PERMIT AMENDMENT APPLICATION

FOR AN AUTHORIZATION TO DISCHARGE WASTE

UNDER THE *ENVIRONMENTAL MANAGEMENT ACT*

PUBLIC CONSULTATION REPORT

MOUNT POLLEY MINE

LONG-TERM WATER MANAGEMENT PLAN

PREPARED FOR

THE MINISTRY OF ENVIRONMENT

PREPARED BY

MOUNT POLLEY MINING CORPORATION

FEBRUARY 28, 2017

DOCUMENT BACKGROUND

On October 20, 2016, Mount Polley Mining Corporation (MPMC) formally applied to the British Columbia Ministry of Environment (MoE) to amend *Environmental Management Act* Permit 11678, issued to MPMC by the MoE, for the Long-term Water Management Plan (LTWMP) for the Mount Polley Mine.

An Application for Authorization to Discharge Waste under the *Environmental Management Act* was submitted to the MoE for each of the two (2) discharges contemplated in the LTWMP: the discharge of mine contact water into Quesnel Lake; and the discharge of mine contact water (via groundwater) to Bootjack Lake. Together, these two (2) documents are herein referred to as the "Application".

The purpose of the Application is to receive authorization for the discharge of mine contact water from the Mount Polley Mine during its operating life, in accordance with the LTWMP. Implementation and operation of the works proposed by MPMC in the LTWMP would require: a permit amendment from the MoE under the *Environmental Management Act*; a project review from Fisheries and Oceans Canada (DFO) under the *Fisheries Act*; approval from, and notification to, the British Columbia Ministry of Forests, Lands, & Natural Resource Operations (MFLNRO) under the *Water Act*; approval from the MFLNRO under the *Lands Act*; and, notification to Environment Canada as required by the Metal Mining Effluent Regulations under the *Fisheries Act*.

In support of the Application, a Consultation Plan was submitted to the MoE on October 20, 2016. The Consultation Plan describes activities to be completed by MPMC following submission of the Application, specifically regarding the public consultation period initiated by posting of the Environmental Protection Notice (EPN). As noted in the Consultation Plan, posting of the EPN and subsequent activities do not represent the initial consultation associated with the Application. Consultation in the context of water management planning for the Mount Polley Mine site has been ongoing during the Mine's development and operation, and, more specifically regarding the Application, since the foundational failure of the Mount Polley Mine Tailings Storage Facility on August 4, 2014.

As noted in Section 4 of the Consultation Plan:

> *"MPMC will document activities and submit a final Consultation Report to the MoE upon the conclusion of consultation for the water discharge permit amendment application. This Consultation Report will include a summary of consultation activities conducted as well as present questions and comments raised during such activities and corresponding responses provided by MPMC."*

This document, *Public Consultation Report*, dated February 28, 2017, is provided by MPMC to the MoE to fulfill this requirement to document activities and submit a Consultation Report summarizing consultation activities, questions and comments, and MPMC responses.

MOUNT POLLEY MINING CORPORATION

MOUNT POLLEY MINE

LONG-TERM WATER MANAGEMENT PLAN – PUBLIC CONSULTATION REPORT

TABLE OF CONTENTS

1.0 BACKGROUND 1
2.0 PUBLIC CONSULTATION 3
2.1 Referrals 4
2.2 Notifications 5
2.3 Public Meetings 6
2.4 Public Comments Received 6
2.5 Summary of Responses to Relevant Concerns 7
2.5.1 TSF Foundation Failure – Breach Response and Remediation 8
2.5.2 Permitting/Consultation 10
2.5.3 Options Analysis 11
2.5.4 Quesnel Lake 14
2.5.5 Proposed Effluent Discharge Limits 15
2.5.6 Proposed Treatment 18
2.5.7 Miscellaneous 23
3.0 JOINT IMPLEMENTATION COMMITTEE 24
4.0 PLC 24
5.0 CMDRC 24
6.0 OTHER CONSULTATION ACTIVITIES 24
7.0 CLOSURE 25

LIST OF FIGURES

TABLE 2.3.1 COMMUNITY MEETING LOG 6
TABLE 2.4.1 UNIQUE COMMENTS (BY LOCATION) 7

APPENDICES

Appendix A – Consultation Plan
Appendix B – Referrals and Notifications
Appendix C – Community Meetings
Appendix D – Public Comments
Appendix E – Supplemental Information to Support Public Comment Responses

MOUNT POLLEY MINE

LONG-TERM WATER MANAGEMENT PLAN – PUBLIC CONSULTATION REPORT

1.0 BACKGROUND

On October 20, 2016, Mount Polley Mining Corporation (MPMC) formally applied to the British Columbia Ministry of Environment (MoE) to amend *Environmental Management Act* (*EMA*) Permit 11678, issued to MPMC by the MoE, for the Long-term Water Management Plan (LTWMP) for the Mount Polley Mine (the "Mine").

The formal application followed, and was informed by, significant dialogue and collaboration with regulators, the public, First Nations, government and stakeholders; its development and content reflects consultation in the context of water management planning completed as part of a process ongoing since the foundational failure of the Mine's Tailings Storage Facility (TSF) on August 4, 2014. MPMC would like to thank and acknowledge all those that have participated in this dialogue and collaboration.

An Application for Authorization to Discharge Waste under the *EMA* was submitted to the MoE by MPMC for each of the two (2) discharges contemplated in the LTWMP: the discharge of mine contact water into Quesnel Lake; and the discharge of mine contact water (via groundwater) to Bootjack Lake. Together, these two (2) documents are herein referred to as the "Application".

The purpose of the Application is to receive authorization for the discharge of mine contact water from the Mine during its operating life, in accordance with the LTWMP. Implementation and operation of the works proposed by MPMC in the LTWMP would require: a permit amendment from the MoE under the *Environmental Management Act*; a project review from Fisheries and Oceans Canada under the *Fisheries Act*; approval from, and notification to, the British Columbia Ministry of Forests, Lands, & Natural Resource Operations (MFLNRO) under the *Water Act*; approval from the MFLNRO under the *Lands Act*; and, notification to Environment Canada as required by the Metal Mining Effluent Regulations under the *Fisheries Act*.

The Application specifically references a document, *Mount Polley Mine Long Term Water Management Plan: Permit Amendment Application under the* Environmental Management Act*: Technical Assessment Report*, prepared for MPMC by Golder Associates Ltd. (Golder), dated October 17, 2016 and made available to the MoE (among other groups) on October 20, 2016. This document is herein referred to as the "LTWMP TAR".

The LTWMP TAR provides the details of water management planning for the Mine, including discharge quality and quantity modelling for the operations, closure and post-closure phases. The Application requests amendment of *EMA* Permit 11678 as required for the operations phase of the Mine, and is supported by the technical assessment of the effluent discharge during operations to identify whether or not receiving water uses would be impaired (included in the LTWMP TAR).

The Application is proposed such that MPMC (for the benefit of the environment, MPMC, regulators, the public, First Nations, government and stakeholders) is afforded the ability to manage surplus site contact water through a permitted discharge of treated surplus mine contact water from the Mine site. Current authorization under *EMA* Permit 11678 (as last amended September 19, 2016) allows for the discharge of treated effluent from the Mine until November 30, 2017 (Section 1.2.2), and requires that a long-term water management plan be developed and implemented (Section 2.9). No authorization currently exists for discharge of mine contact water beyond the current authorization, and the Mine site is subject to surplus water accumulation with or without continued operations at the Mine.

The effluent discharge strategy currently implemented at the Mine, commonly referred to as the Short-term Water Management Plan (STWMP), was authorized on November 29, 2015, and reflects the effluent discharge authorized by *EMA* Permit 11678 to November 30, 2017 as referenced above. The STWMP includes discharge of treated effluent to Quesnel Lake via the Hazeltine Channel, and the key objective in its development and authorization was to manage contact water that had accumulated at the Mine site following the TSF foundation failure, while allowing time to develop the LTWMP. The LTWMP TAR was initially submitted in draft form on June 30, 2016, as required under conditions of *EMA* Permit 11678. Feedback from the review and comment by the MoE, the Ministry of Energy and Mines (MEM) and First Nations (and their respective consultants) on this June 30, 2016 draft LTWMP TAR were addressed and incorporated into the final LTWMP TAR dated October 17, 2016; the latter being submitted in support of the Application on October 20, 2016.

In support of the Application, a Consultation Plan was submitted to the MoE on October 20, 2016. The Consultation Plan describes activities to be completed by MPMC following submission of the Application, specifically regarding the formal public consultation period initiated by posting of the Environmental Protection Notice (EPN). As noted in the Consultation Plan, posting of the EPN and subsequent activities do not represent the initial consultation associated with the Application; consultation in the context of water management planning specifically contemplating the Application has been part of a process ongoing since the foundational failure of the Mine's TSF on August 4, 2014.

The MoE indicated that the Application required public notice and provision of a thirty (30) day period to enable public comment, which was scheduled to conclude on November 24, 2016. It was

indicated by the MoE that MPMC would be responsible for responding to any questions related to the Application that arose during the public review period. On November 16, 2016, the MoE Director extended the public comment period to December 23, 2016.

As noted in Section 4 of the Consultation Plan:

> *"MPMC will document activities and submit a final Consultation Report to the MoE upon the conclusion of consultation for the water discharge permit amendment application. This Consultation Report will include a summary of consultation activities conducted as well as present questions and comments raised during such activities and corresponding responses provided by MPMC."*

This document, *Public Consultation Report*, dated February 28, 2017, is provided by MPMC to the MoE to fulfill this requirement to document activities and submit a Consultation Report summarizing formal consultation activities, questions and comments, and MPMC responses. The consultation carried out meets the requirement of the *Public Notification Regulation*; however, MPMC elected to undertake a considerably expanded scope of consultation than is required by that regulation. The Consultation Plan provided outlined the activities that would be undertaken regarding the MoE-regulated requirements, and the present document (the *Public Consultation Report*) captures such consultation activities and outputs. MPMC is pleased to submit a consultation report summarizing consultation activities, questions and comments and MPMC responses.

2.0 PUBLIC CONSULTATION

This Public Consultation Report (the "Report") documents consultation completed in respect to the Application to fulfill the requirements of the MoE as detailed in the Document Background and Section 1.0 (Background), and as set out in the Consultation Plan submitted by MPMC to the MoE on October 20, 2016 in support of the Application. A copy of the Consultation Plan is included as Appendix A. As noted in the Consultation Plan, formal submission of the Application and issuing of the EPN was not the initial consultation activity for many of the groups.

This document does not include detailed documentation of consultation completed as part of the Cariboo Mine Development Review Committee (CMDRC) review of the Application, which has been submitted separately to the MoE in the document, *Mine Development Review Committee Comment Tracking: Mount Polley Mine Long-term Water Management Plan Technical Assessment Report*, dated February 9, 2017.

This Report does not exhaustively document consultation completed outside of the formal requirements of the MoE; such consultation activities will be more fulsomely described in a separate information sharing summary.

2.1 Referrals

Five (5) documents were provided to the MoE by MPMC as part of the formal submission of the Application:

- a list and map of all mining claims and leases in the area;
- a Consultation Plan;
- a tracking table summarizing how the MoE's comments on the June 30, 2016 draft LTWMP TAR were addressed by MPMC in the October 17, 2016 final LTWMP TAR;
- an open letter to the local communities from the Mount Polley Mine General Manager outlining the water management strategies envisioned for the Mount Polley Mine and summarizing the Application; and,
- the LTWMP TAR, dated October 17, 2016.

The CMDRC Chair was copied on the formal submission of the Application to the MoE.

A copy of the e-mail from MPMC notifying the MoE of the formal submission of the Application was forwarded to representatives of the Williams Lake Indian Band (WLIB) and Soda Creek Indian Band (SCIB; Xatśūll First Nation) on October 20, 2016 through the Mount Polley Mine Joint Implementation Committee.

The Mount Polley Mine Public Liaison Committee (PLC) was informed of the formal submission of the Application to the MoE by MPMC on October 20, 2016, via e-mail from MPMC.

Both the Joint Implementation Committee and the PLC, via their respective correspondence, were referred to the Imperial Metals Corporation (Imperial Metals) website for access to the Application and Supporting Materials.

Copies of a letter from the Mount Polley Mine General Manager outlining the water management strategies envisioned for the Mount Polley Mine and summarizing the Application were e-mailed on October 19, 2016 to: the City of Quesnel (Mayor and Council); the City of Williams Lake (Mayor and Council) and the Cariboo Regional District (Chief Administrative Officer). A copy of the respective letters is included in Appendix B.

The City of Quesnel, the City of Williams Lake, and the Cariboo Regional District, via their respective correspondence, were referred to the Imperial Metals website for access to the Application and Supporting Materials.

Supporting Materials were made available on the Imperials Metals website for access by the MoE, the Joint Implementation Committee, the PLC, City of Quesnel, the City of Williams Lake, the Cariboo Regional District and members of the general public (notification processes for the lattermost being as described in Section 2.2). The following Supporting Materials were

made available on the Imperial Metals website on October 20, 2016 and remained available in this location until January 19, 2017:

- an open letter to the local communities from the Mount Polley Mine General Manager outlining the water management strategies envisioned for the Mount Polley Mine and summarizing the Application;
- the EPN for the LTWMP;
- the LTWMP TAR (dated October 17, 2016); and,
- a series of technical posters summarizing key components of the LTWMP TAR used to support public meeting activities
    - Technical Assessment Report Overview
    - Options Analysis for Discharge Location
    - Water Balance and Water Quality Modelling
    - Impact Assessment for Operations
    - Water Treatment for Operations
    - Water Treatment for Closure
    - Long-Term Water Discharge Monitoring

MPMC notes that the online availability of these materials extended through the full duration of the public notification period, which expired on December 23, 2016.

The CMDRC Chair formally referred the Application to the CMDRC on December 7, 2016. The CMDRC were initially referred to the Imperial Metals website for access to the Application and Supporting Materials.

2.2 Notifications

An EPN under the *EMA* (the "Notice") was drafted by MPMC for the Application: a copy of the Notice is included in Appendix B.

As noted in Section 2.1, the Notice was made available on the Imperial Metals website, in support of the Application, on October 20, 2016. The Notice was published in: the Williams Lake Tribune (October 26, 2016); the Quesnel Cariboo Observer (October 26, 2016); and the BC Gazette (October 27, 2016). A copy of the Williams Lake Tribune posting, a copy of the Quesnel Cariboo Observer posting, and a copy of the BC Gazette posting are included in Appendix B.

Copies of the Notice were posted at: the Big Lake Store, Clarke's General Store (Horsefly), the Likely Post Office, and at the Mine. Photographs of the posting of the Notices are included in Appendix B.

As an additional initiative by MPMC, the open letter included in the Supporting Materials was published in: the Williams Lake Tribune (October 21, 2016) and the Quesnel Cariboo

Observer (October 26, 2016). A copy of the Williams Lake Tribune posting and a copy of the Quesnel Cariboo Observer posting are included in Appendix B.

2.3 Public Meetings

In addition to the referral and notifications as outlined above, consultation with the public was completed prior to and throughout the Application process. Table 2.3.1 provides a summary of the public meetings held as part of the formal public consultation process for the Application during the initially contemplated public consultation period (October 20, 2016 through December 23, 2016).

Table 2.3.1 Community Meeting Log

Date	Event	Location
October 26, 2016	Quesnel Community Meeting	Quesnel (Royal Canadian Legion)
October 27, 2016	Williams Lake Community Meeting	Williams Lake (Royal Canadian Legion)
October 28, 2016	Horsefly Community Meeting	Horsefly (Horsefly Community Hall)
October 29, 2016	Big Lake Community Meeting	Big Lake (Big Lake Community Hall)
October 30, 2016	Likely Community Meeting	Likely (Likely Community Hall)
November 14, 2016	First Nations Community Meeting	Sugarcane Reserve (WLIB Gymnasium)

Community Meetings have been held prior to and throughout the Application process, and notices are made through combinations of: publication in local newspapers; posting in public locations; distribution in hard copy to post office boxes and through e-mail mailing lists; and posting on the Imperial Metals website.

The Notice of Community Meeting (Williams Lake) is provided as an example in Appendix C; copies of the Notice of Community Meeting as published in the Williams Lake Tribune (October 21, 2016; October 26, 2016) and in the Quesnel Cariboo Observer (October 21, 2016) are included in Appendix C.

2.4 Public Comments Received

As detailed in the Notice, public comments were to be provided directly to MPMC (inquiries@imperialmetals.com), with a copy to the MoE (Director of Mining Operations Mount Polley, MtPolleyMinePermit@gov.bc.ca). The MoE Director indicated, in the MoE's formal referral of the Application for public comment, that comments on the Application could also be submitted directly to the MoE (MtPolleyEnvironmental.Enquiries@gov.bc.ca).

Comments received by the MoE and the MEM were compiled by the MoE and provided to MPMC on January 24, 2017 in the form of a summary table. The MoE summary table compiled 139 comments received by the MoE and the MEM. Original copies of the comments summarized in the MoE-provided table were not made available to MPMC. A copy of the table, modified for presentation purposes by MPMC, is included in Appendix D.

MPMC received 17 comments directly. Copies of comments received directly by MPMC are included in Appendix D, and are summarized in a table thereafter. Comments received directly by MPMC were screened for duplicates against the MoE-compiled comments: of the 17 additional comments received by MPMC, five (5) were submitted only to MPMC (i.e., twelve were identified as duplicates already captured in the MoE-compiled summary table).

Table 2.4.1 summarizes the location of the commenters for the 144 combined comments received (MoE-provided comments screened for duplicates against MPMC-received comments), as available based on information included in the comments received by MPMC or the summary table provided by the MoE.

Table 2.4.1 Unique Comments (by Location)

Location	Number
Canada	111
British Columbia (BC)	102
*Local**	*60*
Rest of BC	*42*
United States of America	8
Unspecified	25
Total Unique Submissions	**144**

* 150 Mile House, Big Lake, Horsefly, Likely, Morehead/Morehead Creek, Quesnel Lake, Quesnel, Williams Lake

Of the 144 combined comments, three (3) groups of 'form letter' comments were received, which have been denoted as Form A, Form B and Form C comments . Nine (9) comments were derived from Form A; four (4) comments were derived from Form B; and five (5) comments were derived from Form C. One (1) further comment was submitted under the CMDRC review process (and subsequently responded to as part of the CMDRC process), and two (2) comments were identical (duplicates).

Following this secondary screening, 127 unique comments were identified for review and response by MPMC.

2.5 Summary of Responses to Relevant Concerns

MPMC received a number of thoughtfully worded submissions from members of the public. All public comments received by MPMC were reviewed and the comments relevant to the permit fall into seven (7) main categories: TSF foundation failure – breach response and remediation; permitting/consultation; options analysis; Quesnel Lake; proposed effluent discharge limits; proposed treatment; and, miscellaneous.

2.5.1 TSF Foundation Failure – Breach Response and Remediation

Note: Several comments were received in regards to the TSF foundation failure and resulting breach impacts. MPMC notes that a separate regulatory process, invoked by the MoE's Pollution Abatement Order, has governed the breach response and remediation, not the discharge permit that is the subject of the present application. As MPMC have frequently communicated in public, a discharge permit would have been required regardless of whether or not the failure in the glaciolacustrine layer occurred. Similarly, the breach response activities would also occur regardless of the treated discharge options being sought.

- The damage from the tailings that were deposited on the bottom of Quesnel Lake is underestimated

3D models of the lake turbidity have been developed, and they predicted that the turbidity would decline and particles of sediment would not re-suspend off the bottom. All of MPMC's monitoring work has validated these predictions. Available evidence is consistent with expectations that tailings material is not re-suspending off the bottom of the deep parts of the lake, which is where the vast bulk of the tailings were deposited as a result of the TSF foundation failure.

MPMC are presently completing a risk assessment that will inform how residual sediments from the breach will ultimately be managed; this is planned to be submitted to the MoE in 2017.

- The impact (potential or realized) of the breach is yet to be fully understood, and work should not proceed until it is

The foundation failure of the TSF has been the subject of ongoing assessment since August 2014, with information provided in a range of deliverables, including a Post-Event Environmental Impact Assessment Report (PEEIAR) and Update, and a Human Health Risk Assessment and Ecological Risk Assessment (to be submitted to the MoE in 2017).

The LTWMP TAR focussed on assessment of the proposed discharge of treated effluent from the Mine for a defined operations period. The foundation failure of the TSF in 2014 was not the focus of this assessment.

- potential impacts, specifically on fish are not yet understood

The testing that MPMC did on fish eggs and alevins showed that even the water that flowed down the Quesnel River at the Quesnel River Research Centre (QRRC), when the turbidity from the tailings breach was at its highest in the winter of 2014/2015, did not have a negative effect on the early development stages for fish. This is related to the fact that the copper in the Mine tailings is hosted in minerals that are very stable and do not break down easily or dissolve in lake water.

The negative effect of copper on the sense of smell of fish is caused by dissolved (ionic) copper, not copper in particulates (solid mineral phases). Even then, its effects are ameliorated by binding with substances present in natural waters, such as organic carbon. The levels of dissolved copper in Quesnel Lake at Hazeltine Creek and in the discharge are below known thresholds for olfactory impacts on salmon. In fact, the measured dissolved copper in Quesnel Lake even in the months immediately after the breach did not approach levels where there has been a demonstrated effect on the sense of smell of fish.

- sediments deposited from the breach, specifically those in Quesnel Lake, are bioavailable

MPMC notes that the permit application is for the discharge of treated waters and not sediments.

SRK Consultants undertook an extensive geochemical testing program that evaluated whether tailings in sediments would leach metals under a variety of environmental conditions. They found that submerged tailings are stable and not expected to leach metals in bioavailable form. These geochemical predictions are supported by some of the early data coming in from MPMC breach response studies, which are part of the Ecological Risk Assessment. The report has not yet been prepared because some of the sample results have not yet come in. However, as noted, the breach response program is a separate regulatory initiative.

2.5.2 PERMITTING/CONSULTATION

- The mine was permitted under the pretense that water would never be discharged from the site

The Mine has a positive water balance, which means that there is more yearly rainfall at the site than there is evaporation. This water surplus was forecast before the Mine started operation, and, as discussed with our neighbouring communities during the original consultations that were carried out during the 1990s, was contemplated in the (subsequently approved) Environmental Assessment application. At that time, the discharge strategy contemplated in the Environmental Assessment was to settle the surplus water in settling (sedimentation) ponds and discharge to the local lakes and creeks near the Mine.

During the early development of many mines in BC, the mines do not discharge because they require water for their process early in the mine's life. As this initial need is met, most BC mines develop a positive water balance and must have a discharge under permit. The Mount Polley Mine is no different. In the original Environmental Assessment documentation, it is indicated that treatment of site contact water would be through a sediment pond prior to distributed discharge to local watersheds. As both technology and government expectations have evolved since that time, the current permit application is based on a higher level of treatment than initially was planned, but eventual discharge was a stated part of the mine plan.

MPMC retained a team of qualified professionals to review and modernize the previous plans and make sure that MPMC are applying best practices to manage surplus site water. This work is presented as the LTWMP TAR.

- No consultation has been completed with First Nations

*The Mine is in the traditional territory of the SCIB and the WLIB. MPMC has Participation Agreements in place with both First Nations and those agreements were the first to be completed by any mining company in **BC** at a brownfields site. MPMC regularly meets with the SCIB and WLIB through its Joint Implementation Committee, which is a platform for ongoing information sharing regarding the Mine and its activities. MPMC appreciates the strong relationship and partnerships between MPMC and the First Nation communities and appreciates their collaboration in the development of this LTWMP. Dialogue has been extensive and ongoing throughout.*

2.5.3 Options Analysis

- No alternatives to Quesnel Lake were considered

MPMC and their consultants evaluated over a dozen options to determine the best overall option that considers environmental, technological, social and economic factors. Of these options, three were considered viable.

1. *Distributed discharge to local waterbodies: This option is preferred, but not feasible during operations. MPMC is continuing to pursue this option so that it can be implemented in a phased approach or transition. The goal is to make that transition at closure of the Mine, though it may be sooner (or later) depending on the results of ongoing studies.*
2. *Discharge to Quesnel Lake*
3. *Discharge to Quesnel River*

Both of the latter two options are feasible, but the Quesnel Lake option was deemed better overall based on a comparison of nine of the twelve environmental, technological, social and economic factors. Please refer to LTWMP TAR Appendix G, Attachment 2. This table shows the details of the options analysis that was completed and the rankings for each of the options analyzed (including the Quesnel River option). Economic and environmental rankings are included.

The Options Analysis presented in the LTWMP TAR and the supplementary memorandum dated 20 January 2017, "Addendum to Mount Polley Mine Long Term TAR Options Analysis" (Golder; attached in Appendix E to this Report), followed extensive pre-application community, First Nations and regulatory consultation - this is a process that was maintained through the STWMP TAR development and continued between the implementation of the (current) STWMP and the development of the (proposed) LTWMP and associated TAR. MPMC are aware through that consultation that Quesnel River discharge, downstream of the community of Likely was that community's preferred option; however, that option is environmentally less favourable, as detailed in the LTWMP TAR and supplementary memorandum.

MPMC has accepted our consultants' recommendation that Quesnel Lake is the best receiving environment for treated effluent and that forms the basis of the present permit application. At the same time, MPMC are initiating a number of research projects, including designing pilot systems to test alternative discharge sites and treatment strategies on our consultants' recommendations. The main drivers for these projects and the basis for their recommendation are

environmental; however, they are also informed by input that MPMC have received from the WLIB and SCIB as well as local community members. MPMC are optimistic that we will be able to significantly reduce the amount of treated water that requires discharge into Quesnel Lake during the operating phase of the Mine and especially in the future.

- Quesnel Lake is being proposed as it is already impacted by the breach

The basis for selection of Quesnel Lake is provided in the LTWMP TAR, and detailed in the supplementary options evaluation memorandum (20 January 2017; Golder). None of the criteria used to inform selection are related to the breach. As noted above, the breach is part of a separate regulatory program from the permit, which would be required regardless of the breach.

  - baseline comparisons in Quesnel Lake are to post-breach water quality

    Baseline water quality time periods and locations were defined in Section 3.4 of the LTWMP TAR using the reference condition approach. Baseline data for Quesnel Lake were derived from measurements collected east of Cariboo Sill, so they do not include the influence of the foundation failure of the TSF or the existing discharge.

- Quesnel Lake is being proposed as it is the cheapest option

Of the five options evaluated in the Options Analysis (LTWMP TAR Appendix G), the Quesnel Lake option was the second most expensive. The Quesnel Lake option is objectively not the "cheapest" nor "easiest" option. It is, however, the most appropriate option for a number of reasons articulated in the Options Analysis in the LTWMP TAR. Cost was not a primary determinant of the option selected.

Additionally, the sensitivity analysis included in the 20 January 2017 supplementary memorandum showed that Quesnel Lake option was superior to the Quesnel River option even if all sub-criteria under Environmental, Technological, Social, or Economic pillars are discounted independently (i.e., one at a time).

- Why not Quesnel River rather than Quesnel Lake?

The Options Analysis reflects the version that was sent to multiple parties, including government, First Nations and local community representatives in May 2016. Following receipt of feedback at that time, the Options Analysis was

finalized. As shown in the Options Analysis and a supplementary memorandum dated 20 January 2017, the Quesnel Lake option was shown to be superior to the Quesnel River option in nine of twelve criteria.

The Options Analysis in Appendix G of the LTWMP TAR has weighed Science, Technology, Social Responsibility and Technology evenly. The Quesnel River option does not meet the requirements as detailed in the Options Analysis and as further detailed at the 15 December 2016 Cariboo Mine Development Review Committee meeting. At that meeting, a number of additional consequences and risk factors associated with the Quesnel River option were also highlighted and an analysis was provided of the constraints to primary objective – water management – were also detailed.

An additional significant factor that influenced this analysis is that Quesnel River is important habitat for rainbow trout, salmon and other fish species, and much of this reach of river is spawning habitat. In contrast, the diffusers in Quesnel Lake are very deep where fish do not spend a lot of time and do not spawn. The other main factor is that Quesnel River is a variable flow system whereas Quesnel Lake is not subject to variations in flow. This makes dispersal of the plume in the lake more reliable and predictable than in the river. The physical stability of the diffuser is also a consideration – the installation in Quesnel Lake is very deep, compared to in Quesnel River where it could be an obstacle to river users during low flow and it could get damaged by ice or other debris in this high-energy river. Additional factors are discussed in Appendix G of the LTWMP TAR.

The Options Analysis clearly reflects that the input from local stakeholders who have expressed a strong preference to have the discharge located downstream of where they live.

Additionally, the 20 January 2017 sensitivity analysis showed that Quesnel Lake option was superior to the Quesnel River option even if all sub-criteria under Environmental, Technological, Social, or Economic pillars are discounted independently (i.e., one at a time). The Quesnel River option is only deemed preferable if social preferences are considered at the exclusion of other considerations, including environmental factors.

2.5.4 QUESNEL LAKE

- There is not adequate baseline data for Quesnel Lake

Various time periods were used based on the available information and what has occurred in each area contemplated in the LTWMP TAR. There were insufficient pre-Mine or pre-breach water quality data for Quesnel Lake to define baseline conditions for those periods, as documented in the PEEIAR and described in the 2015 STWMP TAR. Therefore, current water quality data from outside the West Basin, which represents reference locations not influenced by the breach or the existing discharge, were used to define baseline.

- The modelling for the mixing of water in Quesnel Lake is not well understood or reliable

The results of the Cormix (nearfield mixing) model (Appendix H to the LTWMP TAR) indicated the diffusers in Quesnel Lake can be configured to attain more than 40 times dilution. A far field hydrodynamic model (Appendix J of the LTWMP TAR), accounting for stratification and seiching in Quesnel Lake also demonstrated a similar dilution factor could be achieved. Monitoring since 1 December 2015 (commencement of effluent discharge under EMA Permit 11678 for the STWMP) has confirmed that these predictions are both reliable and conservative.

A memorandum dated 25 November 2016, "Analysis of Observed Dilution in Quesnel Lake, Mount Polley Mine, BC" (Golder; attached in Appendix E to this Report), describes the verification of the near-field dispersion model.
The Quesnel Lake hydrodynamic model (LTWMP TAR Appendix J) accounts for the limnological characteristics of Quesnel Lake mechanistically. The model shows that concentrations of treated effluent constituents will not accumulate in Quesnel Lake to levels exceeding BC WQGs. The level of assessment in the LTWMP TAR, which includes this three-dimensional hydrodynamic model projecting several years into the future is a level of enhanced evaluation that is uncommon for discharge permitting studies but adds considerable confidence to the predictions that water uses will not be harmed.

- There has been a change in the colour of Quesnel Lake

MPMC are aware of reports from residents and has expended considerable efforts in pursuit of these reports. A technical memorandum, dated 9 February 2017,

"Quesnel Lake Water Colour" (Golder; attached in Appendix E to this Report), addresses Quesnel Lake colour.

- The discharge will re-suspend sediments from the bottom of Quesnel Lake

Resuspension of sediment was not pertinent to the development of the permit limits proposed in the LTWMP TAR because the diffusers were configured to preclude disrupting sediment resuspension and because total suspended solid (TSS) measurements have been consistently close to or below detection at monitoring point QUL-58 since discharge began on 1 December 2016 under the STWMP.

