Mary River	690	2006-2009	12.3
BR11	Unnamed River	53	2008	16.9
BR25	Unnamed River	113	2008	15.1
Ravn River	Ravn River	8220	2006-2009	11.2
BR96-2	Cockburn River	31	2008	11.1
Rowley River	Rowley River	3500	2006-2009	12.1
BR137	Unnamed River	314	2008, 2010	8.9
Isortoq River	Isortoq River	7170	2006-2009	17.3

Note(s):

1. Source: Detailed Water Withdrawal Plan - Mary River Project (KP, 2021).
2. Source: Hydrology Baseline Report (KP, 2012).

The mean monthly and mean annual unit runoff values for these seven stations are presented in Table 4.2. Flow values with a 10-year return period were calculated for the seven stations and a normal distribution was used to develop the 10-year wet and 10-year dry events for each station. Ratios were developed between the mean monthly discharge and return period discharge for each station. The average of the three stations with the largest catchment areas (H01, H02 and H06) was used to be apply to the mean monthly discharge at the selected water withdrawal stations to derive 10-year dry monthly and annual discharge values. The average of the three largest catchment areas was used as the catchment areas for the selected water withdrawal stations have large catchment areas and therefore it is anticipated to be more applicable.

500,000
550,000
600,000
650,000
700,000
750,000
8,000,000
7,950,000
7,900,000
7,850,000
7,800,000
MILNE INLET
H01
H02
H03
H04
H05
H06
H07
H08
H09
H11
BR11
BR25
BR96-2
BR137
MARY RIVER
RAVN RIVER
ROWLEY RIVER
ISORTOQ RIVER
STEENSBY INLET
Baffin Island
Foxe Basin
Prince Regent Inlet

LEGEND:

- FORMER WATER SURVEY OF CANADA REGIONAL HYDROMETRIC STATION
- ACTIVE PROJECT HYDROMETRIC STATION
- FORMER PROJECT HYDROMETRIC STATION
- MILNE INLET TOTE
- STEENSBY RAILWAY
- EXISTING INFRASTRUCTURE
- RIVER/STREAM/DRAINAGE
- WATER
- CATCHMENT BOUNDARY
- GLACIER

NOTES:

1. GLACIER COVERAGE IS TAKEN FROM NTS 1:50,000 SCALE AND IS ONLY SHOWN WITHIN CATCHMENT BOUNDARIES.
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. WATER SURVEY OF CANADA (WSC) STATIONS OBTAINED FROM ENVIRONMENT CANADA.
4. RAILWAY ALIGNMENT PROVIDED BY SYSTRA (NOV 13, 2023).

SCALE 10 5 0 10 20 30 40 50 km

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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

PROJECT AND REGIONAL HYDROMETRIC STATIONS

Knight Piésold CONSULTING

P/A NO. NB102-181/94

REF NO. 1

REV 0

FIGURE 4.1

Table 4.2 Estimated Long-Term Mean Streamflow

Station	Mean Unit Runoff (l/s/km^2)							
	Jan - May	Jun	Jul	Aug	Sept	Nov - Dec	MAUD	10-Year Dry Annual Flow
H01	0	58.0	34.8	17.7	11.0	0	10.1	6.1
H02	0	110.3	59.2	24.7	16.0	0	17.6	11.5
H04	0	59.0	34.3	20.8	14.0	0	10.7	3.6
H05	0	59.7	31.7	22.0	13.5	0	10.6	4.1
H06	0	103.4	62.1	23.4	18.3	0	16.9	10.5
H07	0	95.5	57.2	19.7	10.8	0	14.8	9.6
H11	0	19.9	20.4	23.0	11.9	0	6.3	3.7

Note(s):

1. MAUD is mean annual unit discharge.

Different methods were used to assess water withdrawals from streams and lakes. These are discussed further in Sections 4.4 and 4.5, respectively.

4.4 HYDROLOGICAL ASSESSMENT - STREAMS

Streams will provide water for dust suppression during the open water period.

The methodology to assess potential impacts on fish habitat in streams involves comparing mean daily flows calibrated to site hydrology stations with watersheds of similar size for which long-term hydrological data are available to determine the percentage of time that the withdrawal rate meets or exceeds the threshold of 10% in amplitude of the instantaneous flow in the river relative to a “natural flow regime” suggested by DFO in the *Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada* (DFO, 2013a).

When determining the impact of flow alteration in fisheries, the National Technical Guidance (Appendix 1 of DFO, 2013a) is as follows:

- *Cumulative flow alterations <10% in amplitude of the actual (instantaneous) flow in the river relative to a “natural flow regime” have a low probability of detectable impacts to ecosystems that support commercial, recreational or Aboriginal fisheries.*
- *Cumulative flow alterations that result in instantaneous flows <30% of the mean annual discharge (MAD) have a heightened risk of impacts to fisheries.*
- *For cumulative water use >10% of instantaneous discharge or that results in flows <30% of the mean annual discharge (MAD), a more rigorous level of assessment is recommended to evaluate potential impacts on ecosystem functions which support fisheries.*

Because only one of the proposed water withdrawal sites (BR-0-1) has real-time flow data, hydrologic estimates were developed for each of the other candidate sites based on drainage area proration from representative hydrometric stations. The streams selected for water withdrawals have catchments ranging from 116 to 5,538 km^2. Thus, historical streamflow data from hydrometric station H06 (catchment area of 240 km^2) for the periods of 2006-08 and 2010-2022 was used to predict streamflow conditions at the water withdrawal locations. This station was selected as it represents the southernmost station with the largest catchment area and longest dataset.

Monthly and annual flow duration curves (FDCs) for H06 is shown on Figure 4.2. The FDCs are useful in understanding the seasonal nature of low flows; flows rise from no-flow in late May or early June and the nival (snowmelt) freshet occurs in late June. Flows then fall through July and August but are sustained by rainfall events. Flows continue to fall through September as air temperature drops and precipitation falls as snow, until streamflow ceases in late September or early October.

Flow duration curves were developed for each of the selected water stations based on pro-rating the watershed of interest against the representative gauging record of H06. Only the period of mid-June to mid-September was used as this represents the period when water will be extracted for dust suppression purposes.

Fifteen (15) candidate streams were identified along the Steensby Railway. The FDCs for these streams are presented on Figure 4.3

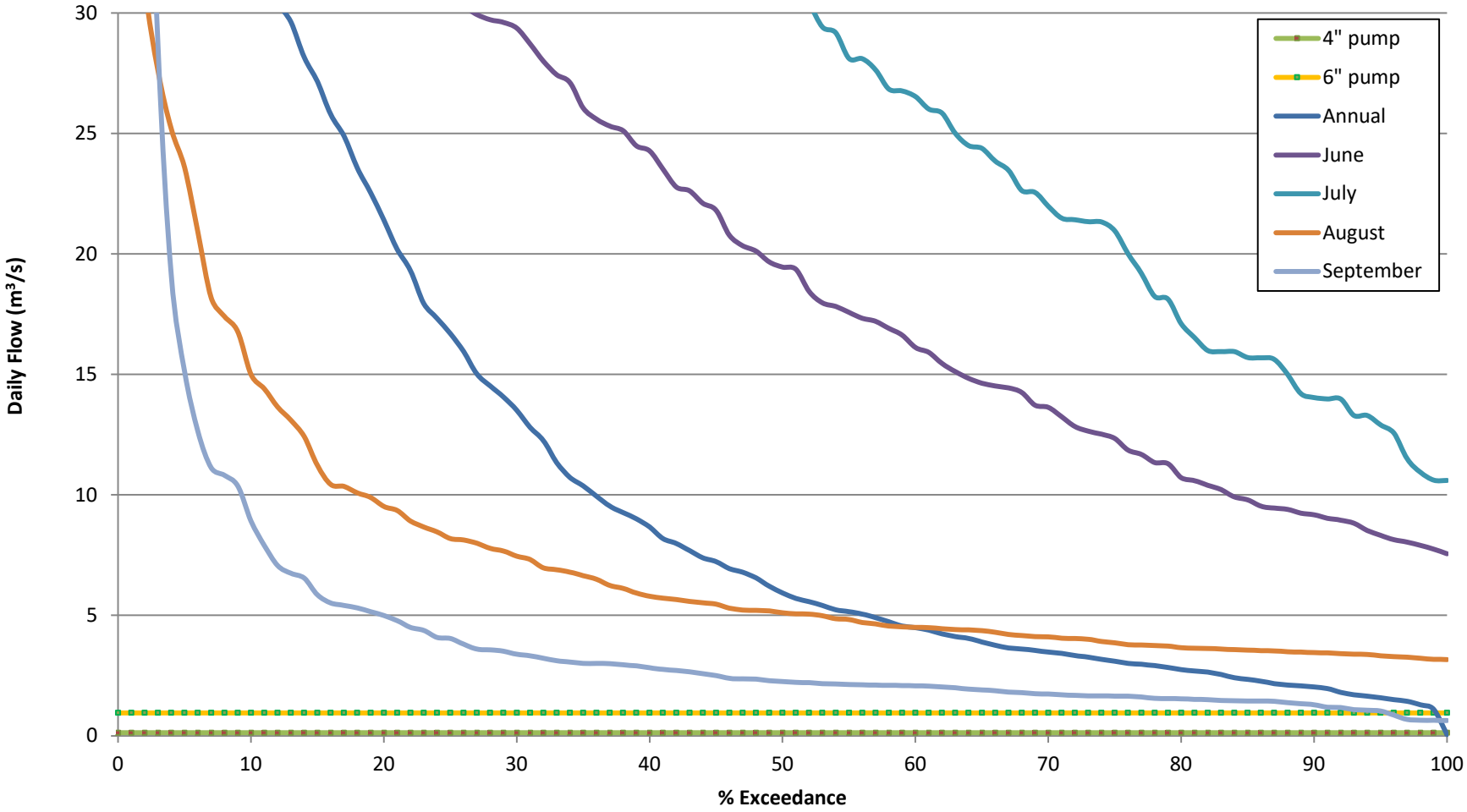
Five of the 15 streams have sufficient flows to meet the 10% of flows threshold, based on their flow duration curves presented on Figure 4.4. Based on the pro-rated flow duration curves, water can be withdrawn from these stations at the maximum pumping rate (5.7 m^3/min) at any time between approximately mid-June to mid-September without exceeding 10% of the instantaneous flow, except for BR-25-1. The maximum pumping rate at BR-25-1 is estimated to be 3.2 m^3/min. The results are summarized in Table 4.3.

Table 4.3 Proposed Stream Water Stations for Dust Suppression Water Withdrawals

Water Station	Waterbody Name	Proposed Daily Maximum Withdrawal	Maximum Pumping Rate
		(m^3/day)	(m^3/min)
BR-0-1	Mary River	300	5.7
BR-25-1	Unnamed River	300	3.2
BR-37-1/CV-R21	Ravn River	300	5.7
BR-46-1	Unnamed River	300	5.7
BR-137-1	Unnamed River	300	5.7

Note(s):

1. Proposed daily withdrawals represent a maximum daily draw associated with each water station.
2. All water stations will not be drawn from daily, so this should not be considered a cumulative water withdrawal volume.



NOTES:

1. CATCHMENT AREA AT HYDROLOGY STATION H06 IS 240 km^2.
2. BASED ON MEASURABLE FLOWS MID-JUNE TO MID-SEPTEMBER.
3. 4" PUMP HAS A MAXIMUM PUMPING RATE OF 0.125 M3/S, 6" PUMP HAS A MAXIMUM PUMPING RATE OF 0.95 m^3/s.

