

DE BEERS GROUP

Gahcho Kué Mine

**2019 Aquatic Effects Monitoring Program
Response Plan – Fish Habitat and Community**

May 2020

ABBREVIATIONS AND ACRONYMS

Abbreviation / Acronym	Definition
AEMP	Aquatic Effects Monitoring Program
De Beers	De Beers Canada Inc
DFMP	Downstream Flow Mitigation Plan
DFO	Fisheries and Oceans Canada
EIS	Environmental Impact Statement
Golder	Golder Associates Ltd.
KLM watersheds	streams and lakes in the KLM watersheds, downstream of Kennady Lake
Mine	Gahcho Kué Mine
MVLWB	Mackenzie Valley Land and Water Board
NT	Northwest Territories
YOY	young-of-the-year

UNITS OF MEASURE

Unit / Symbol	Definition
m	metre

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1 INTRODUCTION

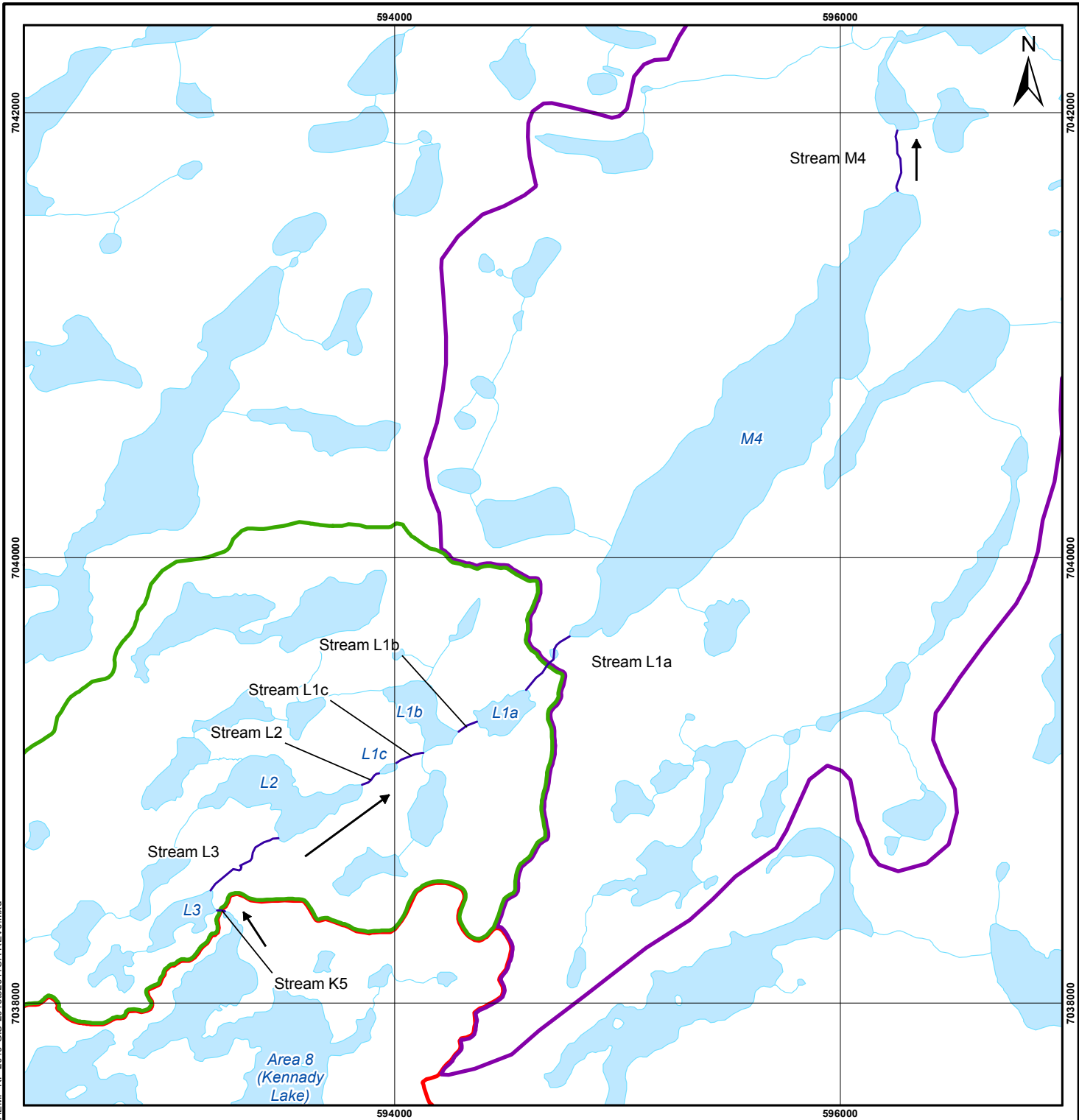
De Beers Canada Inc. (De Beers) monitors the fish habitat and community in streams downstream of the Gahcho Kué Mine (Mine) and Area 8 of Kennady Lake (Area 8) as a component of the Aquatic Effects Monitoring Program (AEMP). This monitoring under the AEMP is a requirement of the Water Licence MV2005L2-0015, issued by the Mackenzie Valley Land and Water Board (MVLWB or the Board; MVLWB 2014). A monitoring program was developed to support the Downstream Flow Mitigation Plan (DFMP; Golder 2012) and to also support the *Fisheries Act* Authorization (Authorization 03-HCAA-CA6-0057.1) for the Mine, which has been integrated with the fish habitat and community and flow mitigation monitoring components of the AEMP. The monitoring programs evaluate the potential effects of the Mine on flow, fish habitat and community, and success of any flow mitigation downstream of Kennady Lake (i.e., the KLM watershed). They also provide information on potential effects on traditional uses of fish based on monitoring in selected streams downstream of Area 8 (Kennady Lake). Between 2015 and 2017, these streams were located in the inter-connected KLM watersheds as shown in Figure 1-1 (i.e., study area).

