BRITISH COLUMBIA

Decision Record

Environmental Protection

Cariboo Region

Date: November 7, 2012

File: 76750-40\11678

Re: Application for Amendment of *Environmental Management Act* Permit PE-11678

This memo records the reasons for decision for an amendment to effluent permit 11678 (AMS tracking #57773). Key documents are referenced; however, there are numerous other documents not specifically listed that were also considered in reviewing the application.

1. Application

Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals, operates the Mount Polley Mine. MPMC submitted a final application on October 9, 2009, later revised in September 2010, to amend its effluent permit to authorize a discharge of mine water to Hazeltine Creek. There are currently no other authorized discharges to Hazeltine Creek; however, there is an authorized discharge to a tributary known as Edney Creek, which is to be replaced with the new discharge to Hazeltine Creek.

MPMC indicates in its technical assessment report (TAR, August 2009 rev-1) at page 30, that 1, 376, 000 m^3 of mine water is to be discharged per year. This is based on average precipitation rates and free flowing toe drains.

The preferred discharge point in Hazeltine Creek is identified in *Lands Ac*t License of Occupation #516031 as being a location midway between the outlet of Polley Lake into Hazeltine Creek, and a bridge downstream over the creek at water monitoring stationW7. Bootjack Creek enters Hazeltine Creek a short distance upstream of the preferred discharge point. Effluent is to be transferred from the source, the perimeter seepage pond, to the creek via a pipeline and released at the side of the river through a diffuser structure.

The source of mine water to be discharged is from a perimeter seepage pond collecting dam seepage and drain water from the impoundment. Other sources that could be directed to this pond in the future are treated rock dump and mine site runoff. Section 5.3 of the TAR predicts effluent quality based on observed water quality from the various sources of mine water. Ongoing water quality monitoring of these sources continues and

data is reported by way of quarterly data submissions and annual interpretive reports.

2. Review Process

MPMC commenced the amendment application at an initial pre-application meeting on October 24, 2006. This was the first of several meeting that were held and attended by various agencies, First Nations and stakeholder representatives to develop requirements for a technical assessment report for an application to discharge mine water. Prior to initiating this amendment MPMC had been investigating site specific water quality objectives for the mine. The amendment pre-application process aimed to identify key issues and an initial draft application was produced in April 2007, followed by a modified draft application in July 2007 as part of the pre-application process. After identification of key issues MPMC developed a more complete application package dated December 23, 2008, which was revised in July 2009 and finalized in September 2010 in response to technical reviewer's comments. The final application is identified as "August 2009 rev-1".

Consultation with First Nations was conducted at the normal to deep level and is documented in the consultation record dated October 22, 2012 written by Karen Moores. A preliminary assessment of the consultation duty was conducted in the fall of 2009 to identify consultation duties with regards to the final application. This assessment was later revised as indicated in the consultation record by Karen Moores following consultation conducted for a Mines Act amendment in 2011. Consultation duties assigned to MPMC consisted of provision and explanation of information regarding the application to the First Nations with interests in the locale of the mine. As part of the consultation process, MPMC funded a third party review of the application conducted on behalf of the Soda Creek Indian Band (Xats'ull) and the Williams Lake Indian Band (T'exelc) by Brian Olding & Associates Ltd. The report produced from this review, dated June 2011 formed the basis for accommodation measures described in the consultation record. I am satisfied that the efforts made to consult met the standards for consultation with First Nations whose interests may be affected by this discharge.

Public consultation conducted by MPMC leading to their final application is documented in their consultation report of July 2009. Public consultation included meetings at the mine site and the community of Likely in 2007. Stakeholder representatives participated in further pre-application phase meetings held to discuss the draft application. The Mount Polley Mine Public Liaison Committee held meetings during the application process where updates were provided to attendees, and a draft permit document was discussed at the May 2012 committee meeting in Big Lake. Concerned public also wrote to the mine and directly to the ministry. Public correspondence up to the summer of 2009 is documented in the MPMC Consultation Report. Responses to communications from the public received by the ministry after that date were provided in November 2011, inviting the concerned persons to contact MPMC to receive regular updates on the

activities at the mine site via the public liaison committee. All requirements for providing public notice under the Public Notification Regulation were met by MPMC.