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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

HYDROLOGY STATION H06 ANNUAL AND MONTHLY FLOW DURATION CURVES

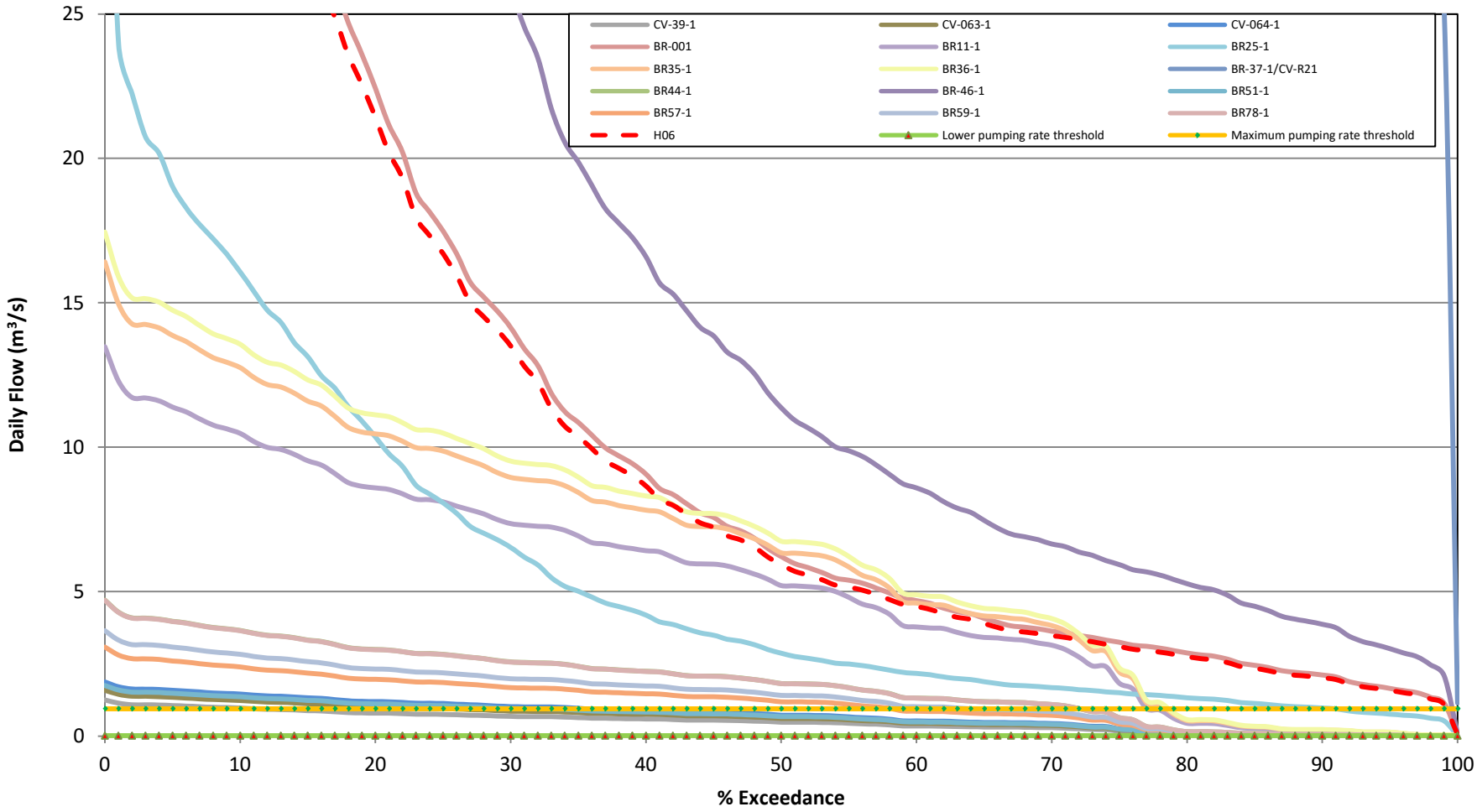
Knight Piésold CONSULTING

P/A NO. NB102-181/94

REF. NO. 1

FIGURE 4.2

REV 0



NOTES:

1. CATCHMENT AREA AT HYDROLOGY STATION H06 IS 240 km^2.
2. BASED ON MEASURED FLOWS MID-JUNE TO MID-SEPTEMBER.
3. THE THRESHOLD IDENTIFIED BY THE LOWER PUMPING RATE IS BASED ON A PUMPING RATE OF 0.75 m^3/min (0.0125 m^3/s) ASSUMING IT REPRESENTS 10% OF THE TOTAL FLOW IN THE STREAM. THE UPPER PUMPING RATE IS 5.7 m^3/min (0.095 m^3/s), SO THE MAXIMUM PUMPING RATE THRESHOLD IS SET AT 0.95 m^3/s.

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MARY RIVER PROJECT

FLOW DURATION CURVES FOR 15 CANDIDATE STREAMS

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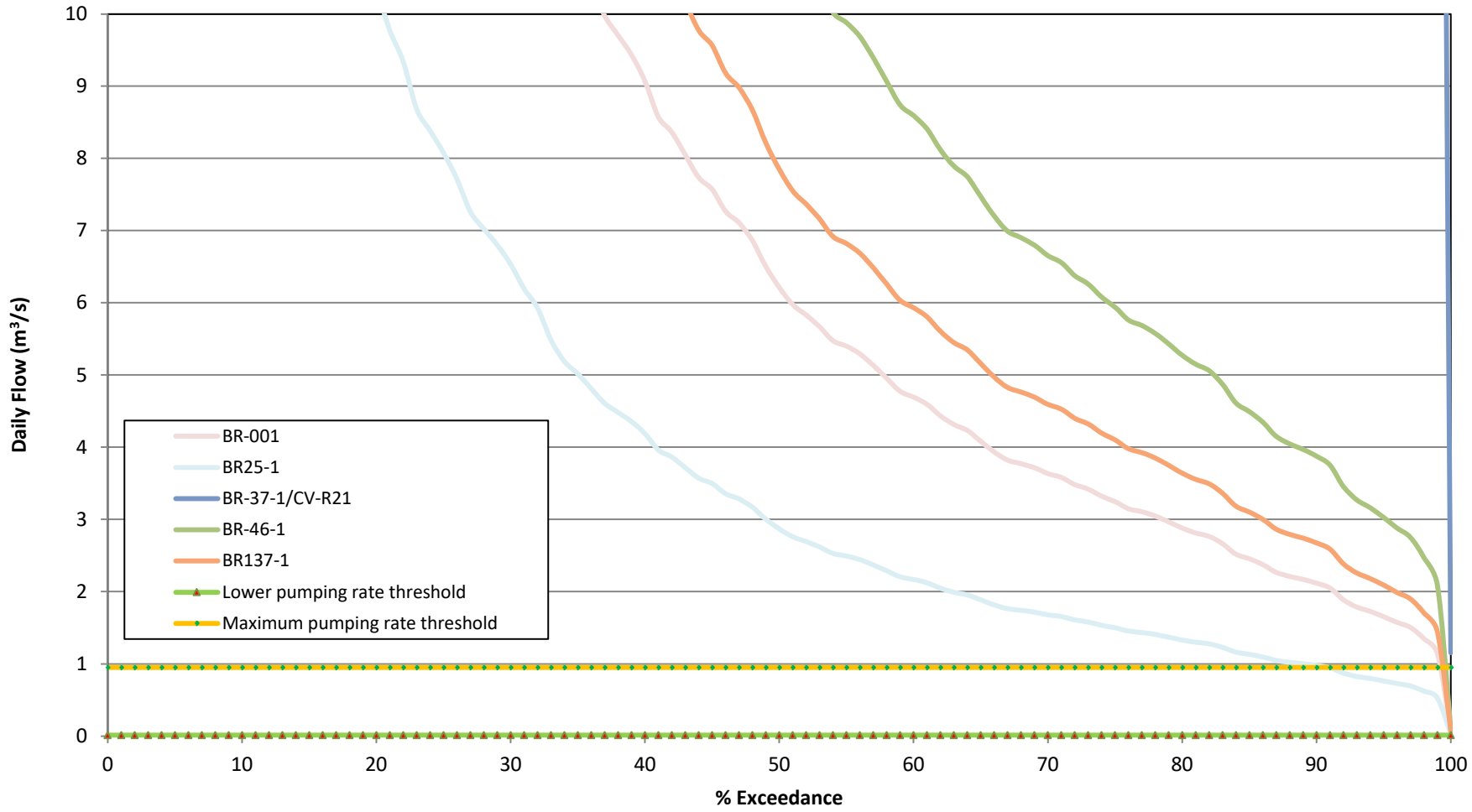
REF. NO. 1

FIGURE 4.3

REV 0



NOTES:

1. CATCHMENT AREA AT HYDROLOGY STATION H06 IS 240 km^2.
2. BASED ON MEASURED FLOWS MID-JUNE TO MID-SEPTEMBER.
3. THE THRESHOLD IDENTIFIED BY THE LOWER PUMPING RATE IS BASED ON A PUMPING RATE OF 0.75 m^3/min (0.0125 m^3/s) ASSUMING IT REPRESENTS 10% OF THE TOTAL FLOW IN THE STREAM. THE UPPER PUMPING RATE IS 5.7 m^3/min (0.095 m^3/s), SO THE MAXIMUM PUMPING RATE THRESHOLD IS SET AT 0.95 m^3/s.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
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MARY RIVER PROJECT

FLOW DURATION CURVES FOR STREAMS MEETING DFO'S THRESHOLD

Knight Piésold CONSULTING

P/A NO. NB102-181/94

REF. NO. 1

FIGURE 4.4

REV 0

4.5 HYDROLOGICAL ASSESSMENT - LAKES

As discussed in Section 2, water withdrawals are proposed from lakes along the Steensby Railway and Steensby Port for several purposes:

- Domestic and industrial uses at camps (previously assessed and approved under the Licence)
- Dust suppression during open water
- Winter road construction during winter

The effect of a single water take from these sources is very small; however, repeated water takes have the potential to lower lake levels and reduce lake outflows.

Lake water withdrawals are identified in Table 4.4.

These lake water withdrawals are assessed in two ways:

- Winter water withdrawals are compared to a DFO (2010a) threshold of 10% of the under-ice lake volume, or for lakes without bathymetric survey volumes, the lake surface area was used to estimate the drawdown over a winter period.
- The combined effects of winter water withdrawals (i.e., drawdown) and open water withdrawals are compared to monthly lake outflows, applying a 10% threshold.

These are described further below.

4.5.1 WITHDRAWALS DURING ICE COVER

Water withdrawals will occur during winter, as described in Section 2.2. These withdrawals are assumed to occur between mid-September and mid-June.

The winter water withdrawal protocol states that the total water withdrawal from a single waterbody over one ice-covered season is not to exceed 10% of the available water under ice, assuming an ice thickness of 2 m (DFO, 2010a). This threshold was applied to the assessment of winter water withdrawals, for those waterbodies for which bathymetry is available. The water withdrawal volumes from these lakes are for domestic and industrial uses at each location, which is inclusive of water for winter road construction.

For the lakes with bathymetry, the proposed winter water withdrawal represents less than 10% of the total under-ice water volume (Table 4.4).

Winter road construction may involve extraction of a small volume of water from an additional lake (Option 2 Unnamed Lake), for which bathymetry is not available. The proposed extraction volumes were related to the lake surface area to estimate the potential drawdown. The proposed extraction represents a drawdown of approximately 1.6 cm (Table 4.4).

Winter withdrawals also have the potential to reduce or delay lake outflows during spring. This is considered in the assessment of withdrawals during open water (Section 4.5.2).

Table 4.4 Assessment of Winter Water Withdrawals

Water Station(s)	Waterbody Name	Winter Road Volumes	Camp Water Volumes [1]	Total Winter Withdrawal	Under Ice Water Volume	Winter Drawdown [2]	Lake Surface Area	Winter Drawdown
		(m^3)	(m^3)	(m^3)	(m^3)	(%)	(m^2)	(cm)
MS-MRY-1	Camp Lake	70,000	179,498	249,498	22,606,000	1.1%	2,112,361	11.8
Ravn Camp Lake	Unnamed lake (“Ravn Camp Lake”)	40,000	61,343	101,343	23,445,148	0.4%	1,899,275	5.6
BR-95-1 Cockburn Tunnels Camp South Cockburn Camp	Cockburn Lake	200,000	58,013	258,013	1,659,517,028	0.02%	37,659,938	0.7
Option 1 Winter Road Station 1	Unnamed lake (ST352)	50,000	-	50,000	197,579,010	0.025%	9,742,858	0.51
Option 1 Winter Road Station 2	Unnamed lake (ST347)	50,000	-	50,000	20,686,000	0.24%	11,532,662	0.43
Option 2 Winter Road	Option 2 Unnamed Lake	150,000	-	150,000	n/a	-	3,820,000	3.9

Note(s):

1. Camp water volumes based upon the daily water withdrawals identified in Table 2.2, extracted over 273 days (Sept 15 to June 15).
2. Measured as a percent of under ice volume.