AEMP Response Plans were submitted following the 2017 and 2018 AEMP years (De Beers 2018; 2019a), with response actions implemented in 2018 and 2019. The initial responses were investigatory, focusing on gathering additional data via a wider search for Arctic Grayling (*Thyallumus arcticus*) presence across an extended study area in 2018 and 2019 (Figure 1-2). The results of the 2018 monitoring indicated that Arctic Grayling were not present in the inter-connected KLM watersheds (both lakes and streams) between Area 8 and Lake 410, despite an extended geographic study area and additional methods to try and capture or find these fish.

As one of the response actions of the approved 2018 AEMP Response Plan (Version 3), a flow augmentation assessment (De Beers 2019b) concluded that providing flows at or above 0.4 m³/s associated with the timing of spring migration would allow for free access to habitats throughout the KLM watersheds and would allow for recolonization by Arctic Grayling. As a result of this conclusion, flow mitigation pumping was adjusted in 2019 to allow for an extended duration of fish passage. The following changes were made:

- The “Dry” Pumping Regime was removed from the operational pumping mitigation to allow for annual access to habitats.
- The pumping targets, which are based on the predicted hydrologic conditions for the year, were simplified to “Above-average” and “Below-average”, thus improving efficiency.
- Flow mitigation pumping targeted the start of ice-out rather than targeting a June 1st date.
- The spring pumping rates were increased to 0.35 m³/s to achieve the minimum target flow of 0.40 m³/s at Stream K5, which was maintained for a minimum of 28 consecutive days.
- The August pumping rates were increased to 0.12 m³/s to counteract evapotranspiration throughout the KLM system and to maintain a minimum flow of 0.1 m³/s at Stream K5.

The 2019 distribution of Arctic Grayling in the inter-connected KLM watershed streams, between Area 8 and lake 410, was not consistent with monitoring programs conducted in 2015 and 2016. However, one adult was captured in Stream L1a during the 2019 summer program. This is the first Arctic Grayling captured or confirmed between Area 8 and Stream M1 since 2016. All other fish species, including Lake Trout, were documented between Area 8 and Lake 410 in 2019.