3. Discussion of Key Issues

Need for and location of discharge:

Mount Polley Mine commenced operation in 1997 and it was expected at that time to have a fourteen year mine life. The original mine plan reviewed during the mine review process, and which was approved in Project Approval Certificate M96-07, describes a 14 year mine life (pg. 23 Mount Polley Project Stage 1 Environmental and Socioeconomic Impact Assessment, Vol 1), with no operational discharge from the tailings impoundment, but potential discharges of site and waste rock dump runoff as discussed in sections 1.3 and 1.4 of a letter from Imperial Metals Corp. dated April 8, 1991 sent to the chair of the Mine Development Steering Committee. The water management plans are also discussed in the reasons for decision document from the issuance of the mine development certificate dated October 1992. Section 4.3 of this document indicates that a future discharges may be required depending on the success of recycling and water conservation efforts.

The mine has operated with only a temporary discharge of seepage water during a period of care and maintenance from 2001-2004, and has successfully been recycling all site water otherwise. New mineral resources and increased mill capacity have slightly increased the mine footprint and extended the mine life compared to what was originally proposed. In order to continue operating the mine, and to continue to recycle as much mine water as possible, the mine requires authorization to release surplus water meeting appropriate standards.

In her assessment report ("Water Quality Assessment Report – PE-11678: Mt. Polley Mining Corporation Permit Amendment Application for the Discharge of Mine Effluent to Hazeltine Creek", May 2012), Chris Swan notes that monitoring to date indicates the most consistent and best quality site water is dam filtered seepage water located near the tailings impoundment. The most variable water quality, with some of the higher concentrations of contaminants of concern is from dump runoff owing to the variety of rock that may be exposed during a given phase of mining. For these reasons it was recommended by Chris Swan that dam filtered water be the source of the discharge.

MPMC has indicated that the preferred location for release of mine water is Hazeltine Creek as it is down gradient and close to the TSF perimeter seepage ponds. This location minimizes the need for pumps and pressure mains that would rely on a power supply and could be more at risk of unplanned spills. The TSF area is also the main location of collection of all site water, the main water storage facility, and a key location at which water management activities are managed.

Public concerns were raised regarding the discharge to this tributary of Quesnel Lake. These concerns related to drinking water, fisheries and recreational values. In reference to Quesnel Lake which Hazeltine Creek flows into, one writer noted that "As one of the few pristine bodies of water remaining in our increasingly polluted world I do not believe we should knowingly permit **any** risk to be taken by dumping toxic waste into its waters" (emphasis in original). Like numerous other submissions from the public and from First Nations, it is clear that the receiving waters for this discharge hold a high social value.

Nonetheless, MPMC has a legitimate need to release water from the mine site for which it does not have capacity to store indefinitely. As noted in Karen Moores report ("Ministry Review", October 26, 2012), there currently is remaining unused storage capacity in the tailings pond. However, MPMC hopes to continue mining in the Cariboo Pit requiring relocation of water from this pit to the TSF, which may consume the remaining storage space in the TSF. A discharge after closure must also be planned for. MPMC has been initiating water recycling and enhanced evaporation techniques to limit the buildup of surplus water, but once dam building stops at the end of mine life, and the site is decommissioned so that water has to flow by way of gravity rather than by pumping, there will not be capacity to store or relocate additional water. MPMC has attempted to put forward a discharge proposal that does not lead to unacceptable conditions or harm to Hazeltine Creek, or to downstream waters or current uses of these water courses, including as fish habitat. As noted by the EAB in decision No. 2006-EMA-006(a) that relates to a mine effluent discharge to the Fraser River, "...the Act is not an example of zero tolerance, or zero harm approach." Thus despite the high social and environmental values of the receiving environment, adopting a zero risk approach in evaluating this application is not in keeping with the purpose of the Environmental Management Act.

