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Glencore Corporation Canada, Boss Mine Site

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submitted by email to john.stroiazzo@glencore-ca.com

attention: Mr. Sean O'Connell, PEng

copy to: Mr. John Stroiazzo, PEng

Subject: Assessment of selected risks to the safety of tailings dams at the Boss Mountain site, identified by BC MEM following the completion of the Mount Polley Panel's report

Gentlemen:

As requested, I have assessed the potential dam safety concerns identified by the BC Ministry of Energy and Mines (MEM) in their memorandum dated February 3, 2015 for tailings dams at the Boss Mountain site. The results of the assessment are discussed in this letter with reference to the numbering of the concerns used in the MEM's memorandum.

Main Dam

The Main Dam comprises a conventional earthfill embankment with a homogeneous till core and a toe drain comprising 150 mm minus rockfill. It is approximately 1,100 m long and up to 14.5 m high. The dam has been designed and constructed to serve as a water retention structure. It retains a pond (± 16 ha in area), with tailings solids submerged adjacent to the dam. Further upstream from the dam the majority of tailings surface is exposed forming a partly vegetated beach. The Main Dam is founded on sand and gravel foundations, with competent till foundations at higher elevations of the valley. The potential dam safety concerns, identified by MEM from the experience with the Mount Polley dam failure, are addressed below.

- 1a There are no clay strata in the Main Dam foundations, which comprise fluvio-glacial sand and gravel deposit and till at the higher foundation elevations.
- 1b Sufficient subsurface investigations (by Geocon in 1970s) were carried out for the Main Dam design purposes.
- 1c N/A (there are no soft soils in dam foundations).
- 1d N/A (no gaps in the information on subsurface conditions have been identified).
- 2a No surplus mine water is stored in the tailings impoundment. Subject to the spillway flow capacity, which regulates the tailings pond level, as much of the tailings impoundment runoff is collected in the tailings pond as is discharged through the overflow spillway.
- 2b N/A (no surplus mine water is stored).

- 2c N/A (no surplus mine water is stored).
- 2d N/A (there is no tailings beach adjacent to the dam; the dam is designed to work as a water retention structure).
- 2e There is a 3.5 m freeboard maintained under normal operating conditions. As with any other water retention dam, if the dam deforms so that its crest falls below the pond operating level, a release of tailings pond water would occur.
- 2f The overflow spillway is designed to pass the maximum design flood. In addition, a 'permanently dry emergency overflow spillway' has been designed and constructed to prevent dam overtopping even if the overflow spillway somehow fails.
- 2g N/A (no gaps have been identified).
- 3a According to the designers (Golder Associates), the gradation of the toe drain sand and gravel satisfies the filter design criteria.
- 3b Since no as-built report for the construction of the Main Dam was prepared, it cannot be confirmed that the toe filter was constructed in accordance with the designs. There are no reasons to suspect that the drain was not properly constructed.
- 3c N/A (no gaps have been identified).

Clarification Pond Dam

The Clarification Pond Dam comprises a conventional earthfill embankment comprising primarily till with some sand and gravel used for the construction of the downstream portion of the dam. The foundations of the dam comprise glacial till or outwash sand and gravels. The clarification Pond Dam is approximately 350 m long and up to 6.0 m high. The dam was designed and constructed to serve as a water retention structure. The potential dam safety concerns with regard to this dam, identified by MEM from the experience with the Mount Polley dam failure, are addressed below.

- 1a There are no clay deposits in the Clarification Pond Dam foundations, which comprise competent sand and gravel and till deposits.
- 1b The records of the original subsurface investigations are not available, however, it is known that the dam foundations comprise till and sand and gravel outwash deposits.
- 1c N/A (there are no soft soils in dam foundations).
- 1d N/A (no essential gaps in the subsurface investigation results have been identified).
- 2a No surplus mine water is stored in the clarification pond. Subject to runoff inflow fluctuations, as much of the runoff is collected in the clarification pond as is discharged through the overflow spillway.

12b N/A (no surplus mine water is stored).

2c N/A (no surplus mine water is stored).

2d N/A (there is no tailings beach adjacent to the Clarification Pond Dam).

2e N/A (there is no tailings beach adjacent to the dam—this dam is designed to work as a water retention structure).

2f The overflow spillway is designed to pass the maximum design flood, which is a short-term event. The design flood presents a criterion much more severe than a sequence of wet years.

2g N/A (no gaps of essence have been identified).

3a The dam design did not include a filter zone (no piping problem is anticipated given the materials used for dam construction).

3b Since no as-built report for the construction of the Clarification Pond Dam was prepared, it cannot be confirmed that the dam was constructed in accordance with the design. There are no reasons to suspect that the drain was not properly constructed.

3c N/A (no gaps have been identified).

North Dam

The North Dam comprises a compacted sand and gravel embankment with rockfill toe drain. The foundations of the dam most likely comprise glacial till or outwash sand and gravels. The North Dam is about 500 m long and up to 7.0 m high.

It is essential to note that the North Dam does not in reality work as a dam structure. It was designed and constructed to prevent the erosion of tailings toward north (according to the design intent: "*The north dam is at the high end of the impoundment area and is not a water dam. Water runs by gravity to the south end where the main dam is located.*"). Consequently, it is considered that the concerns identified with respect to the Mount Polley dam failure are not relevant with respect to the North Dam structure.

In summary, there are no safety concerns of significance at Boss dams with respect to the potential 'Mount Polley' stability issues identified in the MEM's memorandum.

Best regards



Maciej B Szymanski, PhD, PEng