IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT

REPORT ON GEOTECHNICAL INVESTIGATIONS AND DESIGN OF OPEN PITS AND WASTE DUMPS (REF. NO. 1628/1)

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Association of Consulting Engineers of Canada
Association des Ingénieurs-Conseils du Canada

IMPERIAL METALS CORPORATION

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SECTION 1.0 - INTRODUCTION

1.1 GENERAL OVERVIEW

The Mt. Polley Project is located in central British Columbia approximately 56 kilometres north-east of Williams Lake, as shown on Figure 1.1. The nearest settlement is the community of Likely, which is located on the northern tip of Quesnel Lake.

The project derives its name from Mt. Polley, a low mountain with a peak elevation of 1260 metres, approximately 300 metres above the surrounding terrain. Mt. Polley is situated between Polley Lake to the east, and Bootjack Lake to the south-west. The site is accessible by paved road from Williams Lake to Morehead Lake, near Likely, and then by gravel forestry road for the final 10 kilometres to the site.

The project involves open pit mining of an estimated 82.3 million tonnes of copper and gold ore contained in three adjacent orebodies, at a nominal rate of 17,800 tonnes per day. Approximately 92.6 million tonnes of waste rock will be stored in waste rock dumps adjacent to the open pit.

After processing of the ore to produce a copper/gold concentrate, the tailings will be discharged as a slurry into a tailings storage facility designed to provide environmentally secure storage of the solids waste, with collection and recycling of all process solutions. No discharge of process solutions from the site is required.

This report is an updated version of the 1990 Knight Piésold report "Geotechnical Investigations and Design of Open Pit, Waste Dumps and Tailings Storage Facility" prepared for Imperial Metals Corporation. Details related to the tailings storage facility have been omitted. New information concerning modified waste rock dump sites, geotechnical investigations throughout the site, project water management plans, proposed reclamation program, pit bench design, and proposed pit dewatering plans have been incorporated in this report. All new or revised information has been derived from the following documents by Knight Piésold Ltd:

- March 1995 "Report on Geotechnical Investigations for Mill Site and Tailings Storage Facility" (Ref. No. 1623/1).
- February 1995 "Report on Project Water Management" (Ref. No. 1624/1).
- March 1996 "Hallam Knight Piésold Reclamation Plan Report"
- June 1996 "Groundwater Monitoring Program" (Ref. No. 1624/2).

1.2 SCOPE OF REPORT AND ACKNOWLEDGEMENTS

This report summarizes the design for the open pit and waste dumps with a brief discussion on the project water management plans. It is based on the results of field investigations and laboratory testwork. Specific design items which are addressed in the report are:

- Site characteristics including hydrometeorology, regional geology and seismicity.
- The results of geotechnical investigations carried out in the open pit and waste dump areas.
- Assessment of open pit geology, rock mass characteristics, hydrogeology, and dewatering requirements.

- New layout of the waste rock dumps and an assessment of the hydrogeologic impacts.

- Water management plans.

These items are discussed in the following sections of the report and are intended to provide input towards a Work Systems Approval.

All field geotechnical work was carried out under the direction of Knight Piésold Ltd. personnel with active involvement of Imperial Metals Corporation field personnel.

A comprehensive review of geotechnical data pertaining to the open pit design was carried out by Mr. C.O. Brawner, P. Eng. Results of this review with recommendations for open pit slope design are summarized in Section 4.0 of the 1990 Knight Piésold "Report on Geotechnical Investigations and Design of Open Pit, Waste Dumps and Tailings Storage Facility, Ref. No. 1621/1", and are included in this report as Appendix A.

SECTION 2.0 - SITE CHARACTERISTICS

2.1 HYDROMETEOROLOGY

Long and short term climate records are available for a number of locations in the area, as shown on Figure 2.1. Two recently established stations (Likely with 12 years of record and Horsefly with 17 years) are located within 40 km of the site in similar terrain. The project area is subjected to a relatively temperate climate with warm summers and cool winters. The precipitation is well distributed throughout the year.

