# PHASE 2
# DRAFT ENVIRONMENTAL IMPACT STATEMENT

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# 5. Geochemistry

A comprehensive geochemical characterization program was conducted to assess the metal leaching and acid rock drainage (ML/ARD) potential of waste rock, ore, and tailings from the Madrid North, Madrid South, and Boston deposits and 23 proposed quarries between Roberts Bay and Boston. Technical reports detailing the characterization programs are presented in Appendices V3-4C, Geochemical Characterization of Waste Rock and Ore, Madrid North Deposit; V3-4D, Geochemical Characterization of Waste Rock and Ore from the Madrid South Deposit; V3-4E, Geochemical Characterization of Waste Rock and Ore from the Boston Deposit; V3-3A, Geochemical Characterization of Phase 2 Quarries; and V3-4A, Geochemical Characterization of Tailings from the Madrid North, Madrid South and Boston Deposits.

With the exception of Quarry W, Quarry Z, and Quarry AD, rock from all quarries is suitable for use as construction rock on the basis of a low risk of ARD and low risk of metal leaching under neutral pH conditions. Additional studies have been recommended for Quarry W and Quarry Z to assess their suitability as construction material. Quarry AD is within a mineralized zone and recommended for use as mine backfill only.

## 5.1 WASTE ROCK AND ORE

Waste rock and ore from Madrid South, Madrid North and Boston have a low risk of ARD. The primary geochemical concern with respect to waste rock and ore is neutral pH metal leaching — specifically arsenic — which is possibly related to the trace occurrence of the sulphide mineral gersdorffite (NiAsS). The identification of gersdorffite requires detailed petrographic examination to identify and there is no practical field technique for segregation of waste rock that contains gersdorffite.

During mine development, a proportion of waste rock from each mine will be placed on surface in a temporary stockpile, and the remainder will remain in the underground mine. By closure, all waste rock will be placed as backfill underground. In the event localized ARD is produced, it is anticipated that the high carbonate content in the overall waste rock stockpiles would provide sufficient buffering capacity, and that the overall drainage from the stockpile would remain neutral to alkaline. During operations, all contact water will be collected in lined ponds. Contact water from Madrid will be managed with Doris contact water. At Boston, contact water will undergo water treatment.

## 5.2 TAILINGS

There are two distinct types of tailings that will be produced: flotation tailings and detoxified tailings. Flotation tailings are classified as non-potentially acid generating (non-PAG), with potential for leaching of arsenic under neutral pH conditions. Flotation tailings will be placed in tailings impoundment areas (TIA) at Doris and Boston. The detoxified tailings are classified as PAG. Based on humidity cell testing, detoxified tailings are expected to remain neutral for 20 years. Under neutral pH conditions, there is potential for arsenic leaching from the detoxified tailings, and under acidic conditions, concentrations of other metals are expected to increase. Detoxified tailings will be co-disposed with waste rock as backfill underground at Doris and Madrid North.

The Boston underground mine is completely within permafrost whereas a proportion of the Doris and Madrid mines intersect talik. At closure, all backfill in the Doris and Madrid underground mines will be flooded, which will prevent any further oxidation of sulphides and associated release of acidity and/or

metals. Based on the mine schedule and re-flood times for the underground mines, at closure, the detoxified tailings backfill at Doris is projected to be non-PAG. At Madrid North, 70% of the detoxified tailings are projected to be PAG at closure. This is considered in the assessment of re-flooded mine water quality source terms for closure (Appendix V3-4F, Geochemical Source Term Predictions for the Proposed Madrid North, Madrid South and Boston Mines).

## 5.3 SOURCE TERMS

Source terms were developed for waste rock, tailings and quarry rock, and incorporated into a site-wide water and load balance. The outcomes of the water and load balance are presented in Volume 5, Sections 1, 4, 5, and 8 of the application.