4.5.2 WITHDRAWALS DURING OPEN WATER

Open water withdrawals were assumed to occur between mid-June to mid-September. For lakes that have been subject to water withdrawals during the winter, the winter drawdown is included in the quantity of water considered extracted during the month of June, as winter withdrawals could potentially delay lake outflows in the spring.

Regarding the evaluation of open water withdrawals, the FEIS identified the reduction in lake outflow of 10% as a commonly applied threshold value (FEIS Volume 7, Page 19; Baffinland, 2012). Water can be withdrawn from a lake without further evaluation, providing that the monthly water withdrawal volume did not exceed 10% of the mean monthly lake outflow volume. The 10% threshold was also applied to the annual 10-year return period dry year. This methodology has been carried forward into the current assessment.

The four lakes that will be subject to increases in water withdrawals were included in this assessment, including Camp Lake, Ravn Camp Lake, Mid-Rail Lake (“Nivek Lake”), and Cockburn Lake. The results are presented in Table 4.5.

The proposed withdrawal volumes did not exceed a 10% reduction in the monthly or 10-year return period dry outflow at any of the lake withdrawal locations, except during June at the Ravn Camp Lake.

The Ravn Camp Lake will experience a flow reduction of 15% for the month of June. During the month of June, the outflow typically begins in the second half of the month, and thus most of June flows occurs over a shorter timeframe. The overwinter water withdrawals at Ravn Lake result in a minor depth reduction of approximately 5.6 cm, which is within the range of natural water level variations and/or ice thickness. Additionally, recent assessments have demonstrated that the migration of fish during freshet does not occur until the water temperature reach approximately 5-7ºC, with most of the fish movement being noted during at the end of June/early July (KP, 2023). Thus, the impact of the proposed water withdrawal is unlikely to affect fish movement in and out of the lake.

Table 4.5 Assessment of Water Withdrawals from Lakes During Open Water

Water Station	Waterbody Name	Proposed Withdrawals During Open Water		Winter Withdrawals	Reduction in Mean Monthly Discharge During Open Water (%)				
		Domestic /Industrial	Dust Suppression	(Recovered in late June)	June	July	August	September	10-Year Dry Flow
		(m^3/day)	(m^3/day)	(m^3/year)					
MS-MRY-1	Camp Lake	657.5	160	249,498	9.9%	1.2%	1.9%	2.5%	8.2%
Ravn Camp Lake	Unnamed Lake ("Ravn Camp Lake")	245.2	160	101,343	15.2%	1.3%	1.5%	2.1%	8.1%
Mid-Rail Camp Lake	Unnamed Lake ("Nivek Lake")	100	160	-	1.36%	1.07%	1.24%	3.56%	1,74%
BR-95-1	Cockburn Lake	-	160	258,013	0.18%	0.01%	0.02%	0.04%	0.07%
Cockburn Tunnels Camp		212.5	160						
South Cockburn Camp			160						

Note(s):

1. Open water withdrawals may occur between 15 June and 15 September (93 days).
2. Cells highlighted in red are reductions in mean monthly discharge greater than 10%.

5.0 MITIGATION OF IMPACTS TO FISH AND FISH HABITAT

5.1 EFFECTS OF WATER WITHDRAWAL

The potential impacts of water withdrawal on fish and fish habitat can be assessed by understanding the mechanisms and stressors that cause effects in the aquatic environment. DFO has created Pathway of Effect diagrams to illustrate the type of cause-effect relationships that are known to exist for developments in or near water; water withdrawal has the potential to impact fish and fish habitat through the following mechanisms (DFO, 2010b):

- Placement of structures in water
- Entrainment in pumps / impingement on screens
- Use of industrial equipment near fish-bearing waters (i.e., risk of spills and inadvertent sedimentation and/or erosion)
- Oxygen depletion, loss of over-wintering habitat, and/or reductions in littoral habitat during winter water withdrawal from ice-covered waterbodies
- Changes in flow volumes or timing, duration, and frequency of flow

Potential effects and mitigation measures for these mechanisms, as well as residual effects, are described below.

5.2 RELEVANT MANAGEMENT PLANS

Baffinland has developed and implemented comprehensive environmental and socio-economic environmental management plans and monitoring programs to manage the environmental and socio-economic effects of the Mary River Project. The Company intends to apply its experience and these environmental management plans and monitoring programs to manage the construction and operation of the Steensby Railway, in addition to developing additional measures as required to address site-specific issues.

Baffinland's current Environmental Management Plan is its Environmental, Health and Safety (EHS) Management System Framework Standard, developed in 2010 (Baffinland, 2010). The EHS Standard is accompanied by the Hazard Identification and Risk Assessment Standard.

The following plans describe the mitigation measures Baffinland will implement to protect fish and fish habitat during water withdrawals:

- Environmental Protection Plan (EPP; Baffinland, 2021a)
- Fresh Water Supply, Sewage and Wastewater Management Plan (FWSSWMP; Baffinland, 2018)
- Surface Water and Aquatic Ecosystems Management Plan (SWAEMP; Baffinland, 2021b)
- Spill Contingency Plan (SCP; Baffinland, 2021c)

The latest versions of these plans are found on Baffinland's online Document Portal: https://baffinland.com/document-portal/.

5.3 CURRENT WATER LICENCE

Baffinland will continue to abide by the conditions in Part E of the Licence applying to water use and management, including the use of approved water sources, and the respective total daily and annual withdrawal limits.

5.4 PLACEMENT OF STRUCTURES IN WATER

Structures placed in water could result in:

- Changes in channel morphology or shoreline morphometry through removal of instream and riparian vegetation, resulting in loss or alteration of habitat and reduced channel stability.
- Constriction of flow due to instream structures that may change hydraulic characteristics, resulting in a change in substrate composition (scour and deposition).
- Obstruction or interference with the movement and migration of fish.

The water withdrawal activity will not result in changes in channel morphology or shoreline morphometry. Baffinland uses either a 4” or 6” Gorman-Rupp pump to fill the water trucks; the pumps are located on the top of the bank; the only structure placed in the water is the hose and screened intake. Examples of the pumps used are shown in Figure 5.1.

Figure 5.1 Baffinland Water Pumps

The hose and screened intake will not result in a constriction of flow or interfere with fish passage. The hose and intake are fitted with a cam lock 4” or 6” fish screen; an example of the instream hose and intake is shown in Figure 5.2. The hose and screened intake are submerged near the stream bottom and have a minimal footprint. The stream channels at the intake sites will have sufficient wetted width and depth to allow placement of the hose and pump with full submergence, allowing water to flow over the hose rather than around it.

Figure 5.2 Example Water Intake at Site CV-128

No residual effects are anticipated on fish and fish habitat from the footprint of the pumps at the top of bank or the hose and screened intake in the wetted channel.

The following environmental protection measures outlined in the EPP (Baffinland, 2021a) will be followed to minimize potential impacts:

- Plan in water works, undertakings or activities to respect timing windows to protect fish and fish habitat.
- Conduct in-water works, undertakings and activities during periods of low flow.
- Limit the duration of in-water works, undertakings and activities so that it does not diminish the ability of fish to carry out one or more of their life processes (e.g., spawning, rearing, feeding, migrating).
- Employ fish exclusion netting (up and downstream) to isolate the work site if fish are observed in the vicinity of the works, undertakings, and activities.
- Maintain an appropriate depth and flow (i.e., base flow and seasonal flow of water) for the protection of fish.
- Maintain fish passage during the works, undertakings, and activities.
- Avoid changing flow or water level.
- Avoid obstructing and interfering with the movement and migration of fish.
- Use only clean materials (e.g., rock, coarse gravel, wood, steel, snow) for works, undertakings, and activities.
- Install effective erosion and sediment control measures prior to beginning works, undertakings, and activities in order to stabilize all erodible and exposed areas.
- Develop and implement an erosion and sediment control plan to avoid the introduction of sediment into any water body during all phases of the works, undertakings, and activities.
- Schedule work to avoid wet, windy and rainy periods and heed weather advisories.
- Regularly inspect and maintain the erosion and sediment control measures and structures during all phases of the works, undertakings, and activities.
- Regularly monitor the watercourse for signs of sedimentation during all phases of the works, undertakings and activities and take corrective action if required.
- Use biodegradable erosion and sediment control materials whenever possible.

- Keep the erosion and sediment control measures in place until all disturbed ground has been permanently stabilized.
- Remove all sediment control materials once site has been stabilized.
- Dispose of, and stabilize, all excavated material above the operational high water mark (OHWM) or top of bank of nearby.
  waterbodies and ensure sediment re-entry to the watercourse is prevented.

5.5 ENTRAINMENT IN PUMPS / IMPINGEMENT ON SCREENS

Water extraction can result in entrainment (when a fish is drawn into a water intake) or impingement (when an entrapped fish is held in contact with the intake screen). Baffinland has committed to following the interim code of practice for designing, installing, maintaining, and cleaning small end-of-pipe water intake fish screens (DFO, 2020). The interim code of practice applies to small-scale water intakes, where the water intake flow rate is up to 0.150 m^3/s and to fish that have a minimum fork length of 25 mm, requiring that the design opening of the screen material does not exceed 2.54 mm.

The average field capacity of the 4” Gorman-Rupp pump is 0.75 m^3/minute (0.0125 m^3/s). For the 6” pump, manufacturer published operating discharge rates vary from 0.025 m^3/s to 0.095 m^3/s, depending on total head and suction lift.

Additional mitigation measures outlined in the interim code of practice that will be followed include:

- Siting intakes with low concentrations of fish throughout the year.
- Placing screens a minimum of 30 cm above the bottom of the watercourse to prevent the entrainment of sediment and benthos.
- Avoid withdrawing water from the littoral zone when possible.
- Avoid withdrawing water, or reducing the rate of water withdrawal, during critical timing windows to diminish the likelihood of entraining eggs and larval fish.

A qualified professional will identify the exact intake locations at each site, based on suitability of fish habitat.

The critical timing windows during which instream activities should be avoided to reduce the risk of harm to fish and fish habitat in Nunavut are determined by the location of a project (one of two zones) and whether fish species present spawn in the spring or fall (DFO, 2013b). The Mary River Project is in Fish Timing Zone 1, and the spawning period for Arctic char is in the fall. The critical timing window (when work should be avoided) in areas containing Arctic char spawning habitat is September 1 to June 30. A qualified professional will determine if water withdrawal is allowed at each site during the critical timing window, based on suitability of spawning habitat.

No residual effects are expected from entrainment or impingement with the implementation of these measures and following the interim code of practice for fish screens.

5.6 USE OF INDUSTRIAL EQUIPMENT

Baffinland uses 4” or 6” Gorman-Rupp pumps, and the pumps remain at the top of the stream or lake bank; therefore, there will not be any direct mortality of fish or eggs from physical disruption or bank erosion from the pump. The intake hose and screen will not be placed on any Arctic char reeds or in areas where spawning is observed.

Surface water runoff from areas of intense vehicular activity is susceptible to contamination from minor hydrocarbon spills and/or leakage of machinery and equipment. Additionally, machinery and equipment can cause inadvertent sedimentation and/or erosion. As such, the following mitigation measures described in the Surface Water and Aquatic Ecosystems Management Plan (Baffinland, 2021b) will be implemented will be followed to minimize potential impacts:

- Machinery will arrive at site in a clean condition and free of fluid leaks, invasive species and noxious weeds.
- Erosion and sediment control measures will be implemented prior to the start of any construction and maintained until all disturbed ground has been permanently stabilized.
- Low vegetative cover within 100 metres of a waterbody will be preserved unless effective erosion and sediment control measures are in place to protect water quality.
- Measures for managing water flowing onto the site, as well as water being pumped/diverted from the site, will be implemented such that sediment is filtered out prior to the water entering the waterbody (e.g., by discharging water to a vegetated area or to an area further from a waterbody).
- No waste material resulting from work activities will be left in a manner such that it can enter the water.
- Machinery will be refuelled and serviced, and fuel and other materials will be stored at least 31 m from the high water mark.
- Limit fording of the watercourses by machinery to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, a temporary crossing structure will be constructed.