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LEGEND

- Downstream Flow Monitoring Stream
- Flow Direction
- Watercourse
- Waterbody
- Watershed Boundary**
- Kennady Lake Watershed
- L Watershed
- M Watershed

NOTES

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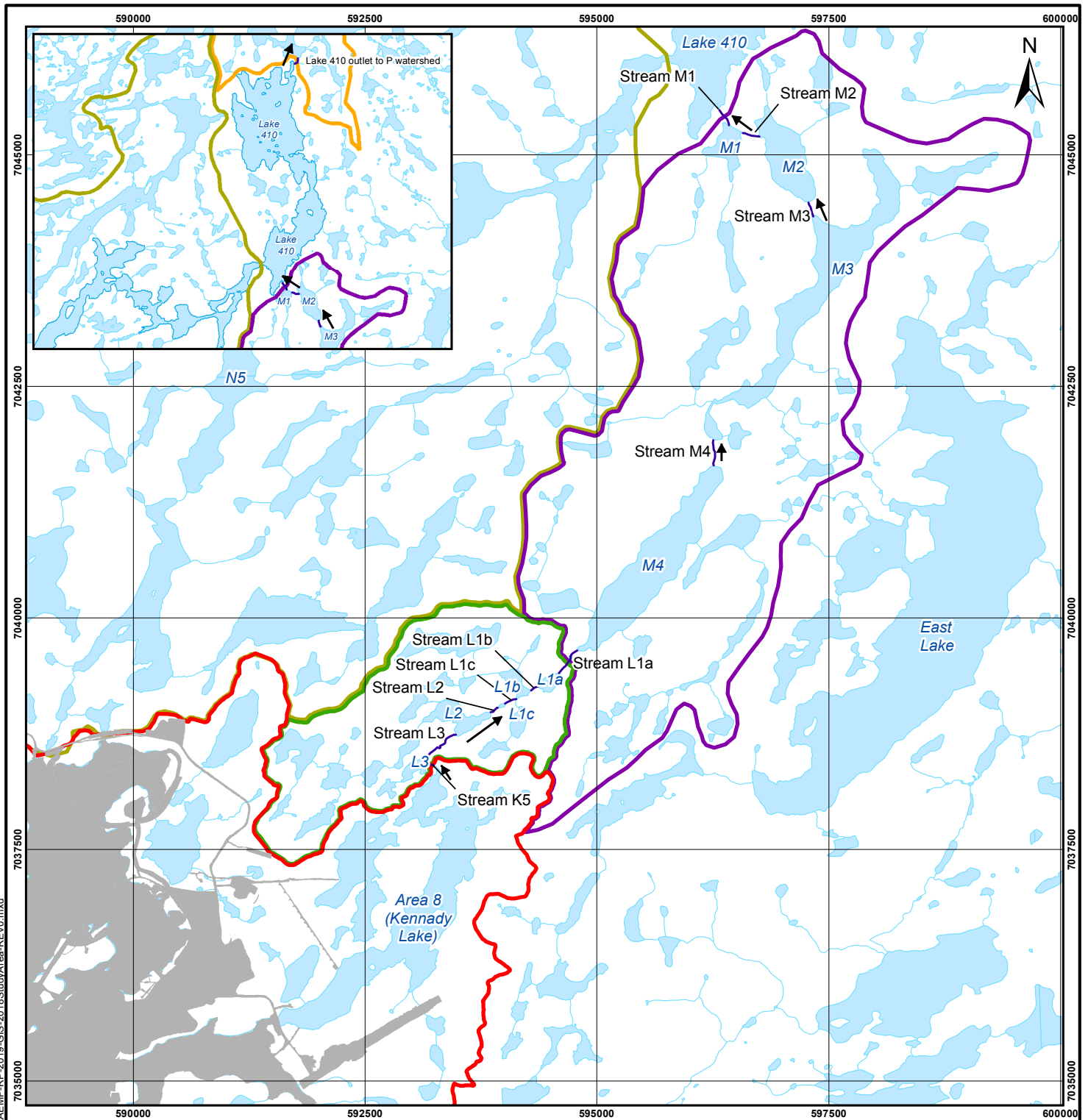
GAHCHO KUÉ MINE

Fish Habitat and Community Study Area (2015 to 2017)

PROJECTION: UTM Zone 12	DATUM: NAD83
Scale: 1:25,000	
FILE No: AEMP-RP-2019-GIS-2015to2017SA-REV0	DATE: February 3, 2020
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Figure 1-1



