2.7 Waste Rock Disposal

2.7.1 Overview

This section describes the handling and disposal of waste rock generated from pre-production during the construction phase and continued underground development during the operations phase. It also provides a closure plan for the reclamation of the temporary waste rock pad.

A temporary waste rock pad was constructed during the advanced exploration phase to contain all of the waste generated from the test mining program. The pad will be expanded to accommodate waste generated during the pre-production phase. During operations, waste from new development will be trucked to the tailings impoundment for permanent disposal, and waste stored on the temporary pad during previous project phases will be hauled to and placed within the tailings facility.

It should be noted that there will be no attempt to classify rock by acid-generating potential. Based on the chemistry tested to date, all waste rock from the mine will be treated as potentially acid-generating (Section 2.4: Rock Characterization).

2.7.2 Waste Rock Quantities

A flowsheet and materials balance for all materials generated during mining is shown as presented in Section 2.5: Mine Plan (Figure 2.5-5). Approximately 1.94 Mt of waste rock will be excavated in the mine over three project phases, as shown in Table 2.7-1.

Table 2.7-1 Waste Rock Generation by Phase and Source

Project Phase	Total Waste (t)	Source of Waste Rock	
		Mine Development	Stope Drifts
Advanced exploration (2005)	62,000	62,000	
Pre-production (2006-7)	70,000	70,000	
Operations (2007-19)	1,808,000	338,000	1,470,000
Total	**1,940,000**	**470,000**	**1,470,000**

The largest portion of waste comes not from the mine development, but from the in-stope waste generated as part of the mining process (76%). This represents stope drifts located in the footwall beneath the thinner portions of the orebody, as described in Section 2.5: Mine Plan. The largest portion of waste rock (93%) will be generated during the operations phase.

Approximately 1.31 Mt of waste will be retained underground for use as loose unconsolidated fill, as discussed in Section 2.5: Mine Plan. The remaining 0.63 Mt will be disposed of on surface in the tailings facility. In addition to this development waste, there also will be 1.05 Mt of dilution waste rock separated from the ore by the dense media separation (DMS) plant prior to processing. This material will also be hauled by truck to the tailings pond for permanent disposal; therefore, the total quantity of waste rock generated by the mine for surface disposal in the tailings pond is 1.68 Mt, representing 57% of the tailings impoundment capacity. The disposal of waste rock in the tailings facility is detailed in Section 2.8: Tailings Disposal.

2.7.3 Disposal Facilities

There will be two waste rock disposal facilities during the life of the operation: the temporary waste rock pad and the tailings pond.

2.7.3.1 Temporary Waste Rock Pad Description

In July 2005, a 4,900 m² temporary waste rock pad was constructed during the advanced exploration phase (Phase I) on the lower slope of the northeast valley wall above Go Creek at (Figures 2.1-1 and 2.7-1). Following subsurface geotechnical investigations (see below) and geotechnical test work, the pad location was selected in a bowl-shaped valley, rectangular-shaped on plan view (Figure 2.7-1). In the general area selected for pad, colluvial veneers with morainal blankets and colluviated moraine and rock cover the sloping surface.

Access to the pad is from the west side via the main road that connects the industrial complex and the camp areas. The road will be shared by haulage trucks and light vehicle traffic on an ongoing basis.

Figure 2.7-1 Waste Rock Pad Plan and Cross-Section (Vol. 2)

The temporary waste rock pad will contain stacked rock to an average height of 8 m with the edges sloped at the natural angle of repose of the broken rock (estimated at 38º) providing an approximate volume of 37,500 m^3 for the advanced exploration program (Phase I). The nominal maximum height of fill will be 10 m. This volume is adequate to contain 100% of the 62,000 t of waste rock and 7,000 t of ore generated during the 2005 test mining program.

The pad will be extended an additional 3600 m² to the north to accommodate the additional 70,000 t of waste rock that will be generated during the pre-production development program (Phase II). This material will be stacked to a height of approximately 10 m, with a nominal maximum height of 13 m (Figure 2.7-1).

The waste pad is a temporary facility only. The ore on the waste pad will be used to commission the mill on start-up. Once the tailings facility has been commissioned, all remaining waste rock on the pad (132,000 t) will be hauled to the tailings facility for permanent disposal. Upon the complete re-location of waste to the tailings pond, the waste pad site will be reclaimed (Section 2.7-4).