In addition, environmental protections measures relating to fuel storage and handling outlined in the EPP (Baffinland, 2021a) will also be implemented, such as:

- Fuel storage containers will be stored in secondary containment and shall not be placed within 31 m of the OHWM of any water body.
- All mobile equipment will be serviced and fueled on land at least 31 m above the OHWM of any waterbody. No petroleum or chemical product will be allowed to spread to surrounding lands or into waterbodies.

5.7 CHANGES IN FLOW VOLUMES OR TIMING, DURATION, AND FREQUENCY OF FLOW

Water withdrawal could result in increased water temperature and decreased dissolved oxygen concentrations; and dewatering of downstream areas, causing desiccation of incubating eggs, fish stranding, and fish passage obstruction, as well as reduction in littoral habitat and riparian vegetation. The assessment of hydrological changes (timing, duration, and frequency) from water withdrawals are discussed in Section 4.

Environmental protections measures relating to water use outlined in the EPP (Baffinland, 2021a) will also be implemented, such as:

- Only approved water sources can be used for Project activities (Appendix E of the EPP) and submitted to the Environment Department on a weekly basis.
- Water supply facilities are to be maintained to the satisfaction of the Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) Inspector.

- Total volumes of water withdrawn by truck from any water body must be recorded on the Water Collection Log (Appendix E of the EPP) and submitted to the Environment Department on a weekly basis.
- Streams or water bodies cannot be used as a water source unless authorized and approved by the NWB.
- If water is required from a source that may be drawn down (small lake or stream), Baffinland shall submit a request for approval to the NWB prior to withdrawing the water.

6.0 NIRB SELF-ASSESSMENT OVERVIEW

While this Notification complies with Items 9 and 14 of Part E of the Licence, which outline the process for adding new water sources, and the scope of the Approved Project and the Type A Water Licence 2AM-MRY1325 remain unchanged, KP has nonetheless reviewed NIRB's process for completing a self-assessment to determine whether the proposed changes constitute a "significant modification" to the Project.

Table 6.1 presents an evaluation relative to NIRB's self-assessment criteria, and Table 6.2 presents a review of NIRB's significance criteria.

Table 6.1 Self Assessment of Proposed Amendment to Approved Project

Self-Assessment Criteria	Proponent Self Assessment
A sufficiently detailed scope of project components and activities to be undertaken during the proposed modification, contrasted with the scope of the original project as previously considered by the Nunavut Planning Commission (NPC), the NIRB and/or the NWB.	A description of the proposed water withdrawal activities is presented in Section 2.0.
Information demonstrating the proponent has considered the significance of the potential impacts associated with the proposed modification using the factors for determining significance as set out in s. 90 of the *Nunavut Planning and Project Assessment Act* (NuPPAA) reflecting any other guidance or information requirements of the NPC, the NIRB and/or the NWB to evaluate the significance of the proposed modification.	The significance of potential impacts has been considered relative to the significance criteria outlined in Section 90 of NuPPAA (Table 6.2).
The proponent should also identify whether any new or modified permits, licenses or other approvals are anticipated to be necessary for the proposed works or activities.	New permits are not required, and the new water withdrawals remain within the overall daily and annual limits of the current Licence.
For proposed modifications to approved projects with a NIRB Project Certificate, information should also be provided as to whether the grounds for a reconsideration of the existing Project Certificate terms and conditions have been met.	The proposed changes do not represent a modification to the Approved Project, and the scope of the Project (and the Water Licence) remain unchanged. This Notification complies with Items 9 and 14 of Part E of the Licence, which outline the process for adding new water sources.

Table 6.2 Change in Factors Related to Section 90 (NuPPAA) Significance Criteria

NuPPAA Section 90 Significance Criteria	Change in Factors Related to Significance of Impacts
Size of Geographic Area and Wildlife Habitats Likely to be Affected	**No change.** The activity (water withdrawals for Steensby Component) remains confined entirely within the PDA for the Approved Project. Therefore, no changes are predicted for any VEC with respect to the size of the geographic area and wildlife habitats likely to be affected.
Ecosystemic Sensitivity of the Area	**No change.** The activity remains within the existing PDA; no new environmental sensitivities have been identified for the freshwater aquatic environment and associated VECs.
Historical, Cultural, and Archaeological Significance of Area	**No change.** See Section 3.0. The activity remains confined to the existing PDA; no new features of historical, cultural or archaeological significance will be affected.
Size of Human and Animal Populations Likely to be Affected	**No change.** The activity is not predicted to more adversely affect any human or animal populations.
Nature, Magnitude, and Complexity of Impacts	**No change.** The activity may result in incremental changes for the freshwater aquatic environment and associated VECs included in the scope of the assessment; however, these effects are consistent with the Approved Project and will not exceed any significance thresholds or change the determination of significance.
Probability of Impacts Occurring	**No change.** The effects of the water withdrawals are consistent with the Approved Project and will not exceed any significance thresholds or change the determination of significance, including the probability of an impact occurring.
Frequency and Duration of Impacts	**No change.** The effects of the water withdrawals are consistent with the Approved Project and will not exceed any significance thresholds or change the determination of significance, including the frequency or direction of an impact occurring.
Reversibility or Irreversibility of Impacts	**No change.** The effects of the water withdrawals are consistent with the Approved Project and will not result in irreversible environmental effects.
Cumulative Impacts	**No change.** There are no other activities that will act cumulatively with the proposed water withdrawals.
Any Other Factor that the Board Considers Relevant	Baffinland is not aware of any other factor that NIRB considers relevant to the assessment of the significance of environmental effects.

7.0 CONCLUSIONS

Proposed changes to water withdrawals are summarized in Table 7.1.

Table 7.1 Proposed Water Stations

Water Station	Waterbody Name	Domestic and Industrial Use		Dust Suppression	
		Camps	Winter Road	Daily Maximum Volume	Maximum Pumping Rate
		(m^3/day)	(m^3/season)	(m^3/day)	(m^3/min)
MS-MRY-1	Camp Lake	657.5	70,000	160	n/a
BR-0-1	Mary River	-	-	300	5.7
BR-25-1	Unnamed River	-	-	300	3.2
Ravn Camp Lake	Unnamed lake (“Ravn Camp Lake”)	245.2	40,000	160	n/a
BR-37-1/CV-R21	Ravn River	-	-	300	5.7
BR-46-1	Unnamed stream	-		300	5.7
Mid-Rail Camp Lake	Unnamed lake (“Nivek Lake”)	100	-	160	n/a
BR-95-1	Cockburn Lake	-	200,000	160	n/a
Cockburn tunnels camp		212.5		160	n/a
South Cockburn camp				160	n/a
BR-137-1	ST352 outlet stream	-	-	300	5.7
ST352 Lake	Unnamed lake	-	150,000	-	n/a

Note(s):

1. Streams are shaded green and lakes are shaded blue.

The assessment determined that these proposed withdrawals are within applicable thresholds, with the exception of an exceedance of the 10% threshold during June at the Ravn Camp Lake water station. Considering several factors, including that most June flows occur in the second half of the month due to the timing of spring freshet, and that fish do not start moving out of lakes into local streams until the lake temperatures increase around the end of June, this threshold exceedance is judged not to represent a significant effect to fish and fish habitat.

Withdrawals from other water stations in the Licence not assessed in this notification remain unchanged.

8.0 REFERENCES

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9.0 CERTIFICATION

This report was prepared and reviewed by the undersigned.

Prepared:

Amber Blackwell, P.Geo.
Project Geoscientist

Reviewed:

Richard Cook, P.Geo. (Limited)
Specialist Environmental Scientist | Associate

REGISTERED PROFESSIONAL ENGINEER
S.R. AIKEN
LICENSEE
2023-11-28
NWT/NU

PERMIT TO PRACTICE
KNIGHT PIESOLD LTD.
Signature
Date 2023-11-28
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

Approval that this document adheres to the Knight Piésold Quality System:

APPENDIX A

Previously Issued IQ Study Maps

(Pages A-1 to A-5)

Figure No.	Rev No.	Description
Figure 1.4	0	Travel Routes - Project Study Area (Interview Results)
Figure 1.8	0	Camping Locations - Project Study Area (Workshop Results)
Figure 1.12	0	Special Places - Project Study Area (Interview Results)
Figure 3.20	0	Water and Ice Features - Project Study Area (Interview Results)
Figure 5.2	0	Fish Locations - Project Study Area (Interview Results)

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500,000
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700,000
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8,000,000
7,950,000
7,900,000
7,850,000
7,800,000
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7,700,000
IGLOOLIK
SCALE 10 5 0 10 20 30 40 50 km

LEGEND:

- TRAVEL ROUTE
- TRAVEL ROUTE USED IN THE PAST
- SEA ICE MAIN TRAVEL ROUTE
- MILNE INLET TOTE ROAD
- PROPOSED RAILWAY ALIGNMENT
- NOMINAL SHIPPING ROUTE

NOTES:

1. IMAGERY: © ESRI DATA & MAPS [ONLINE] (2014). REDLANDS, CA: ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE. ALL RIGHTS RESERVED.
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. THIS MAP WAS PRODUCED FROM INFORMATION COLLECTED DURING INUIT QAUJIMAJATUQANGIT INTERVIEWS WITH LOCAL RESIDENTS. THIS INFORMATION SHOWS PATTERNS OF LAND USE AND LOCAL KNOWLEDGE OF THE LAND. THE MAP IS NOT INTENDED TO BE A COMPLETE REPRESENTATION OF WHAT IS KNOWN.

BAFFINLAND IRON MINES CORPORATION

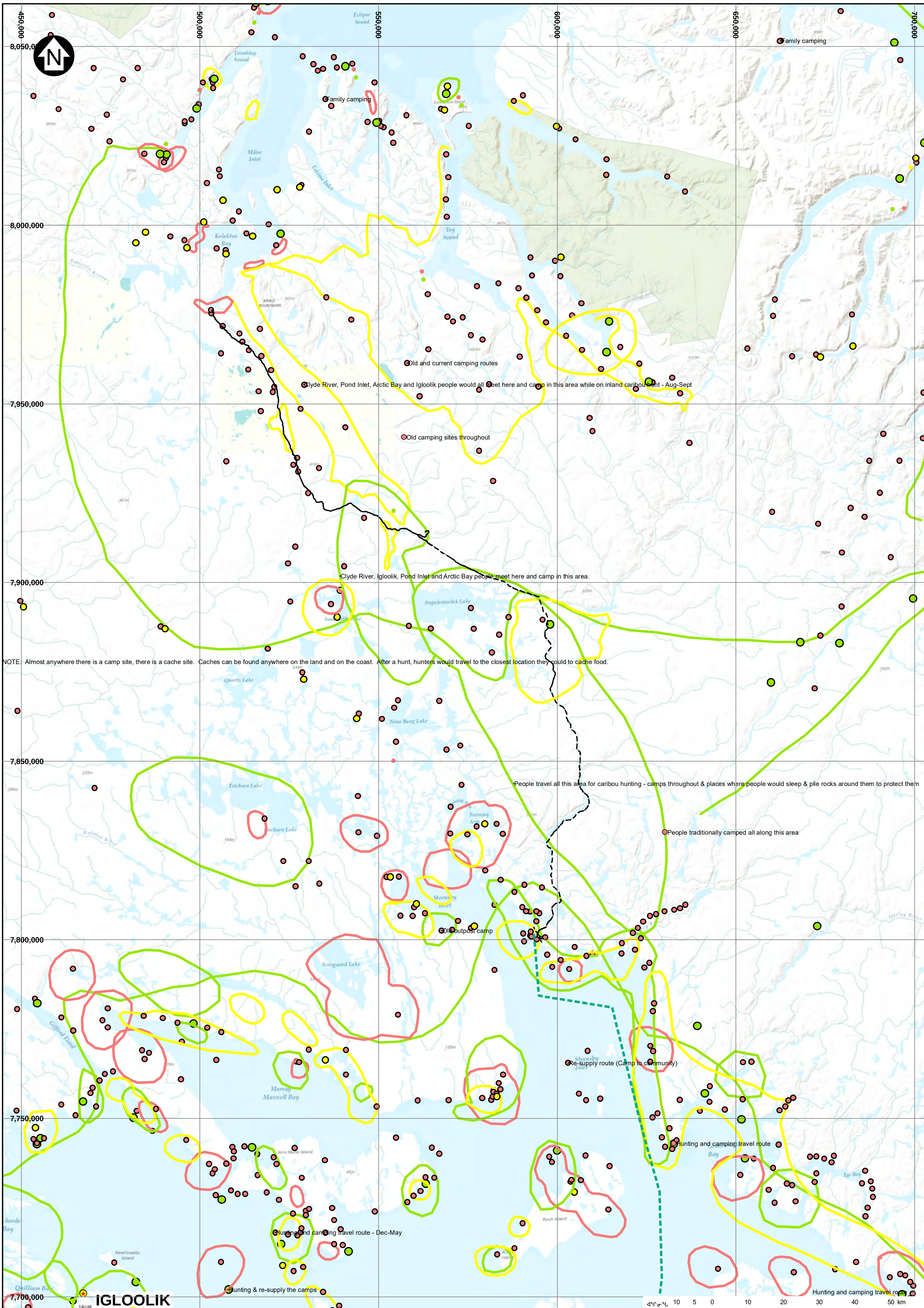
MARY RIVER PROJECT

TRAVEL ROUTES - PROJECT STUDY AREA (INTERVIEW RESULTS)