The permit limits proposed in the LTWMP TAR were designed to be protective of the water uses in Quesnel Lake including designing an outlet system that will not disturb sediments in Quesnel Lake. The hydrodynamic model (Appendix J of the LTWMP TAR) accounts for seiching, residence times and overturning. Therefore, influences of these processes on the dilution factor used to propose effluent permit limits have been accounted for in the model.

2.5.5 Proposed Effluent Discharge Limits

- Proposed effluent limits are greater than those currently authorized in the STWMP

The Mine has been discharging treated water into Quesnel Lake since 1 December 2015 under the STWMP. This water has been discharged into the constructed Hazeltine Channel, and carried to sedimentation ponds near Quesnel Lake, from where it flows into two buried pipes and is discharged (via diffusers) into the lake at depth.

The current EMA Permit 11678 limits were derived under the assumption that all water to be discharged would be passed through the Springer Pit, which reduces peak concentrations of all constituents and removes nearly all particulate metals and TSS. This will not be the case for the remainder of operations, nor for closure. The Springer Pit will soon be drawn down entirely and the discharge will be subject to more variability, which means occasionally higher concentrations. Hence, proposed limits in the LTWMP TAR are necessarily higher.

The Mine is also applying for higher rates of discharge for limited periods of time to be better able to manage periods of high flow (for example at spring freshet), and for higher limits for some of the elements in the discharge, to allow for some variability in flows and composition of site water. However, even with these new

permit limits, the water quality in the treated discharge will continue to be of a high quality, and the EMA Permit 11678 limits proposed in the LTWMP TAR that apply at the end-of-pipe result in concentrations at the edge of the IDZ that meet or are lower than chronic BC WQGs and will not result in acute toxicity at the end-of-pipe. Both the current and the proposed EMA Permit 11678 limits are protective of water uses in Quesnel Lake, including the protection of aquatic life and drinking water.

- The proposed discharge is toxic and/or tailings

Regular toxicity testing of the discharge since December 1, 2015 has confirmed that the water being discharged is not toxic. Discharge of toxic water is prohibited by both the federal Fisheries Act and the provincial EMA.

The Mount Polley Mine will not discharge any solid tailings or tailings slurry as part of the effluent discharge to Quesnel Lake. At no time has this been contemplated or proposed.

- The proposed discharge will cause pollution

The derivation of effluent permit limits proposed in the LTWMP TAR was based on the protection goal of attainment of BC WQGs at edge of IDZ and non-toxic at end-of-pipe. The effluent permit limits proposed in the LTWMP TAR provide enforceable limits that are protective of the environment and do not cause pollution (as per the EMA definition of pollution: "the presence in the environment of substances or contaminants that substantially alter or impair the usefulness of the environment").

- The proposed discharge will contain deleterious materials

As described in Section 2.4 of the LTWMP TAR, deleterious substances are defined in the Metal Mining Effluent Regulation which defines "deleterious" in the context of metal mines (this includes the Mount Polley Mine). All constituent concentrations in the Mine effluent are below Metal Mining Effluent Regulation Schedule 4 limits, and the effluent is non-toxic as predicted by chemical concentrations and confirmed by whole effluent toxicity testing. Therefore, the discharge is not "deleterious".

- Dilution is not an acceptable solution

Water quality guidelines for designated uses are specifically developed to be applied to the receiving water, outside of the IDZ which is located in the immediate area of the point of discharge. They do not apply to the point of discharge (end-of-pipe in the case of the LTWMP TAR) because the pipes are not a habitat. However, dilution is not the solution that MPMC have relied upon. MPMC have applied the MoE's Best Achievable Technology (BAT) policy. The BAT policy puts requirements on dischargers for treating effluents to a high standard and does not rely on dilution alone to mitigate potential impacts. IDZs are typically only allowed when BAT has been applied. The mixing zone concept recognizes that dilution is a normal physical process and the IDZ is a small area in which mixing occurs. A person applying for a discharge permit must demonstrate that their discharge will not cause "pollution" as defined in the EMA. The simplest application of this definition is to confirm that concentrations are lower than the applicable water quality guideline. In the assessment carried out for the Mine (the TAR), water quality guidelines, for all water uses, are met.

- Discharge should meet aquatic guidelines before dilution

As discussed in Section 6.3.1.3. of the TAR, WQGs are not intended to be applied to effluents, nor were they developed with that as their intended use. BC WQGs apply at the edge of the IDZ.

BC's WQGs represent safe levels of substances that protect different water uses, including: drinking water, recreation, aquatic life, wildlife and agriculture. The assessment used chronic BC WQGs protective of the most sensitive water use, typically the protection of aquatic life. The aquatic life guidelines used are protective of the most sensitive species and life stage indefinitely. Therefore, in the assessment, constituents were not identified to be of concern if predicted concentrations were below these safe levels that indicated adverse effects and impairment of water uses would not be expected to occur. This is a standard approach to assessing discharges within BC and elsewhere.

This topic was discussed at several community meetings throughout the development and review processes for both the STWMP and LTWMP. BC WQGs provide policy direction to those making decisions affecting water quality. They are conservative (cautionary) in nature. Provincial policy allows the derivation of higher benchmarks on a site-specific basis, supported by scientific rationale; however, the treated discharge for the Mine is of sufficient quality that generic BC

WQGs can be used in the assessments, notwithstanding the built-in conservatisms of the guidelines. By meeting BC WQGs, environmental and human uses of water are protected, with confidence. For these reasons, BC WQGs provide a cautionary and broadly accepted basis for the Effects Assessment and Water Management Plan in the LTWMP TAR. The MPMC application of water quality guidelines is correct in science, policy and (conservatively) law.

- Water needs to be as good or better than receiving environment prior to discharge

There is no scientific basis for the comparison between effluent limits and lake concentrations. This assertion is not consistent with a scientifically-based evaluation, nor is it consistent with provincial policy respecting discharge permits. Constituent concentrations have been modelled and measured to meet BC WQGs, meaning that all water uses are protected in Quesnel Lake.

- Monitoring of the proposed discharge is important

MPMC has proposed monitoring for the LTWMP TAR be incorporated into the Comprehensive Environmental Monitoring Program.

2.5.6 Proposed Treatment

- Reverse Osmosis was previously contemplated, why isn't it being used now?

Reverse osmosis is not a suitable technology for long-term water management because approximately 40% of the water treated is reject water. That amount can be reduced somewhat at the expense of greater energy use but it still results in an accumulation of large amounts of reject water that is of a worse quality than the original mine contact water and needs to be stored, which is not considered a best practice. Reverse osmosis is not considered a BAT for the Mine and would result in greater water management problems (quantity and quality) within a few years of operation. It would also require storage of large volumes of water, which is not a recommended practice.

MPMC notes that the reverse osmosis plant previously contemplated for use at the Mine was part of an interim water management plan then proposed, and that MPMC purchased this plant in advance of receiving such authorization to discharge. MPMC purchased an additional WTP as part of the STWMP, as this alternative treatment system was selected through the BAT process.

- Untreated water has been, and is proposed to be, discharged from the site to Quesnel Lake

Only water that contains constituent concentrations below the approved limits in EMA Permit 11678 (present or future) can be discharged using the passive treatment (or any) process. According to all the existing permits and regulations, and to the permit amendment that the Mine has requested as part of the LTWMP, MPMC will not be releasing untreated Mine site water to Quesnel Lake.

In 2015, MPMC applied to the MoE for a "bypass" of the WTP in case of high water flows. The original bypass authorization was intended to expedite drawing down the water levels in the Springer Pit with the objective of minimizing the volume of water stored on site. This bypass however, would only allow the Mine to bypass the WTP if the water to be bypassed met the permit limits that applied to water that had been treated. Unfortunately, there was considerable misinformation surrounding the use of this bypass authorization (which was granted); however, the Mine never had to use this bypass, so no untreated water (effluent) was released.

There are three modes of operation for the WTP. 1) active mode, in which reagents are added to the water and mechanical mixing is active. 2) passive mode, in which the chemical dosing systems and mechanical mixing are offline (not active). This mode is in operation when the influent water coming to the WTP meets the discharge criteria without the need for active treatment. 3) proposed modified active mode. In addition to the features provided for the active mode, the modified active mode would allow for more chemicals (higher PAC dosage) or other chemicals (e.g., trimercaptotriazine) to be added to the water to further reduce copper concentration in the influent water during freshet. Both the active and passive modes include passing of the waters through the WTP, including the lamella, and rely on continuous water quality monitoring (which is done with the turbidity meters installed in the inlet piping and clarifier).

The WTP has successfully operated in passive mode, notably between May 2016 and January 2017, which allowed MPMC to discharge surplus water from the site at the authorized flow rate while meeting EMA Permit 11678 water quality limits. However, the WTP only operated in passive mode when treatment (i.e., reduction in constituent concentrations to acceptable levels) had already been provided by the Springer Pit. The Springer Pit has effectively treated the water by removing particulate metals to below EMA Permit 11678 limits. In the absence of this pre-

treatment, the WTP would be operated in active mode, as is the status of the water management strategy at the time of the writing of this Report.

Bypass is not the same as passive mode; it refers to bypass of the WTP. No application is being made to entirely bypass the WTP given appropriate water quality. MPMC will be trialing passive treatment options and these may provide water that is suitable for discharge without further treatment in the WTP.

- Proposed plan does not discuss what happens post-closure

The main purpose of the LTWMP TAR is to propose effluent limits for the remaining years of Mine operations. As described in Section 1.0 of the LTWMP TAR, closure water quality predictions were provided so that the proposed water management plan was adaptable to closure and to inform the design of the passive treatment system at a conceptual level. Closure/post-closure effluent limits are not proposed as part of the LTWMP TAR and are more appropriately defined as the Mine approaches the closure stage. With regards to closure, this is part of a process covered in the Reclamation and Closure Plan (RCP).

As presented in the Section 5.2.3 of the LTWMP TAR, "the objective of the RCP is to return the areas of mining disturbance to equal or better land capability than which existed prior to the mine being developed." This includes reclaiming Mine site facilities (e.g., waste rock dumps) and returning site drainages back to their natural watersheds, to the maximum extent possible. Water quality monitoring and water quality modelling predictions indicate that several drainages may require treatment at closure. MPMC plan to treat these drainages using passive water treatment systems; however, prior to implementing these systems, they need to be designed, piloted and proven to be a feasible solution to treat water in perpetuity. If the technology cannot be proven prior to closure, additional study will be required to design a sustainable passive treatment system that can achieve the objectives of the RCP.

- Passive treatment work and distributed discharge should be pursued; why hasn't work started on this already?

Work on passive treatment and distributed discharge is already underway, and has been since the late 2000s, notably as part of a partnership with the University of British Columbia and other members of the mining industry.

As discussed in Sections 5.5.3 and 6.4 of the LTWMP TAR, only operations phase discharges are part of the present application for an amendment to EMA Permit 11678; however, closure and post-closure discharge water qualities were developed to inform the development of the LTWMP (e.g., inform the piloting of passive/semi-passive treatment designs). This conceptual information presented in the TAR has since been superseded by information provided in the RCP Update January 2017 (Mines Act Permit M-200).

MPMC is working to develop a Work Plan for continuing passive water treatment research, specifically highlighting the completed and ongoing work with Golder and Contango. This work was advanced (relative to the information contained in the Annual Environmental and Reclamation Reports and the LTWMP TAR) in the 15 January 2017 update to the RCP. There is currently lots of interesting research underway and MPMC are planning additional work; the Work Plan is anticipated to be submitted to the MoE following a decision on the LTWMP amendment application.

- Dilution is being proposed instead of the Best Available Technology

The MoE BAT policy was followed in the identification of appropriate-to-site treatment at source. Dilution is an inevitable physical process that occurs and consistent with BC environmental policy, a small zone is defined for this physical process to take place and to identify whether or not the WQG are met after that initial dilution in the near-field. This is the appropriate application of WQG.

- No change in treatment is being proposed, how is this Best Available Technology?

Attachment B of Appendix E (Proposed Water Treatment Plan for Operations Phase Water Management) of the LTWMP TAR refers to BAT assessment that was prepared for the STWMP, indicating that the BAT assessment was conducted, leading to the installation of the Actiflo system for the restricted operations phase. The same rationale used in the selection of the Actiflo system for the restricted operations applies for the operations phase, which includes a modification to the system to improve the performance of the Actiflo system (specifically for additional copper treatment).

Notwithstanding this BAT assessment, MPMC have been actively pursuing additional options to further improve our water management in a manner that our consultants have recommended as part of continual improvements. These

improvements also take into account what MPMC and our consultants have heard from First Nations and the local community with regards to their desired treatment and discharge options. These methods are not proposed because there are a variety of technological and design parameter uncertainties that MPMC are working to resolve but must resolve before we can commit to a specific method.

- The water treatment plant installed hasn't been able to treat the 0.33m^3/s proposed, how is this reliable?

The water balance and receiving water quality results are based on an assumed maximum discharge rate of 0.33 m^3/s (after 1 July 2016). The nominal design capacity of the WTP is 0.23 m^3/s. At the time the water balance model for the LTWMP TAR was developed, the WTP was still being commissioned, and the actual treatment capacity had yet to be determined (initially the WTP was operating below the nominal design capacity).

Since that time, the WTP has been operated for extended periods in "passive mode" at a rate of 0.3 m^3/s, which is the maximum allowable under current EMA Permit 11678 conditions. The maximum treatment capacity in "passive mode" is likely to be higher than 0.3 m^3/s, but cannot be verified at this time due to such verification requiring use of the discharge infrastructure to the Hazeltine Channel (which is not authorized under the existing EMA Permit 11678 conditions).

In "active mode", the WTP has been operated at a maximum of approximately 0.28 m^3/s, but it is noted that commissioning is ongoing following the return to active mode from passive mode in January 2017, and that the maximum discharge rate cannot be verified at this time due to such verification requiring use of the discharge infrastructure to the Hazeltine Channel (which is not authorized under the existing EMA Permit 11678 conditions).

Moving forward, MPMC will be trialling passive treatment options, and effluent from the passive cells may be suitable to bypass the WTP (as it will be treated passively) and 'make up' or displace a portion of the waters discharged through the WTP.

As part of the RCP, MPMC intends on diverting site water and treating it at source with a target of distributed discharge (i.e., not all flow would report to the WTP as it would be treated, as required, by independent systems). This would further reduce the average annual discharge required to be directed to the WTP. MPMC will be pursuing pilot passive/semi-passive system(s), and if successful, these could be used

to treat water during operations (in advance of targeted use in closure and post-closure). While the proving of passive/semi-passive treatment systems is occurring, treated water would be discharged to Quesnel Lake via the WTP, operating at or below the design WTP capacity of the currently installed system.

2.5.7 MISCELLANEOUS

- Precautionary Principle

Reference was made to the Canadian Environmental Assessment Act which references (without defining) the precautionary principle. In that Act (which is not part of the present process) reference to "precautionary" in implementation of decisions are that decisions should be made in a precautionary manner (S.4(1)(b,g)).

The United Nations defines the precautionary principle as "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation". This same definition also occurs in other federal statutes, such as the Canadian Environmental Protection Act.

MPMC notes that the evaluation of the effluent permit has proceeded in a precautionary manner, even though the precautionary principle does not apply to EMA. Conservative assumptions have been made in the LTWMP TAR, uncertainty has been evaluated and cautionary benchmarks have formed the basis of the effects assessment. MPMC further note that this discharge has been in place since 1 December 2015, and considerable source and receiving water monitoring has taken place. In the context of the detailed technical evaluation that has been done to support the discharge permit as well as monitoring of actual discharge, there is neither a threat of serious or irreversible damage because BC WQGs will be met. There is considerable information available to provide confidence, even on a prima facie basis, that the water uses of Quesnel Lake will not be harmed. In this context, the prerequisite for application of the Precautionary Principal (i.e.,"…where there are threats of serious or irreversible damage…") is not met because the specific characteristics of the discharge scenario and water being discharged meet cautionary benchmarks. Moreover, a detailed evaluation of uncertainty has been provided in the LTWMP TAR as part of the evaluation.

3.0 JOINT IMPLEMENTATION COMMITTEE

One (1) Joint Implementation Committee meeting between the SCIB, WLIB and MPMC was held on November 9, 2016, within the initially contemplated public notification period. During the meeting, updates were provided by MPMC on, among other things: site operations and conditions; the STWMP and associated monitoring; and the LTWMP and associated planning, works, and permitting.

4.0 PLC

One (1) regularly scheduled PLC meeting was held on November 17, 2016, within the initially contemplated public notification period. During the meeting, updates were provided by MPMC on, among other things: site operations and conditions; the STWMP and associated monitoring; and the LTWMP and associated planning, works, and permitting.

An extraordinary meeting of the PLC was held on October 26, 2016, within the initially contemplated public notification period. This October 26, 2016 extraordinary meeting was specifically convened regarding the Application, and included, among other things: an overview of historic site water management within the context of the LTWMP; a description of the Application and anticipated review process; and, an overview of the information in the LTWMP TAR.

5.0 CMDRC

Review of the Application through the CMDRC was not originally contemplated by MPMC in the Consultation Plan; however, the MoE Director indicated in the MoE's formal referral of the Application for public comment that the Application would be subject to technical review by the CMDRC.

This Report does not include documentation of consultation completed as part of the CMDRC review of the Application, which has been submitted separately to the MoE in the document, *Mine Development Review Committee Comment Tracking: Mount Polley Mine Long-term Water Management Plan Technical Assessment Report*, dated February 9, 2017.

6.0 OTHER CONSULTATION ACTIVITIES

As is noted in the Consultation Plan and in this Report, and has been acknowledged by regulators, the public, First Nations, government and stakeholders, consultation on the Application has been conducted by MPMC prior to, during, and after the formal public notice period for the Application.

This Report does not exhaustively document consultation completed outside of the formal requirements of the MoE; however, such consultation activities will be more fulsomely summarized in a separate information sharing summary.

7.0 CLOSURE

This Report is provided by MPMC as per the requirements of the MoE to summarize the manner in which MPMC formally advised the local public of the proposed changes under the Application, enabled the public to comment, and, by means of this Report, provided response to any questions related to the Application that arose during the public review period. We trust that this document provides sufficient information for your present needs.

APPENDIX A

CONSULTATION PLAN

Mount Polley Mining Corporation
an Imperial Metals company
Box 12 • Likely, BC V0L 1N0 • T 250.790.2215 • F 250.790.2613

CONSULTATION PLAN FOR THE *ENVIRONMENTAL MANAGEMENT ACT* PERMIT 11678 AMENDMENT APPLICATION FOR WATER DISCHARGE

October 20, 2016

IMPORTANT NOTE

It should be noted that the consultation process is a complex and unique process for each of the identified referral groups, and that the issuing of the Environmental Protection Notice will not be the initial consultation activity for many of these groups. This Consultation Plan was developed based on the Ministry of Environment's Guidance Document that outlines the recommended activities for applicants to take prior to submitting a permit amendment application and in no way summarizes Mount Polley Mining Corporation's consultation activities in regards to the discharge permit amendment application. The final Consultation Report will detail the consultation activities in their entirety.

1 INTRODUCTION

Mount Polley Mining Corporation (MPMC) will be applying for an amendment to their *Environmental Management Act* (*EMA*) Permit 11678 to allow implementation of water discharge for the Mount Polley Mine. Effective consultation is an integral part of the amendment application process and, as such, has been initiated in advance of submitting the formal amendment application to provide opportunity for concerns and issues to be identified and addressed.

This Consultation Plan focuses on consultation with First Nations, government agencies, the public, municipalities, and stakeholders through: publication of an Environmental Protection Notice (EPN), publication of technical information supporting the amendment application, an open letter to the local communities, the Mount Polley Mine Public Liaison Committee (PLC) and public meetings.

2 REFERRALS

Mount Polley Mine and the proposed water discharge is located: within the traditional use area of two (2) First Nations; within the Cariboo Regional District; near to the communities of Likely, Horsefly and Big Lake; near the municipality of Williams Lake; and, in general proximity to the municipality of Quesnel. The following lists outline First Nations, government agencies, and public stakeholders that will be consulted.

<u>First Nations:</u>

- T'exelc First Nation (Williams Lake Indian Band)
- Xats'ull First Nation (Soda Creek Indian Band)

<u>Government Agencies:</u>

- BC Ministry of Environment (MoE)
- BC Ministry of Forest, Lands and Natural Resource Operations (MFLNRO)
- BC Ministry of Energy and Mines (MEM)
- BC Ministry of Aboriginal Relations and Reconciliation (MARR)
- BC Ministry of Agriculture (AGRI)
- Fisheries and Oceans Canada (DFO)
- Ministry of Transportation and Infrastructure (MoTI)
- Cariboo Regional District
- City of Quesnel
- City of Williams Lake

<u>Communities and Municipalities:</u>

- Big Lake
- Horsefly
- Likely
- Quesnel
- Williams Lake

3 CONSULTATION ACTIVITIES

3.1 Environmental Protection Notice

The EPN will be published and posted as follows and will meet the specifications outlined in the Public Notification Regulation under the *BC Environmental Management Act*.

Newspapers

- BC Gazette Part 1
- Williams Lake Tribune
- Quesnel Lake Observer

Hard Copy Postings

- Big Lake Store
- Clarke's General Store (Horsefly)
- Likely Post Office
- Mount Polley Mine site (billboard size)

Online

- On the Imperial Metals website

The public consultation period will run for 30 days following the last date of publication or posting (anticipated to be October 28, 2016). Any questions, comments or concerns raised will be documented and formally addressed as outlined in Section 4.

3.2 Supporting Technical Information

A copy of the Technical Assessment Report (TAR) supporting the *EMA* Permit 11678 amendment application will be voluntarily hosted online through the Imperial Metals website (https://www.imperialmetals.com/our-operations-and-projects/operations/mount-polley-mine/long-term-water-management-plan-application) during the 30-day consultation period. Additionally, a series of technical posters summarizing key components of the TAR, used to support the public meeting activities listed below, will also voluntarily be made available online during the 30-day consultation period.

3.3 Open Letter to the Local Communities

An open letter from the Mount Polley Mine General Manager to local communities outlining the water management strategies envisioned for the Mount Polley Mine and summarizing the *EMA* Permit 11678 amendment application will be circulated by e-mail, mail out, and posted in local newspapers. A copy of this letter will also be made available online through the Imperial Metals website.

3.4 Public Meetings

The following meetings are to be scheduled by MPMC during the 30-day consultation period following the last date of publication of the EPN:

- Big Lake – General Public
- Horsefly – General Public
- Likely – General Public
- Quesnel – General Public
- Williams Lake – General Public
- Williams Lake – Williams Lake Indian Band and Soda Creek Indian Band

3.5 Implementation Committee Meetings

During the 30-day consultation period, a minimum of one (1) Implementation Committee meeting will be held, including representatives of MPMC, the Williams Lake Indian Band and the Soda Creek Indian Band (Xatśūll First Nation).

3.6 Public Liaison Committee

During the 30-day consultation period, a minimum of one (1) Public Liaison Committee Meeting will be held. The PLC will serve as the venue for coordinating technical and regulatory (outside of the MoE) review on the *EMA* Permit 11678 amendment application, and responding to resulting questions and comments. All First Nations and government agencies (save for the municipality of Quesnel) listed in Section 2, as well as representation from the communities of Big Lake, Horsefly and Likely are members of the PLC. Through the PLC process, members may submit verbal and formal written questions and comments, to which MPMC will respond through presentations and formal response documents.

4 CONSULTATION REPORT

MPMC will document activities and submit a final Consultation Report to the MoE upon the conclusion of consultation for the water discharge permit amendment application. This Consultation Report will include a summary of consultation activities conducted as well as present questions and comments raised during such activities and corresponding responses provided by MPMC.

APPENDIX B

REFERRALS AND NOTIFICATIONS

APPENDIX B1

REFERRAL LETTERS TO CITY OF QUESNEL, CITY OF WILLIAMS LAKE, AND CARIBOO REGIONAL DISTRICT

MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION

October 19, 2016

City of Quesnel
410 Kinchant Street
Quesnel BC V2J 7J5
Email: cityhall@quesnel.ca

Dear City of Quesnel Mayor and Council,

The Mount Polley Mine has a positive water balance, which means that there is more yearly rainfall at the site than there is evaporation. This water surplus was forecast before the mine started operation and was discussed with our neighbouring communities during the original consultations that were carried out, along with the Environmental Assessment process, during the 1990s. At that time, the authorized plan was to settle the surplus water in sedimentation ponds and discharge to the local lakes and creeks near the mine.

Mount Polley recently retained a team of qualified environmental professionals to review and modernize the previous plans and make sure that we are applying best practices to manage surplus site water. This work resulted in a detailed Technical Assessment Report which will shortly be posted on the Imperial Metals website (https://www.imperialmetals.com/our-operations-and-projects/operations/mount-polley-mine/long-term-water-management-plan-application).

Mount Polley is now in the process of applying to the Ministry of the Environment for a permit amendment for our water discharge and we will be holding a series of public meetings as part of the public consultation process for this permit amendment application. We would like to take this opportunity to formally invite the Quesnel Mayor or members of the Quesnel Council to attend any or all of the following public meetings:

- Wednesday, October 26, 2016: 7 to 9 pm, Quesnel Royal Canadian Legion
- Thursday, October 27, 2016: 7 to 9 pm, Williams Lake Royal Canadian Legion
- Friday, October 28, 2016: 7 to 9 pm, Horsefly Community Hall
- Saturday, October 29, 2016: 3 to 5 pm, Big Lake Community Hall
- Sunday, October 30, 2016: 3 to 5 pm, Likely Community Hall

Meetings with our First Nations partners are in the process of being scheduled.

For more information, please do not hesitate to contact me at (250) 790-2600 or dreimer@mountpolley.com

Yours sincerely,

Dale Reimer
General Manager, Mount Polley Mine

cc. Hubert Bunce, Ministry of Environment

MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION

October 19, 2016

The City of Williams Lake
450 Mart Street
Williams Lake BC V2G 1N3

Dear City of Williams Lake Mayor and Council,

The Mount Polley Mine has a positive water balance, which means that there is more yearly rainfall at the site than there is evaporation. This water surplus was forecast before the mine started operation and was discussed with our neighbouring communities during the original consultations that were carried out, along with the Environmental Assessment process, during the 1990s. At that time, the authorized plan was to settle the surplus water in sedimentation ponds and discharge to the local lakes and creeks near the mine.

Mount Polley recently retained a team of qualified environmental professionals to review and modernize the previous plans and make sure that we are applying best practices to manage surplus site water. This work resulted in a detailed Technical Assessment Report which will shortly be posted on the Imperial Metals website (https://www.imperialmetals.com/our-operations-and-projects/operations/mount-polley-mine/long-term-water-management-plan-application).

Mount Polley is now in the process of applying to the Ministry of the Environment for a permit amendment for our water discharge and we will be holding a series of public meetings as part of the public consultation process for this permit amendment application. We would like to take this opportunity to formally invite the Williams Lake Mayor or members of the Williams Lake Council to attend any or all of the following public meetings:

- Wednesday, October 26, 2016: 7 to 9 pm, Quesnel Royal Canadian Legion
- Thursday, October 27, 2016: 7 to 9 pm, Williams Lake Royal Canadian Legion
- Friday, October 28, 2016: 7 to 9 pm, Horsefly Community Hall
- Saturday, October 29, 2016: 3 to 5 pm, Big Lake Community Hall
- Sunday, October 30, 2016: 3 to 5 pm, Likely Community Hall

Meetings with our First Nations partners are in the process of being scheduled.

For more information, please do not hesitate to contact me at (250) 790-2600 or dreimer@mountpolley.com

Yours sincerely,

Dale Reimer
General Manager, Mount Polley Mine

cc. Hubert Bunce, Ministry of Environment

MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION

Board of Directors
Cariboo Regional District
C/O Janis Bell, Chief Administrative Officer
Email: jbell@cariboord.ca

Dear Ms. Bell,

The Mount Polley Mine has a positive water balance, which means that there is more yearly rainfall at the site than there is evaporation. This water surplus was forecast before the mine started operation and was discussed with our neighbouring communities during the original consultations that were carried out, along with the Environmental Assessment process, during the 1990s. At that time, the authorized plan was to settle the surplus water in sedimentation ponds and discharge to the local lakes and creeks near the mine.

Mount Polley recently retained a team of qualified environmental professionals to review and modernize the previous plans and make sure that we are applying best practices to manage surplus site water. This work resulted in a detailed Technical Assessment Report which will shortly be posted on the Imperial Metals website (https://www.imperialmetals.com/our-operations-and-projects/operations/mount-polley-mine/long-term-water-management-plan-application).

Mount Polley is now in the process of applying to the Ministry of the Environment for a permit amendment for our water discharge and we will be holding a series of public meetings as part of the public consultation process for this permit amendment application. We would like to take this opportunity to formally invite the members of the Cariboo Regional District to attend any or all of the following public meetings:

- Wednesday, October 26, 2016: 7 to 9 pm, Quesnel Royal Canadian Legion
- Thursday, October 27, 2016: 7 to 9 pm, Williams Lake Royal Canadian Legion
- Friday, October 28, 2016: 7 to 9 pm, Horsefly Community Hall
- Saturday, October 29, 2016: 3 to 5 pm, Big Lake Community Hall
- Sunday, October 30, 2016: 3 to 5 pm, Likely Community Hall

Meetings with our First Nations partners are in the process of being scheduled.

For more information, please do not hesitate to contact me at (250) 790-2600 or dreimer@mountpolley.com

Yours sincerely,

Dale Reimer
General Manager, Mount Polley Mine

cc. Hubert Bunce, Ministry of Environment

APPENDIX B2

ENVIRONMENTAL PROTECTION NOTICE

ENVIRONMENTAL PROTECTION NOTICE

Application for a Permit Amendment under The Provisions of the *Environmental Management Act*

We, Mount Polley Mining Corporation, 200 – 580 Hornby St., Vancouver, BC, V6C 3B6, intend to submit this amendment application to the Director to amend Permit 11678, issued May 30, 1997 and last amended September 19, 2016, which authorizes the discharge of effluent from a copper-gold mine and mill.

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Date: October 20, 2016

Mount Polley Mining Corporation Contact Number: 250-790-2215

Table 1: British Columbia Water Quality guidelines that the treated water will meet at the edge of the initial dilution zone in the receiving environment.