Detailed climatological summaries from 1984 to 1990 for weather stations from within the project area are included in Appendix A of the 1990 Knight Piésold report, Ref. No. 1621/1. Site specific data collected from July 1995 to January 1996 is available in the 1996 Hallam Knight Piésold "Reclamation Plan" report.

The mean annual temperature at Likely, the nearest station to the site, is 4.0°C with an extreme maximum of 33.9°C and an extreme minimum of -37°C. At Quesnel, with approximately 76 years of record, extremes are 40.6°C and -46.7°C. Frost free days in the area range from 199 at Horsefly Lake (elevation 788 m) to 244 at Barkerville (elevation 1244 m).

A preliminary estimate of the total annual and monthly distribution of precipitation for the site has been made using data from a number of stations in the area. The mean annual precipitation at Likely is 699.7 mm and at Barkerville (with over 76 years of record) is 1043.9 mm. Precipitation for the site can be expected to fall within this range. The 1996 Knight Piésold "Groundwater Monitoring Program" report gives a mean annual site precipitation of 755mm. Data for Likely, Barkerville and the site are presented in Table 2.1.

Short term storm intensity, duration, and return period curves have been plotted using data obtained from the rainfall frequency atlas for Canada, and are shown on Figure 2.2. Probable maximum precipitation for the site has also been calculated from data contained in this atlas and is shown on Table 2.2.

Evaporation data and estimated evaporation for the site have been computed using potential evapotranspiration by AES using the Thornwaite model and available data for Quesnel and Williams Lake. This data is shown in Table 2.3. Canadian Climate Normals, Volume 9 contains lake evaporation data for Mica Creek and Blue River which are at similar latitude to the mine site but are judged to be too distant to be relevant.

2.2 REGIONAL GEOLOGY

The Mt. Polley site is located in an alkalic intrusive complex in the Quesnel Trough, a 35 km wide north-west trending volcanic sedimentary belt.

The rock units are segmented into blocks by several faults, including an inferred north-westerly trending normal fault which extends along Polley Lake. The predominant structural orientation of the region is north-west trending and dipping steeply to the north-east. Localized geology in the vicinity of the open pit is shown on Drawing 1628.101.

The topography is generally subdued and has been glaciated. Surficial deposits of well graded, dense glacial till material are common throughout the region and are typically present in greater thicknesses in topographic lows. Bedrock exposures are common at high elevations.

2.3 SEISMICITY

The Mt. Polley site is situated within an area of very low seismic activity. A seismic risk calculation based on a Cornell type probabilistic model has been developed by the Pacific Geoscience Centre. The results for the Mt. Polley site are included as Table 2.4 and are summarized as follows:

Return Period (yrs)	Probability of Exceedence in 50 years (%)	Peak Ground Acceleration (g)	Peak Ground Velocity (m/s)
100	40	.021	.043
475	10	.037	.077
1000	5	.046	.094

The project is located in a NBCC Acceleration Zone 0, and Velocity Zone 1 for structural design requirements.

SECTION 3.0 - GEOTECHNICAL INVESTIGATIONS AND TESTING

3.1 GENERAL

Geotechnical investigations have been carried out to provide design criteria for the proposed open pit and waste dumps facilities. Investigative work consisted of field mapping, test pit excavations, installation of ground water monitoring wells, and diamond drilling with permeability testing. The following provides a summary of the investigation work:

- 1989 - A diamond drilling program and hydrogeologic investigation was conducted by Imperial Metals Corporation, in conjunction with exploration drilling. A total of thirty-nine geotechnical drill holes, including three holes with oriented drill core, were completed in the open pit areas, as shown on Figure 3.1. Details from the oriented drill holes are included as Appendix B. Nine groundwater monitoring wells were also completed, as shown on Figure 3.1.

- 1995 - A geotechnical investigation program consisting of thirty-nine test pits was completed by Knight Piésold throughout the project area. Test pit logs are included as Appendix C. Seven groundwater monitoring wells were completed in the vicinity of the open pits and mill site.

Evaluation of site conditions and geotechnical design criteria were based on the following:

(i) Open Pit

- Detailed logging of rock mass discontinuity data in oriented drill core from angled drill holes, and non-oriented drill core from vertical exploration holes (1989).