Knight Piésold CONSULTING

P/A NO.	REF NO.	REV
NB102-181/35	NB14-00411	0

FIGURE 1.4



ᑐᑭᒥᔭᕐᒋᑦ LEGEND:

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PLACES THAT YOU HAVE CAMPED IN YOUR LIFETIME

ᑭᖑᓂᑎᓐᓂ ᕿᑐᙵᑎᑦ ᐊᒻᒪ ᐃᓚᑎᑦ ᐱᖃᑎᒋᔾᔪᑎᑦ ᐅᐸᒃᓯᒪᕙᓐᓂᖁᑎᑦ
PLACES THAT YOU KNOW YOUR FAMILY AND FRIENDS HAVE CAMPED IN THE PAST

ᓄᓇᒋᔭᐅᖃᑦᑕᓂᖁᑦ ᐃᑦᑕᓂᓴᐅᔪᐊᕐᓂᖏᓄᑦ ᑭᖁᓂᑦ ᓄᓇᒋᔭᐅᕙᓚᐅᖕᒪᖔᑦ ᖃᐅᔨᒪᖏᑦᑎᑦ
CAMPS THAT WERE OCCUPIED SO LONG AGO THAT YOU DON'T KNOW WHO CAMPED THERE

ᕿᖑᐊᓂ ᐊᖁᑎ ᐅᓯᒃᑕᕐᕕᒃ
MILNE INLET TOTE ROAD

ᓄᓇᓯᐅᑎᑯᑦ ᐊᖁᑎᓕᓂᐊᕐᑕᖓ
PROPOSED RAILWAY ALIGNMENT

ᐃᓚᓐᓂᒍᑦ ᐅᒥᐊᕐᔪᐊᓐᓂᑦ ᐊᖁᑕᐅᖃᑦᑕᕐᓂᐊᕐᑐᖅ

ᖃᐅᔨᒪᔭᒃᓴᐃᑦ NOTES:

1. ᓄᓇᖑᐊᓕᐅᕐᑕᐃᑦ: ᑯᐃᓐ ᑲᓇᑕᒧᑦ
IMAGERY: © ESRI DATA & MAPS [ONLINE] (2014). REDLANDS, CA: ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE. ALL RIGHTS RESERVED.
2. ᓄᓇᖑᐊᖅ ᑎᑎᕐᓯᒪᓂᖓ ᒪᓕᒃᑐᖅ UTM (NAD83) ZONE 17 AND IS IN METRES.
COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. ᐅᓇ ᓄᓇᖑᐊᖅ ᐊᕿᕐᑕᐅᓚᐅᕐᓯᒪᔪᖅ ᐃᓄᐃᑦ ᖃᐅᔨᒪᔾᔪᑎᖏᓐᓂᒃ ᑲᑎᒪᔪᑎᒃᑯᓐᓂᒃ ᖃᐅᔨᓴᐅᓂᒃᑯᓐᓂᒃ ᑲᑎᒪᑎᓪᓗᒋᑦ ᐃᒃᐱᐊᕐᔪᖕᒥ (ᔪᓚᐃ 22-23, 2008), ᑲᖏᕐᓗᒐᐱᒃ (ᔪᓚᐃ 18-19,2008), ᓴᓂᕋᔭᖕᒥ 9ᔪᓚᐃ ᓐ%ᓪ, ᖅᖅᖅᓐ0, ᐃᒡᓗᓕᖕᒥ (ᔪᓚᐃ 10-12, 2008), ᐊᒻᒪ ᒥᑎᒪᑕᓕᒃ (ᔪᓚᐃ 15-17 ᐊᒻᒪ ᓯᑎᐱᕆ 4, 2008). ᒪᓐᓇ ᖃᐅᔨᓴᐅᑎᒃ ᖃᐅᔨᑲᐅᑕᐅᔪᓐᓇᖅᑐᖅ ᓄᓇ ᖃᓄᑎᒋ ᐊᑐᕐᑕᐅᕙᓐᓂᖕᖓᓂᒃ ᐊᒻᒪ ᐃᓄᐃᑦ ᖃᓄᑎᒋ ᖃᐅᔨᒪᓂᖏᓐᓂᒃ ᓇᓗᓇᐃᕐᓯᔪᑕᐅᓗᓐᓂ. ᒪᓐᓇ ᓄᓇᒍᐊᖅ ᑕᒪᐃᓂᒃ ᖃᐅᔨᑲᐅᑕᐅᔪᓐᓇᖏᑦᑐᖅ ᑭᓯᐊᓂᓚ ᖃᐅᔨᒪᔭᐅᔪᓐᓂᒃ ᓇᓗᓇᐃᕐᓯᔪᑕᐅᔪᖅ.
THIS MAP WAS PRODUCED FROM INFORMATION COLLECTED DURING INUIT QAUJIMAJATUQANGIT WORKSHOPS IN THE COMMUNITIES OF ARCTIC BAY (JULY 22-23, 2008), CLYDE RIVER (JULY 18-19, 2008), HALL BEACH (JULY 8-9, 2008), IGLOOLIK (JULY 10-12, 2008) AND POND INLET (JULY 15-17 AND SEPTEMBER 4, 2008). THIS INFORMATION SHOWS PATTERNS OF LAND USE AND LOCAL KNOWLEDGE OF THE LAND. THE MAP IS NOT INTENDED TO BE A COMPLETE REPRESENTATION OF WHAT IS KNOWN.

BAFFINLAND IRON MINES CORPORATION

ᓄᐊᕐᔪᓂ ᐅᔭᖅᓯᐅᕐᑐᑦ MARY RIVER PROJECT

ᓄᓇᒥᒃ ᐊᑐᕐᑕᐅᓚᐅᕐᒥᒃ ᖃᐅᔨᓴᕐᓂᒃ ᑕᓪᓕᒪᐃᐅᕙᖕᓂᒃ ᓇᓄᓇᐃᑦᑐᓕᐅᑦᑐᑦ
CAMPING LOCATIONS - PROJECT STUDY AREA (WORKSHOP RESULTS)

Knight Piésold CONSULTING

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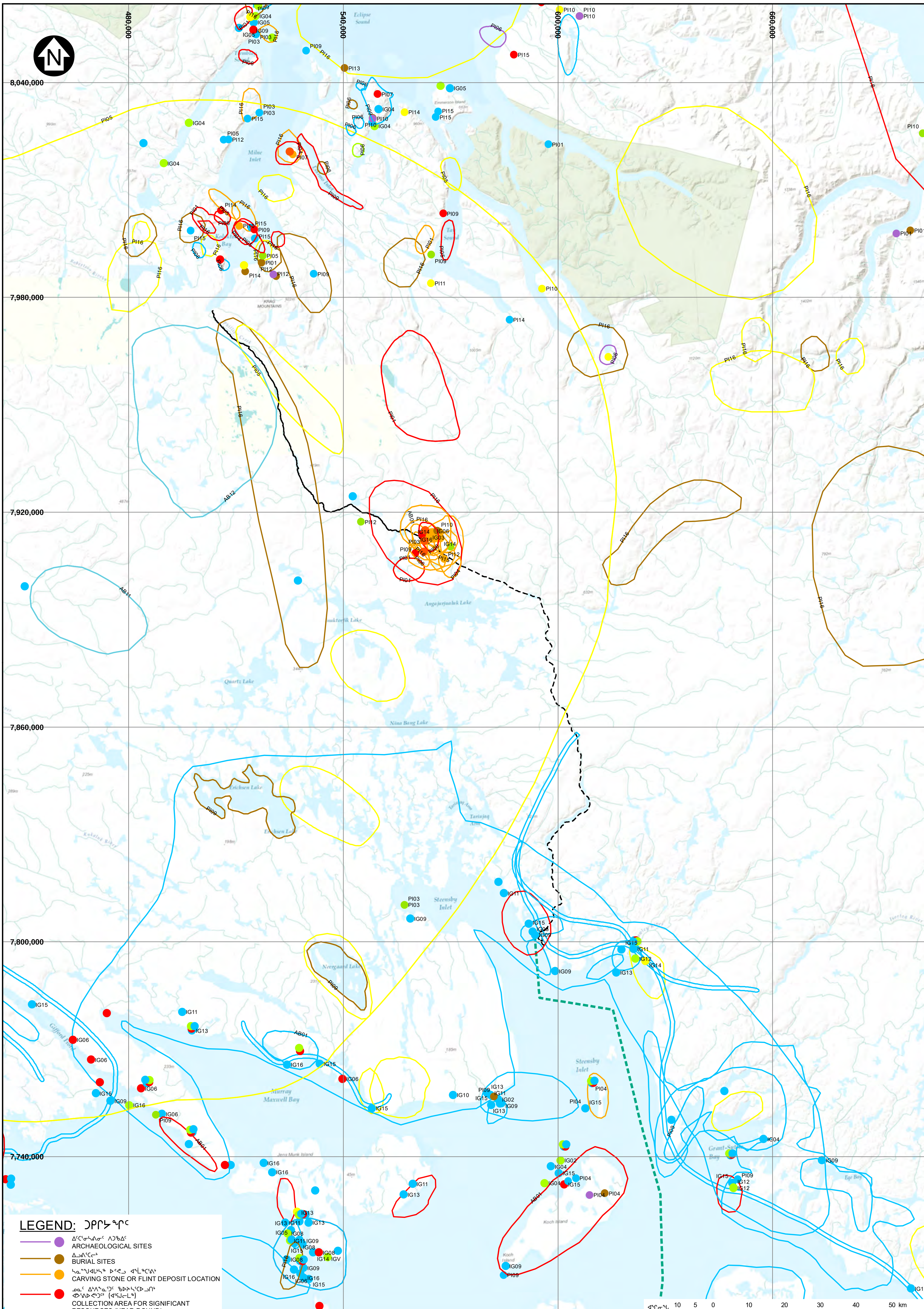

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ARCHAEOLOGICAL SITES

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BURIAL SITES

ᓴᓇᖑᐊᒐᒃᓴᖅ ᐅᑯᓗ ᐊᒻᒪᖅᑕᕕᒃ
CARVING STONE OR FLINT DEPOSIT LOCATION

ᓄᓇᑦ ᐃᑭᐊᕐᓇᕐᑐᑦ ᖃᐅᔨᓴᕐᑕᐅᓗᑎᒃ ᐊᐅᕐᕕᐅᕙᒃᑐᑦ (ᐊᕐᕌᒍᓕᒫᖅ)
COLLECTION AREA FOR SIGNIFICANT RESOURCES (YEAR-ROUND)

ᐊᐱᕐᓱᖅᑕᐅᔪᑦ ᐃᓅᕝᕕᖓ
CONSULTANT'S BIRTH LOCATION

ᐊᐱᕐᓱᖅᑕᐅᔪᑦ ᑕᒫᕐᕕᖓ ᐊᒻᒪ ᐊᑐᖅᑕᐅᕙᒃᑐᑎ ᓅᑦ ᑕᒫᕐᕕᑦ ᐊᕐᕌᒍᓕᒫᒥᑦ ᐊᑐᖅᑕᐅᔪᓂᒃ
CONSULTANT'S CAMP LOCATION AND MAJOR YEAR-ROUND CAMPS

