LDCC Submission to CMDRC – MPMC LTWMP Permit 11678 Amendment Application

January 20, 2017

The Likely and District Chamber of Commerce (LDCC) membership on December 6, 2016, voted 80% against the Mount Polley Mine (MPMC) plan to discharge their mine effluent into Quesnel Lake (QL). This submission summarizes many of the concerns that local residents have about the handling of the post-breach remediation of Quesnel Lake, and the Long Term Water Management Plan (LTWMP) submitted by Imperial Metals (IMC) to support their application to continue discharging mine effluent into the once pristine waters of Quesnel Lake.

Contents

Background

The MPMC dam breach on August 4, 2014 has discharged up to 30 Million Cubic Metres (Mm3) of mine tailings solids, mine water and scoured material into Quesnel Lake. The present “temporary” discharge permit will continue to see up to 10 Mm3 more of basically untreated mine water discharged directly into QL annually (Water Treatment Plant in passive mode = no treatment occurring).

Serious deficiencies in the management and engineering practices at the mine site were noted by both the Independent Engineering Review Panel (IERP – "…mine and engineers employed weak practices onsite…") and the Chief Inspector of Mines (CIM – "…narrow planning perspective of mine management…") reports that led to the grossly serious environmental impacts that occurred when the dam breached.

To the residents of the area, it is obvious that IMC and MPMC have not learned from their mistakes, but continue to promulgate in many regards the same management attitudes they had prior to the breach. MPMC has not admitted their responsibility for the damage caused to Quesnel Lake from the effects of their poor past operating practices. They continue to operate on the premise that it is OK to do only the minimum required in protecting the environment, to do the least possible so as to only meet the BC Water Quality Guidelines (BCWQG), despite the harm that occurred to QL from the breach. We note also that the BCWQG seem to be quite flexible to MPMCs benefit, as they are always requesting that the limits be raised. Instead of discussing and planning mitigation to return QL to its formerly pristine state, IMC and MPMC plan to discharge 10Mm3 per year of mine affected water into the lake indefinitely. Pre-breach QL water quality criteria were in many cases orders of magnitude lower than the BCWQG. Site-specific WQ standards should be used that will ensure that QL can be returned as quickly as possible to the pre-breach pristine quality it was famous for.

Quotes from the **BC Parks 2015 Quesnel Lake Park Management Plan**:

"*…Quesnel Lake; a lake which is provincially unique…the deepest lake in British Columbia and possibly the deepest fiord lake in the world…contain important habitat…support a host of (fish) species… streams, shores and wetlands of the park…designated…critical habitat for salmon and* (blue listed) *Bull Trout…Cariboo-Chilcotin Land Use Plan…part of a mosaic of habitat protection components connecting…aquatic and terrestrial species…"*

Quotes from **Premier Christie Clarke**, made here in Likely on the banks of the lake:

"*…a pristine resource for everybody…be with you, shoulder to shoulder…do everything…to return it to the real pristine beauty…this lake is for our province…this is just such an incredible, incredible asset*…" (CBC News Aug 8, 2014).

Other than MPMC's study reports, there does not appear to be an effort by the regulatory authorities to work publicly with the communities to develop a comprehensive and balanced assessment of the short-term and long-term effects the dam breach discharge has had, and continues to have, on QL. In effect, after 2½ years, there still has not been an independent "report card" summarizing the effect of the breach on the lake. The reports put out by MPMC must be used with caution, as they may be biased towards supporting the position taken in respect to corporate plans and strategies.
Note as well that the University of Northern BC (UNBC) reports: "*The QRRC (Quesnel River Research Centre) team predicts that it will take **s**everal years, or perhaps even decades, before the full impacts of the breach are realized*" (International Innovation Newsletter ("Protecting the pristine Quesnel watershed in Canada," January 29, 2016)).

The results of the dam breach on QL 2½ years ago are still with us today, and the long-term impacts are not known. MPMC predictive models do not explain the continued effects seen on the lake by residents ("green" water that returns regularly, plugged water filters, slimey water, reduced insect hatches, changing water chemistry…). With all this continuing uncertainty of existing effects on QL, it is hard to understand how the continued discharge of essentially untreated mine water effluent into QL, can even be contemplated. With so many unknowns and uncertainty, it is important that the **Precautionary Principle** should be an overriding consideration when deciding how to best protect the QL aquatic environment, as per the Canadian Environment Assessment Act.

Regulatory Process to Date

The present temporary 2 year discharge permit issued in November 2015 was based on concerns with accumulating water volumes at the mine site, with the primary WQ concern being the turbidity of the water, hence the selection of a Veolia Actiflow system, a system that only removes suspended solids (if it is turned on to "active mode"), and will not improve the dissolved element water chemistry. The short-term effluent discharge into the sensitive QL was agreed to by locals as an interim measure only, with the understanding that MPMC would develop a long-term discharge plan that used the more dynamic Quesnel River.

The LTWMP Options Analysis completed by Golder was seriously flawed, in that it included both the mine operational period and the post-closure and reclamation period, two totally inconsistent and separate regulatory requirements. As such the process was confusing and unclear, and at local workshops when concerned citizens and residents tried to have it clarified to focus on the operational period, MPMC pulled the plug on the workshops because "*they were not hearing what they wanted to hear*" (paraphrased from comments made by IMC personnel at Likely public meetings). Suggestions that were forwarded to them as requested were neither acknowledged nor included in the final October 2016 MPMC Options Analysis submitted with the LTWMP Technical Assessment Report (TAR). This options analysis was essentially the same as the one used in 2015 for the STWMP discussions and application. MPMC made no real effort to identify other discharge options or technology, instead focusing on the simplest and cheapest seemingly available, disregarding the very real affects that will occur to the sensitive QL aquatic environment.

The IERP report strongly recommended that Best Available Technology (BAT) and Best Applicable Practice (BAP) be used in future operational and water management considerations at mine sites, but MPMC has carefully cherry-picked when to use these suggestions, and certainly has not embraced the concept wholly in its consideration of water management options. The other major shortcoming of the MPMC Options Analysis was the exclusion of BAT/BAP water treatment technology and suppliers that can remove the significant quantities of deleterious metals, anions and nutrients in the effluent.

MPMC and Golder disparaged the use of the previously considered water treatment option, Reverse Osmosis (RO)), that were under development prior to the breach, because of concerns for disposal of the concentrated brine solution. But they think it is OK to dump all those deleterious substances into QL and dilute it into compliance with the BCWQG?

One of the major difficulties since the breach occurred has been the public accessibility to timely operating and environmental data, particularly from MPMC, but also to some respect to the Ministry of Environment (MoE) as well. There is too much secrecy and dealings behind closed doors, not only with Imperial Metals, but also the government regulators (MoE, FLNRO and DFO in particular) and the First Nations. The MoE says that the MoE decision is based on science, but when significantly important technical information is blocked and not accessible, it becomes quite difficult to put forward valid arguments. The most recent amendment to the PAO that reduced the weekly reporting requirement to a crippled and poor imitation report at monthly intervals means that the public will have no idea what is being discharged and how the WTP is operating, except at quarterly intervals, and that is reported 6 weeks after the end of the quarter.

There appears to be little historical WQ data available for QL, including no baseline study completed by MPMC for their original Environmental Assessment Certificate application (indicating that MPMC had no plans to discharge into Quesnel Lake, as they had promised in any case to local residents in 1990's). Another example of lack of access to data are the reports from the QL Mooring Buoys, that have been operating from 2013 or so? In addition, there have been questions about discrepancies in data reported by MPMC and UNBC that to the best of my knowledge have not yet been addressed.

Initially it was the position of the LDCC that the Quesnel River was the preferred option for effluent discharge, but it is possible that if appropriate water treatment technology was used to bring the effluent WQ down to QL background levels, that the community could consider re-evaluating the continued discharge into QL during the mine operational period.

Quesnel Lake Water Quality

QL is an oligotrophic lake (nutrient poor, oxygen rich). Prior to the dam breach and the present "temporary" mine-water discharge, the biggest influx of nutrients into the lake was the annual return of the salmon runs. There is significant focus on potential metal contamination, which is obviously important, but if suspended solids (TSS) are kept low, many of those metals may be of lesser concern than possibly other WQ criteria in the effluent. These other criteria, include turbidity (NTU), anions (SO4, Cl…), nutrients (basically fertilizers such as nitrates, ammonia, and phosphorus plus assorted micronutrients), total dissolved solids (TDS), Conductivity, etc., that likely has already had and will continue to have, a more profound negative impact on the QL aquatic environment than most of the metals.

In June 2013, Minnow Consulting completed a letter report for MPMC on the effect of nutrient loading on Polley Lake, primarily focused on Phosphorus (P) and Total Nitrogen (TN). It was noted that nutrients, turbidity and conductivity increased in Polley Lake during the period from 2001 to 2012. Some selected excerpts include: ""*…an increase in phosphorus concentration above background levels has the potential to alter a lake's trophic status… would be expected to result in some increase in productivity… some level of eutrophication of Polley Lake has occurred… indicates that an increase in trophic level from the oligotrophic-mesotrophic boundary to the mesotrophic-eutrophic boundary has occurred in Polley Lake… strong indication that North Dump Creek may be (or may have been) the main source of above-background phosphorus in Polley Lake… this seepage was a major cause of the…increase of TP observed at…Polley Lake…"*

I assume that it is safe to say that the seepage from the waste dumps was diverted from Polley Lake, and collected by MPMC to became part of the minesite water collection system. This of course means that it is part of the present and planned future water discharge from the minesite into Quesnel Lake , a lake with low natural primary productivity and therefor very sensitive to changes in nutrient loadings. Minnow 2013 noted: "*…that loadings of both phosphorus and nitrogen must both be carefully considered in lake monitoring and in the management of nutrient loadings."*

Estimated loading of many of these nutrients has been included in the December 23, 2016 Mining Watch submission (Appendix 1), and as well there is applicable discussion in the December 15, 2016 Center for Science in Public Participation (Appendix 2) submission, both of which can be found attached to this CMDRC submission from the LDCC.

