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2 PROPOSED PROJECT OVERVIEW

Pursuant to Part 3 of the British Columbia *Environmental Assessment Act* (BC *EAA*) (Government of BC, 2002a) *Reviewable Projects Regulation* (Government of BC, 2002c), review is required for the proposed Blackwater Gold Project (the Project) because it would constitute a new mine facility with a production capacity greater than 75,000 tonnes per year (t/y) of mineral ore; the Project is expected to have a nominal ore production capacity of 22 million tonnes per year (Mt/y). The BC Environmental Assessment Office (BC EAO) issued an Order under section 10 of the BC *EAA* on 5 November 2012 indicating the Project requires an Environmental Assessment (EA) Certificate and New Gold Inc. (Proponent) may not proceed with the proposed Project without an assessment (BC EAO, 2012).

The proposed Project meets the definition of a designated project under *Canadian Environmental Assessment Act, 2012 (CEAA, 2012)* and the schedules of the *Regulations Designating Physical Activities* (Government of Canada, 2012b) and that the proposed Project Description meets the requirements of the *Prescribed Information for a Description of a Designated Project Regulations* (Canadian Environmental Assessment Agency (Agency), 2012b). The Agency published a Notice of Environmental Assessment Determination on 21 December 2012 indicating that a federal EA is required (Agency, 2012c). The proposed Project is undergoing a coordinated EA review by BC EAO and the Agency.

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2.1 Proponent Description

New Gold Inc. (Proponent) is an international gold producer with operations in Canada, United States (US), Mexico, and Australia, and development projects in Canada and Chile. The Proponent was incorporated under the laws of the Province of British Columbia (BC) on 31 January 1980. The Proponent has corporate offices in Vancouver and Toronto and is listed on the Toronto Stock Exchange (TSX) and the New York Stock Exchange Market (NYSE MKT) under the symbol NGD. The Project will be managed out of the Proponent's Vancouver office. Tim Bekhuys, Environment and Sustainability Director, is the principal New Gold contact person with respect to the Environmental Assessment (EA).

2.1.1 Contact Information

Proponent contact information is as follows:

Project Name:	Blackwater Gold Project
Proponent:	New Gold Inc.
Proponent Address:	Suite 1800, Two Bentall Centre 555 Burrard Street, Box 212 Vancouver, BC, V7X 1M9 Telephone: (604) 696-4100 Facsimile: (604) 696-4110 Internet: www.newgold.com
Principal Contact:	Tim Bekhuys, R.P. Bio, Environment & Sustainability Director E-mail: Tim.Bekhuys@newgold.com Telephone: (604) 696-4100 Facsimile: (604) 696-4110

The Project Management Team for the proposed Project also includes:

- New Gold:
  - Robert Gallagher, President, Chief Executive Officer (CEO) & Director;
  - Peter Marshall, P.Eng., Project Director – Blackwater;
  - Paul Hosford, P.Eng., Feasibility Study Director;
  - Nigel Fisher, Environmental Manager;
  - Claudette Gouger, Community Manager; and
  - Amber Teed, First Nations Coordinator;
- Sustainability Engineering:
  - Keith Ferguson, P.Eng., Environment & Permitting Advisor; and
- AMEC Environment & Infrastructure (AMEC):

- Alvaro Paredes, MPhil, EP, Project Manager.

AMEC has prepared the Application Information Requirements (AIR) for the Project and has been retained by the Proponent to lead the preparation of the Application for an Environmental Assessment Certificate/Environmental Impact Statement (Application). Where applicable, additional information contained in the Application that has been prepared by a qualified professional and information related to the qualified professional's expertise will be identified in the Application.

The Proponent has an office in Vanderhoof that facilitates easy access to information regarding ongoing exploration activities and other details concerning the Project.

2.1.2 Corporate and Management Structures

The Proponent's management structure for the Project is shown in **Figure 2.1-1** and is based on existing operating sites. Corporate Vice Presidents and Directors report to the President and CEO. The Vice-President (VP) of Operations provides direction to the site General Managers for disbursement throughout the site.

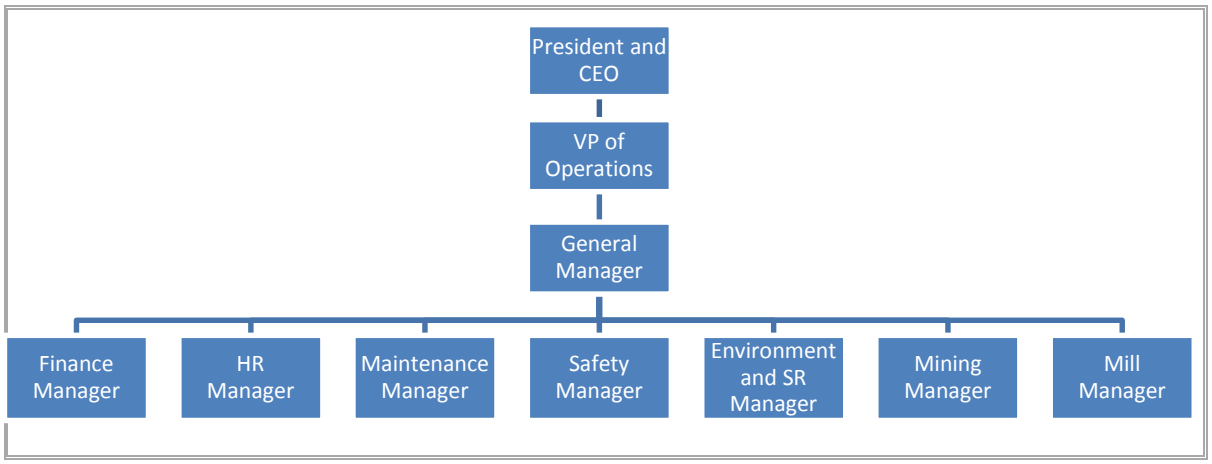


Figure 2.1-1: Corporate and Management Structure for the Project

All Proponent entities insurance is controlled by Marsh Canada and is set for the insurance cycle of 1 September to 31 August. Project liability and insurance policies during the construction phase will include property, crime, auto- and non-owned aircraft usage, course of construction (COC) and wrap-up liability (WUL).

2.1.3 Mechanisms to Ensure Corporate Policies are Implemented

The Proponent corporate policies are communicated through site orientation training to ensure all employees and contractors are aware of their environmental and safety responsibilities.

Corporate Management Systems for Environment, Community Engagement, and Health and Safety will be used to ensure compliance with corporate policies and commitments (**Figure 2.1-2**). These management systems are owned by the Safety and Environment and Social Responsibility Directors. Representatives from the Proponent sites contribute to these management systems to ensure coordination with the site management systems. All management systems by corporate and sites are auditable either by the Proponent's personnel or a third party. The Proponent also maintains a corporate Internal Audit group who audit and provide feedback on various levels of compliance.

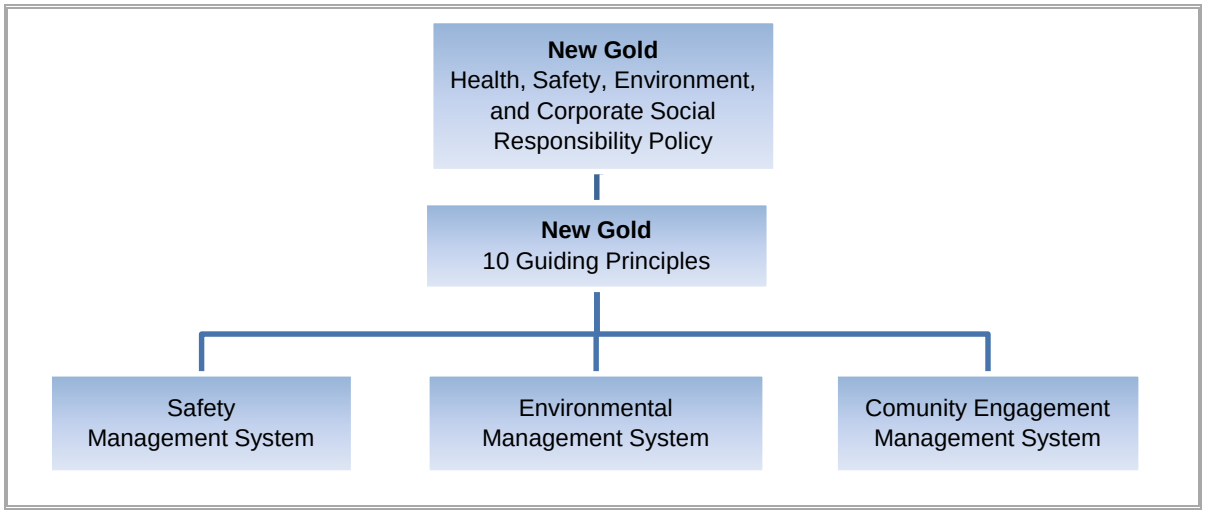


Figure 2.1-2: Corporate Management System

2.1.4 Key Elements of the Proponent's Environment, Health and Safety Management System

The Project Environment, Health, and Safety Management System will be based on the New Gold Health, Safety, Environment, and Social Responsibility 10 Guiding Principles. This structure is shown in **Figure 2.1-3**.

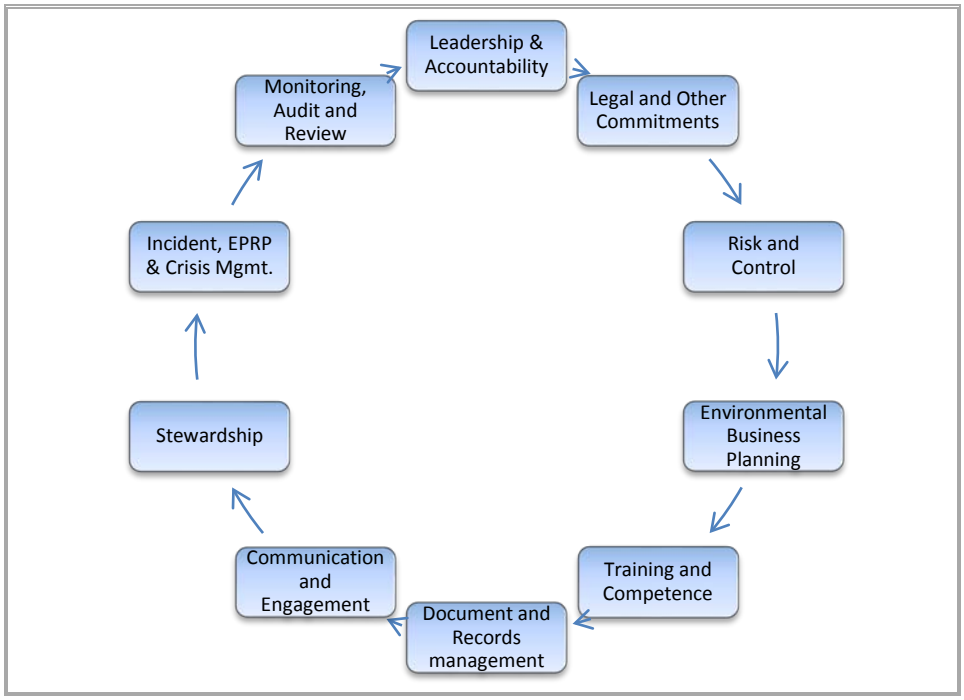


Figure 2.1-3: Health, Safety, Environment, and Social Responsibility Guiding Principles

2.1.5 Personnel Responsible for Preparing the EA

AMEC led and coordinated the EA.

Table 2.1-1 lists the senior authors from AMEC responsible for sections of the Application.

The engineering team that supported the EA is composed of a group of companies engaged independently by the Proponent. These companies included are:

- AMEC – processing, on-site infrastructure, capital and operating cost estimates, and financial analysis;
- Knight Piésold Ltd. (Knight Piésold) – Tailings Storage Facility design (TSF), geotechnical design, transmission line, and water supply;
- GeoSim Services Inc. – geology and resource modelling;
- Independent Mining Consultants Inc. (IMC) – mining;
- Allnorth Consultants Limited (Allnorth) – road design; and
- Ecofor Consulting Ltd. and Avison Management Services Ltd. – field biological and engineering services.

Table 2.1-1: Primary Authors for the EA

Discipline	Primary Author
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Aboriginal Groups	Janine Bedford, M.A.
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A-1 New Gold Mineral Tenures and Claims

A-2 Mine Waste and Water Management Design Report (Knight Piésold Ltd.)

A-3 11x17 Mine Phase Drawings (NorWest Corporation)

A-4 Geotechnical Characterization Report (Knight Piésold Ltd.)

A-5 Construction Sediment and Erosion Control Plan (Knight Piésold Ltd.)

A-6 Updated Water Balance Letter Report (23 December 2013) (Knight Piésold Ltd.)

A-7 Domestic Wastewater Feasibility and Pre-Design (Opus Dayton & Knight)

A-8 Transmission Line Feasibility Study (Knight Piésold Ltd.)

A-9 Feasibility Open Pit Slope Design (Knight Piésold Ltd.)

A-10 Open Pit Water Management Plan (Knight Piésold Ltd.)

Appendix 2.2B: Transmission Line Alternatives Presentation Notes (AMEC E&I)

Appendix Supp: Supplemental Report on Transmission Line Access Roads (AMEC E&I) (App Volume 19)

2.2 Proposed Project Description

This Project Description for the proposed Blackwater Gold Project (Project) includes a description of the following:

- The Project location;
- The Project rationale;
- Regional and local geological and mineral resources;
- The mine plan;
- Process plant site facilities;
- The process plant;
- Waste rock and tailings management;
- Water management;
- Support facilities;
- Transportation and access considerations;
- Activities that will be carried out in the construction phase;
- Decommissioning and closure plans (**Section 2.6**, Reclamation and Closure Plan);
- Scheduling and Project execution;
- Human resources procedures and procurement policy;
- Project economics; and
- Alternate means of carrying out the Project.

Supporting reports are provided in **Appendix 2.2A**.

2.2.1 Purpose and Location of the Proposed Project

As a publicly traded company, New Gold Inc. (Proponent) intends to develop and operate the Project to provide its shareholders with a reasonable rate of return on their investment. The Proponent will do this by economically extracting gold and silver from the Blackwater deposit to help meet strong worldwide demand for these resources.

The Proponent understands Social Responsibility as the way the Proponent contributes to sustainable development by acting ethically and with integrity, and by taking responsibility for the impacts of company decisions and actions on communities and the environment. The Proponent's Social Responsibility strategy includes commitments to excellence in the management of health, safety, environment, labour practices, and community engagement and development through the mine life cycle, from early exploration, development, operation, decommissioning, through mine closure. The Proponent's directors and senior managers support philanthropic and charitable organizations using their personal resources, and the Proponent makes significant contributions to all of our host communities, in the form of donations, and sponsorships to support education, health and wellness, economic diversification, job creation, and food bank initiatives.

The main objective of the Project is the economic extraction of the gold (Au) and silver (Ag) resources from the Blackwater deposit. The Project will produce approximately 7 million ounces (Moz) of Au and 30 Moz of Ag during 17 years of operations and would generate positive economic impacts, including employment and business opportunities and tax payments.

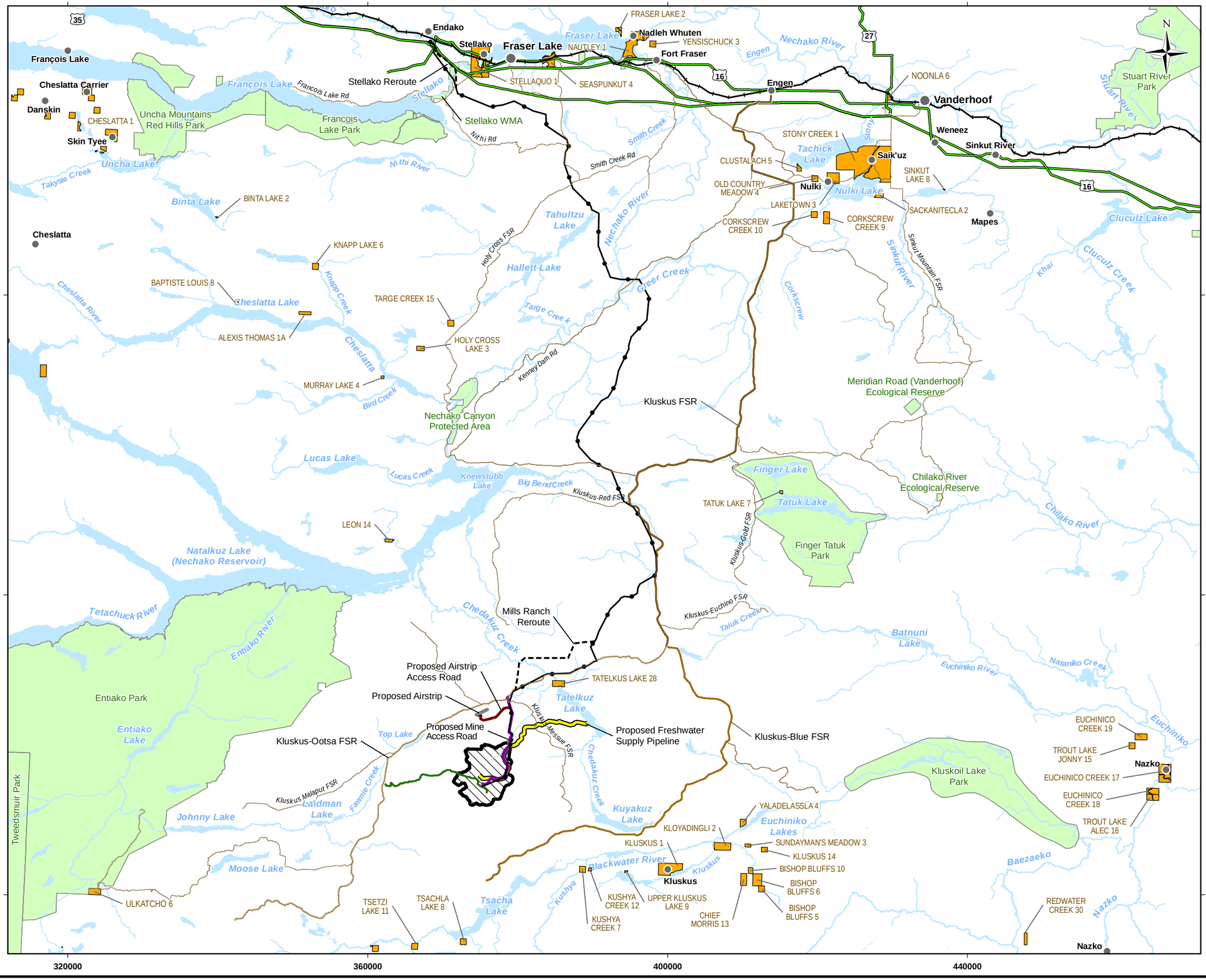
In addition to the identified worldwide demand for gold and silver, the local area and region are facing challenging economic times because of the downturn in the forestry and tourism sectors. Economic benefits that will derive from the Project are therefore much anticipated by most local and regional residents and business, and by several Aboriginal groups in the area. The Proponent expects to provide employment opportunities for 1,000 to 1,500 (peak) construction workers, and have an operations workforce of about 500 people. The life of the mine is projected to be 17 years. The Project will also contribute royalties and tax revenue to the province of British Columbia (BC).

Once in production, the Project will allow the Proponent to increase its current gold and silver production to more than double compared to 2013. Information on need for the project follows the Agency (2013) operational policy statement on project need and alternatives.

The Project is located approximately 110 kilometres (km) southwest of Vanderhoof in central BC, and approximately 160 km west-southwest of Prince George. The mine site is centred at latitude 53°11′22.872″ N, and longitude 124°52′0.437″ W (375400 E, 5893000 N) on National Topographic System sheet 93F/02 (**Figure 2.2.1-1**). A video of the proposed mine development is available upon request. **Table 2.2.1-1** lists straight-line distances to nearby communities shown on **Figure 2.2.1-1**.

The mine site is located within the traditional territories of Ulkatcho First Nation (UFN), Lhoosk'uz Dene Nation (LDN), and the Skin Tyee Nation (STN). Off-site infrastructure such as the Kluskus Forest Service Road (FSR) and the transmission line, cross the traditional territories of Nadleh Whut'en First Nation (NWFN), Nazko First Nation (NFN), Stellat'en First Nation (StFN), and Saik'uz First Nation (SFN).

The main physical activities associated with the proposed Project include the construction, operations, closure, and post-closure of an open pit mine; ore processing facilities; mine waste management facilities; and associated on-site and off-site infrastructure.



Legend

- Populated Place
- Highway
- Kluskus FSR
- Kluskus-Blue FSR
- Kluskus-Ootsa FSR
- Other FSRs
- Railway
- Existing Transmission Line
- Stream
- Waterbody
- Parks and Protected Areas
- Indian Reserve

Project Components

- Exploration Road
- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Transmission Line Reroute
- Proposed Freshwater Supply Pipeline
- Proposed Airstrip Access Road
- Proposed Airstrip Extent
- Proposed Mine Site



Scale: 1:500,000

0 5 10 20

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Proposed Mine Site Location with Mine Access Road, Transmission Line and Freshwater Supply Pipeline

DATE: September, 2014	ANALYST: WR	**Figure** 2.2.1-1
JOB No: VE52277	QA/QC: AP	PDF FILE: Other-100-028_v14_TL_DAIR.pdf
GIS FILE: Other-100-028_v14_TL_DAIR.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

\\Bby-fs2\bby-e-e-gis\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\Other\Other-100-028_v14_TL_DAIR.mxd

Table 2.2.1-1: Distances to Nearby Communities From the Proposed Project

	Name	Mine Site (km)	Linear Components				
			Transmission Line (km)	Kluskus-Ootsa FSR (km)	Mine Site Access Road (km)	Airstrip (km)	Freshwater Supply System (km)
Communities	Danskin	107.3	48.6	89.7	104.7	104.6	108.7
	Endako	99.3	1.3	42.6	89.5	91.4	93.6
	Engen	98.8	28.3	0.0	88.4	91.7	87.9
	Fort Fraser	97.9	16.4	13.0	87.5	90.3	89.0
	François Lake	111.5	48.2	89.6	104.3	104.1	108.9
	Fraser Lake	95.5	5.4	30.9	85.0	87.5	88.2
	Mapes	100.6	47.6	26.2	91.3	95.3	86.4
	Nulki	91.2	28.5	4.5	80.9	84.9	79.2
	Sinkut River	107.0	50.4	27.4	98.0	101.7	93.6
	Vanderhoof	107.2	44.7	20.0	97.0	101.0	94.5
	Weneez	103.4	43.6	20.0	94.2	97.8	90.7
First Nation	***Indian Reserves***						
Lhoosk'uz Dene Nation	Bishop Bluffs #5	39.3	36.8	33.1	36.8	43.8	31.5
	Bishop Bluffs #6	38.0	35.5	31.5	35.5	42.3	35.5
	Bishop Bluffs #10	37.1	34.6	30.3	34.6	41.5	28.8
	Chief Morris #13	36.5	33.9	30.6	33.9	40.9	28.6
	Cluchuta Lake #10A	27.0	25.7	37.3	25.7	33.7	26.2
	Cluchuta Lake 10B	27.4	29.7	40.9	29.7	37.1	30.3
	Kloyadingli #2	31.8	29.3	25.2	29.3	35.8	23.2
	Kluskus #1	25.9	23.6	26.6	23.6	31.2	20.9
	Kluskus #14	38.0	35.4	28.8	35.4	31.7	28.5
	Kushya Creek #7	17.5	15.5	24.5	15.5	24.4	15.5
	Kushya Creek #12	18.6	16.5	25.2	16.5	25.3	16.5
	Sundayman's Meadow #3	35.8	33.2	27.3	33.2	39.6	26.5
	Tatelkus Lake #28	15.4	0.8	0.8	6.1	10.5	4.6
	Tsachla Lake #8	22.1	20.8	32.8	20.	30.1	21.5
	Tzetzi Lake #11	24.4	23.0	34.9	23.0	31.7	23.7
	Upper Kluskus Lake #9	22.5	20.4	27.5	20.4	28.8	20.4
	Yaladelassla #4	34.4	31.7	25.0	31.7	37.5	24.1
	Fraser Lake #2	100.0	14.5	19.7	89.4	92.3	91.8
	Nautley #1	97.4	12.8	15.5	86.9	89.9	89.2

	Name	Mine Site (km)	Linear Components				
			Transmission Line (km)	Kluskus-Ootsa FSR (km)	Mine Site Access Road (km)	Airstrip (km)	Freshwater Supply System (km)
Nadleh Whut'en First Nation	Seaspunkut #4	94.7	11.8	25.2	84.3	86.9	87.3
	Yensischuck #3	99.4	16.5	14.8	88.8	91.8	90.5
Saik'uz First Nation	Corkscrew Creek #9	86.1	25.2	4.1	75.9	79.9	73.6
	Corkscrew Creek #10	86.0	24.1	2.4	75.7	79.6	73.7
	Clustalach #5	90.5	25.5	1.7	80.1	83.9	78.7
	Noonla #6	104.6	40.7	15.1	94.3	98.3	91.2
	Laketown #3	91.0	28.3	4.4	80.7	84.6	78.7
	Old Country Meadow #4	90.2	26.5	2.4	79.8	83.7	78.1
	Sackanitecla #2	92.7	33.2	10.7	82.8	86.9	79.9
	Sinkut Lake #8	99.0	41.7	19.8	89.2	93.4	85.4
	Stony Creek #1	93.2	30.1	6.0	83.5	87.5	81.8
	Tatuk Lake #7	54.2	18.1	7.9	45.5	49.9	40.2
Stellat'en First Nation	Binta Lake #2	82.4	36.2	65.6	74.4	74.7	79.5
	Stellaquo #1	92.9	2.1	32.8	83.0	85.1	87.1
Ulkatcho First Nation	Ulkatcho #1	61.0	59.9	68.1	59.9	63.6	60.4
	Ulkatcho #6	53.6	52.6	60.0	52.6	55.5	52.7
Nazko First Nation	Euchinico Creek #17	89.7	72.5	68.2	86.7	91.4	76.7
	Euchinico Creek #18	88.1	71.5	66.8	85.0	89.6	75.1
	Euchinico Creek #19	86.7	67.3	63.7	83.1	87.6	73.0
	Trout Lake Jonny #15	85.8	67.1	63.1	82.4	86.8	72.2
	Trout Lake Alec #16	88.2	71.5	66.8	85.0	89.6	75.1
	Redwater Creek #30	74.8	67.6	60.9	72.3	78.4	64.6
Skin Tyee First Nation	Skins Lake #16b	97.7	45.2	83.1	91.1	90.7	95.7
	Western Island #14	98.0	47.3	83.7	90.5	89.9	95.1

Notes: Distances reported are shortest straight line distances to mine site and linear components (mine access road, Kluskus-Ootsa FSR, freshwater supply system, transmission line and airstrip);
Communities and Indian Reserves listed are those included in **Figure 2.2.1-1** (Proposed Mine Site Location with Mine Access Road, Transmission). Please note that the table only includes those Indian Reserves occupied by First Nations identified in Schedule B and Schedule C of the section 11 Order Proposed Mine Site Location with Mine Access Road, Transmission Line and Freshwater Supply Pipeline.

