TASEKO MINES LIMITED
PROSPERITY GOLD-COPPER PROJECT
ENVIRONMENTAL IMPACT STATEMENT/APPLICATION

VOLUME INDEX

TASEKO PROSPERITY GOLD-COPPER PROJECT

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VOLUME 3: PROJECT DESCRIPTION AND SCOPE OF PROJECT

March 2009

Table of Contents

List of Tables

List of Figures

Acronyms and Abbreviations

%	percent
<	less than
>	greater than
µ	micro
$\mu g/m^3$	micrograms per cubic metre
AP	Acid Potential
ARD	Acid Rock Drainage
BCCDC	British Columbia Conservation Data Centre
BCEAA	British Columbia *Environmental Assessment Act*
BCM	bank cubic metre
BCMEMPR	British Columbia Ministry of Energy, Mines and Petroleum Resources
BCMOE	British Columbia Ministry of Environment
BCMOFR	British Columbia Ministry of Forests and Range
CDC	Conservation Data Centre
CEAA	Canadian *Environmental Assessment Act*
CEMI	Canadian Environmental and Metallurgical Inc.
CESL	Cominco Engineering Services Limited
DFO	Fisheries and Oceans Canada
EAA	*Environmental Assessment Act*
EAO	Environmental Assessment Office
EC	Environment Canada
EEM	environmental effects monitoring
EMP	environmental management program
EMS	environmental management system
JWA	Jacques Whitford AXYS Ltd.
MEMPR	Ministry of Energy, Mines and Petroleum Resources
MEND	Mine Environment Neutral Drainage
ML	Metal Leaching
MOE	Ministry of Environment
MOFR	Ministry of Forests and Range
non-PAG	non-Potentially Acid Generating
NP	Neutralization Potential
NRCan	Natural Resources Canada
PAG	Potentially Acid Generating
pers. comm.	personal communication
QA/QC	quality assurance/quality control
RIC	Resources Inventory Committee
RISC	Resources Information Standards Committee
ROM	run-of-mine
ROW	right-of-way
SRK	SRK Consulting (Canada) Inc.
TIC	Total inorganic carbon
TSF	tailings storage facility
UBC	University of British Columbia

1 Introduction and Summary

1.1 Introduction

Taseko Mines Limited ("Taseko") proposes to develop the Prosperity Gold-Copper Project, (the "Project") a conventional open pit project that would involve a large open pit mine development with a 20 year operating life. Typical large-scale open pit mining equipment and conventional copper porphyry flotation processing would be used. In addition to the mine and associated tailings and waste rock areas, the project includes development of an onsite mill and support infrastructure, an approximately 125 km long power transmission line corridor, and a 2.8 km mine access road.

A vital and necessary step in the development of a project of this nature involves the completion of an environmental assessment. Environmental assessment itself is a process whereby the environmental effects of a proposed project are predicted and assessed before decisions to proceed with development of the project are made. The two key purposes of an environmental assessment are to minimize or avoid adverse environmental effects before they occur and to serve as a vehicle whereby environmental factors are incorporated into project design and decisions are made with respect to project implementation. The environmental assessment for the Project began 16 years ago in 1993.

This Environmental Impact Statement ("EIS") has been prepared in response to and in accordance with the Project Report Specifications ("PRS") issued by the British Columbia Environmental Assessment Office ("EAO") in 1998 and the more recent EIS Guidelines issued by both the provincial EAO and the federal Minister of the Environment in January of 2009. Both the PRS and the EIS Guidelines were subject to regulatory agency, First Nation and public comment and review before being finalized.

This volume, entitled ***Volume 3: Project Description and Scope of Project*** is one of a nine volume series of reports that together constitute Taseko's Application for an Environmental Assessment Certificate pursuant to the British Columbia *Environmental Assessment Act* (BCEAA) and an EIS for submission to the Federal Review Panel pursuant to the Canadian *Environmental Assessment Act* (CEAA). The information contained within the volume is complete and comprehensive on the subjects discussed. In many instances within this particular volume there are linkages to information contained and predictions and assessments undertaken in some of the other eight volumes. Accordingly it is important to appreciate that the reader must take into consideration the content and assessments contained within all nine volumes in order to fully consider the complete environmental assessment undertaken thus far. Many of the nine volumes include either directly or indirectly by way of appendices a considerable volume of information collected by Taseko in support of this EIS.

This volume, ***Volume 3: Project Description and Scope of Project*** contains to a level of detail appropriate for an environmental assessment, Taseko's information concerning the regional and local geology and the project description. Detailed information concerning the mine plan, the proposed road access and transmission line is included. The volume also details the Acid Rock Drainage/Metal Leaching (ARD/ML) investigations and characterization program undertaken by Taseko and includes details of a proposed Fish Compensation Plan developed as an integral part of the overall Project to compensate for the unavoidable loss of fish and fish habitat in the Fish Creek watershed. Taseko's proposed Environmental Management Program is outlined in sufficient detail to provide a framework upon which further, permit level details will be added at the appropriate time. This project description reflects the benefits of having undertaken extensive drilling and investigation of the mineral deposit, completion of two engineering feasibility studies and the filing of Instrument 43101 compliant information to regulators.

Volume 1: Summary Report is a stand-alone document describing all the environmental effects of the Project and the proposed environmental management and mitigation measures. The significance of each environmental effect and a statement on the Project's overall environmental effect is provided.

Volume 2: Project Planning and Alternatives Assessment provides a historical account of a four year alternatives assessment process that was undertaken to find the most environmentally responsible, technically and economically achievable project plan. It was concluded at the end of this extensive process that the only technically and economically achievable alternative was the Project Plan that is the subject of this current environmental assessment. A 2008 update of economic information is included.

Volume 4: Physical Environment considers potential environmental effects of the Project on the atmospheric, acoustic, surface water hydrology and hydrogeological aspects of the environment. A detailed summary of baseline information collected and assessed key issues, effects assessment, mitigation measures, characterization of any residual project effects, cumulative effects and a discussion of any proposed follow-up monitoring for each of the above mentioned aspects is presented.

Volume 5: Biotic Environment considers potential environmental effects of the Project on stream and lake water and sediment quality, periphyton, zooplankton and benthic invertebrate aquatic ecosystems, fish and fish habitat, terrain and soils, vegetation and wildlife aspects of the environment. A detailed summary of baseline information collected and assessed, key issues, effects assessment, mitigation measures, characterization of any residual project effects, cumulative effects and a discussion of any proposed follow-up monitoring for each of the above mentioned aspects is presented.

Volume 6: Socio-Economics, Human Health and Ecological Risk Assessment considers potential effects of the Project on economic, social, community and health services aspects. Effects of the Project on resource uses including forestry, agriculture and ranching, fishing, hunting, recreation, tourism and trapping are also assessed. Information concerning First Nations cultural heritage including an assessment of Project effects on traditional use is provided. Included in this volume is a human health and ecological risk assessment that considers the potential environmental effects of the Project on human health and terrestrial ecological health. A detailed summary of baseline information collected and assessed, key issues, effects assessment, mitigation measures, characterization of any residual project effects, cumulative effects and a discussion of any proposed follow-up monitoring for each of the above mentioned aspects is presented.

Volume 7: Archaeological and Heritage Resources includes the results of an extensive Archaeological Impact Assessment ("AIA") undertaken in the vicinity of the mine site. Archaeological resources within the proposed mine site area are identified and evaluated and the potential effects of the Project on these resources assessed. Recommendations concerning measures to mitigate unavoidable loss of these resources are included. While First Nations representatives were involved in the design and implementation of the AIA, regrettably circumstances have not afforded Taseko the opportunity to share the results of this AIA with First Nations before including it in this EIS. Taseko's understanding concerning the significance of the information reported and how to evaluate will improve with further dialogue with First Nations and the provincial Archaeology Branch.

Volume 8: First Nations is intended to be a "stand alone" document drawing upon information found throughout many of the other volumes to provide a single source of information thought to be of interest to First Nations. Included within this volume, in accordance with the terms of the EIS Guidelines, is a historical overview of Taseko's ongoing efforts to engage and exchange information with First Nations concerning their interests, issues and understanding of the Project. Where available publicly, information concerning First Nations land claims and rights and title matters, their history in the area, traditional knowledge and land use is also included.

Volume 9: Additional Requirements Pursuant to CEAA contains a discussion on accidents, malfunctions and unplanned events and the effects of the environment on the Project. Information presented concerning accidents, malfunctions and unplanned events is further discussed in many of the other volumes where these events are assessed and the significance of any potential environmental effects determined.

1.2 Summary

The Project components and environmental management are described in this volume. Detailed information concerning the mine plan, the proposed road access and transmission line is included. The Project would involve a large open pit mine development with a 20 year operating life. Typical large-scale open pit mining equipment and conventional copper porphyry flotation processing would be used. In addition to the mine and associated tailings and waste rock areas, the project includes development of an onsite mill and support infrastructure, an approximately 125-km long power transmission line corridor, and a 2.8 km mine access road.

The early sections of this volume contain a background and rationale for the project, description of project setting and land use context. Taseko's information on the regional and local geology is summarized in the next sections. Additional background information on the geology of the Prosperity deposit can be found in MINFILE (record 092O 041), and in two reports in the Appendices of this volume. This project description reflects the benefits of having undertaken extensive drilling and investigation of the mineral deposit, completion of two engineering feasibility studies and the filing of Instrument 43101 compliant information to regulators.

This volume also details the ARD/ML investigations and characterization programs undertaken by Taseko since 1993. Results are formulated from a number of phases of static testing carried out to characterize the variability of ARD potential and metal content of the rocks, kinetic geochemical and tailings characterization programs consisting of laboratory humidity cells and saturated column testing were designed to provide input into waste management planning, and water chemistry predictions (source terms) to inform the overall environmental assessment. Site water chemistry predictions for saturated and unsaturated tailings, non-PAG waste rock dumps, submerged PAG waste and the open pit were produced. An ARD/ML Prediction and Prevention Plan (PPP) will be a requirement of the *Mines Act* Permit for the Prosperity Mine, and ARD/ML assessments need to be continued for mine construction and operations in the form of confirmation of preliminary findings based on short-term testing, calibration of test work results to site conditions and ongoing monitoring to direct waste management activities.

Details are provided for the proposed Fish Compensation Plan developed as an integral part of the overall Project to compensate for the unavoidable loss of fish and fish habitat in the Fish Creek watershed. The purpose of the Fish and Fish Habitat Mitigation and Compensation Plan is to demonstrate the feasibility and scientific rationale that fish and fish habitat losses associated with the Project can be fully mitigated and/or compensated. The Plan focuses on losses related to rainbow trout, its habitat, populations and use, as Fish Lake and associated stream habitats impacted by the Project support a monoculture of this species. The Plan has been developed to meet MOE Regional Freshwater Fisheries Program objectives, DFO Habitat Policy, and the interests of First Nations and the public within and around the Project area. The implementation timing of the compensation elements is tied to the design, construction, operation and closure phases of the Project. Technical information describing how the proposed compensation elements will be implemented along with specific time lines are provided in a companion document to this Plan. The compensation elements outlined in this Plan will be further refined through discussions and input with the Fish and Fish Habitat Technical Working Group. It is expected considerable discussion and review of the Plan and its associated elements will be undertaken with government agencies, First Nations, the public and other interested parties as time progresses.

Taseko's proposed Environmental Management Program is outlined. The Environmental Management System for Prosperity, appropriate for the construction, operation and decommissioning phases of the Project; is a structured system that Taseko will utilize to manage its regulatory and environmental commitments in a cost efficient manner; and, is a tool that will control Prosperity Project's environmental effects as identified during the EA. An overview of a series of written Environmental Management Plans that will comprise this EMS are provided in this section. The plans are designed to form the basis for more detailed procedures and policies to be developed concurrent with project permitting and associated construction and commissioning phases.

2 Project Background and Rationale

Initial exploration activity in the vicinity of the Prosperity deposit was undertaken by prospectors in the early 1930s. In 1963–1964, Phelps Dodge conducted a small exploration drilling program. Taseko Mines Limited (Old Taseko) acquired the property in 1969 and exploration drilling continued in the 1970s and 1980s under option agreements with several mining companies. Hunter Dickinson acquired Taseko (New Taseko) in 1991 and proceeded with extensive drilling, engineering, metallurgical and socioeconomic programs. The work carried out in the 1990s succeeded in delineating a bulk tonnage porphyry gold-copper mineral resource at Prosperity. By 1998, Taseko had advanced the property to the pre-feasibility and feasibility stages. However, in 2000 prevailing metal prices—copper ranging from US $0.60–$0.80 per pound and gold price ranging from US $250–$300 per ounce–and a poor outlook for price performance resulted in the decision to put the project on hold. In the intervening years, at Taseko's request, timeline extension orders were issued by the provincial EA Office. In 2005, improving metal prices prompted the company to re-start work on Prosperity and to advance the project, initiating re-evaluation of previous engineering and economic studies and environmental assessment. In early 2005, Taseko applied to the British Columbia government to re-activate the British Columbia Environmental Assessment process and was granted an extension for the Prosperity Project Application until April 30, 2007. In April 2006 Taseko initiated work necessary to complete the Environmental Assessment Report in time to meet the April 2007 deadline.

The Prosperity mineral deposit is a large gold-copper resource with the potential to generate and estimated capital investment of up to $800 million over the life of the project. It will create 550 direct and 1280 indirect jobs annually and provide 22 years of economic development in the province of British Columbia.

The purpose of the project is to utilize the proven mineral reserve of the Prosperity deposit to create value and opportunity for the people of British Columbia and Canada, and for the shareholders of Taseko.

The project is needed for sustaining the economic and social health of British Columbia communities.

At a capital cost estimated at $800 million and with anticipated operating expenditures of $200 million annually, the magnitude of Prosperity's economic impact, its job creation and business development capacity, can be measured on both a provincial and national scale.

If feasibility studies are positive and Taseko is successful in gaining the necessary government approvals to build the mine, Prosperity will rank as one of the largest single private sector investments in British Columbia this decade.

Extracting and processing the Prosperity mineral deposit is the only way to generate this kind of value and benefit for society.

3 Project Setting

The Fish Lake property is 125 km southwest of Williams Lake, BC, in the Williams Lake Regional District. The deposit is 1 km north of Fish Lake and 10 km northeast of Lower Taseko Lake (51°28'N, 123°37'W; NTS Sheet 92-O/5E). Topography is subdued with elevations ranging from 1450 to 1600 masl. Figure 3-1 shows the location of the Fish Lake property.

Figure 6-1 shows the potential mine layout as it pertains to the site features and mine activities. Also illustrated in Figure 3-1 is the regional setting of the project and its location within that setting.

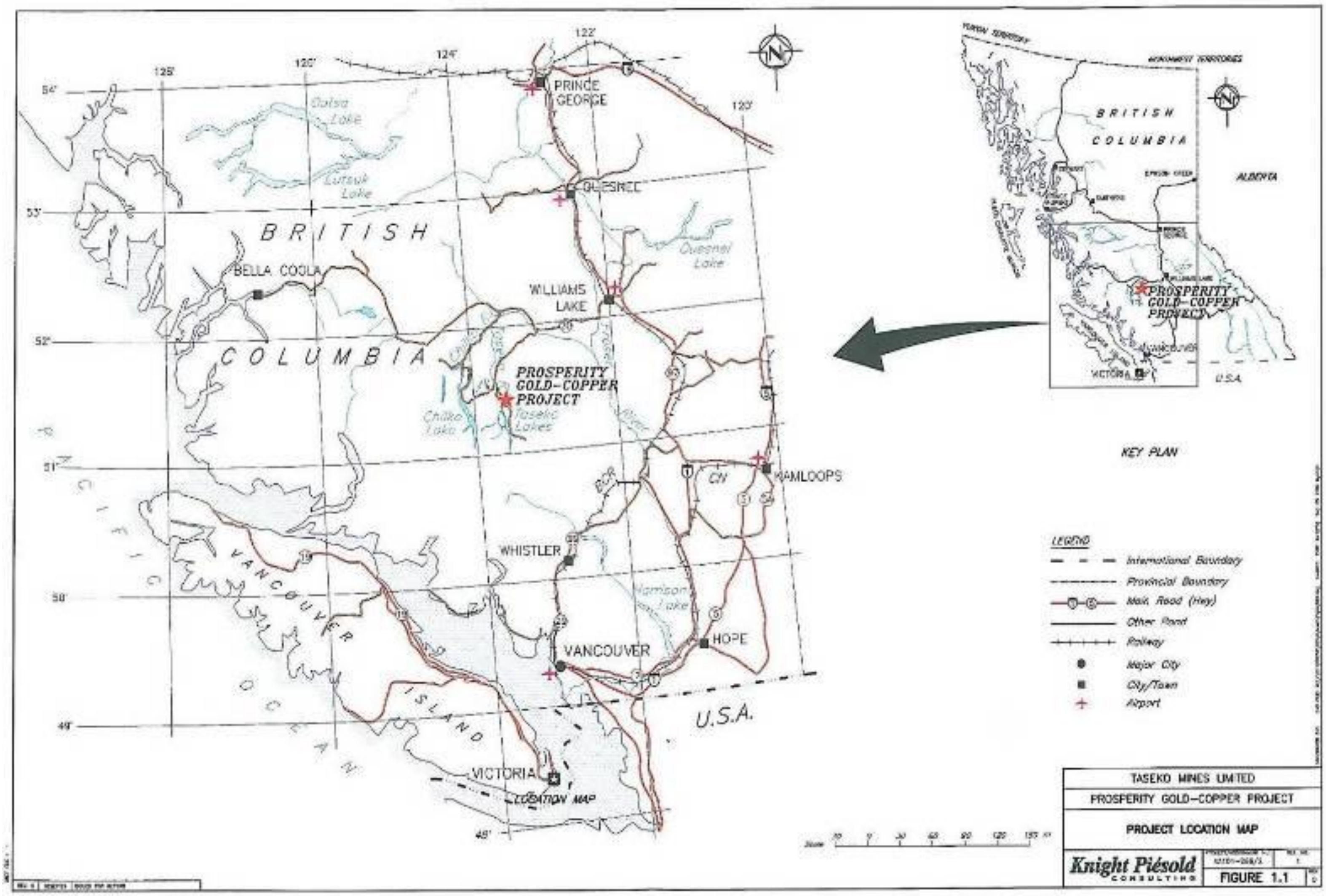

Figure 3-1 **Project Location Map**

4 Land Use Context

The Prosperity Project is located in the Cariboo-Chilcotin District, an area that contains a mix of rural agricultural lands, small acreage holdings and Crown forest lands. The Cariboo-Chilcotin Land Use Plan (CCLUP) provides broad direction for sustainable use of Crown land and resources in this region. The plan divides the area into four zones:

- Enhanced Resource Development Zone
- Integrated Resource Development Zone
- Special Resource Development Zone
- Protected Areas

The project development area is located within an Integrated Resource Management Zone (IRM), within which the following conditions apply:

- Some specific sites within this zone will be appropriate for enhanced resource use.
- Forestry, mineral/placer exploration and mining development, cattle grazing, tourism, recreation, wildcraft/agroforestry, fishing, trapping and hunting are appropriate activities.
- Management objectives for this zone will aim to integrate all values: social, environmental and economic.

More specific to mineral exploration and mine development, the CCLUP states:

> "The mineral and placer industries will have full access to all three zones [not Protected Areas] for exploration and mine development, subject to regulations of applicable statutes. Full access means that all (100%) of the land outside of protected areas is available to exploration and development, guided by the *Mineral Tenure Act* and the *Mines Act.* This respects the industries' requirement for as large a land base as possible to explore for "hidden" resources and recognises that the more intensive activities and impacts tend to be focused on the relatively small areas found to have potential for economically viable mineral occurrences."

The mine site and vicinity is currently zoned RR-1 (Rural 1) under the Cariboo Regional District's Bylaw 1000. Permitted uses in this zone related to mining activities include:

- extracting raw materials from the land, including crushing and screening, provided no further processing takes place on site
- temporary construction, exploration or work camps operated by or on behalf of a Government Agency, Government Department, or registered company for the temporary living accommodation of its employees, provided the method by which sewage is to be disposed of is satisfactory to the Medical Health Officer. On completion of the project concerned, the camp shall be removed and the site restored to a satisfactory condition

Therefore, a zoning amendment would be required for the plant site to allow further processing of the ore and permanent accommodations for mine staff.

A more detailed discussion of land use activities, community plans and communities potentially affected by the Project, including Taseko's understanding of the traditional territories of the First Nations, can be found in Volume 6: Socio-Economic, Human Health and Ecological Risk Assessment and Volume 8: First Nations.

5 Regional and Local Geology

5.1 General

The Prosperity gold-copper deposit subcrops under a 5 to 65 m thick blanket of surficial cover at the north end of Fish Lake. It is predominantly hosted in volcanic rocks which have been intruded by a steeply dipping stock. The stock is surrounded by a swarm of dikes. The stock and dikes are spatially and genetically related to the deposit. The central portion of the deposit is cut by two prominent faults that strike north-south and dip steeply to the west. A central alteration zone is co-extensive with the copper/gold mineralization.

Pyrite and chalcopyrite are the principal sulphide minerals in the deposit. They are uniformly distributed as disseminations, fracture-fillings, veins and veinlets. Native gold occurs as inclusions in, and along microfractures with, copper-bearing minerals and pyrite.

The deposit is oval in plan and is approximately 1500 m long, 800 m wide and extends to a maximum drilled depth of 880 m. It contains a total measured and indicated resources estimated at 1.01 billion tonnes with an average grade of 0.406 g/t Au and 0.243% Cu at a grade cut-off of 0.14% copper. Additionally, a total of 0.21 billion tonnes of inferred resources at an average grade of 0.246 g/t Au and 0.210% Cu were estimated above the same cut-off of 0.14% Cu.

A thorough treatment of the geology of the Prosperity deposit may be found in Appendix 3-5-A. The following sections provide a brief description for contextual purposes.

5.2 Exploration History

Initial exploration activity in the vicinity of the Prosperity deposit was undertaken in the early 1930s when prospectors located pyrite and chalcopyrite-bearing diorite and feldspar porphyritic dikes 1100 m northeast of the deposit.

In 1963–1964, Phelps Dodge Corporation conducted approximately 800 m of percussion (chip recovery) and diamond (core recovery) drilling proximal to the deposit. Results were not encouraging and the mineral claims were allowed to lapse.

In 1969, Taseko acquired the property and drilled 18 holes totalling approximately 2300 m immediately to the south of the area where Phelps Dodge had explored. Taseko discovered significant tonnage grading 0.25 to 0.30% copper.

Between 1970 and 1996 approximately 320 holes totalling 100,000 m were drilled by a number of companies under option agreements.

A scoping level metallurgical testwork program completed by Melis in the early 1990s indicated that acceptable gold and copper recoveries could be achieved by bulk sulphide flotation followed by regrinding and conventional copper flotation. A pre-feasibility study on the viability of a 60,000 t/day open pit gold-copper, mine-mill complex was completed by Kilborn in mid 1994.

Taseko commenced a drilling program in June of 1996 in order to advance the project to feasibility level. By 1998, an additional 125 holes comprising over 50,000 m of NQ and

HQ core had been drilled. Figures 5–1 through 5–3 show the location of geological and geotechnical drilling relative to the open pit.

Previous engineering work on the Prosperity project continued until 2000. Work on the project was suspended at this time due primarily to low commodity prices. Subsequent to increases in metal prices, work was resumed in order to advance the project.

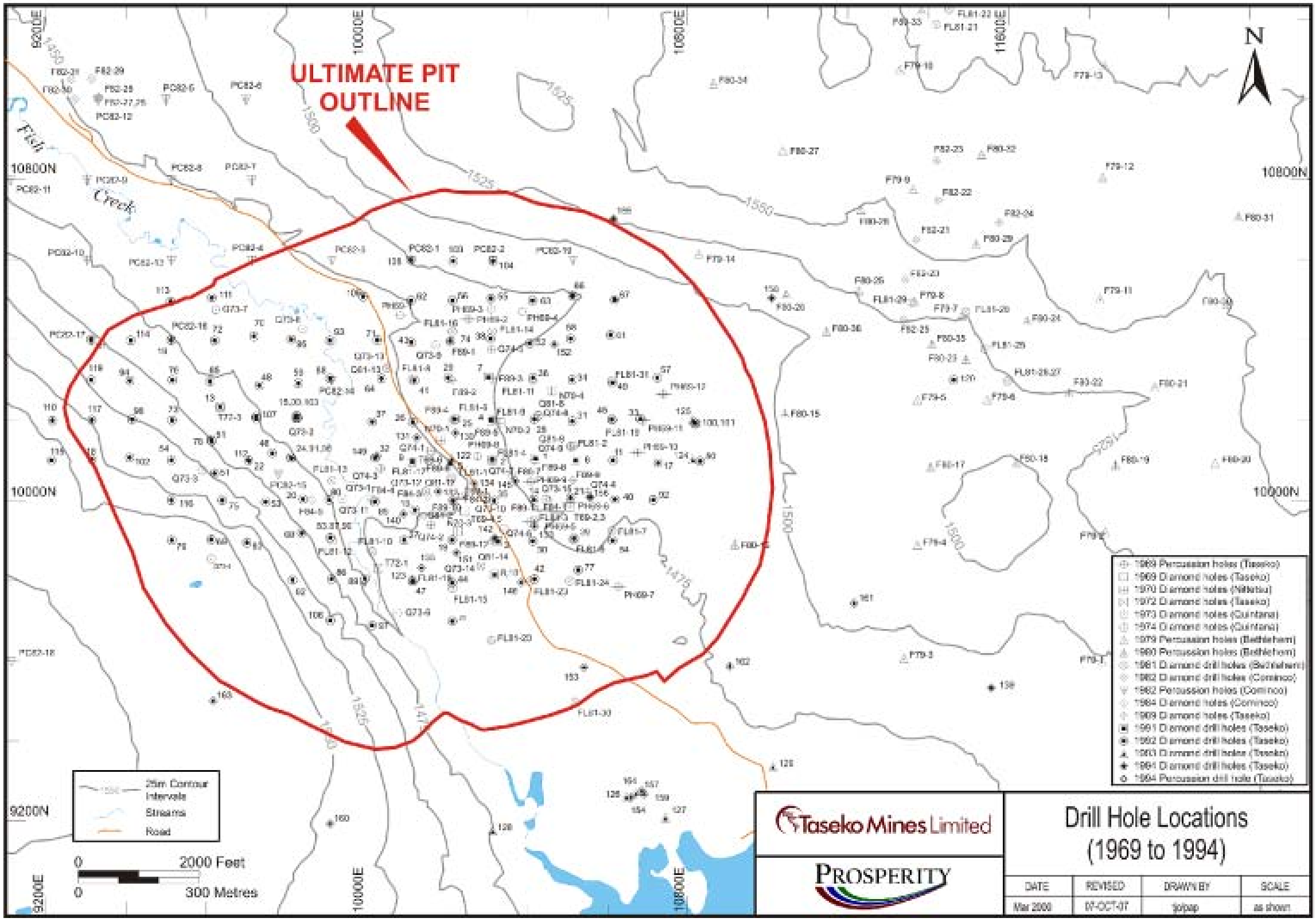

Figure 5-1 Drill Hole Locations 1969–1994

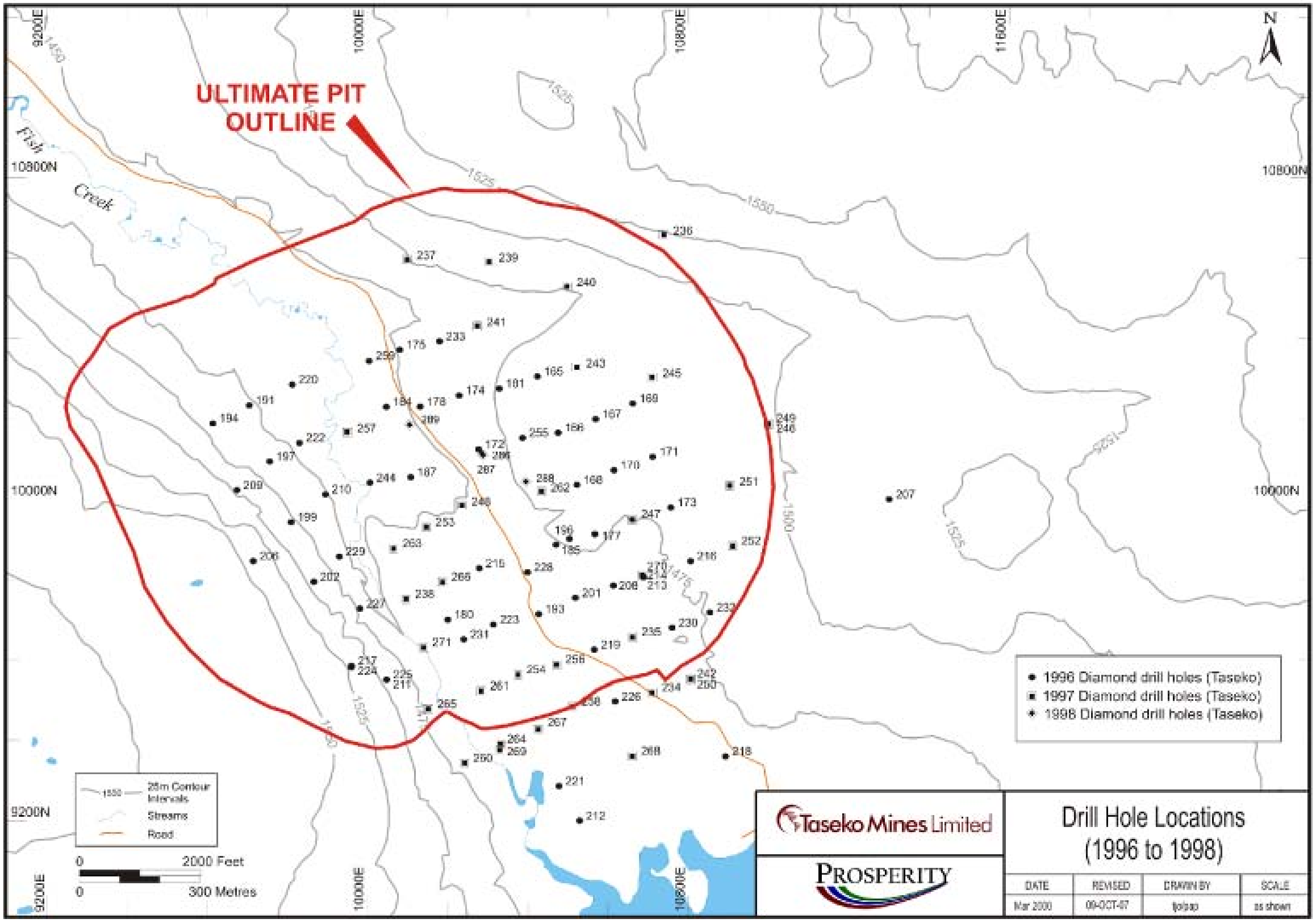

Figure 5-2 Drill Hole Locations 1996–1998

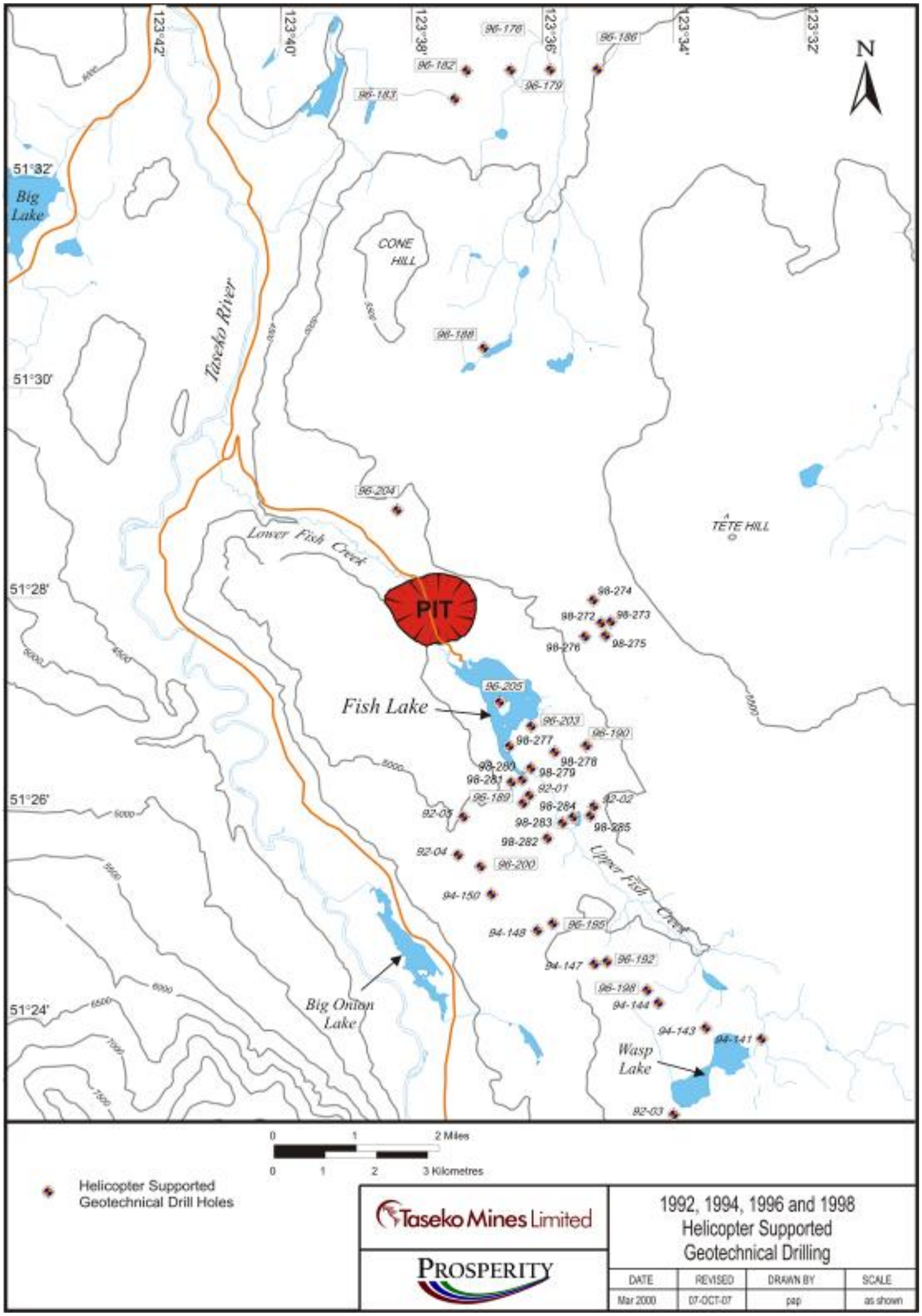

Figure 5-3 1992, 1994, 1996 and 1998 Helicopter Supported Geotechnical Drilling

5.3 Property Geology

5.3.1 Deposit Setting

The Prosperity copper/gold deposit subcrops under a 5 to 65 m thick blanket of surficial cover at the north end of Fish Lake. Interpretation of deposit geology is based on a drill hole database consisting of 384 diamond drill holes totalling 148,400 m and 68 percussion drill holes totalling 6300 m.

The deposit is predominantly hosted in andesitic volcaniclastic and volcanic rocks which are transitional to a sequence of sparsely mineralized, volcanically-derived sedimentary rocks to the south, as shown in Figure 5-4. The andesitic volcaniclastics are comprised of coarse-grained crystal tuff and ash tuff, and thinly bedded tuff with lesser lapilli tuff. The upper eastern portion of the deposit is hosted by sub-volcanic units of crowded feldspar porphyritic andesite and thick feldspar and hornblende porphyritic flows.

In the western portion of the deposit, the multi-phase Fish Creek Stock has intruded into a thick sequence of andesite flows which overlay volcaniclastic rocks. The steeply south-dipping, oval quartz diorite stock, which is approximately 265 m wide by 800 m long, is surrounded by an east-west trending swarm of sub-parallel quartz-feldspar porphyritic dikes which also dip steeply to the south. Together the stock and dikes comprise the Fish Lake Intrusive Complex that is spatially and genetically related to the deposit. Post mineralization (post-ore) porphyritic diorite occurs as narrow dikes that cross-cut all units within the deposit. They represent the final intrusive phase of the emplacement of the Fish Lake Intrusive Complex.

The deposit area is overlain by a variably thick overburden cover consisting of glacial till, basalt flows, and colluvium and lacustrine sediments. The depth of overburden is indicated in Figure 5-5.

The deposit is oval in plan and is approximately 1500 m long, 800 m wide and extends to a maximum drilled depth of 880 m. A central potassium silicate alteration zone is co-extensive with the copper-gold mineralization.

Pyrite and chalcopyrite are the principal sulphide minerals in the deposit. They are uniformly distributed as disseminations, fracture-fillings and sub-vertical veinlets and may be accompanied by bornite and lesser molybdenite and tetrahedrite-tennantite. Native gold occurs as inclusions in, and along microfractures with, copper-bearing minerals and pyrite.

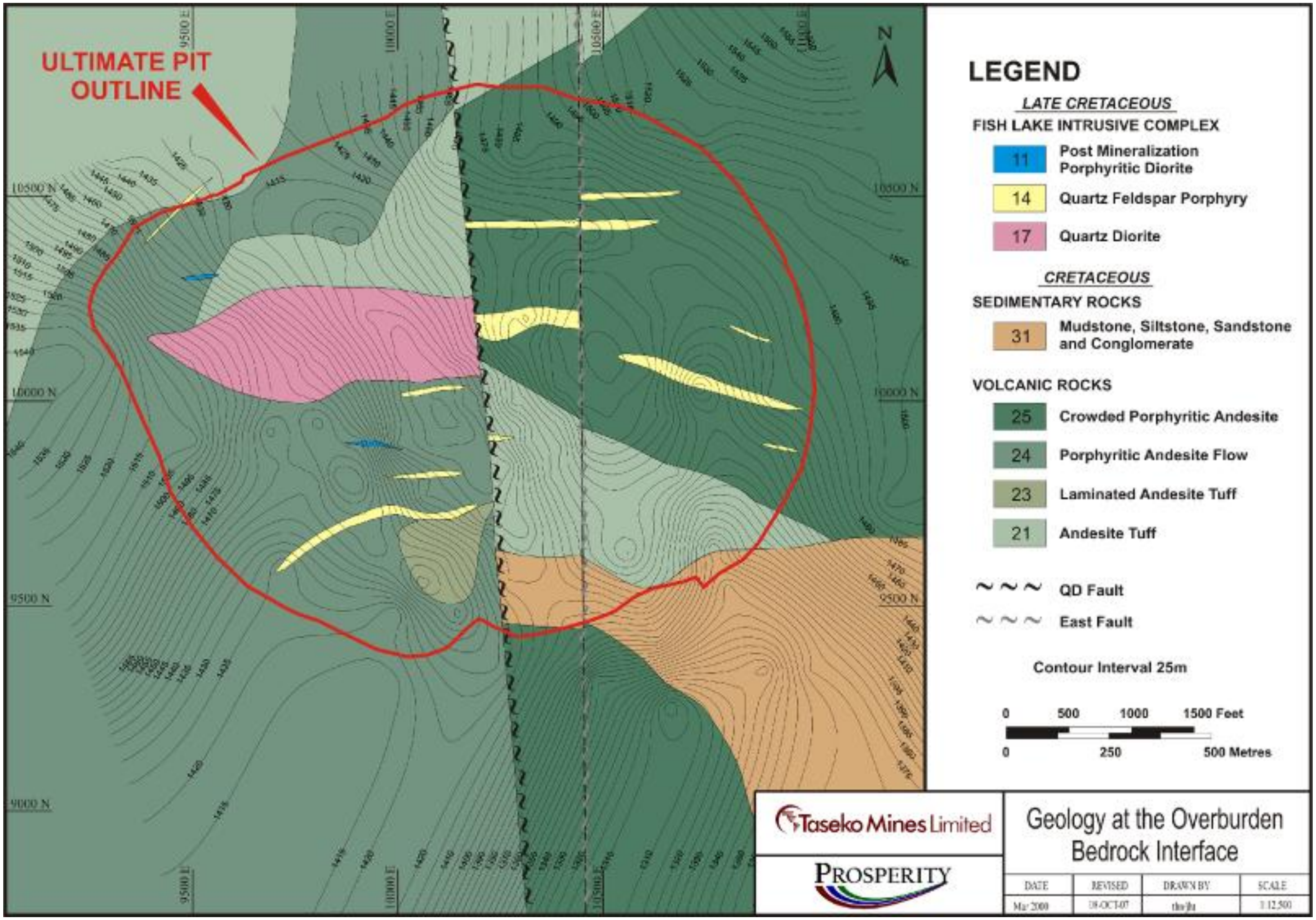

Figure 5-4 Geology at the Bedrock–Overburden Interface

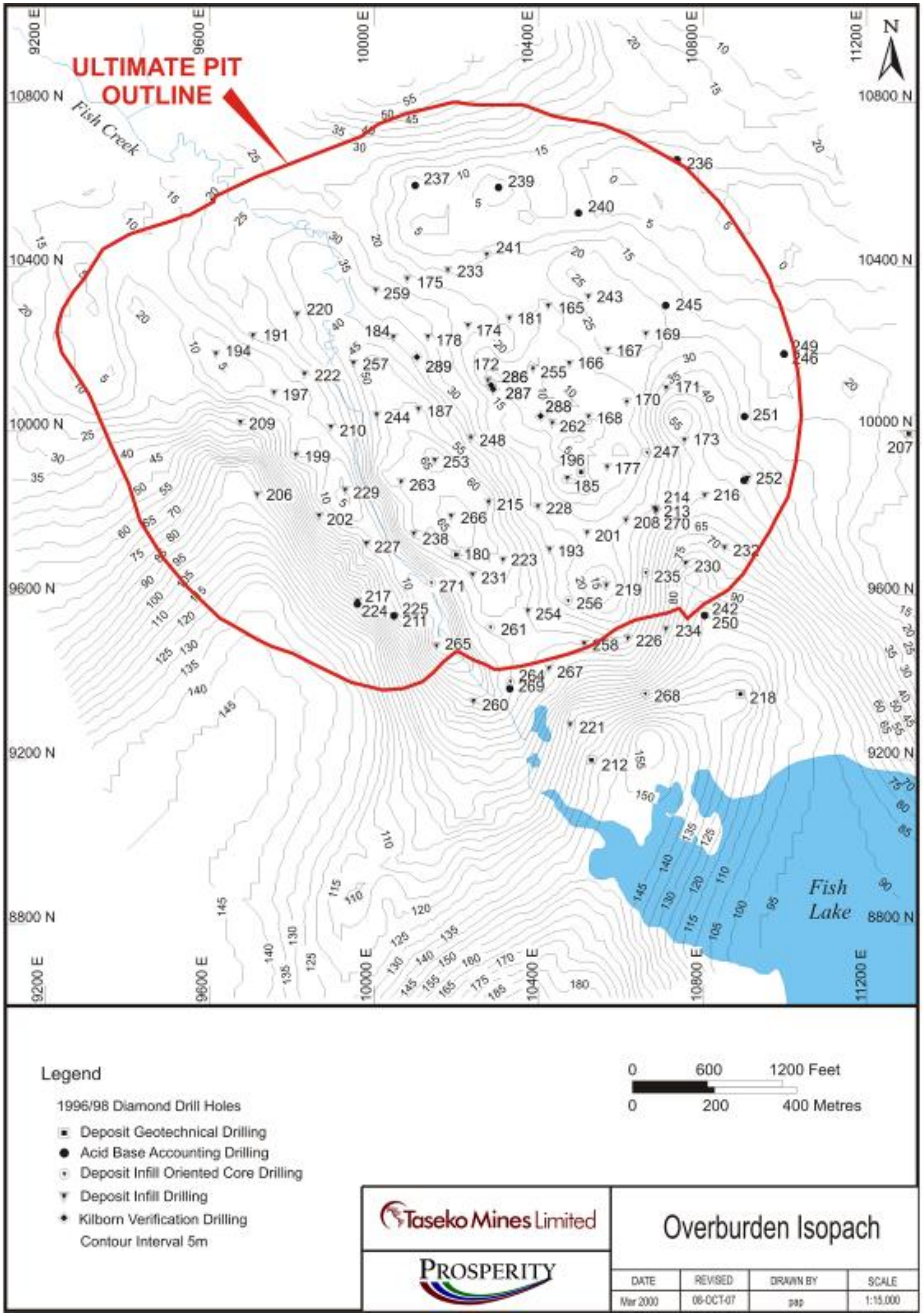

Figure 5-5 Overburden Isopach Plan

5.3.2 Volcanic and Sedimentary Rocks

Five volcanic units and one sub-volcanic unit comprise the majority of the Prosperity deposit host rocks. Sorted by quantity within the proposed pit, they are: andesite crystal, ash and lapilli tuff, porphyritic andesite flow, crowded porphyritic andesite and laminated andesite tuff. Andesite tuffs and flows are commonly interbedded.

A sparsely mineralized, volcanically-derived sedimentary unit occupies the upper south/southeast portion of the deposit.

5.3.3 Fish Lake Intrusive Complex

The Prosperity deposit is spatially and genetically related to the Fish Lake Intrusive Complex which comprises of the Fish Creek Stock, quartz feldspar and lesser feldspar porphyry dikes and post-mineralization porphyritic diorite dikes.

The Fish Creek Stock is a lenticular east-west trending, steeply south-dipping body of porphyritic quartz diorite that has intruded a thick sequence of volcanic rocks.

Quartz feldspar porphyry and feldspar porphyry dikes occur as an east-west trending, steeply south-dipping swarm centered east of the Fish Creek Stock. The quartz feldspar porphyry units cross-cut all of the volcanic and sedimentary rocks identified in the deposit.

The entire suite of rocks (intrusive, volcanic and sedimentary) hosting the deposit is cross-cut by a series of barren, post-mineralization porphyritic diorite dikes. The post mineralization porphyritic diorite unit comprises less than 1% of the deposit rocks.

Figure 5-6 and Figure 5-7 provide typical plan and section views of the Prosperity deposit.

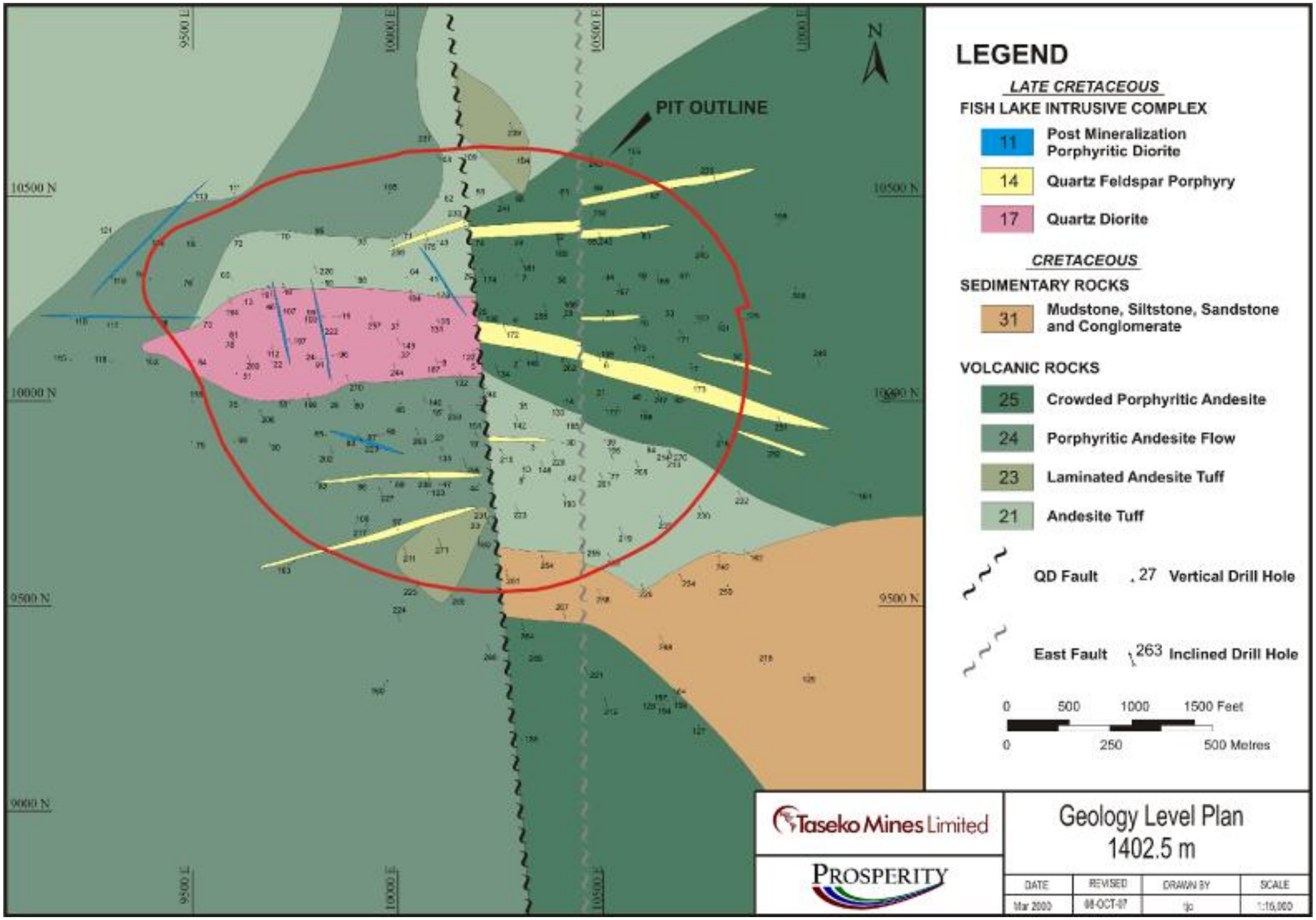

Figure 5-6 Geology Level Plan 1402.5 m

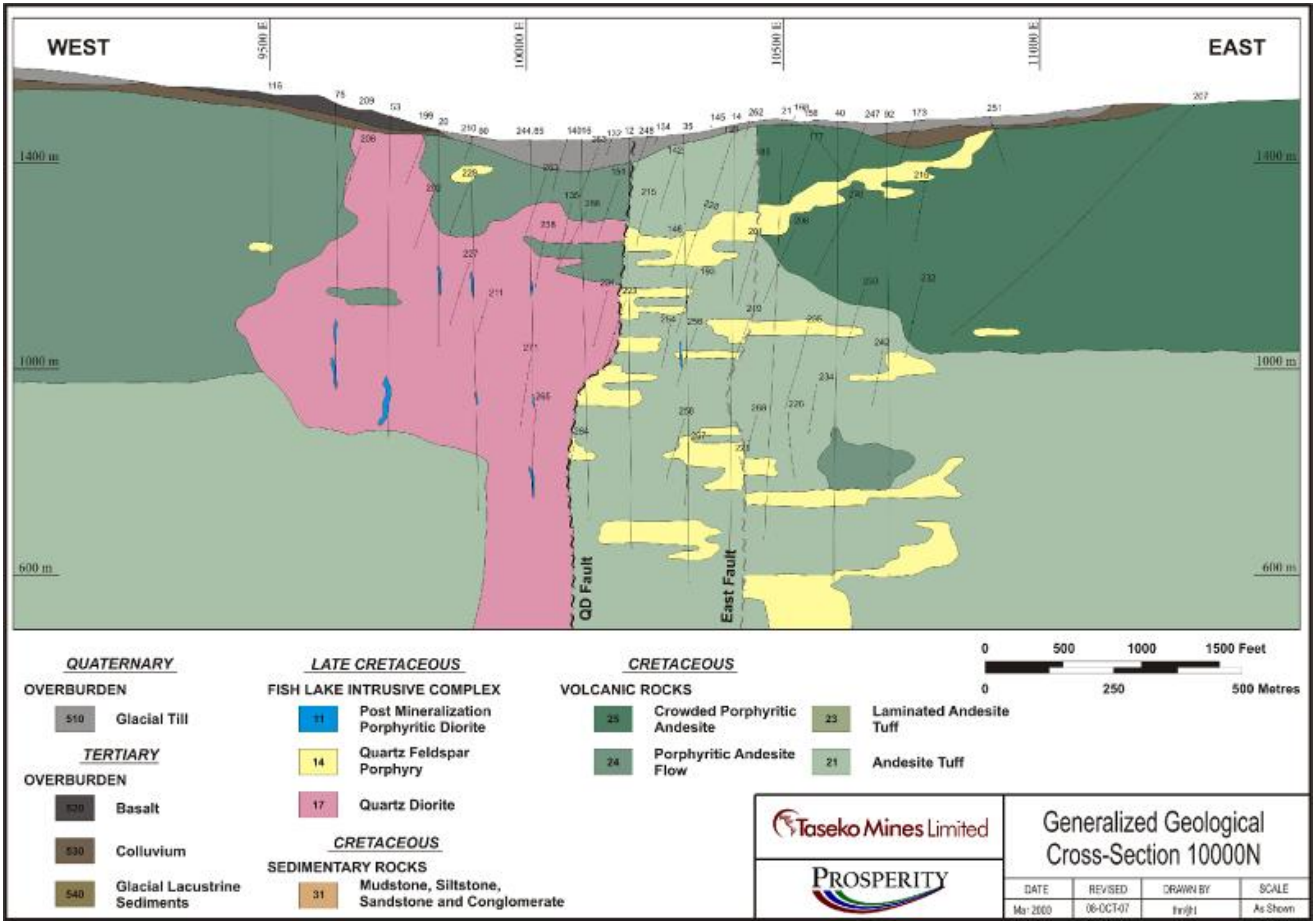

Figure 5-7 Generalized Geological Cross-Section 10000N

5.3.4 Alteration

Five main alteration styles have been identified at the Prosperity deposit: potassium silicate, propylitic, sericite-iron carbonate, phyllic and argillic. Alteration styles do not occur singularly in discrete zones; they commonly overlap and/or overprint each other. However, one alteration style will typically dominate in any given area, hence the naming of a zone specific to the dominant alteration style.

Potassium silicate alteration predominates within the deposit area forming a central east-west trending ovoid zone intimately related to significant copper/gold mineralization (>0.20 g/Au t and >0.20% Cu). The zone of potassium silicate alteration is surrounded by propylitically altered rocks that extend outward for several hundred metres. Along the eastern margin of the deposit a discontinuous belt of phyllic alteration is developed in proximity to the transition between the potassium silicate and propylitically altered rocks. Late stage sericite-iron carbonate alteration forms irregular zones, particularly within the central zone of potassium silicate alteration. Argillic alteration is localized along fault zones and overprints earlier alteration assemblages.

Typical alteration distribution is shown in Figure 5-8.

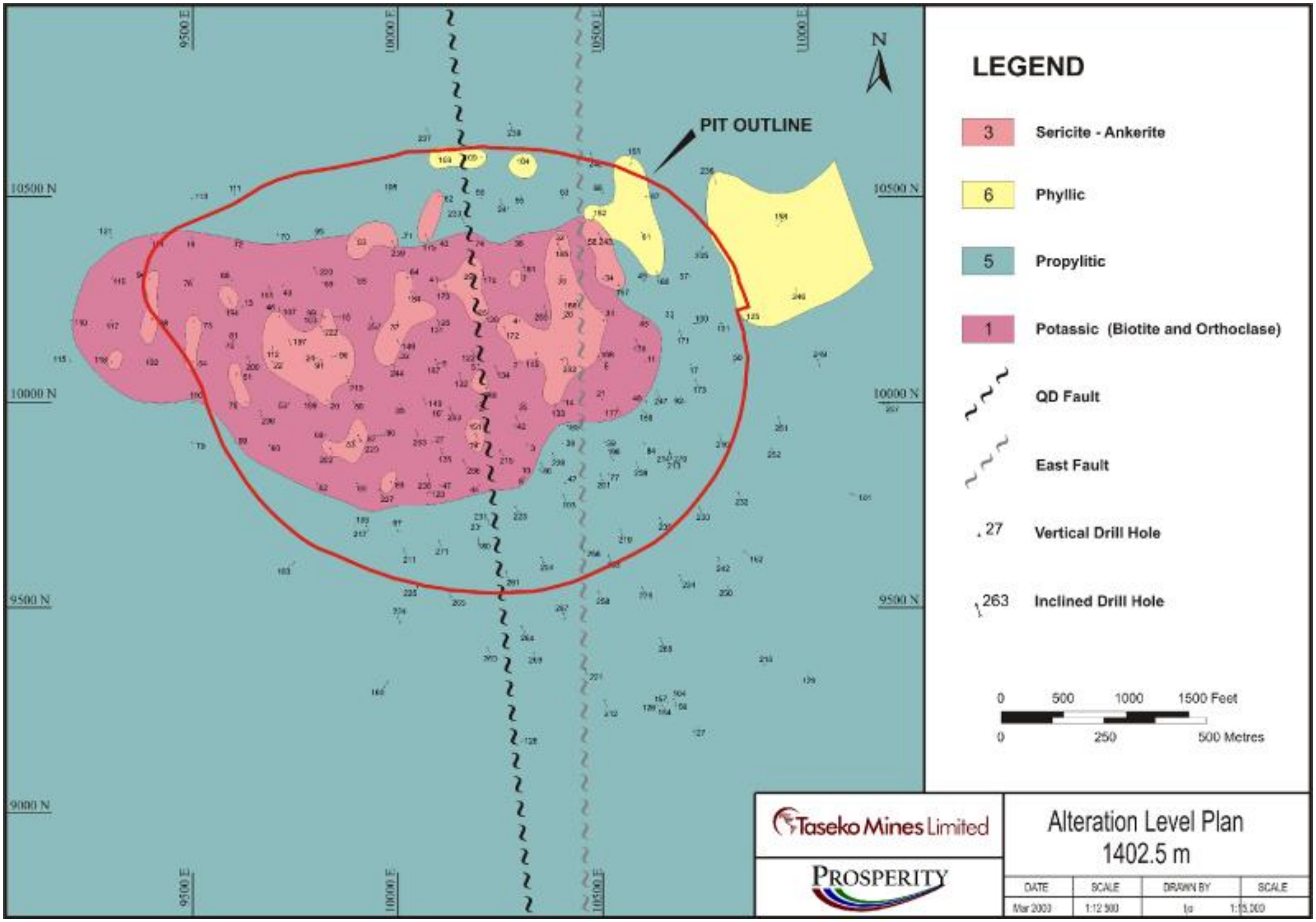

Figure 5-8 Alteration Level Plan 1402.5 m

5.3.5 Structure

Numerous faults were intersected in drill core throughout the deposit area. Faults are usually indicated by strongly broken core, gouge, shear, cataclastic and rarely mylonitic textures. All of the aforementioned features can occur across intervals of less than 1 cm to over 20 m. Utilizing all available data, two predominant faults (the QD and East Faults) have been delineated.

The QD and East Faults are sub-parallel, strike north-south and dip steeply to the west, becoming near vertical down-dip. They cut the central portion of the deposit and are approximately 230 m apart near surface and 330 m apart at depth.

5.3.6 Mineralization

Copper/gold mineralization within the Prosperity deposit is intimately related to potassium silicate alteration and a later, superimposed sericite-iron carbonate alteration. This is particularly true within a central, east-west trending ovoid zone that hosts the majority of the mineable reserve.

Chalcopyrite-pyrite mineralization and associated copper and gold concentrations are distributed relatively evenly throughout the host volcanic and intrusive units in the deposit. A sedimentary unit, located in the upper southeastern part of the mineralized zone, is sparsely mineralized. Post mineralization porphyritic dikes are essentially barren.

Pyrite and chalcopyrite are the principal sulphide minerals and are accompanied by: minor amounts of bornite and molybdenite; sparse tetrahedrite-tennantite, sphalerite and galena; and rare chalcocite-digenite, covellite, pyrrhotite, arsenopyrite and marcasite. Native gold generally occurs as inclusions in, and along microfractures with, copper sulphides and pyrite. Pyrite to chalcopyrite ratios throughout most of the proposed pit area range from 0.5:1 to 1:1 and rise to 3:1 or higher around the periphery of the deposit which coincides with the propylitic, and locally the phyllic, alteration zones.

Sulphide minerals show the thoroughly dispersed mode of occurrence characteristic of porphyry copper deposits. Sulphides occur in relatively equal concentrations as disseminations, blebs and aggregates in mafic sites, as fracture fillings and as veinlets.

Typical gold and copper distribution throughout the deposit is presented in Figure 5-9.

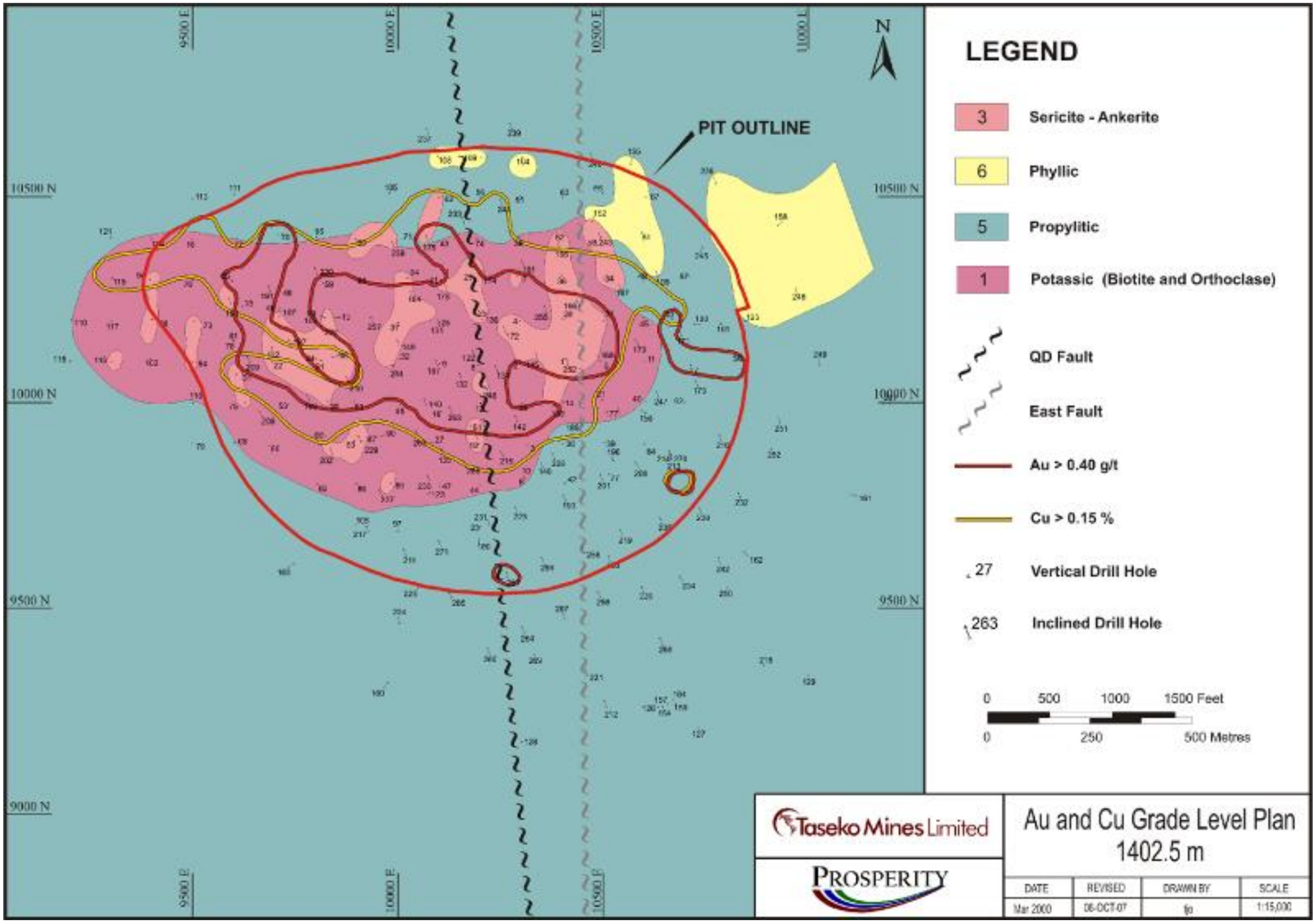

Figure 5-9 Au and Cu Grade Level Plan 1402.5 m

5.4 Resources and Reserves

Geostatistical analysis, including variography and ordinary kriging of the Prosperity drill hole data incorporating the geological and bulk density models have resulted in a Resource Estimate for the Prosperity Project Gold-Copper Deposit of 1010 Mt in the measured and indicated categories at an average grade of 0.406 g/t Au and 0.243% Cu at a 0.14% Cu cut-off as summarized in Table 5-1.

Additionally, 208 million tonnes of inferred mineral resources at an average grade of 0.246 g/t Au and 0.210% Cu were estimated above the same cut-off grade. The block grade estimates and resource classification codes were used for design and calculation of an open pit mineable reserve. The handling of grade estimation and data QA/QC are documented in Appendix 3-5-A.

Table 5-1 Mineral Resources Inventory

Category	Cutoff Copper Grade (%)	Tonnes > Cutoff (000's)	Cu Grade > Cutoff (%)	Au Grade > Cutoff (g/tonne)
Measured	0.14	547,100	0.273	0.461
Indicated	0.14	463,400	0.207	0.340
Total	**0.14**	**1,010,500**	**0.243**	**0.406**
Inferred	0.14	208,300	0.210	0.246

The mineable reserve was established on the basis of $1.50/lb copper, $500/oz Au, and exchange rate of 0.80 $US/$CDN, and 1st quarter 2007 estimates of capital and operating costs as reported in the 43101 compliant technical report dated October 15, 2007.

The tonnes mined in the reserve mine plan are summarized in Table 5-2. These are reported at a pit rim cut-off of C$5.25/t (net smelter return) NSR cut-off.

NSR for purposes of identifying a cut-off value is the value of a tonne of rock after deducting all off-site costs (transportation, marketing, treatment and refining, and penalties) associated with the metal content of that rock and the impact of metallurgical recovery. These assumptions are detailed in the 43101 compliant technical report dated October 15, 2007.

Table 5-2 Reserve Tonnes Mined

	Total Ore: >C$5.25/t NSR				Ovb	Waste	Total	Strip
Bench	Tonnes	NSR	Au	Cu	Tonnes	Tonnes	Tonnes	Ratio
Elevation	(t x 1000)	$/t	g/t	%	(t x 1000)	(t x 1000)	(t x 1000)	
1560	–	–	–	–	22	175	197	0.00
1545	–	–	–	–	1	4,199	4,200	0.00
1530	–	–	–	–	111	5,462	5,573	0.00
1515	6	5.77	0.30	0.11	1,083	5,411	6,500	1,082.33
1500	73	6.20	0.30	0.13	2,257	5,633	7,963	108.08
1485	321	6.93	0.34	0.13	4,312	7,366	11,999	36.38
1470	1,404	8.27	0.34	0.17	11,373	9,689	22,466	15.00
1455	5,446	9.26	0.38	0.19	13,938	14,737	34,121	5.27
1440	9,680	9.36	0.39	0.19	14,414	19,822	43,916	3.54
1425	13,165	9.62	0.39	0.19	13,561	23,860	50,586	2.84

Table 5-2 Reserve Tonnes Mined (cont'd)

	Total Ore: >C$5.25/t NSR				Ovb	Waste	Total	Strip
Bench Elevation	Tonnes (t x 1000)	NSR $/t	Au g/t	Cu %	Tonnes (t x 1000)	Tonnes (t x 1000)	Tonnes (t x 1000)	Ratio
1410	15,790	10.00	0.41	0.19	7,915	26,150	49,855	2.16
1395	18,985	9.96	0.41	0.19	2,604	27,497	49,086	1.59
1380	21,587	9.73	0.39	0.19	219	25,747	47,553	1.20
1365	21,429	9.84	0.40	0.20	–	23,611	45,040	1.10
1350	20,920	9.93	0.40	0.20	–	21,614	42,534	1.03
1335	20,492	10.00	0.40	0.20	–	19,542	40,034	0.95
1320	20,632	10.03	0.40	0.20	–	16,051	36,683	0.78
1305	21,002	10.11	0.41	0.20	–	14,497	35,499	0.69
1290	21,512	10.69	0.41	0.20	–	11,068	32,580	0.51
1275	20,724	10.74	0.41	0.20	–	10,018	30,742	0.48
1260	20,634	10.85	0.41	0.20	–	7,456	28,090	0.36
1245	20,136	11.16	0.42	0.20	–	6,882	27,018	0.34
1230	19,513	11.42	0.42	0.21	–	5,057	24,570	0.26
1215	19,054	11.42	0.42	0.21	–	4,496	23,570	0.24
1200	17,780	11.65	0.42	0.22	–	3,447	21,227	0.19
1185	17,668	11.72	0.41	0.23	–	2,599	20,267	0.15
1170	16,977	12.23	0.43	0.23	–	1,125	18,102	0.07
1155	16,524	12.34	0.44	0.23	–	678	17,202	0.04
1140	14,755	12.99	0.46	0.24	–	427	15,182	0.03
1125	13,912	13.51	0.48	0.25	–	423	14,335	0.03
1110	11,861	14.41	0.51	0.26	–	603	12,464	0.05
1095	10,897	14.86	0.53	0.27	–	778	11,675	0.07
1080	9,368	15.01	0.52	0.28	–	554	9,922	0.06
1065	8,773	14.96	0.51	0.28	–	428	9,201	0.05
1050	7,418	15.33	0.52	0.29	–	242	7,660	0.03
1035	6,834	15.65	0.52	0.30	–	135	6,969	0.02
1020	5,521	16.13	0.53	0.31	–	2	5,523	0.00
1005	4,920	16.43	0.54	0.32	–	–	4,920	0.00
990	3,796	16.76	0.54	0.33	–	–	3,796	0.00
975	3,241	16.90	0.54	0.33	–	–	3,241	0.00
960	2,246	17.25	0.54	0.34	–	–	2,246	0.00
945	1,793	17.30	0.54	0.34	–	–	1,793	0.00
Total	**486,789**	**11.53**	**0.43**	**0.22**	**71,810**	**327,481**	**886,080**	**0.82**

6 Mine Plan

6.1 Overview

The project would involve a large open pit mine development with a 20 year operating life. Typical large-scale open pit mining equipment and conventional copper porphyry flotation processing would be used. In addition to the mine and associated tailings and waste rock areas, the project includes development of an onsite mill and support infrastructure, an approximately 125 km long power transmission line corridor, and a 2.8 km mine access road.

The Prosperity Gold-Copper Project consists of four main elements as follows:

1. Mine: The main features of the mine include the Open Pit, Waste Rock Stockpiles, Primary Crusher and overland Conveyor, the Plant site, and the Tailings Storage Facility
2. Transmission Line: A 125 km long, 230 kV power transmission line to the BCTC transmission corridor in the vicinity of Dog Creek
3. Access Road and Transportation Corridor: Existing access is already established for transportation of goods, services and concentrate with the exception of approximately 3km of new road required to access the plant site
4. Fish Compensation Works: To compensate for the loss of Fish Lake and upstream and downstream spawning habitat, fish compensation works will be developed to be consistent with MOE and DFO policies and legislation

6.1.1 Mine

The general layout of the components of the mine site are shown in Figure 6-1, Mine Layout

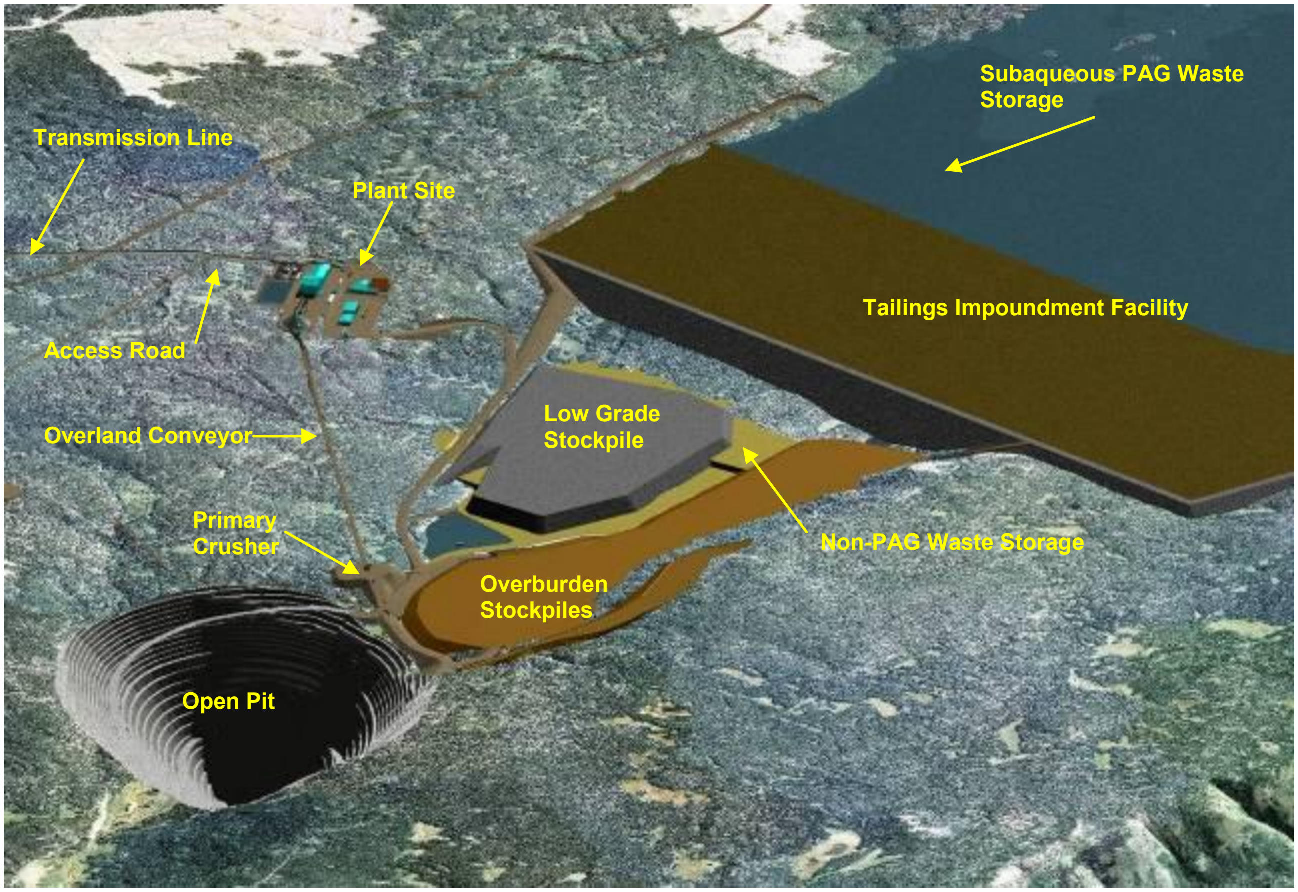

Figure 6-1 Potential Mine Site Layout

Open Pit

The open pit is located just north of Fish Lake. The nominal elevation of the pit rim is 1470 m. The ultimate open pit would be conical in shape, 1200–1600 m in diameter at the pit rim, and 525 m deep to an elevation of 945 m.

The open pit will provide 70,000 tpd mill throughput with an average daily mining rate of approximately 120,000 t of material per day over the active pit life of 17 years, stockpiling lower grade ore for processing in the latter three years of the project. The open pit will yield 487 Mt of ore, 72 Mt of overburden stripping, and 328 Mt of waste rock. Non-potentially acid generating (non-PAG) open pit overburden and waste rock materials will be used to construct the tailings storage facility (TSF) which will impound tailings and potentially acid generating (PAG) waste materials.

Waste Rock Stockpiles

Non-PAG waste rock and overburden produced during active mining will be used in TSF embankment construction or stockpiled in the Waste Storage Area between the Main Embankment and the Open Pit.

PAG waste rock and overburden will be stored subaqueously in the TSF.

Primary Crusher and Overland Conveyor

Ore will be hauled from the open pit mining operation to the primary crushing facilities close to the southeast rim of the open pit. The overland conveyor carries crushed ore directly from the primary crusher to the coarse ore stockpile at the plant site. It will generally follow existing topography on a prepared gravel bed on an upslope route to the coarse ore stockpile 1.9 km due east. A single lane service road will be provided along one side of the conveyor.

Plant Site

The plant site will be located approximately 2 km east of the primary crusher on a relatively flat natural plateau on the east slope of the valley. Primary structures at the plant site will include coarse ore stockpile and reclaim facilities, concentrator building, main 230 kV substation, equipment maintenance shop, warehouse, assay laboratory, and administration and camp facilities. The plant site will be at a nominal elevation of 1569 m.

Tailings Storage Facility

The TSF will be located in the upper Fish Creek valley, starting approximately 1 km south of the mill site. The embankments will be developed in stages throughout the life of the project using low permeability glacial till, overburden and non-PAG waste rock materials from stripping operations at the open pit. The Main Embankment will be expanded in stages across the Fish Creek Valley, and the West Embankment will be constructed along the western ridge which separates the Fish Creek drainage basin from the Big Onion Lake drainage basin.

The Main Embankment will be constructed as a water-retaining structure during the initial years of operations until tailings beaches are well established. Once the tailings beaches have been suitably developed, the Main Embankment will be raised as a free draining dam structure that utilizes a downstream construction method with a filter and a transition zone supported by the downstream shell zone.

The West Embankment will be constructed as a water-retaining dam utilizing the centreline method of construction.

The Fish Lake South Embankment will be constricted as a water-retaining dam. This embankment is to be located to the east of Wasp Lake and to the south of the TSF running in an east west direction across the Fish Creek Valley. The maximum dam height is to be 25 m. Construction of this embankment to create the Prosperity Lake basin is part of the Fish Compensation Plan.

The TSF has been designed to permanently store 477 Mt of tailings and approximately 237 Mt of PAG waste rock and overburden materials and has the potential for increased storage capacity to accommodate significant additional tonnes.

Specific overall features of the TSF include:

- three earth-rockfill, zoned embankments: Main, West, and Fish Lake South
- headwater channel
- headwater retention pond
- seepage collection ditches and ponds

- tailings distribution system
- reclaim water system
- PAG waste storage area
- tailings beaches
- supernatant water pond

6.1.2 Transmission Line and Switching Stations

Electrical power to the mine site will be supplied from the existing BCTC 230 kV transmission line near Dog Creek through a new switching station to be designed and constructed by BCTC.

A 3-km wide, economically and technically feasible route for the transmission line was established following an assessment of a number of possible alternatives. Within this 3 km wide route, a 500 m wide corridor has been determined within which the centreline of the eventual 30 to 80 m wide right-of-way will be selected.

The route, 125 km in length, follows in a general westerly direction from the switching station at Dog Creek and follows access roads over easy terrain for the majority of its length before terminating at the proposed Prosperity development site.

The transmission line will consist of wood or fiberglass pole H-Frame pole structures similar to standard BCTC/BC Hydro designs with average spans of 225 m.

BCTC is responsible for providing a basic transmission extension, which for this project is a transmission switching station consisting of a three 230 kV circuit breaker ring, terminating three 230 kV lines. As per BCTCs extension policy for transmission customers, the facilities agreement, BCTC shall construct to BCTC standards, own, operate, and maintain the basic transmission extension.

Taseko will build a 230 kV substation at the mine site consisting of three SF6 circuit breakers and two identical step-down transformers. The overall plant load demand is estimated to be an average operating load of 104 MW and peak load of 126 MW.

6.1.3 Access Road and Transportation Corridor

Existing road access for purposes of a permanent year-round transportation corridor is already established to within approximately 3 km of the plant site. Existing access from Williams Lake to the mine site for purposes of construction and operation consists of approximately 90 km of provincial highway and 90 km of gravel forest service roads. An additional 3 km of new gravel road construction will be required.

Concentrate transportation to the Gibraltar Mine Concentrate Load-out Facility near Macalister will occur through Williams Lake and continue on 54 km of provincial highway.

6.1.4 Fish Compensation Works

Fish habitat compensation and mitigation strategies are an integral component of the Prosperity Project design. These strategies include the construction and maintenance of a new lake system, called Prosperity Lake, the management of a fresh headwater diversion channel, and a headwater channel retention pond. Prosperity Lake has been designed to maintain the genetic makeup and a self sustaining habitat in perpetuity for trout from Fish Lake. Additionally, the refurbishment and operation of fish culture facilities for the duration of the project life further enhances the objectives of maintaining the genetic integrity of the Fish Lake stock, addressing the loss of the fish production and fishery at Fish Lake, and contributing to the local community partnerships.

Prosperity Lake is to be situated immediately to the east of Wasp Lake and south of the TSF. The lake will be constructed by building a water retention dam and filled via the headwater channel and spring snowmelt runoff. The water conveyance from the headwater retention pond to Prosperity Lake incorporates engineered fish habitat in the form of spawning channels. Prosperity Lake will fill to 132 ha in size, larger than Fish Lake and representing 28 ha of littoral and 104 ha of pelagic area. Prosperity Lake will be stocked with rainbow trout as a self sustaining population.

During the Project construction phase, a system of headwater channels will be constructed along the eastern side of the site in the upper Fish Creek watershed. These channels are designed to capture and direct surplus clean water around the site as part of the water management planning. The headwater channel system comprises both south and north flowing channels. The north flowing channel will capture and direct surplus clean water to lower Fish Creek. The south flowing channel captures and directs flows to the Headwater Channel Retention Pond located to the southeast of Prosperity Lake. This water is then diverted to Prosperity Lake through a water conveyance and newly created spawning channels. From Prosperity Lake the water is then diverted to Wasp Lake and finally to Beece Creek during the life of the operation. At the cessation of operations, water from Prosperity Lake will be diverted to the TSF and then to the open pit. Once the open pit has filled, water flows will once again return to lower Fish Creek.

Complete details of the Fish and Fish Habitat Compensation Plan can be found in Section 8.

6.2 Geotechnical Work

Geotechnical investigations, testing, and analysis for purposes of pit slope stability, waste dump stability, tailings dam construction, condemnation drilling and plant site characterization were undertaken by Knight Piesold over the period 1991 through 2008.

6.2.1 Pit and Waste Dumps

Knight Piésold Ltd. conducted a feasibility level geotechnical review of the proposed 2007 open pit mine plan. All currently available drilling and discontinuity mapping data and stability analyses suggest the recommended pit slope design is reasonable and appropriate.

The complete test results, findings and recommendations for the pit wall slopes, waste dumps and results of hydrological investigations are contained in the KP reports, "*2007 Feasibility Pit Slope Design*", dated July 2007 (Appendix 3-6-C) and "*Waste Storage Area Geotechnical Feasibility Report*", dated February 1999 (Appendix 3-6-D).

A comprehensive geotechnical/hydrogeological database was developed during a previous pit slope study, "*Feasibility Design of the Open Pit*", dated April 1999 (Appendix 3-6-E).

Knight Piesold's work consisted of site reconnaissance and mapping, oriented core diamond drilling and detailed logging of fracture data, in-situ permeability testing, point load testing, uniaxial compressive and tri-axial strength tests and direct shear tests on rock joints.

Geotechnical core logging data were used to develop a rock mass classification system and rock mass model for the deposit. Mapping data were used to determine structural discontinuities and to assess the potential for wedge and plane failures in the pit walls. These assessments were the basis for stability analyses of failure modes along structural discontinuities and for evaluation of deep-seated failure.

The existing geotechnical model incorporates five major geological domains: Overburden, Bedrock above Gypsum Line, Potassic Quartz Diorite, Propylitic Porphyritic Volcanic Rock and Potassic Volcanic Rock. The intact rock strengths were found to be generally strong. Combining the intact rock properties and characteristics of the observed discontinuities allowed the rock mass quality to be summarized as being generally fair. Two major faults have been identified to pass within the pit limits: the QD and the East Faults. These structures are sub-parallel, trend roughly North-South through the centre of the deposit, and are steeply dipping to vertical. The predominant jointing patterns are sub-vertical and coincident with main vein systems.

The water table is currently at or near the ground surface and slope depressurization measures are anticipated in order to facilitate the development of stable pit slopes.

Detailed geotechnical mapping of the rock mass will be completed once bedrock is exposed during pre-production and ongoing mining. Pit face mapping will be supplemented with monitoring of the slope deformations and hydrogeological conditions in and around the pit. Data collected during pit development will be used for ongoing pit slope optimization. Pit slope monitoring will also include regular inspections of benches and pit crests in order to identify any tension cracking or other indications of potential slope instability. Appropriate movement monitoring systems will be required for any potentially unstable areas of the pit.

Historical geotechnical reports related to the open pit include:

- Knight Piésold Ltd., March 1994. Report on Open Pit Design (Appendix 3-6-F)
- Knight Piésold Ltd., March 1994. Open Pit Preliminary Hydrogeological Investigations (Appendix 3-6-G)
- Knight Piésold Ltd., January 18, 1995. Report on 1994 Open Pit Investigation (Appendix 3-6-H)
- Knight Piésold Ltd., June 6, 1997. Draft. 1996 Open Pit Geotechnical Investigation (Appendix 3-6-I)

6.2.2 Plant Site

A geotechnical report dated December 22, 1998 and entitled "*Report on Geotechnical Parameters for the Plant Site Foundation Design*" (Appendix 3-6-J) was prepared by Knight Piesold. This report is based on:

- a field investigation program which included 33 test pits and 5 drill holes and piezometer installations
- laboratory testing of samples

The Knight Piesold report includes the following findings and recommendations:

- At the mill site, the site investigation included a total of 12 test pits and 5 drill holes. The predominant material encountered was a dense to very dense till overlaying bedrock. Three of the test pits encountered bedrock at less than 3 m of depth.
- In general, conventional shallow spread footings may be used for foundations. Knight Piesold have made recommendations for allowable bearing capacities and predicted settlements based on type, depth, size and geometry of foundations bearing on native soil (glacial till), structural fill, and bedrock.
- The estimated depth of frost penetration for this area is 2.5 m. Footings will be located 2.5 m below grade and their excavations will be backfilled with non-frost susceptible material.
- The mine site is located at the north-eastern edge of the Coast Mountains source zone, an area with low seismic activity. Structures will be designed for a Design Basis Earthquake (DBE) for a conservatively chosen 1 in 475 year return period.
- Knight Piesold has made gradation recommendations for structural backfill materials and general yard fill material. Selective borrowing, blending, screening, crushing, and/or washing may be required to meet the gradation requirements for the structural backfill.

Additional technical reports related to foundation investigation and design include:

- Knight Piésold Ltd., January 22, 1999. Report on Geotechnical Parameters for the Plant Site Foundation Design (Appendix 3-6-K)
- Knight Piésold Ltd., January 11, 1995. Report on Plant and Crusher Site Foundation Investigations (Appendix 3-6-L)

6.2.3 Tailings Storage Facility

Several geotechnical site investigation programs were conducted in the TSF area from 1991 to 1998. The programs included drill holes and test pits to investigate the geotechnical characteristics and foundation conditions, and to evaluate the geological factors affecting the design of the TSF.

Drill holes were logged, in situ permeability tests were conducted, representative overburden samples were retrieved for laboratory testing and point load testing was conducted on rock core samples. Groundwater monitoring wells were also installed in the drill holes.

The geotechnical data has been used to evaluate the tailings basin and embankment foundations.

The site investigations conducted at the TSF by Knight Piesold Ltd. include the following:

- Initial overview in February 1991.
- A helicopter site visit and identification of alternate potential tailings storage sites was summarized in "*Report on Preliminary Geotechnical Evaluation*" (Appendix 3-6-M).

- Geotechnical and hydrogeological investigations in the TSF site were completed during the late stages of the 1992 exploration season. Field work comprised general surface reconnaissance, five drill holes, in situ packer permeability testing and installation of groundwater quality monitoring wells. The results of the TSF investigations are included in "*Report on Preliminary Geotechnical Investigations*" (Appendix 3-6-N).
- Geotechnical and hydrogeological investigations conducted in 1994 concentrated on the West Ridge between the West Embankment alignment and Big Onion Lake and consisted of six drill holes, in situ packer permeability testing, groundwater monitoring well installation and surficial mapping. The results are included in "*1994 Geotechnical and Hydrogeological Investigations for Proposed Tailings Storage Facility*" (Appendix 3-6-O).
- Geotechnical site investigations were conducted in 1996 at the TSF site and an alternative site, as part of the final site selection program. A total of seven holes were drilled at the Fish Lake Valley site. In situ permeability testing was carried out and groundwater monitoring wells were installed. Laboratory testing was performed on overburden samples and point load testing was carried out on rock core. The details of the 1996 investigation are included in "*1996 Geotechnical Investigations for Tailings Management Options 2 and 5*" (Appendix 3-6-P).
- Geotechnical and hydrogeological investigations conducted in 1998 resulted in nine drill holes on the floor of Fish Lake Valley. In situ packer permeability tests were conducted and groundwater monitoring wells were installed. Overburden samples were collected for laboratory testing and point load testing was conducted on rock core.
- Seismic refraction and reflection surveys were conducted in 1996 by Frontier Geosciences Inc. The results of the survey are included in "*Report on Seismic Refraction and Reflection Investigation*" (Appendix 3-6-Q).
- Details of the site characteristics, geotechnical, hydrogeological and water management considerations for the tailings facility design, pipeworks, seepage collection and reclamation and closure are contained in the Knight Piésold "*Report on 2007 Feasibility Design of the 70,000 tpd Tailings Storage Facility*". (Appendix 3-6-R).

Additional geotechnical reports related to geotechnical considerations of the tailings storage facility are included in the following reports:

- Knight Piésold Ltd., March 1994. Report on Open Pit Design (Appendix 3-6-F)
- Knight Piésold Ltd., February 10, 1994. Report on Materials for Embankment Construction and Concrete Aggregate (Appendix 3-6-S)
- Knight Piésold Ltd., May 13, 1994. Site Geotechnical Considerations and Design of Tailings Storage Facility (Appendix 3-6-T)
- Knight Piésold Ltd., March 9, 1999, Report on Feasibility Design of the Tailings Storage Facility (Appendix 3-6-U)

6.2.4 Condemnation Drilling

Condemnation drilling has occurred at the mine site as a component of the geotechnical drilling undertaken. As shown on Figure 6.2 of Appendix 3-5-A six holes have been drilled in the waste rock storage area. As shown on Figure 4.1 of Appendix 3-6-R a total of 13 holes have been drilled within the TSF area and as shown on drawing number 10173-16-0140 in Appendix 3-6-K five holes have been drilled in the vicinity of the plant site. Also contained within this EIS is information from seven holes drilled at alternative TSF and waste rock locations no longer considered a component of the Project. In total, 31 geotechnical holes were drilled at the Project site totaling 1603.1 m of drilling. Of this 155.56 m from 8 holes were assayed in 80 samples. The maximum copper value returned from 80 assays is 0.009% Cu and the maximum gold value from 54 assays is 0.02 g/t Au.

6.3 Mining Method

6.3.1 General

The mining method proposed for the Prosperity Project is conventional open pit shovel/truck operations. The mine will operate using industry standard electric rotary drills, electric cable shovels, diesel electric trucks and a fleet of support equipment to maintain roads, dumps and stockpiles. The equipment fleet will incorporate large scale units which have been well proven in existing operations.

The ore and waste will be drilled by rotary blasthole drills and blasted using ammonium nitrate and fuel oil or with emulsion as required.

Ore will be hauled to a gyratory crusher located southeast of the open pit and then conveyed overland to the coarse ore stockpile and subsequently to the concentrator for grinding and flotation. Waste rock will be hauled south from the open pit to either the tailings storage facility, dam construction or to the low grade stockpile base. Overburden will be hauled to the stockpile located on the west flank of the valley, dam construction, or to the TSF.

Ore will be mined from the open pit and hauled directly to the primary crusher for 17 years. The implementation of a declining cut-off grade strategy results in a stockpile of lower grade ore that will be used as supplemental mill feed during the first 16 years of operation with the balance processed at the end of the open pit mine life. This material will be reclaimed and processed as mining in the open pit is completed.

Tailings will be impounded behind a constructed dam approximately 1 km south of the open pit. The dam will be raised in lifts as required during the mine life. PAG waste rock and overburden that is deemed to have the potential to generate acid drainage will be stored under water within the tailings management facility. Non-PAG waste rock and overburden will be used to build the TSF embankments, low grade stockpile base, and for road construction.

6.3.2 Open Pit Design

The open pit design has been based upon the following key considerations:

- geotechnical recommendations and design criteria for maximum pit slope and waste dump locations
- operating constraints of the equipment selected for mining

- minimum haulage road operating width and maximum effective grade within the operating limitations of the primary haulage units
- logical and efficient scheduling of material movement from multiple phases of pit expansion to the crusher, the stockpiles and to final waste material placement sites

The open pit will be mined in four phases commencing with the Phase 1 Starter Pit. The pit will be partially pre-stripped during the preproduction development period. The starter pit will provide building materials for the tailings impoundment starter dam. Subsequent phases are radial expansions of the mine about the starter pit creating a progressively deeper pit.

The minimum pushback width is 80 m; however, in general the expansions are in excess of 100 m width. Haul road allowances have been provided at 35 m. Roads are designed at a maximum of 10% grade.

The ultimate pit features are summarized as follows:

- 1650 m E-W by 1285 m N-S
- total surface area 166 ha
- final ramp exit elevation 1470 m
- ultimate pit bottom elevation 945 m
- maximum wall height–600 m in the SW quadrant with maximum crest elevation 1545 m

Final overall wall slope angles in the following directions:

- north wall 45.5°
- east wall 45.2°
- south wall 43.6°
- west wall 42.4°

Open pit wall slope stability is dependent upon the following site specific factors:

- geological structure
- rock alteration
- intact rock strength
- rock stress
- groundwater conditions
- discontinuity strength and orientation
- pit geometry
- blasting practices
- climatic conditions
- time

These are discussed below.

Geological Structure

In general the rock mass quality at Prosperity ranges from fair to good. There are two major faults within the pit limit. These are referred to as the QD and East Faults. These structures are near vertical, sub-parallel and trend North-South through the center of the deposit. There do not appear to be any major structures that will adversely influence the stability of the pit slopes.

Rock Alteration

The Prosperity Deposit is centered about a diorite intrusive where potassic alteration is associated with the core of the mineralized zone. This central zone of mineralization is surrounded by a propylitic alteration zone. A retro-grade phyllic alteration is overprinted on the propylitic and potassic zones. Within the potassic zone there is a well defined vertical zonation defined by dissolution of gypsum on joint surfaces. The "gypsum" line defines the change from generally competent rock to competent rock and is used to separate structural domains for the purposes of mine design.

Intact Rock Strength

Intact rock strength is an important consideration, as many potential failure surfaces are not completely developed and require some failure of intact rock. The moderate to high strength of the rock at Prosperity site is beneficial due to the high stresses that are expected to develop in the pit slopes during later stages of mining. The uniaxial compressive strength, based on point load tests, varies but averages 112 mPa.

Rock Stress

The rock stress conditions within the rock mass are a significant factor for high slopes. Knight Piesold has used a sophisticated finite difference computer model (FLAC) to assess the potential overstressing of the rock in the proposed pit slopes.

Groundwater Conditions

The water table is currently at or near the ground surface and provisions have been made for a slope depressurization system. Groundwater dewatering wells and slope depressurization will be concentrated in North and South sectors as referred to in Figure 6-2 (Geotechnical Pit Slope Design Sectors Plan) and later in Figure 6-3 (Pit Slope Design–Pit Wall Depressurization Plan).

Discontinuity Strength and Orientation

The predominant jointing patterns are sub-vertical and coincident with the main vein systems. Secondary veins have also been identified dipping out of the East pit slopes. KP has investigated the potential for adversely oriented structural features at depth at or near the final pit walls. The finding of this investigation was that there is a very low likelihood of adverse structures in the form of open joints. Structural features in close proximity to final walls will be primarily quartz and sulphide veins.

Pit Geometry

The ultimate pit geometry is roughly oval and the internal pit phases expand in all directions about the Phase 1–Starter Pit. As such during the life of the mine all internal walls are temporary and will be mined.

Blasting Practices

Drilling and blasting near both temporary and final walls will require buffer blasting. Knight Piesold have recommended overall wall slopes of 30° in overburden, 45° above the "gypsum line" and 50° below the "gypsum line". The KP recommendations for bench and berm configuration were based upon single benching and achieving steep inter-berm face angles up to 75°. The designs incorporated in this study assume that double benching will be possible and that shallower inter-berm angles to 65° will be allowed resulting in berm widths from 10 to 15 m width.

Climatic Conditions

The climatic conditions at the Prosperity Project are typical of the British Columbia Chilcotin District with an annual average of approximately 500 mm of rain equivalent precipitation. The seasons in this area are well defined with relatively predictable periods of "freeze up" in the fall and "break up" in the spring. The "break up" period is characterized by increased water flow from melting snow and cyclical thawing and freezing of the surface materials on pit slopes. This action results in decreased slope stability particularly at the smaller bench scale where there will be a marked increase in small face failures and ravelling of rock.

Time

As discussed in the earlier sections, final walls will occur only in the Phase 4 Pit that is active for a period of 10 years between Year 6 and Year 16 of the production schedule. Phase 1 and Phase 2 pit walls will typically be exposed for two years and the Phase 3 walls will be exposed for four years prior to excavation.

Design Sectors

Based upon three structural domains the open pit has been divided by KP vertically into three major slope design sectors that correspond with:

- Sector I—Surface materials including overburden and basalt
- Sector II—Upper Zone located above the "gypsum line"
- Sector III—Lower Zone located below the "gypsum line"

These major sectors have been further subdivided in great detail; however, the actual design recommendations for each major sector are for the most part identical and are summarized in Table 6-1 Recommended Wall Slopes and shown in Figure 6-2. The overburden will be mined leaving a 30° inter-ramp slope. The basalt formation on surface will be mined leaving a 45° inter-ramp slope. The Middle Zone will be mined leaving a 45° inter-ramp slope and the Lower Zone inter-ramp slope will be increased to 50°.

The benches will be mined at a 15 m height, double benched between berms. Wall slope design changes will be implemented by varying the berm widths and inter-berm slope angles.

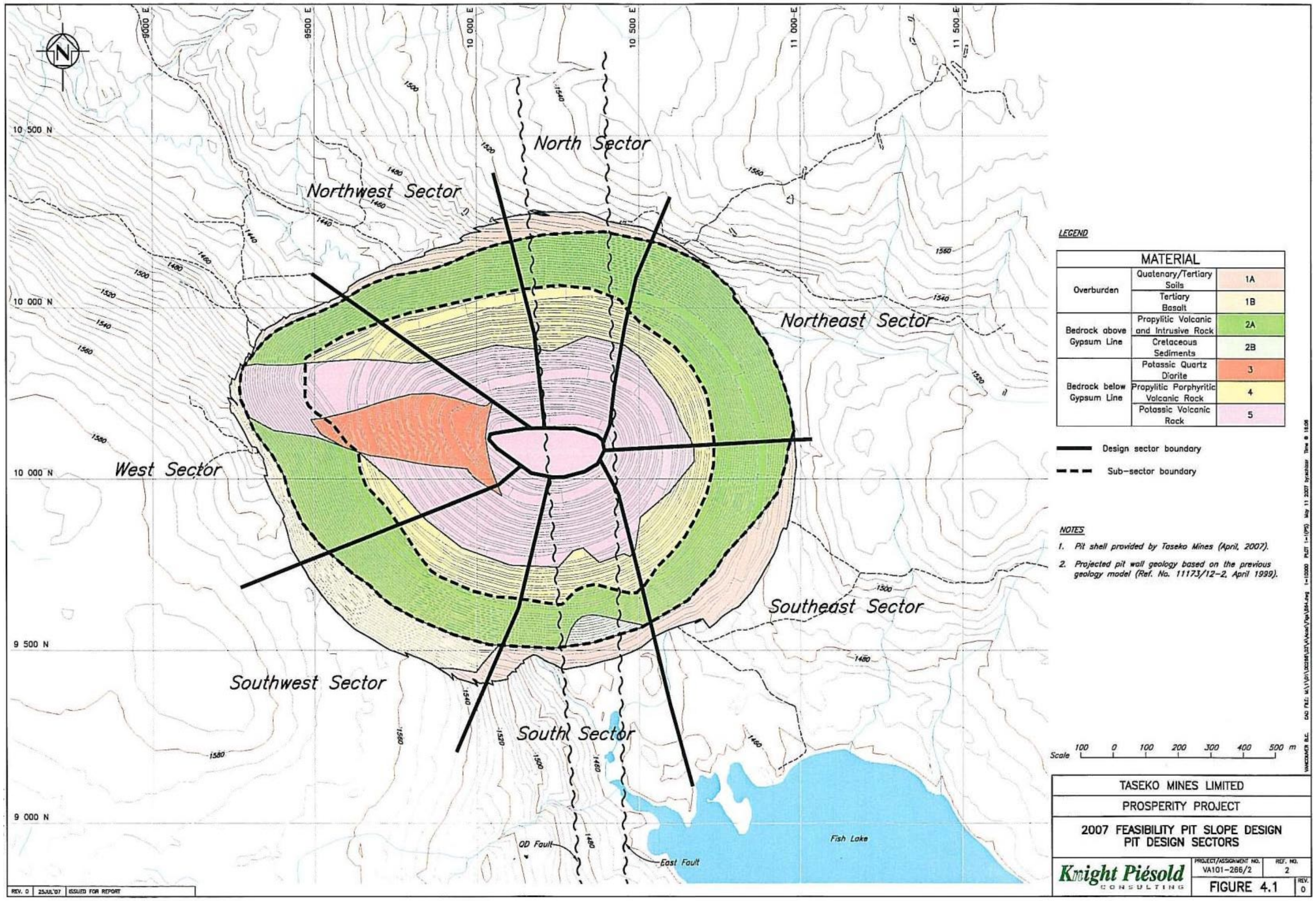

Figure 6-2 Geotechnical Pit Slope Design Sectors Plan

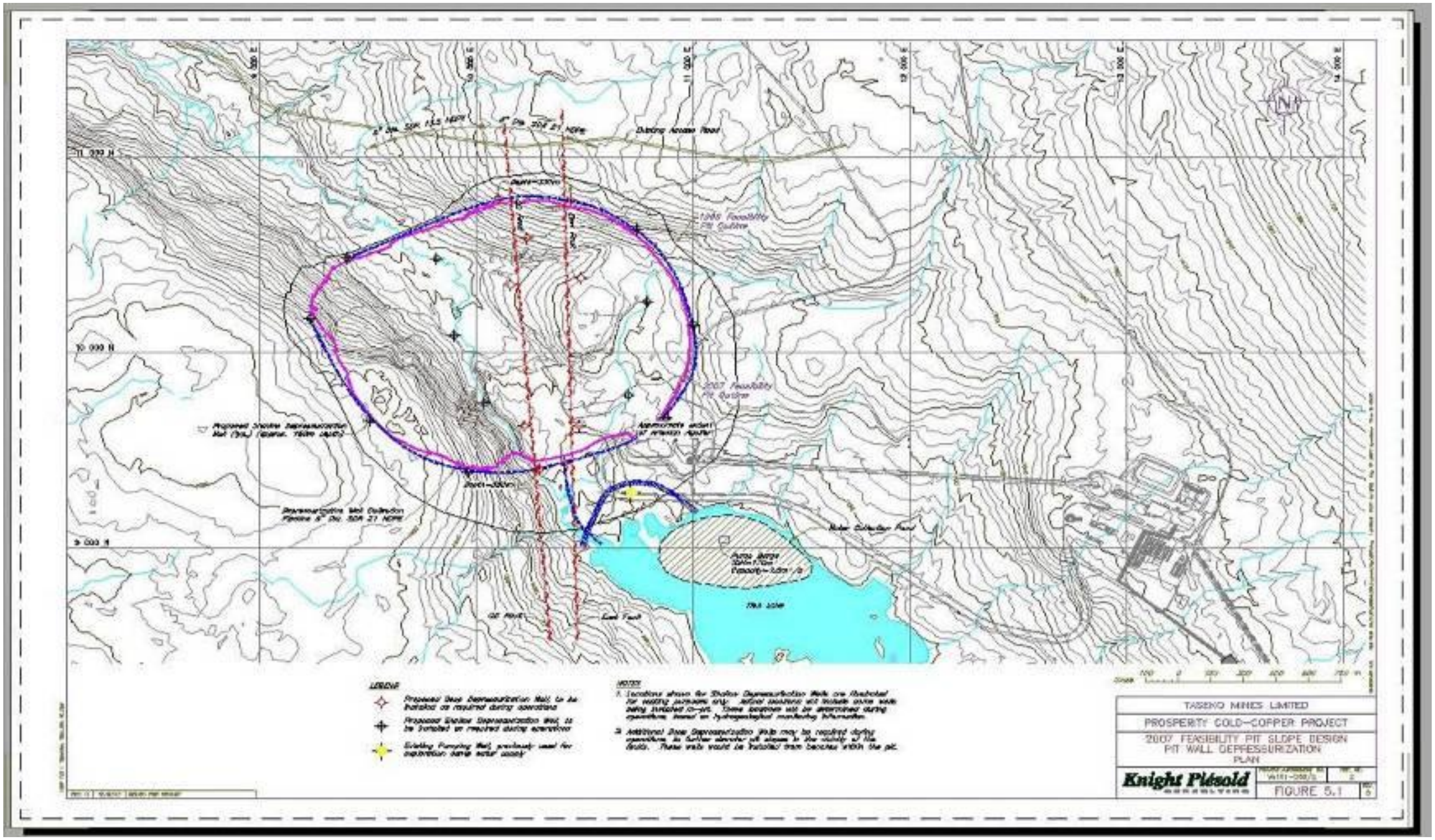

Figure 6-3 Pit Slope Design–Pit Wall Depressurization Plan

Table 6-1 Recommended Wall Slopes

Design Sector	Geologic Domain	Inter-ramp Slope (degrees)	Bench Height (m)	Berm Interval (m)	Berm Width (m)	Interberm Slope (degrees)
Design for Near Surface Materials						
Ia	Overburden	30	15	15	8	40
Ib	Basalt	45	15	30	8	65
Design Above the Gypsum Line						
IIa	Upper west sector	45	15	15	8	65
IIb	Upper west sector–potassic	45	15	15	8	65
IIc	Upper northwest sector	45	15	15	8	65
IId	Upper north sector	30	15	15	8	65
IIe	Upper northeast sector	30	15	15	8	65
IIf	Upper east sector	45	15	15	8	65
IIg	Upper southeast sector	45	15	15	8	65
IIh	Upper south sector	45	15	15	8	65
Iii	Upper southwest sector	45	15	15	8	65
Design Below the Gypsum Line						
IIIa	Lower west sector	45	15	15	8	65
IIIb	Lower northwest sector	50	15	30	11	65
IIIc	Lower north sector	50	15	30	11	65
IIId	Lower northeast sector	45	15	15	8	65
IIIe	Lower southwest sector	50	15	30	11	65
IIIf	Lower south sector	50	15	30	11	65
IIIg	Lower southwest sector	50	15	30	11	65

Pit Dewatering

Mine dewatering has been addressed by Knight Piesold, and reported in "*2007 Feasibility Pit Slope Design*" and is summarized here in terms of how it relates to the mine operations.