Table 1 - Quesnel Lake Historical Nutrient Data					
	Nitrate	**Phosphorus**	**TDS**	**Ammonia**	**TN**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**
QL Nidle 1994	0.067	0.003	60	-	-
HAD03 2016, up to	10	0.016	1000	?	?
PE11678 Present Limits	9.7	0.09	-	0.41	?
Proposed PE11678 Limits	34	0.09	-	1.3	?

The HAD03 (Water Treatment Plant (WTP) discharge) WQ criteria levels are in many instances already orders of magnitude higher than the pre-breach natural QL background levels, and the new effluent discharge WQ criteria limits that MPMC is proposing in their application are up to 500 times or more higher than the background. Residents along the lake have already noticed and reported increased cloudy water, slime growth, filters clogging, reduced insect hatches, etc., though it has been difficult to get meaningful follow-up from either MPMC or regulatory authorities. It appears from past practice that every time MPMC realizes that they may have higher levels of deleterious substances than expected, they ask for the discharge criteria permit limits to be raised.

The west arm of Quesnel Lake water residence time is reported to be about 90 days (compared to 10+ years for the whole lake), which means the contaminating constituents

of the mine water (turbidity, metals, nutrients etc. mentioned above) build up in the relatively static lake water. With that sort of time frame, with the added chemicals and nutrients MPMC has added to nutrient poor QL, the lake starts to "stew", leading to the effects noticed by residents. MPMC is focused solely on meeting BC Water Quality Guidelines, rather than identifying the changes and mitigating the still unknown long-term effects on the formerly pristine QL aquatic environment.

MPMC and Golder have based their assumptions on the models they have developed for QL and the minesite, but as noted in the Guiltner Submission 28Nov16, they also have many disclaimers posted throughout their numerous reports, similar to: "…*where applicable, the model and input data carry inherent uncertainty, unlikely to occur, adverse effects not expected, based on predicated concentration, not expected to be acutely lethal, necessarily predictive exercised, various predictive tools, predictions are based on several inputs, all of which have inherent uncertainty".*

It appears that the QL Tetratech model does not account for the continued stirring up of turbid water that is observed by residents and seen in lake bottom cores (UNBC) and MPMC Turbidity profiles at the mouth of Hazeltine Creek (Appendix 3). In addition, the January 7, 2017 Landsat Photo in Appendix 4 indicates interesting phenomena in ice formation on QL directly out from the Hazelton Creek underwater diffusers. Another inconsistency to the models, and what does it mean for QL? What is actually happening in QL, and who is actually checking it out, rather than trying to justify using it as a recipient of mine waste water?

There is way too much uncertainty in understanding the current conditions in QL (post breach) and what effects are going to be appearing in the future, to allow effluent discharge into the indefinite future, likely 20 years or more. There are so many unknowns and uncertainty, that the **Precautionary Principle** must be used to protect the lake and river, as per the Canadian Environment Assessment Act.

Distributed discharge and natural attenuation through the local watersheds is a commendable goal for post-closure, but the only viable and quickly implemented options for discharging the mine effluent during the operational phase are QL or Quesnel River (QR). Compared to the QR, the west arm of QL is a static and fragile water body with 3 months or more water retention time. The QR is more dynamic and fast moving and the discharge water will quickly mix with the Cariboo and Fraser River waters. The LTWMP TAR reports 3-4 years of mine operations before they start an expected 2 year transition to the closure plan, but it is well known that MPMC has long-term ore reserves that will extend operations 10 to 20 years or more into the future. What is going to happen to QL, still trying to recover from the effects of the 30 Mm3 dam breach, as up to 10 Mm3/year of mine waste water is dumped into the lake for potentially up to 20 years or more?

MPMC Mine-life and Financial Capacity

MPMC reported known resources in 2013 of 411 Million tonnes at 0.482% Cu equivalent grade, which at 22,000 tonnes/day could be equivalent to ~50 years of production. And it is a known fact that the best place to look for new ore bodies is right around an existing

ore body. MPMC's present application is for a 4 -5 year operational time frame, which includes discharging the effluent into QL. Since in all likelihood they will operate for many years beyond that, it is disconcerting to think that they plan to continue to discharge effluent into QL, until they shut down the operation 10 or 20 or more years in the future.

The QL discharge option is without a doubt the cheapest and easiest option for MPMC, but it is also the worst for the environment. As presently structured, it is barely one step above the "do nothing" option originally looked at. Other more protective options are without a doubt more expensive to implement, so just what is the financial capacity of IMC to weather the present costs of operation, that include the continued costs of recovery and remediation from the dam breach, and install appropriate treatment processes do not rely on dilution, and that will fully protect the receiving environment?

The IMC website indicates that MPMC's typical Cash Cost Per Pound of Copper (Cu) produced is about US$1.00/lb of Cu equivalent, which gave a pretty good margin in 2013 when IMC had a $41 Million Net Income based on $188 Million of revenue.

The gross value of the 2013 stated resource at US$2.20/lb Cu (significantly less than the present market Cu price) is over US$8 Billion. MPMC may be suffering financially a bit at the moment due to the dam breach mitigation (somewhat self-inflicted), but their future is quite bright, as can be seen by the confidence the stock market has recently shown in IMC (based on their December 2016 oversubscribed equity offering). As such, it is disappointing that a corporation with such huge economic value cannot see the environmental and social value to develop their environmental responsibility, and spend, in relative terms, a few cents more to truly minimize their impacts on the environment.

Conclusion

Local residents continue to be concerned about MPMC's plan to discharge mine effluent into QL, rather than further downstream into Quesnel River (QR), focusing on the "science" of meeting BC Water Quality Guidelines (BCWQG), and not using "science and social responsibility" to protect QL's formerly pristine water.

BCWQG discourage the use of "dilution as a solution" if other technologies are available to reduce the impacts on the environment. The MoE's 2015 Waste Discharge Factsheet on Best Achievable Technology states "*A BAT evaluation is generally required when making decisions regarding appropriate discharge standards, to ensure the protection of the environment."* MPMC has done only a cursory evaluation for applicable BAT, and the option studies it did complete were confusing (mixing up operational and closure treatment options together). The analysis are also biased towards using the cheapest option available, rather than finding best appropriate treatment process that will provide real environmental protection to the once pristine Quesnel Lake.

I have heard comments from MPMC and MoE personnel complaining about the "burden" of too frequent environmental reporting requirements to the MoE and the public, such as the recently cancelled (without consultation or notice) weekly reports that provided data

on the WTP discharge, Springer Pit and QL water quality. It is well known that mines in other jurisdictions are required to provide detailed data and interpretive environmental reports monthly, and considering circumstances, the present schedule for MPMC is wholly inadequate.

I want to point out that we are discussing here a public resource (the ore body), with mine-affected water being discharged to another public resource (the environment). This whole discussion is taking place because MPMC, a public company that made millions of $$ in the past, and will make 100's of millions more in profits in the future, very badly polluted some very pristine components of the local environment, due to their somewhat irresponsible management practices. The public does not trust MPMC and IMC to not "burden" the environment further, and require the assurance that that they have access to timely data and reports so that they can monitor the mine's effect on the formerly pristine environment (our backyard and livelihood). We are not sure that the MoE is adequately monitoring MPMC activities as the last posted site inspection report was June 14, 2016, but in any case the "burden" for MPMC to adequately inform the public must simply be considered the cost of successfully running the business.

If MPMC truly takes "*…protecting the environment …responsibility to our community and the environment…."* seriously (Dale Reimer, Letter to Community, October 18, 2016), then a full and open BAT evaluation, including the QR discharge option, is required, and quickly too due to the November 2017 deadline. Other options are fully attainable and affordable that will ensure that QL can be returned back to its pre-breach pristine condition as quickly as possible.

Recommendations

1) As per the above discussion, do not approve the October 20, 2016 MPMC Application for the Long Term Discharge of Mine Effluent into Quesnel Lake.
2) Request MPMC to complete a revised Options Analysis that focuses on the mine operational period (excluding closure scenarios), with in-depth analysis on alternate discharge locations and BAT/BAP water treatment technology to reduce impact/loading on receiving environment:
    a. Ensure the inclusion of, and the open consultation and engagement of, local residents and concerned citizens.
3) Develop site specific discharge criteria for Quesnel Lake that are based on the pre-breach WQ in QL:
    a. Ensure the inclusion of, and the open consultation and engagement of, local residents and concerned citizens.
4) The above noted programs will require an expedited regulatory process and tight timelines by both MPMC and MoE to meet the November 2017 expiry of the present temporary discharge permit. Hopefully MPMC have not put all their eggs in one basket, and has been working on contingency plans in case the present LTWMP application is unsuccessful.
5) In consultation with local residents, concerned citizens and other appropriate parties, the MoE and other regulators develop and initiate an integrated and

comprehensive plan (QL environmental working group?) to oversee the study, reporting and mitigation of Quesnel Lake (impacted since the breach in August 2014).