ᐊᓂᓐᓇᔭᐅᓪᓚᕆᒃᑐᑦ ᓄᓇᐃᑦ ᑕᓐᓇᓗ
SPECIAL AREAS

ᕿᒧᒃᓯᓂ ᐊᖁᑎ ᐅᓯᒃᑕᕐᕕᒃ
MILNE INLET TOTE ROAD

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PROPOSED RAILWAY ALIGNMENT

ᐃᓚᖓᓂᑦ ᐅᒥᐊᕐᔪᐊᓂᑦ ᐊᖁᑕᐅᖃᑦᑕᓂᐊᕐᑐᖅ
NOMINAL SHIPPING ROUTE

ᖃᐅᔨᒪᔭᒃᓴᐃᑦ NOTES:

1. ᓄᓇᖑᐊᓕᐊᑕᐃᑦ: ᑯᐃᓐ ᑲᓇᑕᒥᑦ
   BASE MAP: © HER MAJESTY THE QUEEN IN RIGHTS OF CANADA, DEPARTMENT OF NATURAL RESOURCES (2004). ALL RIGHTS RESERVED.
2. ᓄᓇᖑᐊᑉ ᑎᑎᕋᕐᓂᖓ ᒪᓕᒡᓗ UTM (NAD83) ZONE 17 AND IS IN METRES.
   COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. THIS MAP WAS PRODUCED FROM INFORMATION COLLECTED DURING INUIT QAUJIMAJATUQANGIT INTERVIEWS WITH LOCAL RESIDENTS. THIS INFORMATION SHOWS PATTERNS OF LAND USE AND LOCAL KNOWLEDGE OF THE LAND. THE MAP IS NOT INTENDED TO BE A COMPLETE REPRESENTATION OF WHAT IS KNOWN.

A-3 of 5

BAFFINLAND IRON MINES CORPORATION

ᓄᓘᔾᔭᓂ ᐅᔭᕐᑭᓯᐅᕐᑐᑦ MARY RIVER PROJECT

SPECIAL PLACES - PROJECT STUDY AREA (INTERVIEW RESULTS)

Knight Piésold CONSULTING

P/A NO.	REF NO.	REV
NB102-181/35	NB14-00411	0

ᑎᑎᖅᐅᔭᖅᓯᒪᔪᖅ FIGURE 1.12

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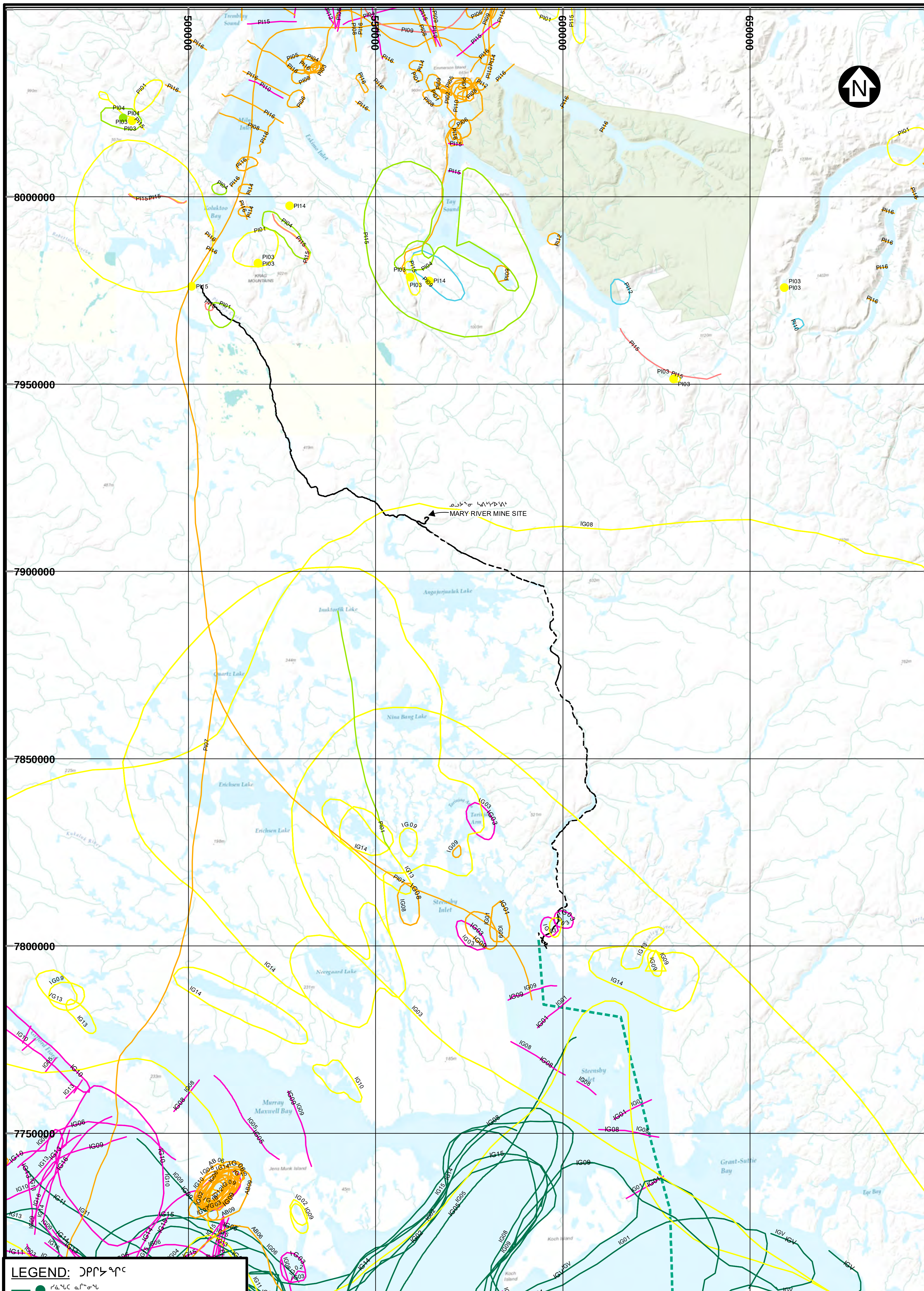


LEGEND: ᑐᑭᓯᒋᐊᕐᕕᒃ

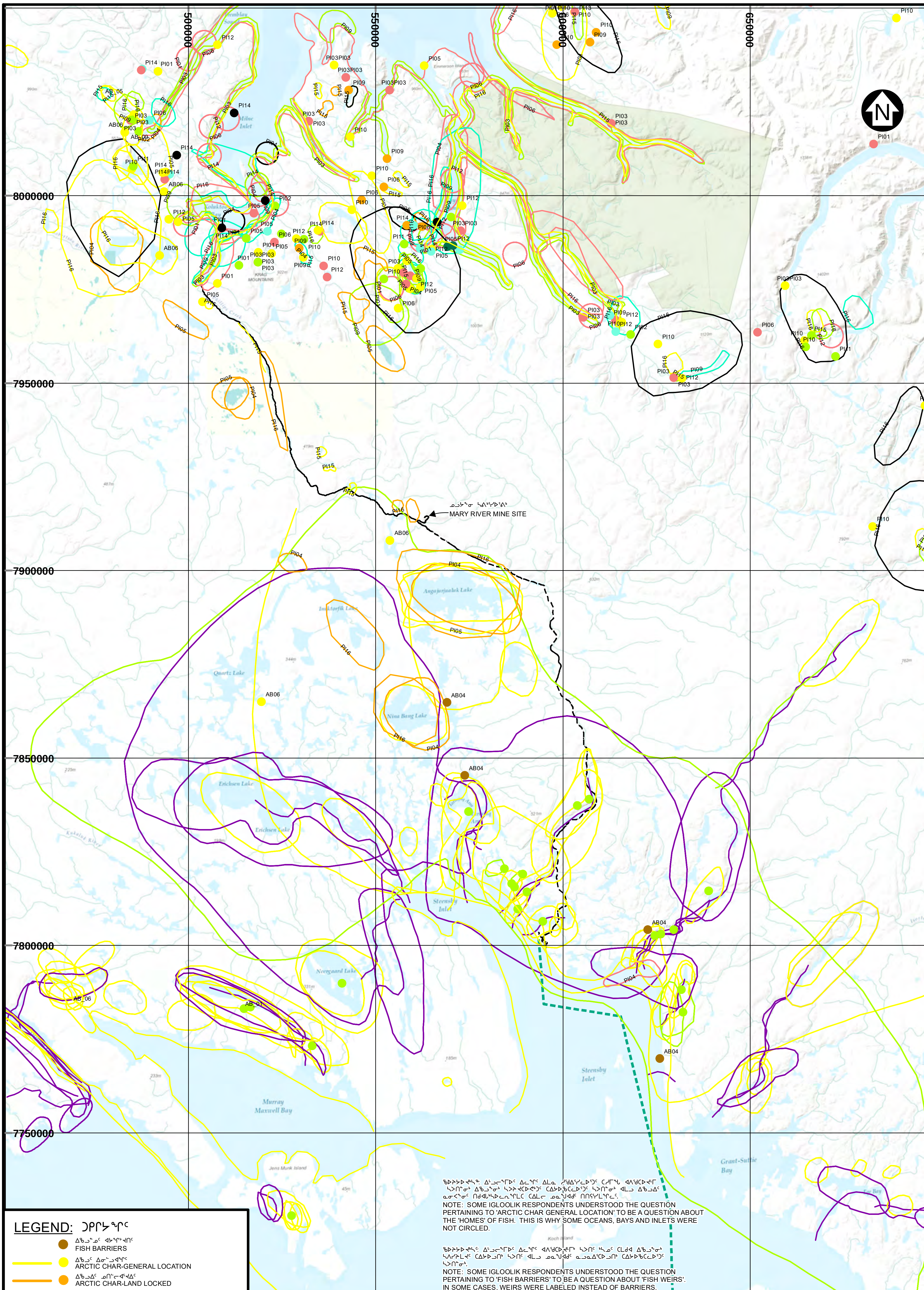
- ᓯᓈᖕᑕ ᓇᒦᓐᓂᖓ — FLOE EDGE LOCATION
- ᑐᕝᒃᑯᑦ ᐊᐃᔪᖅᐸᒃᑐᑦ ᐃᓂᒋᔭᖏᑦ — SEA-ICE LEADS LOCATION
- ᓯᑯᔪᓐᓇᖏᑦᑐᖅ ᐊᕐᕌᒍᓕᒫᖅ — SEA-ICE OPEN YEAR ROUND
- ᑕᓯᑦ ᐊᒻᒪ ᑰᒃᑐᑦ ᐱᒻᒪᕆᐅᓂᖏᑦ — LAKES AND RIVERS OF IMPORTANCE
- ᖃᒥᑦᑕᑦᑐᖅ ᐅᕙᔪᕐᓂᑦ ᐅᓕᑦᑎᓂᖓ ᑕᕝᕙᓪᓗᖃᑦᑕᑦᑐᖅ — BAD FLOOD OR EXTREMELY HIGH TIDE LOCATION
- ᖃᖓᖑᖅᓴᖓᑦ ᐊᕐᕌᒍ ᐃᒧᐊᓂ ᐃᒥᖅ ᐊᓯᔾᔨᖅᑕᕆᐊᖃᑦᑕᖓ — SEASONAL WATER QUALITY CHANGE LOCATION
- ᐃᒥᐅᑉ ᐱᐅᓂᖓ ᐊᓯᔾᔨᕐᓂᖓ ᐃᓂᖓ — GENERAL WATER QUALITY CHANGE LOCATION
- ᕿᑎᐊᓂ ᐊᖅᑯᑎ ᐅᓯᒃᑕᕐᕕᒃ — MILNE INLET TOTE ROAD
- ᓄᓇᓯᐅᑎᒃᑯᑦ ᐊᖁᑎᒋᓂᐊᖅᑕᖓ — PROPOSED RAILWAY ALIGNMENT
- ᐃᓚᖓᓂᒃ ᐅᒥᐊᖅᔪᐊᓂᑦ ᐊᖁᑕᐅᕙᒃᑕᕐᓂᐊᖅᑐᖅ — NOMINAL SHIPPING ROUTE

ᖃᐅᔨᒪᔭᒃᓴᐃᑦ NOTES:

1. ᓄᓇᖑᐊᓕᐅᖅᑕᐅᓯᒪᔪᖅ: ᑯᐃᓐ ᑲᓇᑕᒥ
   IMAGERY: © ESRI DATA & MAPS [ONLINE] (2014). REDLANDS, CA: ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE. ALL RIGHTS RESERVED.
2. ᓄᓇᖑᐊᖅ ᑎᑎᕋᖅᑕᐅᓯᒪᔪᖅ UTM (NAD83) ZONE 17 AND IS IN METRES.
   COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. ᐅᓇ ᓄᓇᖑᐊᖅ ᓴᖅᑭᑕᐅᓯᒪᕗᖅ ᑐᑭᓯᔾᔪᑎᖏᑦ ᐊᐱᖅᓱᖅᑕᐅᓯᒪᔪᑦ ᐃᓄᐃᑦ ᖃᐅᔨᒪᔭᑐᖃᖏᑦ ᓄᓇᖓᓐᓂ.
   THIS MAP WAS PRODUCED FROM INFORMATION COLLECTED DURING INUIT QAUJIMAJATUQANGIT INTERVIEWS WITH LOCAL RESIDENTS. THIS INFORMATION SHOWS PATTERNS OF LAND USE AND LOCAL KNOWLEDGE OF THE LAND. THE MAP IS NOT INTENDED TO BE A COMPLETE REPRESENTATION OF WHAT IS KNOWN.