It has been recognized that the open pit development will have significant impact on the local hydrogeologic regime, as the pit will become a groundwater discharge area. The groundwater table is at or near the surface and development of the open pit will result in a gradual lowering of the water table in the vicinity of the excavation.

Pit inflows will likely be dominated by localized confined aquifers in the southern area of the pit from zones of higher rock mass permeability related to major structures and from unconfined flow in the upper 150 to 300 m of fractured rock mass above the gypsum line. Inflows from good quality, low permeability rock below and peripheral to the gypsum line are expected to be low.

A combination of depressurization techniques including vertical wells, in-pit horizontal drains and collection systems will be implemented as a staged approach during pit development.

Hydrogeologic investigations have identified a confined 2 m thick gravel unit which acts as an artesian aquifer at the overburden/bedrock contact along the ultimate south central slope. This aquifer has been identified as a source of potable water and three groundwater wells are scheduled for installation during preproduction. Additional dewatering wells may be added later in the mine life when the open pit intersects the aquifer.

The QD and East fault zones require deep groundwater depressurization in order to minimize the potential for slope failure on the north and south walls. In Year 1 of mining, three wells will be drilled to a depth of 375 m. Additional wells will be drilled in Year 8 and Year 11. The proposed well locations are shown in Figure 6-3.

Shallow perimeter wells will be located outside the ultimate pit limit. These wells will be 150 m deep and their specific locations will be determined based upon hydrologic monitoring information.

Horizontal drains provide an efficient and relatively cost effective mechanism for the control of groundwater flows and for depressurization of open pit slopes. Drain holes will be drilled 100 m into the slopes at 10° above horizontal. The drain hole spacing on temporary walls will be approximately 150 m on average with adjustment as required. The spacing on final walls will be reduced to 60 m.

Water inflows to the open pit will include both groundwater and direct precipitation. The contribution of direct precipitation to in-pit pumping requirements will vary annually and seasonally.

The open pit dewatering system has been designed to meet the combined requirements of the expected groundwater pit inflow rates and runoff from precipitation. The annual contribution of direct precipitation to the in-pit pumping requirements has been estimated for the average annual precipitation volume with a ten year return period, and the storm flow rate required to remove ponded water from the one in ten year, 24 hour storm event within 96 hours. The peak operational design capacity of the system is 400 l/s.

Staged development of the system will take place and a summary of this process is shown in Figure 6-4. A single 500 mm nominal diameter HDPE pipeline will initially be routed along pit roads. Later this pipeline will be routed directly up the pit slope. The system will discharge into the process water pond near the north end of what is now Fish Lake.

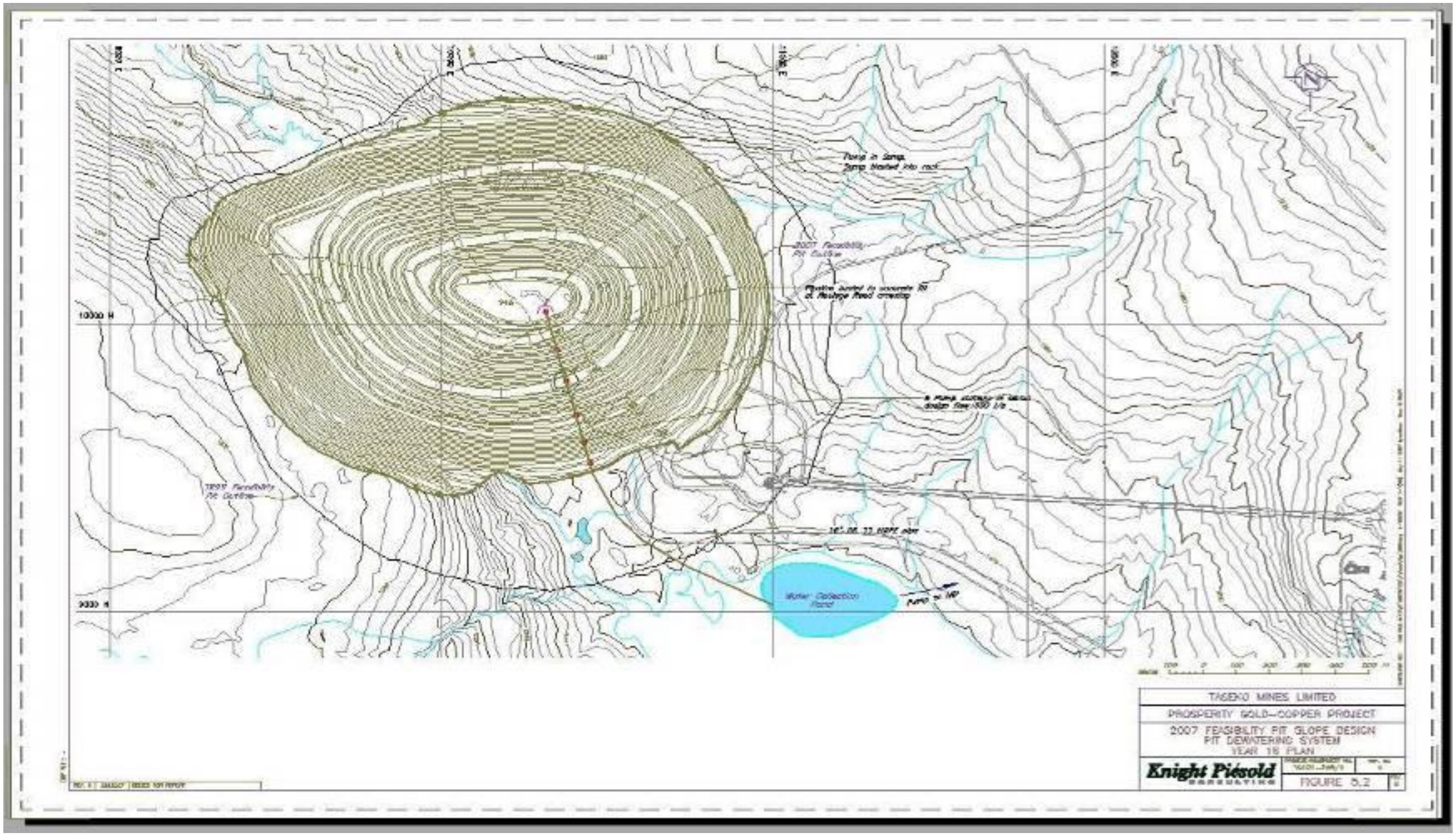

Figure 6-4 Pit Slope Design–Pit Dewatering System Year 16 Plan

6.3.3 Open Pit Operations

The open pit will be mined in four phases commencing with the Phase 1 starter pit. The pit will be partially pre-stripped during the preproduction development period. The starter pit will provide building materials for the tailings impoundment starter dam. The Phase 2 through Phase 4 pits are radial expansions of the mine about the Starter Pit creating a progressively deeper pit.

A variable decreasing cut-off strategy has been employed over the life of the mine. This results in a low-grade stockpile at the end of the open pit mine life. The low grade material is split into two categories by value in order to prioritize later processing.

The mine production forecast has been derived by scheduling ore to provide approximately 25 Mt of ore to the primary crusher annually. The mine will operate 24 hours per day, 365 days per year with a nominal crusher throughput of 70,000 tpd and a life of mine strip ratio of 0.8 tonnes of waste per tonne of ore. The material movement requirements are shown graphically in Figure 6-5.

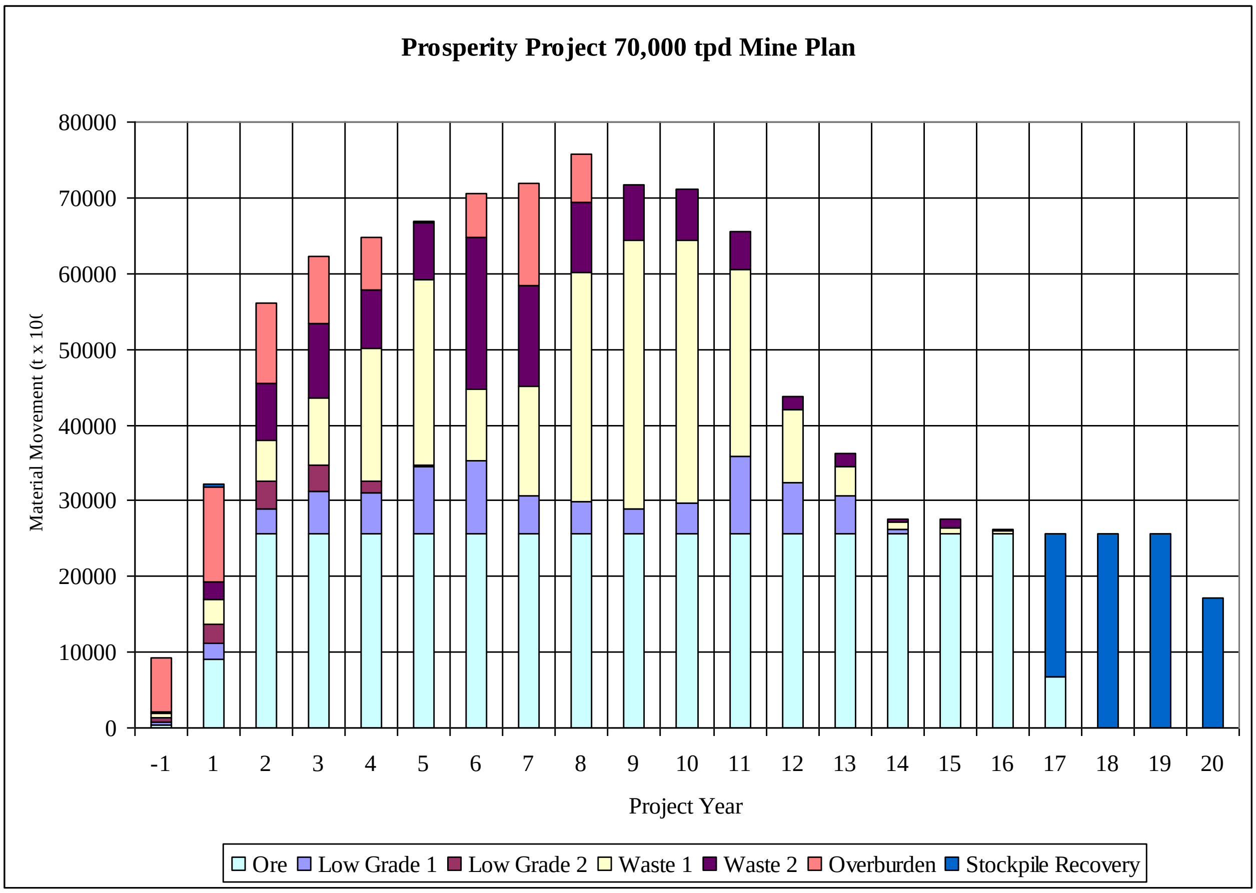

Figure 6-5 Material Movement Schedule

Ore production from the open pit will cease in Year 17 of the current mine plan. Recovery of the lower grade ore from stockpiles will sustain mill production through the middle of Year 20 of the mine plan.

The primary mining fleet in this conventional open pit shovel/truck operation will consist of up to 30–222 t trucks, three 43 m^3 electric cable shovels and four electric rotary blasthole drills. The surfaces of roads, dumps and operating benches will be maintained with a support equipment fleet including track dozers, graders, and excavators.

The life of mine equipment requirement has been summarized in Table 6-2. This does not include the mobile equipment fleet assigned to the mill as plant services equipment.

Haul roads will be required from the mine to the crusher, stockpiles, overburden spoil piles, waste dumps and the TSF for construction and waste storage. These roads will be constructed with non-PAG materials derived from mine operations. They will be built with an operating surface of 30 m and additional allowance for ditches and berms where required. The major haul roads are shown in the mine development drawings following in Figures 6–6 through 6–13.

6.3.4 Explosives

The mining process requires the use of explosives to break apart the rock in the open pit for recovery of the ore for processing and separation from the surrounding waste rock. Due to the large volumes of explosive required and the remote location of the mine site, explosives will be manufactured at the mine site.

Taseko is responsible for the safe management of explosives on the site. This will include any tasks contracted out to a third party. Natural Resources Canada (NRCan) is responsible for regulating the use of explosives under the *Explosives Act*. Section7(1)(a) of the *Explosives Act* states that the Minister of Natural Resources Canada must issue a license for an explosives factory (manufacture) and magazine (storage).

The Prosperity project explosives facilities will comply with all regulatory requirements throughout the construction, operations and closure phases of the project. A fenced compound labeled Explosives Storage as shown on Figure 6-6 will be the site of a contracted explosives manufacturing plant. The compound will include a number of buildings including a fully contained manufacturing plant, storage tanks and silos and plant services. The buildings and site will meet the bulk guidelines published by the Explosives Regulatory Division (ERD) of Natural Resources Canada as well as local, provincial and federal regulations. A sump in the manufacturing plant building will collect any water for eventual emulsion/oil/water separation and disposal.

Two magazines located at the end of the road to the fenced compound as shown on Figure 6-6 will conform to standards set by the Department of Energy, Mines and Resources Canada. The magazines will be bullet-proof, fire resistant, theft-resistant, weather proof, and well ventilated. The magazines are located a safe distance away from both the main site and any main structures or roads, in accordance with Natural Resources Canada Explosives Regulatory Division's Quantity-Distance criteria.

The final configuration and detailed design of the structures on the compound site will be completed as part of the permitting process. The general layout of the site will be designed to allow for ample turning space for bulk transport trucks for the raw materials used in the manufacture of the bulk emulsion explosives and to contain accidental spills if they were to occur.

Ammonium nitrate prill (ANP) will be unloaded pneumatically into one of two 80 tonne overhead storage bins adjacent to the manufacturing plant. It will be transferred to two 100 tonne stainless steel heating tanks located in the manufacturing plant to produce AN solution (ANS). Off-loaded ANS will be unloaded into a storage tank.

Diesel fuel will be used in the manufacture of the emulsion-based explosive. It will be stored in a diesel fuel storage tank, located at least 25 m away from the manufacturing plant and will likely be re-supplied by truck from the mine’s central fuel farm.

An industry standard surfactant is required in the process. The material will be trucked to site and pneumatically unloaded into a 35,000 L storage tank located inside the manufacturing plant.

Sodium nitrate and ethylene glycol are required for the emulsion production process and will be stored in a separate building in the compound.

The manufacturing process will also require some 10,000 L/d of water, to be sourced from the site water distribution system.

A truck storage/wash bay facility in the compound will have a sump and evaporation system for collecting wash water and wastes. The resulting residue will either be recycled into the manufacturing process or disposed of in a blast borehole.

Emulsion explosive will be delivered to the appropriate pit for offloading into the pre-drilled blast holes using a vehicle specially designed for this purpose. Blasting will typically be done once per day. The explosives delivery vehicles will typically be able to load 20–25 holes per trip. An average pattern size of 150–200 holes will be completed and shot (blasted) at a frequency of 2 to 3 per week.

During the filling of each hole with explosives, a Prosperity employee will load the hole with a blasting cap and run detonating cord connecting the holes together for subsequent blasting.

During the construction phase, the use of explosives may be required as part of bedrock excavation associated with the road alignment, bulk earth works and diversion channel. For these activities explosive containers known as “day-boxes” will be used in the field in support of bedrock excavation. The empty day-boxes will be stored during non-working hours in secure areas accessible by authorized staff only. Required explosives quantities will be brought into the field each day from these central locations and kept in secure areas throughout the workday. Also during this construction phase Bulk Explosive products may be transported from existing explosive facilities at the Gibraltar Mine. The activity will continue until the permanent facility is constructed and commissioned at Prosperity.

Table 6-2 Mine Production Equipment

Project Year	Pre-prod	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Major Equipment																					
Blasthole drill		1	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	0	0	0	0
Hydraulic drill	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
Cable shovel (4100)		1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1
Wheel loader (L1850)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Haul truck (220t)		4	12	20	22	25	25	25	28	30	30	30	25	17	16	16	16	8	4	4	4
Haul truck (190t)	5	5	3																		
Track dozer (D10)	4	4	4	5	7	7	7	7	7	7	7	7	5	4	4	4	3	2	2	2	2
Wheel dozer (834)	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1
Grader (16M)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2
Water truck (190t)	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Scraper (637)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3	1
Portable crusher (550JG)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Support Equipment																					
Blasthole stemmer	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0
Cable reeler (980)	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
966 wheel loader	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
980 wheel loader	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Compactor	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Excavator (325)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Low bed (90t)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tire manipulator (980)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Lighting plant	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Engineering 4x4	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2
Engineering 4x2	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3	3
Pit services 4x4	4	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	8	8	8	8
Pit services 4x2	0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	2	2	2
Pit services bus (20 pass)	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1
Pit services but (32 pass)	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Shovel crew rat deck (3t)	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1
Shovel crew hiab (5t)	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Shovel crew hiab (10t)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Surface crew stinger	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Fuel and lube truck	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	2	1	1	1	1
Blasting truck	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0
Light repair truck	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Water truck	2	2																			
Western star	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1

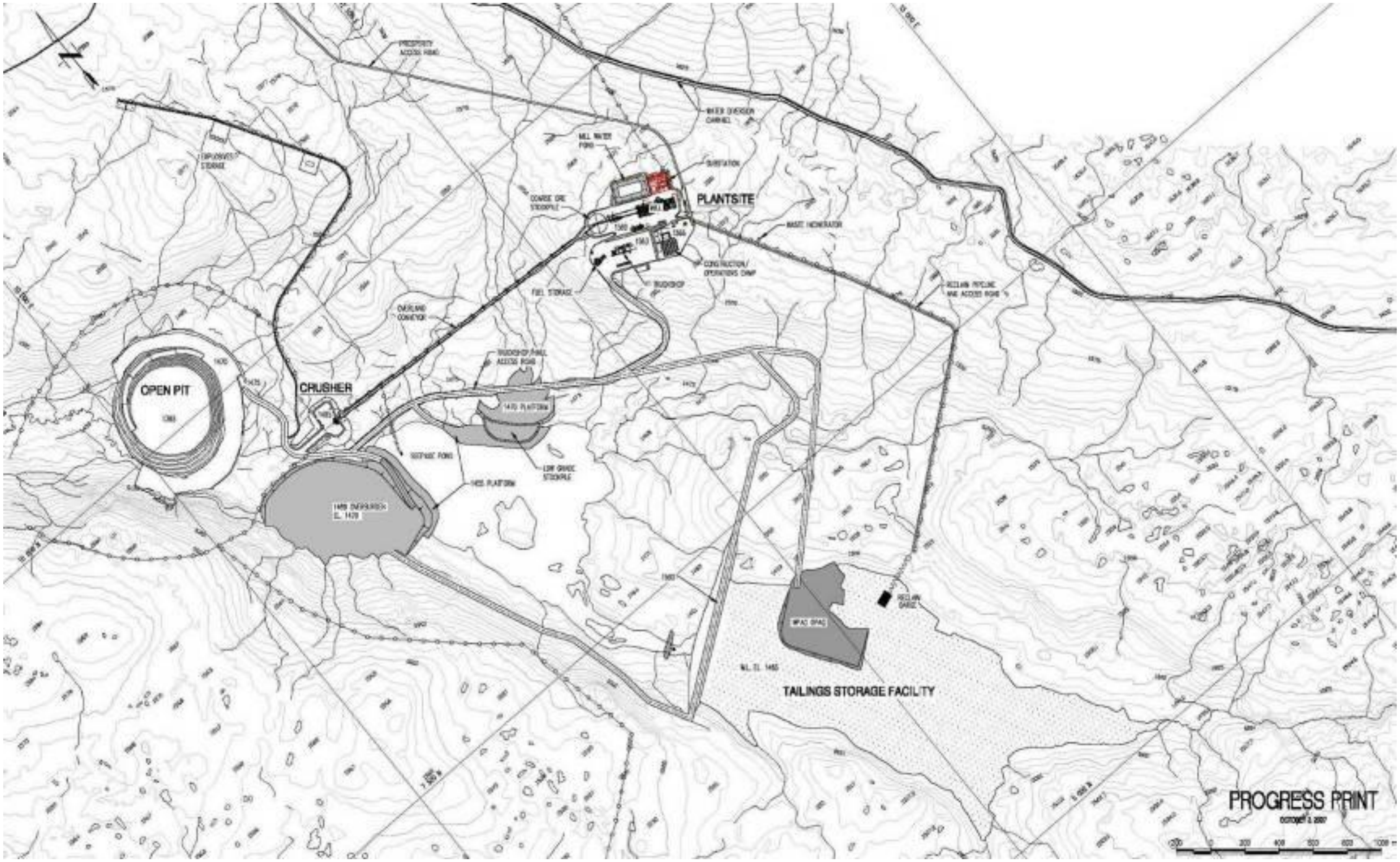

Figure 6-6 Pit and Stockpiles Plan End of Year 1

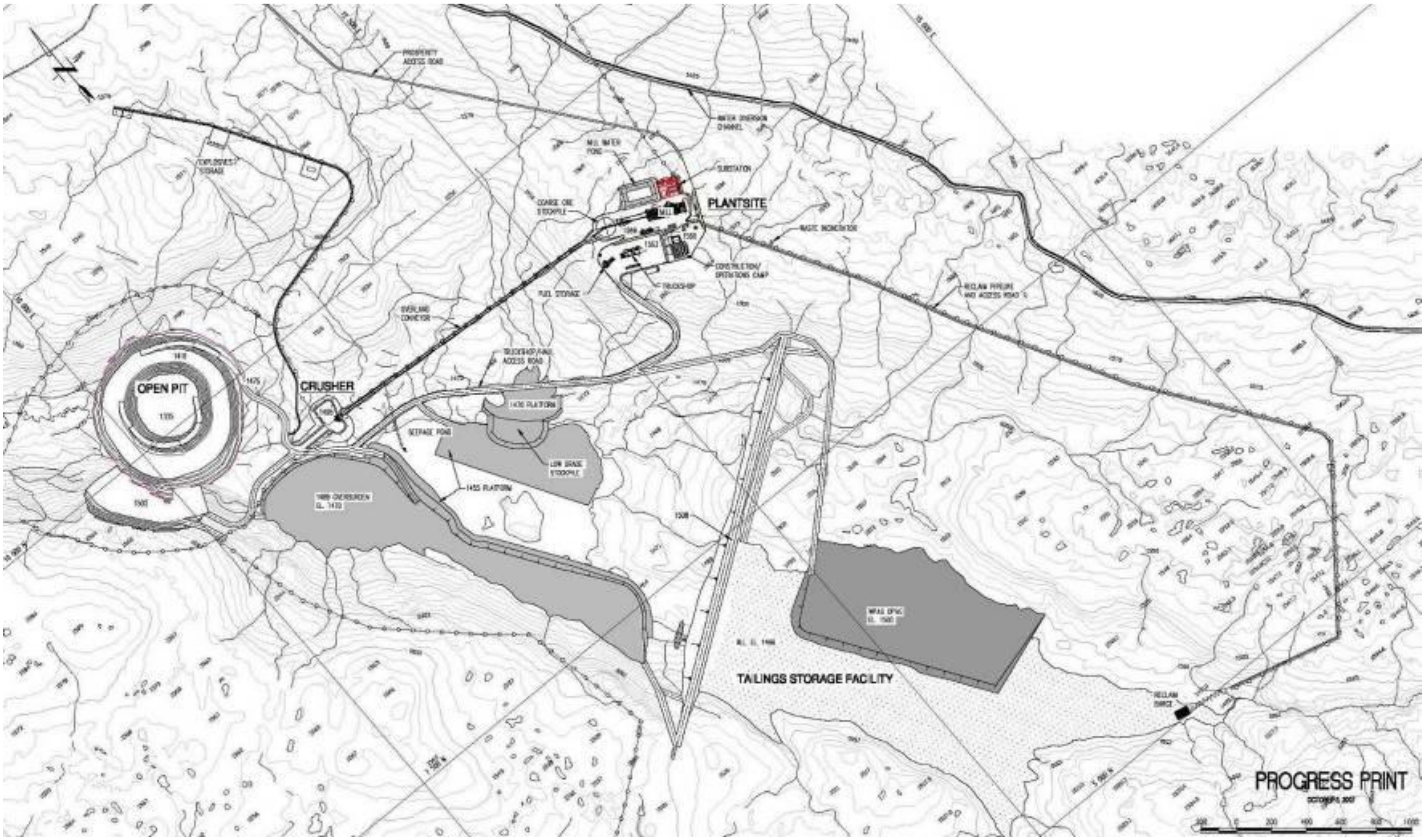

Figure 6-7 Pit and Stockpiles Plan–End of Year 2

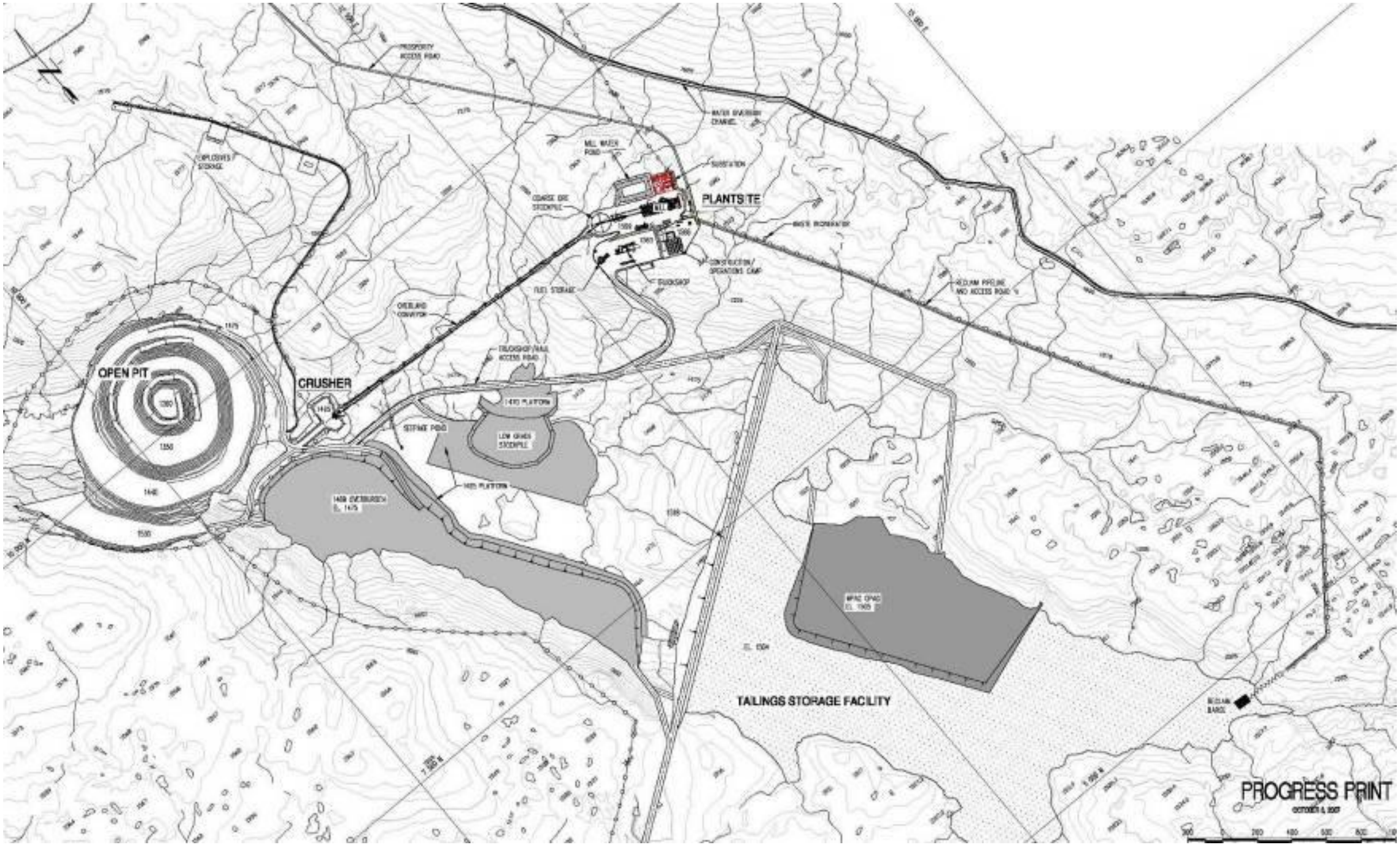

Figure 6-8 **Pit and Stockpiles Plan–End of Year 3**

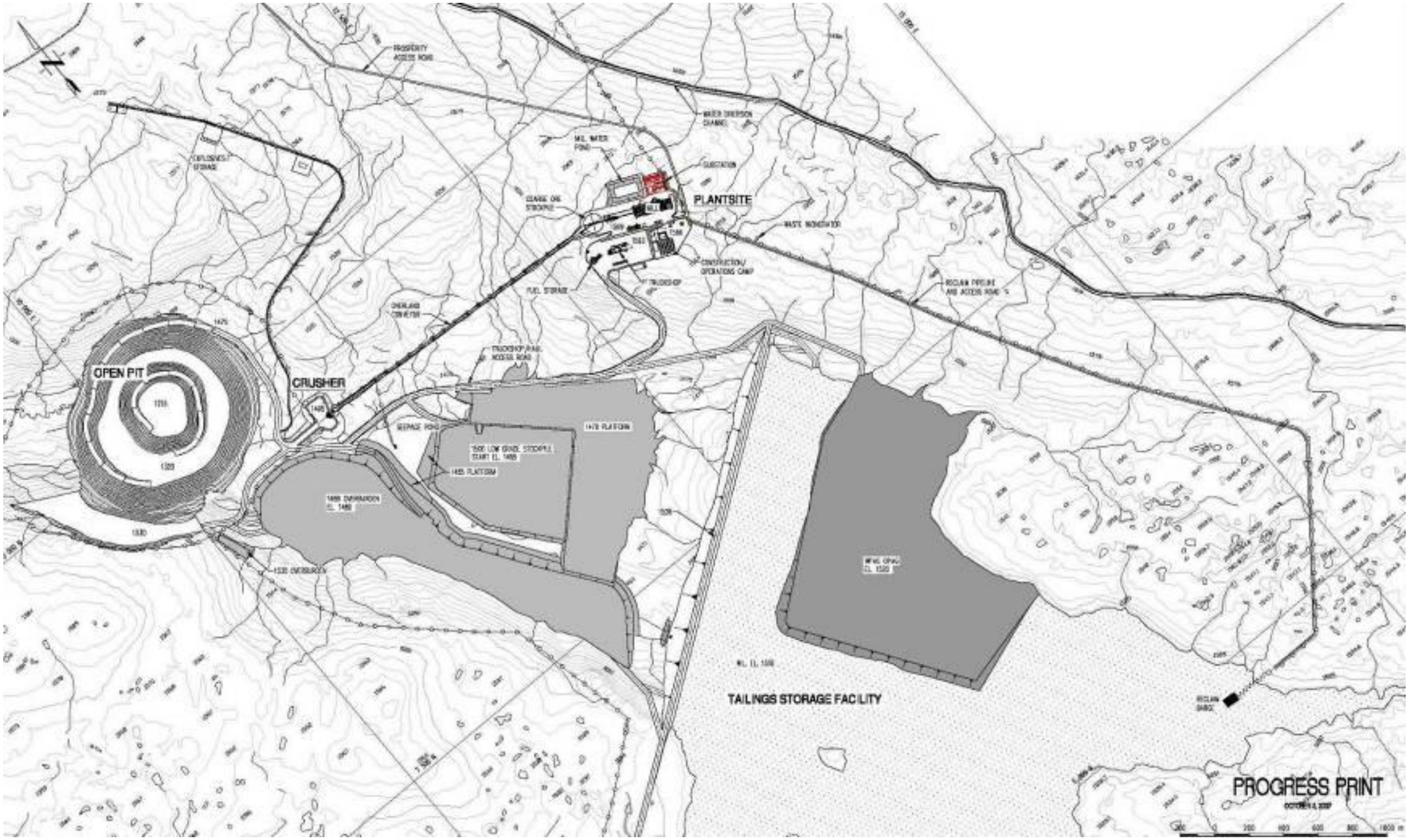

Figure 6-9 Pit and Stockpiles Plan–End of Year 5

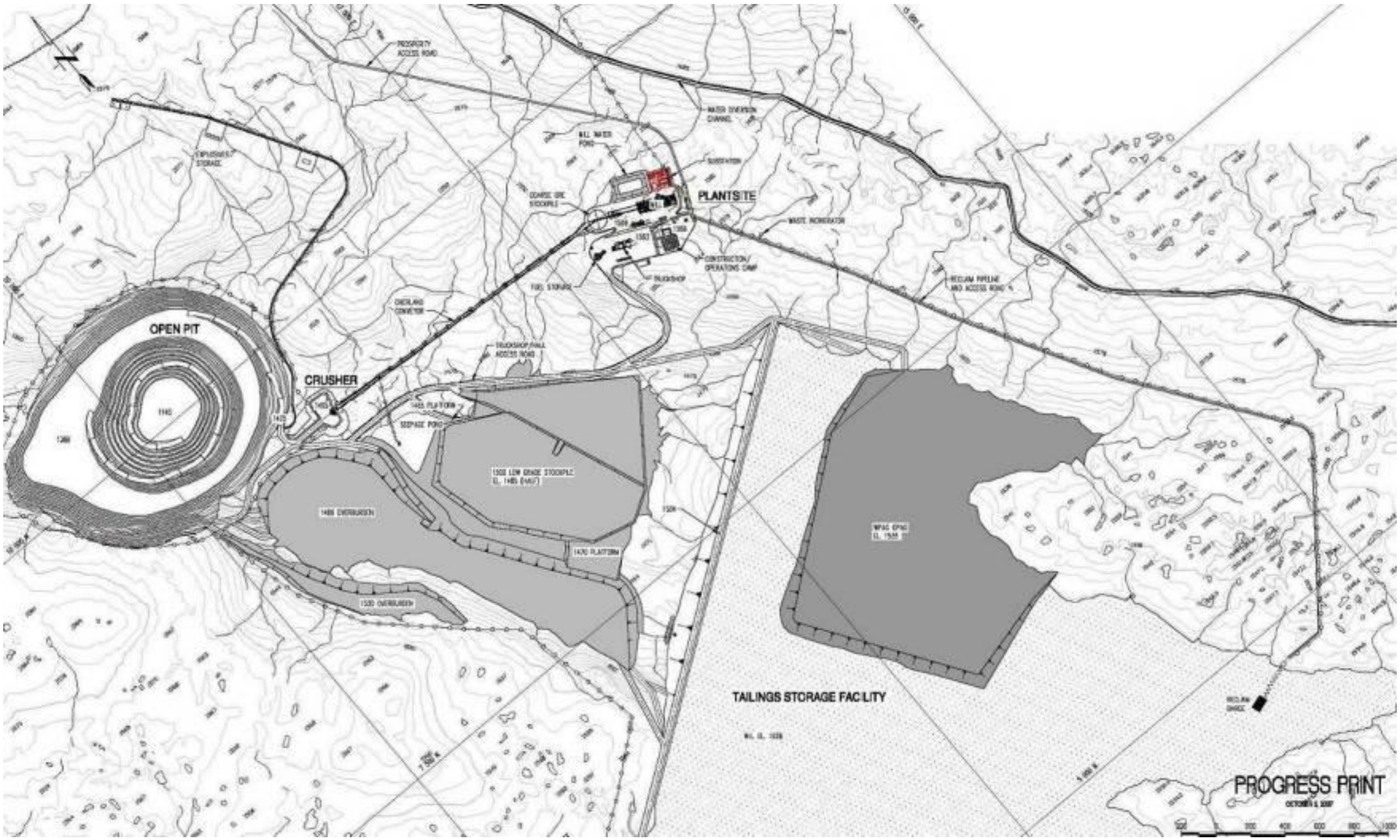

Figure 6-10 Pit and Stockpiles Plan–End of Year 8

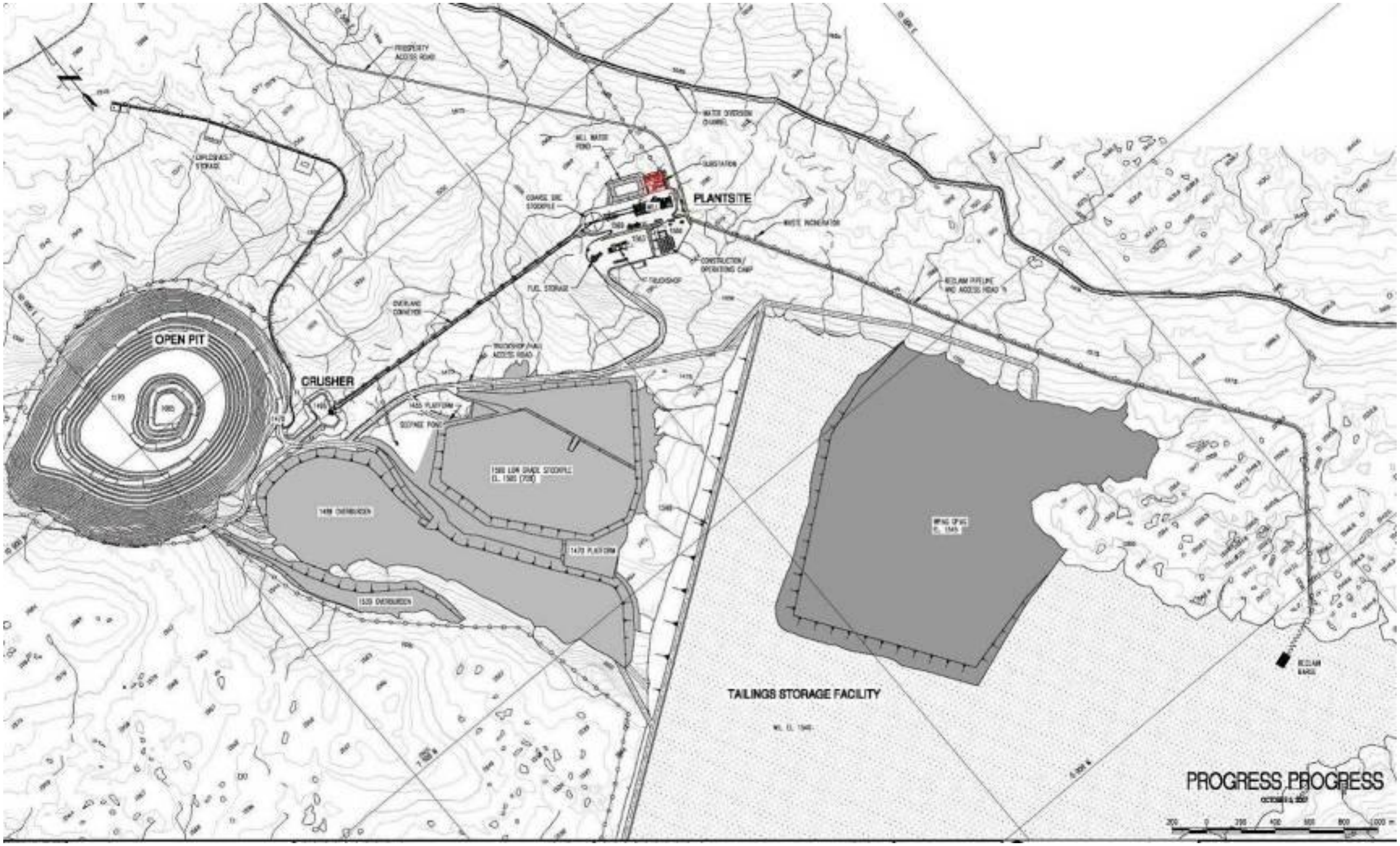

Figure 6-11 Pit and Stockpiles Plan–End of Year 12

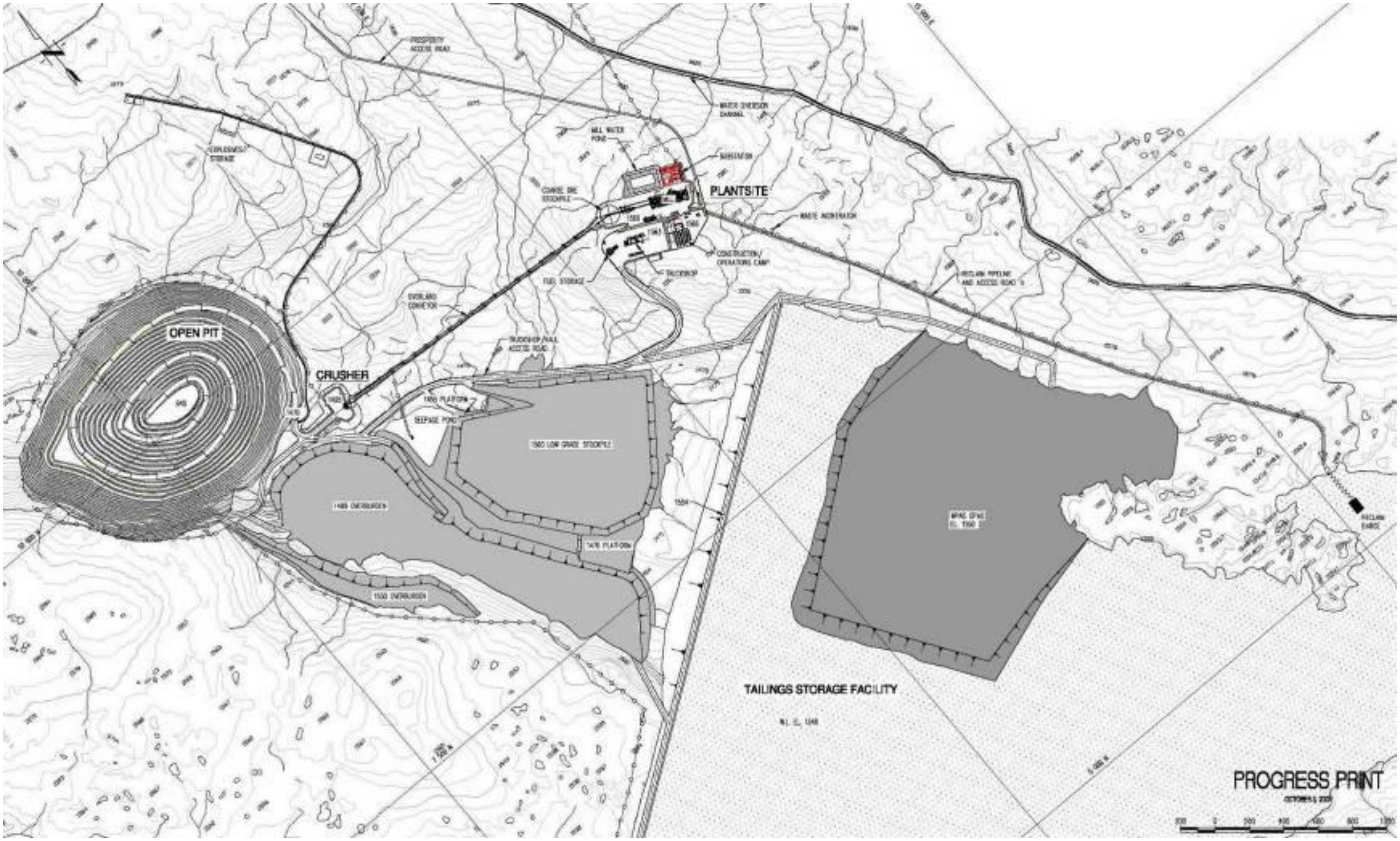

Figure 6-12 Pit and Stockpiles Plan–End of Year 16

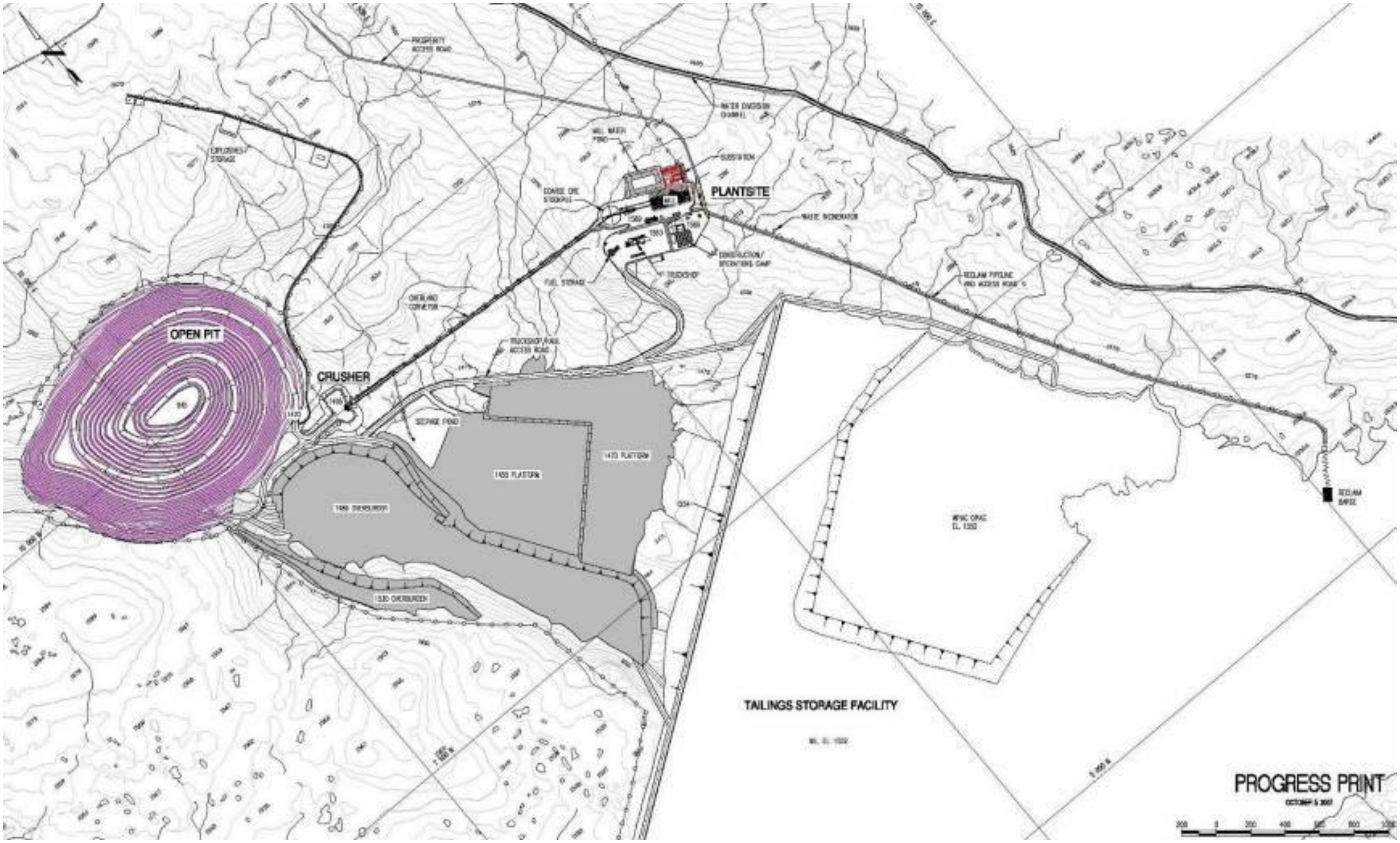

Figure 6-13 Pit and Stockpiles Plan–End of Year 20

6.3.5 Waste Rock Storage

The waste or non-ore material types mined from the pit are subdivided into overburden, waste rock and low grade ore. These materials are further subdivided into PAG and non-PAG proportions of each respective material type if appropriate. Sub-aqueous storage is proposed for PAG overburden and waste rock and the balance of the overburden and waste can be used for construction purposes or placed on surface storage sites where surface drainage is controlled.

The total waste material types are 12 Mt of PAG overburden, 60 Mt of non-PAG overburden, 225 Mt of PAG waste and 102 Mt of non-PAG waste. For mine planning purposes 32 Mt of basalt, which occurs perched in the overburden, has been treated as non-PAG waste rock. In the ARD modelling work this basalt has been included as non-PAG overburden.

The area underlying the overburden and waste dump site is characterized by up to 20 m of glacial till, which overlies Quaternary Glaciofluvial and Glaciolacustrine units. These in turn overlie Miocene Basalt flows and a Miocene Glaciofluvial Unit followed by glacial till and colluvium. These units extend south and overlie the open pit area as well.

The PAG overburden contains weathered rock which includes oxidized or partially weathered sulphide minerals. This material will be placed in the tailings management facility.

Non-PAG overburden will be placed in the overburden stockpile located to the south of the open pit. Overburden piles will be developed in 30m high benches, each offset from the downstream edge by 20 m to provide an overall slope of approximately 2H:1V. Each bench will be constructed from lifts of approximately 15 m by end dumping the material to form an angle of repose slope angle of approximately 1.3H:1V. The final overburden pile will be approximately 60 m high with a final elevation of 1530 m.

The total PAG waste (rock and overburden) which may have potential for acid generation (PAG) is 237 Mt. This quantity of material will be hauled from the pit and placed in the tailings management facility as described in Section 6.7.10.

The variable cut-off grade production will result in the production of low grade ore. The low grade material will be stockpiled separately on the east side of the non-PAG waste rock pad built on the current site of Fish Lake. These stockpiles will be built in 30 m lifts to the natural angle of repose.

As described above the dumps and stockpiles will be constructed in lifts with berms left at 30 m intervals. Overall final slopes will be 2H:1V and crests will be contoured for reclamation. Prior to placement of overburden and waste in the stockpile areas the vegetation will be cleared, and diversion and runoff collection ditches will be constructed.

Stability analyses have been carried out for waste rock and overburden piles. The analyses were performed for static and seismic conditions. A limit equilibrium method of calculation was used. Minimum factors of safety for the static state were 1.5 for overburden and waste rock and for seismic conditions 1.2 for overburden and 1.2 for waste rock.

6.4 Mineral Processing

6.4.1 General

A conventional crushing, grinding and flotation process plant is proposed for the project, utilizing standard unit processes and equipment. The process design criteria are based on a combination of test work results from Prosperity ores, experience from other similar operations, and industry standards.

Figure 6-14 illustrates a simplified flowsheet for the process which will have a nominal throughput of 70,000 dry tpd.

The concentrator will be located approximately 2 km southeast of the open pit and will generally be built on a shallow cut.

Ore will be dumped into the primary crusher located adjacent to the open pit. The crushed ore will then be conveyed to a coarse stockpile where it will subsequently be fed to the grinding circuit which consists of one SAG mill and two ball mills.

Once the ore has been ground to 170 μ, it will be fed to the bulk rougher flotation cells via the overflow of a cyclopac. All of the rougher concentrate will be further reduced in size to 20 μ using five vertimills and then pumped to a bulk cleaner stage in which the concentrate from the rougher cells is pumped to three cleaner flotation stages while the scavenger tails is gravity fed along with the bulk rougher tails to the tailings pond. The third cleaner concentrate will be thickened, stored and dewatered.

Copper concentrate of 25% copper grade and 7.5% moisture will be the final product. The plant will operate 24 hours per day, 365 days per year with scheduled downtime for equipment maintenance.

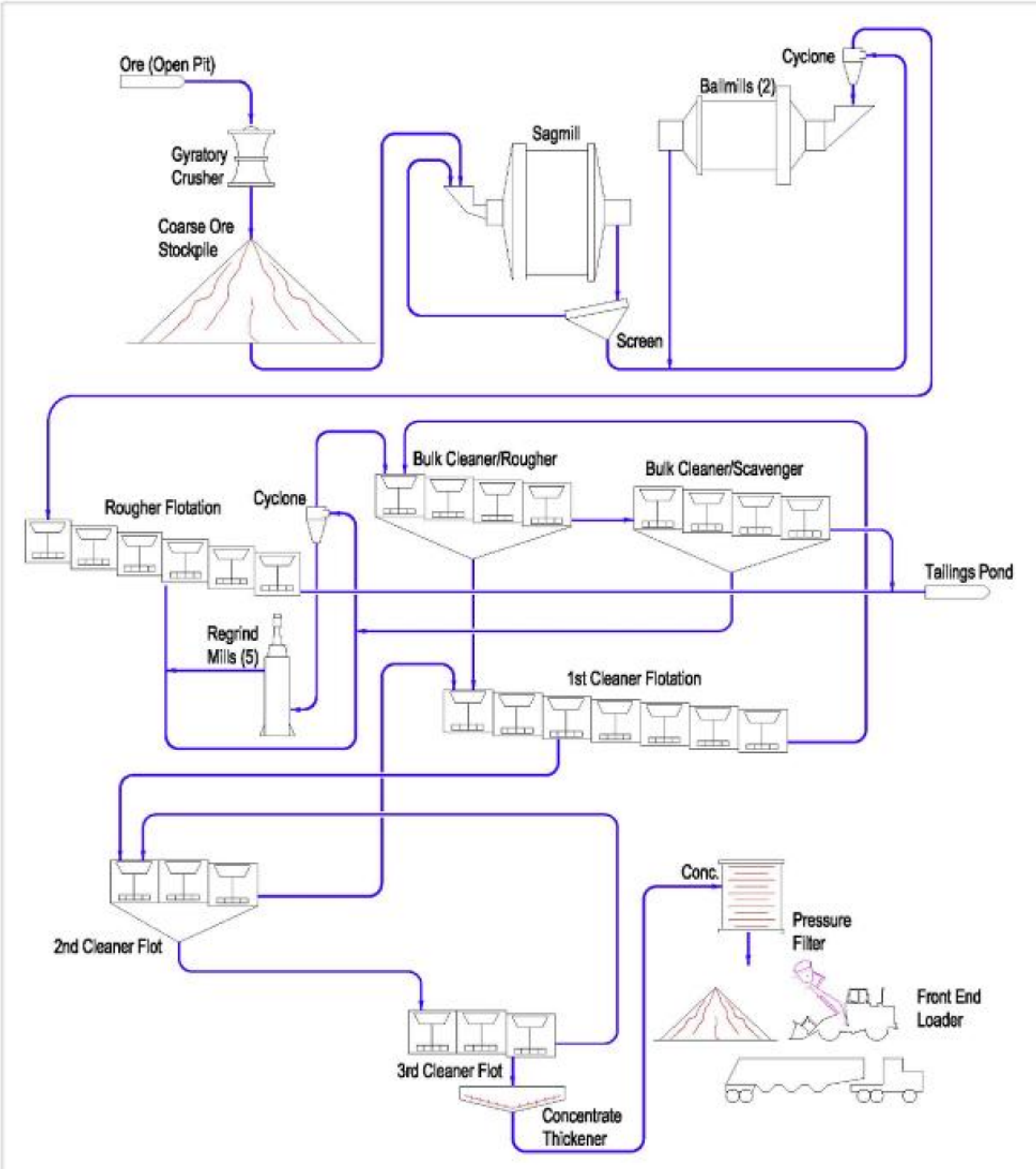

Figure 6-14 Simplified Flowsheet

6.4.2 Primary Crushing

Ore will be hauled from the open pit mining operation to the primary crushing facilities and dumped directly into the dump pocket. There will be two dumping locations directly opposite one another. A rock breaker will be installed over the dump pocket to break large pieces and avoid plugging. An atomizing spray fog system utilizing compressed air and fresh water will be activated during truck dump to control dust emissions.

The gyratory crusher will operate to produce a product size of 80% passing 150 mm. The product will be discharged into a surge bin. From the bin, the ore will be withdrawn with an apron feeder onto the coarse ore conveyor. A fog system will also be employed at the transfer points below the gyratory crusher to reduce fugitive dust emissions and improve working conditions.

A dedicated compressor and air receiver will be situated in the building to provide instrument air as well as air for the dust suppression system.

6.4.3 Coarse Ore Transfer, Storage and Reclaim

The coarse ore conveyor is 1900 m long. The max slope of the conveyor will be 14° and there is single discharge onto the coarse ore stockpile with a live capacity of 17 hours. In order to reduce dust emissions, there will be a water suppression system at the discharge point of the coarse ore stockpile.

Reclaim from the coarse ore stockpile will be provided by three inline apron feeders which can handle the full tonnage using only two of the three feeders. This overcapacity allows full tonnage to be achieved even if one of the belt feeders is undergoing maintenance. The apron feeders will feed onto a single SAG mill feed conveyor. Dust collectors with pickups around the crusher, conveyors and ore transfer points will be installed to minimize fugitive dust in this area.

6.4.4 Concentrator

Figure 6-15 depicts the concentrator building looking south.

The concentrator building (13,600 m^2) is a pre-engineered structure divided into three main sections: the grinding section, which houses the SAG mill and two ball mills, the beneficiation section which houses the flotation cells and vertimills, the reagent storage and tailings handling and the concentrate handling section which houses the thickening, filtration and concentrate load out systems. Tailings can be gravity fed for the first four years of operation and subsequently, only part of the tails will be pumped. Reclaim water is pumped from the tailings dam located 2 km southwest of the concentrator and stored on site.

SAG Mill Circuit

Figure 6-16 shows a picture of the SAG and Ball Mill circuit looking southwest.

Ore will be reclaimed from the coarse ore stockpile via three apron feeders which will in turn feed a SAG mill feed conveyor. The apron feeders will be controlled by a weightometer on the SAG mill conveyor to achieve the nominal operating rate. The 40 x 20 ft SAG mill will be driven by a 21 MW gearless, variable speed drive which will be cooled using fresh water. Process water will be added to the feed chute to achieve a 70% solids concentration in the mill.

Ball Mill Circuit

The ball mill system consists of two 26 x 42 ft mills each in closed circuit with a cyclopac. The cylcopac overflows will feed the bulk rougher circuit while the underflow will be directed to the ball mills to be further ground. The ball mills will be driven by 18 MW gearless, variable speed drives which will be cooled using fresh water. The overflow discharge from each of the ball mills will feed the single SAG mill discharge sump via two launders which will run half-full. These streams along with the SAG mill circuit product will be diluted to 54% solids and then two parallel pumping systems will transport the slurry to the cyclopacs.

Flotation and Regrind

Figure 6-17 shows a picture of the Flotation circuit looking northwest.

Both of the ball mill cyclopac overflows will feed a distributor which feeds three banks of six, 200 m^3 rougher flotation cells giving a mass pull of about 8%. The rougher concentrate from the three banks will be pumped separately to the regrind circuit while the tailings will be gravity fed to the tailings launder.

The rougher concentrate will be reground in five vertimills, each operating in closed circuit with a cyclopac to achieve a product grind of 80% passing 20 µm. The underflow from each cyclopac will be fed back to the vertimill.

The cyclopac overflows will be combined and laundered to a bulk cleaner rougher/scavenger stage. The concentrate from a double bank of bulk cleaner rougher cells, 8 x 130 m^3, is pumped to a three stage cleaner circuit while the tails feeds the bulk cleaner scavenger cells. The concentrate from the bulk cleaner scavenger cells is pumped back to the regrind circuit via the distributor to facilitate further mineral liberation while the tails will be sampled and then gravity fed to the tailings launder.

The cleaning circuit consists of first, second and third cleaner cells with 6 x 30 m^3 and 3 x 30 m^3 configurations respectively. First cleaner concentrate will be pumped to the second cleaner flotation cells while its tailings stream will be pumped to the bulk cleaner rougher bank. The second cleaner will process the combined third cleaner tails/first cleaner concentrate. The tails from the second cleaner will feed the first cleaner cells while the concentrate will be fed to the third cleaner cells. The tails from the third cleaner circuit will gravity feed to the second cleaner cells while the concentrate will be fed to the dewatering circuit.

The concentrator load-out area will be a slab on grade. A front end loader will load concentrate trucks positioned on a truck weight scale. The concentrate thickener and stock tanks will be located at grade inside the load-out section.

Reagents

As common with every flotation process, chemical reagents will be used to aid in achieving the optimal conditions for the recovery of the desired minerals.

The specific chemical reagents have not yet been finalized but test work to date indicates use of some or all of the following:

Collector:	Xanthate PIBX; typically Sodium Isopropyl Xanthate (NAX) and/or Potassium Amyl Xanthate (PAX)
Collector:	Thionocarbamate; Thiophosphate; Thiophosphate

Frother:	Typically MIBC or Pine OilX7002
Flocculent:	Typically Sumaflox 5002
Lime:	CaO

Reagent selection and utilization commonly changes over the life of the project as mineral extraction is optimized.

The reagent area consists of both storage and mixing tanks for preparing the reagents for use. Storage on site for each of the reagents will be at least four days.

Both pulverized quicklime and MIBC will be stored in tanks outside the concentrator. The lime silo will have a slaking system directly underneath the skirted silo and the resulting slurry will be pumped to a lime holding tank. From the holding tank, lime slurry will be pumped in a loop within the plant and returned back to the holding tank with pinch valves located adjacent to the points of use. Lime will be delivered by a bulk tanker once per day. The MIBC is stored outside, as it must be segregated because it is a flammable substance. Five metering pumps, including one spare, will be located inside. The MIBC will be delivered by a bulk tanker (20 m^3) once every two months.

SIBX and flocculent will be delivered in bulk bags and stored in a dedicated area adjacent to the rougher flotation cells. The PAX will be delivered in an 800 kg bulk bag which will be broken in a hopper, fed to a mixing tank and then diluted to the corrected consistency with fresh water.

Flocculent will be delivered in 25 kg sacs and will be manually added to the package system which includes an eductor for carefully wetting the flocculent flakes ensuring they maintain their integrity, and a storage tank which further mixes the floc-water mixture to the appropriate consistency. This product is then gravity fed to a storage tank from where it is pumped to the thickeners using metering pumps. Further water dilution is added after pumping to bring it to the delivery consistency.

The liquid reagent 312/401 will be delivered by bulk truck and stored and subsequently pumped by metering pumps to the flotation circuit.

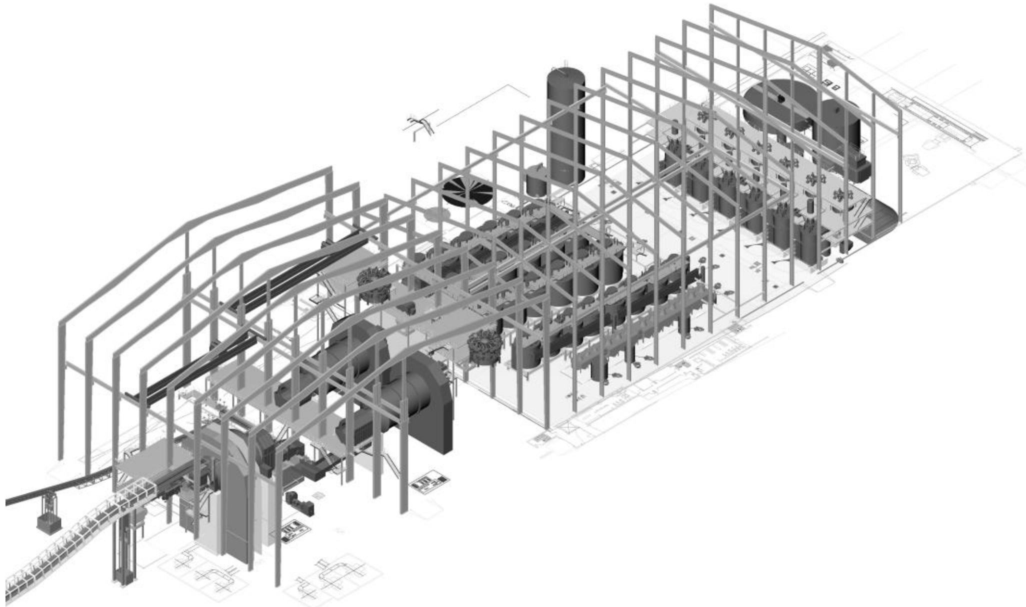

Figure 6-15 Overall Concentrator Layout

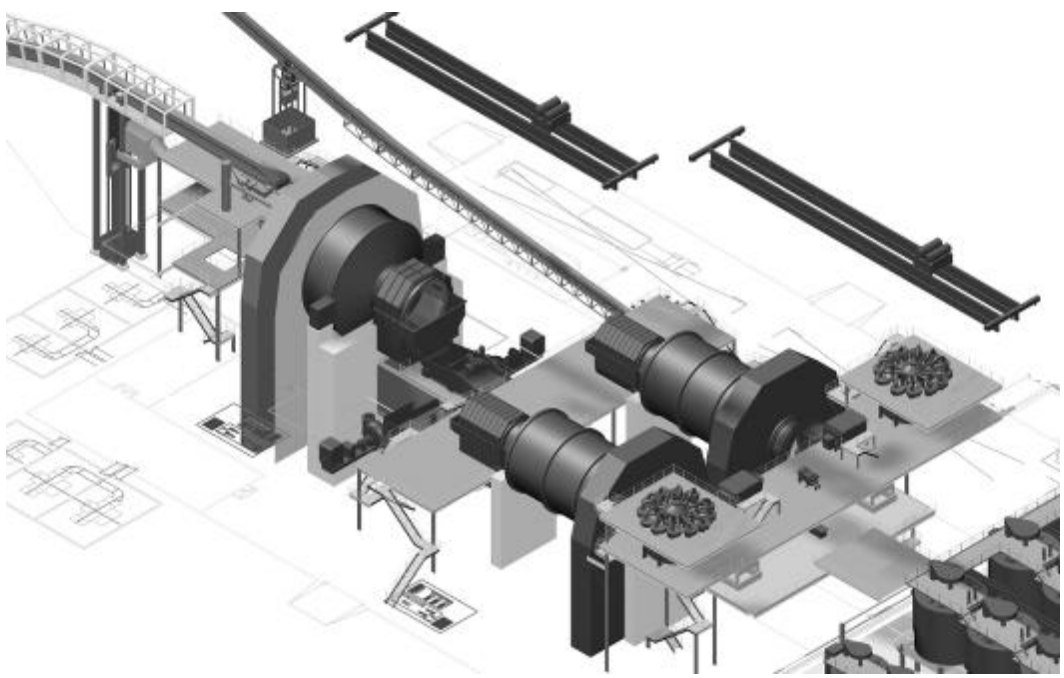

Figure 6-16 Ball and SAG Mill Layout

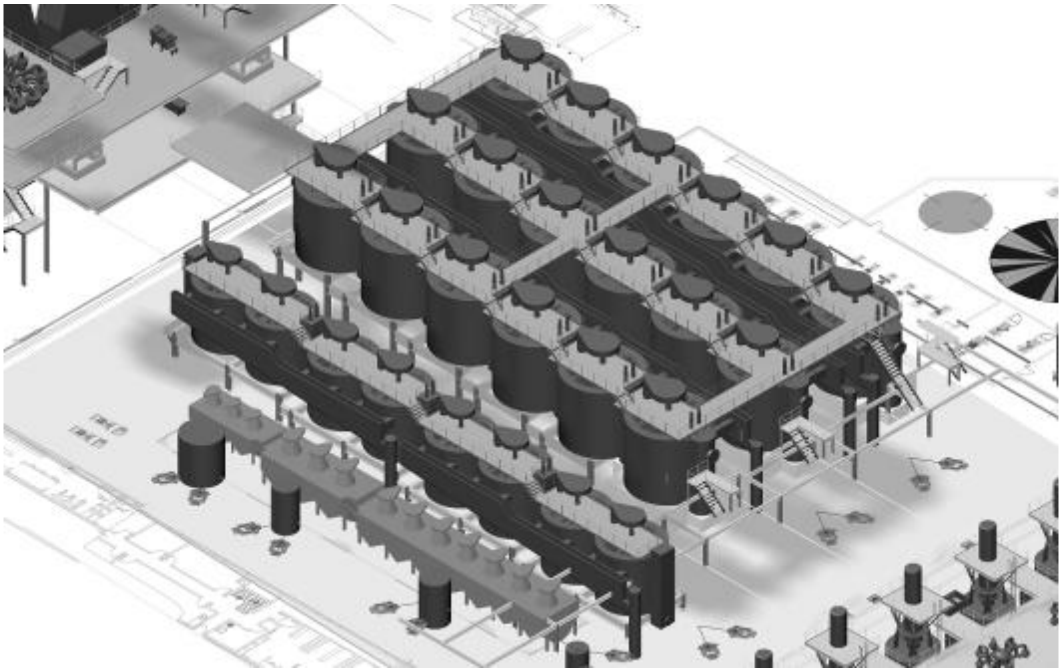

Figure 6-17 Flotation Cells

6.5 Process Buildings and other Infrastructure

6.5.1 General

The plant site, which includes the ore processing and ancillary facilities, will be located on the east flank within the Fish Creek watershed.

The primary crusher will be located approximately 600 m southeast of the Year 1 open pit or 200 m from the ultimate open pit limits. The facility includes one primary crusher building with a truck dump pad at an elevation of 1495 m. The crushed coarse ore will be transported by an overland conveyor from the crusher discharge to the mill coarse ore stockpile.

The overland conveyor will generally follow in existing topography on a prepared gravel bed on an upslope route to the coarse ore stockpile 1.9 km due east. A single lane service road will be provided along one side of the conveyor. Tree clearing along the conveyor corridor will be sufficient to prevent any damage to the conveyor from falling trees and to provide space for snow removal.

The mill site will be located east of the primary crusher on a relatively flat natural plateau on the east slope of the valley. Primary structures on the mill site will include coarse ore stockpile and reclaim facilities, concentrator building, main 230 kV substation, service complex, and assay laboratory. The mill site will be at a nominal elevation of 1560 m. The tailings storage facility will be located in the upper Fish Creek valley, 1 km south of the mill site. The tailing dam starter embankment crest will be at an elevation of 1496 m and the ultimate crest is estimated to reach an elevation of 1554 m.

The camp, which will serve both construction and operations, will be located south of, and on the same natural plateau as the mill site.

The criteria considered and the reasons for selecting the plant and ancillary facilities locations based on the following:

- environmental impacts
- geotechnical conditions required for building and heavy equipment foundations
- haul distance from the pit to the primary crushing facilities
- gravity flow of tailings into the tailings storage facility for the first four years of the operation and pump tailings for the rest of the operating life of the plant
- drainage characteristics
- prevailing wind direction (from west to east)
- exposure to sun (southern and western orientation of mill site)
- accessibility
- traffic patterns (conflicts between mine and mill operations)

6.5.2 Crushing and Storage System

The ore will be hauled from the open pit to the primary crusher dump pocket. The transit of the haul trucks from the pit to the crusher will be approximately 200 to 400 m. The short duration and distance will limit the dust generated by wind.

The covered receiving dump pocket will be feeding a primary gyratory crusher located in an enclosed building.

The dump pocket is equipped with a hydraulic rock breaker to reduce oversize chunks of rocks. The operation of the rock breaker will not be a significant source of dust due to the relatively small amount and large size of the material. The dump pocket will be designed to minimize the amount of fugitive dust by reducing the drop height from the truck to the crusher. The dump pocket will be equipped with a dust suppression fog system using a small quantity of water atomized by compressed air via special fog nozzles.

The gyratory crusher discharge and apron feeder transfers will be designed with dust containment features. The gyratory crusher apron feeder will be enclosed to provide dust containment to the extent possible without producing operational and maintenance constraints. The size and type of dust collection system will be subject to further design and review of the equipment serviced, layout, ore characteristics and ambient conditions.

The crushed ore is transferred from the primary crusher to a coarse ore stockpile via a 1.9 km long overland conveyor. The stockpile will have a live storage capacity of 50,000 t. The Coarse Ore Stockpile Feed Conveyor will be partially covered by wind hoops. The conveyor will deliver the material to the Coarse Ore Stockpile and discharge the ore to the 43 m high conical pile via head-end chute.

Ore will be reclaimed from the coarse ore stockpile by three apron feeders and transferred onto the 274 m long SAG Mill Feed Conveyor.

The SAG mill will produce up to 25% pebbles unsuitable for the ball mills to process. The pebbles will be removed by the vibrating screen located at the discharge of the SAG mill and re-cycled to the SAG Mill via conveyor. The pebble re-circulating system includes provisions for the installation of a cone crusher located next to the Coarse Ore Stockpile.

The three reclaim feeders and the pebble re-cycling conveyor will be discharging material onto the SAG Mill Feed Conveyor equipped with a continuous skirt in the reclaim tunnel. The reclaim feeders and the various transfer points will be designed with dust containment features and supplied with dedicated dust collector unit. The material captured by the dust collector unit will be returned to the SAG Mill Feed Conveyor. Furthermore, the conveyor will be partially covered by wind hoops from the reclaim tunnel to the mill building to reduce the wind sweep on the belt.

6.5.3 Mill Building

The grinding circuit, flotation circuits, regrind circuit, reagent mixing, concentrate storage and load-out areas will be contained in a single building.

A 70/10 t crane will service the SAG mill grinding area and a 50/10 t crane will service the ball mill grinding area. Additionally, two 20 t cranes will be installed over the flotation/concentrate load-out areas. The large bulk flotation cells will be installed on a slab on grade, inside the mill building. The cleaner flotation cells will be located on elevated steel platforms in the flotation section. Areas with process tanks will be provided with curbs with a spill containment capacity equal to 110% of the contents of the largest tank.

The concentrator load-out area will be a slab on grade. A front end loader will load concentrate trucks positioned on a truck weight scale. The concentrate thickener and stock tanks will be located at grade inside the load-out section. Concentrate handling will be conducted inside buildings that are sufficiently enclosed to contain and control concentrate and preclude dispersion and losses. When not in operation the load-out is to be secured with doors closed to mitigate airborne entrainment and dispersion of concentrate. Concentrate trucks are to be covered at all times except during loading or unloading.

The mill building will be a pre-engineered steel frame structure. The roof will consist of metal sheeting on steel trusses and purlins with an insulated, built-up membrane. The walls will be insulated and metal clad. An interior metal clad liner will be installed on all walls for full height to protect the insulation. The electrical rooms will have concrete block walls and the air compressor/blower rooms will be concrete block construction, for noise suppression.

There will be two control rooms provided in the grinding area to contain the instrumentation and mill motor cyclo-converters. The high voltage electrical room and cable spreading areas will be located on each side of the grinding section. Lay down areas will be located on the ground floor of the grinding and flotation section. The low voltage electrical room will be located on the second floor of the flotation area with the control room office located above.

There will be three different heating and ventilation environments provided in the mill building. In the grinding area, roof and wall exhaust fans will remove vapours and excessive heat from the process areas. To provide good air quality in the personnel work areas, fresh makeup air will be supplied with air handling equipment. Makeup air will be heated during cold weather. Additional unit heaters will also be provided at the perimeter of the building, particularly near outside doors and at ground level, where freezing is possible. Electrical rooms and control rooms will be pressurized with filtered outdoor air and air conditioned to remove excess heat to maintain a suitable environment for electrical and electronic equipment.

The flotation area will have a similar heating and ventilation system to that of the grinding area. Offices will be pressurized with filtered outdoor air. Outdoor air will also be used during warmer weather, to counteract internal heat gains from personnel and lighting. Lockers and washrooms will be exhausted to remove excess moisture. Heated makeup air will be provided through air handling equipment. The blower room will be provided with heating, as well as exhaust ventilation, to remove excess heat. Makeup air will drawn from outside through wall louvers. During colder weather the excess heat from the room will be re-directed to inside the main building as useful heat.

The concentrate load-out area exhaust fans will remove truck exhaust fumes in the truck weigh scale and truck drive-through areas. The electrical room will be pressurized with filtered outdoor air, as well as air conditioned to remove excess heat and to maintain a suitable environment for electrical and electronic equipment. The laboratory will be exhausted to remove fumes and vapours. Heated makeup air will be provided through air handling equipment. The compressor room will be provided with makeup, as well as exhaust ventilation. Makeup air will be drawn from outside through wall louvers. During colder weather the excess heat from the compressor room will be directed to inside the concentrate load-out area as useful heat.

6.5.4 Truck Shop

The truck shop and maintenance facilities will be located next to the Administration Building south of the mill building. The facilities will be housed in a pre-engineered building which includes:

- five mine and mobile equipment repair bays
- one tire shop bay
- one welding shop bay
- one wash bay

The bays have been sized to accommodate the mine and ancillary mobile service equipment. One 75/15 t crane will service two repair bays and the welding shop bay. Three 15 t overhead cranes will service the other three bays.

Space has been allocated in the building for the following shops and services:

- machine shop
- electrical shop
- truck shop warehouse

The truck shop warehouse will be used as warm storage with heating units provided throughout the area. Circulation fans will be used to de-stratify the air and an exhaust system will be provided for summer ventilation.

Air compressors and receivers will supply air for the air operated lubrication distribution pumps from a compressor room located next to the repair bays. Welding outlets will be provided together with portable welding curtains and mobile welding fume filters. Heating and ventilation units will heat these areas, particularly near the outside doors.

The units will have the capability of re-circulating air, or bringing in outdoor air, which will be dictated by the quantity of exhaust air being extracted from the area by truck exhaust fans, welding exhaust fans, or general exhaust fans.

Hose reels fed from the lubricant storage area will dispense grease and various grades of lubricants to the shops.

The wash bay will be equipped with high pressure water monitors and steam cleaning equipment. The concrete floor will be sloped towards a drain, and an oil interceptor systems plus waste oil tank will be included to store residual oils. A heating and ventilation unit will provide heating to this area, particularly near the outside doors. The unit will re-circulate air during periods that a truck is idling, but will supply heated outdoor air whenever the exhaust fan is energized.

A sloping concrete apron will extend 15 m in front of the tire repair bay, and bollard sets will be provided to protect the building entrances from vehicular damage.

6.5.5 Warehouse

The warehouse will be located immediately south of the Mill Building in a stretch fabric structure. The total area allocated for warehousing will be 20 m wide x 80 m long.

The warehouse will be used as a cold storage area for the plant with shelving and material retrieval systems included.

6.5.6 Administration Building

The administration and change house facilities will be located next to the Truck Shop, south of the Mill Building. The facilities will be contained in pre-fabricated units with 425 m^2 allocated for the administration offices and 1071 m^2 allocated for the Mine Dry change rooms.

Office space in the administration building will be allocated to the general manager, employee relations, administration, purchasing, accounting, planning, general engineering, geology, mine planning and technical services. Furthermore, there will be divided open areas for geologists and mining engineers, technicians, draftsmen and surveyors. There will also be separate areas for the reception, clerical and secretarial personnel. The balance of the space will house an engineering records room, copy room, lunchroom, conference/meeting room, storage and utility rooms and washrooms.

The offices and open areas will be ventilated and air-conditioned. The supply air systems will be zoned such that offices in the interior will be on different zones to those on the perimeter of the building. Toilets and dry areas will be exhausted to outdoors. Makeup air to these areas will be heated and supplied through air handling equipment. Washrooms and showers will be ventilated at the rate of 12 to 15 air changes per hour, and locker areas will have 6 air changes per hour.

The change house will have an area containing individual (clean and dirty) lockers, washrooms and showers for the mine and mill workers. A separate change room, locker facility, and washrooms for women will also be provided.

Service pipes contained within the perimeter of the building will be buried beneath the concrete slab. Sewage will drain through a system of gravity pipes to the sewage treatment plant.

6.5.7 Laboratory

The assay and environmental laboratory will be located in a separate building near the service complex. The laboratory will be a 550 m^2 single level building and will contain all the assaying and environmental sampling and testing facilities plus associated offices for the laboratory personnel. The laboratory will have dedicated areas for sample bucking and preparation, fire assaying, wet laboratory, metallurgical laboratory atomic absorption equipment and balances, environmental laboratory, and storage for supplies and samples.

The laboratory building will be a pre-engineered, steel frame structure with insulated metal and roof cladding with concrete slab floors. The interior finish will be painted dry wall, block work, linoleum over concrete slabs and panel drop ceilings.

A dust collection system will be provided in the sample bucking and preparation areas. Fume hoods and exhaust fans will be provided in the fire assay, wet laboratory, metallurgical and environment laboratory areas. General exhaust fans will be provided in other areas to ensure that any fumes are removed from the building. Heating and ventilation units will be provided to supply heated outdoor air into the space. Individual heating units will be provided throughout the building for heating during periods that the laboratory is idle. The offices and open areas will be ventilated and air conditioned. The supply air systems will be zoned such that offices in the interior will be on different zones to those on the perimeter of the building.

6.5.8 Fuel and Lubrication–Deliver, Storage and Dispensing

Annual diesel fuel requirements will vary between 5 and 42 million litres a year during the life of the project. The maximum diesel fuel storage facility on-site will be 300,000 litres providing three days of fuel storage when peak consumption of approximately 100,000 litres per day occurs in the middle years of the mine life. The storage volume is considered adequate due to the proximity and the good road transportation network to Williams Lake, where commercial bulk fuel storage facilities are located. The Prosperity Project will utilize low sulphur diesel fuel.

The maximum annual fuel requirements will be in the middle years of the project when the ore/waste haulage equipment fleet size increases to meet longer haul distances from the deeper open pit. The primary consumers of diesel fuel, included in the estimating of the annual consumptions and on-site storage requirements are listed below:

- mining equipment–haul trucks, dozers, graders, loaders
- tailings embankment construction equipment
- plant site mobile equipment including small vehicles
- emergency diesel generators at the main substation

Bulk storage of gasoline on the site for utility vehicle fuel is provided by a 5000 litre fuel storage and dispensing system.

The required on-site diesel fuel storage volume will be provided by one 300 m^3 steel field-erected steel tank and one mobile fuel tanker. Tanks will be located adjacent to the service complex and near the ultimate pit exit within flexible membrane lined, excavated and dyked containments. The containment will provide the required secondary spill storage capacity of the largest tank plus 10% of the volume of the remaining tanks.

Along with the fuel storage tanks there will be facilities for:

- Commercial delivery via 50,000 litre, B-train tanker trucks—A Kamlock type connection will be provided for hook-up to fuel delivery trucks. Fuel delivery trucks will be equipped with pumps capable of filling the tanks. Product level in the tanks will be measured by a visible gauge with an alarm to signal when the tanks are full.
- Fuel dispensing to haul trucks, large mobile equipment and mine fuel truck—A positive displacement pump will dispense fuel for fast fill at capacities up to 30 m^3/hr through a special automatic shut-off nozzle. Each piece of equipment being re-fuelled will require a compatible connection to use this nozzle.
- Fuel dispensing to small vehicles—A small self-contained commercial card-lock dispensing pump with pumping capacities up to 5 m^3/hr will service small vehicles.

Bulk oil tanker trucks will deliver lubricants to site in grease bins and will be stored for distribution at the service complex. Air operated pumps, connected to the grease bins or bulk oil tanks will distribute lubricants to hose reels at the vehicle service/maintenance locations within the complex. Waste oil will be collected by vacuum pumps and stored in a double-walled, above ground waste oil tank prior to removal/recycle off-site by a contractor.

The following measures will be taken to ensure that fuel and lubricants do not escape to surrounding areas:

- to prevent any accidental leakage from the tanks, the piping system will be equipped with emergency fire safety valves and anti-siphon solenoid valves at each tank
- all product delivery and dispensing areas will have concrete grade slabs which are sloped to direct any spillage back into the containment
- any precipitation which falls within the containment will pass through an oil/water separator before it discharges to the environment. To control discharge from the containment, the discharge pipe will have a normally locked valve at its inlet

6.5.9 Fire Protection

Fire water protection will be provided for the mill site area and construction/operations camp. During the project construction period, the camp will have an independent fire protection system (storage tanks and pumps) which will be incorporated into the permanent mill site system when it is operational. The primary crusher and overland conveyor will not be provided with fire water protection, because they will be remote from the mill site system and do not have a high fire risk. Fire suppression or retardant system will be provided in the primary crushing building.

The fire protection system for the mill site will be sized for a maximum flow of 340 m^3/hr. Water to the fire protection system will be supplied from the fire/fresh water storage tank. This steel tank will have an 1100 m^3 capacity of which a volume of 680 m^3 will be held as fire reserve (lower portion of tank). The fire reserve volume is equivalent to 2 hour retention at the fire design flow rate.

Connected to the fire/fresh water tank will be an electric motor driven fire pump, backed by a diesel-engine-driven fire pump set automatically to provide water, on a demand, prompted by a preset pressure drop in the distribution system due to the opening of a sprinkler valve or fire hydrant. A low capacity, high head electric jockey pump will be used to maintain pressure in the system above the fire pump start-up pressure. These pumps will be located in a separate room in the concentrator building.

A looped fire distribution system will be provided around all major buildings, such as the concentrator and service complex. Strategically placed fire hydrants and hose stations will branch from these main loops located to provide adequate protection to the exterior of all the required structures on the mill site. The distribution network will be buried approximately 3 m below grade to provide adequate protection against the estimated frost penetration of 2.5 m. In addition, high risk areas will have automatic sprinklers and portable fire extinguishers.

Alarms will be activated by the start-up of the fire pump, or by activation of any smoke or heat detector, or by manually turning on an area alarm. All fire alarm signals will be monitored at the plant control center.

All major firefighting equipment will be Factory Mutual approved.

Depending on the construction scheduling, the set of fire pumps provided with the initial construction camp site may be relocated for fire protection coverage of the mill site at the completion of construction.

6.5.10 Process Water Supply and Distribution

The Process Water Pond will have a total storage capacity of 110,000 m^3 and will be supplied by three sources:

- pit dewatering, depressurization wells, horizontal drains
- the tailings supernatant pond reclaim
- the Water Collection Pond at the toe of the Waste Storage Area

A cast-in place concrete outlet structure in the process water pond with a manually controlled sluice gate will discharge water by gravity through a buried HDPE pipe into the concentrator building. Process pumps will boost the pipeline pressure for distribution and use in the building.

A barge with vertical turbine pumps in parallel will be installed in the runoff collection sump to pump water at a high sump level to the process water pond. With all four pumps operating, the system will have the capacity to pump 5400 m^3/hr.

Fresh Water will be supplied by:

- Deep Aquifers—As part of the pit dewatering system, depressurization wells in the deep water aquifer will be installed to intercept flows entering the pit. The estimated volume of water from this aquifer is 1,200,000 m^3/yr. This water may also be used as potable water.
- Water collection pond—Runoff from the plant site and open pit, as well as the waste rock and ore storage area flow into the water collection pond. This pond can be used as a source for fresh water as the solids will settle.

These two fresh water sources will discharge into the fire/fresh water tank at the concentrator. Flow in this pipeline will be activated by an automated valve controlled by water levels in the tank. The top 420 m^3 in this tank is available for fresh and gland water use. Pumps will draw water from the tank and distribute through gland and fresh water service loops in the concentrator building. A buried HDPE water main will convey freshwater to locations outside the concentrator building, where it is required.

6.5.11 Potable Water Supply and Distribution

Potable water will be supplied by three proposed wells along the south perimeter of the ultimate open pit. The estimated capacity of each well is 12 m^3/hr. These wells will initially be the source of the project site potable water supply and will function to depressurize the open pit walls as the pit deepens.

The depressurization wells will be installed early in the project so that they can provide potable water during the construction phase. The estimated daily potable water demand during construction will be 200 m^3 which is based on a maximum work force of 800 people. During operations, the estimated daily consumption will be 100 m^3, which is based on an average on-site work force of 400 people.

The wells will be connected to a common pipeline which will be buried below grade to the construction camp. The depth of burial will be sufficient to provide protection from freezing and vehicle traffic. Initially, this pipeline will be connected to the construction camp temporary water storage and distribution system.

A small demand for potable quality water will be required at the explosive manufacturing plant area. A small buried pipeline will be tapped off the well water pipeline to supply water to the area.

For overall operations, a permanent potable tank will be installed near the concentrator building. The vertical, field erected steel tank will have a nominal capacity of 150 m^3. Upon operation, the potable water well supply pipeline will be re-directed from the camp and connected to the permanent tank. Prior to discharging into the tank, the water will be treated by a calcium hypochlorite addition system with a small mix tank and a metering pump.

Potable water pumps in the concentrator building will draw water from the tank for distribution:

- through a pipe loop in the concentrator
- through an underground main to the outside structures on the mill site

The main will be DKPE pipe and will be buried a minimum of 3 m for frost protection. The outside structures serviced by this buried network will be the operations camp, service complex, and assay laboratory.

Some areas requiring potable water will not be connected to this mill site underground system because their demand is small and remote from any potable water main. These areas include the primary crusher, the concrete batch plant and the gatehouse at the mill site entrance. They will have bottled potable water for drinking.

6.5.12 Communications

Telephone and facsimile communications from the project site will be via microwave to the Telus provincial distribution system. Associated equipment will be installed at the camp. Distribution from the main office at the mine services area will be established via buried lines. Radio and internal telephone communications system will be provided from the administration office area to all remote locations on the network (i.e., crusher/conveyor, mobile equipment, reclaim and potable water systems).

6.5.13 Housing

The construction camp will be located adjacent to the south of the mill site. The construction camp will be constructed in stages in order to accommodate the build-up of personnel from the early stage of construction activity to the estimated peak of 1000 during construction. The camp accommodation units and services will be expanded as additional beds are needed. The ultimate construction camp will include the following:

- nine (five leased plus four permanent) 100 room dormitory units, accommodating two per room, washrooms, showers and laundry facilities
- two 50 room management dormitory units accommodating 1 per room, washrooms, showers and laundry facilities
- 2.4 m wide heated and lighted modular corridor between all facilities
- a kitchen/diner, with a seating capacity of 510 in the dining area. The kitchen will have the capacity to provide hot meals to all workers, plus lunch-making facilities for workers required to eat their meals at their place of work. Separate washrooms for male and female personnel will be available

All major camp buildings will be prefabricated modular trailer units. The individual trailer units will be joined together to form weather tight facilities on timber blocking approximately 600 mm above grade. The trailer undersides will be totally enclosed with plywood skirting to finished grade. Windows will be aluminum, sliding sash type, with insect screens. All buildings will be heated and ventilated. Air conditioning will be provided in the dining room, sandwich preparation and recreation facilities only. Extraction fans will be installed in the kitchen, the washrooms and the wet areas of the buildings.

On completion of the construction activities, surplus rental bunkhouse units, one management complex and portions of the dining and recreation buildings will be dismantled and returned to the camp supplier. Buildings that remain as the operations camp will be reconnected to the permanent plant site services.

Workers from Williams Lake and other communities, who live too far away to commute each day to the mine site, will reside in the operations camp. The construction camp developed to house construction personnel will gradually be turned over to the mine operations as the construction activities wind down. The operations camp will be sized initially for 315 employees then expanded to accommodate future employees and contractors.

The general area of the campsite will be graded for positive drainage. All roads and parking areas within the camp site will be raised with an average 150 mm thick layer of gravel to avoid muddy and slippery conditions. Drainage ditches and culverts will be provided as required. Runoff collected from the construction camp area will be channelled towards the site runoff treatment pond, to the west of the camp. This drainage can be achieved readily as the general area of the construction camp has a natural slope of approximately 1% towards the west.

The construction camp will include the following services:

- a potable water storage tank and water treatment system. Water supply to this tank will be obtained from the potable water wells
- a fire water storage tank with 64 m^3 capacity. Water supply to this tank will be from the depressurization wells
- a pump house containing the fire water pumps (electric, back-up diesel, and jockey pump), diesel fuel tank, potable water pumps, and water treatment equipment (in-line filter and hypo-chlorinator)
- a fire protection system complete with buried piping isolation valves and fire hydrants strategically located around the campsite. Camp areas will be equipped with sprinklers and portable fire extinguisher units as required by code. The system will be supplemented with smoke/heat detectors and manual alarm stations. A fire alarm signal will be activated by start-up of the fire pump, or activation of smoke/heat detector, or by annually turning on an alarm station. All alarm signals will be monitored at a central control station
- a potable water distribution system of buried small diameter HDPE piping, connecting the tank/pump house to the demand areas within camp
- a buried, gravity sanitary collection system of PVC gravity sewer pipes and concrete manholes, including a grease trap for the kitchen/diner
- the Rotary Biological Contactor (RBC) unit used for construction, will also be the permanent facility used during the operating years of the mine
- power distribution: Power supply to the construction camp will be from a 2–2200 kW diesel generator set installation. Primary usage of the power will be for heating and lighting. An overhead line will connect the camp to the permanent power system once it is available
- propane supply for the camp will be from eight 450 kg propane tanks with vaporizers. A buried propane distribution piping system will connect the propane supply to the demand locations. Propane will be required mainly for cooking. The propane system will remain in place for the life of the project

All pipes for the construction camp will be buried 3 m for freezing protection. Ultimately the permanent water and sewer systems will be connected to the camp.

6.5.14 Plant Power Distribution

Power will be supplied to the Prosperity facility at 230 kV via a new 125 km overhead line from the BC Hydro switching station at Dog Creek. The plant substation is designed with a single 3-phase 100/133 MVA transformer (230/25 kV) and associated high voltage switch gear circuit breakers and isolation capable of meeting the peak plant power demand requirements. A spare transformer is provided but not connected. In the event of a main transformer failure the operating unit and a spare would be exchanged with the spare unit being put on line.

The secondary of the main step down transformer feeds a 25 kV switch gear line up containing 17 individual breakers which feed the various plant areas as follows:

- SAG mill drive

- ball mill #1 drive
- ball mill # 2 drive
- pebble crushing (future)
- concentrator grinding area
- concentrator floatation area
- concentrator regrind area (2 feed breakers)
- concentrator thickening/load-out area
- water systems
- tailings pump house (future year 4)
- warehouse and assay lab
- mine power supply
- tailings reclaim barge
- tailings dam seepage pumping station
- emergency power supply

There are four 17 MVAR harmonic filters connected to the 25 kV bus to provide power factor correction for the cyclo converter main mill drives.

Each of the 25 kV breakers feed 7.5/10 MVA transformers which set the voltage down to 4160 V to feed plant motive loads at this voltage level and further step down transformer/switchgear unit substations at the 600 V level.

Emergency power is provided by 2–2.2 mw standby diesel generators connected by a tie breaker to the 25 kV breaker line-up.

6.6 Site Access

6.6.1 Roads

Major haul roads for large equipment will be required from the open pit to the crusher, stockpiles, overburden stockpiles, waste dumps and the tailings storage facility for construction and waste disposal. These roads will be constructed with non-PAG materials derived from mine operations. They will be built with an operating surface of 30 m and additional allowance for ditches and berms where required.

A number of smaller ancillary roads will be required to access miscellaneous infrastructure facilities such as site power distribution, overland conveyor access, headwater channel, on-site fish compensation facilities, and explosives magazines. These roads will generally follow existing contours and utilize proximate existing materials wherever possible. Appropriate ditches and culverts for drainage and sediment control will be used where required.

6.6.2 Security

Extensive security fencing is not considered necessary for the project site. The areas which will require fencing are:

- Plant site entrance gatehouse on the Prosperity site access road. This fence will include a 10 m wide gate, will be 1.8 m high chain link topped by 3 strands of barb wire and extending 50 m on either side of the road.
- Start of the road to the explosive magazine area. This fence will include a 6 m wide gate, will be a 1.8 m high chain link topped by three strands of barb wire and extending 50 m on either side of the road.
- Lined process water pond. The fence will be a 2.4 m high wildlife fence.
- Outdoor substations. The fence will be a 1.8 m high chain link topped by 3 strands of barb wire.

The entrance gatehouse will be manned by personnel 24 hours per day, 365 days per year.

6.7 Tailings Impoundment and Storage

6.7.1 General

Tailings will be deposited in an impoundment located in the Fish Creek valley upstream from the Open Pit. The TSF has been designed to provide environmentally secure storage for co-disposal of approximately 480 Mt of tailings and 240 Mt of PAG waste material. Non-PAG waste rock and overburden not used in embankment construction will be stored in the Waste Storage Area located between the Open Pit and the TSF, where Fish Lake is currently located.

Specific overall features of the TSF are listed below and are illustrated in Figure 6-18.

- three earth-rockfill, zoned embankments: Main, West, and Fish Lake South
- headwater channel
- headwater channel retention pond
- seepage collection ditches and ponds
- tailings distribution system
- reclaim water system
- PAG storage area (located within TSF)
- tailings beaches
- supernatant water pond

The Main Embankment will be expanded in stages across the Fish Creek Valley and the West Embankment will be constructed along the western ridge which separates the Fish Creek drainage basin from the Big Onion Lake drainage basin. The embankments will be developed in stages throughout the life of the project using low permeability glacial till, overburden and non-PAG overburden and waste rock materials from stripping operations at the Open Pit.

The Main Embankment will be constructed as a water-retaining dam during the initial years of construction. Once the tailings beaches have been established, the Main Embankment will be constructed as a free draining structure that utilizes a downstream construction method with a filter and a transition zone supported by the downstream shell zone.

The filter and transition zones prevent downstream migration of the tailings while the tailings, which have a relatively low permeability, provide confinement of the supernatant pond. Since the filter and transition zones incorporate non-cohesive materials, the downstream shell zone can settle without affecting the functionality of the facility.

The West Embankment will be constructed as a fully water-retaining dam and expanded using the centreline method of construction.

Seepage losses from the Main Embankment will be collected at the Water Collection Pond, which is located between the non-PAG Waste Storage Area and the Open Pit. Seepage losses from the West Embankment will be returned to the TSF via a seepage collection and recycle system. Special design provisions to minimize seepage losses include the development of extensive tailings beaches (which isolate the Supernatant Pond from the embankments), toe drains at the West Embankment to reduce seepage gradients, and contingency measures for groundwater recovery and recycle.

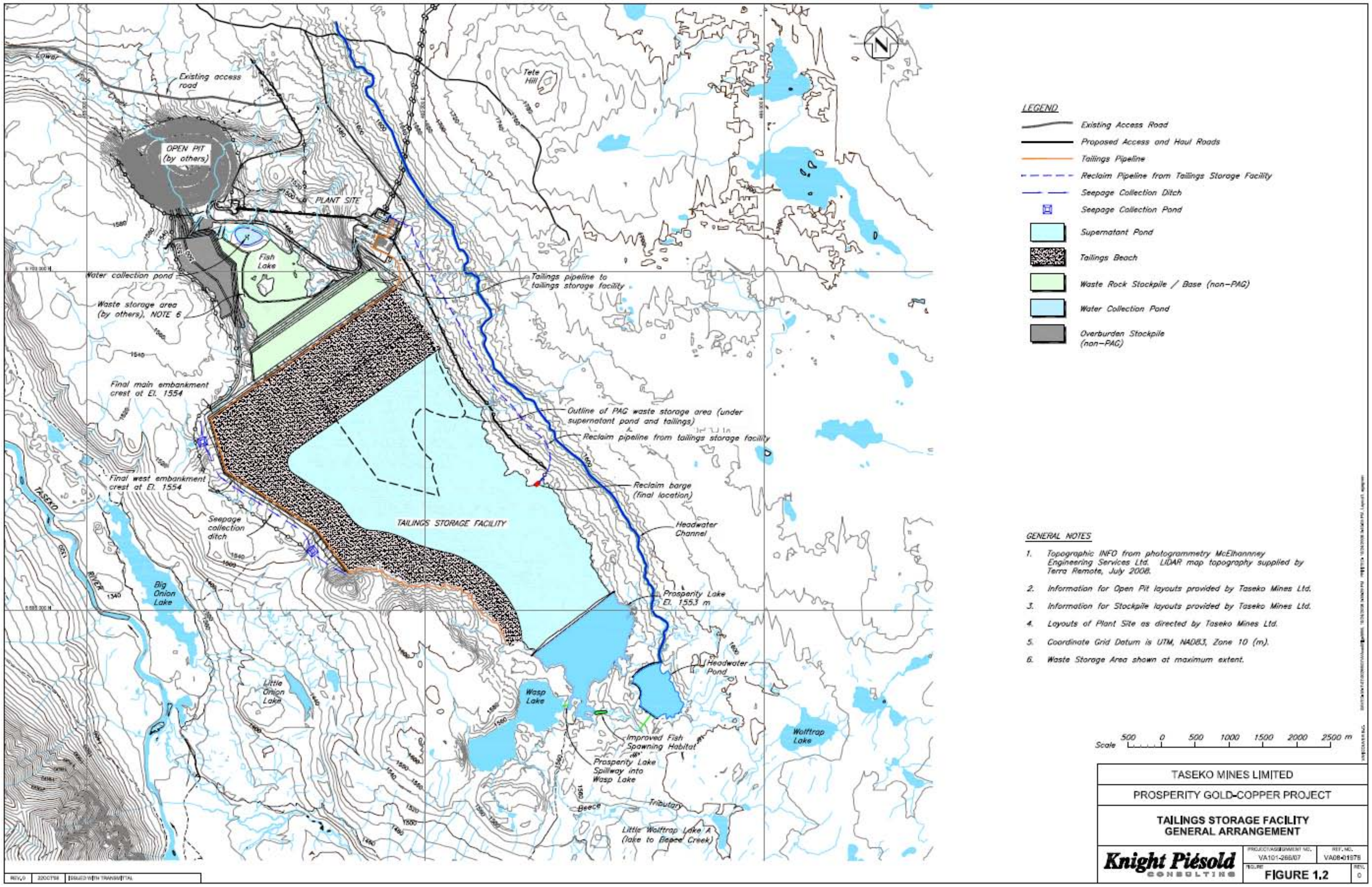

Figure 6-18 Tailings Storage Facility General Arrangement

The south embankment, forming Prosperity Lake dam will be constructed as a water-retaining structure that utilizes a conventional downstream construction method. The dam will include a low permeability glacial till core with a filter, drain and transition zones supported by a downstream shell zone. The Prosperity Lake dam may be constructed using material from a local borrow source; however, material from the open pit may be also be used in the dam construction. A preliminary location for a borrow source of low permeability glacial till has been identified, this borrow source is located within the ultimate TSF.

Construction of the Stage 1a Main Embankment will start approximately 15 months before mill start-up. Approximately 11 Mm^3 of water will be impounded prior to start-up, and will be available for mill commissioning and early operations. This water is derived from the drawdown of Fish Lake, in addition to the storage of one season of precipitation. Mill process water for on-going operations will be reclaimed from the TSF and supplemented with water from the Water Collection Pond. An annual water balance was completed for average precipitation conditions, as well as extreme probabilistic conditions, the results of which indicate that, with careful management, sufficient volume is maintained in the tailings supernatant pond to satisfy ongoing water demands.

Details of the site characteristics, geotechnical, hydrogeological and water management considerations for the tailings facility design, pipeworks, seepage collection and reclamation and closure are contained in the Knight Piésold "*Report on 2007 Feasibility Design of the 70,000 Tonnes per Day Tailings Storage Facility*" (Ref. No. VA101-266/2-1).

6.7.2 Tailings Characteristics

The tailings from the Project operation will be produced from conventional milling of copper and gold ore.

The physical characteristics of the tailings have been obtained using samples from metallurgical test work on drill core assay rejects. The laboratory test work indicated that tailings products from the lower, middle and upper zones of the ore deposit have similar physical characteristics and will be non-PAG.

Detailed laboratory testing and chemical analyses for the tailings solids and liquids were carried out as detailed in Section 7.5.

6.7.3 Site Characteristics

The project is located near the northeastern edge of the eastern Coast Belt, lying between the Intermontane Belt to the east and the western Coast Belt and Wrangellia to the west. The eastern Coast Belt in the Taseko Lakes area has several distinct assemblages of late Palaeozoic to Cretaceous age that have been intruded by granitic rocks of mid-Cretaceous to Tertiary age. The most important structural feature in the region is the Yalakom Fault, a southeast trending and steeply dipping zone, 4 km south of the Prosperity deposit.

The tailings basin area is sited in relatively gentle terrain, with numerous small swamps both along the valley bottom and along the shallow slopes. These swampy areas indicate the relatively low permeability of the surficial materials. Much of the remaining area is forested with very little underbrush.

Geotechnical and hydrogeological investigation programs were conducted as described in Section 6.2.

Much of the site is blanketed by surficial glacial till and a complex series of basalt flows, lacustrine units and lesser fluvial deposits. Localized, poorly consolidated, organic silts will likely underlie much of the swampy areas, while topsoil development is generally thin (<0.3 m) in most other areas.

The glacial till is typically located within the valley bottom and lower valley slopes and ranges in thickness from 2 m to greater than 10 m, is well graded and possesses low permeabilities (approximately 1 x 10-6 cm/s). The till is typically dense to very dense, with occasional soft, weathered material at surface in poorly drained areas.

The surficial glacial till unit will provide a suitable, low permeability foundation for the tailings facility. All organics and soft, wet material will be removed from the tailings embankment footprint prior to fill placement. High permeability sand and gravel materials will be removed from the embankment core zone footprint, and may be incorporated into the embankment fill.

6.7.4 Hazard Classification

A hazard assessment has been carried out to enable appropriate design earthquake and storm events to be determined for the TSF. The selection of appropriate design earthquake and flood events has been based on classification of the tailings dam using criteria provided by the Canadian Dam Association's "*Dam Safety Guidelines*" (1999).

6.7.5 Hydrometeorology

Detailed site hydrology and meteorology is presented in Volume 4, Section 4 of this report.

6.7.6 Tailings Storage Facility Design

The principle objectives of the feasibility design for the TSF are to ensure protection of the regional groundwater and surface waters both during operations and in the long-term, and to achieve effective reclamation at mine closure. The feasibility design of the TSF has taken into account the following features:

- permanent, secure and total confinement of all solid waste materials within an engineered disposal facility
- sufficient capacity and freeboard to store the 1/10,000 year, 72 hour storm event during operations
- control, collection and removal of free draining liquids from the tailings during operations for recycling as process water to the maximum practical extent
- construction of a dam to the south of the TSF to create the basin for Prosperity Lake
- diversion of fresh water from the upper east flank of the Fish Creek watershed to the north towards Fish Creek or to the south towards the Headwater Channel Retention Pond, Prosperity Lake and then to Wasp Lake and Beece Creek during operations via a headwater channel

- the inclusion of monitoring features for all aspects of the facility to ensure performance goals are achieved and design criteria and assumptions are met
- staged development of the facility over the life of the project

The overall project general arrangement is shown in Figure 6-19. The staged development of the TSF during pre-production (Year -1), Years 5 and 19 together with a longitudinal section through the Main Embankment of the TSF is shown in Figure 6-20 to Figure 6-22 respectively.