6) PE11678 Section 2.10 (Communication Plan) - The present communication of environmental data to the specified parties is insufficient and totally subject to the whims of MPMC. Revise Section 2.10 to:
    a. Ensure the timely and cooperative development of a communication plan that provides timely and fulsome reporting of MPMC environmental data and reports to the specified parties (see additional recommendations below regarding reporting in section 3.9);
    b. Separate the requirements of the Public Liaison Committee (PLC) into a separate section all to itself, as it serves a different audience, purpose and agenda than the above-mentioned environmental communication plan revision.
    c. Revisit the PLC Terms of Reference to review the ToR requirements, including ensuring that the main burden of sharing MPMC operating and environmental data to the public falls upon MPMC, and not the non-funded members of the PLC.
7) PE 11678 Section 3.9 (Reporting): Revise reporting requirements so the local residents and public are adequately informed as to operating and environmental affairs at the MPMC mine site:
    a. Reinstate <u>Weekly</u> reporting for (formerly under the PAO):
        i. WTP operation and discharge WQ;
        ii. Springer Pit operation and WQ;
        iii. Quesnel Lake WQ data in the west basin;
        iv. Mine site and breach related rehabilitation summaries and updates;
        v. Basic trending charts of specific data.
    b. Require submission of <u>Monthly environmental reports</u> with data, summaries, interpretive reports and trending charts on PCOC's;
    c. If Monthly reporting is initiated, then the Quarterly reports may become redundant;
    d. Otherwise, the Quarterly reports should include interpretive discussion and fairly comprehensive trending charts.
    e. All environmental reports are to be posted in a timely manner on the MPMC website.
8)

Thank you for the opportunity to submit these comments and recommendations to the Cariboo Mine Development Review Committee for consideration by the regulators. If you require further information or clarifications, please contact the undersigned.

Sincerely,
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Appendix 1 – Mining Watch Submission - 23Dec16

Submission to BC Ministry of Environment: Mount Polley Mine Permit Application for Long Term Water Management Plan & Discharge into Quesnel Lake

MiningWatch Canada

December 23, 2016

Content

Introduction

MiningWatch Canada was created in 1999 as a co-ordinated public interest response to the threats to public health, water and air quality, fish and wildlife habitat, and community interests posed by some irresponsible mineral policies and practices in Canada and around the world. It is supported by twenty-seven Canadian environmental, social justice, Indigenous, and labour organisations.

MiningWatch has worked on environmental and water quality assessments of dozens of mining projects, directly or in collaboration with other groups, experts and affected communities. We have been very active in trying to improve water quality law, policy, and practice, working with administrative and legislative bodies and even resorting to litigation when it proved necessary to protect the public interest and the integrity of Canadian waters.

MiningWatch Canada is very concerned about Mount Polley Mining Corporation's (MPMC) application for a long-term permit to discharge not-fully treated mine waste water into Quesnel Lake.[1] We recommend that the BC Ministry of Environment (MOE):

[1] Golder Associates 2016: https://imperialmetals.com/assets/docs/3_2016-10-17---LTWMP-Technical-Assessment-Report-(Golder).pdf

1. reject this permit application and require MPMC to propose alternative options to its long-term water management plan, including full treatment of mine effluent and possible discharge points into less sensitive waters;
2. require a 'dry closure' to reduce risks and ensure long-term stability, as recommended by the Independent Expert Panel report[2] on the 2014 Mount Polley dam breach and spill;
3. strengthen current MPMC's financial securities to eliminate long-term public liability for site closure, clean-up, maintenance, and perpetual care;[3]
4. obtain clear support and consent from all of the locally affected communities, First Nations, and organizations for a proposed long-term water management and closure plan—including proper remedies for the people that were, and still are, affected by the 2014 mine spill.

This submission focuses primarily on the rationale behind our **Recommendation #1**.

Over 38,000 tonnes of contaminants in the first 5 years

If approved, this permit would allow MPMC to discharge, over the next 5 years, more than 38,000 tonnes of additional contaminants into Quesnel Lake, including over 0.9 tonnes of arsenic, 1.1 tonnes of copper, 1.9 tonnes of zinc, 2.4 tonnes of selenium, 2.9 tonnes of phosphorous, 11.8 tonnes of molybdenum, 32.6 tonnes of iron, 42.4 tonnes of ammonia, 489.7 tonnes of unspecified suspended solids, 1,110 tonnes of nitrite, and 36,237 tonnes of sulphate. These quantities would increase by as much as 53% if a maximum yearly discharge of 10M m3 (10 billion litres) is used instead of the predicted average discharge of 6.5M m3 (6.5 billion litres) per year. They would be added to the 18M m3 of mine waste that the 2014 mine spill already spread at the bottom of Quesnel Lake, downstream from Hazeltine Creek. The current permit application does not fully address the risks and impacts of those additional contaminants in the water and on the sediments, particularly over longer period.[4]

Failing to meet BC's Water Quality Guidelines

The current permit application would allow MPMC to increase contaminants release into Quesnel Lake over its current 'temporary' permit levels (Sept. 2016 permit) by up to 25% for selenium, 54% for sulphate, 80% for molybdenum, 175% for copper, 217% for ammonia, 251% for nitrite, 264% for chromium, 611% for zinc, 724% for arsenic, and 809% for iron.[5]

While MPMC claims that it would respect the federal Metals and Mining Effluent Regulations (MMER), it should be remembered that the MMER limits provide poor guidelines: only 5 toxic metals are regulated and their limits should be considered as ceiling, 'never-to-be surpassed' levels. The US

[2] https://www.mountpolleyreviewpanel.ca/final-report
[3] MPMC states that, as of January 2016, the Reclamation and Closure Bonding in place for the mine totals only $22.1 million (https://www.imperialmetals.com/assets/docs/mp-technical-report-may-20-2016.pdf, p.20-167). MiningWatch considers this bond to low when considering all of the long-term risks, maintenance, and perpetual care issues, as well as potential risks of additional failures, spills, or accidents. See also the following recent reports on the financial risks and liabilities of contaminated mine sites in British-Columbia: BC Auditor General (http://www.bcauditor.com/sites/default/files/publications/reports/OAGBC%20Mining%20Report%20FINAL.pdf). Economist Robyn Allan (https://d3n8a8pro7vhmx.cloudfront.net/ubcic/pages/1290/attachments/original/1463347826/Toward_Financial_Responsibilty.pdf), and MiningWatch's analysis (http://miningwatch.ca/news/2016/5/30/new-analysis-british-columbia-ranks-worst-canada-unsecured-environmental-liability)
[4] For a more detailed description of the impacts of the 2014 spill on waters, ecosystems and fish habitat, see http://miningwatch.ca/sites/default/files/the_lawsuit_0.pdf
[5] Dr. David Chambers, Center for Science in Public Participation (CSP2), Letter to BC Ministry of Environment Re: Comments on Mt. Polley Technical Assessment Report, December 2016, and Golder Associates 2016 https://imperialmetals.com/assets/docs/3_2016-10-17---LTWMP-Technical-Assessment-Report-(Golder).pdf

Environment Protection Agency (EPA) and most provinces and territories usually apply stricter water quality guidelines.

Overall, MPMC's permit application would allow it to discharge contaminants at levels significantly higher than the BC's Drinking Water and/or Fresh-Water Aquatic Life 30-day Guidelines: 44% higher for molybdenum, 300% for chromium, 409% for sulphates, 460% for Arsenic, 500% for phosphorous, 687% for zinc, 1033% for nitrite, 1550% for copper, 3650% for selenium[6]. And the gap widens even more when compared to pre-breach, unaltered waters of Quesnel Lake[7].

Dilution is not an acceptable solution

MPMC justifies such discharge levels by counting on an 'Initial Dilution Zone' (IDZ) that would 'water down,' over a distance of approximately 100m into Quesnel Lake, contaminant levels to ambient BC water quality guidelines. Instead of investing into water treatment technologies and practices to ensure that its effluent quality meets the BC's water quality guidelines at the point of discharge, MPMC is counting on the natural waters of Quesnel Lake to do the cleaning job and dilute contaminants.

MiningWatch Canada considers this approach as unacceptable and contrary to best available practices and technologies. Both BC and Canadian water quality guidelines discourage or prohibit the use of an 'initial dilution zone' (IDZ) if alternative technologies and practices are available and economically achievable (BAT-EA)[8]. The Canadian Guidance on the Site-Specific Application of Water Quality Guidelines (SSA-WQG) insists that "*mixing zones should not be used as an alternative to reasonable and practical pollution prevention, including wastewater treatment (pollution prevention principle)*"[9]. Even Golder Associates, the main author for the permit application, acknowledges this fundamental principle: *"[Initial Dilution Zones] are typically only allowed when BAT has been applied*"[10].

The Canadian Guidance also states that water quality limits obtained through a dilution zone "*cannot be higher than those that are developed based BAT-EA*". It dictates that it cannot 'impinge on critical fish or wildlife habitats,' result in 'accumulation of toxic substances in water or sediment,' or adversely affect 'the aesthetic qualities' of the receiving waters. BC's 2015 Waste Discharges policy also insists to take into account "*many considerations… when developing waste discharge standards*," including "*environmental sensitivity, cumulative effects… local air and water shed plans, First Nations interests, other guidelines, and stakeholder input.*"[11] It "*encourages the consideration of technologies that are not yet in commercial operation, to promote innovation,*" and refers to technology as including any "*industrial processes… pollution control equipment… and engineering practices.*"[12] We argue that MPMC's permit application fails to meet many of the above criteria.