- Selected laboratory testing of fault gouge material (1990).

- Permeability testing in vertical drill holes (1989)

- Installation of three pneumatic and standpipe piezometers (1989), and installation of groundwater wells monitoring flow from the pit to Bootjack Lake (1995).

(ii) Waste Dumps

- Laboratory studies on the acid generation potential of waste rock (1990).

- Condemnation drilling in the vicinity of the proposed waste dumps (1989).

- Groundwater well monitoring flow from the south-east dump to Polley Lake (1995).

3.2 OPEN PIT

3.2.1 General Description

The open pit will consist of three interconnecting pits, namely the Central, North and West Pits as shown on Drawing 1625.230. The Central and North Pits will extend approximately 1,100m in a north-south direction and the Central and West pits approximately 1,100m in an east-west direction. The total area of the open pits at the conclusion of the operation will be approximately 70 ha. Mining is scheduled to commence in the Central Pit. Development of the North and West Pits will follow.

3.2.2 Geotechnical Drilling

The exploration program conducted by Imperial Metals Corporation in 1989 was expanded to provide additional information on the rock structure within the proposed open pit areas. Geotechnical drill logs were developed in addition to the geologic logs for 39 drill holes. The drill hole locations are shown on Figure 3.1. The following parameters were routinely recorded:

- RQD (rock quality designation)
- Discontinuity spacing and description of surface conditions
- Discontinuity orientation with respect to the core axis
- Discontinuity infilling materials
- Point load test results

Three inclined geotechnical drill holes, MP89-152, MP89-153 and MP89-154 were drilled in 1989 to provide true orientation of the rock discontinuities.

Stereonet plots of the joint and fracture orientations measured in each of the three inclined holes have been developed by the Schmidt contouring method and are presented in Figures 3.2, 3.3 and 3.4. A combined plot of all discontinuity data is included in Figure 3.5. A summary of rock types, RQD, fracture index and unconfined compressive strength data for the three inclined geotechnical drill holes is included as Appendix B.

The predominant rock types encountered were intrusion breccia, syenodiorite and monzonite, with minor occurrence of mafic dykes. Several fracture zones were identified and occasional clayey to sandy zones of fault gouge were encountered in the drill core. Two samples of fault gouge were analyzed in the laboratory as follows:

Drill Hole	MP89-143	MP89-152
Depth	38 m (125 ft)	90 m (245 ft)
Gradation		
Gravel	6 percent	7 percent
Sand	28 percent	16 percent
Silt	46 percent	23 percent
Clay	20 percent	54 percent
Atterberg Limits		
L.L.	57 percent	86 percent
P.L.	26 percent	36 percent
P.I.	31 percent	50 percent
Pocket Penetrometer	disturbed	4.5 tons/ft^2
Natural Moisture Content	23.5 percent	26.5 percent

In general, the rock mass quality comprising the proposed open pit walls was found to have variable conditions, ranging from strong and fresh to weak and altered rock. The uniaxial compressive strength of intact core samples ranged from very high (>200 MPa) to very low (<5 Mpa). Zones of very weak and highly altered rock were identified at localized intervals in most drill holes. Highly fractured zones up to 100 metres in thickness were encountered in several drill holes. Zones of increased fracturing, more intense alteration and lower rock mass quality are recognized to be generally associated with large scale structural features such as faults and contacts between the intrusive geologic units.

Discontinuities in the rock mass generally reflect the regional structural trend, as the dominant joint set was observed to strike 170 degrees and dip 75 degrees to the north-east. A secondary joint set was found to be approximately orthogonal to the main set, striking 30 degrees and dipping 20 degrees to the north-west. Discontinuities observed in the core were generally rough, and contained calcite and chlorite cementation. However, smooth, polished and slickensided joints were also identified. It should be noted that these orientations are based on the results of oriented core from three drill holes. Information on rock mass structure from the other cored drill holes supports these general orientations, however a more comprehensive model of the rock mass structure will be established with the initial development of the open pit.