Parameter	Units	Maximum BC Water Quality Guidelines			Chronic BC Water Quality Guidelines	
		Aquatic Life	Drinking Water	Wildlife Water	Aquatic Life	Wildlife Water
Physical Parameters						
Dissolved Oxygen	mg/L	**5 – 9**	-	-	**8-11**	-
Total Suspended Solids	mg/L	+25 mg/L from background	-	**+20 mg/L from background**	**+5 mg/L from background**	-
Water Temperature	°C	**±1°C change from background**	15	±1°C change from background	-	-
pH (field)	pH Unit	6.5 - 9.0	**6.5 - 8.5**	-	**6.5 - 9.0**	-
Major Ions						
Chloride	mg/L	600	**250**	600	**150**	-
Sulphate	mg/L	-	**500**	-	**218**	-
Nutrients						
Ammonia	mg/L (as N)	**20.5***	-	-	**1.84***	-
Nitrate	mg/L (as N)	32.8	**10**	100	**3**	-
Nitrite	mg/L (as N)	**0.060***	1	10	**0.02***	-
Total Phosphorus	mg/L	-	**0.01**	-	**0.005 - 0.015 in lakes**	-
Total Metals						
Aluminum	mg/L	-	-	**5**	-	-
Antimony	mg/L	-	-	-	**0.009***	-
Arsenic	mg/L	**0.005**	0.025*	0.025*	-	-
Boron	mg/L	**1.2**	5	5	-	-
Chromium VI	mg/L	-	-	-	**0.001***	0.05*
Cobalt	mg/L	**0.11**	-	-	**0.004**	-
Copper	mg/L	**0.0067***	0.5	0.3	**0.002**	-
Iron	mg/L	**1**	-	-	-	-
Manganese	mg/L	**1.09***	-	-	**0.83**	-
Molybdenum	mg/L	2	0.25	**0.05**	1	-
Selenium	mg/L	-	**0.01**	-	**0.002**	0.002
Silver	mg/L	**0.0001***	-	-	**0.00005***	-
Zinc	mg/L	**0.03***	5	-	**0.0075**	-
Dissolved Metals						
Aluminum	mg/L	**0.1***	0.2	-	**0.05**	-
Antimony	mg/L	-	-	-	-	-
Cadmium	mg/L	**0.000288***	-	-	**0.000127**	-
Iron	mg/L	**0.35**	-	-	-	-

Notes:
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Bold indicates most conservative guideline of each maximum and chronic water quality guideline
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COMMUNITY

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Water Temperature	°C	**±1°C change from background**	15	±1°C change from background	-	-
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Antimony	mg/L	-	-	-	**0.009***	-
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Boron	mg/L	**1.2**	5	5	-	-
Chromium VI	mg/L	-	-	-	**0.001***	0.05*
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Copper	mg/L	**0.0067***	0.5	0.3	**0.002**	-
Iron	mg/L	**1**	-	-	-	-
Manganese	mg/L	**1.09***	-	-	**0.83**	-
Molybdenum	mg/L	2	0.25	**0.05**	1	-
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Hospital auxiliary seeks volunteers

Gaeil Farrar
Staff Writer

The Cariboo Memorial Hospital Auxiliary has started another year of volunteering and invites interested volunteers to join them.

The auxiliary raises funds in various ways, most notably by running the hospital gift shop.

"We invite interested volunteers to drop by the hospital gift shop to pick up an application form," says auxiliary member Cynthia Wilson.

In addition to profits earned by running the hospital gift shop the auxiliary raises funds by holding raffles, silent auctions, bake sales and receiving donations.

Funds raised are used to purchase smaller pieces of equipment needed by the hospital. During the past year the auxiliary has purchased three pressure relief mattresses, seven activity boards, three neonatal stethoscopes, and two vital sign machines for the hospital.

The auxiliary also provides two $1,000 scholarships each year for young adults entering medical studies.

Some of the funds raised also help to purchase favours for patients to put on their dinner trays; supplying baby layettes for new mothers in need.

Volunteers also deliver flowers from local florists to patients.

The Cariboo Memorial Hospital Auxiliary has been operating in Williams Lake since 1923 when the first job of members was to make sheets for the hospital beds, Wilson says.

The auxiliary is currently selling tickets on their seasonal raffle. First prize is a queen-sized quilt designed and donated by Elaine Watt. Second is a framed Bateman cougar print. Third prize is a Reva Schick doll. Tickets are available at Save-On, Safeway or Walmart until Nov. 25.

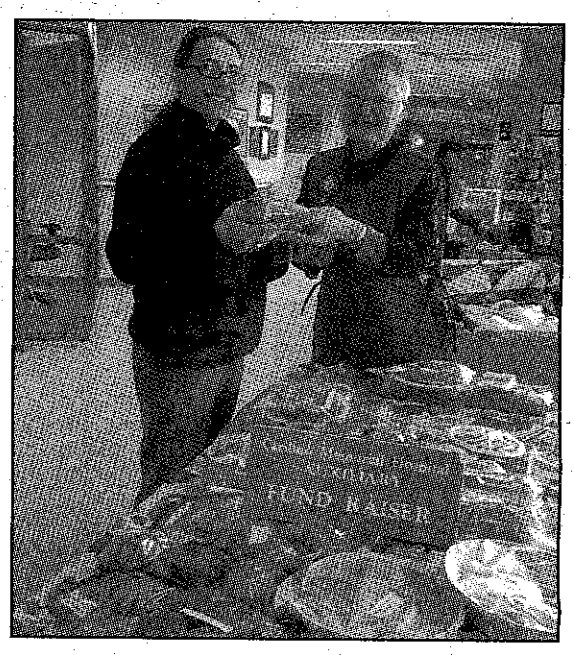


Photo submitted

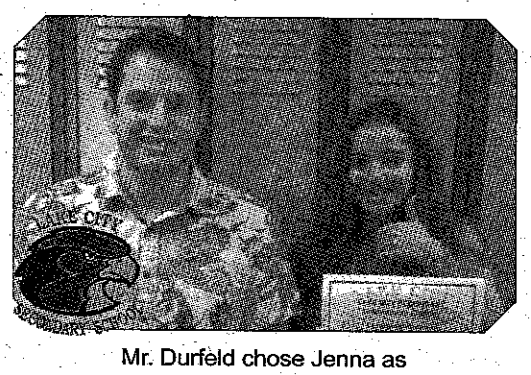
Amanda Schiemann (left) buys some baking from Cariboo Memorial Hospital Auxiliary member Judy Reid during a recent auxiliary bake sale held at the hospital.

Lake City Secondary STUDENTS OF THE WEEK

WL Campus
CHAMATH WIJESEKERA

Mrs. Pritchard chose Chamath as
STUDENT OF THE WEEK
because Chamath is always willing to learn French, and for his great participation!
Congratulations Chamath!

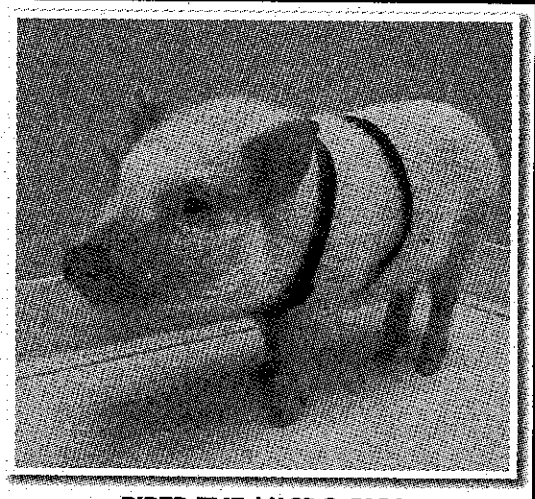
Columneetza Campus
JENNA MIRANDA



Mr. Durfeld chose Jenna as
STUDENT OF THE WEEK
In recognition of Jenna's hard work, positive attitude and solid study habits throughout the week!
Congratulations Jenna!

JTA 4x4
Suspension Lifts • General Automotive Repair
Joe Schellenberg
Owner/Technician
250-398-2600
fax 250-398-2610 - jta4x4autorepair@gmail.com
1075 Mackenzie Ave. N. (located in old ARS building)

MY BEST FRIEND



PIPER THE MICRO PIG!

Even miniature pigs can produce a lot of piglets in a lifetime and health risks increase for unspayed pet pigs. A pig spay is similar to a dog or cat but is more difficult when they get older. Pet pigs should also have annual health exams. Remember pet pigs should not be fed "like a pig": Call if you have questions!

animal care hospital
Full Service Veterinary Hospital & Mobile Services
Small & Large Animals
Phone 250-392-5510 for Appointments or 24 hr. Emergency Service
"When Pets need a Helping Hand"

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Zinc	mg/L	**0.03***	5	-	**0.0075**	-
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Antimony	mg/L	-	-	-	-	-
Cadmium	mg/L	**0.000288***	-	-	**0.000127**	-
Iron	mg/L	**0.35**	-	-	-	-

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NEWS

CONTRIBUTED PHOTO

Children enjoy playing on the Explorer Dome climbing structure in Riverside Park.

Quesnel man suing city of Kamloops

A father visiting Kamloops with his son is suing the city, claiming his child suffered injuries after he fell from playground equipment at Riverside Park.

Blake Lawlor, on behalf of his son Brock, filed a lawsuit in B.C. Supreme Court alleging a piece of equipment called the Explorer Dome is "a hazard and would be dangerous to visitors of the park."

The playground equipment features a net system suspended by arching metal tubes.

The lawsuit claims Brock suffered an arm fracture when he fell off the playground structure on April 16 this year.

That fall and broken arm resulted in anxiety and sleep disturbance, the lawsuit claims.

The Quesnel family is seeking damages and future health-care costs. The statement of claim blames the city for failing to warn of the alleged danger of the equipment with a sign and for not installing padding beneath the equipment.

It alleges the city breached the Occupiers Liability Act.

Q-City Page

A feature highlighting meetings, proposals and events important to Quesnel residents.

SALE OF SURPLUS EQUIPMENT

The City of Quesnel is disposing of five pieces of equipment and parts as follows:

Unit	Equipment
T-21	1997 Ford 1-ton flat deck truck
T-22	1997 International Dump/Sand truck
M-30	1974 Jeager air compressor
B-1	1995 Toyota Corolla
T-29	2001 Ford ¾ ton crew cab pick-up
Parts	Crate of surplus weedeater and water pump parts

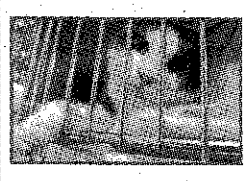
All pieces will be sold on an as is where is basis. Interested buyers may view the equipment at the Public Works Office at Johnston Bridge Loop, Monday to Friday from 8:30 am until 4 pm. Sealed bids for each unit will be accepted at City Hall, 410 Kinchant Street, Quesnel, BC, V2J 7J5 until November 9, 2016 at 2 p.m. The sealed bid must be clearly marked "Surplus Equipment Bid - Unit ____". The City reserves the right to reject any or all bids, to waive defects in any bid document, and to accept any bid which it may consider to be in the best interest of the City. The lowest or any bid will not necessarily be accepted.

Enquiries may be directed to Public Works at 250-992-6330.

City Hall - 410 Kinchant Street, Quesnel, BC, V2J 7J5 T - 250-992-2111 W - www.quesnel.ca
Hours of operation are from 8:30 a.m. to 4:30 p.m., Monday to Friday (except Statutory Holidays)

Adopt a Shelter Cat!

The BC SPCA cares for thousands of orphaned and abandoned cats each year. If you can give a homeless cat a second chance at happiness, please visit your local shelter today.



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Any person who may be adversely affected by the proposed amendment and wishes to provide relevant information may, within 30 days after the last date of posting, publishing, service or display, send written comments to the applicant (Mount Polley Mining Corporation, inquiries@imperialmetals.com, Box 12, Likely BC, V0L 1N0), with a copy to the Ministry of Environment Director of Mining Operations Mount Polley (MtPolleyMinePermit@gov.bc.ca, 2080 A Labieux Road, Nanaimo BC, V9T 6J0). The identity of any respondents and the contents of anything submitted in relation to this application will become part of the public record.

Date: October 20, 2016

Mount Polley Mining Corporation Contact Number: 250-790-2215

Chris

ENVIRONMENTAL PROTECTION NOTICE

Application for a Permit Amendment under The Provisions of the *Environmental Management Act*

We, Mount Polley Mining Corporation, 200 – 580 Hornby St., Vancouver, BC, V6C 3B6, intend to submit this amendment application to the Director to amend Permit 11678, issued May 30, 1997 and last amended September 19, 2016, which authorizes the discharge of effluent from a copper-gold mine and mill.

This permit amendment application requests that a discharge point for the discharge of treated mine contact water be modified in Permit 11678. The location from which the discharge originates is within Mining Leases 345731, 410495, 524068, 575346 and 933989, and Mineral Claim 514039, 514044, CB16 204475, PM5 206450, and POL2 411010, Cariboo Mining Division, Cariboo Land District. The discharge will occur at depth into Quesnel Lake, adjacent to Mineral Claim 501479. The maximum rate of all water discharged from this facility will be 0.6 cubic meters per second and the maximum volume will be 10,000,000 cubic meters per year. Table 1 shows British Columbia Water Quality Guidelines that the treated water will meet at the edge of the initial dilution zone in Quesnel Lake. By meeting these guidelines, end uses such as drinking water, aquatic health and recreation are protected in Quesnel Lake.

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Date: October 20, 2016

Mount Polley Mining Corporation Contact Number: 250-790-2215

Table 1: British Columbia Water Quality guidelines that the treated water will meet at the edge of the *initial dilution zone in the receiving environment.*

Parameter	Units	Maximum BC Water Quality Guidelines			Chronic BC Water Quality Guidelines	
		Aquatic Life	Drinking Water	Wildlife Water	Aquatic Life	Wildlife Water
Physical Parameters						
Dissolved Oxygen	mg/L	**5 – 9**	-	-	**8-11**	-
Total Suspended Solids	mg/L	+25 mg/L from background	-	**+20 mg/L from background**	**+5 mg/L from background**	-
Water Temperature	°C	**±1°C change from background**	15	±1°C change from background	-	-
pH (field)	pH Unit	6.5 - 9.0	**6.5 - 8.5**	-	**6.5 - 9.0**	-
Major Ions						
Chloride	mg/L	600	**250**	600	**150**	-
Sulphate	mg/L	-	**500**	-	**218**	-
Nutrients						
Ammonia	mg/L (as N)	**20.5***	-	-	**1.84***	-
Nitrate	mg/L (as N)	32.8	**10**	100	**3**	-
Nitrite	mg/L (as N)	**0.060***	1	10	**0.02***	-
Total Phosphorus	mg/L	-	**0.01**	-	**0.005 - 0.015 in lakes**	-
Total Metals						
Aluminum	mg/L	-	-	**5**	-	-
Antimony	mg/L	-	-	-	**0.009***	-
Arsenic	mg/L	**0.005**	0.025*	0.025*	-	-
Boron	mg/L	**1.2**	5	5	-	-
Chromium VI	mg/L	-	-	-	**0.001***	0.05*
Cobalt	mg/L	**0.11**	-	-	**0.004**	-
Copper	mg/L	**0.0067***	0.5	0.3	**0.002**	-
Iron	mg/L	**1**	-	-	-	-
Manganese	mg/L	**1.09***	-	-	**0.83**	-
Molybdenum	mg/L	2	0.25	**0.05**	1	-
Selenium	mg/L	-	**0.01**	-	**0.002**	0.002
Silver	mg/L	**0.0001***	-	-	**0.00005***	-
Zinc	mg/L	**0.03***	5	-	**0.0075**	-
Dissolved Metals						
Aluminum	mg/L	**0.1***	0.2	-	**0.05**	-
Antimony	mg/L	-	-	-	-	-
Cadmium	mg/L	**0.000288***	-	-	**0.000127**	-
Iron	mg/L	**0.35**	-	-	-	-

Notes:
W = working guideline, M = interim guideline
Bold indicates most conservative guideline of each maximum and chronic water quality guideline
*indicates guideline is dependent on another parameter and representative average conditions in the receiving environment were applied

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PENDER ISLAND
WOODEN LOCK CO.

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2016

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A GHOULISH NIGHT

AT THE PUB

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BEST COSTUME
MOST CRIMINAL
CROWD FAVORITE

FRIDAY OCTOBER 28th 2016

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CHOCOLATE MOOSE CAFE

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Commence Before Nov. 10,2016
We only Have 1 (One) Bee.

STOP
ENVIRONMENTAL PROTECTION NOTICE
This site is the subject of an application for a permit amendment under the *Environmental Management Act*. For further details see the application posted below.
For further information contact the Environmental Protection Program indicated on the application form.
20

APPENDIX B3

PUBLICATION OF OPEN LETTER TO LOCAL RESIDENTS

LOCAL NEWS

Upcoming forum to discuss the reality of Aboriginals doing business

Monica Lamb-Yorski
Staff Writer

A popular forum on the realities of Aboriginals doing business is coming to Williams Lake on Thursday, Nov. 17.

Open to First Nations leaders, industry, government, contractors and individuals, the Nation2Nation community forum will help address priorities for working in partnership on resource development in First Nations territories, organizer Lisa Mueller said.

Mueller is the CEO and creator of All Nations Consulting and was inspired to host community forums after participating in one in the Lower Mainland where she noticed of the 400 people in attendance, she was one of a handful of First Nations people there.

"Last year we held one in Terrace and it sold out," she said. "About 150 people maxed the room and we had people from all over

Lisa Mueller

the country and even a speaker from one of the mines was from the U.S. It made me realize that the conversation needed to take place. I've created a space for First Nations leaders to share how industry and government can better do business within their territory."

Mueller thinks the forum will benefit Williams Lake and the area.

"The forum is not just about the Tsilhqot'in title decision, it is about non-First Nation and First Nation people working together," she said. "It's not for any certain First Nation or industry it is a safe place for all of them to come in the room and have a respectful conversation on how to better do economic development and business in First Nations communities."

Speakers will include BC AFN Chief Shane Gottfriedson, Chief Derek Orr of the McLeod Lake Indian Band, Bryan Cox, vice president of Mining Association of B.C., Greg D'Avignon of the BC Business Council and Stewart Muir from Resource Works.

"I always have four people on a panel and a moderator, and I mix up the conversations," Mueller said.

Mueller said she finds there are a lot of questions in the audience at the forum but realizes it can be intimidating for non-First Nations to ask questions of First Nations because they don't want to ask the wrong questions or offend the leaders.

"Some questions never get asked so at our last forum I create an opportunity for the audience to anonymously text in a question and who they wanted to ask and then my team grabs those questions and brings them to the moderator. It has really broken down that barrier."

The forum will take place from 10 a.m. to 4:30 p.m. in the Pioneer Complex at 353 Hodgson Road, followed by a networking social from 5 to 7 p.m.

Anyone with questions can contact Mueller at 250-631-3396.

REMEMBRANCE DAY
NOVEMBER 11, 2016
In Search of Photos...
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The Tribune will honour our **War Heroes** who served to defend Canada.
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Deadline for submission is **November 2nd**.
(Photos must be re-submitted each year!)
E-mail your pictures and a brief **20** word history along with years of service to...
gaylene@wltribune.com
THE WILLIAMS LAKE Tribune
250-392-2331 188 North 1st Ave. Williams Lake, B.C. V2G 1Y8

MOUNT POLLEY MINING CORPORTION
an Imperial Metals company
Box 12 • Likely, BC V0L 1N0
250-790-2215 • F-250-790-2613

October 18, 2016

Dear Local Residents:

The Mount Polley Mine has a positive water balance, which means that there is more yearly rainfall at the site than there is evaporation. This water surplus was forecast before the mine started operation and was discussed with our neighbouring communities during the original consultations that were carried out, along with the Environmental Assessment process, during the 1990s. At that time, the authorized plan was to settle the surplus water in sedimentation ponds and discharge to the local lakes and creeks near the mine.

Recently, we have retained qualified environmental professionals to review and modernize the previous plans and make sure that we are applying best practices to manage surplus site water. This work resulted in a detailed Technical Assessment Report which has been posted on the Imperial Metals website

(https://www.imperialmetals.com/our-operations-and-projects/operations/mount-polley-mine/long-term-water-management-plan-application).

The report recommends that we approach water discharge in two phases: firstly, remove suspended particulates with a water treatment plant using modern technology, and then discharge the treated water at depth into Quesnel Lake; and, secondly, continue to undertake studies of passive treatment, with a goal to distribute the treated water to the local watersheds. Studies into the passive treatment of surplus site water and distributed discharge into the local watersheds will continue in parallel to the first phase of water treatment and discharge to Quesnel Lake, with transition into the second phase being completed after the site is reclaimed, or earlier (during operations) if possible.

The permit amendment that we are now seeking is for the first phase of water discharge. This would be implemented by changing some of the routing of the currently authorized discharge to Quesnel Lake; however, the water originates from the same sources as the water currently being discharged and will be subject to the same treatment. We have been discharging treated water into Quesnel Lake from our water treatment plant since December 1, 2015 and the lake water quality has been carefully monitored since that time. The monitoring indicates that this discharge has not had adverse effects on the water uses of Quesnel Lake. The Technical Assessment Report evaluates the new routing options, takes a longer time horizon view and evaluates our proposed permit amendment, and concludes that water uses will not be impacted. We are aware of the importance of Quesnel Lake to its users and we continue to closely monitor our operations and surrounding environment to be sure that Quesnel Lake water uses are not negatively impacted.

Mount Polley agrees with the consultants' recommendations for our interim and long term water management plan and we encourage everyone in the community to review the Technical Assessment Report and to provide us with their feedback during the upcoming permit consultation process.

In closing, all of us who work at the Mount Polley Mine would like to extend our thanks to all the members of our local First Nations and the citizens of the local communities who have provided input to the process of getting the mine operating and protecting the environment. We take our responsibility to our community and the environment in which we operate seriously, and we strive to be positive contributors to the community.

Yours sincerely,

Dale Reimer,
General Manager, Mount Polley Mine

NEWS

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an Imperial Metals company
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250-790-2215 • F-250-790-2613

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Yours sincerely,

Dale Reimer,
General Manager, Mount Polley Mine

SD28's Parent Advisory Councils to receive gaming grants

Schools in Quesnel and area will be receiving $57,980 as part of more than $11 million in B.C. government gaming grants for Parent Advisory Councils (PACs) and District Parent Advisory Councils (DPACs) working with public and independent schools throughout British Columbia.

PACs and DPACs play a key role in keeping parents connected to teachers and school administrators through positive, supportive involvement in the education provided to their children.

The grants provide support for extracurricular activities, including sports, arts, class trips and other school activities.

Why this matters:

• PACs and DPACs will share $11,121,840 in community gaming grant funding from the B.C. government this year.

• A PAC is the officially recognized collective voice of parents in their school. A PAC, through its elected officers, may advise the school board, the principal and staff on matters relating to the school and student education.

• DPACs advise the board of education on any matter relating to education in their school district. DPACs advocate for parental involvement in the education system and give input into the development of education policy and curricula.

"We are putting this money back into the community where it will help our young people the most," Cariboo North MLA Coralee Oakes said.

"Our PACs will use this funding to make this school year a great one."

"We are putting this money back into the community where it will help our young people the most. Our PACs will use this funding to make this school year a great one."
Coralee Oakes, MLA

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REMEMBER TO RECYCLE

APPENDIX C

COMMUNITY MEETINGS

Mount Polley Mining Corporation
an Imperial Metals company
Box 12 • Likely, BC V0L 1N0 • T 250.790.2215 • F 250.790.2613

Mount Polley Mine Community Meeting

When: **Thursday, October 27, 2016**

Where: Royal Canadian Legion Hall
385 Barnard Street (downstairs)

Time: 7:00pm - 9:00pm

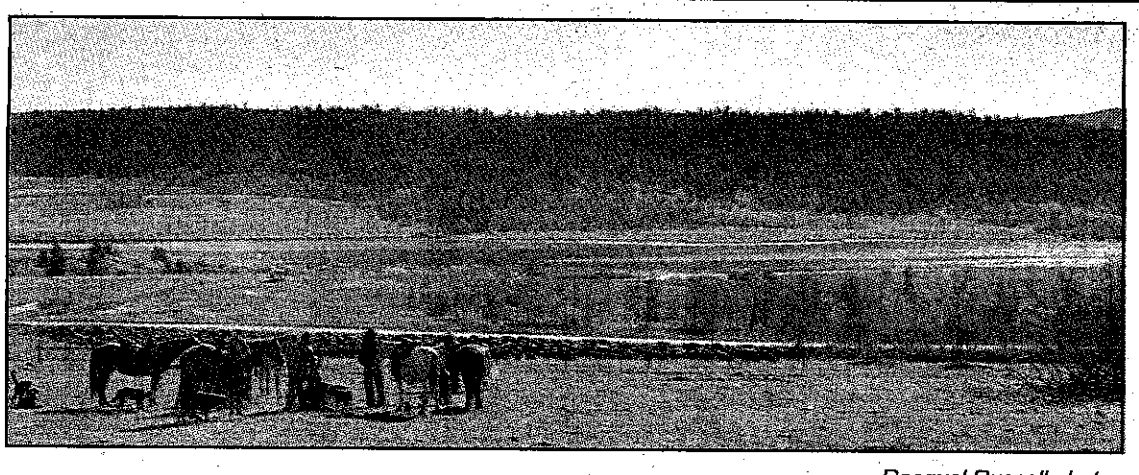
All Williams Lake community members are welcome and encouraged to attend.

Mount Polley Mine invites Williams Lake residents to join them for an Open House with poster displays from 7 to 8 pm, followed by a presentation and Q&A session from 8 to 9 pm.

The purpose of this meeting is to provide information to and opportunities for the public to ask questions about the Mount Polley Mine proposed water discharge permit amendment.

Coffee and snacks will be served.

LOCAL NEWS



Racquel Russell photos

Cowboys from three ranches gather their cattle at Riske Creek in preparation for moving their herds from the Raven Lake Range across Highway 20 to Harper Meadow Range.

Round-up time in the Chilcotin

Linda-Lou Howarth
Special to Tribune/Advisor

Ranchers are approaching their busiest time of the year, rounding up cattle from the summer ranges.

At Riske Creek the first round-up of the season involved moving cattle from the Raven Lake range across Harper Meadow, then to the Bald Mountain range for about a month.

The Douglas Lake Cotton Division Ranch, River Ranch and Wineglass Ranch all took part in this round up.

They gathered and pushed cattle, crossing Highway 20 into Harper Meadow and on up to the back of Bald Mountain where the cattle stayed for a couple weeks or so.

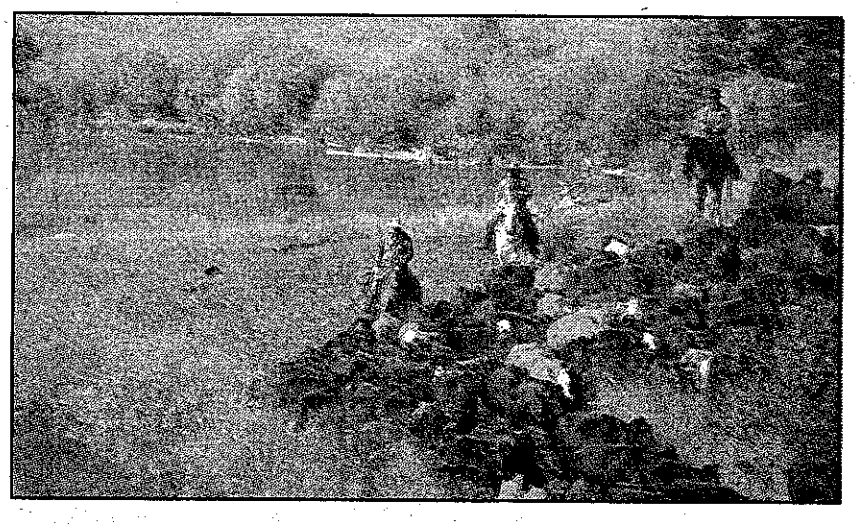
The riders spent quite a few days searching for the elusive cattle in a fairly large range, coaxing cows to head home.

Most cows high tail it as fast as they can to get to a different pasture, but there is always a batch that are pretty cagey at hiding on the riders.

Still, their awesome cow dogs manage to find them and push them out.

A bit of time was spent around campfires where riders cozy up to the warm fire while waiting for others to arrive pushing their cows into the holding grounds.

Cowboys enjoy this time as they catch up on gossip, swap stories, perhaps swap some gear, and share tips on working a horse or a dog.



From the left cowboys Mike Jasper and Ian Durrell from the Wineglass Ranch and Joe Roberson from the Douglas Lake Cotton Ranch Division move cattle around Harper Meadow Lake.

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39th Annual Winter Arts and Crafts Fair
FRIDAY, OCT. 28 3:00pm to 9:00pm
SATURDAY, OCT. 29 9:00am to 4:00pm
Concession!
ADMISSION $2.00
includes entry to door prizes.
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MOUNT POLLEY MINING CORPORTION
an Imperial Metals company
COMMUNITY MEETING
Thursday, October 27, 2016
Royal Canadian Legion
385 Barnard Street (downstairs)
7:00pm – 9:00pm
All Williams Lake community members are welcome and encouraged to attend.
Mount Polley Mine invites Williams Lake residents to join them for an Open House with poster displays from 7 to 8 pm, followed by a presentation and Q&A session from 8 to 9 pm.
The purpose of this meeting is to provide information to and opportunities for the public to ask questions about the Mount Polley Mine proposed water discharge permit amendment.
Coffee and snacks will be served.

ALL SCHOOLS WELCOME!
DRY GRAD 2017 MEETING
Thursday, October 27
7:00 pm
LCSS - WL Campus LIBRARY
VOLUNTEERS DESPERATELY NEEDED!
KEY COMMITTEE POSITIONS STILL NEED TO BE FILLED
Planning is on hold until positions are filled
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NEWS

MOUNT POLLEY
MINING CORPORTION
an Imperial Metals company

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Coffee and snacks will be served.

Public invited to comment on Mount Polley long-term water plan

A long-term water management plan proposed for Mount Polley is now available for public comment.

"Mount Polley Mining Corporation is applying to discharge treated mine effluent to both Quesnel Lake at a depth of 40 to 50 metres, as well as to Bootjack Lake via groundwater," the ministries of environment, energy and mines, and Aboriginal relations and reconciliation said in a press release Tuesday.

The permit application will go through a 30-day public-consultation period, as well as a comprehensive technical review by the Cariboo Mine Development Review Committee.

Additionally, public consultation sessions on the long-term water management plan are scheduled for Wednesday, Oct. 26, 7 p.m. to 9 p.m., at the Royal Canadian Legion, Quesnel; Thursday, Oct. 27, 7 p.m. to 9 p.m., open house and town hall, Royal Canadian Legion, Williams Lake; Friday, Oct. 28, 7 p.m. to 9 p.m., open house, Horsefly Community Hall; Saturday, Oct. 29, 3 p.m. to 5 p.m., open house, Big Lake Community Hall and Sunday, Oct. 30, 3 p.m. to 5 p.m., open house and town hall, Likely Community Hall.

Public feedback will help inform the company's final water management plan, expected to be in place by fall 2017.

MPMC had previously submitted its draft technical assessment report for the long-term water management plan which underwent an internal government-to-government review involving the Ministry of Environment, Ministry of Energy and Mines, Williams Lake Indian Band and Soda Creek Indian Band.

The results of that review have helped inform MPMC's formal permit amendment application and supporting technical assessment report.

Final comments to the ministry on the report are due on Thursday, Nov. 24, 2016.

Please submit comments with the subject line "Comments on technical assessment report" to: MtPolleyEnvironmentalEnquiries@gov.bc.ca.

Mount Polley's permit amendment application and supporting technical assessment report can be found at: http://www.envgov.bc.ca/epd/mountpolley/.

All information on the incident can be viewed on the ministry's dedicated webpage: http://www.envgov.bc.ca/epd/mountpolley/.