2.7.3.2 Geotechnical Assessments

Three areas were assessed in the general vicinity of the current waste rock pad location (Figure 2.7-2). Six test pits in Area 1 (TP05-43 to -48) were excavated in the general footprint area of the existing pad. These test pits were excavated using a 420D Cat backhoe down to a depth ranging from 3.5-3.9 m on May 22, 2005. The test pits were logged by Klohn Crippen, and representative samples were sent to the Klohn Crippen Vancouver laboratory for further visual classification and index property tests. In general, the pad area was found to have an impervious layer underlying the pad with a minimum thickness of 3 m, sufficient thickness for the site to be developed as a temporary waste rock pad site.

Figure 2.7-2 Plant Site and Waste Rock Pile Site Investigation Plan (Vol. 2)

Two 2-in diameter monitoring wells were installed down slope from the waste rock pad at location MW-05-1 to monitor groundwater quality at two different depths (Figure 2.7-2). These monitoring wells are located about 350 m southeast of the southeast corner of the pad. The test holes were logged using cuttings recovered from the drill holes, and falling head and packer permeability tests were carried out in the deep drill hole, MW05-1A.

2.7.3.3 Pad Construction Details

In order to provide a base for the waste rock pad, the existing organic layer and topsoil was stripped to expose the underlying impervious till-like layer. The organic layer was stockpiled for future reclamation activities. The newly exposed till-like surface was then graded, contoured and proofrolled to facilitate the collection of water from the pad to the south end.

As site permeability with the clay layer could not achieve 10^{-6} cm/s, an area slightly larger than footprint of the pad was lined with an impervious 30 mm Enviro Liner® encased in geotextile cloth for protection. The liner is intended to prevent the infiltration of water into the foundation subsoil. The Enviro Liner® is a proprietary polyolefin material designed by Layfield for outstanding durability, chemical resistance, and flexibility. The Enviro Liner® formulation includes a proprietary UV inhibitor/antioxidant additive package which makes it the most durable thin film geomembrane available on the market for exposed service applications. The 30 mil Enviro Liner® has been tested extensively and has been shown to provide the same exposed service life as can be expected from 60 mil HDPE. Every step in the production of the Enviro Liner® geomembrane is completed according to Layfield's ISO 9002 Quality System to ensure that the liner adheres to stringent standards for all geomembrane applications. Every panel is produced as a custom panel and quality control reports are prepared for each panel produced.

The liner was supplied, placed and anchored by a specialist contractor in compliance with its quality control and assurance programs. The preparation and excavation of the site was inspected and approved by a professional engineer licensed to practice in the Yukon and by the supplier both prior to liner installation and rock placement. To protect the installed liner from potential damage due to the waste rock placement, a layer of geotextile fabric and a 0.5 m thick protective layer of clay material was placed over the Enviro Liner®.

2.7.3.4 Water Collection and Diversion

Runoff from most of the catchment area upslope of the waste pad is intercepted by the access road ditch located northeast of and upslope of the pad. The access road and collection ditch conform to the approximate shape of the pad (Figure 2.7-1). Culverts were installed to direct flow from the access road ditch towards Go Creek.

All runoff from the waste rock pad is and will be collected in the collection sump where it is treated. Once the water meets the applicable criteria to allow for discharge, it is discharged down slope to a vegetated area that eventually drains into Go Creek.

2.7.4 Tailings Facility

During the operations phase, the waste from the mine will be hauled to the tailings facility for permanent disposal and eventually encapsulated by the tailings. Details pertaining to the tailings facility design and operation are described in Section 2.8: Tailings Disposal. The 132,000 t of waste rock stored on the waste pad during the previous phases will also be relocated to and permanently placed in the tailings facility over a two-year period.

2.7.5 Waste Rock Pad Closure Plan

Reclamation of the waste rock pad will commence shortly after all waste has been moved to the tailings facility, estimated to be mid 2009. In the event that the project does not proceed to production or should a period of temporary closure occur prior to the completion of waste relocation and site reclamation activities, the waste will be capped with a 1 m thick layer of clay material that will be compacted in three 0.33 m lift thickness layers using clay from adjacent diggings. Test pitting revealed an abundance of suitable clay material for this cover in the immediate area, most notably test pit hole TP05-12, which demonstrates clay to at least 5 m depth.

Prior to the placement of the capping material, the surface of the waste rock pad will be graded and smoothed by a bulldozer to facilitate shedding of surface water. Consideration will be given to delay the placement of the second and third lifts of the capping material to reduce post-construction deformation of the capping layer. Since the waste rock would be end dumped from haul truck to the waste pile with no compaction, time-delayed rockfill settlement is to be expected. By delaying the placement of the upper layers of the capping material, their long-term integrity could be enhanced.

Finally, the stockpiled topsoil and vegetation mat will be spread over the capped permanent waste rock pad. The surface of the organic material will then be seeded to re-establish the vegetation cover. All drainage from the waste rock pad will be collected and treated until it meets the applicable criteria to allow for discharge.