ᐊᖏᓂᖓ SCALE: 10 5 0 10 20 30 40 50 Km ᑭᓛᒥᑕ

BAFFINLAND IRON MINES CORPORATION			
ᓄᓘᔾᔭᓂ ᐅᔭᖅᓯᐅᖅᑐᑦ — MARY RIVER PROJECT			
ᓇᓗᓇᐃᖅᑕᐅᓂᖏᑦ ᐃᒪᖃᖅᐸᓐᓂᖏᑦ ᐊᒻᒪ ᓯᑯᖃᖅᐸᓐᓂᖏᑦ ᑕᒪᓐᓇ ᖃᐅᔨᓴᕐᓂᖅ ᐊᐱᖅᓱᖅᑕᐅᓚᐅᖅᑐᑦ — WATER AND ICE FEATURES - PROJECT STUDY AREA (INTERVIEW RESULTS)			
Knight Piésold CONSULTING	P/A NO. NB102-181/35	REF. NB14-00411	REV. 0
	ᑎᑎᖅᑲᓯᐅᑎᖓ FIGURE	3.20	



ᖃᐅᔨᓴᐅᑎᒃᓴᖅ: ᐃᒡᓗᓕᖕᒥᐅᑦ ᐃᓚᖏᑦ ᐃᒪᓇ ᓱᒋᐃᕐᓯᓚᐅᕐᑐᑦ ᑕᓱᒥᖓ ᐊᐱᖁᑕᐅᔪᒥ ᓵᕐᑎᓂᒃ ᐃᖃᓗᖕᓂᒃ ᓴᕘᔪᑕᐅᕙᒃᑐᑦ ᑕᐃᔭᐅᖃᑕᐅᕐᑐᑦ ᓵᕐᑎᓂᒃ ᐊᒻᒪ ᐃᖃᓗᐃᑦ ᓇᓂᐸᖕᓂᑦ ᑎᑯᐊᒃᓴᐅᓚᕆᖓᓚᑦ ᑕᐃᒪᓕ ᓄᓇᖑᐊᑦ ᑎᑎᕋᓯᒪᖏᓚᑦ.
NOTE: SOME IGLOOLIK RESPONDENTS UNDERSTOOD THE QUESTION PERTAINING TO 'ARCTIC CHAR GENERAL LOCATION' TO BE A QUESTION ABOUT THE 'HOMES' OF FISH. THIS IS WHY SOME OCEANS, BAYS AND INLETS WERE NOT CIRCLED.

ᖃᐅᔨᓴᐅᑎᒃᓴᑦ: ᐃᒡᓗᓕᖕᒥᐅᑦ ᐃᓚᖏᑦ ᐊᐱᖁᑕᐅᔪᒥᒃ ᓴᐳᑦ ᓴᓂᑦ ᑕᒪᐊ ᐃᖃᓗᖕᓂᒃ ᓴᐱᕆᓯᒪᔪᑦ ᑕᐃᔭᐅᓗᓂᒃ ᓴᐳᑦ ᐊᒻᒪ ᓄᓇᖑᐊᑦ ᓇᓗᓇᐃᕐᑕᐅᓗᓂᒃ ᑕᐃᔭᐅᖃᑕᐅᕐᑐᑦ ᓴᐳᑎᓂᒃ.
NOTE: SOME IGLOOLIK RESPONDENTS UNDERSTOOD THE QUESTION PERTAINING TO 'FISH BARRIERS' TO BE A QUESTION ABOUT 'FISH WEIRS'. IN SOME CASES, WEIRS WERE LABELED INSTEAD OF BARRIERS.

LEGEND: ᑐᑭᓯᔾᔪᑏᑦ

- ᐃᖃᓗᖕᓄᑦ ᐊᔪᕐᓴᕐᓇᕐᑐᑦ — FISH BARRIERS
- ᐃᖃᓗᑦ ᐃᓂᒌᓗᐊᕐᑏᑦ — ARCTIC CHAR-GENERAL LOCATION
- ᐃᖃᓗᐃᑦ ᓄᑎᕐᓕᐊᕐᔪᐃᑦ — ARCTIC CHAR-LAND LOCKED
- ᐃᖃᓗᐃᑦ ᖃᓂᒻᒪᓐᓇᕐᑐᓕᑦ — ARCTIC CHAR-DISEASED
- ᐃᖃᓗᐃᑦ ᐅᓄᕐᓂᕐᑦ ᐊᔾᔨᒋᖕᖏᑦᑐᑦ — ARCTIC CHAR-POPULATION FLUCTUATING
- ᑰᖕ ᐱᒻᒪᕆᐅᔪᖅ — RIVER OF IMPORTANCE
- ᐃᖃᓗᓕᐅᕐᕕᐅᔪᖅ ᑲᔪᓯᓂᖅ — FISHING LOCATION YEAR-ROUND
- ᐊᐅᓚᓴᕐᕕᐅᔪᑦ ᒪᑭᑕᕐᕕᐅᔪᓗ ᐃᖃᓗᓕᐅᕐᕕᑦ — JIG AND NET FISHING LOCATION
- ᑕᕆᐅᕐᒥ ᐃᖃᓗᓕᐅᕐᕕᒃ — OCEAN FISHING LOCATION
- ᕿᖑᐊᓂ ᐊᖁᑎ ᐅᓯᒃᑕᕐᕕᒃ — MILNE INLET TOTE ROAD
- ᓄᓇᓯᐅᑎᑯᑦ ᐊᖁᑎᒋᓂᐊᕐᑕᖓ — PROPOSED RAILWAY ALIGNMENT
- ᐃᓚᓐᓂᑯᑦ ᐅᒥᐊᕐᔪᐊᓐᓂᑦ ᐊᖁᑕᐅᖃᑦᑕᕐᓂᐊᕐᑐᖅ — NOMINAL SHIPPING ROUTE

ᖃᐅᔨᒪᔭᒃᓴᐃᑦ NOTES:

1. ᓄᓇᖑᐊᓕᐊᕆᔭᐅᑦ: ᑯᐃᓐ ᑲᓇᑕᒧᑦ
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2. ᓄᓇᖑᐊᑉ ᑎᑎᕐᓯᒪᓂᖓ ᒪᓕᒃᑐᖅ UTM (NAD83) ZONE 17 AND IS IN METRES.
COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. ᐅᓇ ᓄᓇᖑᐊᖅ ᓴᖅᑭᑕᐅᓯᒪᔪᖅ ᑐᑭᓯᔪᑎᓴᐃᑦ ᐅᖃᐅᓯᐅᔪᑦ ᐃᓄᖕᓄᑦ ᐊᕐᕌᒍᓄᑦ ᐃᓄᐃᑦ ᖃᐅᔨᒪᔭᑐᖃᖏᓐᓂᑦ ᓄᓇᓕᒥ ᐊᐱᖅᓱᖅᑕᐅᓯᒪᔪᑦ ᓄᓇᓕᓐᓂ. ᑖᒃᑯᐊ ᓇᓗᓇᐃᖅᑕᐅᓯᒪᔪᑦ ᐃᓄᓐᓄᑦ ᓴᖅᑭᑎᑦᑎᓯᒪᔪᑦ ᓄᓇᐅᑉ ᐊᑐᖅᑕᐅᓂᖓᓂᒃ ᐊᒻᒪ ᓄᓇᓕᓐᓂ ᖃᐅᔨᒪᔭᐅᔪᓂᒃ ᓄᓇᒥᒃ. ᐅᓇ ᓄᓇᖑᐊᖅ ᐃᓗᐃᑦᑑᖏᑦᑐᖅ ᑭᒡᒐᖅᑐᐃᓇᓂᓗ ᐃᓗᐃᑦᑐᒥᒃ ᑕᒪᐃᓐᓂᒃ ᖃᐅᔨᒪᔭᐅᔪᓂᒃ.
THIS MAP WAS PRODUCED FROM INFORMATION COLLECTED DURING INUIT QAUJIMAJATUQANGIT INTERVIEWS WITH LOCAL RESIDENTS. THIS INFORMATION SHOWS PATTERNS OF LAND USE AND LOCAL KNOWLEDGE OF THE LAND. THE MAP IS NOT INTENDED TO BE A COMPLETE REPRESENTATION OF WHAT IS KNOWN.

ᐊᖏᓂᖓ SCALE: 10 5 0 10 20 30 40 50 Km ᑭᓛᒥᑕ

BAFFINLAND IRON MINES CORPORATION		
ᓄᓗᔾᔨᓂ ᐅᔭᕐᓯᐅᕐᑐᑦ — MARY RIVER PROJECT		
ᓇᓗᓇᐃᖅᑐᓂᒃ ᐃᖃᓗᒃᑲᓐᓂᐅᕙᖕᓂᒃ ᐊᒻᒪ ᖃᐅᔨᓴᐅᑎᓂᒃ ᐊᐱᖅᓱᖅᑕᐅᔪᑦ — FISH LOCATIONS - PROJECT STUDY AREA (INTERVIEW RESULTS)		
Knight Piésold CONSULTING	P/A NO. NB102-181/35	REF. NB14-00411	REV. 0
	ᑎᑎᖅᑐᒐᖅ FIGURE	5.2	