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[6] Ibid. and http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines
[7] Golder Associates 2016, Table 3-16: https://imperialmetals.com/assets/docs/3_2016-10-17---LTWMP-Technical-Assessment-Report-(Golder).pdf
[8] http://ceqg-rcqe.ccme.ca/download/en/221, http://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/pulp-paper-wood/best_achievable_control_tech.pdf
[9] http://ceqg-rcqe.ccme.ca/download/en/221
[10] Golder Associates, Appendix E, Attachment B
[11] BC MOE, Factsheet Waste Discharges, March 2015 http://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/pulp-paper-wood/best_achievable_control_tech.pdf
[12] BC MOE, Factsheet Waste Discharges, March 2015 http://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/pulp-paper-wood/best_achievable_control_tech.pdf

As an advising and steering committee member for over 15 years of the Mine Environment Neutral Drainage (MEND) group and the National Orphaned/Abandoned Mine Initiative (NOAMI), both industry-government and multi-stakeholder initiatives,[13] we have contributed to, and reviewed multiple studies focused on mine waste and mine effluent technologies and practices. In one report produced for MEND in 2014, Hatch clearly identifies an array of technologies that could be used to significantly reduce most of the contaminants identified above to about one third of their current proposed permit limits[14]. For MPMC, cost estimates for those methods would range from $7 to 11 million per year in operation, and about $14 to 22 million in initial investment.[15] Hatch's report also identifies higher-cost, higher-performance treatment methods. While MPMC's financial capacity is relatively limited, those cost levels fall within the range of the project's annual operating and capital costs estimated at an average of $130 million per year for next five years.[16] They also fall within the range of the company's annual gross revenue and available cash flow, respectively at $350 million and $108 million from Jan. 2016 to Sept. 2016, which represents a 483% and 800% increase when compared to the same period the year before.[17]

Non-degradation standard

The Canadian Guidance on the Site-Specific Application of Water Quality Guidelines (SSA-WQG) identifies 'non-degradation' as one of three main approaches to limit or eliminate waste water effects into receiving waters.[18] The other two approaches include a technology-based approach, using best available and economically achievable technologies (BAT-EA), and an approach based on the 'assimilative capacity' of the receiving waters using a dilution zone. Both latter approaches were discussed above.

Under a non-degradation approach, the Canadian Guidance SAA-WQG explains that contaminant "*limits are established based on the natural background levels,*" ensuring that "*environmental receptors… have no incremental risk of adverse effects due to discharges from point sources*".[19] In other words, mine effluent quality at the discharge point needs to be 'as good' or 'better' than the receiving water quality as to avoid its degradation.

Several US States and mines—such as in Montana, Alaska and Washington States—enforce a non-degradation (or antidegradation) standard for waste water discharge.[20] Where a non-degradation standard is legislated, proponents cannot deviate from its application unless they can satisfy exceptional conditions. This represents, overall, a much stricter framework than the Canadian guidelines, which do not legally require the application of a non-degradation standard.

Two examples of US mines enforcing a non-degradation standard are the Buckhorn Mine (Kinross Gold Corporation) in Northern Washington State, near the Canadian border, and the Pogo Mine in Alaska (Sumitomo Metal Mining Pogo LLC). Buckhorn Mine's permit requires extensive effluent treatment and imposes strict limits, which compared to MPMC's current permit application, would

[13] http://mend-nedem.org/default/ et http://www.abandoned-mines.org/en/
[14] E.g. for As, Fe, Se, Zn, and TSS (see Hatch 2014, Table 10.1 for base metal mines: http://mend-nedem.org/wp-content/uploads/MEND_3.50.1_BATEA.pdf).
[15] Assuming a 6.5 to 10.0 Mm3/year of effluent treatment, an operational cost of $0,02 to $1,08/m3, and an initial investment of $550 to $19 800/m3/h (see Hatch 2014, Table 10.1 for base metal mines: http://mend-nedem.org/wp-content/uploads/MEND_3.50.1_BATEA.pdf).
[16] https://www.imperialmetals.com/assets/docs/mp-technical-report-may-20-2016.pdf, p.21-170
[17] https://www.imperialmetals.com/for-our-shareholders/press-releases/imperial-reports-third-quarter-2016-financial-results
[18] http://ceqg-rcqe.ccme.ca/download/en/221
[19] http://ceqg-rcqe.ccme.ca/download/en/221
[20] E.g. Montana http://www.mtrules.org/gateway/Subchapterhome.asp?scn=17.30.7, http://deq.mt.gov/Portals/112/DEQAdmin/DIR/Documents/legal/Chapters/CH30-07.pdf, or Alaska http://dec.alaska.gov/commish/regulations/pdfs/18%20AAC%2070.pdf

represent a 73% reduction in ammonia release, 76% for copper, 78% for zinc, 94% for iron, 98.6% for arsenic, and 99.8% for sulphate[21]. Except for copper, these reduced levels would meet all of the BC water quality guidelines[22]. For its part, the Pogo Mine permit in Alaska requires an 'off-river' dilution and effluent treatment in order to meet existing water quality conditions into the Goodpasture River, as prescribed by a non-degradation standard. If levels are too high, the waste water is re-routed back to the treatment and off-river dilution process.[23]

Outstanding waters

Some States—such as Montana and Alaska—require a mandatory non-degradation standard if receiving waters are, or can be classified as "*outstanding resource waters.*"[24] Alaska defines such waters as "*a water of a national or state park or wildlife refuge*" or "*a water of exceptional recreational or ecological significance.*"[25] Montana can designate 'outstanding waters' using similar criteria.[26]

It can be argued that Quesnel Lake is an 'outstanding resource water.' It is one of deepest lakes in the world, home to multiple fish species crucial to regional fisheries, a source of drinking water, and is sacred to local residents and Indigenous peoples who depend on its quality for their livelihoods.

According to BC Parks, the Quesnel Lake area meets BC's Protected Areas Strategy "Goal 2 (Special Feature)," which objective is to "*protect special natural, cultural heritage, and recreational features, including rare and endangered species and critical habitats, outstanding or unique botanical, zoological, geological, and paleontological features, outstanding or fragile cultural heritage features, and outstanding recreational features.*"[27]

BC Parks adds: *"Quesnel Lake… is provincially unique… the deepest lake in British Columbia and possibly the deepest fiord lake in the world."* [28] Various areas within Quesnel Lake *"contain important habitat for fish species which support a host of species including… Lake Trout, Rainbow Trout, Redside Shiner, Chinook Salmon, Coho Salmon, Sockeye Salmon, Kokanee, as well as the blue-listed Bull Trout."*[29]

In the wake of the 2014 mine waste spill, even Premier Christy Clark did not hesitate to recognize the outstanding value of Quesnel Lake for British-Columbia: *"This is a pristine resource for everybody… We are going to be with you, shoulder to shoulder, to do everything we can to return it to the real pristine beauty we all know this lake is for our province, because this is just such an incredible, incredible asset".*[30]

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[21] WA Department of Ecology, National Pollutant Discharge Elimination System, Permit No.WA0052434, 2014 (paper copy only).
[22] Selenium is not a contaminant if interest at the Buckhorn Mine.
[23] https://www3.epa.gov/region10/pdf/permits/npdes/ak/ak0053341-fs.pdf
[24] Montana Code http://www.mtrules.org/gateway/Subchapterhome.asp?scn=17.30.7 and Alaska Water Quality Guidelines http://dec.alaska.gov/commish/regulations/pdfs/18%20AAC%2070.pdf
[25] Paragraph 3, Provision 18 AAC 70.015, Alaska's Department of Environmental Conservation Water Quality Standards: http://dec.alaska.gov/commish/regulations/pdfs/18%20AAC%2070.pdf
[26] E.g. if one, or more, of the following criteria are met: (a) waters have been designated as wild and scenic; (b) endangered or threatened species found in the waters; (c) outstanding recreational fishery in the waters; (d) only source of suitable water for a municipality or industry; (e) only source of suitable water for domestic water supply. Paragraph 4, Provision 75-5-316 "Montana Outstanding resource water classification -- rules -- criteria -- limitations -- procedure – definition" http://leg.mt.gov/bills/mca/75/5/75-5-316.htm
[27] Ibid.
[28] *BC Parks 2015, Quesnel Lake Park Management Plan,* http://www.env.gov.bc.ca/bcparks/explore/parkpgs/quesnel_lk/quesnel-lk-mp.pdf?v=1482786732317
[29] Ibid.
[30] *Premier Christie Clarke, CBC News 8 Aug. 2014*

Local opposition and lack of consent

In this context, it is not surprising that local residents and First Nations members have mobilized to oppose MPMC's current permit application and any further, long-term discharge of mine waste water into Quesnel Lake.[31] They are already affected by both the dumping of 18 billion litres of mine waste at the bottom of Quesnel Lake in 2014 and the 'temporary' discharge of contaminated mine effluent that followed. Destruction of Hazeltine Creek, blurry waters, clogged water filters, and slimy beaches along the lake are some of the visible impacts since 2014. People have also lost part of their livelihood and suffered various social and cultural impacts. There are also long-term impacts to people and ecosystems that remain yet to be documented.[32]

As stated above, BC's 2015 Waste Discharges policy insists to take into account "*many considerations… when developing waste discharge standards*," including "*environmental sensitivity… First Nations interests… and stakeholder input.*"[33] Ongoing concerns raised by members of Xat'sull (Soda Creek) and T'exelc (Williams Lake Indian Band), as well as formal opposition taken by local organizations such as the Likely Chamber of Commerce, Concerned Citizens of Quesnel Lake, and local members of First Nation Women Advocating for Responsible Mining, clearly indicate that MPMC's long-term water management plan, as currently proposed, is unacceptable. Alternative options should be considered, taking into account locally affected communities, residents, and First Nations.