3.2.3 Permeability Testing

Permeability testing was completed in five vertical exploration holes in 1989 as shown on Figure 3.1. The test apparatus consisted of an NQ double packer wireline system with a flow meter and pressure gauge for accurate monitoring of test conditions.

The test results are included in Table 3.1. In general, the measured rock formation permeabilities were less than about 1×10^{-5} cm/s, but occasional higher permeability zones (approximately 10^{-4} cm/s to 10^{-3} cm/s) were encountered, often associated with zones of intensely fractured bedrock. The geometric mean of all the permeability tests is 8.4×10^{-6} cm/s.

3.2.4 Groundwater Monitoring

Groundwater instrumentation installed in 1989 in the open pit area included three 40 mm diameter standpipe piezometers for water level measurement and groundwater sampling. These wells are still operational. Two multiple port pneumatic piezometers were installed for measurement of water levels and hydraulic gradients, but their status is unknown. Water level measurements were also obtained in open drill holes at the site. In August 1995, three groundwater monitoring wells were installed in the vicinity of Bootjack Lake to monitor the groundwater flow from the open pit and the mill site. An additional monitoring well was installed to monitor the groundwater flow from the east waste dump to Polley Lake. These are discussed in the 1996 Knight Piésold groundwater monitoring report, Ref.

No. 1624/2. This report reviews past well monitoring programs and presents the results of the 1995 wells. It serves as a compilation of the current understanding of the site's hydrogeological conditions and the anticipated impacts that will result from the project development.

In general, groundwater levels around the project area were measured at depths in the order of 30 metres at higher elevations, and 3 to 10 metres at lower elevations, as summarised in Table 3.2. Hydraulic gradients measured in the multiple port installations appeared to be approximately hydrostatic, however, temporary artesian flows were encountered in a few holes during drilling.

3.2.5 Pit Dewatering

Water inflow into the open pits results from groundwater seepage and surface runoff. While groundwater seepage is assumed to be relatively constant over the life of the mine, surface water inflows can be more variable depending on open pit area, precipitation levels and surface water diversions surrounding the pit perimeters. Groundwater flow is difficult to predict accurately, but experience at other mines suggests that the inflow will be in the order of 0.005 m^3/s to 0.025 m^3/s. These rates may be temporarily higher if permeable fracture systems are intersected, but short term dewatering of these fracture zones should occur.

Surface water inflow due to direct precipitation will vary according to rainfall intensity, and is expected to average about 0.01 m^3/s to 0.02 m^3/s on an average annual basis depending on the undiverted catchment area of the pit(s). These values are based on an average annual precipitation of 755 mm/yr (as discussed in Section 2.1), a runoff coefficient of 75% and initial and final pit areas of 41 ha and 90 ha respectively.

Water accumulating in the pit bottom will be transferred to an in-pit sump located on the East side of the Central Pit, about 60 metres above the ultimate base. From there, it will be pumped to the mill for use as process water or discharged into the tailings basin. However, during storm events considerable water will accumulate in the pit bottom where it will be temporarily stored in a bottom sump until it is transferred to the higher sump. Pumping requirements will be determined during initial operations and the pumping capacity will be selected to accommodate increased pumping requirements during and after storm events.

If additional water storage capacity is required, a separate external pit sump may be installed during later mine operations.

Perimeter dewatering wells, and/or horizontal drains may be installed in and around the pits to draw down groundwater levels should it be necessary to control seepage and enhance pit slope stability. These requirements will be progressively determined during mine development.

In the later years of mine operation, the Central Pit may be used for waste rock disposal while the West Pit is mined. Groundwater and surface runoff could then accumulate in the Central Pit and may result in increased lateral seepage rates into the West and North Pits. The West Pit is about 50 metres deeper than the Central Pit and seepage would occur through a bench approximately 150 m high which separates the two pits. The permeability of the bedrock throughout the pit area has been determined to be less than approximately 1×10^{-5} cm/s, but may range from 1×10^{-4} cm/s to 1×10^{-3} cm/s in zones of fractured bedrock (natural geologic fracture zones and/or blast damaged zones). There are three geologic contacts in the vicinity of the bench which have been identified as zones of weak and highly altered rock. These discontinuities could serve as relatively high permeability seepage paths into the West Pit and will be evaluated during initial and ongoing pit development.