2.2.1.1 Geographical Setting

2.2.1.1.1 Accessibility

The Project site is readily accessible by vehicle from the Kluskus Forest Service Road (FSR) that originates approximately 100 km west of Prince George, and 10 km west of Vanderhoof, off Highway 16 (Yellowhead Highway) (**Figure 2.2.1-1**). At km 146.5 on the Kluskus FSR, an 18-km mine road provides direct access to the Project site and exploration camp (which Granges built in 1986, and Richfield later improved). The current driving time from Vanderhoof to the Project site is approximately 2.5 hours. There are no communities within the mine site study area, mine site access road study area, airstrip study area, or freshwater supply system (FSS) study area (Figure 3.1-1, **Appendix 7.1.2A**). The proposed transmission line will connect with the existing transmission line, approximately 1 km south of the community of Endako. The Kluskus FSR joins Highway 16 in the Engen area. Both of these junctures are located within the District of Vanderhoof. Other nearby communities include Stellako and Fraser Lake.

Plans are to construct a new 16-km access road to the Project site at approximately km 126 of the Kluskus FSR. All bridges on the new section of road will be rated at 100-ton capacity, and will be clear span.

Helicopter access is available from bases in Vanderhoof, Prince George, or Quesnel. Prince George has a large regional airport (YXS) with an 11,450 foot (ft) (3,490 metre [m]) asphalt runway suitable for large aircraft and a 24-hour flight service station.

The Canadian National Railway has direct service to Prince George and Vanderhoof from most origins in Canada and the United States.

2.2.1.1.2 Climate

The climate at the Project site is sub-continental, characterized by brief warm summers and long cold winters resulting from the influence of cold Arctic air. The climate is also influenced by moisture-laden weather systems moving east by way of the low Kitimat Ranges. Temperatures range from a minimum of –40 degrees Celsius (°C) in winter to a maximum of 32°C in summer. Average annual precipitation is 636 millimetres (mm), with 310 mm falling as rain and the remainder as snow. The rainy season is from May to September. Snow typically starts to accumulate in October, and snowmelt is generally between April and May. The prevailing wind is from the southwest.

The weather is not expected to present any unusual difficulties for mining operations.

2.2.1.1.3 Local Resources and Infrastructure

Two ranches are located within a 20-km radius of the Project site. Some services are available in Vanderhoof, but Prince George is the regional hub, with air service from major centres.

There is no grid-connected power system near the Project site. The main BC Hydro 500 kilovolt (kV) transmission lines supplying western BC are located approximately 100 km to the north. Several interconnection points from the 500 kV lines to existing 230 kV substations and transmission lines are possible in the area between Fraser Lake and Vanderhoof. Generators currently provide power for the Project exploration camp.

The ore deposit is located on the north slope of Mount Davidson, and the Project infrastructure, including the process plant, waste storage, and tailings storage, will be sited predominantly in the Davidson Creek watershed.

Precipitation runoff, groundwater from pit dewatering, tailings storage facility (TSF) reclaim water, and supplemental fresh water from nearby Tatelkuz Lake are the water sources for mineral processing. A groundwater well field will be developed to supply fresh water for the construction and operations camps.

2.2.1.1.4 Physiography

The Project site ranges from just over 1,000 m in low-lying areas northeast of the proposed mine site to 1,800 m at the summit of Mount Davidson on the southwest side of the site.

Outcrop on the Project site is limited. Most of the area is covered with glacial deposits 2-m or more deep, except for the upper 150 m of Mount Davidson. The slopes of Mount Davidson are covered by till and colluvium, but the majority of the lease claim area surface deposits are lodgement with minor deposits of ablation till.

2.2.1.1.5 Environmental Significance and Value of the Geographical Setting

The current land use in the Project Regional Study Area (RSA) is predominantly forestry and mineral exploration. Ranching and agriculture (the latter centred in the north nearer to Vanderhoof) are also non traditional land uses. Several First Nations traditional territories occupy the area and traditional land use is carried out by these First Nations. Non-traditional land use is discussed in **Section 7.2.6** and traditional land use in **Section 7.2.7**.

There are no parks or protected areas in the immediate area of the proposed mine, nor crossed by proposed linear facilities (road, transmission line, water supply pipeline). Entiako and Tweedsmuir provincial parks lie to the north and west approximately 20 km from the Project. The existing Kluskus FSR passes just to the north of Finger Taluk Provincial Park and the proposed transmission line would pass approximately 20 km to the east of Nechako Canyon Protected Area and about 7 km east of Francois Lake Protected Area. There are no ecological reserves in the regional study area. Parks and protected areas are discussed in **Section 7.2.6**.

Wetlands within the mine site and linear corridors provide a variety of hydrological, biochemical, habitat, and ecological functions. Hydrological functions include groundwater recharge; flow moderation (flood protection); shoreline and erosion protection; climate regulation. Biochemical functions include water quality treatment; nutrient and organic export; carbon sequestration and storage. Ecological/Habitat functions include biological productivity and biodiversity. A small part

of the proposed mine site is currently occupied by wetlands (13%); wetlands comprise approximately 7% of the transmission line corridor, 6% of the mine access road corridor, 8% of the freshwater supply pipeline route, and 4% of the airstrip and airstrip access road corridor. Wetlands potentially affected by the Project are discussed in **Section 5.3.7**.

There are a number of flora, fauna, and ecosystems considered to be at risk, or of management concern by the BC and/or federal governments in the Project regional study area. Plants and ecosystems at risk typically occupy very small parts of the Project area; the exception is whitebark pine, which is found on Mount Davidson at higher elevations in the Project mine site. Whitebark pine is provincially blue-listed and its loss from an area would also result in loss of Clark's nutcrackers because the bird is dependent on the pine seeds for food. In recognition of the importance of whitebark pine, the Proponent has developed a Whitebark Pine Management Plan to specifically address potential Project effects on the tree. The plan can be found in **Section 12.2.1.18.4.4**. Plant species and ecosystems at risk are discussed in **Section 5.4.6**

Fauna at risk include a number of species that do, or could potentially, occur in the Project RSA. These fauna are discussed in **Sections 5.4.7** through **5.4.15** and include representatives of invertebrates, amphibians, birds and mammals. The Tweedsmuir-Entiako Northern Caribou herd winter range occurs to the west of the Project. The herd is listed as Threatened in Schedule 1 of the *Species at Risk Act* (*SARA*) and Red-listed by the province, and is identified for emphasis in biodiversity management in the Vanderhoof Land and Resource Management Plan (LRMP). In response to this conservation initiative, the Proponent addresses caribou management in the Environmental Management Plans (EMPs), **Section 12.2.1.18.4.6**.

A population of white sturgeon (*Acipenser transmontanus*) is present in the Nechako River. That river is outside the aquatic RSA of this Project, but it will be crossed by the transmission line. The Nechako white sturgeon population was red-listed by the province in 2010 (BC Conservation Data Centre [BC CDC], 2013). Its conservation status is S1 or "critically imperilled" due to long-term reproductive failure that began in the 1960s after the river was dammed for purposes of hydroelectric power production. In 2003, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) classified the Nechako sturgeon as "endangered" (COSEWIC, 2003; Ptolemy and Vennesland, 2003).

Moose are an important cultural and land food species, and management strategies were developed to maintain habitat, to control access, and address harvest pressure. Wildlife management is discussed in **Section 12.2.1.18.4.6**.

2.2.2 Project Overview

2.2.2.1 Assessed Project

Pursuant to Part 3 of the BC *Environmental Assessment Act* (BC *EAA*) (Government of BC, 2002a) *Reviewable Projects Regulation* (Government of BC, 2002b), review is required for the Project because it would constitute a new mine facility with a production capacity greater than 75,000 tonnes per year (t/y) of mineral ore; the Project is expected to have a nominal ore production capacity of 22 million tonnes per year (Mt/y). The BC Environmental Assessment Office (BC EAO)

issued an Order under section 10 of the BC *EAA* on 5 November 2012 indicating the Project requires an Environmental Assessment (EA) Certificate and the Proponent may not proceed with the Project without an assessment (BC EAO, 2012).

Federally, the Project is considered a "designated project" under Section 16 (c) of the *Regulations Designating Physical Activities* (SOR/2012-147) (Government of Canada, 2012) since the production rate will exceed the threshold for a gold mine of 600 tonnes per day (t/d). Designated projects are subject to the *Canadian Environmental Assessment Act* (*CEA Act*), 2012 (Canadian Environmental Assessment Agency (Agency) 2012). The Project Description meets the requirements of the *Prescribed Information for a Description of a Designated Project Regulations* (Agency, 2012a). The Agency published a Notice of Environmental Assessment Determination on 21 December 2012 indicating that a federal EA is required (Agency, 2012b). The Project is undergoing a coordinated EA review by BC EAO and the Agency.

The Proponent is intending to develop the Project, an open pit Au and Ag mine, and ore processing facilities with a nominal milling rate capacity of 60,000 t/d (22 Mt/y) over 17 years. The mine site occupies an area of about 3,300 hectares (ha) and is located within a group of 69 mineral claims, 66 of which are recorded under the Proponent's name and three others recorded in the name of third parties. The Proponent has an option to acquire the third party claims subject to a royalty.

Granges Inc. discovered the Blackwater mining property in 1973, with work primarily done by ground and air surveys with some soil sampling. Additional ground and air surveys along with trenching took place in the 1980s. Drilling began in 1985 and approximately 64 holes were drilled between 1985 and 1987. There was limited development activity in the 1990s, with only 10 holes drilled. In 2005, Silver Quest Resources Ltd. (Silver Quest) acquired the Davidson property and drilled seven holes in 2005 and 2006 with a focus on historical drilling on high-grade vein gold targets as well as silver.

In 2009, Silver Quest optioned 75% of northern Davidson property to Richfield Ventures Corp. (Richfield), and Richfield optioned 100% of the southern Davidson property. Richfield conducted the initial drill program, targeting bulk tonnage potential, and eventually optioned the southern Jarritt property to consolidate the southern half of the Project.

In 2010, Richfield continued the drilling program and completed the preliminary metallurgical testing. In 2011, Richfield announced the initial mineral resource estimate and formalized a joint venture with Silver Quest on 75% of the owned northern Davidson property. In June 2011, the Proponent acquired Richfield, and in the third quarter of 2011, the Proponent acquired Silver Quest.

The Proponent's environmental baseline studies began in May 2011 and were conducted until 2013. Results from the environmental baseline studies are presented in **Section 5.1** for atmospheric, acoustic, aquatic and terrestrial environment, in **Section 6.1** for economics, in **Section 7.1** for Social, **Section 8.1** for Heritage, and **Section 9.1** for Health. Hydrology, water quality and climate baseline studies are continuing.

The March 2013 resource update documented in the Application forms the basis for the NI 43-101 Feasibility Study (FS) (New Gold, 2014). The FS resource estimate includes data for all drilling completed by Richfield and the Proponent between 1 August 2009 and 16 January 2013. The Proponent's environmental baseline studies began in May 2011, and are ongoing. Drilling continued in 2012, with 270,301 m drilled in 896 holes—207,333 m in 716 holes for resource delineation and infill drilling, 12,036 m in 54 holes for Project engineering studies, and 40,921 m in 104 holes for testing the mineral potential of areas selected for operations facilities and infrastructure. In Q4 2012, 29,987 m in 121 holes were drilled to convert a portion of the Indicated Mineral Resources to the Measured Classification. Also in Q4 2012, another 13,412 m in 34 holes were completed to test the mineral potential of the areas where operations facilities and infrastructure might be sited.

The Project will be based on a conventional diesel-powered, truck-shovel open pit mine, which will feed the whole-ore, cyanide- (CN) leaching process plant. Au and Ag will be recovered to make a gold–silver doré product, and shipped by air or road. The Project has measured and inferred of 344.4 million tonnes (Mt) grading 0.74 grams (g) Au and 5.5 g Ag, for 7.07 Moz Au and 30 Moz Ag. The main activities associated with the Project include construction, operations, and closure[1] of an open pit mine, ore processing facilities, mine waste management facilities, and associated on-site and off-site infrastructure.

Given the large size and the dispersed nature of mineralization within the Project footprint, open pit mining is the only feasible option for economic extraction of the ore. The current resource estimate indicates combined Indicated and Inferred resources of 7.1 Moz Au and 30 Moz Ag at a 0.32 grams per tonne (g/t) Au equivalent (AuEq) cut-off grade. The FS resource plan involves mining 344 Mt of ore, 690 Mt of waste rock, and 50.4 Mt of overburden, for a total production of 1,084 Mt. Ore will be processed in a process plant to be constructed north of the open pit. Tailings from the process plant will be treated by a sulphur dioxide (SO_2)/air treatment plant to destroy CN and precipitate heavy metals before disposal in the TSF.

Geochemical characterization of the waste rock has been conducted and potentially acid generating (PAG) and metal leaching (ML) waste rock will be primarily disposed of under water, in the TSF, with a small amount remaining in the open pit. Non-acid generating (NAG) waste rock will be deposited on land, covered with overburden, and the land revegetated at closure. The location of the mine waste storage facilities was selected primarily based on discussions with local Aboriginal groups and the Proponent's environmental analysis, as per the Guidelines for the Assessment of Alternatives for Mine Waste Disposal (Environment Canada [EC], 2011). Specifically, the TSF avoids the Blackwater River drainage to the south, whitebark pine to the south (listed on Schedule 1 of the *SARA* [Government of Canada, 2002]), and the Ungulate Winter Range (UWR) to the west. A key objective of the Project design is to prevent surface water from the proposed mine site discharging into nearby streams. Process and site drainage water will be

[1] The term 'closure' is preferred to the term 'decommissioning' because it is more inclusive and takes into account other activities such as clean-up, recontouring, revegetation, and reclamation, which are implemented during the closure phase of the Project.

collected and stored in the TSF and recycled for use in mineral processing during the operations and early closure phases.

During operations, the Project will generate air emissions, discharge liquids, and generate solid waste, which will be responsibly managed in accordance with applicable regulations. Reagents, including CN, fuel and lubricants, explosives, and blasting agents will be transported regularly to the proposed mine site for use during operations. The Project will adhere to the International Cyanide Management Code (ICMC) (International Cyanide Management Institute [ICMI], 2012), and follow EC's Environmental Code of Practice for Metal Mines (EC, 2009).

After the operations phase, the Project will be decommissioned and the land reclaimed. Proposed end land uses after mine closure are return of land for traditional use by Aboriginal groups, recreation, and wildlife habitat. The closure strategy considers accelerated flooding of the open pit via water pumped from the TSF and Tatelkuz Lake. After filling, the pit lake will discharge into the TSF and then into Davidson Creek. Constructed wetlands will be established in the saturated areas of the TSF impoundment, and exposed beaches and PAG/ML waste rock will be covered with overburden. NAG waste rock dumps will also be covered with overburden, and runoff from these facilities will report to the open pit or the TSF. It is expected that, post-closure, the TSF overflow will be of acceptable quality for discharge into Davidson Creek. At closure, any water diversions around the TSF will be breached to return watercourses to their natural direction of flow.

The Project will comprise the following on-site and off-site components:

- Mine site;
- Open pit;
- Overburden and waste rock dumps;
- Ore and low-grade ore (LGO) stockpiles;
- Topsoil stockpiles and borrow pits;
- Construction laydown area;
- TSF and associated structures;
- Water management structures, including site runoff, ditches, diversion, and sediment and erosion control;
- Process plant site and facilities, including mill, conveyors, and crushers;
- Construction and operations camps;
- Core logging area;
- Explosives manufacturing and storage facilities;
- Hazardous material storage and distribution;
- On-site infrastructure, facilities, and services including:
  - Electrical substation and distribution;
  - Mine haul and access roads;
  - Truck shop;

- Equipment and fuel storage areas and facilities;
- Communications network;
- Laboratories;
- Safety and environmental control;
- Potable water distribution and treatment;
- Sewage treatment and disposal facilities;
- Waste disposal facilities;
- Non-hazardous waste incinerator;
- Backup power generation facilities;
- Gravel washing;
- Screening and cement batch plants;
- Maintenance;
- Administration and warehouse facilities;
- Emergency response facilities;
- Firewater distribution; and
- On-site roads.

- Offsite infrastructure includes:
  - Water supply intake, pump stations, pipeline, equipment, and associated access roads;
  - Electric transmission line connecting the mine site with an existing substation and related access roads;
  - Upgrades to a portion of the Kluskus-Ootsa FSR;
  - Transportation infrastructure for workers, materials, and equipment to the mine site;
  - Site access roads, and new access road to connect the mine site with the existing FSRs; and
  - Other transportation infrastructure to service the Project including the airstrip, helicopter pad, and related facilities.

2.2.2.2 Changes from the Initial Project Description

This section presents key changes made to the Project as a result of consultation with stakeholders and Aboriginal groups.

Table 2.2.2-1 lists key changes from the Project Description—submitted to the BC EAO and the Agency for review to determine whether the Project would be reviewable—and accepted November 2012. Beneficial changes include:

- Keeping infrastructure out of the Blackwater River watershed;
- Construction of a new mine access spur road to replace the current exploration road which would have traversed part of the northern caribou winter range;

- Maintaining natural flows in Davidson Creek through pumping of water from Tatelkuz Lake throughout operations and closure; and
- Aligning the transmission line where possible along existing forest access roads and addressing concerns raised by stakeholders.

During consultation with Aboriginal groups, concerns regarding potential effects to Blackwater River were raised and Aboriginal groups have noted the cultural importance of this waterbody. The Nuxalk-Carrier Grease Trail runs along the Blackwater River and was one of the main trails to transport eulachon from the coast to the interior of BC. Aboriginals also expressed concerns about potential effects of the project on the northern caribou herd and on fish populations in Davidson and Chedakuz creeks.

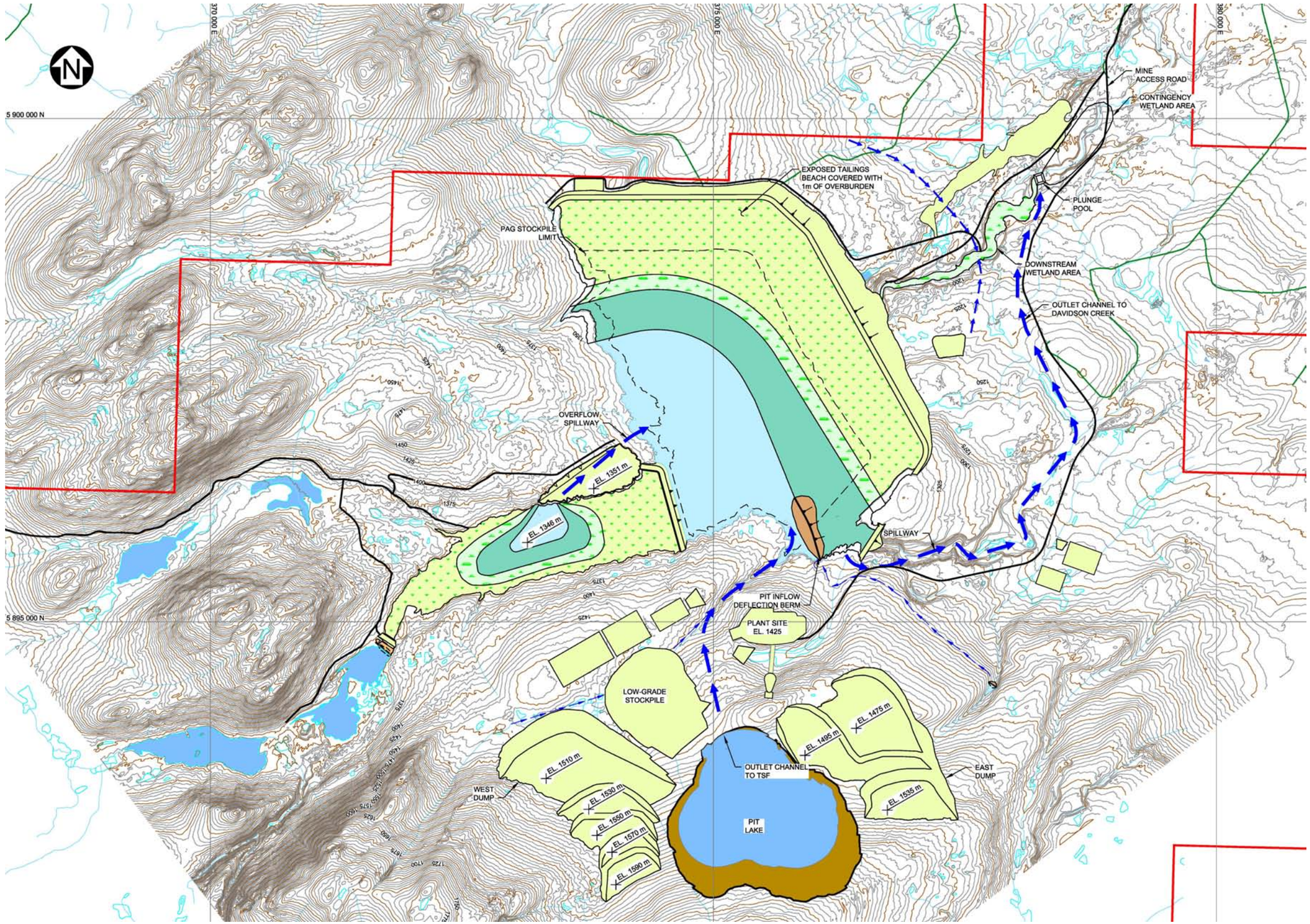
Benefits to the general public will be largely economic and are discussed further in **Sections 2.2.7.6** and **2.2.7.8.** The community of Vanderhoof and surrounding areas will likely benefit directly from the option to use a northern access route rather than the proposed route from Anahim Lake in the south. There are additional benefits to avoiding the Blackwater River as well.