Conclusion

MiningWatch Canada is very concerned about Mount Polley Mining Corporation's (MPMC) application for a long-term permit to discharge not-fully treated mine waste water into Quesnel Lake. In light of the issues described above, we recommend the BC Ministry of Environment (MOE) to reject this permit application and require MPMC to propose alternative options, including full treatment of mine effluent and possible discharge points into less sensitive waters. This is the main recommendation of this submission. It supports the position of locally affected residents and community members whose well-being and livelihoods have depended on the quality of Quesnel Lake waters in the past, and will continue to do so in the future.

Thank you for the opportunity to share our views on this important matter.

Ugo Lapointe
Co-manager and Canada Program Coordinator
MiningWatch Canada

***Thank you to MEC & Patagonia for supporting the work we do in BC to help better protect critical ecosystems and livelihoods affected by mining.*

[31] See for example: http://www.wltribune.com/opinion/letters/400459181.html, http://www.wltribune.com/opinion/letters/401759055.html, http://image.issuu.com/161209115211-a79251e4b6fe407ab9ddd41abd85469b/jpg/page_10.jpg, http://www.wltribune.com/news/405644506.html, and http://www.princegeorgecitizen.com/opinion/columnists/mount-polley-brings-new-cause-for-concern-1.4477108

[32] For a more detailed description of the impacts of the 2014 spill on waters, ecosystems and fish habitat, see http://miningwatch.ca/sites/default/files/the_lawsuit_0.pdf

[33] BC MOE, Factsheet Waste Discharges, March 2015 http://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/pulp-paper-wood/best_achievable_control_tech.pdf

Appendix 2 - CSP2 Comments on Mt Polley TAR - 15Dec16

CENTER for SCIENCE in PUBLIC PARTICIPATION

224 North Church Avenue, Bozeman, MT 59715
Phone (406) 585-9854 / Fax (406) 585-2260 / web: www.csp2.org / e-mail: csp2@csp2.org
"Technical Support for Grassroots Public Interest Groups"

December 15, 2016

Province of British Columbia
Ministry of Environment
MtPolleyEnvironmental.Enquiries@gov.bc.ca

Re: Comments on Mt Polley Technical Assessment Report

The Center for Science in Public Participation provides technical advice to public interest groups, nongovernmental organizations, regulatory agencies, mining companies, and indigenous communities on the environmental impacts of mining. CSP2 specializes in hard rock mining, especially with those issues related to water quality impacts, reclamation bonding, and tailings dam safety.

GENERAL COMMENTS

Through the Technical Assessment Report (TAR) the Mount Polley Mining Company (MPMC) is asking the Ministry of Environment to significantly increase the discharge limits for Environmental Management Act Permit 11678 that was modified on September 19, 2016, to in part authorize the use of Quesnel Lake for dilution of mine effluent. The September permit also increased the discharge limits for copper, molybdenum, selenium and sulfate, and the criteria for cadmium eliminated. Quesnel Lake water is cleaner that in Hazeltine Creek, even before the accident.

The Initial Dilution Zone (IDZ) and lack of additional would allow MPMC to increase the amount of discharge of metals, over the amount allowed under the increased limits of the September 16, 2016 permit, by 724% for arsenic, 264% for chromium, 175% for copper, 809% for iron, 611% for zinc, 217% for ammonia, 251% for nitrate, and 54% for sulfate (270% over the June 7, 2013 permit).

The fundamental rationale for granting a discharge into Quesnel Lake at increased permit limits seems to be two-fold: (1) that an IDZ, a zone of mixing where water quality standards are exceeded, is standard operating procedure and should be granted the mine; and, (2) that the present treatment systems meets or exceed Best Available Technology requirements, and need not be improved. Neither of these arguments should be taken at face value, and will be addressed in the section-specific comments.

Treatment of the mine effluent to meet water quality standards is easily technologically achievable, and arguably should be required to minimize further damage to Quesnel Lake. In essence, asking for a dilution zone in Quesnel Lake is adding insult to injury.

Thank you for the opportunity to comment on the Technical Assessment Report. If you have any questions on my comments, please feel free to call at any time.

Sincerely:

David M. Chambers, Ph.D., P. Geop.

SECTION-SPECIFIC COMMENTS

3.4.4 Hazeltine Creek

Table 3-19 summarizes the existing water quality in Hazeltine Creek. It is noted that Hazeltine Creek exceeds the 30-day average BC Water Quality Guidelines for turbidity, total suspended solids, phosphorus, chromium, copper, and iron.

The measured water quality for Hazeltine Creek was within BC Water Quality Guidelines for 2012, and the levels of turbidity, total suspended solids, phosphorus, chromium, copper, and iron were all several times lower than measured in 2015-2016 (MPMC 2013). There is no mention or summary in the Technical Assessment Report of baseline water quality in Hazeltine Creek prior to the dam break.

These statistics are cited to demonstrate that prior to the dam failure, water going into Quesnel Lake was of significantly higher quality than that presently being discharged from Hazeltine Creek into the lake, and of even higher quality than the proposed discharge of treated water into Quesnel Lake.

3.6.5 Biological Tissue Sampling

In the section on Benthic Invertebrate Tissue Chemistry (Golder 2016, p. 81) that selenium levels in profundal samples were elevated, probably from natural sources. Nonetheless, even if the elevated selenium is due to "other than mine" influences, adding additional selenium through a discharge will only exacerbate the problem.

Recommendation: Sampling of benthic invertebrates in Quesnel Lake should be continued to insure that the additional selenium released from the spill, and from the proposed mine discharge, not increase the already elevated level of selenium in invertebrates.

4.1.2 Tailings Storage Facility

It is noted that "*At closure, … Approximately 15% of the surface area of the TSF basin is proposed to be covered with water, ...*"

As a result of the Mt Polley accident, the Mt Polley Expert Panel recommends the dry closure of all tailings facilities (Expert Panel 2016, Section 9.3.2 BAT Methods). It is not economically feasible to close the Mt Polley tailings facility in a dry manner, but since the tailings are not acid generating, it is not clear why any surface water is necessary or desirable for the tailings facility when closed.

There is no explanation for closing the tailings facility with a partial lake cover offered in the Technical Assessment Report. The tailings facility would be marginally safer if closed as close to dry conditions as possible.

Recommendation: The tailings facility should be closed with a dry surface, or at most a lined stream channel, unless justification is given for the necessity of a 15% surface lake area.

5.2.1.2 Quality of Discharge

For water treatment MPMC is employing an Actiflo treatment plant, which is described in Appendix E, Proposed Water Treatment Plan for Operations Phase Water Management. The Actiflo Treatment plant is meant to control TSS and turbidity, not metals (e.g. Cu or Mo) or metal leachates (As and Se).

It is also noted in Appendix E that "*Effluent TSS and turbidity levels achieved are consistently low, typically less than 10 mg/L for TSS, and turbidity ranges from 0.2 to 2 nephelometric turbidity units (NTU).*"

The predicted levels in the effluent for Total Suspended Solids (TSS) and turbidity are not modelled, nor data presented, in the TAR, so it is not possible to calculate the reduction in the Actiflo unit.

During operation the expected reduction in the level of copper from settling in the Actiflo unit is approximately 33% for copper and 10% for selenium in the Actiflo treatment system (Golder 2016, Appendix E, Table 1). A conventional lime treatment system can remove greater than 90% of the copper. Selenium is not reduced by lime treatment. Selenium is typically reduced in a biotreatment cell, which can reduce the level greater than 90%.

Recommendation: MPMC should employ conventional treatment to reduce metals, selenium, and arsenic before discharging effluent.

6.3 Tailings Storage Facility

It is noted that "*Because of the large freshet volumes, it will be necessary to utilize the TSF for temporary detention, ... When the volume of water in the TSF reaches 3.5 Mm^3, water is pumped to the Springer Pit.*"

In Section 4.1 it is stated that it is an objective to: "… *maintain adequate tailings beaches, with the goal of a minimum of 100-m-long beaches.*" Are these commitments, or just goals?

Recommendation: MPMC should be required to maintain a minimum tailings beach for dam safety.

6.3.2 Effluent Permit Limits

It can be seen from Table 1: 19Sep16 Permit-Predicted-Requested Water Quality Criteria (below) that MPMC is requesting a significant loosening of the discharge criteria, over what is required in the present permit.

Table 1:
19Sep16 Permit / Predicted / Requested Water Quality Criteria

	19Sep16 MoE Permit Requirement	Operational Quesnel Lake Predicted Max Effluent Concentration	TAR Request	TAR Request Multiple of Present Permit Limit (X times)
$Al_{dissolved}$	none	0.360	n/a	-
As	0.0034	0.014	0.028	8
$Cd_{disolved}$	none	0.00017	none	-
Cr	0.0011	0.002	0.004	4
Cu	0.012	0.049	0.033	3
Fe	0.11	0.76	1.0	9
Mo	0.20	0.18	0.36	2
Se	0.060	0.087	0.075	1
V	0.0081	0.036	n/a	-
Zn	0.0083	0.059	0.059	7
pH	6 - 9.5	n/a	6 - 9.5	-
NH_4	0.41	0.64	1.3	3
NO_2	9.7	17	34	4
P	0.090	0.004	0.090	1
SO_4	720	556	1110	2

As noted in the comments on section 3.4.4 Hazeltine Creek above, the discharge from Hazeltine Creek into Quesnel Lake was of considerably higher water quality than after the accident. The accident has impacted water quality in Hazeltine Creek. In the Technical Assessment Report MPMC is asking to significantly increase the concentrations of the contaminants in the discharge over that presently allowed in the 19Sep16 Permit.