It is helpful to know the social values placed on the receiving environment, however, and to take these values into account when determining what permit requirements are necessary for the protection of the environment. In determining what conditions are required to protect the environment, the framework outlined in EAB decision No. 2006-EMA-006(a) is useful:

[113] In order to determine the impact on the environment, three critical questions must be answered: (1) what are the potentially harmful physical, chemical and biological components of the discharge (i.e., will the receiving environment assimilate, dissolve or treat the discharge); (2) how will these impact the receiving environment; and (3) whether there are any particular sensitivities or special features of the receiving environment that should be taken into consideration?

Potentially harmful characteristics of the effluent:

Water quality characteristics of concern are identified in Chris Swan's assessment report and in Karen Moores' Ministry Assessment report. The key water quality characteristics identified in these reports are: hardness, nitrate, sulphate, cadmium, copper, molybdenum, selenium, phosphorus, dissolved aluminum, iron, and temperature. Selenium is identified as a concern in various media: sediment, benthic invertebrates, periphyton, and fish tissue, whereas the other contaminants are a concern for the water column only.

Hardness is identified as a potential concern as the current hardness concentration at W7 is elevated compared to background. Current hardness levels peak seasonally during low flow, when the proportion of groundwater input to the creek is greatest. Also, figure 4.1.1 in Chris Swan's report indicates an increasing trend from year to year since mining commenced. Effects directly from high hardness are not known, but the hardness levels dictate the guideline for some metals. The evaluation by Chris Swan recommended a value to use for hardness (73 mg/L) in calculating hardness dependent water quality guidelines (cadmium and copper). This value is based on an annual mean from 1995-2008 data collected prior to more recent higher hardness concentrations. Use of this value for hardness in calculating metal guidelines avoids allowing the use of induced elevated hardness due to the discharge which would allow for higher metal guideline values. There is no water quality guideline in B.C. for hardness, so other than monitoring and avoiding the use of induced hardness to calculate guidelines for metals no other precaution has been suggested.

Nitrate is identified as a contaminant of concern relating to a species of tree frog common to the area. A target from the BC Water Quality Guideline of 3 mg/L was recommended to prevent effects on frog reproduction.

Sulphate was identified as a concern due to high levels in mine water and the potential effects on fish reproduction. Sulphate may also affect certain aquatic mosses, e.g. F*ontinalis antipyretic*a, and the larvae of the pacific tree frog. Testing by MPMC showed reduced effect on exposed aquatic moss when hardness in the water is high. However, MPMC did not conduct testing of the effect of sulphate on sensitive invertebrates during sensitive life stages or on any fish species. Chris Swan suggested a mean dilution factor of 4:1 to reach the guideline value of 100 mg/L for sulphate.

Cadmium is a parameter whose water quality guideline depends on hardness, and at the hardness selected for the assessment (73 mg/L) the guideline for cadmium is 0.025 ug/L. Cadmium in Hazeltine Creek is variable, and the existing data is difficult to interpret due to the limitation in available lab detection limits for some of the data, and so a baseline mean and 98th percentile values could not be calculated for the entire data set. In last year's annual report the mean value for cadmium in the perimeter seepage pond was

0.06 ug/L, lower than the projected effluent value of 0.1 ug/L, but still above the applicable guideline. Chris Swan identified cadmium as needing the greatest dilution compared to the other contaminants of concern, in order to be protective. In B.C. the current guideline for cadmium in its total form is a working, not an approved guideline, and the CCME guideline is currently under review. Karen Moores recommended an annual mean target equal to the calculated guideline, and lower detection limits to enable observance of the annual mean. She noted that cadmium is subject to frequent non-detects and high detection limits. This may limit the ability to determine 30 day means consistently. I note that the CCME water quality guidance document (Canadian Environmental Quality Guidelines, Chapter 4 Water – Aquatic Life) indicates that the most sensitive aquatic organisms and the test organism upon which the cadmium guideline are based are *Daphnia* (water fleas). Both chronic and acute toxicity testing using daphnia are required in the amended permit. One point of clarification which I include in the amended permit is that the annual mean for cadmium noted in the table in the permit covers the annual discharge period of April to October, and excludes months when the discharge is not authorized.