Table 2.2.2-1: Key Changes Between the Initial Project Description and the EA Project Description

November 2012 Project Description	EA Project Description
Transmission Line[1]	
Six alternatives presented: 1 follow existing roads; cross private property near Vanderhoof 2 interconnect to a new substation west of Vanderhoof 3 interconnect to the Glennanon substation near Fraser Lake; two subalternatives 4 interconnect to BC Hydro 230 kV system 5 interconnect to BC Hydro 138 kV system 6 interconnect to a new substation further west than No. 2 7 Similar to 2 but avoid private property	One alternative with two sub-options based on a trade-off study • Option 3 best alternative overall, based on environmental, social, technical, schedule, and cost • Option 3b chosen because 3a would provide insufficient power Two sub-options carried forward for assessment[2] • minimize disturbance to the Stellako River Wildlife Reserve • avoid running the line near private property Two other options suggested by Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) were discounted for environmental, social, and economic reasons discussed in **Appendix 2.2B**. • follow the Kluskus FSR north to Greer Creek, then west to link with Option 3b • north off Kluskus FSR to follow Holy Cross, then due north to Endako
Airstrip	
Airstrip listed as a potential	Airstrip part of the Project[2]
Freshwater Supply Pipeline	
The need for process make-up water was noted and the preferred source (Tatelkuz Lake) identified, but no water supply line route shown	Tatelkuz Lake water supply is confirmed and the route shown on Project area maps[3]
Site Layout	
Site layout generalized including size and capacity of on-site waste management facilities[4]	Specific engineering preliminary design is provided in the EA Project Description, with details on timing, construction, amount of wastes, type of wastes, geotechnical information, and environmental protection measures[5]
Waste Rock Classification	

November 2012 Project Description	EA Project Description
Waste rock was classified as: • PAG 1 & 2 • NAG 3 • NAG 4	An additional classification is added for NAG rock that is low metal leaching, NAG5[6] • PAG 1 & 2 • NAG3 • NAG4 • NAG5

Note:
[1] A memorandum detailing options and choice rationale was issued to Ministry of Environment, attached as **Appendix 2.2B**, together with subsequent discussion addressing Ministry of Forests, Lands and Natural Resource Operations recommendations to look at variations to Options tabled by the Proponent.
[2] Refer to **Figure 2.2.3-88**.
[3] Refer to, e.g., **Figure 2.2.1-1**.
[4] **Figure 4.4-1** from the 2012 Project description shows a general layout (attached below as **Figure 2.2.2-1**). This can be compared with **Figure 2.2.2-2**.
[5] **Figure 2.2.3-47** shows the mine general arrangement at Year 10.
[6] A summary discussion is provided in **Section 2.2.3.4.3**; a full description of rock types together with supporting data are provided in the geochemistry **Appendix 5.1.3.1A**.



Legend

- UPLAND BEACH
- UPLAND SLOPE
- BOG / WETLAND AREA
- EMERGENT VEGETATION WETLAND
- POND
- ROCK SLOPES
- MINE ACCESS ROAD
- DIVERSION CHANNEL
- SEEPAGE COLLECTION TRENCH
- SPILLWAY

Source
Knight Piésold Engineering and Environmental Services
http://www.knightpiesold.com/en/

CLIENT: newgold™

PROJECT: Blackwater Gold Project

November 2012 General Arrangement Closure Plan

DATE: May, 2014	ANALYST: KP	**Figure** 2.2.2-1
JOB No: VE52420	QA/QC: WR	PDF FILE: PostClosurePlanNov2012.pdf
AI FILE: PostClosurePlanNov2012.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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372000 376000 380000 384000 388000

5908000 5904000 5900000 5896000 5892000

Proposed Transmission Line
Mills Ranch Reroute
Proposed
Transmission Line
Turtle Creek
Davidson Creek
Tatelkuz
Lake
Proposed Mine
Access Road
Proposed Fresh
Water Pipeline
Kluskus-Ootsa FSR
Freshwater
Pumpstation
Sand and Gravel
Screening Plant
Seepage
Collection Trench
Esker Borrow
Source
Snake
Lake
Topsoil
Diversion Ditches
Freshwater
Reservoir
Environmental
Control Dam (ECD)
Site C Main Dam
Borrow Source
Pond
Topsoil
Stockpile
Emergent
Vegetation Wetland
Upland
Beach
Bog/Wetland Area
Pond
Construction Camp
Lake
01428UEUT
Truck Shop
Plant Site
Site C West Dam
Construction
Laydown 1
Operation Camp
Diversion Ditches
Low-Grade
Stockpile
East Waste
Rock Dump
Lake
01538UEUT
Lake
01682LNRS
West Waste
Rock Dump
Explosive Facilities
Open Pit
Chedakuz Creek
Kuyakuz
Lake

N

Legend

- Kluskus-Ootsa FSR
- Exploration Road
- Existing Road
- Contour (20 m)

Project Components

- Proposed Mine Access Road
- Proposed Transmission Line
- Mills Ranch Reroute
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Construction Haul Road
- Mine Haul Road
- Flow Direction
- Seepage Collection Trench
- Spillway
- Tailings Pipeline
- Water Reclaim Pipeline
- Proposed Airstrip Extent
- Proposed Mine Footprint
- Proposed Mine Site
- Bog / Wetland Area
- Borrow Source
- Construction Site
- Embankment fill
- Emergent Vegetation Wetland
- Esker Borrow Source
- Fresh Water Reservoir
- Low-Grade Stockpile
- NAG Waste Rock / Overburden
- Open Pit
- Pond
- Reclaim System
- Pumpstation
- Tailings Beach
- Top Soil
- Upland Beach

Scale:1:70,000

0 0.5 1 2 3

Kilometres

Reference

BC Government GeoBC Data Distribution
Knight Piésold Consulting Engineers

CLIENT: newgold

PROJECT: Blackwater Gold Project

Proposed Mine Site Facilities and Access Road Year 17

DATE:	ANALYST:	**Figure 2.2.2-2**
April, 2014	WR	
JOB No: VE52095	QA/QC: AP	PDF FILE: Other-100-115_SiteFacilities_year17_v3_minsite.pdf
GIS FILE: Other-100-115_SiteFacilities_year17_v3.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095 Richfield Blackwater\Mapping\Other\Other-100-115 SiteFacilities_year17_v3.mxd

2.2.3 On-Site Components and Infrastructure

Table 2.2.3-1 presents a summary of the main on-site Project components and facilities, with approximate dimensions and capacities. These components and facilities are described in greater detail in the subsequent sections.

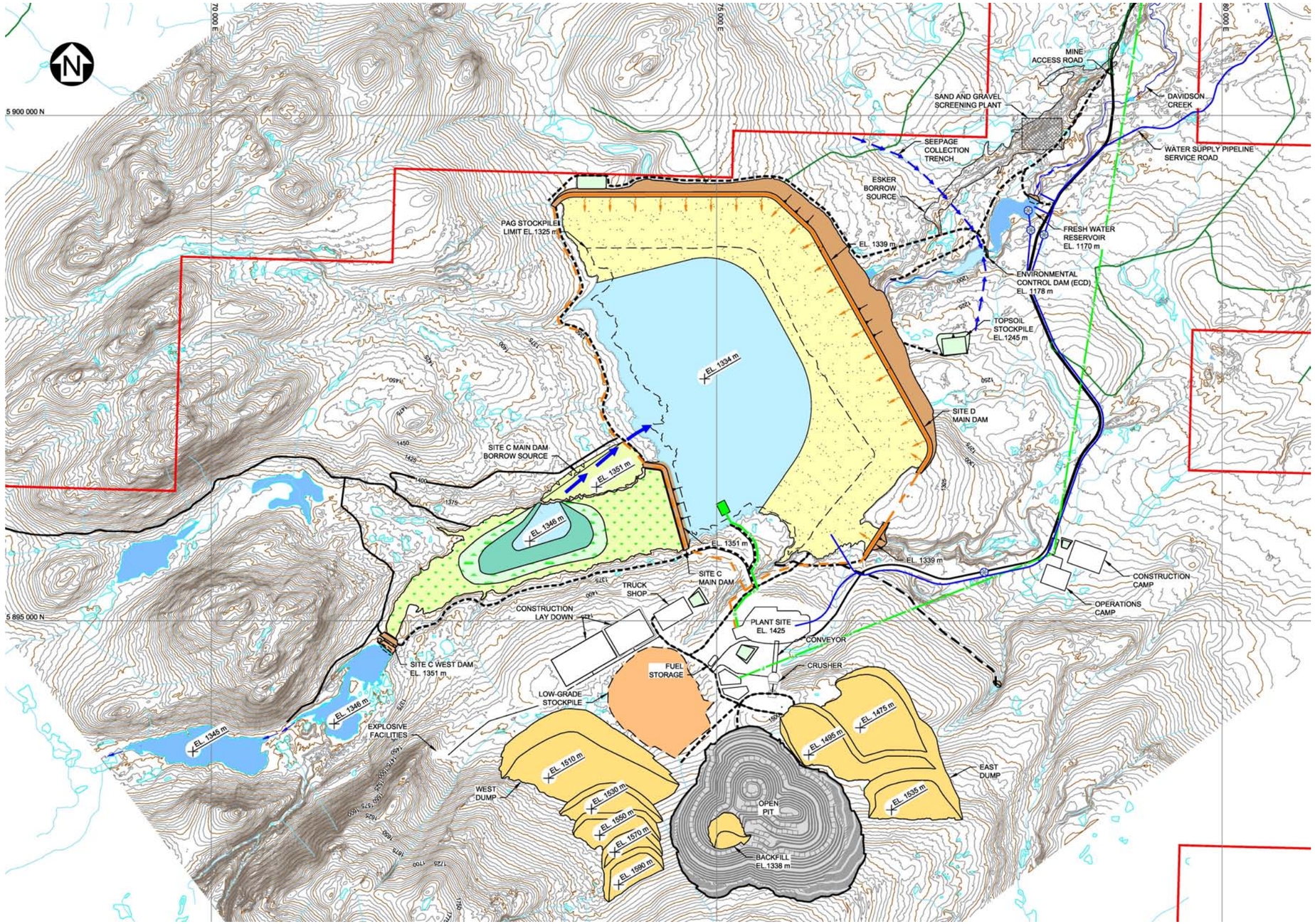
Figure 2.2.3-1 shows the location of these facilities.

Table 2.2.3-1: Project Components and Facilities – Approximate Dimensions and Capacity

Project Component or Facility	Dimensions and/or Capacity
On Site	
Mine Site	Occupies approximately 4,400 ha, and accommodates all mine, ore processing, mine waste, water supply and management, and on-site infrastructure
Open Pit	Footprint of approximately 238 ha with approximate dimensions 2 km from east to west and 1.5 km from north to south, with an anticipated depth of 550 m below ground surface
West Waste Rock Dump	Footprint of approximately 172 ha to store 87 Mt of NAG 4, NAG 5 and OVB, with an elevation of 1,535 masl (160 m high)
East Waste Rock Dump	Footprint of approximately 158 ha to store 50 Mt of Type 5 NAG and OVB, with an elevation of 1,590 masl (105 m high)
Low-Grade Ore Stockpile	Footprint of approximately 76 ha to store 50 Mt of LGO
Construction Laydown	Occupies approximately 31 ha
Construction Camp	Occupies approximately 8 ha with the capacity to accommodate 1,000 to 1,500 personnel during construction phase
Truck Shop	Occupies approximately 6 ha
TSF(1)	Footprint of approximately 1,117 ha comprising Site C, which occupies 192 ha, and Site D, which occupies 925 ha. The maximum elevation of the main dam for Site D is 1,339 masl (149 m high) The TSF is designed to store a total of 784 Mt of both tailings and PAG waste rock
Process Plant Site	Occupies approximately 35 ha, with industrial buildings to process 60,000 t/d (22 Mt/y) of ore, to produce 7.07 Moz Au and 30 Moz Ag; this surface includes the crusher and the conveyor. The process plant site is located at an elevation of 1,425 masl The process plant site will have an area for storage of hazardous materials (e.g., CN), and it will also include the core logging area
Operations Camp	Occupies approximately 5 ha, with buildings to accommodate up to 500 personnel during the operations phase
Topsoil Stockpile	Footprint of approximately 10 ha, distributed in two locations within the mine site
Borrow Areas	73 ha comprising 30 ha for the Site C main dam and 43 ha for the Site D main dam; the borrow areas also include a sand and screening plant

Project Component or Facility	Dimensions and/or Capacity
Sand and Gravel Screening Plant and Cement Batch Plant	Nominal 8 ha downstream from Dam D site in esker borrow source area.
Off Site	
Transmission Line	The main route ROW occupies approximately 561 ha—140 km long, 230 kV line over a ROW 40 m wide for standard spans, 50 m for long spans, 30 m within private parcels. The Mills ranch re-route (also referred to as the Tatelkuz Lake Ranch re-route) ROW occupies approximately 61 ha - 15.3 km long and 40 m wide. The main route with the Mills ranch re-route ROW occupies approximately 563 ha – 141 km long and 40 m width along the re-route. The Stellako re-route ROW occupies approximately 32 ha – 8.0 km long and 40 m wide. The main route with the Stellako re-route ROW occupies approximately 563 ha - 141 km long and 40 m width along the re-route. The main route ROW with both re-routes occupies approximately 565 ha—141 km long, 230 kV line over a ROW 40 m wide for standard spans, 50 m for long spans, 30 m within private parcels.
Transmission Line Access Roads	Permanent: 92.43 km; 185 ha. Existing requiring upgrades: 41.60 km; 83 ha. ROW 20 m
Mine Access Road	Starting at km 124.5 of the Kluskus–Ootsa FSR, and occupies approximately 28 ha—15 km long over a ROW 20 m wide Final location to be determined.
Kluskus-Ootsa FSR Realignment	The length for the re-alignment section of the Kluskus-Ootsa FSR is approximately 1.5 km and 20 m wide.
Freshwater Supply System	Freshwater requirements will be met by pumping water from Tatelkuz Lake, via a 20-km long pipeline (**Figure 2.2.2-1**) to a water reservoir downstream of TSF dam D. The ROW for the proposed pipeline is 10 m wide, and has an area of 21.1 ha. This water will be used for ore processing and flow maintenance in Davidson Creek. The pipeline will be placed adjacent to a road approximately 5 m to 10 m wide, depending on local ground conditions. The pumping station will be located on the shores of Tatelkuz Lake, and during construction a laydown area will be required to support the construction activities. It is anticipated that the area required for the pumping station will be approximately 100 m x 100 m.
Airstrip	An approximately 1.7 km long and 100 m width wide airstrip will be built near the mine site, with location selected in consideration of existing land use, access, and environmental conditions. The airstrip ROW area is approximately 15.5 ha. An access road to the airstrip is also proposed. The airstrip access road ROW is approximately 5.7 km length and 10 m width, with an area of 5.5 ha.
Helipad	Nominal 10 m square in an otherwise cleared area; will be located in previously disturbed area, final location to be determined.

Note: CN = cyanide; FSR = Forest Service Road; ha = hectare; km = kilometre; kV = kilovolt; LGO = low-grade ore; m = metre; masl = metres above sea level; Moz = million ounces; Mt = million tonnes; Mt/y = million tonnes per year; NAG = non-acid-generating; OVB = overburden; PAG = potentially acid-generating; ROW = right-of-way; t/d = tonnes per day



Legend

- UPLAND BEACH
- BOG / WETLAND AREA
- EMERGENT VEGETATION WETLAND
- UPLAND SLOPE
- TAILINGS BEACH
- POND
- EMBANKMENT FILL
- PAG WASTE ROCK
- NAG WASTE ROCK / OVERBURDEN
- LOW-GRADE ORE
- TOPSOIL
- RECLAIM SYSTEM
- WATER SUPPLY PUMPSTATION
- CONSTRUCTION HAUL ROAD
- MINE HAUL ROAD
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- FRESH WATER FLOW DIRECTION
- WATER RECLAIM PIPELINE
- NEW GOLD PROPERTY BOUNDARY
- TRANSMISSION LINE
- SPILLWAY
- SEEPAGE COLLECTION TRENCH
- TAILINGS PIPELINE
- TAILINGS DEPOSITION

Source
Knight Piésold Engineering and Environmental Services
http://www.knightpiesold.com/en/

CLIENT: newgold™

PROJECT: Blackwater Gold Project

Overall Site Layout of Open Pit and Waste Facilities

DATE: May, 2014	ANALYST: KP	**Figure** 2.2.3-1
JOB No: VE52420	QA/QC: WR	PDF FILE: End of Year 17 Plan.pdf
AI FILE: End of Year 17 Plan.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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Given the large size and the disseminated nature of mineralization within the Project footprint, open pit mining is the only feasible option for economic extraction of the ore. The current reserve estimate indicates combined Proven and Probable total reserves of 8.17 Moz of Au and 60.8 Moz of Ag at a 0.3 g/t gold equivalent cut-off grade (New Gold, 2014).

Ore would be processed in a mill to be constructed north of the open pit. Tailings from the mill will be treated by a SO_2/air treatment plant to destroy cyanide and precipitate heavy metals prior to disposal in the TSF. CN management and treatment will follow ICMC for the Manufacture, Transport, and Use of Cyanide in the Production of Gold (ICMI, 2012).

Geochemical characterization of the waste rock has been conducted and it is proposed that PAG (PAG1 and PAG2) waste rock and high solid phase zinc (Zn) concentration NAG (NAG3) waste rock be disposed under water in the TSF or in the open pit. NAG waste rock with solid phase Zn concentrations less than 1000 parts per million (ppm) (NAG4 and NAG5) would be deposited on land, covered with overburden, and re-vegetated at closure; NAG5 waste rock will also be used for constructiuon.

Project alternatives are discussed in **Section 2.5**. Key in selection of the preferred alternatives were that the TSF avoids the Blackwater River drainage to the south, whitebark pine (listed on schedule 1 of SARA) to the south, and the UWR to the west. Designing the project to maintain flows in Davidson Creek addressed a key issue of Aboriginals that aquatic resources should not be seriously affected by the Project. A key design philosophy was also to avoid the Blackwater River that has cultural significance to Aboriginal groups and is a heritage river.

2.2.3.1 Geology and Mineral Resources

2.2.3.1.1 Property and Mineral Tenure

2.2.3.1.1.1 Mineral Tenure and Tenure History

Granges Inc., beginning in 1973, initially explored the Project area near the Blackwater claim block. In 2005, Silver Quest acquired an interest in the Project, and in 2009 Richfield became involved through a joint venture.

In 2011, the Proponent acquired Richfield, Silver Quest, and a third company, Geo Minerals Limited, to consolidate the Project ground holdings.

Table 2.2.3-2 summarizes the previous exploration activities.

Table 2.2.3-2: Blackwater Exploration History

Year	Operator	Work Completed
1973	Granges	Regional silt survey located anomalous Ag, Zn, and Pb in the Mount Davidson area. This was followed by a wide-spaced soil survey northeast of Mount Davidson
1976	Granges	Soil sample and ground magnetometer surveys to follow up 1973 soil results
1977	Granges	Pem claim staked covering most of the presently defined mineral deposit. Pulse EM survey on the Pem claim (12.5 km)
1979	Granges	Vector Pulse EM survey on the Pem claim (7 km)
1981	Granges	Helicopter EM and magnetometer survey
1981	Granges	Horizontal Loop EM survey on the Deb #1 claim
1981	Granges	Reconnaissance mapping of the Mount Davidson area
1982	Granges	Soil geochemistry (220 samples) and ground magnetometer survey (20.8 line km) on the Pem claim
1983	Granges	Hammer seismic survey
1984	Granges	Hand-trenching (30 trenches for a total of 66 m) and VLF survey (4.8 line km) on the Pem claim; only 1 trench intersected bedrock
1985	Granges	Winkie drilling on the Pem claim (8 holes for a total of 507 m; Holes DAV 1-8)
1986	Granges	Construction of access road from KM 146.5 on the Kluskus-Ootsa FSR, east 18 km to the Pem grid
1986	Granges	Percussion drilling on the Pem claim (34 holes for a total of 1,524 m; RC 1-34)
1987	Granges	Diamond drilling on the Pem claim (22 holes for a total of 2,725 m; Holes DAV 9-31)
1992	Granges	Line cutting (58.8 km); collection of 955 soil samples and 35 stream silt samples; geological mapping over 6,000 ha at a scale of 1:10,000; 50 km of geophysical surveys (IP, Mag, VLF); Diamond drilling (5 holes for a total of 785 m; Holes BD92-32 to BD92-36)
1994	Granges	Line cutting (48.2 km); collection of 29 rock samples, 1,598 soils samples, 23 silt samples, and 4 lake sediments; Dighem airborne geophysical survey (881 line km of EM, Mag, and radiometrics); 20-km IP survey over the Dave claim; Diamond drilling (5 holes for a total of 759 m; Holes DAV 94-37 to DAV 94-41)
1997	Kennecott Canada	4 km of line cutting and an Induced Polarization survey on the Dave claim
2005	Silver Quest	Diamond drilling (5 holes for a total of 939 m; Holes DAV05-01 to DAV05-05)
2006	Silver Quest	Diamond drilling (2 holes for a total of 394 m; Holes DAV06-06 and DAV06-07)
2007	Silver Quest	Soil sampling program, 335 samples
2009	Richfield	Diamond drilling (18 holes for a total of 3,621 m; Holes BW0042 to BW0059)
2010	Richfield	Diamond drilling (57 holes for a total of 21,336 m; Holes BW0060 to BW0116)
2011	Richfield	Diamond drilling (59 holes for a total of 19,727 m; Holes BW0117 to BW0175)
2011	New Gold	Diamond drilling (125 holes for a total of 49,316 m; Holes BW0176 to BW0295, 297, 298 (+50R)); additional metallurgical test holes (7 holes for a total of 2,282 m)
2012	New Gold	Diamond drilling (716 holes for a total of 207,333 m; Holes BW0296 and BW0299 to BW1013); in addition: geotechnical (13 holes for a total of 5,003 m); metallurgical test (20 holes for a total of 1,816 m); waste rock characterization (14 holes for a total of 2,952 m); and hydrological monitoring (7 pilot holes for a total of 2,265 m)
2013	New Gold	Diamond drilling (1 hole for a total of 420 m; Hole BW1014); Additional hydrological monitoring (3 pilot holes for a total of 1,146 m)

Note: EM = electromagnetic; km = kilometre; m = metre; IP = induced polarization; VLF = very low frequency

2.2.3.1.1.2 Mineral Claims

The Proponent holds mineral tenures or has agreements in place for land that would be used for the mine (New Gold, 2012). The Proponent's mineral tenures in the region comprise a total area of 104,615 ha. The Proponent holds all mineral tenures intersected by the proposed mine site footprint.

The Project claim block comprises 71 mineral claims totalling 27,503 ha (**Figure 2.2.3-2**), all 100% owned by the Proponent. The currently defined Blackwater deposit spans one of the Davidson claims (509273, but not 509274 and 509275), the Dave claim (515809), and the Jarrit claim (515810).