ALL SCHOOLS WELCOME!
DRY GRAD 2017 MEETING
Thursday, October 27
7:00 pm
LCSS - WL Campus LIBRARY
VOLUNTEERS DESPERATELY NEEDED!
KEY COMMITTEE POSITIONS STILL NEED TO BE FILLED
Planning is on hold until positions are filled
Call 250-302-8423 or visit www.wldrygrad.ca for more information
www.wldrygrad.ca
Williams Lake Dry Grad 2017

Shot dog recuperating from surgery

Monica Lamb-Yorski
Staff Writer

Thanks to the generosity of the public, a dog at the Williams Lake SPCA is recovering from surgery to amputate his leg after he was shot.

Last Thursday, Max's story was shared with media by the BC SPCA, asking for help because bones in his leg were shattered from the elbow down exposing bone and an infected wound.

It did not take long for donations to come into the SPCA to cover the expected $1,500 cost of his medical treatment, manager Liz Dighton told the *Tribune* Monday.

"The fact that he had been shot and was hiding from the public for two weeks really struck a chord with people."

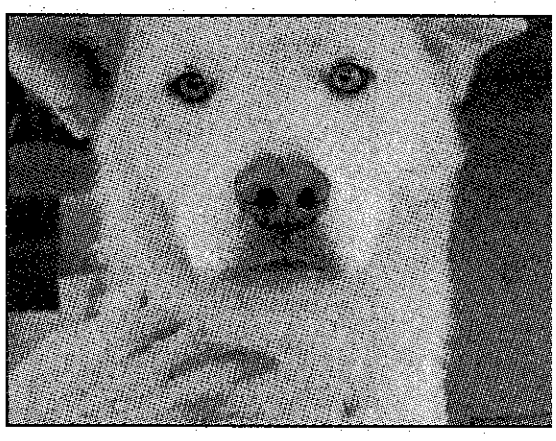
A Good Samaritan spied Max soon after he was shot, but it took some work to be able to bring him into the SPCA.

Max, who is a German Shepherd Husky mix, is recovering well and learning how to balance on three legs, Dighton said.

He will have to be moved to a branch in Vancouver because the legal requirement is that animals must undergo a behaviour assessment before they can be adopted.

The local branch is closed until Thursday, Oct. 27, because staff are dealing with an overload of animals, she added.

As a society, the SPCA relies on donations from the public to pay for surgeries.



Max the dog

Thursday October 27
All You Can Eat PASTA
5:30-7pm
Adults $10 - Kids $5
Members and Guests Welcome

Meat Draw
Every Friday 5pm-6pm
Every Saturday 3pm-5pm

Friday, October 28 @ 5:30pm

$15 Steak Night with all the trimmings
COME IN COSTUME
Live Band
PERFECT MATCH
Members and Guests Welcome

Legion 385 Barnard Street, Williams Lake • 250-392-7311 (Office) • 250-392-4255

It's Fun! It's Free! It's StrongStart!

StrongStart centres are school-based early learning centres facilitated by an Early Childhood Educator. All children 0-5 years old are welcome to attend with a parent/caregiver.

Cataline	Monday to Friday	9:00 am to 12:00 pm
Marie Sharpe	Monday to Friday	9:00 am to 12:00 pm
Mountview	Monday to Friday	8:30 am to 11:30 am
Big Lake	Mondays	9:00 am to 12:00 pm
150 Mile House	Tuesdays & Thursdays	8:30 am to 11:30 am
Horsefly	Wednesdays	9:00 am to 12:00 pm

SCHOOL DISTRICT NO. 27 (CARIBOO-CHILCOTIN)

For more info call 250-398-3839

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HOROSCOPES

October 23 - 29, 2016

ARIES - Mar 21/Apr 20
Aries, you will soon learn that any obstacle can be overcome if you set your mind to it. While a certain task may seem daunting right now, you won't allow it to intimidate you.

TAURUS – Apr 21/May 21
Others are paying attention to you even if they seem distracted, Taurus. Embrace the scrutiny and do your best to reciprocate any special attention coming your way.

GEMINI – May 22/Jun 21
Gemini, make an effort to be there for a loved one this week. You have a unique ability to listen and support others, and your loved one will not take your efforts for granted.

CANCER – Jun 22/Jul 22
Cancer, if your energy and attention span is a bit scattered this week, take steps to ensure all of your responsibilities are taken care of. A respite is on the horizon.

LEO – Jul 23/Aug 23
Leo, by observing others you can learn how they operate and make the most of your chances to work with them. Apply a similar approach to your personal relationships.

VIRGO – Aug 24/Sept 22
Try to tackle a financial project this week, Virgo. Select something relatively easy to begin with, and then go from there if you find yourself in a financial groove.

LIBRA – Sept 23/Oct 23
It's time to get the creative juices flowing, Libra. Tackle a project around the house, like painting or rearranging a room. Look for a new creative hobby as well.

SCORPIO – Oct 24/Nov 22
Scorpio, you have a lot of energy and a need to strive toward perfection in all that you do. Those traits will prove valuable around the office this week.

SAGITTARIUS – Nov 23/Dec 21
Keep trying to convince someone that your ideas are credible, Sagittarius. With a little more persuasion, you may win this person over and he or she will become a big supporter.

CAPRICORN – Dec 22/Jan 20
Capricorn, even if you don't want to go along with what the group is doing this week, you just may have to concede that what is best for the group trumps your personal preference.

AQUARIUS – Jan 21/Feb 18
Aquarius, financial issues may be keeping you on your toes, but it's nothing you can't handle if you stick to your plan. You may want to do some tinkering, however.

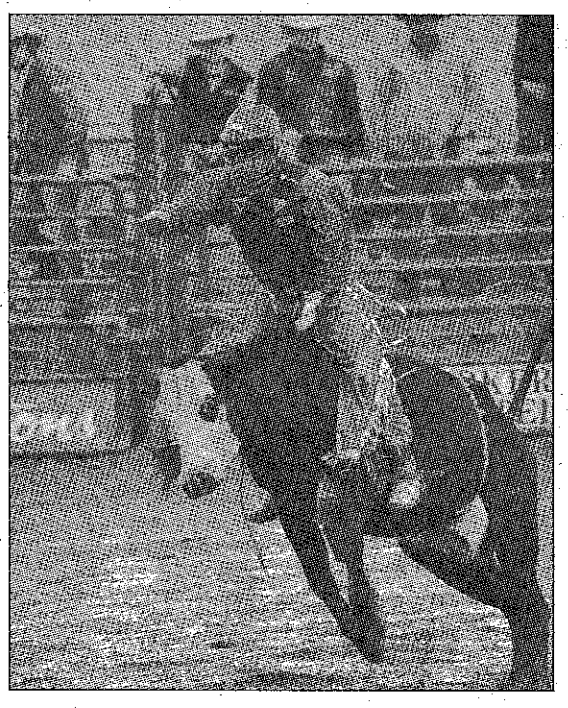
PISCES – Feb 19/Mar 20
Pisces, continue to bring the right people into your inner circle. One person in particular has your eye and might be just what you need.

FAMOUS BIRTHDAYS
OCTOBER 23 - Ryan Reynolds, Actor (40)
OCTOBER 24 - Drake, Rapper (30)
OCTOBER 25 - Adam Goldberg, Actor (46)
OCTOBER 26 - Emilia Clarke, Actress (30)
OCTOBER 27 - Simon LeBon, Singer (58)
OCTOBER 28 - Brad Paisley, Singer (44)
OCTOBER 29 - Tove Lo, Singer (28)

Quesnel riders clean up at 2016 BCRA awards banquet

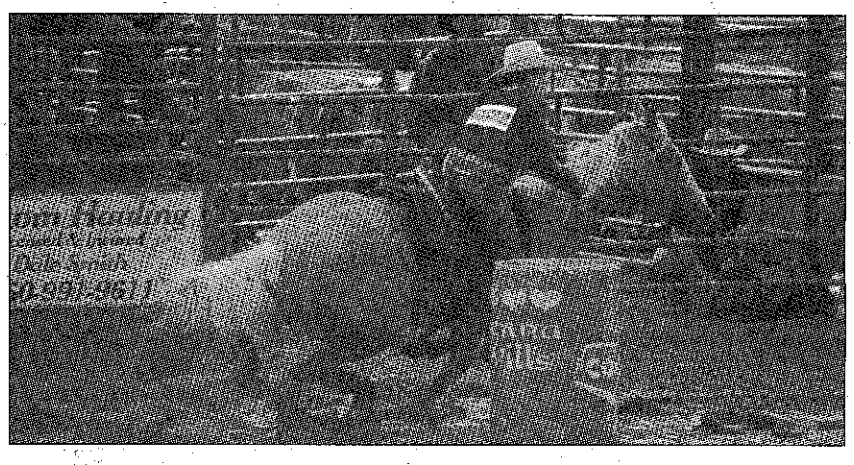
The 2016 British Columbia Rodeo Association awards banquet was held Oct. 15 with Quensel riders stealing the show.

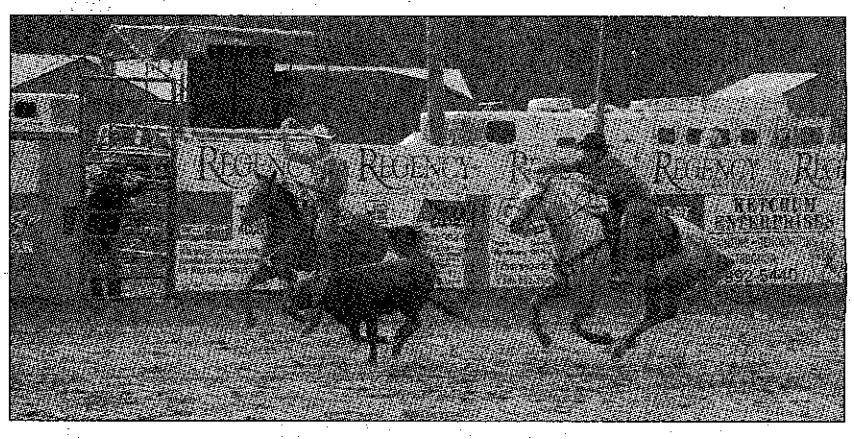
Steve Lloyd took home the Tie-Down Roping championship buckle and was named season leader, Lane Cork was named Bull Riding champion, Lane Paley won the Junior Steer Riding buckle, Ryan McNaughton won the Team Roping season leader header award, Dyson Leneve was named Junior Breakaway Roping season leader, Matt O'Flynn won the BCRA Sportsmanship award and Taylor Cherry won All Around Cowgirl and 2016 Rookie of the Year.

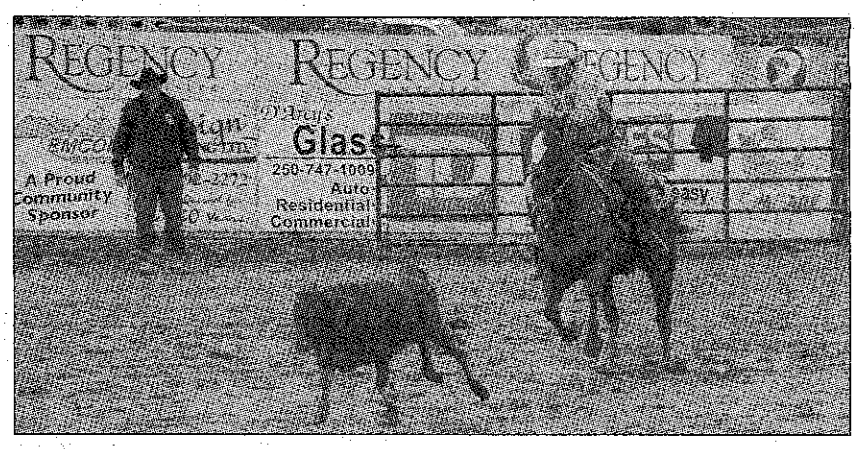


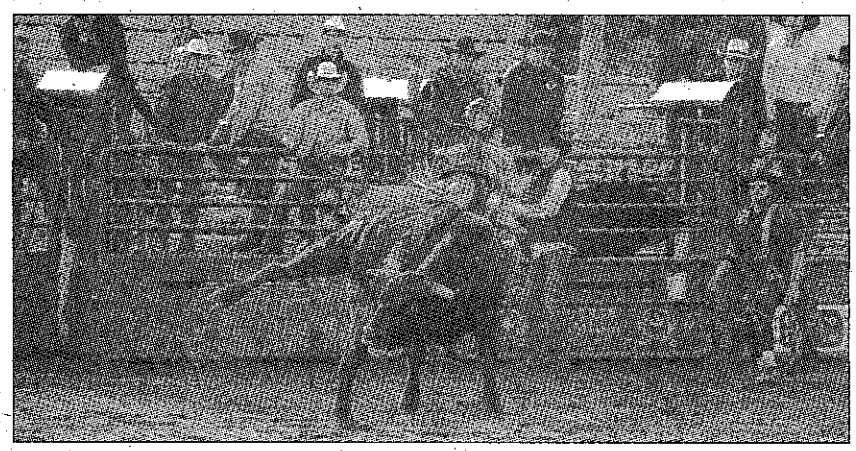
Clockwise from top right. Taylor Cherry All Around Cowgirl and 2016 Rookie of the Year. Ryan McNaughton Team Roping season leader. Dyson Leneve winner of the Junior Breakaway Roping season leader. Lane Cork Bull Riding champion. Steve Lloyd Tie Down Roping champion. Lane Paley Junior Steer Riding champion. Matt O'Flynn winner of the BCRA Sportsmanship award.

PHOTOS BY KAREN POWELL









MOUNT POLLEY
MINING CORPORTION
an Imperial Metals company

COMMUNITY MEETING

Wednesday, October 26, 2016
Quesnel Legion Branch Hall
262 Kinchant Street
7:00pm – 9:00pm

All Quesnel community members are welcome and encouraged to attend. Mount Polley Mine invites Quesnel residents to join them for an Open House with poster displays from 7 to 9 pm. Technical experts will be in attendance to answer questions.

The purpose of this meeting is to provide information to and opportunities for the public to ask questions about the Mount Polley Mine proposed water discharge permit amendment.

Coffee and snacks will be served.

APPENDIX D

PUBLIC COMMENT TRACKING

Regulated Toxic Substances Plan
Stakeholder Comments

Comment ID	Date	Location	Communities	In Province	Unknown Location	First Nations	Political Groups	Conservation Groups	Other Groups	
For Permit Amendment										
1 pRoTox-MacMillAN-Ludwig	20-Nov-19	Big Lake, BC	[redacted] While the BC Ombudsman has authority to conduct an independent investigation, he has no power to compel or enforce the implementation of his recommendations. The Ministry can refuse to implement the recommendations of the Ombudsman, or can engage the same for long periods of time, while continuing to operate in a manner that is contrary to the Ombudsman's recommendations. The Ministry can also refuse to implement the recommendations of the Ombudsman, or can engage the same for long periods of time, while continuing to operate in a manner that is contrary to the Ombudsman's recommendations. [redacted]							
1 pRoTox-MacMillAN-Ludwig	21-Nov-19	Montreal, QC	[redacted] Hi Kevin, Thanks for the quick response and thanks for the thorough. The reason I ask is because I'm working on a Master's thesis on the Mount Polley disaster. I'm interested in the science, but I am also looking at the ethics. I'm from Lillooet and I know the lake well. Perhaps I'm being naive, but I feel that there is some hope that the lake will recover. I'm hoping that the science will show that the lake will recover. [redacted]							
1 pRoTox-MacMillAN-Ludwig	21-Nov-19	Cowichan, BC	[redacted] Thanks for your response. I'm very interested in science, but I'm also interested in ethics. It sounds like there is some hope that the lake will recover. Do you think that the science supports that hope? I'm a PhD student in the Department of Philosophy at McGill University. I'm interested in the ethics of the Mount Polley disaster. I'm from Lillooet and I know the lake well. Perhaps I'm being naive, but I feel that there is some hope that the lake will recover. I'm hoping that the science will show that the lake will recover. [redacted]							
For Permit Amendment										
1 pRoTox-MacMillAN-Ludwig	20-Nov-19	Burnaby/Lake Bk	[redacted]	[redacted] [redacted]						
1 pRoTox-MacMillAN-Ludwig	21-Nov-19	Williams Lake, BC	[redacted]					[redacted] [redacted] [redacted] [

APPENDIX D1

MOE PUBLIC COMMENT TRACKING TABLE

Comments from Mail Mailbox

Comments from MAM Mailbox

Comment ID	Date	Location	Communities	In Province	Out of Province	Unknown Location	First Nations	Political Groups	Conservation Groups	Other Groups
For Permit Amendment										
1	02 Oct 18	Donald, BC	We attended for information meeting in Donald, on October 1st, for the extensions of the Discharge Permit for Mount Polley. Very informational meeting with meaningful, freedom to display of information Mount Polley. Where is all critical measurements be alleged in Donald. There's always on personnels, full time jobs in the area, should be investors of the Forest industry. There are approx 12 people who live and work their families in Donald, who work at Mount Polley. That number fluctuates from time to time, but has been around that. During the year the mine has been in operation Based on the information received about the water discharge process at the mine, and the importance of discharge to our economy, we support this amendment to the current Permit to be approved.							
2	08 Nov 18	Unknown				This is a follow up to a previous comment that I submitted under regarding the application to amend the permit 30 247 0, regarding long term water discharge by Mount Polley mine. We have had a presentation on the forecast Statistical Report and it appears that the suggested direction regarding water discharge will work. In the meantime, there is always the need for controlled short, medium and long term monitoring of the water quality and quantity. Mount Polley has been a good neighbour to the community and has been very responsive to concerns and requests for information. I am confident that Mount Polley will continue to be a good neighbour and, if the proposed amendment is approved and we only find the monitoring of the discharge to give a little more notice than would be normally be expected, I am confident that it is actually meeting the intent of the Permit. The operation, which is essential to the economic well being of the region, is in good hands. Thank you.				
3	21 Nov 18	Big Lake, BC								
4	30 Dec 18	Likely, BC								
5	31 Dec 18	Big Lake, BC								
Against Permit Amendment										
6	20 Oct 18	Quesnel, BC	It's Mount Polley Lawsuit. We the Plaintiffs are the ones who lost our livelihoods, our life, our family life, our life, our health, our life, our life, our life

86	11-Dec-14	Sarnia, BC		My family has been harmed and Quesnel Lake and surrounding area around the early 1970s'. It has always held a special place in my mature and we all frequent the area as many years take the 20 kd Street Pulley Environmental disaster was to alarming to relate that general worldwide attention. Since then, detailed analytical reports have shown that it could have been, and should have been avoided but should be not been is nothing that we've learned from that experience. Sadly, the Pulley Mill Site is not the only one, there are suspects that will be being ignore temporarily, leaving contaminants that is important which requires thorough environmental assessment. As long as there is the possibility that my grandchildren may be compelled to go swimming the Quesnel, a partner for what that has proved to be the Mill Site, I should not go on to the Mill Site. I should not go on to the Mill Site if I am not assured that it is properly and adequately decontaminated. Contaminants are found in quite a few Pulley Sites and well worth the Pulley Sites and well worth the Pulley Sites and well worth the

75	10-Dec-16	Williams Lake, BC	I feel it is necessary to review the history of this proposal in order to place the August 2, 2016 Chapter and the current application in context. I believe that the view of Terra Nova's mine was approved and I don't have any first hand knowledge of what happened. Fortunately, a submission to the Mount Polley Independent Expert Engineering Investigation and Review Panel by the Environmental Law Centre from the University of Victoria includes a comprehensive documentation of the approval of the Mount Polley Mine. According to the submission, a key issue for the public and First Nations concerning approval of the Mount Polley Mine was the adequacy of the consultation process. The Environmental Law Centre submission states that "Consultation with First Nations and the public was inadequate in the approval process for the Mount Polley Mine. Consultation was not meaningful, and did not take place at a time when decisions could still be influenced. Consultation was also inadequate because many First Nations were not adequately consulted, despite incorporation of traditional knowledge and evidence into EA and consultation processes. Government approved EA chapters on a timeframe basis, that infrastructure is advanced it doesn't appear that the public has been provided with any information on the proposed Chapter

E09	11-Dec-18	Old Bible House, BC	------------------------------ Oil Bible House, BC. I, Jessica "Bill" is the further discharge of any toxic stream water system in Quesnel Lake and ecologically significant tributaries of Cariboo Creek in respect the proposed amendment to permit 110 Fly Ash Pulp Pipeline as a storage on Quesnel Lake for 50 years and that the discharge in Quesnel Lake disposing and an effort to the Government of the Cariboo Chilcotin. I am not the Quesnel Lake, as the Lake Quesnel, Bill, as the Lake Bill Bill Bill

C07	23-Dec-14	Jolly, BC	As a concerned citizen, and resident of Jolly, I am writing to express my concerns on the technical assessment report (TAR) submitted by Mount Polley Mining Corporation (MPMC) regarding long term water management. To begin, this TAR exemplifies the problems that industry and regulators have created for society. In which decision making exercises economic and socio-cultural values have priorities over environmental values. The classic dispute surfaces which expected losses to which is a long-term effects a concerning. I understand that, around the, and long-term effects of millions of tons of waste that are contained at the bottom of Quesnel Lake. A decision has been made to dump the waste into Quesnel Lake, and now we are all stuck with the consequences. Mr. Chairman, I am not a scientist, I am not a lawyer, I am not a politician, I am just a concerned citizen. I am concerned that the TAR is being used to convince people that it is safe to dump tailings into Quesnel Lake

APPENDIX E

SUPPLEMENTAL INFORMATION TO SUPPORT PUBLIC COMMENT RESPONSES

TECHNICAL MEMORANDUM

DATE 20 January 2017 **REFERENCE No.** 1662612-073-TM-Rev0-33283

TO Luke Moger
Mount Polley Mining Corporation

CC Don Parsons (MPMC) and 'Lyn Anglin (IMC)

FROM Jerry Vandenberg and Lee Nikl **EMAIL** Jerry_Vandenberg@golder.com; Lee_Nikl@golder.com

ADDENDUM TO MOUNT POLLEY MINE LONG TERM TAR OPTIONS ANALYSIS – MOUNT POLLEY MINE

1.0 INTRODUCTION

This memorandum has been prepared in response to a letter from the Government-to-Government Working Group (G2G) to Luke Moger, Mount Polley Mining Corporation (MPMC), dated 22 December 2016. The letter follows up on information presented by MPMC and Golder Associates Ltd. (Golder) at the Cariboo Mine Development Review Committee (CMRDC) meeting of 15 December 2016. This 15 December 2016 CMDRC meeting was convened to discuss the Long-term Water Management Plan (LTWMP) for the Mount Polley Mine, and, specifically, the ongoing regulatory review of MPMC's associated *Environmental Assessment Act* (EMA) Permit 11678 amendment application. MPMC and Golder are pleased to receive the feedback included in this 22 December 2016 G2G letter that this CMDRC meeting was helpful in advancing a better understanding of options analysis and selection of the preferred option as proposed in MPMC's LTWMP.

The above-noted G2G letter requests "an estimate of the total cost associated with development, implementation and operation of the Quesnel River and Quesnel Lake discharge options over the life of the discharge" be provided by MPMC to the CMDRC membership by 20 January 2017. It is noted in the letter that, "both Ministry of Environment and the Williams Lake and Soda Creek Indian Bands are receiving numerous requests from the public and band members for a cost comparison between the Quesnel River and Quesnel Lake discharge options". The purpose for the provision of a cost estimate, as stated in the letter, is to, "help in the public's understanding of the choices MPMC is making relative to the future operations of the mine".

The discharge referred to in that letter is described in the LTWMP Technical Assessment Report (TAR; Golder 2016) for the Mount Polley Mine. Appendix G of the TAR provides an Options Analysis that was used to select the discharge location. By considering environmental, technological, social and economic criteria, the Options Analysis indicated that Quesnel Lake was the selected option and this is the option that forms the basis of MPMC's EMA Permit 11678 amendment application. The issuance of this EMA Permit 11678 amendment, for that option and in advance of spring melt, is a critical path requirement to enable MPMC to responsibly manage site water, with or without operations at the Mount Polley Mine.

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2.0 COST ANALYSIS

As further discussed below, in keeping with the established process for completing an Options Analysis, detailed engineering, including cost estimation, has not been completed for those options that were found not to provide satisfactory, reliable and resilient environmental performance. In such cases, cost was not a determining factor – environmental performance was the driving reason. The cost analysis that is sought in the 22 December 2016 G2G letter has therefore not been carried out. If we had such a cost estimate derived, Golder would have been pleased to have provided this to the Ministry of Environment and Xatśūll First Nation and Williams Lake Indian Band through MPMC. We appreciate that the G2G letter represents questions from public and band membership and we appreciate the importance of providing answers for these parties. Unfortunately, no such cost analysis is available and there are substantial costs that would be incurred just to develop the cost estimate. We therefore hope that the following explanation of the decision process will provide a better understanding of the options analysis. We also provide further considerations below to provide some dimension to costs.

When undertaking an Options Analysis, it is sufficient to know that one option costs more than another, without knowing exactly what those costs are. This relative scoring is applicable to any criteria considered in an Options Analysis. In the event that two options were evaluated to be close together (in terms of score), then more detailed cost analyses would be required to differentiate between the options. In the case of the two options noted in the G2G letter, Quesnel Lake and Quesnel River, it was known that, at a rudimentary level, the cost will be driven primarily by the length of the pipe, which is considerably longer for the Quesnel River option. While this rather simple comparison is sufficient for the Options Analysis, some of the factors that would come to play with regards to cost include (but are not limited to) the items below. The determination of the costs that would apply, even for Class C or D cost estimates, would require further engineering analysis and study for an option that has been found to not satisfy the environmental needs. Again, it is noted that the descriptions below are related only to cost (i.e., the Economic criteria), with more information regarding the Environmental, Technological and Social criteria considerations detailed in the TAR.

- Distance—while for the purposes of options analysis, we assumed distance implications to be the same between options. However, it may be more expensive per metre of pipe to build to the river. Our engineers advise that the pipe may need to be steel rather than HDPE because of hydraulic pressure implications of a river discharge.
- Steel Pipe—some of the implications of the need for a steel pipe would mean increased construction material costs and different construction methodology. While the HDPE pipe can be fused using local equipment and expertise, steel pipe would require specialized equipment and Red Seal certified welding contractors that may not be locally available.
- Terrain and construction implications of that terrain—the pipe run to Quesnel Lake is a fairly simple terrain over which to construct. The terrain that the pipe crosses on the way to Quesnel River is more complex, resulting in the possibility that there is a greater construction cost per linear distance. This detailed evaluation has not been carried out.
- Pumping stations—there may need to be pumping booster stations. These are typically expensive not only because of the types of pumps required but also because of the need to provide power to those stations.
- Capital and operating costs of an in-river diffuser—this is a dynamic section of river, and a mid-channel diffuser structure would be subjected to considerable design, inspection and maintenance challenges as it would be subject to fluctuating flow regimes, ice and bedload movement in the form of large rocks/boulders.

The Quesnel River option would also require additional studies such as a fish habitat survey to identify non-fish spawning areas for an initial dilution zone.

The Options Analysis is not sensitive to a change in any single criterion, including cost. As outlined in the original Options Analysis, of the twelve secondary criteria listed, nine favour Quesnel Lake over Quesnel River, two are tied, and one favours Quesnel River. Furthermore, as described in the following section of this memorandum, removing any of the four pillars of the Options Analysis entirely does not change the outcome of the analysis. In other words, even if costs are completely ignored, the Quesnel Lake option remains a better overall option compared to the Quesnel River option—cost was not the determining factor. Returning to the purpose of completing the costing as requested in the G2G letter (to help public's and band membership's understanding of the MPMC's choices), it is the sentiment of both Golder and MPMC that understanding the above is key in satisfying this purpose, and advocate that, conversely, provision of more detailed costing does not best serve this purpose.

In the context of providing as much information as we are able to, based on what is available, we have provided additional detail on the sensitivity analysis below.

3.0 SENSITIVITY ANALYSIS

A common technique for determining the robustness of a decision that is supported by an Options Analysis is to perform a sensitivity analysis on the final table. This is done by changing the weighting or scores in a transparent manner to understand how the decision might change under "what-if" scenarios. In this case, the "what-if" scenario to be evaluated is "what if costs are ignored entirely". This scenario can be evaluated by setting the weighting of all Economic criteria to zero and multiplying the non-economic weightings by 4/3 to arrive at equivalent overall scores. This has been done individually for each of the four "pillars" of the Options Analysis (Environmental, Technological, Social and Economic).

The resulting matrices are presented in Attachment 1, and the results are summarized in Table 1. A copy of the original Options Analysis is included as Attachment 2 for reference. Because the majority of comments received since the submission of the EMA Permit 11678 amendment application have focused on the evaluation of Quesnel Lake versus Quesnel River, this memorandum focuses exclusively on those two options. As shown in Table 1, the Quesnel Lake option is superior to the Quesnel River option regardless of which pillar is removed.

What this illustrates is that no single criterion would change the outcome of the Options Analysis, whether that criterion were ignored or incorrectly assessed. So while cost was not the determining factor, neither was any other single factor. The Quesnel Lake option is superior in terms of environmental, technological and economic considerations.

Table 1: Scores and Ranks of Sensitivity Analysis

Sensitivity Analysis	Quesnel Lake		Quesnel River	
	Score	Rank	Score	Rank
No Environmental Criteria	392	1	333	2
No Technological Criteria	367	1	337	2
No Social Criteria	408	1	253	4
No Economic Criteria	408	1	337	2
Original Options Analysis	*394*	*1*	*315*	*4*

4.0 CLOSURE

The reader is referred to the Study Limitations, which follows the text and forms an integral part of this memorandum.

Although we do not have available the information requested in the 22 December 2016 G2G letter, we trust that this letter provides at least some of the basis of cost comparisons that would be factored into development of a cost estimate. We would further add that the engineering studies needed to develop the cost estimate of options that are not the subject of MPMC's application would take additional time and resources and could potentially delay a critical path item. The consequences of delayed permits would be accumulation of surplus water on site—the very outcome that water management planning is seeking to avoid.

Importantly, it is also the sentiment of both Golder and MPMC that understanding the inputs and use of an Options Analysis is key in satisfying the purpose as stated in the G2G letter, namely to "help in the public's understanding of the choices MPMC is making relative to the future operations of the mine". While MPMC and Golder did consider costs as part of their Options Analysis for water management at the Mount Polley Mine, and have endeavoured to provide additional information as to the considerations for the Quesnel River option (as compared to the Quesnel Lake option) in this memorandum, it is advocated that understanding the Options Analysis process, and the reasons for which detailed costing is not required for the considerations for this application, is important in fulfilling such purpose.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Jerry Vandenberg, MSc, PChem
Principal, Environmental Chemist

ORIGINAL SIGNED

Lee Nikl, MSc, RPBio
Principal, Aquatic Scientist

JV/LN/it/cmm

Attachments: Study Limitations
Attachment 1: Options Analysis with Each of the Four Pillars Excluded
Attachment 2: Original Options Analysis from October 2016 Technical Assessment Report

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REFERENCE

Golder (Golder Associates Ltd.). 2016. Permit Amendment Application under the Environmental Management Act: Technical Assessment Report. Submitted to Dale Reimer, Mount Polley Mining Corporation, Golder Doc. No. 1411734-162-R-Rev0-16000. 17 October 2016.