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LEGEND

- Downstream Flow Monitoring Stream
- Flow Direction
- Watercourse
- Waterbody
- 2019 Mine Footprint
- Watershed Boundary**
- Kennedy Lake Watershed
- L Watershed
- M Watershed
- N Watershed
- P Watershed

GAHCHO KUÉ MINE

Fish Habitat and Community Study Area (2018 and 2019)

PROJECTION: UTM Zone 12		DATUM: NAD83		DE BEERS GROUP
Scale: 1:60,000 <div style="display: flex; justify-content: center; align-items: center; gap: 10px;"> 1 0.5 0 1 </div> <div style="display: flex; justify-content: center; align-items: center; gap: 10px;"> </div> Kilometres				
FILE No: AEMP-RP-2019-GIS-2018StudyArea-REV0		DATE: February 3, 2020		
JOB NO: 18104155	REVISION NO: 0	OFFICE: GOLD-CAL	DRAWN: LS CHECK: CV	Figure 1-2

NOTES
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De Beers submitted a technical report to the Board in December 2019 (De Beers 2019c), presenting a summary of the results of the monitoring associated with the Response Actions carried out in 2019 and a summary of the flow and fish catch results. As one adult Arctic Grayling was captured in 2019, the Moderate Action Level criterion related to flow mitigation: “*Arctic Grayling are absent in a subsequent monitoring year*”, was not triggered. However, two of the low action level criteria related to flow mitigation were triggered in 2019:

- Arctic Grayling adults are not moving to spawning areas within the normal spring period (as per baseline information)
- Arctic Grayling fry are not present in the system and/or not distributed similar to baseline

The board was notified on December 1, 2019 that the 2019 Low Action Level thresholds were exceeded (De Beers 2019d). As per Part I, Condition 7.B of the Water Licence, a new AEMP Response Plan is required, detailing the exceedance and proposed Response Actions.

2 ACTION LEVEL DESCRIPTION

As this AEMP Response Plan is a continuation of the approved previous version, this section summarizes the Low Action Level descriptions for the two criteria triggered in 2019:

1. Arctic Grayling adults are not moving to spawning areas within the normal spring period.

Arctic Grayling move to spawning habitat during or immediately after ice break-up and tend to return to summer feeding habitat a few days or weeks after spawning (Stewart et al. 2007). This pattern has been documented previously within the KLM watersheds, with most fish fence observations showing fish moving from downstream habitat back into Kennedy Lake by mid-June (Golder 2014, 2015, 2016, 2017).

The ecological implication of the Low Action Level exceedance *Arctic Grayling adults not moving to spawning areas within the normal spring period* is that the persistence of an Arctic Grayling population downstream of Area 8 could be impaired if fish are unable to access spawning habitat, or if the timing of spawning is altered. Changes to spawning success may result in adult Arctic Grayling being unable to reproduce, resulting in the sustained absence of Arctic Grayling (De Beers 2016).

2. Arctic Grayling fry are not present in the system and/or not distributed similar to baseline.

Arctic Grayling fry, or young-of-the-year (YOY), emerge from spawning habitat and move to sheltered rearing habitat near their spawning habitat. YOY generally remain in their rearing habitat for the first growing season before moving to overwintering habitat (Stewart et al. 2007). This pattern of habitat use and timing has been documented previously at site, with abundant YOY fish observations (greater than 1,000 YOYs in 2014) in the summer and declining in the fall (Golder 2014, 2015, 2016, 2017).

The ecological implication of the Low Action Level exceedance “*Arctic Grayling fry not being present in the system and/or not being distributed similar to baseline*” is that the persistence of an Arctic Grayling population downstream of Area 8 could be impaired if successful recruitment to the population does not occur. Changes to recruitment success may result if Arctic Grayling fry are unable to survive or grow, and thus the potential for sustained absence of Arctic Grayling (De Beers 2016).