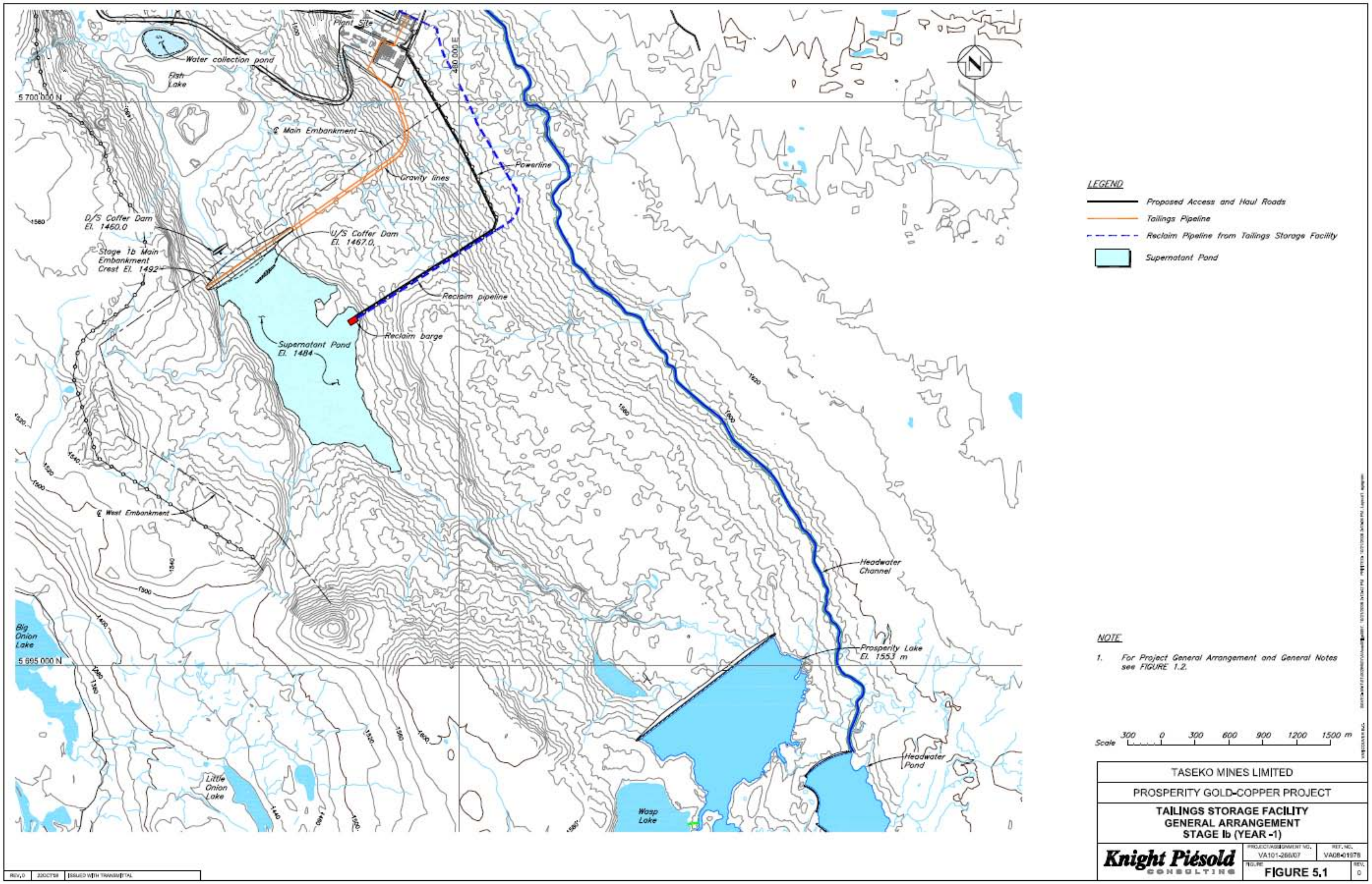

Figure 6-19 Tailings Storage Facility General Arrangement–Stage Ib (Year-1)

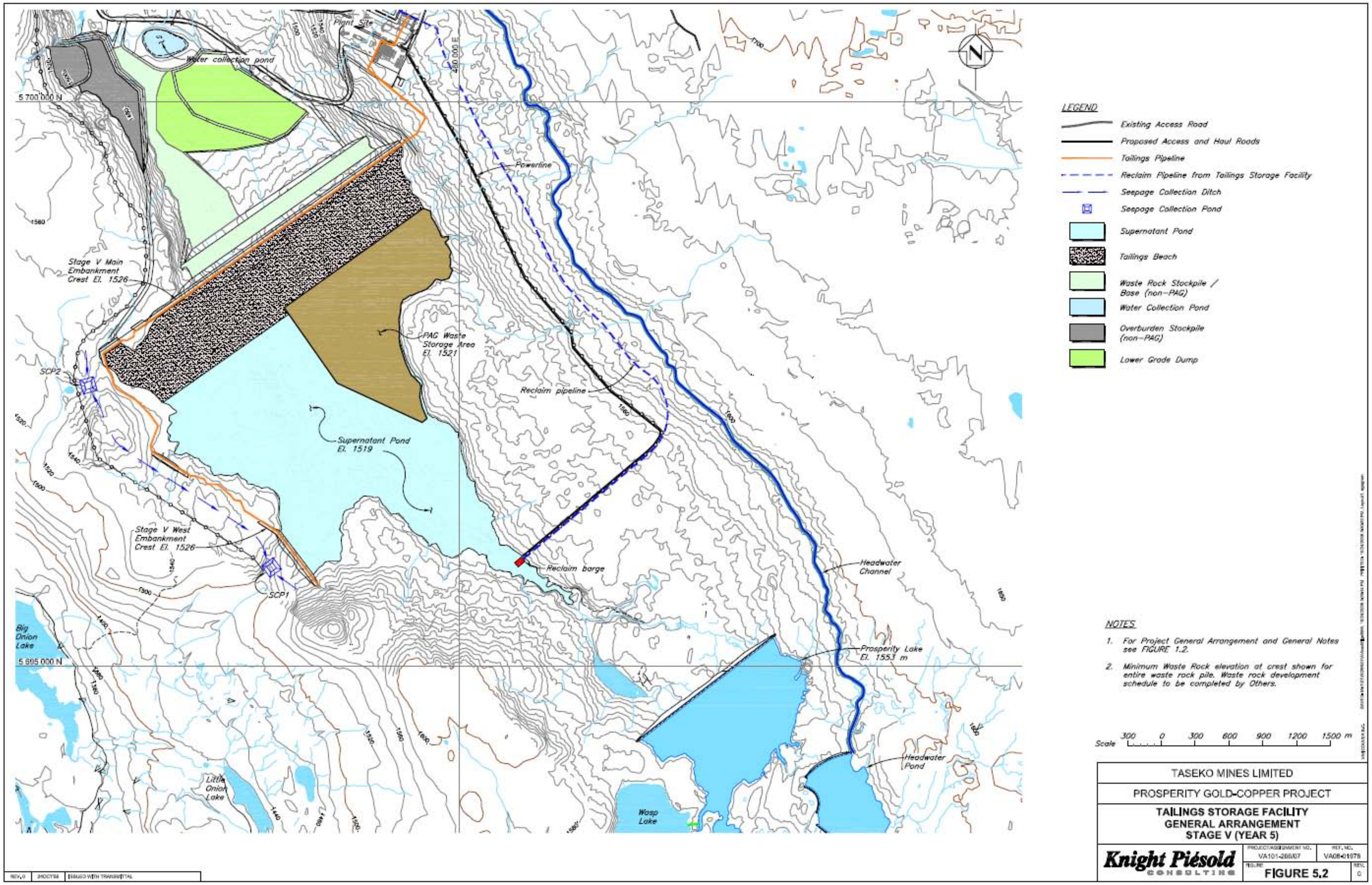

Figure 6-20 Tailings Storage Facility General Arrangement–Stage V (Year 5)

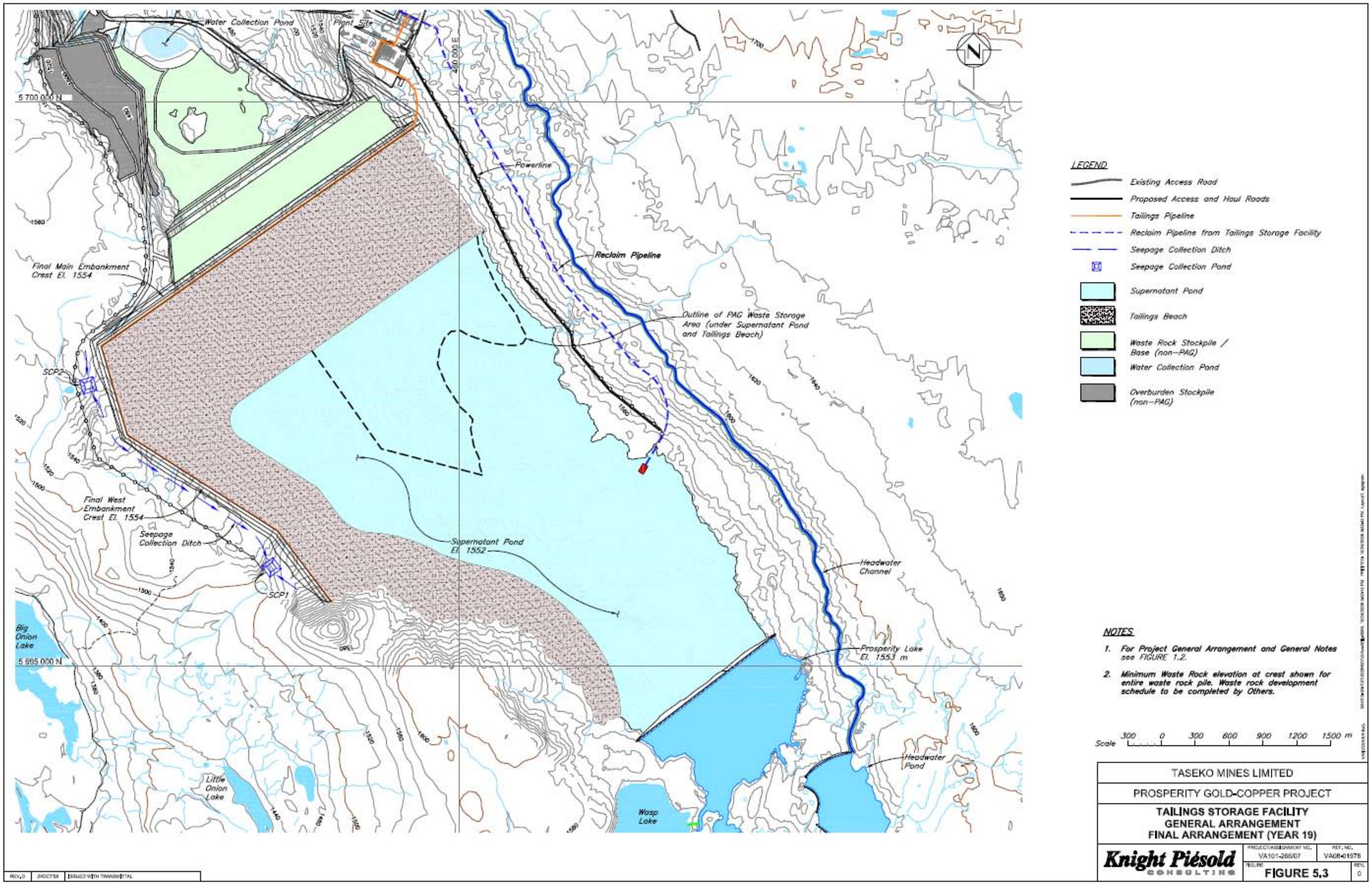

Figure 6-21 Tailings Storage Facility General Arrangement–Final Arrangement

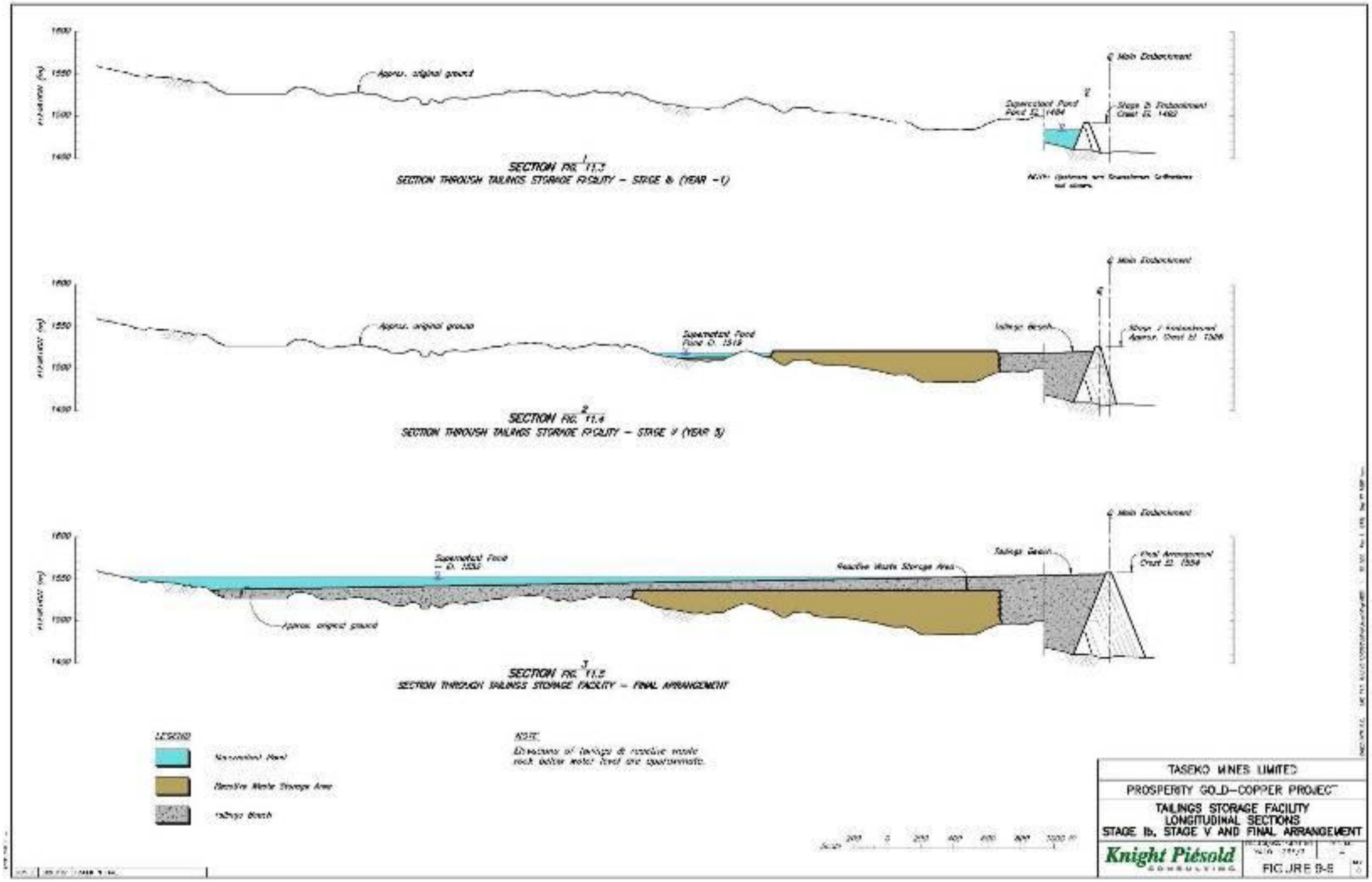

Figure 6-22 Tailings Storage Facility–Longitudinal Sections–Stage Ib, Stage V and Final Arrangement

6.7.7 Tailings Storage Capacity

The TSF has been designed to permanently store 480 Mt of tailings and approximately 240 Mt of PAG material. There is potential for PAG waste material to be selectively incorporated into the upstream shell zone of the Main Embankment for Stages I and II and in the upstream Shell Zone of the West Embankment. However, the current Open Pit material balances developed for this study only consider use of non-PAG materials.

Non-PAG waste rock and overburden produced during active mining will be used in embankment construction or stockpiled in the Waste Storage Area between the Main Embankment and the open pit.

Each stage of the TSF development has been sized to store tailings based on a milling rate of 70,000 t of ore per day, PAG waste rock and overburden from the open pit, supernatant water and freeboard for storm water storage, including an allowance of one metre for wave run-up protection. The TSF has also been designed with a storage capacity that allows for capacity of all the identified resource and reserve material should it be processed. After closure, the probable maximum flood (PMF) event would be attenuated within the TSF and routed through a spillway towards the open pit.

6.7.8 Embankment Construction

The total fill requirements for the Main Embankment and West Embankment are 31.5 and 10 Mm^3, respectively. The Main Embankment will be constructed as a water-retaining structure during the initial years of operations until tailings beaches are well established. Once the tailings beaches have been established, the Main Embankment will be raised as a free draining downstream dam structure. This transition is scheduled for Year 3. The West Embankment will be constructed as a water-retaining centreline structure. Typical cross sections of the Main and West Embankments are shown in Figure 6-23 and Figure 6-24 respectively. Components of the embankment cross sections are as follows:

- Core Zone (Zone S):
  Constructed with low permeability glacial till placed in 300 mm lifts and compacted to 95% of the Modified Proctor maximum dry density using a smooth drum vibratory roller. A minimum of four passes will generally be required to achieve this compaction requirement. The material will consist of well graded silty sand with some gravel and will generally require no processing except for the removal of oversized particles.
- Filter Zone (Zone F):
  Constructed with clean, fine to coarse sand, Zone F material will be placed in 300 mm lifts and compacted with a smooth drum vibratory roller. A minimum of four passes will generally be required to achieve the compaction requirement of at least 90% of the Modified Proctor maximum dry density. This filter zone will function as a crack stopper and will reduce pore pressures within the embankment (particularly during the early years when the Main embankment functions as a water retaining structure).
- Filter Zone (Zone G):
  Zone G will consist of borrowed or processed sand and gravel and will prevent downstream migration of the tailings into the courser transition zone and Waste Rock

Storage Area. It will be constructed in maximum 300 mm lifts and compacted to 95% Modified Proctor density using a smooth drum vibratory roller. A minimum of four passes will generally be required to achieve this compaction requirement. Because Zone G will consist of non-cohesive materials it will be capable of accommodating settlement within the Waste Storage Area and Zone T.

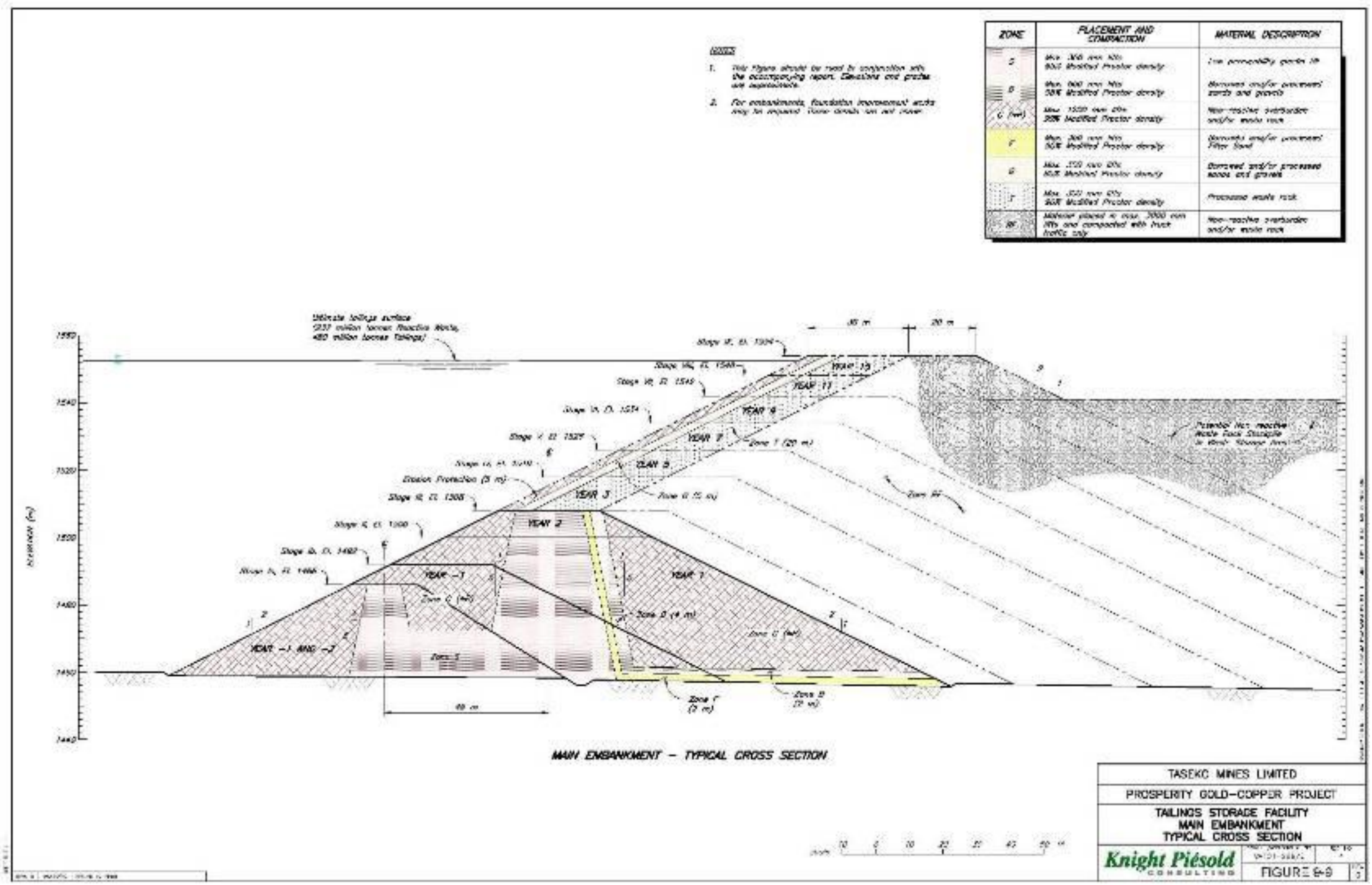

Figure 6-23 Tailings Storage Facility–Main Embankment Typical Cross Section

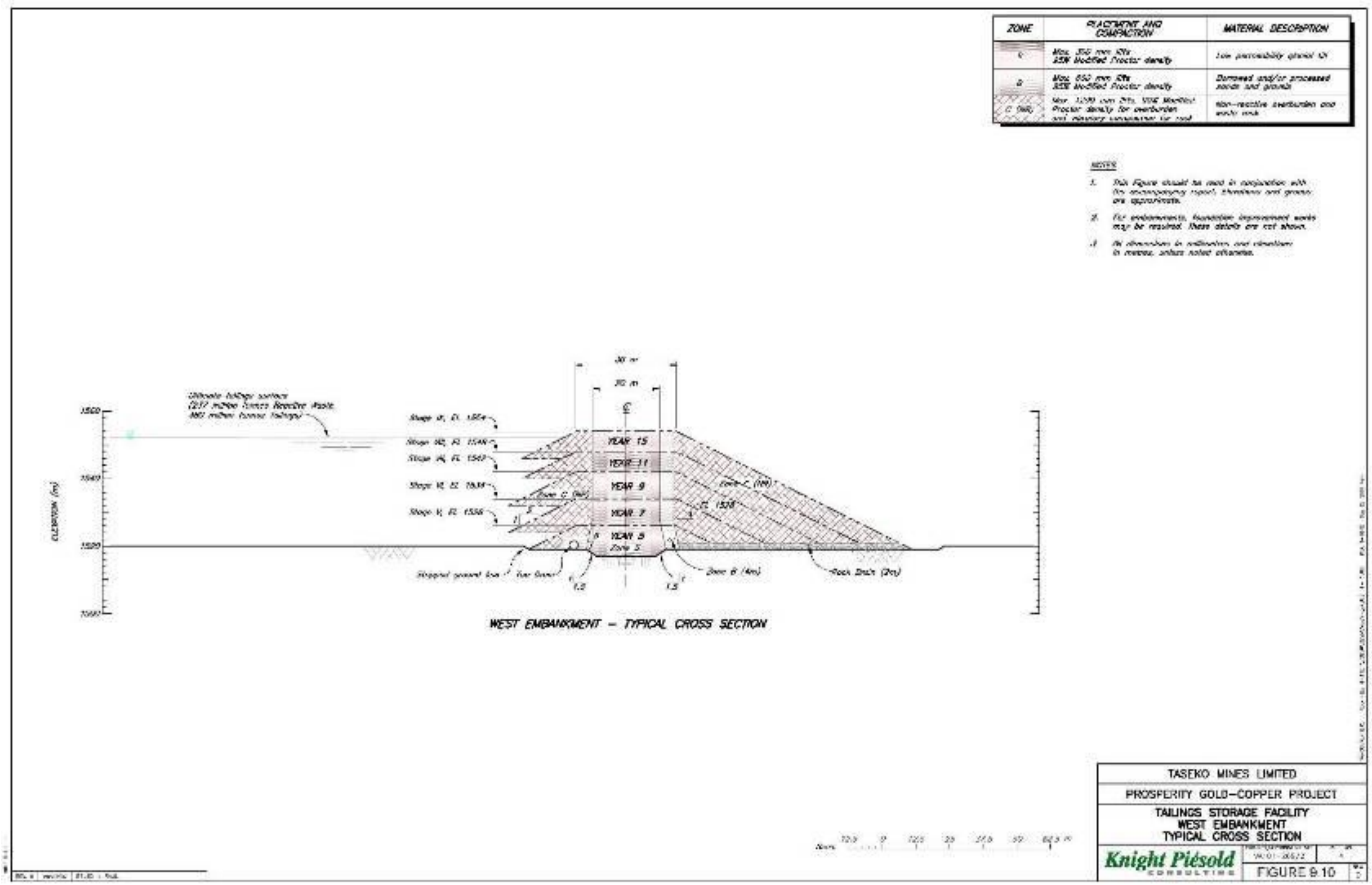

Figure 6-24 Tailings Storage Facility–West Embankment Typical Cross Section

- Transition Zone (Zone B):
  Zone B will be constructed with non-PAG alluvial, colluvial material, sandy glacial till or processed or select unprocessed blasted rock and will be placed in 600 mm lifts compacted with a smooth drum vibratory roller. A minimum of four passes will generally be required to achieve the compaction requirement of at least 95% of the Modified Proctor maximum dry density. The transition zone will prevent the migration of fines from Zone S and Zone F into the pervious Zone C.
- Transition Zone (Zone T):
  Zone T will be constructed using process waste rock and will serve as a gradational transition between the finer Zone G and the potentially coarse Waste Storage Area and will prevent migration of tailings into the Waste Storage Area. It will be placed in maximum 300 mm lifts and compacted with a minimum of four passes using a smooth drum vibratory packer. Similar to Zone G, Zone T will consist of non-cohesive materials and will be capable of accommodating settlement within the Waste Storage Area.
- Shell Zone (Zones C and RF):
  The shell zones will be constructed with random fill comprising non-PAG waste rock and overburden. For Zone C, overburden material will be placed in 1200 mm lifts and compacted to 90% of the Modified Proctor maximum dry density, while rockfill will be placed in 1200 mm layers with compaction requirements likely achieved with truck traffic only. In the downstream shell (Zone RF), material may be placed in 3 m lifts and compacted with truck traffic only.

Placement of non-PAG waste rock or overburden against the downstream shell of the Main Embankment (within the waste storage area) will provide additional structural support, but is not required to satisfy operating or long-term stability requirements.

Construction of each of the embankment stages has been scheduled to correspond with material availability from the open pit and the tailings production rate.

Geotechnical instrumentation, comprising piezometers and movement monuments, will be installed in several planes along the Main and West Embankments and foundations during construction and over the life of the project. The instrumentation will be monitored during construction and operation of the TSF to assess embankment performance and to identify any conditions different to those assumed during design and analysis. Groundwater wells will also be installed at suitable locations downstream of each embankment. Amendments to the ongoing designs and/or remediation work can be implemented to respond to the changed conditions, should the need arise.

Complete details of the TSF geotechnical instrumentation is provided in the Knight Piésold "*Report on 2007 Feasibility Design of the 70,000 Tonnes per Day Tailings Storage Facility*" (Ref. No. VA101-266/2-1).

6.7.9 Tailings Development–Layout and Operating Strategy

The discharge of tailings from the delivery pipelines into the TSF will be from a series of large diameter valve offtakes located along the Main and West Embankments. Tailings discharge will begin along the Main Embankment and will be extended along the West Embankment starting in Year 4 of operations.

The coarse fraction of the tailings are expected to settle rapidly and will accumulate closer to the discharge points, forming a gentle beach with an average slope of about 1%. Finer tailings particles will travel further and settle at a flatter slope adjacent to and beneath the supernatant pond. The development plan for the tailings beaches and the PAG Waste Storage Area is shown on Figure 6-25 through Figure 6-30.

6.7.10 PAG Waste Storage Area Development

PAG waste will be hauled to the TSF for co-disposal with tailings and submergence by the tailings and supernatant pond. The PAG waste storage area has been designed in step with the mine production schedule. It will be developed at the same or similar rate of rise as the tailings. At closure, the PAG waste rock and overburden will be submerged below tailings and pond water. Based on the present mining schedule, a minimum of three years of tailings deposition will occur after final placement of PAG materials. They will therefore be maintained in a saturated state in perpetuity.

During operations the elevation of the PAG waste storage area at any given time will be a balance between maintaining a dry, stable placement surface and minimizing the material to be move below the natural flood elevation in the event of premature closure.

The PAG waste storage area will be developed within the impoundment along the east side of the valley and will be offset a minimum of 500 m from the Main Embankment, in order to allow development of tailings beaches. This zone of tailings beach will provide a low permeability transition zone between the coarse, permeable PAG waste rock and the tailings embankments, and will function as a seepage control measure.

6.7.11 Stability Considerations

Embankment stability analyses were carried out to investigate the stability of the embankment under both static and seismic conditions. These comprised checking the stability of the embankment arrangement for each of the following cases:

- static conditions during operations and post-closure
- earthquake loading from the Operating Basis Earthquake (OBE) and the Maximum Design Earthquake (MDE)
- post-earthquake conditions using residual (post-liquefaction) tailings strengths

Stability analyses, in accordance with international recommendations (ICOLD 1995) and standard industry practice satisfy the minimum requirements for factors of safety and indicate that the proposed design is adequate to maintain both short term (operational) and long term (post-closure) stability. The seismic analyses indicate that any embankment deformations during earthquake loading from the OBE or MDE would be minor, and would not have any significant impact on embankment freeboard or result in any loss of embankment integrity. The results also indicate that the embankments are not dependent on tailings strength to maintain overall stability and integrity.

6.7.12 Tailings Discharge System

Tailings from the mill process will be delivered by gravity from the mill to the TSF for as long as possible. Thereafter, the required head for gravity discharge may be provided by pumping to a head tank above the east abutment of the Main Embankment, or by pumping directly to discharge. The initial requirement for pumping is deferred to Year 5 of operations, at which time tailings discharge from the West Embankment begins. At that stage, pumping will only be required when tailings are being discharged from the West Embankment. Discharge from the Main Embankment will be by gravity until Year 7 of operations.

Two gravity pipelines will be laid from the mill to the east abutment at start-up. One pipeline will extend to the centre of the Main Embankment, and the second to the West abutment. Each pipeline will be sized to carry up to 50% of the design tailings production from the mill. Discharge into the TSF will be from valved off-takes along the two pipelines on the Main Embankment crest. A full diameter off-take in each line will allow for "emergency" discharge at the east abutment.

During the first year of operations, a third line will be laid from the mill to the east abutment. In Year 4, the third discharge pipeline will be extended across the Main Embankment and along the crest of the West Embankment. A tailings pump station will be required to service this pipeline. Both of the gravity pipelines on the Main Embankment will remain in service. Discharge from the pipelines will not be continuous, but will be rotated between lines as appropriate for tailings distribution within the TSF and to ensure adequate beach development.

It will not be necessary to provide any emergency tailings line dump pond or tailings recovery system at the mill to handle pipeline drainage during emergency or planned shutdowns, as long as the Mill Tailings Head Box elevation remains sufficiently above the embankment crest elevation. This requirement must be re-evaluated during ongoing operations.

Initial and final tailings discharge line configurations are shown in Figure 6-25.

6.7.13 Reclaim Water System

Water will be reclaimed from the tailings pond by a barge mounted pump station. The water will consist of supernatant from the settled tailings and runoff from precipitation and snowmelt within the catchment area. A dedicated pipeline will convey the reclaimed water to the process water pond, located adjacent to and upgradient from the mill.

The floating reclaim pump station in the TSF will initially be confined in a deep narrow channel at a location remote from the point of tailings discharge. This will maximise the potential for the recovery of water of acceptable clarity. Relocation of the barge will be required to accommodate development of the PAG waste rock area and increases in the elevation of the tailings pond. The barge will be relocated during Years 2 and 6 and moved to its final location during Year 16.

The barge pumps will be controlled from the mill control room, based on the water level in the process water pond. The barge will be fitted with vertical turbine pumps, including standby pumping capacity and all necessary control, check, drainage and isolation valves. One pump will normally be operated at all times during winter to reduce the potential for freezing of the water in the reclaim pipeline.

Reclaimed water will be pumped from the reclaim barge to the process water pond at the mill. The reclaim pipelines will be graded to minimize high or low sections and to allow for gravity drainage back into the TSF, or the process water pond.

The reclaim pipeline from the TSF will consist of sections of large diameter HDPE and steel pipe. Steel pipe would be used only for the initial high pressure sections of the pipeline while HDPE pipe will be used for the remainder of the pipeline. Layouts of the initial and final reclaim system are shown in Figure 6-25.

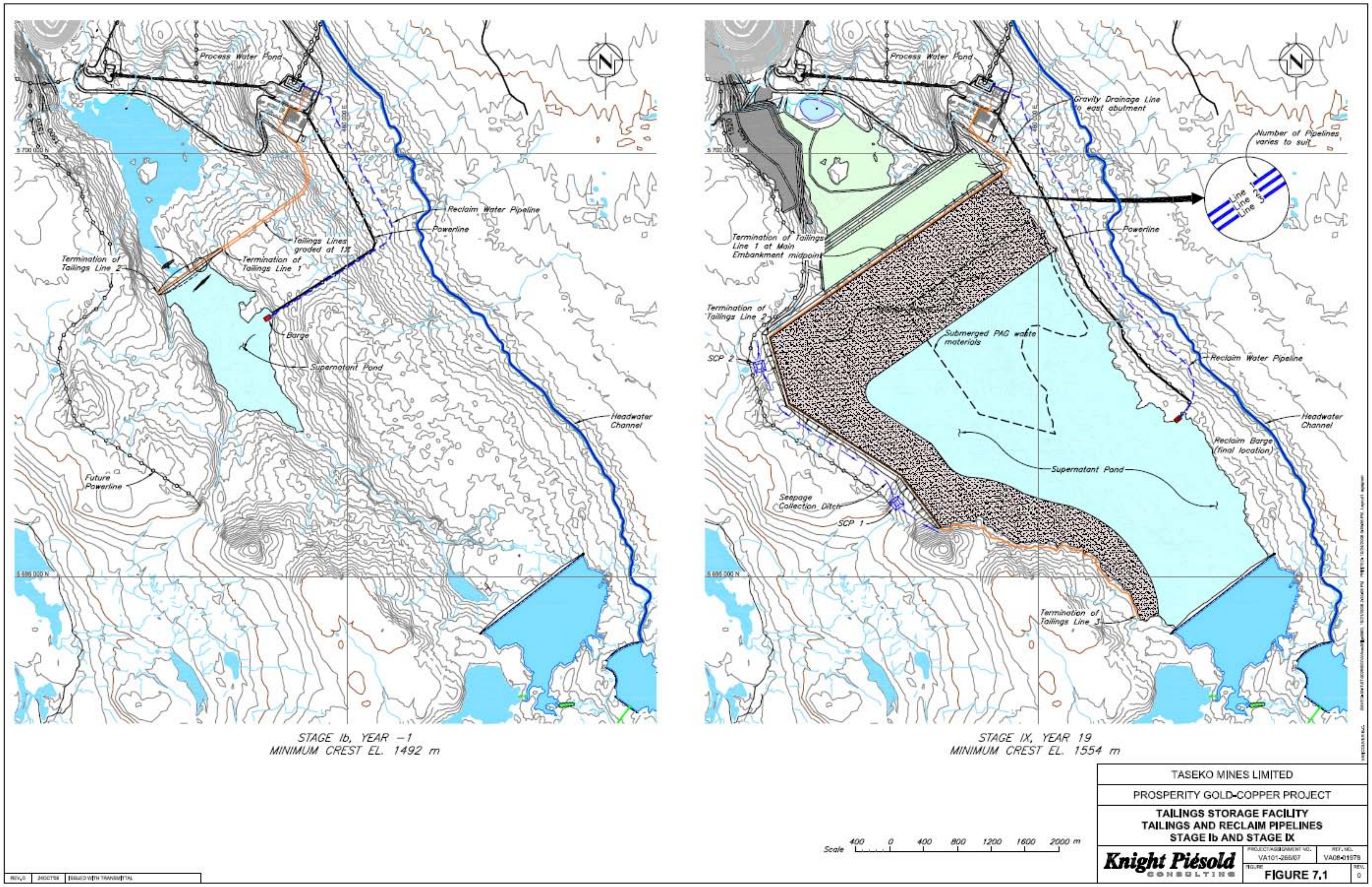

Figure 6-25 Tailings Storage Facility–Tailings and Reclaim Pipelines–Stage Ib and Stage IX

6.8 ARD/ML Prevention and Mitigation ARD

The ARD/ML Prevention and Mitigation Plan is designed around segregating and appropriately storing the PAG and non-PAG material found in four different classes. These four classes of material are:

1. mine area overburden
2. waste rock
3. tailings
4. low grade ore

Criteria for the classification of the PAG and non-PAG material will be determined based on standard industry tests on each of these four classes of material such as rinse pH, sulphide sulphur, modified neutralization potential and net acid generation test. PAG material will be stored in the tailings pond in a subaqueous manner. Non-PAG material will be stored in a sub aerial manner.

Waste delineation and segregation will occur in the following generalized process for Mine Area Overburden and waste rock.

1. Blast hole chips will be collected from surveyed drill holes.
2. These chip samples will be tested onsite for parameters specific to each waste rock type with regards to its PAG/non-PAG nature.
3. Dig limits will be calculated based on this information and used to determine the location of colour coded field stakes to indicate boundaries.
4. Material will be loaded into haul trucks. Shovel operators will use proven methodology to indicate the type of material loaded to the haul truck driver.
5. Material will be dumped at the appropriate storage facility with monitoring at the disposal locations to ensure that the wastes are appropriately dumped.

Existing data shows tailings material to be non-PAG. As such, no specific management criteria have been established. However, periodic sampling and testing will be conducted.

Low grade ore is to be processed in the final years of the mine and stored on a non-PAG base between the pit and the tailings pond. Excess mill capacity in the early years of the Prosperity Project will be used to process as much low grade ore as is practicable, thereby reducing the volume of material to be stored.

Details of PAG and non-PAG classification and management can be found in Section 7.

6.9 Sewage and Solid Waste Management

Sewage from the mill site and camp areas will be collected by a gravity sewer system, consisting of buried PVC pipes and concrete manholes at all junctions and will be conveyed to a sewage treatment plant. For the concentrator, a sewage lift station and force main will be required to pump its sewage to a gravity sewer main. The lift station will be a packaged pump station with a fibreglass chamber and the force main will be HDPE pipe. All buried sewer pipes will be buried the minimum required for freeze and vehicle traffic protection.

One sewage treatment plant (STP) will be used to service the mine during the construction phase and continue for operation. The maximum capacity of the plant will be based on a maximum workforce of 1000 during construction. Sewage treatment will be by a packaged Rotating Biological Contactor (RBC) unit, which will include:

- flow equalization
- primary settlement
- sludge storage
- RBC unit
- final clarifier
- chlorine contact chamber
- effluent pump chamber

A packaged RBC unit will be used because it is simple to fabricate off-site into modular components, suitable for remote applications, has good reputation for low maintenance, good stability under fluctuating organic and hydraulic loads, low energy consumption and simple to operate.

The STP will be located at the west end, low side, of the mill site, well away from the camp and other occupied areas. The STP which will be partially buried to permit gravity feed of the influent and will include:

- buried concrete slabs for anchoring tanks
- easy accessibility from grade for inspection and maintenance of unit
- heating and lighting
- an alarm to signal loss of rotation

During construction, the treated effluent discharge will be pumped to a tile field or lagoon. The size of the tile field will be based on an effluent quality of 45 mg/L BOD5 and 60 mg/L TSS and an estimated percolation rate of 20 minutes per inch, which is equivalent to a sandy loam material. Prior to any construction, tile field design and location will have to be verified by field percolation tests. The tile field has been proposed because it is regarded as a favourable method of disposal by permitting authorities.

Once the mine is operational, the treated STP effluent will be discharged to the tailings storage facility. A buried pipeline will discharge the effluent into the gravity section of the tailings pipeline near the concentrator building. At that time, the chlorine contact chamber will be activated because the effluent will become part of the reclaim water from the TSF.

Sewage from the washroom facilities that are remote from the mill site gravity sewer system will be directed to nearby sewage holding tanks. These tanks will be emptied at regular intervals and their contents treated at the mill site STP.

The solid waste management program will be primarily focused on recycling as many products as possible. All oil, glycols and chemicals will be separately stored for transportation to appropriate facilities to be reconditioned and re-introduced into the market place. These efforts will also be undertaken with paper, metal, computer and tire products. The domestic wastes that are generated will be collected separately and with all other products that cannot be captured as described above, will be placed in a permitted landfill on site.

6.10 Water Management and Sediment Control

6.10.1 General

The main objective of the Water Management Plan is to control all water that originates from within the project area in an environmentally responsible manner. This includes optimizing the use of available water sources to supply the water requirements of the milling process and related mining activities, thereby eliminating the demand for external make-up water.

The water management activities include the following:

- A Construction of a Headwater Channel along the east slope of the Fish Creek Valley during the pre-production period to collect and divert clean runoff north towards Fish Creek and south towards Prosperity Lake, Wasp Lake and Beece Creek.
- Collecting and recycling seepage from the TSF, waste storage areas, ore stockpiles, and the open pit.
- Controlling, collecting, and utilizing undiverted surface water runoff upstream from the open pit.
- Eliminating uncontrolled release of water from the Project area.
- Optimizing the volume of water stored in the tailings supernatant pond to meet operations and closure requirements.
- Managing the system to facilitate decommissioning of the open pit dewatering and depressurization facilities immediately following completion of mining activities in Year 16. The artesian aquifer wells will be maintained throughout the life of mine to provide a source of potable water.

The main components of the water management plan during the early stage of development include the following;

- Fish Lake will be pumped down approximately 3 m prior to construction of the Stage Ia embankment.
- Downstream of the Main Embankment a sump and cofferdam will prevent flow from Fish Lake into initial foundation excavation.
- A small earthfill dam will be constructed at the outlet of the lake, along the access road alignment, to enable controlled discharge of water to Fish Creek and maintain sufficient freeboard within the basin.
- A Headwater Channel will be constructed along the east slope of the Fish Creek Valley during the pre-production period to collect and divert clean runoff north towards Fish Creek and south towards Prosperity Lake, Wasp Lake and Beece Creek.

The Fish Lake basin area will be utilized as a natural sediment pond, providing retention time for inflow to settle out sediment. Provided that the water quality is suitable, the lake will be drawn down periodically to restore the surge capacity. Prior to completion of the

Fisheries Compensation Works, provisions will be made for localized diversion of surface runoff to minimize sediment transport into the lake area. At the open pit area, the pit water will require sediment control prior to discharge until the open pit dewatering system is established.

Once construction of the Stage Ia Main Embankment is complete, the TSF will be used to impound surface water flowing from the undiverted portion of the upper Fish Creek Valley. During operations the location of the supernatant pond will be situated away from the embankments and controlled by the development of the tailings beaches and the PAG waste storage area. The supernatant pond location will be controlled in order to reduce seepage losses at the embankments and to provide a clean, accessible source of water for the milling process.

6.10.2 Water Balance

Estimated water demands, along with estimates of available water sources, were included in site water balances to estimate the expected process water surplus or deficit for each year of operation. The site water balance was completed for average precipitation conditions. In addition, for water management and engineering design, a probabilistic water balance was completed that takes into consideration extreme wet and dry years.

Process water and fresh water that is required for the operation of the mill is primarily supplied from the following sources:

- pit dewatering, depressurization wells, horizontal drains
- tailings supernatant pond
- water collection pond at the toe of the waste storage area

As the supernatant pond is the main source of process water, water balances were completed in order to estimate the annual water surplus or deficit at the TSF. Annual site water balances were based on average precipitation conditions, for the year prior to start-up, the 20 years of operation, and post-closure.

The annual water balance summary for average precipitation conditions is provided in Table 6-3. As indicated, there will be no requirement for supplementary make-up water for average annual precipitation conditions.

Immediately prior to start-up, the Main Embankment of the TSF will store approximately 11 Mm^3 of water. Water volumes fluctuate between 6 and 9 Mm^3 during the first 12 years of operation due to water containment in void spaces as PAG material is placed in the TSF. As PAG placement is reduced from Year 12 onward the water volume begins to rise, peaking in Year 16 at 17 Mm^3. Subsequent annual water deficits starting in Year 17 result from the cessation of inflow from the open pit dewatering facilities, as the open pit is permitted to commence filling. The pond volume at closure is approximately 15.8 Mm^3 and the annual post-closure surplus in the TSF is estimated at approximately 6.5 Mm^3.

Table 6-3 Tailings Storage Facility–Annual Water Balance Summary–Average Pond Volume

Year of Operation	Average Year End Pond Volume (m^3)
1	9,060,643
2	5,984,458
3	6,773,821
4	9,557,322
5	8,205,869
6	9,007,402
7	9,293,876
8	8,365,003
9	7,182,827
10	5,975,888
11	6,201,810
12	8,075,056
13	9,625,974
14	12,069,955
15	14,691,147
16	17,483,458
17	16,919,667
18	16,425,720
19	15,864,008

Under extreme dry conditions, the results of the analysis indicate that there may be a requirement to divert a portion of flows from the catchment east of the headwater channel in order to maintain the necessary pond volume to facilitate continuous, uninterrupted operations.

The probabilistic water balance is highly conservative, and still indicates that there will be no requirement for a permanent make-up water supply, with any shortfalls being appropriately addressed with careful management of water throughout operations.

6.10.3 Surface Water Control

All mine site runoff from the disturbed project areas including the open pit, mill site, waste dumps and tailings storage facility will be directed to the site runoff water collection pond, which is the north end of Fish Lake. Drainage ditches will be constructed from all the disturbed areas including the primary crusher, the overland conveyor, the mill site and the camp to direct surface runoff from these areas to this sump during operations. At the construction phase, the sump may not yet be available for site runoff collection. Temporary measures will be used which include silt fencing, and sediment basins and traps to limit sediment discharge from any disturbed areas to the environment.

Swampy areas exist on the natural plateau where the mill site is to be located. A minimum of 2 m has been allowed for excavation from the plateau to establish the rough grade for the site. In the areas of the swamps, an additional 2 m may be excavated and backfilled with suitable fill material.

Groundwater was measured at 1 and 2 m below existing grade (at 2 of the 5 drill hole locations on the mill site). It is representative of artesian conditions rather than a shallow water table. The existing soil in this area is frost susceptible. To reduce the potential for frost heave, drainage measures to minimize seepage and infiltration into the foundation soils will include:

- positive final grade drainage away from structures toward swales and/or yard area perimeter ditches
- routing of rainwater from building roofs by rainwater leaders to storm drains which discharge to the yard area perimeter ditches
- foundation drains around the perimeter of each building

6.10.4 Seepage Collection and Control

Tailings Impoundment Construction

Surface and seepage water will be controlled during construction of the Stage 1a Main Embankment as shown on Figure 6-26. A small diversion ditch will also be constructed upstream of the upper cofferdam to divert a small stream in this area. Downstream of the Main Embankment a sump and lower cofferdam will control flow from Fish Lake during initial foundation preparation in the valley bottom. Fish Lake will be pumped down approximately 3 m prior to construction of the Stage 1a embankment and the water conveyed into lower Fish Creek or used as required for site activities. A small earthfill dam will be constructed at the outlet of the lake to enable controlled discharge of water to Fish Creek.

Once construction of the Stage 1a Main Embankment is complete, the TSF will be used to impound surface water flowing from the undiverted portion of the upper Fish Creek Valley. Approximately 11 Mm^3 of water will accumulate in the TSF prior to mill start-up. The pond level is projected to reach a minimum elevation of 1484 m prior to start-up. The reclaim barge will be used to provide water from the pond for mill start-up.

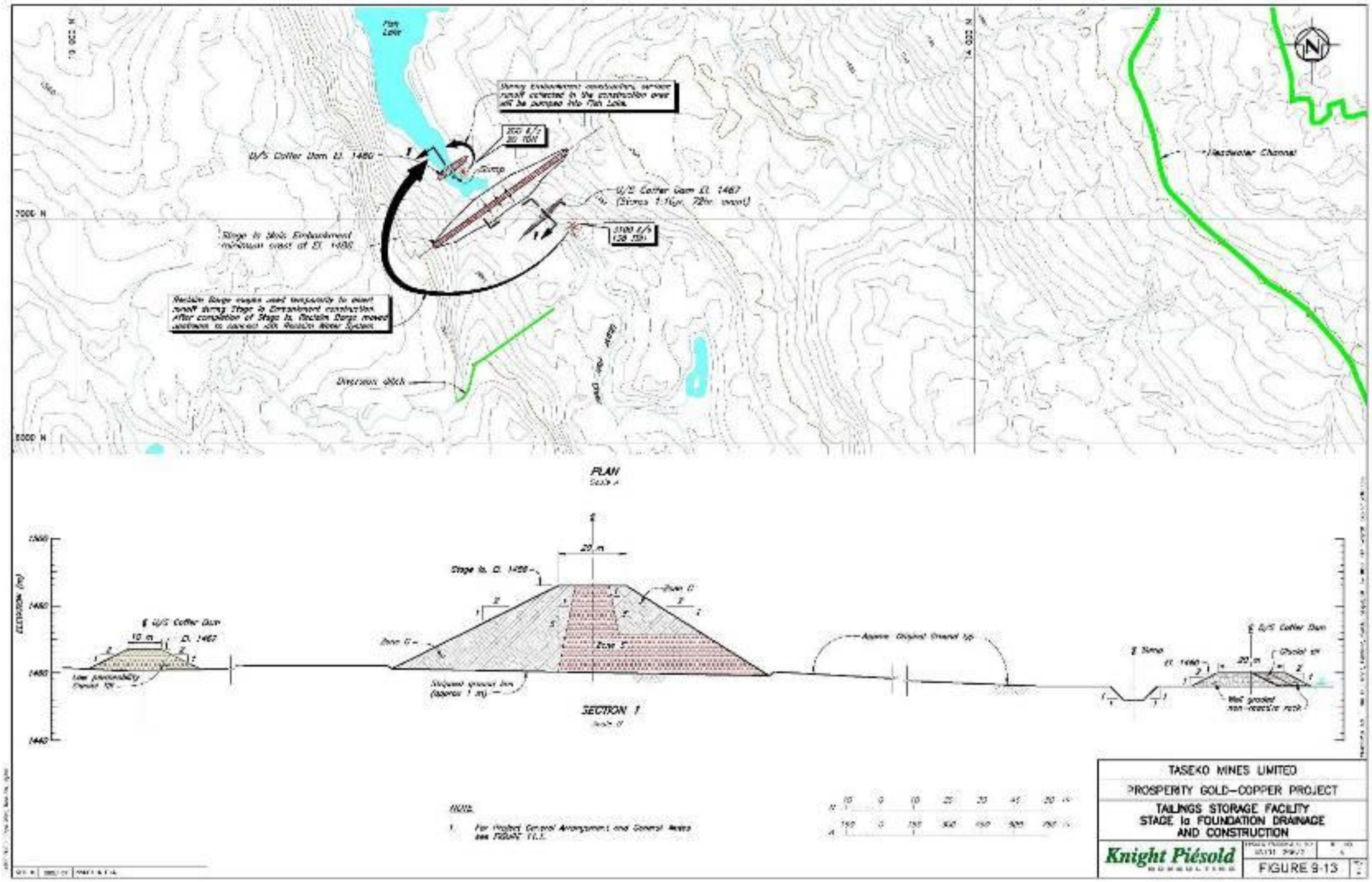

Figure 6-26 Tailings Storage Facility–Stage Ia Foundation Drainage and Construction

Tailings Impoundment Operation

During operations, the location of the tailings supernatant pond will be controlled by the development of the tailings beaches and the PAG Waste Storage area. The supernatant pond will be situated away from the embankments and towards the east side of the valley. The pond location will be controlled in order to reduce seepage losses at the embankments and to provide a clean, accessible source of water for the milling process. Any seepage water collected in the Seepage Collection Ponds will be returned to the TSF.

Seepage from the TSF will result from infiltration of ponded water directly through the embankment fill and the natural ground and from expulsion of pore water as the tailings mass consolidates. The seepage will largely be controlled by the low permeability core zone constructed prior to development of the tailings beach, the tailings deposit, and the low permeability foundation materials.

Seepage through the Main Embankment will naturally drain into the Waste Storage Area downstream of the embankment and then into the Open Pit or the Water Collection Pond. Groundwater monitoring may be installed in the downstream area as part of the monitoring program and may be converted to recovery wells to also evaluate seepage rates in the foundation and to recover any foundation seepage.

The Open Pit will function as an ideal seepage collection point by intercepting any seepage that may otherwise migrate down gradient to lower Fish Creek. The Water Collection Pond will collect not only seepage but also surface runoff from the facilities lying within the contributing drainage catchment. The water collected in either the Open Pit or the Water Collection Pond will be returned to the Process Water Pond for use in the milling circuit.

The West Embankment will be constructed with toe drains to collect seepage through the embankment. Seepage collected in the embankment drainage systems will be transferred to one of two SCP located at topographic low points at the downstream toe. The Seepage Collection Ponds will be constructed with a compacted glacial till (low permeability) liner and designed to provide two day storage from seepage and surface runoff for the 1 in 10 year, 24 hour storm event (including a 1 m freeboard allowance).

Also, seepage collection ditches constructed along the toe of the West Embankment will be used to collect seepage and surface runoff and direct the flow to the Seepage Collection Ponds, from where it will be pumped back to the TSF.

HDPE pipelines laid along the downstream face and across the crest of the embankment will convey water from the Seepage Collection Ponds into the TSF.

Groundwater will be monitored in wells situated downstream of the Main Embankment and between the West Embankment and the Taseko River. If deemed necessary, as part of the mitigation measures listed in the EIA document, groundwater recovery wells will be installed in the same locations, with water being pumped to the TSF.

Steady state seepage analyses were carried out to estimate the amount of seepage from the TSF, through the embankments and foundation materials. The seepage flow rate is expected to vary over the life of the TSF as it is gradually filled with tailings, PAG waste materials and supernatant water.

6.11 Transmission Line

6.11.1 General

The Prosperity project requires an average electrical load of 104 MW with a peak load of 126 MW. The most appropriate configuration for this supply is a 230 kV wood or fiberglass pole H-Frame transmission line similar to standard BCTC/BC Hydro designs. A detailed route analysis determined that no special structures would be required (including the crossing of the Fraser River) and that one family of structures would suffice for the entire line.

Previous studies determined that the most appropriate corridor for a new transmission line was one tapping into the existing BC Hydro 230 kV transmission line near Dog Creek where a new switching station would need to be designed and constructed by BCTC. This 125 km long corridor begins from the proposed switching station near Dog Creek and follows a westerly direction using existing access roads over easy terrain for the majority of its length before terminating at the proposed Prosperity development site.

The complete selection process was divided into four phases. Ian Hayward International (IHI) identified a total of nine possible corridors which in turn were investigated and technically and financially evaluated against certain criteria.

Subsequently a refinement to the 3km wide corridor and the identification of a 500m wide route, including preliminary forestry and clearing economics and preliminary design recommendations and cost estimates was provided. A description of these two phases and the results of a 2007 Feasibility Study update are provided in Appendix 3-6-A. As the IHI analysis did not fully incorporate environmental factors into the corridor selection process in May 1997 Taseko asked Triton Environmental Consultants Limited (TECL) to review IHI's work in light of these factors and to confirm or revise the selection of the recommended corridor accordingly. In their May 1997 Report TECL concluded that two Options, Option 6 and Option 9 were acceptable corridors and that a more detailed engineering, environmental and socio-economic assessment of these two Options be undertaken (Appendix 3-6-B).

A more detailed assessment and comparison between Options 6 and 9 was undertaken and Option 6, the current proposed corridor was preferred. This assessment and conclusion were discussed thoroughly by the Project Committee and Technical Working Group during the period leading up to the finalization of the PRS such that only Option 6 was included in the final PRS.

Phase 3 as represented by this report is a further refinement of the 500 m wide corridor. The future Phase 4 will incorporate constraints identified during the final design and construction of the transmission line.

The route has been located in accordance with the following criteria:

- commences from an appropriate location for a 230 kV switching station near Dog Creek
- follows existing transportation and access corridors, where possible
- refrains from conflict with the Cariboo-Chilcotin Land Use Plan (CCLUP) by avoiding Protected Areas and Resource Development Areas
- avoids First Nation reserves

- minimizes overall line length from a cost as well as an environmental standpoint
- follows natural topographical features while avoiding areas of excessive steepness, high elevation, lakes and marshy areas
- minimizes disturbance to private property
- minimizes impact on the forestry resource
- establishes satisfactory alignment, span length, soils and slope stability for the Fraser River crossing
- allows "green belts" at the edges of lakes and creek crossings
- minimizes the quantity and magnitude of Points-of-Intersection (PIs)
- allows for possible future adjustments, due to environmental, socioeconomic or construction issues

An overall visual geotechnical review was performed during the process of choosing the transmission line routing. It was observed that most of the route had geological and geotechnical conditions that were conducive to normal woodpole design parameters, i.e. conventional auger and/or backhoe excavation. The general geologic/geotechnical assessment was conducted by Robert (Bob) Tape, M.Eng., P.Eng. of Esse Nova Engineering, Inc. in November 1998.

The only area deemed to require additional geological and geotechnical investigation was the actual structure locations for the Fraser River crossing due to possible erosion. Further evaluation of the wetlands in the Tête Angela Creek area may be needed.

A mineral reserve has been established on the 3 km wide footprint, 1.5 km either side of the current centerline. This reserve does not establish tenure but merely ensures that any parties staking mineral claims are aware of the future potential use of this corridor and have no recourse for compensation.

In 2008, the proposed Transmission Line was flown and a 500 m wide orthophoto of the entire 125 km line was prepared as shown on Figures 6–27, 6–28 and 6–29. Marked on these orthophotos are existing and proposed cut block areas. It is anticipated that this information will be utilized in the selection of the final centre line alignment.

6.11.2 Points-of-Intersection and Route Description

The route was defined by IHI engineers during site investigations between September, 1996 and November, 1998. The field study included aerial reconnaissance by helicopter and selected ground visits along the corridor.

The PI names and coordinates are listed in Table 6-4, followed by a brief description of each PI site and line segment, as well as pertinent data affecting the selection of the corridor routing.

Dog Creek Switching Station

The Dog Creek Switching Station site is located approximately 75 km north of Kelly Lake Substation, on flat, easily accessible terrain. The proposed tap-off point is approximately 4.5 km north of Dog Creek, accessible via an existing service road.

Figure 6-27 Taseko Transmission Corridor Orthography Series 1

Figure 6-28 Taseko Transmission Corridor Orthography Series 2

Figure 6-29 Taseko Transmission Corridor Orthography Series 3

Table 6-4 Point-of-Intersection Listing

PI Name	Latitude	Longitude	Distance Between PIs (m)
Dogsy	5,725,260	570,970	0
Platform	5,726,100	547,580	23,410
First Ridge	5,725,800	545,750	1,850
Fraser River East Bank	5,726,160	545,140	710
Fraser River West Bank	5,725,680	544,620	710
Word Creek	5,724,000	537,080	7,720
Farwell Creek	5,729,180	527,520	10,870
Vedan Creek	5,731,080	517,900	9,810
Mons Lake	5,729,700	501,920	16,040
New	5,728,200	498,900	3,370
Big Creek	5,724,700	494,470	5,650
Bambrick	5,724,020	487,520	6,980
Willan Lake	5,723,230	483,000	4,590
Tête Hill	5,703,820	460,000	30,100
Road	5,701,000	459,600	2,850
Mine	5,700,950	459,337	270
Total Distance			124.93 km
The calculated distance of 124.93 km may increase if route adjustments are needed for environmental or property concerns. A line length of 125 km has been used for the project cost estimates.			

PI Dogsy to PI Platform

From the proposed Dog Creek Switching Station to the upper bank of the east side of the Fraser River, the first 14 km stretch covers gently rolling terrain with minor changes in elevation. Approximately 5 km from the Switching Station, Brigham Creek must be crossed. This small canyon, approximately 70 m deep and 250 m wide, does not represent any construction or design difficulties. Between km 10.5 and PI Platform, 550 m of elevation is lost in a gradual slope down to the ridges heading towards the Fraser River. Construction access should pose no difficulty in this section. This is due to the gentle nature of the terrain and the fact that the area is networked by several existing access roads. This section of the line affects three private properties owned by two different parties. The properties are presently used for grazing. PI platform was established to align the approach through the gullies leading down to the plateau proposed for the east side of the Fraser River crossing.

PI Platform to PI Narrow Ridge to PI First Ridge to PI Fraser EB

This short section of only 1.4 km navigates the transmission line approaching the Fraser River and onto the plateau proposed for the actual crossing site. A portion of the land in the east bank of the Fraser River is currently classified as Agricultural Land Resource.

Some of the potential construction sites in this area may have restricted vehicular construction access due to steep terrain.

PI Fraser EB to PI Fraser WB

The actual Fraser River crossing is in the magnitude of 710 m and represents minimal design and construction difficulties. Sites on either side of the river will have restricted vehicular construction access. PIs on either side were established to align for a perpendicular crossing at sites suitable for construction.

PI Fraser WB to PI Word

This 7.5 km section begins with a 2 km long uphill climb gaining some 600 m in elevation. Construction through this 2 km section will be difficult and access limited. Once on the Fraser Plateau, the remaining 5.5 km is through relatively flat terrain, all easily accessible. PIs were aligned to mitigate construction difficulty on the climb up to the Fraser Plateau.

PI Word to PI Farwell

The next 11 km crosses over and then parallels the Gang Ranch road along mildly undulating terrain. No construction difficulties are anticipated in this section and no private properties are affected. PIs were established to align with the existing access corridor.

PI Farwell to PI Tilton

This 10 km section runs through gentle, flat terrain. No access problems are expected as there are several existing access corridors throughout. The route crosses numerous Crown-owned lots with various forestry related licenses on them. Farwell Creek and Vedan Creek are crossed in this section; however, no special PI placing was necessary because of the small size of the creeks.

PI Tilton to PI Mons

This 17 km section, running parallel to the road, again runs through gentle, flat terrain. Some areas of small localized marshland are encountered. Numerous Crown-owned lots with various forestry related licenses as well as two privately owned lots are crossed by the line. PI Tilton is located sufficiently south to avoid the majority of numerous small lakes. PI Mons is located sufficiently south so that the line avoids Big Creek and also prevents direct interference with the access road.

PI Mons to PI Big Creek

This 8 km section runs in a parallel direction to Big Creek, passes by Mons Lake, and eventually crosses over Big Creek. Four privately owned lots, as well as Crown properties with various forestry and agricultural related licenses, are crossed by the line. The number of properties crossed may be reduced on completion of the detailed centre line survey. Both PIs were established with careful consideration to leaving a “green belt” while passing Mons Lake, aligning for a near perpendicular crossing of Big Creek, and mitigating impact on private properties.

PI Big Creek to PI Bambrick

The first 3 km of this 7 km section follows an existing cleared area of flat, easily accessible terrain. The remaining 4 km traverses the side of a moderate hill and then crosses Bambrick Creek near PI Bambrick. Another consideration in the alignment of PI Big Creek was to align the corridor onto a 3 km long previously logged area. This section is flat and readily accessible for construction purposes. PI Bambrick was established to cross Bambrick Creek with near perpendicular alignment and additional elevation. Closer alignment to the road was also achieved.

PI Bambrick to PI Willan

PIs avoided further interference with Bambrick. The next 4.5 km section parallels the road over moderately undulating terrain. PI Willan was established south enough to allow for a substantial “green belt” between the corridor and Willan Lake. The alignment of both PIs avoided further interference with Bambrick Creek.

PI Willan to PI Tête

This 30 km section begins with a short section of small, localized marshland before passing over two rolling hills. At 12 km from PI Willan, the transmission line passes Kloatut Lake on the southeast side. The line then climbs steadily for another 7 km before peaking at an elevation of 1830 m on the side of Vedan Mountain. After Vedan Mountain, elevation decreases steadily until the Tête Angela Creek crossing. The line passes Tête Hill on the left side. Access is presently available via a forest service road at a distance of 11 and 13 km from PI Willan. Access in the Tête Angela area may be limited due to environmental considerations. Helicopter construction methods may have to be employed in order to mitigate environmental impact however, new forestry road construction has recently commenced. The positioning of PI Willan allows for a "green belt" between the transmission line and the lake. The crossing of the Tête Angela Creek should not cause any disturbance of riparian environments.

PI Tête to PI Road

This short section of approximately 3 km has been relocated to coincide with the Prosperity Plant substation location.

P.I. Road to P.I. Mine

This short section of line only consists of approximately two spans and provides a near 90° crossing of the mine road while maintaining 20 m ground clearance above the road as originally specified by Taseko.

Prosperity Substation

The substation is planned for the side of the plant closest to the incoming transmission line. Construction access will be via the mine access road.

6.11.3 Forestry Resources

Clearing widths for the 230 kV H-frame wood pole transmission line have been evaluated on the basis of 225 m average spans and will average 30 to 80 m.

Based on an assessment of January 2007 the merchantable timber is estimated at 44,000 m^3 for the entire line. This included 20,000 m^3 of dead and threatened pine. Mountain Pine Beetle (MPB) have killed or damaged extensive areas of merchantable sized material along the proposed route. It is assumed that some of the beetle kill is recent enough that there may be some marginal value in the dead standing pine. This value will decrease with time. Continued spread of MPB and accelerated forestry activity since January 2007 has further reduced forestry values.

6.11.4 Construction

The majority of the area is currently being actively logged and the need to construct new access roads is decreasing with time. If access roads need to be constructed they will be built in accordance with the Forest Practices Code, Forest Road Engineering Guidelines

Measures consistent with the Forestry Practice Code and standard industry practices will be used to protect fish and fish habitat during transmission line construction.

Ninety percent of the 3230 2.1–3.6 m deep pole holes will be excavated in earth and overburden. Ten percent will be excavated in rock and slash. Holes will be backfilled with gravel and native soil.

Construction will likely require the rental, installation, operation, catering and removal upon completion for a 42 man construction camp in the vicinity of Big Creek. Minimal use of the Prosperity Camp is anticipated by the transmission line contractor. Accommodation will be located in Williams Lake for work east of the Fraser River.

6.12 Access Road

The project site is currently accessible overland by traveling west along the paved Bella Coola Highway ("Highway 20") from Williams Lake to Lees Corner, then south-west along the all-weather logging roads as shown in Figure 6-30. The total road distance from Williams Lake to the property is approximately 194 km. The access route for construction and operations will be comprised of a portion of the following roads:

- Provincial Highway No. 20–existing 90 km of 2-lane, paved road
- Taseko Lake Road (Whitewater Road)–existing 68.4 km gravel road
- 4500 Road (Riverside Haul Road)–existing 19.4 km single lane gravel road to be upgraded with pull outs added and spaced at 2 km intervals
- Project Site Access Road–a new 2.8 km, 5-m wide, single lane gravel road with pull outs to be constructed

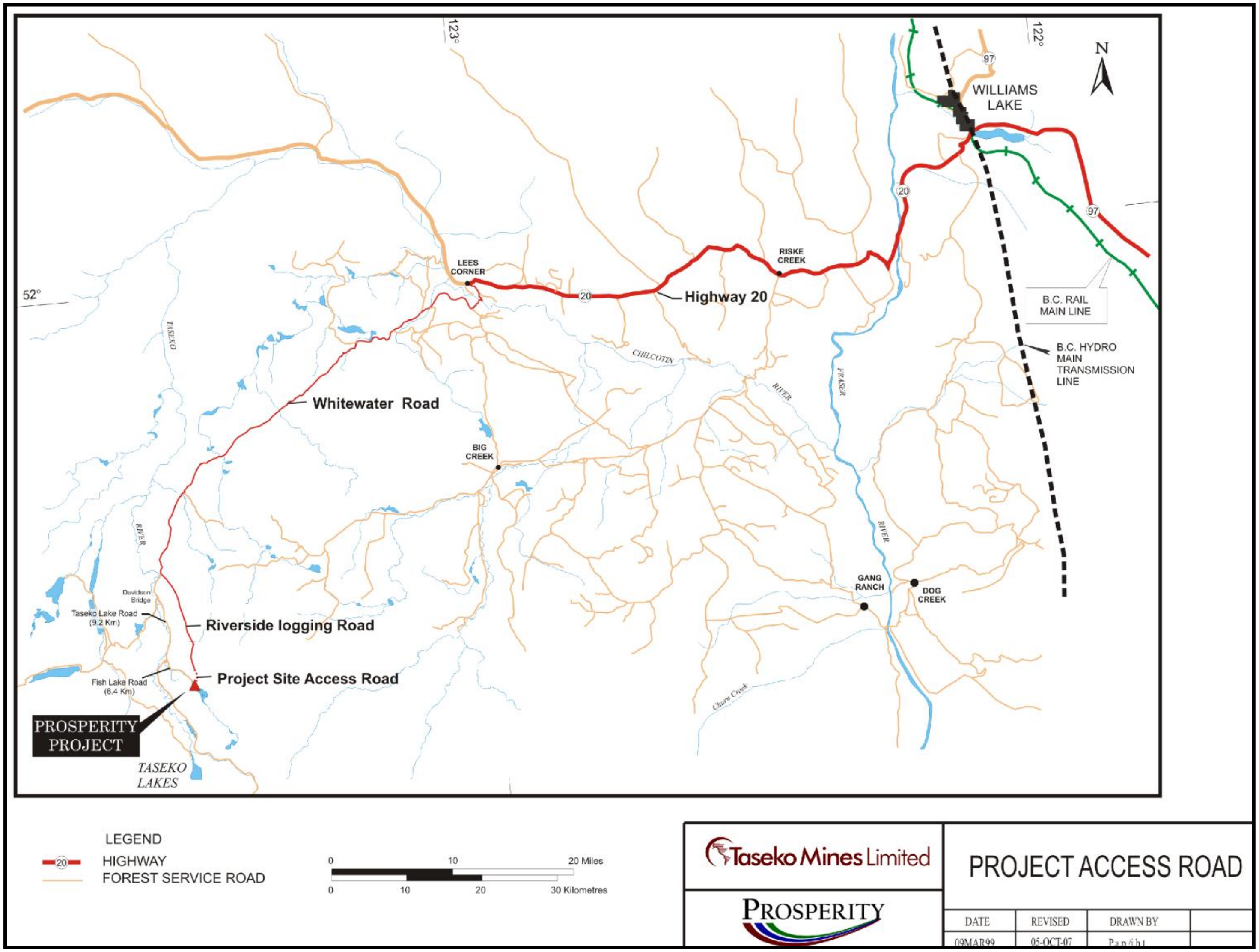

Figure 6-30 Prosperity Access Corridor

The mine site will be accessed by a gravel road from Highway 20. The road will provide year round access for the delivery of supplies, products and personnel, and the transportation of concentrate from the mine site.

On Highway 20, the allowable axel load of all delivery trucks is restricted to 70% from mid-March to mid-May due to the spring thaw and high volume of precipitation. During this period the service schedule of the delivery and concentrate trucks will be changed to ensure the uninterrupted operation of the plant.

The existing road between Highway 20 and the plant site is approximately 91.4 km long and is designated as the Taseko Lake Road, the 4500 Forest Service Road (formerly Riverside Road) and Prosperity Plant Access Road. The Taseko Lake Road, approximately 68.4 km long crosses two rivers and both bridges are full axle load rated. Reconnaissance of this section was carried out in November of 2006 and no sections were identified that will require upgrading for the Prosperity Project. The following 19.4 km long the 4500 Road will be upgraded to a single lane with pull outs spaced at 2 km intervals. The road bed will be improved with suitable material. The last section, the approximately 2.8 km long Prosperity Plant Access Road will be new road construction, single lane with pull outs.

In 1993 and again in 2006 Taseko undertook an Archaeological Impact Assessment (AIA) in the vicinity of the proposed new access road. A review of the areas surveyed in both 1993 and in 2006 confirms that approximately 2 km of the 2.8 km proposed access road has been surveyed as part of an AIA. It is anticipated that once a final alignment of the road has been determined and before construction of the access road begins, any area that has not been previously surveyed will undergo an AIA.

Trucks hauling concentrate from the Prosperity mine site will use Provincial Highway No. 97 from Williams Lake, travelling 54 km along the existing two-lane, paved road to the Gibraltar Mine Concentrate Load-out Facility near Macalister.

6.13 Concentrate Transportation and Rail Load-out Facility

Metallurgical and mill process testing conducted by Taseko indicate that conventional crushing, grinding, staged flotation, and filtering would produce a concentrate averaging 24.5% copper, 38.5 grams per tonne of gold, 89 grams per tonne of silver, and 7.5% moisture.

Concentrate trucks will be loaded with a front end loader within the confines of the concentrator building. Control measures such as a truck wash will be utilized to ensure that concentrate trucks are free of any uncontained concentrate prior to leaving the building.

Concentrate trucks will be covered at all times, except during loading or unloading.

Concentrate will be trucked to the CN Rail mainline at the existing Gibraltar Mine Concentrate Load-out Facility near Macalister.

The existing facility near Macalister is currently owned and operated by Gibraltar Mines Limited and will be used to handle concentrate from Prosperity. Any capital improvements to the concentrate loading facility will occur within the existing yard, requiring no change to the overall footprint of the facility. Any capital improvements and any pre-requisite regulatory requirements will be managed by Gibraltar.

Concentrate truck traffic to and from the Prosperity mine site will consist of an average of approximately 15, 40 tonne B-train trailers per day to fill 7 rail cars per day over the life of Prosperity.

Gibraltar concentrate transportation requirements at a milling rate of 55,000 tpd are eleven B-train trailers per day to fill five rail cars per day.

Dumping of concentrate trucks and loading of rail cars will be conducted within an enclosure sufficient to preclude the airborne dispersion of concentrate.

Railcars will continue to be equipped with lids so as to preclude the airborne dispersion and loss of concentrate during rail shipment.

6.14 Development Schedule and Activities

The construction, operation, and reclamation of the Prosperity project are divided into four phases for purposes of the environmental assessment.

The construction phase starts with the issuance of appropriate permits to start development and ends at that point at which the concentrator reaches commercial production. This spans a period of roughly two years.

The operations phase begins at this point and continues for approximately 20 years until no tailings are generated by the concentrator. Some reclamation activities begin during this operational period.

The closure phase begins at the cessation of tailings production and continues until the open pit begins to discharge water to lower Fish Creek approximately 25–30 years later. Decommissioning of site infrastructure and reclamation are completed early in this period.

The post-closure phase begins when the open pit has filled with water and begins to discharge to Fish Creek. Activities in this period are all related to environmental monitoring and follow-up. This period will continue until all conditions of the *Mines Act*, Reclamation Code, and permits have been fulfilled and Taseko has been released from all obligations under the *Mines Act*.

Environmental monitoring is a key activity that occurs throughout the entire life of the project as outlined in the Environmental Management Plan.

6.14.1 Construction Phase

The main activities in the construction schedule are summarized in Figure 6-31. The yellow bars in the figure represent continuous activities while the beige bars represent discontinuous activities or those activities which will be conducted at some time within the indicated time span. A brief description of these activities follows.

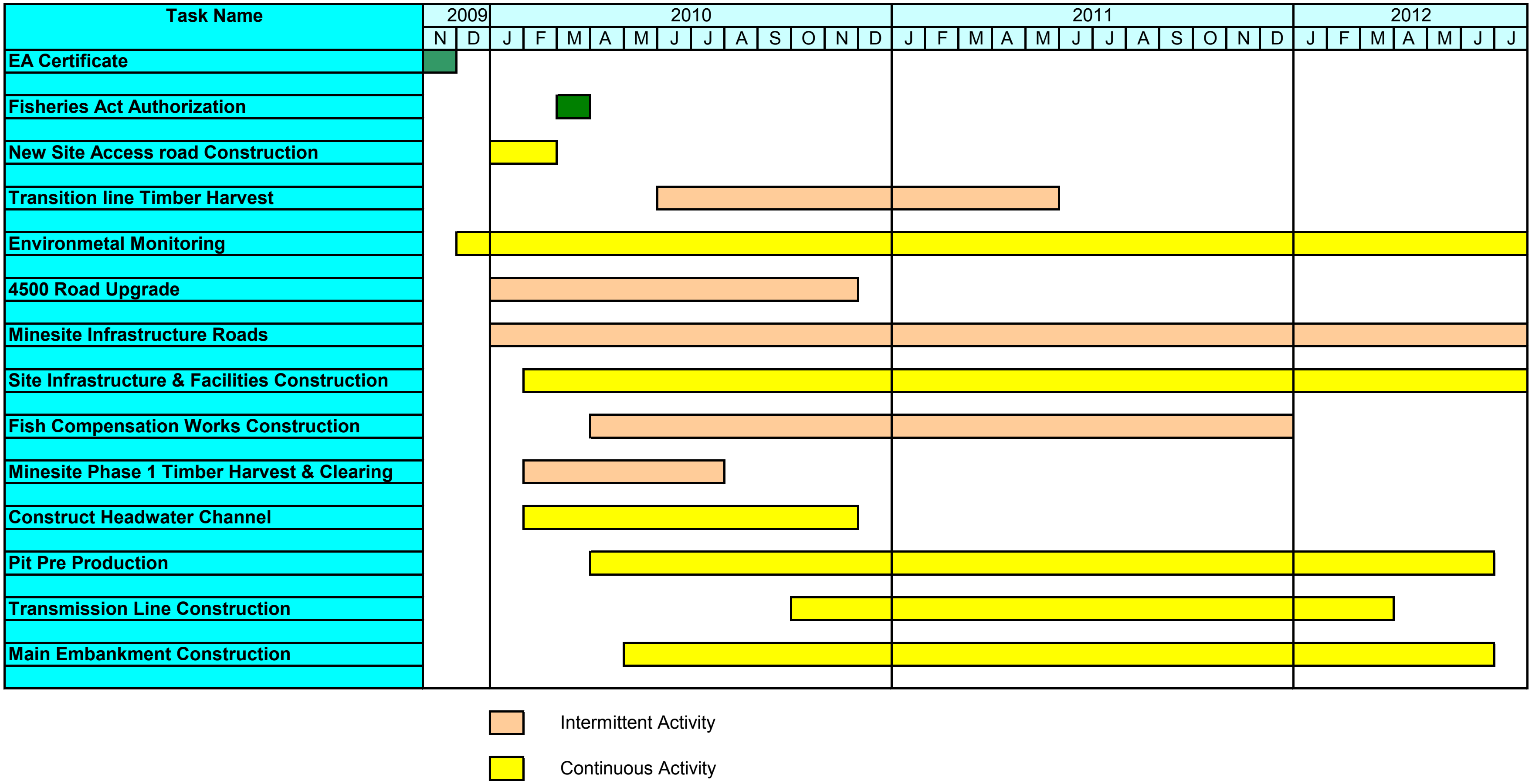

Figure 6-31 Construction Phase Schedule

The development of the new site access road will start as soon as permitting is in place. The pilot road will be roughed into the plant site and access developed within the mine site footprint to allow Phase 1 timber harvesting and access for initial equipment for bulk earthworks.

The extent of harvesting, grubbing and clearing in Phase 1 will be sufficient to allow pit pre-production, site infrastructure development, tailings dam construction, headwater channel construction, stockpile development, construction of the south dam for the creation of the Prosperity Lake fish compensation works, stripping of the Prosperity Lake basin, and tailings deposition for several years. The limit of work completed in Phase 1 will be a balance between maximizing deteriorating forestry values due to Mountain Pine Beetle infestation, operational needs, minimizing premature disturbance, and compliance with an approved closure plan.

Upgrading of the new site access road, 4500 Road, and development of site infrastructure roads will start as soon as road construction material is accessed within the mine site area.

Priority site infrastructure roads will include access to the fish compensation works near Wasp Lake, main embankment site and to the open pit. The fish compensation works include the headwater channels, the Headwater Retention Pond and the Dam for the creation of Prosperity Lake. All roads will be built in accordance with the Forest Practices Code, Forest Road Engineering Guidelines.

Priority site infrastructure development will be the plant site area to establish drainage and foundation preparation for the camp, followed by laydowns, an equipment maintenance area, and other infrastructure as outlined in Section 6.5.

Concurrent with bulk earthworks at the plant site and primary crusher will be the preparation of structures and systems for the lowering of the Fish Lake water level and relocation of the fish, and initial pit pre-production activities.

Fish Lake will be lowered by approximately 3 m to allow construction of the north coffer dam at the main embankment and concentrate the rainbow trout population in a deeper area at the north end of the lake to facilitate capture. A small earthfill dam will be constructed at the outlet of the lake to enable controlled discharge of water to lower Fish Creek. The lake will be lowered by controlled pumping from the lake to Fish Creek. Dependent upon project scheduling and water balance considerations, this water may also be used to provide a portion of the fill volume required for Prosperity Lake.

Once the water flows are controlled around the main embankment footprint construction of the main embankment can begin as outlined in Section 6.7.8. A borrow pit within the limits of the TSF may be used for initial construction materials.

The headwater channel will be completed during the low flow period and in operation for the 2010 freshet.

Initial pit pre-production activities will be limited to the higher ground east of Fish Creek. An initial sediment control system may be required until the fish have been removed from Fish Lake and the barren lake can be used as a sedimentation pond. Once the fish have been removed from the lake pre-production activities will include development of initial pit benches in the starter pit, tailings dam haulage road, ore and waste haulage roads, overburden and waste rock stockpile dumps, establishment of the pit dewatering system, and installation of the pit power distribution system.

The timing of the transmission line timber harvest will be based on optimizing contractor efficiency, mitigating any sensitive biophysical constraints and ensuring harvesting does not delay line construction. This may not be a continuous activity but staged to accommodate seasonal or environmental constraints.

Transmission line construction will be complete by mid 2011 to allow the possibility of establishing construction power (approximately 100 MW) prior to completion of the BCTC line reinforcement required for full power. The timeline allows for winter construction if required for any ecosystem constraints.

The Dog Creek switching station construction and line reinforcement will be completed by BC Hydro by 2011, in time for infrastructure commissioning.

6.14.2 Operations Phase

The main activities in the operations phase are included Figure 6-32. A brief description of these activities follows.

The phasing of the open pit simply involves the sequential enlarging of the surface expression of the open pit in a radial fashion until completion of mining activities in the pit. This is done in order to delay the removal of waste material until required to access ore at lower levels. There is no change in other surface activities beyond the addition of more material to designated stockpiles and tailings dam construction.

Construction of the main embankment continues through 2026. Construction of the west embankment begins in 2014 and continues through 2026. Construction is expected to be a seasonal activity as required to maintain the embankments at an elevation consistent with the design criteria.

Processing of ore continues into 2030 with the introduction of stockpiled lower grade ore in 2026.

There is the potential to delay logging and clearing within the ultimate disturbance area of the tailings storage facility dependant on the extent of harvesting, grubbing and clearing completed in Phase 1. The distribution of work between Phases 1 and 2 will be a balance between maximizing deteriorating forestry values due to MPB infestation, operational needs, minimizing premature disturbance, and compliance with an approved closure plan.

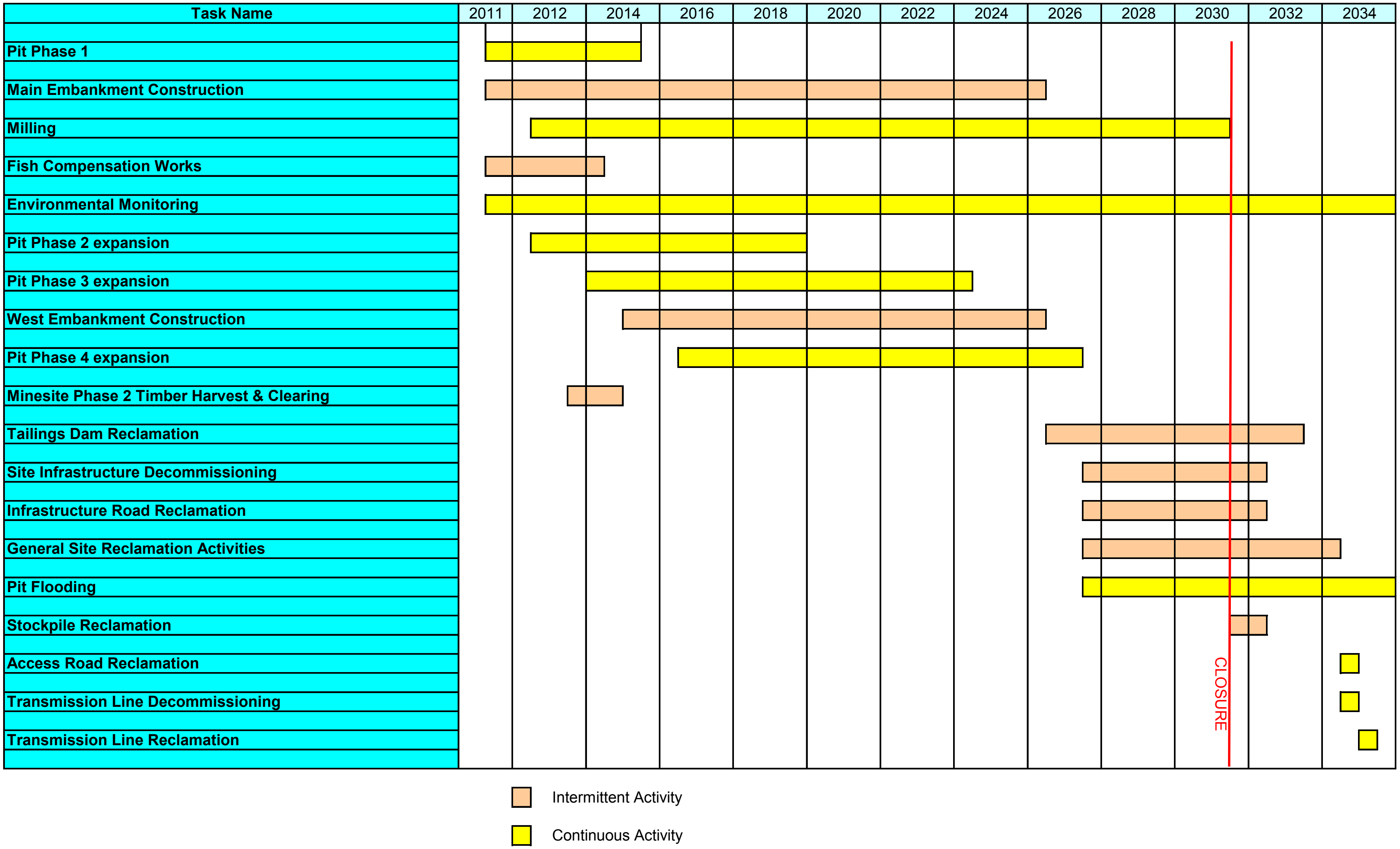

Figure 6-32 Post Construction Schedule

6.14.3 Closure Phase

Intent

The general concept applied to project reclamation and end land use is that reclamation will be conducted with the goal of establishing equivalent post-mine capability for a variety of end land uses. Ecosystem variety and vegetation dynamics will ensure that the post-closure landscape is capable of productively supporting a range of simultaneous uses similar to pre-development conditions, where primarily forested ecosystems provided a range of values from wildlife habitat to recreational fisheries. Thus, the primary focus of the reclamation program is to foster a return to appropriate and functional ecosystems, supported by soil salvage and replacement strategies that ensure this is possible. The focus of the reclamation program will be to establish self-sustaining vegetation and wildlife species habitat. The reclamation planning for the water features and riparian zones has been designed to create productive rainbow trout habitat for a potential recreational fishery.

Conceptual Closure Plan

The general sequence and timelines for closure activities are included in Figure 6-32. Conceptual mine site features at closure are depicted in Figure 6-33; however, boundaries of some features such as the tailings beach and the stockpiles may change during detailed design and permitting, and in consideration of avoiding significant archaeological sites. Site features at closure will include:

- the Pit Lake, which will fill the open pit
- the non-PAG waste rock dump and low grade stockpile area
- the overburden dump
- the main tailings embankment
- the tailings beach
- the TSF Lake with submerged PAG waste materials
- the spawning channels connecting Lower Fish Creek, the Pit Lake, the TSF Lake, Prosperity Lake, the Headwater Channel Retention Pond, and Wasp Lake

Estimated maximum depths of each of the water bodies are:

- Pit Lake at Open Pit 500 m
- Prosperity Lake 22 m
- TSF Lake 7 m

Upon cessation of milling activities, the open pit will fill to its designed spill elevation over a period of approximately 25 years, releasing water into the lower Fish Creek in Year 44.

Figure 6-33 Conceptual Reclamation Plan

The mill and crusher sites will be completely dismantled upon closure of the mine. All buildings not required for long-term closure will be removed and foundation footings broken down to ground level in preparation for soil cover and revegetation treatments. Components of the buildings that have value will be sold, with the remainder of the materials either recycled or disposed of on-site using the designated dry landfill.

The transmission line will be decommissioned, dismantled, and reclaimed.

During the final months of operations, the supply and demand of chemicals and reagents used for the daily mining and milling activities will be monitored carefully, so that the smallest volume will remain when operations cease. Any residual products will be packaged appropriately and shipped back to the supplier. Alternatively, other mine operations that may be in closer proximity to the Prosperity property could use these products for their continuing operations.

Used oil and oil filters will be collected and recycled off site as part of the operational phase. During the closure phase, trucks and other equipment will be required for reclamation, and this procedure of collecting and recycling will continue until all closure activities have been completed.

General aspects of the closure plan for the tailings facility include:

- Selective discharge of tailings around the facility during the final years of operations to establish a final tailings beach that will facilitate surface water management and reclamation.
- Dismantling and removal of the tailings and reclaim delivery systems and all pipelines, structures and equipment not required beyond mine closure.
- Construction of an outlet channel/spillway at the east abutment of the South Embankment to enable discharge of surface water from Prosperity Lake to the TSF. Details concerning the conceptual design and proposed maintenance of the outlet channel/spillway are presented in Appendix 3-6-C.
- Construction of an outlet channel/spillway at the east abutment of the Main Embankment to enable discharge of surface water from the TSF to the open pit and ultimately to Lower Fish Creek. Details concerning the conceptual design and proposed maintenance of the outlet channel/spillway are presented in Appendix 3-6-V. This full closure scenario will also work well in the event of premature closure of the mine.
- Removal of the seepage collection system at such time that suitable water quality for direct release is achieved.
- Removal and regrading of all access roads, ponds, ditches and borrow areas not required beyond mine closure.
- Long-term stabilization of all exposed erodible materials.

The roads, plant site facilities, and decommissioned water management structures will be reclaimed through replacement of windrowed soil. The overburden dump, tailings beach and tailings embankments will be reclaimed through placement of salvaged and stockpiled soil.

If any road access is required within the mine project areas after closure, these roads will be left in semi-permanent deactivated condition. Semi-permanent deactivation will allow the road to remain in place and be useable but also environmentally stable. Semi-permanent deactivation measures to be carried out include: removal of culverts and replacement with cross-ditches; installation of ditch blocks at cross ditch locations; installation of waterbars across the road to direct road surface water off the road; removal or breaching of windrows along the road edge; outsloping/insloping of the road surface as appropriate; and revegetation of exposed soil surfaces for erosion and weed establishment control. General reclamation practices and reclamation monitoring are described in Volume 3: Project Description and Scope of Project and Section 9.4: Reclamation and Decommissioning Plan.

Premature Closure

Integral to the design of the tailings dam is the ability to address premature closure issues. In the event of premature mine closure, the PAG waste and low-grade stockpile are to be handled in the following manner. The PAG waste would be excavated to a level below the natural flood elevation of the TSF. This material would remain there in perpetuity. Low-grade stockpile material could be handled in one of three ways.

- process the low-grade stockpile material and deposit tailings in the TSF
- haul the low-grade ore back to the pit such that it is below the ultimate flood elevation
- leave the low-grade ore in its stockpile and cover the stockpile to minimize water infiltration and monitor

In the event of premature closure the economic and environmental considerations would be used to determine which of these options, or combination of options would be used. During the initial years of the operation, the mill processing facility could potentially exceed the scheduled processing rate, representing an opportunity to minimize the size of the low-grade stockpile.

6.14.4 Post-closure Phase

Taseko will be responsible for all environmental monitoring and reclamation programs until such time as all conditions of the *Mines Act*, Reclamation Code, and permits have been fulfilled and Taseko has been released from all obligations under the *Mines Act*.

If any post closure activities are required they may include a continuation of environmental monitoring conducted during the history of the project. These might include:

- periodic inspection of the TSF embankments
- evaluation of water quality and flow rates
- fish and aquatic life monitoring
- soil and vegetation monitoring

7 Acid Rock Drainage and Metal Leaching

7.1 Introduction

7.1.1 Project Summary

7.1.1.1 Introduction

Taseko is proposing to develop the Prosperity gold-copper deposit into a mine with on-site mineral processing. Mining will be carried out by open pit using conventional truck and shovel methods, with production of a copper concentrate by differential flotation. A detailed description of the Project can be found in Volume 3, the following summarizes those components of the Project that are critical to an understanding of the ARD/ML assessment.

The Prosperity deposit is centered in the northwest-trending valley of Fish Creek, immediately north and downstream of Fish Lake. Figure 7-1 shows the present location of Fish Lake, the outline of the proposed open pit, and upper and lower Fish Creek. Lower Fish Creek flows into the Taseko River approximately 6 km downstream of Fish Lake.

7.1.1.2 Operational Period

An open pit will be developed to access the Prosperity ore. Ore grade rock will be stored in a live ore stockpile near the mill, and low grade ore will be stockpiled in the Fish Creek valley upgradient of the pit. Ore will be processed at a rate of 70,000 tpd, with a similar quantity of tailings reporting to a conventional Tailings Storage Facility (TSF). The TSF will be located upgradient of the pit and the low grade ore stockpile, and will consist of a basin developed by the construction of embankments across Fish Creek valley and along a portion of the ridge southwest of upper Fish Creek. Tailings will be deposited from spigots along the Main and West embankments, forming a beach against the embankments and sloping towards a pond at the southeast end of the facility. The ultimate layout of the mine is shown in Figure 7-2.

At the start of operations, the water from Fish Lake will be pumped to either the TSF pond to provide an initial reservoir of water for milling operations, or to a new purpose-built basin called Prosperity Lake to will receive the fish stocks currently resident in Fish Lake. Process water will be reclaimed from the TSF pond over the mine life, and a portion of the upgradient catchment will be diverted through Prosperity Lake via Wasp Lake into the Beece Creek drainage. As a contingency against a process water deficiency, investigations to date have shown that any shortfall in process water can be overcome by developing water supply wells in the vicinity of the mill.

Pit operations will proceed for approximately 16 years, at which time mill feed will switch from run-of-mine ore to stockpiled low grade ore. At the end of operations, the low grade ore stockpile will be eliminated.

Waste stripping will produce both overburden and waste rock with non-potentially acid generating (non-PAG) rock and overburden used for construction materials or stored in purpose-built storage facilities. Potentially acid generating (PAG) waste rock and overburden will be placed in a PAG disposal facility within the TSF, and will be inundated with tailings over the life of mine such that, at the end of operations, the PAG disposal facility will be encapsulated with saturated tailings. This complete encapsulation will be possible through milling of stockpiled low grade ore for an additional three years following the completion of pit operations.

Pit dewatering will consist of a pit sump that reports to a Water Collection Pond (WCP) located between the pit and the low grade ore stockpile. This pond will also capture local runoff, and seepage from the Main Embankment, low grade ore stockpile, non-PAG waste stockpile, and overburden stockpile. Water from the WCP will be pumped to the mill during milling operations for use as process water.

Figure 7-1 Site Overview

Figure 7-2 Mine Layout

7.1.1.3 Closure and Post-closure Period

Following operations, site reclamation will be carried out (see Volume 3, Section 9 for the detailed reclamation plan). Key aspects of the reclamation plan, as they related to the post-closure water quality predictions, are summarized here. Figure 7-3 shows a plan view of the site layout after closure measures are complete.

The mill and other structures will be removed. The mill site and the base of the low grade stockpile will be revegetated, with placement of growth media as required. Other disturbed areas will be similarly revegetated to a self-sustaining state.

Tailings beaches will be covered with growth media and a vegetative cover will be established. The headwater diversion around the TSF will continue to discharge to Prosperity Lake. An engineered spillway will be established at the northwest end of Prosperity Lake at such elevation as required to direct lake discharge into the TSF to form TSF Lake. TSF Lake will fill to an elevation of 1552 m, and an outflow channel will be developed to convey water from the TSF Lake to the open pit via an engineered spillway through the Main Embankment. Figure 7-4 shows a post-closure long section of the TSF.

The open pit will be allowed to flood to its natural spill elevation through surface inflows from both the pit catchment and the TSF outflow. Pit filling is predicted to take approximately 30 years from the time pit dewatering ceases. Once the Pit Lake level reaches an elevation of 1440 m, excess water will be discharged to lower Fish Creek.

Figure 7-3 Post-closure Arrangement: Plan

Figure 7-4 Post-closure Arrangement: Long Section

7.1.2 Regulatory Background

Mining in British Columbia is governed by the *Mines Act* (British Columbia 1996). Section 10(1) of the *Mines Act* states the following:

> "Before commencement of any work in, on or about a mine, the owner, agent or manager must apply for and obtain a permit from the chief inspector and must, as part of the application, file with the district inspector a plan outlining the details of the proposed work and a program for the protection and reclamation of the land and watercourses affected by the mine, including the information, particulars and maps established by the regulations or the code."

In the above, "the code" refers to the Health, Safety and Reclamation Code for Mines in British Columbia, which constitutes an appendix to the *Mines Act*. Section 10.1.9 of the code states the following:

> "Plans for the prediction, and if necessary, the prevention, mitigation and management of metal leaching and acid rock drainage shall be prepared in accordance with the Guidelines for Metal Leaching and Acid Rock Drainage at mine sites in British Columbia."

The Guidelines for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia (Price and Errington 1998) were published by the equivalent of BC Ministry of Energy, Mines and Petroleum Resources (MEMPR) in 1998. This document describes the provincial government's policies and broad expectations for prediction and management of acid rock drainage and the related issue of metal (and heavy element) leaching at mine sites. The document provides a number of guiding principles, one of which states:

> "Whenever significant bedrock or unconsolidated earth will be excavated or exposed, the Proponent is responsible for the development and implementation of an effective ARD/ML program. The program must include prediction, and, if necessary, prevention, mitigation and monitoring strategies."

The purpose of this section of the EA is to describe the geochemical prediction studies completed and in progress for the Project, and the implementation of the findings from the studies as prevention, mitigation and monitoring strategies for the Project.

BC MEMPRs overall guidelines are complemented by the document "*Draft Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia*" (Price 1997). It is understood that this document is not intended to be prescriptive but that appropriate methods are to be selected for site-specific conditions. This general principal has been followed for the geochemical studies at the Project.

7.1.3 Agency Consultation

As part of the 1990s effort towards development of the Project, four technical subcommittees were struck by the Project Committee, including the Water Quality/ARD technical subcommittee. The purpose of the technical subcommittees was to develop a set of draft Project Report Specifications (PRS) against which the Project Report would be evaluated. Meetings of each technical subcommittee were chaired by the provincial Environmental Assessment Office (EAO).

Meetings of the Water Quality/ARD subcommittee were held through a combination of formal meetings and teleconferences between July 1997 and December 1998. Participants consisted of representatives from First Nations, the EAO, Ministry of Employment and Investment, Ministry of Environment, Lands and Parks, Environment Canada, and

Taseko. Minutes of these meetings were taken by the EAO and are preserved as part of the Project history.

A "Status of Review" document summarizing the status of the ARD/ML review of the Prosperity Project was drafted by the BC Ministry of Energy and Mines in February 1998 (Bellefontaine 1998). This document reflects Taseko's progress towards meeting the ministry's ARD/ML Guidelines (Price 1997) and outlines areas where additional information would be needed to adequately characterize the Project's ARD/ML potential. The February 1998 "Status of Review" also reflects the progress of the ongoing discussions of the technical subcommittee.

Technical subcommittee meetings and ministry review were suspended around the beginning of 1999 when the Project was put on hold, however certain ARD/ML test work and evaluation was continued through 2000. The Prosperity Project was revived in 2006, and in July 2007, a briefing meeting and teleconference was held between representatives of Taseko and various provincial agencies (including MEMPR and MOE) to provide an update on the status of ARD/ML characterization of the Project. A brief overview of the Project was provided (including a discussion of the mine plan and the reclamation plan), and the rationale for ongoing ARD/ML test work was presented.

7.1.4 Exploration History

Initial exploration activity in the vicinity of the Prosperity deposit was undertaken in the early 1930s when prospectors located pyrite and chalcopyrite-bearing diorite and feldspar porphyritic dikes 1100 m northeast of the deposit.

In 1963–1964, Phelps Dodge Corporation conducted percussion and diamond drilling programs proximal to the deposit. Six diamond drill holes totalling 611 m were completed in 1963 and two diamond holes totalling 112 m were completed in 1964. Results from these programs were not encouraging and the mineral claims were allowed to lapse.

In 1969, Taseko acquired the property and drilled 12 percussion holes totalling 1265 m and 6 diamond drill holes totalling 1036 m immediately to the south of the area in which Phelps Dodge had explored. Taseko discovered significant tonnage grading 0.25 to 0.30% copper.

In 1970, Nittetsu Mining Company optioned the property from Taseko and completed 236 m of core drilling in four holes before returning the property to Taseko. In 1972, Taseko tested the property with two additional diamond drill holes totalling 156 m.

Quintana Minerals Corporation optioned the property from Taseko in 1973 and completed a 23-hole diamond drill program totalling 4705 m during 1973–1974. Vertical drill hole Q73-10, collared in the center of the deposit, intersected 415 m of disseminated and stockwork copper-gold mineralization at an average grade of 0.31% Cu and 0.54 g Au/t. The drill hole bottomed in mineralization of similar grade.

Bethlehem Copper Corp. optioned the property in 1979 and by 1981 had completed 3225 m of percussion drilling in 36 holes and 10,445 m of diamond drilling in 37 holes.

Following the corporate merger of Bethlehem Copper Corp. and Cominco Ltd., Cominco acquired the Bethlehem option agreement on the property. During the years 1982 to 1989, a 19-hole percussion program totalling 1620 m and a 29-hole diamond drilling program totalling 3707 m were completed. Work programs also included 50 line kilometres of induced polarization, magnetic and soil geochemical surveys. The induced polarization survey outlined a 2 x 3 km east-west trending zone of high chargeability. Also undertaken was a limited metallurgical test work program which focused on achieving high copper recovery, with little emphasis on gold recovery, by production of a conventional copper flotation concentrate.

In 1990, Cominco Ltd. reported a drill–indicated mineral resource of 208 Mt at an average grade of 0.23% Cu and 0.41 g Au/t to 360 m below surface. Many of the drill holes used to calculate this resource bottomed in resource grade gold-copper mineralization.

In 1991, control of Taseko was assumed by the Hunter Dickinson management team, who carried out an extensive drilling program and expanded the known dimensions of the deposit to 1450 m in an east-west direction, 850 m north-south and to a depth of 850 m. By the end of 1992, an additional 67,738 m in 121 NQ and HQ diamond drill holes were completed by Taseko and the geological resource was increased to 976 Mt grading 0.48 g Au/t and 0.23% copper. A scoping level metallurgical test work program completed by Melis Engineering Ltd. indicated that acceptable gold and copper recoveries could be achieved by bulk sulphide flotation followed by regrinding and conventional copper flotation. A pre-feasibility study on the viability of a 60,000 tonne/day open pit gold-copper, mine-mill complex was completed by Kilborn Engineering Pacific Limited at this time.

A further 4065 m in 12 inclined HQ diamond drill holes were completed in 1994 by Taseko. These inclined drill holes penetrated the upper third of the deposit to gain a better understanding of the gold and copper distribution with respect to the orientation of mineralized veinlets. A significant grade increase of 11% in gold and 4% in copper was reported in the oriented drill holes (Copeland et al. 1995). A map showing the location of these and all other pre-1996 drill holes in the deposit area is presented in Figure 7-5.

Taseko commenced a drilling program in June of 1996 to advance the Project to feasibility-level and to confirm that the increase in grade found in the 1994 inclined drill hole program was continuous over the entire deposit. By May 1997, 107 holes comprising 49,465 m of NQ and HQ core had been drilled: 92 holes were within the proposed pit area (Figure 7-6) and 15 holes were in proposed tailings and waste rock storage areas on other parts of the property (not shown).

A summary of all drilling carried out by the various operators during the period 1963-1997 is presented below in Table 7-1.

Figure 7-5 Drill Hole Locations, 1969–1994

Figure 7-6 Drill Hole Locations, 1996–1998

Table 7-1 Drilling Summary: 1963 to 1997

		Percussion Drilling		Diamond Drilling		All Drilling	
Year	Company	No. of Holes	(m)	No. of Holes	(m)	No. of Holes	(m)
1963	Phelps Dodge	0	0.00	6	611.12	6	611.12
1964	Phelps Dodge	0	0.00	2	112.16	2	112.16
1969	Taseko	12	1,264.92	6	1,036.30	18	2,301.22
1970	Nittetsu	0	0.00	4	235.80	4	235.80
1972	Taseko	0	0.00	2	156.40	2	156.40

Table 7-1 Drilling Summary: 1963 to 1997 (cont'd)

		Percussion Drilling		Diamond Drilling		All Drilling	
Year	Company	No. of Holes	(m)	No. of Holes	(m)	No. of Holes	(m)
1973	Quintana	0	0.00	14	2,972.30	14	2,972.30
1974	Quintana	0	0.00	9	1,732.50	9	1,732.50
1979	Bethlehem	14	1,106.40	0	0.00	14	1,106.40
1980	Bethlehem	22	2,118.60	0	0.00	22	2,118.60
1981	Bethlehem	0	0.00	37	10,445.50	37	10,445.40
1982	Cominco	19	1,619.55	12	707.06	31	2,326.61
1984	Cominco	0	0.00	5	1,002.60	5	1,002.60
1989	Cominco	0	0.00	12	1,997.00	12	1,997.00
1991	Taseko	0	0.00	10	7,506.03	10	7,506.03
1992	Taseko	0	0.00	111	60,276.80	111	60,276.80
1993	Taseko	0	0.00	8	2,104.04	8	2,104.04
1994	Taseko	1	199.95	34	7,775.79	35	7,975.74
1996	Taseko	0	0.00	69	28,422.45	69	28,422.45
1997	Taseko	0	0.00	38	21,042.33	38	21,042.33
Total Drilling		**68**	**6,309.42**	**379**	**148,136.07**	**447**	**154,445.49**

7.1.5 Chronology of ARD/ML Investigations

There have been a number of phases of ARD/ML characterization carried out by Taseko and its consultants from 1992 to present. Table 7-2 briefly summarizes these characterization programs. The various rounds of test work are described in further detail in Sections 7.2 through 7.5.