Contaminant Summary:

- Aluminum (Al)
  - Aluminum is usually measured as a dissolved ion. Post-spill dissolved aluminum levels in Hazeltine Creek are approximately equal to pre-spill levels, but still approximately 10 times higher than in Quesnel Lake.
  - Aluminum can be toxic at levels predicted in the discharge (Golder 2016, Table 6-2), and is approximately 43 times higher than in Quesnel Lake.
  - Presently there is no requirement to measure or monitor Al. At a minimum, Al should be measured, if not given a permit limit.
- Arsenic (As)
  - MPMC is requesting a discharge limit approximately 8 times the present permit limit.
- Cadmium (Cd)
  - Cadmium in the discharge is predicted to be above BC Water Quality Guidelines (Golder 2016, Table 6-2).
  - Cd should be added to the list of permit limits.
- Chromium (Cr)
  - MPMC is requesting a discharge limit approximately 4 times the present permit limit.
- Copper (Cu)
  - MPMC is requesting a discharge limit approximately 3 times the present permit limit.
  - Copper levels in Hazeltine Creek prior to the dam failure were approximately 0.006 mg/L (MPMC 2013). The existing permit limit is 0.012 mg/L, which is significantly above the 2012 level. The water quality standard for copper can be met with additional treatment.
- Iron (Fe)
  - MPMC is requesting a discharge limit approximately 9 times the present permit limit.
- Molybdenum (Mo)
  - MPMC is requesting a discharge limit approximately 2 times the present permit limit.
- Selenium (Se)
  - MPMC is requesting a discharge limit approximately the present permit limit, which would allow them to keep discharging with no selenium treatment system.
  - Selenium levels in Hazeltine Creek prior to the dam failure were approximately 0.001 mg/L (MPMC 2013). The existing permit limit is 0.060 mg/L, which is 60 times the 2012 level. The water quality standard for selenium can be met with additional treatment.
- Vanadium (V)
  - Vanadium is included in the present permit. MPMC is asking that it be removed.
  - Vanadium in the predicted discharge to Quesnel Lake is 0.036 mg/L (Golder 2016, Table 6-2). The present level of Vanadium in Hazeltine Creek is 0.006 mg/L (Golder 2016, Table 3-19).
- Zinc (Zn)
  - MPMC is requesting a discharge limit approximately 7 times the present permit limit.

- Ammonia (NH4)
  - MPMC is requesting a discharge limit approximately 3 times the present permit limit.
- Nitrate (NO2-3)
  - MPMC is requesting a discharge limit approximately 4 times the present permit limit.
  - Nitrate can be reduced through biological treatment.
- Phosphorus (P)
  - The present Permit Limit is 6 times the BC Water Quality Guidance.
  - Predicted phosphorus in the effluent is approximately 0.03 mg/L (Golder 2016, Table 5-11).
  - Phosphorus is not present naturally, and is not a typical additive for mine processing.
- Sulfate (SO4)
  - MPMC is requesting a discharge limit approximately 2 times the present permit limit.
  - Quesnel Lake could be affected if the effluent is discharged at this limit since it is approximately 5 times the water quality standard (Golder 2016, Table 6-4).

Recommendation: The present permit limits are near the BC Water Quality Guidelines, and the BC Water Quality Guidelines are achievable with additional water treatment, which is not being proposed by the MPMC.

6.3.4.2 Study Boundaries and Assessment Nodes

It is in this section that the first detailed discussion of an Initial Dilution Zone (IDZ) is made. An IDZ is now authorized for: Quesnel Lake, for the discharge from the water treatment plant; and, for Bootjack Lake, which will receive contaminated groundwater from the Springer Pit when it is filled with water.

The IDZs was added to the September 19, 2016, permit. No initial dilution zone was authorized in the previous permit of June 7, 2013. And, at the present time there is no authorization for an IDZ in Bootjack Lake – that would need to be added to the revised permit.

Unfortunately, an IDZ in Bootjack Lake is inevitable, unless the pit is pumped dry in perpetuity. Groundwater flow from the Springer Pit into Bootjack Lake is projected to exceed BC Water Quality Guidelines for fluoride, sulfate, nitrate, nitrite, antimony, copper, selenium, and dissolved aluminum (Golder 2016, Table 6-2). The worst case dilution in Bootjack Lake is 28:1 for selenium (Golder 2016, Appendix J, Table 3.1).

As for the IDZ in Quesnel Lake, it is noted:

> *The IDZ is the initial portion of a larger mixing zone applied to a specific effluent discharge. The concept recognizes the role of dilution in mitigating the effects of effluents and that there is an accepted area of higher concentrations of contaminants prior to where full mixing occurs. [The Ministry of Environment]'s Best Achievable Technology (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.* (Golder 2016, Appendix E, Attachment B)

According to their website, MoE currently defines BAT as: "*Best Achievable Technology means the technology which can achieve the best waste discharge standards, and that has been shown to be economically feasible through commercial application.*"

Golder has discussed Metal Mining Effluent Regulations (MMER) as guidance for treating the discharge (Golder 2016, Section 2.4.3). As noted, the MMERs are technology-based requirements. Technology-

based requirements are generally considered do-not-exceed levels, and are also generally not subject to dilution.

Golder also cites Pouw et al. (2015) for guidance on the efficiencies of 31 Canadian water treatment systems, as presented in the following table:

Table 1: Summary of Proposed BATEA for the Base Metal Subsector

Model Effluent Treatment Flowsheet	Proposed BATEA	Effluent Quality
■ hydroxide precipitation for metals ■ coagulant and flocculant dosing and pond-based settling for TSS ■ natural degradation of ammonia ■ pH adjustment with CO_2	model flowsheet *(model effluent treatment)* +: polymeric organosulphide reagents for metals polishing[(a)]	Al < 0.79 mg/L As <0.01 mg/L Cu <0.03 mg/L Fe <0.30 mg/L Pb <0.02 mg/L Ni <0.05 mg/L Se <0.04 mg/L Zn <0.02 mg/L TSS <10 mg/L NH_3/NH^{4+} <4 mg/L

a) This column describes the proposed augmentation of the model flowsheet to achieve the effluent quality in the column on the right. Stated in a different way, this is the additional treatment step that could be added to the model flowsheet that is proposed as an economically achievable means of achieving improved water quality in the effluent. In this case organosulphide reagents are proposed to lower metals concentrations.

Source: Pouw et al, 2015.

Kristin Pouw was the primary author on a large study funded by the Mine Environmental Neutral Drainage (MEND) secretariat of Natural Resources Canada completed in 2014. The table below presents the results from that study (Pouw 2014). The reference cited by Golder (Pouw 2015) for the table above is from a presentation given by one of the authors at the 10th International Conference on Acid Rock Drainage and the International Mine Water Association's Annual Meeting, ICARD-IMWA 2015. Santiago, Chile. It is odd that the Effluent Quality data cited by Golder are not identical with the MEND report data, since the authors are the same, and time period likewise similar.

Table 6-7: Treated Effluent Summary for the Base Metal Subsector

Parameters	Units	Effluent Concentration Basis	Minimum	Average	95th Percentile	Maximum
pH		Monthly Mean	3.7	7.8	9.0	12.3
Aluminum	mg/L	Grab/Composite	0.00005	0.11	0.39	28.1
Ammonia, total	mg-N/L	Grab/Composite	0.0015	0.94	3.95	39.1
Arsenic	mg/L	Monthly Mean	0.00005	0.0035	0.02	0.061
Copper	mg/L	Monthly Mean	0.0008	0.02	0.06	4.2
Cyanide	mg/L	Monthly Mean	0.0005	0.031	0.052	2.6
Iron	mg/L	Grab/Composite	0.001	0.64	1.82	104
Lead	mg/L	Monthly Mean	0.00002	0.005	0.015	0.2
Nickel	mg/L	Monthly Mean	0.00025	0.091	0.38	14.7
Radium-226	Bq/L	Monthly Mean	0.005	0.025	0.106	0.736
Selenium[10]	mg/L	Grab/Composite	0.00005	0.006	0.024	0.073
Zinc	mg/L	Monthly Mean	0.0001	0.06	0.25	17.5
TSS	mg/L	Monthly Mean	0.01	4.3	13	106

Notes:
Values reported as less than the method detection limit have been incorporated at 50% of the MDL value.
All metal concentrations are total metal concentrations, i.e., the sum of dissolved and suspended fractions.

The point to be made is that the data for Effluent Quality cited by Golder appears to be 95th percentile data, which is unduly biased up by (nominally) older, less efficient treatment systems. This can be easily seen by looking at the "maximum" value for each constituent in the MEND table.

"Average" in the MEND table would equate to an average performing treatment plant. Minimum in the MEND table should represent theoretical BAT technology. With the exception of zinc, the average values in the MEND table are all below the limits requested in the TAR. This would make the treatment system, and permit limits, less than "average" for Canadian base metal mine water treatment.

Recommendation: Since Quesnel Lake has already seen significant harm by an accidental discharge from the Mt Polley mine, an initial zone of dilution is not appropriate for the Mt Polley mine discharge, since the impacts of a discharge could never be differentiated from the impacts of the spill.