STUDY LIMITATIONS

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ATTACHMENT 1
Options Analysis with Each of the Four Pillars Excluded

Primary Criteria

Criteria	Description	Status Quo (for comparison only)	Option 1 - Pipeline to Quesnel Lake	Option 2 - Re-locating Hazeltine Creek Discharge	Option 3 - Pipeline to Quesnel River	Option 4 - Distributed to Bootjack Lake, Polley Lake, Hazeltine Creek	Option 5 - Science based environmental benchmarks
Environmental	Does not cause adverse impacts to aquatic, terrestrial or human	✓	✓	✓	✓	✓	✓
Legal	Complies with all applicable provincial and federal policy and law	✓	✓	✓	✓	✓	✓

Secondary Criteria

Criteria		Description	Weighting	Status Quo (for comparison only)			Option 1 - Pipeline to Quesnel Lake			Option 2 - Re-locating Hazeltine Creek Discharge			Option 3 - Pipeline to Quesnel River			Option 4 - Distributed to Bootjack Lake, Polley Lake, Hazeltine Creek			Option 5 - Science based environmental benchmarks		
				Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments
Environmental	Assimilative Capacity	Minimum of 10x dilution, >100x dilution preferred	0	1	0	Low dilution at point of discharge	5	0	High predicted and measured dilution	1	0	Low dilution at point of discharge	3	0	>10x dilution, large IDZ required at low flows	4	0	Effluent distributed to multiple locations	2	0	Benchmarks and treatment tailored to receiving environment
Environmental	Aquatic Effects	Minimize receiving effects on receiving environment	0	1	0	Prevents or prolongs rehabilitation	5	0	All WQG met at IDZ	2	0	Incomplete restoration of Hazeltine Creek	3	0	IDZ may impinge on fish spawning habitat	3	0	Discharge distributed but into unimpacted water body	4	0	Benchmarks would be derived to minimize aquatic effects
Environmental	Terrestrial Effects	Minimize disturbance (land clearing, construction area, linear disturbance)	0	5	0	Minimal pipeline and infrastructure required	2	0	Use of existing infrastructure; some new linear disturbance	4	0	Minimal pipeline along disturbed corridor	1	0	Additional linear disturbance and diffuser construction	3	0	Low terrestrial disturbance	5	0	Minimal pipeline and infrastructure required
Environmental	Long Term Sustainability	Ensure location will be viable for long term	0	1	0	Short-term solution	3	0	Suitable for long term but not permanent	2	0	Allows progressive rehabilitation	3	0	Suitable for long term but not permanent	5	0	Viable permanent solution that restores pre-mining flows	4	0	Viable permanent solution
Technological	Risk and Consequence of Failure	Minimize likelihood of failure and potential effect of failure	8.333	1	8.3333	Risk of uncontrolled release to Quesnel Lake	5	41.667	Deep diffuser in low traffic area	1	8.3333	Risk of uncontrolled release to Quesnel River	2	16.667	Diffuser located in shallow flow	3	25	Distributed flows disperse risk	4	33.333	Low risk of failure; minimal infrastructure
Technological	Complexity	Prefer lower complexity	8.333	3	25	Low complexity of system; high complexity of flow management	4	33.333	Single pipeline and use of existing diffuser	3	25	Low complexity of system; high complexity of flow management	2	16.667	Long pipeline; river diffuser	1	8.3333	Most complex drainageand discharge systems	5	41.667	Low complexity
Technological	Flexible Design	Adaptable and scalable	8.333	1	8.3333	No flexibility - current system is already limited	5	41.667	Readily adaptable to higher flows	1	8.3333	No flexibility - current system is already limited	4	33.333	Some flexibility but may be limited seasonally	3	25	Limited scalability; readily adaptable	2	16.667	Difficult to scale
Technological	Risk of Non-compliance	Prefer higher reliability	8.333	1	8.3333	Requires highly managed flows	5	41.667	Lowest variability in receiving environment	1	8.3333	Requires highly managed flows	2	16.667	Dilution impacted by variable flow rate in receiving environment	4	33.333	Lake systems less variable than lotic	3	25	Dependent upon derivation
Social	Restoration of Fish Habitat	Preference to restore more habitat in Hazeltine Creek sooner	16.67	1	16.667	Prevents or prolongs rehabilitation	5	83.333	Allows complete restoration	2	33.333	Partial restoration Short timeline	5	83.333	Allows complete restoration	3	50	Allows complete restoration but in longer time frame	3	50	Allows complete restoration but in longer time frame
Social	Acceptance of Option	Stated preference of stakeholders	16.67	1	16.667	Not favoured by any stakeholder	2	33.333	Allows restoration of Hazeltine Creek but entails discharge upgradient of Likely	1	16.667	Not favoured by any stakeholder	5	83.333	Preferred by Likely residents	4	66.667	Stated preference of some stakeholders	2	33.333	Anticipated low acceptance
Economic	Capital Cost	Lower capital cost	16.67	5	83.333	No capital cost	2	33.333	Higher cost of pipeline installation	3	50	Short pipeline required	1	16.667	Higher cost of pipeline installation	4	66.667	Multiple discharge locations, all nearby	4	66.667	Low infrastructure cost; additional studies required
Economic	Operating Cost	Lower operating cost	16.67	1	16.667	High management and monitoring effort	5	83.333	Minimize maintenance and monitoring locations	1	16.667	High management and monitoring effort	4	66.667	Long pipeline and river diffuser to maintain	2	33.333	Long-term monitoring at multiple locations	3	50	Long-term monitoring

Final Scoring

Environmental		0	Subtota	0		Subtota	0		Subtota	0		Subtota	0		Subtota	0		Subtota	0	
Technological		33.3	Subtota	50		Subtota	158.33		Subtota	50		Subtota	83.333		Subtota	91.667		Subtota	116.67	
Social		33.3	Subtota	33.333		Subtota	116.67		Subtota	50		Subtota	166.67		Subtota	116.67		Subtota	83.333	
Economic		33.3	Subtota	100		Subtota	116.67		Subtota	66.667		Subtota	83.333		Subtota	100		Subtota	116.67	
TOTAL SCORE		100	**TOTAL**	**183.33**	**not ranked**	**TOTAL**	**391.67**	**Rank: 1**	**TOTAL**	**166.67**	**Rank: 5**	**TOTAL**	**333.33**	**Rank: 2**	**TOTAL**	**308.33**	**Rank: 4**	**TOTAL**	**316.67**	**Rank: 3**

Primary Criteria

Criteria	Description	Status Quo (for comparison only)	Option 1 - Pipeline to Quesnel Lake	Option 2 - Re-locating Hazeltine Creek Discharge	Option 3 - Pipeline to Quesnel River	Option 4 - Distributed to Bootjack Lake, Polley Lake, Hazeltine Creek	Option 5 - Science based environmental benchmarks
Environmental	Does not cause adverse impacts to aquatic, terrestrial or human	✓	✓	✓	✓	✓	✓
Legal	Complies with all applicable provincial and federal policy and law	✓	✓	✓	✓	✓	✓

Secondary Criteria

Criteria		Description	Weighting	Status Quo (for comparison only)			Option 1 - Pipeline to Quesnel Lake			Option 2 - Re-locating Hazeltine Creek Discharge			Option 3 - Pipeline to Quesnel River			Option 4 - Distributed to Bootjack Lake, Polley Lake, Hazeltine Creek			Option 5 - Science based environmental benchmarks		
				Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments
Environmental	Assimilative Capacity	Minimum of 10x dilution, >100x dilution preferred	6.667	1	6.6667	Low dilution at point of discharge	5	33.333	High predicted and measured dilution	1	6.6667	Low dilution at point of discharge	3	20	>10x dilution, large IDZ required at low flows	4	26.667	Effluent distributed to multiple locations	2	13.333	Benchmarks and treatment tailored to receiving environment
Environmental	Aquatic Effects	Minimize receiving effects on receiving environment	13.33	1	13.333	Prevents or prolongs rehabilitation	5	66.667	All WQG met at IDZ	2	26.667	Incomplete restoration of Hazeltine Creek	3	40	IDZ may impinge on fish spawning habitat	3	40	Discharge distributed but into unimpacted water body	4	53.333	Benchmarks would be derived to minimize aquatic effects
Environmental	Terrestrial Effects	Minimize disturbance (land clearing, construction area, linear disturbance)	6.667	5	33.333	Minimal pipeline and infrastructure required	2	13.333	Use of existing infrastructure; some new linear disturbance	4	26.667	Minimal pipeline along disturbed corridor	1	6.6667	Additional linear disturbance and diffuser construction	3	20	Low terrestrial disturbance	5	33.333	Minimal pipeline and infrastructure required
Environmental	Long Term Sustainability	Ensure location will be viable for long term	6.667	1	6.6667	Short-term solution	3	20	Suitable for long term but not permanent	2	13.333	Allows progressive rehabilitation	3	20	Suitable for long term but not permanent	5	33.333	Viable permanent solution that restores pre-mining flows	4	26.667	Viable permanent solution
Technological	Risk and Consequence of Failure	Minimize likelihood of failure and potential effect of failure	0	1	0	Risk of uncontrolled release to Quesnel Lake	5	0	Deep diffuser in low traffic area	1	0	Risk of uncontrolled release to Quesnel River	2	0	Diffuser located in shallow flow	3	0	Distributed flows disperse risk	4	0	Low risk of failure; minimal infrastructure
Technological	Complexity	Prefer lower complexity	0	3	0	Low complexity of system; high complexity of flow management	4	0	Single pipeline and use of existing diffuser	3	0	Low complexity of system; high complexity of flow management	2	0	Long pipeline; river diffuser	1	0	Most complex drainageand discharge systems	5	0	Low complexity
Technological	Flexible Design	Adaptable and scalable	0	1	0	No flexibility - current system is already limited	5	0	Readily adaptable to higher flows	1	0	No flexibility - current system is already limited	4	0	Some flexibility but may be limited seasonally	3	0	Limited scalability; readily adaptable	2	0	Difficult to scale
Technological	Risk of Non-compliance	Prefer higher reliability	0	1	0	Requires highly managed flows	5	0	Lowest variability in receiving environment	1	0	Requires highly managed flows	2	0	Dilution impacted by variable flow rate in receiving environment	4	0	Lake systems less variable than lotic	3	0	Dependent upon derivation
Social	Restoration of Fish Habitat	Preference to restore more habitat in Hazeltine Creek sooner	16.67	1	16.667	Prevents or prolongs rehabilitation	5	83.333	Allows complete restoration	2	33.333	Partial restoration Short timeline	5	83.333	Allows complete restoration	3	50	Allows complete restoration but in longer time frame	3	50	Allows complete restoration but in longer time frame
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Final Scoring

Environmental		33.3	Subtota	60		Subtota	133.33		Subtota	73.333		Subtota	86.667		Subtota	120		Subtota	126.67	
Technological		0	Subtota	0		Subtota	0		Subtota	0		Subtota	0		Subtota	0		Subtota	0	
Social		33.3	Subtota	33.333		Subtota	116.67		Subtota	50		Subtota	166.67		Subtota	116.67		Subtota	83.333	
Economic		33.3	Subtota	100		Subtota	116.67		Subtota	66.667		Subtota	83.333		Subtota	100		Subtota	116.67	
TOTAL SCORE		100	**TOTAL**	**193.33**	**not ranked**	**TOTAL**	**366.67**	**Rank: 1**	**TOTAL**	**190**	**Rank: 5**	**TOTAL**	**336.67**	**Rank: 2**	**TOTAL**	**336.67**	**Rank: 3**	**TOTAL**	**326.67**	**Rank: 4**

Primary Criteria

Criteria	Description	Status Quo (for comparison only)	Option 1 - Pipeline to Quesnel Lake	Option 2 - Re-locating Hazeltine Creek Discharge	Option 3 - Pipeline to Quesnel River	Option 4 - Distributed to Bootjack Lake, Polley Lake, Hazeltine Creek	Option 5 - Science based environmental benchmarks
Environmental	Does not cause adverse impacts to aquatic, terrestrial or human	✓	✓	✓	✓	✓	✓
Legal	Complies with all applicable provincial and federal policy and law	✓	✓	✓	✓	✓	✓

Secondary Criteria

Criteria		Description	Weighting	Status Quo (for comparison only)			Option 1 - Pipeline to Quesnel Lake			Option 2 - Re-locating Hazeltine Creek Discharge			Option 3 - Pipeline to Quesnel River			Option 4 - Distributed to Bootjack Lake, Polley Lake, Hazeltine Creek			Option 5 - Science based environmental benchmarks		
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Environmental	Long Term Sustainability	Ensure location will be viable for long term	6.667	1	6.6667	Short-term solution	3	20	Suitable for long term but not permanent	2	13.333	Allows progressive rehabilitation	3	20	Suitable for long term but not permanent	5	33.333	Viable permanent solution that restores pre-mining flows	4	26.667	Viable permanent solution
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Final Scoring

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Technological		33.3	Subtota	50		Subtota	158.33		Subtota	50		Subtota	83.333		Subtota	91.667		Subtota	116.67	
Social		0	Subtota	0		Subtota	0		Subtota	0		Subtota	0		Subtota	0		Subtota	0	
Economic		33.3	Subtota	100		Subtota	116.67		Subtota	66.667		Subtota	83.333		Subtota	100		Subtota	116.67	
TOTAL SCORE		100	**TOTAL**	**210**	**not ranked**	**TOTAL**	**408.33**	**Rank: 1**	**TOTAL**	**190**	**Rank: 5**	**TOTAL**	**253.33**	**Rank: 4**	**TOTAL**	**311.67**	**Rank: 3**	**TOTAL**	**360**	**Rank: 2**

Primary Criteria

Criteria	Description	Status Quo (for comparison only)	Option 1 - Pipeline to Quesnel Lake	Option 2 - Re-locating Hazeltine Creek Discharge	Option 3 - Pipeline to Quesnel River	Option 4 - Distributed to Bootjack Lake, Polley Lake, Hazeltine Creek	Option 5 - Science based environmental benchmarks
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Economic	Capital Cost	Lower capital cost	0	5	0	No capital cost	2	0	Higher cost of pipeline installation	3	0	Short pipeline required	1	0	Higher cost of pipeline installation	4	0	Multiple discharge locations, all nearby	4	0	Low infrastructure cost; additional studies required
Economic	Operating Cost	Lower operating cost	0	1	0	High management and monitoring effort	5	0	Minimize maintenance and monitoring locations	1	0	High management and monitoring effort	4	0	Long pipeline and river diffuser to maintain	2	0	Long-term monitoring at multiple locations	3	0	Long-term monitoring

Final Scoring

Environmental		33.3	Subtota	60		Subtota	133.33		Subtota	73.333		Subtota	86.667		Subtota	120		Subtota	126.67	
Technological		33.3	Subtota	50		Subtota	158.33		Subtota	50		Subtota	83.333		Subtota	91.667		Subtota	116.67	
Social		33.3	Subtota	33.333		Subtota	116.67		Subtota	50		Subtota	166.67		Subtota	116.67		Subtota	83.333	
Economic		0	Subtota	0		Subtota	0		Subtota	0		Subtota	0		Subtota	0		Subtota	0	
TOTAL SCORE		100	**TOTAL**	**143.33**	**not ranked**	**TOTAL**	**408.33**	**Rank: 1**	**TOTAL**	**173.33**	**Rank: 5**	**TOTAL**	**336.67**	**Rank: 2**	**TOTAL**	**328.33**	**Rank: 3**	**TOTAL**	**326.67**	**Rank: 4**

ATTACHMENT 2
Original Options Analysis from October 2016 Technical Assessment Report

TECHNICAL MEMORANDUM

DATE 17 October 2016 **REFERENCE No.** 1411734-164-TM-Rev0-16000

TO Dale Reimer, General Manager
Mount Polley Mining Corporation

FROM Janis Drozdiak and Jerry Vandenberg **EMAIL** Janis_Drozdiak@golder.com; Jerry_Vandenberg@golder.com

OPTIONS ANALYSIS FOR MOUNT POLLEY MINE LONG-TERM WATER MANAGEMENT PLAN

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) has developed a Long-Term Water Management Plan per Section 2.9 of British Columbia *Environmental Management Act* Permit 11678. One component of the Long-Term Water Management Plan is an options analysis, which considered potential discharge locations for treated effluent. The primary goal of the options analysis was to identify discharge options for the long-term water management strategy, which will be suitable for the remainder of Mount Polley Mine operations, closure, and post-closure. This document presents an introduction to the process that was used to screen, evaluate, and select options. It includes a list of options for discharge locations, as well as the weighting and ranking of these options.

2.0 OPTION EVALUATION METHOD

The Kepner-Tregoe (K-T) process was used to evaluate the discharge location for the long-term water management strategy. This method comprises the following steps:

1) **Identify and define potential options**—For the discharge location, a number of options are available. At this stage, all potentially viable options are included in a list, without assigning any preference or likelihood to any given option. A “do nothing” option is included for comparative purposes. A description is included for each option.

2) **Identify and define primary screening criteria**—Primary criteria, also called non-compensatory criteria, are those that have pass/fail or absolute minimum or maximum requirements. Primary criteria are intended to screen an initial list, which may include many options, down to a few options that can be evaluated in more detail.

3) **Identify and define the secondary criteria**—Secondary criteria are those that need to be weighed and evaluated against each other. They are often competing or conflicting demands that make a decision more difficult and less obvious to parties with different priorities. Secondary criteria are often categorized according to the “triple bottom line”: environmental, social, and economic factors; a fourth factor, technical feasibility, is sometimes also included as a separate category, as was done in this case. A description of what constitutes a better or worse option should be included so that options can be objectively ranked against each other. Only criteria that can differentiate options should be included.

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4) **Agree on the rules for weighting and ranking**—Certain rules must be followed to make an objective and transparent decision. The following rules were applied in this options analysis:

   - Total weighting must equal 100.
   - Major categories (e.g., social, environmental, economic, technical) are assigned equal weighting.
   - Rankings are from one to five; the lowest score (i.e., least preferable) must be one and the highest must be five; intermediate ranks need not be evenly or linearly spaced.
   - Two options may tie on a given criterion, but all options may not tie evenly.
   - Final scores are non-binding because the options analysis is completed in advance of detailed engineering and scientific evaluation. The options analysis supports, but does not bind, a decision. If a leading option is later rejected, justification will be provided for its rejection.

5) **Arrange options and criteria**—In a spreadsheet, a matrix is arranged with options in a row at the top and criteria down a column on the left.

6) **Assign weightings to each criterion**—The weightings reflect the importance or priority of each criterion, with the most important criteria having higher weight. These weightings should be somewhat linear (i.e., a criterion that is twice as important as another criterion should be weighted approximately twice as heavily) because, upon completion of the process, they will directly affect a numerical score that indicates the optimal option.

7) **Apply the primary criteria**—Potential options are screened and options to be subjected to detailed evaluation are shortlisted. Options that fail primary criteria are not considered or evaluated further.

8) **Rank each option**—Moving through one criterion at a time, each option is ranked.

9) **Score each option**—Scores are calculated by multiplying each weighting by each ranking, and summing the products. The preferred option(s) are selected based on overall rankings.

10) **Conduct a sensitivity analysis**—In the case of either lack of consensus, or uncertainty regarding weightings or rankings, individual weightings and rankings can be adjusted to see if it would change the highest ranked option. A sensitivity analysis can also be done to explore “what if” scenarios to evaluate changing conditions.

Input for the each of the steps listed above was gained from previous options analyses (listed in the following section) as well as Water Workshops held by MPMC in Likely, BC and the MPMC Public Liaison Committee meeting at the Mine on 12 May 2016. Electronic copies of the options analysis (a blank version and a completed version) were distributed to MPMC’s Public Liaison Committee for input in advance of a public meeting in Likely on 25 May 2016, during which additional feedback was gathered.

3.0 OPTIONS ANALYSIS – DISCHARGE LOCATION

3.1 Previous Analyses

Previous options analyses have been completed as part of the short-term *Technical Assessment Report in Support of an Effluent Permit Amendment* (Golder 2015) and the *Alternative Discharge Design and Construction Plan* (Golder 2016). Through these analyses, ten options were originally screened, feedback was obtained from interested parties, and five options were shortlisted as the most viable or popular options for the detailed analysis described herein.

3.2 Option Description

Five potential discharge locations and a “status quo” option have been identified, as described in Table 1.

Table 1: Description of Potential Discharge Location Options

Option	Title	Description
1	Pipeline to Quesnel Lake	Using pipeline to convey discharge to Quesnel Lake.
2	Relocating Hazeltine Creek discharge	Locating the point of discharge further downstream to allow rehabilitation of fish habitat in the upper reach of Hazeltine Creek and connection to Polley Lake.
3	Pipeline to Quesnel River	Using pipeline to convey discharge to Quesnel River.
4	Distributed to Bootjack Lake, Polley Lake, Hazeltine Creek	Distributing flows to multiple waterbodies, preferably in proportion to pre-development flows.
5	Science-based environmental benchmarks	Developing science-based environmental benchmarks, in accordance with provincial guidance, and discharging to the assimilative capacity of Hazeltine Creek while rehabilitating the creek to fish habitat.
6	Status quo	“Do nothing” option, evaluated for comparative purposes only. Not considered as a viable option beyond permitted date of November 2017.

3.3 Option Comparison

The major advantages and disadvantages of the potential discharge location options are listed in Table 2.

Table 2: Advantages and Disadvantages of Potential Discharge Location Options

Option	Title	Advantages	Disadvantages
1	Pipeline to Quesnel Lake	■ High predicted and measured dilution ■ Deep diffuser in low traffic area ■ Allows complete rehabilitation of Hazeltine Creek	■ High cost of pipeline installation
2	Relocating Hazeltine Creek discharge	■ Minimal pipeline along disturbed corridor ■ Short pipeline required	■ Low dilution at point of discharge ■ Risk of uncontrolled release to Quesnel Lake ■ Requires highly managed flows
3	Pipeline to Quesnel River	■ Stated preference of many Likely residents ■ Allows complete rehabilitation of Hazeltine Creek	■ Additional linear disturbance and diffuser construction ■ Large initial dilution zone required that may impinge fish spawning areas ■ Dilution variable with flow ■ Higher cost of pipeline installation due to distance

Option	Title	Advantages	Disadvantages
4	Distributed flows to Bootjack Lake, Polley Lake, Hazeltine Creek	■ Viable permanent solution that restores pre-mining flows ■ Stated preference of some stakeholders and First Nations	■ Most complex drainage and discharge systems ■ Long-term monitoring at multiple locations
5	Science-based environmental benchmarks	■ Minimal pipeline and infrastructure requirements ■ Low technological complexity	■ Difficult to scale flows ■ Anticipated low public acceptance ■ Long-term monitoring
6	Status quo	*Not evaluated*	*Not evaluated*

3.4 Primary Option Screening

A primary screening of discharge location options was carried out with the criteria listed below:

- **Environmental**—does not cause adverse impacts to aquatic, terrestrial, or human receptors
- **Legal**—complies with all applicable provincial and federal policy and law

The primary screening did not remove any options, but the criteria were maintained as requirements so that if any options were subsequently modified during detailed studies, they must adhere to these criteria.

3.5 Detailed Evaluation

Secondary criteria were applied to differentiate options, as presented in Table 3.

Table 3: Evaluation Criteria for Discharge Locations

Environmental	
Assimilative capacity	Minimum of 10× dilution; >100× dilution preferred
Aquatic effects	Minimize effects on receiving environment
Terrestrial effects	Minimize disturbance (land clearing, construction area, linear disturbance)
Long-term sustainability	Location should be viable for long term, preferably for the remainder of operations and through to post-closure
Technological	
Risk and consequence of failure	Minimize likelihood of failure and potential effect of failure
Complexity	Prefer lower complexity
Flexible design	Prefer adaptable and scalable
Risk of non-compliance	Prefer higher reliability
Social	
Restoration of fish habitat	Preference to rehabilitate more habitat in Hazeltine Creek sooner
Acceptance of option	Stated preference of stakeholders
Economic	
Capital cost	Prefer lower capital cost
Operating cost	Prefer lower operating cost

3.6 Option Weighting and Ranking

The evaluation criteria described in Table 3 were used in the K-T analysis of discharge location options. Weights were assigned to the criteria based on the relative importance of each specific criterion. Quantitative ratings were assigned to each option using the numeric values 1 to 5 (5 being the most preferable, 1 the least preferable). Rankings for each option were multiplied by the relative weighting for each criterion. These weighted scores were summed to determine the total score for each option.

Where possible, quantitative analyses were completed to rank the proposed discharge options.

3.6.1 Noted Considerations for Assimilative Capacity

The assimilative capacity of the discharge location was assessed to determine the following:

- The minimum dilution factors as outlined in Table 3.
- The length of the mixing zone required to achieve the target dilution range.
- Likelihood that the proposed dilution zone impinges on fish spawning habitat.

Calculations of the dilution factors for discharges to Quesnel Lake (Appendix H of the TAR), Quesnel River (Attachment 1 of this Appendix) and Hazeltine Creek (Golder 2015) indicated the following:

- A greater than 40 times dilution can be achieved in Quesnel Lake at the edge of a 100 metre initial dilution zone – for most modelled scenarios a greater than 100 times dilution was achieved.
- For a centreline discharge to the Quesnel River, a 91x dilution factor can be achieved during the 7Q2 low flow and the site generally provides sufficient dilution to achieve equal to or greater than 100x dilution at the edge of a 100 metre mixing zone (see Attachment 1).
- There are periods when the minimum dilution of 10x will not be achievable in Hazeltine Creek.

The Quesnel Lake discharge was ranked over the Quesnel River option since the modelling work considered a centreline discharge. In reality, the discharge from the Mine would be at the edge of the river, which would reduce the modelled dilution by half or, the mixing zone length would have to be doubled to 200 metres to achieve the same dilution. The Hazeltine Creek option was given the lowest ranking due to the lack of dilution.

3.6.2 Noted Considerations for Aquatic Effects

As noted above, the quantitative analysis was also completed to determine if the mixing zone length would impinge on fish spawning habitat. The Quesnel Lake option is considered favorable to both the Quesnel River and Hazeltine Creek discharge options in this context, since the diffusers could be located at depth and away from the shore allowing the discharge to be designed in a manner that would not impinge on fish spawning habitat (in this instance, in the lake). A description of habitat considerations for Quesnel River is included below.

The upper mainstem of the Quesnel River provides valuable spawning habitat for numerous fish species (Pederson 1998). Kokanee salmon utilize the Narrows of Quesnel River near the town of Likely for spawning (Pederson 1998). A large portion of the Interior Fraser coho salmon population spawns in Quesnel River between Quesnel Lake and the UNBC Quesnel River Research Centre (Pederson 1998). Chinook salmon spawn in the Narrows and at the bridge near Likely (Pederson 1998). Dolly Varden spawn in Quesnel River from the Likely Bridge downstream to the UNBC Quesnel River Research Centre (Pederson 1998). The Quesnel River has also been identified as critical habitat for Quesnel Lake rainbow trout, which are believed to spawn in the river. The spawning habitat in the upper mainstem is not continuous but it is widely distributed and it will be determined by the presence of suitable depth, velocity and substrate conditions that are appropriate for the needs of each individual species.

As noted above, the Quesnel River would require a mixing zone of approximately 200 metres to achieve a similar dilution to the achievable dilution in Quesnel Lake. Although, fish spawning habitat is discontinuous in Quesnel River, discharge to this waterbody was given a lower ranking in comparison to Quesnel Lake due to the increased likelihood of the long mixing zone (e.g., 200 metres long and one-quarter river width) coming into contact with fish habitat.

4.0 RESULTS

A populated matrix is included as Attachment 2, and Table 4 shows the total final score for each option. The results indicate that, to balance environmental, technological, social, and economic criteria, the pipeline to Quesnel Lake is the best overall option for the Long-Term Water Management Plan.

Table 4: Options Analysis Final Results

Option	Title	Score	Overall Rank[(a)]
1	Pipeline to Quesnel Lake	393.75	1
2	Relocating Hazeltine Creek discharge	180	5
3	Pipeline to Quesnel River	315	4
4	Distributed to Bootjack Lake, Polley Lake, Hazeltine Creek	321.25	3
5	Science-based environmental benchmarks	332.5	2
6	Status quo	182.5	-

(a) For the overall rank, the lowest number indicates the most preferred overall option

Science-based environmental benchmarks (SBEBs) were ranked as the second most viable option based on the criteria employed in the current options analysis. After the options analysis was completed, MPMC discussed SBEBs with the MoE, and based on the outcomes of these discussions, MPMC will not be considering SBEBs at this time in the proposal of the Long-Term Water Management Plan. SBEBs are, however, left in this options analysis to maintain the information that has been presented to community members and to provide a comprehensive overview of the options that have been considered in the development of the Long-Term Water Management plan.

With the exclusion of SBEBs from this analysis, the option of distributed flows becomes the second most preferable option. MPMC continues to pursue this option in the context of closure and post-closure water management.

4.1 Sensitivity Analysis

As part of the analysis, a number of perspectives were sought to evaluate whether the analysis is sensitive to a particular discipline or lens through which it is viewed. The analysis was first completed by an environmental scientist for an environmental perspective, second by a design engineer for a technical perspective, and third by MPMC for an operator perspective. Each of these perspectives came to the same conclusion on the overall rankings, with little variation in numerical scores. Finally, the options analysis was distributed to MPMC's Public Liaison Committee and other interested members of the public in May 2016 for the social perspective. The feedback received indicated that, if environmental, technological, social, and economic factors are weighted evenly, the overall rankings are not sensitive to any particular lens or perspective.

5.0 CLOSURE

We trust this memorandum meets your current requirements. If you have any questions or require additional details, please contact the undersigned.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Janis Drozdiak, PEng
Associate, Senior Pipeline Engineer

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Principal, Senior Environmental Chemist

Attachments: Study Limitations
Attachment 1: Preliminary Analysis of Hydrological Capacity and Initial Dilution Zone Mixing for the Quesnel River Discharge Option
Attachment 2: Options Analysis Matrix

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ATTACHMENT 1

Preliminary Analysis of Hydrological Capacity and Initial Dilution Zone Mixing for the Quesnel River Discharge Option

TECHNICAL MEMORANDUM

DATE 17 October 2016 **REFERENCE No.** 1411734-201-TM-Rev0-16000

TO Luke Moger
Mount Polley Mining Corporation

FROM Shouhong Wu, Robert Millar and Jerry Vandenberg **EMAIL** Shouhong_Wu@golder.com; Robert_Millar@golder.com; Jerry_Vandenberg@golder.com

PRELIMINARY ANALYSIS OF HYDROLOGICAL CAPACITY AND INITIAL DILUTION ZONE MIXING FOR THE QUESNEL RIVER DISCHARGE OPTION

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by Mount Polley Mining Corporation (MPMC) to undertake a preliminary analysis of the hydrologic capacity and initial dilution zone (IDZ) of the Quesnel River Discharge Option. This location is being considered as a potential long-term option for discharge of treated mine water from the Mount Polley Mine (the Mine). The approximate location of the proposed discharge site (the site), as considered in the Quesnel River Discharge Option, is 4.2 km downstream of the Likely Bridge (Figure 1).