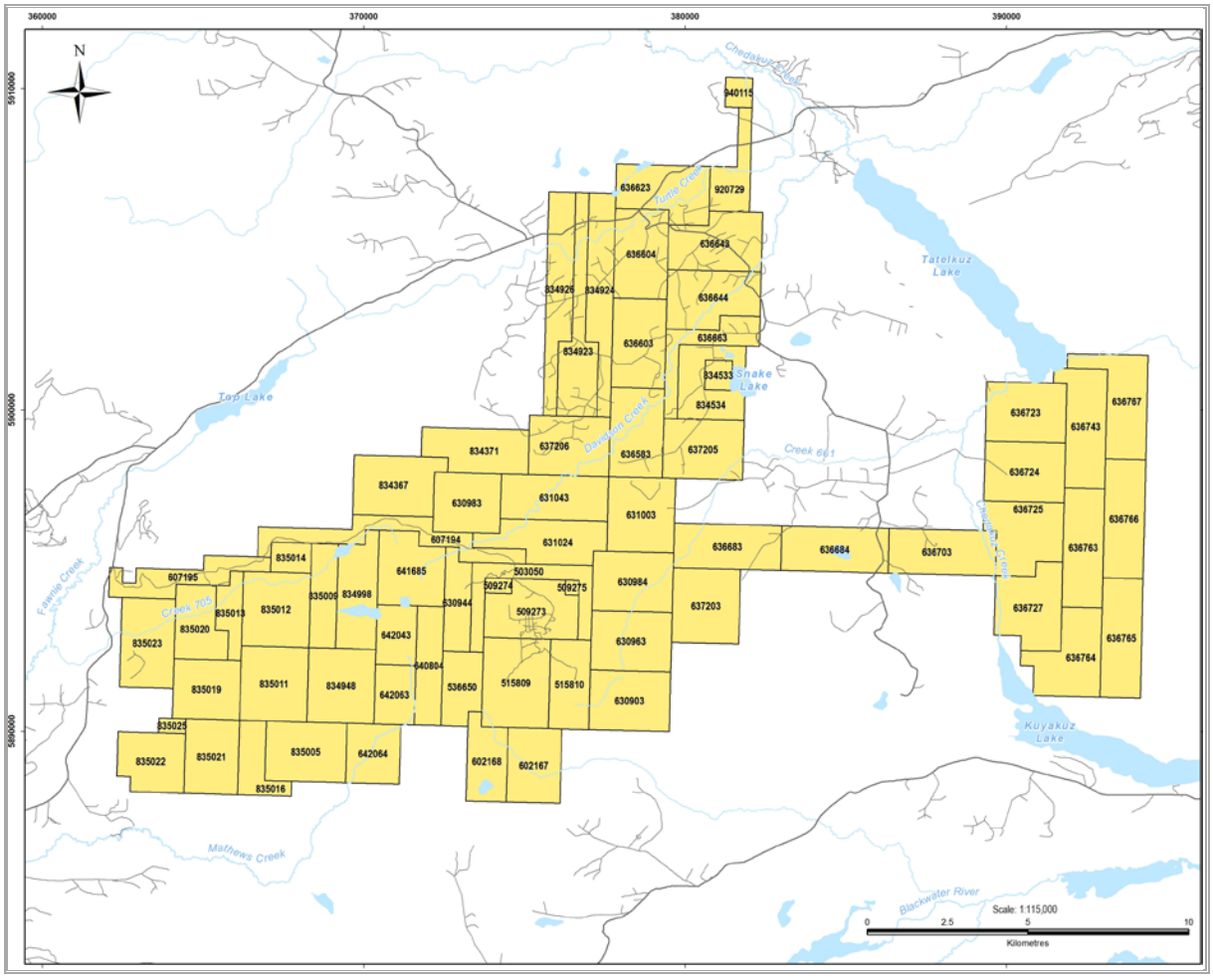


Figure 2.2.3-2: Project Mineral Claims

All Blackwater claims have been moved to a common expiry date of 2022.

All claims in the Blackwater claim block are cell claims. There are predecessor claims for Blackwater claims 515809 and 515810, and historical encumbrances associated with one of the predecessors, and Blackwater claim 636683. None of the Blackwater claims appears to overlap any legacy claims, or areas of any Crown-granted mineral claims.

The Blackwater tenures and claims are presented in **Appendix 2.2A-1**.

2.2.3.1.2 Ownership of the Project

2.2.3.1.2.1 Surface Rights

A review of certain surface rights near the Project was undertaken in November 2013. No prior rights were found that would prevent development of the Project.

2.2.3.1.2.2 Nature and Extent of Title and Royalties

Royalties on the Project claims are summarized below.

2.2.3.1.2.2.1 Dave Option

The Proponent, through Richfield, acquired a 100% interest in mineral claim 515809 (Dave Option), obtained in 2010 from five individuals. The optionors retained a 2.5% Net Smelter Return (NSR). The Proponent has purchased 40% of the Dave NSR royalty for $1,000,000, and a 1.5% NSR royalty remains. The claim covers part of the Blackwater deposit.

2.2.3.1.2.2.2 Jarrit Option

The Proponent, through Richfield, acquired a 100% interest in mineral claim 515810 (Jarrit Option) secured in 2010 from four individuals. The optionors retained a 2% NSR royalty. The Proponent has purchased half of the Jarrit NSR royalty for $1,200,000, and a 1% NSR royalty remains. The claim covers part of the Blackwater deposit.

2.2.3.1.2.2.3 JR Option

In January 2011, Richfield acquired an option to earn a 100% interest in JR claims 637203, 637205, and 637206, from the same optionors as the Jarrit Option. The optionors retained a 3% NSR royalty. Terms of the agreement transferred to the Proponent upon its acquisition of Richfield. The Proponent exercised the option to acquire a 100% interest in the JR claims in January 2013. The Proponent may purchase two-thirds of the JR claims NSR royalty for $1,000,000 at any time, such that a 1% NSR royalty would remain.

2.2.3.1.3 Regional Geology

The Project is located on the Nechako Plateau near the geographic centre of BC. The plateau is part of the Intermontane Belt superterrane situated between the Coast Belt to the west and the Omineca Belt to the east (**Figure 2.2.3-3**). Topographic relief for the plateau is moderate with elevations ranging from 1,000 metres above sea level (masl) to 1,800 masl. The Intermontane Belt consists of an assemblage of three accreted tectonostratigraphic terranes: Stikine, Cache Creek,

and Quesnel (Riddell, 2011). The Project site is underlain by rocks of the Stikine terrane, comprising an assemblage of magmatic arc and related sedimentary rocks that span Jurassic to early Tertiary times. These rocks have been exposed within an easterly trending structural high termed the Nechako uplift.

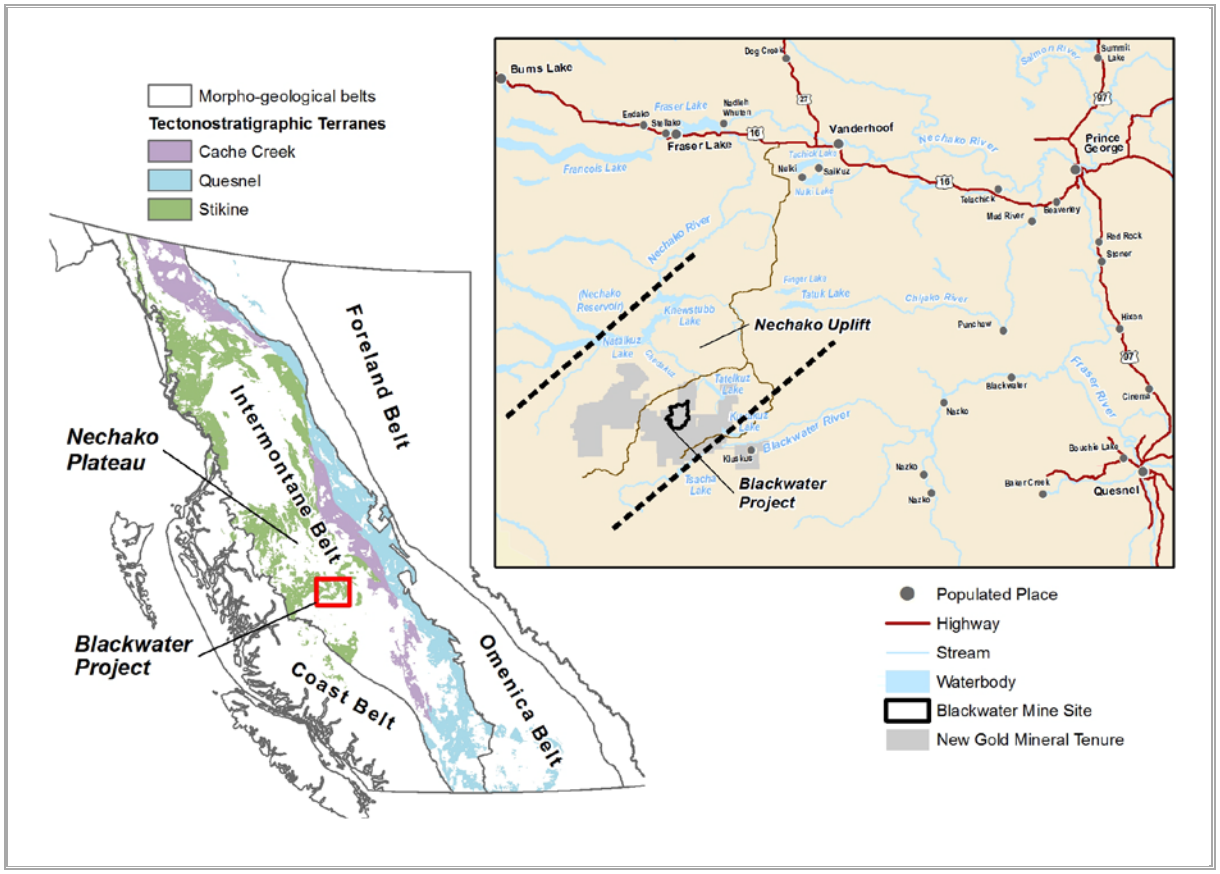


Figure 2.2.3-3: Blackwater Project Location and Tectono-Stratigraphic Setting

The Nechako uplift is bounded to the north and south by the northeast striking Natalkuz and Blackwater faults, respectively (Diakow and Levson, 1997; Diakow et al., 1997). The latest extensional displacement along these faults juxtaposes older Mesozoic and Tertiary rocks in the central part of the uplift against younger Cretaceous and Tertiary volcanic rocks to the north and south (Diakow et al., 1994; Diakow and Levson, 1997; Friedman et al., 2001). Although the Natalkuz and Blackwater faults are poorly defined due to scarce bedrock exposures—a feature characteristic of the Nechako Plateau in general—strong linear trends marking the traces of these structures are evident in the available gravity and airborne magnetics data for the region. The eastern and western limits of the uplift are not clearly defined by current geologic mapping coverage. The northwesterly trending Chedakuz fault and adjacent Nechako range transect the uplift, and mark the eastern limit of the Project area. To the west, the Nechako uplift extends into a provincial park well beyond the area currently being explored by the Proponent.

2.2.3.1.4 Local and Deposit Geology

Quaternary glacial overburden, colluvial, and fluvial deposits mask approximately 95% of the bedrock within the Project site. Outcrop is sparse and limited to peaks, ridges, and stream gullies draining off the flanks of Mount Davidson. Geology is therefore based largely on observations from geologic field mapping and exploration drilling conducted between 2009 and 2013. **Figure 2.2.3-4** is a sketch map of the top-of-bedrock geology for the Project site. The red dashed line shown in **Figure 2.2.3-4** delineates the outer limits of the pyrite probability shell generated for the mineral resource estimate discussed in **Section 2.2.3.1.11**.

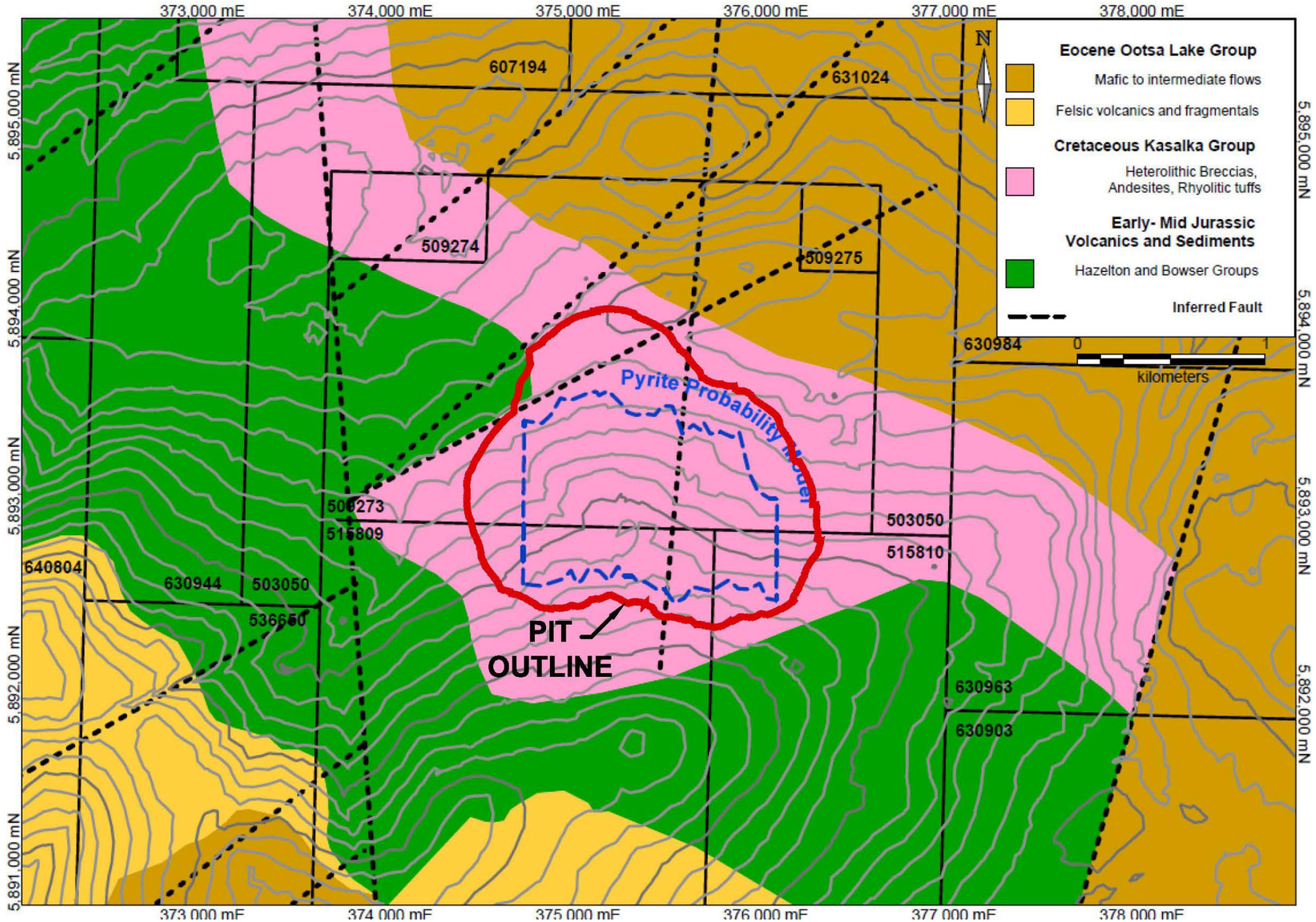
The Project site is underlain by a sequence of volcanic units consisting of heterolithic breccias, rhyolitic tuff, and andesite. The local volcanic section is further subdivided as follows: a lower sequence of andesite, felsic volcaniclastic rock, heterolithic breccias, and tuff, which host the Blackwater deposit, and an upper sequence of post-mineral Eocene age felsic volcanic and fragmental rocks and mafic to intermediate flows belonging to the Ootsa Lake Group. The felsic volcaniclastic rocks and tuff of the lower sequence are late Cretaceous in age based on U-Pb geochronologic dating of zircons, which yielded ages ranging from 72.4 + 1.0 million years (Ma) and 74.1 + 2.2 Ma (Mortensen, 2011). The adjacent andesites have been interpreted as conformably underlying the felsic volcaniclastic rocks, and thus belong to the late Cretaceous Kasalka Group. Additional work is required to constrain fully the age of the andesite in the lower volcanic sequence.

2.2.3.1.5 Mineralization

Core drilling has defined a zone of continuous gold mineralization that extends at least 1,300 m along its longest dimension east-west and at least 950 m north-south. The vertical thickness of the zone ranges up to 600 m, remaining open at depth in a few locations.

In general, all rocks at the Project site are mineralized, with trace pyrite-pyrrhotite-sphalerite in outboard andesite flows and volcaniclastics, or as gold-bearing polymetallic sulphide mineralization within the fragmental felsic unit of the deposit. The only exceptions are Eocene dacite porphyry dykes intersected along the southern and northwestern part of the drilling grid, and amygdaloid mafic intermediate flows in the northern part of the grid, possibly related to the Eocene Ootsa Group.

Mineralized rocks within the main resource area can be broadly divided into a thick succession of felsic to intermediate pyroclastic and volcaniclastic rocks, volcanic flows and breccias, and related volcanic and lithic-derived sedimentary units (fine to coarse epiclastic rocks). Whole-rock analysis indicates that these units range from rhyolite to dacite to andesite in composition. Detailed age relationships between the mineralized host rocks are not entirely understood, but the vertical succession and locally observed progressive interbedding of these units suggest the andesite to be oldest, followed by the felsic tuffs, and subsequently the felsic volcaniclastic rocks.



Source
Knight Piésold Engineering and Environmental Services
http://www.knightpiesold.com/en/

CLIENT: newgold™

PROJECT: Blackwater Gold Project

Top of Bedrock Geology Near the Blackwater Deposit

DATE: May, 2014	ANALYST: KP	**Figure** 2.2.3-4
JOB No: VE52420	QA/QC: WR	PDF FILE: BedrockGeolBWdeposit.pdf
AI FILE: BedrockGeolBWdeposit.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Ridgfield_Blackwater\Mapping\Other\ProjectDescription\KP\BedrockGeolBWdeposit.mxd

Disseminated gold-silver mineralization is defined by an east-west-trending tabular-conical-shaped deposit with a lateral extent of up to 1,300 m east-west x 950 m north-south. Mineralization remains open at depth in the southwestern part of the deposit as well as to the north and northwest. The centre of the deposit has an average thickness of 350 m and, where open, a vertical extension of up to 600 m. The mineralized zone plunges shallowly to the north and northwest, with inferred steep, north-plunging, higher-grade mineralized shoots measuring tens of metres thick, likely influenced by near-vertical structural intersections.

Gold-silver mineralization is associated with a variable assemblage of pyrite-sphalerite-marcasite-pyrrhotite ± chalcopyrite ± galena ± arsenopyrite (± stibnite ± tetrahedrite ± bismuthite).

Sulphide mineralization can be divided into the following types:

- Disseminated – as pinhead to coarse blebby sulphide grains and aggregates typically ranging from 1% to 5% total volume of the rock but locally exceeding this volume. Disseminations may be uniform or irregular, with sulphides displaying an anhedral-to-euhedral crystal form.
  Disseminations of a dark-grey, very fine-grained sulphide material called dendritic black sulphide (DBS) is common, and may form as fine disseminations to coarse clusters, as thicker coatings to fractures, or as an irregular network of dendritic microcracks within the rock mass;
- Porosity infill – sulphides that fill, rim, or replace devitrified pyroclasts, tephra, and juvenile pumiceous material. Sulphides also commonly form parallel to compositional layering and laminations within felsic pyroclastic flows and laminated tuff units. Mineralized amygdules and altered feldspars are also observed in the andesite flow units;
- Vein – polymetallic, anhedral to euhedral sulphide assemblages in sub-millimetre to centimetre-scale polymetallic veinlets-veins of quartz-sericite-chlorite-clay (illite) ± (iron) carbonate ± tourmaline ± vivianite;
- Hydrothermal brecciation and related silicification – centimetre- to metre-scale zones of hydrothermal brecciation, alteration, and elevated sulphide content. These breccia zones are typically healed with silica-sericite-sulphide cement and cut by a micro-stockwork of vitric quartz ± sulphide veinlets; and
- Structure-related (possibly late) – sulphides crushed to comminuted in brittle fault breccia and gouge.
  Hydrothermal alteration (and possibly contact metamorphism) has produced several superimposed alteration assemblages, including pervasive silica-sericite-clay (illite) ± biotite alteration and veinlet/fracture-controlled silica-sericite-chlorite-clay ± iron carbonate ± tourmaline. Possible early biotite-silica-albite ± chlorite/actinolite hornfelsing event may have been significant, although mineralization in these rocks appears to be lower than in units without evident hornfelsing. Visible native gold has been noted in some drill holes.

Secondary quartz occurs in several modes:

- Pervasive, amorphous to translucent silicification with associated illite ± sericite. Commonly holes display intense silicification of felsic units, epiclastics, and more intermediate volcaniclastic rocks with biotite alteration of the matrix (hornfels);
- Cryptocrystalline silica replacements in felsic ash-tuff layering;
- Silica cement/matrix to local hydrothermal brecciation; and
- Sub-millimetre vitric quartz veinlets in zones of intense silicification; commonly as a micro-stockwork.

Given the lack of outcrop, geological interpretation is based primarily on drill information plotted on section and plan views.

The Project geological model is based on three principal components: lithology and structure, alteration, and mineralization. The lithologic and structural component includes andesite, volcanic fragmentals, and laminated volcanics. Au and Ag mineralization is hosted predominantly within a central core of felsic tuffs and volcaniclastic breccias that are enveloped by a sequence of massive and more cohesive andesitic flows and tuffs. The deposit is roughly rhombohedral in plan, bounded by near-vertical northwest- and northeast-trending faults. The fragmental package is funnel-shaped and elongated WNW-ESE, and open to the southwest at depth. The alteration component indicates the presence of two centres of texture-destructive sericitic alteration cored by an ammonium-bearing overprint, and haloed by early potassic alteration and hornfelsed andesite. The mineralization component has been built through a combined “Pyrite + DBS” simulation, which identified the pyritic mineralization domain, and independently confirmed the presence of key faults seen in the lithologic and structural model.

2.2.3.1.6 Deposit Type

The Blackwater deposit is an example of a volcanic-hosted, epithermal-style Au-Ag deposit.

Pervasive stockwork veined and disseminated sulphide mineralization is hosted within felsic- to intermediate-composition volcanic rocks that have undergone extensive silicification and hydrofracturing.

The geological setting, style of Au-Ag mineralization, and associated alteration assemblage for the Blackwater deposit share the characteristics of both low- and intermediate-sulphidation epithermal deposit types, according to the classification system of Sillitoe and Hedenquist (2003). Au-Ag mineralization is associated with a variable assemblage of pyrite-sphalerite-marcasite-pyrrhotite ± chalcopyrite ± galena ± arsenopyrite (± stibnite ± tetrahedrite ± bismuthite). Sulphide and gangue mineralogy is reasonably characteristic of an intermediate sulphidation regime (Sillitoe and Hedenquist, 2003). However, the massive fine-grained silicification present at the Project site is more typical of high-sulphidation deposits and minor carbonate gangue of a low-sulphidation environment.

Figure 2.2.3-5 is a typical section showing the main features of calc-alkaline volcanic arc setting and associated epithermal and related mineralization.

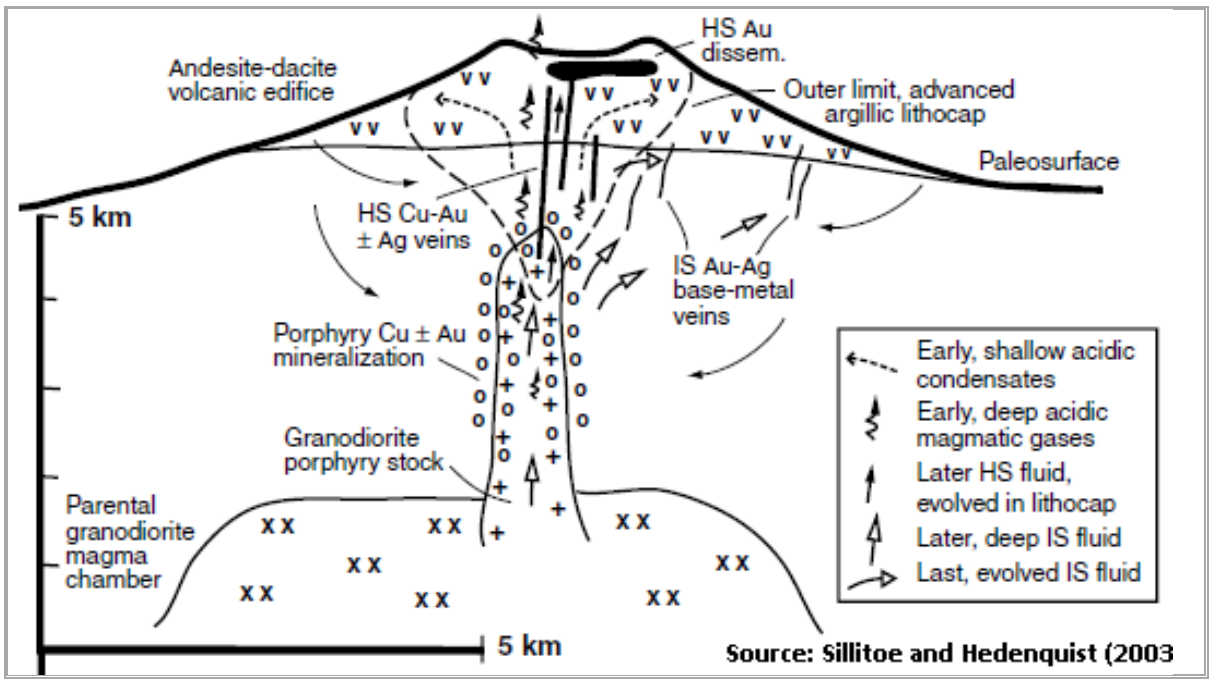


Figure 2.2.3-5: Schematic Section of Calc-Alkaline Volcanic Arc Setting and Associated Epithermal and Related Mineralization

Figure 2.2.3-6 illustrates the hypothesized relationship of the mineralized volcanic rocks to surrounding strata.

