

Mount Polley Database Construction and Analysis

Report prepared by:

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Executive Summary

The Mount Polley Mining Corporation (MPMC) mines for copper and gold at the Mount Polley Mine near Quesnel Lake in British Columbia. On 4 August 2014 the tailings pond impoundment breached releasing tailings material into Polley Lake, Hazeltine Creek, and Quesnel Lake. Since the breach, government, corporate, and academic organizations have been collecting data to understand the effects of accidental tailings release on the aquatic systems. However, the data collected are not readily available to other organizations that could use the information to inform further monitoring, research, and remediation. The British Columbia Ministry of Environment & Climate Change Strategy (BCENV) asked organizations to contribute data surrounding Mount Polley from pre- and post-breach for a database. Pyle Consulting Inc. then compiled the contributed data, created a searchable database, and analyzed the data to answer specific questions posed by the BCENV.

Several organizations (e.g., BCENV, MPMC, Azimuth, and University of Lethbridge) contributed water, sediment, and biological data to the database. The data were in various formats and states of completeness. We standardized the format (e.g., layout of data and units), filled in missing information (e.g., sample identification and details), and compiled the data before depositing them into the database. The database was constructed using MySQL and contains 21 tables, such as 'Waterbody', 'Limnology', and 'Fish'. Each datum in a table has a unique identifier that is used to link it to other tables in the database. The connections between tables allows for users to search for a specific waterbody or fish species for example and receive all data pertaining to that specific waterbody or species.

Using the database, we attempted to answer specific questions posed by the BCENV. Questions and corresponding responses are as follows:

- 1) "Are the concentrations of metals and phosphorus higher in Quesnel Lake and other affected waterbodies (e.g., Polley Lake and Hazeltine Creek) post-breach than pre-breach? How do the concentrations of metals and nutrients compare to the BCENV water quality guidelines (WQG) and sediment quality guidelines (SQG) for the protection of freshwater aquatic life?"

Water copper (Cu), aluminum (Al), and arsenic (As) concentrations increased post-breach.

Copper (total) concentrations were elevated post-breach in Quesnel Lake, Polley Lake, Hazeltine

Creek, and Edney Creek exceeding the WQG in Quesnel Lake and Hazeltine Creek. Aluminum (dissolved) increased in both Edney Creek and Polley Lake post-breach, but only concentrations in Edney Creek exceed the WQG. Arsenic (total) increased in Polley Lake and Hazeltine Creek, but did not exceed the WQG. Phosphorus (total) increased in Quesnel Lake, Polley Lake, and Hazeltine Creek post-breach, but only remain elevated years later in Polley Lake and Hazeltine Creek. However, these concentrations have since dropped and generally are below the WQGs. Sediment Cu and As in the West Arm of Quesnel Lake exceeded the SQG post-breach and still remain around the SQG levels. Selenium (Se) concentrations exceeded SQGs both pre- and post-breach.

Total phosphorus (P) concentrations in Quesnel Lake, Polley Lake and Hazeltine Creek increased post breach. However total P levels in Quesnel Lake appear to have returned to background levels whereas concentrations in Polley Lake and Hazeltine Creek remain elevated.

- 2) “Are Cu and other metals associated with the tailings that were deposited into Quesnel Lake and other waterbodies (e.g., Polley Lake and Hazeltine Creek) by the breach available to biota (i.e. fish, benthic invertebrates, plankton, and amphibians)?”

Fish were the most sampled biota for metals. However, pre-breach data are almost nonexistent and post-breach data are minimal preventing us from comparing metal concentrations in fish pre- and post-breach. Based on high levels of metals in fish tissues, it can be ascertained that metals (Cu, Al, As, and Se) are bioavailable to fish in Quesnel Lake.

- 3) “What effects, if any, did the breach have on the biota (i.e. fish, benthic invertebrates, plankton, and amphibians) of Quesnel Lake and the other affected waterbodies (e.g., Polley Lake and Hazeltine Creek)?”

Other than metal accumulation by fish, benthic invertebrate and plankton communities were the only biological effect adequately sampled for analysis. Benthic invertebrate and plankton community data are limited spatially and temporally restricting our analysis to Quesnel Lake and Polley Lake. Benthic invertebrate communities in Quesnel Lake and Polley Lake, in the areas directly impacted by the breach, were dominated by metal-pollution tolerant families post-breach. Family diversity also decreased in Quesnel Lake in the areas affected by the breach. Plankton family diversity decreased and species richness increased in Polley Lake following the breach.

Pre-breach plankton data was not available for Quesnel Lake or Quesnel River thus no comparisons were made.

- 4) “Are there any spatial or media (i.e., water, sediment, and biota) data gaps in the database?”

The current database is incomplete since there was partial participation by organizations. There are spatial, temporal, and media gaps that limited our ability to conduct pre- and post-breach comparisons for water, sediment, and biota. Water was heavily sampled compared to sediment and biota, however, all media require more pre- and post-breach data for complete analyses.

- 5) “What recommendations can be made for future action?”

We recommend the BCENV continues to work with organizations to obtain and collect data that will fill gaps in the database. To ensure that data can be easily incorporated into the database, we recommend establishing a standard sampling scheme for water, sediment, and biota.