The North and Central Pits are separated by a larger bench, approximately 100 m high. Both pits are of the same depth. A north-south trending fault has been found which cuts the west side of the bench and could be a zone of high permeability which will be evaluated during future pit development. It is unlikely that seepage from the Central to North Pits will be a significant consideration due to long seepage path lengths and low seepage gradients.

3.3 WASTE DUMPS

3.3.1 Waste Characterisation

A detailed program of acid/base accounting was completed in 1989 and 1990 on potential waste rock materials from the open pit. This program involved the collection of random samples of drill core and subsequent analyses for:

- total sulphur
- neutralization potential
- total acid generation potential (calculated on the basis of total sulphur)

These tests were carried out by Envirochem Services Ltd. and Coastech Research, both of North Vancouver, B.C. The results of the waste characterization tests for the 94 samples tested are included in Appendix C of the 1990 Knight Piésold report, Ref. No. 1621/1. The testwork indicates that the waste rock will not be acid generating. ARD tests are discussed extensively in the 1996 Hallam Knight Piésold "Reclamation Plan Report".

3.3.2 Surficial Materials

The revised waste dump sites are shown on Drawing No. 1625.230. In general, the sites are characterized by gently undulating topography. The Central pit may be used for waste rock disposal when development of the west pit proceeds during the later stages of operation.

The North dump is situated on a relatively flat area with bedrock knobs and ridges. Colluvium, glacial till and forest litter were encountered along the flat area to a maximum thickness of approximately 20 metres. The North dump has a capacity for 16 million tonnes and will likely be used during the mining of the North Pit later on in the mine life.

The South-East dump is situated along the crest of a broad ridge. The topography is relatively flat and undulating. A veneer of colluvium, glacial till and forest litter is present over most of the area. Bedrock was encountered in drill holes at depths ranging from approximately 3 to 7.6 metres.

Groundwater in the vicinity of the waste dumps is generally shallow with flow directions governed by the surface topography.

SECTION 4.0 - OPEN PIT SLOPE DESIGN

4.1 GENERAL

This section provides a revised summary of Section 4.0 of the 1990 Knight Piésold "Report on Geotechnical Investigations and Design of Open Pit, Waste Dumps and Tailings Storage Facility" authored by Mr. C.O. Brawner. A proposed blasting program and details of anticipated groundwater inflow and pumping requirements can be found in the original report, which is included as Appendix A.

4.2 FACTORS WHICH INFLUENCE PIT SLOPE STABILITY AND SLOPE ANGLE

Factors which influence rock slope stability of open pit mines include geologic structure, groundwater conditions and dynamic acceleration forces generated during blasting.

The potential for pit slope instability is generally related to the presence of adversely oriented geologic discontinuities in the pit slopes. Typical slope failure mechanisms include circular, planar, block, wedge, and toppling modes as shown in Figure 4.1.

The presence of groundwater in the pit slopes influences stability by reducing rock mass shear strength due to reduced effective stress, creating seepage forces towards the pit slopes, creating hydrostatic forces in tension cracks, and increasing hydrodynamic shock due to blasting below the water table. Consequently, it is important that low water levels and groundwater pressures be maintained in the pit slopes. The most effective way to develop this control is with the installation of horizontal drains. Drainage requirements can most effectively be determined during initial development of the open pit by inspection of bench faces for seepage, and through the drilling of exploratory drain holes.

Dynamic acceleration forces due to blasting must be reduced at the final pit face to allow the steepest practical slopes to be developed, thereby minimizing the waste to ore ratio. This requires controlled blasting techniques to maintain the design pit slope angles.

Slope movements, reflecting instability of the pit slopes, are typically indicated by the development of tension cracks along the pit or bench crests. Periodic inspections along the pit crest and bench locations will identify areas which may require further scaling and/or monitoring.