Appendix F: Closure Water Treatment Plan – Conceptual Design,
Attachment C - Selenium Target Derivation

It is noted in the TAR that zooplankton at Hazeltine Creek and Polley Lake were above BC dietary guidelines (Golder 2016, pp. 80-81)

Golder has cited several studies which show that selenium impact coldwater fish species at 10 mg/kg and above. Golder also noted:

> *"The initial uptake step is the largest and most variable part of this stepwise process, in which selenium concentrations increase on the order of 100× to 10,000× from parts per billion (µg/L) in water to parts per million (mg/kg dry weight [dw]) in algae. The magnitude of increase in the initial uptake step depends on aqueous selenium concentration and other site-specific factors such as sulphate concentration and biogeochemical conditions (Williams et al. 1994; Stewart et al. 2010; Lo et al. 2015).*

They evidently use the coldwater selenium tissue concentration with the uptake factors to then calculate a discharge concentration, and they conclude:

> *"Receiving waters at the Mount Polley Mine do not exhibit distinct patterns of selenium bioaccumulation compared to receiving waters at other mines (Section 3.1) and rainbow trout as the most abundant fish species in Hazeltine Creek are not expected to be more sensitive to selenium compared to benchmarks adopted elsewhere in BC (Section 3.2). Therefore, a total selenium concentration of 10 µg/L, if met in Hazeltine Creek, would not be expected to cause adverse effects to resident aquatic life."*

One would assume that BC and other regulatory agencies are also aware the studies cited by Golder in the TAR, and utilized these and additional research to establish the water quality guidelines/criteria published by the agency. Basing site-specific criteria on research other than the conservative approach taken by agencies in establishing water quality guidelines/criteria is short-circuiting the permitting process. If site-specific criteria are to be applied, those criteria should be based on site-specific research. The approach taken in the TAR to establishing site-specific criteria for selenium is fundamentally flawed.

Recommendation: There is no compelling evidence presented in the TAR to change the selenium criteria upward. Since there is no selenium-specific treatment being employed at the site, the selenium criteria should be returned to the value utilized in the June 7, 2013, Permit (MoE 2013).

Appendix L: Development of a Molybdenum Screening Value for the Impact Assessment

Golder notes:

> *"The US Fish and Wildlife Service proposed a molybdenum criteria for the protection of cattle (the most sensitive mammal) exposed via drinking water of less than 10 mg/L based on the minimum toxic concentration between 10 and 50 mg/L for calves from the Kincaid (1980) study (Eisler 1989)."*

and;

> *"Based on the available toxicity data for molybdenum discussed above, effects to livestock occur between 10 and 50 mg/L and effects to wildlife are at even higher molybdenum concentrations."*

It is not clear if Golder is accurate in using mg/L instead of ug/L, which would make more sense. The CCME Guideline for molybdenum in agricultural uses is 0.5 mg/L. Most other regulatory jurisdictions have a guideline of 0.01 mg/L for agricultural and irrigation uses (USEPA, South Africa, Food and Agricultural Organization).

The values for molybdenum concentrations that are protective of livestock and wildlife are very high in comparison with protective values published by other world regulatory sources.

Recommendation: The Golder research should be verified. 0.01 mg/L is the appropriate guideline to use for a criterion for molybdenum in Quesnel and Bootjack Lakes.

Table 2 - Comparison of Water Quality Guidelines, Permit Requirements, and Suggested Permit Limits, is attached as a quick reference to the various permit guidelines, existing and predicted water quality parameters referenced in the TAR.

References:

Expert Panel 2016. Report on Mount Polley Tailings Storage Facility Breach, Independent Expert Engineering Investigation and Review Panel, Province of British Columbia, January 30, 2015

Golder 2016. Mount Polley Mine Long Term Water Management Plan, Permit Amendment Application under the Environmental Management Act: Technical Assessment Report, Golder Associates, 17 October 2016.

MoE 2013. Amended Permit 11678, Environmental Protection Division, Ministry of Environment, June 7, 2013

MoE 2016. Amended Permit 11678, Environmental Protection Division, Ministry of Environment, September 19, 2016.

MPMC 2013. 2012 Water Quality Report, Mount Polley Mining Corporation, 28Mar13

Pouw 2014. Study to Identify BATEA for the Management and Control of Effluent Quality from Mines, MEND Report 3.50.1, Kristin Pouw, Kathryn Campbell, Lisa Babel, Hatch, September 2014.

Table 2 - Comparison of Water Quality Guidelines, Permt Requirements, and Suggested Permit Limits

Contaminant	(Units)	7Jun13 MoE Permit Requirement	19Sep16 MoE Permit Requirement	Water Quality Standard[1]	East Quesnel Lake 95th Percentile[2]	Operational Quesnel Lake Predicted Max Effluent Concentration[3]	TAR Request	TAR Request Multiple of Present Permit Limit (X times)	Comment
$Al_{dissolved}$	mg/L	none	none	0.05	0.0091	0.390	n/a	-	Post-spill dissolved aluminum levels in Hazeltine Creek are approximately equal to pre-spill levels, but still approximately 10 times higher than in Quesnel Lake. Aluminum can be toxic at levels predicted in the discharge (Golder 2016, Table 6-2), and is approximately 43 times higher than in Quesnel Lake. **Al should be added to the list of permit limits.**
As	mg/L	none	0.0034	0.005	0.00015	0.014	0.028	8	MPMC is requesting a discharge limit approximately **8 times the present permit limit.**
$Cd_{disolved}$	mg/L	0.025	none	0.0001	< 0.000005	0.00017	none	-	Cadmium in the discharge is predicted to be above BC Water Quality Guidelines (Golder 2016, Table 6-2). **Cd should be added to the list of permit limits.**
Cr	mg/L	none	0.0011	0.001	< 0.0005	0.002	0.004	4	MPMC is requesting a discharge limit approximately **4 times the present permit limit.**
Cu	mg/L	0.007	0.012	0.002	0.0012	0.049	0.033	3	MPMC is requesting a discharge limit approximately **3 times the present permit limit**. Copper levels in Hazeltine Creek prior to the dam failure were approximately 0.006 mg/L (MPMC 2013). The existing permit limit is 0.012 mg/L, which is significantly above the 2012 level. The water quality standard for copper can be met with additional treatment
Fe	mg/L	none	0.11	1	0.04	0.76	1.0	9	MPMC is requesting a discharge limit approximately **9 times the present permit limit.**
Mo	mg/L	0.05	0.20	0.25	0.00043	0.18	0.36	2	MPMC is requesting a discharge limit approximately **2 times the present permit limit.**
Se	mg/L	0.002	0.060	0.002	< 0.0005	0.087	0.075	1	Selenium levels in Hazeltine Creek prior to the dam failure were approximately 0.001 mg/L (MPMC 2013). The existing permit limit is 0.060 mg/L, which is significantly above the 2012 level. MPMC is requesting a discharge limit approximately the present permit limit, which would allow them to keep discharging with no selenium treatment system. The water quality standard for selenium can be met with additional treatment.
V	mg/L	none	0.0081	-	< 0.0005	0.036	n/a	-	Vanadium is included in the present permit. **MPMC is asking that it be removed.** Vanadium in the predicted discharge to Quesnel Lake is 0.036 mg/L (Golder 2016, Table 6-2). The present level of Vanadium in Hazeltine Creek is 0.006 mg/L (Golder 2016, Table 3-19).
Zn	mg/L	none	0.0083	0.0075	< 0.003	0.026	0.059	7	MPMC is requesting a discharge limit approximately **7 times the present permit limit.**
pH	s.u.	none	6 - 9.5	6.5 - 8.5	8	n/a	6 - 9.5	-	Drinking water criteria should be enforced in the permit limit.
NH_4	mg/L	none	0.41	1.8	< 0.5	0.64	1.3	3	MPMC is requesting a discharge limit approximately **3 times the present permit limit.**
NO_2	mg/L	3	9.7	3	0.15	17	34	4	MPMC is requesting a discharge limit approximately **4 times the present permit limit.** Nitrate can be reduced through biological treatment.
P	mg/L	none	0.090	0.015	0.0038	0.03	0.090	1	The present Permit Limit is **6 times the BC Water Quality Guidance**. Predicted phosphorus in the effluent is approximately 0.03 mg/L (Golder 2016, Table 5-11). Phosphorus is not present naturally, and is not a typical additive for mine processing.
SO_4	mg/L	309	720	218	6.5	556	1110	2	MPMC is requesting a discharge limit approximately **2 times the present permit limit.** Quesnel Lake could be affected if the effluent is discharged at this limit since it is approximately 5 times the water quality standard (Golder 2016, Table 6-4).
TSS	mg/L	none	15	+5 mg/L from background	< 3.0	n/a	15	1	Even though this limit is above background, Quesnel Lake will should not be significantly affected if the effluent is discharged at this limit.
Initial Dilution Zone (IDZ)	n/a	No Initial Dilution Zone (IDZ) in Quesnel Lake	Initial Dilution Zone of 100 meters in Quesnel Lake	n/a	n/a	n/a	n/a	n/a	**An IDZ is a zone where water quality criteria are exceeded for chronic effects. CSP2 recommends No IDZ in Quesnel Lake, since it is only being allowed to dilute the mine discharge with no significant increase in water treatment.**
Rainbow Trout	96hr LC_{50} % Mortality	Selenium 1 µg /g wet wt (mean)	50%	n/a	n/a	n/a	n/a	n/a	This is a measure of acute lethality in the effluent
Daphnia Magna	48hr LC_{50} % Mortality	-	50%	n/a	n/a	n/a	n/a	n/a	This is a measure of acute lethality in the effluent
Ceriodaphnia 7-day reproduction	inhibition of survival and reproduction	-	> 25%	n/a	n/a	n/a	n/a	n/a	This is a measure of chronic lethality in the effluent
Salmonid 7-day ELS toxicity	non-viable alevins	-	> 25%	n/a	n/a	n/a	n/a	n/a	This is a measure of chronic lethality in the effluent