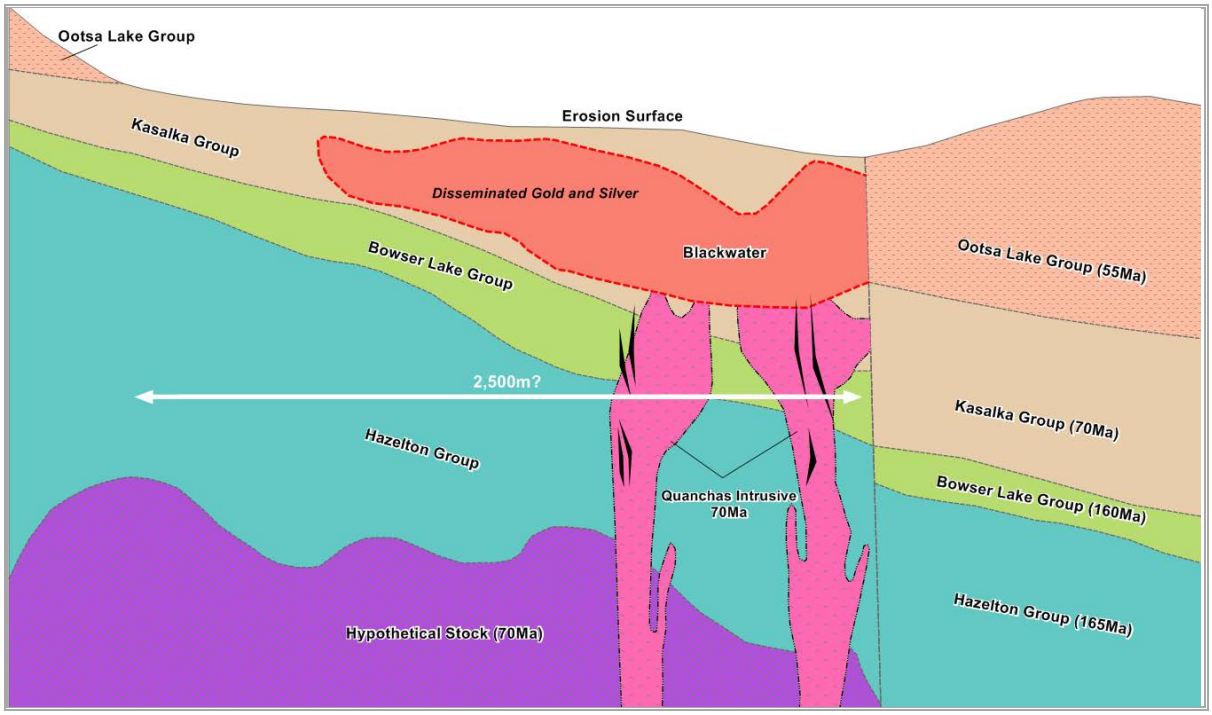


Figure 2.2.3-6: Cross-Section of Conceptual Model

Table 2.2.3-3 is a summary of key features of the deposit styles at the Project site.

2.2.3.1.7 Overburden

Overburden thickness typically ranges from 5 m to 10 m, but increases to 50 m to 110 m east of the deposit.

2.2.3.1.8 Exploration

2.2.3.1.8.1 Geological Mapping and Sampling

Given the lack of bedrock exposures in the immediate Blackwater deposit area, geologic information has been obtained primarily by exploration drilling. In 1992, Granges carried out 1:10,000 scale geologic mapping to the north of the deposit, and in an earlier 1984 program excavated a total of 30 hand trenches. However, only one—in the northwestern part of the resource area—reached bedrock, and returned an anomalous silver grade from a grab sample. More recently, the Proponent's mapping of pits and road-cut exposures over the deposit has confirmed the geologic interpretation of the deposit in the subsurface.

Table 2.2.3-3: Epithermal Gold Deposit Types as Defined by Sillitoe and Hedenquist

	High Sulphidation		Intermediate Sulphidation	Low Sulphidation	
	Oxidized Magma	**Reduced Magma[1]**		**Subalkaline Magma**	**Alkaline Magma**
Type example	El Indio, Chile (vein)	Potosi, Bolivia	Baguio, Philippines (Au-rich); Fresnillo, Mexico (Ag-rich)	Midas, Nevada	Emperor, Fiji
	Yanacocha, Peru (disseminated)				
Genetically related volcanic rocks	Mainly andesite to rhyodacite	Rhyodacite	Principally andesite to rhyodacite but locally rhyolite	Basalt to rhyolite	Alkali basalt to trachyte
Key proximal alteration minerals	Quartz-alunite/APS; quartz-pyrophyllite/dickite at depth	Quartz-alunite/APS; quartz-dickite at depth	Sericite; adulatria generally uncommon	Illite/smectite-adularia	Roscoellite-illite-adularia
Silica gangue	Massive fine-grained silicification and vuggy residual quartz		Vein-filling cruciform and comb quartz	Vein-filling cruciform and colloform chalcedony and quartz; carbonate-replacement texture	Vein-filling cruciform and colloform chalcedony and quartz; quartz deficiency common in early stages
Carbonate gangue	Absent		Common, typically including maganiferous varieties	Present but typically minor and late	Abundant but not manganiferous
Other gangue	Barite common, typically late		Barite and manganiferous silicates present locally	Barite uncommon; fluorite present locally	Barite, celestite, and/or fluorite common locally
Sulphide abundance	10 to 90 vol %		5 to >20 vol %	Typically <1 to 2 vol % (but up to 20 vol % where hosted by basalt)	2 to 10 vol %
Key sulphide species	Enargite, luzonite, famtinite, covellite	Acanthite, stibnite	Sphalerite, galena, tetrahedrite-tennantite, chalcopyrite	Minor to very minor arsenopyrite ± pyrrhotite; minor sphalerite, galena, tetrahedrite-tennantite, chalcopyrite	
Main metals	Au-Ag, Cu, As-Sb	Ag, Sb, Sn	Ag-Au-Zn, Pb, Cu	Au ± Ag	
Minor metals	Zn, Pb, Bi, W, Mo, Sn, Hg	Bi, W	Mo, As, Sb	Zn, Pb, Cu, Mo, As, Sb, Hg	
Te and Se species (Not determined)	Tellurides common; selenides present locally	None, known but few data	Tellurides common locally; selenides uncommon	Selenides common; tellurides present locally	Tellurides abundant; selenides uncommon

Note: APS = aluminum-phosphate-sulphate minerals;
Characteristics of the Project

2.2.3.1.8.2 Exploration Geochemistry

The Proponent carried out soil and stream geochemical surveys over parts of the Project site between late May and mid-September 2012. The sampling programs were conducted by a mixed crew of the Proponent's staff and contracted personnel from UTM Exploration Consultants, with the work supervised by the Proponent's exploration management.

The purpose of the geochemical surveys was two-fold: (1) to conduct a soil orientation survey over the known Blackwater deposit, and (2) to investigate the potential for additional areas of mineralization in the Project site by testing surface soils and silts in streams draining regions of higher relief. **Figure 2.2.3-7** shows both the soil survey sample sites on east-west grid lines and the silt sample locations on streams within the Project site.



Figure 2.2.3-7: Soil and Silt Survey Locations

A total of 4,517 samples were collected: 1,415 from Ah soil horizon (i.e., soil organic matter), 1,379 from Upper-B soil horizon (i.e., subsurface material), and 1,723 from MMI (i.e., mobile metal ion). The results of the soil survey indicate numerous areas displaying multi-element anomalies

including Au, Zn, Ag, copper (Cu), bismuth (Bi), and molybdenum (Mo), many of which merit follow-up investigation.

Additionally, in 2012 a total of 43 stream silts were collected in key drainage areas around the Project site. Results indicated anomalous Cu and Zn values from streams to the northwest and southeast of the Blackwater deposit. As summarized in **Table 2.2.3-2**, previous operators performed extensive soil geochemistry testing between 1982 and 2007.

2.2.3.1.8.3 Geophysics

During 2010, Richfield contracted Quantec Geoscience Ltd. of Toronto to conduct a Titan 24 Direct Current (DC) resistivity and Induced Polarization (IP) chargeability geophysical survey. The objective of the study was to determine the relationship between IP chargeability and resistivity, and zones of known Au mineralization within the mineral resource area, to aid in geologic interpretation and drill targeting. The survey was conducted along five 3.5 km-long north-south lines spaced 400 m apart, with dipole length of 100 m. In October 2011, Quantec carried out a second-phase survey, consisting of eleven 2-km north-south lines with dipole length of 50 m, on behalf of the Proponent.

The results of the survey indicate good correspondence between known mineralization and the Titan IP-resistivity results. In general, zones of significant Au mineralization correlate positively to zones of moderate resistivity and moderate IP chargeability. **Figure 2.2.3-8** shows the survey line locations and extent, and **Figure 2.2.3-9** shows the results along line 5500E, where one of the prominent chargeability features correlated well with a medium- to high-resistivity gradient, and most drill holes intersected significant Au mineralization.

2.2.3.1.9 Other Surveys and Investigations

2.2.3.1.9.1 Topographical Grids and Surveys

Eagle Mapping Ltd. generated detailed topography in August 2010 from an aerial survey flown on July 7 of the same year. Topography was generated at 2-m contour intervals over an area of 5 square kilometres (km^2) and at 5-m contours over an area of 56 km^2.

Eagle Mapping Ltd. performed an aerial light detection and ranging (LiDAR) survey of the Project area on 8 and 9 August 2011. Although the area of interest (AOI) for this survey was 412 km^2, the survey actually covered approximately 500 km^2 to buffer the true AOI for quality assurance purposes.

2.2.3.1.9.2 Petrology, Mineralogy, and Research Studies

Polished section petrographic analysis has been conducted on selected drill samples. In 2009 and 2010, sample suites were selected for understanding the nature of the host volcanic and volcaniclastic rocks, and the gold and silver mineralization. Sample descriptions were performed by Vancouver Petrographics Ltd.

In 2009, Eco Tech Laboratories performed whole-rock lithogeochemical analyses with the aim of constraining the geochemical fingerprint of the host volcanic rocks by providing insight into the tectonic affinity, geochemical classification, and petrological evolution.

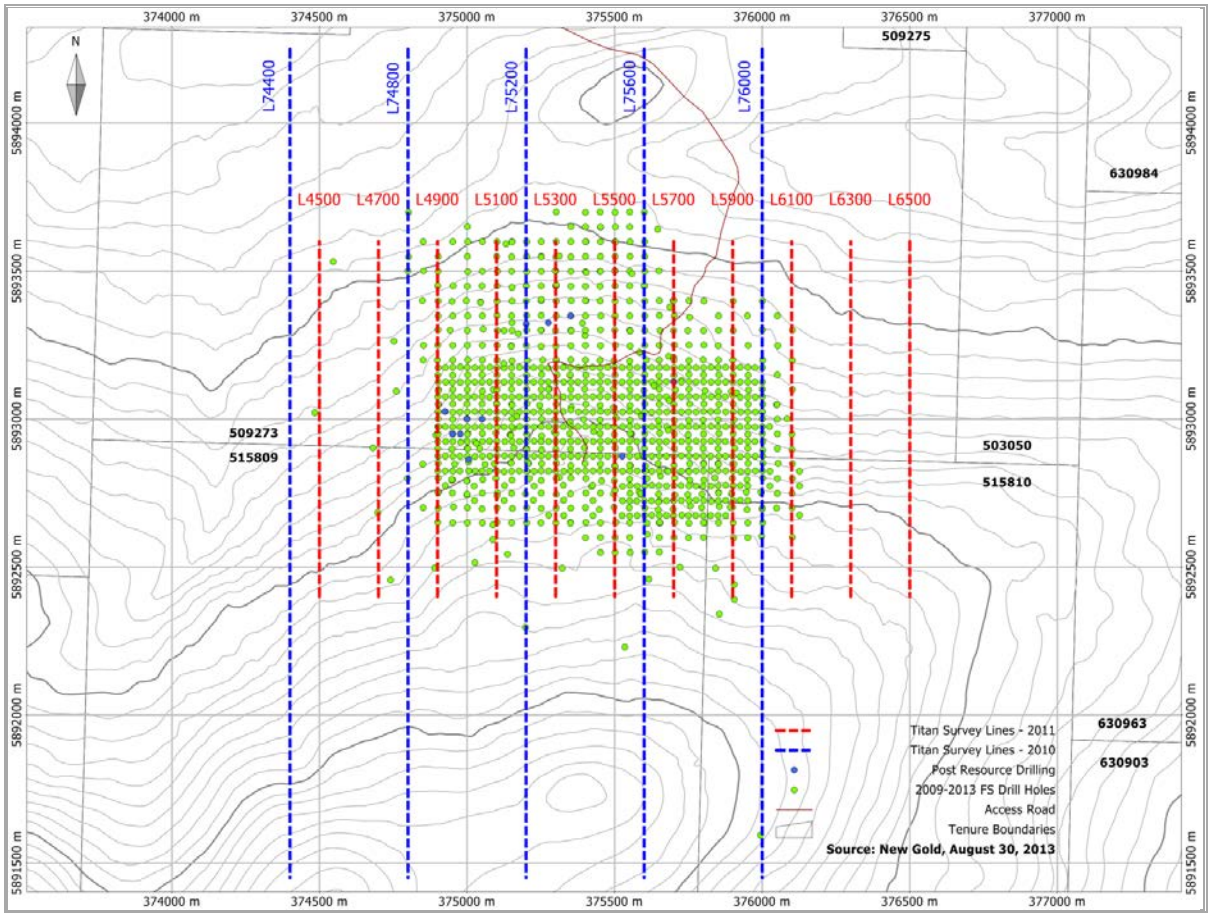
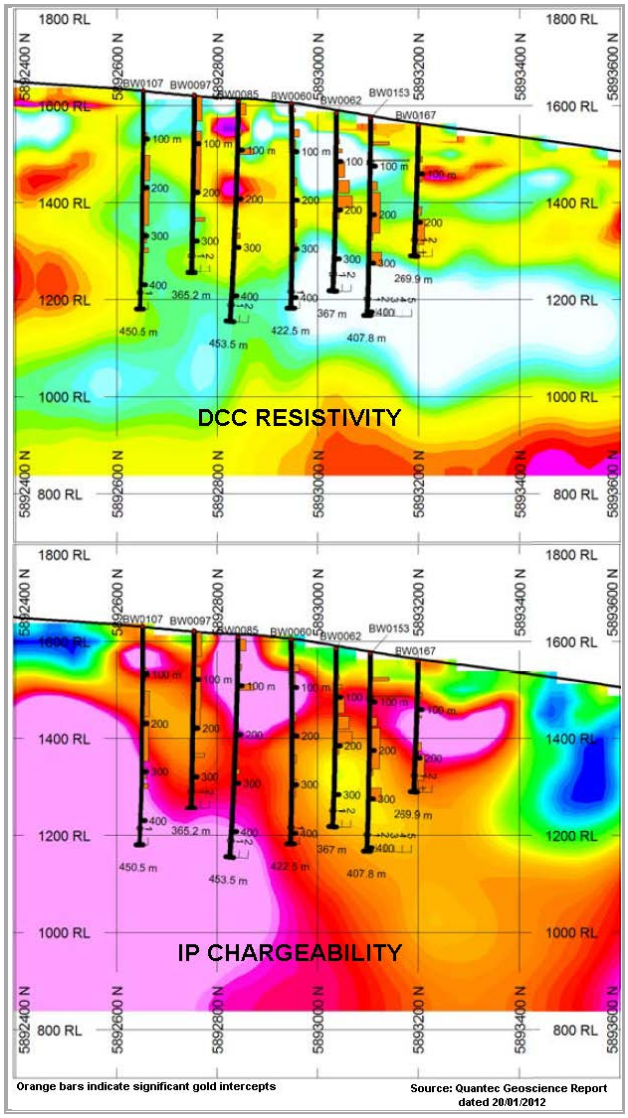


Figure 2.2.3-8: Titan 24 DC IP Survey Lines



Gold Intercept grade scale 1 g/t Au

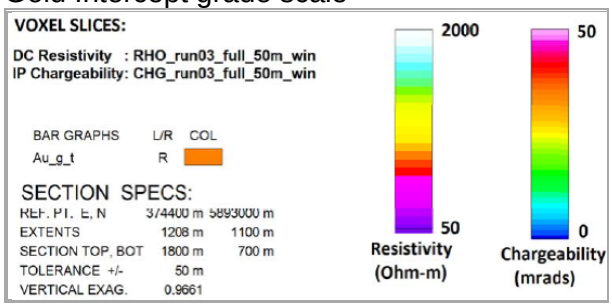


Figure 2.2.3-9: Quantec 3D Results on Line 5500E

The Metallurgical Division of Inspectorate Laboratories completed an analysis of a drill composite from drill hole BW0059. Opaque phases identified from X-ray diffraction analysis included quartz, micas, orthoclase, clays, and minor calcium sulphates and carbonates. Pyrite, iron oxides (limonite, hematite, magnetite, goethite), and pyrrhotite were the main iron-bearing phases.

Mineralization identified included sphalerite, chalcopyrite, cubanite, and traces of tetrahedrite, chalcocite, and dioptase. In some samples, the chalcopyrite and cubanite were observed to be tightly intergrown. Other minerals such as rutile, ilmenite, and traces of graphite were also observed.

2.2.3.1.10 Drilling

2.2.3.1.10.1 Richfield and the Proponent's Drilling

A total of 1,149 core drill holes (357,507 m) were drilled in the Project area between 2009 and January 2013 (**Table 2.2.3-4**). Of this total, Richfield completed 134 holes and the Proponent 1,015 holes. Drilling by parties other than Richfield and the Proponent, referred to as legacy drilling, is summarized in **Table 2.2.3-2**.

Table 2.2.3-4: Feasibility Study Drill Hole Summary Table

Series	Year	Company	Holes Drilled	Total (m)	Intervals Assayed	Assayed (m)
BW0042 to BW0059	2009	RVC	18	3,621.23	3,408	3,413.62
BW0060 to BW0116	2010	RVC	57	21,335.92	20,034	20,219.03
BW0117 to BW0175	2011	RVC	59	19,727.37	18,243	18,840.15
Subtotal RVC			134	44,684.52	41,685	42,472.80
BW0176 to BW0295, 297, 298 (+50R)	2011	New Gold	125	49,315.78	45,577	46,230.03
BWMET01 to BWMET07	2011	New Gold	7	2,281.91	1,347	1,364.76
BW0296 and BW0299 to BW1013	2012	New Gold	716	207,333.15	192,848	195,943.88
BWMET08 to BWMET27	2012	New Gold	20	1,816.50	0	0.00
BWWR01 to BWWR14	2012	New Gold	14	2,952.50	1,120	2,697.45
Pilot Holes	2012	New Gold	7	2,265.27	1,879	1,928.00
GM12-01 to GM12-13	2012	New Gold	13	5,003.00	4,555	4,772.99
Condemnation – DDH	2012	New Gold	18	7,036.53	4,551	4,634.28
Condemnation – RC	2012	New Gold	91	33,252.00	16,493	33,004.50
BW1014	2013	New Gold	1	420.00	413	414.00
Pilot Holes	2013	New Gold	3	1,145.74	0	0.00
Subtotal New Gold			1,015	312,822.38	268,783	290,989.89
Total			**1,149**	**357,506.90**	**310,468**	**333,462.69**

Figure 2.2.3-10 shows locations of all drill holes in the Project site. **Figure 2.2.3-11** illustrates the Richfield and the Proponent drilling in the Blackwater deposit area, and **Figure 2.2.3-12** gives the approximate locations of drill holes completed by other predecessor companies in the immediate area of the mineral deposit. Only data from drilling conducted by Richfield and the Proponent were used for the mineral resource estimate in **Section 2.2.3.2.12**.

Figure 2.2.3-13 to **Figure 2.2.3-15** are representative cross-sections depicting drill holes and grades.

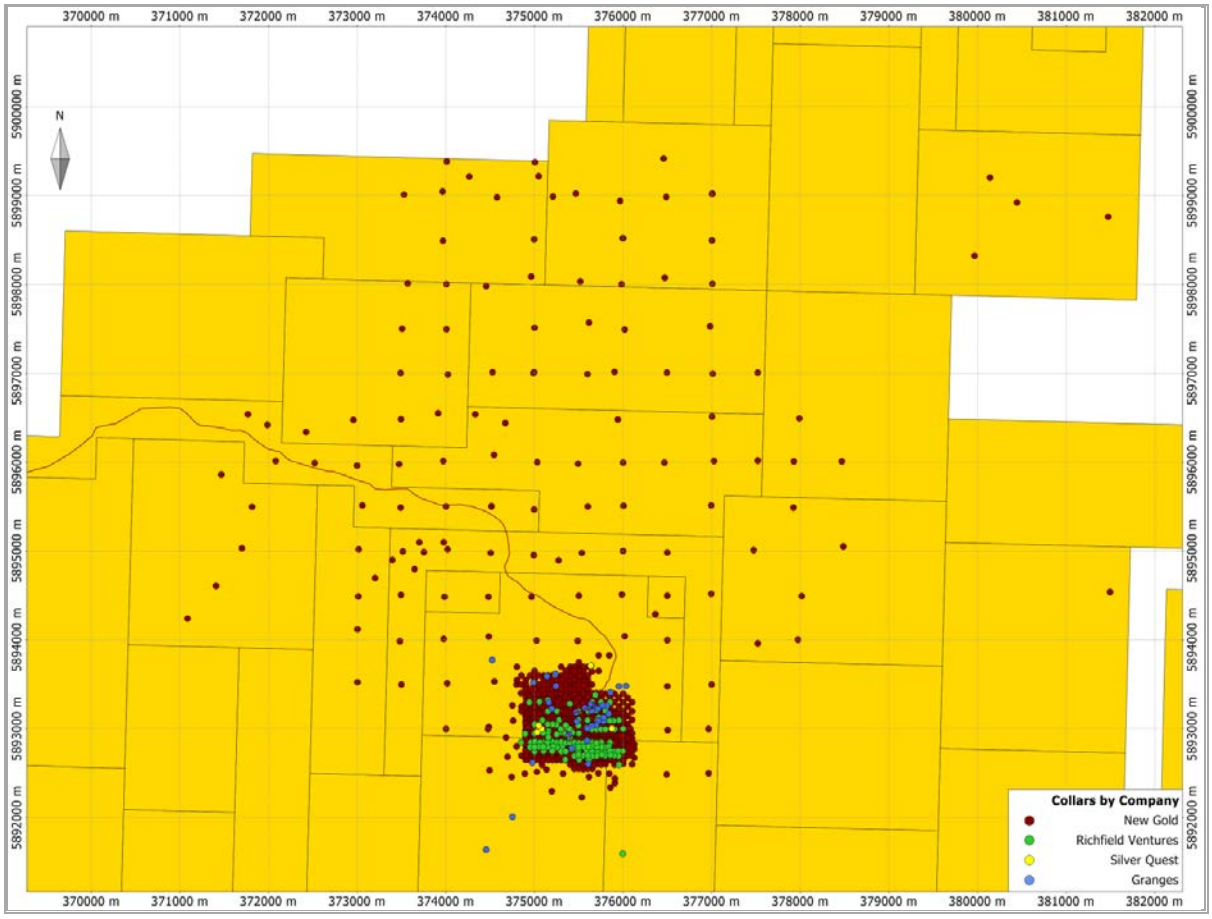


Figure 2.2.3-10: Drill Hole Location Plan – All Drilling

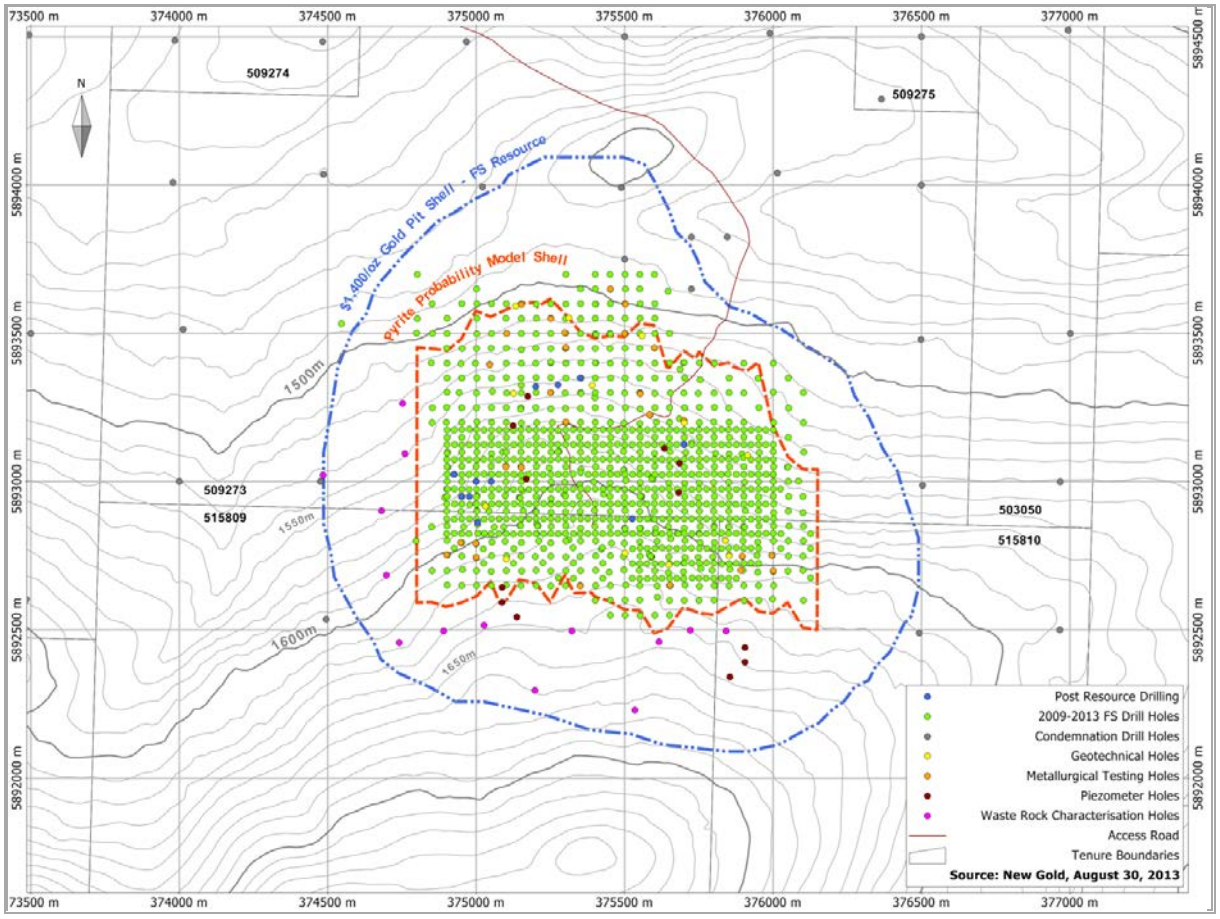


Figure 2.2.3-11: Drill Hole Location Plan – Richfield and the Proponent's Drilling