3 LIKELY CAUSES AND LINES OF EVIDENCE

As discussed in the approved 2017 AEMP Response Plan (De Beers 2018), it is likely that the sequence of multiple events, some Mine-related and some environmental (i.e., climate-related), may be responsible for the lack of Arctic Grayling observations in the KLM watersheds since 2016. Specifically, the 2017 AEMP Response Plan concluded that these multiple events all contributed to the result of no observed Arctic Grayling in 2017 with the timing of each stressor such that one perturbation potentially confounded the other. In summary:

- The isolation of Area 8 and removal of a large proportion of the Arctic Grayling population from Kennady Lake occurred in 2014 and 2015 as part of the fish out.
- In 2014, naturally occurring high water temperatures were recorded, which may have caused additional mortalities to the already reduced population in Area 8 (due to the fish out) and the immediate downstream watershed.
- In 2016, high water temperatures, likely caused by a combination of high air temperatures, dry conditions, and low flow conditions, may have caused additional mortalities to the already reduced population and restricted movement to refuge or overwintering habitats.

In addition to the likely causes presented, the evidence indicated that the availability of suitable physical habitat (excluding considerations of temperature) and access to spawning habitat was not the cause of the observed decline and subsequent absence of Arctic Grayling in 2017 (De Beers 2018). However, dry hydrologic conditions have occurred every year since 2016, and although short periods of moderate flows have allowed access to spawning habitat, sustained periods of higher flows have not occurred that would allow for the widespread movement of fish throughout the system without encountering barriers.

The evidence suggests that the remaining population of Arctic Grayling downstream of Kennady Lake are either at such low numbers that the possibility of detection is low, or have been restricted to deeper, cooler waters in the inter-connected lakes within the KLM watersheds and have avoided detection or are currently absent from the KLM watersheds.

The catch results in the KLM watersheds observed in 2019 are indicative of the catch results from the previous two years of monitoring where Arctic Grayling were absent, and that the recolonization of the habitats from a downstream population has not yet resulted in a widespread redistribution of Arctic Grayling in the KLM system. The recolonization has likely been restricted by consecutive dry hydrologic conditions across the region since 2016.

Expanded monitoring completed in 2019 did not detect Arctic Grayling in the M watershed or at the outlet of Lake 410 in 2019, which may result in a further delay in recolonization if the source population for recolonization of Arctic Grayling is located further downstream in the Kirk Lake watershed.

4 RESPONSE ACTIONS

4.1 Proposed Actions for 2020

In 2020, a continuation of the special effects study implemented in 2019 will be conducted to monitor the presence and possible return (based on the 2019 results) of Arctic Grayling within the KLM watersheds. Additional sampling will also be conducted further downstream in the P watershed, downstream of Lake 410, as part of the revised AEMP monitoring.

4.1.1 Revise the Low Action Level Criteria, if Warranted and Scientifically Defensible

No additional revisions are recommended at this time.

4.1.2 Set Site-specific Benchmarks, if Appropriate

No site-specific benchmarks are required for the fish habitat and community Action Levels.

4.1.3 Revise the Moderate and High Action Level Criteria, if Warranted and Scientifically Defensible

No additional revisions are recommended at this time.

4.2 Timeline

The 2020 AEMP fish habitat and community monitoring field programs will commence in spring and be concluded in September 2020. Thereafter, data analysis will occur to determine if any Action Levels were exceeded.

4.3 Projection of Environmental Responses

Recolonization of Arctic Grayling from downstream habitats will likely be contingent on the provision of adequate flows through pumping mitigation in combination with a naturally wetter climate cycle. Provided adequate flow conditions occur, recolonization of Arctic Grayling within the KLM watersheds is possible, as suggested by the presence of a single large adult Arctic Grayling in Stream L1a in the summer of 2019. However, Arctic Grayling were also not detected at the outlet of Lake 410 during sampling in 2019, which may be indicative of a regional trend in the Arctic Grayling population (i.e., in areas not affected by mine development) in response to consecutive dry hydrologic years in the region.

Recolonization may be gradual and may not occur simultaneously throughout the system. Detection of Arctic Grayling is a positive outcome; however, Arctic Grayling may not be distributed throughout the system as they were during baseline for several years to come. If the distribution of Arctic Grayling remains different from baseline, then the Low Action Level would remain triggered and Arctic Grayling would remain a focus of future response plans.

4.4 Monitoring Plan

Monitoring will focus on the success of recolonization of Arctic Grayling within the KLM streams based on the implementation of additional flow mitigation, as implemented in 2019.

4.5 Reporting Schedule

A technical report presenting the results of the 2020 monitoring program described herein will be submitted to the Board on or before December 1, 2020.

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