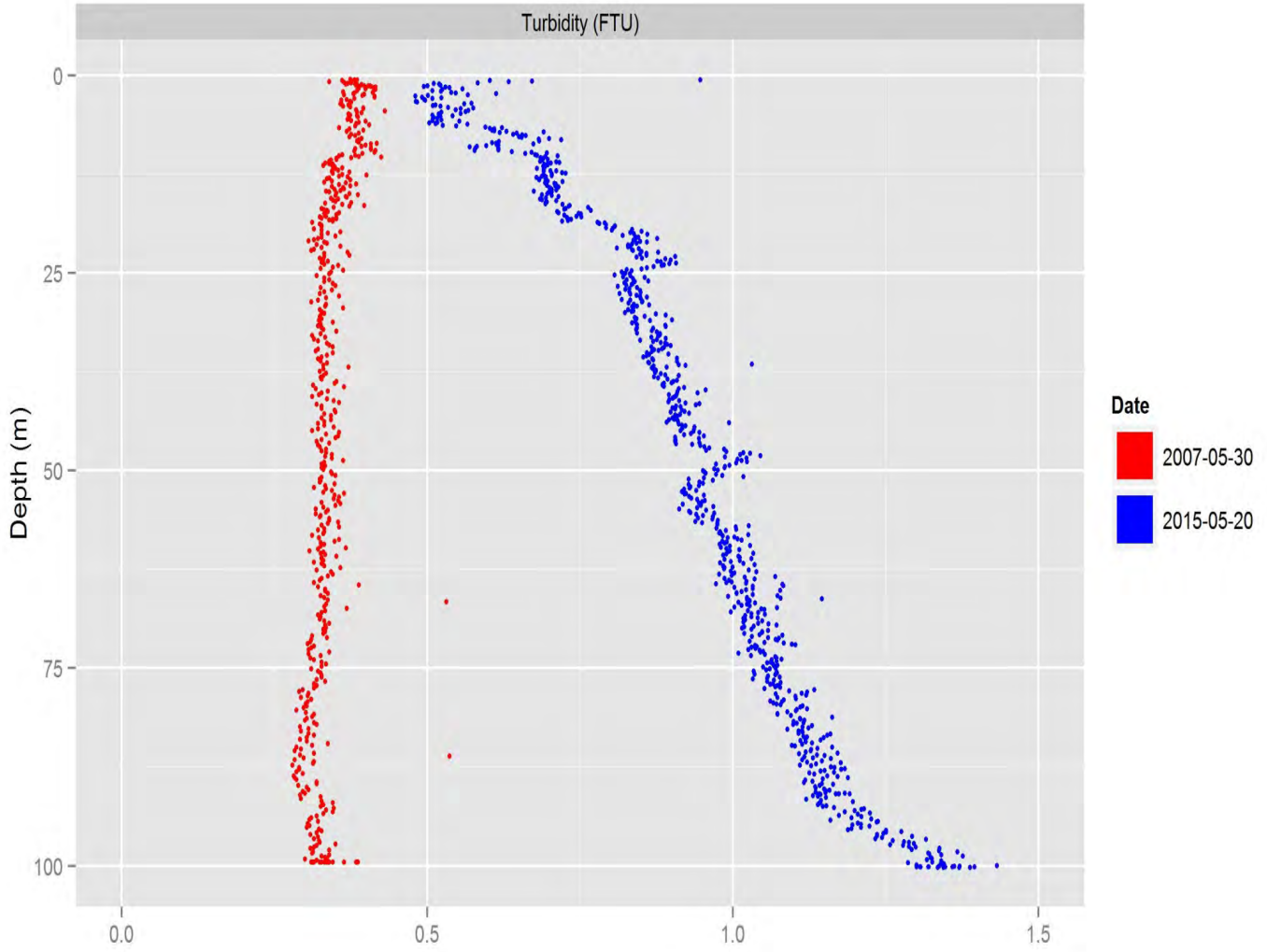
[1] BC Drinking Water or Fresh Water Aquatic Life 30-day Guidelines used, except where noted (e.g., molybdenum, total aluminum). Maximum (Max) guidelines substituted where 30-d guidelines do not exist.

[2] No data presented for present water quality West of Cariboo Island, although it is the major portion of Quesnel Lake, and it is implied that water quality in the western portion of the lake is not as good as the water east of the Cariboo Island sill, which forms a barrier

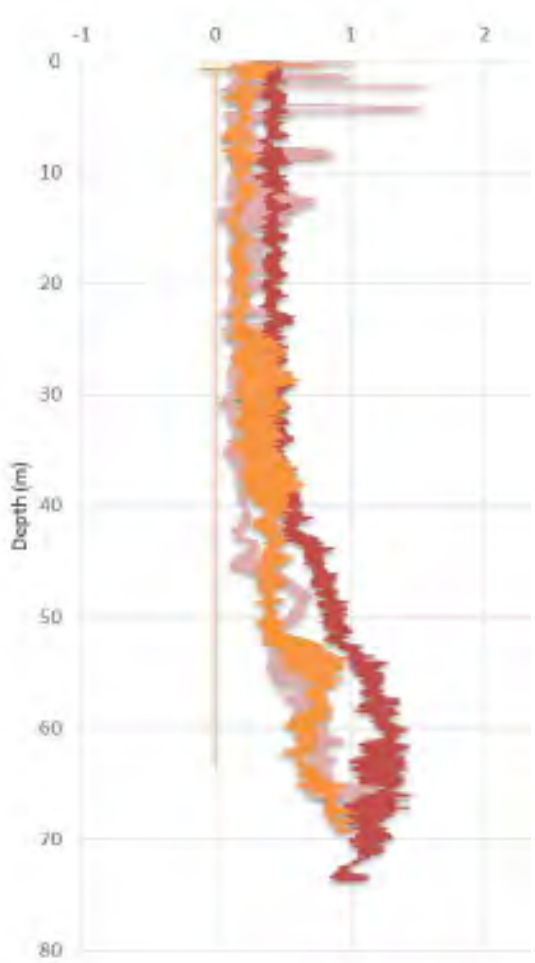
[3] Table 6-2: Comparison of Predicted Untreated Mine Site Water Chemistry Relevant to the Quesnel Lake Discharge and Springer Pit Seepage to Maximum BC Water Quality Guidelines and Metal Mining Effluent Regulation Limits

Appendix 3 – QL Turbidity Near Hazeltine Creek

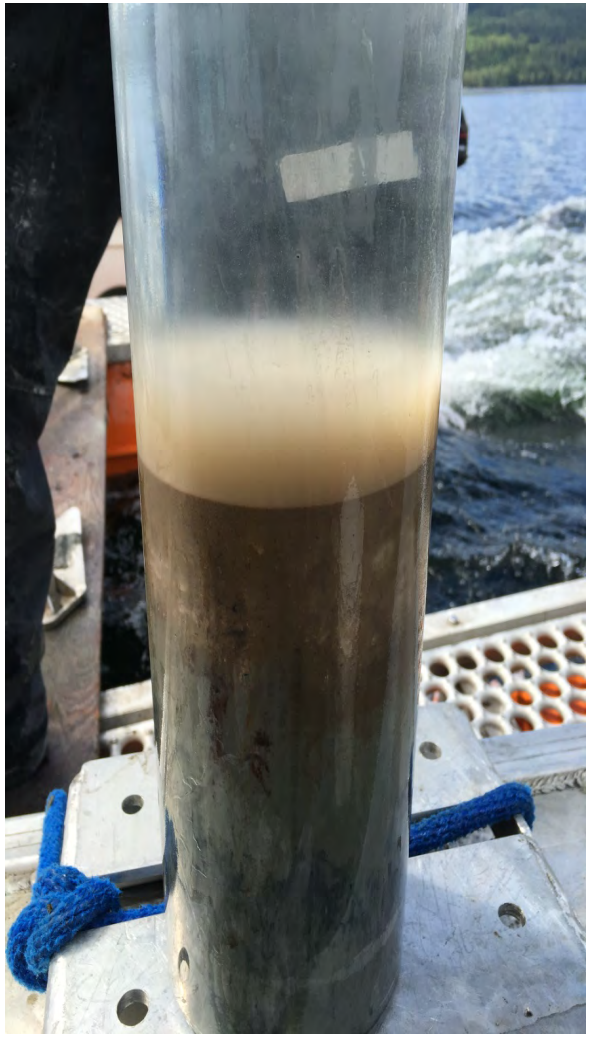
Quesnel Lake Turbidity 2007 & 2015 near Hazeltine Creek



Turbidity QUR-58 at Outfall, Hazeltine Creek, November 2016



Halo Zone with mobile layer, east of impact zone



Halo Zone with mobile layer, west of impact zone

Appendix 4 – Landsat QL Ice 10Jan17

QL West Basin Ice – Landsat January 7, 2016

Excerpt from a LandSat 8 image, taken on 10 January 2017. It's false-colour, to highlight variation in ice quality.

Interesting to note the area of thin ice/open water near the mouth of Hazeltine Creek.

This is a false-colour view of the West Arm of Quesnel Lake on 10th January 2017, compiled from images captured by the Operational Land Imager on Landsat 8, and made available by the US Geological Survey through Earth Explorer (http://earthexplorer.usgs.gov/). In this rendering, the red display channel represents reflectances in Band 4 (red), the blue channel represents Band 5 (Near Infra-Red), and the green channel represents Band 6 (Short-Wave Infra-Red 1). More information on false-colour images is available from the NASA Earth Observatory pages (http://earthobservatory.nasa.gov/Features/FalseColor/).