MPMC is applying for an amendment of *Environmental Management Act* (EMA) Permit 11678 for a maximum annual discharge rate of 10 million metric metres (Mm^3). A discharge rate of 0.33 cubic metres per second (m^3/s) reflects the constant rate required to discharge the maximum annual volume of 10 Mm^3, which would be sufficient to manage water under the 99.5 percentile wet-year scenario (i.e., 199 years out of 200) based on hydrologic analysis found in Appendix B of this Technical Assessment Report. However, to balance larger flows during freshet, MPMC is also applying for a maximum instantaneous discharge rate of 0.6 m^3/s. This would allow for increased operational capability to manage water levels in the Springer Pit and peak flows during freshet: minimizing the volume of surplus water required to be stored on site.

The approach presented below represents a desktop analysis using general equations and parameter values from the literature. Additional field measurements would be required to refine or confirm the results.

2.0 HYDROLOGICAL CAPACITY AND FAR FIELD DILUTION RATIOS

The average far-field hydrologic capacity at the site can be determined by the ratio of the mean annual discharge (MAD) at the site divided by the effluent discharge rate. This provides the average dilution ratio. The hydrology in the Quesnel River is well established, with an Environment Canada flow gauge (08KH001) installed near the Likely Bridge. The flow gauge has been in operation since 1924, with continuous data since 1948.

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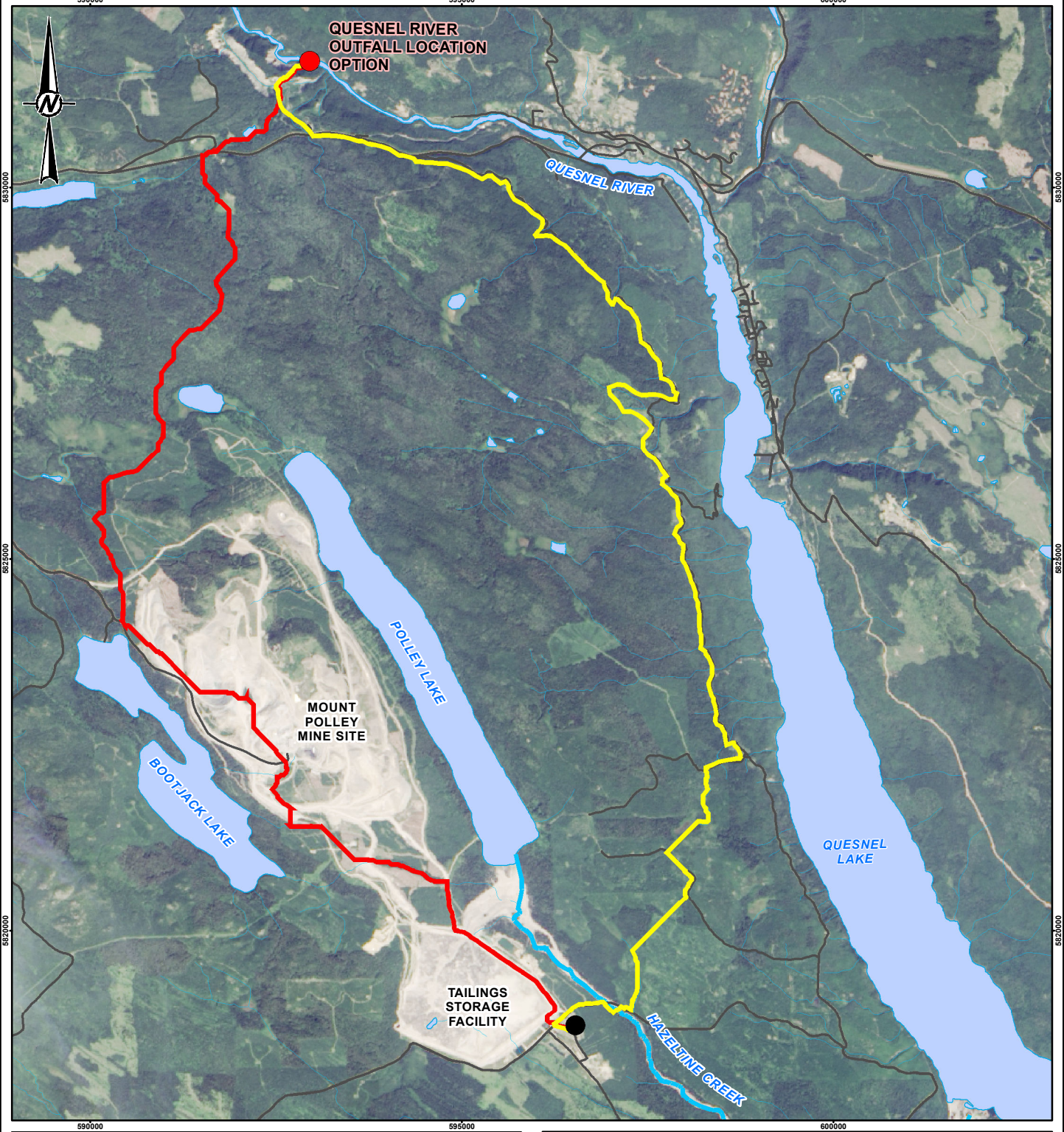
The 2010 annual hydrograph for Quesnel River near the Likely Bridge, together with the mean, minimum, and maximum recorded flows for the period of record, are shown in Figure 2. The MAD is 130 m^3/s; the mean seven-day low water flow (7Q2) is 30 m^3/s; and the mean annual peak flow (mean annual flood) is 394 m^3/s.

In general, a dilution ratio greater than 100:1 is desired under the EMA regulations. Dilution ratios as low as 10:1 may be acceptable with additional assessment, but are likely not acceptable. The average dilution ratio for the design effluent discharge is 394:1 (130/0.33). For the mean seven-day mean low water (7Q2), the dilution ratio is 91:1 (30/0.33).

Based on the hydrology, after complete mixing, the Quesnel River discharge site would generally provide sufficient far-field dilution (greater than 100:1) for all flows, although the minimum dilution for the 7Q2 low flow (91:1) is slightly less than the desired 100:1. However, these dilution ratios are based on complete mixing in the Quesnel River flow. Additional analysis is required for the near-field, or IDZ, which is discussed below.



LEGEND

- SOURCE LOCATION
- LONG-TERM OUTFALL LOCATION

LONG-TERM QUESNEL RIVER PIPELINE ROUTE OPTIONS

- OPTION QR-C
- OPTION QR-D
- ROAD
- WATERCOURSE
- WATERBODY

0 1.5 3

1:75,000 KILOMETRES

REFERENCE(S)

1. WATERCOURSE AND LAKE DATA OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. ORTHOPHOTO OBTAINED FROM NASA 20140217
3. PROJECTION: UTM ZONE 10; DATUM: NAD 1983

CLIENT
IMPERIAL METALS
MOUNT POLLEY MINING CORPORATION

PROJECT
MOUNT POLLEY MINE
TECHNICAL ASSESSMENT REPORT

TITLE
QUESNEL RIVER OUTFALL LOCATION OPTION

CONSULTANT

Golder Associates

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PREPARED	CD
REVIEWED	RM
APPROVED	JV

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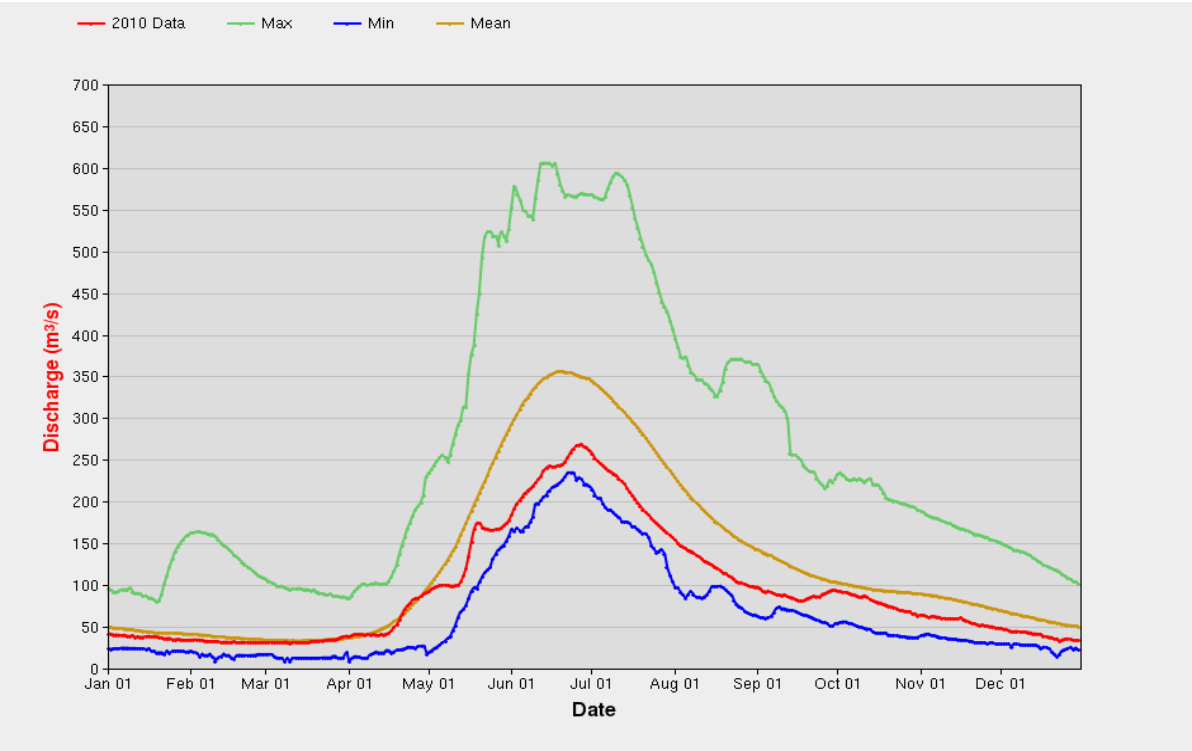

Figure 2: Annual Hydrograph for the Quesnel River at Likely (1924-2010)

3.0 INITIAL DILUTION ZONE

Under the *BC EMA, Municipal Wastewater Regulation* (Government of British Columbia, 2012), the length and width of the IDZ for streams and rivers are defined from mean low water (7Q2):

1) The width, perpendicular to the path of the stream, is the lesser of:

    a. 100 m

    b. 25% of the width of the stream

2) The length, parallel to the path of the stream, is the distance between a point 100-m upstream and a point that is the lesser of:

    c. 100 m downstream

    d. a distance downstream at which the width of the effluent plume equals the width determined under paragraph (1)

For mean low water, the width of the flow is estimated to be approximately 33.3 m (which is approximately half the bankfull width of 65.1 m), and therefore the width of the plume must be less than 8.3 m.

Based on the above, the IDZ for the Quesnel River site is defined as a zone that is 8.3 m wide, and within 100 m downstream of the discharge location (Figure 3). The desired minimum dilution at the boundary of the IDZ is 100:1.

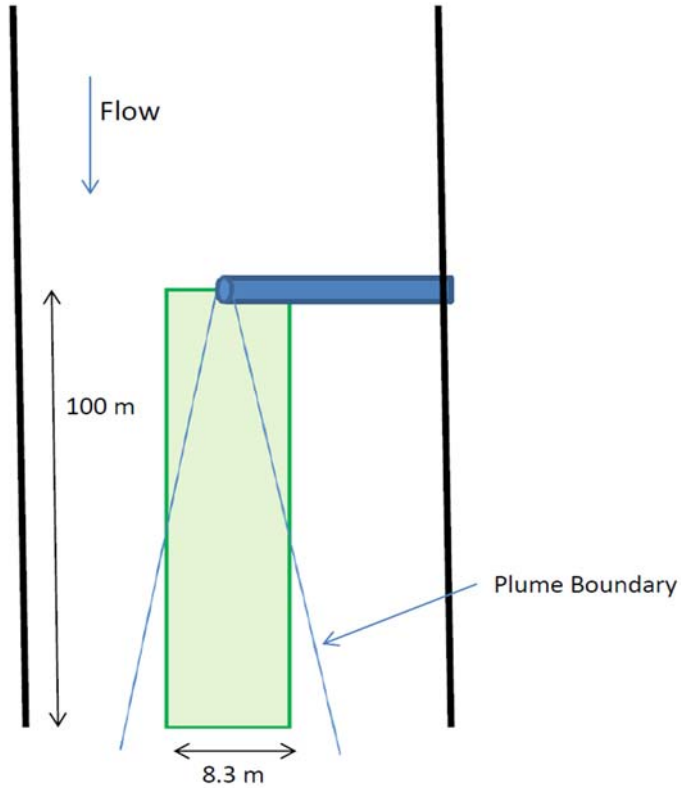

Figure 3: Definition Sketch for the IDZ for a Centreline Discharge

3.1 IDZ Dimensions for Quesnel River

The estimated IDZ for the site has been estimated through a two-dimensional advection-dispersion mixing analysis (see Attachment 1). The mixing parameter values have been assumed from literature values (Fischer et al. 1979). The variation in width, depth, and velocity with discharge have been estimated using hydraulic geometry relations (Leopold and Maddock, 1953). Details of the analysis are provided in Attachment 1.

3.1.1 Results

The key results for a single-point, centreline discharge with no diffuser are summarized in Table 1.

The minimum dilution ratios at the boundary of the IDZ for the design effluent discharge of 0.33 m^3/s under a range of Quesnel River flows are provided in column 5. For the design effluent discharge of 0.33 m^3/s, the minimum dilution rate of 100:1 at the boundary of the IDZ could only be achieved when flow in the Quesnel River was 119 m^3/s or greater. At mean low water (30 m^3/s), a minimum dilution ratio of 30:1 was estimated.

For each Quesnel River flow assessed (column 1) the corresponding maximum effluent discharge that would achieve a minimum dilution ratio of 100:1 at the boundary of the IDZ was also estimated (column 6). For the 7Q2 mean low flow (30 m^3/s), an effluent discharge of 0.1 m^3/s or less would achieve a minimum dilution ratio of 100:1 at the boundary of the IDZ. For flows in Quesnel River greater than 237 m^3/s, the minimum dilution of 100:1 would be achieved for the discharge of 0.6 m^3/s (column 6).

Table 1: Summary of IDZ Results for a Single-point, Centreline Discharge

Quesnel River Flow (m^3/s)	River Top Width (m)	Water Depth (m)	Flow Velocity (m/s)	Minimum Dilution Ratio ([a])	Maximum Effluent Discharge to Meet 100:1 Dilution (m^3/s)
[1]	[2]	[3]	[4]	[5]	[6]
30	33.3	0.78	1.16	30	0.10
50	37.9	0.96	1.38	47	0.16
119	**47.5**	**1.35**	**1.85**	**100**	**0.33**
150	50.4	1.48	2.01	122	0.40
237	56.7	1.78	2.34	182	0.60
264	58.4	1.86	2.43	200	0.66
400	65.1	2.20	2.80	287	0.95

Note: (a) At the boundary of the IDZ for the design effluent discharge of 0.33 m^3/s.

A single bank discharge point and multiple point discharges were also assessed (see Attachment 1). The single bank discharge resulted in lower dilution ratios (0.5 times those in Column [5]). The diffuser length was constrained by the plume width, and a two-port diffuser at the channel centreline provided a modest (+5%) increase in the maximum effluent discharge values (Column [6]).

4.0 ANNUAL EFFLUENT DISCHARGE

Based on the maximum effluent discharges that achieved a minimum dilution ratio of 100:1 at the boundary of the IDZ (Table 1 Column [6]), it is possible to determine the annual discharge volume that satisfies the near-field dilution requirements. To do so, discharge of treated effluent from the Mine was adjusted daily up to the maximum rate of 0.6 m^3/s based on real-time water levels recorded by Environment Canada at flow gauge 08KH001 near the Likely Bridge[1].

Annual discharge capacity estimates are provided based on historical Quesnel River daily flows (1948 through 2010) for maximum discharge rates of 0.33 m^3/s and 0.6 m^3/s (Table 2). For a maximum discharge rate of 0.33 m^3/s, the average annual discharge capacity is 7.5 Mm^3 (0.24 m^3/s). For a maximum instantaneous discharge rate of 0.6 m^3/s, the average annual discharge capacity is 9.8 Mm^3 (0.31 m^3/s). To achieve a discharge of 10 Mm^3 under 1:200-yer wet conditions, the maximum instantaneous discharge of 0.6 m^3/s would be required.

Table 2: Annual Effluent Discharge Capacity

Scenario	Maximum Discharge 0.33 m^3/s		Maximum Discharge 0.6 m^3/s	
	Mm^3	m^3/s	Mm^3	m^3/s
99.5% (Wet)	8.9	0.28	11.6	0.37
Average	7.5	0.24	9.8	0.31
0.05% (Dry)	6.1	0.19	7.7	0.24

[1] https://wateroffice.ec.gc.ca/report/report_e.html?type=realTime&stn=08KH001

5.0 CONCLUSIONS

The following conclusions are based on the above analysis (for a single-point centreline discharge port):

1) For an effluent discharge rate of 0.33 m^3/s the Quesnel River site generally provides adequate capacity to provide far-field dilution ratio of greater than, or equal to 100:1; although for mean 7Q2 low flow the dilution is 91:1.

2) The near-field dilution in the IDZ is limiting when flow in the Quesnel River is less than 119 m^3/s, which occurs on about 227 days per year (62%), on average.

3) To achieve a dilution ratio of greater than or equal to 100:1 at the boundary of the IDZ, the effluent discharge rate would need to be reduced below 0.33 m^3/s when the flow in the Quesnel River is less than 119 m^3/s.

4) A diffuser length would be limited by the mixing zone width, and would increase centreline dilution by approximately 5%.

5) Subject to a minimum dilution ratio of 100:1 at the boundary of the IDZ, the maximum instantaneous discharge rate of 0.6 m^3, requested by MPMC in the EMA Permit 11678 amendment application, would be required to provide 10 Mm^3 annual discharge capacity for 99.5% (1:200-year) wet conditions. Under this scenario, effluent flow rates would need to be continuously managed such that effluent flow is reduced or curtailed in response to changing river discharge rates.

6.0 CLOSURE

We trust that the information presented in this memo is sufficient for your present requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

GOLDER ASSOCIATES LTD.

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SW/RGM/JV/kp

Attachment : Mixing Calculations

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ATTACHMENT 1
Mixing Calculations

TECHNICAL MEMORANDUM

DATE 17 October 2016 **REFERENCE No.** 1411734-204-TM-Rev0-16000

TO Luke Moger
Mount Polley Mining Corporation

FROM Shouhong Wu and Robert Millar **EMAIL** Shouhong_Wu@golder.com; Robert_Millar@golder.com

MIXING CALCULATIONS

1.0 INTRODUCTION

The two-dimensional advection-dispersion analysis is based on the following assumptions.

- The 7Q2 (mean annual low flow) of the Quesnel River is 30.3 m³/s.
- River bankfull width is 65 m.
- Bankfull flow is 400 m³/s.
- The maximum, average, and minimum effluent discharge are, respectively, 0.3, 0.2, and 0.1 m³/s.
- River bed slope S_o = 0.0075.

2.0 CALCULATION OF TOP WIDTH AND WATER DEPTH FOR DIFFERENT RIVER FLOW RATES

The river top width and water depth for different flow rates were estimated by the regime equations from Leopold and Maddock (1953):

$$\begin{cases} W = aQ^{0.26} \\ H = bQ^{0.40} \end{cases} \quad [1]$$

where Q is river flow; W and H are, respectively, top width and water depth (m); and a and b are coefficients to be calibrated. The coefficient a has a value of 13.7 that is obtained using the provided bankfull top width and flow rate. A value of 0.2 was used for b that resulted in reasonable values for Manning's roughness n.

The estimated W, H and n values corresponding to different flow rates are listed in columns 2, 3 and 5 of Table A1 respectively.

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3.0 CALCULATION OF TURBULENT MIXING COEFFICIENT

The turbulent mixing coefficient ε_t was calculated based on the equation by Fischer et al. (1979):

$$\varepsilon_t = 0.6Hu^* \quad [2]$$

where 0.6 is assumed for irregular natural rivers, and u^* is shear velocity:

$$u^* = \sqrt{g * H * S_0} \quad [3]$$

and g is gravitational acceleration. The calculated u^* and ε_t values corresponding to different discharges are listed in columns 6 and 7 of Table A1, respectively.

4.0 FULL DEPTH MIXING ASSUMPTION

Table A1 indicates that the water depth ranges from 0.78 m to 2.2 m for discharges ranging from 30 m³/s to 400 m³/s, and the mean velocity (listed in column 4 of Table A1) varies from 1.2 m/s to 2.8 m/s. A full depth mixing was assumed because of the shallow river depth and high velocity.

Table A1: Lowest Dilution Factor at Edge of IDZ for Maximum Effluent Discharge (Centreline or Bank)

River Flow	Width	Water Depth	Flow Velocity	Manning's Roughness	Shear Velocity	Mixing Coefficient	Froude Number	Minimum Dilution [(a)]		Maximum Effluent Discharge [(b)]		
								Single-point Discharge at Centreline	Single Bank Discharge Point	Single-point Discharge at Centerline	Single Bank Discharge Point	Maximum IDZ Width for q_{m1}
Q (m^3/s)	W (m)	H (m)	V (m/s)	n	u* (m/s)	ε_t (m^2/s)	Fr	S_{m1}	S_{m2}	q_{m1}(m^3/s)	q_{m2} m^3/s)	L (m)
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
30.3	33.3	0.78	1.16	0.063	0.240	0.113	0.420	30	15	0.100	0.050	5.4
50.0	37.9	0.96	1.38	0.061	0.265	0.152	0.451	47	24	0.155	0.078	5.7
119	47.5	1.35	1.85	0.057	0.315	0.256	0.509	100	50	**0.330**	0.165	6.4
150.0	50.4	1.48	2.01	0.056	0.330	0.294	0.526	122	61	0.404	0.202	6.6
236.5	56.7	1.78	2.34	0.054	0.362	0.386	0.560	182	91	0.600	**0.300**	7.0
264	58.4	1.86	2.43	0.052	0.372	0.413	0.569	200	100	0.661	0.330	7.1
400.0	65.1	2.20	2.80	0.052	0.402	0.530	0.603	287	144	0.948	0.474	7.5

Notes

(a) At the boundary of the IDZ for the design effluent discharge of 0.33 m^3/s.

(b) To have dilution factor of 100 at edge of the IDZ.

5.0 CALCULATION OF THE LOWEST DILUTION FACTOR S_M AT THE EDGE OF INITIAL DILUTION ZONE FOR CENTRELINE EFFLUENT DISCHARGE

Let us first assume that the effluent is discharged into the river by a single point directly at the river centreline. At any cross section downstream of the discharge point, a constituent concentration is calculated by the equation from Fischer et al. (1979):

$$C = \frac{qC_0}{VH\sqrt{\frac{4\pi\varepsilon_t x}{V}}}\exp\left(-\frac{Vy^2}{4\varepsilon_t x}\right) \qquad [4]$$

where x and y are the longitudinal and lateral distances from the effluent, q is effluent discharge (m^3/s), C_0 is effluent's initial constituent concentration (mg/L). Eqn. [4] is valid for x in a range where the plume edge will not reach the river bank. By Eqn. [4], at any cross section downstream of the centreline discharge point, the highest concentration occurs at the river centreline (y=0). Because dilution factor $S=C_0/C$ we can evaluate the lowest dilution factor S_m at any downstream cross section by:

$$S_m = \frac{HV}{q}\sqrt{4\pi\varepsilon_t x/V} \qquad [5]$$

Eqn. [5] was used to evaluate the lowest dilution factor corresponding to the maximum effluent discharge of 0.3 m^3/s and at the edge of initial dilution zone (IDZ), which has a length of x=100 m (Government of British Columbia 2012), and the results are listed in column 9 of Table A1. This column indicates that for 7Q2 in the Quesnel River, the dilution factor at the edge of the IDZ is as low as 30:1 (Column 9).

For effluent discharge at bank, the lowest dilution factor at any downstream cross section occurs at bank, and its value equals to half of the value calculated by Eqn. [5]. Column 10 of Table A1 lists the lowest dilution factor corresponding q = 0.33 m^3/s and at the edge of IDZ. This column indicates that for 7Q2 on the Quesnel River, the dilution factor at the edge of IDZ is as low as 15. Table A1 also indicates that the allowable effluent discharge at bank is 0.474 m^3/s when river discharge equals bankfull discharge of 400 m^3/s.

6.0 CALCULATION OF THE ALLOWABLE MAXIMUM EFFLUENT DISCHARGE

Under the *Environmental Management Act, Municipal Wastewater Regulation* of BC (2012) at the edge of IDZ, the dilution ratio ≥ 100:1 is preferred. This dilution ratio can be achieved by controlling the effluent discharge. In Eqn. [5] when H, V and ε_t are known, if given x and S_m values, a corresponding q value can be calculated. In Table A1, column 11 shows the calculated q values for centreline discharge by setting x =100 m and S_m = 100 in Eqn. [5]. This column indicates that when the river flow is less than approximately 119 m^3/s, the allowable effluent discharge is less than 0.33 m^3/s. The maximum allowable discharge (to meet the criterion of S>=100) at the bank are listed in column 12 of Table A1. This column indicates that when the river flow is less than about 264 m^3/s the allowable effluent discharge is less than 0.33 m^3/s. The variations of the allowable maximum allowable discharge, centreline and at the bank, with river flow are shown in Figure A1.

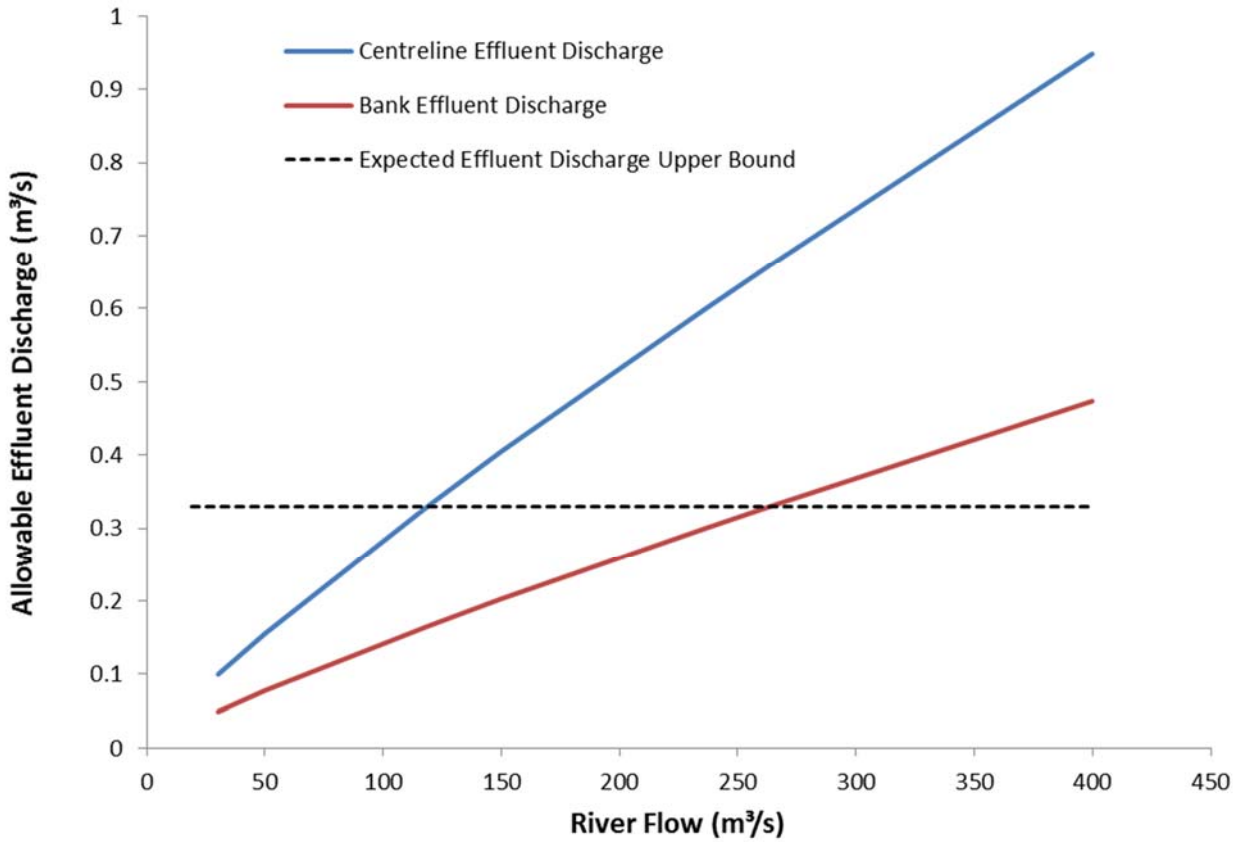

Figure A1: Variation of Allowable Effluent Discharge with River Flow to Meet Dilution Factor no less than 100 at Edge of IDZ

7.0 MAXIMUM WIDTH OF IDZ

To solve y² as a function of x from Eqn. [4]:

$$y^2 = \frac{Bx}{2} ln(\frac{A^2}{x}) \qquad [6]$$

where

$$A = \frac{qC_0/C}{H\sqrt{4\pi\varepsilon_t V}} \quad \text{and} \qquad [7]$$

$$B = \frac{4\varepsilon_t}{V} \qquad [8]$$

Eqn. [6] can be used to plot the contour for a given dilution factor S and Figure A2 shows an example.

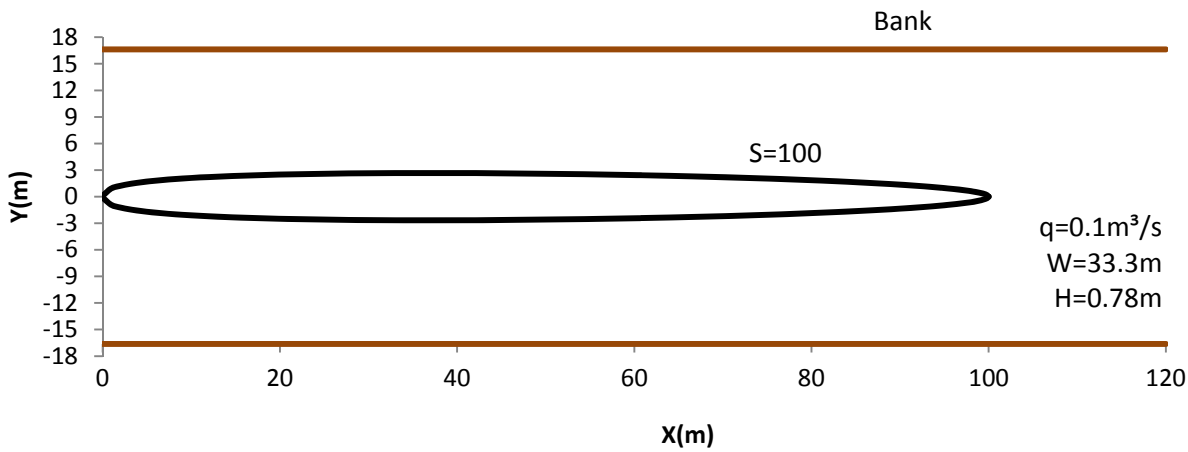

Figure A2: IDZ Boundary Contour for q=0.1 m³/s

It can be proved that y² has maximum value at x= A²/e (where *e* is natural log constant [2.7183]) and the maximum width L for a constant C contour is:

$$L = 2y = A\sqrt{2B/e} \qquad [9]$$

In Table A1, column 13 lists the *L* values for the different controlled *q* values listed in column 11. Column 13 indicates that for 7Q2 river flow, the maximum IDZ width is 5.4 m for controlled effluent discharge, which is about 16% of the river width of 33.3 m, and that for a bank discharge, the maximum IDZ width is 7.5 m, which is about 12% of the river width of 65.1 m.