Table 7-2 Summary of Prosperity ARD/ML Characterization

Testing Phase	Period	Material Tested	Material Source	Description
Phase 1	1992–1993	Ore, tailings	Diamond drill core, process testing residues	Elemental analysis and ABA testing on 24 ore composites and 27 tailings composites
Phase 2	1993–1994	Overburden, waste rock, ore	Assay pulps from analysis of 1991–1993 diamond drill core	Over 400 samples tested for ABA parameters
Phase 3	1997	Overburden, waste rock, ore, tailings	Drill core, assay pulps from analysis of 1996–1997 diamond drill core, and process testing residues	Over 200 rock samples, and 3 ore and tailings composite samples tested for ABA parameters
Phase 4	1998–2000	Waste rock	1996, 1997 diamond drill core	12 humidity cell tests and 9 column tests on waste rock
Phase 5	2006–present	Ore, low grade ore, waste rock, tailings, overburden	Archived assay pulps, archived diamond drill core, purpose-produced tailings, and test pit grab and drill core overburden samples from 2007	Humidity cell tests (ore, low grade ore, waste rock, tailings), column tests (waste rock, tailings), shake flask extractions (waste rock, overburden), ABA testing (waste rock)

7.1.6 Geological Context

7.1.6.1 Other Sources of Information

The following sections summarize the geological description prepared by Taseko and described in detail in Volume 3, Section 5. Additional background information on the geology of the Prosperity deposit can be found in MINFILE (record 092O 041), Caira et al. (1995) and Brommeland et al. (1998).

7.1.6.2 Regional Setting

The Prosperity Project is located within the western-most portion of the Intermontane Belt, about 50 km northeast of the Coast Plutonic Complex boundary. The surrounding area is underlain by poorly exposed, late Palaeozoic to Cretaceous sedimentary and volcanic rocks which have been intruded by plutons of mid-Cretaceous to early Tertiary age. Sub-horizontal Miocene plateau basalts and non-marine sedimentary rocks of the Chilcotin Group form a discontinuous and locally extensive post-mineral cover in the immediate Project area. The regional Yalakom Fault, which lies to the southwest of Prosperity, may have imparted some related structural controls which were important to the localization of mineralization at the deposit (Figure 7-7).

Figure 7-7 Regional Geology

7.1.6.3 Surficial Geology

The Prosperity gold-copper deposit subcrops under a 5 to 65 m thick blanket of surficial cover at the north end of Fish Lake.

Regional glaciation occurred most recently during the Wisconsinan (15,000 to 18,000 years before present) during which time ice moved over the low lying and undulating surface of the West Fraser Plateau in a northerly and northeasterly radial dispersal pattern (Talisman 1997). The hummocky topography resulting from this period of glaciation is typical of that produced by an ablating ice mass and includes kames, eskers and kettles deposited on top of earlier lodgement till or basal till.

During Wisconsinan glaciation, ice movement in the vicinity of Fish Lake was from south to north (Caira and Findlay 1994). Recent alluvial activity has cut into, and deposited sediments on the older Wisconsinan sediments. In the proposed pit area, three main types of glacially-derived overburden were recognized glacial till, glaciofluvial material, and glaciolacustrine material.

Prior to the most recent glaciation, Chilcotin Group flood basalts were deposited regionally across over 25,000 km² in the interior plateau of south central British Columbia. In the immediate vicinity of the Prosperity deposit, flood basalts are sandwiched between the Wisconsinan sediments above and underlying colluvial and lacustrine sediments.

In general, east of Fish Creek and north of Fish Lake the overburden consists predominantly of a patchy and variably thick sequence of basal till that covers colluvium and bedrock. A prominent 750 m long esker occurs on the east side of Fish Creek and extends south to within 250 m of the outlet of Fish Lake. The west side of Fish Creek is underlain mainly by a thick sequence of basalt flows which can be observed in cliffs outcropping along the bank of the creek. Overlying these basalt flows is an irregular cover of basal till up to 22 m thick. In turn, the flows rest directly on bedrock or overlie a layer of colluvium which varies irregularly in areal extent and is 8 to 70 m in thickness. The southern portion of the deposit, adjacent to Fish Lake is covered by an extensive deposit of lake sediments (Figure 7-8).

Detailed geological logging of the overburden within the proposed pit indicates that there are four major types of overburden present: glacial till, basalt flows, colluvium and glacial lacustrine sediments. This overburden sequence consists mainly of basalt and glacial till with lesser colluvium and sediments. The sequence varies from 0 to 65 m in thickness over the deposit, but is as thick as 155 m to the south of the deposit near Fish Lake (Figure 7-9). The overburden level plans in Figure 7-10 through Figure 7-14 show the distribution of the four main overburden units laterally and with depth.

Figure 7-8 OVB Surficial Geology

Figure 7-9 Overburden Isopach

Figure 7-10 Overburden Level Plan 1567.5 m

Figure 7-11 Overburden Level Plan 1522.5 m

Figure 7-12 Overburden Level Plan 1477.5 m

Figure 7-13 Overburden Level Plan 1432.5 m

Figure 7-14 Overburden Level Plan 1387.5 m

7.1.6.4 Host Rocks

The deposit is predominantly hosted in Cretaceous andesitic volcaniclastic and volcanic rocks which are transitional to a sequence of sparsely mineralized, volcanically derived sedimentary rocks to the south (Figure 7-15). The andesitic volcaniclastics are comprised of coarse-grained crystal tuff and ash tuff, and thinly bedded tuff with lesser lapilli tuff. The upper eastern portion of the deposit is hosted by subvolcanic units of crowded feldspar porphyritic andesite and thick feldspar and hornblende porphyritic flows as in Table 7-3.

Figure 7-15 Geology at the Overburden Bedrock Interface

Table 7-3 Prosperity Project Geology Codes

	Quaternary Cover		
	Pleistocene Glacial Till		
Cenozoic	511	TILB	Basal Till
	512	CLAYU	Clay
	513	SICLU	Silt/Clay Mix
	514	SILTU	Silt

Table 7-3 Prosperity Project Geology Codes (cont'd)

	515	GRAVU	Gravel
	Miocene to Pliocene Basalt Flows		
	520	BSLT	Basalt
	Tertiary Cover		
	Colluvium		
	531	FANL	Fanglomerate–Limonitic
	532	FAN	Fanglomerate
	Glacial Lacustrine Sediments		
	541	GRAV	Gravel
	542	SICL	Silt/Clay Mix
	543	CLAY	Clay
	544	SILT	Silt
Mesozoic	**Late Cretaceous Fish Lake Intrusive Complex**		
	11	PMPD	Post Mineralization Porphyritic Diorite
	12	INBX	Igneous Breccia
	13	FP	Feldspar Porphyry
	14	QFP	Quartz Feldspar Porphyry
	Fish Creek Stock (QD)		
	15	QD3	Subporphyritic to Equigranular Quartz Diorite
	16	QD2	Seriate Porphyritic Quartz Diorite
	17	QD1	Heterogeneous Fine Porphyritic Quartz Diorite
	Cretaceous Sedimentary Rocks		
	31	SEDS	Mudstone, Siltstone, Sandstone and Conglomerate
	Cretaceous Volcanic Rocks		
	25	SUBV	Crowded Porphyritic Andesite
	24	FLOW	Porphyritic Andesite Flow
	23	BEAT	Laminated Andesite Tuff
	22	DEBF	Andesite Lapilli Tuff and Debris Flow
	21	MAT	Andesite Tuff (ash tuff)
	21	FAXT	Andesite Tuff (mainly crystal tuff)

In the western portion of the deposit, the multi-phase Fish Creek Stock has intruded into a thick sequence of andesite flows which overlay volcaniclastic rocks. The steeply south-dipping, oval quartz diorite stock which is approximately 265 m wide by 800 m long is surrounded by an east-west trending swarm of subparallel quartz-feldspar porphyritic dikes which also dip steeply to the south. Together the stock and dikes comprise the Late Cretaceous Fish Lake Intrusive Complex that is spatially and genetically related to the deposit. Post mineralization (post-ore) porphyritic diorite occurs as narrow dikes that crosscut all units within the deposit. They represent the final intrusive phase of the emplacement of the Fish Lake Intrusive Complex.

Geology level plans shown in Figure 7-16 through Figure 7-18 show the plan distribution of the deposit host rocks with depth. The cross-section shown in Figure 7-19 cuts the deposit on a north-south axis shows the spatial relationship between the core of the intrusive complex and the surrounding volcanic country rock. Figure 7-20 shows a section cutting the deposit east-west, or roughly perpendicular to the regional structure that is manifested as the QD Fault and the East Fault in the vicinity of the Prosperity deposit.

Figure 7-16 Geology Level Plan 1402.5 m

Figure 7-17 Geology Level Plan 1207.5 m

Figure 7-18 Geology Level Plan 997.5 m

Figure 7-19 Generalized Geological Cross-Section 9900 E

Figure 7-20 Generalized Geological Cross-Section 10,000 N

Volcanic and Sedimentary Rocks

Five volcanic units and one subvolcanic unit comprise the majority of the Prosperity deposit host rocks. Sorted by quantity within the proposed pit, they are porphyritic andesite flow, andesite crystal, ash and lapilli tuff, and crowded porphyritic andesite. Andesite tuffs and flows are commonly interbedded.

The volcanic rocks present in the deposit area are not typical of the surrounding area and are likely of limited regional extent. Similar volcanic rocks outcrop near the mouth of Fish Creek 3.5 km to the north and they may correlate with those of the deposit.

A sparsely mineralized, volcanically-derived sedimentary unit occupies the upper south-southeast portion of the deposit. Stratigraphically, these sediments although of a different facies, are considered to be the lateral equivalent to the volcanic assemblage that outcrops near the mouth of Fish Creek.

Fish Lake Intrusive Complex

The Prosperity deposit is spatially and genetically related to the Fish Lake Intrusive Complex which comprises of the Fish Creek Stock, quartz feldspar and lesser feldspar porphyry dikes and post-mineralization porphyritic diorite dikes.

The Fish Creek Stock is a hypabyssal lenticular east-west trending, steeply south-dipping body of porphyritic quartz diorite that has intruded a thick sequence of volcanic rocks. It is composed of three phases, the heterogeneous fine-grained porphyritic quartz diorite, seriate porphyritic quartz diorite and subporphyritic to equigranular quartz diorite units. These units are very similar in chemical composition, but differ in textural characteristics. Contacts are commonly gradational with heterogeneous fine porphyritic quartz diorite grading into seriate porphyritic quartz diorite and seriate porphyritic quartz diorite grading into subporphyritic to equigranular quartz diorite over distances of several m to 10s of m. The heterogeneous fine porphyritic quartz diorite and seriate porphyritic quartz diorite units also occur independently.

Quartz feldspar porphyry and feldspar porphyry dikes occur as an east-west trending, steeply south-dipping swarm centered east of the Fish Creek Stock. The quartz feldspar porphyry units crosscut all of the volcanic and sedimentary rocks identified in the deposit. The contemporaneity of the quartz feldspar porphyry dikes and the Fish Creek Stock is suggested by the occurrence of some units of transitional lithology, close to the border of the stock.

The entire suite of rocks (intrusive, volcanic and sedimentary) hosting the deposit is crosscut by a series of barren, post-mineralization porphyritic diorite dikes. The post mineralization porphyritic diorite unit comprises less than 1% of the deposit rocks.

7.1.6.5 Structure

Numerous faults were intersected in drill core throughout the deposit area. Faults are usually indicated by strongly broken core, gouge, shear, cataclastic and rarely mylonitic textures. All of the aforementioned features can occur across intervals of less than 1 cm to over 20 m. Utilizing all available data, two predominant faults (the QD and East Faults) have been delineated.

The QD and East Faults are subparallel, strike north-south and dip steeply to the west, becoming near vertical down-dip (Figure 7-20). They cut the central portion of the deposit and are approximately 230 m apart near surface and 330 m apart at depth. The western QD Fault trends approximately 355º and has a steep westward dip of 82 to 86º. This fault marks the eastern boundary of the Fish Creek Stock. The East Fault strikes approximately 360º and has a steep westward dip of 85 to 87º.

7.1.6.6 Alteration

Five main alteration styles have been identified at the Prosperity deposit, potassium silicate, propylitic, sericite-iron carbonate, phyllic and argillic. Alteration styles do not occur singularly in discrete zones they commonly overlap and/or overprint each other. However, one alteration style will typically dominate in any given area, hence the naming of a zone specific to the dominant alteration style (Figure 7-21).

Potassium silicate alteration predominates within the deposit area forming a central east-west trending ovoid zone intimately related to significant gold/copper mineralization (>0.20 g/Au t and >0.20% Cu). The zone of potassium silicate alteration is surrounded by propylitically altered rocks that extend outward for several hundred meters. Along the eastern margin of the deposit a discontinuous belt of phyllic alteration is developed in proximity to the transition between the potassium silicate and propylitically altered rocks. Late stage sericite-iron carbonate alteration forms irregular zones, particularly within the central zone of potassium silicate alteration. Argillic alteration is localized along fault zones and overprints earlier alteration assemblages, and has not been independently incorporated into the ARD/ML characterization due to the small quantity present relative to the other four alteration types.

The sequence of alteration events at the Prosperity deposit commenced with the emplacement of the Fish Lake Intrusive Complex and the development of a hydrothermal convective cell. Concentric, thermally controlled zones of potassium silicate enclosed by propylitic alteration developed within and adjacent to the intrusive complex. At higher levels in the system a slightly later episode of phyllic alteration occurred as a result of mixing between fluids of the hydrothermal cell and meteoric waters. This phyllic alteration overprinted both potassium silicate and propylitic alteration in certain areas. Sericite-iron carbonate and argillic alteration, the latest events in the alteration history, resulted from the migration of late stage hydrothermal fluids and meteoric waters along structural features. This process led to the formation of secondary mineral assemblages in the host rocks which overprint all other alteration styles.

Selected level plans which pertain to alteration are shown in Figure 7-22 through Figure 7-24.

Figure 7-21 Alteration at the Overburden Bedrock Interface

Figure 7-22 Alteration Level Plan 1402.5 m

Figure 7-23 Alteration Level Plan 1207.5 m

Figure 7-24 Alteration Level Plan 997.5 m

7.1.6.7 Mineralization

Gold-copper mineralization within the Prosperity deposit is intimately related to potassium silicate alteration and a later, superimposed sericite-iron carbonate alteration. This is particularly true within a central, east-west trending ovoid zone that hosts the majority of the mineable reserve.

Chalcopyrite-pyrite mineralization and associated copper and gold concentrations are distributed relatively evenly throughout the host volcanic and intrusive units in the deposit. A sedimentary unit which is located in the upper south eastern part of the mineralized zone is sparsely mineralized. Post-mineralization porphyritic dikes are essentially barren.

Pyrite and chalcopyrite are the principal sulphide minerals and are accompanied by: minor amounts of bornite and molybdenite, sparse tetrahedrite-tennantite, sphalerite and galena and rare chalcocite-digenite, covellite, pyrrhotite, arsenopyrite, enargite and marcasite. Native gold generally occurs as inclusions in and along microfractures with copper sulphides and pyrite. Pyrite to chalcopyrite ratios throughout most of the proposed pit area range from 0.5:1 to 1:1 and rise to 3:1 or higher around the periphery of the deposit which coincides with the propylitic and locally the phyllic alteration zones.

Sulphide minerals show the thoroughly dispersed mode of occurrence characteristic of porphyry copper deposits. Sulphides occur in relatively equal concentrations as disseminations, blebs and aggregates in mafic sites, as fracture fillings and as veinlets. Disseminated sulphide mineralization is marginally more prevalent than veinlets in intrusive rocks while in volcanic rocks, the reverse was noted.

Gold and copper distribution throughout the deposit is presented in Figure 7-25 through Figure 7-27.

Figure 7-25 Au and Cu Grade Level Plan 1402.5 m

Figure 7-26 Au and Cu Grade Level Plan 1207.5 m

Figure 7-27 Au and Cu Grade Level Plan 997.5 m

7.1.6.8 Gypsum and Anhydrite

Anhydrite ($CaSO_4$) and gypsum ($CaSO_4 \cdot 2H_2O$), the major sulphate minerals in the deposit, occur below a zone of broken and weakly weathered rock which is caused by the dissolution of gypsum.

Mode of Occurrence

Colourless to orange and pale pink gypsum veins are generally a few millimetres wide but can range up to several centimetres wide and be as closely-spaced as one veinlet per centimetre and in more densely veined intervals, comprise over 5% of the rock.

Gypsum is most often observed healing microfractures and fractures. It also follows older, reactivated sulphide and magnetite bearing veins/veinlets, sometimes incorporating minor wallrock sulphides. It occurs as massive aggregates in the following veins: calcite with or without dolomite, quartz-carbonate with or without sulphides, quartz with or without sulphides, and sulphide veins/veinlets. Gypsum is less commonly seen infilling vugs in carbonate (dolomite-calcite with or without ankerite) vein breccia and variably pseudomorphing anhydrite.

Purple anhydrite usually occurs as aggregates in various vein types; less commonly, it occurs as massive veins up to 5 cm wide and as disseminated small grains identifiable only in thin section. Anhydrite rarely occurs as: alteration patches with quartz, gypsum, biotite, chlorite, calcite and magnetite; as massive blebs and lenses together with gypsum, quartz, calcite, magnetite, pyrite and chalcopyrite; and in vugs with gypsum and chalcopyrite. Veins comprised of anhydrite are noted to contain, in order of decreasing abundance, sulphides (chalcopyrite > pyrite >> molybdenite), quartz, dolomite, calcite, gypsum, magnetite and hematite.

Spatial Distribution

Gypsum veinlets/veins are pervasive below a sharp upper border, labelled the “Gypsum Line”, which marks the lower limit of gypsum dissolution by ground water. The Gypsum Line varies from 75 to 275 m below the surface throughout the proposed pit and separates a near surface zone of broken rock from more competent rock below.

In the northwestern portion of the deposit, gypsum occurs 100 to 110 m below surface (1340 m elevation); in the southwestern portion, it is 200 to 275 m below surface (1250 to 1280 m elevation), the Gypsum Line is relatively smooth and gradually deepens to the south.

In the central deposit area, the Gypsum Line is more irregular with a trough 330 m below surface (1130 m elevation), proximal to the QD Fault in the southeast corner of the proposed pit. Less pronounced peaks occur in the central proposed pit area where the Gypsum Line is only 75 to 100 m below surface.

In the eastern part of the deposit, the Gypsum Line becomes smoother and ranges from 150 m below the surface in the northwest corner to 210 m below the surface (1260 to 1350 m elevation) in the southeast corner.

Anhydrite’s distribution with respect to depth is determined by the temperature at which calcium sulphate was precipitated from hydrothermal solutions. Anhydrite formed at high temperatures well below surface, while gypsum formed at low temperatures at shallower depths. A late episode of gypsum veining overprinted the entire deposit as the hydrothermal system cooled and collapsed (Brommeland et al. 1998).

7.1.6.9 Geological Model

Taseko used a block model approach to modelling project geology and defining ore-grade mineralization, with 20 x 20 x 15 m blocks on 15 m levels forming the basic structure of the model. The following describes how the geology block model was coded.

Geologic Controls Used for Domain Definition

The geologic domains for the Prosperity Gold-Copper Deposit Block Model were established by considering the relationship of gold and copper mineralization to four key geologic parameters, alteration, lithology, structure and the gypsum line. Individual models were created for each of these key parameters which were then amalgamated to produce the final geologic/domain block model. A brief description of each of these geologic parameters follows.

Alteration

Four types of alteration were considered during the construction of the alteration model: potassium silicate, sericite-iron carbonate, propylitic and phyllic. An alteration solids model and an alteration block model were created by the Project geologists in a series of steps. First, the drill hole alteration data was plotted in two orthogonal sets of cross-sectional views. Then the outlines of the four units were interpreted using the original drill logs, core photos, and sawn core slabs for reference. The resulting polygons were digitized and the mid-bench intersection of these cross sectional polygons were plotted in plan. Outlines of the units were then interpreted in plan view using overlays of the drill data in this view to ensure that the base information was honoured. These plan view polygons were then digitized. A solid model of alteration was created by extrapolating the bench polygons vertically 7.5 m above and below the mid-bench elevation. The alteration block model was created by assigning each block the code of the dominant alteration unit. The block model code and mineral assemblage associated with each alteration style is presented in Table 7-4.

Table 7-4 Alteration Codes and Descriptions

Code	Alteration	Mineral Assemblage
1000	Potassium Silicate	Biotite and/or chlorite + pyrite + sericite + magnetite + orthoclase + chalcopyrite
3000	Sericite-iron carbonate	Sericite + iron carbonate + clay + hematite
5000	Propylitic	Chlorite + calcite + pyrite
6000	Phyllic	Quartz + sericite + pyrite

Lithology

Nine lithological types were considered during the construction of the lithology model (apart from additional overburden types listed in Table 7-6). Gold-copper mineralization is present in all of these lithologies, including some isolated occurrences in the otherwise barren post mineralization porphyritic diorite dikes. A lithologic solid model and a lithologic block model were created in much the same way as the alteration models described above. The block model codes and brief descriptions of each of the lithological units are presented in Table 7-5.

Table 7-5 Lithology Codes

Code	Lithology	Description
110	Post Mineral Porphyritic Diorite Dikes	Post mineralization porphyritic diorite dikes
140	Quartz Feldspar Porphyry	Quartz feldspar porphyry dikes
170	Quartz Diorite	Includes fine porphyritic, seriate porphyritic and subporphyritic quartz diorite
210	Andesite Crystal Tuff	Coarse and fine grained andesite tuffs
220	Andesite and Lapilli Tuff	Lapilli tuffs and debris flows
230	Bedded Andesite Tuff	Very fine to fine-grained bedded crystal tuff
240	Porphyritic Andesite Flow	Porphyritic andesite flows
250	Crowded Porphyritic Andesite	Fine-grained crowded plagioclase porphyritic andesite
310	Sedimentary unit	Mudstone, siltstone, sandstone and conglomerate

Table 7-6 Overburden Codes

Block Model Code	Unit Description	Group Code	Group Description
511 512 513 514 515	Basal Till Clay Silt / Clay Mix Silt Gravel	51	Glacial Till
520	Basalt	52	Basalt
531 532	Fanglomerate–Limonitic Fanglomerate	53	Colluvium
541 542 543 544	Gravel Silt / Clay Mix Clay Silt	54	Glacial Lacustrine Sediments

Structures and the Gypsum Line

Two local faults (QD and East Fault) were delineated with a reasonable level of confidence during the construction of the lithologic model. The mid-bench intersections of these sub-vertical, essentially planar faults were used to create 3-D surfaces of these structural features. The “gypsum line” was modeled by plotting the interpreted drill hole intersections of this feature in plan view and contouring them to form a 3-D surface. This formed an undulating, essentially sub-horizontal surface. The intersection of the two faults and the gypsum line was used to sub-divide the deposit into six structural or “geographic” domains (Figure 7-28), which were then modeled as solids. A domain/gypsum block model was created from this solids model. Details are listed in Table 7-7.

Figure 7-28 Conceptual Model of Geographical (Structural) and Geologic Domains

Table 7-7 Geographic Domain Codes and Descriptions

Code	Geographic Domain	Description
1	West zone above the gypsum line	The area west of the QD Fault and above the gypsum line
2	Central zone above the gypsum line	The area bounded by the QD and East Faults and above the gypsum line
3	East zone above the gypsum line	The area east of the East Fault and above the gypsum line
4	West zone below the gypsum line	The area west of the QD Fault and below the gypsum line
5	Central zone below the gypsum line	The area bounded by the QD and East Faults and below the gypsum line
6	East zone below the gypsum line	The area east of the East Fault and below the gypsum line

COMBO Code

Each block in the blocks model was assigned a unique value for each of alteration code, lithology code, and domain code. These values were then combined into a single four-digit code (referred to as the COMBO code) that defined the geological attributes of each block.

The COMBO code was combined by adding together the alteration, lithology, and domain codes for each block to yield a single four digit number. Because the code for each geological attribute was a unique order of magnitude, the COMBO code structure results in alteration indicated in the first digit, lithology in the second and third digit, and domain in the fourth and final digit. For example, a potassic quartz diorite in the West Zone below the gypsum line (Alteration = 1000, Lithology = 170, Domain = 4) would have a COMBO code of 1174.

ABA Block Model

Each block in the block model was assigned an ABA code to allow volumes of PAG and non-PAG waste to be estimated for mine planning purposes. Coding was carried out by Taseko geologists by carrying out the following steps:

1. Plotting Phase 2 and 3 ABA data on level plans representing the mid-bench elevation of every bench (i.e., level plans at 15 m vertical intervals). The collection and interpretation of the ABA data are described in Section 7.3.
2. Defining PAG/non-PAG polygons by interpolating between spatially representative ABA data points. Interpretation was carried out manually and the level plans immediately above and below were reviewed to ensure that the interpretations were consistent vertically as well as laterally.
3. PAG/non-PAG polygons were digitized and the result was extruded upwards and downwards to make three dimensional solids for each bench.
4. The extruded solids, with the associated PAG/non-PAG designations, were then used to code each block in the block model as either PAG (code = 1) or non-PAG (code = 2).

The block model was coded using a preliminary classification criteria that was adopted to allow mine planning to proceed in advance on the completion of ARD/ML characterization. Based on experience with other porphyry copper deposits, a provisional estimate of available neutralization potential (NP) was made by subtracting 10 kg $CaCO_3$ equiv. /tonne from the NP value determined in laboratory tests to deduct the portion of measured NP commonly derived from silicate minerals. This estimate of available NP was then compared to acid potential (AP) values to arrive at a waste category classification, as follows:

- Non-PAG: all material having (NP-10)/AP ≥2
- PAG: all material having (NP-10)/AP <2

The block model was then used to estimate tonnages of PAG and non-PAG waste that would be produced as mining progresses. Subsequent ARD/ML characterization showed that the "NP-10" value underestimates actual available NP, indicating that the preliminary classification is conservative in that it overestimates the tonnage of PAG waste. Details are discussed in Section 7.3.

7.1.6.10 Geological Features Relevant to ARD/ML Characterization

The following features of the geology are relevant to the ARD/ML characterization.

- The main rock types are quartz diorite intrusives, andesitic volcanics, and volcanically-derived sediments.
- Alteration is pervasive and rock mineralogy is dominated by alteration type. Economic mineralization is largely hosted in a potassic core surrounded by propylitic host rock.
- Pyrite and chalcopyrite are the principle sulphide minerals. These occur as disseminations, fracture-fillings and sub-vertical veinlets.
- Pyrite and chalcopyrite are accompanied by minor amounts of bornite and molybdenite; sparse tetrahedrite-tennantite, sphalerite and galena; and rare chalcocite-digenite, covellite, pyrrhotite, arsenopyrite and marcasite.
- Potentially leachable elements include arsenic, antimony, copper, cadmium, molybdenum, lead and zinc.
- There is potential for preferential exposure of veinlet and fracture-fill sulphides during blasting.
- Carbonate minerals are present and dolomite and calcite are the main minerals.
- The dominant silicate minerals have low reactivity and are expected to contribute limited acid consuming capacity at near neutral pH.
- Calcium sulphate is a major alteration mineral. It can be expected to leach from exposed rock to release dissolved sulphate.

7.1.7 Acknowledgements

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- Taseko—Project geology, block modeling, mine design

- Knight Piesold Consulting—infrastructure design, baseline and Project water balance, baseline characterization of groundwater
- Bruce Geotechnical Consultants—hydrogeology
- Jacques Whitford AXYS—input to design of water quality predictions
- Watermark Consulting Inc.—Phases 1 through 4 ARD/ML program
- Canadian Environmental and Metallurgical Inc.—static and kinetic testing for Phases 3, 4 and 5
- Petrascience Inc.—mineralogical characterization
- Earth and Ocean Sciences, U.B.C.—microprobe analysis of mineral grains

7.1.8 Ongoing Studies

This report was prepared in July 2008 using data generated through January 2, 2008. This cut-off date was selected to allow test results to be used to develop water quality predictions. A number of kinetic tests are ongoing and are summarized in Table 7-8, and the kinetic test data are reported in appendices are current through June 2008 for reference. Further results from ongoing tests will be presented in subsequent addenda to this report.

Table 7-8 Ongoing Testing

Material Type	Test Type	Number of Ongoing Tests
Rock	Humidity Cells	13
	Subaqueous Columns	2
Tailings	Humidity Cells	2
	Unsaturated Columns	2
	Subaqueous Columns	2

7.2 Design of 2006-2008 ARD/ML Characterization Program

7.2.1 Overall Design

The overall objectives of the Phase 5 ARD/ML characterization program that was initiated in 2006 were to collect the remaining information required as inputs to:

- waste management planning (for example, is the rock/tailings potentially-ARD generating and/or metal leaching?)
- effect assessment (what concentrations of metals and other components might leach from mine facilities containing rock/tailings?)

On review of the mine plan and the information from Phases 1 through 4 of ARD/ML characterization, SRK prepared a summary of information required to meet the above objectives (Table 7-9). A "gap analysis" was then carried out to determine what information requirements had been met through earlier work, and to identify remaining information needs. The "gap analysis" included a review of the minutes from technical subcommittee meetings, and the February 1998 "Status of Review" document (Bellefontaine 1998).

The Phase 5 characterization program was then designed to fill ARD/ML information gaps identified during the gap analysis. Available sample material for additional test work included a limited quantity of archived drill core and a broader range of archived assay pulps from much of the 1990s exploration work.

Table 7-9 Overview of Proposed Mine Facilities and Associated ARD/ML Information Requirements

Facility	Component	Data Needed	Methods	Notes	Metal Scan	ABA	Optical Petrographics	QXRD	Microprobe on carbonate grains	BC MEM Extractions	Rock HCTs	Tailings HCTs	Column Tests	Specific Water Samples
Overburden Stockpiles	Bulk characterization	Elemental characteristics and ARD potential	Metals and ABA analysis	Carried out during exploration (includes Chilcotin basalt)	219	57								
	Leachability	Soluble load	Extraction tests	Tested material as available in 2007						24				
Waste Rock Stockpiles	Bulk characterization	Lithological composition of waste rock, tonnages	Drilling and mine planning, block modelling	–										
		Occurrences of minerals (types, crystal form, occurrence)	Drill hole logging	All exploration holes										
		Elemental content of rock for all regulated parameters	Selenium and mercury analyses	Most elements included in exploration assays; selenium not included in assays, therefore analyzed to fill information gap	92									
		Spatial variation of acid potential, neutralization potential at block scale	Acid-base accounting (total S, S as SO_4, modified NP, total inorganic carbon)	Eight holes sampled and analyzed continuously on approximately 6 m intervals		165								
		Spatial variation of acid potential, neutralization potential at zone scale	Acid-base accounting (total S, S as SO_4, modified NP, total inorganic carbon)	Full spatial coverage by randomly selected samples throughout each zone-carried out during exploration	>35,000	443								
	Correlation of bulk characteristics to mineralogy	Mineralogy of carbonates. Different types of carbonates occur at Prosperity- Ca, Mg and Fe content needs to be determined to allow interpretation of TIC analyses	Thin section descriptions, QXRD and microprobe for carbonate type and composition	Targetted 3 samples/rock type x 3 main rock types x 4 alteration types			23	23	371					
	Correlation of bulk characteristics to potential for ARD	Rate of acid generation and neutralization potential depletion	Humidity cells	Propylitic and phylic tested previously. Potassic, high Zn, basalt, low grade ore, and ore samples require testing							12 complete, 13 in progress			
	Contaminant release rates for non-acidic and acidic conditions (on a rock type bases)	Rate of release of all potential contaminants	Humidity cells, columns, shake flasks	Humidity cells and columns included in above and in previous testing						32			9 complete	
	Chemistry of seepage and runoff	Site water quality database to inform calibration of water chemistry estimated from laboratory tests	Scale-up of test results	Kinetic testing as described above										
	Hydrology	Waste storage area hydrology	Hydrological interpretation	From baseline monitoring										Baseline monitoring
Pit Walls	Bulk characterization	Characteristics of pit walls	Geological and block models	Included in waste rock modelling										
			Exploration and mine planning											
		Highwall characteristics	Similar program as waste rock	Included in waste rock testing										

Table 7-9 Overview of Proposed Mine Facilities and Associated ARD/ML Information Requirements (cont'd)

Pit Walls (cont'd)	Correlation of bulk characteristics to mineralogy and release rates	Same as waste rock	Included in waste rock	Included in waste rock										
	Conatminant release rates for non-acidic and acidic conditions (on a rock type basis)	Same as waste rock	Included in waste rock	Included in waste rock										
	Chemistry of seepage and runoff	Seepage from pit walls	Included in waste rock	Included in waste rock										
		Chemistry of inflow water	Groundwater wells	From baseline monitoring										Baseline monitoring
	Hydrology	Water balance for pits	Hydrological interpretation	Water balance by Knight Piesold										
Tailings Storage Facility	Bulk characterization	Acid potential, neutralization potential, element content	Acid-base accounting (total S, S as SO_4, ICP-MS scan, neutralization potential, total inorganic carbon)	Perform on samples frmo bench scale flotation on ore-grade material	31	31								
	Correlation of bulk characteristics to mineralogy and release rates	Mineralogy	Thin sections	Prepared from kinetic test samples			2	2	63					
		Rate of depletion of sulphide and acid neutralizing minerals	Humidity cells	Perform on samples from bench scale flotation on ore-grade material								3		
	Contaminant release rates	Rate of release	Humidity cells	As above										
	Chemistry of seepage and runoff	Unsaturated conditions	Column tests	Perform on samples from bench scale flotation on ore-grade material									1 (duplicate)	
		Saturated or near-saturated conditions	Column tests	As above									1 (duplicate)	
	Chemistry of porewater for saturated PAG rock	Saturated or near-saturated conditions	Column tests	Perform on composite PAG sample from humidity cell sample rejects									1 (duplicate)	
	Hydrology	Tailings area water balance	Hydrological interpretation	Water balance by Knight Piesold										

7.2.2 Design Details

7.2.2.1 Waste Rock and Overburden

The 1998 BC MEM "Status of Review" summary, and the 2006 SRK review of the available ARD/ML information identified the following gaps in the waste rock characterization:

- humidity cell testing of potassic waste
- humidity cell testing of high zinc propylitic waste
- humidity cell testing of typical Chilcotin basalt
- confirmation humidity cell testing of worst-case Chilcotin basalt
- subaqueous column testing of potentially acid generating waste rock
- saturated and unsaturated column testing of tailings
- leaching tests on assay pulps for water quality predictions
- static testing to assess the feasibility of segregation of PAG and non-PAG waste rock
- elemental analysis to assess Hg and Se content of waste rock

The 830 pit forms the basis for the current mine plan, with the pit shell forming the ultimate pit wall that will be exposed at the end of mining. To characterize rock that will remain in the ultimate pit walls, a slightly larger pit shell (referred to as the 852 pit) was used to define the lower limit of material considered in the ARD/ML evaluation described here.

7.2.2.2 Ore and Low Grade Ore

The 1998 BC MEM "Status of Review" summary, and the 2006 SRK review of the available ARD/ML information identified the following gaps in ore and low grade ore characterization:

- humidity cell testing of ore material
- humidity cell testing of low grade ore material

7.2.2.3 Pit Walls

ARD/ML information required for assessing pit wall loadings has been gathered as part of the waste rock, low grade ore and ore characterization programs. No additional ARD/ML testing has been carried out specifically for evaluating pit wall behaviour.

The distribution of alteration units in the pit wall was defined by intersecting the ultimate pit shell with the alteration solids developed by Taseko from the exploration drill hole database. Hydrology inputs, including rates of wall runoff and pit filling by surface and groundwater, were provided by Knight Piesold.

7.2.2.4 Tailings

The 1998 BC MEM "Status of Review" summary, and the 2006 SRK review of the available ARD/ML information identified the following gaps in the tailings characterization:

- humidity cell testing of tailings
- unsaturated column testing of tailings
- subaqueous column testing of tailings

7.3 Rock and Overburden Characterization

7.3.1 Sample Collection and Field Methods

7.3.1.1 Previous Characterization Programs

Taseko conducted vertical and angled diamond drilling on the Prosperity deposit in several campaigns between 1991 and 1997. Retrieved core was logged and split, and split samples were submitted for elemental analyses by aqua regia digestion followed by ICP finish. Mercury analysis was carried out by cold vapour atomic absorption (CVAA). Drill core was archived in at the Prosperity site, and assay pulps were archived in Taseko's warehouse in Port Kells, British Columbia.

Phase 1 Static Testing

A metallurgical testing program was carried out at Lakefield Research in 1992/1993. Batch flotation tests were carried out using 24 composite ore samples each collected from approximately 200 m of drill core from a single drill hole. The central portion of the Prosperity deposit was divided into eight blocks (designated A through H; Figure 7-29), and one sample was collected from the upper, middle, and lower portions of each region. The composites were labelled according to sub-zone (blocks A to H), depth within the deposit (U = upper, M = middle and L = lower) and the number of the drill hole from which the sample was taken. Appendix 3-7-A lists the sampled composite intervals used.

Nine locked cycle flotation tests were performed to evaluate metallurgical conditions in different regions of the deposit using feed prepared from the 24 individual drill hole ore composites. Three large ore composites representing the upper, middle, and lower portions of the deposit were tested, as well as six smaller ore composites representing the west (blocks A, B, C and D) and east (blocks E, F, G and H) zones for each of the three levels.

A parallel static testing program was carried out whereby elemental analyses and ABA tests were performed on each of the 24 ore composites. ABA analyses were performed at Mineral Environments Laboratories (Min-En) on the 24 ore composites and associated batch flotation tailings composites from the individual drill holes, and on the nine larger locked cycle flotation tailings composites were prepared from the eight samples within each of the U, M and L depths (Phase 1 tailings testing is discussed further in Section 7.5).

Figure 7-29 Phase 1 Metallurgical Sample Locations

ABA testing is reported to have been carried out according to the modified Sobek method, this is assumed to be equivalent to the modified ABA method (MEND 1991). Elemental analyses were carried out by Lakefield Research using ICP analysis (Hallam Knight Piesold 1993; Watermark 1997). The digestion method is not known. Aqua regia digestion is assumed because it was commonly in use at that time.

Phase 2 and 3 Static Testing

Taseko conducted over 33 000 elemental analyses and 343 ABA tests on core samples and assay rejects of rock and overburden collected from within the 852 pit limits during drilling campaigns spanning 1991 through 1998. Figure 7-5 and Figure 7-6 show the collar locations of all drill holes sampled for ABA testing in Phase 2 and 3, and sample intervals and lithology are listed in Appendix 3-7-B. Cross sections showing ABA sample locations are provided in Appendix 3-7-C.

Phase 2 ABA tests were conducted at Chemex Laboratories, North Vancouver (Watermark 1997), according to the EPA 600 procedure, also known as the Sobek method (Sobek et al. 1978).

Phase 3 ABA tests were carried out at Cominco Engineering Services Ltd., Vancouver, British Columbia, using the Modified ABA method (MEND 1991).

Phase 4 Static and Kinetic Testing

Taseko conducted 12 humidity cell tests, and 9 column tests on a range of waste rock samples collected from 1996 and 1997 drill core. Shake flask extractions, elemental analyses, and ABA tests were performed on all kinetic test samples. Of the kinetic test samples, five were sourced from within the 852 pit limits, while seven were within the limits of the larger pit under consideration at the time.

The Phase 4 testing program was carried out by Cominco Engineering Services Limited (CESL) according procedures recommended by Price (1997) under the direction of Watermark Consulting Inc. Phase 4 kinetic testing was initiated in 1998 and continued into 2000. Samples were selected to cover a range of materials that would be placed in the non-PAG dumps, with a focus on materials with NP/AP ratios between one and three. A few samples with NP/AP ratios less than one were selected to inform evaluations of inclusion of small pockets of PAG waste in the non-PAG dumps, of delays to onset of acid generation for PAG material placed in the PAG disposal facility, of loadings from temporarily exposed PAG rock in the PAG disposal facility prior to flooding, and of effects of PAG rock remaining in the ultimate pit highwall.

Figure 7-6 shows the collar locations of all drill holes sampled for Phase 4 testing, and sample intervals and characteristics are listed in Appendix 3-7-D.

7.3.1.2 2006-2008 Rock Characterization Programs

The Phase 5 static and kinetic testing program was started in 2006, and kinetic testing remained ongoing at the time this report was prepared. Phase 5 was intended to gather the remaining necessary information to complete the ARD/ML assessment and to develop a water quality prediction for the Prosperity Project.

Phase 5 Static Testing

Archived assay pulps from 1991 through 1997 drilling programs were retrieved for a variety of tests.

- To assess soluble weathering products that had accumulated in the assay pulps, 32 shake flask extractions (3:1 method, Price 1997) were carried out. Sample intervals and material types are catalogued in Appendix 3-7-E, and collar locations are shown in Figure 7-6.
- To evaluate leaching and ABA characteristics of the Chilcotin basalts (an important source of construction rock), archived bags of core samples were retrieved from Taseko's warehouse. Fines that had accumulated in the bags were subjected to shake flask extractions, and ABA tests were performed on core samples over 6 to 10 m composite intervals. Sample intervals are catalogued in Appendix 3-7-F, and collar locations are shown in Figure 7-6.
- To evaluate whether PAG and Non-PAG waste occurs in sufficiently-discrete zones that segregation will be feasible, composite samples (approximately 6 m in length) were prepared from the archived assay pulps for two drill holes and subjected to ABA tests. Composite samples were prepared from the collar to the intersection of the drill trace with either the ore zone or the pit wall.

  An additional six drill holes from the modelled non-PAG zone in the southwest portion of the pit were evaluated in similar fashion, to test both whether segregation is feasible and whether the modelled non-PAG characteristic of a large portion of the waste in the southwest portion of the pit was accurate. Sample intervals are catalogued in Appendix 3-7-G, and collar locations are shown in Figure 7-5 and Figure 7-6.
- Selenium content was determined for the 68 samples from DDH 92-071 and DDH 92-082 which were composited for evaluation of segregation as noted above. Mercury analyses were also carried out on the same samples to confirm mercury concentrations.
- To evaluate the leaching properties of overburden materials, three 2007 test pit grab samples and eight core samples from a single 2007 diamond drill hole were submitted for shake flask extraction testing. Sample locations and logs are catalogued in Appendix 3-7-H, and collar and test pit locations are shown in Figure 7-30.

Figure 7-30 Phase 5 Overburden Sample Locations

Phase 5 Kinetic Testing

Archived drill core from 1992, 1996, and 1997 was collected from the core storage facility at the Prosperity site. Materials targeted for collection included ore and low grade ore, potassic waste and propylitic waste with elevated zinc content. Samples were collected by SRK in December 2006 with assistance from Taseko staff.

The coded assay database was used to identify appropriate target intervals. It was expected that many intervals would be missing due to disintegration of core racks and to previous retrieval of core for other testing programs. The samples that were ultimately retrieved were selected based on actual intervals that were available from within the target population at the time of collection.

Archived Chilcotin basalt core was retrieved from Taseko's warehouse in September 2007. The sawn half core from the entire length of DDH 96-224 had been stored in wooden bins, including the upper 94 m of basalt core, with composite samples contained in large plastic bags each holding about 10 m intervals.

Table 7-10 lists the samples selected for kinetic testing, and drill collar locations are shown in Figure 7-5 and Figure 7-6.

Table 7-10 Core Intervals Collected for Phase 5 Kinetic Testing

HCT ID	Hole ID	From (m)	To (m)	Interval (m)	Sample ID	Material Type
HC1	92-011	142	144	2	92-011 142-144	Low Grade Ore
HC2	92-048	158	160	2	92-048 158-160	Low Grade Ore
HC3	92-059	58	60	2	92-059 58-60	Low Grade Ore
HC4	92-084	90	92	2	92-084 90-92	High Zn propylitic waste
HC5	97-251	68	70	2	97-251 68-70	High Zn propylitic waste
HC6	92-024	150	152	2	92-024 150-153	Potassic waste
HC7	92-083	86	88	2	92-083 86-88	Potassic waste
HC8	92-084	318	320	2	92-084 318-320	Potassic waste
HC9	97-264	290	292	2	97-264 290-292	High Zn propylitic waste
HC10	See Tailings section for source of feed				KM 1961 master comp ½" crush	Composite ore
HC11	See Tailings section for source of feed				KM 1961 master comp ½" crush	Composite ore
HC12	96-224	50	58	8	234170-24173 comp	Chilcotin Basalt
HC13	96-224	86	94	8	234189-234192 comp	Chilcotin Basalt

A composite sample of PAG rock was prepared for subaqueous rock column testing from the available samples listed in Table 7-10. The composite was prepared using equal weights of PAG low grade ore and of each of two high zinc propylitic samples; Table 7-11 lists the intervals used to prepare the PAG composite.

Table 7-11 Makeup of Subaqueous Rock Column Composite Sample

HCT ID	Hole ID	From (m)	To (m)	Interval (m)	Sample ID	Material Type
HC1	92-011	142	144	2	92-011 142-144	Low Grade Ore
HC4	92-084	90	92	2	92-084 90-92	High Zn propylitic waste
HC9	97-264	290	292	2	97-264 290-292	High Zn propylitic waste

7.3.2 Phase 5 Laboratory Methods

7.3.2.1 Mineralogical Characterization

Mineralogical characterization was carried out on all samples gathered for Phase 5 humidity cell testing, as well as on several archived samples from the Taseko geology collection. Locations and descriptions of these samples are provided in Appendix 3-7-I.

Polished thin sections were examined by petrographic microscope and optical thin section descriptions were prepared by Petrascience Consultants Inc. of Vancouver. Individual carbonate grains were identified optically and carbonate mineral species were determined by election microprobe at the Department of Earth and Ocean Sciences at UBC. Parallel samples were submitted to UBC for quantitative X-ray diffraction analysis with Rietveld refinement (QXRD).

7.3.2.2 Static Geochemical Testing

During exploration, drill core was analyzed at a variety of laboratories for elemental content by aqua regia digestion with ICP finish. Mercury analyses were carried out by cold vapour atomic absorption for drill core collected from 1991 to 1997, but selenium was not included in the analytical suite. As part of Phase 5 ARD/ML characterization, a total of 68 samples were analyzed for selenium and mercury at Canadian Environmental and Metallurgical Inc. (CEMI) in 2006 to assess whether elevated selenium was present and to provide a set of modern mercury analyses.

ABA testing was carried out at CEMI according to the MEND (1991) method which includes paste pH, sulphur speciation (total sulphur and sulphate sulphur), and Modified Neutralization Potential (NP). Sulphide sulphur was estimated by difference. Carbonate NP was estimated by analyzing for Total Inorganic Carbon (TIC).

7.3.2.3 Leach Extractions

Shake flask extractions (SFEs) were carried out on 32 archived assay pulps via a 24 hour extraction using a 3:1 ratio of distilled water to solid (Price 1997).

Twelve samples of overburden collected during drilling and test pitting programs in 2007 were also tested using the method described above.

7.3.2.4 Kinetic Testing

Humidity Cell Tests

The thirteen humidity cell tests (HCTs) listed in Table 7-10 were carried out by CEMI according to the method presented in MEND (1991) and recommended by Price (1997). HCTs consisted of plexiglass columns loaded with 1 kg of crushed rock, and flushing was carried out by flood leach on a weekly cycle. Cell operation consisted of an initial flush with 750 mL of deionized water, followed by weekly flushing with 500 mL of deionized water.

Leachate analysis was initially conducted on a weekly/ biweekly schedule, as follows:

- pH, ORP, conductivity–weekly
- Sulphate, chloride, fluoride, acidity and alkalinity–biweekly

- Metals by ICP-MS–First flush, second week and then at two week intervals (i.e., 0, 2, 4, 6 etc.)

After 57 cycles (HC1 through HC9) and 47 cycles (HC10 and HC11), monitoring frequency was reduced in January 2008 to the following schedule:

- pH, ORP, conductivity–biweekly
- Sulphate, fluoride, acidity and alkalinity–biweekly
- Metals by ICP-MS–every fourth weekly cycle
- HC12 and HC13 were continuing to be monitored on the initial schedule as of June 2008

Subaqueous Rock Column Tests

Duplicate subaqueous rock columns (Sub WR A and Sub WR B) were constructed using 61 cm lengths of 17.14 cm diameter Plexiglass pipe. These columns were fitted with a perforated PVC disk and a nylon mesh at the base, and charged with 3.90 kg of composite PAG sample, crushed to less than 12.7 mm (1/2”). This mass of sample filled each column to a depth of 11 cm and deionized water was added to achieve a 30 cm depth of water over the sample surface. Monitoring ports were located in the base of the column to sample porewater and in the side of the column to sample the water cover.

Because the available sample consisted of 1990s core, a series of initial flushing cycles were carried out to remove stored weathering products. Each flushing cycle consisted of flooding the column with deionized water, allowing it to equilibrate for 24 hours, and draining. This procedure was repeated five times (until minimal change in leachate conductivity was observed between cycles) and the leachate was composited and analyzed for metals and other parameters.

Column operation consisted of withdrawing only the minimum quantity of water required for analyses from the bottom port and the side port. Water removed was made up by adding deionized water (up to 160 mL) to the water cover on a weekly basis. The water cover was circulated to ensure oxygen concentrations did not become depleted at the rock interface.

Monitoring was conducted of both the overlying water cover and the sample porewater, via sampling ports in the side and base of the column respectively. Water cover monitoring was limited to immediately measureable parameters, and was carried out on the following schedule:

- pH, ORP, conductivity and dissolved oxygen (DO)–weekly (through week 27); biweekly (week 29 through week 49)

Porewater analysis was carried out on the following schedule:

- pH, ORP, conductivity and dissolved oxygen (DO)–weekly (through week 27); biweekly (week 29 through week 49)
- Sulphate, acidity and alkalinity–biweekly
- Chloride and fluoride–biweekly (through week 27); then every fourth week (week 31 through week 49)

- Metals by ICP-MS–biweekly (through week 27); then every fourth week (week 31 through week 49)

7.3.3 Results and Interpretation

7.3.3.1 Mineralogical Assessment

Form of Sulphur

The mineralogical studies indicated that the dominant sulphide mineral in the rocks hosting the Prosperity deposit is pyrite, with lesser chalcopyrite and traces of digenite, covellite, enargite, sphalerite and several occurrences of undetermined mixed Fe+Cu sulphide minerals (Appendix 3-7-J). The abundance of primary sulphate minerals gypsum and anhydrite was found to be up to 12.5 wt% of the samples evaluated by quantitative x-ray diffraction (QXRD).

The occurrence of sulphur in individual rock groups, as measured in Phase 2 and 3 ABA tests, is shown in Figure 7-31. The late porphyritic diorite dikes (Unit PMPD) have uniformly low total sulphur concentrations, with a high proportion of the sulphur present as sulphate. All other units display a wide range of both total and sulphate sulphur content.

Static test results and summary statistics for Phase 2 and 3 ABA parameters, sorted by rock types, alteration types, PAG and non-PAG waste classes, and ore/low grade ore/waste categories are presented in Appendix 3-7-K-1 through 3-7-K-4 and statistics for elemental content for all rock types are presented in Appendix 3-7-L-1 through 3-7-L-4.

Figure 7-31 Sulphate Sulphur vs. Total Sulphur for All Lithologies

Form of Neutralization Potential

Results of optical characterization of samples completed for this study (provided in Appendix 3-7-J) indicate several types of minerals capable of neutralizing acid to some degree, including carbonates, potassium feldspar, biotite and sericite. QXRD results (Appendix 3-7-J) added several other silicates including actinolite, clinochlore, diopside, kaolinite and vermiculite. The QXRD results indicated that the main carbonate minerals are calcite, dolomite, ankerite and siderite. Rhodochrosite was not identified by QXRD.

Microprobe analyses (Appendix 3-7-M) of 434 optically-selected carbonate mineral grains from the Prosperity deposit showed that the main types of carbonate were calcite and dolomite, with minor ankerite and siderite (Figure 7-32). Manganese content was minimal for all grains, with a maximum manganese content of 7% measured for a single grain.

Figure 7-32 Carbonate Composition as Determined by Microprobe Analysis

As shown in Table 7-12, the majority of grains analyzed were calcite and dolomite. Calcite grains contained minimal cations other than calcium, however dolomite grains contained minor iron component (up to 36 mole percent as iron carbonate). Although QXRD identified ankerite rather than dolomite, the technique cannot reliably distinguish between the two forms. The majority of binary carbonate grains were correctly classified as dolomite rather than ankerite because magnesium exceeds iron (Gribble and Hall, 1992). The composition of these carbonates varies continuously from 13 to 30% Mg. As shown, one grain was iron and magnesium carbonate that was classified as siderite but the composition is intermediate between magnesite and siderite. Based on the results obtained, average compositions for calcite, the series ankerite-dolomite, and siderite are shown in Table 7-13.

Table 7-12 Tally of Mineral Grain Composition as Determined by Microprobe Analyses

Alteration Rock Type Mineral	Potassic Intrusive (Count)	Potassic Volcanic (Count)	Propylitic Intrusive (Count)	Propylitic Volcanic (Count)	Propylitic Sedimentary (Count)	Phyllic Intrusive (Count)	Phyllic Volcanic (Count)	Low Grade Ore (Count)	Ore (Count)
Calcite	34	16	28	7	34	21	19	43	6
Ankerite	0	0	0	0	1	0	0	1	0
Siderite	0	1	0	16	5	0	0	5	2
Dolomite	47	23	0	10	20	24	0	16	15
Rhodochrosite	0	0	0	0	0	0	0	0	0
Total grains analyzed	81	40	28	33	60	45	19	65	23

Table 7-13 Average Compositions of Carbonate Minerals in Mine Rock

Mineral	Average Formula	Formula Weight (g/mole)
Calcite	$Ca_{0.97}Mg_{0.01}Fe_{0.01}Mn_{0.01}CO_3$	100.2
Ankerite-Dolomite	$Ca_{1.09}Mg_{0.66}Fe_{0.24}Mn_{0.01}(CO_3)_2$	193.8
Siderite	$Ca_{0.04}Mg_{0.12}Fe_{0.82}Mn_{0.01}CO_3$	111.2

The majority of silicate minerals are aluminosilicates. These provide limited buffering ability at higher pHs due both to the release of aluminum during dissolution and to the resistant silicate crystal structure. The buffering capacity provided by aluminosilicates below pH 5 is not effective in controlling concentrations of copper in water and should be eliminated from calculations of potential for ARD. Only reactive neutralization potential derived from calcium and magnesium carbonates should be considered in the assessment of ARD potential.

Bulk neutralization potential values determined by the Sobek et al. (1978) and MEND (1991) methods is expected to represent a combination of neutralization potential below pH 5 by aluminosilicates ($NP_{Silicate}$) and inorganic carbon contained in calcium and magnesium carbonate minerals ($IC_{Ca,Mg}$). This can be represented by

$$NP = NP_{Silicate} + IC_{Ca,Mg}.$$

Several different types of calcium, magnesium and iron carbonate minerals are present at Prosperity, and total inorganic carbon (TIC) content of the rocks is not a reliable indicator of neutralization potential available from calcium and magnesium carbonate minerals. TIC represents total carbonate content:

$$TIC = IC_{Fe,Mn} + IC_{Ca,Mg}$$

The combination of QXRD data and microprobe-indicated carbonate mineral composition allows the $IC_{Ca,Mg}$ content to be evaluated, resulting in an estimate of $NP_{Silicate}$ (SRK 2006). The following steps were carried out:

1. The first step was to check that TIC indicated by chemical analysis corresponded to the mineralogical distribution indicated by QXRD. TIC from mineralogy was calculated from:

$$TIC_{mineralogy} = 12P_{calcite}/FW_{calcite} + 24P_{ankerite}/FW_{ankerite} + 12P_{siderite}/FW_{siderite}$$

where P and FW are the proportions and formula weights of the indicated minerals. The formula weights were calculated from the average formulas provided in Table 7-13. The proportion of ankerite was assumed to represent the proportion of ankerite-dolomite. Comparison of analytical and mineralogical TIC is provided in Figure 7-33. A reasonable correlation is indicated for the nine samples tested with a tendency for QXRD to indicate higher carbonate content than the chemical analysis at lower levels of carbonate. The results show that the mineralogical analyses are generally consistent with bulk analytically-measured carbonate content. The subsequent calculations do not require that TIC from mineralogy and chemical analysis be equivalent; however, the comparison indicates that QXRD quantified carbonate content.

2. The second step was to use the mineralogical results to calculate the fraction of carbonate associated with calcium and magnesium from the mineralogical results. This fraction ($f_{Ca,Mg}$) is calculated from:

$$f_{Ca,Mg} = \{\sum(x_{Ca,m} + x_{Mg,m})IC_m\}/TIC_{mineralogy}$$

where IC_m is the carbonate content indicated by QXRD associated with each mineral (m) and $x_{Ca,m}$ and $x_{Mg,m}$ are the mole proportions of calcium and magnesium in each mineral indicated by microprobe (Table 7-13). For the nine samples tested, $f_{Ca,Mg}$ varied from 17 to 98%. The low proportion is for the sample containing siderite.

The $f_{Ca,Mg}$ fractions obtained were then applied to the analytical TIC to estimate $IC_{Ca,Mg}$ relative to the laboratory-measured TIC.

Figure 7-34 shows $IC_{Ca,Mg}$ (expressed as kg $CaCO_3$/t) compared to bulk neutralization potential. All nine samples showed good correspondence between $IC_{Ca,Mg}$ and NP, indicating that there is little to no contribution of $NP_{Silicate}$ to the bulk NP, and therefore that $NP = IC_{Ca,Mg}$.

In summary, the bulk laboratory measured NP can be used without adjustment as an estimate of the neutralization potential that is available to consume acid under neutral pH weathering conditions. Therefore, the provisional adoption of (NP-10) to represent available NP for waste scheduling purposes is conservative.

Figure 7-33 Comparison of QXRD TIC and Analytical TIC

Figure 7-34 Comparison of $IC_{Ca,Mg}$ and NP

7.3.3.2 Assessment of Elemental Content

Summary statistics of elemental content by rock type for waste rock within the 852 pit are presented in Appendix 3-7-L. Median concentrations of selected heavy elements are summarized in Table 7-14.

Median Cu concentrations are up to 13 times crustal average concentrations, with the three quartz diorite phases (QD1, QD2, and QD3) having the highest median copper concentrations. The highest median Hg concentrations also occur in quartz diorite, with QD3 having 18 times the crustal average Hg concentration. Quartz diorite unit QD1 has the highest median As and Mo concentrations, with 72 and 18 times crustal average concentrations respectively.

Median Sb concentrations are uniformly greater than the crustal average, although several rock types show median Sb concentrations of 1 ppm, which was the analytical limit of detection. The greatest Sb median concentrations occurred in overburden, with OVBN having an Sb concentration of 55 times the crustal average.

Cd, Mn, Pb and Zn were present close to or below crustal average concentrations in all waste rock types.

Table 7-14 Median Concentrations of Selected Heavy Elements

			As	Cd	Cu	Hg	Mn	Mo	Pb	Sb	Zn
		Units	ppm	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm
		Crustal Average[1]	1.8	0.16	68	85	1,060	1.2	13	0.2	76
Rock Type	**No. of samples**	**Statistic**									
OVBN	5	Median	1	0.1	349	655	922	2	11	11	50
BSLT	137	Median	108	0.1	32	10	428	10	1	1	50
OVB2	83	Median	1	0.1	344	60	377	13	1	7	51
PMPD	1,774	Median	1	0.1	25	115	380	2	7	1	45
FP	203	Median	1	0.1	188	103	142	2	19	6	16
QFP	4,388	Median	10	0.1	312	260	134	8	9	6	24
QD3	1,654	Median	8	0.1	642	1,520	225	2	7	1	29
QD2	2,548	Median	3	0.1	637	280	191	10	4	1	25
QD1	819	Median	130	0.1	864	83	224	21	1	1	24
SEDS	585	Median	13	0.1	56	83	345	1	21	4	23
SUBV	7,857	Median	1	0.1	490	165	194	6	6	1	25
FLOW	3,281	Median	1	0.1	531	210	212	6	3	1	22
BEAT	322	Median	1	0.1	137	85	202	6	1	1	17
DEBF	211	Median	1	0.1	227	75	167	2	2	2	13
FAXT	10,043	Median	1	0.1	352	90	177	12	1	1	18

NOTE:
[1] Concentration of element in Earth's crust as a whole, from Price (1997), Appendix 3.

7.3.3.3 Acid-Base Accounting Assessment

Waste Rock Characteristics

ABA results by rock type for all Phase 2 and Phase 3 in-pit samples are shown in Figure 7-35, and summary ABA statistics for individual rock types are presented in Appendix 3-7-K. Results from Phase 5 (Appendix 3-7-MM) are not shown in the figures as these samples were not used in coding the ABA block model (which forms the basis for the mine plan). The results show that there is no correlation between rock type and NP/AP characteristics, with most rock types exhibiting a wide range of NP and AP values. The exceptions are the late porphyritic diorite (unit PMPD) and the Tertiary basalt (BSLT).

PMPD forms numerous post-mineralization dikes that cut the deposit and host rocks. PMPD had moderate to high NP and low AP, which caused this unit to consistently have NP/AP values greater than two. Figure 7-36 shows the Phase 2 and Phase 3 ABA results by alteration type (unaltered overburden results included for reference). Overall, there is no correlation between alteration type and NP/AP characteristics, with all four main alteration types displaying a range of NP/AP values from <<1 to >2.

Figure 7-35 NP vs. AP by Lithology

Figure 7-36 NP vs. AP by Alteration Unit

Ore Characteristics

ABA results for ore samples from Phases 1, 3 and 5 metallurgical testing are shown in Figure 7-37 NP/AP values range from 0.65 to 3, assuming pyrite is the only source of sulphide sulphur. Since chalcopyrite is the dominant copper ore mineral, a portion of the sulphide sulphur will be hosted by chalcopyrite. Complete static test characterization for the Phase 5 ore sample is provided in Appendix 3-7-NN.

The plot shows that all ore samples tested had NP greater than 20 kg $CaCO_3$/t. The contained NP will neutralize any acid produced over the planned duration of ore exposure in the pit and the ore stockpile.

Figure 7-37 Overburden NP vs. AP

7.3.3.4 Assessment of Segregation

Assay pulps from two 1992 drill holes and eight 1996/97 drill holes were composited and analyzed for ABA parameters to test whether the scale of PAG/non-PAG variation was sufficiently large that waste could be selectively and successfully managed by segregation of PAG material. The goal of segregation will be to ensure that non-PAG waste rock contains negligible PAG rock and therefore will not generate ARD. Pulps were composited over roughly 6 m intervals to approximate half pit bench heights. A secondary objective of this testing was to evaluate whether test results matched the PAG/non-PAG classification that was assigned during the ABA block modelling process.

The results of the continuous ABA analysis for each drill hole are shown in Figure 7-38, and lines showing potential segregation criteria of NP/AP = 2 and NP/AP = 1.5 are shown for reference (see Section 7.3.3.7 for a discussion of segregation criteria). Since all 1996/97 drill holes were oriented at a nominal 45º angle, a 6 m down-hole composite interval represents approximately 4.25 m vertical thickness. 1992 drill holes were drilled vertically, and depth intervals correspond directly to vertical thickness of rock.

Overall, the results show that segregation is a feasible waste management strategy for Prosperity, as the scale of variation in waste category (PAG or non-PAG) is generally manageable at the bench or half bench scale. Operational bench scale classification will be more challenging in some areas than in others, the vertical variability shown for DDH 92-071, and to a lesser extent DDH 92-082, in Figure 7-38 may mean that some non-PAG rock occurring in narrower widths will need to be disposed as PAG if effective segregation cannot be achieved.

Figure 7-38 Continuous NP/AP vs. Depth

Drill holes 96-224 was chosen to evaluate the characteristics of the near surface Tertiary basalt. The zone of elevated sulphur located 90 m down-hole was expected and is discussed further in Section 7.3.3.7. The continuous ABA testing suggests that this unit typically has low sulphide sulphur content and that zones of locally elevated sulphur content occur at a sufficiently large scale that segregation could be carried out if required based on operational monitoring results.

Drill holes 96- 219, -230, 97-235, -254. -256, -258 and -261 were chosen to test the ABA characteristics of waste rock in the southwest portion of the pit. The ABA model predicts a disproportionate volume of the non-PAG waste rock produced by the Project will be sourced from this zone, and it will be important to be able to segregate appropriately in this portion of the pit.

Figure 7-39 shows an oblique view of the southwest portion of the pit, with the traces of the above-mentioned drill holes plotted to show the extent of the modelled non-PAG rock in this area of the pit.

Figure 7-39 Continuous NP/AP Drill Traces

The results of the continuous ABA testing shown in Figure 7-38 for the drill holes in the southwest portion of the pit show that the predicted non-PAG character of the rock is largely confirmed:

- DDH 96- 219 and 97-258 were modelled as non-PAG over the interval tested, with the end of the tested interval coinciding with the intersection of the modelled PAG zone.
- The plot of DDH 97-235 results shows a single sample with NP/AP<1- this sample has very low sulphide sulphur (<0.01%) and NP (6 kg $CaCO_3$ equiv./tonne), and would be better classified as "inert" in this context.
- DDH 97-256 shows higher sulphide sulphur content, and NP/AP values that transition from PAG to non-PAG in the tested interval. This modelled classification is not correct for these samples. The end of the tested interval coincides with the top of the modelled PAG zone, and the results for 97-256 show that, in some areas, there

may be substantial uncertainty in the modelled location of the PAG/non-PAG boundary.

- The end of the test interval for DDH 96-230, 97-254 and -261 also coincided with the entry of the drill trace into the modelled PAG zone. Only a short section of modelled non-PAG rock was available in 96-230, which returned high NP/AP values except for the lowest composite tested. 96-254 returned a section of NP/AP <2 (coinciding with a higher sulphur zone) in the middle of the tested section, however the base of the tested interval had NP/AP>2. Similarly, 97-261 had non-PAG NP/AP values at the end of the tested interval adjacent to the modelled PAG zone, and returned a single high sulphur, low NP/AP interval near the mid-point of the tested section.

Overall, the continuous ABA testing results show that segregation is a feasible waste management strategy and that operational monitoring will be necessary to ensure waste rock is appropriately classified and managed.

7.3.3.5 Selenium Assessment

The composite samples from DDH 92-071 and DDH 92-082 which were submitted for continuous ABA analysis were also tested for selenium content to evaluate whether selenium is likely to be elevated in the Prosperity host rocks. Mercury analyses were also conducted as a check against the original exploration assays. Results of the selenium and mercury analysis are provided in Appendix 3-7-N.

Selenium concentrations ranged from 0.1 to 5 ppm, with a median concentration of 1.3 ppm, and appear to be correlated with Cu and S content. Average crustal abundance of selenium for both basaltic and granitic rock is 0.05 ppm (Price 1997). The limited analysis described here indicates that the selenium content of the Prosperity host rocks is elevated and that leaching selenium from tailings and mine rock may be a concern.

Phase 5 mercury analyses returned lower values than measured during analyses carried out in the 1990s as part of exploration. All phases of Hg analyses were carried out using the Cold Vapour Atomic Absorption technique, with detection limits around 5 ppb in the earlier testing, and no Phase 5 samples below this concentration (minimum Phase 5 concentration of 15 ppb). The lower concentrations measured in Phase 5 testing suggest that some of the mercury has volatilized and been lost during the period of storage. The results do however confirm the validity of the mercury values contained in the exploration assay database.

7.3.3.6 Tertiary and Quaternary Cover Materials

Unconsolidated Overburden Characteristics

Phase 2 and Phase 3 ABA results for all overburden and Tertiary basalt samples tested are shown in Figure 7-40. Samples of till, basalt, and conglomerate had low sulphur content and low neutralization potential—these materials are classified as non-PAG (NP/AP >2), will likely be nearly geochemically inert when excavated, and will be good candidates for use as general construction material. A summary of Phases 2 and 3 overburden ABA testing results is included in Appendix 3-7-O.

Figure 7-40 Overburden NP vs. AP

Four out of four samples of limonitic conglomerate (Unit 531 [FANL]) were found to have elevated sulphide sulphur content and to have acidic paste pH values. These samples were sourced from adjacent 2 m intervals in a single drill hole (DDH 96-216, Figure 7-6). No other samples of FANL were subjected to ABA testing; however, the unit was easily identified geologically. Lateral and vertical distribution of FANL have been estimated by Taseko geologists by correlating between drill holes based on the geological description in the logs (in the same manner carried out for all other overburden units). For mine planning purposes, it has been assumed that the entire volume of FANL will be classified as PAG and that this volume will be placed in the PAG disposal facility. This assumption will need to be verified by operational testing.

Leach extraction tests carried out on 11 overburden samples from 2007 returned uniformly neutral leachates, with pH ranging from 7.15 to 7.94. Soluble sulphate ranged from 3 to 303 mg/kg, and while soluble trace element load generally increased with soluble sulphate, correlations were poor. Complete results of overburden leach extraction testing are presented in Appendix 3-7-P.

Tertiary Basalt Characteristics

Phase 5 ABA results discussed in the previous section showed the Tertiary basalt can have sulphide sulphur concentrations up to 0.5% (compared to average basalt sulphide sulphur concentrations of 0.03%). Of the 14 drill holes from which Tertiary basalt samples were analyzed, the four highest sulphide sulphur contents were measured from samples sourced from an 18 m interval (88–106 m) in DDH 96-224. Outside of DDH 96-224, the maximum sulphide sulphur content in Tertiary basalt was measured to be 0.02%. Therefore, this unit is considered to be largely non-PAG, with the potential for rock with locally elevated sulphide sulphur that will require segregation.

Phase 5 ABA results also showed that NP greatly exceeds TIC-NP for the Tertiary basalt analyzed from DDH 96-224. This is discussed further in Section 7.3.3.7.

7.3.3.7 Assay Pulp Leach Extractions

Thirty-two 24 hour distilled water leach extractions were performed on assay pulps retrieve from storage. Complete results of are presented in Appendix 3-7-Q.

Leachate for one sample of potassic intrusive (Sample 234029) had an acidic pH of 2.87, with leachable Sb (1.5 mg/kg) and Hg (12 µg/kg), but low leachable sulphate (210 mg/kg) compared to other pulps tested (median 1143 mg/kg). All other samples had neutral leachate pH ranging from 7.35 to 8.14 with a wide range of leachable sulphate (24 to 5817 mg/kg). Soluble load of several elements were plotted against pH and sulphate, with a positive correlation between Ni and sulphate being the only correlation observed. Although pH conditions varied little, there was a generally at least a tenfold range of soluble load for the elements examined.

In general, these tests provided little useful information on element leachability except to demonstrate the solubility of sulphate due to dissolution of gypsum. Maximum concentrations of other ions were well below expected solubilities of their respective secondary minerals.

7.3.3.8 Kinetic Geochemical Testing

Phase 4 Results

Phase 4 Humidity Cell Tests

Twelve humidity cell tests (HCTs) were carried out on samples of different rock units and alteration types. Static characteristics of the individual samples tested are summarized in Table 7-15. Complete tabular results and selected plots of Phase 4 HCT results are provided in Appendices 3-7-R and 3-7-S.

HCT K3 was carried out on sample that was intended to assess "worst case" weathering characteristics of Tertiary basalt. The sample had a slightly acidic paste pH (5.9) and displayed acidic leaching conditions for the entire duration of testing. Additional samples of Tertiary basalt were tested as part of the Phase 5 program, and the Phases 4 and 5 results are discussed together in the Phase 5 discussion below.

The other 11 Phase 4 HCTs remained pH neutral for the 77 week duration of testing. Leachate pH for each cell varied within a stable range, with leachate from all cells ranging from 7.1 to 8.6 from the second week on.

Phase 4 samples appear to have been selected specifically to target material with low sulphate sulphur content. Sulphate release from HCTs K4 through K14 were correspondingly low, with leachate sulphate concentrations well below the solubility of gypsum ($CaSO_4 \cdot 2H_2O$). Typical release rates ranged from 1 to 7 mg/kg/wk for the period of stable release beginning around week 20.

Leachate concentrations for most trace elements were below the standard analytical detection level throughout the testing period. A single round of low-level analyses was carried out in week 46, and the resulting analytical data were used in determining source terms for the different alteration units (discussed in Section 7.3.4). Both Cd and Se concentrations were less than the low-level detection limits (Cd limit of detection = 0.00005 mg/L; Se limit of detection = 0.001 mg/L), and several other trace elements had similarly low leachate concentrations (e.g., Cr, Co, Ni, Ag). Where concentrations were below detectable levels, calculations of release rates adopted the limit of detection as the leachate concentration. These calculated release rates provide an upper bound estimate of the actual rates of release occurring within the test cells.

Phase 4 Column Tests

Nine column leaching tests were carried out on samples of different rock units and alteration types. Static characteristics of the individual samples tested are summarized in Table 7-16. Complete tabular results and selected plots of Phase 4 column test results are provided in Appendices 3-7-T and 3-7-U.

Unsaturated columns containing between 23 to 33.5kg of rock were operated for 543 days. Columns were leached with 1 L of deionized water, with leaching cycles varying from 1 to 4 days for the first 60 days, then weekly for the duration of testing.

Leachate pH for all columns varied within a stable pH neutral range (7.5 to 8.3) for the duration of testing. Sulphate production was lower in the initial 60 day period, then increased to maximum observed concentrations before declining for the duration. All columns displayed the same trend, with maximum sulphate concentrations for individual columns ranging from 142 to 383 mg/L. From around Day 270 on, the rate of decrease in weekly sulphate concentration slowed, with sulphate concentrations appearing to approach a steady state ranging from 36 to 183 mg/L. These concentrations are lower than would be expected if equilibrium dissolution of gypsum ($CaSO_4 \cdot 2H_2O$) was occurring.

Concentrations of most trace elements were at or near the limit of detection for the analytical method used for the duration of testing. Exceptions were Mn and Zn, with most leachates showing detectable Mn (>0.005 mg/L) during the initial period of leaching extending to Day 130. The sericite-iron carbonate altered QD1 in column K4 displayed the highest Mn concentration (0.268 mg/L) and the highest rate of Mn leaching, with leachate Mn remaining above detection (0.005 mg/L) through Day 214.

Table 7-15 Static Characteristics of Phase 4 Humidity Cell Test Samples

HCT	Hole ID	From (m)	To (m)	Interval (m)	Rock type	Alteration Type	Paste pH	S(T)	$S(SO_4)$	AP	NP	NP/AP
								%	%	kg $CaCO_3$/t		
K3	96-224	94	104	10	BSLT	-	5.9	0.35	0.09	8	21	2.5
K4	96-224	156	166	10	QD1	Sericite- Iron Carbonate	8.0	2.27	0.03	70	-55	-0.8
K5	96-224	198	202	4	FAXT	Sericite- Iron Carbonate	8.1	1.53	0.02	47	41	0.9
K6	96-224	270	280	10	BEAT	Propylitic	8.1	0.50	0.01	15	97	6.4
K7	96-225	102	104	2	BEAT	Propylitic	8.2	1.07	<0.01	33	6	0.2
K8	96-225	194	204	10	FLOW	Propylitic	8.4	1.87	0.04	57	99	1.7
K9	97-236	172	178	6	QFP	Phyllic	8.2	4.09	0.04	127	119	0.9
K10	97-236	206	216	9.9	SUBV	Phyllic	8.4	3.31	0.06	102	73	0.7
K11	97-237	150	159.8	9.8	FAXT	Propylitic	8.6	1.58	0.02	49	22	0.5
K12	97-239	62	72	10	SUBV	Phyllic	8.4	1.63	0.04	50	88	1.8
K13	97-251	170	180	10	SUBV	Propylitic	8.8	0.83	0.03	25	52	2.1
K14	97-252	218	228	10	SUBV	Propylitic	8.7	1.27	0.03	39	51	1.3

Table 7-16 Static Characteristics of Phase 4 Column Test Samples

Column Test	Hole ID	From (m)	To (m)	Interval (m)	Mass (kg)	Rock Type	Alteration Type	Paste pH s.u.	S(T) %	S (SO_4) %	AP	NP	NP/ AP
											kg $CaCO_3$/t		
K4	96-224	156	166	10		QD1	Sericite- iron carbonate	8	2.27	0.03	70	-55	-0.8
K5	96-224	198	202	4	9.5	FAXT	Sericite- iron carbonate	8	3.53	0.02	110	37	0.3
	97-237	122	132	10	13.5								
K6	96-224	270	280	10		BEAT	Propylitic	8.1	0.5	0.01	15	97	6.4
K8	96-225	194	204	10		BEAT	Propylitic	8.4	1.87	0.04	57	99	1.7
K10	97-236	206.1	216	9.9	23.5	SUBV	Phyllic	8.4	2.93	0.05	90	85	0.9
	97-236	226	236	10	10								

Table 7-16 Static Characteristics of Phase 4 Column Test Samples (cont'd)

Column Test	Hole ID	From (m)	To (m)	Interval (m)	Mass (kg)	Rock Type	Alteration Type	Paste pH s.u.	S(T) %	S (SO_4) %	AP	NP	NP/AP
											kg $CaCO_3$/t		
K11	97-237	150	159.8	9.81	23.5	FAXT	Propylitic	8.6	1.51	0.02	47	36	0.8
	96-225	30	40	10	10								
K12	97-239	62	72	10	19	SUBV	Phyllic	8.4	1.78	0.04	54	98	1.8
	97-236	226	236	10	10								
K13	97-251	170	180	10	20	SUBV	Propylitic	8.7	1.15	0.03	35	60	1.7
	97-251	242	251.2	9.16	5								
K14	97-252	218	228	10	20	SUBV	Propylitic						
	97-251	242	251.2	9.16	10			8.7	1.74	0.03	53	61	1.1

Most columns leached zinc at concentrations above detection levels (0.005 mg/L) in the initial stages of testing. By Day 116, leachate Zn concentrations in eight of nine columns had declined below 0.02 mg/L and continued to decline for the duration of column testing. Column K10 (SUBV with phyllic alteration) leached Zn at detectable concentrations over the duration of testing, with the highest observed zinc concentration in all columns (0.096 mg/L) occurring in K10 on Day 116. Column K10 leachate zinc concentration declined to 0.02 mg/L in the last round of monitoring carried out on Day 543. Zinc content of K10 was the second highest of all columns (246 ppm), with only K12 having a higher initial zinc concentration (262 ppm).

Phase 5 Results

Thirteen HCTs were carried out on samples of the rock units and alteration types catalogued in Table 7-10. Static characteristics of the individual samples tested are summarized in Table 7-17.

A duplicate subaqueous waste rock column test was carried out for a composite PAG rock sample prepared from equal weights of the samples tested in HC1, HC4, and HC8. No static tests were performed on the composite sample- Table 7-17 includes calculated average composite characteristics for the subaqueous column test material.

Complete tabular results and selected plots are provided in Appendices 3-7-V and 3-7-W.

Host Rock

Potassic Waste

HCTs HC6, HC7 and HC8 are testing potassic waste. Leachate from all three tests has remained within a stable neutral pH range for the 79 weeks of testing to date, with maximum observed pH of 8.45 in HC7 leachate in week 12 and minimum observed pH of 6.83 in HC6 leachate in week 46.

The rock in HC6 and HC8 had initial $S(SO_4)$ contents of 0.79 and 0.9% respectively, and sulphate release from these tests reflects the leaching of calcium sulphate minerals (gypsum ($CaSO_4{\cdot}2H_2O$) or anhydrite [$CaSO_4$]). The rock in HC7 had an total sulphur content of 0.02%, and a $S(SO_4)$ content of 0.01%, and low reported sulphate concentrations in HC7 leachate reflect the low total sulphur content of the material being tested.

Trace element release for all three potassic HCTs was stable or declining as of June 2008. HC7 showed the highest initial As release of all Phase 5 tests, with release rates ranging from 0.0015 to 0.0039 mg/kg/wk for the first 20 weeks of testing before declining to a range similar to HC6 and HC8. From week 50 through week 77, As release from all potassic tests was stable and ranged from 0.00006 to 0.0005 mg/kg/wk.

Table 7-17 Static Characteristics of Phase 5 Kinetic Test Samples

Humidity Cell ID	Rock Type	Alteration Type	Paste pH	Fizz Test	CO2	TIC-NP	S(T)	$S(SO_4)$	S(S-2)	AP	NP	NP/ AP
			s.u.		%	kg $CaCO_3$/t	%	%	%	kg $CaCO_3$/t		
HC1	SUBV	Phyllic	8.3	Slight	2.72	62	2.02	0.03	1.99	62	58	0.9
HC2	FAXT	Potassic	8.2	Slight	0.76	17	1.73	1.57	0.16	5	22	4.5
HC3	FAXT	Potassic	8.8	Slight	4.07	93	2.08	0.05	2.03	63	83	1.3
HC4	SUBV	Propylitic	6.9	None	0.35	8	6.04	0.1	5.94	186	9	0.0
HC5	SUBV	Propylitic	7.7	None	2.54	58	2.48	0.05	2.43	76	5	0.1
HC6	QFP	Potassic	8.5	Slight	1.43	33	1	0.79	0.21	7	32	4.9
HC7	PMPD	Potassic	9.2	Mod.	8.01	182	0.02	0.01	0.01	0.3	158	507
HC8	SUBV	Potassic	8.4	Slight	1.02	23	2.7	0.9	1.8	56	26	0.5
HC9	FLOW	Propylitic	9.1	Mod.	4.45	101	0.56	0.02	0.54	17	93	5.5
HC10, HC11	Ore Comp.	-	8.15	Mod.	3.89	88	1.69	0.46	1.23	38	71	1.9
HC12	BSLT	-	8.01	None	0.07	1.6	0.02	<0.01	0.02	0.6	14	23
HC13	BSLT	-	5.76	None	<0.02	<0.5	0.47	0.25	0.22	7	19	2.7
Sub WR A, B (average of HC1, HC4, HC8)	-	-	-	-	1.36	31	3.59	0.34	3.24	101	31	0.3

High Zn Propylitic Waste

HCTs HC4, HC5 and HC9 are testing propylitic waste with elevated zinc content, with 678, 638, and 779 ppm Zn, respectively. For reference, the 99th percentile zinc content for all in-pit assay intervals to be 498 ppm, which demonstrates the anomalously high zinc content of the selected samples.

HC4 and HC5 had low NP/AP ratios (<0.05 and 0.1, respectively). HC4 leachate was pH neutral to slightly acidic (pH 5.97 to 7) through week 43, transitioned from pH 6 to pH 3.4 by week 59, the continued to decline at a slower rate through the most recent monitoring in week 79 at ph 2.72. Zn release from HC4 was steadily increasing, with a release rate of 4.6 mg/kg/wk for the latest (week 77) monitoring in June 2008.

Release rates for other trace elements increasing from HC4 as the cell becomes increasingly acidic. Al, Cd, Cr, Co, Cu, Fe, Mn, Ag, and U also underwent order-of-magnitude increases in release rates with decreasing leachate pH. Pb release rates initially increased with release of other trace metals, but appeared to stabilize in the range of 0.0003 to 0.002 mg/kg/wk from week 39 on. Notably, Sb, As, Se, Mo, and Hg release rates were not increased by the development of increasingly acidic weathering conditions in HC4.

HC5 leachate ranged from pH 5.53 to 6.89 through week 67, but recent monitoring results show pH dropping to pH 5.16 in week 79. Zn release from HC5 peaked in week 9 at 0.24 mg/kg/wk, then dropped to below 0.01 mg/kg/week for the duration of monitoring. However, HC5 is expected to progress to fully acidic conditions at some stage and a parallel increase in Zn release is expected.

Sulphate release from HC5 declined steadily from 75 mg/kg/wk to 13 mg/kg/wk throughout the duration of the test. Cd release appeared to be stable at 0.0005 to 0.0009 mg/kg/wk from week 9 through week 77. Co, Pb and Ni followed a similar pattern to Zn release, with early peaks in release from weeks 5 to 15 mg/kg/wk followed by declines to a stable range of release rates that persisted through the June 2008 monitoring. Mn release was higher than for other Phase 5 tests (0.6 to 1.8 mg/kg/wk from week 15 on).

In contrast, rock in HC9 had an NP/AP ratio of 5.5, and maintained pH neutral leachate (range 7.46 to 8.56) in testing through June 2008. Sulphate release rates were low (ranging from initial rate of 27 mg/kg/wk to 2 mg/kg/wk in the more recent monitoring) and reflect the low total (0.56%) and sulphate (0.02%) sulphur content of the sample.

Release rates for Zn and other trace elements from HC9 were generally stable or declining over the testing period, with release rates similar to other pH neutral Phase 5 tests.

Ore and Low Grade Ore

Ore (HC10, HC11) and low grade ore (HC1, HC2, HC3) humidity cell tests had neutral pH leachate ranging from pH 6.95 to 8.0 over the duration of testing to date. Although the low grade ore samples were collected from the limited core that was available, static characterization showed that the selected materials had NP/AP ratios (HC1 = 0.9, HC2 = 4.5, and HC3 = 1.3) straddling the median NP/AP value (1.5) indicated for low grade ore in Phase 2 and 3 testing (see Appendix 3-7-K-3 for Phase 2 and 3 ABA results for low grade along with summary statistics). The three Phase 5 low grade ore HCT samples span the NP/AP range from 20th to 85th percentile of the low grade ore population tested in Phases 2 and 3.

Sulphate release rates varied. HC2 had the highest sulphate sulphur (1.57%) content of all Phase 5 samples, and one of the highest sulphate release rates (ranging from initial release of 909 mg/kg/wk in early testing to 117 mg/kg/wk in week 77). HC10 and HC11 (initial $S(SO_4)$of 0.46%) had similar early sulphate release rates to HC2, likely reflecting leaching of calcium sulphate minerals (gypsum or anhydrite), and a similar long term trend of declining sulphate release. In contrast, the two samples with low initial sulphate content (HC–0.03% $S(SO_4)$; HC3–0.05% $S(SO_4)$) declined from release around 100 mg/kg/wk sulphate to 4 to 20 mg/kg/wk sulphate. The trend of sulphate release from HC1 and HC3 from weeks 57 through 77 suggests that sulphate release from these cells may have reached steady state due to depletion of the small amount of sulphate sulphur that was initially present.

Trace element release from ore samples was near the upper limit of release rates for pH neutral Phase 5 HCTs. In particular, Mo release from ore and low grade ore HCTs was up to 100-fold higher than for the highest producing propylitic or potassic sample tested, with a maximum Mo release of 0.23 mg/kg/wk from HC11.

Overall, release rates for most parameters from ore and low grade ore HCTs were stable or declining. One exception is Ba in HC11, which increased from week 31 (0.0068 mg/kg/wk) to week 63 (0.03 mg/kg/wk), likely in response to increased dissolution of barite with declining leachate sulphate concentrations. Ba release then dropped from to 0.016 mg/kg/wk in the most recent leachate sample, indicating that Ba release is not yet at steady state.

Tertiary Basalt

Tertiary basalt is expected to be an important construction material due to its high stratigraphic position over the deposit and its anticipated favourable geochemical characteristics. A Phase 4 humidity cell test (Cell K3, sulphide sulphur 0.26%, Table 7-15) was carried out for 77 weeks on a basalt sample from the elevated sulphide sulphur interval from DDH 96-224 that was discussed in Section 7.3.3.5. Despite having a NP/AP value of 2.5, the paste pH was slightly acidic (pH 5.9), and acidic conditions developed almost immediately (initial pH 4.7, minimum pH of 3.4 in week 21) and declined for roughly 30 weeks before gradually increasing to greater than pH for at the time the test was halted at 77 weeks.

During initial Phase 5 review of previous test work, it was decided to confirm the K3 results by carrying out another HCT on the similar, adjacent high sulphide core interval from DDH 96-224. The Phase 5 high sulphide Tertiary basalt was tested in HC13 (NP/AP = 2.7, paste pH 5.8, 0.22% sulphide sulphur). An initial pH in HC13 of 4 increased to above pH 5 after 7 weeks, and varied within a stable range between pH 5.1 and 5.9 through week 40 (the most recent results at time of reporting).

Both acidic basalt cells released Co, Cu, Mn, Ni, and Zn at elevated rates relative to other rocks. Release of Co, Cu, and Ni had declined to detection levels in K3 by week 77, but remained elevated and responding to pH fluctuations in HC13 as of week 40.

A parallel sample of "typical" Tertiary basalt was tested during Phase 5 for comparison (HC12–0.02% sulphide sulphur, paste pH 8, NP/AP of 22.7). This sample had an initial pH of 6.5 which increased to around 7.5 and remained in that range for the duration of testing. Sulphate release from HC12 is the lowest of all Phase 5 samples tested, and release of most elements follows the same pattern.

Notably, release of Si occurred at similar rates for the neutral basalt (HC12) and the acidic basalt (HC13). This suggests weathering of silicates is occurring in a way that is not accelerated by acidic conditions in the range of pH 5 to 6. Aluminum release is correlated with pH, but is not clearly correlated with release of silica.

Phase 5 continuous ABA testing of basalt in DDH 96-224 (Section 7.3.3.5) found that measured NP ranged from 12 to 27 kg $CaCO_3$ equiv./tonne, but that TIC-NP was much lower (range 0 to 4.5 kg $CaCO_3$ equiv./tonne). These results suggest a silicate source for measured NP in Tertiary basalt.

Based on the observed behaviour of K3 and HC13, it is likely that any basalt with elevated sulphide sulphur (>0.1%) will generate acid conditions until the sulphide sulphur depletes. The majority of the Tertiary basalt is expected to have low sulphide sulphur (<0.1%), and the HC12 behaviour indicates that this rock will leach at low rates.

Figure 7-41 NP vs. TIC-NP for Tertiary Basalt

7.3.3.9 Interpretation

Site Specific Criterion for PAG Rock

Estimates of quantities of PAG and non-PAG waste rock are presently based on a provisional criterion of (NP-10)/AP = 2, as discussed in Section 7.1.6.9. The provisional criterion was adopted based on waste characteristics at other B.C. copper porphyries, and its use was necessary to allow mine planning to proceed in advance of completion of ARD/ML predictions. The present state of Prosperity ARD/ML testing now allows an evaluation of a site specific criterion that defines PAG and non-PAG rock.

Data obtained from Phases 4 and 5 humidity cells provide an indication of the site-specific criterion. The relative rates of sulphide oxidation (represented by sulphate release) and carbonate dissolution (represented by release of calcium and magnesium) can be used to estimate discrete sample NP/AP (or more accurately $IC_{Ca,Mg}$/AP since the ratio corresponds to carbonate release) required to maintain neutral drainage conditions. The method has been described elsewhere (for example, Day et al. 1997) and involves calculation of molar normalized Ca+Mg release relative to sulphate.

There are several limitations of the method.

- Laboratory tests are performed on materials that are prepared using procedures that do not necessarily simulate blasting in terms of exposure of minerals.
- Laboratory tests tend to accelerate the dissolution of carbonate minerals due to the use of high water to solid ratios (Mattson 2005). This effect diminishes as the oxidation rate increases and leaching of carbonates occurs in response to acid generation.
- The resulting $IC_{Ca,Mg}$/AP is applicable to discrete samples, and therefore cannot be applied to large scale rock mixture unless the rock mixture has uniform lithological and geochemical characteristics.

A further complication of the method at Prosperity is the presence of calcium sulphate which masks sulphide oxidation and carbonate depletion rates. To address this limitation, only those humidity cells with less than 0.1% sulphate sulphur were considered in the evaluation. Cells producing acidic drainage were also excluded, as the rate of buffering in these cells is insufficient to maintain neutral conditions. Twelve tests had neutral drainage and sufficiently low sulphate sulphur content to allow the correlation between sulphide content and sulphate release to be observed.

The average molar ratio of calcium+magnesium to sulphate release is shown compared to sulphate release in Figure 7-42. The figure shows that the molar ratio is highest for the samples showing very low sulphate release (correlated with low sulphide content). The ratio is lower for the one phyllic and two low grade ore samples showing relatively higher sulphate release rates. The ratios for two of these three samples are between the theoretically predicted bounding ratios of 1 and 2 based on complete or partial utilization of carbonate buffering capacity and indicate an $IC_{Ca,Mg}$/AP criterion of 1.5 or lower.

Figure 7-42 (Ca+Mg)/SO_4 vs. SO_4

Overall, this interpretation of humidity cell release rates shows that as sulphate release rates increase, the molar ratio falls between the theoretical limits (1 to 2) but the site specific criterion may lie between 1 and 1.5. The proposed $IC_{Ca,Mg}$/AP criterion for discrete sample classification is 1.5. As discussed in Section 7.3.3.1, $IC_{Ca,Mg}$ is approximately equal to NP for the Prosperity host rocks.

As noted in Section 7.1.6.9, Taseko has used a criterion of (NP-10)/AP <2 to define PAG rock for planning purposes; this provides an additional factor of safety to allow for uncertainties such as the possible preferential release of pyrite along veins by blasting.

Determination of time to onset

The time or delay to onset of ARD (t_{onset}) depends on both the availability of reactive neutralization potential (i.e., carbonate content as calcium and magnesium, $IC_{Ca,Mg}$) and the rate at which reactive neutralization potential ($R_{IC,Ca,Mg}$) is depleted:

$$t_{onset} = IC_{Ca,Mg}/R_{IC,Ca,Mg}$$

However, the rate at which carbonate is depleted is actually a function of the acid generation (sulphide oxidation) rate (R_S). In molar terms, the rate of carbonate depletion to sulphide depletion is the same as the NP/AP criterion for PAG rock ($\{IC_{Ca,Mg}/AP\}_{crit}$) indicated in the previous section:

$$R_{IC,Ca,Mg}/ R_S = \{IC_{Ca,Mg}/AP\}_{crit}$$

The humidity cell data indicated that rate of oxidation of sulphide is correlated with sulphide content of the rock (Figure 7-43, samples with high sulphate release and lower sulphide content contain gypsum). Assuming a direct linear relationship between oxidation rate and sulphur content, then

$$R_S = k.AP$$

where k is the slope of the line for those samples with low initial sulphate sulphur content. The non-zero intercept is not included because if no sulphide is present then the rate of sulphide oxidation is zero.

Figure 7-43 HCT Sulphate Release vs. Sulphide Sulphur Content

When these three relationships are combined, the delay to onset is:

$$t_{onset} = (IC_{Ca.Mg}/AP)/(k.\{IC_{Ca,Mg}/AP\}_{crit})$$

Therefore, the delay to onset is function of $IC_{Ca,Mg}/AP$ of the sample, the overall rate of oxidation of sulphide (k) and the effectiveness of NP utilization ($\{IC_{Ca,Mg}/AP\}_{crit}$). Longer delays are indicated for rock higher NP/AP assuming constant values for the two other factors.

A best estimate for t_{onset} for PAG waste rock was calculated using the average k and $IC_{Ca,Mg}/AP$ as follows:

- $k = 7.18 \times 10^{-5}$ $week^{-1}$. This value represents the average slope of the relationship between sulphide-S and rate of oxidation (see earlier relationship between sulphate release and sulphide content). Since weathering at the site will occur under cooler conditions than the room temperature conditions used for testing, this rate constant was reduced to 23% of the lab rates based on an Arrhenius correction calculated for average site temperatures.

  $\{IC_{Ca,Mg}/AP\}_{crit} = 1.5$.

To estimate the uncertainty in the estimate of t_{onset}, a second set of constants was used ("worst case").

- $k = 9.66 \times 10^{-5}$ $week^{-1}$. This value represents the 95th percentile of the slope of the relationship between sulphide-S and rate of oxidation
- $\{IC_{Ca,Mg}/AP\}_{crit} = 2$. This value represents the worst case for the utilization of buffering capacity

Using the ABA database from Phase 2 and Phase 3 testing, the distribution of measured NP/AP was used to calculate the distribution of t_{onset} for PAG rock (i.e., NP/AP<1.5) (Figure 7-44). The graph predicts that 50% of rock can be expected to become acidic in about 385 and 215 years (best estimate and worst cases respectively).

Figure 7-44 Timing of Onset of Acid Generation

A small proportion of rock (5%) is shown as becoming acidic within 38 years (which corresponds to the maximum wall age of that portion of the pit wall below the final Pit Lake elevation). The "best estimate" and "worst case" fractions that are shown to be acidic after 38 years are similar- this shows that the calculation is not particularly sensitive to the rate of sulphide oxidation for time frames on the order of decades.

For the purpose of waste management, an estimate of acceptable exposure times is required since the PAG waste rock is being submerged. It is preferable that the rock is not acidic prior to submergence because it could contribute acidic leachate and leaching of acidic salts could contribute to the tailings impoundment acid and metal load. The criterion is therefore that any acidity is neutralized internally by interaction with the remaining alkalinity.

Taseko plans to submerge or encapsulate PAG rock within two years of placement in the PAG rock storage facility. The calculated distribution of t_{onset} indicates that little of the

PAG rock will generate acidic leachate in this time frame and acid that might be generated would be neutralized locally by reactive minerals in adjacent PAG rock or by excess alkalinity in the tailings pond water or pore water.

Effect of Waste Rock Mis-Classification

Waste rock will be sorted into "PAG" and "non-PAG" types using the following operational steps:

- collection of samples from blasthole cuttings
- analysis of blasthole cuttings at the on-site laboratory for acid-base accounting or appropriate surrogates
- modelling of ABA results
- definition of dig limits using ABA results
- communication of dig limits to pit operations
- de-lineation of dig limits
- excavation of waste rock by shovels into dump trucks
- dumping of waste rock into designated disposal area based on material type

This process has been applied successfully for ore and waste segregation for many years. In the last decade or so it has been transferred to the segregation of waste rock for waste management at open pit mines including several examples in British Columbia (Huckleberry Mine, QR Mine, Kemess South Mine).

Like segregation of ore and waste, mis-classification of materials can occur as a result of operational conditions and human error at any one of the above steps. Since mis-classification of ore and waste affects the economic viability of mines, the success of ore segregation has been studied. Although segration failures as high as 10% have histrorically been recorded Taseko expects that segregation failures at Prosperity will affect only 3% of the rock at the Prosperity Project, as this is now typical of modern open pit mine operations. Taseko (Tom Broddy, pers. comm.) believes that this upper limit of 3% can be successfully managed and improved upon with the application of current technology.

The 3% failure rate means that about 3% of the rock sent to non-PAG waste rock disposal is as "non-PAG" rock will be PAG rock (i.e., rock classified as non-PAG will contain 3% PAG rock). This leads to consideration of:

- the effect of the overall "non-PAG" classification on the non-PAG waste rock disposal areas
- the potential for development of localized ARD generating "hot-spots" in the non-PAG waste rock

The former has been evaluated by first considering the effect of overall average NP/AP ratios of varying degrees of mis-classification. Figure 7-45 shows the NP/AP ratio obtained by mixing small amounts of PAG into non-PAG rock. Each line represents different combinations of median, worst and best PAG and non-PAG defined as:

- median non-PAG and PAG—characteristics defined by samples with 50th percentiles for NP/AP
- best PAG—characteristics defined by a sample with 95th percentile for NP/AP

- worst non-PAG and PAG—characteristics defined by a sample with 5^{th} percentile for NP/AP

In each case, NP is calculated using the site-specific correction for NP (i.e., NP-10), and the resulting NP/AP was used to separate PAG and non-PAG sets.

The median non-PAG NP/AP ratio shown in Figure 7-45 is 4.9 (corresponding to AP of 13 kg $CaCO_3$/t and NP of 57 kg $CaCO_3$/t). Mixing of this rock with 3% median PAG rock (AP 43 kg $CaCO_3$/t, NP 24 kg $CaCO_3$/t) results in NP/AP of 4.1, falling to 3.4 if the mix ratio is 10%. If the worst case for PAG is used (AP 85 kg $CaCO_3$/t, NP 0 kg $CaCO_3$/t), the overall mix is NP/AP is 3.7 (at 3%) and 2.6 (at 10%). The expected frequency of this latter mixture (i.e., rock with less than the 50^{th} percentile NP/AP non-PAG and less than the 95^{th} percentile NP/AP PAG) is 2.5%. Mixing of the worst case for both PAG and not-PAG results in NP/AP of 1.9 (at 3%) and 1.7 (at 10%) but the expected frequency of this mixture is 0.25%, representing a very small proportion of the rock mass.

These calculations imply that the non-PAG rock mass contains sufficient high NP/AP material to robustly absorb mis-classification errors at the large scale of overall NP/AP and that the overall "non-PAG" status of the non-PAG rock disposal areas can be maintained with the expected mis-classification rates of 3%. Furthermore, 3% PAG rock is well below the overall proportion of PAG rock that could be expected to trigger acidification of nonn-PAG even if assuming that only soluble alkalinity is available to neutralize acidity (see previous discussion for $_{tonset}$).

The effect of ARD hotspots was evaluated as follows. Accidentally-placed PAG rock in the non-PAG rock disposal areas can be expected to become mixed with non-PAG rock as a normal consequence of end-dumping or dozing of free-dumped waste rock. Since PAG rock will be placed at a low frequency (3% of all rock), it is reasonable to expect that PAG rock will be dumped over non-PAG rock resulting in a PAG/non-PAG mixture, and subsequently covered by additional non-PAG rock. The maximum proportion of PAG in this mixture would therefore be roughly 33%. The probability of placing PAG on PAG is small (0.09%, i.e. 3% of 3%).

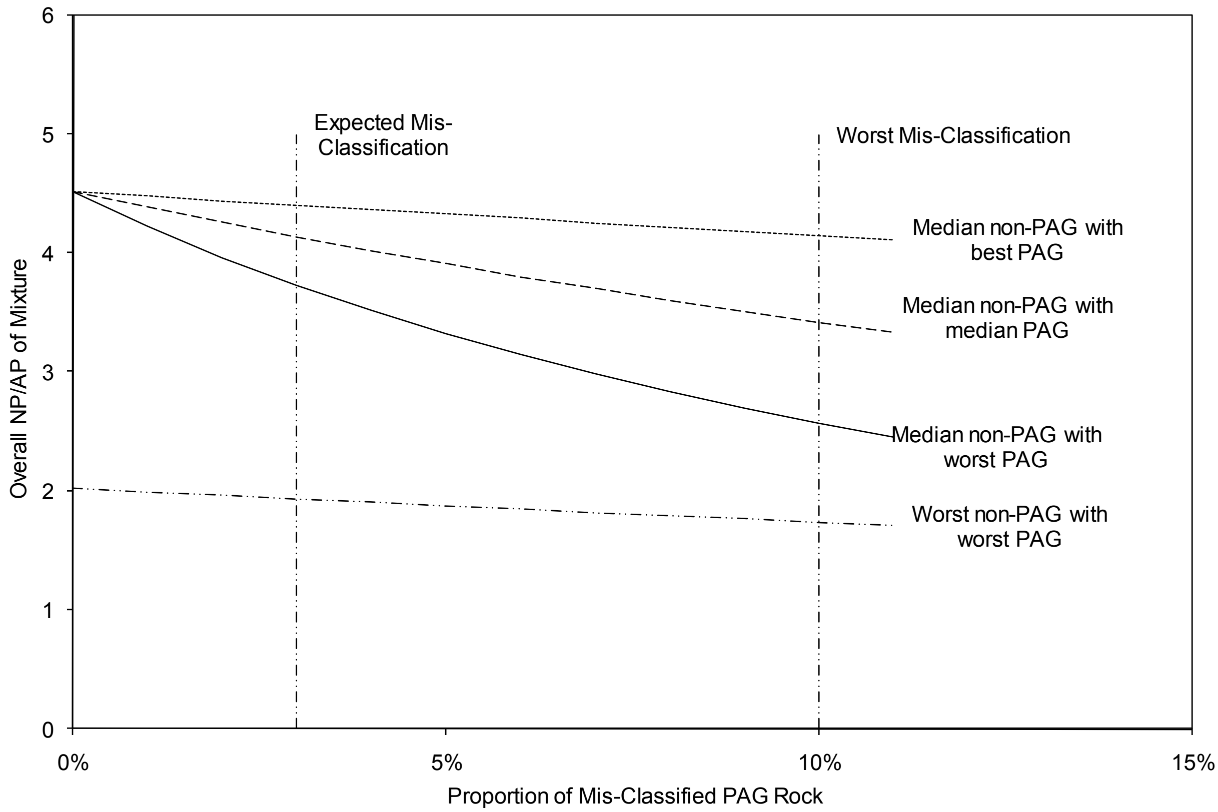

Figure 7-45 Large-Scale Effect of PAG Rock Mis-classification on NP/AP

The result of mixing at the scale of the disposal location is shown in Figure 7-46 using the same material characteristics as Figure 7-45. The mixing of median PAG and non-PAG rock shows that the proportion of PAG would need to be greater than 33% before the mix NP/AP decreases below two. For the worst case PAG, the proportion of PAG is 15%. These calculations imply that dump face mixing may balance the characteristics of PAG about 50% of the time. In areas where the characteristics of PAG rock are worse, the probability for larger scale zones of rock with NP/AP <2 is higher. The calculations for larger scales indicate that ARD generated at this scale should be mitigated by the excess NP in the non-PAG material. However, metals leached from these hot spots not completely precipitated as pH increases (primarily zinc at Prosperity) will remain in solution and may be expressed as elevated zinc concentrations in seeps.

The actual effect of hotspots both in terms of ARD generation and metal leaching is not predictable with the current state of knowledge of the behaviour of PAG and non-PAG waste rock mixtures. Effects depend on numerous factors not least including the oxidation rate of the rock, oxygen availability, acid neutralizing mineral availability and reactivity, disposal method and waste rock dump construction methods. It is certain that less than the 3% of the PAG rock accidentally placed in the non-PAG waste rock dumps will result in some ARD generating hotspots, and that probably 50% of this rock will be adequately mitigated by conventional waste rock placement. The assessment provided here is conservative in several because the NP/AP classification criterion used was two whereas the actual NP/AP threshold has been estimated to 1.5. For rock with NP/AP close to 1.5, actual acid production would be low from the small amount of AP remaining when NP is depleted.