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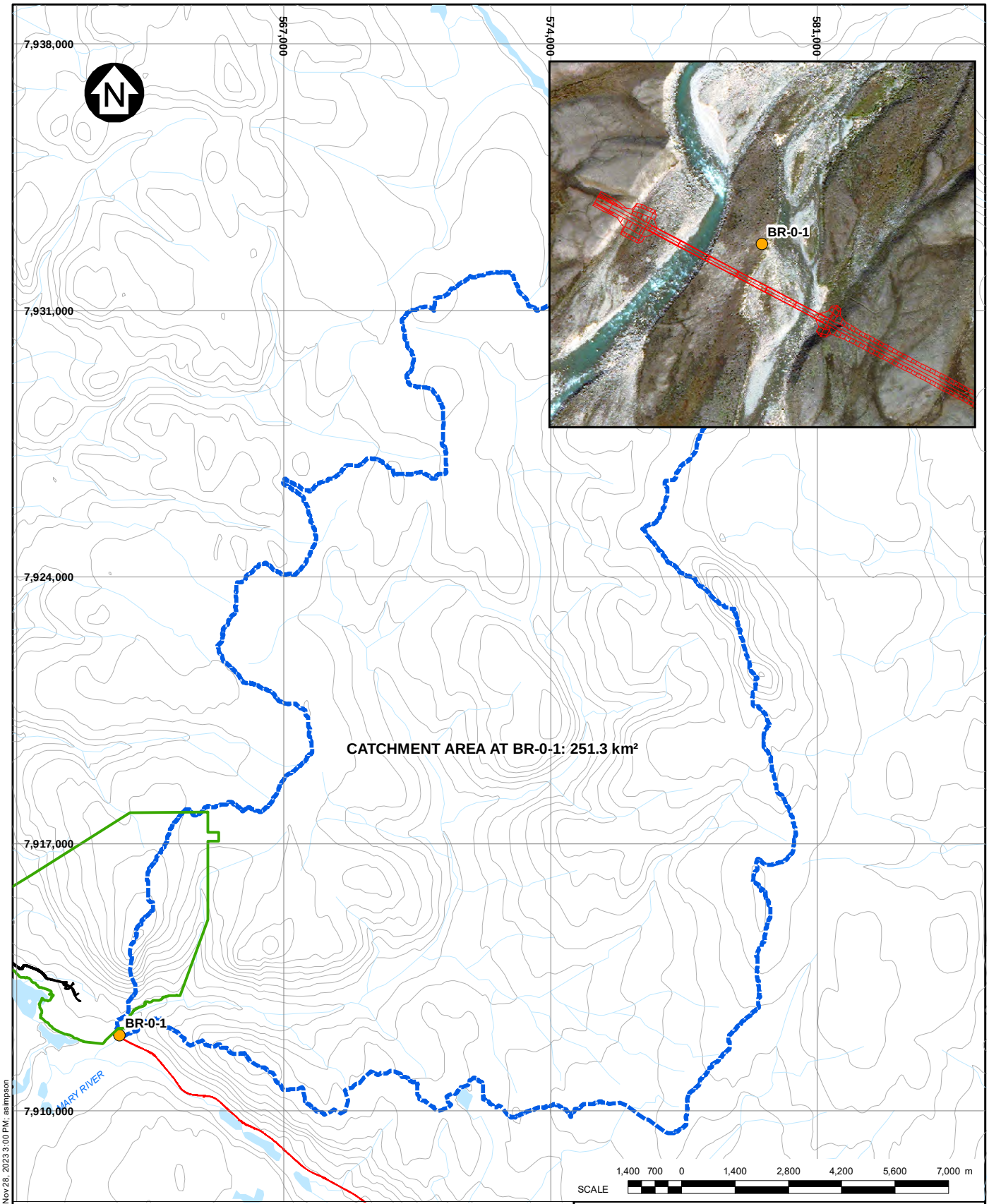
APPENDIX B

Catchment Boundaries

(Pages B-1 to B-9)

Figure No.	Rev No.	Description
Figure B.1	0	Water Station BR-0-1 Catchment
Figure B.2	0	Water Station BR-25-1 Catchment
Figure B.3	0	Water Station BR-37-1 Catchment
Figure B.4	0	Water Station BR-46-1 Catchment
Figure B.5	0	Water Station BR-137-1 and ST352 Catchment
Figure B.6	0	Water Station Ravn Camp Lake Catchment
Figure B.7	0	Water Station Mid-Rail Camp Lake Catchment
Figure B.8	0	Water Stations Cockburn Lake Catchments
Figure B.9	0	Water Station ST353 (3 km Lake) Catchment



LEGEND:

- WATER STATION
- STEENSBY RAILWAY
- POTENTIAL DEVELOPMENT AREA
- CATCHMENT BOUNDARY

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. BASE MAP IMAGERY: c 2021 DIGITAL GLOBE, INC.
3. RAILWAY ALIGNMENT PROVIDED BY SYSTRA (NOV 13, 2023).

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	28NOV'23	ISSUED WITH REPORT	GMJ	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

WATER STATION BR-0-1 CATCHMENT

Knight Piésold CONSULTING

P/A NO. NB102-181/94

REF NO. 1

FIGURE B.1

REV 0

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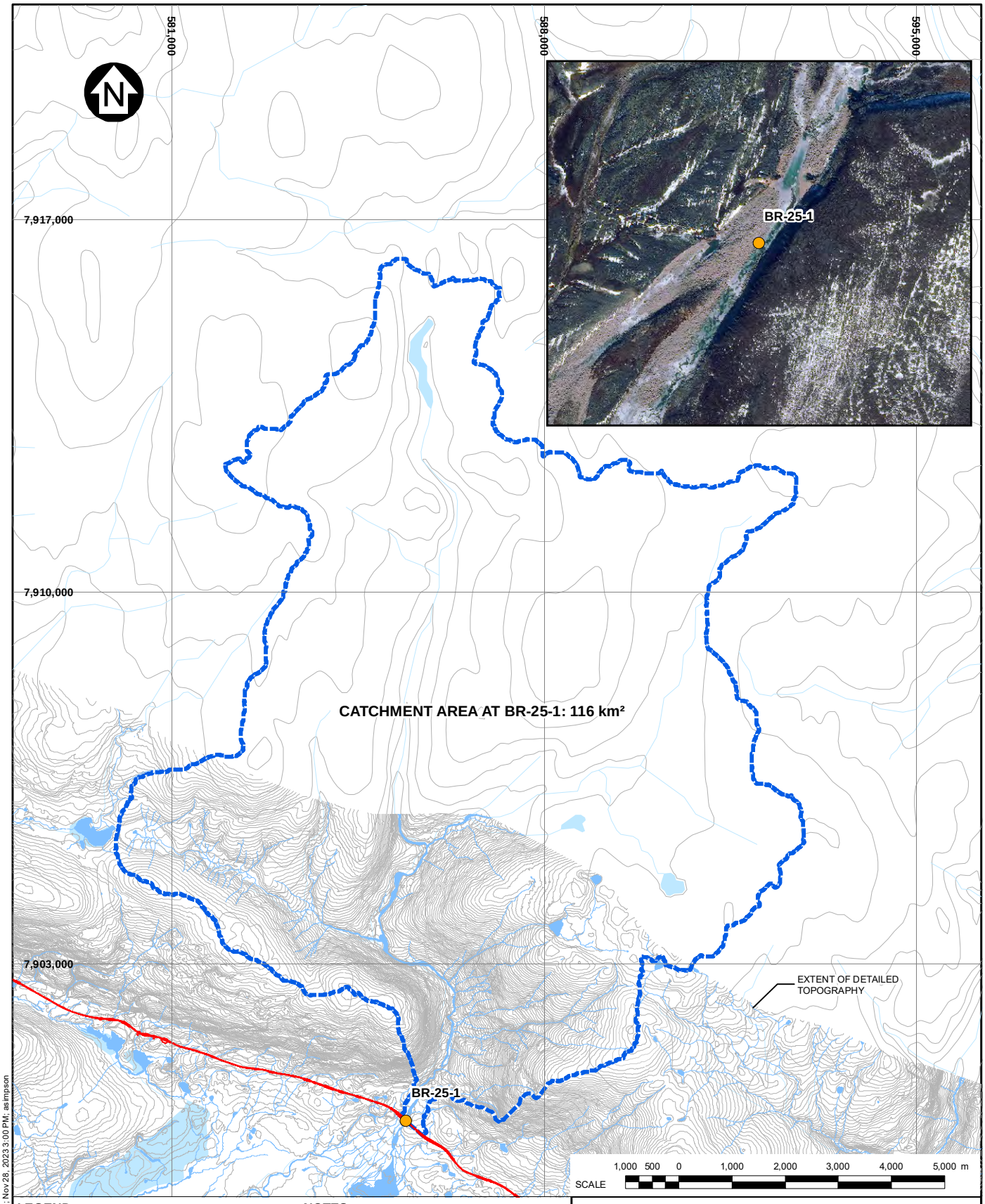

LEGEND:
- WATER STATION
- STEENSBY RAILWAY
- CATCHMENT BOUNDARY

NOTES:
1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. BASE MAP IMAGERY: c 2021 DIGITAL GLOBE, INC.
3. RAILWAY ALIGNMENT PROVIDED BY SYSTRA (NOV 13, 2023).

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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

WATER STATION BR-25-1 CATCHMENT

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FIGURE B.2 | REV 0

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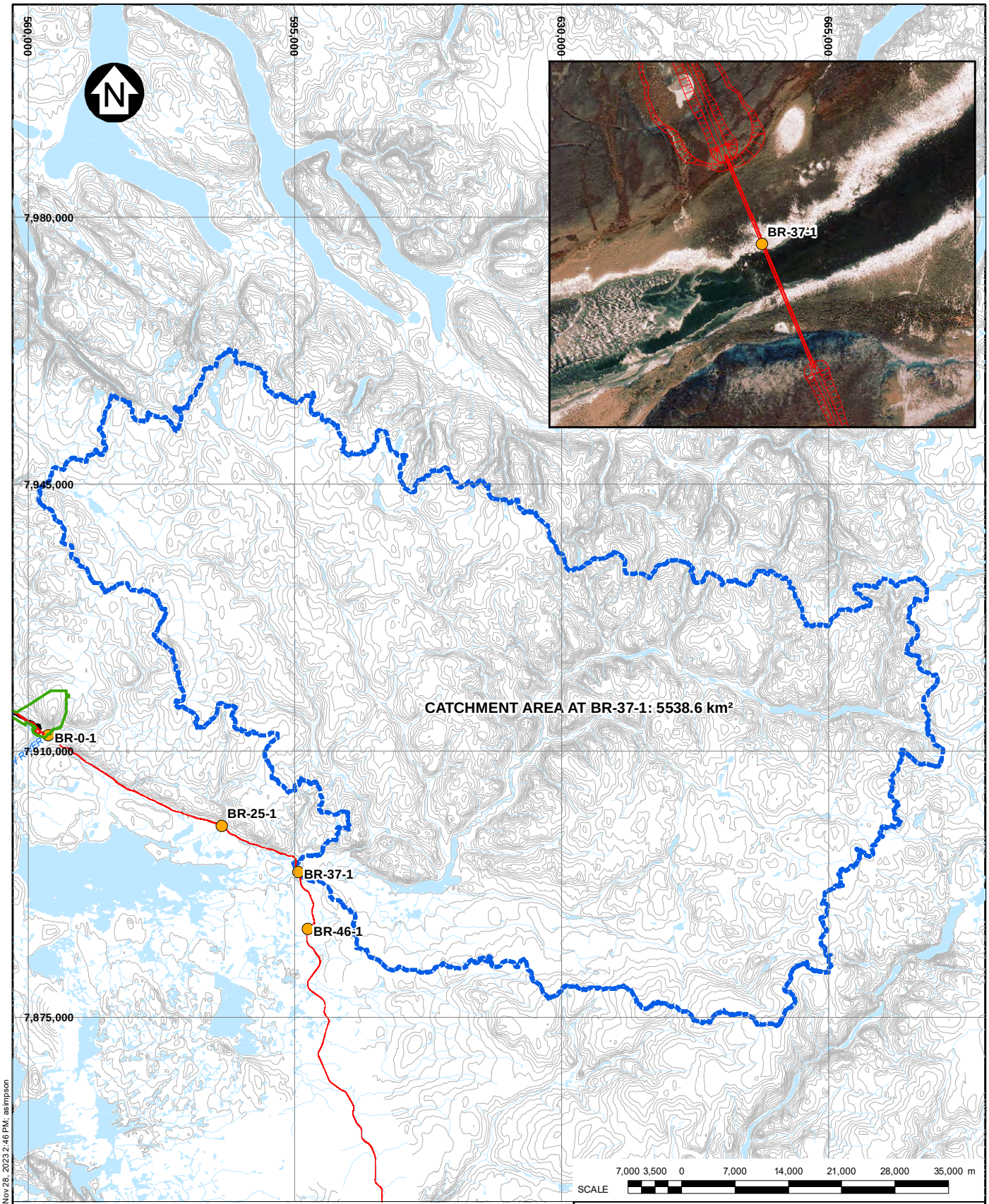

LEGEND:

- WATER STATION
- STEENSBY RAILWAY
- POTENTIAL DEVELOPMENT AREA
- CATCHMENT BOUNDARY

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. BASE MAP IMAGERY: c 2021 DIGITAL GLOBE, INC.
3. RAILWAY ALIGNMENT PROVIDED BY SYSTRA (NOV 13, 2023).

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
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MARY RIVER PROJECT

WATER STATION BR-37-1 CATCHMENT

Knight Piésold CONSULTING

P/A NO. NB102-181/94

REF NO. 1

FIGURE B.3

REV 0

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