Copper in the discharge waters is predicted most likely to be 9 ug/L (table 2 of Chris Swan's report). Chris Swan discusses the affect of dilute concentrations of copper on migrating fish olfactory cue intake which can occur under certain conditions. A water effects ratio assessment conducted for MPMC indicates that a target for W7 of 7 ug/L for copper is safe. Only a slight amount of dilution in the creek water is required to meet this target. Average copper concentrations at W7 are 2.5 ug/L indicating sufficient dilution capacity before reaching 7 ug/L. No impact from copper is expected if the targets are met at W7.

Molybdenum content in this discharge is not of concern for aquatic life as the expected levels in the effluent do not approach the water quality guidelines for aquatic life. Guidelines for wildlife are of interest, particularly the potential to affect wild ruminants. The B.C. Water Quality Guidelines are set at 0.05 ug/L to protect wildlife. First nations had raised the concern about wildlife drinking water from the creek or consuming riparian vegetation in contact with creek water that might contain elevated molybdenum. Using a target of 0.05 ug/L there is no significant risk to wild ruminants from molybdenum. The predicted most probable effluent concentration for molybdenum was 0.08 ug/L, and the current concentration of molybdenum at W7 is far less that this value, so it does not appear much dilution is required to meet this target.

Selenium concentration in the discharge and receiving environment was reviewed by Chris Swan. Selenium is a concern with respect to its affect on egg laying vertebrates. It is an element that is essential to life, but can also bioaccumulate. It was noted that selenium in the water column is not significant, but that the selenium content in other media are of a concern and appear to be increasing near the mine. The cause of this increase and cycling of selenium in the environment around the mine in not clear, and

additional monitoring is needed to fully understand the movement of this element in the receiving environment. Managing this element by limiting its concentration in the water column alone is unlikely to be sufficient to prevent effects from occurring. In addition to water quality targets, targets for selenium in sediment and fish tissue are needed.

Phosporus is a concern with respect to excess nutrient enhancement of the creek. Instead of a target for phosphorus, a target for Chlorophyll-a is recommended. Chlorophyll-a is noted in Karen Moores' report as a surrogate for phosphorus, which is the limiting nutrient in Hazeltine Creek.

Dissolved aluminum and total and dissolved iron are identified as contaminants of concern in Karen Moores report. Elevated dissolved aluminum appears to correlate with those months of the year when there is significant surface runoff, i.e. spring and fall (see. Chris Swan's report at figure 4.3.2). Iron is common in surface and mine waters. Total iron peaks have been observed in Hazeltine Creek at high flow and are likely associated with sediment reporting to the creek during freshet. The B.C. water quality guideline for dissolved aluminum is a maximum of 0.1 mg/L and 30-day average of 0.05 mg/L, and for iron is a maximum of 1 mg/L total iron and 0.35 mg/L in dissolved form. Targets for these contaminants were not developed for W7, however, since the effluent is generally lower in aluminum and iron content than the background receiving waters.

Karen Moores also discussed temperature as a concern; however, no specific target is suggested, although temperature will be monitored continuously in the creek. Chris Swan notes that temperature is a concern for rainbow trout, and that historic temperatures have exceeded the optimal range for incubating rainbow trout. She goes on to say that predicted changes are expected to be within natural variability and within the 1 degree change prescribed in the BC water quality guidelines. Since the creek is fed mainly by Polley Lake, the lake temperature is likely the greatest impact to creek temperatures. Cooling of creek water during the hotter months is likely available from groundwater, which increases as a proportion of inflow during the summer and tends to be cooler than surface water. By comparison, water emanating directly from embankment drains maintain a cooler and more consistent temperature, as shown in the latest annual report (2011 MPMC annual report) which indicates the temperature for E5 (dam drain water) varied from about 6 to 8 C over the entire year. In the summer months, once this drain water collected in the collection ponds exposed to surface warming, it tended to heat to temperatures similar to that found in Hazeltine Creek (11 to 17 C). The issue of temperature can be addressed in the Annual Discharge Plan to ensure that undesirable temperature change to the Creek does not occur.