4.3 STRUCTURAL GEOLOGY

Three inclined boreholes, MP89-152 to MP89-154 were drilled using the clay imprint procedure to orient the rock mass structure. Stereographic plots are shown in Figures 3.2 to 3.5. The overall plots indicate a predominant joint set with an average strike of 170 degrees and an average dip of 75 degrees east. A secondary joint set was revealed striking on average 30 degrees and dipping 20 degrees north west. These geologic structures are the features which will influence slope stability throughout the pit walls, and potentially lead to certain types of instability in each pit face depending on the face orientation. The pit slope design must accommodate these potential failure mechanisms.

Generally, the rock strength is moderate to high so that stability will be controlled by the geologic structures. In addition to the joint sets described above, several localized zones featuring very closely spaced fractures, development of clayey gouge material and low compressive strength were noted. These localized zones may require additional design requirements, such as reduction of bench face angles, or installation of steel mesh and/or shotcrete to control bench face stability, which will be evaluated during development of the pit.

Details of the rock mass discontinuity data (R.Q.D. and joint frequency), together with unconfined compressive strength data, are provided in Appendix B.

4.4 EVALUATION AND CONTROL OF GROUNDWATER

The groundwater table is generally close to the ground surface, ranging from 30 metres depth in topographically higher areas, to 3 metres depth in lower elevations around the project area. In some cases, artesian conditions were encountered in exploration drill holes. Drainage measures will be developed in the pit allowing for pit walls to be excavated at the steepest slopes possible and to prevent potential bottom heaving of the pit floor. Drainage measures to control seepage into the pit and improve stability of the pit walls will include the installation of horizontal drain holes, as determined from observed conditions in the initial pit development.

4.5 PIT SLOPE AND BENCH DESIGN

Design of initial pit slopes is based on a relatively steep bench face of 70 degrees, with inter-ramp slope angles of 52 degrees, shown as Design I in Figure 4.2. This design is based on the available structural information, and assumes drained conditions in the pit slopes. Where favourable interaction of rock mass structure and pit wall geometry are revealed during initial pit development, Design II will be utilized to optimize pit slope angles. These two pit slope designs are included to accommodate the different combinations of geologic conditions and pit slope orientations. A summary of the proposed design geometry for pit slopes is presented in Table 4.1. It should be highlighted that pit slope design will be modified based on updated geology and on additional geotechnical information obtained during early pit development.

For final pit design, controlled blasting will be used to develop the relatively steep bench face angles. Bench faces will be scaled to reduce ravelling and reduce width requirements for catch berms. The most recent pit design was completed using Mintec's MEDSYSTEM software.

SECTION 5.0 - WASTE DUMP LAYOUTS

5.1 WASTE DUMP LOCATIONS AND CONSTRUCTION

Waste dump sites are shown on Drawing No. 1625.230. Selection of waste dump sites has included consideration of environmental and economic factors, in addition to optimization of waste rock haulage.

The waste dumps are generally situated on relatively flat topography and will be underlain by glacial till and bedrock. Sufficient quantities of suitable topsoil and glacial till will be stripped and stockpiled for reclamation of the dumps. The ultimate waste dumps, as shown on Drawing No. 1625.230 include final reclaimed slopes of 2h:1v. During operations, the waste rock will be placed in individual benches as required to control surface erosion.

Drainage ditches will be used to control surface runoff from the North and South-East waste dumps. The dumps will be graded to direct runoff from the tops of the dumps into the open pit areas. The ditches will collect runoff from the dump slopes and will transfer the water to sediment control ponds as shown on Drawing No. 1625.230. The water will then be discharged into the tailings basin. There will be three main perimeter drainage ditches, as follows:

- The first drainage ditch will run north to south along the eastern end of the South East waste dump.

- The second drainage ditch will run west to east along the southern end of the final limit of the South-East dump.

- The third drainage ditch will run south between the South-East waste dump and the mill site. It is then directed east and will connect to the first drainage ditch. This ditch will cut across the southern end of the South-East waste dump, to be used later in the mine life. As the dump advances, the ditch will be converted to a rock drain so that drainage can continue as the dump is developed. It is anticipated that natural segregation of coarser material will occur during waste rock placement. The coarser material will fall to the base of the advancing dump and the ditch will be filled with durable, coarse material. In the event that coarse, durable material is not available to fill the ditch, suitable material will be selected and placed in the ditch prior to covering it with the waste dump. This requirement will be evaluated as the waste dump develops.