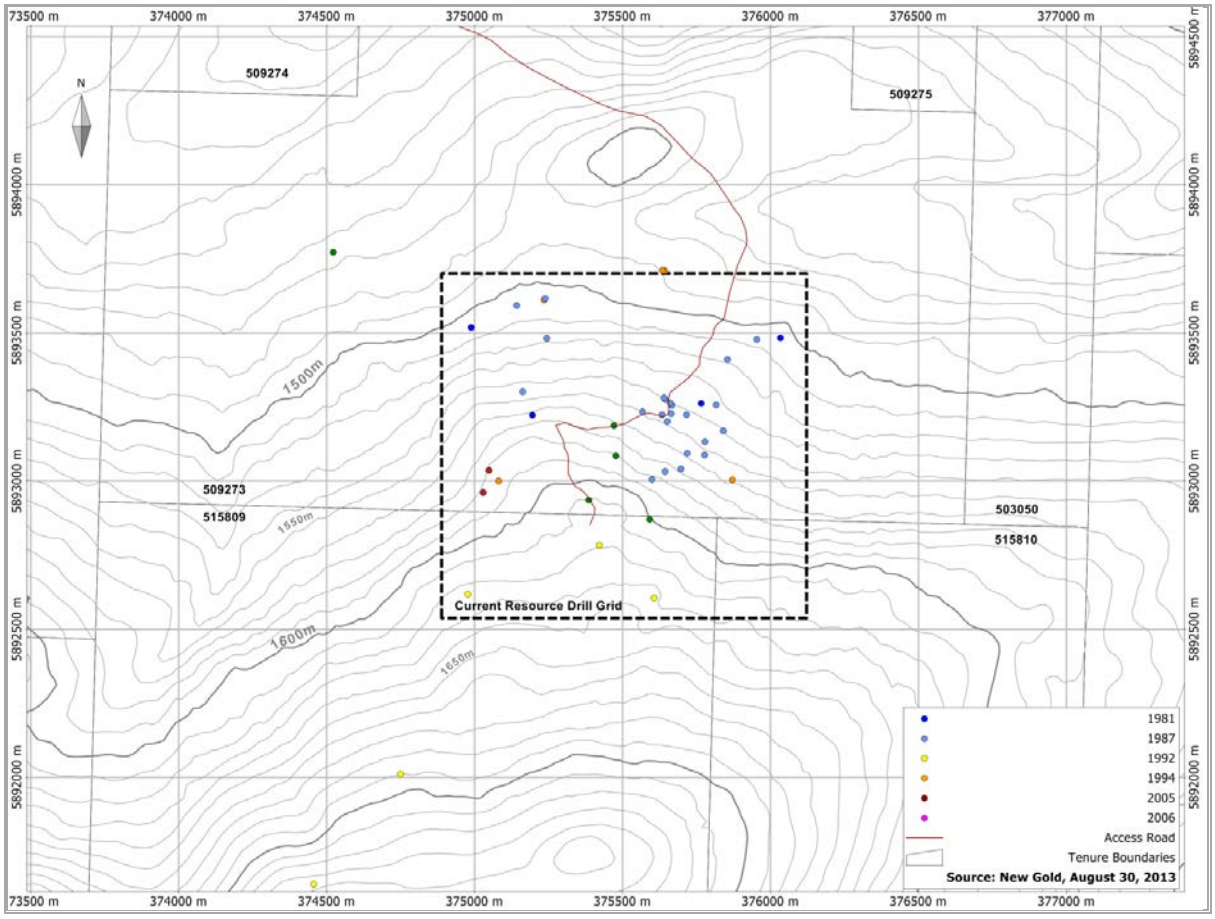


Figure 2.2.3-12: Drill Hole Location Plan – Historic Drilling

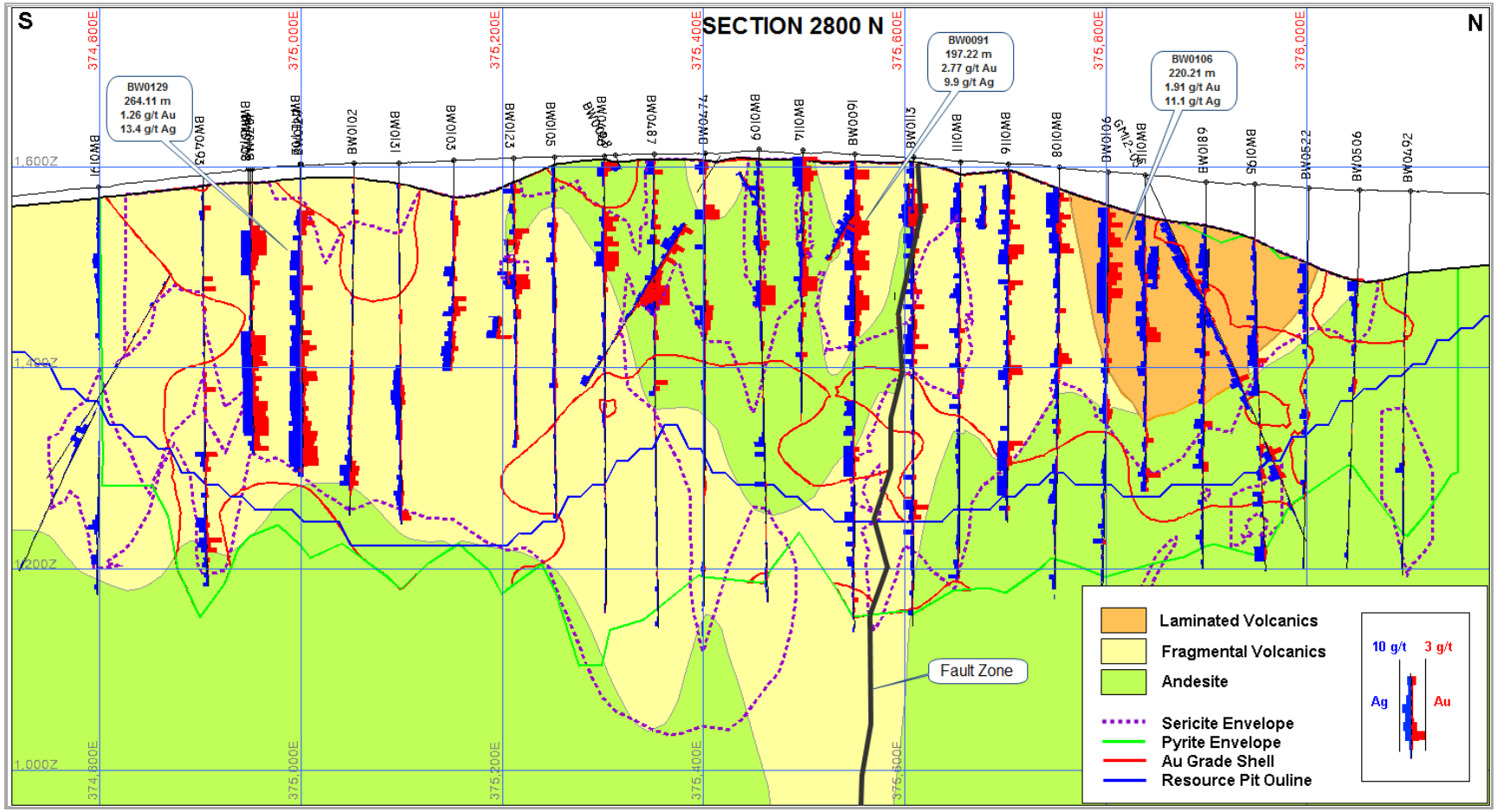


Figure 2.2.3-13: Cross-Section 2800 N

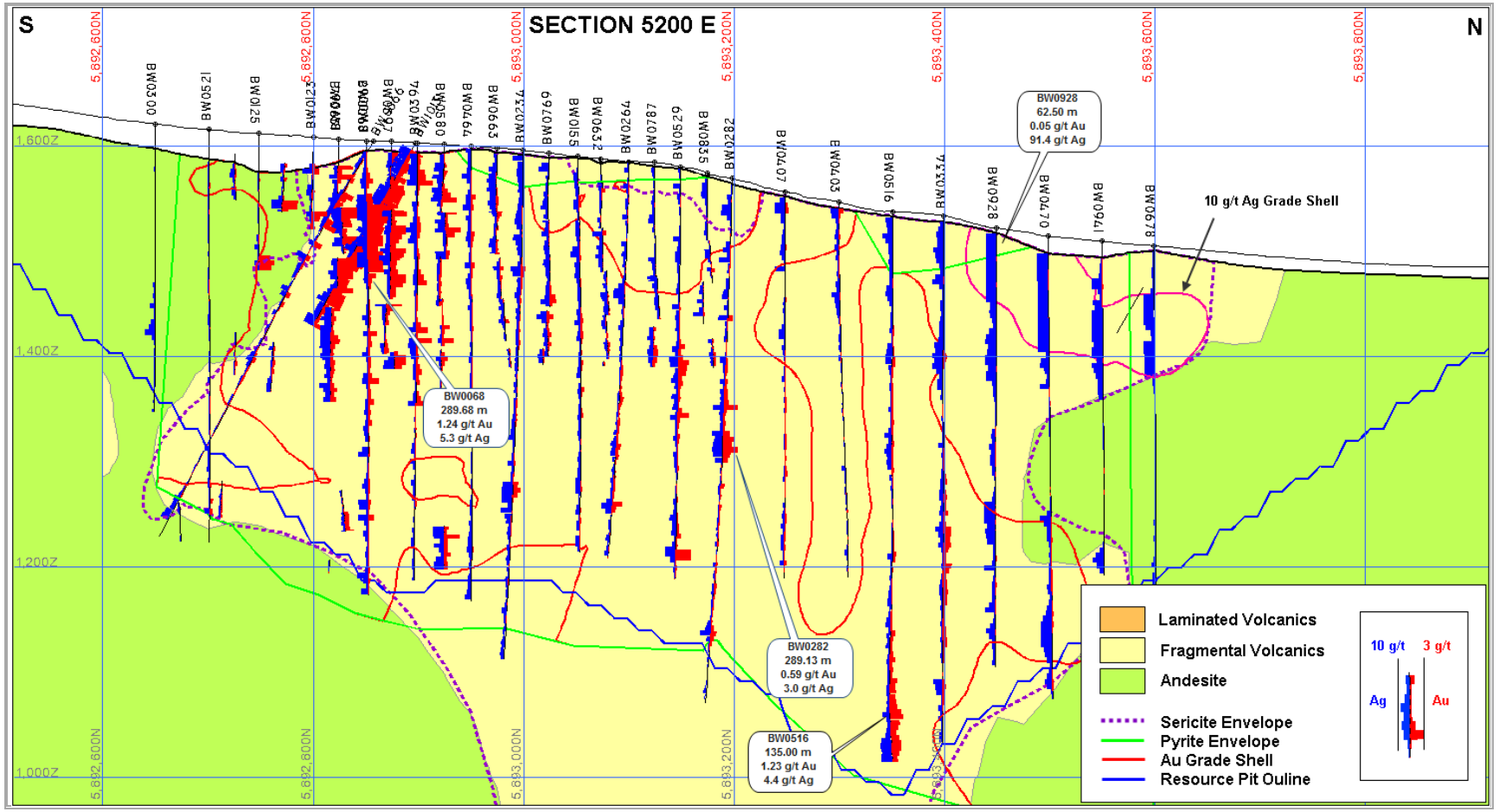


Figure 2.2.3-14: Cross-Section 5200 E

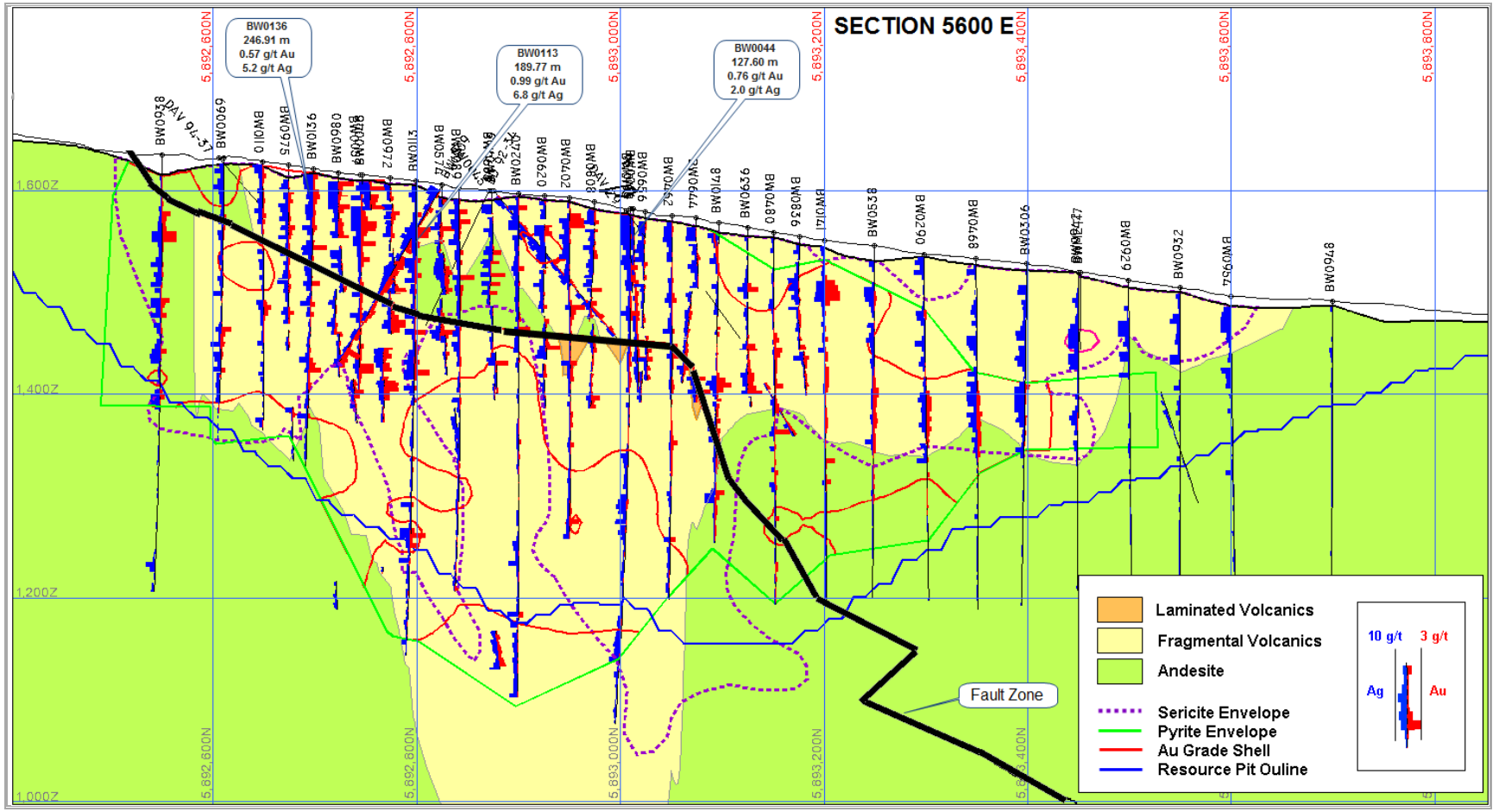


Figure 2.2.3-15: Cross-Section 5600 E

2.2.3.1.10.2 Drill Hole Results

Typical drill hole orientations are indicated in the sample cross-sections on **Figure 2.2.3-13** to **Figure 2.2.3-15**. These sections show examples of summary assay (or mineralization intensity) values.

Gold and silver mineralization occurs within an irregularly shaped system of stockwork and disseminated sulphides that strikes approximately east-west and dips moderately to the north. Depending on the inclination of an individual drill hole, and the local dip of mineralization, drill intercept widths are approximately equivalent to true widths.

2.2.3.1.10.3 Recovery and Rock Quality Designation

Core recovery for the drilling programs completed from 2009 to 2012 averaged 92% and had a median core recovery of 96%. Poor core recovery often occurs in zones of faulting and fracturing. The average rock quality designation (RQD) value for this period was 44%.

2.2.3.1.10.4 Exploration Potential

The Project site offers good potential for discovery of additional mineralization that may support mineral resource estimation. Work to develop this potential is ongoing, and involves a combination of detailed interpretation of deposit geology from the growing body of exploration drill hole information in conjunction with expanded geologic mapping, geochemical sampling, airborne and ground-based geophysical methods, and exploration drilling—all beyond the limits of the Blackwater deposit as they are currently known, and within the greater Project area.

2.2.3.1.10.5 Geotechnical and Characterization Drilling

Other drilling for Project characterization studies is summarized below. Most of the holes indicated are shown on **Figure 2.2.3-11**.

2.2.3.1.10.6 Geotechnical and Hydrological Drilling

Thirteen specific geotechnical hazard quotient (HQ) holes were drilled, for a total length of 5,003 m.

Ten specific hydrological pilot holes (HQ) were drilled to serve as monitoring stations, where a piezometer is installed to measure the aquifer level in the deposit area. HQs are numbered PH12-2-1, PH12-3-1, PH12-3-2, PH12-3-3, PH12-4-1, PH12-4-2, PH12-4-3, PH13-1-1, PH13-2-2, and PH13-2-3. The total length of these hydrological holes is 3,411 m.

2.2.3.1.10.7 Metallurgical Drilling

Twenty-seven specific metallurgical holes were drilled, four HQ holes, BWMET01 to 04, and 23 PQ holes, BWMET05 to 27. Total length of these holes is 4,098 m.

2.2.3.1.10.8 Waste Rock Characterization Drilling

Fourteen specific waste rock characterization holes (HQ) were drilled, BWWR01 to 14, for a total length of 2,952.5 m. Samples were tested for geochemical parameters including Acid/Base Accounting (ABA) and metals.

2.2.3.1.10.9 Condemnation Drilling

Eighteen diamond drill holes (HQ) and 91 reverse circulation holes were drilled to condemn potential site facility areas surrounding the Blackwater deposit. The locations of waste storage facilities including the TSF and external waste rock dumps, together with the process plant and low grade ore stockpile were confirmed through this drilling. The aggregate of these holes are 7,036 m and 33,252 m, respectively. Locations of these condemnation drill holes are shown on **Figure 2.2.3-16**.

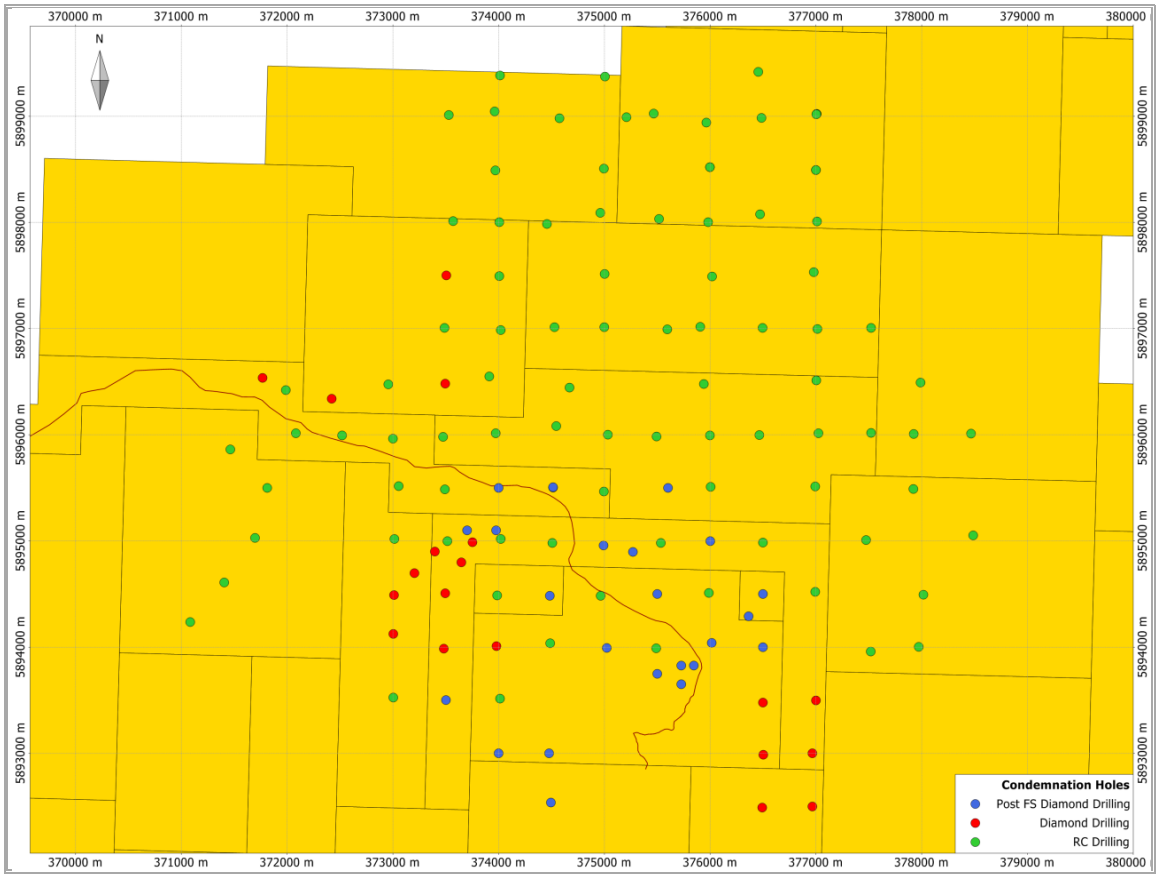


Figure 2.2.3-16: Condemnation Drilling Locations

2.2.3.1.11 Mineral Resource Estimates

2.2.3.1.11.1 Geologic Model

Lithology was consolidated into six categories: overburden, laminated volcanics, fragmentals, andesite, sediments, and intrusive phases. Indicator kriging was used for preliminary modelling to guide a sectional interpretation honouring drill hole intercepts. Final wireframe models of the principal units were generated using the sectional interpretation. The intrusive phase unit was not modelled because few drill intercepts were available.