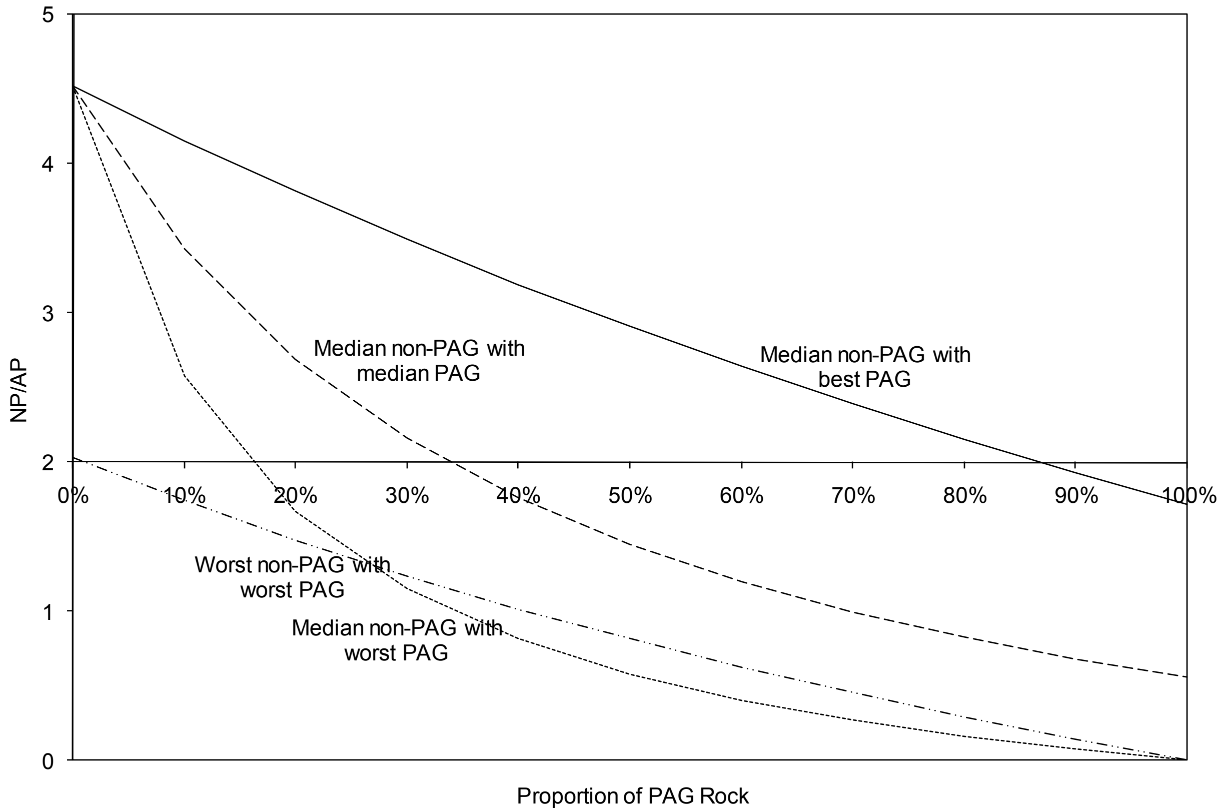

Figure 7-46 Small-Scale Effect of PAG Rock Mis-Classification on NP/AP

Depletion of Trace Elements under Acidic Weathering Conditions

Estimating Acidic Release Rates

One challenge in ARD/ML prediction is extrapolating acidic elemental release rates from neutral pH release rates measured in laboratory tests. This is necessary in cases such as Prosperity where the considerable NP in most PAG materials causes laboratory testing of PAG rock to remain pH neutral for long durations.

One approach is to look to analogous cases where the transition from neutral to acidic weathering conditions has been observed. A long term humidity cell testing waste rock with low sulphate sulphur from Huckleberry Mines (SRK 2002) displayed stable acidic release rates after a long period of stable neutral pH weathering. Copper release rates increased by a factor of 680 and sulphate release increase by a factor of 5 from neutral to acidic leaching conditions.

SRK considers this test to represent an appropriate analog for Prosperity. The copper and sulphate rate increase factors have been adopted in extrapolating pH neutral release rates from Prosperity HCTs to estimate acidic release rates for elements and sulphate, respectively. The one exception is selenium, for which no increase in release rate has been applied since selenium mobility is not expected to increase under acidic conditions and may in fact become less mobile due to sorption of selenite ions.

Estimating Depletion of Trace Elements

Under acidic weathering conditions, rates of trace element leaching are sufficiently high that the trace element content of weathering rock is depleted over time. Calculations were carried out to estimate the time to deplete the trace element content of Prosperity HCT samples. Calculations consisted of increasing the observed neutral release rates by a factor of 680 (described above) and determining the time required to leach the contained mass of each element.

Copper depletion times were calculated to be longer than for other trace elements due to the relatively high copper content of the test samples. The average time to deplete copper from all waste rock humidity cells was 16 years, with depletion of other trace elements generally occurring much faster.

For the purposes of estimating elemental loading for water quality predictions, it was assumed that a given volume of rock would release all trace elements at acidic rates for a duration of 16 years and then no further release would occur. This is a conservative approach, as depletion calculations indicate the total contained mass of most elements would be leached in shorter time periods; for example, the average depletion time of cadmium for all waste rock HCTs was three years.

Subaqueous Waste Rock Columns

The duplicate saturated rock column tests were intended to evaluate leaching of PAG waste rock under flooded conditions that will exist in the PAG rock storage facility or flooded pit walls at closure. The test material had a calculated NP/AP of 0.3; however, there is considerable NP and TIC-NP (Table 7-17) and the delay to onset of acidic conditions for this sample would be greater than any operational exposure period. Therefore, the leachate from the columns provides an indication of the porewater chemistry that can be expected in the PAG storage facility. Table 7-18 shows the worst case values for key parameters observed in the column leachates.

Forty-nine weeks of data have been collected and tests are ongoing. Reproducibility between the two columns has been excellent, and the following discussion relates to the results from both tests. Porewater is represented by leachate from the bottom ports. The side ports sample the water cover, and were monitored for pH, conductivity, ORP and dissolved oxygen (DO) only.

Table 7-18 Maximum Concentrations in Subaqueous Rock Column Leachate

pH (min) s.u.	Sulphate mg/L	Acidity mg $CaCO_3$/L	Alkalinity (min) mg $CaCO_3$/L	F mg/L	Cd mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Se mg/L	Zn mg/L
6.54	1608	76	88	0.4	0.0015	0.019	28.1	0.0043	1.43	0.011	0.005	0.0037	0.008

Porewater pH stabilized around pH 7 by week eight, and varied within a stable range of 6.6 to 7.5 for the duration of testing to date. DO and ORP are substantially reduced in the porewater relative to the water cover, and have varied within a stable range. Porewater chemistry was dominated by calcium and sulphate. Selenium and cadmium concentrations were at or near detection levels. Initial manganese concentrations up to 1.4 mg/L were observed, however these dropped below 0.8 mg/L by week nine and continued to decline for the duration of testing. Concentrations of other parameters were stable or declining. Tables and graphs showing concentrations are provided in Appendix 3-7-X and 3-7-Y.

Equilibrium modeling (MINTEQA2, Allison et al. 1991) of week three porewater from test Sub WR B indicated that gypsum was near saturation (saturation index -0.13) and that rhodochrosite ($MnCO_3$) and tenorite (CuO) were undersaturated (SI of -0.86 and -2.8, respectively). Equilibrium concentrations of Cu and Mn were modeled to be 0.09 and 1.91 mg/L respectively. Column porewater chemistry is therefore likely controlled by gypsum equilibrium and kinetically limited dissolution of minerals hosting most other parameters.

7.3.4 Source Terms for Site Water Chemistry Predictions

7.3.4.1 Introduction

The following sections describe the methods by which source terms for chemical loadings from mine rock were estimated for use as inputs to the site water and load balance. These predictions address metal leaching and acid rock drainage effects and reflect predictions of dissolved concentrations and loads. Total metal loadings are not included in these predictions. Table 7-19 shows the kinetic tests that were used to develop the source terms.

Table 7-19 Test Results Used in Defining Rock Source Terms

Rock Unit	Phase 4 Humidity Cells (1998- 2000)	Phase 5 Humidity Cells (2006-2008)	Cut-off date for Phase 5 results used in water quality prediction
Potassic	None	HC6, HC7, HC8	January 2, 2008 (Week 55)
Sericite- Iron carbonate	K4, K5	None	n/a
Propylitic	K6, K7, K8, K11, K13, K14	HC4, HC5, HC9	January 2, 2008 (Week 55)
Phyllic	K9, K10, K12	none	n/a
Low grade ore	None	HC1, HC2, HC3	January 2, 2008 (Week 55)
Ore	None	HC10, HC11	January 2, 2008 (Week 55)
Tertiary basalt	K3	HC12, HC13	n/a

7.3.4.2 Non-PAG Waste Rock Storage Facility

Chemical loading from the non-PAG Waste Rock Storage Facility (WRSF) dump and the Main Embankment were estimated based on release rates from HCTs and scaled up to suit site conditions (SRK 2006). Loads estimated for the non-PAG WRSF are shown in Appendix 3-7-KK, along with annual average concentrations calculated for comparative purposes from load estimates and an estimated non-PAG WRSF runoff of 491, 738 m^3/year (see Appendix 3-7-JJ). Neutral pH release rates were calculated for each alteration unit as follows:

1. Compile test results from neutral HCTs to produce average lab release rates for each alteration unit (omit cells which have gone acid, as the release rates are elevated due

to low pH and are not representative of non-PAG). See Appendix 3-7-ZY for release rate compilation.

2. Scale lab rates to field rates (scaling factors: Arrhenius temperature correction (determined using the average annual baseline temperature at Prosperity: factor of 0.23); particle size correction (factor of 0.2); contact correction (factor of 0.5) to account for incomplete flushing of secondary weathering products).
3. Apply the field rates to tonnage of rock in non-PAG dump from mine schedule (summarized in Table 7-20). Assume final tonnage for duration of Project, no reductions for only partially constructed dump in early years of schedule.
4. Check for gypsum equilibrium and adjust to reflect equilibrium control (set at 1800 mg/L sulphate and 700 mg/L Ca for modelling purposes, based roughly on equilibrium values from MINTEQA2 modelling of PAG porewater (modelled concentrations of 1616 mg/L sulphate and 652 mg/L Ca) (Allison et al. 1991).
5. Non-PAG dump loadings report as annual load (mg/year) to Water Collection Pond. The only consideration of concentrations is reduction of Ca and sulphate concentrations to reflect equilibration with gypsum.

Table 7-20 Summary of Waste Tonnages

Description	Alt Code	Non-PAG	PAG	Total	%PAG
		tonnes x 10^6	tonnes x 10^6	tonnes x 10^6	
Overburden (incl.BSLT)	-	90.3	9.5	98.8	10%
Unaltered	-	0.3	-	0.3	0%
Potassic	1000	31.6	44.6	76.2	59%
Sericite- iron carbonate	3000	7.0	5.6	12.6	44%
Propylitic	5000	26.1	138.1	164.2	84%
Phyllic	6000	5.4	37.2	42.6	87%
	Total	70.5	225.5	295.9	

NOTE:
Tonnages estimated by Taseko using block models and the 830 pit shell.
PAG defined as material having (NP-10/AP<2)

7.3.4.3 PAG Waste Rock

Saturated PAG Rock Source Term

Taseko plans to operate the PAG waste storage facility such that PAG material is inundated within two years of placement. The predicted time to onset of acid leaching conditions is much longer, therefore neutral pH release rates are appropriate for estimating loadings from PAG to porewater.

A combined PAG+tailings porewater source term was derived using maximum observed concentrations from all saturated PAG and saturated tailings columns, with Cu and Mn increased to equilibrium concentrations with tenorite (CuO) and rhodochrosite ($MnCO_3$) (MINTEQA2, Allison et al. 1991; SRK 2006). The maximum column Cu concentration of 0.02 mg/L was increased to the modelled equilibrium Cu concentration of 0.09 mg/L;

the maximum column Mn concentration of 1.43 mg/L was increased to the modelled equilibrium Mn concentration of 1.91 mg/L.

Unsaturated PAG Rock Source Term

Flushing from recently-placed PAG during the two year exposure period was estimated using neutral release rates for each alteration type from HCTs, scaled for temperature and surface area, but assuming 100% flushing (no contact correction) due to flooding of rock by tailings pond. Derivation of the unsaturated PAG rock source term is described as follows:

1. Compile bulk composition of PAG (20% Potassic, 2% Ser-Fe Carbonate, 61% Propylitic, 17% Phyllic-Table 7-20).
2. Using average neutral release rates calculated for each ALT type (as part of Non-PAG dump prediction), calculated a bulk weighted average neutral PAG release rate.
3. Correct rate for temperature (0.23 factor [heat release by oxidation is not expected to be significant]) and particle size (0.2 factor). Assume 100% flushing due to inundation, therefore no correction for contact factor.
4. Apply bulk neutral PAG corrected release rate to exposed volume (estimate from max. footprint area on Knight Piesold drawing B04.dwg x 2 m exposed height [assumed based on discussions with Knight Piesold]).
5. All load assumed to report to tailings pond (conservative, will likely be inundated/ surrounded by tailings, and soluble load will report to porewater).

7.3.4.4 Low Grade Ore Stockpile

Low grade ore samples tested in humidity cells HC1, HC2 and HC3 had NP/AP ratios of 0.9, 4.5 and 1.3, respectively. Based on the evaluation of the time delay to onset of acidic conditions (Section 7.3.3.8), the material with NP/AP of 0.9 would be expected to maintain neutral pH conditions for hundreds of years. Therefore, the low grade ore stockpile is expected to remain pH neutral over the 19 year period of operations. Loads estimated for the low grade ore sotckpile are shown in Appendix 7-LL, along with annual average concentrations calculated for comparative purposes from the load estimates and an estimated low grade ore stockpile runoff of 165,562 m^3/year based on mean annual precipitation and waste rock runoff coefficients in Appendix 3-7-JJ.

Neutral pH release rates were calculated for low grade ore in similar fashion to waste rock, as follows:

1. Compile test results from low grade ore HCTs to produce an average lab release rates for low grade ore.
2. Scale lab rates to field rates (scaling factors: Arrhenius temperature correction (factor of 0.23), particle size correction (factor of 0.2), contact correction (factor of 0.5) to account for incomplete flushing of secondary weathering products).
3. Apply the field rates to estimated contained tonnage in the low grade ore stockpile at its maximum size. No reductions in calcium or sulphate load were applied to account for concentrations exceeding gypsum solubility.
4. Low Grade Ore Stockpile loadings report as annual load (mg/year) to WCP.

7.3.4.5 Ore Stockpile

The ore handling plan consists of: drill and blast; load and haul to gyratory crusher; crush to <150 mm; and convey overland to ore stockpile. On average, blasted ore will be exposed in the pit and ore stockpile for one month prior to milling. ABA results (Figure 7-37) show that there is sufficient NP in the ore to maintain pH neutral drainage conditions over the duration of exposure.

Leachate from the ore stockpile will report to the Water Collection Pond, which will be pumped either to the mill or directly to the TSF. Any soluble load not leached from the ore stockpile will be dissolved during processing and will report to the TSF in the tailings slurry. Since the TSF is the ultimate receptor for all soluble loads from the ore stockpile, no reduction in annual load was applied to account for storage of secondary weathering products.

Ore stockpile loadings were therefore calculated as follows:

1. Compile test results from ore HCTs (HC10 and HC11) to produce average lab release rates for ore.
2. Scale lab rates to field rates (scaling factors: Arrhenius temperature correction (factor of 0.23), particle size correction (factor of 0.2). As noted above, no scaling factor to account for storage of secondary weathering products was applied.
3. Apply the field release rates to annual ore throughput (70,000 t/day * 365 days/year) over a 30 day period. No reductions in calcium or sulphate load were applied to account for concentrations exceeding gypsum solubility.
4. Annual loadings (mg/yr) were modelled as reporting directly to the WCP.

7.3.4.6 Plant Site

To allow for chemical loads generated by the plant site during operations (in addition to ore stockpile loads), chemical release was estimated by assuming material equivalent to low grade ore was present over 50% of the plant area to a depth of 0.1 m. Plant site loadings were therefore calculated as follows:

1. Adopt test results from low grade ore HCTs to produce an average lab release rates for low grade ore in the plant site area.
2. Scale lab rates to field rates (scaling factors: Arrhenius temperature correction (factor of 0.23), particle size correction (factor of 0.2), contact correction (factor of 0.5) to account for incomplete flushing of secondary weathering products).
3. Apply the field release rates to assumed mass of low grade ore in the plant site area. No reductions in calcium or sulphate load were applied to account for concentrations exceeding gypsum solubility.
4. Annual loadings (mg/yr) were modelled as reporting directly to the WCP.

7.3.4.7 Tertiary and Quaternary Overburden and Rock Stockpiles

Tertiary and Quaternary materials were tested in Phase 2 and 3 for ABA properties, but no leach extraction data was available. Initially, the background runoff quality (routine monitoring station W1) was adopted as a proxy for overburden runoff quality.

As part of Phase 5 in fall 2007, samples were collected from three test pits and one drill hole. These samples were subjected to 3:1 shake flask extractions. Leachates were neutral to slightly alkaline, with generally low extractable metal load. Elements that were present in somewhat elevated leachable quantities were Cu (for most samples) and As, Mn, Mo, and Se for selected samples. Most of the samples with elevated leachable loads were sourced from the drill hole (Figure 7-30) rather than the shallow test pits, with the drill hole being located to target the underlying near-surface ore deposit.

7.4 Open Pit Characterization

7.4.1 Methods

7.4.1.1 Operational Water Chemistry

Pit development will take place in four phases, with the ultimate pit wall being exposed in the fourth and final phase. The Phase 4 pit shell designed by Taseko is referred to as the 830 pit, and it is this ultimate pit shell that was used as an input to the assessment of pit water chemistry.

The mining schedule developed by Taseko is shown in Figure 7-47, and shows the timing of the development of the Phase 4 pit wall. For the purposes of the pit water chemistry assessment, it was assumed that the final pit wall for a given bench was entirely developed in the first year that Phase 4 mining occurred at that elevation.

A pit wall map was generated with the GEMS 6.1 software package using the 830 pit shell and the alteration block model provided by Taseko (Figure 7-48). From the wall map, the exposed surface area of each alteration unit was calculated in 5 m vertical increments (Figure 7-49). Volume and tonnage of each alteration unit with elevation were calculated by applying a thickness of two m to the calculated surface area (this represents over-blast and sub-grade placement), and by applying an in-situ specific gravity of 2680 kg/m^3 to the wall rock (pers. comm., Smyth 2008).

Figure 7-47 Timing of Final Pit Wall Exposure

Figure 7-48 Map of Alteration Types in Ultimate Pit Wall

Figure 7-49 Pit Wall Age and Surface Area by Alteration Type

The open pit portion of the site-wide water and load balance was modelled in spreadsheet format using the water balance developed by Knight Piesold as a starting point. Element and sulphate loads were modelled using the release rates for each alteration type (discussed in Section 7.3.4). This series of calculations yielded an estimate of annual soluble load produced by exposed pit walls.

During the dewatering phase (Years 0 through 16), the model was set up to allow 50% of the load generated each year to be flushed to the pit sump, and 50% to be stored. During dewatering, this flushed load will report to the TSF via the WCP. Groundwater inflows were assigned an average chemistry from baseline monitoring of groundwater wells in the vicinity of the pit.

Exposure of the final pit wall does not start until Year 6 of the schedule. For the purposes of approximating pit water chemistry in these initial years, it was assumed that the full Year 6 wall was exposed and contributing load from Year 0 through 6. For Year 7 through 16, the cumulative rock mass exposed above the lowest exposed Phase 4 elevation was used to estimate the annual load generated.

7.4.1.2 Closure Water Chemistry

Beginning in Year 17, mining will be complete and the pit will be allowed to flood. During the flooding phase, stored oxidation products in broken rock in the pit walls would be dissolved by the rising Pit Lake waters, and the effects of this dissolution process were modelled by adding the entire stored load to the Pit Lake in Year 17. For the period of filling (Years 17 through 44), the entire annual load was added to the Pit Lake, with no allowance for storage of soluble weathering products, to maintain a simple approach to calculating annual loads during this period of decreasing wall exposure. This approach is considered conservative, as chemical loads to the Pit Lake will be overestimated during the period. Beginning in Year 45, a storage factor of 50% was applied to the release rates to account for incomplete flushing of weathering products within the wall rock and bench talus in the highwall.

Pit filling is expected to span the period from Years 17 to 44, with the final Pit Lake surface elevation controlled by the low point in the pit rim at 1440 m. At the time of initial surface discharge, the oldest portion of the final pit wall above 1440 m will have been exposed for approximately 38 years.

ABA block modelling indicated that approximately 69% of the waste rock is PAG, and it is conservatively assumed that the highwall contains PAG and non-PAG rock in the same proportions as the bulk waste (Table 7-20). Estimates of time to onset of acidic conditions (Section 7.3.3.8) indicate that it is unlikely that significant PAG material will generate acid during the 38 year period between exposure and flooding (Figure 7-44), and therefore exposed wall rock below 1440 m is assumed to remain neutral during the period of exposure.

To assess long-term loads to the Pit Lake, PAG rock exposed in the highwall was modelled as generating acidic runoff and related increased metal loads beginning in Year 45 (i.e., immediately following establishment of the lake surface at 1440 m). Estimates of "time to onset" of acidic conditions, together with estimates of depletion of contained sulphides and metals, showed that a maximum of 3% of the PAG rock would be acidic and leaching metals at peak rates at any given time, and that this maximum would occur from schedule years 136 to 327. To maintain a conservative approach to prediction, the maximum predicted amount of acidic PAG was assumed to be present in the walls from Year 45 on.

To account for increased loadings under acidic conditions, sulphate release observed at neutral pH was increased by a factor of five, and elemental loadings were increased by a factor of 680, based on observations from long term kinetic testing spanning periods of both neutral and acidic weathering of copper porphyry waste rock from another site in British Columbia (Section 7.3.3.9). No increase was applied to rates of selenium release, as selenium is known to be less mobile under acidic conditions than at neutral pH (e.g., HCT results for HC4, in Appendix 3-7-V).

7.4.2 Source Term for Site Water Chemistry Predictions

Potassic, sericite- iron carbonate, propylitic, and phyllic alteration units were assigned the source terms (as release rates in mg/kg/yr) derived for each unit in the waste rock assessment. Tertiary basalt and overburden were treated in the same manner to estimate loading from each material type to the Pit Lake.

As the open pit will be the furthest downgradient component of the mine site, development of a water chemistry estimate requires consideration of a number of load sources external to the pit itself. For this reason, pit water chemistry estimates are discussed in with the overall site water and load balance in Section 7.6.

7.5 Tailings Characterization

7.5.1 Background

Prosperity ore will be processed by crushing, grinding, and flotation to produce gold-copper concentrates. An initial bulk sulphide flotation step will produce a rougher concentrate and rougher tailings. Cleaning of the rougher concentrate will result in a final copper concentrate and a stream of cleaner tailings. Flotation residues will be combined into a single bulk tailings stream for disposal in the TSF. The main processing reagent of geochemical interest is lime, which regulates pH.

Taseko plans to place bulk tailings in a purpose-built impoundment in the upper Fish Creek valley. As shown in Figure 7-2, the impoundment will require construction of embankments across the valley (the Main Embankment) and along a portion of the ridge that forms the southwest boundary of the Fish Creek valley (the West Embankment).

Tails will be deposited by spigotting from the embankments. This process will develop a coarser-grained, unsaturated tailings beach that slopes from the embankments to the opposite side of the TSF. The beach will transition into a pond towards the southeast end of the facility, and in closure outflow from this pond will report to Lower Fish Creek via an engineered spillway in the Main Embankment. Tailings seepage will report downgradient of both embankments.

The following sections describe the tailings ARD/ML test work that was considered in the design of the TSF and that informs water chemistry predictions for seepage and surface water leaving the TSF.

7.5.2 Previous Tailings Characterization Programs

7.5.2.1 Phase 1 Metallurgical Testing

Metallurgical test work on samples of Prosperity ore was carried out by Lakefield Research Ltd. under the supervision of Melis Engineering Ltd. in 1992 and 1993 (Hallam Knight Piesold 1993; Melis 1994; Watermark 1997) as discussed for ore in Section 7.3.1.1. A parallel program of ABA testing and elemental analysis was carried out for both ore samples and flotation tailings residues from the metallurgical test work.

Twenty-four composite samples from up to 200 m intervals in individual diamond drill holes were subjected to batch flotation tests. Vertical and lateral deposit-scale variability was tested by carrying out locked cycle tests nine composites prepared from the eight individual drill hole composites from each of the upper, middle, and lower zones of the deposit. The Phase 1 feed samples were composited as catalogued in Appendix 3-7-AA.

ABA tests on both feed and tailings samples were carried out by Min-En Laboratories, Vancouver, British Columbia. Analytical methods are not known. Sulphur analysis included total and sulphate-sulphur determinations, and AP is based on sulphide-sulphur calculated by difference. The Sobek method is assumed to have been used for NP determination.

Min-En also conducted the elemental analyses of the feed samples, with major elements determined by whole rock analysis and trace elements determined by ICP (digestion not specified, aqua regia assumed). Elemental analyses of the locked cycle tailings samples were conducted by Saskatchewan Research Council, methods are not known, but are assumed to be similar to those employed by Min-En for feed samples.

7.5.2.2 Phase 3 Metallurgical Testing

Taseko carried out a metallurgical testing program in July and August of 1997 at Lakefield Research Limited. The program was overseen by Melis Engineering, and included locked cycle and pilot plant testing on three composite ore samples representing the upper, middle and lower portions of the deposit.

Phase 3 pilot plant samples were composited from half core intervals that were retained after sawing core lengthwise and shipping one half of the sawn core for analysis. Appendix 3-7-BB lists the core intervals that comprised the upper (HCU), middle (HCM), and lower (HCL) samples. ABA and elemental analysis were carried out on ore feed and tailings samples for each of the pilot plant samples.

ABA tests on both feed and tailings samples were carried out by Lakefield Research Ltd. using a method equivalent to the Modified ABA procedure (MEND 1991). Elemental analyses of both feed and tailings samples were conducted by Saskatchewan Research Council by ICP-MS (digestion not specified, assumed to be aqua regia as it was commonly in use at the time).

7.5.3 2006–2008 Tailings Characterization Program

7.5.3.1 Phase 5 Sample Sources

Previous phases of testing had not characterized the kinetic weathering characteristics of Prosperity tailings. To produce tailings samples for kinetic testing, a program of sampling and batch flotation was carried out.

Twenty-two ore grade intervals from nine 1991 and 1992 drill holes were collected from archived core during the December 2006 sampling round described in Section 7.3.1.2. These older ore grade intervals were collected because no ore grade intervals from the more recent drilling were available due to having been consumed in the Phase 3 metallurgical program.

Ore samples were shipped to G&T Metallurgical Services Ltd. (G&T) of Kamloops British Columbia. Taseko reviewed the available ore intervals and prepared compositing instructions to G&T to achieve a typical ore composite. The core intervals selected for the composite and the recommended mass proportions of each are listed in Appendix 3-7-CC.

G&T prepared a single master composite ore sample using the proportions of available core listed in Appendix 3-7-CC. A split of this master composite was reserved for kinetic testing (as described in Section 7.3.1.2). The remainder of the master ore composite was consumed in a series of batch flotation tests carried out specifically to generate tailings for ARD/ML testing. The rougher and cleaner tails were maintained as separate products, and the entire mass of residue was delivered to CEMI for further testing.

7.5.3.2 Mineralogical Characterization

Mineralogical analysis was conducted on separate cleaner and rougher tails that were produced from bench-scale flotation tests. The rougher and cleaner scavenger tails were each subjected to mineralogical analysis by optical microscopy, quantitative x-ray diffraction with Rietveld refinement (QXRD), and determination of carbonate mineral species by electron microprobe, as described for rock samples in Section 7.3.1.2.

7.5.3.3 Static Testing

ABA testing and elemental analyses were conducted by CEMI on separate cleaner and rougher tails, and on the combined tailings product. ABA tests were carried out following the Modified ABA method (MEND 1991) and elemental analyses were carried out by aqua regia digestion followed by ICP-MS finish.

7.5.3.4 Tailings Kinetic Testing

All Phase 5 kinetic testing was carried out by CEMI.

Tailings Humidity Cell Tests

Duplicate humidity cell tests (HC A and HC B) were carried out on combined tailings to provide information on primary rates of release for tailings weathering products. The tailings HCTs were constructed and operated according to the MEND humidity cell testing protocol (MEND 1991). One kilogram of tailings was tested in each of the humidity cells.

Tailings Unsaturated Column Tests

Duplicate unsaturated column leaching tests (Unsat Column A and Unsat Column B) were conducted to provide a better understanding of how tailings in the unsaturated beach will weather, and what the chemistry of infiltrating water will be. Columns were constructed of Plexiglas pipe with an inner diameter of 10 cm and a length of 46 cm, and sample material was supported by a perforated PVC disk overlain by nylon mesh. The duplicate columns were charged with 4.2 kg (dry weight) of combined tailings, which resulted in a sample depth of 37 cm. Columns were operated in the vertical position by trickle leaching with 230 to 500 mL of deionized water on a weekly cycle.

Tailings Saturated Column Tests

Duplicate saturated column leaching tests (Sub A and Sub B) were conducted to provide a better understanding of the chemistry of tailings porewater and overlying pond water. Saturated tailings columns were of identical construction to the saturated waste rock columns described in Section 7.3.2.4 (17 cm diameter x 61 cm long Plexiglass tubing with a PVC and nylon base). Monitoring ports were located in the base of the column and in the side of the column to sample the water cover. The duplicate saturated columns were each charged with 5 kg (dry weight) of tailings, for a total tailings depth of 16.5 cm.

The saturated columns were initially filled with deionized water to a height of 30 cm above the tailings surface. Operation consisted of withdrawing only sufficient water for analyses from the bottom port and the side port, and by making up for water lost by adding an appropriate amount of deionized water to the water cover on a weekly basis. The water cover was circulated to ensure oxygen concentrations did not become depleted at the tailings interface.

7.5.4 Results and Interpretation

7.5.4.1 Static testing

Mineralogy

The complete results of the optical microscopy investigation are provided in Appendix 3-7-J.

Inspection of the cleaner tailings sample thin section (Sample 1961-02 Cu Cleaner) indicated pyrite, quartz, white mica and carbonates as the major mineral constituents of the sample, with pyrite making up approximately 25% of the sample by visual estimation. Pyrite grains were noted to be liberated and subangular. Traces of chalcopyrite were noted as small (<50 µm) liberated grains. No other sulphide minerals were identified. Gypsum was the only major non-sulphide host mineral reported, with a QXRD-reported abundance of 1.8% by weight. The sample was noted to display moderate reaction with dilute HCl.

Inspection of the rougher tailings sample thin section (Sample 1961-02 Cu Ro) indicated quartz, white mica, feldspars, carbonates, and chlorite as the major mineral constituents of the sample. Pyrite and chalcopyrite were noted as trace constituents, occurring as very fine (<50 µm) liberated grains, and a single liberated hematite grain with a core of pyrite was observed. No other sulphide minerals were identified. The sample was noted to display strong reaction with dilute HCl.

Results of tailings sample evaluation by quantitative X-ray diffraction with Rietveld refinement (QXRD) are shown in Table 7-22. The accuracy of the QXRD method is low for minerals which make up less than 1% of the sample; however, the technique is useful in defining the major mineral species present. The QXRD results generally confirm the thin section observations, with the cleaner tailings sample reporting 22.7% pyrite. Carbonate minerals identified in both samples consisted of calcite, dolomite, and ankerite with a combined total of >8% by weight for both samples. A minor amount of siderite (0.5%) was noted in the rougher tailings. The complete QXRD results can be found in the mineralogical characterization report in Appendix 3-7-J.

Electron microprobe analysis (EMPA) results shed further light on the carbonate mineralogy of the tailings samples. Fifteen grains in the cleaner tailings polished thin section were probed, with 13 being identified as dolomite and two identified as calcite. Twenty-five grains in the rougher tailings polished thin section were probed, 15 were determined to be dolomite, 6 were determined to be calcite, and 4 were determined to be siderite. Figure 7-50 displays the EMPA results on a ternary diagram that shows the range of carbonate minerals identified. The complete EMPA results can be found in Appendix 3-7-M.

Figure 7-50 EMPA Results for Tailings Carbonates

ABA Results

ABA results for tailings from Phases 1, 3 and 5 had sulphide sulphur contents that ranged from 0.03 to 1.09%, and associated AP values between 0.9 and 34 kg $CaCO_3$/tonne. Modified NP and Sobek NP values ranged from 31 to 97 kg $CaCO_3$/tonne. Appendix 3-7-DD contains complete ABA analyses for Phases 1, 3 and 5 tailings characterization, and results of all three phases of testing are summarized in Table 7-21.

Total inorganic carbon (TIC) was measured in Phases 3 and 5 testing only. Figure 7-51 shows a plot of NP against TIC-NP. For all samples tested, TIC-NP exceeds NP, which indicates that some of the carbonate minerals contain iron and manganese. These results show that it is appropriate to use NP rather than TIC-NP as a measure of available neutralization potential, as was found for the deposit host rocks (Section 7.3.3.3).

Figure 7-51 Tailings NP vs. TIC-NP

Figure 7-52 shows a plot of tailings NP and AP for all three phases of testing. The following points summarize key geochemical observations.

- Phase 1 batch flotation tailings display a wide range of NP values (31 to 97 kg $CaCO_3$/t). The reflects the nature of the source materials- individual drill hole composites from 24 different regions of the deposit were tested.
- Phase 1 batch flotation tails have a lower median AP than other samples tested. This may reflect poor performance of the batch cleaner stage, which would result in a higher percentage of pyrite reporting to concentrate and a lower AP value in the resulting tails.
- Phase 1 locked cycle tails display a narrower range of NP values than the Phase 1 batch flotation tails, however the median value is similar. This reflects the composite nature of the locked cycle feed, and shows that Phase 1 batch and locked cycle NP values are consistent.
- Phase 1 locked cycle tails have a higher median AP than the Phase 1 batch flotation tails, possibly reflecting higher pyrite removal in the locked cycle cleaner stage.
- Phase 3 locked cycle and pilot plant tests were conducted on splits of the same sample, however the ABA results show that the two methods did not yield a geochemically uniform tailings product. The pilot plant test conducted on the intermediate depth sample (PP6) had a NP/AP ratio of 1.5 (the lowest of all samples tested).
- The single Phase 5 batch flotation tails sample had a higher NP/AP ratio than all Phase 3 tails and most of the Phase 1 locked cycle tails. The Phase 5 sample had a NP of 60 kg $CaCO_3$/t (slightly above the median of Phase 1 and 3 locked cycle and pilot plant samples). However, similar to the Phase 1 batch flotation tests, AP for the Phase 5 sample was lower than for most Phase 1 and 3 locked cycle/ pilot plant tails.

Figure 7-52 Comparison of Tailings NP to AP

ABA tests were also carried out on the separate Phase 5 rougher and cleaner tails. Results are tabulated in Table 7-21. The cleaner tails returned a sulphide sulphur content of 10.9% and a NP/AP ratio of 0.2, indicating that the cleaner tails were PAG. The rougher tails returned a sulphide sulphur content of 0.15% and an NP/AP ratio of 16.7, indicating that a separate rougher tailings product would be non-PAG.

Of the tailings tested, the characteristics of the Phase 3 pilot plant tails are considered to the best approximation of the future mill tailings product. Based on NP/AP values of 3, 1.5 and 2.8 for the upper, middle, and lower pilot plant tailings, respectively, it is expected that the bulk tailings will be non-PAG.

Elemental Analysis

Results of elemental analysis of Phases 1, 3 and 5 tailings are shown in Table 7-23.

The Phase 1 locked cycle tailings contained 240 to 390 ppm copper. The Phase 3 pilot plant tailings contained a narrower range of copper concentrations (280 to 310 ppm). The Phase 5 batch flotation tailings had a higher copper concentration (364 ppm) than any of the Phase 1 or 3 samples, possibly due to partial oxidation of the drill core used as feed for Phase 5 testing.

As Phase 5 tailings were subjected to humidity cell and column testing, it is useful to compare Phase 5 elemental concentrations with those determined for the Phase 3 pilot plant tailings, as the pilot plant tailings are considered the best approximation of tailings that will be produced by the full-scale plant. In addition to having higher copper content, the Phase 5 tailings had higher Mn, Ni, Se, and Zn than all three pilot plant tails, and Phase 5 Mo content was the same as the highest Mo content measured for Phase 3 tails. Phase 3 samples had Cd content below detection (0.5 ppm) while the Phase 5 sample had a Cd content of 0.36 ppm, which was lower than the limit of detection for the Phase 3 testing.

Elements present in lower concentrations in the Phase 5 tails include B, Ba, Bi, Co, Cr, Ga, Hg, Th, Tl, U and V. Other elements in Phase 5 samples were within the concentration ranges measured for Phase 3, including As, Mo, Pb and Sb.

In summary, the Phase 5 tailings samples had higher concentrations of several elements and similar or lower concentrations of several others when compared to Phase 3 pilot plant tailings. The Phase 5 tailings that are being tested in humidity cells and leaching columns are considered to be an acceptable proxy for full scale tailings from the Project in terms of overall metal content.

Table 7-21 Summary of Tailings ABA Results

Sample ID	Year	Process Type	Level	Paste pH	CO_2 %	$CaCO_3$ NP	S(T) %	S (SO_4) %	S (S^{2-}) %	AP[a]	NP[b]	Net NP[c]	Fizz Test	NP/ AP	TIC-NP/ AP
										(kg $CaCO_3$/ t)					
AL98	1993	Batch	Lower	-	-	-	0.72	-	0.46	14	94	79	-	6.5	-
BL54	1993	Batch	Lower	-	-	-	0.52	-	0.3	9	75	65	-	8.0	-
CL37	1993	Batch	Lower	-	-	-	0.68	-	0.09	3	61	58	-	21.6	-
DL85	1993	Batch	Lower	-	-	-	0.34	-	0.19	6	54	48	-	9.0	-
EL02	1993	Batch	Lower	-	-	-	0.32	-	0.03	1	75	74	-	80.1	-
FL19	1993	Batch	Lower	-	-	-	0.23	-	0.03	1	89	88	-	94.7	-
GL01	1993	Batch	Lower	-	-	-	0.45	-	0.03	1	89	88	-	95.3	-
HL03	1993	Batch	Lower	-	-	-	0.53	-	0.07	2	60	57	-	27.2	-
AM13	1993	Batch	Middle	-	-	-	0.72	-	0.05	2	39	38	-	25.1	-
BM51	1993	Batch	Middle	-	-	-	0.78	-	0.5	16	70	54	-	4.5	-
CM48	1993	Batch	Middle	-	-	-	0.58	-	0.13	4	83	79	-	20.4	-
DM68	1993	Batch	Middle	-	-	-	1.32	-	0.46	14	33	18	-	2.3	-
EM26	1993	Batch	Middle	-	-	-	1.08	-	0.44	14	55	42	-	4.0	-
FM27	1993	Batch	Middle	-	-	-	0.75	-	0.11	3	58	54	-	16.8	-
GM31	1993	Batch	Middle	-	-	-	1.93	-	1.09	34	63	29	-	1.8	-
HM21	1993	Batch	Middle	-	-	-	1.03	-	0.17	5	78	73	-	14.7	-
AU76	1993	Batch	Upper	-	-	-	0.51	-	0.37	12	31	19	-	2.7	-
BU22	1993	Batch	Upper	-	-	-	0.15	-	0.1	3	66	63	-	21.0	-
CU88	1993	Batch	Upper	-	-	-	0.62	-	0.18	6	54	48	-	9.6	-
DU80	1993	Batch	Upper	-	-	-	0.54	-	0.32	10	70	60	-	7.0	-
EU07	1993	Batch	Upper	-	-	-	0.27	-	0.17	5	85	80	-	16.0	-
FU12	1993	Batch	Upper	-	-	-	0.2	-	0.05	2	63	62	-	40.4	-
GU28	1993	Batch	Upper	-	-	-	0.34	-	0.13	4	97	92	-	23.8	-
HU14	1993	Batch	Upper	-	-	-	0.2	-	0.11	3	90	87	-	26.3	-
L2	1993	Locked cycle	Lower	-	-	-	0.87	-	0.54	17	71	54	-	4.2	-
ABCD-L	1993	Locked cycle	Lower	-	-	-	0.79	-	0.46	14	57	42	-	3.9	-
EFGH-L	1993	Locked cycle	Lower	-	-	-	0.59	-	0.25	8	68	60	-	8.7	-
M2	1993	Locked cycle	Middle	-	-	-	1.3	-	0.78	24	70	46	-	2.9	-
ABCD-M	1993	Locked cycle	Middle	-	-	-	1.16	-	0.54	17	71	54	-	4.2	-
EFGH-M	1993	Locked cycle	Middle	-	-	-	1.53	-	0.8	25	59	34	-	2.3	-
U15	1993	Locked cycle	Upper	-	-	-	1.03	-	0.84	26	69	43	-	2.6	-
ABCD-U	1993	Locked cycle	Upper	-	-	-	0.85	-	0.49	15	49	34	-	3.2	-
EFGH-U	1993	Locked cycle	Upper	-	-	-	0.97	-	0.73	23	68	45	-	3.0	-
PP7	1997	Pilot Plant	Lower	8.29	3.0	67	1.17	0.63	0.49	15	43	27	Slight	2.8	4.4
PP6	1997	Pilot Plant	Middle	7.84	2.8	63	1.83	0.60	0.092	29	44	15	Slight	1.5	2.2
PP8	1997	Pilot Plant	Upper	8.04	3.7	83	1.02	0.20	0.61	19	57	38	Mod.	3.0	4.4
PP8 Duplicate	1997	Pilot Plant	Upper	8.11	3.8	86	1.02	0.17	1	31	60	28	Mod.	1.9	2.7
Test 19	1997	Locked cycle	Lower	7.93	2.8	62	1.19	0.83	0.46	14	55	40	Mod.	3.8	4.3
Test 20	1997	Locked cycle	Middle	7.84	2.9	66	1.86	0.80	0.97	30	57	27	Mod.	1.9	2.2
Test 21	1997	Locked cycle	Upper	7.72	3.5	80	1.45	0.33	0.91	28	61	33	Mod.	2.2	2.8
Test 21 Duplicate	1997	Locked cycle	Upper	7.71	3.6	82	1.46	0.37	0.95	30	64	34	Mod.	2.1	2.7
Cleaner + Rougher Tails Comp.	2007	Batch	Mixed	7.95	4.0	92	0.64	0.30	0.34	11	60	49	Slight	5.6	8.6
KM1961-02 Cu Clr Scav Tails	2007	Batch	Mixed	7.85	3.6	82	11.02	0.10	10.92	341	71	-270	Slight	0.2	0.2
KM1961-02 Cu Rougher Tails	2007	Batch	Mixed	7.75	4.0	91	0.46	0.32	0.14	4	73	69	Slight	16.7	20.8

NOTES:

[a] AP = Acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. AP is determined from calculated sulphide sulphur content: S(T) - S(SO_4).

[b] NP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.

[c] NET NP = NP–AP

Table 7-22 Summary of Rietveld XRD Results for Tailings Samples

Sample ID	Description	Quartz wt%	Plagioclase wt%	K-feldspar Wt%	Muscovite wt%	Paragonite wt%	Clinochlore Wt%	Calcite wt%	Dolomite wt%	Ankerite wt%	Siderite wt%	Kaolinite wt%	Gypsum wt%	Magnetite wt%	Pyrite wt%	Total wt%
1961-02 Cu Cleaner	Cleaner tailings	16.9	11.1	1.6	21	4.4	6.3	2.8	-	5.6	-	4.6	1.8	1.2	22.7	100.1
1961-02 Cu Ro	Rougher tailings	36.3	18.5	1.6	16.8	4.9	5.1	1.6	7.5	-	0.5	4.2	2.2	0.9	-	100.0

Table 7-23 Elemental Analyses of Tailings

	Phase	1	1	1	1	1	1	1	1	1	3	3	3	5	5	5
	Sample ID	L2	ABCD-L	EFGH-L	M2	ABCD-M	EFGH-M	U15	ABCD-U	EFGH-U	HCL	HCM	HCU	Cleaner + Rougher Tails	KM1961-02 Cu Clr Scav Tails	KM1961-02 Cu Rougher Tails
	Test ID	L2	L14	L15	M2	M13	M14	U15	U24	U25	PP7	PP6	PP8	-	-	-
Element	Units															
Ag	ppm	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	0.20	0.96	0.19
As	ppm	11	14	6.6	8.6	11	11	18	21	15	6.1	11	15	8	39	4.3
B	ppm	<10	<10	<10	<10	<10	<10	<10	<10	<10	32	43	25	3	3	2
Ba	ppm	-	-	-	-	-	-	-	-	-	470	400	360	62	33	64
Be	ppm	2	2	2	<1	2	2	2	2	2	<0.5	<0.5	<0.5	-	-	-
Bi	ppm	<2	<2	<2	<2	<2	<2	<2	<2	<2	0.2	0.5	0.2	0.17	1.66	0.08
Cd	ppm	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	0.36	0.2	0.27
Co	ppm	12	12	10	12	16	13	18	12	13	18	20	16	12	164	6
Cr	ppm	-	-	-	-	-	-	-	-	-	84	80	81	34	200	18
Cu	ppm	340	240	390	300	300	360	360	250	320	310	280	290	364	480	325
Ga	ppm	14	20	18	16	22	20	15	19	18	28	19	28	3	3.3	3.1
Hg	ppb	440	1,000	310	280	500	810	760	1,200	450	350	390	420	202	332	225
Li	ppm	7	12	7	8	11	11	7	11	13	19	18	26	-	-	-
Mn	ppm	-	-	-	-	-	-	-	-	-	230	210	260	278	305	285
Mo	ppm	250	<4	7	9	<4	<4	25	<4	<4	24	16	12	24	94	35
Ni	ppm	14	43	59	52	69	60	140	54	64	18	18	16	24	169	15
Pb	ppm	59	11	<4	11	13	13	20	10	18	<1	<1	21	11	73	9.2
Sb	ppm	<4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	2.5	0.8	3.5	1.0	2.7	0.79
Se	ppm	-	-	-	-	-	-	-	-	-	<0.5	0.7	<0.5	0.9	18	0.3
Sn	ppm	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5	<0.5	<0.5	-	-	-
Sr	ppm	-	-	-	-	-	-	-	-	-	420	370	320	97	89	99
Th	ppm	<0.05	3.5	3.5	2.2	3.5	3	2.1	3..5	3.5	3.9	3.1	2.4	1.8	1.6	1.5
Tl	ppm	-	-	-	-	-	-	-	-	-	0.9	<0.1	1.3	0.06	0.18	0.07
U	ppm	-	-	-	-	-	-	-	-	-	2.3	3.2	2.5	0.3	0.4	0.3
V	ppm	-	74	87	-	98	78	-	78	96	130	110	110	46	44	46
W	ppm	-	<4	<4	-	<4	<4	-	<4	<4	<2	4	<2	<.1	0.3	<.1
Zn	ppm	-	60	30	-	52	52	-	55	82	34	39	72	106	83	92

7.5.4.2 Kinetic testing

Results of tailings kinetic testing through June 2008 are provided in Appendix 3-7-EE and Appendix 3-7-FF. The following sections discuss the key geochemical features of the results.

Humidity cell testing

Humidity cells HCA and HCB contain duplicate samples of Phase 5 tailings, and had been running for 66 weeks as of June 24, 2008. Cell leachates were initially around pH 7.5, and rose to a stable range around pH 8 from week 20 on. In generally, the duplicate tailings humidity cells produced leachates with similar chemistry over time (Appendix 3-7-DD).

Calcium and sulphate release were initially high (roughly 300 and 800 mg/kg/wk, respectively) due to dissolution of gypsum and anhydrite, and declined over the period from weeks 13 to 21 to much lower stable rates (9.5 and 6.5 mg/kg/wk, respectively) that most likely reflect release of sulphur due to sulphide oxidation and flushing of weathering products. Barium release increased beginning in week 19, which is most likely related to the increased solubility of the sparingly soluble mineral barite ($BaSO_4$) in response to declining sulphate concentrations in the leachate.

Release of most other parameters was either flat or decreasing from week 40 on. An exception was molybdenum, which showed an increase from around 0.005 mg/kg/wk in week 43 to around 0.016 mg/kg/wk in week 65.

Subaqueous column testing

Duplicate subaqueous columns containing bulk tailings composite (Subaqueous Column A and Subaqueous Column B) have 65 weeks of data available. Monitoring of both the water cover (Sub A Side Port and Sub B Side Port) and the tailings porewater (Sub A Bottom Port and Sub B Bottom Port) has been carried out. Column test results are displayed graphically on plots in Appendix 3-7-FF.

The duplicate tests have generally shown good reproducibility, however a weekend malfunction caused by leaking tubing in a recirculating pump caused the water cover in Subaqueous Column B to drain between weeks 43 and 45 monitoring. The problem was noticed the following Monday and the water cover was re-established using deionized water. Laboratory staff reported that the surface tailings were disturbed by pouring replacement water into the test column. The reproducibility of particularly the duplicate water cover monitoring was understandably poor in subsequent weeks. Subaqueous Column A remained intact and continues to provide valid test results.

Water Cover

The initial pH of the water cover (Sub A Side Port, Sub B Side Port) was around 6.6, indicating that equilibrium between the water cover and the tailings solids had not been achieved. From week four on, water cover pH for both tests generally ranged between seven and eight. Dissolved oxygen ranged from 6.5 to 11 mg/L over the test period, with typical values around 8 mg/L suggesting that the water cover was in equilibrium with atmospheric oxygen.

Sulphate concentrations in the water cover increased gradually to around week 17, then remained within a steady range of 376 to 503 mg/L between weeks 17 and 35, before beginning to decline. A similar pattern was observed for calcium, suggesting initial increases were due to dissolution of gypsum or anhydrite, with declining concentrations reflecting depletion of near-surface grains and depletion of the resident load in the water column by removal of water for monitoring purposes and replacement with deionized water.

Elemental concentrations in the water cover are generally stable (F, Al, Se) or decreasing in the manner described for calcium and sulphate. Exceptions are barite and magnesium, for which steadily increasing concentrations likely reflect dissolution of barite and magnesium-bearing carbonates as calcium and sulphate concentrations decline.

Tailings Porewater

Initial porewater pH values near pH 8 declining over the course of 15 weeks to pH 7, then ranged from a minimum of pH 6.74 to a maximum of pH 7.59 from weeks 15 through 65. Porewater appears to be undersaturated with dissolved oxygen, with typical concentrations of 4 mg/L and a range of 2 to 6 mg/L. Dissolved iron concentrations were between 0.4 and 3.9 mg/L over most of the testing period.

Sulphate and calcium concentrations were initially elevated (1400 to 1900 mg/L sulphate and 500 to 600 mg/L calcium) suggesting equilibrium dissolution of gypsum or anhydrite. However, sulphate concentrations appear to begin to slowly decline around week 45 and continue to trend downward. Calcium concentrations increase to 776 mg/L in week 43 before declining back to around 580 mg/L in week 63.

The majority of parameters monitored are decreasing as testing progresses. Several parameters (F, Mo, U, Mg, and Ca) had peak concentrations at some point during the testing period, with the more recent data indicating a decrease in porewater concentrations with time. Several other parameters (Al, Ba, Cu, Sr, Se) appear to have achieved stable porewater concentrations. Overall, the stable, declining, or peaked concentration behaviours suggest that the reactivity of the tailings being tested is slowly declining as the outer surfaces of the tailings particles weather.

Unsaturated column testing

Duplicate unsaturated columns containing bulk tailings composite (Unsat Column A and Unsat Column B) have 65 weeks of data available. Monitoring of leachate has been carried out via a port in the base of the column. Reproducibility in the duplicate column results has been high over the duration of testing to date.

Leachate pH was between 7.55 and 8.14 over the test period. Sulphate has declined from initial leachate concentrations of around 1900 mg/L to week 65 concentrations around 1350 mg/L. Calcium concentrations were initially stable at around 550 mg/L, then increased over the course of several months to around 700 mg/L before declining to around 630 mg/L in the later cycles. The increase in calcium concentrations between weeks 27 and 53 was partially paralleled by an increase in sulphates concentrations over this period, but differences between the trends of calcium and sulphate indicate that gypsum and anhydrite were not the only sources of dissolved calcium.

The majority of other parameters are stable or decreasing. In particular, stable cobalt concentrations in unsaturated column test leachate were higher than in other tailings tests (up to 0.0035 mg/L), with pyrite being the suspected source of cobalt in leachate. The exceptions to the trend of stable or decreasing concentrations were increasing barium and zinc concentrations during the later stages of testing. Barium concentrations appear to have increased in response to declining sulphate concentrations and increased dissolution of barite. Up to five-fold increases in zinc concentrations from weeks 43 to 65 do not appear to be correlated with geochemical behaviour of other parameters; as leachate concentrations are within 10 times the lower detection limit of 0.001 mg/L, and as zinc is considered a ubiquitous contaminant in laboratory environments, it is possible that the apparent trend of increasing zinc release is an artefact of the testing procedure.

Column operating procedures entailed adding a sufficient quantity of water to obtain leachate for analyses—actual volumes for addition were specified as a range and actual additions were left to the technician's judgement. This resulted in variable water additions over the duration of testing which need to be considered when comparing leachate concentrations over time.

7.5.4.3 Interpretation

The results of the mineralogical investigation showed that the tailings neutralization potential measured through ABA testing is roughly equivalent to the neutralization potential attributable to calcium+magnesium carbonates. Neutralization potential calculated from TIC measurements was found to overestimate the available neutralization potential due to a proportion of iron and manganese in the carbonate minerals.

Sulphate sulphur content of the tailings is variable and can be significant. Sulphur speciation will be necessary when monitoring production tailings to arrive at accurate estimates of acid potential.

ABA testing on Phase 1 batch and locked cycle flotation tailings showed that nearly all samples tested had NP/AP values greater than two. However, the Phase 3 locked cycle and pilot plant tailings samples overall had lower NP/AP ratios than the Phase 1 samples, with the lowest measured NP/AP ratio of all samples tested coming from the middle zone pilot plant tailings (sample PP6, NP/AP= 1.5).

On the basis of the static test results, the full scale Prosperity tailings are expected to be non-PAG. However, monitoring of the ABA characteristics of the bulk tailings product will be necessary to ensure that full scale tailings conform to these expectations.

Humidity cell and unsaturated column testing on Phase 5 tailings show that runoff from exposed tailings beaches will be dominated by leaching of gypsum. Metal leaching during the operational period would be negligible, and at closure there will be no exposed tailings to contribute loadings to surface runoff.

The sub-aqueous column leach test on Phase 5 bulk tailings sample showed that leaching under these conditions is negligible with the exception of minerals that are somewhat soluble in water. These minerals include gypsum, fluorite and carbonates which are potentially sources of major ions (i.e., total dissolved solids), fluoride and manganese. MINTEQA2 was used to evaluate the porewater leachate chemistry with respect to these minerals. Leachates were close to saturation with respect to gypsum (saturation index -0.067), calcite (-0.23), celestite (strontium sulphate, -0.21), and wulfenite (lead molybdate, 0.051), but under-saturated with respect to fluorite (-0.99) and rhodochrosite (-0.83). Assuming that these minerals are present, the stable leach column chemistry is a reasonable surrogate for seepage chemistry from the area(s) of the impoundment used for disposal of tailings (Table 7-24). Manganese concentrations may be higher than indicated by the column test if rhodochrosite is present- although x-ray diffraction and electron microprobe assessment of the Phase 5 tailings sample did not identify rhodochrosite as discrete mineral phase, other carbonate minerals were found to contain trace amounts of manganese.

Table 7-24 Maximum Concentrations in Tailings Subaqueous Column Leachate

pH (min.)	Sulphate	Acidity	Alkalinity (minimum)	F	Cd	Cu	Fe	Pb	Mn	Mo	Ni	Se	Zn
s.u.	mg/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
6.74	1886	15	83	0.4	0.0004	0.017	3.92	0.0013	0.6	0.12	0.01	0.0089	0.021

7.5.5 Tailings Source Terms for Water Chemistry Predictions

7.5.5.1 Saturated Tailings

Porphyry copper tailings porewater is often found to have dissolved concentrations of Cu, Mn, and Fe in equilibrium with tenorite (CuO), rhodochrosite ($MnCO_3$) and ferrihydrite ($Fe_2O_3 \cdot 0.5H_2O$). As discussed in the previous section, equilibrium modelling of saturated tailings leachate indicated that the leachate was undersaturated with respect to these minerals. To arrive at an estimate of full scale tailings porewater chemistry, additional MINTEQA2 runs were carried out to determine equilibrium copper, manganese, and iron concentrations.

Modelling was carried out starting with the leachate chemistry from the cycle that returned the lowest pH (pH 6.87, Sub A Bottom Port 20070807). Tenorite, rhodochrosite, gypsum, ferrihydrite, and calcite were allowed to equilibrate at fixed pH, and P_{CO2} was set to atmospheric partial pressure. As a separate exercise, P_{CO2} was increased by an order of magnitude to evaluate sensitivity to variation in dissolved CO_2, and results of this sensitivity analysis indicated minimal change in predicted porewater chemistry.

Therefore, a source term tailings porewater chemistry was compiled using equilibrium copper and manganese concentrations, and maximum values observed in column leachate for all other parameters (minimum values for pH and alkalinity). This source term was used in estimating West Embankment seepage chemistry.

Because PAG rock will be disposed in the eastern portion of the TSF, a combined tailings and PAG rock porewater source term was developed to inform estimate of Main Embankment seepage chemistry. A similar assessment to that described for saturated tailings porewater was carried out for PAG waste rock porewater. The maximum values for parameters from all saturated rock and tailings columns, along with equilibrium concentrations of copper and manganese, were adopted as the estimate for a single "saturated PAG plus tailings porewater" source term.

It should be noted that, subsequent to developing the tailings porewater source terms, ongoing testing returned concentrations for As, Sn, and Ti that exceeded the previous maxima by a small amount. Source term estimates were not revised. To assess whether TSF Pond water entrained during tailings sedimentation would be likely to dominate the tailings porewater chemistry, the TSF Pond chemistry from Year 10 (middle of mine life), Year 19 (final year of processing), and Year 30 (11 years after processing is complete) was compared with the ”Saturated PAG + Tailings Porewater” source term. It was found that sulphate, Ca, Cd and Cu are higher in the Porewater source term than in the Pond Estimates for all three periods of comparison. Concentrations of Ba, Be, Cr, Sb, Se and Zn were modelled as having up to 80, 700, 100, 700, 20 and 20% (respectively) higher concentrations in TSF Pond depending on the model year. As indicated above, most other trace elements of concern were higher in the ‘Saturated PAG + Tailings Porewater’ source term. In considering that the Pond water quality estimate does not account for precipitation of iron oxyhydroxides and scavenging of metals, it is reasonable to proceed using the ”Saturated PAG + Tailings Porewater” source term as derived.

The two source terms were then used as inputs to the site water chemistry prediction. See Appendix 3-7-GG for saturated tailings source term chemistry.

7.5.5.2 Unsaturated tailings

A comparison of humidity cell and column test release rates showed that columns are releasing weathering products at a lower rate than humidity cells on both in terms of mass and with respect to flowpath length. From this result, it is inferred that equilibrium conditions have developed within the column and are acting to control the aqueous concentrations of weathering products.

Two separate unsaturated tailings source terms were developed. A beach runoff source term was developed to allow estimates of loadings to the tailings pond via beach runoff. This “Beach Runoff” source term consists of the maximum concentrations observed from the unsaturated tailings columns, and is considered to be conservative as the surface tailings are likely generate lower concentrations due to exposure and repeated flushing.

A “Beach Infiltration” source term was also developed using maximum observed concentrations from unsaturated tailings columns as a basis. These maximum concentrations were then compared to a compiled database of seepage chemistry from porphyry mines in British Columbia to see if higher concentrations might be expected (based on porphyry waste rock seepage (Day and Rees 2006). Where the database concentrations exceed the Prosperity column concentrations, the higher concentration from the database was adopted as the estimate. As a result of this review, alkalinity in the “Beach Infiltration” source term was decreased, and Se and Zn concentrations were increased. See Appendix 3-7-GG for unsaturated tailings source term chemistries.

7.6 Site Water and Load Balance

7.6.1 Description of Water and Load Balance Model

Estimates of chemical loadings from the different site components were used together with the site water balance developed by Knight Piesold to generate overall water and load balance for the Project. This water and load balance forms the basis for the estimates of site and discharge water quality that have been used to assess the environmental effects of the Project (Volume 5, Section 2).

The five main components of the water and load balance are shown in Table 7-25, along with the sources of load (inputs) and losses of load (outputs) for each component. A schematic representation the main components of the water and load balance is shown in Figure 7-53 (for the operational period) and in Figure 7-54 (for the post-closure period).

The water and load balance is a modified mass balance model that was used to estimate dissolved concentrations of regulated parameters in site discharge. Chemical loading from the various mine components is incorporated as source terms, and chemical mass is maintained as a dissolved component except in those instances noted in the source term descriptions in Section 7.3.4. In particular, Ca, SO_4, Fe, Cu and Mn masses were added to the tailings pore water source term to account for expected dissolution of tailings minerals containing these parameters, while Ca and SO_4 masses were removed from non-PAG dump loadings to reflect control of respective concentrations by the solubility product of gypsum.

For each of the five model components, a number of sources contribute chemical mass to the system. For each source, a source term was identified to represent the expected chemical contribution from each source. For surface and groundwater entering the site, baseline water quality monitoring data were adopted as source terms. For all other sources, source terms were developed from ARD/ML characterization testing as described in Section 7.3.4.

Figure 7-53 Schematic Water and Load Balance—Operations

Figure 7-54 Schematic Water and Load Balance—Post-closure

7.6.2 Factors Leading to a Conservative Prediction

Development of a site wide water and load balance was governed by the requirement to apply conservative assumptions where specific information was deficient (Price 1997). The following points summarize the main prediction elements that lead to a conservative prediction of site discharge water quality.

- Source Terms
  - maximum concentrations from laboratory test work were generally selected for development of source terms (initial elevated release due to flushing in HCTS was excluded)
  - where concentrations were below detection, detection levels were adopted for development of source terms. This represents an upper bound for observed concentrations rather than a maximum observed value
  - where assumptions were required, selection of model parameters was conservative. For example, the low grade ore stockpile is assumed to be in place and generating load at its maximum ultimate capacity for the entire 19 years of ore processing
- Pit Lake water quality prediction
  - Year 0 to 6: assumes entire area of Year 6 final wall is exposed during this period and generating contaminants
  - Year 17: stored load from pit mining period is assumed to flush into pit, including all stored load in high wall above final flood elevation that never will be inundated and fully flushed by lake water. This provides an upper bound to the chemical load contributed by the pit
  - Years 17 to 44: all load generated by permanent highwall is assumed to be flushed. This provides an upper bound for loading to pit during this period, and was adopted for simplicity of calculation and to be conservative

    - No removal of load in the Pit Lake is accounted for during any of the above time periods. Experience at other Pit Lakes indicates that mineral precipitation, scavenging of metals by particulates followed by particulate settling, and biological processes can be responsible for removal of dissolved elemental load from the water column in Pit Lakes (e.g., Martin et al. 2006)
- TSF Lake water quality prediction
    - tailings consolidation assumed to proceed through Year 40. All porewater expelled during consolidation is assumed to be expelled back into the TSF Pond with the chemical load that would arise from having concentrations at the estimated tailings porewater values
- In reality, a portion of the expelled water will report to tailings seepage as a component of total seepage. Seepage volumes will not increase, so in effect the assumption that all consolidation water reports to the TSF Pond will be overestimating the chemical loads generated.
    - no removal of mass from water column was accounted for. Mineral precipitation, scavenging and settling of dissolved metals by particulates, and biological removal processes are processes that may contribute to mass removal from the TSF Lake water at full scale

7.6.3 Results

The outcomes of the site water and load balance are estimates of future water chemistry in TSF and Pit lakes. These future water chemistry estimates are presented in tabular form in Appendix 3-7-HH (for TSF Lake) and in Appendix 3-7-II (for Pit Lake).

The future water chemistry estimates are discussed in the context of implications for the receiving environment in Volume 5, Section 2.

Table 7-25 Component Inputs, Outputs, and Source Terms

Component	Water and Load Inputs	Input Source Terms	Component Outputs
1. Prosperity Lake	Direct Precipitation	No associated load	Evaporation
	Local Catchment Runoff	Background	Discharge to TSF
	Wasp Lake	Background, Precipitation	
	Headwater Channel	Background	
2. Tailings Storage Facility	Prosperity Lake	Calculated in Component 1	Evaporation
	Direct Precipitation	No associated load	Water lost to tailings and PAG porewater
	Undisturbed Catchment Runoff	Background	Reclaim Water
	Drawdown of Fish Lake	Background	Seepage (Main Embankment)
	Tailings Slurry	Calculated in Component 4	Seepage (West Embankment)
	Direct Precipitation	No associated load	Surface discharge to Open Pit
	Tailings porewater	Tailings Porewater Prediction	
	PAG Waste Runoff	Unsaturated PAG Loading Prediction	

Table 7-25 Component Inputs, Outputs, and Source Terms (cont'd)

Component	Water and Load Inputs	Input Source Terms	Component Outputs
	Beach runoff	Beach runoff prediction	
	Water Collection Pond	Calculated in Component 3	
	West Embankment Seepage Recycle	Tailings Porewater Prediction	
	Camp Effluent	Nitrogen and Phosphorous only, from manufacturer's performance specifications	
	Diversion Leakage	Background	
3. Water Collection Pond	Open Pit	Calculated in Component 5	Evaporation
	Plant Site Runoff	Plant Site Load Prediction	Pumped to Mill (operations only)
	Non-PAG Waste Stockpile Runoff	Non-PAG Load Prediction	Pumped to TSF (operations only)
	Non-PAG Waste Stockpile Catchment Runoff	Background	Discharge to Open Pit (closure only)
	Low Grade Ore Stockpile	Low Grade Ore Load Prediction	
	Overburden Stockpile	Background	
	Diversion Leakage	Background	
	Main Embankment Seepage	Tailings Porewater Prediction	
	Direct Precipitation	No associated load	
	Open Pit Catchment Runoff	Background	
4. Mill Load Summary	Water Collection Pond	Calculated in Component 3	Tailings Slurry
	Reclaim	Calculated in Component 2	Water in Concentrate
	Water from Ore	Ore Loading Prediction	
5. Pit Lake	Direct Precipitation	No associated load	Evaporation
	Catchment Runoff	Background	Pumped to WCP (operations only)
	Runoff from Exposed Pit Wall	Pit wall loading prediction	Discharge to Lower Fish Creek (closure only)
	Main Embankment Seepage	Tailings Porewater Prediction	
	Groundwater	Baseline Groundwater Chemistry	
	Discharge from WCP	Calculated in Component 3	
	Discharge from TSF	Calculated in Component 2	

7.7 Conclusions and Recommendations for the ARD/ML Prediction and Prevention Plan

Overall conclusions of the ARD/ML assessment are as described in the following summary sections.

7.7.1 Geology, Mineralization and Alteration

- The Prosperity deposit is hosted by andesite flows and volcaniclastic rocks intruded by several phases of quartz diorite intrusions and cut by a complex of quartz feldspar porphyry dikes.
- Pyrite and chalcopyrite are the principal sulphide minerals and are accompanied by: minor amounts of bornite and molybdenite, sparse tetrahedrite-tennantite, sphalerite and galena and rare chalcocite-digenite, covellite, pyrrhotite, arsenopyrite, enargite and marcasite.
- The deposit is dominated by potassic alteration (predominantly biotite) with internal zones of sericite- iron carbonate alteration. The bulk of the surrounding host rock is characterized by propylitic alteration (chlorite+calcite+ pyrite) with smaller zones of phyllic alteration (quartz+sericite+pyrite).
- Anhydrite and gypsum are ubiquitous below an upper leached zone that typically occurs at a depth of 150 m below surface, but extends to greater than 300 m below surface in regions of higher fracture density.
- The deposit is covered by a thick package of Tertiary glacial sediments, colluvium and basalt, and Quaternary glacial sediments. A smaller portion of the Tertiary colluvium may have been sourced from the paleo-surface of the mineralized bedrock and is considered PAG based on ABA characteristics.

7.7.2 Static Geochemical Characteristics of Rocks

A number of phases of static testing were carried out to characterize the variability of ARD potential and metal content of the rocks. Interpretation of the results considered both rock and alteration type as a basis for managing waste rock. The following were concluded by this study and by Taseko and its subcontractors in previous studies.

- All rock and alteration types contain rock that ranges in ABA classification from PAG to non-PAG. The exceptions are a late dike unit (PMPD) and a Tertiary basalt unit (BSLT) which have shown minimal potential for acid generation.
- The average sulphide sulphur content of rock is near 2%. It is slightly lower in the intrusives (intrusive unit average ranging from 1.1 to 2.63%) and greater in the volcanics (volcanic and subvolcanic unit average ranging from 1.79 to 2.54%). Extreme sulphide sulphur concentrations exceed 9%.
- Sulphate concentrations are highly variable but are several percent in rock below the zone leached by meteoric waters.
- Assessment of neutralization potential and carbonate mineralogy indicates that modified neutralization potential (NP) reflects the available neutralization potential associated with calcium and magnesium carbonate minerals ($IC_{Ca,Mg}$).
- The ABA block model constructed by Taseko indicates that a large zone of non-PAG waste rock is present peripheral to the ore in the southwest portion of the pit. Most of the waste adjacent to the ore, and peripheral to the ore in the northwest side of the pit, is classified as PAG.
- Continuous sampling of core from 10 holes indicates that potential for ARD typically varies over the scale of tens of meters with local zones of smaller scale variation

between PAG and non-PAG rock. This indicates that waste management by segregation of PAG and non-PAG rock is a practical approach for the Project, and that operational monitoring will be important for appropriate waste classification.

- Quaternary overburden is classified as non-PAG as a result of low sulphide sulphur content (up to 0.2%) and moderate NP (average 25 kg $CaCO_3$ equiv./ tonne, up to 44 kg $CaCO_3$ equiv./ tonne).
- Tertiary overburden is mostly classified as non-PAG; however, there is a limonitic colluvium unit (FANL) that is classified as PAG based on limited testing. FANL samples subjected to ABA analysis showed acidic paste pH values at the time of testing.
- Tertiary basalt typically has low sulphide content and low calcium and magnesium carbonate NP. There are local zones of higher sulphide sulphur content (up to 0.5%) that will need to be managed as PAG due to the low calcium and magnesium carbonate NP. Modified NP was found to overestimate calcium + magnesium carbonate NP for the Tertiary basalt.

7.7.3 Kinetic Geochemical Characteristics of Rocks

Two kinetic geochemical characterization programs (Phases 4 and 5) consisting of laboratory humidity cells and saturated column testing were designed to provide input into waste management planning (geochemical criteria) and water chemistry predictions (source terms) to inform the overall environmental assessment. The following were concluded.

- Sulphate release will be dominated by leaching of calcium sulphate (gypsum and anhydrite). To evaluate sulphide oxidation rates, kinetic test results for samples with low initial sulphate content were considered. Observed sulphide oxidation rates were low.
- Kinetic test results were used to develop a site-specific criterion for segregation of PAG and non-PAG rock. The criterion is NP/AP = 1.5. For the purpose of waste management planning, Taseko has used a criterion of (NP-10)/AP = 2.
- The delay to onset of ARD in PAG rock was calculated based on kinetic test results. These calculations showed that there will be a long delay (decades to centuries) before the majority of the PAG rock transitions from neutral to acidic weathering conditions. Since Taseko plans to flood PAG rock within two years of placement, it is expected that pH neutral weathering conditions will be maintained within the PAG waste rock.

7.7.4 Static Geochemical Characteristics of Tailings

Static tailings characterization occurred in two phases (Phases 1 and 3). The following were concluded:

- Static testing of samples of different ore types for Phase 1 indicated that a single bulk tailings product would be non-PAG.
- Phase 3 locked cycle and pilot plant test tailings had lower NP-AP ratios than Phase 1 testing, however ABA results confirmed the Phase 1 conclusion that a bulk tailings product would be non-PAG.

- The lowest observed NP/AP ratio (NP/AP = 1.5) was measured for a Phase 3 pilot plant tailings sample (PP6). Tailings with similar ABA characteristics are unlikely to develop acidic weathering conditions; however, monitoring will be necessary to verify that the operational tailings product has ABA characteristics similar to the Phase 1 and Phase 3 samples.

7.7.5 Kinetic Geochemical Characteristics of Tailings

Kinetic tailings characterization occurred in Phase 5. The following were concluded:

- Humidity cell testing on Phase 5 combined tailings composites indicated initial leaching and depletion of calcium sulphate minerals, followed by stable sulphate release that reflects sulphide oxidation rates in the HCTs.
- Initial elevated release of trace elements from HCTs likely reflects flushing of accumulated oxidation products that were produced since the core was produced in 1992.
- Subaqueous column testing on Phase 5 combined tailings samples indicated that tailings disposed underwater will leach low concentrations of most heavy metal ions. Leaching of sulphate and manganese can be expected from dissolution of calcium sulphate and carbonates, and leaching of fluoride can be expected dissolution of fluorine bearing minerals (possibly apatite, which was identified in select thin sections).
- Unsaturated column testing on Phase 5 combined tailings samples indicated that unsaturated tailings beaches will leach low concentrations of most heavy metal ions. Similar to the saturated tailings column tests, leaching of sulphate and manganese can be expected from beached tails due to dissolution of calcium sulphate and carbonates. Leaching of fluoride in the unsaturated columns occurred at lower concentrations than in the saturated columns.

7.7.6 Site Water Chemistry Predictions

Site water chemistry predictions for saturated and unsaturated tailings, non-PAG waste rock dumps, submerged PAG waste and the open pit were produced using a combination of scale-up of humidity cell and column test results, thermodynamic calculations (for reliable mineralogical controls), and comparison with monitoring data from other copper mines in British Columbia. The following were concluded:

- Leaching of sulphate from tailings, waste rock and wall rock will be controlled by calcium sulphate dissolution.
- The effect of dilution is expected to be significant due to the large catchment area of the site.
- Tailings characterization showed that a single bulk tailings product is expected to be non-PAG.
- Tailings seepage will be pH neutral and is expected to contain sulphate, copper, and manganese concentrations controlled by equilibrium dissolution and precipitation of gypsum ($CaSO_4 \cdot 2H_2O$), tenorite (CuO) and rhodochrosite ($MnCO_3$).
- Subaqueous column testing on combined tailings samples indicated that tailings disposed underwater will leach low concentrations of most heavy metal ions.

Leaching of sulphate, manganese and fluoride can be expected from dissolution of calcium sulphate, carbonates and fluorine-bearing minerals such as apatite.

- Pit flooding is expected to require decades following cessation of mining with overflow to Lower Fish Creek about 26 years after mining is complete.
- Pit water will remain pH neutral indefinitely, and pit water chemistry will be dominated by surface inflow from TSF Lake and by seepage from the TSF and the non-PAG waste rock storage facility. Loadings from the pit high wall are predicted to be much lower than cumulative loadings from these other sources.

7.7.7 ARD/ML Prediction and Prevention Plan

The ARD/ML Prediction and Prevention Plan (PPP) will be a requirement of the *Mines Act* Permit for the Prosperity Mine. The PPP recognizes that the ARD/ML assessments completed during the certification and permitting phases need to be continued for mine construction and operations in the form of confirmation of preliminary findings based on short-term testing, calibration of test work results to site conditions and ongoing monitoring to direct waste management activities. The PPP also recognizes that it is not practical to completely evaluate all waste components and that monitoring and management plans need to be in place to address potential for effects due to ARD/ML. The Prosperity ARD/ML PPP has been developed and is included in Volume 3, Section 9.2.

8 Fisheries Compensation Plan

8.1 Introduction

The purpose of the Fish and Fish Habitat Mitigation and Compensation Plan (“the Plan”) is to demonstrate the feasibility and scientific rationale that fish and fish habitat losses associated with the Project can be fully mitigated and/or compensated. The Plan focuses on losses related to rainbow trout, its habitat, populations and use, as Fish Lake and associated stream habitats impacted by the Project support a monoculture of this species. The Plan is reflective of the MOE Benchmark Statement for fish, fish habitat and fisheries of the Fish Lake watershed (MOE 2008a). The Plan has been developed to meet MOE Regional Freshwater Fisheries Program objectives, DFO Habitat Policy, and the interests of First Nations and the public within and around the Project area.

The following sections present the relevant legislative requirements and policies (Section 8.2), and discuss the principles used in developing compensation strategies (Section 8.3). The rationale, objective, design considerations, and recommendations for monitoring are then provided for each compensation element (Section 8.4). Finally, a summary of how the Plan achieves the overall environmental objectives for compensation is provided in Section 8.5.

The majority of the compensation elements are on-site and integrated into the overall mine development. The implementation timing of the compensation elements is tied to the design, construction, operation and closure phases of the Project. Technical information describing how the proposed compensation elements will be implemented along with specific time lines are provided in a companion document to this Plan entitled the “Fish and Fish Habitat Mitigation and Compensation Implementation Plan”.

The compensation elements outlined in this Plan will be further refined through discussions and input with the Fish and Fish Habitat Technical Working Group (“Technical Working Group”). It is expected considerable discussion and review of the Plan and its associated elements will be undertaken with government agencies, First Nations, the public and other interested parties as time progresses. Details of the compensation elements will be provided in forthcoming applications for the necessary statutory permits, approvals and authorizations and based on guidance from the Technical Working Group.

Fish, fish habitat and fishery losses associated with the project are detailed in Volume 5, Section 3.3. Mitigation strategies for routine Project construction, operation and closure are guided by Best Management Practices (BMPs), Operational Policy guidance and project specific environmental management plans described in Volume 3, Section 9 of this report. Detailed baseline conditions with relevance to fish and fish habitat mitigation and compensation planning include: Surface Water Hydrology and Hydrogeology (Volume 4, Section 4); Water Quality and Aquatic Ecology (Volume 5, Section 2); Fish and Fish Habitat (Volume 5, Section 3); Terrain and Soils (Volume 5, Section 4); and, Vegetation and Wetlands (Volume 5, Section 5).

8.2 Regulatory Framework and Policy

This section outlines the legislative requirements and policies considered in developing the Plan. The regulatory setting as it relates to the overall Project is described in detail in Volume 2, Section 4.

8.2.1 Provincial Government

8.2.1.1 Ministry of Environment

The provincial government has primary responsibility for land and water use decisions on provincial Crown lands and utilizes a variety of statutes to manage fish habitat and other environmental values. Through delegated authority under the federal *Fisheries Act*, MOE has responsibility for the province's non-salmon freshwater fisheries which also include sea-run steelhead, cutthroat and Dolly Varden. In this capacity, MOE has the lead on freshwater fish governance, conservation and recreation. The licensing of freshwater recreational fishing is enabled under the Province's *Wildlife Act* (excerpt from MOE 2007).

MOE is also responsible for providing input to DFO on provincial fishery values and fisheries management planning in relation to commercial and recreational fisheries management decisions (MOE 2007). MOE advises DFO on fish habitat-related issues for freshwater fish, including water management under the provincial *Water Act*, land use impacts related to forestry under the *Forest and Range Practices Act* and the management of riparian protection in urban areas under the *Fish Protection Act*.

With respect to the Project, MOE staff participated in addressing the adequacy of baseline data and information, provided assistance in identifying a range of potential compensation opportunities to meet the MOEs conservation and protection goals, and assisted in the development of the fish and fish habitat compensation framework and plan review.

The compensation measures introduced by this Plan are guided by the aims of the Freshwater Fisheries Program Plan, the regional Small Lakes Management Strategy, and the MOE Benchmark Statement as detailed in the following sections. MOE has indicated it will work with DFO to assist Taseko in the development and implementation of this Plan.

Freshwater Fisheries Program Plan

One of the five corporate goals of the provincial government is to make "*British Columbia's fisheries management the best, bar none*" and, to achieve this goal, a comprehensive Freshwater Fisheries Program Plan (FFPP) was developed. The Freshwater Fisheries Program is developed and delivered through the Environmental Stewardship Division (ESD) and the Freshwater Fisheries Society of BC (FFSBC), a non-profit organization previously part of the MOE. The ESD, while supported by the other divisions within the MOE, has the overall responsibility and ownership for the Freshwater Fisheries Program (excerpt from MOE 2007).

Under the mandate of the ESD, MOE has developed a FFPP providing provincial guidance and outlining the strategic direction for freshwater fisheries management in the province. The ESD is responsible for administering the FFPP with support from FFSBC, Fish and Wildlife Branch, Ecosystems Branch, Parks and Protected Areas Branch and the

Regional Operations. The MOE regional operations provide the on-the-ground delivery of the FFPP and act as the main interface between stakeholders and the agency. The regional operations also provide support to projects (e.g., restoration, support to stewardship groups) and provide advice to agencies (excerpt from MOE 2007).

Objectives of the FFPP pertaining to the Project are (MOE 2008a):

- conserve wild fish and their habitats
- optimize recreational opportunities based on fishery resource

Small Lakes Management Strategy

As part of its Regional Objectives, MOE, Cariboo Region, is developing a Small Lakes Management Strategy to "*guide assessment and development of economically viable small lake fisheries for the region*" (MOE 2008a). The goals of the Small Lake Management Strategy include (MOE 2008a):

- increase angler participation while ensuring the long-term sustainability of wild stocks
- promote stocked lake fisheries
- provide a diversity of opportunities to ensure quality of experience for all anglers
- evaluate angler preferences for stocked lake fisheries
- rationalize lake specific management plans and stocking programs to reflect angler preference and deliver reasonable return on investment
- simplify fishery regulations

The Small Lake Management Strategy has to date focused on lakes in the region which support, or are capable of supporting, fisheries that contribute to the stability and diversity of the regional economy and opportunities for First Nation fisheries (MOE 2008a). The Fish Lake fishery contributes a small increment to the regional economic benefit and as such has not yet been included in the Small Lake Management Strategy. MOE, therefore produced a Benchmark Statement, specifically for the Prosperity Project, to provide a regional objective statement for Fish and Little Fish lakes to be used for mitigation and compensation planning (MOE 2008a).

Benchmark Statement

In August 2008, MOE prepared a Benchmark Statement in regards to the fish, fish habitat and fisheries of Fish and Little Fish Lakes in the Taseko Watershed (MOE 2008a). Given the mine development options, MOE have considered that it is not appropriate, nor necessary, to require that Fish Lake be maintained through the life of mine (MOE 2008a). The Benchmark Statement therefore recommends there should be commitment to implement compensation measures that are effective in augmenting MOE fishery management initiatives, to provide enhanced First Nations and public fishing opportunities in small lakes of the Chilko/Taseko watershed (MOE 2008a). MOE requires the compensation measures need to be effective for at least the period of time that either: the lake and fishery does not exist due to mining activities; or, replacement habitat is not fully functional in delivery of a fishery (MOE 2008a). The Benchmark Statement also communicates the stewardship objectives of the MOE (Cariboo Region) in respect to the fish, fish habitat and fisheries of Fish and Little Fish lakes. It also establishes the significance of the two lakes and their fisheries in a regional context, and provides a point of reference for mitigation and compensation planning for this Project.

The Benchmark Statement indicates that regional management initiatives for Fish and Little Fish lakes and associated stream habitat should result in the following (MOE 2008a):

- maintenance of the genetic line exhibited in the trout population of the Fish Lake system
- lake and stream environments of similar or better productive capacity for trout as provided by the Fish Lake system now
- a healthy, self sustaining trout population
- a trout fishery for First Nations and the public of at least similar character to what is supported by Fish Lake under current conditions

8.2.1.2 Freshwater Fisheries Society of British Columbia (FFSBC)

The FFSBC is a non-profit organization which works in partnership with the provincial government to deliver the fish stocking program, and also provides conservation fish culture services supporting steelhead and sturgeon recovery programs. FFSBC is also responsible for the promotion and marketing of freshwater fishing in the province and works with MOE on the development and implementation of provincial and regional fisheries management planning including small lakes management planning.

The FFSBC strategic objectives include playing a key role in the conservation and restoration of British Columbia's wild fish populations. Strategies to support this objective include support to MOE and other partners to conserve and restore wild fish in the province through the provision of specialist services including:

- restoring and improving fish habitat through the provision of fisheries engineering services
- providing fish health diagnostic services and fish health policy advice
- providing technical and professional support services for the design and implementation of conservation fish culture programs

With respect to the Project, FFSBC provided technical support and advice in an assessment of fish culture options, fish health diagnostics, and in working with the MOE on small lakes management planning.

8.2.2 Federal Government

8.2.2.1 Department of Fisheries and Oceans Canada (DFO)

DFO is responsible for the management of First Nation fisheries, commercial and recreational fisheries in tidal waters and salmon fisheries in non-tidal waters, and has the lead responsibility for fish habitat protection under the federal *Fisheries Act*. Under Section 35(2) of the *Fisheries Act* any project or activity which causes the "harmful alteration, disruption or destruction of fish habitat" (HADD) requires authorization from DFO. The federal *Fisheries Act* defines "fish habitats" as those parts of the environment "on which fish depend, directly or indirectly, in order to carry out their life processes" and defines "fish" to include all the life stages of "fish, shellfish, crustaceans, marine animals and marine plants" (DFO, 1986). The Habitat Policy was developed pursuant to the *Fisheries Act* and provides objective statements against which DFO can measure its performance in fish habitat management (DFO, 1986). The Habitat Policy applies to all projects with the potential to "alter, disrupt or destroy fish habitats", and provides a framework within which these changes can be assessed.

In the context of this Project, DFO indicated in a letter to Taseko dated January 8, 2007 it:

> "will consider the harmful alteration, disruption or destruction of fish habitat resulting from the project as part of an Environmental Assessment" and would "work with the BC Ministry of Environment to determine whether the compensation proposals to offset the loss of fish habitat in Fish Lake are appropriate and support the provincial fish management objectives."

Habitat Policy

The DFO long-term Habitat Policy objective is "to achieve an overall net gain of the productive capacity of fish habitats" (DFO 1986). To move toward this objective, three main goals are considered including conservation, restoration, and fish habitat development (DFO 1986). Conservation of fish habitat is the first goal of the Habitat Policy which endeavours to "maintain the current productive capacity of fish habitats supporting Canada's fisheries resource, such that fish suitable for human consumption may be produced" (DFO 1986). Fish habitat conservation is implemented by using the guiding principle of "No Net Loss" (NNL) of the productive capacity of habitats (DFO 1986). The NNL principle is fundamental to the habitat conservation goal where DFO strives to balance unavoidable habitat losses with habitat replacement on a project-by-project basis (DFO 1986).

The second goal of the Habitat Policy is fish habitat restoration: "rehabilitation of the productive capacity of fish habitats in selected areas where economic or social benefits can be achieved through the fisheries resource" (DFO 1986). Restoration achieves the objectives of the Habitat Policy by increasing the productive capacity of habitat through the restoration of damaged fish habitats.

The third goal of the Habitat Policy is fish habitat development: "improvement and creation of fish habitats in selected areas where the production of fisheries resources can be increased for the social or economic benefit of Canadians" (DFO 1986). This goal can be achieved through increasing the productive capacity of habitats by manipulating, creating or providing access to new spawning, rearing and food producing areas (DFO 1986).

DFO's preference under the Habitat Policy is to avoid HADD. However, if efforts to redesign or relocate the Project are undertaken and residual impacts remain despite this mitigation, then compensation is required (DFO 1998). Compensation is defined in the Habitat Policy as:

> "The replacement of natural habitat, increase in the productivity of existing habitat, or maintenance of fish production by artificial means in circumstances dictated by social and economic conditions, where mitigation techniques and other measures are not adequate to maintain habitats for Canada's fisheries resources" (DFO 1986).

Where HADD is identified for the Project, habitat compensation under Section 35(2) of the *Fisheries Act* will be used to achieve an overall net gain of the productive capacity of fish habitat. Compensation planning for this Project follows the DFO hierarchy of preferences outlined below.

Hierarchy of Preferences

The hierarchy of preferences provides guidance for compensation planning to achieve NNL of productive capacity. The hierarchy of preferences is as follows (DFO 2006):

1. create or increase the productive capacity of like-for-like habitat in the same ecological unit at or near the development site
2. create or increase the productive capacity of unlike habitat in the same ecological unit
3. create or increase the productive capacity of habitat in a different ecological unit
4. as a last resort, use artificial production techniques to maintain a stock of fish, deferred compensation or restoration of chemically contaminated sites

Habitat "compensation elements" for the purposes of this document refer to the individual initiatives identified to compensate for the loss of fish and fish habitat from this Project. These compensation elements address the Habitat Policy objective of achieving overall gain of productive capacity with the supporting goals of conservation, fish habitat restoration and the development of habitats by following guidance established by the NNL principle and the hierarchy of preferences.

8.2.3 First Nations and Public Input

First Nations consultation is the responsibility of the federal and provincial governments and the proponent as part of the assessment process of major projects in BC. First Nations participated along with MOE in identifying potential areas suitable for habitat compensation in the initial development of compensation elements. First Nations and stakeholder consultation has occurred as part of the ongoing development of the Project, and is detailed in Volume 8 of this report. It is anticipated further input on the compensation elements will be received from First Nations and the public as planning proceeds. This is consistent with the MOE's guiding principle under its Freshwater Fisheries Program Plan that "First Nations and stakeholder interests and preferences should be explicitly addressed in fisheries management, restoration, and enhancement plans" (MOE 2007).

8.3 Compensation Planning

As part of overall Project planning, a detailed alternatives assessment as described in Volume 2, Section 6 determined it would not be economically feasible to relocate, redesign or otherwise mitigate the Project to avoid a HADD. However, key elements of a fish and fish habitat compensation plan have been integrated into the Project design to benefit fish, fish habitat and Project operations. These elements are outlined in Section 8.4 of this plan. The overall approach to compensation planning reflects the needs, mandates and aspirations of governments, First Nations and the public. The goal of the Plan is to balance these interests.

The MOE fisheries program goal "to conserve wild fish and their habitats" includes protection, maintenance and restoration management activities. Those activities related to fish stocks can be classed as mitigation, and those associated with habitat restoration or enhancement as compensation, when proposed and implemented by project proponents to offset project effects on those resources. Alternatively, the DFO Practitioners Guide to Habitat Compensation (2006) defines the terms from a federal perspective. Specific to compensation, for the purposes of an environmental assessment under CEAA "mitigation" includes both mitigation and compensation. Under the DFO Habitat Policy, mitigation serves to avoid a HADD, while compensation occurs to offset a HADD. The Practitioners Guide also notes that compensation to offset a HADD and achieve NNL is considered after it proves impossible or impractical to avoid a HADD for fish habitat through project relocation, redesign or mitigation. For the sake of clarity, activities associated with the Plan are referred to as compensation (e.g., compensation elements).

Compensation measures outlined in this section are designed to meet the broader MOE range of fish and fish habitat management priorities. These measures were developed following guidance under the umbrella of the MOE Freshwater Fisheries Program Plan, the strategy for conservation and restoration of BC's wild fish populations, the Cariboo Region Small Lakes Management Strategy for Fish Lake and Little Fish Lake as summarized in MOE Benchmark Statement for the Taseko River Watershed (MOE 2008a) and DFO Habitat Policy.

8.3.1 Guiding Principles

In addition to guidance applied from the MOE Benchmark Statement and DFO Habitat Policy the following guiding principles have been used to assess the adequacy of each compensation element:

- quantitative and measurable over time
- demonstrated technical feasibility based on experience and proven techniques as described in manuals and guidelines
- adequate funding for implementation, follow-up and monitoring for success, long-term management and maintenance
- feasible, practical and achievable

8.3.2 Compensation Objectives

The development of this Plan considered the legislative requirements and policy detailed in Section 8.2, the timeframes for compensation (operations, closure) and the inclusion of other essential aspects of compensation planning (defined below) which together aim to present a scientifically sound plan supported within the regulatory setting. Consultation with regulators is an important aspect to the development and identification of compensation elements and it is recognized as a critical path item for this compensation plan. Consultation with First Nations and the public will also provide important input for refining and shaping the final compensation elements. The Plan is intended to be a living document and will evolve to a final Plan and agreed upon elements following consultation with DFO, MOE, First Nations, the public and other stakeholders.

The specific objectives of the mitigation and compensation plan are outlined in the following sections.

8.3.2.1 Maintaining Genetic Integrity

Fish and Little Fish lakes and their associated inlet and outlet streams maintain a monoculture self-sustaining population of rainbow trout. Bedrock controlled falls on lower Fish Creek prevent upstream movement of any species resident to the Taseko River.

A sample of 50 Fish Lake trout was collected in 2002 and a genetic assessment of these and 54 other populations of BC rainbow trout/steelhead has been completed (Tamkee 2001; Appendix 3-8-A). In summary, the rainbow trout in the Fish Lake watershed show no genetic distinctiveness as measured by microsatellite DNA, when compared to a broader geographic range of BC populations. As such, this population is likely phylogenetically similar to other BC interior populations of rainbow trout. Although the Fish Lake rainbow trout population may not be genetically distinct, the Plan aims to ensure the genetic integrity of this stock. As discussed in Section 8.2, this is consistent with the MOE requirement that management initiatives for Fish Lake and associated stream habitat should result in the maintenance of the genetic line exhibited in the trout population of the Fish Lake system. Plans to accomplish this strategy are outlined in this report.

Compensation planning aims to provide a robust strategy for maintaining the genetic integrity of the Fish Lake rainbow trout population. The Plan includes the construction of a new lake and spawning channel to support a self-sustaining population of Fish Lake rainbow trout. However, until such time as monitoring can conclude this lake would have minimum risk of failure to maintain the population, a strategy to maintain additional genetic refugia for Fish Lake stock is proposed. MOE has assisted Taseko with the identification of a number of Chilcotin area lakes which could house a representative sample of the Fish Lake population. As these lakes would likely not be self-sustaining, they would require annual supplemental stocking with Fish Lake progeny produced from a fish culture facility.

The fish culture program will include the need to approximate the genetic variability and not exaggerate the contribution of a small proportion of the population. Required elements for review include (adapted from DFO 2006):

- determination of an effective breeding strategy involving an estimate of the number of pairings that need to take place
- design of the fish culture facilities
- egg incubation/rearing procedures that allow separation of genotypes (families as appropriate)
- comprehensive disease testing and control, where appropriate

8.3.2.2 Maintaining the Fishery

The development of the Project will eliminate angling opportunities in Fish Lake. There is an estimated 388 to 548 recreational days catching about 4100 to 4900 trout annually on Fish Lake. MOE has considered that compensation planning by this Project provides an opportunity to tailor management initiatives for the replacement of the Fish Lake fishery (MOE 2008a). The replacement of the Fish Lake fishery will be achieved through the construction of a new lake. The replacement fishery could be developed to produce a large number of smaller trout for family fishing (as is currently seen in Fish Lake) or develop a fishery with small numbers of large trout to create a "trophy" style fishery (MOE 2008a). The MOE provided direction in the Benchmark Statement that the ministry would prefer the development of the "replacement" fishery to provide for increased recreational activity that yields a reasonable catch per unit effort (6 to 10 per day) of fish ranging up to 1 kg (MOE 2008a). It is anticipated that the character of the fishery to be developed through compensation planning will be determined from input from agency, public and First Nation consultation. It is also recognized that appropriate compensation measures for Fish Lake and associated stream habitat should also increase opportunities for First Nations food/ceremonial fisheries and recreational angling opportunities in the Taseko and Chilko watersheds (MOE 2008a).

Until such time as monitoring can conclude that the constructed lake can provide a suitable replacement fishery for Fish Lake, the stocking of fry from the fish culture facility and/or the transplant of mixed age class of fish from Fish Lake into recipient lakes would be required. The lakes selected for maintaining the genetic integrity of the stock (see Section 8.3.2.1) can also provide recreational fishing opportunities. Access improvements and the construction of recreational facilities (e.g., campsites) would likely be required to fully realize the recreational potential of the selected lakes.

8.3.2.3 Maintaining the Productive Capacity

Productive capacity is defined by DFO (1986) as "the maximum natural capability of habitats to produce healthy fish, safe for human consumption, or to support or produce aquatic organisms upon which fish depend". DFO Habitat Policy provides guidance that the objective of net gain in productive capacity can be achieved through three main goals, one of which includes fish habitat development. An estimation of Fish Lake productive capacity was provided by the MOE Benchmark Statement, with Fish Lake considered to have higher than average productivity (TDS 130 mg/l), capable of supporting a substantial standing crop of trout (85,000 fish, approximately 700 fish/ha) (MOE 2008a). Compensation planning is also guided by the upper confidence limit of fish biomass estimated at 24.1 $kg/ha^{-1}/yr^{-1}$ for Fish Lake (Triton 1997b) (Section 8.4.1.6). Stream habitats in the Fish Lake system are also productive, stream habitats below Fish Lake, above the falls, are estimated by MOE (2008a) to produce 18,000+ one year rainbow trout or equivalents. These productive capacity estimates for Fish Lake and Fish Lake stream habitat provide the "benchmark" from which to guide the technical feasibility of compensation planning.

8.4 Compensation Elements

8.4.1 Prosperity Lake

Prosperity Lake will be located immediately east of Wasp Lake. The lake will be created by building a water retention dam, removing vegetation and organic soils, as well as filling the lake with snowmelt runoff collected in the Project's headwater channel system. Creation of the lake basin including dam foundation and clearing/stripping of soils is expected to be completed prior to the fall of 2010. Once the lake is constructed, it is expected that freshet flows of 2011 and 2012 will be required to fill the lake. The development of Prosperity Lake will result in 49 ha littoral and 64 ha pelagic area, and at 113 ha in size will be larger than Fish Lake. Once completed, Prosperity Lake will be stocked with the Fish Lake strain of rainbow trout.

Technical elements of Prosperity Lake are described in the following sections with the intent of showing the type and quantity of habitat to be created as well as its feasibility. The creation of Prosperity Lake is consistent with regional stewardship objectives, specifically in regard to the aims of the regional Small Lakes Management Strategy (MOE 2008).

8.4.1.1 Rationale

Within the MOE small lakes management and conservation and protection of wild fish strategies, MOE Benchmark Statement and the federal Habitat Policy, the rationale for the development of the Prosperity Lake compensation element is to:

- re-establish a lake and stream ecosystem to replace the Fish Lake complex (like-for-like under the habitat policy)
- provide for a self-sustaining population of Fish Lake stock to ensure a minimum viable population for maintaining the genetic integrity. This will require:
    - the replacement of Fish Lake inlet and outlet stream spawning and fry rearing areas with engineered inlet stream habitat
- provide a source of gametes for hatchery-reared fry to outplant as fall fry to other lakes, and eventually
- provide a fishery to replace the fishery lost at Fish Lake

8.4.1.2 Objective

The Prosperity Lake compensation element will consist of a 113 ha lake comprised of 49 ha of shoal and 64 ha of pelagic area, with approximately 2 km of inlet stream complexed to provide spawning for about 50 pairs of rainbow trout and summer rearing habitat for approximately 30,000 fry. These numbers will be refined at the detailed design and permitting phase.

Fisheries management objectives have been developed for the Prosperity Lake compensation element beginning with the objective of maintaining a minimum viable population to ensure genetic integrity, through to maintaining a population size commensurate with providing gametes to a fish culture facility and ultimately providing for a recreational fishery at closure. These objectives are described in further detail below.

#1: Maintain a Minimum Viable Population (MVP) for Genetic Integrity

Discussions with MOE staff (email from Mike Ramsay to Michael Whelan, July 8, 2007) suggest that 1000 individuals would be sufficient as a MVP for maintaining genetic integrity of a stock of fish. As a conservative measure, MOE suggested a MVP target of 2000 individuals.

The age class structure of Fish Lake includes 44% age 0+, 25% age 1 to 2, 14% age 2 to 3 and 17% age 4 to 6 (Triton 1999c). A similar age class structure in Prosperity Lake (based on a MVP target of 2000 individuals) would result in 880 juveniles, 500 age 1 to 2, 280 age 2 to 3 and 340 age 4 to 6 fish. Age 4 to 6 fish are considered mature, and would comprise the spawning population in Prosperity Lake. Using the average size at age data and the corresponding growth rate from fish sampled in Fish Lake, the Prosperity Lake population of the number and age class structure indicated would grow

58 kg/year using the average growth rate per age class. This value of 58 kg/year equates to 0.5 kg/ha/year in the Prosperity Lake setting, a value clearly below the predicted 15 kg/ha/year value of what the lake will be able to produce (see Section 8.4.1.6). As such, the maintenance of a MVP of 2000 fish is a realistic objective for the lake.

#2: Provide a Supply of Eggs for Fish Culture and Maintain a MVP for Genetic Integrity

The second management objective is to annually supply 100,000 eggs for fish culture, for the eventual outplant of fed fry into selected lakes within the region. Based on an average fecundity of 1500 eggs/female, 50 spawning pairs would be required, or approximately 100 age 4 to 6 fish with a 1:1 sex ratio in addition to the 340 age 4 to 6 fish required to maintain the MVP target. This would require a total population of 2883 fish with a similar age class structure to Fish Lake, comprised of 1268 age 0+ fish; 721 age 1 to 2; 404 age 2 to 3 and 490 age 4 to 6 fish.

Using the average size at age data and the corresponding growth rate from fish sampled in Fish Lake, the Prosperity Lake population of the number and age class structure indicated would grow 84 kg/year using the average growth rate per age class. This value of 84 kg/year equates to 0.7 kg/ha/year in the Prosperity Lake setting, a value clearly below the predicted 15 kg/ha/year value of what the lake will be able to produce (see Section 8.4.1.6). As such, the yearly production of 50 spawning pairs for fish culture in addition to the maintenance of a MVP of 2000 fish is a realistic objective for the lake.

#3: Optimize the Standing Crop of Fish to Yield Individuals up to 1 kg

The MOE indicated in the Benchmark Statement that their preference for the type of fishing experience associated with compensation measures include reasonable catch per unit of effort (6 to 10 fish per day) of fish ranging up to 1 kg. Using Fish Lake fish average size at age data, the maximum population that could be supported in Prosperity Lake based on the primary productivity model would be approximately 60,000 fish. However, the largest individuals of Fish Lake fish rarely exceed 250 g. Using the average size at age data and the corresponding growth rate from a lake with fish in the 1 kg range (Pyramid Lake, Alberta; in Scott and Crossman 1998), Prosperity Lake could support a population of 20–25,000 (approximately 175–220 fish/hectare) with an age class structure similar to Fish Lake.

8.4.1.3 Summary of Prosperity Lake Attributes

This section summarizes the main attributes of Prosperity Lake. Detailed assessment of Prosperity Lake morphometric characteristics, water quality, mercury redistribution and productive capacity are provided in Sections 8.4.1.5, 8.4.1.6 and 8.4.1.7, respectively.

Prosperity Lake will include the construction of a water retaining dam aligned immediately south of Little Fish Lake, running east-west across the Fish Creek Valley. The total surface area of Prosperity Lake will be 113 ha comprising 64 ha of pelagic area and 49 ha of littoral area with a shoreline perimeter of 7886 m. Prosperity Lake will have 43.4% littoral area. The volume of Prosperity Lake will be 7 Mm^3 including a pelagic volume of 5.9 Mm^3 and a littoral volume of 1.1 Mm^3. Prosperity Lake maximum depth will be 17.4 m and its mean depth will be 6.2 m. In a review of the success of 28 lake manipulation projects in BC and Alberta, Hartman and Miles (2001) identified the main factors negatively or positively affecting project success. The drag line construction of shallow lakes (<20 m in depth) with 25 to 40% littoral areas was listed as a factor contributing to successful projects while the truck or shovel construction of deep lakes with less than 15% littoral areas was listed among the factors causing difficulties with constructed lake projects. Excessive littoral area was identified as a cause of warm water temperatures and an increased frequency of winterkill (Hartman and Miles 2001). In consideration of these observations Prosperity Lake is expected to provide adequate habitat for rainbow trout. Furthermore, its morphometric characteristics compared with other productive lakes in the region are similar.

The risk of winter kill in Fish Lake and other lakes in the regional study area was assessed by Triton in 1999 using average late winter DO concentrations from 1992 to 1999. The assessment suggested the best means for designing lakes with low probability of winter kill was to design them to have similar maximum depths to lakes in the region that are known to have low incidences of winter kill. The maximum depth of Prosperity Lake would be greater than 43 lakes known to support monocultures of wild rainbow trout in the regional study area. The maximum depth of Prosperity Lake would also be greater than the maximum depth of the three lakes stocked in the area in 1996 and 1998 (Big Onion Lake, Slim Lake and Vick Lake). Based on this information, it is expected Prosperity Lake should have no greater probability of winter kill than the monoculture lakes in the Cariboo-Chilcotin area or the recently stocked lakes.

Surface water quality predictions for Prosperity Lake were made through mass balance calculations combining the new lake's inputs (the constructed headwater channel, Wasp Lake and net precipitation). Water quality data obtained as part of the baseline water quality studies were used to define the inputs. The predicted water quality was assessed against the BC and the Canadian water quality guidelines for the protection of freshwater aquatic life (MOE 2006; Nagpal et al. 2006; CCME 2007) and with water quality data for Fish, Little Fish, Slim and Vick lakes to evaluate the new lake's potential to support and produce fish in a self-sustaining population. Predicted physicochemical parameters and major ions were within the applicable water quality guidelines and/or the range of observed baseline data for lakes supporting monocultures of wild rainbow trout in the regional study area. Predicted nutrient concentrations suggested Prosperity Lake will be meso-eutrophic, similar to Fish and Little Fish lakes. Model predictions were developed for a total of 27 total and dissolved metals. All metals were below their respective water quality guideline with the exception of iron and cadmium, which is present in naturally high concentrations in the area. A review of recent iron and cadmium toxicity data obtained by MOE and the US Environmental Protection Agency indicated predicted levels in Prosperity Lake are not expected to hinder the establishment of a self sustaining rainbow trout population.

A mercury model (Johnston et al. 1991) was used to predict mercury levels in fish resulting from the creation of Prosperity Lake. Based on this model it is expected mercury levels in Prosperity Lake fish will be similar to those currently observed in Fish Lake. There is no reason to believe fish will not be safe for consumption for humans and wildlife.

The productive capacity of Prosperity Lake was estimated following a weight of evidence approach using three models: the Small Lake Stocking Model (MWLAP 2003), Primary Productivity Model (Downing et al. 1990) and the Morphoedaphic Model (Ryder 1965). These models have been widely used in the context of small lake fisheries and are considered relevant to the project. The results indicated Prosperity Lake productive capacity will be slightly less when compared to Fish Lake productive capacity.

Noteworthy, there has been a deliberate decision to construct Prosperity Lake with less shoal habitat than Fish Lake so as to influence a change in fish size distribution. The deeper waters of Prosperity Lake combined with a lesser proportion of spawning habitat are expected to produce larger fish to offer a better angling experience and facilitate achieving regional objectives for fisheries enhancement.