8.0 DIFFUSER WITH MULTIPLE PORTS

If a diffuser with multiple ports is used, the discharge will be fully mixed across the diffuser length in a short downstream distance from the diffuser, and this will improve dilution. For a diffuser across the river and positioned at the river centerline, Eqn. [10] is used to estimate the constituent concentration at the center of a cross section *x* metres downstream of the diffuser:

$$C = \frac{\frac{q}{n} * C_0}{VH\sqrt{\frac{4\pi\varepsilon_t x}{V}}} \sum_{i=1}^{N} \exp\left(-\frac{V y_i^2}{4\varepsilon_t x}\right) \qquad [10]$$

where N is number of diffuser ports and y_i is the distance between port i centreline and the river centerline. The concentration calculated by Eqn. [10] will be lower than actual concentrations because Eqn. [10] is the result of superimposing the constituent concentration profiles of N independent plumes.

The Government of British Columbia (2012) specifies that the width of IDZ at its downstream extent is less than 25% of the river width, which is approximately 8.0 m wide for 7Q2 river flow. The maximum IDZ width is 5.4 m for single-point centreline discharge, and therefore the diffuser length should be less than approximately 2.6 m.

If a 2.6-m diffuser with two ports is used, for 7Q2 flow of 30.3 m³/s, the allowable effluent discharge via the river centreline can be increased by approximately 5% from 0.1 m³/s to 0.105 m³/s.

9.0 CLOSURE

We trust that the information presented in this memo is sufficient for your present requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

GOLDER ASSOCIATES LTD.

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ATTACHMENT 2
Options Analysis Matrix

Primary Criteria

Criteria	Description	Status Quo (for comparison only)	Option 1 - Pipeline to Quesnel Lake	Option 2 - Re-locating Hazeltine Creek Discharge	Option 3 - Pipeline to Quesnel River	Option 4 - Distributed to Bootjack Lake, Polley Lake, Hazeltine Creek	Option 5 - Science based environmental benchmarks
Environmental	Does not cause adverse impacts to aquatic, terrestrial or human	✓	✓	✓	✓	✓	✓
Legal	Complies with all applicable provincial and federal policy and law	✓	✓	✓	✓	✓	✓

Secondary Criteria

Criteria		Description	Weighting	Status Quo (for comparison only)			Option 1 - Pipeline to Quesnel Lake			Option 2 - Re-locating Hazeltine Creek Discharge			Option 3 - Pipeline to Quesnel River			Option 4 - Distributed to Bootjack Lake, Polley Lake, Hazeltine Creek			Option 5 - Science based environmental benchmarks		
				Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments
Environmental	Assimilative Capacity	Minimum of 10x dilution, >100x dilution preferred	5	1	5	Low dilution at point of discharge	5	25	High predicted and measured dilution	1	5	Low dilution at point of discharge	3	15	>10x dilution, large IDZ required at low flows	4	20	Effluent distributed to multiple locations	2	10	Benchmarks and treatment tailored to receiving environment
Environmental	Aquatic Effects	Minimize receiving effects on receiving environment	10	1	10	Prevents or prolongs rehabilitation	5	50	All WQG met at IDZ	2	20	Incomplete restoration of Hazeltine Creek	3	30	IDZ may impinge on fish spawning habitat	3	30	Discharge distributed but into unimpacted water body	4	40	Benchmarks would be derived to minimize aquatic effects
Environmental	Terrestrial Effects	Minimize disturbance (land clearing, construction area, linear disturbance)	5	5	25	Minimal pipeline and infrastructure required	2	10	Use of existing infrastructure; some new linear disturbance	4	20	Minimal pipeline along disturbed corridor	1	5	Additional linear disturbance and diffuser construction	3	15	Low terrestrial disturbance	5	25	Minimal pipeline and infrastructure required
Environmental	Long Term Sustainability	Ensure location will be viable for long term	5	1	5	Short-term solution	3	15	Suitable for long term but not permanent	2	10	Allows progressive rehabilitation	3	15	Suitable for long term but not permanent	5	25	Viable permanent solution that restores pre-mining flows	4	20	Viable permanent solution
Technological	Risk and Consequence of Failure	Minimize likelihood of failure and potential effect of failure	6.25	1	6.25	Risk of uncontrolled release to Quesnel Lake	5	31.25	Deep diffuser in low traffic area	1	6.25	Risk of uncontrolled release to Quesnel River	2	12.5	Diffuser located in shallow flow	3	18.75	Distributed flows disperse risk	4	25	Low risk of failure; minimal infrastructure
Technological	Complexity	Prefer lower complexity	6.25	3	18.75	Low complexity of system; high complexity of flow management	4	25	Single pipeline and use of existing diffuser	3	18.75	Low complexity of system; high complexity of flow management	2	12.5	Long pipeline; river diffuser	1	6.25	Most complex drainage and discharge systems	5	31.25	Low complexity
Technological	Flexible Design	Adaptable and scalable	6.25	1	6.25	No flexibility - current system is already limited	5	31.25	Readily adaptable to higher flows	1	6.25	No flexibility - current system is already limited	4	25	Some flexibility but may be limited seasonally	3	18.75	Limited scalability; readily adaptable	2	12.5	Difficult to scale
Technological	Risk of Non-compliance	Prefer higher reliability	6.25	1	6.25	Requires highly managed flows	5	31.25	Lowest variability in receiving environment	1	6.25	Requires highly managed flows	2	12.5	Dilution impacted by variable flow rate in receiving environment	4	25	Lake systems less variable than lotic	3	18.75	Dependent upon derivation
Social	Restoration of Fish Habitat	Preference to restore more habitat in Hazeltine Creek sooner	12.5	1	12.5	Prevents or prolongs rehabilitation	5	62.5	Allows complete restoration	2	25	Partial restoration Short timeline	5	62.5	Allows complete restoration	3	37.5	Allows complete restoration but in longer time frame	3	37.5	Allows complete restoration but in longer time frame
Social	Acceptance of Option	Stated preference of stakeholders	12.5	1	12.5	Not favoured by any stakeholder	2	25	Allows restoration of Hazeltine Creek but entails discharge upgradient of Likely	1	12.5	Not favoured by any stakeholder	5	62.5	Preferred by Likely residents	4	50	Stated preference of some stakeholders	2	25	Anticipated low acceptance
Economic	Capital Cost	Lower capital cost	12.5	5	62.5	No capital cost	2	25	Higher cost of pipeline installation	3	37.5	Short pipeline required	1	12.5	Higher cost of pipeline installation	4	50	Multiple discharge locations, all nearby	4	50	Low infrastructure cost; additional studies required
Economic	Operating Cost	Lower operating cost	12.5	1	12.5	High management and monitoring effort	5	62.5	Minimize maintenance and monitoring locations	1	12.5	High management and monitoring effort	4	50	Long pipeline and river diffuser to maintain	2	25	Long-term monitoring at multiple locations	3	37.5	Long-term monitoring

Final Scoring

Environmental		25	Subtotal	45		Subtotal	100		Subtotal	55		Subtotal	65		Subtotal	90		Subtotal	95	
Technological		25	Subtotal	37.5		Subtotal	118.75		Subtotal	37.5		Subtotal	62.5		Subtotal	68.75		Subtotal	87.5	
Social		25	Subtotal	25		Subtotal	87.5		Subtotal	37.5		Subtotal	125		Subtotal	87.5		Subtotal	62.5	
Economic		25	Subtotal	75		Subtotal	87.5		Subtotal	50		Subtotal	62.5		Subtotal	75		Subtotal	87.5	
TOTAL SCORE		100	**TOTAL**	**182.5**	**not ranked**	**TOTAL**	**393.75**	**Rank: 1**	**TOTAL**	**180**	**Rank: 5**	**TOTAL**	**315**	**Rank: 4**	**TOTAL**	**321.25**	**Rank: 3**	**TOTAL**	**332.5**	**Rank: 2**

TECHNICAL MEMORANDUM

DATE 25 November 2016 **REFERENCE No.** 1662612-023-TM-Rev0-32100

TO Colleen Hughes and Luke Moger
Mount Polley Mining Corporation

CC Don Parsons and Shouhong Wu

FROM Paul Beddoes and Jerry Vandenberg **EMAIL** pbeddoes@golder.com; jvandenberg@golder.com

ANALYSIS OF OBSERVED DILUTION IN QUESNEL LAKE, MOUNT POLLEY MINE, BC

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) operates the Mount Polley Mine (the Mine) which is located approximately 56 km northeast of Williams Lake, BC. Discharge of treated effluent from the Mine is conveyed by Hazeltine Creek channel and is discharged from the upper sedimentation pond by gravity through two pairs of submerged diffusers in Quesnel Lake. Dilution characteristics of this discharge were predicted as part of the Short-term (Golder 2015) and Long-term Water Management Plan - Technical Assessment Reports (TARs) (Golder 2016a).

To verify those predictions, this assessment evaluated monitoring data to estimate actual dilution at the edge of the Initial Dilution Zone (IDZ) in Quesnel Lake, defined as a 100 m radius from the diffusers. In the context of Environmental Effects Monitoring (EEM), dilution at 250 m was also assessed.

The following objectives are addressed in this memorandum:

- Summarize predicted dilution at 250 m from the diffusers using the previously completed modelling.
- Compare predicted dilution to calculated dilution based on observed water quality in Quesnel Lake as a post-audit of near-field modelling. This comparison was completed for predicted and measured values at 100 m from the diffusers where monitoring is conducted as per requirements of BC *Environmental Management Act* Permit 11678.

2.0 PREDICTED DILUTION

The dilution of the mixed effluent plume in the receiving environment was predicted using the Cornell Mixing Zone Expert System (CORMIX) (Doneker and Jirka, 2007) to estimate dilution ratios at the edge of the IDZ under a variety of seasonal and wind driven conditions. Mixed effluent refers to the combination of water treatment plant effluent and Hazeltine Creek flows. The water treatment plant effluent is expected to be fully mixed within Hazeltine Creek before discharge from the sedimentation pond.

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2.1 Dilution at 100 m

Modelling completed as part of the Short-term Water Management Plan TAR (Golder 2015) predicted the dilution from single-port temporary diffusers to be located near Hazeltine Point. Sixteen model simulations were completed to evaluate a range of receiving environment conditions. A description of this analysis and the modelling approach can be found in Golder (2015).

Dilution at the edge of the IDZ (100 m) was predicted to be greater than 52 times (x) in all simulations, and greater than 100x in 13% of simulations (Table 1).

Table 1: Predicted Plume Centerline Dilution Factors at 100 m (Golder 2015)

Current Velocity	5th Percentile (0.001 m/s)	Maximum (0.048 m/s)
Minimum	54	52
Median	73	69
Maximum	75	>100

Near-field modelling was updated as part of the Long-term Water Management Plan TAR (Golder 2016a) to assess dilution performance of the as-built Y-shaped diffusers. Input parameters were updated to reflect as-built configuration and current velocity at as-built depths. A total of 240 CORMIX simulations were completed to evaluate a range of receiving environment conditions.

In the updated model, predicted dilution at the edge of the IDZ ranged from 37x to over 100x at 100 m (Table 2). Predicted dilution was greater than 40x in 94% of simulations, and greater than 100x in 25% of simulations.

Near-field modelling results from Golder (2015) and Golder (2016a) found dilution performance at 100 m was primarily influenced by:

- Lake current velocity: dilution can be higher or lower when the current velocity is low compared to the cases when the current velocity is high. This is because the higher the lake current, the more ambient mixing, which increases dilution, but reduces the time before the plumes reach the IDZ boundary.
- Stratification: dilution is typically higher under well-mixed conditions because the vertical mixing depth is limited by the thermocline when the lake is stratified.

Table 2: Predicted Plume Centerline Dilution Factors at 100 m (Golder 2016a)

Current Velocity[1]	5th Percentile (0.001 m/s)	Maximum (0.042 m/s)	
Hypolimnion Depth	**15 m**	**20 m**	**15 m**
Minimum	64	55	37
Median	81	87	45
Maximum	>100	>100	>100

2.2 Dilution at 250 m

To support biological monitoring studies under Section 11(a) in Schedule 5 of the Metal Mining Effluent Regulations (MMER), previous modelling results were evaluated to assess dilution performance at 250 m. A subset of the 240 simulations from Golder (2016a) was rerun and dilution assessed at 250 m. Predicted dilution ranged from 43x to over 250x at 250 m (Table 3). Predicted dilution at 250 m was above 100x in 56% of the simulations that were evaluated. Similar to the dilution performance at 100 m, dilution at 250 m was influenced by lake current velocity and hypolimnion depth. Although dilution was greater than 100x in 56% of the scenarios, most scenarios represent combinations of variables that are intended to capture worst-case conditions that occur infrequently. Therefore, dilution is expected to exceed 100x most of the time.

Table 3: Predicted Plume Centerline Dilution Factors at 250 m

Current Velocity	5th Percentile (0.001 m/s)	Maximum (0.042 m/s)	
Hypolimnion Depth	**15 m**	**20 m**	**15 m**
Minimum	120	64	43
Median	133	99	52
Maximum	>250	140	139

3.0 POST-AUDIT OF NEAR-FIELD MODEL

Water quality monitoring of the mixed effluent, Quesnel Lake at the edge of the IDZ, and ambient Quesnel Lake provide data to calculate observed dilution. Water quality data were received from MPMC for effluent monitoring between February 2016 and September 2016, including data at the following stations:

- HAC-12: Water quality in Hazeltine Creek upper sedimentation pond prior to discharge to Quesnel Lake (i.e., “mixed effluent”)
- QUL-58: Water quality at 100 m from the diffuser (i.e., “IDZ”)
- QUL-120a: Water quality in the east basin of Quesnel Lake (i.e., “ambient”)

A post-audit of the near-field modelling presented in Golder (2015) was completed by calculating dilution based on these monitoring data and comparing against model predictions. Since the QUL-58 station is approximately 100 m from the diffuser discharge, dilution calculated using HAC-12 data to represent mixed effluent water quality can be compared directly to predicted dilution at 100 m. When the plume is detected, QUL-58 is sampled from the plume centreline at approximately 100 m from the diffuser. However, logistical constraints in detecting the plume and maintaining a consistent sample location mean samples collected at QUL-58 may not be along the centreline.

Observed dilution at the IDZ boundary was calculated from these data using Equation 1 for dates where data were available at all stations. Although monitoring was not always conducted at all sites on the same day due to logistical constraints, samples were collected within one or two days and effluent quality had low variability during this period because the feed water was drawn from a pit lake with a large residence time. Rapid changes along Hazeltine Creek due to runoff or rainfall events may cause discrepancies between data collected within one or two days.

$$D = \frac{(C_{eff} - C_{amb})}{(C_{IDZ} - C_{amb})}$$ Equation 1

Where: D = calculated dilution at the IDZ boundary
C_{eff} = observed concentration in the effluent
C_{IDZ} = observed concentration at the IDZ boundary
C_{amb} = observed ambient concentration

The monitoring data included measurements for 85 different parameters. Dilution calculations focussed on those parameters with the greatest relative difference in concentrations measured in the mixed effluent and the IDZ. Six parameters were selected for these calculations based on relative differences of over 50 in the mixed effluent versus the IDZ: sulphate, nitrate, total manganese, total molybdenum, and total selenium. Although relative difference of TDS concentrations between the mixed effluent and the IDZ were below 50x, this parameter was used to calculate observed dilution because it has been identified as a key parameter in previous work (Golder 2016b). Copper has been identified as a key parameter in previous work (Golder 2016b); however, the relative difference between treated effluent and IDZ concentrations was too low to provide reliable predictions of dilution. Note that the relative difference between mixed effluent and ambient concentrations is a purely mathematical metric that does not imply potential effects to aquatic health; potential ecological effects are assessed elsewhere (Golder 2015, 2016a).

Where ambient concentrations were above IDZ concentrations, or IDZ concentrations were above mixed effluent concentrations, the plume was assumed to be non-detectable, which equates to infinite dilution. Where multiple measurements were available at QUL-58 (i.e., bottom, mid, and surface), the maximum concentration was assumed to represent the plume and was therefore used to calculate dilution.

A mean ambient water concentration based on QUL-120a was used in calculations since similar monitoring dates were not available at this location. Measured concentrations of parameters used to calculate dilution generally did not vary by more than 10% over the post-audit period between February 2016 and September 2016. This assumption induces uncertainty into the calculation when dilution factors are high because this equation becomes sensitive to concentrations where C_{IDZ} approaches C_{amb}. Measured concentrations at HAC-12 were used to represent effluent (C_{eff}), which aligns with modelling assumptions and provides an “apples-to-apples” comparison.

Dilution calculations based on Equation 1 assume that all parameters behave conservatively within the IDZ (i.e., settling, sorption, and redox reactions are negligible). These processes are likely not significant within the IDZ because the residence time within the IDZ is short and the effluent is low in particulate matter.

3.1 Estimated Dilution

Calculated dilution for selected parameters is provided in Table 4 and Figure 1. Calculated dilution ranged from 30 to >1,000; median dilution calculated for each date ranged from 89 to 611. Dilution based on a single parameter is subject to considerable uncertainty; however, the median values on a given date provide a reasonable estimate of the overall plume behaviour on that day.

Table 4: Calculated Dilution Factors at the IDZ

Date	Total Dissolved Solids	Sulphate	Nitrate	Total Manganese	Total Molybdenum	Total Selenium	Median Dilution
2/22/2016	247	289	∞	927	285	275	287
3/29/2016	157	213	1604	349	168	333	273
4/11/2016	∞	141	∞	744	135	477	611
5/5/2016	∞	124	204	108	171	202	187
5/10/2016	151	310	727	344	449	590	397
5/17/2016	102	114	136	30	138	165	125
5/24/2016	329	208	313	152	234	270	252
6/20/2016	62	103	109	165	110	107	108
6/27/2016	84	365	403	172	500	692	384
7/6/2016	39	339	343	91	321	316	318
8/2/2016	37	138	109	64	114	123	111
9/6/2016	70	92	79	101	97	86	89

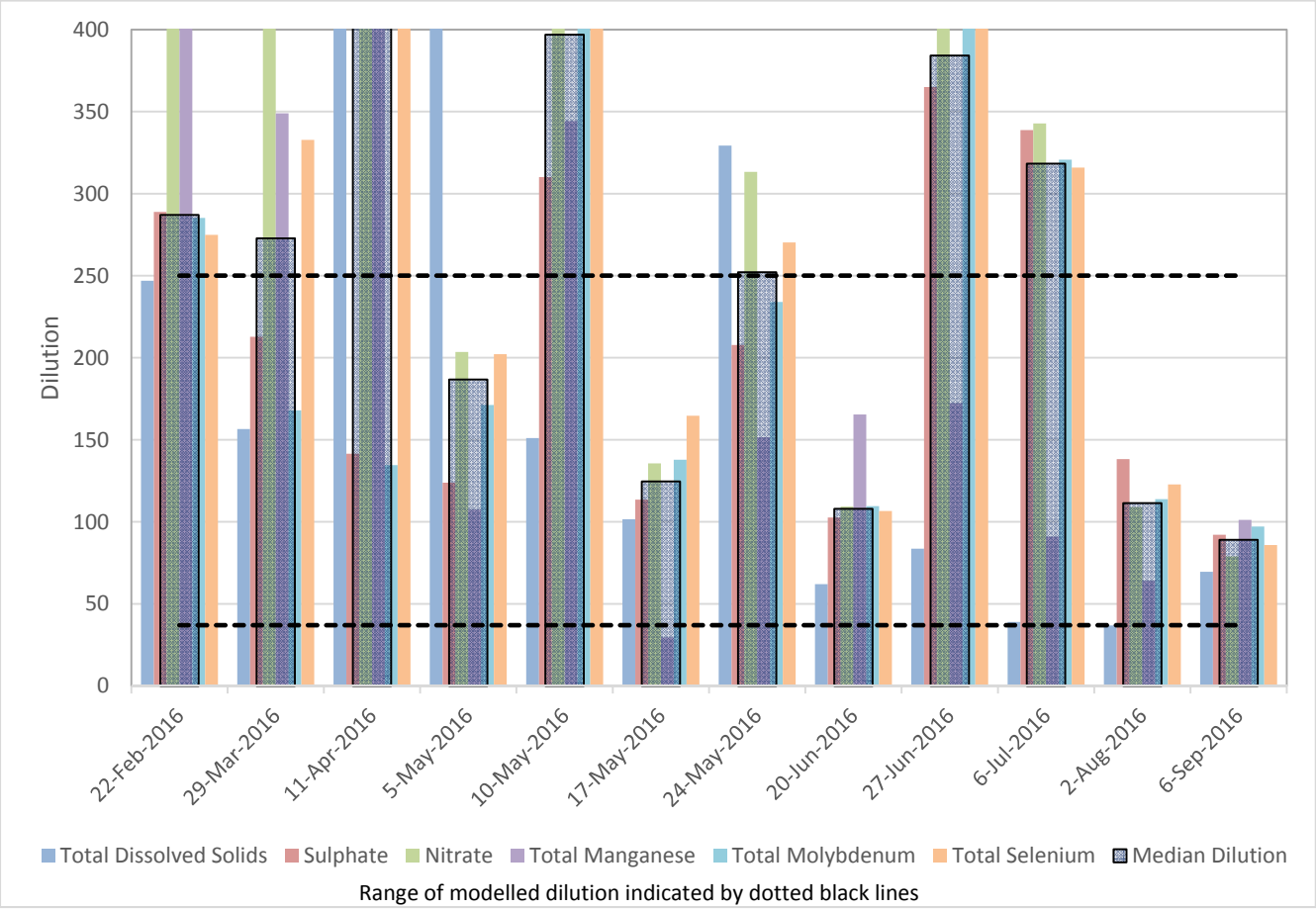

Figure 1: Calculated Dilution Factors in the IDZ using HAC-12 Observations

In general, dilution calculated from observed water quality is within the range predicted by the near-field model, or higher. It is expected that observed dilution would exceed predicted dilution because:

- The near-field model incorporates conservative assumptions, which tend to result in under-estimation of dilution at the edge of the IDZ.
- The specific climate and wind conditions leading to minimum dilution predictions may not have been encountered in the post-audit data.
- The minimum dilution predicted by the near-field model is along the plume centreline; if sampling at QUL-58 is not along the centreline, the calculated dilution will be over-estimated.
- Similarly, if all samples are not collected at exactly the same point, there will be differences in the dilution factor calculated for each set of parameters. This is a logistical limitation of the post-audit because samples are collected by Kemmerer sampler from a boat situated 50 m above and 100 m away from the diffusers. Sample locations are determined in the field by measuring in-situ profiles to detect the plume. Separate casts are required to collect adequate sample volumes for ions, metals and nutrients. Consequently, each subsample will have been collected at a slightly different distance off the plume centreline due to movement of the boat, as well as drift of the Kemmerer, during sampling.

Given the sampling constraints described above, this analysis focuses on the median dilution calculated for any given date rather than on results for individual parameters.

Dilution calculated based on observed concentrations is generally higher at the beginning of the post-audit period (February to May 2016) and decreases toward the end of the post-audit period (June to September 2016) (Figure 1). A corresponding decrease in wind speed is also observed over this period based on monitoring at weather stations #1 (Tree Plots) and #2 (Tailings Storage Facility) (Figure 2). Measured wind speed was as low as 0 m/s on the dates with lowest observed dilution. Since lake current velocity is a function of wind speed, this is consistent with the results of near-field dilution modelling which found dilution is affected by lake current.

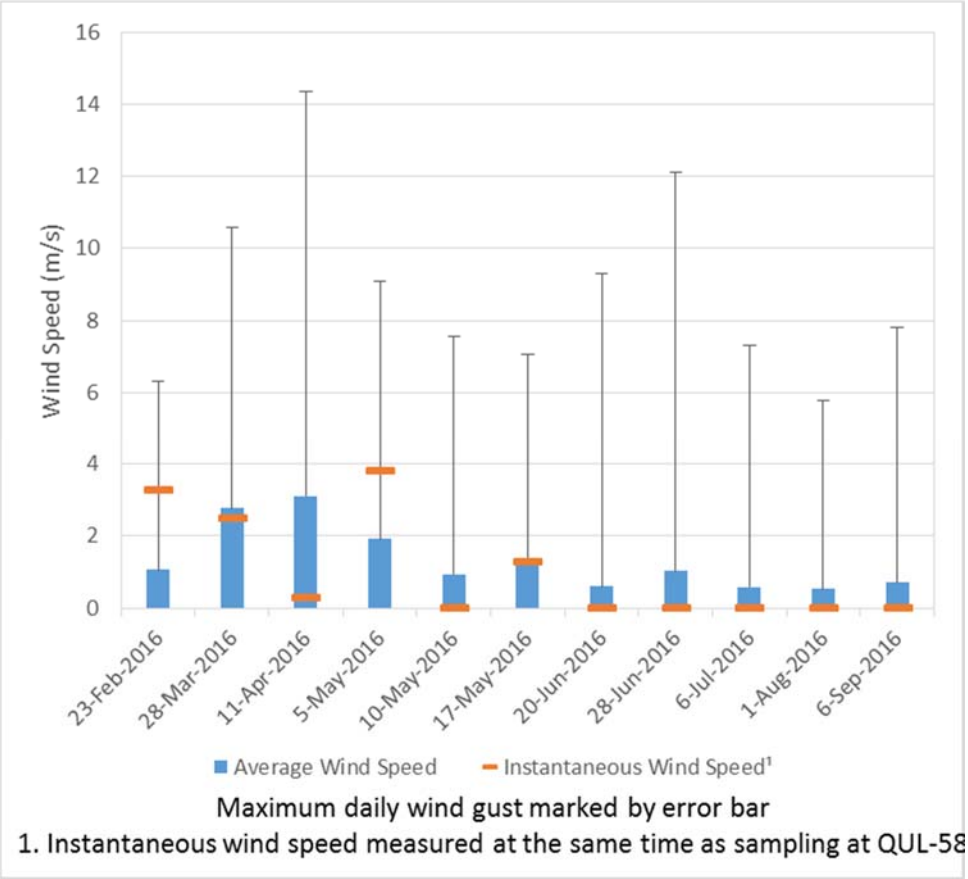

Figure 2: Observed Wind Speed

In addition to the lower instantaneous wind speed, lake profile measurements show the development of stratification in the lake on about 17 May 2016 (Figure 3, Table 4). Lower calculated dilution corresponds with dates when the lake was stratified (Figure 1). This is consistent with the predictions of near-field dilution modelling as described in Section 2.1.

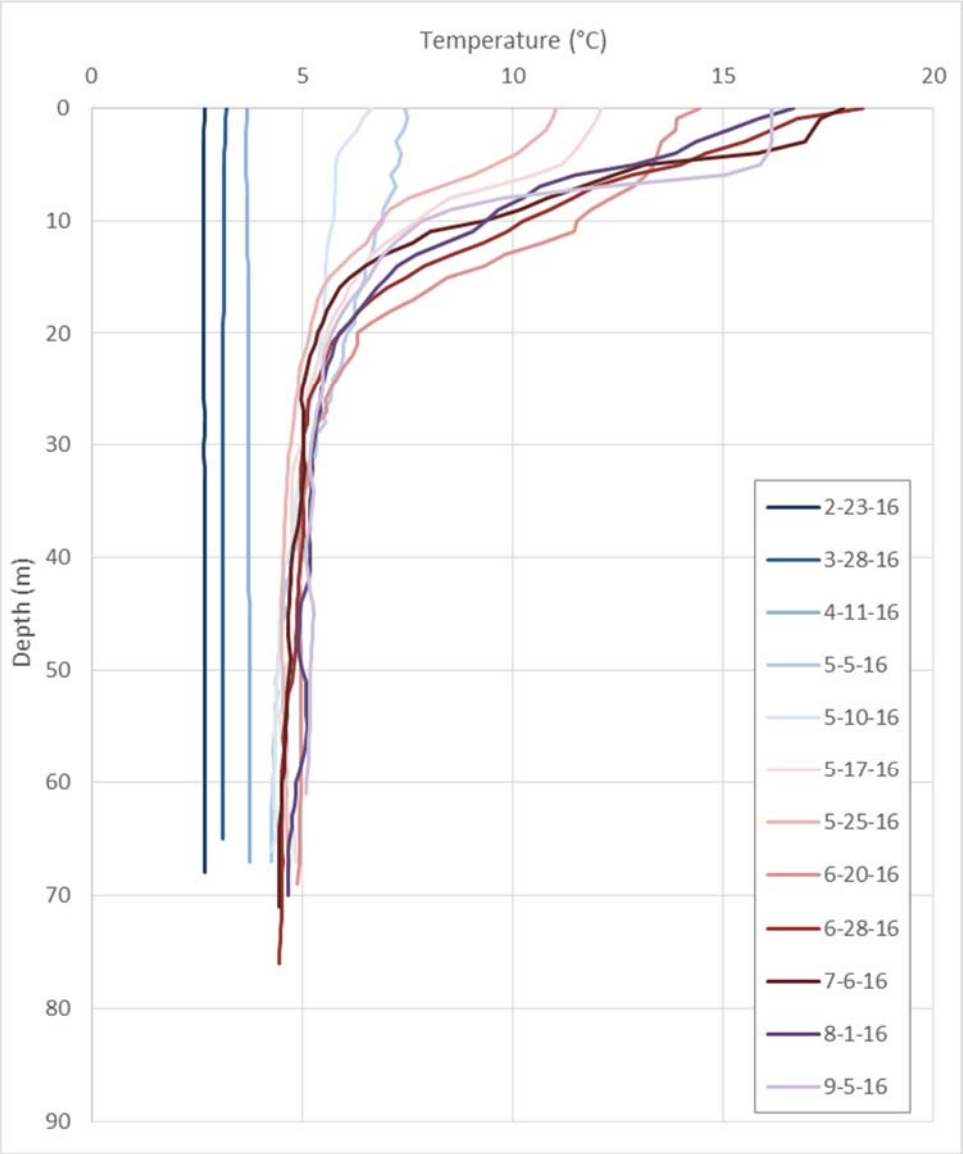

Figure 3: Quesnel Lake Profile Data for the Post-Audit Period (QUL-58)

Table 5: Approximate Thermocline Depth at QUL-58

Date	Hypolimnion Depth (m)
2/23/16	-
3/28/16	-
4/11/16	-
5/05/16	-
5/10/16	-
5/17/16	8
5/25/16	10
6/20/16	15
6/28/16	16
7/06/16	13
8/01/16	13
9/05/16	10

4.0 SUMMARY

Near-field dilution model predictions for the discharge to Quesnel Lake were re-evaluated to assess dilution at 250 m horizontal distance from the diffuser. These predictions are based on modelling completed as part of the Short-term and Long-term Water Management Plan TARs (Golder 2015, 2016a). Most predictions at 250 m exceeded 100x dilution (Table 3). Minimum dilution at 250 m (43x) occurred when the highest lake current velocity was assumed, similar to predictions at 100 m (Table 1). Lower dilution predictions are associated with the highest lake velocity because there is less time for mixing before the plume reaches the IDZ boundary (Golder 2016a).