Gold mineralization is dominantly hosted within the volcanic fragmental unit, a suite of volcaniclastic rocks and breccias of apparent felsic to intermediate composition. The encompassing fragmental package is roughly rhombohedral in plan, bound by near vertical northwest- and northeast-trending faults. It is funnel-shaped and elongated WNW-ESE, enveloped by massive cohesive andesite, and open to the southwest at depth.

The final lithologic model is illustrated on **Figure 2.2.3-17**.

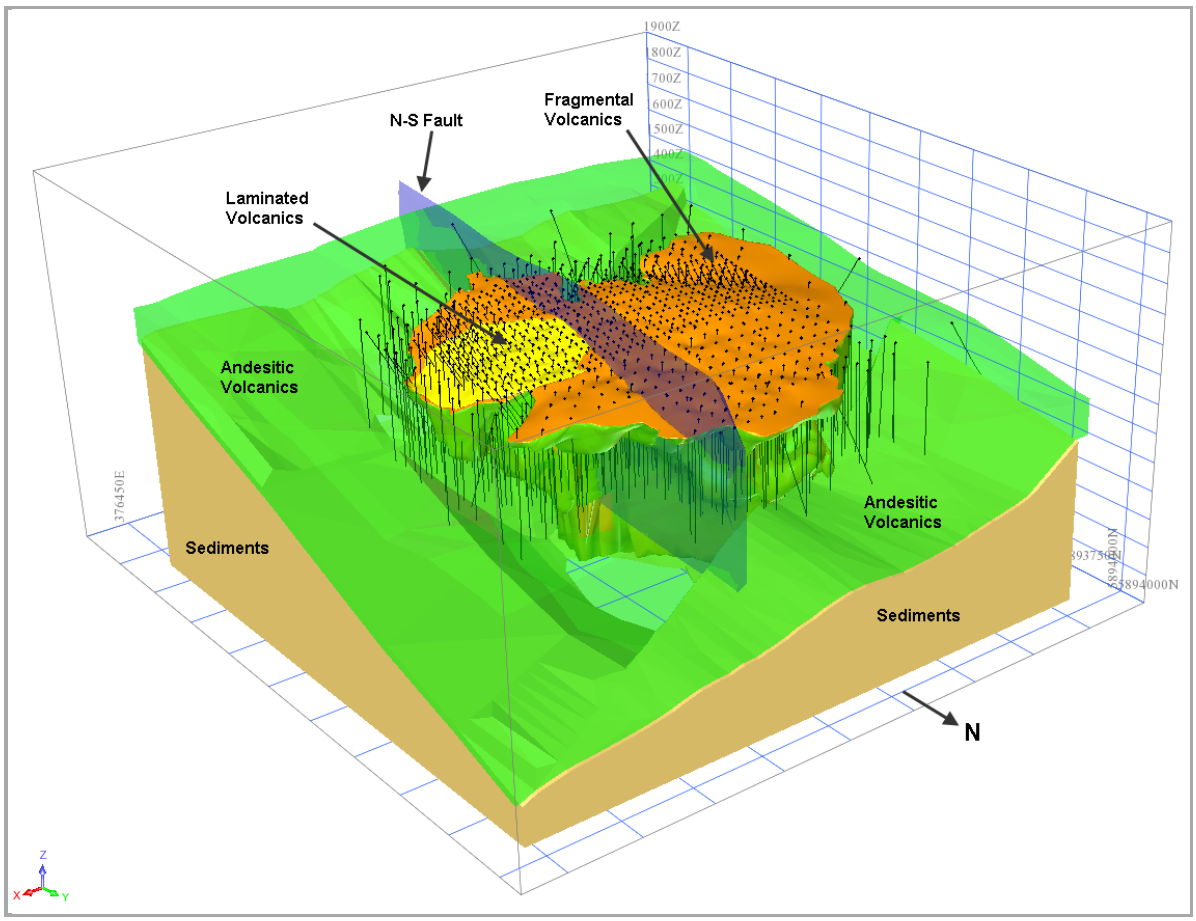


Figure 2.2.3-17: Lithologic Model

2.2.3.1.11.2 Structural Model

A selection of 462 drill holes was re-logged by core photographs to identify major fault intervals used to create the structural model. Mineralization is strongly controlled by northwest-southeast-trending structures characterized by zones of tectonic brecciation and chloritic gouge. Northeast-trending structural discontinuities also appear to have a major control on alteration and mineralization but do not appear to be affected by recent movement. A set of east-northeast-trending graben-forming faults bound the mineralization and fragmental package to the north and south. A major north–south-trending fault dissects the ore body and east-northeast-trending faults along UTM 375600 E. This fault represents a well-defined disruption in lithology, alteration, and mineralization patterns, and was used to subdivide the model into two structural domains, one to the east and one to the west of the fault.

2.2.3.1.11.3 Alternation Model

A two-phase alteration study was completed to develop the alteration model for the deposit. For the first phase some 20 widely spaced drill holes were re-logged in detail across sections 375050 E and 375700 E at 5892900 N, and analyzed by Short Wave Infrared (SWIR) spectrometer at approximately 10 m intervals down hole. Subsequently, the second phase involved selecting an additional 135 representative holes, which were collected on approximately 100-m centres for re-logging and spectral analysis at a nominal 20 m down hole sample spacing. Analysis of spectral data and identification of mineral species was done using the SPECMIN™ spectral reference libraries from Spectral International, Inc. and The Spectral Geologist™ data-processing software developed by the Commonwealth Scientific and Industrial Research Organisation.

Two spectral readings were collected from each sample to ensure reproducibility and to test for heterogeneity of the samples. Measurements were collected on fresh broken surfaces, with the exception of select analyses done on fracture fill.

The alteration minerals most commonly identified included muscovite, high- and low-temperature illite, ammonium-bearing illite, smectite, silica, biotite, and chlorite. Relative proportions of alteration mineral species were quantified by intensity, grouped into alteration assemblages, and plotted on down-hole spectral strip logs.

The resulting alteration assemblages were defined as follows:

- Potassic Hornfels: biotite ± K-feldspar “flooding” or replacement by biotite and/or garnet with pyrrhotite ± actinolite ± alkali Feldspar (albite, orthoclase);
- Sericite-Chlorite: illite, Fe-chlorite ± interlayered illite-smectite, carbonate (commonly siderite);
- Quartz-sericite: fine-grained sugary greenish-grey to buff-coloured quartz, muscovite, or highly crystalline illite + pyrite, black sphalerite, DBS, and lesser pyrrhotite, rare tourmaline;
- Silica-sericite: silica, illite ± pyrite, red sphalerite, pyrrhotite;
- Massive Silica: grey glassy massive finely crystalline silica, sulphide-destructive; and

- Ammonium: ammonium-bearing micas and rare buddingtonite (NH_4-bearing feldspar).

The six alteration assemblages were subsequently consolidated into three principal domain categories for modelling: ammonium-bearing illite overprint (NH_4), texture-destructive quartz-mica "sericitic" (SER), and potassic (POT).

The alteration model indicates the presence of two centres of texture-destructive sericitic alteration cored by the ammonium-bearing overprint and haloed by early POT alteration and hornfelsed andesite. Statistical analysis shows that the NH_4 and SER alteration domains closely coincide, and they were therefore combined as a single domain (SER) for resource modelling. A wireframe encompassing the distribution of sericitic alteration was generated from a sectional interpretation of detailed drill hole information (**Figure 2.2.3-18**). An indicator model of alteration types, simulations of logged silica and sericite intensity, and block estimates of alkali cation percentages, particularly aluminum, provided additional support to the modelled alteration domains.

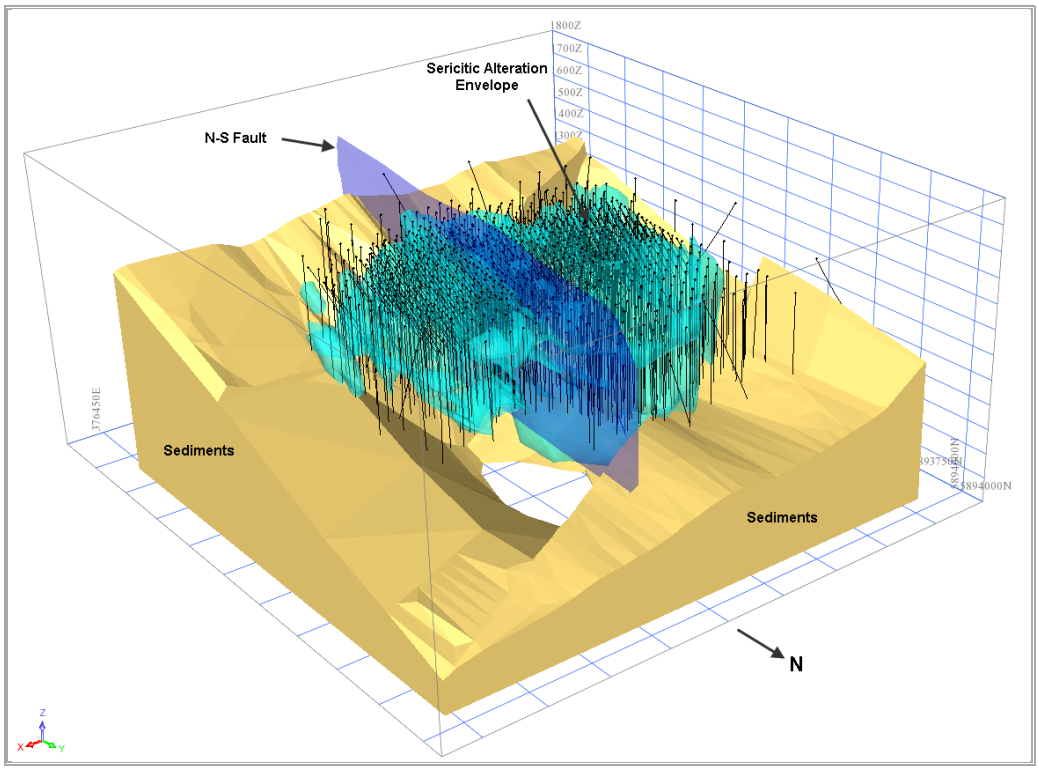


Figure 2.2.3-18: Sericite Alternation Envelope

Statistical comparisons of the modelled sericite and silica between gold and silver, respectively, demonstrate the relationships between mineralization and alteration. Similar comparisons also demonstrate the relationships between gold and logged sulphides, particularly pyrite and DBS mineralization.

The lower simulated mineral abundance of 0.5 vol% pyrite + DBS was useful for outlining the overall limits of gold and silver mineralization, while the higher mineral abundances of 1 vol% and 2 vol%, respectively, were found to highlight structures and fault intersections where sulphide "hot spots" occur. These zones often correspond to long, high-grade gold intersections in drill core.

A sectional model was interpreted based on the probability model of the 0.5 vol% pyrite + DBS distribution and wire-framed to create a "Pyrite Shell." This domain was used as an outer constraint of gold estimation in the model (**Figure 2.2.3-19**).

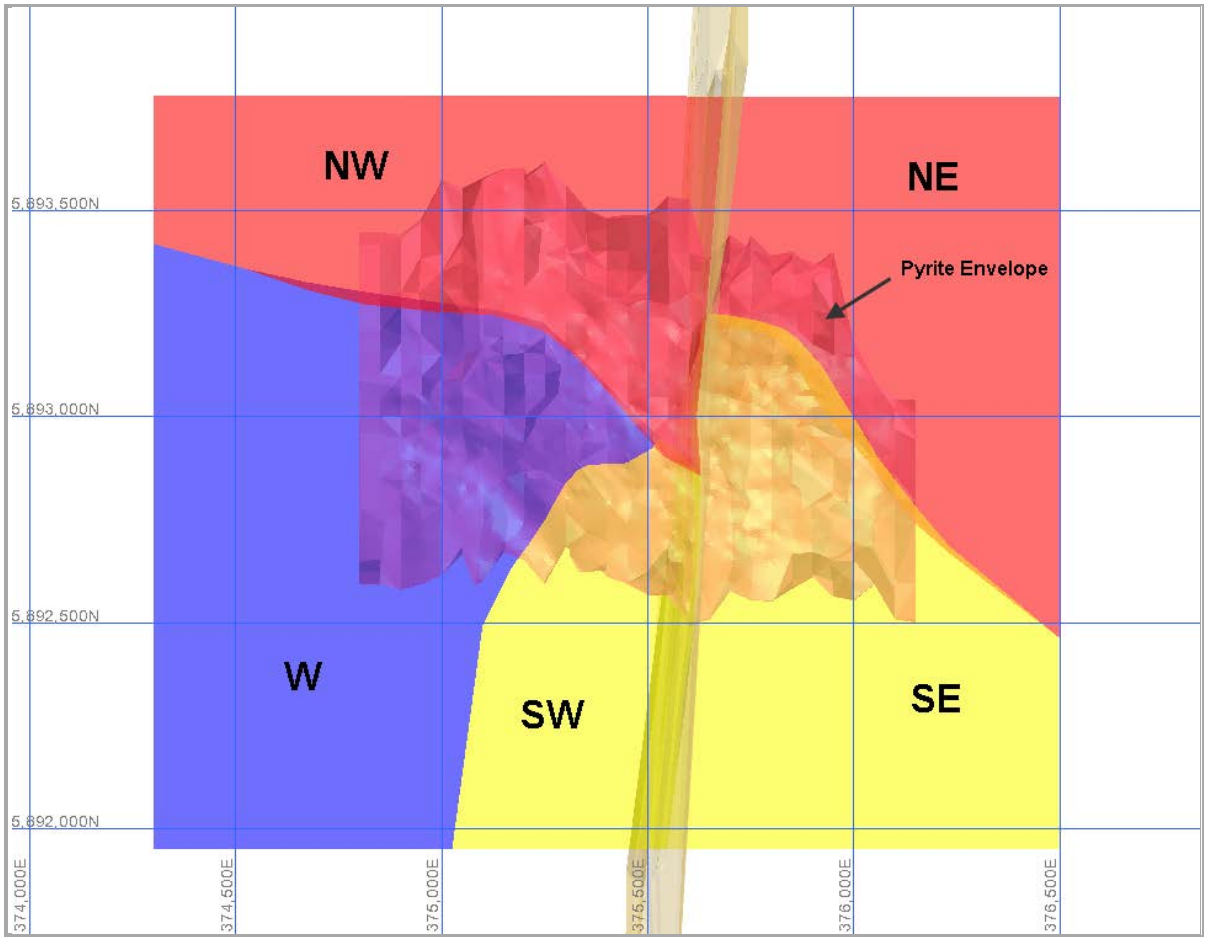


Figure 2.2.3-19: Structural Domains Showing Pyrite Envelope

2.2.3.1.11.4 Grade Shell Models

A grade shell domain was generated for gold within the mineralized Pyrite Shell, to better delineate areas of very low-grade material. The domain was created by indicator kriging of 5-m composites using a threshold of 0.1 g/t Au. This is termed the "Gold Grade Shell" (**Figure 2.2.3-20**).

A second grade shell domain was created to constrain a high-silver/low-gold zone in the upper north area of the deposit that was mostly outside the Pyrite Shell. This domain was created by

indicator kriging of 5 m composites using a threshold of 10 g/t Ag, and is referred to as the "North Silver Zone." This zone extends approximately 500 m east-west and 150 m north-south, and is approximately 75 m thick. The zone extends to surface and dips gently to the north (**Figure 2.2.3-20**).

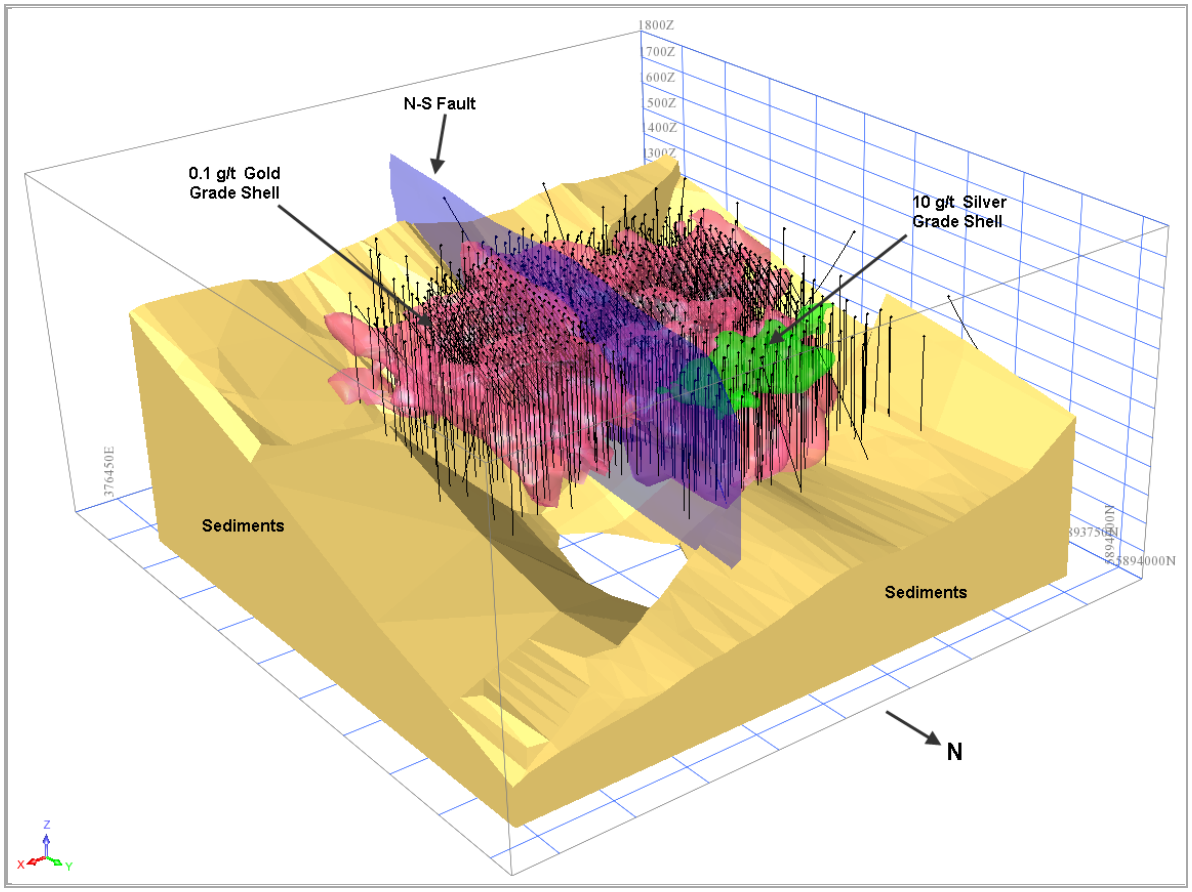


Figure 2.2.3-20: Grade Shell Models

The east and west structural blocks were further subdivided into five structural domains, to model changes in orientation of the mineralized zone, and continuity trends for gold. These domains were grouped together for variography where grade continuity showed consistent trends (**Figure 2.2.3-19**).

2.2.3.1.11.5 Weathered Surface Models

A bedrock surface was modelled by creating profiles based on drill hole intercepts and generating a digital elevation model. Surfaces representing the base of the weathered oxide and oxide-sulphide transition zones were also generated and used to code the blocks (**Figure 2.2.3-21**).

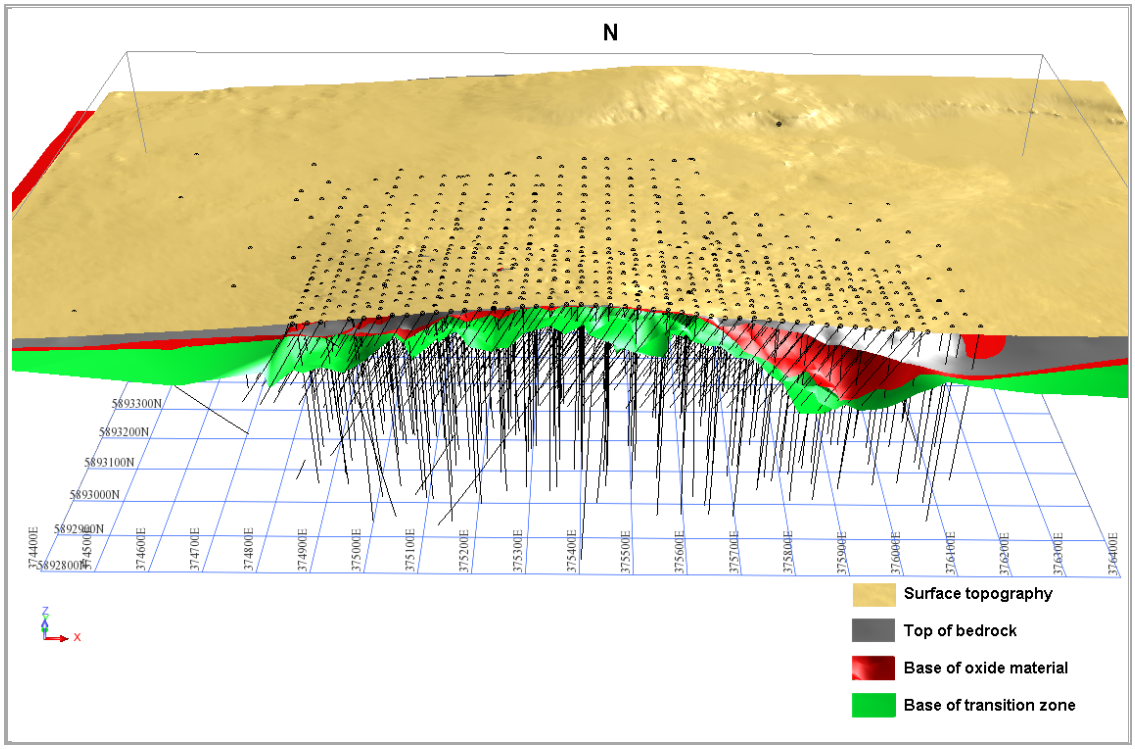


Figure 2.2.3-21: Weathering Profiles Used for Material Type Coding

2.2.3.1.12 Available Data

The total sample database for the Project contains results from 1,046 core holes totalling 315,319 m drilled between January 1987 and 15 January 2013. Of these, 1,010 holes were drilled since the start of 2009, including 974 holes drilled to delineate the mineral resource, 4 holes drilled for metallurgical testing in 2011, and 11 geotechnical holes completed in 2012. Fourteen waste rock characterization holes (BWWR series) were also completed in 2012. Portions of these holes occurring within the resource area were analyzed and used in the resource estimation. Data from seven pilot (PH series) holes were also included.

Due to lack of quality assurance/quality control and accurate survey information, holes drilled before 2009 were not used for geologic modelling, statistical analysis, or grade estimation of the FS mineral resource. **Table 2.2.3-5** summarizes the drilling information used in the FS mineral resource estimation.

Table 2.2.3-5: Summary of Drilling Used for Resource Estimation

Series	Year	Company	Holes Drilled	Total (m)	Intervals Assayed	Assayed (m)
BW0042 to BW0059	2009	RVC	18	3,621.23	3,408	3,413.62
BW0060 to BW0116(1)	2010	RVC	56	20,920.17	19,864	20,048.28
BW0117 to BW0175	2011	RVC	59	19,727.37	18,243	18,840.15
Subtotal RVC			133	44,268.77	41,515	42,302.05
BW0176 to BW0295, 297, 298 (+50R)(2)	2011	New Gold	124	48,903.28	45,168	45,820.53
BWMET01 to BWMET04(3)	2011	New Gold	4	1,435.91	1,347	1,364.73
BW0299 to BW1013, 296	2012	New Gold	716	207,333.15	192,848	195,943.88
GM12-01 to 13(4)	2012	New Gold	11	4,202.50	3,826	3,992.19
BWWR-01 to 14	2012	New Gold	14	2,952.50	1,120	2,697.45
PH12-2-1 to PH12-4-3(5)	2012	New Gold	7	2,265.27	1,103	1,126.62
BW01014	2013	New Gold	1	420.00	413	414.00
Subtotal New Gold			877	267,512.61	246,554	252,140.20
Total			**1,010**	**311,781.38**	**288,069**	**294,442.25**

Note: (1) Excludes BW100 – drilled significantly outside the resource area
(2) Excludes BW294
(3) Only four holes assayed at the time of preparing resource estimate
(4) Excludes GM12-09 and GM12-13, which were not assayed at the time of preparing resource estimate
(5) Includes only 2012 holes; 2013 pilot holes were not assayed at the time of preparing resource estimate

2.2.3.1.13 Secondary Elements

Secondary elements associated with gold and silver mineralization were estimated by the Inverse Distance method to the second power (ID^2), in a single domain, using 10-m down-hole composites—they include arsenic (As), calcium (Ca), cadmium (Cd), Cu, nickel (Ni), lead (Pb), Total sulphur (S), antimony (Sb), and Zn. Results were used to develop the acid rock drainage (ARD) model; details of these estimates are presented in **Section 2.2.3.4**, Waste Rock and Tailings Management.