Model/parameter	Fish Lake	Prosperity Lake
Small Lake Stocking Model–Mean # yearlings	28,881	21,000
Small Lake Stocking Model–range of # yearlings	12,030–42,059	16,891–42,398
Morphoedaphic index	30.9	22.7
Primary Productivity Model	15.6	15

8.4.1.4 Element Design

Prosperity Lake will include the construction of a water retaining dam aligned immediately south of Little Fish Lake, running east-west across the Fish Creek Valley. Figure 8-1 shows a plan view of Prosperity Lake, with its inlet spawning channels and the Headwater Channel Retention Pond (HCRP). Figure 8-2 shows cross-sections of Prosperity Lake as it will look when it is full of water.

The dam will likely be constructed in two stages, with the first stage designed to hold about 50% of the volume, expected to be complete before freshet. Construction of the second stage will follow immediately and be constructed to the maximum design elevation, capable of containing the entire design volume of 7 Mm^3. Prosperity Lake is anticipated to be filled with the completion of the second freshet.

Prior to the first freshet, the area that will be flooded by about 50% of the volume of the lake will be stripped of vegetation and soil. This aspect satisfies the needs of the reclamation plan and the mercury mitigation plan. Prior to the second freshet, the full area to be flooded by Prosperity Lake will be stripped of vegetation and soil. The primary source of water year on year for Prosperity Lake will come from that diverted by the HWC.

Figure 8-1 Prosperity Lake and Headwater Channel Retention Pond

Figure 8-2 Prosperity Lake Sections

Geotechnical Works and Technical Feasibility

The Prosperity Gold-Copper Project will include significant earthworks to construct fish compensation works to replace habitat lost during the construction and operation of the project. A description of the geotechnical works and technical feasibility is discussed in the following sections. The design of the Prosperity Lake Dam is currently at a preliminary stage and additional site investigation is scheduled for late 2008 to support the detailed design of the structure.

Prosperity Lake Dam

The Prosperity Lake Dam will be constructed as a water-retaining structure that utilises a conventional downstream construction method. The dam will include a low permeability glacial till core with a filter, drain and transition zones supported by a downstream shell zone. A typical section of the Prosperity Lake Dam is shown on Figure 8-3. The Prosperity Lake Dam has been laid out to provide the most productive fish habitat possible within the natural ground and replicate lake attributes similar to those of Fish Lake (i.e., sized to store at least 7 Mm^3 of water in order to create sustainable fish habitat).

Figure 8-3 Prosperity Lake Dam Typical Section

The Prosperity Lake Dam may be constructed using material from a local borrow source; however, material from the open pit may be also be used in the dam construction. A preliminary location for a borrow source of low permeability glacial till has been identified and is located within the ultimate tailings storage facility.

The site investigation in the Prosperity Lake Dam area is limited and further work is required to confirm the ground conditions are as expected. This additional work is planned for late 2008 or early 2009. There is high quality data that was developed during previous site investigations in the area including three drill holes in the ridge between Wasp Lake and Prosperity Lake. The data collected in previous site investigation programs include the results of drilling, in-situ testing, laboratory testing, test pits, seismic surveys, aerial mapping and surficial mapping. One hole drilled during the 1994 geotechnical and hydrogeological investigations located close to the Prosperity Lake abutment encountered a glacial till thickness of approximately 6 m and artesian groundwater conditions. The data from this drill hole, when combined with the seismic survey data, surficial mapping data and aerial photography data, are a reasonable indicator that a till blanket extends over the Prosperity Lake Dam embankment and the Prosperity Lake impoundment.

The foundation of Prosperity Lake dam is expected to consist of a dense, low permeability glacial till, similar to that which covers a large majority of the Fish Creek Valley. The glacial till layer forms a natural liner and is important for controlling basin seepage from Prosperity Lake. Care will be taken to preserve the till during preparation of the embankment foundation and lake basin. If the surficial materials are soft it will be necessary to excavate the embankment foundation to competent till or bedrock. The lake basin will be prepared by removing the surficial organic layer prior to lake infilling in order to minimize the migration of metals/mercury contained within the organics into the lake water. Additional site investigations are required to confirm the extent and thickness of the glacial till within the Prosperity Lake basin and dam foundation.

An appropriate dam classification has been defined for the Prosperity Lake Dam using criteria provided by the Canadian Dam Association's (CDA) "Dam Safety Guidelines" (2007). This has been carried out to define appropriate design earthquake and storm events for the Prosperity Lake Dam.

Headwater Channel

A Headwater Channel will be constructed along the east slope of the Fish Creek Valley during the pre-production period to collect and divert clean runoff. The Headwater Channel will minimise the volume of runoff reporting to the Tailings Storage Facility from the undisturbed portion of the catchment area. The location and extent of the

Headwater Channel is shown on Figure 8-1. Typical sections of the Headwater Channel are shown on Figure 8-7.

The Headwater Channel will supply clean water to the Headwater Retention pond and Prosperity Lake.

Headwater Channel Retention Pond

The Headwater Retention Pond is designed to provide a controlled flow of water into Prosperity Lake via an enhanced fish habitat channel in an existing natural stream bed. This water supply is for the support of fish rearing habitat during the summer low flow months. The Headwater Retention Pond has been sized to store approximately 1 Mm^3 of water.

The Headwater Retention Pond is comprised of three small water-retaining embankments with a maximum height of 6 m to produce a storage pond water depth of approximately five metres. This pond will fill during each spring freshet and gradually empty over the following summer months. A constant water flow in the steam will be maintained by a low level outlet in the pond that will remain open at all times. The Headwater Retention Pond has also been assessed using criteria provided by the CDAs "*Dam Safety Guidelines*" (2007). The construction of the headwater pond will be similar to the Prosperity Lake Dam with a central till core supported by filters and a downstream shell. Construction material for the Headwater Retention Pond is anticipated to come from within the pond basin.

Morphometric Characteristics

The principal morphometric characteristics predicted for Prosperity Lake are summarized in Table 8-1. The total surface area of Prosperity Lake will be 113 ha comprising 64 ha of pelagic area and 49 ha of littoral area with a shoreline perimeter of 7886 m. The volume of Prosperity Lake will be 7 Mm^3 including a pelagic volume of 5.9 Mm^3 and a littoral volume of 1.1 Mm^3. The littoral to pelagic ratio will be 0.77 in terms of surface area and 0.20 in term of volume. Prosperity Lake maximum depth will be 17.4 m and its mean depth will be 6.2 m (Knight Piesold pers. comm. 2008).

Table 8-1 Morphometric Characteristics of the Proposed Prosperity Lake

Physical Characteristics	Values
Nominal water elevation (m)	1,553
Surface area (ha)	113
Pelagic area (ha)	64
Littoral area (ha)	49
Percent littoral area	43.4
Littoral/pelagic ratio (by area)	0.77
Shoreline perimeter (m)	7,886
Maximum depth (m)	17.4
Mean depth (m)	6.2
Volume (m^3)	7 M
Pelagic volume (m^3)	5.9 M
Littoral volume (m^3)	1.1 M
Percent littoral volume	16.3
Littoral/pelagic ratio (by volume)	0.20

The predicted morphometric characteristics of Prosperity Lake were compared with the range of morphometric characteristics available for wild rainbow trout monoculture lakes in the Cariboo-Chilcotin region. The comparison focuses on Fish Lake and Little Fish Lake to demonstrate the design of the proposed compensation lake provides the capacity to support a self-sustaining population of rainbow trout. Information on wild rainbow trout monoculture lakes in the Cariboo-Chilcotin region was obtained from Triton (1997) and Triton (1999a). Discussions were also held with MOE staff in Williams Lake.

Elevation

Prosperity Lake will have a nominal water elevation of 1553 m. The elevation of Prosperity Lake will be 1556 m to allow water to flow to Wasp Lake and then to Beece Creek. The elevation of Wasp Lake is estimated at 1553 m. At closure and post-closure, the spillway from Prosperity Lake to the TSF Lake will be approximately 1553 m so the flows will not reach the 1553 minimum elevation of the southwest end of Wasp Lake, and will flow to the TSF instead.

Surface Area

Surface area of 57 surveyed rainbow trout monoculture lakes in the Cariboo-Chilcotin region ranged from 4.5 to 1092.2 ha. 54 of the 57 lakes showed surface areas between 4.5 and 250 ha and only four lakes (Crooked, Oppy, Pendleton and Tisdall) had surface areas greater than 250 ha. Surface areas of Fish Lake and Little Fish Lake are 111 ha and 6.6 ha, respectively. There are 42 lakes with surface areas smaller than that of present-day Fish Lake and 15 lakes with surface areas greater than that of Fish Lake.

The surface area of Prosperity Lake (113 ha) will be 2 ha more than the surface area of Fish Lake (111 ha). The surface area of Prosperity Lake will be within the range of the surveyed monoculture lakes in the Cariboo-Chilcotin region.

The littoral area, sometimes referred to as shoal area, is defined as the area between the lake outline and the 6 m (20 foot) contour lines. Information on littoral areas for lakes in the Cariboo-Chilcotin region was found for Fish Lake, Little Fish Lake, and Rat Cabin Lake (south and north). Information on littoral zone was also found for three lakes stoked with rainbow trout in 1996 and 1998: Big Onion Lake, Slim Lake and Vick Lake. Littoral area for the above listed lakes ranged from 1.3 to 83.5 ha with Fish Lake having the highest amount of littoral area (Table 8-2). Little Fish, Rat Cabin (south and north) and Vick Lakes are relatively small, shallow lakes with littoral area accounting for 100% of the lake total surface area. The littoral area accounted for 75% of the total surface area of Fish Lake, 91% of the total surface area of Big Onion Lake and 5% of the total surface area of Slim Lake. The littoral area of Prosperity Lake will account for 43.3% its total surface area.

Table 8-2 Littoral and Total Areas of Selected Lakes in the Cariboo-Chilcotin Region

	Littoral area (ha)	Total area (ha)	Percent of littoral area
Fish Lake	83.5	111	75
Little Fish Lake	6.6	6.6	100
Rat Cabin Lake (south)	28.4	28.4	100
Rat Cabin Lake (north)	30.4	30.4	100
Big Onion Lake	57.8	63.4	91
Slim Lake	13	28.7	45
Vick Lake	12.1	12.1	100
Prosperity Lake	49	113	43.4

Perimeter

Perimeter of 58 surveyed rainbow trout monoculture lakes in the Cariboo-Chilcotin region ranged from 908 to 26,119 m. 52 of the 57 lakes had perimeters less than 12,000 m and five lakes (Crooked, Oppy, Tisdall, Naglico and Upper Pendleton) had perimeters greater than 12,000 m. There are 51 lakes with a perimeter smaller than that of present-day Fish Lake (11,756 m) and 5 lakes with perimeters greater than that of Fish Lake.

The shoreline perimeter of Prosperity Lake (7886 m) will be 3870 m smaller than the perimeter of Fish Lake (11,756 m) and 5170 m smaller than the perimeter of Fish Lake and Little Fish Lake combined (13,056 m). The shoreline perimeter of Fish Lake includes the perimeter of the five islands present on Fish Lake. The perimeter of Prosperity Lake falls within the mid-range of shoreline perimeters for most trout monoculture lakes in the Cariboo-Chilcotin region.

Depth

Maximum depth of 49 surveyed rainbow trout monoculture lakes in the Cariboo-Chilcotin region ranged from 2 to 83.8 m. There are 37 lakes with a maximum depth lower than that of present-day Fish Lake (13 m) and 11 lakes with a maximum depth greater than that of Fish Lake. The maximum depth of Prosperity Lake will be greater than that of Fish Lake and will be greater than that of most trout monoculture lakes in the Cariboo-Chilcotin region.

Mean depth of the monoculture lakes ranged from 0.7 to 30.7 m with 45 of the 49 lakes showing mean depths less than 10 m. There are 31 lakes with a mean depth lower than that of present-day Fish Lake (4 m) and 17 lakes with a mean depth greater than that of Fish Lake. The mean depth of Prosperity Lake (6.2 m) will be 2.2 m greater than that of Fish Lake and will be greater than that of most trout monoculture lakes in the Cariboo-Chilcotin region.

Volume

Volume of 49 surveyed rainbow trout monoculture lakes in the Cariboo-Chilcotin region ranged from 0.04 to 335.3 Mm^3 with 46 of 49 lakes having volumes less than 25 Mm^3

and only 3 lakes had larger volumes (Crooked, Oppy and Tisdall lakes). There are 37 lakes with a volume lower than that of present-day Fish Lake (4.4 Mm^3) and 11 lakes with a volume greater than that of Fish Lake.

The volume of Prosperity Lake (7 Mm^3) will be 2.6 Mm^3 greater than the volume of Fish Lake (4.4 Mm^3) and 2.4 Mm^3 greater than the volume of Fish Lake and Little Fish Lake combined (4.6 Mm^3). The volume of Prosperity Lake would be greater than that of most trout monoculture lakes in the Cariboo-Chilcotin region.

Comparison Summary

The morphometric characteristics of Prosperity Lake were compared to those of the impacted lakes: Fish Lake and Little Fish Lake (Table 8-3).

Table 8-3 Morphometric Characteristic Comparison of Impacted Lakes with Prosperity Lake

Physical Characteristics	Fish Lake	Little Fish Lake	Fish and Little Fish Lakes Combined	Prosperity Lake	Comparison of Prosperity Lake with the Fish Lake	Comparison of Prosperity lake with Fish and Little Lakes Combined
Total surface area (ha)	111	6.6	117.6	113	+2	-4.6
Littoral area (ha)	83.5	6.6	90.1	49	-34.5	-41.1
% littoral area	75	100	77	43.4		
Pelagic area (ha)	27.2	0	27.2	64	+36.8	+36.8
Littoral/pelagic ratio (area)	3.07	N/A	3.31	0.77		
Shoreline perimeter (m)	11,756	1,300	13,056	7,886	-3,870	-5,170
Max. depth (m)	13	4.4	N/A	17.4	+4.4 (Fish Lake) +13 (Little Fish Lake)	
Mean depth (m)	4	2	N/A	6.2	+2.2 (Fish Lake) +4.2 (Little Fish Lake)	
Total volume (m^3)	4.4 M	1.3 M	5.7 M	7 M	+ 3.4 M	+1.3 M
NOTE: N/A = Not Applicable						

In a review of the success of 28 lake manipulation projects in BC and Alberta, Hartman and Miles (2001) identified the main factors negatively or positively affecting project success. The drag line construction of shallow lakes (<20 m in depth) with 25 to 40% littoral areas was listed as a factor contributing to successful projects while the truck or shovel construction of deep lakes with less than 15% littoral areas was listed among the factors causing difficulties with constructed lake projects. Excessive littoral area was identified as a cause of warm water temperatures and an increased frequency of winterkill (Hartman and Miles 2001). In consideration of these observations Prosperity Lake is expected to provide adequate habitat for rainbow trout. Furthermore, its morphometric characteristics compared with other productive lakes in the region are similar.

8.4.1.5 Predicted Water Quality in Prosperity Lake

Surface water quality predictions for Prosperity Lake were made through mass balance calculations combining the new lake's inputs (the constructed headwater channel, Wasp Lake and net precipitation). Water quality data obtained as part of the baseline water quality studies from sampling site "W1" upstream of Fish Lake were used to define inputs from the headwater channel (i.e., from tributaries that would be diverted around the project) (Volume 5, Section 2). Water quality data from the "Wasp Lake" site were used to define inputs from Wasp Lake. It should be noted that Wasp Lake water quality was only included in the model starting in Year 21. Water quality predictions were made for Years 1 to 45 of Prosperity Lake. Predicted water quality parameters include physicochemical parameters, major ions, nutrients and metals (Knight Piésold 2008). Predicted water quality parameter concentrations were expressed in term of yearly mean for year 1 to 45 as well as maximum mean, minimum mean and mean for the entire 45 year modelled period (Appendix 3-8-B).

The predicted water quality in Prosperity Lake was compared with water quality baseline data from Fish Lake, Little Fish Lake, Slim Lake and Vick Lake to evaluate the new lake's potential to support and produce fish in a self-sustaining population. The predicted water quality was also assessed against the BC water quality guidelines for the protection of freshwater aquatic life (MOE 2006; Nagpal et al. 2006) and the Canadian water quality guidelines for the protection of freshwater aquatic life (CCME 2007), where available. In addition, the predicted water quality in Prosperity Lake was compared with baseline water quality conditions for W1 and Wasp Lake to demonstrate the general consistency of predicted values with the concentrations of the main (future) water inputs into Prosperity Lake.

Physical Parameters

Mean concentrations were modelled for total dissolved solids (TDS, mg/L), pH and hardness (mg/L). Mean model results, along with available BC and Canadian guidelines for the protection of freshwater aquatic life and available background data are shown in Table 8-4, below.

Table 8-4 Mean Predicted TDS, pH and Hardness in Prosperity Lake

Parameter	Mean Concentrations							Guidelines	
	Prosperity	W1	Wasp Lake	Fish Lake	Little Fish Lake	Slim Lake	Vick Lake	BC	CCME
TDS(mg/L)	199*	188	126	120	136	244	241	–	–
pH	7.5*	7.7	7.8	7.9	7.3	8.3	7.7	6.5 to 9**	6.5 to 9**
Hardness (mg/L)	133*	125	82	81	99	167	181	–	–

NOTES:
*mean of the 45 year modelled period
**maximum value; no 30-day average guideline has been developed for pH

Yearly means TDS in Prosperity Lake are predicted to reach a maximum of 204 mg/L, and average 199 mg/L over the 45 year modelled period. The mean predicted TDS levels fall within the range of mean epilimnetic TDS levels observed in W1, Wasp Lake, Fish Lake, Little Fish Lake, Slim Lake and Vick Lake (120 to 244 mg/L) (Table 8-4). The predicted TDS levels fall within the range of natural waters (0 to 1000 mg/L) and BC interior waters (up to 750 mg/L) observed by the Ministry of Environment, Lands and Parks (1998). There are no BC or Canadian freshwater guidelines for the protection of aquatic life for TDS.

The predicted yearly means and 45 year mean pH in Prosperity Lake are 7.5 and are within the BC approved range (6.5 to 9) where unrestricted changes in pH are permitted (MOE 2006). The predicted pH is within the preferred range of pH for juvenile salmonids noting reduced growth occurring at pH <6 and mortality occurring at pH <4 or >10 (Zweig et al. 1999).

Yearly mean hardness in Prosperity Lake is predicted to reach a maximum of 136.1 mg/L and average 132.9 mg/L through the 45 year modelled period. These values are reflective of hard water conditions (≥120 mg/L), which can reduce the toxicity of some metals like cadmium, copper, lead and zinc. There are no BCWQ or CCME guidelines for hardness.

Comparisons of predicted mean values for TDS, pH and alkalinity to water quality baseline data for W1, Wasp, Fish, Little Fish, Slim and Vick lakes and to guidelines for the protection of freshwater aquatic life, where available, indicate Prosperity Lake should have the potential to support and produce fish in a self-sustaining population.

Overwintering Dissolved Oxygen

Dissolved oxygen (DO) concentration is a key characteristic defining the suitability of lakes for overwintering fish. In some lakes of south-central British Columbia, average late winter DO concentrations occasionally fall below the minimum necessary to support fish life (Ashley et al. 1992); mass death of fish, called winter kill, ensues (Triton 1999).

Dissolved oxygen was not predicted as part of the modelled water quality for Prosperity Lake, however, as indicated in Volume 5, Section 2.3.1.3 of this report, the risk of winter kill in Fish Lake and other lakes in the regional study area was assessed by Triton in 1999 using average late winter DO concentrations (not weighted by lake volume at-depth) from 1992 to 1999 (Taseko 2008b; Triton 1999b). These studies were repeated in 2007 for Fish and Wasp Lakes, with similar results. Fish Lake and Big Onion Lake, which are the deeper lakes in the regional study area, showed mean late winter (March) unweighted DO concentrations of 3 to 3.4 mg/L, respectively. Based on these results and on risk categories defined by Lirette and Chapman (1993) for lakes in the Cariboo-Chilcotin region [poor (<1 mg/L), fair (1 to 3 mg/L), good (3 to 6 mg/L) and excellent (>7 mg/L)], Fish and Onion Lakes were at the border between moderate and low risk for winter kill. Little Fish Lake, Little Onion Lake and Wasp Lake, which are shallower and whose mean later winter DO concentrations of 0.9 to 1.8 mg/L were placed in the high to moderate risk category for winter kill. The lake with the greatest average DO concentration and the greatest depth was Fish Lake. Based on this finding, it was suggested the best means for designing compensation lakes with low probability of winter kill was to design them to have similar maximum depths to lakes in the region that are known to have low incidences of winter kill (Triton 1999b).

Maximum depth of Prosperity Lake will be 17.4 m. Comparison of the maximum depth of Prosperity Lake with the range of maximum depths (2 to 83 m) of 48 lakes known to support monocultures of wild rainbow trout in the area shows that the maximum depth of Prosperity Lake would be greater than 43 of these lakes. The maximum depth of Prosperity Lake would also be greater than the maximum depth of the three lakes stocked in the area in 1996 and 1998 (Big Onion Lake: 12 m, Slim Lake: 14 m; Vick Lake: 4.3 m). Based on this information, it is expected Prosperity Lake should have no greater probability of winter kill than the monoculture lakes in the Cariboo-Chilcotin area or the recently stocked lakes.

Major Ions

Mean concentrations of chloride, fluoride and sulphate were modelled for Prosperity Lake. Predicted means as compared with available guidelines and background data for W1, Wasp Lake and Little Fish Lake are shown in Table 8-5.

The modelled chloride, fluoride and sulphate mean concentrations in Prosperity Lake are as follows:

- Predicted yearly mean chloride concentrations reached a maximum of 1.96 mg/L and averaged 1.93 mg/L over the 45 year modelled period. These values are well below the BC guidelines of 600 mg/L (maximum) and 150 mg/L (30-day average). They are also below the reported average background chloride concentration of 8.3 mg/L for natural freshwaters (MELP 1998).
- Predicted yearly mean fluoride levels reached a maximum of 0.079 mg/L and averaged 0.078 mg/L over the 45 year modelled period. These values are below the 0.3 mg/L maximum fluoride concentration of the BC guidelines.
- Predicted yearly mean sulphate levels reached a maximum of 1.5 mg/L and averaged 1.5 mg/L over the 45 year modelled period. These values are well below the 50 mg/L alert level of sulphate specified in the BC guidelines.

Table 8-5 Mean Predicted Chloride, Fluoride and Sulphate Concentrations (mg/L) in Prosperity Lake

Parameter	Mean Concentrations							Guidelines**	
	Prosperity	W1	Wasp Lake	Fish Lake	Little Fish Lake	Slim Lake	Vick Lake	Max	30-day Avg
chloride (mg/L)	1.93*	1.7	1.4	0.5	0.8	1.2	1.1	600	150
fluoride (mg/L)	0.078*	0.08	0.093	–	–	–	–	0.3	–
sulphate (mg/L)	1.5*	1	<1.15	1.5	2.3	5.9	5.5	50–100	–

NOTE:
* mean of the 45-year modeled period
** there are no CCME guidelines for these parameters

Comparisons of predicted major ions concentrations to water quality baseline data for W1, Wasp, Little Fish, Slim and Vick lakes and to guidelines for the protection of freshwater aquatic life, where available, indicate Prosperity Lake should have the potential to support and produce fish in a self-sustaining population. Sulphate is predicted to be present at levels which do not cause adverse effects for aquatic life and which should support the growth of algae. Water containing sulphate in concentration less than 0.5 mg/L will not support the growth of algae (Singleton 2000).

Nutrients

Nitrogen

Mean nitrate, nitrite and ammonia concentrations were modelled for Prosperity Lake. Predicted means as compared with the BC and CCME guidelines and available background data for W1, Wasp Lake and fish-bearing lakes in the project area are shown in Table 8-6.

Predicted yearly mean nitrate levels averaged 0.0166 mg/L over the 45 modelled period and reached a maximum of 0.0187 mg/L from year 30 on. These levels are below the 30-day average recommended nitrate concentration for the protection of aquatic life in BC of 40 mg/L (MOE 2006). The predicted yearly means of nitrate are low compared to MELP’s 1998 reported level of less than 0.3 mg/L in most surface waters without anthropogenic inputs.

Predicted maximum yearly mean and 45 year mean for nitrite were 0.0031 mg/L. These levels are below the BC maximum guideline of 0.06 mg/L when chloride levels are <2 mg/L and below the 30-day average BC guideline value of 0.02 mg/L when chloride levels are <2 mg/L. MELP (1998) indicated nitrite is typically present in natural waters at levels less than 0.001 mg/L.

Ammonia concentrations reached a maximum yearly mean of 0.11 mg/L, dropping to 0.1 mg/L by Year 21. The predicted 45 year mean ammonia concentration was 0.1 mg/L. These concentrations are below the most conservative ammonia concentration of the BC guideline of 1.23 mg/L for freshwaters with a pH of 7.5 and a temperature of 20°C.

Table 8-6 Modelled Nitrate, Nitrite and Ammonia Concentrations in Prosperity Lake

Parameter	Mean Concentrations							Guidelines	
	Prosperity	W1	Wasp Lake	Fish Lake	Little Fish Lake	Slim Lake	Vick Lake	BC**	CCME
Nitrate	0.0166*	0.006	<0.029	0.03	0.039	0.027	<DL	40	13
Nitrite	0.0031*	–	<0.00225	–	0.002	–	–	0.02	0.06
Ammonia	0.1*	0.04	0.035	0.039	0.026	0.011	0.035	1.23	–

NOTES:
*mean of the 45 year modelled period
**30-day average guideline

Predicted mean nitrate and nitrite concentrations are lower than those in the Fish and Little Fish lakes. The predicted mean ammonia concentration will be higher than those observed in W1, Wasp, Fish and Little Fish lakes but below the BC guideline for ammonia for the protection of aquatic life.

Phosphorus

Total phosphorus, dissolved phosphorus and ortho-phosphorus mean concentrations were modelled for Prosperity Lake. Predicted means as compared with the BCWQ and CCME guidelines and available background data for W1, Wasp Lake and fish-bearing lakes in the project area are shown in Table 8-7.

Predicted total phosphorus 45 year mean concentrations was 0.033 mg/L, with a maximum yearly mean of 0.034 mg/L. Total phosphorus concentrations in most uncontaminated freshwaters range from 0.010 and 0.050 mg/L (CCME 2007). The predicted total phosphorus values suggest the trophic status of the new lake will be meso-eutrophic (0.020 to 0.035 mg/L) as categorized by the CCME (2007). Baseline total phosphorus concentrations indicate Fish and Little Fish lakes also fall in the meso-eutrophic category while Wasp and Slim lakes fall in the mesotrophic category (0.010 to 0.020 mg/L). Vick Lake has the highest total phosphorus concentrations with a mean of 0. 043 ml/L, placing it into the eutrophic lake category (0.035 to 0.1 mg/L). Predicted Prosperity Lake as well as baseline total phosphorus concentrations in Fish and Little Fish lakes, exceed the BC guidelines, with average baseline concentrations ranging from 0.025 mg/L (n=14) and 0.026 mg/L (n=7) in Fish and Little Fish lakes respectively. The BCWQ guidelines for total phosphorus in lakes, where salmonids comprise the most abundant species, range from 0.005 to 0.015 mg/L (inclusive).

Table 8-7 Modelled Phosphorus in Prosperity Lake

Parameter	Mean Concentrations							Guidelines**	
	Prosperity	W1	Wasp Lake	Fish Lake	Little Fish Lake	Slim Lake	Vick Lake	BC	CCME
Phosphorus - T	0.0326*	0.041	0.013	0.025	0.026	0.019	0.043	0.005 to 0.15	0.01 to 0.02***
Phosphorus - D	0.0197*	0.018	0.0065	0.015	0.016	0.005	0.011	–	–
Ortho-P	0.0118*	0.008	0.0027	0.006	0.011	0.002	0.005	–	–

NOTE:
*mean of the 45 year modelled period
**maximum value; no 30-day average guideline has been developed for pH
***mesotrophic as described by CCME

Nitrogen to Phosphorus Ratio

Ratios of DIN (nitrate+nitrite+ammonia) to orthophosphate (PO_4) can be used to identify limiting nutrients for phytoplankton production. Ratios of <16 generally indicate nitrogen limited growth, whereas ratios >16 indicate phosphorus limited growth (Wilcox 2003). The ratio of mean predicted concentrations of DIN and orthophosphate in Prosperity Lake was 50.123, suggesting phosphorus limited algal growth. This is consistent with the conditions in the majority of lakes in BC, where phosphorus is normally the limiting nutrient for algal growth. Calculations are provided in Table 8-8:

Table 8-8 Predicted Average Ratio of DIN to PO_4 in Prosperity Lake

Parameter	Mean Concentration	Molar Weight	Conversion to Molar Mass (g/mol)
PO_4	0.0119	94.971	1.25301×10^{-7}
NO_2	0.0165	46.006	3.58653×10^{-7}
NO_3	0.0031	62.005	4.9996×10^{-8}
NH_3	0.1	17.031	5.87182×10^{-6}
Ratio of NO_2+NO_3+NH_3 to PO_4			50.123

NOTE:
based on modelled concentrations

Comparisons of predicted nutrient concentrations to water quality baseline data for W1, Wasp, Little Fish, Slim and Vick lakes indicate Prosperity Lake should have a similar probability of supporting fish than Fish Lake or the recently stocked Slim and Vick lakes. Further discussion of lake productive capacity is provided in Section 8.4.1.6.

Metals

Model predictions were developed for a total of 27 different metals in their total and dissolved form (Knight Piésold 2008). Results were compared to the BC and Canadian maximum and 30-day guidelines for the protection of freshwater aquatic life, when available (MOE 2006; Nagpal et al. 2006; CCME 2007). All metals were below their respective guideline with the exception of total and dissolved iron and total cadmium.

Iron

Predicted mean concentrations for total iron are expected to reach a maximum of 2.07 mg/L and average 1.95 mg/L. These concentrations exceed the maximum updated BC guideline for total iron of 1 mg/L and the CCME guideline of 0.3 mg/L (MOE 2008b; CCME 2007). Predicted mean concentration for dissolved iron are expected to reach a maximum of 1.04 mg/L and average 0.98 mg/ exceeding the updated BC guideline of 0.35 mg/L for dissolved iron (MOE 2008b). There are no 30-days guidelines for total or dissolved iron.

As mentioned earlier, background iron is found in naturally elevated concentrations in the project area. For example, background total and dissolved iron concentrations for W1, one of the main input into the new lake, averaged 1.06 and 0.99 mg/L respectively (Table 8-9).

MOE considers a total iron concentration of 1 mg/L as a safe upper limit on the basis of published toxicity data for a variety of fish species, including coho salmon (*Onchorhynchus kisutch*), rainbow trout (*O. mykiss*) and brook trout (*Salvelinus fontinalis*). Studies conducted by Smith and Sykora (1976) indicated a safe upper limit iron concentration of between 0.97 and 1.27 mg/L (lime-neutralized suspended) iron for coho alevins (MOE 2007). Similarly, the safe upper limit for brook trout was between 7.5 and 12.5 mg/L (lime-neutralized suspended) iron, with adverse effects observed during juvenile development (Smith and Sykora 1976 in MOE 2007). More recent toxicity testing conducted in 1997 and 1998 for MOE showed LC_{50} concentrations for rainbow trout >6.4 mg/L in soft water (50 mg/L hardness), >15.2 mg/L in medium water (100 mg/L hardness) and >53.6 mg/L in hard water (250 mg/L hardness). MOE has indicated the total guideline of 1 mg/L could be considered overprotective for many situations (MOE 2008b).

Based on the recent toxicity data obtained by MOE (2007) and on the fact that iron is present in naturally high concentrations in the area, predicted iron levels in Prosperity Lake are not expected to hinder the establishment of a self sustaining rainbow trout population.

Cadmium

Predicted mean concentrations of total cadmium are expected to reach a maximum of 0.000064 mg/L and average 0.000055 mg/L which exceeded the interim maximum guideline value of 0.0000423 mg/L (at a predicted hardness of 133 mg/L as $CaCO_3$) (Nagpal et al. 2006). Cadmium concentrations have been below the limit of detection in the majority of the baseline water quality samples, however, the detection limit has been higher than the water quality guideline making any comparisons difficult. Baseline cadmium levels were below detection (0.0002 or 0.00005 mg/L) at W1 and in all sampled lakes.

The interim guideline for cadmium is based on the lowest observed effect level (LOEL) of 0.00017 mg/L for the Water flea, *Daphnia magna,* obtained in a study by Biesinger and Christensen completed in 1972. A safety factor of 0.1 was then applied to this data to obtain the maximum allowable cadmium concentration. Brown et al. (1994) found continuous exposure of rainbow trout adults to cadmium levels of up to 0.0055 mg/L did not affect growth or survival. The authors did note however that eggs from rainbow trout exposed to 0.00185 and 0.0034 mg/L did not develop into fry. Brown et al. (1994) also reported delayed oogenesis in brown trout exposed to 0.0093 and 0.0291 mg/L cadmium, but noted eggs and fry developed normally after fertilization. Additional toxicity data for rainbow trout have been published as part of the updated US Environmental Protection Agency (US EPA) guideline for cadmium (US EPA 2001). The lowest LC_{50} for rainbow trout was 0.00038 mg/L and the species mean acute value (SMAV) was 0.0021 mg/L (normalized at a hardness of 50 mg/L). This rainbow trout SMAV was selected by the USEPA as the final acute value (FAV) used to derive the acute national criterion maximum concentration (CMC) for cadmium.

Based on the fact that predicted average cadmium levels in Prosperity Lake are 3.1 times lower than the LOEL of 0.00017 mg/L for *Daphnia magna* used to derive the BC water quality guideline and about 30 times lower than the rainbow trout mean acute value used by the US EPA, it is expected predicted cadmium levels in Prosperity Lake are not expected to hinder the establishment of a self sustaining rainbow trout population.

Table 8-9 Modelled Total Metals (mg/L) in Prosperity Lake

Parameter	***Mean Concentrations of Total Metals***							***Guidelines (Maximum)***	
	Prosperity	**W1**	**Wasp Lake**	**Fish Lake**	**Little Fish Lake**	**Slim Lake**	**Vick Lake**	***BCWQG (2006)***	***CCME (2006)***
Cadmium	0.000055	<DL	<0.0002	<0.00005	<0.00005	<0.0002	<0.0002	0.000042	0.000017
Iron-total	1.95	1.06	0.075	0.142	0.28	0.015	0.107	1	0.3
Iron-dissolved	0.98	0.75	0.03	0.081	0.198	<0.01	0.031	0.35	–

8.4.1.6 Mercury Redistribution

Mercury in New Lakes and Reservoirs

Increased levels of mercury (Hg) are found in lakes and reservoirs created by flooding soils and terrestrial vegetation. Soil in particular has been identified as the primary source of mercury in new reservoirs (Therriault and Schneider 1998). Flooded soils and vegetation release mercury and organic matter. The latter stimulates methylating bacteria, resulting in the formation of methyl mercury (CH_3Hg^+) a neurotoxin and teratogen which bioaccumulates through the food chain. Increased levels of methyl mercury in fish as a result of lake or reservoir creation are well documented. At the onset of flooding, mercury levels in fish tend to increase quickly and remain at higher levels for at least five years (Therriault and Schneider 1998).

Provincial and Federal Mercury Tissue Guidelines

Fish from reservoirs or anthropogenic lakes provide humans and piscivorous wildlife with a potential exposure pathway to methyl mercury. MOE (2006) has developed a range of guidelines for total mercury concentrations in fish tissue, for humans with a diet based primarily on fish. These guidelines are based on the weekly amount of fish consumed and are shown in Table 8-10. Health Canada has a long standing consumption guideline of 0.5 ppm mercury in commercial fish, although in 2007 a new standard of 1 ppm was provided for selected commercial species, such as orange roughy (*Hoplostethus atlanticus*), shark and fresh or frozen tuna. The guideline 0.5 ppm remains in place for canned tuna (Health Canada 2007).

Table 8-10 Summary of Provincial Fish Tissue Guidelines for Mercury[1]

Total Hg concentration in the edible portion of fish and shellfish µg Total Hg /grams (wet-weight)	*Safe quantity for weekly consumption on regular basis in grams (wet-weight)*
0.5	210
0.4	260
0.3	350
0.2	525
0.1	1,050

NOTE:
[1] MOE (2001) Ambient Water Quality Guidelines for Mercury. Table 2.

Mercury in Fish Tissue Samples Collected From the Taseko Watershed

A total of 272 fish tissue samples were collected for metals analysed in the Taseko watershed between 1995 and 1997 and in 2006 and 2008. Liver and muscle tissue samples were collected from bull trout (*Salvelinus confluentus*), whitefish (*Prosopium sp*.) and rainbow trout (*Oncorhynchus mykiss*) in the Taseko River mainstem and drainages in the Project footprint. A summary of the tissue sampling program is provided in Table 8-11.

Mercury concentrations in muscle tissue samples from bull trout captured in the Taseko River, Beece Creek and Lower Fish Creek averaged 0.044 ppm and ranged from 0.011 to 0.136 ppm. Concentrations in muscle tissue from whitefish captured in the Taseko River and Beece Creek averaged 0.052 ppm and ranged from 0.033 to 0.1 ppm. Lastly, average rainbow trout muscle tissue concentrations were 0.086 ppm and ranged from 0.15 to 0.34 ppm. Regression analyses of rainbow trout mercury tissue concentrations and fish length, as well as mercury concentrations and fish weight showed relationships of R^2 =0.4222 and R^{2} = 0.3735 respectively (Figure 8-4 and Figure 8-5).

Table 8-11 Fish Tissue Samples Collected in the Taseko Watershed

Location	Number of Samples by Species and Location		
	Bull Trout	Whitefish	Rainbow Trout
Taseko River	10 (M) 10 (L)	10 (M) 10 (L)	12 (M) 12 (L)
Lower Fish Creek	3 (M) 3 (L)	–	10 (M) 10 (L)
Fish Lake	–	–	43 (M) 29 (L)
Inlet to Fish Lake			10 (M)

Table 8-11 Fish Tissue Samples Collected in the Taseko Watershed (cont'd)

Little Fish Lake	–	–	10 (M) 10 (L)
Beece Creek	10 (M) 5 (L)	4(M) 3 (L)	4 (M) 4 (L)
Groundhog Creek	–	–	10 (M) 4 (L)
Tête Angela (E)	–	–	10 (M 3 (L)
Tête Angela (W)	–	–	10 (M) 10 (L)
Tête Angela Lake	–	–	3 (M)

NOTES:
(M) = muscle; (L) = liver
collected from 1995–1997 and 2006–2008. Results of 2008 sampling data are not yet available

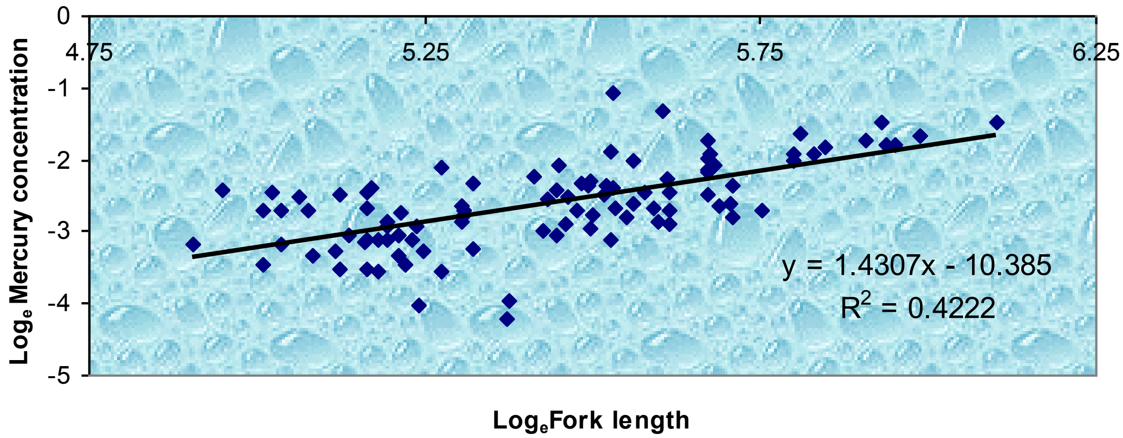

Figure 8-4 Log Transformed Mercury Concentration vs. Length in Rainbow Trout

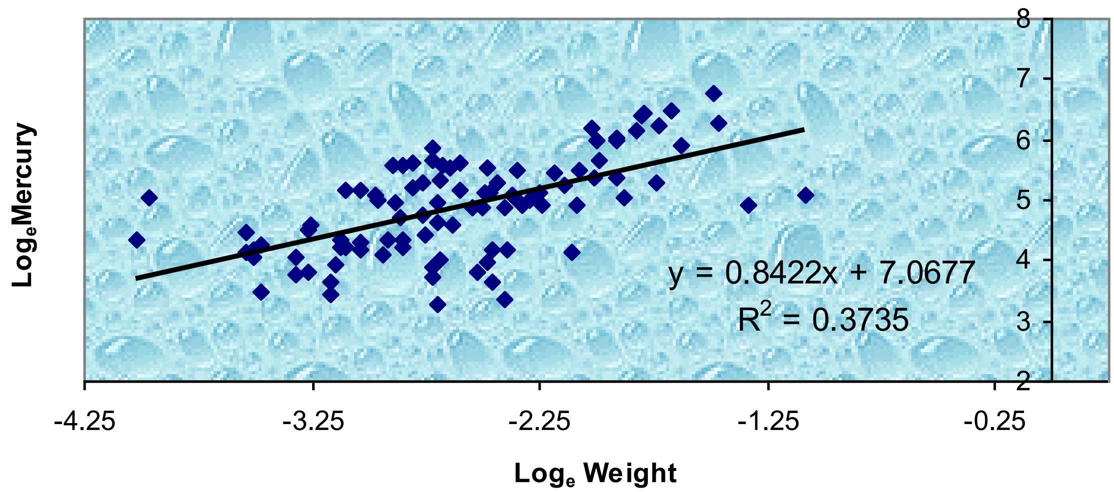

Figure 8-5 Log Transformed Mercury Concentration vs. Weight in Rainbow Trout

Regression analyses for bull trout showed stronger relationships between mercury concentration and fork length (R^2 = 0.8145) and mercury concentration and weight (R^2 = 0.6213). The baseline data showed weak relationships between mercury concentration and fork length or weight in whitefish, ranging from R^2 = 0.1562 to R^2 = 0.1917 respectively.

All sampled bull trout, whitefish and rainbow trout muscle tissue concentrations were below the Health Canada guideline of 0.5 ppm. Average muscle concentrations in the sampled species were also generally below the average mercury concentrations of 0.09 ppm measured in fish tissues from specimens collected in 54 uncontaminated BC lakes (Rieberger 1992).

The maximum and mean bull trout mercury concentrations in the Taseko Project area were lower than mean mercury concentrations reported by Baker (2002) in the following waterbodies:

- Williston Reservoir (0.56 ppm)
- Carpenter Reservoir (0.54 ppm)
- Kinbasket Reservoir (0.34 ppm)
- Revelstoke Reservoir (0.16 ppm)
- Arrow Reservoir (0.16 ppm)

Potential exceedances of the MOE tissue guidelines for people whose diet consists primarily of fish were noted for each of the three species. Muscle tissue concentrations in excess of 0.1 ppm were noted in 27 rainbow trout samples, 5 bull trout samples and 5 whitefish samples. The 0.1 ppm guideline applies to people consuming 1050 g of fish tissue (wet weight) per week.

Predicted Mercury Levels in Fish from Prosperity Lake

The Johnston et al. (1991) mercury model was used to predict mercury levels in fish after lake creation. It is important to note this model was not built to account for pre-impoundment vegetation and soil stripping. Consequently, the modelled outputs are considered worst case and should soil stripping occur mercury is not expected to increase in Prosperity Lake fish.

This model combines information on physical waterbody characteristics with mercury in fish tissue data to predict levels of mercury in fish post impoundment. The model was developed for northern pike (*Esox lucius*), walleye (*Stizostedion vitreum*) and lake whitefish *(Coregonus clupeaformis*), but has been applied to other species, such as Dolly Varden (*Salvelinus malma*) and mountain whitefish (*Prosopium williamsoni*). The model has been applied in this case because lake whitefish are a reasonable surrogate for rainbow trout and a similar approach was successfully adopted for the Kemess North Project (Triton 2005).

Predicted mercury concentration in fish following impoundment was estimated as total body burden based on selected physical characteristics and using the following variable linear model as developed by Johnston et al. (1991):

$$MERC_i = b_o + b_1X_1 + \varepsilon$$

$MERC_i$ is the predicted mean mercury burden of species *i*, X_1 is a physical variable, and b_0 and b_1 are fitted parameters obtained from the Johnston et al. (1991) study. The results of the model predictions for mercury burden in fish were then added to observed mercury levels in fish captured in the Taseko Project area. When we applied the model, we used fitted parameters derived for lake whitefish from the Johnston *et al*. study as a surrogate for rainbow trout. These parameters were as follows:

• Rise	b1	8.15
• Percent Flooding (PF)	b1	1.6
• Flooded area to volume ratio (AVR)	b1	1.12

Upstream variables were not used in our analyses, as existing lakes and rivers were not going to be flooded. The model values of b_1 were derived for lake whitefish with a mean length of 350 mm. We therefore used regression analyses of length (mm) versus weight (g), to estimate the weight of a 350 mm long rainbow trout (430 g). This value was used in the model to estimate the predicted increase in a fish. The predicted average increase in mercury levels in Prosperity Lake were as follows:

- Rise = (8.15*12) = 97.8 / 430 = 0.227 ppm
- PF = (1.6*77.01) = 123.216 / 430 = 0.287 ppm
- AVR = (1.12*9.121) = 10.216 / 430 = 0.024 ppm

Using percent flooding (PF) as the strongest driver of mercury increases, and existing baseline concentrations of mercury in fish tissue, a rainbow trout from Prosperity Lake measuring 200 mm will have an estimated tissue concentration of 0.361 ppm Hg. A 400 mm rainbow trout will have an approximate tissue concentration of 0.481 ppm Hg (Figure 8-6).

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- Percent Flooding (PF) b_1 1.6
- Flooded area to volume ratio (AVR) b_1 1.12

Upstream variables were not used in our analyses, as existing lakes and rivers were not going to be flooded. The model values of b_1 were derived for lake whitefish with a mean length of 350 mm. We therefore used regression analyses of length (mm) versus weight (g), to estimate the weight of a 350 mm long rainbow trout (430 g). This value was used in the model to estimate the predicted increase in a fish. The predicted average increase in mercury levels in Prosperity Lake were as follows:

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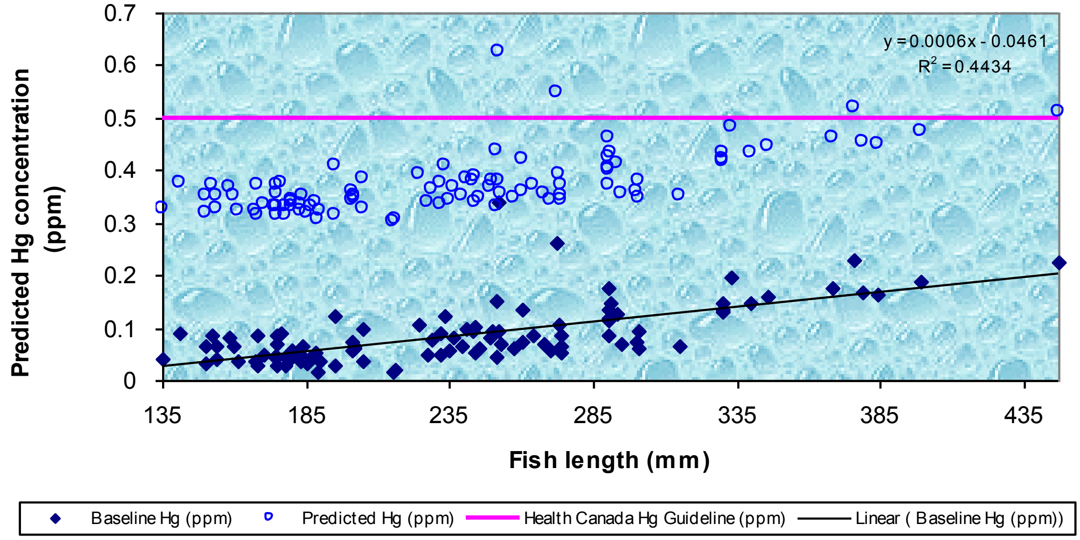
The predicted values generally fell below the federal consumption guideline of 0.5 ppm (Health Canada 2007), although 4 of 100 (4%) of fish in the PF dataset were predicted to have concentrations of >0.5 ppm. Similarly, one fish from the RISE dataset had a predicted tissue concentration of >0.5 ppm. Using the provincial fish tissue guidelines (MOE 2006), safe consumption would be limited to roughly 250 grams per week from fish in the 200 mm range and 210 grams per week from fish in the 400 mm size range (see also Table 8-12).

Readers are reminded the predicted increases are based on the premise soils and vegetation will be flooded, thus leading to increased methylmercury concentrations in fish tissues. For reasons explained in the following section mercury levels are not expected to increase to those nominally predicted and shown in Figure 8-5. The predictions are considered maximum and improbable and it is expected mercury levels in Prosperity Lake fish will be similar to those currently observed in Fish Lake. There is no reason to believe fish will not be safe for consumption for humans and wildlife.



NOTE: based on percent flooding as the primary driver of mercury increases in fish tissue

Figure 8-6 Baseline Hg and Predicted Hg vs. Fish Length

Table 8-12 Predicted Mercury Concentrations and Fish Consumption Guidelines

Total Hg concentration in the edible portion of fish and shellfish µg Total Hg /grams (wet-weight)[1]	Safe quantity for weekly consumption on regular basis in grams (wet-weight)[2]	Health Canada consumption guideline for commercial fish (2007)	Predicted mercury concentration by size class and application of provincial guidelines
0.5	210	0.5 for canned tuna 1 ppm for large predatory species including shark, marlin, swordfish and escolar	100 to 200 mm range; predicted average Hg level of 0.341 ppm, safe consumption limit of <350 g / week
0.4	260		200 to 300 mm range; predicted average Hg level of 0.379 ppm, safe consumption limit of <350 g > 260 g / week
0.3	350		300 to 450 mm range, predicted average Hg level of 0.440 ppm, safe consumption limit of <260 g >210 g / week
0.2	525		Guideline data from BC Approved Water Quality Guidelines (2006) Table 14 and Health Canada March 2007 Information Update
0.1	1,050		

NOTE:
[1 2] MOE 2006

Measures to Reduce Potential for Methyl Mercury Levels in Prosperity Lake

Prosperity Lake will be created through flooding an area roughly 1,326,587 m^2 in size. However, because of the need to reclaim soils, the vegetation and soils of the proposed lake basin and Headwater Channel Retention pond will be stripped prior to flooding. This will include burning non-timber slash, which will be followed by the removal of organic and mineral soil down to the C horizon. This will leave behind clays and compact glacial till to form the lake substrate. Available soil quality data from the entire project area indicate the C horizon has a median organic matter content of 0.9% (n=22, average 2.5%). Soils with <4% organic matter are considered to have low overall percentages of organic matter. Approximately 916,384 m^3 of soil will be removed from the Prosperity Lake basin through the soil reclamation program. This includes roughly 437,290 m^3 of organic soil and 479,094 m^3 of mineral soil. Organic soils comprise 47.7% of the total soil volume that will be removed from the Prosperity Lake area, with mineral soils comprising the remaining 52.3% (Volume 1, Section 6.10: Conceptual Reclamation and Closure Plan). Removing soil and vegetation before flooding will eliminate large reserves of nutrients that would otherwise be released into the new lake and stimulate the activity of methylating bacteria.

Vegetation and soil removal have been identified as mitigation measures to limit methyl mercury production post impoundment (Fisheries and Oceans Canada 2005; Hydro Quebec 2003; Boiridy 1996). Removing vegetation alone is not a sufficient mitigation measure for methyl mercury control, as tree cover for example can take up to 100 years to decay and would therefore not be considered the primary contributor of either mercury or nutrients in an inundated system (Therien 1992, in Boiridy 1996). Soil organic layers on the other hand, including needles and leafy debris, are expected to decay quickly (within five years) releasing mercury and nutrients into the system more rapidly than vegetation cover alone (Boiridy 1996). Combined vegetation and soil removal is therefore considered more effective. The Practioner’s Guide to Federal Requirements for Waterpower Development Environmental Assessment Processes in Ontario (2006) identifies vegetation removal to inhibit methyl mercury production as a potential federal information requirement for CEAA review.

Although examples of soil and vegetation removal before flooding are rare in the published literature, some examples of controlled burns prior to flooding were located. Friedli et al. (2001) noted burning vegetation and soil before impoundment reduced total mercury in those media by over 95%. Mailman and Boday (2005) also identified reduced levels of inorganic and methyl mercury in burned vegetation and soils, although their study did not show consistently lower concentrations of methyl mercury in aquatic biota. Removing soil and vegetation in the Prosperity Lake area prior to flooding is expected to prevent the increase in fish tissue mercury levels that was predicted using the Johnston et al. (1991) model.

8.4.1.7 Productive Capacity

The productive capacity of Prosperity Lake was examined in the context of its relative ability to support a self-sustaining population of rainbow trout. Estimation of productive capacity has been conducted to describe the technical feasibility of the proposed lake habitat creation. Methods for estimation have been chosen with the intention of comparing the capacity of displaced habitat (i.e., Fish Lake) with Prosperity Lake.

Fish Lake productive capacity has been previously estimated using mark-recapture data (Triton 1997b). The direct method used involved calculating fish biomass production (i.e., instantaneous growth rate divided by average biomass over given pair of ages) for five pairs of age classes, then combining production over age to obtain an annual production for the entire Fish Lake population. The resulting direct estimate for Fish Lake production was 2675 kg/yr^{-1}, and 24.1 $kg/ha^{-1}/yr^{-1}$ based on the 1996 to 1997 capture data. The Fish Lake fish data (1996–1997, Triton 1997b) produced an estimate of 49,057 total fish with 95% confidence limits of -35 and +67% (85,000). For the purposes of compensation planning, the upper confidence limit of 85,000 trout is being used along with its corresponding 24.1 $kg/ha^{-1}/yr^{-1}$ production estimate.

Models for estimating productive capacity were chosen as a means of estimating capacity based on projected physical parameters for Prosperity Lake. The productive capacity models described below have been widely used in the context of small lake fisheries and are considered relevant to the project. Productive capacity of Prosperity Lake has been estimated using three models: the Small Lake Stocking (MWLAP 2003), Primary Productivity (Downing et al. 1990) and Morphoedaphic index (Ryder 1965). Fish Lake water quality data collected from 1993 to 2006 was input into the models to calculate the corresponding productive capacity estimates. Mean monthly water quality data collected near the inlet to Fish Lake are expected to be representative of water quality in Prosperity Lake. The flows passing through station W1 represent the vast majority of total flows which will feed supply water to Prosperity Lake.

Productivity Models

Small Lake Stocking Model

The Small Lake Stocking Model has been used by provincial government biologists (MWLAP 2003) to estimate the fish stocking levels in candidate lakes. This model uses total dissolved solids (TDS), lake surface and shoal area (<6 m deep) to estimate the productive capacity for fish. In this context, productive capacity and carrying capacity for rainbow trout yearlings are considered to be synonymous. The model equation is:

$$\#\ yearlings = TDS / ((2.47 / Shoal\ Area) + (0.247 / Surface\ Area))$$

Shoal area is considered to be ten times more productive than deep water areas in terms of carrying capacity for fish stocking. The model parameter values for Fish Lake and Prosperity Lake are reported in Table 8-13. The mean productive capacity value for Prosperity Lake is slightly lower than for Fish Lake (21,000 vs. 28,881 yearlings). In term of minimum and maximum productive capacity, however, Prosperity Lake shows higher values than Fish Lake (16,891 vs. 12,030 and 42,398 vs. 42,059, respectively).

Table 8-13 Small Lake Stocking Model

Parameter	Fish Lake	Prosperity Lake	Slim Lake
Total Dissolved Solids Range (mg/L)	90–180 (N=31)	113–285 (N=12)	
Total Dissolved Solids Mean (mg/L)	123.6	141	273
Shoal Area (ha)	83.5	49	13
Surface Area (ha)	111	113	28.7
Productive Capacity Mean (# yearlings)	28,881	21,000	2,812
Productive Capacity Range (# yearlings)	12,030–42,059	16,891–42,398	

The management intent and rationale behind the small lake stocking model is to use the estimate to determine the number of yearling fish which can be added to a lake under a "put and take" recreational fishery program. The aim of Prosperity Lake compensation is to have a self-sustaining fish population, so the yearling estimates produced herein should not be taken literally, but rather as a measure of Prosperity Lake productive capacity relative to Fish Lake.

At 21,000 yearlings, Prosperity Lake's estimated capacity for yearling Rainbow trout falls is higher than the average stocking planned in 2008 for the Cariboo-Chilcotin region (15,529 yearlings; FFSBC 2008).

Morphoedaphic Index

The Morphoedaphic index (MEI) (Ryder, 1965) has also been used by provincial biologists to determine lake productive capacity for fish. This MEI uses TDS divided by mean depth to determine an index of productive capacity for lakes. The morphoedaphic model parameter values for Fish Lake and Prosperity Lake are presented in Table 8-14. The MEI value for Prosperity Lake is slightly lower than for Fish Lake (22.7 vs. 30.9).

Table 8-14 Morphoedaphic Model

Parameter	Fish Lake	Prosperity Lake	Slim Lake
Total dissolved solids mean (mg/L)	123.6	141	273
Mean depth (m)	4	6.2	5.6
Morphoedaphic index	30.9	22.7	48.8

There has been a deliberate decision to construct Prosperity Lake with less shoal habitat than Fish Lake so as to influence a change in fish size distribution. The deeper waters of Prosperity Lake combined with a lesser proportion of spawning habitat are expected to produce larger fish. While overall fish biomass per unit area is predicted to be less in Prosperity Lake than Fish Lake, the trout population is anticipated to produce a better angling experience and facilitate achieving regional objectives for fisheries enhancement.

Primary Productivity Model

A fish production model developed by Downing et al. (1990) uses total phosphorus in lakes as an index of primary productivity and in turn, a predictor of productive capacity for fish. This Primary Productivity model was used on 14 lakes with measured fish populations, resulting in an $r^2 = 0.67$ ($p = 0.002$) (Downing et al. 1990). The correlation between fish productive capacity and Primary Production was found to be stronger than correlations between fish and the morphoedaphic index (Downing et al. 1990), hence it was considered for estimates and comparisons for Prosperity Lake.

The Primary Productivity model equation used here is:

$$\text{Fish Production (kg/ha}^{-1}\text{/yr}^{-1}\text{)} = 10\text{\^{}}(0.332+0.531/\text{LOG}_{10}\text{(Total Phosphorus (}\mu\text{g/L))}$$

Total phosphorus (TP) samples collected monthly at Station W1 were used to represent expected values for Prosperity Lake. W1 loadings are considered to be the most important source of TP to Prosperity Lake and hence the best estimate for all Project phases. The influence of the terrestrial TP loadings from pre-stripped lands underlying Prosperity Lake was considered, however they are not expected to contribute more than

0.018% of the Lake TP (D. MacGregor, SRK Consulting, pers. comm. 6/25/08). The estimation of pre-stripped land contributions to Prosperity Lake TP is based upon:

- lake area (113 ha) and volume (7 Mm^3)
- calculated range of phosphorus values which could be flushed from flooded terrestrial sources. Soluble phosphorus values derived from shake flash extractions of 12 overburden samples collected within the Project open pit area in 2007
- calculated range of TP concentration in Prosperity Lake assuming no other sources

The monitoring station W1 TP (mg/L) mean monthly values were flow-adjusted using mean monthly flow data to provide the most representative estimate of expected concentration in Prosperity Lake. The flow adjusted TP value and the resulting productive capacity estimate are reported in Table 8-15. Limnology studies on trophic status (Wetzel 2001) classify lakes with mean TP equal to 26.7 µg/L as mesotrophic and those with 84.4 µg/L as eutrophic. The mean W1 TP value of 39 µg/L suggests that Prosperity Lake will have a tropic status which lies between meso and eutrophic.

Table 8-15 Primary Productivity Model

Parameter	Fish Lake	Prosperity Lake
Total Phosphorus Mean (µg/L)	42.0[1]	39
Productive Capacity Mean (kg/ha/yr)	15.6	15

NOTE:
[1] Mean for May samples

Water samples (N = 31) collected in May 1996, 1997, and 2006 from Fish Lake were used to calculate the mean TP value and its productive capacity. TP samples were collected from both littoral and pelagic areas of Fish Lake. May TP samples were chosen as being more representative of Fish Lake productivity given they were collected during spring turnover of lake nutrients, a period where primary production and TP concentration are assumed to have the closest correlation (15.6 vs. 15 $kg/ha^{-1}/yr^{-1}$).

Overall, the Prosperity Lake productive capacity as estimated by the described Primary Productivity model is considered to be comparable to the capacity ($kg/ha^{-1}/yr^{-1}$) of Fish Lake and capable of supporting a self-sustaining population of stocked rainbow trout.

8.4.1.8 Climate Change

Prosperity Lake sensitivity to climate change is low as the inlet and outlet (to Wasp Lake) will be designed to withstand flood events, and Prosperity Lake could divert surplus water going to Wasp Lake to supply water to the TSF in the case of drought conditions.

8.4.1.9 Monitoring

To ensure Prosperity Lake is constructed to design specifications, compliance monitoring will be scheduled at regular intervals throughout construction. The construction monitoring schedule will generally follow recommendations described in Standards and Best Practices for Instream Works (MWLAP 2004). Compliance monitoring will terminate once the filling of the lake has been completed at which time the final comparison of the physical properties of the lake (e.g., surface area, maximum depth, littoral area) can be assessed against design specifications.

To determine the accuracy of environmental effects predictions and effectiveness of Prosperity Lake, a monitoring program will be developed and implemented. The program will focus on the biological effectiveness (e.g., the presence of a self-sustaining population of rainbow trout) and physical properties (e.g., water quality) of the lake.

The follow-up program will include assessments of selected water quality parameters (e.g., mercury, dissolved oxygen, suspended sediment, temperature, pH), riparian vegetation survival, and fish use. The monitoring of fish use will include population estimate and a description of population structure (e.g., age distribution, length at age) such that it can be determined whether the target of a self-sustaining population of fish of sufficient number to maintain genetic integrity (e.g., the MVP target) has been met.

The following schedule has been nominally identified:

- monthly assessments of water quality during the growing season (May-September) and one sampling event over the winter
- monitoring of invertebrate production (focusing on the aquatic invertebrate biomass per unit volume sampled) in mid-August, each year for five years after lake is filled
- annual index sampling (e.g., to confirm fish survival after winter, growth, health, relative numbers) as well as periodic (e.g., every five years) detailed population estimates to determine if the population target and desired size/age class distribution has been obtained
- once the establishment of self-sustaining population of rainbow trout has been confirmed, the frequency of biological and water quality assessments will be reviewed, and modified if necessary

Remedial or adaptive measures will be applied following any evaluation that determines a reduction in functionality or integrity of the compensation element based on a quantified trigger value. Further details regarding the monitoring program are provided in the Implementation Plan.

8.4.2 Little Fish Lake

Although Little Fish Lake is not considered a “compensation element”, the destruction of Little Fish Lake will not occur for at least the first seven years of mine development. This retention of Little Fish Lake has a number of advantages, including the provision of 2000 fish as Prosperity Lake fills, which not only helps balance the lag time for the development of Prosperity Lake with the loss of Fish Lake, but it also provides additional security for the maintenance of genetic integrity and provides a complete age-class structure of rainbow trout. A cofferdam will be constructed upstream (south) of Little Fish Lake which will allow the construction and filling of Prosperity Lake without impacting Little Fish Lake. A small portion of water from the Headwater Channel will be diverted into Little Fish Lake prior to the alignment of Prosperity Lake to maintain hydrological flow requirements to allow natural spawning to continue in the outlet.

The retention of Little Fish Lake for the first seven years of mine development contributes to the MOE Benchmark Statement for preserving the genetic attributes of the Fish Lake stock, for the following reasons:

- provides a source of gametes for hatchery-reared fry for outplants to recipient lakes
- potential for transplanting this population directly into Prosperity Lake
- provides an additional source of mixed adult age classes for outplants into recipient lakes

Little Fish Lake is located upstream of Fish Lake, in Reach 9 of the Fish Creek drainage, and is the headwaters of the drainage. Little Fish Lake has been surveyed for fish and fish habitat by Triton (1999a) and Hallam Knight Piésold Ltd. (HKP 1995). The following physical information has been adapted from Triton (1999a).

8.4.2.1 Physical Habitat Parameters

Little Fish Lake is at an elevation of 1527 m and has a watershed drainage area of 1470 ha. It has three inlet streams and one outlet (Fish Creek, Reach 8), with a self-sustaining monoculture population of rainbow trout. The shoreline of Little Fish Lake is fairly uniform but narrow with no islands or bays and therefore has a relatively low shoreline development index (SDI = 1.43).

The lake reaches a maximum depth of 4.4 m (100% littoral) and has a mean depth of 2 m. The volume of Little Fish Lake is 128,000 m^3 and the surface area is 6.6 ha. The shoreline drops off fairly rapidly along the west and east side of the lake, while the inlet and outlet bays are shallow. There are three ephemeral inlets and one permanent outlet stream (Reach 8 of Fish Creek). The outlet stream has been extensively studied by Triton (1999b). The outlet reach had several beaver dams and provides the primary spawning and rearing habitat to rainbow trout found in Little Fish Lake. The inlet (Reach 10 of Fish Creek) is also ephemeral. Details regarding the outlet stream (Reach 8) are provided in Volume 5, Section 3 of the EA report.

8.4.2.2 Little Fish Lake Fish Population

Little Fish Lake has been sampled for fish on four occasions between 1993 and 1997 and only rainbow trout were captured. A survey of Little Fish Lake was conducted by HKP on August 30, 1993. A gill net was set for 2.25 hours, resulting in the capture of 13 rainbow trout (CPUE of 5.7 fish/hour). The outlet of Little Fish Lake was sampled using an electrofisher on August 29, 1994 and resulted in the capture of 25 rainbow trout (HKP 1995; cited in Triton 1999).

A gill net was set on August 18, 1997 for two hours (13:13–15:30) and no fish were caught or observed. Triton staff angled on the same day (during the same time period that the net was set), but no fish were captured. Triton staff used a lake trap on August 21, 1997, which resulted in the capture of five rainbow trout (CPUE of 0.18 fish/hour) (Triton 1999a). A gill net was set on September 25–26 1997 for 17 hours (15:00–08:00 and no fish were caught. The net was set again on September 26 at 10:00 in a different location, which resulted in the capture of 72 adult rainbow trout before the net was fully deployed.

8.4.2.3 Genetics

There has been no separate genetic analysis of Little Fish Lake, however, based on the connectivity of Fish and Little Fish lakes, the assumption is that there is genetic mixing between the two lakes.

8.4.2.4 Productivity Models

Morphoedaphic Index

The Morphoedaphic Index (MEI) uses TDS divided by mean depth to determine an index of productive capacity for lakes. Little Fish Lake MEI is 76 which is higher than Fish Lake MEI of 31. Using the yield curve for north-temperate lakes provided in Hartman and Miles (2001) and MEI of 76 indicates a fish yield of approximately 10 or 66 kg/yr for Little Fish Lake.

Primary Productivity Model

The Primary Productivity Model uses total phosphorus in lakes as an index of primary productivity and in turn, a predictor of productive capacity for fish. Based on TDS of 22 µg/L collected from the 1990s (Triton 1999a) the productive capacity for Little Fish Lake is 11.1 kg/ha/yr (equivalent to 73.3 kg/yr) compared with Fish Lake at 15.6 kg/ha/yr.

The average predicted yield between the MEI and Primary Productivity Model is approximately 70 kg/yr for Little Fish Lake. Using a similar age class structure to Fish Lake (44% age 0+, 25% age 1 to 2, 14% age 2 to 3, and 17% age 4-6), and average size at age data reported in Section 8.4.1, the yield of 70 kg/yr could support a population of 2000 individuals. It has been suggested that 2000 individuals would be sufficient as a minimum viable population. Based on the actual sampling results in Little Fish Lake (most notably the capture of 72 adults before complete deployment of the gill net), and the modelled results, Little Fish Lake should be considered an adequate source of brood stock to maintain the genetic integrity of the stock. In conjunction with Fish Lake (years 1–2) and the various recipient lakes, the inclusion of Little Fish Lake adds robustness and a further fail-safe for the maintenance of the genetic stock of Fish Lake fish.

8.4.3 Constructed Channels

At the Project pre-construction phase, a system of headwater channels will be constructed along the eastern side of the Project area in the upper Fish Creek watershed, as detailed in Volume 3, Section 6 of this report. The channels are designed to capture and direct surplus clean water around the Project site as part of water balance and water management planning.

The headwater channel will capture and direct surplus flows to lower Fish Creek to the north and directs flows to the Beece Creek drainage to the south during Project operations. The following sections outline the details and benefits of the headwater channel system to supply water and nutrients to downstream fish habitat, including engineered habitat compensation elements.

The Headwater Channel element sensitivity to climate change is low as channels will be designed to accommodate extreme events in the order of at least 1:100 year return. This includes channel capacity, integrity (rip-rap) for excess water, and clay linings to minimize seepage losses to ensure flows for Prosperity Lake.

8.4.3.1 Headwater Channel

The headwater channel is approximately 10.8 km long and will capture and direct approximately 3.2 Mm^3 of seasonal flow southward into engineered fish habitat compensation works and then through Wasp Lake to Beece Creek during Project operations. The headwater channel will also serve to provide seasonal non fish-bearing habitat as it will collect and direct flows and nutrients to downstream fish-bearing habitats. As described in Section 8.4.2.1, for the initial filling period until Prosperity Lake is filled with the estimated 7 Mm^3, the majority of the flows will be sent south to Prosperity Lake assisting in filling the lake (Figure 8-1). At closure, all Fish Creek drainage will return to the Fish Creek watershed (refer to Figure 8-1).

Rationale

The rationale for the headwater channel is to collect and divert surplus clean water around the Project site as part of water balance and water management planning. As an additional benefit this channel will also function to supply water to engineered downstream works as part of the Prosperity Lake compensation element.

Objective

The objective of the headwater channel from a fish and fish habitat mitigation and compensation perspective is to:

- ensure that the channel functions as 43,200 m^2 of seasonal non fish-bearing habitat and that seasonal flows report to fish-bearing waters
- provide an additional 3.2 Mm^3 seasonally to the downstream HCRP for providing controlled and base flows to approximately 4400 m^2 of stream spawning and fry rearing for Fish Lake rainbow trout housed in downstream Prosperity Lake
- provide 3.2 Mm^3 annually to supply water to fill and maintain Prosperity Lake as self sustaining trout habitat

Element Design

The design of the headwater channel is to capture and direct seasonal flows originating primarily from snowmelt and precipitation around the Project site. The channel will be approximately 1 m at the bottom, with 1V:1.5H side slopes and a 4 m bank to bank top (Figure 8-7).

Baseline flows estimated by Knight Piésold are based on the calculated catchment area for the headwater channel and flow estimates and timing from the water gauge for the inlet of Fish Lake (Station W1; Figure 8-7 and Figure 8-8). The seasonal snowmelt and spring precipitation flows are concentrated in the months of April to June. However, it is anticipated that summer/fall precipitation combined with the channel interception of any near surface groundwater may accumulate by kilometre of stream such that the lower sections of the headwater channel above the HCRP could maintain perennial flows. Flow calculations indicate a potential range of 0.004 to 0.033 m^3/sec flows in the lower reaches in the non spring runoff months (Figure 8-7).

Figure 8-7 Headwater Channel Typical Sections

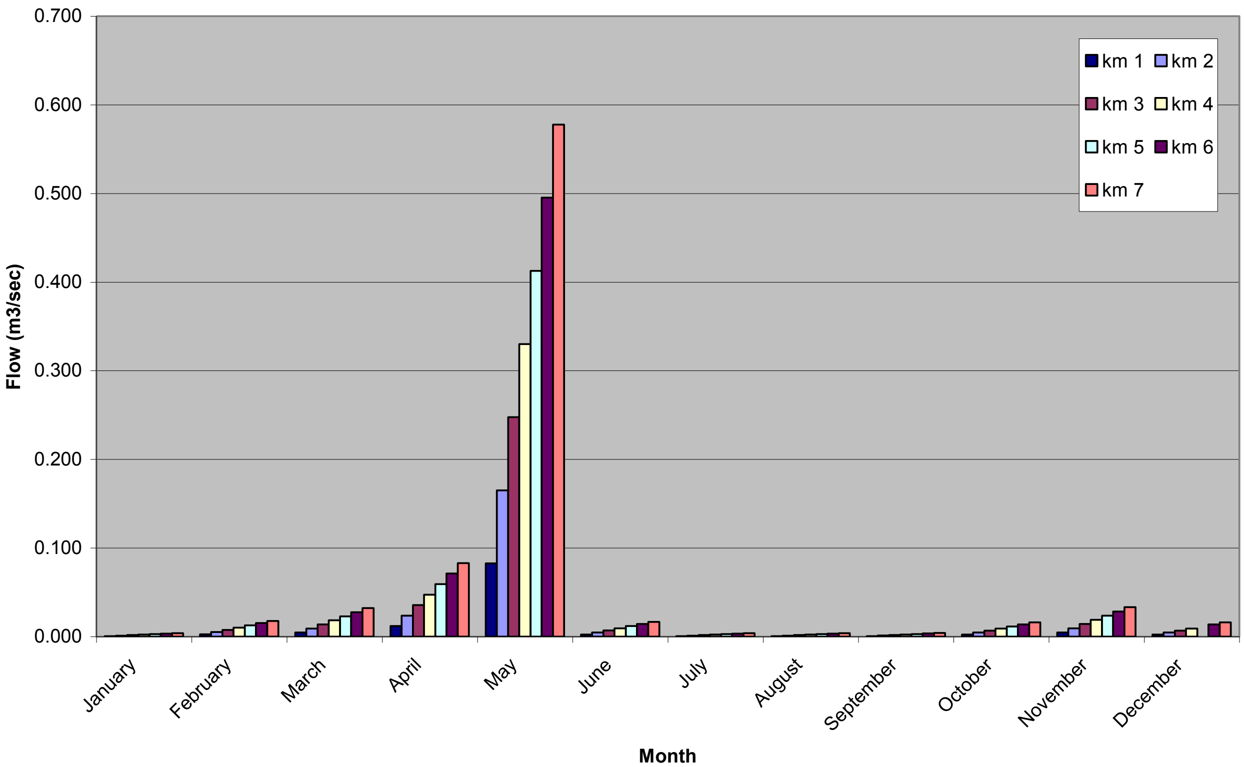


Figure 8-8 Flow Distributions by Kilometre of Headwater Channel

In total, the annual contribution of approximately 3 Mm^3 downstream to the HCRP and Prosperity Lake will provide sufficient seasonal flows to maintain spawning and seasonal juvenile rearing in the inlet to Prosperity Lake and a source of nutrients, food and oxygen to the lake. The HCRP is designed to capture and store surplus spring runoff to be used throughout the egg incubation and seasonal fry rearing in the inlet to Prosperity Lake. Perennial flows are not required to sustain the lake's trout population as fall fry will emigrate to the lake in the late summer as flows are reduced, as is the case for the inlet stream to Fish Lake which normally dries up by about the end of July.

At the design stage further assessment of the potential for part of this stream to provide perennial flows will be conducted. In the meantime this channel combined with the north extension of the headwater channel will offset the loss of ephemeral non fish bearing habitat lost or harmfully altered by the Project development.

Headwater channel preliminary design estimates suggest a channel efficiency of approximately 85%. During the detailed design phase, the design capacity of the channels will be refined to determine the appropriate return period. Further geotechnical assessment is planned to determine areas which may require rip-rap or compacted liner to minimize seepage and facilitate flows.

A 3.5 km northern extension of the headwater channel is proposed to annually capture about 1 Mm^3 of the total 1.25 Mm^3 of north flowing water to reduce the deferral period for Prosperity Lake to become fish habitat and to assist TSF water balance start up needs. The expectation is to only utilize this northern extension during the initial filling phase of

Prosperity Lake, and thereafter allowing this additional annual volume to be directed north of the open pit via the north flowing headwater channel. Should this additional water be required in Prosperity Lake or in the TSF, this northern extension of the headwater channel will allow for these flows to be utilized beneficially.

Table 8-16 Flow Distributions by Kilometre of Headwater Channel

	Seasonal Flow Distribution		Headwater Channel Flows (m3/sec)						
	%	m^3/sec	km 1	km 2	km 3	km 4	km 5	km 6	km 7
January	0.5%	0.004	0.001	0.001	0.002	0.002	0.003	0.003	0.004
February	2%	0.018	0.003	0.005	0.008	0.010	0.013	0.015	0.018
March	4%	0.032	0.005	0.009	0.014	0.018	0.023	0.028	0.032
April	10%	0.083	0.012	0.024	0.036	0.047	0.059	0.071	0.083
May	72%	0.578	0.083	0.165	0.248	0.330	0.413	0.495	0.578
June	2%	0.017	0.002	0.005	0.007	0.009	0.012	0.014	0.017
July	0.5%	0.004	0.001	0.001	0.002	0.002	0.003	0.003	0.004
August	0.5%	0.004	0.001	0.001	0.002	0.002	0.003	0.003	0.004
September	0.5%	0.004	0.001	0.001	0.002	0.002	0.003	0.004	0.004
October	2%	0.016	0.002	0.005	0.007	0.009	0.011	0.014	0.016
November	4%	0.033	0.005	0.009	0.014	0.019	0.024	0.028	0.033
December	2%	0.016	0.002	0.005	0.007	0.009	0.011	0.014	0.016

NOTE:
Annual Flow Volumes for Catchment Areas A and B = 3,223,548 m^3
2/3 Annual Flow = 2,149,032 m^3

8.4.3.2 Headwater Channel Retention Pond (HCRP)

Rationale

As part of the headwater channel clean water capture and delivery system to Prosperity Lake, the HCRP is proposed to assist the management of seasonal flows to downstream spawning and fry rearing habitat in the inlet to Prosperity Lake. Although the pond will not be accessible to fish, it will have an inherent productive capacity for invertebrates, macrophytes and other organisms. Flows from the HCRP will assist in making the downstream channel highly productive.

Objectives

The objective is to capture and store up to 1 Mm^3 of surplus clean water during spring snowmelt for paced flow releases at about 0.5 m^3/s during spawning (start of freshet in April to June 15) and about 0.2 m^3/s during fry rearing (June 15 to August 31, with a ramp-down to zero by September 15). The flows will be released to a 2.2 km channel that connects the HCRP and Prosperity Lake, the majority of which will be rearing habitat and only the appropriate length will be spawning habitat to support about 50 pairs of rainbow trout adults and 30,000 fry.

Element Design

The 26.1 ha retention pond will be located and constructed about 2 km upstream of Prosperity Lake in-line with the headwater channel (Figure 8-1). The pond will have a maximum depth of about 6 m the water retaining dam structure will have a maximum height of about 8 m and will have a crest width of 5 m across. The dam will be constructed of local borrow materials, similar to those sourced for the construction of the south dam at Prosperity Lake. The location and dimensions of the HCRP will be designed to match the design of Prosperity Lake and its inlet. Design specifications for the HCRP are outlined in Figure 8-9.

Figure 8-9 Headwater Channel Retention Pond Sections

The HCRP will receive spring snowmelt runoff collected in the headwater channel and will allow flows to freely increase into the outlet channel up to about 0.5 m^3/s until higher stream flows begin. At this point the retention pond will store flows up to capacity and at the same time regulate flows downstream to match that required for successful spawning and fry rearing. Flows will be regulated until late August when they will be reduced and shut off by mid-September to encourage fry to migrate downstream to overwinter in Prosperity Lake.

As part of the development and operation of the HCRP, a 2.2 km long outlet stream leading to Prosperity Lake will be constructed. This section of stream will be designed and managed as the inlet spawning and juvenile rearing area for Prosperity Lake. Controlled flows from the HCRP estimated to be adequate for inlet stream spawning and seasonal juvenile rearing include the following:

- April 16 to April 30 (15 days @ 0.25 m^3/s) = 320,00 m^3

- May 1 to June 15 (46 days @ 0.5 m^3/s) = 1,987,200 m^3
- June 16 to July 31 (46 days @ 0.2 m^3/s) = 794,880 m^3
- August 1 to August 31 (31 days @ 0.1 m^3/s) = 267,840 m^3
- September 1 to September 15 (15 days starting at 0.1 m^3/s ramping down to 0) = 60,480 m^3

The total volume of water required to accommodate the inlet spawning and seasonal rearing is about 3.11 m^3 and close to the annual available supply of snowmelt and precipitation.

The design specifications for this stream including habitat complexing for spawning and rearing areas as outlined in Figure 8-10, Figure 8-11 and Figure 8-12. Spawning and associated cover area will accommodate about 50 pairs of Prosperity Lake spawning adults. Based on 1500 eggs per female and an egg to fry survival estimate of about 40%, approximately 30,000 fry will be produced. The amount of spawning and juvenile rearing will be further assessed at the detailed design stage to ensure a controlled amount of spawning and juvenile rearing will not provide over-recruitment to the lake and could support a sustainable population of about 20–25,000 rainbow trout. At closure, the retention pond will be reclaimed and seasonal flows will maintain the Prosperity Lake inlet spawning and rearing capacity similar to the existing Fish Lake inlet flows and habitat.

Sensitivity to climate change for the HCRP element is low as the facility will be designed and will function to both attenuate extreme flood events as well as to hold water for downstream fish spawning and stream rearing during low flows.

Figure 8-10 Prosperity Lake Inlet

Figure 8-11 Prosperity Lake Inlet Spawning Channel Overview

Figure 8-12 Prosperity Lake Inlet Spawning Channel Detail

8.4.3.3 Monitoring

To ensure the channels are constructed to design specifications, monitoring will be scheduled at regular intervals throughout construction of the various channel components. The construction monitoring schedule will generally follow recommendations described in Standards and Best Practices for Instream Works (MWLAP 2004).

To determine the accuracy of environmental effects predictions and effectiveness of the proposed channels, a monitoring program will be developed and implemented. The program will adhere to methods established in the Guidelines for Instream and Off-Channel Routine Effectiveness Evaluations (FIA 2003) and focus on the biological effectiveness (e.g., seasonal use for rainbow trout spawning in the HCRP outlet/Prosperity Lake inlet) and physical integrity of constructed channel components.

The follow-up program will include assessments of water quality (e.g., temperature, pH) and quantity, habitat structure and attribute integrity and functionality (e.g., substrates), riparian revegetation survival, and fish use by species- and life-stage (limited to the Prosperity Lake inlet channel). The following schedule has been nominally identified:

- seasonal assessments of water quality, biological (where relevant) and physical attributes of the constructed channels during the first year of operation (four assessments)
- annual assessment of the Prosperity Lake inlet channel during the rainbow trout spawning and egg incubation period

Remedial or adaptive measures will be applied immediately following any evaluation that determines a reduction in functionality or integrity of the compensation element based on a quantified trigger value.

8.4.4 Fish Culture

Fish culture activities are required to maintain the genetic integrity of the Fish Lake stock of rainbow trout and to replace the fishery at Fish Lake, two key objectives of the Compensation Plan. Taseko engaged the services of the FFSBC to review the current condition of the existing MOE Hanceville Hatchery and other fish culture options to determine the technical feasibility, benefits and costs of producing Fish Lake gametes. The results of this assessment are provided in a report titled: An Assessment of the Hanceville Hatchery as a Rainbow Trout Fry Production Facility, Freshwater Fisheries Society of BC, June 20, 2008, attached as Appendix 3-8-C.

Fish culture activities associated with the Compensation Plan are integral to the maintenance of the genetic integrity of Fish Lake stock of rainbow trout until Prosperity Lake can be shown to support a self-sustaining population of fish. Fish culture presented as part of the Plan is not a permanent solution to propagate the Fish Lake stock, but rather a temporary means to ensure the genetic integrity of Fish Lake stock while a permanent solution (i.e., Prosperity Lake) is being developed. The production of fry additional to those produced for the maintenance of genetic integrity provides for the opportunity of lake stocking and fishery enhancement (a more traditional use of a hatchery facility).

The benefits and disadvantages of each of the options are outlined in the following sections, and guidance in regard to which option should be moved forward is anticipated as part of the upcoming Technical Working Group meetings.

8.4.5 Rationale

The rationale for the implementation of fish culture activities is to:

- maintain the genetic integrity of the Fish Lake stock until such time as Prosperity Lake is able to support a self-sustaining population of fish
- address the loss of the fishery at Fish Lake
- potentially contribute to local community socioeconomic benefits and partnerships

Fish culture is known to be technically feasible, biologically sound and cost effective for the life of the Project.

8.4.5.1 Objective

The management objective for the fish culture element is to seasonally produce 80,000 fall fry using Fish Lake stock to:

- maintain back-up gene pools of Fish Lake stock in Slim, Blue and Koster lakes and Lake 6267 at an individual lake population size of about 3000, which because they will not be self-sustaining, will require annual outplants
- maintain a recreational fishery in Slim, Blue and Koster lakes and Lake 6267 for a combined total of 600 recreational angling days (a 20% increase compared to the current recreational fishery on Fish Lake). If these lakes are utilized access improvements and the construction of recreational facilities (e.g., camp sites) will also be required to meet this objective
- make available additional fry for outplant to other lakes in support of MOE's small lakes management planning and potential First Nations food fishery needs

8.4.5.2 Element Design

Three options have been investigated for the production of fry: the use of a decommissioned MOE facility (the Hanceville Hatchery), the use of an existing operational FFSBC facility (the Clearwater Hatchery), and the construction of a new facility in the vicinity of the mine site.

Hanceville Hatchery

The Hanceville Hatchery is located approximately 70 km west of Williams Lake on a 108 ha ranch owned by the Province (Figure 8-13). The Hatchery is easily accessible from a gravel road system connected to Highway 20, near Lees Corner. The Hatchery facilities were constructed about 25 years ago and consist of a simple post and beam wooden building enclosing seven large fish rearing troughs, three vertical tray incubators and other fish culture equipment. This facility is currently not in use. Details of the current hatchery layout and photos of hatchery components are included in Appendix 3-8-C.

Figure 8-13 Location of Hanceville Hatchery

The water supply for the hatchery originates at a spring located about 300 m upstream of the hatchery. Water is diverted from the spring pond into a collection box which then flows by gravity through a plastic waterline to the hatchery facility. The spring water supply flows year round at approximately 2800 L/minute and at a fairly consistent 11 to 15°C. All previously tested water quality characteristics have shown the water supply to be suitable for fish culture needs. After passing through the hatchery, water is discharged into an adjacent settling pond and then continues downstream via a ditch and creek toward the Chilcotin River. Three nearby ranch operations may utilize this discharged water for irrigation purposes by agreement with MOE.

For the hatchery to be utilized a number of key design features will need to be constructed as follows:

- replacing the hatchery building to meet current building code including a new concrete floor, upgraded site access and surrounding area

- upgrading the electrical system to meet code requirements
- upgrading the hatchery water source intake and protecting it from access by wildlife, cattle and others
- refurbishing, upgrading and installing new fish culture equipment as needed to meet new regulations and make use of new technologies
- providing for seasonal staff accommodation, including sewage management

Seasonal staff requirements, (define the months of operation and hours/day needed for workers) have been identified to include a senior fish culturist, junior fish culturist and associated benefits, truck and equipment purchase or rental, accommodation, and supplies to run the hatchery facility.

Figure 8-14 Hatchery NE View

Clearwater Hatchery

The Clearwater Hatchery is an operational FFSBC facility in the North Thompson River drainage that produces native and domestic rainbow trout and kokanee. The hatchery currently stocks fish into 330 lakes annually, and could accommodate the production of Fish Lake fish. Benefits of using the Clearwater Hatchery include:

- less risk compared to the Hanceville Hatchery as fish would be produced under the supervision of experienced fish culture staff and would be less likely to have health problems or losses from human error or mechanical failures
- lower costs. It is estimated that the Clearwater Hatchery could produce the 80,000 fry for approximately $1M less than the Hanceville Hatchery option, a savings of $50,000 per year for the life of mine that could be directed to other compensation opportunities (FFSBC 2008)

Alternate Hatchery Site

A new fish culture facility could be constructed in the vicinity of the mine site. The benefit of such a facility is that maintenance and staffing could be provided as part of mine operations. A groundwater source would need to be located and likely heated to allow fish to reach the target size by September. Risk associated with this option relates to the reliance on a pumped water supply which could result in catastrophic loss of eggs or fry during a mechanical or electrical failure (FFSBC 2008). Costs associated with this option would be intermediate compared to the Hanceville Hatchery and Clearwater Hatchery options. Initial construction costs would be greater than the Hanceville option (due to groundwater sourcing and the development of an entirely new site), however long-term operational costs would be less due to the potential for shared staffing and maintenance resources with the mine.

8.4.5.3 Permits

Any of the fish culture options will require a number of statutory permits and approval. The Federal/Provincial Introductions and Transfers Committee must approve the culture and movement of fish in British Columbia. Key elements of the planning and assessment for obtaining approval to move fish into a facility and to produce fish include at least a one year full Schedule 2 fish health assessment. An application for transfer of this stock or its progeny to a multi-species or stock facility (e.g. Clearwater Hatchery) would require an additional two year health assessment.

In order to support the approval to transplant Fish Lake stock to the Prosperity Lake compensation element or to a fish culture facility, a fish health assessment was conducted pursuant to Fish Health Protection Regulations–Manual of Compliance, Miscellaneous Special Publication 31 (revised), Fisheries and Oceans Canada 1984 (revised 2004). The results of this assessment are required in support of making an application to the federal-provincial Introductions and Transfers Committee. The health assessment was completed by the FFSBC laboratory in Nanaimo on both Fish Lake inlet and outlet recently spawned adults and newly emerged fry. Results of this assessment are provided in Appendix 3-8-D. In summary, the results from the Fish Lake health assessment detected the presence of enteric redmouth (*Yersinia ruckeri*), which is a listed "pathogen of concern" under Schedule II of the Fish Health Protection Regulation. The detection of a pathogen of concern will likely raise a 'red flag' with the Introductions and Transfers Committee. Discussions will need to occur with MOE to determine the extent to which this pathogen is of concern in their region. In addition, it needs to be determined if the occurrence of this pathogen will hinder the transplant of mixed age class adults from Fish Lake into recipient lakes. Taseko will follow the application guidelines and advice from the committee, FFSBC and MOE.

The MOE regulates the use of surface waters and the discharge of hatchery waste water to the environment. MOE is licenced under the *Water Act* to use up to 1 cubic foot per minute (1800 L/minute) of the total of 2800 L/minute spring water supply for fish culture purposes at the Hanceville Hatchery. This licence is held in good standing and available for continued hatchery use. The Clearwater Hatchery is an operational facility with the requisite water use and waste water permits in place.

The reconstruction and upgrade of the Hanceville Hatchery facility or the construction of a new fish culture facility will require adherence to, and inspection by, the relevant local regional district and provincial health building and electrical authorities. The Clearwater Hatchery is an operational facility with the requisite health and electrical permits in place.

Taseko will work with MOE and FFSBC at the permitting stage to satisfy the details required to build or upgrade a fish culture facility and to obtain the necessary permits, approvals and other authorizations required to bring a facility into production.

8.4.5.4 Recipient Lakes

In order to provide a back-up population of Fish Lake stock to help maintain the gene pool, MOE provided Taseko with a list of candidate lakes which could receive a representative portion of the original Fish Lake stock. It is assumed that the Fish Lake monoculture stock comprises one family unit. The selection of the size range and number of rainbow trout transferred to recipient lakes will be based on a random selection process. As these lakes have no self sustaining capability due to no inlets or outlets, an annual stocking program using Fish Lake gametes from a fish culture facility will be required to keep these populations sustainable. The number of fish in each lake would conform to the guidelines for ensuring the stock would represent and maintain the genetic integrity of the Fish Lake stock. Based on MOE advice a population level of 2000 trout is adequate for this purpose (pers. comm. email from Mike Ramsay to Michael Whelan, July 18, 2007). The selected recipient lakes would also be the means to replace the Fish Lake recreational and First Nation fishery that will be temporarily lost.

Slim Lake

Slim Lake sits at an elevation of 1347 m and is located about 7 km north of the Project site (Figure 8-15). The lake has no inlets or outlets and is located in the upper Tête Angela Creek drainage. The lake drainage is about 500 ha with a surface area of 28.7 ha and a volume of 1,611,000 m^3. With a shoal area of 13 ha, a maximum depth of 14 m and mean depth of 5.6 m, the potential for winterkill is not significant based on an MOE assessment.

Figure 8-15 Location of Slim Lake

This lake was stocked with rainbow trout in 1996 and 1998 and in 2004 and 2006 this lake was stocked with 2000 AF3N (all female triploid) stock which are considered non-reproductive.

The lake will be initially stocked with approximately 1000 mixed age group trout from Fish Lake as part of a fish salvage program. The lake will then be stocked annually with about 2000 fall fry from a fish culture facility. As the population stabilizes a total population of about 3000 is expected. Lake water quality analyses and use of the morphoedaphic index productivity model (TDS/mean depth) confirms the lake can maintain this population level. The lake population may also be used to supply eggs to the fish culture facility, as required.

At present there is no road access to the lake and a few anglers hike the 3 km to the lake from the Taseko Lake road. However, the current Branch 4500 forest road and associated spur roads to cutblocks, bring road access to within 1 km of the east side of the lake. As such this lake may also provide for recreational angling should access to the lake and campsite development be acceptable to all parties.

Blue Lake (WBID: 00919NARC)

This lake is currently a low use stocked lake with about 130 angler days annually. The lake has no inlets or outlet stream (Figure 8-16), has a surface area of 14 ha and winter oxygen assessment indicates minimum risk of winterkill. The lake has good survival of stocked rainbow trout.

Figure 8-16 Location of Blue Lake

Koster Lake (WBID: 00239BBAR) UTM coordinates 10.541057.5698148

Based on a 1997 survey this lake was barren with no recruitment. The lake has 2-wheel-drive access, a surface area of 20 ha (Figure 8-17) and TDS of 166 ppm. Winter oxygen tests in 1987 indicate no risk of winterkill, however further surveys are required to confirm this conclusion. The lake is on the MOE list for potential stocking.

Figure 8-17 Location of Koster Lake

Lake 6267 (WBID:00878MAHD) UTM Coordinates 10.647801.5762325

Based on a 1999 survey, this lake is barren with no recruitment. The lake has 4-wheel-drive access, a surface area of 25 ha (Figure 8-18), a TDS of 37 ppm and winter oxygen tests in 1999 indicate no risk of winterkill. The lake is on the MOE list for potential stocking

Further assessment of lake morphometry, lake productivity and potential stocking rates with the advice and cooperation of MOE will be conducted during the 2008 field season for all of the above lakes in preparation for these lakes to receive Fish Lake stock.

Figure 8-18 Location of Lake 6267

8.4.5.5 Monitoring

A monitoring program will be developed and implemented to determine the accuracy of environmental effects predictions and effectiveness of fish culture operations. Monitoring of fish culture activities will include the health of cultured fish, and the number of fry produced to ensure outplant objectives can be met. Monitoring of fish populations (e.g., population size and structure) in outplant lakes will also be required to ensure that the genetic integrity of the Fish Lake stock can be maintained until such time that the Prosperity Lake compensation element is fully functioning (e.g., maintaining a self-sustaining population of rainbow trout). Finally, the angler use of outplant lakes will be monitored (e.g., creel surveys or aerial boat counts) to ensure recreational fishery targets are met.

The following schedule has been nominally identified:

- annual assessment of the health of cultured fish and production targets such that the outplant objectives can be met
- annual assessment of rainbow trout populations in outplant lakes until Prosperity Lake is filled and the rainbow trout population in Prosperity Lake is confirmed to be self-sustaining (approximately Years 1 to 5)
- annual assessment of angler use of outplant lakes in conjunction with MOEs small lake management planning. Monitoring frequency and methodology to be determined with regional MOE staff

Remedial or adaptive measures will be applied immediately following any evaluation that determines a reduction in functionality or integrity of the compensation element based on a quantified trigger value.

8.5 Achievement of Environmental Objectives

The environmental objectives of this Plan are guided both by the MOE regional management initiatives and DFO Habitat Policy. As such, this Plan has been developed to achieve the following objectives:

- maintenance of the genetic line exhibited in the trout population of the Fish Lake system
- a healthy, self sustaining trout population
- a trout fishery for First Nations and the public of at least similar character to what is supported by Fish Lake under current conditions
- lake and stream environments of similar or better productive capacity for trout as provided by the Fish Lake system now

The Compensation Plan provides a robust methodology for the maintenance of the genetic line of Fish Lake fish. Starting from the time that fish are removed from Fish Lake, there will be a minimum of five sources of Fish Lake fish. The initial sources will include Little Fish Lake and the four recipient lakes (e.g., Slim, Koster, Blue and Lake 6267). For a period of time (approximately Years 5–7) there will be six sources of Fish Lake fish as the initial stocking of Prosperity Lake begins. At approximately Year 7 Little Fish Lake will be lost as part of mine development, leaving five sources (Prosperity Lake plus the recipient lakes). Ongoing monitoring of Prosperity Lake will have demonstrated that upon mine closure, Prosperity Lake will be fully functioning, providing for a self-sustaining population and fishery.

The Compensation Plan provides both the flexibility and capacity for MOE to augment the diversity and nature of freshwater fisheries in the area. Once targets are established fish culture facilities can produce all fry to outplant into regional lakes. This combined with the potential to undertake selected access and facility improvement (e.g., campsites, boat launch) at recipient lakes can go a long way towards establishing fisheries of similar or better character to what is currently provided at Fish Lake.

Similarly, the Compensation Plan provides for the potential to augment a First Nation food fishery both through the stocking of recipient lakes, but also through the ability of the fish culture facility to produce more fry than needed for the specific compensation elements described in this plan. The available fry could be outplanted into lakes that are of interest to regional First Nations (e.g., barren lakes closer to First Nation communities).

In regards to the productive capacity of lentic habitat in the Fish Lake system, the plan provides for on-site like for like compensation of lake habitat with the development of Prosperity Lake. Modelling and assessment have shown that the lake will provide sufficient water quality and productivity to support a self-sustaining population of rainbow trout. The compensation is like for like and within the Fish Lake watershed.

In regards to the productive capacity of lotic habitat in the Fish Lake system, the Headwater Channel and the Headwater Channel Retention Pond will provide sufficient seasonal flows to maintain spawning and seasonal juvenile rearing in the inlet to Prosperity Lake and a source of nutrients, food and oxygen to the lake. Once firm production targets have been established the inlet spawning channel can be designed to produce the appropriate number of juveniles.

Table 8-17 provides a summary of the environmental objectives addressed by each of the compensation elements.

Table 8-17 Summary of Environmental Objectives Addressed by Each Compensation Element

Environmental Objective	Compensation Element		
	Prosperity Lake (including HCRP and channels)	**Recipient Lakes**	**Fish Culture**
Conserve wild fish and their habitat	X	X	X
Optimise recreational opportunities based on the fishery resource	X	X	X
Increase angler participation while ensuring the long term sustainability of wild stocks	X	X	X
Promote stocked lake fisheries	X	X	X
Provide a diversity of opportunities to ensure quality of angler experience	X	X	
Maintenance of the genetic line of Fish Lake trout	X	X	X
Lake and stream environments of similar or better productive capacity for trout as currently provided by the Fish Lake system	X		
A healthy, self sustaining trout population	X		
A trout fishery for First Nations and the public of at least similar character currently provided by Fish Lake	X	X	X

8.6 Implementation of Compensation Elements

A companion document to this plan, entitled Fish and Fish Habitat Mitigation and Compensation Implementation Plan ("the Implementation Plan"), provides technical details regarding the implementation of the proposed mitigation and compensation elements as well as their expected timeframe. The reader is referred to the Implementation Plan for details on how aspects of the fish and fish habitat compensation and mitigation planning will be implemented, from practical on-ground realities, scheduling and costs through to permitting and approvals.

8.6.1 Follow-up Monitoring and Adaptive Management

With respect to mitigation and compensation measures, a compliance monitoring program verifies the proper implementation of all such measures whereas a follow-up program is used to determine the accuracy of EA conclusions and the efficacy of the required mitigation measures. CEAA defines follow-up as "a program for verifying the accuracy of the environmental assessment of a project, and determining the effectiveness of any measures taken to mitigate the adverse environmental effects of the project".

An outline of the follow-up and monitoring for each element is provided in Section 8.4. A defined follow-up, monitoring and adaptive management plan will be developed for each of the elements in support of making applications for authorizations, permits and other approvals. The follow-up programs will be designed to support or verify the predictions made concerning the likelihood of "no significant environmental effects"; aid in the detection of unanticipated environmental effects; and provide an assessment of the success of management programs and the possible need for adjustments through adaptive management should the results indicate the need. These plans will follow appropriate provincial and federal legislation, policies and programs, including the CEAA Operational Policy Statement: Follow-up Programs under the Canadian *Environmental Assessment Act* (CEAA 2007), and policy direction under the British Columbia *Environmental Assessment Act*. Compliance monitoring programs will also be developed and implemented to meet applicable provincial and federal permits, licences and approvals.

Adaptive management as part of the development of the compensation elements will provide a management tool to adjust the elements as required, ensuring goals are met and habitats are functioning within specified timelines. Ongoing monitoring of compensation planning activities, including collection of baseline data, will provide information which will be measured against established targets and timeframes for individual compensation plans. Should deficiencies or data gaps be identified, the adaptive management framework will trigger a feedback mechanism to ensure deficiencies are addressed and compensation efforts continue moving toward the overall goal of achieving No Net Loss.

The adaptive management process for this Project will incorporate contingency planning, management objectives, ongoing monitoring and the proponent's commitment for achieving benchmark goals along specified timelines with regard to fish and fish habitat compensation plans.

9 Environmental Management Program

The following outlines an Environmental Management System (EMS) for the Prosperity Project, as well as provides an overview of the Environmental Management Plans (EMPs) that will form an integral part of the project providing guidance on all environmental aspects during the construction, operations and decommissioning phases. The series of written plans that will comprise this EMS will be designed to form the basis for more detailed procedures to be developed concurrent with project permitting and associated construction and commissioning phases.

9.1 Environmental Management System

The EMS is a structured system that Taseko will utilize to manage its regulatory and environmental commitments in a cost efficient manner. It is also a tool that will control Prosperity Project's environmental effects as identified during the Environmental Assessment.

9.1.1 Environmental Policy

Taseko is committed to continual improvement in the protection of human health and stewardship of the natural environment.

In order to fulfill this commitment throughout all stages of development, construction, operation and closure of the Prosperity Project, Taseko will:

- prevent pollution, within the bounds of the operation
- comply with relevant environmental legislation, regulations, and corporate requirements
- integrate environmental policies, programs, and practices into all activities regarding the Project
- ensure that all employees understand their environmental responsibilities and encourage dialogue on environmental issues
- develop, maintain, and test emergency preparedness plans to ensure protection of the environment, workers and the public
- work with Government and the public to develop effective and efficient measures to improve protection of the environment, based on sound science
- establish and maintain an environmental committee to review environmental performance and ensure continued recognition of environmental issues as a high priority

9.1.2 Objectives and Targets

Table 9-1 outlines the priority objectives required to ensure Prosperity meets the Environmental Policy. Measurable targets and performance indicators will be set for each environmental component with the approvals and permits.

Table 9-1 Prosperity Project–Priority Objectives

Surface Water and Groundwater	Prevent downstream changes in quality due to mining activity
Fisheries–Loss of fish and fish habitat	Implement a successful compensation plan
Air Emissions	Achieve or beat target air emissions objectives
Wildlife and habitat	Minimize land disturbance and practice progressive reclamation

9.1.3 Regulatory/ Legal Requirements

Taseko will implement measures to ensure compliance and review reporting performance with relevant environmental legislation and industry standards. Environmental Management Plans will reference and comply with legislation and regulations that will apply to the Project. Applicable legislation and regulations at the time of writing include but are not limited to:

- Federal
  - Canadian *Environmental Assessment Act*
  - Canadian *Environmental Protection Act*
  - *Transportation of Dangerous Goods Act*
  - *Species at Risk Act*
  - *Fisheries Act*
  - *Navigable Waters Protection Act*
- Provincial
  - British Columbia *Environmental Assessment Act*
  - *Environmental Management Act*
  - *Water Act*
  - *Forest and Range Practices Act*
  - *Weed Control Act*
  - *Mines Act*
  - *Wildlife Act*
  - *Fisheries Act*
  - *Heritage Conservation Act*

9.1.4 Environmental Management Team

Essential to the success of any EMS is the clear understanding of the roles, responsibilities, and level of authority that employees and contractors have when working at the mine site.

For the Prosperity Project, it will be Taseko's responsibility to clearly define and communicate roles, responsibilities and authorities for implementing the project's EMS.

This will achieve effective environmental management in line with the environmental policy and permit conditions specified by the regulatory authorities. Taseko will appoint a qualified person to ensure that EMS requirements are established, implemented and maintained, and that performance of the EMS is reported to management for review and action. EMS policies, programs and practices will be integrated into management plans and operational controls wherever practical.

All documentation associated with Prosperity's EMS will clearly state who is responsible for ensuring the requirements defined are fulfilled. Taseko will be responsible for overall management of the mine and will therefore be responsible to establish employment agreements for employees and contractors, to communicate environmental requirements to them, and to conduct periodic reviews of performance against stated requirements.

The following individuals or positions will play key roles in environmental management for the Prosperity Mine. Currently planned division of responsibilities is as follows, with details to be finalized in a Responsibility Procedure as the Project advances.

Vice President, Operations is responsible for ensuring that adequate resources are available to the EMS and that site personnel are fulfilling their responsibilities required to achieve environmental commitments.

Prosperity General Manager is a Taseko employee reporting to the Vice President, Operations, and is responsible for environmental performance as one aspect of his/her overall responsibility for mine operations. The position is responsible for ensuring compliance with environmental requirements and performance of the Prosperity Project during construction and operations. This position is directly responsible for ensuring that operations carried out by Taseko employees and contractors conform to the plans and standards established in the EMS and that they meet regulatory requirements. The General Manager will support and ensure the integration of EMS programs into project operations and is responsible for allocating adequate resources for EMS implementation. This position also reports actual or anticipated non-compliance and non-performance to Taseko corporate and to regulatory agencies in a timely manner.