To protect water quality from harmful effects from those contaminants that might be greater in concentration in the effluent than the appropriate guidelines and the receiving water background concentrations, targets to be met in the receiving environment at site W7 are proposed, and are discussed in Karen Moores' report. An Annual Discharge

plan, that has to be approved by the Director, will stipulate the source water for discharge, the quantity and timing of release, and minimum quality requirements such that the targets are met at monitoring site W7.

Potential Impact on the Receiving Environment:

The effect of increased discharge in the creek was identified as a concern in the review process. According to Karen Moores' report, any increase of the creek flow would remain within normal historic range during the discharge period, as higher flows occurred historically prior to recent mine development and historic diversion of Bootjack Lake to the north. Chris Swan notes that an increase in minimum base flow in Hazeltine Creek could increase the amount of functional fish habitat. The final application report provides an assessment of physical impacts to the creek and concludes that bank erosion potential is low near the release point and low to medium at other points downstream, that flows will increase towards historic rates, and recommendations are made that can be used in developing the Annual Discharge Plan to prevent undesirable physical impacts to the creek.

The location of discharge was adjusted to avoid a gravel bar and braided area of streambed to ensure adequate mixing at low flows. The *Lands Act* tenure application confirms the location of the release point and a site management plan is attached to the tenure governing site development for the pipeline and release site.

The authorized quantity of discharge is a maximum of 1.4 million cubic metres per year, which is based on mean site water balance projections for surplus water, i.e. water that is in excess of site storage capacity. The actual amount in surplus will likely vary from year to year depending on weather patterns, snowpack, and site activities in a given year that affect storage capacity. The authorized flow will be limited by the stipulation that the discharge must not contribute more than 35% of creek flow, which means that flows will have to be reduced as the natural creek discharge reduces in summer and fall. The Annual Discharge Plan may also call for flow reductions in order to meet the objectives of the plan, particularly the water quality targets for site W7.

Downstream monitoring site W7 is identified as the location where the water quality targets must be met. This site is preferred as it is a short distance downstream (about 800 m reported in Chris Swan's report), providing enough space for mixing but not so far that additional flow of any significance enters the creek. Site W7 has a long dataset of pre-discharge data associated with it for both flow and water chemistry. It is also easy to access as there is a bridge crossing the creek just below the monitoring site.

Dispersion modeling using the CORMIX model was conducted and reported in the application in Appendix J (KPL, June 25, 2009). Using mean monthly flow from records for the water flow station at site W7, the modeling provided a predicted percent of

effluent in Hazeltine Creek for each month under a proposed discharge option that varied effluent discharge rate each month according to a proposed discharge schedule. The report indicates that rapid mixing occurs near the release point, and that further downstream dilution depends on additional inflow of runoff waters entering the creek as it flows towards Quesnel Lake. Most notably, Edney Creek joins Hazeltine Creek above monitoring site W11 and provides the most significant additional dilution after the initial dilution zone and prior to the effluent reaching Quesnel Lake. Effects to water quality at site W7 predicted in this report are driven by the ratio of effluent to total creek flow which simplifies developing the Annual Discharge Plan, since it can be assumed that full mixing of the effluent into the creek occurs prior to site W7.

In her report, Karen Moores indicates that the potential chronic effect from the contaminants of concern is the leading issue. A primary means of avoiding chronic effects is through limiting the percent effluent in the creek. The discharge is to not exceed 35% of creek flow at any time, a proportion identified as the geometric mean of the no-observed-effect-level and the lowest-observed-effect-level from chronic testing of rainbow trout through the embryo-alevin-fry stages (ref. TAR, pg 54). Percent effluent below 35% is predicted not to lead to chronic effects. The targets for site W7, if met, also contribute to the prevention of chronic effects.