Existing groundwater levels at the waste dump sites have been observed to be within a few metres of the ground surface, with a phreatic surface similar to the general topographical features. Due to the segregation of waste rock during placement, coarser particles will collect along the base of the dump providing free draining conditions within the waste dump materials.

5.2 STABILITY ANALYSES

Stability analyses of the waste dump have been carried out for a range of natural ground conditions and maximum dump height. A typical stability analysis is shown on Figure 5.1.

Strength parameters for the rockfill have been assumed from published information on the shear strength of rockfill by Leps (1970), and recommended values from the US Forest Service Intermountaine Region, Dump Stability Performance Objectives and Evaluation Criteria. These are summarized in Figure 5.2. Strength parameters for the foundation material are based on an in-situ layer of till, as stripping of topsoil and organic debris will be implemented.

The stability analyses were carried out for base translational failure along the waste rock/foundation contact using a non-circular analysis. The analyses were completed for the final reclaimed slopes of 2h:1v, using a maximum dump elevation of 1170 metres, as shown in Figure 5.1. The calculations take into account the maximum natural slope of the terrain in the waste dump area which does not exceed 38°. Previous stability analyses, outlined in the 1990 "Report on Geotechnical Investigations and Design of Open Pit, Waste Dumps and Tailings Storage Facility" (ref 1621/1) indicated that for the final reclaimed dump slopes, a minimum factor of safety of 1.3 can be achieved for all terrain on site, regardless if topsoil is stripped.

However, topsoil stripping will be implemented in the waste dump locations, creating a factor of safety against failure greater than 1.5 on all terrain, as indicated in Figure 5.3. The topsoil will be used for reclamation, as discussed below.

5.3 RECLAMATION

Areas designated for waste rock storage will be logged, grubbed and cleared prior to mining. Topsoil, overburden and coarse woody debris will be removed and stockpiled. These materials will be removed in a staged manner so that material removed from each succeeding raise is replaced on the previously completed raise. This leapfrog pattern will reduce the need for large soil stockpiles, will minimize haul costs, and will accelerate the recolonization of reclaimed areas by native materials from soil seed banks, bud banks, and rooted offsets. Most importantly, reclamation of completed raises of the waste dumps will commence almost immediately instead of being deferred until the end of mining.

Waste rock dumps will be constructed by end dumping, re-contoured to an ultimate slope of 2h:1v, covered with a layer of overburden/topsoil and re-vegetated. Individual dumps will not exceed 50 m in height. The top surfaces of the stockpiles will drain toward the open pits, but will be designed to have ridges and depressions, to blend in with the surrounding topography and to create habitat diversity. The final surfaces will be covered with a layer of overburden and topsoil, then re-vegetated. Final reclamation of the waste dumps will involve spreading of topsoil and glacial till and seeding or planting as required.

For further discussion on proposed reclamation plans, refer to the 1996 Hallam Knight Piésold "Reclamation Plan Report".

SECTION 6.0 - WATER MANAGEMENT PLAN

An overview of all water associated with the Mt. Polley Project is provided in the 1995 Knight Piésold "Report on Project Water Management". An overall project water balance was completed by integrating the water balances for the mine site, including the open pits, waste dumps and mill site with the tailings facility and the undisturbed catchment areas immediately upgradient from it. The @RISK Analysis and Modelling program was used to describe the effects of the statistical nature of precipitation over the entire life of the project.

The report demonstrated that the tailings facility and open pit can and will be operated so that no surface discharge of excess water will be required and that make-up water requirements from Polley Lake will be minimized by addition and use of surface runoff from waste dumps and undisturbed catchment areas. Included in the report is the most recent hydrometeorological information obtained, including precipitation, snowmelt, evaporation and runoff. The report discusses assumptions made and presents conclusions and recommendations concerning make-up water supply and the project water management plan.

SECTION 7.0 - REFERENCES

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