Operational Department Heads, reporting to the General Manager, will be responsible for effective implementation of the EMS to achieve environmental permit compliance and uphold the commitments of the Environmental Policy. Issues of non-compliance will be reported to the Prosperity General Manager.

An Environmental Coordinator, reporting to the Superintendent of Engineering (an Operational Department Head) will be responsible for monitoring the performance of the EMS and reporting any actual or anticipated non-compliance or non-performance to the respective Department Head. The Coordinator, like every employee at Prosperity, has the authority and responsibility to stop a specific activity if there is an environmental issue. The Environmental Coordinator is directly responsible for ensuring that environmental monitoring is undertaken in compliance with regulatory requirements, and for meeting environmental regulatory reporting requirements, including: reporting under the Mine and Reclamation Permit, Waste Management Permit, and other permits, licenses and approvals. The Environmental Coordinator will work with operational staff to plan and implement progressive reclamation, and to monitor performance of mitigation and management systems. This person will also assess needs and develop plans for contingency measures, if monitoring and surveillance plans indicate this is required. This position will also be responsible for the delivery of environmental site orientation and environmental awareness training to all employees.

Environmental Technicians, reporting to the Environmental Coordinator, will be responsible for environmental field sampling and construction monitoring and for compiling this data into reportable formats

Periodically, there will be a need for consultants and students to provide additional environmental support services.

Direct responsibility and accountability for environmental performance and safety rests with all management and supervisory staff of all departments under the direction of the Department Head. Supervisors are responsible for ensuring that workers are properly instructed to work in an environmentally appropriate manner, and to meet standards associated with their specific jobs. They will be supported in the delivery and documentation of the environmental policy, operational procedures, training materials, inspections, task observations, and auditing by the Environmental Coordinator.

All permanent and contract employees have the responsibility to adhere to the procedures, guidelines, plans, and environmental objectives in their area of responsibility and for immediately reporting any environmental issue to the respective Department Head or to the Environmental Coordinator. All site personnel, whether Taseko employee or contract worker, will be held accountable to work in a safe and environmentally responsible manner. Further to this, all worksite personnel will be expected to work in accordance with all Taseko environmental and safety policies and management systems.

9.1.5 Training and Awareness

Work activities that could create an impact upon the environment will be identified so as to schedule appropriate personnel training. Mechanisms will be put in place to ensure employees, contractors and other agents associated with the Project are aware of any potential environmental impacts of their work activities, and their roles and responsibilities in conforming to the Project's EMS policies.

The Human Resources Department will conduct formal training on the Environmental Emergency Response and Spill Contingency Plan at Prosperity. All newly hired employees, contractors and consultants will be briefed on the plan and all employees are informed periodically on any changes and updates to the plan. These plans will be subjected to periodic testing to ensure that training and awareness of policies and procedures are at an acceptable level and to ensure that the procedures are adequate.

9.1.6 Internal and External Communications Policy

Effective EMS implementation requires good communication between various levels and functions within the company, and between the company and stakeholders. Procedures will be established to maintain suitable internal or external communications channels for situations such as accidents, incidents and emergencies, and for statements of environmental performance. In addition, a process will be developed for:

- communicating internally to employees
- receiving documenting and responding to communication from external interested parties
- communicating significant environmental aspects within the Company and externally

9.1.7 Documentation and Document Control

A combination of procedures and management techniques, such as environmental management plans and monitoring programs, will be used to assist Prosperity in fulfilling its policy requirements and the conditions of regulatory bodies and other stakeholders. Document control procedures will be developed to ensure that documents are readily available and particularly that current versions of relevant documents are available for use by employees. Procedures will be in place to ensure documents can be easily located, periodically reviewed, updated and approved.

9.1.8 Emergency Preparedness

The EMS will assist personnel to identify the potential for uncontrolled situations and to prepare themselves in the advent of their occurrence. Information from the environmental impact assessment process (including specialist studies, stakeholder input, and permitting requirements) will be used to compile a list of significant issues and activities. These issues and activities may require some means of control, such as management plans, physical infrastructure, and monitoring programs. Procedures will be established for responding to actual and potential accidents, incidents and emergency situations with the aim of preventing and mitigating their effects. Emergency preparedness will be tested where practicable, and systems and procedures will be reviewed following each emergency incident.

9.1.9 Monitoring

Specific programs will be developed to monitor the key characteristics of the project's operations and activities that are considered as having potential for a significant effect on the environment. A list of environmental and socioeconomic aspects and associated impacts will also be used as a reference to identify the legal requirements that are applicable to the project. Ongoing compliance with legal requirements will be monitored and, where necessary, reported to relevant parties. Data from monitoring and measurement will be analyzed and compared with performance criteria or predictions, or to determine compliance. Non-compliance investigations will be performed as necessary to ascertain the causes and to provide guidance for the implementation of solutions.

9.1.10 Incidents and Non-conformance Reporting

The Environmental Management Plans will describe methods and responsibilities for how incidents and non-conformances against specified operating criteria are recorded and reported. Corrective and preventive action implementation procedures will be established to guide the mitigation of any resulting environmental effects. Investigations into cause and effect will be conducted as appropriate.

9.1.11 Environmental Audits

The EMS will define the frequency and scope of internal and external audits to verify the company's conformance with specified environmental management requirements and conditions established by regulatory bodies. Audits will also assess the effectiveness of the EMS and identify opportunities for improvement.

9.1.12 Management Review

Prosperity's environmental committee and management team will carry out reviews of the EMS and its programs to ensure they continue to effectively meet the needs at the site. Quarterly reporting to Management is proposed during operations, with a formal annual Management Review.

Where appropriate, changes to EMS policy and systems may be approved by the General Manager, and the outcomes will be recorded and reported as necessary.

9.2 Environmental Management Plans

The EMPs form an integral part of the project, as they provide guidance on all environmental aspects during the construction, operations and decommissioning phases. They convert the proposed environmental assessment mitigation measures into actions that are intended to minimize and, where possible, eliminate environmental impacts associated with the project.

The EMP overviews provided in this section have been developed to provide a description of procedures and records that will be further developed in compliance with both regulatory requirements as well as Prosperity's environmental policy. All plans are presented at the conceptual level as the project has not yet been given approval or obtained permits requiring detailed engineering plans.

The objectives of the EMPs may include but are not limited to the following:

- to identify environmental protection issues for each discipline (e.g. terrain and soils, wildlife) discussed in Volumes 4–7, as they pertain to each phase of the Project
- to identify the environmental protection requirements for mitigating identified environmental risks
- to provide a tool for achieving those requirements in the field, and more generally
- to provide supporting information for environmental permit applications

The EMPs will define the roles of Taseko, contractors, and subcontractors by:

- serving as a reference document for Project personnel when planning and conducting specific environmental management activities and mitigation measures
- establishing the scope of the procedures (to be prepared by Taseko personnel or contractors), including the contractors' specific environmental management responsibilities

Finally, the EMPs will outline communication requirements by:

- specifying a mechanism for communication of revisions to the procedures due to changes in site conditions
- establishing a framework for environmental incident reporting

Appropriate EMPs will be provided to contractors submitting tenders at each phase of the Project. It may be necessary to prepare separate procedures for individual components of the Project, due to activity- and site-specific differences.

See the Summary of Mitigation (Volume 1, Section 14) for a summary of the mitigation measures that will be included in the procedures.

9.2.1 Environmental Management Plan for Construction Phase

An environmental management plan specific to the construction of Prosperity will include, at a minimum, procedures and policies with respect to site access, geotechnical stability, soils salvage, erosion control, vegetation, wildlife, cultural and heritage resources and emergency response. This plan will be prepared prior to the commencement of construction activities, and used to guide employees and contractors through initial development phases of the project. Roles and responsibilities of environmental supervisors for contractors will be the key to each component of this plan to emphasize the need for an on-site training, monitoring and communications.

9.2.1.1 Access

The access component for the construction period will be designed to safely meet the needs of mine employees contractors, local residents, and the general public. The plan will describe the policies and procedures that will control transportation and access to and from the Prosperity mine site, and access restrictions for lands surrounding the property.

9.2.1.2 Geotechnical Stability

Geotechnical stability monitoring for the Construction Phase will focus on construction-related slope stability issues at Project excavation and building sites such as the access road, transmission line, and mine buildings.

Prevention of damage to soil and mass wasting events will be a focus of the geotechnical stability assessments and monitoring. Detailed on-site terrain stability will be assessed as needed to identify unstable areas, particularly slopes greater than 60%. Slopes surrounding the excavation and building sites will be surveyed prior to the start of work and as needed during construction. The survey data will be used to monitor the slope stability. Slope stability problems could necessitate some adjustments to the alignment of the access roads and transmission line, and the final positions of some structures, to ensure that Project components are constructed on stable terrain.

Groundwater and surface water monitoring data may be used to avoid geotechnical events, as high groundwater content and erosion from surface flows can weaken slopes. Strategies will be developed to minimize water-related geotechnical events include surface water diversion, selective work stoppage during heavy rain and snowmelt events (as needed), and protection of banks that could become undercut. It may be necessary to re-grade slopes or reduce the load on upper slopes to reduce the risk of mass wasting. Banks and slopes affected by construction will be stabilized, restored and re-vegetated as needed to increase their stability and minimize the rates of surface water runoff or ground-water infiltration.

9.2.1.3 Soil Salvage

- A variety of best management practices will be employed to ensure that soils are handled and stored properly during all phases of the mine development project (see Volume 3, Section 9.2). Soil salvage protocols specific to the construction areas will be developed, including measures to control erosion and to minimize soil compaction. The plan will detail how stockpiles will be designed to prevent anaerobic conditions and where they will be located to protect them from further disturbance or contamination.

Non-mined Materials Handling

Non-mined materials during the Construction Phase will include:

- building materials
- fuel and maintenance materials for mobile equipment
- spoil/cut and fill/rock
- timber
- organic and mineral soils
- construction debris
- concrete produced on site at a concrete batch plant
- pavement

Procedures will be developed that outline how these materials will be produced, transported, used, stored, and disposed of in order to prevent or minimize their environmental effects during construction.

9.2.1.4 Emergency Response

The Emergency Response Plan for the Construction Phase will include detailed protocols on preparedness, prevention, response, and contingency plans to address:

- health and safety requirements
- information on hazardous product found on site
- practice drill procedures
- preventative measures (e.g. re-fuelling protocols)
- initial notification procedures
- personnel responsibilities and contact information
- response protocols for initial response, control, containment, and clean-up
- procedures for incident reporting and assessment

In addition, the Emergency Response Plan will be developed for the potential construction-related accidents and malfunctions discussed in Volume 9. All Project employees and contractors will receive training on appropriate emergency response procedures.

9.2.1.5 Air Quality and Noise Management

Land clearing and burning for construction is the primary sources of criteria air contaminants (CAC) emissions (mainly particulates) while mine equipment is the primary source of greenhouse gases (GHGs). Procedures will be developed to ensure contractors use the Best Available Technology Economical Available (BATEA) and Best Management Practices to minimize both of these emissions, such as contractors minimizing burning and prioritizing revegetation (for carbon sequestration) in temporarily disturbed areas.

Several components of the Project will produce noise that could disturb the acoustic environment. Policies may be developed to minimize the effects of noise and artificial light on nearby communities, such as contractors by restricting construction activities to daytime hours (07:00 to 21:00) wherever possible in areas identified as noise and light sensitive, and by regularly inspecting and maintaining construction equipment to ensure that high quality mufflers are installed.

9.2.1.6 Erosion and Sediment Control

The erosion and sediment control procedures specific for the Construction Phase which may include, but not be limited to, the following:

- use of sediment and erosion control prevention techniques, material and equipment
- control strategies for on-site water, and off-site water as it pertains to the construction area, for each mine feature including diversion ditch designs and sediment control ponds
- sediment and erosion control procedures around fish-bearing waters during installation of any proposed clear-span bridges
- delineation of potential erosion control areas of concern
- restoration of erosion control areas of concern
- contingency plans for stream loading and sediment control
- monitoring and surveillance program

All necessary sediment and erosion control mitigation measures will be in place and operational prior to construction.

9.2.1.7 Vegetation Management

Activity specific measures will be developed for contractors to minimize damage to vegetation at each of the Project components, but several general measures include:

- minimize vegetation loss (including rare plants and ecosystems of conservation concern) through environmentally sensitive Project design
- implement best management practices including the creation of buffer zones around wetland habitats, maintaining connectivity among wetlands within wetland complexes, and restricting employee and contractor access to wetlands outside of construction or work areas
- where possible, minimize the extent of grubbing, stripping and the removal of shrubs and herbaceous species, and retain the humus layer and vegetation root mat
- re-establish vegetation on disturbed areas as soon as reasonably possible
- ensure water flow around work site is not interrupted
- wherever possible, schedule any construction to occur in sensitive wetland and riparian areas to occur when potential impacts are minimized
- remove any green felled or windthrown spruce from the site as required in consultation with MOFR, to avoid build up of spruce bark beetle populations; leave

any mountain pine beetle "green attack" trees from the site except under MOFR direction

- encourage slope stability and minimize soil quality degradation through grass seeding and slope revegetation

The invasive plant management plan (Volume 5, Section 5, Appendix 5-5-K) outlines procedures to be followed during all phases of mining, some of which are specific for contractors that will be arriving with equipment.

Wetland and riparian ecosystems will be monitored during construction of the mine access road and any access roads used to support construction or maintenance of the transmission line corridor.

9.2.1.8 Wildlife Management

Wildlife control measures and environmental protection procedures will be put in place to minimize risks to wildlife and humans during the construction phase. Controls and procedures to be developed prior to the initiation of work on the site may include:

- education for drivers to minimize the risk of collisions with wildlife
- work windows, when planning proposed work methods, activities, and schedule, in order to protect listed populations and/or individuals and their habitat
- development of a problem wildlife prevention and response plan, and initiate Bear Aware and Safety training
- controls for helicopter over-flights to minimize acoustic disturbance during the big horn sheep lambing period

Specific to the construction of the transmission line, procedures developed for bird protection may include:

- evaluation and selection of the most appropriate bird markers
- incorporation of trees and shrubs into the route design where feasible, to provide natural obstacles for birds to navigate, directing their flight over lines
- identification of high collision risk areas
- confirmation that conductor/line spacing is large enough to greatly minimize or eliminate electrocution risk
- evaluation and selection of perch deterrents (e.g., "bird spikes") for the poles

9.2.1.9 Fisheries Management

A Fisheries Compensation Plan, to be implemented during the construction phase, is presented in Volume 3, Section 8.

9.2.1.10 Cultural and Heritage Protection

The Cultural and Heritage Protection Plan for the Project will apply during the construction phase. The Plan will describe methods for the protection of heritage and archaeological sites through avoidance where possible, procedures for mitigation and recovery where avoidance is not feasible, and procedures for any newly discovered archaeological sites to ensure work is halted and sites are appropriately managed.

9.2.1.11 Occupational Health and Safety Plan

Occupational Health and Safety Plans will be provided to Taseko for approval by contractors responsible for construction, as required by Worksafe BC.

9.2.1.12 Transmission Corridor Management Plan

In order to address First Nations, landowner and public concerns regarding increased access, archaeological and cultural resources, and potential water and wildlife impacts, policies and procedures will be developed specific to transmission corridor construction, maintenance and decommissioning.

As part of the permitting and consultation, Taseko will work with Ministry of Forests and Range, First Nations and Ministry of Environment to assist with the development of a public access plan while protecting wildlife and heritage values. In addition, Taseko will work with the landowners and the grazing tenure holders to develop schedules and policies that protect the natural grasslands and minimize disturbance to grazing systems during construction.

Sensitive Areas Preservation

Certain areas on-site and along the right-of-way may be designated environmentally sensitive. These areas include but are not limited to areas classified as:

- erodible
- ecological
- scenic
- historical and archaeological
- cultural
- fish and wildlife refuges

Finalizing the centerline for the corridor will take into consideration all available information so as to avoid sensitive areas where possible. During construction, contracting crews will take all necessary actions to avoid adverse impacts to these sensitive areas and their adjacent buffer zones. These actions may include:

- suspension of work or change of operations during periods of sensitive times during the construction period

As described in Volume 3, Section 9.2.13, Cultural and Heritage Protection Plan, if prehistoric or historic artifacts or features are encountered during clearing or construction operations, Taseko and its contractors will halt work and the operations will immediately cease for at least 30 m in each direction, and construction superintendent will be notified. The site will be left as found until a significance determination is made. Work may continue elsewhere beyond the 30 m perimeter if that work does not affect the potential site.

Water Crossings and Water Quality

Contractor construction activities will be performed by methods that will prevent entrance or accidental spillage of contaminants, debris, and other pollutants into streams, dry watercourses, lakes, and ponds. The clearing contractor will erect and use best management practices such as silt fences on steep slopes and next to any stream, wetland, or other waterbody. Additional best management practices may be required for areas of disturbance created by construction activities. Appropriate permits from the Ministry of Environment for works in and about streams, and from Ministry of Forests and Range will be obtained as required. In addition, there will be compliance with all the criteria and guidance contained in the Department of Fisheries and Oceans applicable Operational statements and the Ministry of Environment's "*A Users Guide to Working In and Around Water*". Each crossing will be planned and the appropriate approval or notification under the Water Act will be submitted before work begins. Every attempt will be made to schedule these stream-crossing changes during the least risk window. Any Habitat Alteration Disturbance or Destruction (HADD) will be submitted to Department of Fisheries for authorization.

Vegetation Management

The management of the power line right-of-way for vegetation control will closely follow the BC Hydro guidelines. The first activity on the right-of-way will be to clear the standing timber. The vegetation management objective will be to eliminate all tall-growing tree species from the corridor, and to remove any hazard or problem trees that are outside the corridor before construction gets underway. Tree removal will be undertaken to a maximum width of 80 m. Merchantable wood will be separated and piled in sorting areas to be transported. The remaining brush from the timber will be either windrowed and crushed at the sides of the right-of-way or burned at the appropriate time and under fire regulation permit. Where appropriate, brush piles may be utilized to limit future ATV access. To further limit access, low-growing species will be left intact.

Wildlife Management

Wildlife impacts from the power line right-of-way can be mitigated through controlling vegetation. Because the right-of-way has to be cleared of tall and fast growing vegetation, it is in a continual state of succession. In consultation with First Nations, Ministry of Forests and Range, and Ministry of Environment, Taseko will develop best management practices for the maintenance of the vegetation that will provide appropriate wildlife habitat while minimizing public access, and maintaining a safe and reliable transmission facility.

Archaeological and Cultural Heritage Resources Sites

Once the centerline for the transmission corridor is confirmed, archaeological investigations on areas proposed for disturbance will be conducted on the priority areas under the guidance of a professional archaeologist and appropriately permitted will be initiated.

9.2.2 Transportation and Access Management Plan

9.2.2.1 Introduction

The Transportation and Access Management Plan for the Prosperity Mine will be developed to safety meet the needs of mine employees and contractors, local residents, and the general public. The plan will describe policies and procedures addressing all transportation and access issues within Taseko's control on and around the Prosperity mine site, including:

- access to and from the Prosperity mine site
- areas the property boundaries
- adjacent Crown lands accessed from the property

Procedures will also be included for road maintenance requirements and monitoring. Within the mine site, roads will be developed in accordance with the Health, Safety and Reclamation Code for Mines in British Columbia (2003) and become an integral component of the Mine Plan and the Health and Safety Plan for the Prosperity Mine.

9.2.2.2 Access To and From Site

The mine site will be accessed by a gravel road from Highway 20 west of Williams Lake. The road will provide year round access for the delivery of supplies, products and personnel, and the transportation of concentrate from the mine site.

On Highway 20, the allowable axel load of all delivery trucks is restricted to 70% from mid-March to mid-May due to the spring thaw and high volume of precipitation. During this period the service schedule of the delivery and concentrate trucks will be changed to ensure the uninterrupted operation of the plant.

The existing road between Highway 20 and the plant site is approximately 91.4 km long and is designated as the Taseko Lake Road, the 4500 Forest Service Road (formerly Riverside Road) and Prosperity Plant Access Road. The Taseko Lake Road, approximately 68.4 km long crosses two rivers and both bridges are full axle load rated. The following 19.4 km along the 4500 Road will be upgraded to a single lane with pull outs spaced at 2 km intervals. The last section, the approximately 2.8 km long Prosperity Plant Access Road will be new road construction, single lane with pull outs.

Trucks hauling concentrate from the Prosperity mine site will use Provincial Highway No. 97 from Williams Lake, traveling 54 km along the existing 2 lane, paved road to the Gibraltar Mine Concentrate Load-out Facility near Macalister.

Transportation policies to the mine site will apply to personnel, materials, and supplies. Transportation policies from the mine site will apply concentrates and wastes. The policies that will be developed apply to private roads associated with the project and include the expectation that employees, contractors and suppliers will comply with the policies on public transportation corridors and roadways. Each segment of the access corridor (Highways 97 and 20, the Taseko Lake and 4500 Road) may each require specific procedures that will be addressed in the plan.

In order to minimize traffic, workers will be bussed to and from the mine site from strategic locations such as Williams Lake. Workers will be staying at a camp facility during the days they are working.

All mine vehicles, including concentrate trucks and busses, will be restricted to traveling at posted speed limits or as appropriate for road conditions. Following designated speed limits will prevent excessive amounts of dust from passing vehicles.

9.2.2.3 Mine Site Access Restrictions

Access to the project site will be restricted to employees, contractors, regulators and guests. Access control protocols will be developed and implemented to ensure employee and contractor safety and to minimize social and environmental effects related to the project. Employees will be informed of these access control protocols at the time of hire.

Extensive security fencing is not considered necessary for the project site. The areas which will require fencing are:

- plant site entrance gatehouse on the Prosperity site access road
- start of the road to the explosive magazine area extending 50 m on either side of the road
- wildlife fence around lined process water pond and substation

The entrance gatehouse will be manned by security personnel 24 hours per day, 365 days per year.

9.2.2.4 Mine Site Traffic

Major haul roads for large equipment will be required from the open pit to the crusher, stockpiles, overburden spoil piles, waste dumps and the tailings management facility for construction and waste disposal. A number of smaller ancillary roads will be required to access miscellaneous infrastructure facilities such as site power distribution, overland conveyor access, headwater channel, on-site fish compensation facilities, and explosives magazines.

The Transportation and Access Plan will outline the procedures for assigning project transportation routes, speed limits and access limits. The reduction in nonessential use of the project roadways will minimize the disturbance to the environment by reducing noise, dust, animal–vehicle interactions, and spill probability. Policies may include:

- restricted access of private vehicles to the project site, which will mitigate an increase in traffic on the internal roadway system
- onsite transport will also be restricted to authorized drivers with vehicles equipped for onsite use
- vehicle speed limits will be posted throughout the project

The mine owned and leased equipment fleet will be kept in sound mechanical condition through regular scheduled maintenance by experienced mechanics. Engine and exhaust systems will be operated at manufacturer’s specifications to minimize exhaust gases. All contractors will be required to maintain their vehicles per factory specifications.

9.2.2.5 Access from Mine Site to Adjacent Crown Lands

Employees staying onsite during their rotation will restrict their off hour activities to the Prosperity mine site, access roads and pre-defined recreational areas that will be determined before construction begins.

9.2.2.6 Transmission Corridor

The transmission corridor passes through Crown forest land administered by the Ministry of Forests and Range which have other users or permit holders, including grazing tenures. The Ministry will set the criteria for occupancy and the procedures for maintenance. In addition, the corridor passes through private lots and agricultural land in the vicinity of the Fraser River.

There may be issues around the potential for increased access resulting in disturbance of cultural sites, wildlife and wildlife habitat. As part of the permitting and consultation, Taseko will work with Ministry of Forests and Range, First Nations and Ministry of Environment as the Ministries develop a public access plan to protect wildlife and heritage values. In addition, Taseko will work with the landowners and the grazing tenure holders to develop procedures that can be implemented during construction and maintenance of the corridor that help restrict ATV access.

9.2.2.7 Road Maintenance

For the private roads that Taseko is responsible for, road maintenance procedures will be developed. Regular maintenance is expected to include but not be limited to:

- gravelling, grading and sub-grade repairs
- dust treatment as required from time to time (water sprays)
- removal of fallen trees, rocks and debris
- maintenance of safety berms
- winter snow removal and application of traction aggregate
- maintenance of signage
- ensuring ditches, culverts and settling ponds operate effectively

The least amount of clearing or brushing of vegetation required to safely permit the road sight lines to be maintained will be done. Despite this objective, lines of sight along the access road will need to be maintained to ensure adequate forward vision for the posted speed limit.

9.2.2.8 Protection of Wildlife

The protection of wildlife will be an important consideration during road development and use. Proper road use procedures will be developed as part of Taseko's safety and environmental orientation programs with the objective of minimizing impacts on wildlife. Policies that will be considered include:

- no Taseko employee or contractor employee will be permitted to have firearms on site
- no Taseko employee or contractor will be permitted to hunt or sport fish while on their rotation at the mine site
- Project-related wildlife vehicle collisions or near misses will be recorded and reviewed regularly to identify problem areas. If necessary, appropriate measures will be implemented (e.g., warning signs) to avoid future problems

9.2.2.9 Dust, Emissions and Noise Management

Dust will be of most concern on unpaved roads between the mine and Hanceville. If dust related to equipment, truck and bus traffic compromises private and/or public road safety, mitigative measures to control dust will include but not be limited to:

- the enforcement of speed limits
- road watering, or using a dust suppressant
- upgrading the road-surfacing materials by adding a gravel base

Taseko will cooperate with the Ministry of Transport with respect to controlling dust and safety issues for the portion of the road that is a public highway.

Air emissions from vehicles will be mitigated by but not be limited to:

- regular maintenance of all mobile equipment
- not allowing vehicles to idle, except when necessary
- imposing speed limits

To manage noise, vehicles and equipment will be equipped with silencers and noise suppression systems where possible.

9.2.2.10 Implementation and Monitoring

To implement the Transportation and Access Management Plan, safety and security personnel will be appointed by Taseko before construction. The safety and security personnel will ensure contractors and employees are given proper orientation.

Taseko will liaise with logging companies on their activities and methods to prevent accidents. These may include monitoring of radio frequencies, travel restrictions, and turn-off checks.

All vehicles entering and leaving the site will be monitored by security staff posted at the security gate at the entrance to the mine site. Security will make sure that vehicles entering the mine site are equipped with required safety devices such as buggy whips. Security will also maintain current copies of transporter licenses, insurance, permits whenever possible.

The Transportation and Access Management Plan will be developed by Taseko and its contractors and maintained over the life of the Prosperity Project. Taseko will work closely with the Ministry of Forests and Range and the Ministry of Transportation to develop the plan for compliance with the applicable regulations. The plan will address environmental conditions, measures, and mitigation processes defined in the Project's EA. New items identified through the Project's approval process and information collected during the Project's follow-up program will be addressed as well.

9.2.2.11 Closure

At mine closure, all roads within the mine site, including haul roads, will be reclaimed using the following methods:

- road surfaces will be ripped or otherwise treated to decompact soils within the running surfaces

- culverts will be removed, with creek crossings and cross-ditches established in accordance with the post-mine water management system
- on sidehills, sidecast material will be pulled back to the extent practicable to establish grades that complement the reclaimed landscape
- prepared surfaces will be capped with salvaged soils from adjacent windrows
- roads will be revegetated in accordance with concepts presented in Reclamation and Decommissioning Plan to meet reclamation goals of appropriate end land use objectives, erosion prevention and weed control

If any road access is required within the mine project areas after closure, these roads will be left in semi-permanent deactivated condition. Semi-permanent deactivation will allow the road to remain in place and be useable, but also environmentally stable. Semi-permanent deactivation measures which will be carried out to include removal of culverts and replacement with cross-ditches; installation of ditch blocks at cross ditch locations; installation of waterbars across the road to direct road surface water off the road; removal or breaching of windrows along the road edge; outsloping/insloping of the road surface as appropriate; and revegetation of exposed soil surfaces for erosion and weed establishment control.

9.2.3 Mine Materials Handling Plan

9.2.3.1 Materials description and volumes

Mined waste materials at Prosperity consist of overburden, waste rock and tailings. The disposal of these materials will carried out in accordance to their PAG and non-PAG properties. PAG materials will be disposed of within the TSF to be submerged below water and non-PAG materials will be used for construction of the tailings embankments or placed on the waste rock dump downstream of the main tailings dam. Characterization and segregation of PAG/non-PAG is described in Volume 3, Section 7. A summary of the materials mined and tonnages are illustrated in Table 9-2.

Table 9-2 Mined Materials and Tonnages

Material Classification	Kilotonnes	Kilotonnes
Cumulative low grade		87,000
Cumulative PAG waste and overburden		237,000
Cumulative non-PAG overburden		60,000
Cumulative non-PAG waste		102,000
Direct pit to mill feed		400,000
Construction borrow material overburden and rock	6,600	
Total	**6,600**	**886,000**

9.2.3.2 Acid Rock Drainage Prediction

Analytical methods include routine procedures for on-site testing for waste management, off-site confirmatory analyses and non-routine procedures. The following procedures will form part of the routine analyses:

- rinse pH (Price 1997)

- sulphur as sulphide determined by Leco furnace on a rock initially leached with hydrochloric acid to remove sulphate (MEND 1991)
- modified neutralization potential (MEND 1991)
- net acid generation (NAG) test (MEND 1991)

Potential for ARD would generally be determined by the measurement of (NP-10)/AP. Paste and rinse pH are used to classify the immediate potential of rock and overburden to release metals. For rock samples, a paste pH criterion of 6 is used. If the paste pH is above this level, it is very likely that the rock contains no acidity at the time of testing and that immediate metal leaching will not be significant.

For oxidized overburden materials, rinse pH is used. For these materials, a classification criterion of seven has been used to separate materials based on copper leaching potential. Any oxidized overburden with rinse pH<7 or with (NP-10)/AP<3 will be disposed in the PAG waste rock storage facility.

9.2.3.3 Mined Waste Material Delineation and Segregation

Delineation and segregation of PAG and non-PAG waste rock types will be a central requirement for waste management at the Prosperity Project. The potential for ARD would generally be determined by the measurement of (NP-10)/AP. Actual permit conditions will specify the operational criterion. This criterion will apply to the bulk of the waste rock and will be used to segregate rock for subaqueous disposal in the PAG waste rock storage facility and sub aerial disposal in the non-PAG waste rock storage facility.

The methods used to segregate waste types will essentially be the same as those used at open pits throughout the world for segregation of ore and waste. The Prosperity Project will use state of the art vehicle information technology that has been proven for more than 20 years at different mine sites worldwide. This technology uses a combination of radio control systems, high precision GPS (Global Position Systems) with both linked to a central computer in the Mine Engineering office. Accurate and timely information transfer will permit mine operators to make confident decisions by monitoring, controlling and managing mining equipment in real-time.

While ore dilution is an accepted practice with open pit mining, mixing of PAG with non-PAG waste will be minimized. In blasts with both PAG and non-PAG material, conservative dig limits will be established to ensure that PAG material is not migrating into the non-PAG material. Monitoring at disposal locations will be used to ensure that wastes are appropriately dumped.

Table 9-3 provides an overall summary of four main disposal or management facilities and the types of material destined for each facility. All materials in this table are below ore grade.

In addition to the facilities indicated in Table 9-3, a temporary low grade ore storage facility will be developed during the initial pit development using material with lower gold and copper grades. The ore will be used as supplemental feed during operations with the balance processed at the end of pit development. In the event of a premature closure, a strategy for managing or processing the stockpile will be developed depending on the volume of ore present, economics at the time, and environmental risk.

Table 9-3 Summary of Waste Management Facilities, Source Materials and Criteria Used for Classification

Facility	Material	Criteria
Tailings storage facility	PAG waste rock	(NP-10)/AP <2
	Overburden	(NP-10)/AP<3 or rinse pH<7
	Tertiary basalt	Sulphide sulphur >0.1%
	Tailings	All
Main tailing embankment and non-PAG waste rock storage facility	Non-PAG waste rock	(NP-10)/AP >2
	Overburden (as required for embankment construction)	(NP-10)/AP>3 and rinse pH>7
West embankment	Overburden	(NP-10)/AP>3 or rinse pH>7
	Tertiary basalt	Sulphide sulphur <0.1%
Overburden stockpile	Overburden	(NP-10)/AP>3 and rinse pH>7

9.2.3.4 ARD/ ML and Prevention

Overburden consists of transported unconsolidated surficial materials such as glacio-fluvial deposits and glacial till. Tertiary basalt is also included in this category due to its stratigraphic position and its geochemically unique characteristic in comparison to the deposit host rocks. Overburden may be used for construction purposes or stockpiled for future reclamation. A portion of the overburden (Unit FANL—limonitic conglomerate) is expected to be acid generating and will be managed as per PAG rock management procedures. Placement of acidic overburden in the TSF may affect the water quality of the impoundment during operations. This effect may be reduced by adding lime directly to the impoundment as part of the mill process or by adding lime to the overburden before disposal. If lime is to be added directly to overburden material, the required lime dosage will need to be determined by shake flask extractions or other testing to measure acidity.

Mined waste rock will be the major geological waste product. The waste rock will be segregated during mining based primarily on potential to produce ARD. Waste rock defined as PAG will be placed in the tailing impoundment to achieve permanent underwater disposal. Waste rock classified as non-PAG will be placed in the non-PAG storage facility or used in construction of the tailings embankments. The potential for ARD would generally be determined by the measurement of NP/AP. Waste rock with a NP/AP ratio greater than two will be placed on the main tailing embankment or on the non-PAG waste rock storage facility. Those materials with a NP/AP less than two will be placed within the TSF and eventually flooded to mitigate ARD.

A single tailings product will be discharged to the TSF and will form a shallow tailings beach containing relatively coarse tailings and a pond area containing process water and relatively finer grained tailings. Any seepage water that exits the TSF through the Main and West embankments during operations will be collected in the WCP. Additional outflow from the TSF will be via surface discharge through a spillway in the Main Embankment starting during the closure period.

Existing data show that tailings will be non-PAG, based on testing from tailings produced from ore samples collected across the deposit. Seepage chemistry is expected to be dominated by calcium and sulphate, with an increase in copper, manganese, and fluoride concentrations and low concentrations of other trace elements. Performance of tailings disposal will be assessed through monitoring of tailings solids, of seepage water down gradient of both the Main Embankment and the West Embankment, and of tailings pond supernatant. A periodic composite of the quarterly tailing sand samples will be submitted for mineralogical analysis using optical and XRD methods.

9.2.3.5 Contingency Stockpile Locations for PAG Rock

The PAG waste rock disposal facilities for the Prosperity Project could be located within the basin of the tailings storage facility. In the event that access to the tailings impoundment for placement of PAG waste rock was interrupted then a contingency stockpile would have to be located on the east abutment of the main tailing dam. Every effort should be made to direct place the PAG waste in the tailing impoundment to save the cost of double handling.

9.2.3.6 Soil Stockpiles

Approximately six soil stockpiles will be located around the Prosperity Property to be used for reclamation when the property is decommissioned. The west stockpile located immediately south of the open pit will be used to reclaim the roads around the pit, the non-PAG waste dumps and the bulk waste rock fill which forms the main impoundment dam. A northeast stockpile is located in between the open pit and the plantsite which will be used to reclaim roads on the east side of the open pit and the plantsite to the south east. The other four soil stockpiles are strategically located around the tailing pond and will be used to reclaim parts of the main embankment, the west embankment and exposed beaches around the periphery at closure.

9.2.3.7 Tailings Impoundment Waste Management Plan

The tailings impoundment will be formed in the basin shaped meadows south of the open pit with the Main Embankment being built immediately south of Fish Lake, the West Embankment on the west side tied in with the Main Embankment and the South Embankment that forms the divide between the tailing pond and Prosperity Lake. The Main Embankment and the West Embankment will be raised in stages through the life of the project. The South Embankment, a smaller structure, will be constructed during the first few years of construction

The discharge of tailings from the delivery pipelines into the TSF will be from a series of large diameter valved off takes located along the Main and West Embankments. Tailings discharge will begin along the Main Embankment, and will be extended along the West Embankment starting in Year 4 of operations. The coarse fraction of the tailings are expected to settle rapidly and will accumulate closer to the discharge points, forming a gentle beach with a slope of about 1%. Finer tailings particles will travel further and settle at a flatter slope adjacent to and beneath the supernatant pond. The beaches will be developed with the intent to maximize storage volume and to control the location of the supernatant pond.

The PAG waste storage area will be developed within the impoundment along the east side of the valley and will be offset a minimum of 500 m from the Main Embankment, in order to allow development of tailings beaches. This zone of tailings beach will provide a low permeability transition zone between the coarse, permeable PAG waste rock and the tailings embankments, and will function as a seepage control measure.

Potentially PAG waste will be hauled to the TSF for co-disposal with tailings and submergence by the tailings and supernatant pond. The PAG waste storage area has been designed in step with the mine production schedule. It will be developed at the same or similar rate of rise as the tailings but will be several meters higher to provide a dry, stable placement surface. The ongoing maximum elevation of the PAG waste rock and overburden may be maintained at an elevation above the natural flood level of the supernatant pond. At closure, the PAG waste rock and overburden will be submerged below tailings and pond water. Based on the present mining schedule, a minimum of three years of tailings deposition will occur after final placement of PAG materials. In the case of premature closure, a portion of the PAG waste materials will need to be excavated to an elevation below the natural flood elevation. They will therefore be maintained in a saturated state in perpetuity.

A conceptual Tailings Impoundment Operating Plan is provided in the following section.

9.2.4 Tailings Impoundment Operating Plan

The following section provides a conceptual tailings operating and management plan for the proposed Prosperity Project. The plan will be refined as design details develop at the permitting stage.

9.2.4.1 Dam Design and Raising Schedule

The tailings impoundment will be formed in a shallow valley, with containment provided by three dams, the Main Embankment, the West Embankment and South Embankment Dam. The main Embankment and West embankment will be raised in stages through the life of the project. The Southern, a minor structure, will be constructed in several stages during the initial years of development

All three dams will have a central core of compacted glacial till fill of low hydraulic conductivity. The till core of each dam will be keyed into the native till that blankets most of the impoundment area and hence forms a natural "liner" that will serve to limit the rate of seepage loss from the impoundment.

The Main Embankment will be expanded in stages across the Fish Creek Valley and the West Embankment will be constructed along the western ridge which separates the Fish Creek drainage basin from the Big Onion Lake drainage basin. The embankments will be developed in stages throughout the life of the project using low permeability glacial till, overburden and non-reactive overburden and waste rock materials from stripping operations at the Open Pit. The Main Embankment will be constructed as a water-retaining dam during the initial years of construction. Once the tailings beaches have been established, the Main Embankment will be constructed as a free draining downstream structure. This transition is scheduled for Year 3 (embankment Stage IV). The West Embankment will be constructed as a fully water-retaining dam and expanded using the centreline method of construction.

The Southern Embankment (Prosperity Lake) will have a central core of compacted glacial till, with upstream and downstream shells of granular fill and appropriate filter zones. The Southern Embankment will be constructed and operated as a water-retaining dam. Closure will include riprap zones on the upstream face of the dam for erosion protection. The Southern Embankment will form the divide between Prosperity Lake and the tailing impoundment.

Embankment Development

The embankments will be developed in stages throughout the life of the project using low permeability glacial till, overburden and non-reactive waste rock materials from stripping operations at the open pit. The Main Embankment will be expanded in stages across the Fish Creek Valley, and the West Embankment will be constructed along the western ridge which separates the Fish Creek drainage basin from the Big Onion Lake drainage basin.

The Main Embankment will be constructed as a water-retaining structure during the initial years of operations until tailings beaches are well established. Once the tailings beaches have been suitably developed, the Main Embankment will be raised as a free draining dam structure that utilizes a downstream construction method with a filter and a transition zone supported by the downstream shell zone. This transition is scheduled for Year 3. The filter and transition zones prevent downstream migration of the tailings while the tailings, which have a relatively low permeability, provide confinement of the supernatant pond. Since the filter and transition zones incorporate non-cohesive materials, the downstream shell zone can settle without affecting the functionality of the facility.

The West Embankment will be constructed as a water-retaining dam utilizing the centreline method of construction. The Southern Embankment construction will be built during the first several years so that sufficient water is in place to accommodate fish removed from Fish Lake.

Beach Development

The discharge of tailings from the delivery pipelines into the TSF will be from a series of large diameter valved off-takes located along the Main and West Embankments. Tailings discharge will begin along the Main Embankment, and will be extended along the West Embankment starting in Year 4 of operations.

The coarse fraction of the tailings are expected to settle rapidly and will accumulate closer to the discharge points, forming a gentle beach with a slope of about 1%. Finer tailings particles will travel further and settle at a flatter slope adjacent to and beneath the supernatant pond. The beaches will be developed with the intent to maximize storage volume and to control the location of the supernatant pond. Selective tailings deposition will be used to maintain the supernatant pond away from the embankments, in order to reduce seepage and to ensure that reclaimed water is clear and accessible for reuse in the milling process.

Potentially Acid Generating Waste Storage Area Development

The PAG waste storage area will be developed within the impoundment along the east side of the valley and will be offset a minimum of 500 m from the Main Embankment, in order to allow development of tailings beaches. This zone of tailings beach will provide a low permeability transition zone between the coarse, permeable reactive waste rock and the tailings embankments, and will function as a seepage control measure

Potentially reactive waste will be hauled to the TSF for co-disposal with tailings and submergence by the tailings and supernatant pond. The PAG waste storage area has been designed in step with the mine production schedule. It will be developed at the same or similar rate of rise as the tailings but will be several meters higher to provide a dry, stable placement surface. The ongoing maximum elevation of the PAG waste rock and overburden may be maintained at an elevation above the natural flood level of the supernatant pond. At closure, the PAG waste rock and overburden will be submerged below tailings and pond water. Based on the present mining schedule, a minimum of three years of tailings deposition will occur after final placement of reactive materials. In the case of premature closure, a portion of the PAG waste materials will need to be excavated to an elevation below the natural flood elevation. They will therefore be maintained in a saturated state in perpetuity.

9.2.4.2 Seepage

Seepage Reduction

Special design provisions to minimize seepage losses include the development of extensive tailings beaches (which isolate the Supernatant Pond from the embankments), toe drains at the West Embankment to reduce seepage gradients, and contingency measures for groundwater recovery and recycle. The South embankment has water ponded on either side of the dam and should have no transfer of water.

The principal objectives of the design for the TSF are to ensure protection of the regional groundwater and surface waters both during operations and in the long-term (post-closure), and to achieve effective reclamation at mine closure. The feasibility design of the TSF has taken into account the following requirements:

- The dam designs will include a core of compacted, low hydraulic conductivity glacial till to limit seepage through the dam where appropriate.
- The core zones for each dam will be tied into the native foundation till blanket; effectively cutting off seepage flows through the high hydraulic conductivity sands and gravels comprising the upper aquifer.
- The tailings discharged into the impoundment will, once the impoundment is well developed beyond the first few years of operation, serve to limit the rate of seepage through the foundation soils. This will be of particular benefit in any areas where the natural glacial till blanket is discontinuous and there is direct communication between the upper and lower aquifers.
- Diversion of clean surface runoff water to the north towards Fish Creek or to the south towards Wasp Lake and Beece Creek from upstream of the TSF, Open Pit, mill site, and Waste Storage Area during operations via a headwater channel.
- The inclusion of monitoring features for all aspects of the facility to ensure performance goals are achieved and design criteria and assumptions are met.
- Limit seepage during operations, particularly in the early years prior to effective blanketing of the basin with tailings solids, from the tailings impoundment to the downstream receiving environments.

Seepage Control Measures and Monitoring

Seepage through the Main Embankment will naturally drain into the Waste Storage Area downstream of the embankment and then into the Open Pit or the WCP. Groundwater monitoring may be installed in the downstream area as part of the monitoring program and may be converted to recovery wells to also evaluate seepage rates in the foundation and to recover any foundation seepage.

The Open Pit will function as an ideal seepage collection point by intercepting any seepage that may otherwise migrate down gradient to lower Fish Creek. The Water Collection Pond will collect not only seepage but also surface runoff from the facilities lying within the contributing drainage catchment. The water collected in either the Open Pit or the WCP will be returned to the Process Water Pond for use in the milling circuit.

The West Embankment will be constructed with toe drains to collect seepage through the embankment. Seepage collected in the embankment drainage systems will be transferred to one of two Seepage Collection Ponds (SCP) located at topographic low points at the downstream toe. Also, seepage collection ditches constructed along the toe of the West Embankment will be used to collect seepage and surface runoff and direct the flow to the Seepage Collection Ponds, from where it will be pumped back to the TSF.

The Seepage Collection Ponds will be constructed with a compacted glacial till (low permeability) liner. Both of the ponds will be designed to provide for two days of storage from seepage and surface runoff for the 1 in 10 year, 24-hour storm event (including a 1 m freeboard allowance). The pumpback system will be designed for year round operation and will comprise a submersible pump with one standby.

HDPE pipelines laid along the downstream face and across the crest of the embankment will convey water from the SCP into the TSF.

Groundwater will be monitored in wells situated downstream of the Main Embankment and between the West Embankment and the Taseko River. If deemed necessary, as part of the mitigation measures to be listed in the EA document, groundwater recovery wells may be installed in the same locations, with water being pumped to the TSF.

On-going water quality monitoring will be used to assess the effectiveness of the seepage collection system. In the unlikely event that the seepage collection system is found to not effectively recover seepage, it will be necessary to install additional seepage control provisions. The efficiency of the primary seepage recovery system may be improved with an additional interception ditch and pumpback system at the base of the West Ridge. Although current information and seepage analyses do not suggest that a secondary system will be required, its inclusion will be assessed further as the project progresses.

Seepage Water Quality

Pore water within tailings retains some dissolved and suspended solids. These products are mobilized by seepage passing through the tailings toward the dams. As a result of this mobilization, the seepage water will tend to have slightly different chemistry than the water in the tailings pond.

The quality of this water has been predicted based on experience at other mines and from humidity cells. During operation, a percentage of this seepage is collected at seepage collection dams and returned to the tailings pond. Some of the seepage may escape seepage collection reporting to the underlying aquifer. This volume is generally very low.

As the open pit is developed deeper the ground water draw down cone will force ground water to drain to the pit.

At closure, seepage pump back will no longer be in operation, therefore all seepage from Main and West Embankment will drain towards the open pit.

9.2.4.3 Water Management and Sediment Control

The main components of the water management plan during the early stage of development include the following:

- Fish Lake will be pumped down approximately 3 m prior to construction of the Stage Ia embankment.
- Downstream of the Main Embankment a sump and cofferdam will prevent flow from Fish Lake into initial foundation excavation.
- A small earthfill dam will be constructed at the outlet of the lake, along the access road alignment, to enable controlled discharge of water to Fish Creek and maintain sufficient freeboard within the basin.
- A Headwater Channel will be constructed along the east slope of the Fish Creek Valley during the pre-production period to collect and divert clean runoff toward the proposed Prosperity Lake fish compensation plan.

After fish salvage, the lake basin area will be utilized as a natural sediment pond, providing retention time for inflow to settle out sediment. Provided that the water quality is suitable, the lake will be drawn down periodically to restore the surge capacity. At the open pit area, the pit water will require sediment control prior to discharge until the open pit dewatering system is established.

Once construction of the Stage Ia Main Embankment is complete, the TSF will be used to impound surface water flowing from the undiverted portion of the upper Fish Creek Valley. During operations the location of the supernatant pond will be situated away from the embankments and controlled by the development of the tailings beaches and the reactive waste storage area. The supernatant pond location will be controlled in order to reduce seepage losses at the embankments and to provide a clean, accessible source of water for the milling process.

9.2.4.4 Site Water Balance

As the supernatant pond is the main source of process water, water balances were completed in order to estimate the annual water surplus or deficit at the TSF. The TSF Water Balance is a model which describes the movement of water within the operational system throughout the life of mine. External influences on this model include precipitation and evaporation. These are the principle input parameters from which all other parameters are calculated.

Process water and fresh water that is required for the operation of the mill is primarily derived from the water collection pond and the TSF supernatant pond. The water collection pond receives all water derived from the open pit dewatering and waste storage area runoff, as well as seepage from the TSF, and catchment runoff.

An annual site water balance was based on average precipitation conditions for the year prior to start-up, and 19 years of operation, based on complete years of production.

As indicated, there will be no requirement for supplementary make-up water for average annual precipitation conditions. Immediately prior to start-up, the Main Embankment of the TSF will store approximately 11 Mm^3 of water, derived from the storage of one freshet and the almost complete drawdown of Fish Lake. Due to low density of tailings during the initial years of operations, the available water in the supernatant pond gradually decreases as water received into the TSF is trapped in the pore spaces of the tailings, reaching a low of 4 Mm^3 during Year 6. Following Year 6, the dry density of the tailings reaches the assumed maximum, and the Pond begins to accumulate water, reaching a maximum volume during operations of approximately 22.6 Mm^3 during Year 16. Subsequent annual water deficits starting in Year 17 result from the cessation of inflow from the open pit dewatering facilities, as the open pit is permitted to commence filling. The pond volume at closure is approximately 18.7 Mm^3 and the annual post closure surplus in the TSF is estimated at approximately 6.6 Mm^3.

In order to evaluate the design of the TSF and availability of sufficient water for continuous operations, annual site water balances were calculated for extreme precipitation conditions. The design of the TSF embankments is dependent on the probable maximum pond volumes for each year of operations, and continuous operations of the mine are influenced by the probable minimum pond volumes.

Under extreme dry conditions, the results of the analysis indicate that there may be a requirement to divert a portion of flows from the catchment east of the headwater channel in order to maintain the necessary pond volume to facilitate continuous, uninterrupted operations. Additionally, a large proportion of the fresh make-up water derived from the deep aquifer remains largely unused during each year of operations, and could be potentially utilised to supplement deficits in the TSF under these extreme conditions.

9.2.4.5 Tailings Discharge System

Tailings from the mill process will be delivered by gravity from the mill to the TSF for as long as possible. Thereafter, the required head for gravity discharge may be provided by pumping to a head tank above the east abutment of the Main Embankment, or by pumping directly to discharge. The initial requirement for pumping is deferred to Year 5 of operations, at which time tailings discharge from the West Embankment begins. At that stage, pumping will only be required when tailings are being discharged from the West Embankment. Discharge from the Main Embankment will be by gravity until Year 7 of operations.

Tailings Delivery to the Tailings Storage Facility

Two gravity pipelines will be laid from the mill to the east abutment at start-up. One pipeline will extend to the centre of the Main Embankment, and the second to the West abutment. Each pipeline will be sized to carry up to 50% of the design tailings production from the mill. Discharge into the TSF will be from valved off-takes along the two pipelines on the Main Embankment crest. A full diameter off-take in each line will allow for “emergency” discharge at the east abutment.

During the first year of operations, a third line will be laid from the mill to the east abutment. In Year 4, the third discharge pipeline will be extended across the Main Embankment and along the crest of the West Embankment. A tailings pump station will be required to service this pipeline. Both of the gravity pipelines on the Main Embankment will remain in service. Discharge from the pipelines will not be continuous, but will be rotated between lines as appropriate for tailings distribution within the TSF and to ensure adequate beach development.

During later years of operations the tailings may be pumped to the point of discharge. Valving will allow for discharge to be directed to the appropriate discharge pipeline. The tailings discharge system will be flexible enough to take advantage of tailings discharge by gravity for as long as possible, thereby reducing the annual pumping costs associated with the system.

It will not be necessary to provide any emergency tailings line dump pond or tailings recovery system at the mill to handle pipeline drainage during emergency or planned shutdowns, as long as the Mill Tailings Head Box elevation remains sufficiently above the embankment crest elevation. This requirement must be re-evaluated during ongoing operations.

Discharge into the Tailings Storage Facility

Tailings will be discharged from the delivery pipelines into the TSF from large diameter valved off-takes located along the pipelines on the Main and West Embankments and the ridge along the west side of the facility. The off-takes will consist of rubber lined steel tees or elbows, with appropriate valving and HDPE discharge piping. In-line valves installed at intervals along the delivery pipelines will allow the tailings discharge locations to be relocated as appropriate for beach development.

9.2.4.6 Reclaim Water System

Water will be reclaimed from the tailings pond by a barge mounted pump station. The water will consist of supernatant from the settled tailings and runoff from precipitation and snowmelt within the catchment area. A dedicated pipeline will convey the reclaimed water to the process water pond, located adjacent to and upgradient from the mill.

Reclaim Barge

The floating reclaim pump station in the TSF will initially be confined in a deep narrow channel at a location remote from the point of tailings discharge. This will maximize the potential for the recovery of water of acceptable clarity. Relocation of the barge will be required to accommodate development of the PAG waste rock area and increases in the elevation of the tailings pond. The barge will be relocated during Years 2 and 6 and moved to its final location during Year 16.

The barge pumps will be controlled from the mill control room, based on the water level in the process water pond. The barge will be fitted with vertical turbine pumps, including standby pumping capacity and all necessary control, check, drainage and isolation valves. One pump will normally be operated at all times during winter to reduce the potential for freezing of the water in the reclaim pipeline.

Reclaim Pipelines

Reclaimed water will be pumped from the reclaim barge to the process water pond at the mill. The operational storage capacity of this pond will be approximately 110,000 m^3. The reclaim pipelines will be graded to minimize high or low sections and to allow for gravity drainage back into the TSF, or the process water pond.

The reclaim pipeline from the TSF will consist of sections of large diameter HDPE and steel pipe. Steel pipe would be used only for the initial high pressure sections of the pipeline, between the barge and the headwater channel, while HDPE pipe will be used for the remainder of the pipeline.

9.2.4.7 Instrumentation and Monitoring

Geotechnical instrumentation will be installed in the tailings embankment and foundation during construction and over the life of the project. The instrumentation will be monitored during the construction and operation of the TSF to assess embankment performance and to identify any conditions different to those assumed during design and analysis. Amendments to the on-going designs and/or remediation work can be implemented to respond to the changed conditions, should the need arise.

Geotechnical instrumentation, comprising piezometers and movement monuments will be installed at selected planes along the Main and West Embankments. Groundwater wells will be installed at suitable locations downstream of each embankment.

Instrumentation

Vibrating wire type piezometers will be installed in the embankment foundation, fill and tailings materials to measure pore water pressures during initial placement and operations. The piezometers will be distributed throughout the various foundation and fill zones to provide a spectrum of monitoring data. The piezometer leads will be appropriately routed from the fill to read-out panels for ease of monitoring.

Movement monuments will be installed on the embankment crest following the completion of selective embankment raises to monitor deflections along the slope and crest of the embankment. Periodic surveying of the monument locations will provide early warning of movements and possible acceleration of movement which often occurs prior to failure.

Groundwater monitoring/recovery wells will be installed at appropriate locations along the downstream toe. The wells will be used to recover samples for water quality monitoring.

Monitoring Program

The instrumentation monitoring should be done routinely both during construction and operations. Following initial installation of the geotechnical instrumentation, measurements should be taken and analyzed on a daily basis to monitor the response of the earthfill and foundation from earthfill loading.

The frequency of monitoring for the piezometers and inclinometers may be decreased to bi-monthly readings once the effects of initial construction have dissipated. Surface movement monuments should be surveyed twice per year during operations. Water quality monitoring of the seepage through the embankment and foundation shall be monitored monthly during operations.

9.2.4.8 Decommissioning and Closure

Upon mine closure, surface facilities will be removed in stages and full reclamation of the TSF will be initiated. General aspects of the closure plan include:

- Selective discharge of tailings around the facility during the final years of operations to establish a final tailings beach that will facilitate surface water management and reclamation.
- Dismantling and removal of the tailings and reclaim delivery systems and all pipelines, structures and equipment not required beyond mine closure.
- Construction of an outlet channel/spillway at the east abutment of the Main Embankment to enable discharge of surface water from the TSF to the open pit and ultimately to Lower Fish Creek. This full closure scenario will also work well in the event of premature closure of the mine.
- Removal of the seepage collection system at such time that suitable water quality for direct release is achieved.
- Removal and regrading of all access roads, ponds, ditches and borrow areas not required beyond mine closure.
- Long-term stabilization of all exposed erodible materials.

The possibility of creating a self-sustaining fishery in the closed facility is being explored jointly with the EA team.

9.2.4.9 On-going Monitoring Requirements

The seepage collection ponds and recycle pumps will be retained until monitoring results indicate that any seepage from the TSF is of suitable quality for direct release to downstream waters. The groundwater monitoring wells and all other geotechnical instrumentation will be retained for use as long term monitoring devices.

Post-closure requirements will also include an annual inspection of the TSF and an on-going evaluation of water quality, flow rates and instrumentation records to confirm design assumptions for closure.

9.2.5 Geotechnical Stability Monitoring Plan

A Geotechnical Stability Monitoring Plan for the Prosperity Project will be developed during the detailed design phase that will provide monitoring procedures for the open pit, the waste rock disposal facilities and the tailings storage facility. The site conditions and monitoring objectives each of these facilities are different, and as a result the methods used for each geotechnical monitoring will be site specific. It is to be expected that these monitoring procedures may be modified during mine operations as operational experience is gained and site conditions change. This section provides an overview of the typical components that will be found in a geotechnical stability monitoring plan for each of the three components.

The Open Pit

The open pit will be excavated into the host soil and rock. The typical objective of an open pit geotechnical monitoring program is:

- to maintain a safe working environment
- the identification and monitoring of pit wall deformation
- the early identification of slope stability issues or concerns

- the monitoring of water level in the open pit walls
- the monitoring of the effectiveness of pit wall controls (i.e., pit wall dewatering, blasting procedures, and wall push back)

A pro-active approach to geotechnical monitoring for all pit design sectors during all stages of the pit development will be implemented. The monitoring and reporting will follow the Operations Monitoring and Surveillance (OMS) plan. This OMS plan will detail the operational procedures, the geotechnical monitoring program and actions to take in the event of an atypical occurrence. It will be implemented as a staged approach and will include geotechnical and tension crack mapping, surface displacement monitoring, the installation of subsurface displacement monitoring (i.e., Multiple Point Borehole Extensometers, slope movement prisms, and/or slope indicators) and the installation of piezometers to monitor pit depressurization and the water level in the pit walls. In addition the mine will ensure that suitable staffing resources are allocated to collect, process and interpret the geotechnical monitoring data, typically on a weekly basis but more frequently as required. The timely identification of accelerated movements from surface displacement monitoring and tension cracks is critical.

Waste Rock Disposal Facilities

The waste rock disposal facilities for the Prosperity Project are located between the open pit and the tailings storage facility, as well as within the basin of the tailings storage facility. The waste rock disposal facilities will consist of large volumes of generally random rockfill material from the open pit and rock will be placed with minimal compaction.

The waste rock disposal facilities will be developed based on the OMS plan. For the placement of waste rock the geotechnical monitoring program will include the following components: visual observation to evaluate performance, records of placement rates, face advance rates, wireline extensometer to monitor disposal facility deformation, foundation piezometers to monitor pore water pressure and a regular waste rock disposal facility survey.

The mine will ensure that sufficient and competent personnel are available and responsible for ensuring that the waste rock disposal facilities monitoring is carried out regularly. Because of the large volumes of material being moved and the rapidly changing conditions under which the mine waste rock disposal facilities operate, the routine monitoring will likely occur as a daily activity with the pit supervisor preparing a shift report based on visual observation for routine operations. Additional documented walkovers of the waste rock disposal facilities will be required following extreme or unusual events. A weekly and quarterly report on waste rock disposal facilities operations and monitoring would typically be prepared for mine planning.

Tailings Storage Facility

The TSF will be equipped with a variety of geotechnical instrumentation installed in the tailings embankment and foundation during construction and over the life of the Project, as laid out in the OMS. The geotechnical instrumentation will be monitored during the construction and operation of the TSF to assess embankment performance and to identify any conditions different to those assumed during design and analysis. Amendments to the on-going designs and/or remediation work can be implemented to respond to the changed conditions, should the need arise.

The geotechnical instrumentation may include visual observation, vibrating wire piezometers, slope inclinometers and surface movement monuments. Additionally, standpipes, seepage monitoring ponds, seepage flow weirs and load cells may be used. The geotechnical instrumentation will generally be installed in planes along the tailings embankments and groundwater monitoring wells will be installed at suitable locations downstream of each embankment. The frequency of monitoring for the piezometers and inclinometers during construction and following first filling will be higher than for the typical operating condition. Monitoring frequency is typically reduced to bi-monthly readings once the effects of initial construction have dissipated. Surface movement monuments should be surveyed twice per year during operations. Water quality monitoring of the seepage through the embankment and foundation shall be conducted routinely during operations.

The OMS plan will detail the operational procedures, the geotechnical monitoring program and actions to take in the event of an atypical occurrence, with a flow chart of pre-prepared plans to execute in the event of an emergency situation. A review of the geotechnical instrumentation records would typically be undertaken at least annually by the design engineer and a periodic Dam Safety Review by a qualified and experienced independent engineer would be undertaken as set by the Canadian Dam Association Guidelines.

9.2.6 Concentrate Load-out Facility Operating Plan

The concentrate load-out facility is owned and operated by Gibraltar Mines Ltd. An operating plan for the facility is currently being developed by Gibraltar to specify procedures and policies that address diesel emissions, dust, noise and safety. The operating plan will be completed prior to the operating phase of Prosperity. Concentrate hauling contractors for Prosperity will comply with the Gibraltar's policies and procedures in place, which may include the following:

Diesel Emissions

- Truck engines will not be left to idle except when necessary and speed limits will be imposed.

Dust

- Concentrate haul trucks leaving the Prosperity mine site must be properly covered and any residual concentrate on the vehicle must be washed off prior to embarking on route to the concentrate load-out facility.
- Truck fenders and box edges are to be swept after loading or unloading.
- Truck dump area is to be swept, as required, following unloading.
- All doors of the load out to be closed during unloading.
- When the truck exits the dumping area, any copper concentrate that may be spilled during unloading, is swept, shovelled and returned to the shed.
- Any spillage on the road will be removed immediately with the appropriate reporting procedures followed.

- The truck is washed in the wash bay at the mine site a minimum of weekly (or every trip if necessary) in order to prevent transfer of concentrate to the highway or community.

Noise

- Where practical, loading and unloading activities will be restricted to daytime hours (i.e., 07:00 to 22:00 adjusted for seasonal variations of daylight).
- Vehicles will be routinely maintained and serviced to ensure optimal operation and mufflers are in good working condition.
- Vehicle speed limits will be followed.

Safety

- Vehicle speed limits will be imposed.
- Vehicles will be regularly inspected to ensure compliance with all requires safety features.

9.2.7 Materials Handling and Waste Management

The Materials Handling and Waste Management (MHWM) Plan will identify opportunities to reduce, reuse and recycle waste, prior to resorting to disposal. This will be done through the identification and management of the various waste streams. The plan will also ensure that all aspects of domestic and industrial waste management (collection, transportation, storage and disposal) are conducted in a responsible manner protective of the environment. This plan will be supported by various procedures related to the handling of hazardous and non-hazardous wastes, management of the various waste storage facilities, and the Spill Prevention and Response Plan.

9.2.7.1 Materials Handling

Materials Inventory

An inventory of types and quantities of all chemicals used on site will be developed and updated regularly. Material Safety Data Sheets (MSDS) will be obtained and made available at point of use. The MHWM Plan will describe specific handling, storage and disposal requirements so that the potential risks to employees' health and to the environment are controlled.

Typical hazardous materials that will be transported to and from and stored on site at Prosperity, include the following.

- Transported to and stored at the site :
  - petroleum products (diesel fuel, gasoline, lubricants, hydraulic fluids, oil and solvents)
  - propane (during construction only)
  - explosives (e.g., ammonium nitrate (AN))
  - batteries

- mill reagents (flotation collectors such as xanthate, thionocarbamate, and thiophosphate, frothing agents such as methyl isobutyl carbinol (MIBC)and pine oil, flocculants, and quicklime)
- antifreeze

- Transported from and stored at the site:
  - copper/gold concentrates
  - waste batteries
  - waste oil
  - waste solvents
  - empty petroleum and reagent drums, carboys, and pails

There will be other materials stored on site in relatively small quantities. These include but not limited to supplies such as:

- fluorescent mercury and sodium lights
- laboratory reagents
- scraps of treated lumber
- bottled gases (acetylene and oxygen)
- solvents for shop supplies

Specifications for materials storage and handling will be developed to protect workers and the environment. The MHWM Plan will outline the design requirements for a hazardous waste storage facility including secondary containment, elevated deck to detect leaks, appropriate signage and fencing. In general, hazardous liquids, such as solvents, mill reagents and lab chemicals, will be stored with secondary containment to comply with relevant legal requirements. Flammable substances will be securely stored in dedicated locations. Regulatory signs will be attached to the storage facilities or containment structures. Firefighting and other emergency response equipment will be available near all storage areas.

Explosives

Explosives will be used for blasting the rock in the open pit. The MHWM Plan will provide information on how explosives will be transported, stored, and used in a safe and environmentally sound way at Prosperity. A contractor will be engaged to supply explosives, primarily ammonium nitrate-fuel oil mix (ANFO). All explosives manufacturing, storage and product delivery systems will be subject to existing federal and British Columbia regulations. The contractor will own and operate the explosives manufacturing plant and will deliver the explosives to the pit. The explosives supplier/on-site contractor will be licensed and permitted to operate in British Columbia.

Explosives will be used at safe distances from facilities or personnel. There will be two separately mounted container magazines with lightning protection for accessories such as detonators and container magazines with lightning protection for explosives. Each container pair will have its own perimeter fence and perimeter security lights. The distance between each container pair will be at least 60 m.

The ANFO plant will be at least 100 m from the container magazines. It will consist of an ammonium nitrate shed with all the necessary equipment including bulk handling and a diesel tank. The permanent explosives storage area pad will be constructed of sized fill and include a barrier surrounding the explosives storage area. The plant will also be surrounded by its own perimeter security fence with lights. All buildings will be surrounded by a second fence. Access to the magazines will be restricted to authorized personnel only. Blast notification procedures and other safety procedures and policies will be developed prior to construction.

Hydrocarbon Management

All hydrocarbons, including waste oils, will be provided secondary containment facilities that meet current industry standards. These installations will be regularly reviewed. The MHWM Plan will describe hydrocarbon handling, transport, reception, transfer, use and disposal procedures. The objective of these procedures is to manage the pollution risk and minimize spill potential. The MHWM Plan will also describe or refer to spill response procedures including containment, reporting, clean-up, and corrective action; these procedures will be described in the emergency preparedness and response documentation.

9.2.7.2 Waste Management

The MHWM Plan will identify ways of reducing waste, mainly through minimizing packaging and where applicable, returning packaging for reuse. The Plan will emphasize reuse, and will also highlight the recycling program which will see segregation at the source of the most typical recyclables including aluminum cans, paper and cardboard. Non-hazardous and hazardous waste will be segregated at source to reduce the potential for environmental effects. Disposal mechanisms for both non-hazardous and contaminated wastes will be developed for the MHWM Plan.

Waste Management Facilities

The various waste management facilities, which will include a hazardous waste storage area, landfill, landfarm, and a laydown area for used tires, scrap metal and wood, will be a part of the Plan.

Non-hazardous and Domestic Waste

The domestic waste management plan will consist of a series of guidelines that will minimize the potential impact on the environment. Domestic waste, including paper, plastics, glass, tins, scrap metal, food and other biodegradable materials will be collected in labelled, secure refuse bins. Domestic waste that can not be recycled or re-used will deposited in the landfill and the MHWM Plan will include the design, construction and operation details according to relevant regulatory requirements. Landfill operating procedures will ensure that this waste stream is handled to not create a wildlife attractant.

The MHWM Plan will incorporate the treatment of domestic waste water / sewage, both during construction and operations. The majority of the information pertaining to the operation and optimal performance of the sewage treatment system will be provided in an operation and maintenance plan, a supporting document, supplied by the manufacturer. An important component of the management of sewage will be the training of operators who can be certified under the Environmental Operators Certification Program to operate the sewage treatment plant.

Sewage from the mill site and camp areas will be collected by a gravity sewer system. One sewage treatment plant (STP) will be used to service the mine during the construction phase and continue for operation. The STP will be located at the west end, low side, of the mill site, well away from the camp and other occupied areas.

During construction, the treated effluent discharge will be pumped to a tile field or lagoon. Prior to any construction, tile field design and location will have to be verified by field percolation tests. Once the mine is operational, the treated STP effluent will be discharged to the TSF. A buried pipeline will discharge the effluent into the gravity section of the tailings pipeline near the concentrator building. At that time, the chlorine contact chamber will be activated because the effluent will become part of the reclaim water from the TSF.

Sewage from the washroom facilities that are remote from the mill site gravity sewer system, will be directed to nearby sewage holding tanks. These tanks will be emptied at regular intervals and their contents treated at the mill site STP. Sludge from the STP will be removed to an off-site municipal facility approximately every two months.

Hazardous Waste

Hazardous wastes will include, but not be limited to, used waste oil, glycol, grease, hydraulic oil, used oil filters, oily rags and absorbent materials, solvents, batteries, mill reagents and lab chemicals. The majority of hazardous waste will be disposed of off-site, the exception being the reuse of some waste oil in the blasting process (ANFO). Throughout the operational period, many chemicals and reagents will be used for the daily mining and milling activities of the mine. During the final months of operations, the supply and demand of these chemicals and reagents will be monitored carefully, so that the smallest volume will remain when operations cease. Any residual products will be packaged appropriately and shipped back to the supplier. The transportation of hazardous wastes will follow the federal Transportation of Dangerous Goods Regulation requirements.

Hydrocarbon Management

Used oil and oil filters will be collected and recycled off site as part of the operational phase. Records of waste oil removal and recycling will be kept. During the closure phase, trucks and other equipment will be required for reclamation, and this procedure of collecting and recycling will continue until all closure activities have been completed. Should soil become inadvertently contaminated during the operational and closure phases it will be treated on-site with appropriate products, as necessary.

Contingency Plans

The MHWM Plan will identify situations for which contingency plans may be required.

9.2.7.3 Spill Prevention and Response

The objective of the Spill Prevention and Response Plan will be to promote the prevention of the accidental release of harmful substances into the receiving environment and, in the event of a spill, to provide adequate information to guide the response crew to safely, efficiently and effectively respond to and clean-up a spill.

The Spill Prevention and Response Plan will be designed to prevent spills through the development of procedures in the transfer, handling and storage of fuel and other hazardous products and wastes, plus awareness training in these procedures. Prevention will be further supported by regular environmental site inspections and written assessments.

In the event of a spill, the Spill Prevention and Response Plan will incorporate a spill response action plan that will detail how to manage a spill, depending on the product that was spilled, the quantity spilled and the location of the spill. The Plan will maintain a list of products that are used at, and transported to and from, the mine site. For each product a data sheet will be available in the Plan that documents the physical and chemical properties of the product, safety measures related to that product such as personal protective equipment, and methods for containing and removing the product if spilled, plus the storage, transfer and disposal of the spilled product.

The Spill Prevention and Response Plan will also provide details related to the structure of the spill response team, and the duties and responsibilities of each individual on that team, including the responsibilities of the person who discovered the spill. Contact lists for persons/agencies to notify in the event of a spill, from corporate, to government, to clean up contractors and suppliers, to neighbouring dwellings/communities, will also be a component of the Plan.

Other components of the Plan will include an inventory of the location of spill response kits and their contents, the policy on reporting spills, and a spill response form that will form the written documentation and recording of spills.

Lastly, the Plan will dictate that emergency response personnel receive spill response and cleanup training from a qualified instructor.

Responsibility

The Environmental Coordinator will be appointed the Spill Contingency Coordinator. If the Environmental Coordinator is unavailable, the Manager of Mining will be the designated and in his/her absence the Manager of Milling. The Environmental Coordinator must be notified of any reportable spills as soon as possible and must ensure that all of the proper authorities have been notified. The Environmental Coordinator will also act as the liaison between Prosperity Mine and any outside agencies. A complete Prosperity Mine contact list will be created and kept current.

Every employee at the Prosperity Mine will be responsible for using environmentally safe operating practices to minimize environmental damage in the event of a spill

Training

All supervisors and employees will be trained in:

- The prevention of spills, the safe handling of all materials and an awareness of hazards associated with materials they work with.
- Emergency Response Team notification and emergency response procedures.
- The use of the WHMIS and the MSDS.

In addition to the above, all supervisors will be trained in:

- The use of the Spill Prevention and Response Plan. This includes a working knowledge of reference information (contact lists, hazardous material information sheets) in the event of a spill.
- The 5-step spill handling procedure—assessment, containment, cleanup, reporting and disposal.

Accidents and Malfunctions

As identified and discussed in Volume 9, procedures specific for potential accidents and malfunctions will be developed and incorporated into the Spill Prevention and Response Plan. At a minimum, spill response procedures will be developed for:

- fuel spills on land
- fuel spills in water
- major leakage from tailings or pipelines
- concentrate haul spill

9.2.8 Emergency Response

This section provides a conceptual framework for emergency response at the Prosperity Mine. The plan outlined within this document provides a policy level overview that will be further expanded and refined as the application and permitting process progresses. Specific components will be developed prior to construction and incorporated into the Construction Management Plan. It will be continually updated into a full Emergency Response Plan (ERP) as mine development progresses.

In support of a policy for Emergency Response at Prosperity, the following guidelines are identified:

1. Personnel safety is the primary concern.
2. Notification of an event to key Prosperity Mine personnel and/or relevant third parties is mandatory.
3. Containment of the event is critical to limit injury and damages.
4. Reactive responsibilities will be assigned prior to the event occurring, wherever possible.
5. External communications will be channelled through the Mine General Manager of the Prosperity Mine or his designate.
6. It is the responsibility of all employees to report any errors or omissions in the Plan to the Emergency Response Co-coordinator. Effective response is dependent upon all aspects of the Emergency Response Plan being current.
7. All employees are to be aware of the Emergency Response Plan and understand their responsibilities.

9.2.8.1 Purpose

The purpose of the ERP is to ensure that Prosperity Mine personnel can react quickly and appropriately to emergencies which may affect employees or the operation of the Prosperity Mine. This ERP will be designed to provide a set of procedures for emergency response to various incidents or occurrences. It will further provide a series of activities to allow for the restoration of critical business functions within an identified timeframe should the incident be of a serious nature or magnitude.

The ERP will address all levels of emergencies:

- Level 1—Individual Emergency
- Level 2—Crew Emergency
- Level 3—Departmental Emergency
- Level 4—Property wide Emergency

9.2.8.2 Components

The ERP will have two main components which identify activities and responsibilities in response to an incident: Emergency Response Team, and Recover Team Responses. The Emergency Response Team is intended to be a first response only and will essentially provide activities to ensure the safety of our employees, contact of required emergency services, and a return to normal operations following the incident. If the incident is of a serious nature and requires further escalation, then the second component, the Recover Team Responses, will be activated. This section identifies responsibilities, activities and references required to restore operational capabilities within the four main areas of the Company.

9.2.8.3 Considerations

The comprehensive Emergency Response Plan will identify a base set of activities to follow in response to general types of emergency. The considerations identified below will assist in the responses to our requirements:

1. Requirements for first aid are set out in the Occupational Health and Safety Guidelines, Occupational Health and Safety Regulation Issued by WorkSafeBC (the Workers' Compensation Board of BC).
2. A first aid station will be maintained and equipped with a rapid contact system for physicians in Williams Lake. An effective means of summoning the first aid attendant will be developed. There will be trained Industrial First Aid personnel on site, and a helipad that can be used for medical evacuations. A specific procedure will be developed for summoning either a road ambulance or Provincial Air Ambulance.
3. All operating shifts shall have and maintain an Emergency Response Team trained in Mine Rescue techniques as per the Mines Code (part 3.7) and be comprised of various employees representing all departments. A mine Emergency Response Plan will be developed and filed with the Chief Inspector for Mines. The Manager will ensure that there is a fully trained mine rescue team, with an appropriate number people trained in mine rescue procedures. This team will form the core of the emergency response team, responsible for rescue and fire fighting duties in the event of an emergency.
4. An on site telephone Emergency number will be posted and highly visible throughout the site.
5. "Muster Locations" outside of each building where all employees can meet after a building will be identified and posted.

6. All employees shall be trained in how to activate the Emergency Response Team should an emergency occur.

9.2.8.4 Emergency Responses

The Prosperity Project ERP will detail a series of responses and provide a list of activities to react to accidental incidents listed under the following headings:

Fire Emergency Response—The comprehensive Fire Emergency Response component will based on, but not limited to, the plan used at its Gibraltar Mine operation. Upon discovering a fire, every person working at the Prosperity Project will be aware of, and capable of, carrying out initial containment measures. These would include an attempt to control the fire with the nearest extinguisher, raising the alarm, and seeking assistance. The emergency response team will be well trained in fire fighting techniques, and will be available to respond to fire alarms. If there is a forest fire near the mine site, management will initiate close monitoring of the fire and seek advice from the Ministry of Forests and Range. Sources of water for forest fire fighting will be identified in the ERP.

Accident, Serious Injury or Death Emergency Response—When injuries require patient transfer to the Provincial Ambulance Service or air evacuation shall be arranged. The First Aid Attendant will instruct the Direct Supervisor to call for it. All treatment and transportation decisions are entirely the responsibility of the First Aid Attendant. Accident site security and investigation must be carried out as if there is a fatality; all operations in the area will be suspended, mine officials must be notified immediately, and the Mines Inspector and Occupational Health and Safety Committee must be notified within 16 hours.

Acts of God Emergency Response—The ERP will address responses to any incident which results in the release of contained water or, flooding from internal or external sources, any type of weather related situation such as snow storms, tornadoes, hurricanes, major electrical storms, etc. which affects the company's ability to conduct business, and any incident (i.e., berm or dump failure/seismic activity) which endangers people or damages property.

Essential Services Emergency Response—This response will be aimed at providing a list of activities to react to incidents caused by loss of primary services such as electrical power, and water.

Telephone Threat Emergency Response—A procedure is in place at the Gibraltar Mine for dealing with threats of violence, sabotage (bomb threat) that have been transmitted by telephone and will be incorporated into the Prosperity ERP.

Spill Emergency Response—Procedures for responding to any incident which results in an environmental spill on or off the property are identified in the Spill Response section of the Materials Handling and Waste Management Plan above.

Accidents and Malfunctions—In addition, ERP procedures and policies will be developed for the potential construction-related accidents and malfunctions discussed in Volume 9. Emergency response procedures will be developed for, at a minimum:

- fuel spills on land
- fuel spills in water
- major leakage from tailings or pipelines

- concentrate haul spills
- block road culverts
- excessive water in the TSF
- loss of power to TSF seepage recovery

9.2.9 Air Quality and Noise Management Plan

The main objective of the Air Quality and Noise Management Plan will be to ensure that the levels of fugitive dust, emissions, noise and artificial light generated by the Prosperity Project activities are managed to ensure the protection of humans, vegetation, fish, wildlife and other biota. Project policies for management of air quality and noise will be made known to all employees, contractors and subcontractors. The comprehensive Air Quality and Noise Management Plan will be developed to meet regulatory specifications.

9.2.9.1 Air Quality—Dust

Measures that may be used through construction and operations to reduce fugitive dust levels may include but not limited to the following:

- revegetation or covering of exposed areas subject to wind erosion
- use of large haul trucks for ore and waste transport to minimize the number of trips required between the source and destination
- installation of dust extraction and ventilation filtration systems within the plant complex
- installation of dust collection systems at the primary and secondary crushers
- regular application of surface-binding chemicals or water on roads and exposed surfaces
- vehicle speed regulations to minimize dust
- in order to evaluate the effect of dust suppression measures and systems the company will implement monitoring programs including dust monitoring stations in sensitive ecological or work environments

Construction Phase

During construction, fugitive dust will be generated from vehicles traveling on unpaved roads, construction of the access corridor (including blasting in quarry pits) and other construction activities, including clearing, earthworks, topsoil removal and stockpiling. Fugitive dust can be exacerbated by dry climatic conditions and winds. Dust control is an important aspect of the project environmental management system. The comprehensive Air Quality Management Plan will be developed to meet or exceed regulatory specifications during construction. Fugitive dust will be managed by:

- applying water or surface-binding chemicals as a dust suppressant to unpaved roads and active earthworks areas during dry weather
- imposing speed limits to limit the amount of fugitive dust generated by vehicles

- alternatives to wood waste burning during site and power line clearing will be investigated

Operations Phase

The comprehensive Air Quality Management Plan will be developed to reduce fugitive dust levels and to meet or exceed regulatory specifications during the Prosperity Mine operations.

Fugitive dust can be created by vehicle traffic on unpaved roads, ore transfer, truck loading and unloading, and blasting. To mitigate fugitive dust around the open pits, water will be sprayed on the haul roads, vehicle speeds will be enforced, and blasting practices optimized to reduce noise and dust.

Fugitive dust caused by wind erosion on the tailings will be limited by maintaining a water cover over the deposited materials. Fugitive dust caused by wind erosion on the waste rock piles will be mitigated by progressive reclamation.

The source of dust from the ore processing area will be the ore stockpile, primary and secondary crushers, conveyors and ore transfer points. Most of the dust created in these areas will be captured by dust collectors. Where buildings are open on two sides, the two open ends will be oriented at 90º to the prevailing wind direction to reduce fugitive dust. The other indoor ore processes are wet and hence dust will be negligible.

More-active measures of dust suppression will be implemented at the outdoor facilities associated with the plant. A dust suppression system will be used at the primary crusher, and water will be sprayed around the crusher, the ore stockpile pad and the process plant itself to minimize fugitive dust from ore handling and local traffic on unpaved roads.

Traffic on the unpaved access corridor may contribute to the generation of fugitive dust. Mitigative measures include the enforcement of speed limits of contractors and employees, no-idling policies, road watering/calcium sealing and upgrading the road-surfacing materials with coarse local aggregates.

The concentrate load-out facilities will be the Gibraltar facility on the CN Rail line 9 km north of McLeese Lake. Dust control measures are identified in Section 9.2.6 Concentrate Load-out Management Plan.

Other mitigative measures will be incorporated for the management of fugitive dust at the project (i.e., a vegetation cover) will be established on stripped surface areas as required.

Closure Phase

Activity will be significantly reduced during this phase. However, all precautions exercised in the construction and operations phases regarding equipment operations and hours of operation will still closely be observed in the closure phase as well.

9.2.9.2 Air Quality—Emissions

In all aspects and phases of the Prosperity Project the Air Quality Management Plan will be developed to meet or exceed the regulatory requirements of the Canada and British Columbia Ambient Air Quality Objectives for air emissions. Taseko will incorporate the Best Available Technology Economically Achievable (BATEA) measures to reduce Criteria Air Contaminant (CAC) emissions.

Construction Phase

The main sources of air pollutants during the construction and commissioning phase will be diesel exhaust and waste incineration. During this phase, land clearing burning briefly produces the majority of CAC emissions (mainly particulate). Taseko personnel will restrict disturbances and manage all land clearing as much as possible to minimize burning.

During the construction phase, diesel emissions will be produced primarily by light and heavy duty vehicles, stationary construction equipment and haul trucks carrying loads to and from the camp.

Diesel emissions will include carbon monoxide/dioxide, nitrogen oxides, sulfur dioxide, particulate matter (PM) and residual unburned fuel vapours. Air emissions from vehicles will be mitigated and managed by:

- minimizing diesel emissions through regular maintenance of all generators and mobile equipment
- not allowing vehicles to idle, except when necessary
- imposing speed limits
- avoiding spills during the refuelling of vehicles and stationary power equipment to minimize the release of hydrocarbons to the atmosphere

Air emissions will also be produced by the incineration of inorganic and organic wastes. Emissions from waste incineration will be mitigated by:

- implementing waste segregation and recycling programs to reduce the quantity of inorganic wastes incinerated, thereby decreasing CO_2 emissions
- investigating alternatives to wood waste burning during site and power line clearing

Operations Phase

The comprehensive Air Quality Management Plan will be developed to meet or exceed regulatory specifications during the Prosperity mine operations phase. Air emissions will be controlled and monitored throughout the life of the project. The main pollutants will include greenhouse gases (mainly carbon dioxide, carbon monoxide and nitrous oxide), sulphur oxides (SOx), nitrogen oxides (NOx) and volatile organic compounds (VOCs). Activities that will produce gaseous air emissions during operations include mining (blasting, earthworks, excavation), ore processing, tailings and waste rock disposal/storage, and the transportation of personnel and materials to and from the mine site by means of the access road.

Mining activities that result in air emissions include blasting and the operation of diesel-powered mining equipment and haul trucks for transporting waste and ore. Emissions include SOx, NOx, CO and PM.

To reduce diesel emissions, equipment engines will not be left to idle except when necessary, speed limits will be imposed, the consumption of fuel, diesel or used oil will be monitored, and equipment and vehicles will be regularly maintained. Optimizing vehicle movements to minimize emission of GHG emissions will be a priority at the Prosperity site. Taseko will explore the availability and potential use of biodiesel fuel in mine equipment.

Equipment use in the ore processing area will be limited to propane powered equipment utilizing state of the art scrubbing systems to allow for utilization within enclosed buildings. Such pieces of equipment will be propane powered Bobcats, fork lifts and mobile man lifts.

Traffic on the unpaved access corridor will contribute to air emissions through diesel exhaust. Mitigative measures include the enforcement of speed limits and no-idling policies.

To reduce diesel emissions, equipment engines will not be left to idle except when necessary, speed limits will be imposed, the consumption of fuel, diesel or used oil will be monitored, and equipment and vehicles will be regularly maintained.

Other mitigative measures will be incorporated for the management of air emissions: the waste incinerator will have a built-in emission control system, and the fuel storage tanks will be equipped with pressure valves to control fuel vapour air emissions.

Closure Phase

Activity will be significantly reduced during this phase. However, all precautions exercised in the construction and operations phases regarding equipment operations and hours of operation will still closely be observed in the closure phase as well.

9.2.9.3 Workplace Air Quality Control

The workplace is generally defined as an indoor setting where air quality control is required to provide an environment that protects the health and safety of workers. Indoor air quality control measures will be established during both the construction and operations phases of the project.

Workers in outdoor settings may also be exposed to air contaminants, but the effects of dilution and dispersal into the volume of the air mass reduce the need for protective measures. The main air contaminants that can affect the health and safety of workers are PM, CO and diesel exhaust.

The major project locations where workplace air quality will be of concern are the process plant and open pit mining areas.

The comprehensive Air Quality Management Plan will be developed to meet or exceed regulatory specifications for workplace air quality control during the Prosperity Mine operations.

The workplace air quality guidelines for the Prosperity Project will include provisions for:

- conducting periodic monitoring of workplace air quality for air contaminants relevant to employee tasks and equipment operations
- providing good ventilation systems
- providing air pollution control equipment such as scrubbers
- maintaining protective respiratory equipment and air quality monitoring equipment in good working order

- ensuring that employees use protective respiratory equipment when the exposure levels for various contaminants, including welding fumes, solvents and other materials present in the workplace, exceed local or internationally accepted standards

9.2.9.4 Noise

The comprehensive Noise Management Plan will be developed to meet or exceed regulatory specifications for noise levels during the Prosperity Mine operations. Noise levels will be controlled to protect employees and to minimize disturbance to wildlife. Noise monitoring options and strategies will be developed and assessed in accordance with BC Reg. 382/2004 and CSA Standard Z107.56-94 Procedures for the Measurement of Occupational Noise Exposure. Noise dosimeters (which measure high level sounds) and sound-level meters (which monitor ambient noise) will be used for measuring noise exposure in the identified risk areas.

High noise zones, such as the crusher and the mill, will be identified and mapped. Zones of high noise levels will be clearly marked, and employees operating in high-noise zones will be required to wear hearing protection. Vehicles and equipment will be equipped with silencers and noise suppression systems that, where possible, meets occupational industrial acoustic standards (i.e., 85 dBA at 1 m).

Most of the noise generating equipment (e.g., crushers, air compressors, blowers, etc.) will be housed inside buildings with adequate insulation and metal cladding for noise suppression. Conveyors will be enclosed. The primary chorusing unit will be housed inside the crusher building. Typically, blasting activities will be restricted to daytime hours (i.e., 07:00 to 22:00).

To minimize the noise effects from construction, the following mitigation measures will be implemented:

- where practical, construction activity will be restricted to daytime hours (i.e., 07:00 to 22:00 adjusted for seasonal variations of daylight)
- noise mitigation measures that are installed on power generator and construction equipment (e.g., mufflers) will be kept in good working condition
- construction equipment not in use will be turned off when practical

During Project construction, operations and closure, the following mitigation measures will be implemented to minimize noise effects from Project-related road traffic:

- vehicles will be routinely maintained and serviced to ensure optimal operation and mufflers are in good working condition
- vehicle speed limits will be followed
- project roads will be maintained to minimize vehicle noise associated with vibration

Taseko is committed to managing noise issues and to promptly responding to any noise complaint. In the event of a noise complaint, a local noise survey will be conducted to determine the cause, and mitigative measures will be identified and where feasible, implemented. Wildlife reactions to blasting will be evaluated and, if significant effects are observed, mitigation measures will be explored and evaluated.

During the closure phase of the Project, mitigation measures are similar to those during construction, including:

- schedule all decommissioning and reclamation related activities during daytime hours (07:00–22:00), wherever possible
- perform regular inspection and maintenance of vehicles and equipment to ensure that they have high quality mufflers installed and worn parts replaced where practical turn off equipment when not in use

9.2.9.5 Artificial Light

The potential for artificial light management issues will be discussed through the permitting and consultation. Mitigative measures can be identified for any artificial light issues and incorporated into the Air Quality and Noise Management Plan once the detailed design of the mine site is complete and the mill is constructed and operating.

9.2.10 Water Management Plan

Water is a key component in the mine processing and in the Fish Compensation Plan. Water must be managed to ensure: compliance with operating permits, smooth and uninterrupted operation of the mine, control of effects to water quality and quantity in the Fish Creek watershed.

As such, Taseko is committed to developing a comprehensive water management plan that applies to all mining activities undertaken during all phases of the Prosperity Project. This EMP will be developed prior to pre-construction and construction activities. The main objectives of the Water Management Plan will be to:

- regulate the movement of water around the mine site to ensure long term environmental protection
- define the environmental control structures to be put in place to manage volumes required for the Fish Compensation Plan and mine processing
- implement proper procedures for the protection of water quality to ensure that any discharges meet and/or exceed the permitted water quality levels and guidelines

The following provides an overview of the components that will be included in the Water Management Plan under the categories of Water Volume Control, Erosion Prevention and Sediment Control, and Water Quality. Material contained in this section is closely related to material appearing elsewhere in the report.

9.2.10.1 Water Volume Control

Changes to Flow Pathways and Drainage Areas at Mine Site

The following section provides a brief summary on the changes to flow pathways and drainage areas within the project area.

Permanent changes will occur to Fish Creek from the construction of a tailings and waste rock impoundment. The total potential undiverted catchment area of the proposed tailings and waste rock impoundment and the open pit area is estimated to be 125 km^2; thus, it is imperative to implement water management in this area.

Diversions are necessary to minimize the amount of water entering the tailings and waste rock impoundment and the open pits. These diversions will consist of diversion structures and diversion channels that will reduce the total catchment area to 39.3 km^2 for operation Years 2 to 4 and to 35.7 km^2 for Years 5 to 20. Additional diversions will be built for the tailings dam construction period to further reduce the catchment reporting to the dam area.

The water management activities will include the following:

- diverting a portion of the undisturbed runoff from the Fish Creek catchment area through a headwater channel and into the Wasp Lake fisheries compensation works
- collecting and recycling seepage from the TSF, waste storage areas, ore stockpiles, and the open pit
- controlling, collecting, and utilizing undiverted surface water runoff upstream from the open pit
- eliminating uncontrolled release of water from the Project area
- optimizing the volume of water stored in the tailings supernatant pond to meet operations and closure requirements
- managing the system to facilitate decommissioning of the open pit dewatering and depressurization facilities immediately following completion of mining activities

At closure of the mine all the freshwater diversions will be breached allowing water to flow into the tailings and waste rock impoundment. Excess water in the tailings and waste rock impoundment will exit into the pit below the dam through a spillway on the right abutment.

Construction

The pre-construction and construction phases of mine development commence approximately 24 months prior to operations. These phases are characterized by extensive clearing, grubbing and stripping, development of access roads and haul roads, construction of the Headwater Diversion Channel, Prosperity Lake, Mine Facilities, and commencement of the TSF Starter Embankment. Prosperity Lake will be constructed at the southern end of the Fish Creek Valley to capture diverted flow from the Headwater Channel. The Headwater Channel will be constructed along the eastern flank of the Fish Creek Valley. This channel will divert undisturbed runoff from a large portion of the catchment and will direct water either north into Lower Fish Creek, or south into Prosperity and/or Wasp Lake. An Optional Diversion Channel will allow the mine to divert a small portion of water either north or south, depending on ongoing operational requirements.

During pre-construction, a portion of the population of fish will be relocated from Fish Lake to satisfy the requirements of the Fisheries Compensation Plan (Section 8). The lake level will then be lowered approximately 3 m by discharging 2.5 Mm^3 into Lower Fish Creek. This will provide sufficient storm storage and natural runoff capacity for the remainder of the construction phase, as construction commences on the Open Pit and TSF Starter Embankment. The drawn down Lake will also serve for sediment control, with all runoff within the Mine footprint being directed to Fish Lake. A water collection pond will be established at the North end of the Fish Lake basin, and will act as a repository for the pit-dewatering, and for the project area catchment runoff as construction continues.

This runoff will include the Open Pit Catchment, Embankment Seepage, non-PAG Waste Storage Area catchment runoff, and Plant Site runoff. Commencement of the TSF Main Embankment will result in surface water runoff from the undisturbed catchment (below the headwater diversion channel) being impounded behind the Main Embankment. Fish Lake will ultimately be completely drawn down with 4.3 Mm^3 of water being impounded behind the TSF Main Embankment. This will provide sufficient water for commencement of operations.

Operations

At the start of operations (Year 1), the TSF Pond will contain 6.9 Mm^3 of water collected from runoff, as well as 4.3 Mm^3 from the drawdown of Fish Lake, for a total of about 11 Mm^3. The headwater diversion channel will continue to divert undisturbed runoff from the South Flowing and Optional Diverted Catchments through Prosperity Lake and/or Wasp Lake to the Beece Creek watershed, and to Lower Fish Creek from the North Flowing Catchment. Runoff from the undisturbed TSF catchment will continue to collect in the TSF throughout operations. Seepage and surface runoff from the West Embankment, directed through toe drains and collection ditches, will be pumped back into the TSF. Groundwater and surface runoff into the Open Pit, including water from the vertical depressurization wells, will be diverted to the Water Collection Pond. Runoff from the non-PAG Waste Storage Area, Ore Stockpiles, and Plant Site will also be collected in the Water Collection Pond. All water from the Water Collection Pond will be recycled to the Plant Site process water pond, or pumped directly into the TSF Supernatant Pond. The TSF, Open Pit dewatering, runoff collection systems, and stockpile diversions will provide adequate Plant Process water from Year 2 until the end of Year 16.

Make-Up Water

As discussed in Volume 4, Section 4 there is a water balance for the mine site and no requirement for make-up water.

Potable Water

Potable water for the project will be obtained from multiple wells (Volume 3, Section 6). As such, should one well fail the others would act as back up until necessary repairs are completed. If an event were to occur where potable water is transported to site a management plan will be developed for this.

During construction, production from wells will be confirmed against forecasted required volumes and contingency plans will be developed as required to address shortfalls.

Process and Reclaim Water

As described in Volume 3, Section 6 the process water requirements come from three sources: Pit dewatering, tailings supernatant pond reclaim and the water collection pond. The water system is a closed system and contained to the footprint of the mine site. A management plan will be developed to mitigate onsite spillage should a failure of the system occur.

Closure

Following year 16, the Open Pit dewatering system will be deactivated and the Pit will commence filling (Years 17–44). The Supernatant Pond, Seepage Collection, and Stockpile Runoff provide sufficient Plant process water for ongoing operations, without any requirement for external supplementary water.

The TSF Lake will continue to fill naturally for approximately one year after operations. Upon the commencement of the closure phase (Year 21), a channel will be constructed to discharge water from Wasp Lake into Prosperity Lake and then into the TSF Lake. Throughout closure, Prosperity Lake will continue to receive diverted water from the headwater Channel. The TSF Lake will discharge into Pit Lake through a spillway constructed on the North end of the Main Embankment, within two years after closure.

At the commencement of post-closure (Year 44), the Embankment slopes and the TSF beach will be sufficiently re-vegetated for long-term stabilization of any exposed, potentially erodible materials. The following measures have been incorporated into the Project design to ensure that the TSF is stable and self-sustaining: engineered zoned embankments designed as per the Canadian Dam Association Guidelines; long beaches to keep the supernatant pond away from the embankment crests, thereby improving stability of the structures; a constructed spillway sufficient to prevent overtopping and eroding of the embankments, as well as maintaining the supernatant pond at the desired elevation; and the inclusion of vibrating wire piezometers within each embankment to allow for on-going monitoring of the structure's stability.

At post-closure, the Pit Lake will commence discharging into Lower Fish Creek. The south-flowing portion of the headwater diversion channel around the mine footprint will continue to divert undisturbed runoff to Prosperity Lake, as a long-term component of the proposed fisheries compensation system.

Direct precipitation and runoff from the surrounding catchment that is not diverted by the diversion structures will be routed to the tailings impoundment.

Water Balance for Mine Site

A thorough understanding of water movement, including flow patterns, flow volumes and occurrence, throughout the project site is essential to water management planning.

As the supernatant pond is the main source of process water, water balances were completed in order to estimate the annual water surplus or deficit at the TSF. Annual site water balances were based on average precipitation conditions, for the year prior to start-up, the 20 years of operation, and post-closure.

Immediately prior to start-up, the Main Embankment of the TSF will store approximately 11 Mm^3 of water, derived from the storage of one freshet and the almost complete drawdown of Fish Lake. Due to density of tailings during the initial years of operations, the available water in the supernatant pond gradually decreases as water received into the TSF is trapped in the pore spaces of the tailings, reaching a low of 4 Mm^3 during Year 6. Following Year 6, the dry density of the tailings reaches the assumed maximum, and the Pond begins to accumulate water, reaching a maximum volume during operations of approximately 22.6 Mm^3 during Year 16. Subsequent annual water deficits starting in Year 17 result from the cessation of inflow from the open pit dewatering facilities, as the open pit is permitted to commence filling. The pond volume at closure is approximately

18.7 Mm^3 and the annual post closure surplus in the TSF is estimated at approximately 6.6 Mm^3.

Under extreme dry conditions, the results of the analysis indicate that there may be a requirement to divert a portion of flows from the catchment east of the headwater channel in order to maintain the necessary pond volume to facilitate continuous, uninterrupted operations. Additionally, a large proportion of the fresh make-up water derived from the deep aquifer remains largely unused during each year of operations, and could be potentially utilized to supplement deficits in the TSF under these extreme conditions. The probabilistic water balance is highly conservative, and still indicates that there will be no requirement for a permanent make-up water supply, with any shortfalls being appropriately addressed with careful management of water throughout operations.

Access Corridor Water Management

The mine site will be accessed from the Forest Service 4500 road as described in Volume 3, Section 6 and is referred to as the Prosperity Plant Access Road. Construction and maintenance of this road will follow the Forest Practices Code of BC and standard industry practices. Upgrades will be required to the 4500 road and will also be constructed and maintained as per the Forest Practices Code.

The Taseko Lake Road, Highway 20 and 97 are maintained by the Ministry of Highways and upgrades, if necessary, will follow the Ministry of Transportation guidelines.

Transmission Corridor Water Management

The 125 km long transmission corridor begins at the proposed switching station near Dog Creek and terminates at the mine site (Volume 3, Section 6). The construction and maintenance of the access roads and the corridor will be consistent with the Forest Practice Code and standard industry practices to protect fish and fish habitat.

Contractor construction activities will be performed by methods that will prevent entrance or accidental spillage of contaminants, debris, and other pollutants into streams, dry watercourses, lakes, and ponds. The clearing contractor will erect and use best management practices such as silt fences on steep slopes and next to any stream, wetland, or other waterbody. Additional best management practices may be required for areas of disturbance created by construction activities. Appropriate permits from the Ministry of Environment for works in and about streams, and from Ministry of Forests and Range will be obtained as required. In addition, there will be compliance with all the criteria and guidance contained in the Department of Fisheries and Oceans applicable Operational statements and the Ministry of Environment's "*A Users Guide to Working In and Around Water*". Each crossing will be planned and the appropriate approval or notification under the *Water Act* will be submitted before work begins. Every attempt will be made to schedule these stream-crossing changes during the least risk window. Any HADD will be submitted to Department of Fisheries for authorization.

Diversion Structures

Diversions are necessary to manage the amount of water entering the tailings impoundment and minimize the water entering into the open pit. All of the water management structures are designed to reflect both regulatory requirements and engineering standards.

A Headwater Channel will be constructed along the east slope of the Fish Creek Valley during the pre-production period to collect and divert clean runoff. The Headwater Channel will minimise the volume of runoff reporting to the Tailings Storage Facility from the undisturbed portion of the catchment area.

The Headwater Channel will supply clean water to the Headwater Retention pond and Prosperity Lake. Regular channel inspections and maintenance will be required to keep the channels operational year-round.

Prosperity Lake

Prosperity Lake will include the construction of a water retaining dam aligned immediately south of Little Fish Lake, running east-west across the Fish Creek Valley. The dam will likely be constructed in two stages, with the first stage designed to hold about 50% of the volume, expected to be complete before freshet. Construction of the second stage will follow immediately and be constructed to the maximum design elevation, capable of containing the entire design volume of 7 Mm^3. Prosperity Lake is anticipated to be filled with the completion of the second freshet.

Prior to the first freshet, the area that will be flooded by about 50% of the volume of the lake will be stripped of vegetation and soil. This aspect satisfies the needs of the reclamation plan and the mercury mitigation plan. Prior to the second freshet, the full area to be flooded by Prosperity Lake will be stripped of vegetation and soil. The primary source of water year on year for Prosperity Lake will come from that diverted by the HWC.

The Prosperity Lake Dam will be constructed as a water-retaining structure that utilises a conventional downstream construction method. The dam will include a low permeability glacial till core with a filter, drain and transition zones supported by a downstream shell zone. The Prosperity Lake Dam has been laid out to provide the most productive fish habitat possible within the natural ground and replicate lake attributes similar to those of Fish Lake (i.e., sized to store at least 7 Mm^3 of water in order to create sustainable fish habitat).

The Prosperity Lake Dam may be constructed using material from a local borrow source; however, material from the open pit may be also be used in the dam construction. A preliminary location for a borrow source of low permeability glacial till has been identified and is located within the ultimate TSF.

Headwater Channel Retention Pond

The Headwater Retention Pond is designed to provide a controlled flow of water into Prosperity Lake via an enhanced fish habitat channel in an existing natural stream bed. This water supply is for the support of fish rearing habitat during the summer low flow months. The Headwater Retention Pond has been sized to store approximately 1 Mm^3 of water.

The Headwater Retention Pond is comprised of three small water-retaining embankments with a maximum height of 6 m to produce a storage pond water depth of approximately five metres. This pond will fill during each spring freshet and gradually empty over the following summer months. A constant water flow in the steam will be maintained by a low level outlet in the pond that will remain open at all times. The Headwater Retention Pond has also been assessed using criteria provided by the CDAs "*Dam Safety*

Guidelines" (2007). The construction of the headwater pond will be similar to the Prosperity Lake Dam with a central till core supported by filters and a downstream shell. Construction material for the Headwater Retention Pond is anticipated to come from within the pond basin.

Monitoring and Surveillance

To ensure the channels are constructed to design specifications, monitoring will be scheduled at regular intervals throughout construction of the various channel components. The construction monitoring schedule will generally follow recommendations described in Standards and Best Practices for Instream Works (MWLAP 2004).

To determine the accuracy of environmental effects predictions and effectiveness of the proposed channels, a monitoring program will be developed and implemented. The program will adhere to methods established in the Guidelines for Instream and Off-Channel Routine Effectiveness Evaluations (FIA 2003) and focus on the biological effectiveness (e.g., seasonal use for rainbow trout spawning in the HCRP outlet/Prosperity Lake inlet) and physical integrity of constructed channel components.

The follow-up program will include assessments of water quality (e.g., temperature, pH) and quantity, habitat structure and attribute integrity and functionality (e.g., substrates), riparian revegetation survival, and fish use by species- and life-stage (limited to the Prosperity Lake inlet channel). The following schedule has been nominally identified:

- seasonal assessments of water quality, biological (where relevant) and physical attributes of the constructed channels during the first year of operation (four assessments)
- annual assessment of the Prosperity Lake inlet channel during the rainbow trout spawning and egg incubation period

Remedial or adaptive measures will be applied immediately following any evaluation that determines a reduction in functionality or integrity of the compensation element based on a quantified trigger value.

9.2.10.2 Water Quality Control

The EMP will identify sources of wastewater and effluent, and specify the collection and storage of wastewater and effluent before treatment and disposal or release. The EMP will also specify what methods of treatment will be used to achieve acceptable discharge water quality standards; treated water will not be permitted to exit the site unless specified water quality criteria have been met. Means to contain effluent where release is not feasible will be described. Wells will be monitored regularly to determine possible effects of the project on groundwater quality. Results will be compared to specified water quality criteria.

Mitigations designed to protect water quality will also protect sediment quality and aquatic communities, including fish. The Plan will comply with the following documents and guidance:

- Fish-Stream Crossing Guidebook (MOF 2002)
- Riparian Management Area Guidebook (MOF 1995)

- Pacific Region Operational Statement Overhead Line Construction Version 2 (DFO 2006)
- Model Class Screening Report - Embedded Culverts Project in Fish-bearing Streams on Forestry Roads In British Columbia (DFO 2005)
- Land Development Guidelines for the Protection of Aquatic Habitat (DFO and MOELP 1992)

The Prosperity Project incorporates many design features that limit potential effects on the environment. Its compact design provides containment of all mine waters on site until approximately 24 years post-closure, at which time there will be two discharge points to surface water: the main discharge from the pit to Fish Creek and the smaller discharge of TSF seepage to Big Onion Lake and eventually the Taseko River.