Sensitivities or Special Features in the Receiving Environment:

Chris Swan identified the most sensitive aquatic receptors in the receiving environment in section 3.2 of her report. Hazeltine Creek is identified as critical fish habitat. While a number of species potentially use the lower portion of the creek, nearer the release point Hazeltine Creek provides rainbow trout spawning and rearing habitat. Rainbow trout reproduction is likely the most exposed receptor to this discharge since the location where spawning, incubation and rearing occurs is in the area of effluent release, and the discharge will occur during these stages of the rainbow trout lifecycle. The rainbow trout in the Polley Lake/Hazeltine Creek system also occupy a much smaller range, all of which is influenced by the mine, than other species that use only the lower portion of Hazeltine Creek. Chris Swan identifies in table 3.2 of her report the contaminants of particular concern regarding chronic effects to rainbow trout and other fish. These are: sulphate (can affect fertilization and egg development) and selenium (trophic transfer via food chain can affect egg laying vertebrates). The effect of exceeding optimal temperature conditions, discussed above, is also a concern for rainbow trout egg incubation, and it is noted that in some years the creek already exceeds optimal conditions for incubation in June. Ongoing biological monitoring is required to evaluate and monitor for impacts from this discharge on the rainbow trout in this system.

Acute and chronic toxicity from the effluent due to metals exposure to biota is a risk that requires ongoing scrutiny. The effluent will have to pass acute toxicity testing on rainbow trout and daphnia magna. Chronic testing will be required to confirm risk to

rainbow trout embryo/alevin development and to Ceriodaphnia dubia, a species considered sensitive to metals, notably cadmium.

As noted above, there is a high social value attached to the receiving environment. As a result the permit requires ongoing communication with the public and with First Nations by maintaining a public liaison committee and establishing a communication protocol with the two First Nations having interests in the area of Hazeltine Creek.

Uncertainty and Precautionary Approach

As some uncertainty exists, initially only the available 801,000 cubic metres of dam filtered water is approved for discharge. As noted previously this water is of the best quality and poses the least risk the receiving environment. Other sources may be considered in subsequent years following review of receiving environment and environmental effects monitoring, and review of the results of ongoing assessment of treatment options for mine water.

A monitoring plan will be required outlining details of the monitoring to be conducted. One technical issue that this plan can address is the use of site water versus simulated lab water for chronic biological testing. The intent is to coordinate requirements between the permit and federal Metal Mine Effluent Regulations to the extent possible, while obtaining the best information for assessing the risk of this discharge on an ongoing basis.

Each year the Annual Discharge Plan will have to be produced which provides an opportunity to take a precautious approach at the initiation of this discharge without limiting what could be found to be safe in the future as the effects of the discharge are better understood. At the same time, this approach does not permanently authorize an amount of release of mine water that may require further limitations or treatment as identified from the monitoring program.

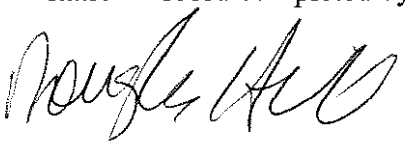
Some key water quality guidelines are currently under review (cadmium, sulphate and selenium). Review of the targets for W7 can be done once these guidelines are finalized. If this further review reveals that the targets in this amendment are too stringent or insufficient to protect receptors, then the targets for site W7 can be updated.

A minor enhancement of the surface runoff and mine drainage control clause was made in the amended permit to change the standard for water management under extreme events up to a one in two hundred year event consistent with other similar permit for major mines and standards established by agreement with other provincial resource management agencies.

4. Decision

For the reasons discussed above the permit is amended authorizing the mine water discharge subject to the conditions in the amended permit.

This memo summarizes the reasons for issuing the amended permit. Although all information presented was considered, this memo discusses only the key points and documents that were considered most relevant. Advice from ministry staff was considered and is documented in the Ministry Assessment written by Karen Moores dated October 26, 2012, and in the May 2012 report written by Chris Swan, Impact Assessment Biologist. In regards to first Nations consultation, the decision relies on advice in the Consultation Record completed by Karen Moores on October 22, 2012.



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