Monitoring of effluent and IDZ water quality has continued since completion of near-field modelling and commencement of discharge. These data provided the basis to calculate observed dilution at the 100-m IDZ boundary and to perform a post-audit of the near-field modelling. Dilution performance of the diffuser was calculated using measured concentrations of TDS, sulphate, nitrate, total manganese, total molybdenum, and total selenium (Table 4). Calculated dilution was generally higher than predicted dilution, which is expected given the conservative assumptions used in modelling, and the logistical challenges associated with sampling directly in the plume centreline.

Calculated dilution was generally higher at the beginning of the post-audit period (Figure 1). The lower dilution calculated at the end of the post-audit period corresponds to dates with low wind speed during sampling in the lake (Figure 2) and with the development of stratification in the lake (Figure 3). These findings are consistent with the results of near-field modelling which found that dilution was affected by both lake current speed and hypolimnion depth.

5.0 CLOSURE

We trust that this technical memorandum satisfies your current requirements. If you have any questions, please do not hesitate to contact the undersigned.

GOLDER ASSOCIATES LTD.

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PAB/JV/pn/kp

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Doneker, R. L., G. H. Jirka. 2007. *CORMIX User Manual: A Hydrodynamic Mixing Zone Model and Decision Support System for Pollutant Discharges into Surface Waters*. Report EPA-823-K07-001, U.S. Environmental Protection Agency, Washington, DC.

Golder Associates Ltd. (Golder). 2015. *Technical Assessment Report in Support of an Effluent Permit Amendment – Mount Polley Mine*. Appendix E: Conceptual Design of Diffuser in Quesnel Lake. Submitted to Mount Polley Mining Corporation (MPMC): May 2015.

Golder. 2016a. *Long-term Water Management Plan Technical Assessment Report – Mount Polley Mine*. Appendix H: Dilution Performance Review of As-Built Temporary Diffusers in Quesnel Lake. Submitted 17 October 2016.

Golder. 2016b. *Long-term Water Management Plan Technical Assessment Report – Mount Polley Mine*. Appendix D: Water Quality Modelling Report. Submitted 17 October 2016.

Mount Polley Mining Corporation (MPMC). 2016. *Quesnel Lake Dilution*. Email from Colleen Hughes. 3 October 2016.

TECHNICAL MEMORANDUM

DATE 9 February 2017 **REFERENCE No.** 1662612-103-TM-Rev0-22313

TO Luke Moger
Mount Polley Mining Corporation

CC Don Parsons (MPMC)

FROM Jerry Vandenberg and Michael Herrell **EMAIL** Jerry_Vandenberg@golder.com; Michael_Herrell@golder.com

QUESNEL LAKE WATER COLOUR

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) has heard concerns from local residents that Quesnel Lake has taken on a green hue. Therefore, MPMC and Golder Associates Ltd. (Golder) have evaluated potential causes of green colouration through monitoring and analysis since December 2015.

The current hypothesis is that Quesnel Lake has historically taken on a green hue in certain locations, at certain angles, and during certain seasons. Green colour in natural lakes is not uncommon in BC. Heightened awareness to the lake water quality and view is likely revealing a green hue that was occasionally present but never noticed before 2014. The following text describes the lines of evidence that support this hypothesis.

2.0 CHEMICAL CONSTITUENTS

The chemical makeup of water can affect its colour in a number of ways that are well understood. These mechanisms form the basis of spectrometry and colourimetry, which are branches of analytical chemistry. Chemicals that are dissolved or suspended in the water can transmit different colours, depending on the concentrations of the constituents, the path length through the water and the strength and wavelength of incoming radiation. The application of spectral chemistry to water colour is described mathematically by Environment Canada researchers[1]. In a companion paper[2], the same researchers used spectral chemistry to classify rivers in BC as: Type 1, dominantly snowmelt or glacial melt, perceived as blue to turquoise to green; Type 2, dominantly snowmelt and groundwater fed, perceived as green to brown; and Type 3, with high concentrations of total suspended solids or chlorophyll or dissolved organic matter, perceived as brown.

Pure water in a white or transparent vessel will transmit blue when unfiltered sunlight enters the water surface. The ultraviolet (UV) waves within the sunlight transmit the blue. If the UV waves are filtered through clouds, the remaining light energy is insufficient to transmit blue. Lakes also take on a blue hue when they reflect the blue sky above. These two factors combine to give the usually recognized blue lake colour. Divers know that this blue fades as one descends into water and the blue wavelengths are absorbed by the water above.

[1] Jerome et al. 1994. Colours of natural waters: 1. Factors controlling the dominant wavelength. Northwest Science. 68(1):43-52.

[2] Jerome et al. 1994. Colours of natural waters: 2. Observations of spectral variations in British Columbia Rivers. Northwest Science. 68(1):53-60.

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Depending on the water clarity, the water can take on other shades or other colours entirely. Organic carbon impinges the well-known brown colour in many BC lakes, generally near the headwaters. Other chemicals, notably copper, tend to give the water a green or turquoise hue. Therefore, copper concentrations were examined to evaluate whether dissolved or suspended copper could be leading to the perceived green hue.

Copper concentrations were elevated in Quesnel Lake following the breach (as documented in the Post Event Environmental Impact Assessment) and increased during fall turnover in 2014. These concentrations are shown in Figure 1 and Figure 2, along with the subsequent decline to below BC Water Quality Guidelines for Aquatic Life. The water was below the copper guideline after December 2014 in Quesnel Lake and thereafter was only measured above this concentration in a few samples near the mouth of Hazeltine Creek. Since April 2015, copper has remained below all applicable BC Water Quality Guidelines at all points in Quesnel Lake (Figure 3).

The Mount Polley Mine has been discharging water within the conditions and limits in *Environmental Management Act* Permit 11678. Since discharge began on 1 December 2015, copper concentrations in Quesnel Lake have remained below guidelines, at 100 m from the diffusers and beyond.

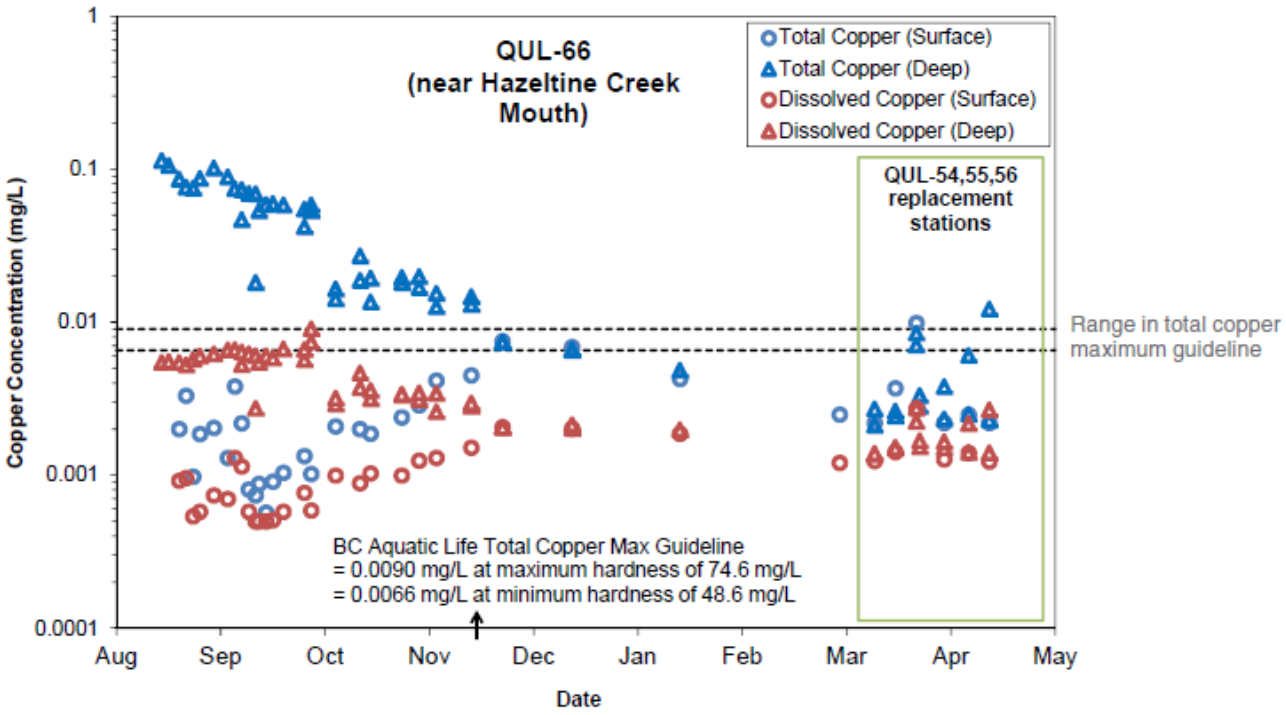
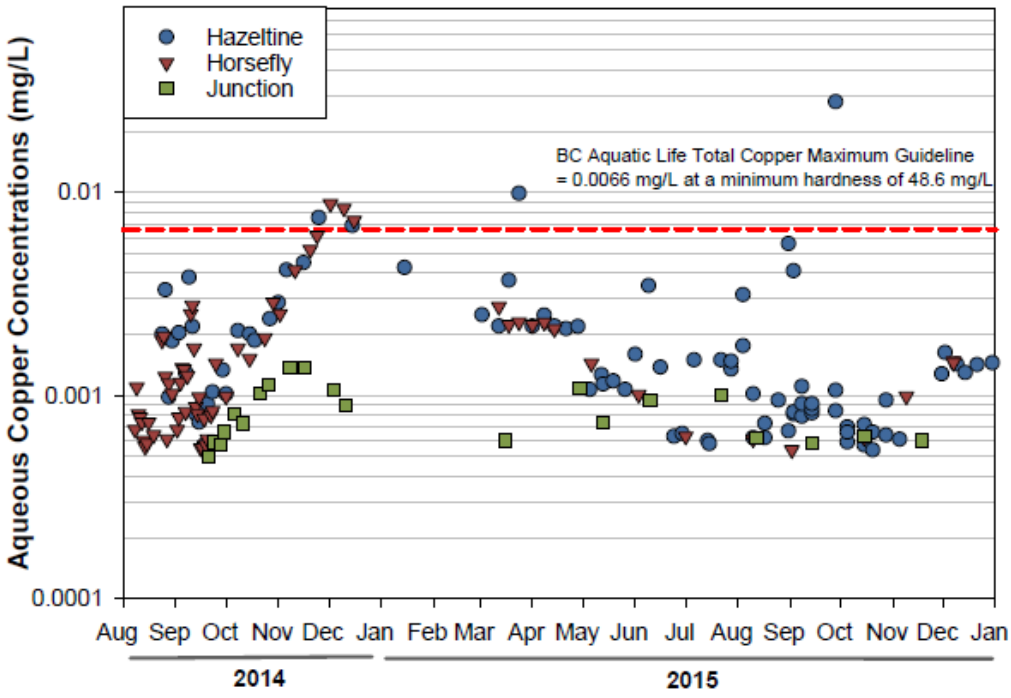


Figure 1: Total and Dissolved Copper Concentrations at Surface and Deep Site in Quesnel Lake, August 2014 to May 2015



Note: Potentially anomalous value observed in Hazeltine in May 2015.

Figure 2: Total Copper Concentrations at Surface Stations in Quesnel Lake, 2014 and 2015

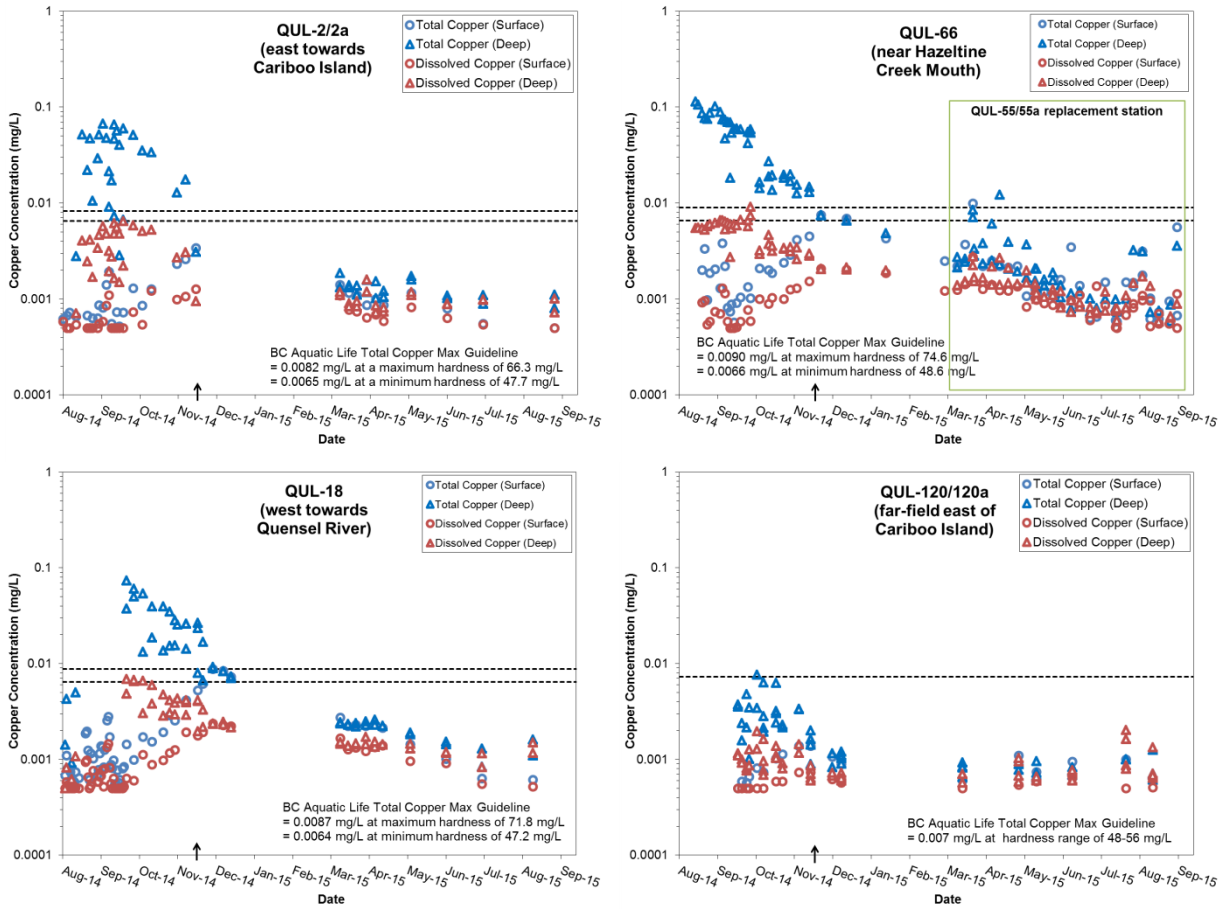


Figure 3: Copper Concentrations at Four Points in Quesnel Lake, August 2014 to September 2015

Note: Arrow represents the approximate timing of mid-November turnover in Quesnel Lake.

3.0 PLANTS AND ALGAE

Eutrophication is a well-known process that results from excessive nutrient inputs, including nitrogen and other macronutrients, but especially phosphorus. Eutrophication leads to green lake colour due to increases in phytoplankton and plant growth, which may give off different shades of green depending on the size and abundance of the phytoplankton, which include microscopic species. Eutrophication also tends to make the surface of the lake turbid, as phytoplankton scatter light.

Quesnel Lake is an oligotrophic system, meaning that phosphorus and phytoplankton concentrations are low. Similar to copper, phosphorus concentrations increased near the mouth of Hazeltine Creek at times in 2015, but elsewhere in the lake the concentrations remained well below guidelines throughout 2015 (Figure 4). This means that the green colour in the lake was likely not related to algae or other biota.

During the evaluation of nutrient concentrations in Quesnel Lake in December 2015, limnologists at the Ministry of Environment (MoE) and primary productivity specialist biologists at Golder were consulted, and they confirmed this interpretation.

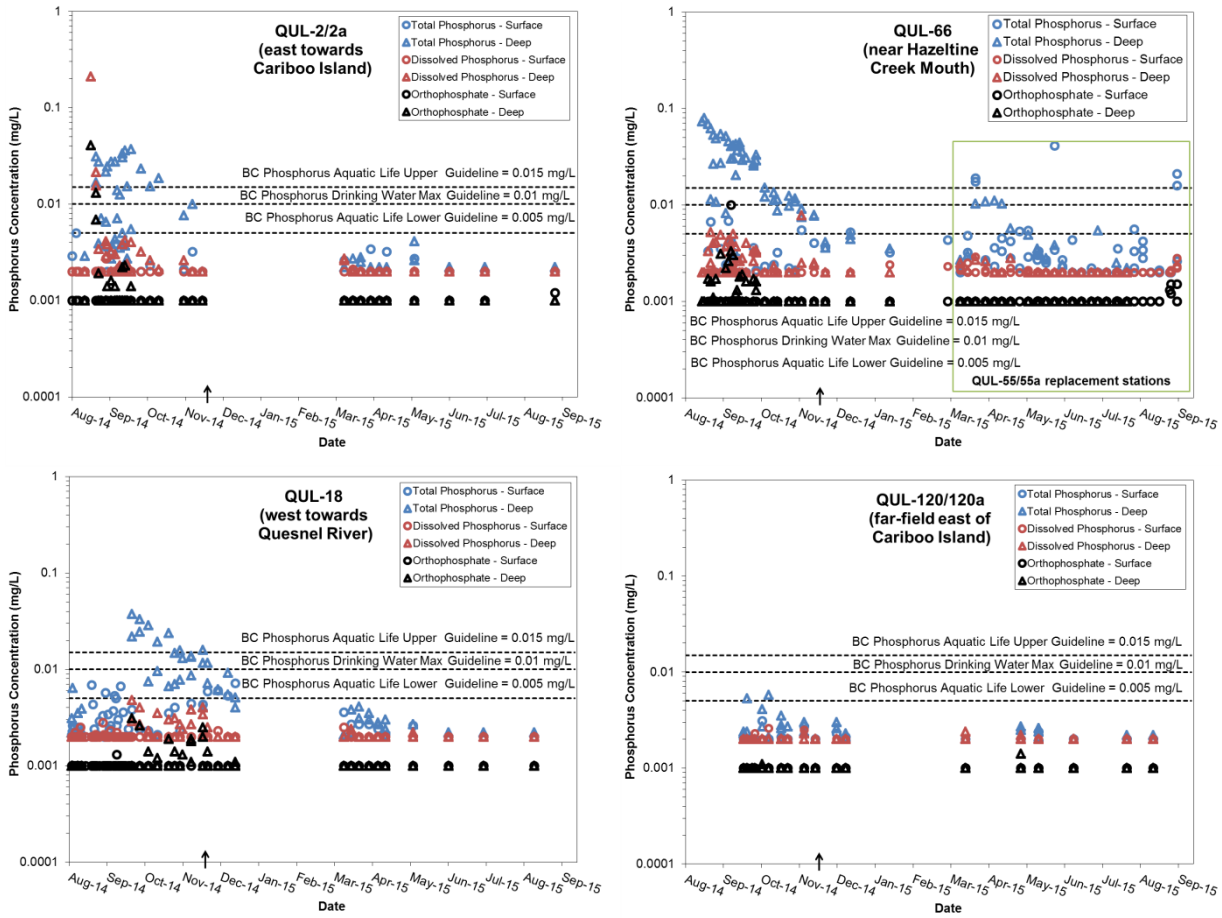


Figure 4: Phosphorus Concentrations in Quesnel Lake, August 2014 to September 2015

Note: Arrow represents the approximate timing of mid-November turnover in Quesnel Lake.

4.0 PHOTO RECORD

Aerial and satellite photographs were examined to determine whether there were discernible changes in colour from year to year or season to season in the past, but the resolution of the photos was insufficient to discern any colour change. GIS techniques were attempted to detect colours but no algorithm detected any difference.

Photos were provided in the MoE memorandum dated 17 December 2015[3]. The MoE has also investigated the green colour; the memorandum provides information in addition to what is listed here.

The MoE memorandum noted the difference in lake colour between fall of 2014 and 2015, which is evident in Photos 1 to 4. In 2014, a temporary glacial green colour was evidently due to suspended tailings material and native till mixture that was deposited in Quesnel Lake and carried downstream during and after fall turnover, coincident with the increases in copper noted above. In the 2015 photos, the water is most green where the evergreen trees are directly reflecting off the lake surface – the outline of the trees is evident around the green section.

[3] BC Ministry of Environment. 2015. Quesnel River at Likely, Green Colour Observations in the late Fall of 2015. 7 December 2015. 7pp.

The MoE memorandum noted that:

- *The 2014 and 2015 photo comparison shows a vast difference in colour and clarity of the water in the Quesnel River. In 2014 the colour was milky green (like glacial water) with limited visibility. In December 2015 the water appears green in the deeper part of the water but clear in the shallow foreshore. While the colour of the Quesnel River was green in late November/December of 2015, it was considerably different from the glacial green appearance of the water in the fall of 2014*

The MoE memorandum also included two photos (Photos 5 and 6) that were taken from the Likely Bridge. The photos show a different shade of green in the two photos, which appears to be due to the angle of the photograph. The lake appears blue in the section where the blue sky is reflecting over the hill. The memorandum notes that turbidity in the lake during this time was “very low”, at 0.5 NTU and remained below water quality guidelines throughout the 2015 fall turnover period.

Quesnel River; take upstream, off the Likely Bridge (one year apart)

Photo 3. Dec 10, 2014 (8.6 NTU)

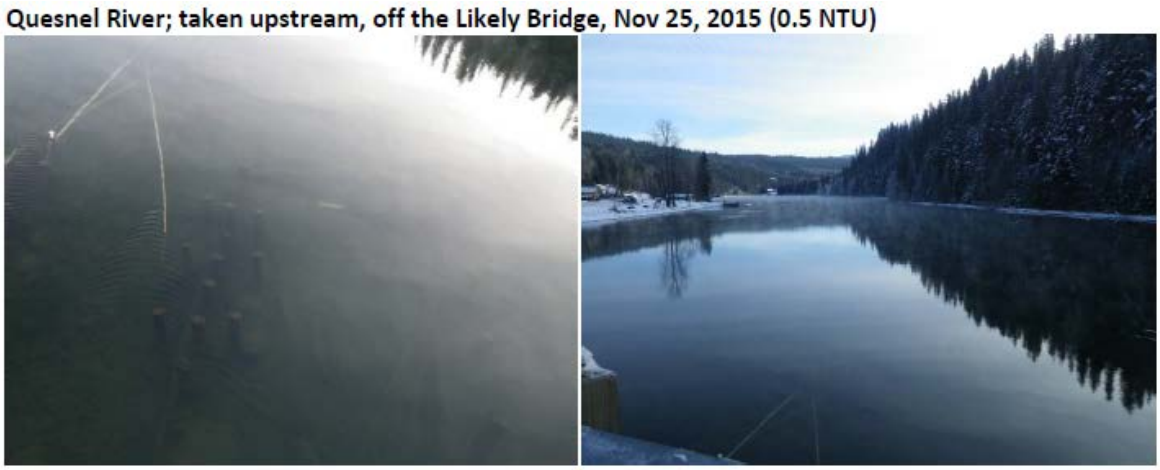
Photo 4. Dec 10, 2015 (0.5 NTU)

Quesnel River across from the Likely dock (one year apart)

Photo 5. Dec 10, 2014 (8.6 NTU)

Photo 6. Dec 10, 2015 (0.5 NTU)

Photos 1 to 4: Green Colour Apparent in Quesnel Lake in 2014 and 2015 (MoE 2015)



Photos 5 and 6: Two Shades of Quesnel Lake in Photos Taken at Different Angles from Same Location (from MoE 2015)

The milky green colour in 2014 corresponded to elevated turbidity readings throughout the West Basin of Quesnel Lake (Figure 5). The turbidity was limited to the deep stations until fall turnover in 2014, which brought turbid waters to the surface and toward Quesnel River. Internal seiches led to both of these phenomena at times between August and December 2014.

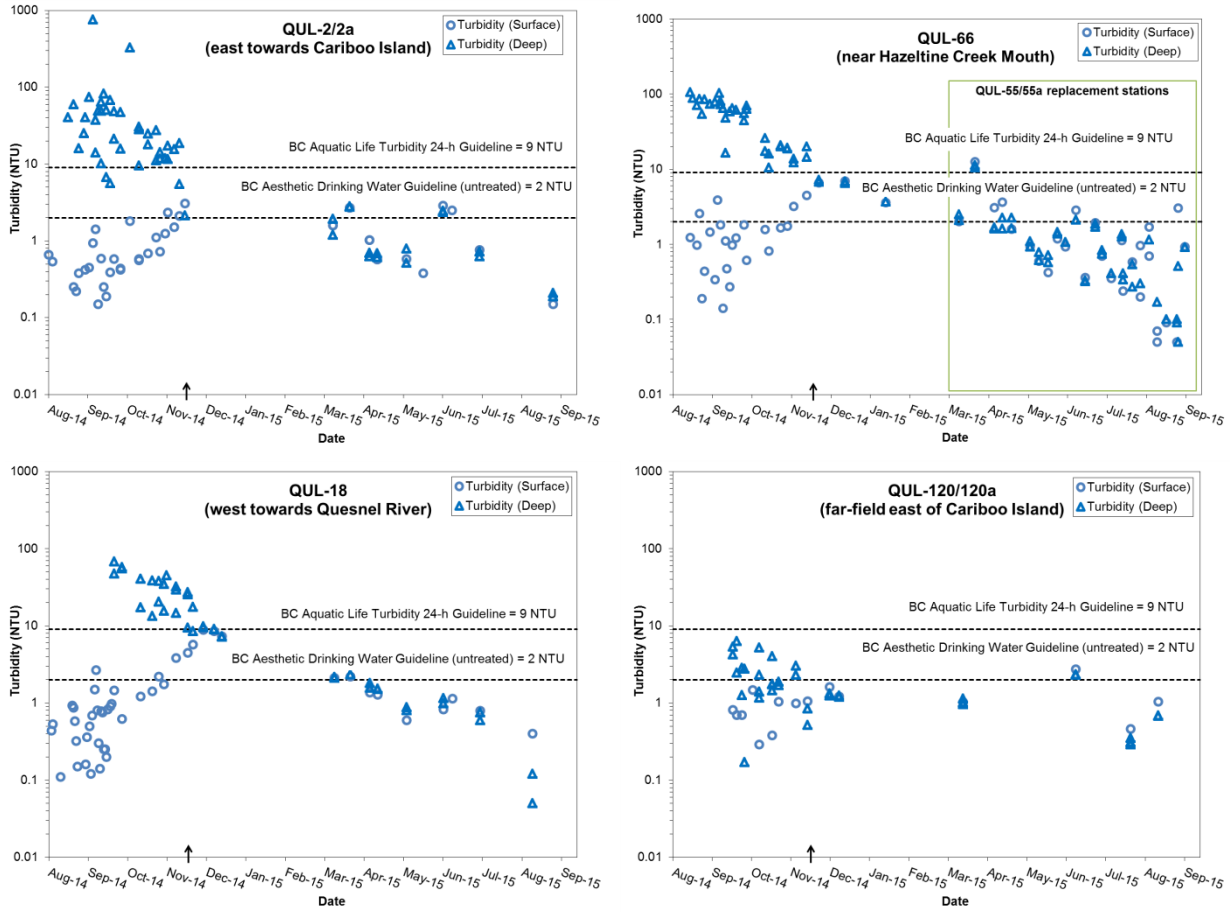


Figure 5: Turbidity Values in Quesnel Lake, August 2014 to September 2015

Note: Arrow represents the approximate timing of mid-November turnover in Quesnel Lake. Background assumed equal to 1 NTU.

The MoE memorandum also provided photographs taken by the Ministry of Transportation before 2014. In the 2013 photograph (Photo 7), Quesnel Lake appears forest green as it reflects off the forest behind.

In summary, the green colour observed in 2015 appears most prominently in areas where it reflects the forest in the background. The green is similar in shade to the lake in 2013 and unlike the milky green that occurred in 2014.

Photo 7: Quesnel Lake near Likely in August 2013 (from MoE memo)

5.0 CHRONOLOGY

Concern around the green colour in Quesnel Lake was recorded in the minutes for the 27 November 2015 Environmental Working Group. The MoE memorandum noted the first mention of this concern as 28 November 2015. This time corresponded with fall turnover in the lake, approximately one year after the first post-breach lake turnover. These stated concerns pre-date the beginning of the discharge to the lake (within the conditions and limits in *Environmental Management Act* Permit 11678) on 1 December 2015. Therefore, it is not possible that the permitted discharge could have caused the green hue.

6.0 HUMAN PERCEPTION

Water colour is an important aesthetic metric for members of the public; not just in BC, but world-wide[4]. In a study of public perception of water colour and clarity of rivers and lakes in New Zealand, researchers posed a series of questions to members of the public who were recreating around rivers and lakes. Not surprisingly, respondents favoured clear, blue water over a green hue, and green over yellow or brown. Waters were thought to be suitable for bathing and aesthetics if they exceeded 30 on the Munsell colour scale – this includes blue, blue-green, green, and green-yellow. Yellow and brown waters were only rated as suitable when the respondents knew that the yellow or brown was caused by natural factors such as humic acids.

[4] Smit et al. 1995. Human perception of water appearance. 1. Clarity and colour for bathing and aesthetics. New Zealand Journal of Marine and Freshwater Research. 29: 29-43.

7.0 CONCLUSIONS

Multiple lines of evidence support the hypothesis that Quesnel Lake has appeared green at times before 2014 but that the green hue was never noticed before the breach. Perceptions became more heightened after the breach, and the green colour was noticed more frequently than before. In the past year, the internal green colour of the lake has not changed, which means that the factors controlling light are external to the lake (e.g., reflection, cloud cover, sun angle, viewer angle, background). The green colour observed in 2015 was similar in hue to pre-2014 water.

At no time since 1 December 2015 has the Mine released any quantity of any substance that would be likely to impart a green colour on the lake. Frequent monitoring throughout the lake has confirmed that concentrations of substances that could cause a green hue are low in Quesnel Lake. The proposed discharge will also not release sufficient quantities of any substance that would impart a green colour on the lake, which can be confirmed by ongoing monitoring.

8.0 CLOSURE

The reader is referred to the Study Limitations, which follows the text and forms an integral part of this memorandum.

We trust the above meets your present requirements. If you have any questions or requirements, please contact the undersigned.

GOLDER ASSOCIATES LTD.

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Principal, Senior Environmental Chemist

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Attachment: Study Limitation

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