Project design aspects and mitigation measures to reduce potential effects of discharge from the Pit Lake include:

- diversion of clean water to lower Fish Creek and Wasp Lake until post-closure
- operation of a compact closed system, that contains all mine waters on site until approximately 27 years post-closure, and directs any surface drainage, effluent
- treatment plant, sediment or metal-laden water to the TSF during operations
- the planned configuration of the mine, with the pit being the most downstream element, which provides for a very reliable system of water management in that no surface water can leave the Project without passing through the open pit and is a very robust measure of controlling discharge to Lower Fish Creek
- proper storage of PAG waste rock and tailings in deep portions of the TSF, overlain by non-PAG tailings; submerging PAG materials has been shown to be effective in TSF design elements, including: materials used to build and line the embankment, development of extensive tailings beaches to keep the supernatant water an appropriate distance from the embankment crest, seepage collection ditches and ponds, materials used to construct the West Embankment, use of the pit as a groundwater and surface water catchment for the Project area, and locating of all Project elements within a single watershed
- controlling metal leaching (Volume 3, Section 7: ARD/ML)
- reclamation planning for the 25 to 30 year closure phase that avoids revegetation of features projected to be flooded as part of the pit, to prevent build up of organic matter and concerns about methylation of mercury once the location is flooded
- the ability to control flows from the TSF into the pit post-closure to reduce loadings during the early spring low flow period on the Taseko River if monitoring indicates that increased levels of metals, hardness and sulphate at that time of year are predicted to pose a risk to aquatic life
- use of the TSF and pit as depositional areas to reduce sediment and metals loadings to surface waters, with up to 27 years prior to discharge to lower Fish Creek

Taseko recognizes there is uncertainty inherent in the mass balance model used to predict pit water quality, but is confident that both the opportunity and the technology are available to address any exceedances of water quality guidelines adequately. Natural attenuation processes in the pit (precipitation of metals to the sediment) that cannot be accounted for in the mass balance model, and are not easily modelled, will reduce metals levels below those predicted as reasonable worst case estimates. In addition, there are treatment options available that are feasible using current technology. The need for treatment will be assessed through monitoring programs during operations and closure to assess the actual geochemical performance of the Project (to calibrate the water quality prediction to site data) and during the 27 years required for the pit to fill. Data from these monitoring programs will remove a large amount of uncertainty contained in the current prediction about metal loads generated by the different waste sources.

Should monitoring indicate the need for water treatment, there are current technologies capable of achieving the necessary load reductions to meet existing provincial and federal guidelines and objectives.

Taseko will deal with uncertainty about predicted versus actual pit discharge concentrations by committing to meet generic or site-specific WQG that may be developed for the Project during the permitting stage. Additional mitigations, such as treatment of groundwater than contains porewater seeping through the western embankment and moving toward Big Onion Lake, would need to be assessed based on monitoring programs and implemented if actual groundwater quality is not as good as the conservative predictions made.

9.2.11 Erosion Control and Sediment Retention Plan

Taseko is committed to developing and implementing an erosion and sediment control plan (ESCP) consistent with industry best management practices (BMPs) to mitigate environmental effects attributed to sediment. Whereas detailed ESCPs are developed prior to construction to address construction specific mitigation techniques, a conceptual ESCP is a planning level tool addressing general Project erosion and sediment control requirements.

This conceptual plan deals with management of sediments arising from erosion of overburden fines in areas disturbed during construction and operation and includes design considerations for erosion and sediment control structures. The goal of this conceptual ESCP is to develop measures that will minimize erosion and intercept potential sediments as close to the source as possible. Measures presented in the following conceptual ESCP will act as a guideline for the detailed and site-specific ESCP that will be implemented at the time of construction to comply with regulatory requirements.

This ESCP covers six main management areas of the project where construction disturbance will be concentrated. These areas include:

- access corridor
- transmission line corridor
- borrow areas
- mine open pit/plant site/mill site/waste rock dump areas
- mine TSF
- ancillary facilities

Access Corridor

Access for construction and operations will be provided by the following roads:

- Provincial Highway No. 20 (90 km of an existing double lane paved road) from Williams Lake to the Taseko Lake Road
- Taseko Lake Road (a.k.a. Whitewater Road) (68.4 km of existing gravel road)
- 4500 Road (a.k.a. Riverside Haul Road) (19.4 km of existing single lane gravel road) which will be upgraded with pullouts at 2 km intervals
- Prosperity Mine Access Road (2.8 km of new single lane gravel road, which will be constructed 5 m wide and with pullouts)
- Provincial Highway Route No. 97 (54 km of existing double lane paved road) from Williams Lake to the Gibraltar Concentrate Load-out Facility near Macalister

The new Project site access road will be gravel, 2.8 km long, 5 m wide, one lane, with pullouts. Upgrades to the existing 4500 Road will also be completed. The existing 5 m wide road will be expanded to 8 m and the bed and surface will be upgraded with 450 mm of suitable material. A total of 10 pullouts, spaced 2 km apart will be constructed.

No road crossings over Taseko River or Fish Creek are anticipated. Site specific erosion and sediment control measures for watercourse crossings will be addressed in the detailed ESCP that will be completed once further details of the Project development become available.

New roads will be constructed according to the Forest Practices Code, Forest Road Engineering Guideline. Road construction within the project site will provide adequate drainage to minimize damage due to erosion. Small settling ponds with rock overflow weirs may be created if treatment is required to settle road runoff prior to discharge into watercourses. Gravel roads will be maintained by grading and adding gravel when necessary. Gravel road surfaces will be graded so that they are crowned at the center to promote drainage. A network of drainage ditches and culverts will be installed to convey storm water efficiently. Exposed soils such as road edges and ditches will be seeded with a grass mix that meets the requirement for Canada No. 1 Seed (minimum purity of 97%, and a minimum germination of 75%). Native species will be used wherever feasible. Paved roads will be kept free of mud and debris from mine traffic to the greatest extent possible.

Transmission Line Corridor

A 230 kV power transmission line 125 km long and 500 m wide, with switch stations at Dog Creek and the mine site, will be constructed to supply power from the BC Hydro Grid. The transmission line corridor has been designed to avoid lakes and wetlands and to follow the access corridor wherever possible. Clearing for the transmission line right-of-way will follow erosion and sediment control measures outlined in the Fisheries and Oceans Canada (DFO) Operational Statement for Overhead Line Construction (DFO 2007). The total cleared forest area required for installation of the transmission line is estimated as 585 ha. Transmission poles will be excavated in earth and overburden 2.1 to 3.6 m deep (90% of the poles) or in rock and slash (10% of the poles). Holes will be backfilled with gravel and native soil. Silt fencing will be used around sensitive watercourses and/or wetlands within the 80 metre transmission line corridor.

Borrow Areas

In order to manage erosion and sediment from borrow areas, the following measured will be implemented:

- clearing in borrow areas will be limited to the greatest extent possible
- banks will be sloped to provide positive drainage
- runoff from borrow areas will be directed to ditches or other sediment treatment areas
- large borrow sites will be contoured to direct runoff to a sediment trap at the downstream end
- bare surfaces will be stabilized with temporary erosion control blankets in areas of high erosion risk (evidence of rill erosion) with permanent vegetation being established as soon as final grades are established

Further techniques to manage runoff from all borrow sites will be addressed in the site-specific ESCP.

Mine Open Pit/Plant Site/Mill Site/Waste Rock Dump Areas

All mine site runoff from the disturbed project areas including the open pit, mill site, waste dumps and tailings storage facility will be directed to the site runoff water collection pond south of the open pit. Drainage ditches will be constructed to collect water from all the disturbed areas including the primary crusher, the overland conveyor, the mill site and the camp to direct surface runoff from these areas to the pond during operations. During the construction phase, the pond may not yet be available for site runoff collection, so temporary measures will be used, which will include silt fencing, and sediment basins and traps to limit sediment discharge from any disturbed areas to the environment.

Mine Tailings Storage Facility

A headwater channel will be constructed along the east slope of the Fish Creek valley during the pre-construction period to collect and divert clean runoff to Wasp Lake.

Surface and seepage water will be controlled during construction of the Stage 1a Main Embankment. A small diversion ditch will be constructed upstream of the upper cofferdam to divert a small watercourse. Downstream of the Main Embankment, a sump and lower cofferdam will control flow from Fish Lake during initial foundation preparation in the valley bottom. Fish Lake will be pumped down approximately 3 m prior to construction of the Stage 1a embankment and the water conveyed into lower Fish Creek. Drawdown of Fish Lake should occur during periods of low rainfall or storm events and the draw down rate should be monitored and adjusted as needed to prevent mobilization of unconsolidated material. A small earthfill dam will be constructed at the outlet of the lake to enable a controlled discharge of water to Fish Creek. The lake basin area will be utilized as a natural sediment pond, providing retention time for inflow to settle out sediment.

Ancillary Facilities

The main construction camp will be located adjacent to and south of the proposed mill site. The general areas of the campsite will be graded for positive drainage. All roads and parking areas within the camp will be raised with an average 150 mm thick layer of gravel to mitigate muddy conditions. Drainage ditches and culverts will be constructed and installed as required. Runoff collected from the construction camp area will be channelled towards the water collection pond, to the west of the camp. This drainage can be achieved readily, as the general area of the construction camp has a natural slope of approximately 1% towards the west. Temporary measures such as silt fencing, sediment basins and sediment traps may also be used to limit discharge from disturbed areas to the environment while the water collection pond is under construction.

9.2.11.1 Activity based mitigation

Taseko will continue to identify areas of high risk for erosion and sedimentation throughout the life of the project (planning and design, construction, operation, decommissioning and reclamation). General mitigation for each stage of the project is described below. Detailed mitigation plans will be developed for these identified areas during the project permitting, and will be updated during construction and operations.

General Mitigation

Measures will be implemented to minimize downstream sediment concentrations. BMPs for surface erosion protection and sediment control include, but are not limited to:

- maximize the diversion of clean water around areas of potential disturbance
- establish buffer zones around disturbed areas for natural filtering of surface runoff
- intercept sources of potential sediment-laden water as close to source of erosion as possible and re-direct runoff to stable areas
- minimize disturbance and/or removal of vegetation
- utilize bioengineering practices by establishing self-sustaining vegetation in erosion-prone areas once use of disturbed areas is no longer required
- place vegetation matting on slopes susceptible to surface erosion
- use appropriate sediment traps and barriers such as silt fences and rock check dams to minimize erosion and sheet flow in areas prone to erosion
- use silt fencing extensively during the construction phase around the perimeter of the mine site, on access roads, on the transmission line corridor (in sensitive areas) and near sediment sources to prevent the transport of sediment-laden water to natural watercourses
- use rock check dams or riprap to reduce water velocity and scour potential and to provide temporary sediment retention
- use sediment catch basins
- use water bars to divert sediment laden water out of ditches and into adjacent stable, vegetated areas
- use ditch armouring depending on factors such as steepness, soil type and presence of immediate downstream watercourses
- undertake operations in sensitive areas during periods of dry weather where possible

- minimize traffic through sensitive areas and select equipment that will generate the least disturbance
- minimize slopes and/or use mid-slope benching where possible
- cover exposed slopes with side slopes greater than 1H:1V with polyethylene sheeting
- install silt fencing in ditch line and at outlets of cross drain culverts
- use non-woven geotextile to control erosion in ditches and around the perimeter of sediment ponds
- line ditches with loose/fine substrates using clean gravel
- install French drains to redirect subsurface flows where possible

Pre-Construction and Construction Phase Mitigation

The pre-construction and construction phase will include disruption of existing habitat and terrain. Construction disturbance typically results in the release of fine sediments into any surface runoff flowing through the work area. As a result, all erosion and sediment control measures, including sediment ponds, must be implemented at the outset of construction. Erosion and sediment control measures will be inspected and maintained regularly.

Surface drainage patterns will be managed to minimize erosion and associated sedimentation. For ditches (at all project areas), measures such as armouring, geotextile, silt fencing, and sediment ponds will be utilized. Exposed soil in roadside slopes will be revegetated with an appropriate seed mix as soon as possible. Sediment ponds that are no longer required after construction will be reclaimed and revegetated.

Pre-construction and construction activities will be monitored routinely by a qualified Environmental Monitor for the duration of this phase of the Project. Qualifications and reporting requirements for the Environmental Monitor are addressed in Section 9.2.11.3 Monitoring and Inspection.

Operations Phase

During operation of the mine, erosion and sediment control measures will include, but not necessarily be limited to:

- routine erosion and sediment management (precipitation/snowmelt) along the access road, the transmission line corridor, and within the mine site
- management of operations during major precipitation events

Procedures will be established for the collection and analysis of water quality samples to ensure that site runoff complies with permit requirements and regulatory requirements. Protocols will also be established for the monitoring and maintenance of erosion control measures. The Environmental Coordinator for the site will have the ability to shut work down if non-compliance issues are observed, or where it is anticipated that unforeseen circumstances are likely to cause environmental damage.

Mine Closure

At the time of mine closure, the basic components that will require erosion and sediment control include:

- breaching of diversion (into tailings pond and subsequently Wasp Lake)
- flooding of the tailings and waste rock impoundment facility
- construction of the permanent spillway for the tailings dam
- reclamation of overburden stockpiles
- removal and regrading of all access roads, ponds, ditches and borrow areas not required beyond mine closure
- long-term stabilization of all exposed erodible materials

All areas above the waterline with forest capability will be reclaimed to promote productive forest ecosystems. Reclamation techniques are detailed in the Conceptual Reclamation Plan, Volume 3, Section 6.11.3.3 of the EIS.

Any roads within the project area required for access after closure will be semi-permanently deactivated. Semi-permanent deactivation measures include:

- removal of culverts and replacement with cross ditches
- installation of ditch blocks at cross ditch locations
- installation of waterbars across roads to direct water away from the road
- sloping the road surface, as appropriate
- revegetation of exposed soils surfaces

Installed closure components must be sustainable in the long term and should involve a minimal amount of subsequent inspection and maintenance once constructed. Further information on reclamation and closure works is provided in Volume 3, Section 9.3: Reclamation and Decommissioning Plan

9.2.11.2 Erosion Control Techniques and Best Management Practices

Erosion Control

Erosion refers to the dislodgement, removal and loss of topsoil, sand, silt or clay from its original location by water, wind, ice or gravity. During construction of a mine and ancillary facilities, soil erosion is caused by vegetation removal and the exposure of soils to water, and to a lesser extent, wind.

Conditions that influence surface runoff, including slope steepness, slope morphology, and material type and texture, are used to assess surface erosion potential. Types of water erosion on soils include raindrop splash, sheet erosion, rill and gully erosion, and stream and channel erosion.

Erosion control involves minimizing the extent and duration of land disturbance that exposes bare soil. Erosion control measures are typically more effective than sediment control, and will therefore take precedence. The following provides some additional detail on erosion control measures that may be appropriate.

Runoff Interception and Control

Diversion of surface water will minimize the volume of water running onto disturbed areas, thereby reducing the potential of erosion from these areas, and the level of sediment control and treatment that might otherwise be required.

A headwater channel will be constructed along the east slope of the Fish Creek valley to collect and direct clean water away from the mine site. Water will be diverted north into Fish Creek downstream of the northern-most extremity of the pit and south into Wasp Lake.

Further interception or diversion channels will be constructed at various locations in order to capture and control stormwater runoff, and to direct it off site. Ditches prevent stormwater from entraining sediment from exposed areas and may partially filter out potential pollutants. Diversion ditches typically discharge directly to the downstream environment or to locations where no potential for adversely affecting the environment would occur.

Diversion ditches may be designed in accordance with the following criteria, subject to detailed construction plans and site constraints:

- Sized to accommodate 110% of peak or storm flows (a 25 year event based on the Rainfall Frequency Atlas of Canada). Sizing of ditches should allow vegetation planting for further erosion control.
- Corners and outfalls will be armoured with rip rap or boulders.
- Ditches should have sufficient grade and capacity to carry the expected runoff, and should be designed and spaced to drain the entire site effectively.

Appropriate channel lining will be specified depending on channel gradients and velocities. Some initial flushing, erosion and self-armouring are expected following construction. Small sediment ponds with rock overflow weirs will be constructed to collect this initial flushing prior to discharging to Fish Creek. A number of permanent interception/diversion ditches will be constructed as part of the overall operations phase.

Diversion berms may be constructed on exposed slopes to intercept sheet flow, re-routing the water to more stable areas. If required, berms will be placed to ensure that water will not drain back onto the disturbed areas.

Sediment traps may be used where drainage ditches are required. Sediment traps are any structure constructed for the purpose of effectively removing suspended sediment from runoff. The construction of sediment traps typically involves the construction of a containment area or pools within a ditch to retain runoff for a long enough period of time that suspended materials can settle. Sediment traps and silt fences will be cleaned regularly to maintain maximum efficiency.

All ditches will be graded to direct runoff to the drainage ditches, or directly to the sediment ponds. Silt fences and gravel berms will be installed at intervals along the length of the ditches as required, in order to promote the settling out of sediment. All runoff will be directed to the sediment ponds for final settling prior to being discharged to a drainage ditch. During large storm events, if appropriate, surface storm water runoff can be directed into vegetated/undisturbed areas where water will flow away from the site. The Environmental Monitor should be onsite to confirm whether the discharging of storm water runoff to vegetated areas is suitable for the site and will not cause further erosion. If water is discharged to vegetated areas, the hose outlet will be modified (e.g., with a capped PVC pipe) to diffuse water and energy at the outfall. The environmental monitor on site should verify that runoff from large storm events is managed sufficiently so that scouring of vegetated surfaces does not occur. Diverting water onto vegetated undisturbed areas still may result in significant erosion depending on the nature of the land surface (i.e., gradient, and focusing of water and gully formation and flows may require further diffusion at the outfall.

Dewatering

Dewatering may be required on occasion throughout the life of the Project in order to keep work areas. Dewatering may also proceed in areas where concrete work is being completed to ensure that the concrete work is completed in the dry. As per the contract documents, pumps used to maintain dewatered areas may discharge water towards or into Fish Creek provided that the water is clean and free of all deleterious substances.

Bed protection and stabilization, as well as energy dissipation measures, may be required where the diversion ditches discharge into Fish Creek. To dissipate energy, water may be discharged over large rocks to reduce velocities. If pumps are used, a capped perforated PVC pipe may be attached to the pump outlet to diffuse water energy and prevent erosion at the outfall.

No water will be extracted from fish bearing waters unless the pump intake is equipped with a fish exclusion screen. The fish exclusion screen must prevent entrainment (drawing fish into the intake) and impingement (holding fish against the screen so it is unable to free itself) and comply with the Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO 1995).

Grubbing and Stripping

Grubbing and stripping pertains primarily to activities along the new section of main access road (2.4 km), the transmission line corridor, and the access roads to the transmission line corridor. Grubbing and stripping limits will be marked in the field using fencing or spray paint prior to the commencement of work to ensure that vegetation in adjoining areas is not disturbed.

The grubbing and stripping of soils is to be limited to areas absolutely necessary to satisfy the construction requirements of the Project. Where construction can be completed without grubbing and stripping, none shall occur. Grubbing will not proceed more than five days in advance of any subsequent activity without the installation of appropriate surface drainage control. Grubbing will be suspended during and immediately after intense rainstorms that have resulted in excessive runoff. Any stripped topsoil shall be stockpiled and covered for future use in restoration.

Stockpiling

Temporary stockpiles of excavated material or backfill may be kept on-site. Any piles of earth or erodible construction materials stockpiled on-site will be placed so that erosion into ditches or other open water cannot occur and in a location that stockpiles will not impede drainage. All stockpiles with side slopes greater than 1V:1H will be covered with tarpaulins or plastic sheeting for erosion control. A silt fence will be required around the toe of stockpiles to prevent sediment movement from the stockpile. All silt fencing will be dug in a minimum 200 mm into the ground. Runoff that originates from stockpiled materials will be collected and directed to the sediment pond or trap.

Slope Protection

Erosion protection measures will be used to reduce and eliminate the detachment or migration of slope soils at all times, especially during rain events, and will be used in conjunction with the runoff control measures described above. Where feasible, exposed slopes with slopes greater than 1V:1H will be covered by tarpaulins and/or polyethylene sheeting. Tarpaulins and plastic sheeting will be secured with stakes and staples, or rocks, and may be bordered by silt fences. Erosion control blankets may also be used on sensitive slopes. Where blankets are used they will be secured at the top of the slope by trenching the blanket into a shallow trench and by securing the blanket to the ground. The sides of each roll of blanketing will be overlapped by 5 to 15 cm, and the ends of each roll will be shingled with a 10 to 20 cm overlap.

Check Dams

Check dams can be used to both control water runoff velocities and allow for suspended sediment to settle out. Check dams can also filter coarse suspended solids from the water column. Effective check-dams are typically 600 mm in height, constructed of clean crushed rock (gravel), have silt fencing installed on top, and are installed every 50 to 75 m along the channel. Locations of check dams will be determined in the field by the Environmental Monitor and the contractor, but at a minimum should be installed in all surface runoff collection ditches. A combination of silt fences and check dams may be used to reduce water velocity in ditches leading to existing natural drainages.

Erosion Control Blanket

An erosion control blanket (rolled erosion control product) is a biodegradable soil covering used to protect exposed soils from erosion which may be installed during any phase of the project. The installation of an erosion control blanket is designed to protect disturbed and exposed soils and slopes 1V:1H and steeper, where the potential for erosion is high (silts and sand), and on slopes where vegetation may be slow to develop. The location of erosion control blankets will be determined in the field by the Environmental Monitor and the contractor.

French Drain

French drains may be used to redirect surface and ground water away from areas. Composed of a ditch filled with gravel, a French drain is primarily utilized to prevent ground and surface water from penetrating or damaging building foundations. If necessary, the on site environmental monitor may recommend the field fit installation of a French drain to distribute water away from areas that may be sensitive to soil saturation or water pooling.

Contingency Planning & Work in Rain

Rainfall events can result in significant erosion due to the impact of the water on exposed soils and the runoff generated. In the event of heavy runoff, diversion berms and check dams will be used to slow flows and prevent erosion. Tarpaulins and plastic sheeting over exposed soils will also reduce erosion. Check dams may be constructed of clear crushed gravel, sand bags, or silt fences. Materials required to handle excess runoff following a storm event will be stored on site at all times. If a severe storm results in runoff exceeding the capacity of the sediment control provisions, additional measures will be undertaken to contain the runoff or work will be halted.

Sediment Control

Where water diversion and erosion control are not enough to prevent the erosion of disturbed soils, retention of sediment-laden water through the use of sediment ponds and other forms of sediment traps will be undertaken (sediment control). The following provides some additional detail on erosion control measures that may be appropriate.

Sediment Control Ponds

The following environmental practices will be implemented if sediment ponds are required:

- sediment ponds will be located in the lowest practical point of the catchment area
- the location, number and size (volume capacity) of ponds will depend on the area (topography) and extent of construction activities
- the inlet and outlet of sediment ponds should distribute flows evenly across the width of the pond and baffles should be installed to reduce the potential for remobilization of settled sediment within the pond
- the pond outlet invert will consider input flow rates and pond capacity and will be established at an elevation (relative to the pond inlet) that allows for adequate retention time for the settling of suspended sediments, prior to final discharge

Design parameters for sediment ponds are summarized from the Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al. 1992) and provided in Table 9-4.

Table 9-4 Design Parameters for Sediment Control Ponds

Parameter	Comment
Design Particle Size	0.02 mm
Design Pond Area	Design to the 5-year storm event (1:5) or a minimum of 1% of the total erodible area
Design Horizontal Velocity	Horizontal velocity will not cause suspension or erosion of deposited material
Design Hydraulic Retention Time	Minimum 40 minutes
Design Drawdown Time	48 hours with no incoming flows or loss of accumulated solids
Overflow Spill Capacity	Developed site 1:10 year storm event
Emergency Spillway Capacity	Developed site 1:100 year storm event

During the construction phase, appropriately sized sediment ponds will be constructed at strategic locations, to allow sufficient retention time for fine suspended particles to settle out of the water prior to being discharged to the downstream environment. If necessary (i.e., for problematic sediments such as glaciolacustrine clays), flocculants (settling aids) will be considered. Any flocculant used must be non-toxic to the receiving environment.

All sediment-laden water captured by runoff control interception ditching should be directed to a sediment pond. During operation of the mine, the tailings and waste rock impoundment will receive the majority of site runoff not collected by perimeter drainage.

The tailings impoundment will therefore act as a sediment pond. Surface runoff directed into diversion ditches will be of similar quality to freshwater upstream of the project site, and will not need to be directed towards the sediment ponds.

The sediment pond will undergo annual maintenance and if sediment levels reach 75% of pond capacity. Removal of excess sediment will proceed during dry weather or in isolation of flows. Sediment removed during maintenance activities can be drained and if possible will be used for developing reclaimed features such as the Pit Lake, TSF beach or TSF Island.

All sediment control facilities will be closely monitored to ensure sediment discharge levels are maintained below both construction and operations phase permit levels. The maximum allowable discharge level for total suspended solids from the tailings facility during operations is set by the Canada Metal Mine Effluent Regulations at 15 mg/L (monthly average); however, no discharge from the tailings facility is planned until the post-closure phase.

Silt Fencing

Silt fences and related support structures provide an effective barrier for sediment-laden runoff from erodible slopes and surfaces, trapping the sediment close to the erosion source and preventing mobilization into runoff. While they are very effective on short relatively steep slopes, these devices must be properly installed and maintained to be effective.

Silt fences will be properly installed on the lower perimeter of slopes where the potential for erosion is high and/or it is desirable to contain waterborne movement of soils. Other areas where silt fences will be used include the bottom of cut or fill slopes, the base of material stockpiles and disturbed natural areas. Each silt fence will be embedded a minimum of 200 mm into the ground and reinforced with wire, stakes or gravel. Maintenance of silt fences will be required and installation of new fences will occur where needed.

9.2.11.3 Monitoring and Inspection

To effectively mitigate project-related erosion and sediment impacts, the ESCP must be properly implemented in the field. Quick and appropriate decisions in the field regarding critical issues such as placement of erosion controls, dewatering, spoil containment, and other construction related items are essential.

To ensure that the ESCP is properly implemented, at least one Environmental Monitor (EM) will be designated by Taseko during active construction. The EM should report directly to the Resident Engineer / Chief Inspector who has overall authority. The EM will have the authority to stop activities that violate the environmental conditions of permits and authorizations and to order corrective action.

Qualifications of the Environmental Monitor

Taseko will employ a qualified EM who is familiar with the field implementation of erosion and sediment control measures to monitor water quality as well as general instream and riparian construction activities. The EM may be required to monitor pH and turbidity at any discharge points or at runoff areas and will ensure that instream and riparian habitat protection measures are followed.

Environmental Monitor Responsibilities

At minimum, the EM will be responsible for:

- providing guidance to ensure compliance with the ESCP
- inspecting erosion and sediment control measures for proper installation and maintenance
- identifying, documenting and recommending corrective measures to return activities to a state of compliance with the ESCP
- advising the Resident Engineer / Chief Inspector of recommended corrective measures and of when conditions such as wet weather make it advisable to restrict construction activities that have the potential to generate sediment laden water
- verifying the timing and spatial extent of clearing and construction
- verifying the locations of buffer zones around sensitive areas such as watercourses and wetlands
- prepare compliance monitoring reports to confirm works abide with the ESCP and relevant guidelines or conditions of regulatory approvals

9.2.11.4 Reporting Requirements

After each site visit, the EM will document the following:

- silt fencing is in an appropriate location and functioning as intended
- road surfaces affected by construction activities are clean and free of excessive fine sediment that may enter a watercourse
- all attempts are made to reduce the transport of fine materials from the worksite to natural watercourses
- runoff from the active worksite is in compliance with the DFO Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al. 1992) at the time of sampling (i.e., suspended sediments less than 25 mg/L above background levels or less than 75 mg/L above background levels during rainfall conditions)

In addition, recommendations to improve sediment and erosion control will be provided to the Resident Engineer / Site Inspector.

9.2.12 Vegetation and Wildlife

9.2.12.1 Vegetation Management

Vegetation communities will be affected within the proposed project footprint and transmission corridor. The Vegetation and Wildlife Management Plan will outline strategies and procedures for avoiding vegetation loss, minimizing disturbance, mitigating against invasive species and site rehabilitation through the life of the project and upon closure.

Activity specific measures will be developed for contractors and employees to minimize damage to vegetation at each of the Project components, but several general measures include:

- minimize vegetation loss (including rare plants and ecosystems of conservation concern such as wetlands, riparian areas, grasslands and old growth forest) through environmentally sensitive Project design
- implement best management practices including the creation of buffer zones around wetland habitats, maintaining connectivity among wetlands within wetland complexes, and ensuring obstacles are utilized where possible to limit public access to wetlands beyond the Projects maximum disturbance area
- where possible, minimize the extent of grubbing, stripping and the removal of shrubs and herbaceous species, and retain the humus layer and vegetation root mat
- wherever possible, schedule any construction to occur in sensitive wetland, riparian and grassland areas to occur when potential impacts are minimized
- remove any green felled or wind thrown spruce from the site as required in consultation with Ministry of Forests and Range, to avoid build up of spruce bark beetle populations; and not remove any mountain pine beetle “green attack” trees from the site
- encourage slope stability and minimize soil quality degradation through grass seeding and slope revegetation; ensure water flow around work sites is not interrupted
- re-establish vegetation on disturbed areas as soon as reasonably possible; progressive reclamation activities will be used, when feasible, to revegetate disturbed areas within the mine site

Specific to the transmission corridor, measures to be included in the Vegetation and Wildlife Management Plan will include minimizing disturbance by timing construction to when soils are frozen or dry, delivery of transmission poles to wetland and grassland areas by helicopter, and minimizing area of disturbance during pole installation. Within the grassland ecosystems above the Fraser River, measures for minimizing disturbance and protecting existing plant communities will be rigorous.

Specific to the access road, dust deposition on plant communities arising from traffic will be minimized by procedures for such as using dust suppressants when conditions warrant, and ensuring that loaded concentrate trucks are covered to prevent dust escaping during transit.

9.2.12.2 Invasive Plant Management

The invasive plant management plan (Volume 5, Section 5: Vegetation) outlines procedures to be followed during all phases of mining, some of which are specific to contractors that will be arriving with equipment.

Principles set out in the invasive plant management program consist of a coordinated approach to:

- prevention
- proper identification and knowledge of species
- inventories, mapping and monitoring

- educated control decisions based on knowledge of potential damage, cost of control method and environmental impact of the weed and control decision
- combining weed management methods
- ongoing evaluation of the effectiveness of the strategies used

This approach will be applied throughout all stages of construction, operation, and reclamation. Wetland, riparian and grassland ecosystems, in particular, will be monitored for new infestations during construction of the mine access road and transmission corridor, and any access roads used to support construction or maintenance of the transmission line corridor. Areas within the mine site will be monitored for weed infestations during operations, and for an extended period following closure until revegetation reaches a self-sustaining state.

9.2.12.3 Wildlife Management

Direct and indirect effects on wildlife can be expected as part of project development and operations. Wildlife impact mitigation strategies (Volume 5, Section 6) and procedures will be fully developed in Taseko's comprehensive Vegetation and Wildlife Management Plan. This plan will be made available to all project employees and contractors.

Wildlife control measures and environmental protection procedures will be put in place to minimize risks to wildlife and humans during the construction, operations and closure phases. Controls and procedures to be developed prior to the initiation of work on the site may include:

- minimizing site clearing and prior to activities, inspect the area for any wildlife habitat features; avoid site clearing of moderate or higher quality denning habitat in mid-winter to reduce the risk of destroying or disturbing active dens
- education for drivers to minimize the risk of collisions with wildlife, enforcing speed limits, and recording all Project-related wildlife-vehicle collisions or near misses
- establish work windows when planning proposed activities in order to protect listed populations and/or individuals and their habitat
- development of a problem wildlife prevention and response plan, and initiate Bear Aware and safety training
- evaluate wildlife reactions to blasting and, if significant effects are observed, explore and evaluate mitigation measures
- put in place controls for helicopter over-flights to minimize acoustic disturbance during the big horn sheep lambing period

Specific to the construction of the transmission line, site clearing will be limited to minimum width required and new access roads will be minimized wherever feasible. Procedures developed for bird protection may include:

- evaluation and selection of the most appropriate bird markers
- incorporation of trees and shrubs into the route design where feasible, to provide natural obstacles for birds to navigate, directing their flight over lines
- identification of high collision risk areas

- confirmation that conductor/line spacing is large enough to greatly minimize or eliminate electrocution risk
- evaluation and selection of perch deterrents (e.g., "bird spikes") for the poles

Throughout the Project area, and particularly on the transmission corridor, temporary access roads will be deactivated in such a manner so as to deter ATV travel. Where fencing is required for cattle, wildlife-friendly fencing will be used in accordance with specifications recommended by the Ministry of Environment.

Mitigation measures to be implemented during construction and operational phases will include the creation of policies to limit human activities in and around the project operations and camp areas as well as no-hunting and no-recreation policies for employees while on their work rotation.

To decrease the attractions for bears and other scavengers, the Vegetation and Wildlife Management Plan will be integrated with the waste management and recycling program. Littering, feeding and harassing wildlife will be prohibited at all times on any Project site. By limiting and controlling garbage generation, fewer human–wildlife interactions will occur.

9.2.13 Cultural and Heritage Protection

Unique to the Prosperity Project, an extensive AIA has been developed for the mine site. The results of the AIA and the mitigation plan are presented in Volume 7. When possible, Taseko's objective is to preserve heritage and archaeological sites through avoidance. When avoidance of sites of significance is not feasible, procedures in the mitigation plan will ensure that archaeological data is recovered and recorded in order to enhance the archaeological knowledge of the local and regional area.

9.2.14 Occupational Health and Safety

The comprehensive Prosperity Occupational Health and Safety Plan will be developed to uphold Taseko's commitment to a safe environment for employees, contractors and visitors. All aspects of the Taseko's Prosperity Project will conform to the health and safety requirements detailed in the *Mines Act* and the Health, Safety and Reclamation Code for Mines in British Columbia (2003). Day to day workplace rules will be in accordance with the Parts 2 and 3 of the Code. The Prosperity Project Safety Manager will take the lead in establishing an Occupational Health and Safety Committee. This plan also addresses requirements that are not legislated under the *Mines Act* and subject to the BC *Workers Compensation Act [RSBC 1996]*.

The Occupational Health and Safety Plan will set out the framework under which health and safety on the mine site, to and from the mine site and at the concentrate load out facility will be managed. The roles and responsibilities of the company, manager, superintendents, supervisors, and workers are set out under this plan. The plan also covers contractors that are Prosperity site, including the power line right-of-way. Contractors not on-site are excluded from this plan and are expected to adhere to the appropriate legislation of their jurisdiction.

The programs that will be outlined under the plan include provisions for the anticipation, recognition, evaluation and control of physical, chemical, radiological, biological, ergonomic and psycho-social factors that may exist at the project site and in other project related activities.

Vision Statement

Taseko is committed to establishing a healthy and safe working environment for all individuals at its Prosperity Project. To achieve this, Taseko will develop and maintain an occupational health and safety plan designed to prevent injuries and disease for all personnel. All employees and contractors will be required to know and follow our stringent safety guidelines for safe work procedures.

Strategic Objectives

The following strategic objectives have been designed to reflect the commitments set out in the in Taseko's Health and Safety Policy:

- identify workplace hazards
- minimize the potential for occupational injuries, disease or loss of life
- meet workers' expectations to be informed as to the potential environmental and psycho-social factors that may affect the health and well-being of workers and apply this knowledge in the prevention of accidents and occupational diseases
- meet stakeholders' expectations to ensure the health and safety of all persons on-site, including meeting training needs
- identify and make provisions to address the needs of all individuals with respect to health and safety; in such away their ability to do work is not compromised
- share information related to the health and safety of workers so they can share and contribute to the achievement of goals
- ensure that contractors activities legislated by the *Workers Compensation Act* are addressed with similar commitments to health and safety and legal obligations are met
- meet the legal requirements of the BC *Mines Act* (1996), Regulation and the appropriate sections of the Health, Safety and Reclamation Code
- limit financial losses resulting in injuries and disease

9.2.14.1 Strategies and Program Planning

To meet the strategic objectives outlined above, Taseko will incorporate the following in their Occupational Health and Safety Plan for Prosperity:

- safety policies that at least cover on-site work, camp accommodation, off-site work, transportation of personnel, and contractors
- a safety management program that focuses on the prevention and management of workplace accidents and injuries, including musculoskeletal disease (MSD); as required under the BC *Mines Act* (1996)
- an occupational health management program that focuses on the anticipation, evaluation and control of worker exposure to environmental factors and stressors that may be physical (other than accident and ergonomic hazards), chemical, radiological or biological, in order to prevent short- and long-term occupational diseases; this program will integrate a workplace monitoring program as required under the BC Health, Safety and Reclamation Code
- a worker well-being program that focuses on optimizing social conditions at work to minimize stress and enhance well-being in workers

- a program for on-site medical attention and care
- a return-to-work program to help returning injured workers to work as soon and as safely as possible
- a risk communication program that focuses on (a) the need to raise awareness of risks to human health and the roles and responsibility of managers, supervisors, workers, health and safety committees that are related to the identification, prevention and control of these risks; and (b) the need to integrate feedback from workers
- a training program in order to have competent workers, supervisors, managers and committees, with respect to worker health and safety

9.2.14.2 Implementation

Taseko's Health and Safety Policy states: It is the policy of Taseko to provide and maintain safe and healthy working conditions, and to establish operating practices which safeguard employees and physical assets.

To achieve this goal Taseko dedicates itself to:

- meeting or exceeding all industry standards and legislative requirements
- developing and enforcing safe work rules and procedures
- providing employees with the information and training necessary for them to work safely and effectively
- acquiring and maintaining materials, equipment and facilities so as to promote good health and safety
- encouraging employees at all levels to take a leadership role in accident prevention by reporting and/or correcting unsafe situations
- providing a safe and healthy workplace for all of our employees, contractors and visitors
- train and motivating all of our people to work in a safe and responsible manner
- making health and safety a part of all business decisions
- integrating the highest safety standards through exploration, design, construction, operations and closure
- applying "best practice" to our health and safety activities
- exceeding community expectations for health and safety
- striving for continuous improvement in our health and safety program
- holding all of our people accountable for health and safety

As per the *Mines Act*, the Mine Health and Safety Program will use the following to establish a safe and positive working environment for employees:

- clear and demonstrated commitment from management
- competent personnel in coordinator roles
- health and safety policy
- general safety rules
- codes of practice
- safe work procedures
- a management system to identify the requirements of the program

- a list of hazardous materials and work situations
- safe handling procedures
- provision of antidotes for chemicals used
- monthly crew safety meetings
- procedures for accident and serious incident investigation
- procedures for safety tour inspections
- a written preventative training program regarding musculoskeletal disorders

Codes of practice will focus on project design. Safe work procedures will focus on employee roles and responsibilities. They will be written in a way that can be clearly understood and performed in a consistent manner. The scope will be reduced and expanded by the manager and/or the Occupational Health and Safety Committee, as is their duty under the *BC Mines Health, Safety and Reclamation Code*. This program will integrate a workplace monitoring program.

Codes of practice and safe work procedures will be developed and/or reviewed before each project phase (construction, operations and closure). These will be implemented and updated for the duration of the project, using a continual improvement process. To assure mine safety, Taseko will focus on general safety rules, safe work procedures and internal operational policies and training. Policies will be addressed and managed by department, as required by the BC *Health, Safety and Reclamation Code*. Specific roles and responsibilities, scope, objectives, tasks, timescales and budgets will be established for each phase, and adjusted accordingly. Objectives and performance standards will be established and reviewed annually. Where improvements are required, action plans will be developed to achieve stated goals.

9.2.14.3 Roles and Responsibilities

The Safety and Security Department will implement the programs outlined within the Occupational Health and Safety Plan. The Health and Safety Coordinator will have a thorough understanding of the company's operations and associated occupational health hazards. The coordinator will be familiar with appropriate methods to identify, evaluate, and control health and safety hazards. The Occupational Health and Safety Plan will outline the roles and responsibilities for the following:

- commitments and responsibilities at the corporate level
- Mine Manager's responsibilities
- Superintendents' responsibilities
- Supervisors' responsibilities
- Workers' responsibilities
- Contractors' responsibilities

9.2.14.4 Occupational Health and Safety Committee

At the beginning of development, an Occupational Health and Safety Committee will be formed and composed of two or more persons representative of management and an equal or greater number of worker representatives. Outcomes from health and safety management meetings will be communicated to employees, and contractors.

The Occupational Health and Safety Committee will have specific responsibilities with respect to this plan and include:

- reviewing Mine Health and Safety Program and all other programs under the Occupational Health and Safety Plan for completeness and effectiveness on an ongoing basis and submit its findings to the Mine Manager
- implementing monthly inspections of workplaces and comply with meeting and reporting requirements as set out in the BC *Mines Act*
- participating in the investigation of reportable incidents

9.2.14.5 Hazardous Materials

A formal system will be implemented to monitor and guide the purchase, handling, use, storage and transport of hazardous materials. The Safety and Security and Environment Department will assess all new substances when they are purchased by Taseko or used on site by contractors. A list of hazardous materials will be kept for each department. Hazardous materials to be used on site include:

- petroleum products (e.g., diesel fuel, gasoline, lubricants, hydraulic fluids, oil and solvents)
- explosives (e.g., ammonium nitrate [AN])
- batteries
- mill reagents (e.g., flotation collectors such as potassium amyl xanthate, frothing agents such as methyl isobutyl carbinol (MIBC), flocculants, and quicklime)

9.2.14.6 Other Procedures and Policies

Other procedures and policies include:

- monthly crew safety meetings
- procedures for accident and serious incident investigation
- procedures for safety tour inspections
- safe handling procedures (see Hazardous Materials Management Plan)
- storage and provision of appropriate antidotes on-site
- storage and maintenance of personal protective equipment
- provision of information regarding services and support available to workers

9.3 Reclamation and Decommissioning Plan

This Reclamation and Decommissioning Plan for the Prosperity Gold-Copper Project provides:

- first, an overview of the regulatory framework and associated requirements under the BC *Mines Act*
- second, a listing of the reclamation and decommissioning objectives for Prosperity
- third, a description of the general reclamation practices proposed that are consistent with the Health, Safety and Reclamation Code (MEMPR 2003)
- finally, a description of Prosperity's decommissioning and closure activities

9.3.1 Regulatory Framework and Requirements

9.3.1.1 Mine Plan and Reclamation Plan Submission

The conceptual reclamation practices and the decommissioning activities outlined in this plan are consistent with the BC *Mines Act* and its Health, Safety and Reclamation Code. The intention of these conceptual descriptions in the EA is to provide a basis for detailed reclamation planning and bonding discussions that will be held with the BC Ministry of Energy, Mines and Petroleum Resources (MEMPR) at a later date as part of the permitting application. With respect to recreation values, wildlife, wildlife habitat, at-risk plant communities and the habitat of species at risk the conceptual reclamation approaches and decommissioning plan is intended to mitigate any residual effects from mining to these values.

It is understood that if the Prosperity project is approved, this conceptual reclamation plan will be subject to public and regulatory agency scrutiny as part of the Mine Development Review Process before being finalized. As the mine and associated reclamation plans evolve during the course of mine operations, applications for amendments to the *Mines Act* Permit are required under the Code, with the approved amendments being subsequently attached to the original *Mines Act* Permit.

9.3.1.2 Reclamation Cost Reporting

The policy for cost reporting in BC is intended to provide reasonable assurance that government funds will not be used for mine reclamation. For new mines, the policy is to set the reclamation security at a level that reflects all outstanding decommissioning and closure obligations existing at that time, including reclamation, maintenance, long-term treatment, and monitoring. As part of the application for a *Mines Act* Permit, a detailed projection of reclamation costs is required.

9.3.2 Reclamation and Decommissioning Plan Objectives

The Reclamation and Decommissioning Plan for Prosperity has three main objectives:

- provide for stable landforms
- prevent erosion and sedimentation to protect aquatic resources
- re-establish a productive land use that is of value for wildlife and recreation, and mitigates the residual effects of mining on wildlife habitat, at-risk plant communities and the habitat of species at risk

Design of permanent mine-related landforms such as the open pit, impoundment dams, waste rock and tailings areas has been undertaken to ensure long-term stability after mine closure. Each containment structure has been designed to be fully compliant with the Canadian Dam Association Safety Guidelines and the Interim Guidelines of the BC Mine Waste Rock Pile Research Committee as per sections 10.6 of the Code.

Geotechnical and hydrogeological field investigations were undertaken to enable the feasibility level design of the tailings and waste rock impoundment facility, open pits, waste rock storage areas, plant site foundations and water diversions. An overview of the Geotechnical Stability Monitoring Plan is provided in Volume 3, Section 9.2.

An overview of the Erosion Control and Sediment Prevention Plan to be developed is provided in Volume 3, Section 9.2. The purpose of this plan is to mitigate environmental effects attributed to sediment in order to protect aquatic resources. This conceptual plan deals with management of sediments arising from erosion of fines in areas disturbed during construction and operation and includes design considerations for erosion and sediment control structures.

The end land use and capability objectives are based on information on pre-development site conditions. The general concept applied to project reclamation and end land use is that reclamation will be conducted with the goal of establishing post-mine capability on an average site-wide basis equivalent to the average capability of the land prior to mining.

Similar to pre-development conditions where primarily forested ecosystems provided a range of values, the post-closure landscape will be capable of productively supporting a range of simultaneous end land uses. Historical hunting and trapping in the area by the Tsilhqot'in people is a critical component when considering area land use. The primary end land use goal will be wildlife habitat, including habitat for small mammals and waterfowl. The Prosperity Lake feature and associated spawning channels have also been designed to support productive rainbow trout habitat for a potential recreational fishery.

9.3.3 Reclamation Practices

The reclamation approach for the Prosperity Gold-Copper Project includes techniques to meet the primary end land use objective of wildlife habitat. The primary focus of the reclamation program is to foster return to appropriate and functional ecosystems, supported by soil replacement strategies that will facilitate the establishment of self-sustaining vegetation communities.

General reclamation practices to promote the return of wildlife and specific habitat features to the reclaimed mine site include those listed below. Where reclamation practices are of particular benefit to the KI species, these are shown in brackets (e.g. [black bear]); however, it should be understood that these measures are not limited in application to the KI species. For example, movement corridors beneficial to ungulates and bears will also be used by wolves, coyotes, etc. KI species for this Project for which there is habitat capability on the reclaimed landscape include great blue heron, Barrow's goldeneye, Mallard, short eared owl, fisher, mule deer, moose, black bear and grizzly bear (Volume 5, Section 6: Wildlife).

General reclamation practices include:

- Salvage and storage of sufficient quality soil materials for reclamation.
- Recontouring surfaces where appropriate to facilitate optimum plant production, appropriate site drainage, and animal access.
- Site preparation to alleviate compaction where required and facilitate drainage.
- Soil replacement to stimulate plant establishment, suitable quality forage for animal consumption, and long-term sustainable ecosystem function.
- Seeding areas as soon as possible after placement of soil with a seed mix suitable for erosion protection and that also provides summer forage for bears, moose and mule deer.
- Planting deciduous and coniferous trees in variable densities and clumps (from open to dense forest), creating habitat patches and forest openings that increase the suitability of the reclaimed landscape for a variety of species for feeding and shelter (ungulates, bears, short-eared owl).

Additional techniques to further improve site suitability for wildlife use during the detailed reclamation planning process required for *Mines Act* permitting can be considered and could include:

- Maintaining forest connections to adjacent undisturbed forest to enable movement of wildlife (bears, ungulates) and plants across the mine site by leaving natural forest intact within the mine site where possible.
- Providing visual breaks along road edges through a combination of topographic features (berms) and dense plantings of conifers and large deciduous shrubs (bears, ungulates).
- Adding large logs, rock piles, stumps, and other coarse woody debris to future forested areas to provide micro-habitats for small mammals. These rock piles will also provide visual breaks for large animals moving across reclaimed sites (short-eared owl, fisher, bears, ungulates).
- Planting artificial snags and installing nest boxes on poles in areas less than 500 m from Prosperity Lake (Barrow's goldeneye).

These techniques are further described in the following sections.

9.3.3.1 Soil Salvage and Stockpiling

The soil salvage plan is based upon the data collected by Talisman in 1996 and 1997 (Talisman Land Resource Consultants Inc. 1997a), and soil sampling and mapping completed by JWA in 2006. Details of the reclamation suitability criteria for soil used to generate salvage volumes are outlined in the Terrain and Soils assessment (Volume 5, Section 4).

The primary limitation to soil suitability for reclamation in the Project area is coarse fragment content. Coarse fragment content greater than 50% by volume is common, with greater than 70% coarse fragment content occurring in colluvial and glaciofluvial soils. Most morainal soils have coarse fragment contents between 40 and 75%. Morainal soil texture is frequently sandy loam to loam with some soils possessing finer textured (silt loam to clay loam) lower soil horizons. Most morainal soils are rated "fair" for use in reclamation due to high coarse fragment content or fine texture. The colluvial and glaciofluvial soils have coarse sandy loam to loamy sand texture, as well as high coarse fragment contents, making them poorly suited or unsuitable for use in reclamation (for the complete discussion of soils mapping and suitability for reclamation, see Volume 5, Section 4).

The overburden materials in the pit area were assessed for suitability for reclamation and were rated generally poor to unsuitable (Talisman Land Resource Consultants Inc. 1997b). The primary limitation for the overburden material was high pH values (8.1 to 8.8), with additional limitations of fine textures (silt loam to heavy clay) in the glaciolacustrine material and coarse fragment content (up to 86%) in the glaciofluvial materials. At depths ranging from 25 to 39 m, the material also becomes sodic, and unsuitable for use in reclamation. Chemical analyses indicate that isolated overburden samples had arsenic, chromium, and nickel concentrations higher than the agricultural criteria recommended by the Canadian Council of Ministers for the Environment, and copper concentrations in overburden were frequently greater than the 63 mg/kg agricultural criterion (CCME 1999). Thus, it is not proposed that significant volumes of overburden be used as a surface reclamation material.

Three types of soil salvage will occur during the project and the type selected is dependent on the infrastructure being developed:

- *Windrowed soils:* for linear features such as channels, roads, and retention ponds, soil will be excavated and placed in linear piles or berms along the features. The depths of soil replaced for reclamation will be dependent on the amount of soil that was available to salvage from the sites. All linear features will have soil windrowed unless they are at risk of dust deposition which may impact soil quality; for example, the conveyor line and roads near the mine pit area will have soil removed from the location for storage in stockpiles away from the operation.
- *Two-lift operation of soils:* In areas of buried services, a two-lift soil salvage operation will be used. For this salvage method the first lift would be for the soil and the second lift for the subsoil or overburden. When soil is placed back in a trench it is done in the reverse order thereby preventing admixing of lower quality material with soil that is used as a plant growth medium. No long-term soil storage is required as soils will be replaced once the infrastructure is in place.
- *Soil stripping and storage in stockpiles:* this is the removal of soil after vegetation has been cleared and transporting the soil by haul trucks to designated long-term storage sites. Sites proposed for this type of soil salvage include areas that will be covered by mine features such as the plant site, tailings pond and beaches, tailings storage facility embankments, and waste dumps. The storage locations take into consideration the volumes required for reclamation of project development areas such as the tailings storage facility beaches and embankments, plant site and conveyor line, overburden stockpile waste dumps, and the non-PAG waste rock dumps. Salvage of sufficient soils for a replacement depth of 50 cm was selected to provide a sufficient rooting medium for plant growth. The soil cap will be replaced in one lift.
- Due to the limited availability of soils with low coarse fragment content suitable for reclamation in the project area, both mineral and organic soils will be salvaged and stored together in the stockpiles. Based on the volumes calculated for salvage and storing in stockpiles, the mixed soil material will consist of approximately 34 percent organic soils and 66% mineral soils by volume.

A soil salvage plan was developed which takes into account the volumes of soil required for reclamation. Table 9-5 details the areas of soil salvage and volumes that will be put into storage. Figure 9-1 shows the locations of soil salvage areas as well as the soil stockpile locations listed in Table 9-6.

Figure 9-1 Areas of Soil Salvage

Table 9-5 Estimated Soil Salvage and Stockpile Volumes

Salvage Sites	Map ID #	Area (ha)	Salvage Volumes (m^3) Organic	Salvage Volumes (m^3) Mineral	Mixed/ Windrowed	Totals	Stockpile Site
Windrowed Soil Sites							
Channel Road (Headwater Channel Road)	1	9.9			59,810	59,810	Headwater Channel windrow
Headwater Channel Retention Pond	4	25.2			208,394	208,394	HC Retention Pond windrow
Headwater Channel	5	9.9			58,796	58,796	Headwater Channel windrow
Road (includes reclaim line)	13	17.6			97,277	97,277	Roads & Reclaim Line windrows
Windrowed Soils Sub-totals:		***62.6***			***424,277***	***424,277***	
Stockpiled Soil Salvage Sites:							
Crusher, Conveyor & Haul Road	2	12.7	37,673	45,225		82,898	Plant Site Stockpile
Pit Wall area (above 1440 m elevation)	3	34.8	56,491	117,787		174,278	West Stockpile
Main Embankment	6	24.5	62,267	81,096		143,363	East Stockpile
Overburden Stockpile Waste Dump area	7	63.1	34,793	250,264		285,057	West Stockpile
Pit Lake area	8	83.8	188,673	363,096		551,769	Northeast Stockpile
Plant Site	9	35.1	55,054	136,398		191,452	Plant Site Stockpile
Prosperity Lake	10	132.2	437,290	479,094		916,384	South Stockpile
TSF Beach	11	232.3	550,276	833,918		1,384,194	West Embankment Stockpile
Reclaimed Non-Reactive Waste Rock Dump area	12	98.0	320,314	346,663		666,977	East Stockpile
South Embankment	14	9.1	34,095	32,008		66,103	South Stockpile
Spillway & Water Conveyance	15	2.0	6,221	8,122		14,343	Northeast Stockpile
Surge Pond Beach	16	5.0	16,750	17,927		34,677	West Stockpile
West Embankment	17	27.0	23,118	102,981		126,099	West Embankment Stockpile
TSF Reclaimed Beach area 3	19	114.3	0	502,968		502,968	South Stockpile
TSF Reclaimed Beach area 5	21	16.7	0	76,050		76,050	South Stockpile
Fish Lake	23	10.6	26,676	41,422		68,098	East Stockpile
Reclaimed Non-Reactive Waste Rock 1	24	7.0	8,865	24,920		33,785	East Stockpile
Reclaimed Non-Reactive Waste Rock 2	25	18.7	26,792	76,832		103,624	East Stockpile
Stockpiled Soil Sub-totals:		***916.0***	***1,858,672***	***3,495,350***		***5,354,023***	
Totals:		**978.7**	**1,858,672**	**3,495,350**	**424,277**	**5,778,300**	

A total of six stockpiles have been selected for soil storage (Table 9-6). Selecting the stockpile locations has taken into account: the volume of soil that must be stored within its dimensions, topography (gentle to flat slopes), avoidance of natural drainages, and travel required for stockpiling. In addition, the need to be at a sufficient distance from mine project activities to avoid dust contamination was also considered. The West Stockpile, located west of Fish Lake, will require some site levelling prior to stockpiling. All other stockpiles will be sufficiently level enough for soil to be deposited once vegetation is cleared.

Upon completion of construction, a final mine site map will be prepared showing the exact locations and dimensions of stockpiles.

Table 9-6 Soil Stockpile Sites

Name	Area (ha)	Approximate Dimensions			Soil Volumes (m^3)		
		Length (m)	Width (m)	Height (m)	Organics	Mineral	Total
Plant Site Stockpile	6.0	300	200	5	92,726	181,624	274,350
West Stockpile	25.4	1,415	200	2	108,034	385,978	494,011
Northeast Stockpile	22.5	750	300	3	194,895	371,218	566,113
East Stockpile	17.5	500	350	6	444,914	570,934	1,015,848
West Embankment Stockpile	20.7	1,000	225	7	573,394	936,899	1,510,293
South Stockpile	43.7	1,430	360	3	471,386	1,090,119	1,561,505
Totals:	**135.8**				**1,858,672**	**3,495,350**	**5,354,022**

For the soil salvaging and stockpiling operations, Taseko will undertake a variety of best management practices to ensure that soils are handled and stored properly during all phases of the mine development project. Best management practices proposed to be carried out include:

Best Management Practices for Soil Stripping and Salvage

- Wet conditions will be avoided when possible during soil salvage operations.
- Excessive traffic will be avoided during the salvage process to minimize admixing, compaction and rutting.
- Traffic will be confined to established routes to avoid unnecessary compaction of soil in undisturbed areas.
- Erosion control measures provided in the Erosion Control and Sediment Retention Plan (Volume 3, Section 9.2) will be implemented.

Best Management Practices for Soil Stockpiles

- Soil will be stockpiled in suitable locations where it will not be moved or subject to further disturbance to minimize admixing and physical deterioration.
- Stockpile locations will be a sufficient distance away from operations to protect soils from contamination from risk of spills or metal deposition (i.e., dust from the mine) (Volume 4, Section 2: Air Quality).

- Protective ditches will be constructed around stockpiles to prevent any spill reaching stockpiles and prevent any erosion from stockpiles from escaping off site.
- Erosion will be managed by limiting the height and slope of stockpiles. Where possible, slopes will be less than 3:1 and heights will not exceed 10 m.
- Stockpiles will be oriented to reduce wind erosion and stockpiles will not be stored at heights of land to reduce wind exposure.
- Where appropriate, erosion control measures will be implemented.
- Any vegetation slash that is not cleared from the site will be mulched and incorporated into soil stockpiles.
- Soil stockpile locations will be identified by signage to prevent removal of material from the site or contamination with other materials.
- Vegetation will be promptly established on stockpiles to reduce exposure of bare soil to wind and water and establishment of invasive plants.
- Weed prevention will be followed as outlined in Section 5.2.2.1 and in the Taseko Invasive Plant Management Strategy (Volume 5, Appendix 5-5-K).

9.3.3.2 Recontouring

The non-PAG waste rock piles and overburden stockpiles will be resloped as required to meet end land use goals, facilitate the placement of soil, and revegetate as part of the reclamation plan, as well as assist the long-term geotechnical stability of these waste piles.

9.3.3.3 Surface Treatment for Compaction

Surfaces of waste rock and overburden piles compacted from equipment traffic will be scarified as necessary prior to soil capping.

9.3.3.4 Soils Replacement

Volumes of soil required for reclamation are listed in Table 9-7. The soil replacement depth is based on average pre-development rooting depths.

The roads and decommissioned water management structures will be reclaimed through replacement of windrowed soil.

The overburden dump, non-PAG waste rock dump, plant site and conveyor line, and tailings embankments will be reclaimed through placement of 50 cm of salvaged and stockpiled soil in one lift. The replaced soil cap will consist of up to 34% organic soils by volume mixed with mineral soils based on the amount of organic soils that are expected to be salvaged and mixed into stockpiles. Where required, soil may be scarifying prior to seeding if the surface becomes compacted due to truck or equipment traffic.

Portions of the tailings beach requiring capping to enhance vegetation growth and reduce effects from wind erosion will received a lift stockpiled soil to a depth of 50 cm, with the exception of a proposed a 100 m wide zone on the beach area measured from the high water mark. Soil replacement is not planned for this zone to prevent erosion of the soil capping material along the shoreline. Establishment of riparian and shoreline vegetation is expected to be successful without soil capping.

Best Management Practices for Replacement

- During the closure phase of the project, soil will be placed on the beach surface as soon as tailings deposition ends at mine closure to prevent dust formation.
- Soil will be transported from the stockpiles to the reclamation sites as soon as they become available.

Table 9-7 Soil Volumes Required for Reclamation

Disturbance Site	Area (ha)	Soil Capping Depth (cm)	Soil Volume Required (m^3)	Soil Source/Stockpile
Windrowed Soil Sites				
HC Retention Pond	26.7	78	208,394	HC Retention Pond windrow
Headwater Channel & Road	18.6	64	118,606	Headwater Channel windrow
Road (includes former reclaim line)	17.9	54	97,277	Roads & Reclaim Line windrows
Windrow Sub-totals:	***63.2***		***424,277***	
Stockpiled Soil Sites				
Plant Site	35.1	50	175,500	Plant Site Stockpile
Crusher, Conveyor & Haul Road	14.5	50	72,500	Plant Site Stockpile
Overburden Stockpile Dump	70.2	50	351,000	West Stockpile
Non-Reactive Waste Rock Dump	240.9	50	1,204,500	West, Northeast, & East Stockpiles
TSF Beach	642.1	50	3,210,500	East, West Embankment & South Stockpiles
TSF Main, West & South Embankments	67.9	50	339,500	East, West Embankment & South Stockpiles
Stockpile Sub-totals:	***1,070.7***		***5,353,500***	
Totals:	**1,133.9**		**5,777,777**	

NOTE:
For Windrowed Soil Sites- volumes of soil salvaged are the volumes that are replaced at time of reclamation; therefore, replacement soil depths will depend on the areas to cover at time of reclamation. Depths in Table 9–7 are based on the site areas and the calculated soil salvage volumes of the sites in Table 9-5.

9.3.3.5 Interim Revegetation

Interim reclamation refers to the seeding of soil stockpiles, soil windrows, disturbances associated with the transmission corridor, diversions ditches and mine features, particularly sloping sites as they become temporarily or permanently inactive, for the purpose of weed and erosion control. Interim revegetation involves seeding of a grass and legume ground cover consisting of non-invasive agronomic species. For disturbances associated with the transmission corridor that fall within the grassland zones, only native species will be used.

Ground cover will successfully reduce water impacts, velocities, and runoff on the slopes. Candidate species for interim reclamation, weed control and reclamation designed to control surface erosion on dump slopes are given in Table 9-8.

Table 9-8 Candidate Species for Interim Reclamation

Agronomic or Commercially Available Native Grasses	Legumes
Altai fescue	Red clover
Rocky Mountain fescue	Alsike clover
Blue bunch wheatgrass	Cicer milkvetch
Bromegrass	Alfalfa
Timothy	Sainfoin
Tall fescue	Birdsfoot Trefoil
Crested wheatgrass	
Orchardgrass	
Kentucky Bluegrass	

Due to the large amount of disturbed ground that is created in mining operations, development of a program to prevent weed species from becoming a management problem on the mine site and associated disturbances is necessary. The invasive plant management that is proposed by Taseko will be implemented (Volume 5, Appendix 5-5-K: Invasive Plant Management Strategy).

9.3.3.6 Final Revegetation

All areas with moderate forest capability will be reclaimed using treatments designed to promote return to productive forest ecosystems with wildlife and recreation values. Such treatments will include varied combinations of planting of coniferous and deciduous seedlings, and understory species to provide stand diversity. Candidate vegetation species for reclamation are given for predicted post-closure site series in Table 9-9. Planted areas may be inter-seeded with nitrogen-fixing agronomic legumes to enhance site nutrient, control surface erosion and prevent weed establishment on newly reclaimed sites.

Areas with low forest capability, but moderate to high capability for wildlife, such as shorelines suitable for waterfowl habitat and recreation for fisheries, will be reclaimed using treatments to promote productive open landscapes with wildlife and waterfowl values. Such treatments will include combinations of seeding or transplanting wetland sedges and rushes, and planting deciduous shrubs.

The initial reclamation objective on slope faces will be controlling surface erosion to prevent degradation of the soil cap as described above in Section 9.4.3. It is expected that these areas will provide a variety of changing habitats over time on the reclaimed mine site. As natural regeneration progresses they will provide a diversity of habitat through the natural invasion of deciduous tree and shrub species, and will eventually evolve into mature conifer forest ecosystems.

Placement of rock piles, coarse woody debris, or the creation of topographic relief on the dump face will be conducted where possible to enhance the wildlife habitat value of the reclaimed site. Planting of trees and shrubs will be conducted predominantly on the dump plateaus and in variable densities and clumps (from open to dense forest), creating habitat patches and forest openings that increase the suitability of the reclaimed landscape for a variety of species for feeding and shelter.

As with the dumps, the initial focus of revegetation efforts on the tailings will be seeding with a grass/legume mix to prevent erosion of the soil cap. Planting of deciduous shrub and tree species will be conducted in island groupings. Placement of rock piles and coarse woody debris will be conducted to enhance the wildlife habitat values on the reclaimed tailings.

Two areas with potential Barrow's goldeneye nesting habitat were also identified on the tailings beach, as they fall within 500 m of open water bodies (Prosperity Lake and small marsh west of west embankment) suitable for feeding. Nesting boxes on poles and standing snags will be considered in these areas, in addition to revegetation treatments.

Table 9-9 Candidate Species for Final Reclamation

Biogeoclimatic Subzone	Site Series	Map Code	Tree Component	Shrub and Herb Component
SBPSxc	01	LK	Lodgepole pine Aspen	Willow Kinnikinnick Prickly rose Juniper
	02	LC	Lodgepole pine	Kinnikinnick Pine grass
MSxv	01	LG	Hybrid white spruce Lodgepole pine	Crowberry Grouseberry
	04	GK	Lodgepole pine Hybrid white spruce	Crowberry Kinnikinnick Grouseberry Soopolallie

9.3.3.7 Reclamation Monitoring and Maintenance

Reclamation success will be monitored throughout mine life to ensure that reclamation techniques being utilized are appropriate for land capability objectives. Possible parameters that will be assessed include:

- forage production and effectiveness for controlling erosion
- conifer and deciduous tree seedling survival and growth
- encroachment rate and diversity of native species
- wildlife use of reclaimed areas

The success of Prosperity Lake, both as a component of the Fisheries Compensation Plan, as well as an integral part of the reclamation plan, will be monitored regularly to evaluate the success of the lake to self-sustain a fish population. Details of the monitoring will be identified in the Fish and Fish Habitat Section of the EA, Volume 5, Section 3.

The suitability of reclaimed sites for wildlife use will be assessed through trace element monitoring in vegetation. Soils and vegetation on the Prosperity project area have naturally "elevated" metal concentrations in comparison to published standards from non-mineralized areas (see Volume 5, Section 4); therefore, similar elevated metal concentrations are expected to occur after mining and reclamation. Elevations of metals concentrations above baseline due to mining activities could occur due to dust deposition on surrounding areas and soil stockpiles within the mine footprint. Measures to prevent the elevation of soil and vegetation metals on the mine and surrounding areas will be implemented through:

- the dust control measures described in Volume 3, Section 9.2

- soil placement to pre-disturbance rooting depths to reduce the oxidizing of waste rock and tailings material, and to prevent plants from rooting in the more mineralized materials
- prevention of soil acidification through prevention of ML/ARD as described in Volume 3, Section 7

9.3.4 Decommissioning Plan

The conceptual decommission plan for the Prosperity Gold-Copper Project area is described below. This closure plan includes conceptual mapping of probable post-closure land capability (Figure 9-2), a description of decommissioning activities for specific features, and long-term commitments for water management and monitoring. The conceptual mapping provided in Figure 9-2 illustrates is expected to be defined in more detail during the permitting process: the actual shoreline of the tailings beach may vary; and, the footprint of the non-reactive waste rock and overburden may change to avoid of archaeological features.

Figure 9-2 Conceptual Final Reclamation Plan

9.3.4.1 Post-closure Land Capability

Post-closure ecosystem mapping was accomplished by integrated post-closure soil characteristics and forecasted landform topography, including slope and aspect, to predict soil moisture and nutrient regimes.

In general, the projected post-closure site series are similar to pre-development ecosystems as replaced soil materials and depths are very similar to pre-development conditions. The post-closure site topography encompasses a wider range of slope angles and aspects than the pre-development site. Pre-development site aspects were typically flat to gentle, with moderate south-west facing slopes bounding the site to the north and east; post-closure sites will consist of longer, steeper slopes with predominantly northwest and northeast aspects. The typical edaphic conditions are expected to be the same due to the replacement of the soil rooting zone and an organic-enriched horizon. Where clearing has been the only disturbance associated with development (e.g., on areas adjacent to roads or ditches), post-closure site series will be identical to those found in the same area prior to development.

Projected post-mining land capability can be forecasted for forestry, wildlife and recreation.

Forestry

Forested ecosystems include moderate forestry capability (zonal and wetter sites) and low forest capability (drier and nutrient poor sites) that provide wildlife habitat and recreational opportunities. Post-mining forest capability projections were determined using Site Index–Biogeoclimatic Ecosystem Classification (SIBEC) correlations (Ministry of Forests, 2006), based on Predictive or Terrestrial Ecosystem Mapping (PEM or TEM). SIBEC correlates capability (potential site productivity, or site index, or projected dominant tree height at breast-height age 50) with ecological classification units (site series), and is the currently accepted method in British Columbia for estimating site productivity without on-site measurements. Detailed forest capability in pre- and post-mine footprint is discussed in Volume 5, Section 5.

There will be an overall increase in the amount of higher elevation area within the disturbance footprint due to the creation of the tailings storage facility and dump features. The higher elevations of these features are predicted to result in an increase in the amount of area in the post-closure reclaimed landscape that will be located in the drier, colder Sub-boreal Pine Spruce biogeoclimatic zone, with a corresponding decrease in the area in the Montane Spruce zone.

The largest change in the distribution of ecosites and forest capability in the post-closure footprint is the reduction in area of terrestrial ecosystems due to the creation of TSF Lake and Prosperity Lake, and a reduction in moderate forest capability land over and increase in lower forest capability land.

Wildlife

Post-mining wildlife capability, including waterfowl, of forested and non-forested sites include high capability for mule deer and Barrow's golden eye nesting, moderate capability for moose, black bear, grizzly bear, short-eared owl, fisher, and low capability mallard, and great blue heron. Wildlife capability ratings were developed using *British Columbia Wildlife Habitat Rating Standards* (RIC 1999). For each species, detailed wildlife habitat capability in the pre- and post-mine footprint is discussed in Volume 5, Section 6. Wildlife habitat capability ratings on the conceptual reclamation plan figure are based on the highest rating for a species out of all life requisites and seasons assessed; for example, where Pl–Kinnikinnick–Lingonberry habitats were rated as having grizzly bear spring, summer, and fall feeding capability values of "3", "3" and "4", respectively, the overall rating used for the conceptual reclamation plan was "3" for grizzly bears in that habitat.

The post-closure footprint area will have a low capability for mallard and great blue heron feeding habitat in the TSF Lake and water management-related water bodies (surge pond) and through the creation of the adjacent Prosperity Lake it will have moderately high capability for feeding habitat. Areas on the TSF tailings beach within 500 m of Prosperity Lake and natural water bodies west of the west embankment will have moderately high capability for Barrow's goldeneye nesting habitat.

All terrestrial features are predicted to have moderate to moderately high capability for mule deer, moose, and grizzly bear habitat. All terrestrial features below approximately 1550 m in elevation (main embankment, non-PAG waste rock dumps, overburden dump, and plant site and associated features) also have moderately high capability for black bear habitat. Habitat capability for fisher and short-eared owl on all post-closure terrestrial features is low. The pit walls and area around the surge pond have been rated as having no wildlife habitat capability, however this may be an underestimation of the eventual capability of these features, as, over time, weathering in the pit walls and natural revegetation will likely produce features such as nesting spots for prairie falcons (pit walls), feeding habitat around the surge pond for ungulates and bears, and nesting habitat for mallards.

Recreation

Post-mining capability for recreational fisheries is expected to be high capability in Prosperity Lake, and moderate capability in the TSF Lake. Recreational opportunities will also be provided by: improved safer access to the reclaimed mine site area by the upgraded access road; and, hunting opportunities on the former mine site due to the creation of wildlife habitats.

9.3.4.2 Decommissioning of Structures and Specific Features

Mine site features at closure will include:

- the Pit Lake, which will fill with water to the 1440 m elevation of the pit, and surrounding rock walls
- the soil capped non-PAG waste rock dump, plant site and main tailings embankment
- the TSF with submerged PAG materials, soil capped tailings beach, and the uncapped tailings beach (shoreline)
- the south embankment separating Prosperity Lake from the TSF Lake
- Prosperity Lake
- spawning channels upstream of the Prosperity Lake
- a TSF Lake spillway and a reclaimed water collection pond connecting the TSF Lake and the Pit Lake

Other features requiring decommissioning include:

- transmission line
- interior roads and linear disturbances
- water courses
- access road

Areas that will be returned to landforms similar to pre-mining include:

- plant site
- soil stockpile footprints
- transmission corridor

All structures and equipment will be removed in the decommissioning and closure phase. The only features that will be retained are key diversion ditches and structures required to meet long-term water management objectives. Structures to be removed include all plant site facilities, the conveyor belt, maintenance/warehouse complexes, substations, power lines and poles, and the explosives storage site.

Concrete building/structure foundations (i.e., slabs, footings and foundation walls) will be left in place if the concrete is steel-reinforced, or otherwise broken apart. Compacted areas will be ripped prior to revegetation, and windrowed soil will be pushed back over concrete to a minimum depth of 50 cm prior to revegetation. The site will be revegetated as conceptually described in Section 9.4.3 using vegetation suitable for the predicted edaphic conditions.

Non-PAG Waste Rock, Plantsite and Tailings Embankments

Final configuration of waste rock is illustrated in Figure 9-2. At mine closure, all waste rock dumps not previously revegetated through progressive reclamation during operations will be reclaimed using the following methods:

- plateau surfaces will be ripped or otherwise treated to decompact soils within the running surfaces
- surfaces will be capped with salvaged soils from stockpiles
- surfaces will be revegetated in accordance with concepts presented in Section 9.4.3 to meet reclamation goals of appropriate end land use objectives, erosion prevention and weed control

Tailings Storage Facility

Final configuration of the tailing storage facility is illustrated in Figure 6-21. At mine closure, the TSF will be reclaimed using the following methods:

- with the exception of the shoreline, the tailings beach surfaces will be capped with salvaged soils from stockpiles where required to enhance vegetation establishment and reduce effects from wind erosion
- surfaces will be revegetated in accordance with concepts presented in Section 9.4.3 to meet reclamation goals of appropriate end land use objectives, erosion prevention and weed control
- rocks and coarse woody debris in piles will be used for line of sight breaks and habitat enhancement

A strip of beach up to 100 m wide, measured from the high water mark of the TSF Lake, will not be capped with soil, but will be seeded. When water quality monitoring confirms the area is suitable for wildlife use, plantings of wetland species will be conducted to enhance natural vegetation succession that is occurring to speed wildlife habitat establishment. Figure 6-21 likely underestimates the wildlife capability of this shoreline zone due to uncertainties regarding water quality and the timeframe for the area to become suitable habitat; however, once revegetated with emergent and wetland species, the zone is expected to have high capability for small mammals, waterfowl, breeding habitat for amphibians. Where the silty substrate allows access, wetland enhancement for large wildlife species (bear, moose, deer) and will be enhanced with planting of native shrubby species.

Pit

The pit will naturally begin filling with water once operations have ceased at the mine, beginning in Year 17. Additionally, water from the TSF will be released to the pit starting in Year 21, thereby increasing the filling rate. The pit walls of the lower benches will be submerged early on in the closure phase, with less chance for release of metals load to the pit lake. The walls with PAG rock in the middle and upper benches of the pit have a greater opportunity to release metals and sulphate to the pit lake as they will take longer to submerge and therefore have a greater amount of time to oxidize.

The potential for bench-scale and overall slope stability issues needs to be mitigated through careful blasting, mine sequencing, and pit wall dewatering. The proposed pit-dewatering program includes provisions for rock mass depressurization to enhance wall stability, as well as for the control of surface runoff and infiltration via a combination of pumps and diversion ditches.

The pit will be allowed to fill with water over 27 years, to the 1440 m elevation. Approximately 31 ha of rock wall will be left exempt from reclamation (Section 10.7.14 of the *Health, Safety and Reclamation Code)*. Approximately 10–15 ha of pit wall will consist of overburden (not visible on Figure 6-21), which will be sloped to 30° and seeded with a grass/legume mix. No soil capping will be conducted on the overburden walls.

Access Road, Mine Site Interior Roads and Other Linear Disturbances

At mine closure, all roads within the mine site, including haul roads, will be reclaimed using the following methods:

- road surfaces will be ripped or otherwise treated to decompact soils within the running surfaces
- culverts will be removed, with creek crossings and cross-ditches established in accordance with the post-mine water management system
- on sidehills, sidecast material will be pulled back to the extent practicable to establish grades that complement the reclaimed landscape
- prepared surfaces will be capped with salvaged soils from adjacent windrows
- roads will be revegetated in accordance with concepts presented in Section 9.4.3 to meet reclamation goals of appropriate end land use objectives, erosion prevention and weed control

If any road access is required within the mine project areas after closure, these roads will be left in semi-permanent deactivated condition. Semi-permanent deactivation will allow the road to remain in place and be useable, but also environmentally stable. Semi-permanent deactivation measures which will be carried out to include removal of culverts and replacement with cross-ditches; installation of ditch blocks at cross ditch locations; installation of waterbars across the road to direct road surface water off the road; removal or breaching of windrows along the road edge; outsloping/insloping of the road surface as appropriate; and revegetation of exposed soil surfaces for erosion and weed establishment control.

Portions of the access road corridor decommissioned to restrict public access will be restored using applicable guidelines and regulations. The objective of the restoration will be wildlife and recreation.

Transmission line

The transmission corridor will be returned to pre-development conditions, as feasible, using a combination of continued natural succession and in areas of soil disturbance, including access roads for decommissioning activities and pole sites, site preparation, seeding and planting. In areas of soil disturbance along the transmission corridor following removal of poles, adjacent stockpiles of soils will be replaced and the area seeded with non-invasive agronomic species. Plantings of deciduous and coniferous species can be conducted should natural reforestation not be occurring at a satisfactory rate. In the grassland zones, only native grass species will be used.

Watercourse Re-establishment

Water management system reclamation at mine closure will focus on the deactivation of structures and subsequent stabilization and revegetation.

The reclamation of water management structures will include:

- removal of non-essential diversion ditches
- removal of the headwater channel retention pond
- re-establishing drainages into original creek channels where possible
- stabilization of the structures for erosion control

Windrowed soil will be pushed back over cleared areas following recontouring of deactivated structures and revegetated as conceptually described in Section 9.4.3. Initial revegetation will consist of seeding with a forage mix to prevent erosion, using native seed where available. Edaphic conditions are predicted to be the same as those that existed prior to development, and natural regeneration of vegetation appropriate to edaphic conditions should occur rapidly.

The water courses, roads and other linear features will be allowed to reforest naturally following soils replacement and seeding with erosion control species. Plantings of deciduous and coniferous species can be conducted in these areas should natural reforestation not be occurring at a satisfactory rate.

9.3.4.3 Mine Site Water Management

Following Year 16, the Open Pit dewatering system will be deactivated and the Pit will commence filling (Years 17–44). The supernatant pond, seepage collection, and stockpile runoff provide sufficient Plant process water for ongoing operations without any requirement for external supplementary water. The closure period extends throughout the 27 years anticipated for filling of the pit. The pit will start filling with water from precipitation, runoff and the TSF. The TSF will remain in place, with a cover of non-PAG tailings and water to prevent leaching of metals related to ARD generation.

Upon mine closure, surface facilities will be removed in stages and full reclamation of the TSF will be initiated. General aspects of the closure plan include:

- selective discharge of tailings around the facility during the final years of operations to establish a final tailings beach that will facilitate surface water management and reclamation
- dismantling and removal of the tailings and reclaim delivery systems and all pipelines, structures and equipment not required beyond mine closure
- construction of an outlet channel/spillway at the east abutment of the Main Embankment to enable discharge of surface water from the TSF to the open pit and ultimately to Lower Fish Creek. This full closure scenario will also work well in the event of premature closure of the mine. A conceptual level assessment including design considerations, location and approximate sizing for the post-closure spillway was undertaken and is provided in Appendix 3-6-V.
- removal of the seepage collection system at such time that suitable water quality for direct release is achieved

- removal and regrading of all access roads, ponds, ditches and borrow areas not required beyond mine closure
- long-term stabilization of all exposed erodible materials

The TSF Lake will continue to fill naturally for approximately one year after operations. Upon the commencement of the closure phase (Year 21), a channel will be constructed to discharge water from Wasp Lake into Prosperity Lake and then into the TSF Lake. Throughout closure, Prosperity Lake will continue to receive diverted water from the headwater Channel. The TSF Lake will discharge into Pit Lake through a spillway constructed on the North end of the Main Embankment, within two years after closure.

At the commencement of post-closure (Year 44), the Embankment slopes and the TSF beach will be sufficiently revegetated for long-term stabilization of any exposed, potentially erodible materials. The following measures have been incorporated into the Project design to ensure that the TSF is stable and self-sustaining: engineered zoned embankments designed as per the Canadian Dam Association Guidelines; long beaches to keep the supernatant pond away from the embankment crests, thereby improving stability of the structures; a constructed spillway sufficient to prevent overtopping and eroding of the embankments, as well as maintaining the supernatant pond at the desired elevation; and, the inclusion of vibrating wire piezometers within each embankment to allow for on-going monitoring of the structure's stability.

The south-flowing portion of the headwater diversion channel around the mine footprint will continue to divert undisturbed runoff to Prosperity Lake, as a long-term component of the proposed fisheries compensation system.

The post-closure period will begin when the filled pit begins to discharge to Fish Creek. This will be in approximately Year 44 of operations, after 27 years of pit filling, and will restore flows to Reaches 1 through 6 of Fish Creek. The pit water quality will be monitored and released only if it will enable water in Fish Creek to meet either Canadian Council of Ministers of Environment (CCME) and BC water quality guidelines (WQG) or site specific WQG (for parameters that exceed WQG during the baseline period or parameters for which site-specific conditions apply). The WQG will be met as a result of natural geochemical processes (e.g., precipitation of metals in ambient conditions) and, if required, water treatment (either of specific sources, in the pit, or with a water treatment plant upstream of the Pit Lake spillway). The need for treatment will be identified through monitoring of water quality during the 27 years the pit is filling. Should discharge to Fish Creek be required, effluent, water quality and environmental effects monitoring programs will be conducted in accordance with MMER.

9.3.4.4 Long-term Monitoring and Maintenance

Post-closure reclamation monitoring for the mine site will continue until a self-sustaining vegetation cover that meets end land use objectives has been established and documented. The primary objectives of the environmental monitoring program after closure will remain consistent with those during operations. Monitoring objectives will be to determine the actual environmental effects produced by mine-related activities and to determine the effectiveness of rehabilitation measures in achieving end land use goals. Monitoring will include ground and surfaced water quality, seepage volumes, aquatic biology, landform stability, vegetation production, wildlife habitat use, and wildlife suitability. More information on the monitoring program, including data collection and evaluation methods and thresholds that trigger mitigation, will be established in consultation with the MEMPR and till be provided at the time of permitting.

9.3.4.5 Early Closure

In the event of a premature closure, the decommissioning plan in this section will be implemented with the following modifications:

- if required, PAG waste rock material in the TSF will be excavated and re-distributed to ensure PAG is submerged
- if low-grade ore is stockpiled, evaluate the volume, quality, and environmental risk of the material, and in consideration of economics at the time, develop and implement a plan that includes either processing the ore in the plant, re-handling back to the pit for submerging with water from the TSF, or, capping to prevent metal leaching

9.4 Environmental Effects Monitoring and Follow-up Program

9.4.1 Introduction

The EA has evaluated the potential risks and impacts to the receiving environment. During the various phases of the Project (construction, operation and closure), a variety of follow-up and monitoring programs will be necessary to manage the potential beneficial and adverse affects of the Project and to verify the accuracy of the EA. The monitoring and follow-up program is also designed to incorporate pre-project information including the baseline data, compliance data such as established benchmarks, regulatory documents, standards or guidelines, and real time data which would consist of observed data gathered in the field.

The following sections describe the follow-up and monitoring programs to the extent possible at this stage of mine design and site development. Volumes 4, 5 and 6 provide additional detail with regard to the need for the monitoring, a description of the proposed monitoring program, and the adaptive management that will occur based on the monitoring results and ever-increasing data set and understanding of the ecosystems surrounding the mine site. It is acknowledged that additional development of these monitoring plans and programs will be necessary as the project schedule progresses, such that construction follow up and monitoring programs are established and functioning prior to the commencement of construction, and similarly for operations and closure. In this regard, key milestones for the completion of the detailed monitoring programs are commencement of construction, completion of construction and commencement of mining operations, and cessation of mining operations and commencement of closure activities.

Monitoring programs are expected to be required as part of permits and licenses issued by various governmental agencies, including BC Energy Mines and Petroleum Resources, BC Environment and Department of Fisheries and Oceans. The monitoring outlined below is anticipated to provide the basis to address these requirements, though the reporting of findings may be agency specific. Taseko will work toward the preparation of a consolidated environmental report prepared to address all annual monitoring and reporting requirements in one document.

9.4.2 Adaptive Management

Taseko is committed to monitoring the effects of the Prosperity Project and to follow-up with the results of these programs. If any unforeseen adverse effects arise during the life of the Project, measures will be taken to correct these effects and prevent them from occurring in the future. Each of the monitoring programs proposed is designed to ensure the Environmental Management System (EMS) outlined in the previous section is functioning effectively. As part of the adaptive management process, the EMS will be updated and associated training programs enhanced to improve the level of environmental protection based on the results of these programs. The adaptive management process for this Project will incorporate contingency planning, management objectives, ongoing monitoring and the proponent’s commitment for achieving benchmark goals along specified timelines.

9.4.3 Surface Water Hydrology and Hydrogeology

As a result of the changes in surface water flow patterns and hydrology in and around the TSF, the follow-up and monitoring programs for surface water and hydrogeology are designed to ensure the baseline conditions were adequately predicted and that on-going operation of the TSF has minimal impact. In general terms, the monitoring program will include:

- collect additional hydrogeologic data in the adjacent Big Onion and Little Onion lake systems, Wasp Lake and Taseko River
- transport simulations used to evaluate concentration and transport times for seepage migration to Big Onion Lake should be improved beyond their current scoping level
- installation of the compliance monitoring well network should proceed such that baseline conditions in the new wells can be established a minimum of one year prior to commencement of active mining activities
- a groundwater well network should be installed along the length of the west tailings embankment and sampled on a quarterly basis for deviation from baseline conditions
- installation of an adequate number of contingency seepage collection and pump back wells during the construction period should also be considered for this area of the project based on the potential for effects to other VECs

9.4.4 Water Quality and Aquatic Ecology

Follow-up and monitoring for water quality and aquatic ecology will focus on verification that impacts are not occurring from the mine development. Baseline and pre-construction information will be critical in the establishment of current understanding, some of which has already been completed or is currently underway. Future monitoring will occur during all phases of mine construction, operation and closure.

Water Quality

- Ongoing water quality studies in lower Fish Creek, Wasp Lake, Beece Creek, TSF and Pit Lake to confirm water characteristics at various stages of the Project.

- Groundwater wells will be installed and monitored in the area projected to be below the western TSF embankment to better understand movement of groundwater between the Fish Lake and Big Onion Lake watersheds.
- Standard limnological procedures and the analytical program developed for the EA should be followed.
- If water quality parameters are greater than predicted, additional measures will be identified (e.g., liming of Pit Lake, water treatment plant) and implemented to adequately treat water outflows to protect aquatic life.

Sediment Quality

- Sediment quality assessments in lower Fish Creek and Wasp Lake to confirm predicted sediment characteristics during applicable Project phases will occur.

Aquatic Ecosystems

- A baseline survey to determine whether aquatic moss is present in Fish Creek will be done.
- Aquatic biota will be monitored to confirm predicted effects during applicable Project phases.
- Wasp Lake and Beece Creek will be monitored prior to Project start-up and during the early years of clean water diversion to verify the predictions and monitor the process of stabilization of Wasp Lake.
- Fish Creek and Taseko River will be monitored prior to discharge of pit lake water post-closure to establish a new baseline (given the 57 year interval of reduced flows in the stream).
- Fish Creek and Taseko River will also be monitored post-closure in accordance with the required MMER Environmental Effects Monitoring program. An expanded program, including periphyton, is recommended.
- Monitoring will also address any uncertainty distinguishing pre-closure logging and post-closure Project effects.
- The monitoring programs will use methods similar to those employed for baseline surveys (analysis of periphyton and benthic invertebrate assemblages in pool and riffle habitat of streams, analysis of phytoplankton, zooplankton and benthic invertebrates of lakes) and will be conducted in association with water and sediment monitoring programs.

MMER

- MMER effluent and water monitoring programs and Environmental Effects Monitoring of the aquatic organisms (fish health, benthic invertebrates, fish tissue, supporting environmental factors), or any similar legislation once there are discharges from the site.

9.4.5 Fish and Fish Habitat

With respect to mitigation and compensation measures, a compliance monitoring program verifies the proper implementation of all such measures whereas a follow-up program is used to determine the accuracy of EA conclusions and the efficacy of the required mitigation measures. CEAA defines follow-up as "a program for verifying the accuracy of the environmental assessment of a project, and determining the effectiveness of any measures taken to mitigate the adverse environmental effects of the project".

An outline of the follow-up and monitoring for each element is provided in Volume 3, Section 8.4. A defined follow-up, monitoring and adaptive management plan will be developed for each of the elements in support of making applications for authorizations, permits and other approvals. The follow-up programs will be designed to support or verify the predictions made concerning the likelihood of "no significant environmental effects"; aid in the detection of unanticipated environmental effects; and provide an assessment of the success of management programs and the possible need for adjustments through adaptive management should the results indicate the need. These plans will follow appropriate provincial and federal legislation, policies and programs, including the CEAA Operational Policy Statement: Follow-up Programs under the Canadian *Environmental Assessment Act* (CEAA 2007), and policy direction under the British Columbia *Environmental Assessment Act*. Compliance monitoring programs will also be developed and implemented to meet applicable provincial and federal permits, licences and approvals.

Adaptive management as part of the development of the compensation elements will provide a management tool to adjust the elements as required, ensuring goals are met and habitats are functioning within specified timelines. Ongoing monitoring of compensation planning activities, including collection of baseline data, will provide information which will be measured against established targets and timeframes for individual compensation plans. Should deficiencies or data gaps be identified, the adaptive management framework will trigger a feedback mechanism to ensure deficiencies are addressed and compensation efforts continue moving toward the overall goal of achieving NNL.

The adaptive management process for this Project will incorporate contingency planning, management objectives, ongoing monitoring and the proponent's commitment for achieving benchmark goals along specified timelines with regard to fish and fish habitat compensation plans.

In-stream Habitat

- Follow-up programs will be conducted in all constructed off-channel habitats. Program methods will focus on physical habitat structure effectiveness and integrity, and species specific fish use.
- Surveys will be conducted seasonally during the first year of operations, annually during Years 2–5, and biennially from Years 6–20.
- Instream habitat associated with the TSF compensation element will similarly be surveyed during the first two years of operation.
- The follow-up program will also include assessments of water quality and quantity, periphyton and benthic invertebrate diversity and abundance.

- Compliance monitoring will be scheduled at regular intervals throughout the construction period. The construction monitoring schedule will generally follow recommendations described in Standards and Best Practices for Instream Works (MWLAP 20046).

Lake Habitat

- Compliance monitoring will be scheduled at regular intervals throughout the construction and closure period as described for Instream Habitat. The monitoring program will focus on the quantity and integrity of lake design features that are required, as well as the barren lakes stocking management option (as appropriate).
- Assessments of lake depth, quantities of shoal and pelagic habitats, any and all in-lake fish cover structure placements (e.g., large woody debris, boulders and aquatic vegetation) and riparian revegetation program(s) (e.g., species, quantities and percent survival).
- Remedial or adaptive measures will be applied immediately following any evaluation that determines a reduction in functionality or integrity of any biological or physical channel attributes as specified in as-built design criteria.

Rainbow Trout Populations

- A follow-up program will also be conducted for any barren lakes where rainbow trout stocking has occurred.
- Scheduled routine assessments of fish condition and health at the Hanceville Hatchery will also be conducted throughout the life-of-mine.
- Annual assessments of fish populations in all compensation elements, management programs and contingencies will be conducted during their respective first four years of operation.
- During Years 5 through 20, spawner abundance will be determined through routine visual observation estimates of spawning sections.
- Spawner assessments will be conducted in the TSF lotic habitats for four years following implementation.

Fish Lake Recreational Angling Opportunities

- Angler interviews and creel census for recreational angling will be conducted throughout the life-of-mine and early closure for the TSF compensation element a basis for adaptive management.

9.4.6 Terrain and Soils

Mine Site Follow-up and Monitoring for Soil

Follow-up and monitoring activities for the mine site are designed to ensure reclamation suitability can be restored at Project closure that allows for similar land use, these measures in turn result in preservation of the soil resource. Follow-up and monitoring activities for each phase of the Project and specific to reclamation suitability are outlined in Volume 5, Section 9. The following list is intended to provide the details of the follow-up and monitoring programs that are designed to protect the soil resource and are applicable at all phases of the project:

- The environmental supervisor must ensure suitable soil quality for reclamation. If the quality of soil does not meet the requirements of the reclamation plan, additional areas of soil salvage will need to be identified. Lower quality of soil can be assessed by coarse fragment content. Also, if undesirable overburden material has inadvertently been incorporated into soil, physical and chemical analysis can provide an indication of soil quality.
- Soil stockpiles should be checked regularly and after storm events or rapid snow melt to ensure vegetation cover is maintained and additional erosion control measures are effective.
- Prior to revegetation efforts at reclamation, the effectiveness of soil mitigation should be evaluated for compaction, rutting, and drainage.
- Once vegetation is established, visual inspections of vegetation vigor and cover density will provide an indication of soil fertility. If soil fertility has been diminished from baseline conditions, foliar analysis will to determine the fertilizer amendments that may be required.
- For new road construction, it is assumed that soils with reclamation value will be stripped and windrowed unless it is deemed to be in proximity of metal deposition, where metal exceedences are anticipated. If in an area where metal exceedences are anticipated soil will be stockpiled an appropriate distance from Project activities associated with metal deposition.
- The Human Health Risk Assessment (Volume 6, Section 6) provides the details of where long-term soil sites will need to be established, in addition to the metals that should be measured. These monitoring sites should be established prior to construction activities and continue until reclamation of the mine site is complete.
- At post-closure the shoreline along the TSF and Pit lakes should be checked for evidence of erosion on an as needed basis to protect the soil resource.

Transmission Line Follow-up and Monitoring for Soil

Follow-up and monitoring activities for the transmission line are designed to ensure agriculture capability is maintained, which in turn results in preservation of the soil resource. Follow-up and monitoring activities specific to agriculture capability are outlined in Volume 5, Section 5. The following items intended to provide the details of the monitoring programs that are designed to protect the soil resource.

- An environmental supervisor with knowledge of soil must be assigned to the site during construction and decommissioning activities of the Project. The environmental supervisor will also have to have knowledge of agriculture and be able to incorporate landowner requests into any required mitigation.
- During construction and at decommissioning, visual inspections should be completed to ensure no detrimental physical changes such as admixing, compaction and rutting and erosion occur on the site. Visual inspections should not only be of the surface, but the depth of tillage (approximately 30 cm below the surface) should be checked for admixing and compaction.

Terrain

The following follow-up and monitoring activities are recommended for the operations phase of the Project:

- A geohazard specialist will monitor unstable or potentially unstable areas using strain gauges or other terrain stability monitoring devices. Of particular concern is the commencement of pit development as that is when detrimental vibrations to terrain stability can be most far reaching as blasting is occurring at the ground surface.
- Monitor terrain stability in the 3.4 ha of unstable terrain where groundwater increases are anticipated.

9.4.7 Vegetation

Follow up and monitoring for vegetation and wetlands includes monitoring wetland and riparian ecosystems during construction of the mine access road and any access roads used to support construction or maintenance of the transmission line corridor. In addition monitoring activities will be completed as part of the reclamation program to ensure growth of planted grasses, forbs, shrubs and tree seedlings. Monitoring is also prescribed as part of the invasive plant management plan (Volume 5, Section 5, Appendix 5-5-K).

- Wetland monitoring is proposed during access road construction to ensure that wetlands are avoided wherever possible and that prescribed mitigation measures are followed.
- Construction monitoring is recommended in the access road and transmission corridor RSAs to ensure that prescribed riparian mitigation measures are implemented effectively.
- Reclamation monitoring of reclaimed riparian ecosystems is recommended in the mine site area as part of the reclamation monitoring program.

9.4.8 Wildlife

Follow-up programs are intended to evaluate whether mitigation measures are effective. Six follow-up programs are proposed for wildlife:

Barrow’s Goldeneye

Annual Barrow’s Goldeneye nest surveys will be conducted in the mine RSA to determine use and success (e.g., species, brood size).

Shorebird and Waterfowl

Given uncertainties regarding the potential for shorebird and waterfowl use of habitat within the mine LSA during post-closure, Taseko will develop and implement a follow-up survey program to determine use patterns for TSF Lake. The program will be developed in consultation with the BC Ministry of Environment. The follow-up program will use survey data gathered prior to mine development to establish a baseline (e.g., species present, relative abundance). Incidental observations of aquatic furbearers will also be collected as part of this program.

Amphibians

Given uncertainties regarding the potential for amphibian recolonization of habitat within the mine LSA during post-closure, Taseko will develop and implement a follow-up survey program to determine whether or not amphibian populations re-establish within TSF Lake. The program will be developed in consultation with the BC Ministry of Environment. The follow-up program will use survey data gathered prior to mine development to establish a baseline (e.g., species present, relative abundance). Incidental observations of aquatic furbearers will also be collected as part of this program.

Wildlife-Vehicle Collisions

Taseko will record all project-related wildlife-vehicle collisions or near misses. These data will be regularly reviewed by the environmental site monitor. If a problem area is identified appropriate actions will be taken (e.g., warning signs, site-specific speed limits). In addition, Taseko will report any wildlife mortalities resulting from project vehicles to the BC Ministry of Environment regional office and the BC Ministry of Transportation.

Grizzly Bear Populations

Given its threatened status, any human-caused grizzly bear mortalities in the South Chilcotin Ranges Grizzly Bear Population Unit (GBPU) are a serious concern. Taseko proposes that a "Grizzly Bear Mortality Investigation Program" be implemented under the direction of the BC Ministry of Environment. As part of this program, Taseko would be required to investigate any Project-related grizzly bear mortalities and report the findings to the BC Ministry of Environment. The findings would then be evaluated in the context of existing company policy, mitigation measures and plans, and any potential improvements would be discussed and implemented as required. In turn, the BC Ministry of Environment would be required to communicate to Taseko the occurrence and findings related to any non-Project-related human-caused grizzly bear mortalities in the GBPU. The BC Ministry of Environment would be responsible for ensuring any future industrial developers in the GBPU are included in the program.

9.4.9 Atmospheric Environment

To verify the accuracy of the environmental assessment on air quality and noise, and to determine the effectiveness of the measures taken to mitigate any adverse environmental effects of the project follow-up and monitoring is recommended. As detailed in Volume 4 Section 2.4.3, follow-up actions for Criteria Air Contaminants (CACs) include:

- develop and maintain an annual inventory of GHGs for both internal management and potential external reporting needs
- develop and implement an air quality and dust control management plan, as per the Mine Proponents Guide
- prepare and submit a burn plan for vegetative debris consistent with the Open Burning Smoke Control Regulation (BC Reg. 145/93) prior to initiation of the construction and commissioning phase

With respect to CACs an ambient air quality and meteorological monitoring program is also planned:

- one station, to be established at or very near the mine disturbance boundary on the northern and western extremity to measure both PM_{10} and DF
- a second identical station, to be established in a region nearby, unaffected by mine emission sources to establish a baseline
- a continuous monitoring station for the collection of meteorological data at a regionally-representative location to assist in the interpretation of these (and other) data

9.4.10 Socio-Economic, Human Health and Ecological Risk

- Monitoring proposed is for truck traffic on the Whitewater Road to determine if it exceeds stated capacity as set by MOT.
- Compensation agreements with licensees at the mine site and buffer need to be negotiated prior to the onset of construction. All other mitigation strategies will be reviewed with the EAO and the respective licensees or stakeholders at three points in time, once prior to construction, again prior to the onset of operations and finally one year after the onset of operations.
- To confirm the conservative nature of the risk assessment and the predicted metal loading in soils, Taseko will undertake a monitoring program for metal concentrations in soils, local surface water and vegetation throughout the Project. Results of the monitoring program will be compared against baseline conditions. If increases in concentrations of chemicals of concern occur over time, a formal quantitative assessment may be required.
- If through monitoring, concentrations of metals in water and/or fish were elevated over background concentrations, Taseko would undertake a risk assessment to ascertain if the levels were of a sufficient concentration to pose a potential risk.
- In addition, a number of the monitoring recommendations made in other volumes and sections of the EA will also serve to protect human and ecological health (e.g., air monitoring, Volume 4, Section 2).Summary of Residual Project and Cumulative Effects for Human and Ecological Health.

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10.2 Written Communications

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Mike Ramsay. July 18, 2007. Email from Mike Ramsay to Michael Whelan, summarizing studies, models to determine minimum viable populations.

Mike Ramsay. June 26, 2008. Memo from Mike Ramsay to Triton Environmental. Position paper on Fish Lake.

Michael Whelan. September 7, 2007. Email from Mike Whelan to Norm Ringstad, summarizing Chinook information for the Taseko River, Senior Fisheries Biologist, Jacques Whitford AXYS Ltd.

10.3 Oral Communications

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11 Appendices

Regional and Local Geology

Appendix 3-5-A	Geology Report 1998

Mine Plan

Appendix 3-6-A	Prosperity–Feasibility Study
Appendix 3-6-B	Transmission Line Corridor Selection–1997
Appendix 3-6-C	2007 Feasibility Pit Slope Design
Appendix 3-6-D	Waste Storage Area Geotechnical Feasibility Report
Appendix 3-6-E	Feasibility Design of the Open Pit
Appendix 3-6-F	Report on Open Pit Design
Appendix 3-6-G	Open Pit Preliminary Hydrogeological Investigations
Appendix 3-6-H	Report on 1994 Open Pit Investigations
Appendix 3-6-I	1996 Open Pit Geotechnical Investigation
Appendix 3-6-J	Report on Geotechnical Parameters for the Plant Site Foundation Design - 1998
Appendix 3-6-K	Report on Geotechnical Parameters for the Plant Site Foundation Design–1999
Appendix 3-6-L	Report on Plant and Crusher Site Foundation Investigations
Appendix 3-6-M	Report on Preliminary Geotechnical Evaluation
Appendix 3-6-N	Report on Preliminary Geotechnical Investigations
Appendix 3-6-O	1994 Geotechnical and Hydrogeological Investigations for Proposed TSF
Appendix 3-6-P	1996 Geotechnical Investigations for Tailings Management Options 2 and 5
Appendix 3-6-Q	Report on Seismic Refraction and Reflection Investigations, July 1997
Appendix 3-6-R	Report on 2007 Feasibility Design of the 70,000 tpd TSF
Appendix 3-6-S	Report on Materials for Embankment Construction and Concrete Aggregate
Appendix 3-6-T	Site Geotechnical Considerations and Design of TSF
Appendix 3-6-U	Report on Feasibility Design of the TSF
Appendix 3-6-V	Conceptual Design -TSF Spillway

Acid Rock Drainage/Metal Leaching

Appendix 3-7-A	Phase 1 Characterization: Sample Sources
Appendix 3-7-B	Phase 3 Metallurgical Testing: Feed Sample Sources
Appendix 3-7-C	Cross sections showing ABA Sample Sources
Appendix 3-7-D	Phase 4 Kinetic Test Sample Sources
Appendix 3-7-E	Phase 5 Shake Flask Extraction Sample Sources
Appendix 3-7-F	Phase 5 Basalt Characterization Sample Sources
Appendix 3-7-G	Phase 5 Assessment of Segregation: Core Lengths Composited for ABA Testing
Appendix 3-7-H	Phase 5 Overburden Samples
Appendix 3-7-I	Phase 5 Mineralogical Assessment Sample Sources
Appendix 3-7-J	Phase 5 Mineralogy: Petrography and X-ray Diffraction
Appendix 3-7-K-1	Phase 2 and 3 ABA Results and Summary Statistics by Rock Type
Appendix 3-7-K-2	Phase 2 and 3 ABA Results and Summary Statistics by Alteration Type
Appendix 3-7-K-3	Phase 2 and 3 ABA Results and Summary Statistics by Ore and Waste Class
Appendix 3-7-K-4	Phase 2 and 3 ABA Results and Summary Statistics by ARD Classification
Appendix 3-7-L-1	Phase 2 and 3 ICP Results and Summary Statistics by Rock Type
Appendix 3-7-L-2	Phase 2 and 3 ICP Results and Summary Statistics by Alteration Type
Appendix 3-7-L-3	Phase 2 and 3 ICP Results and Summary Statistics by Ore and Waste Class
Appendix 3-7-L-4	Phase 2 and 3 ICP Results and Summary Statistics by ARD Classification
Appendix 3-7-M	Phase 5 Mineralogy: Carbonate Speciation by Electron Microprobe
Appendix 3-7-N	Phase 5 Selenium and Mercury Analyses
Appendix 3-7-O	Summary of Phase 2 and 3 Overburden ABA Testing
Appendix 3-7-P	Phase 5 Overburden Shake Flask Extraction Results
Appendix 3-7-Q	Phase 5 Assay Pulp Shake Flask Extraction Results
Appendix 3-7-R	Phase 4 Humidity Cell Test Results: Tables
Appendix 3-7-S	Phase 4 Humidity Cell Test Results: Charts
Appendix 3-7-T	Phase 4 Column Test Results: Tables
Appendix 3-7-U	Phase 4 Column Test Results: Charts
Appendix 3-7-V	Phase 5 Humidity Cell Test Results: Tables

Appendix 3-7-W	Phase 5 Humidity Cell Test Results: Charts
Appendix 3-7-X	Phase 5 Waste Rock Column Test Results: Tables
Appendix 3-7-Y	Phase 5 Waste Rock Column Test Results: Charts
Appendix 3-7-Z	Mine Rock Source Term Inputs To Water Quality Predictions
Appendix 3-7-AA	Phase 1 Composite Ore Sample Makeup
Appendix 3-7-BB	Phase 3 Composite Ore Sample Makeup
Appendix 3-7-CC	Phase 5 Composite Ore Sample Makeup
Appendix 3-7-DD	Compiled Tailings Static Testing Results
Appendix 3-7-EE	Phase 5 Tailings Humidity Cell Test Results
Appendix 3-7-FF	Phase 5 Tailings Column Test Results
Appendix 3-7-GG	Tailings Source Term Inputs to Water Quality Predictions
Appendix 3-7-HH	Estimate of Future Water Chemistry in TSF Lake
Appendix 3-7-II	Estimate of Future Water Chemistry in Pit Lake
Appendix 3-7-JJ	TSF Seepage Assessment and Site Water Balance
Appendix 3-7-KK	Annual Load Estimates and Accompanying Chemical Concentrations: non-PAG WRSF
Appendix 3-7-LL	Annual Load Estimates and Accompanying Chemical Concentrations: Low Grade Ore Stockpile
Appendix 3-7-MM	Phase 5 ABA Results- Segregation Assessment
Appendix 3-7-NN	Phase 5 Static Characteristics for Ore Humidity Cell Sample

Fisheries Compensation Plan

Appendix 3-8-A	Rainbow Trout Microsatellite DNA Database Notes
Appendix 3-8-B	Predicted Water Quality Parameter Concentrations
Appendix 3-8-C	Assessment of the Hanceville Hatchery
Appendix 3-8-D	Fish Lake Rainbow Trout Health Assessment