2.2.3.1.14 Validation

2.2.3.1.14.1 Visual Inspection

Figure 2.2.3-22 to **Figure 2.2.3-29** illustrates cross-sectional views of block-model grade distribution. Drill-hole traces display 5-m composites, which are colour-coded the same as the blocks.

Figure 2.2.3-30 and **Figure 2.2.3-31** show grade distribution of all estimated blocks from different viewing angles.

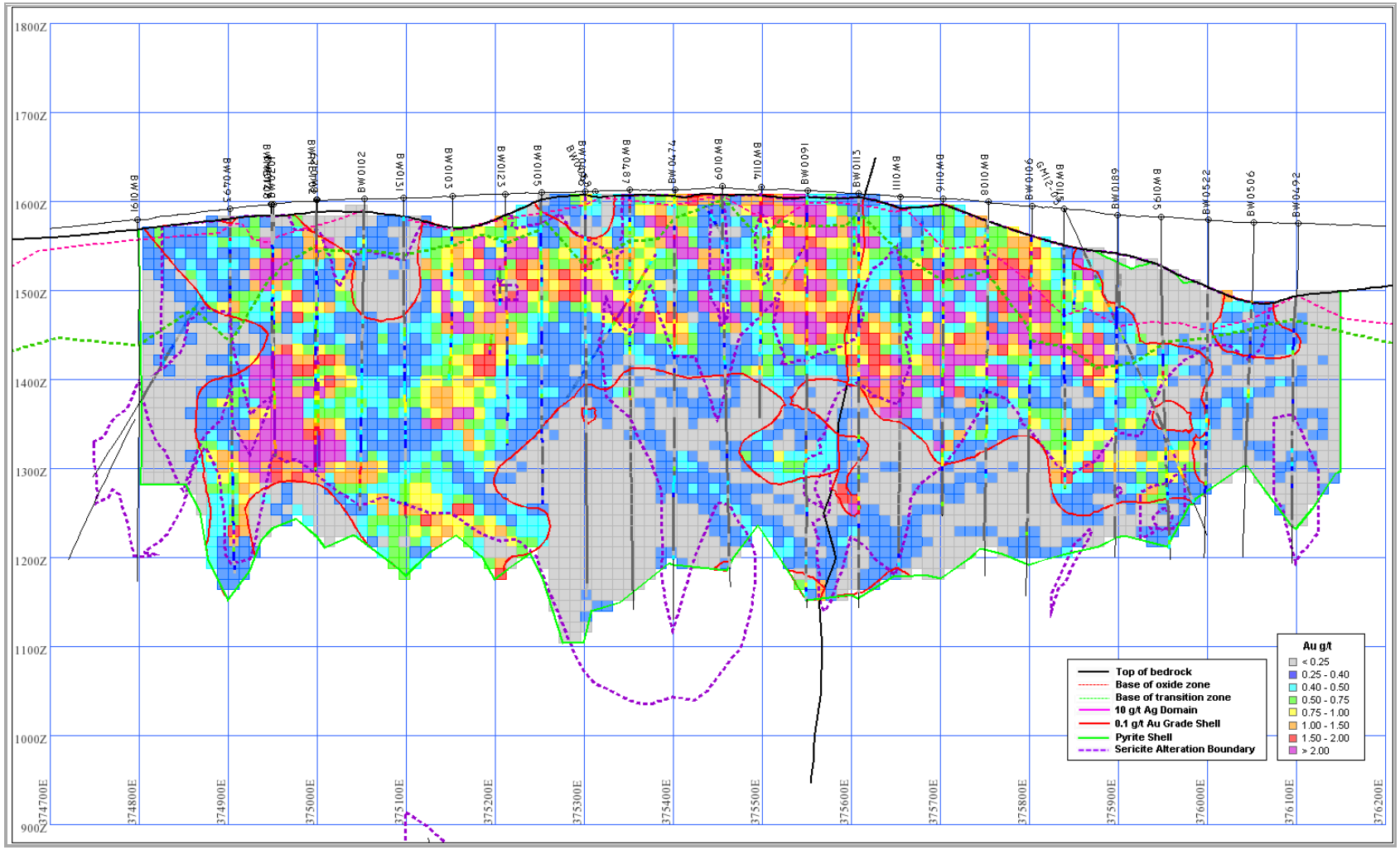


Figure 2.2.3-22: Gold Block Grade Distribution – Section 5892800 N

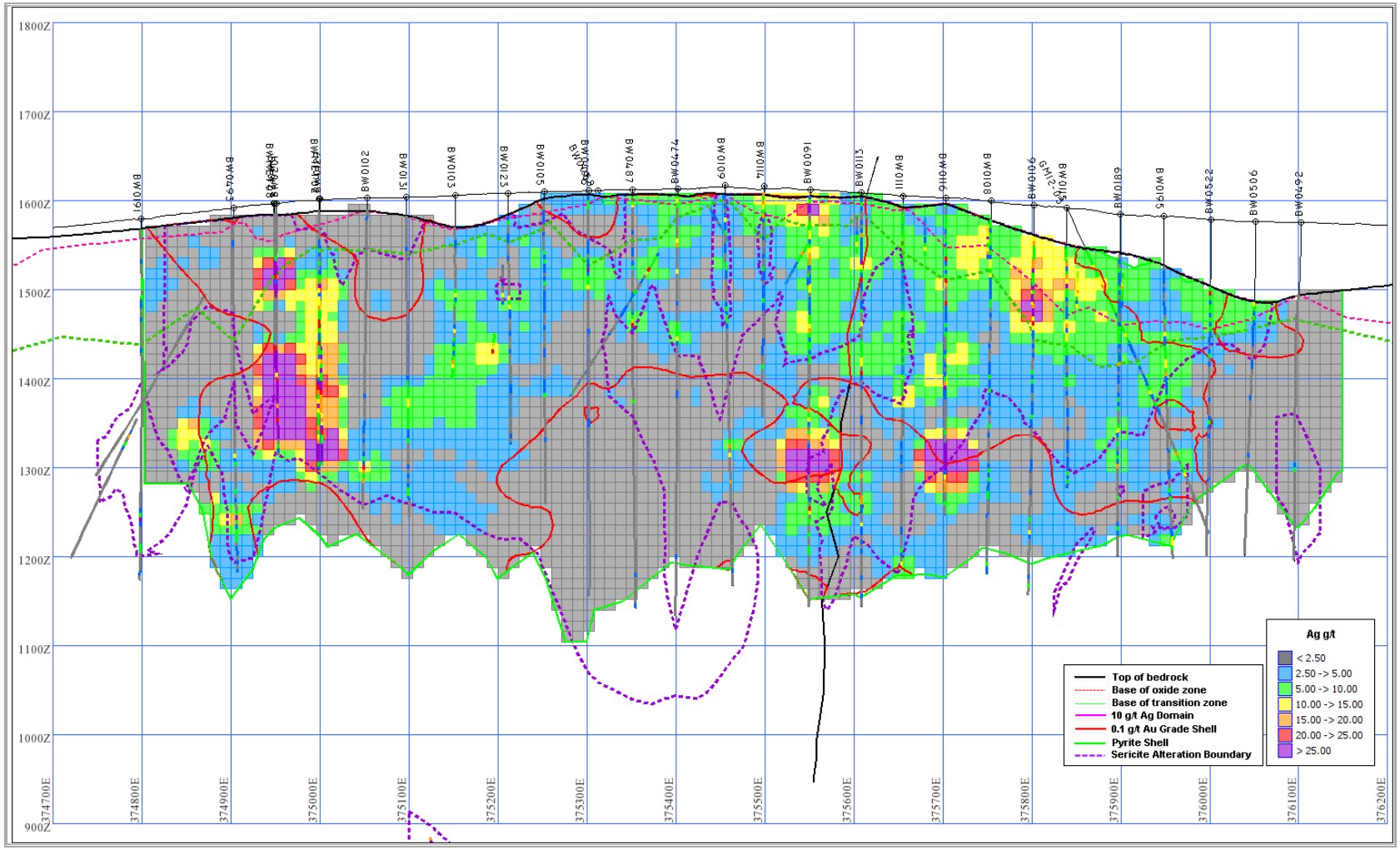


Figure 2.2.3-23: Silver Block Grade Distribution – Section 5892800 N

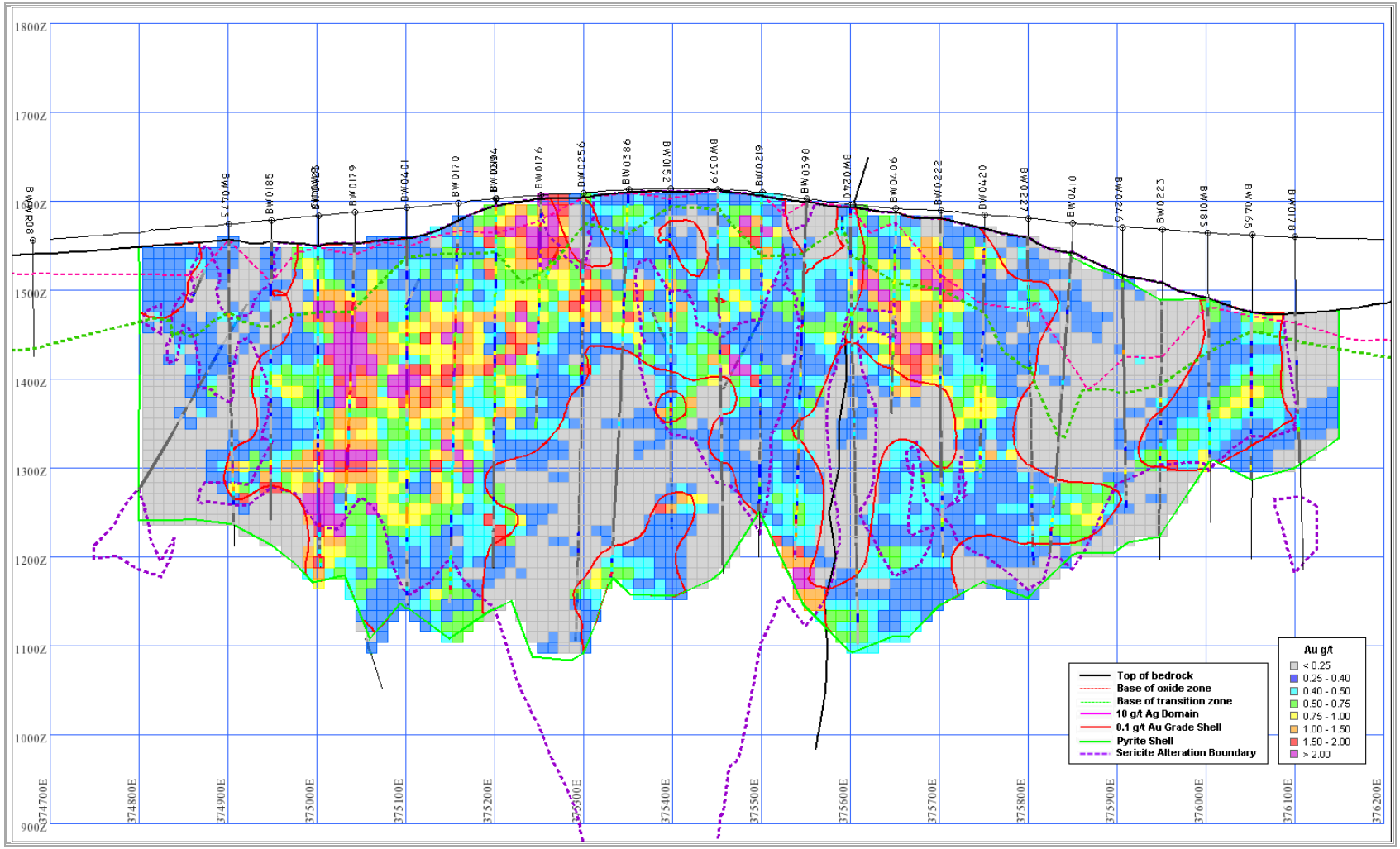


Figure 2.2.3-24: Gold Block Grade Distribution – Section 5892900 N

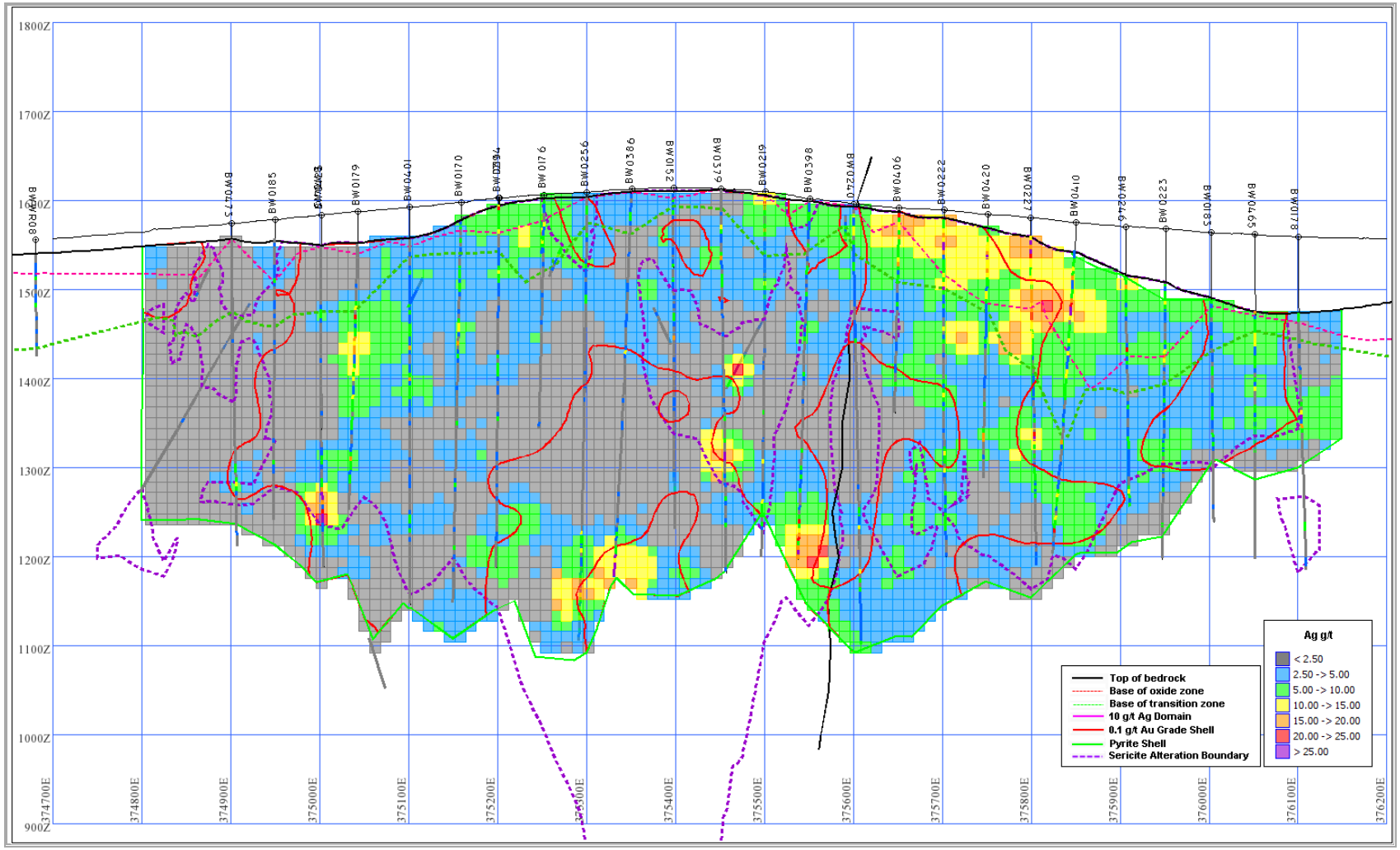


Figure 2.2.3-25: Silver Block Grade Distribution – Section 5892900

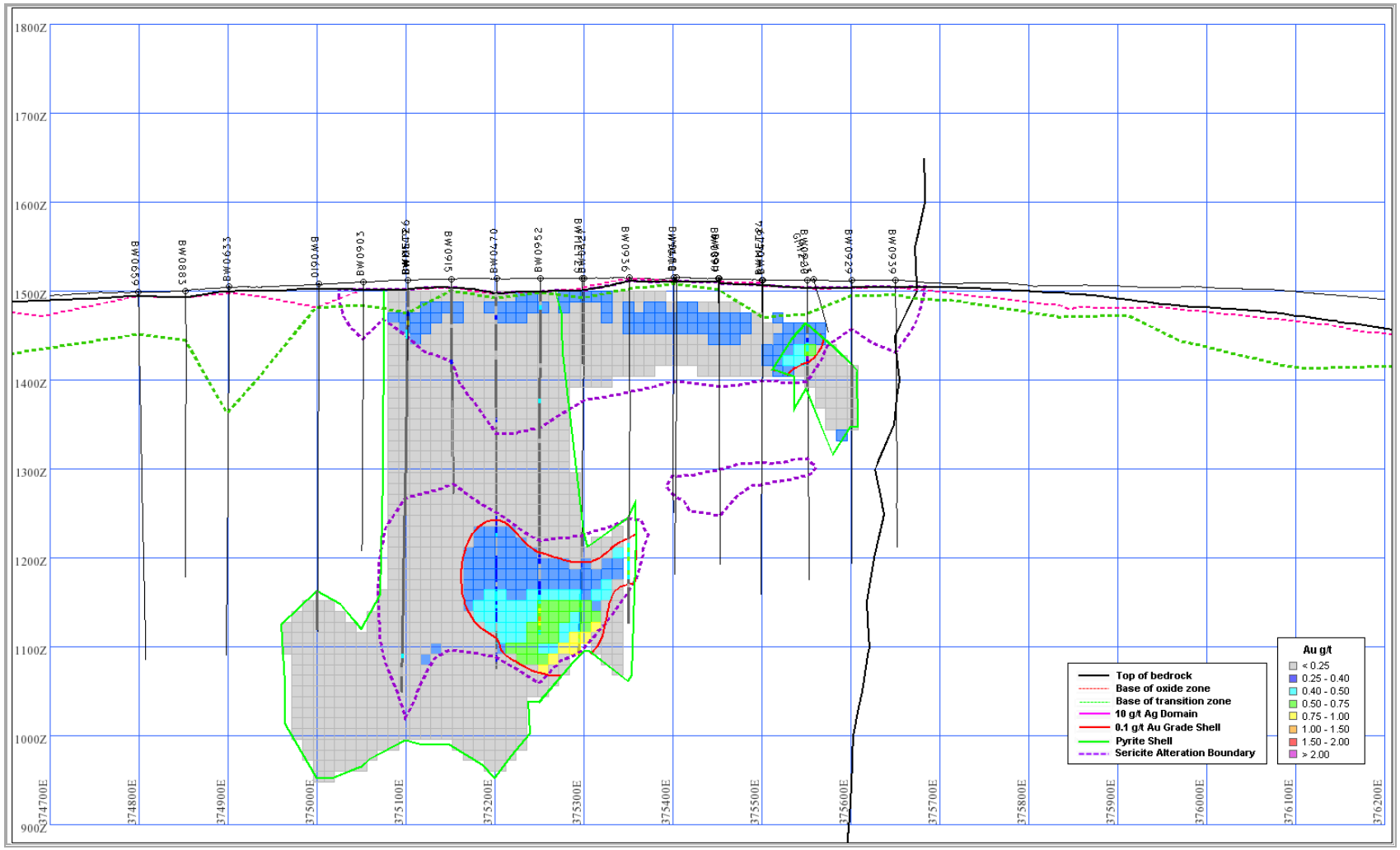


Figure 2.2.3-26: Gold Block Grade Distribution – Section 5893500 N

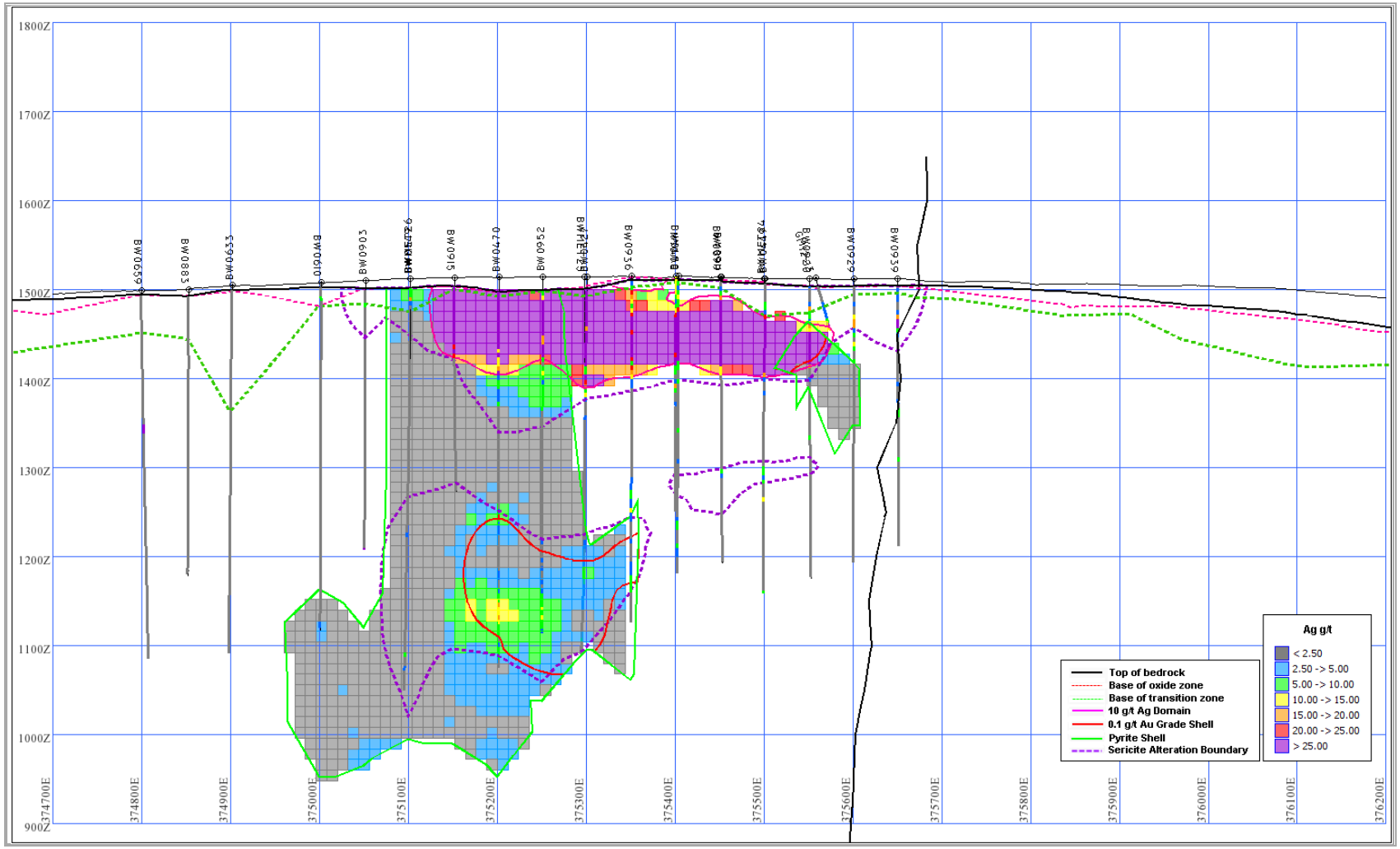


Figure 2.2.3-27: Silver Block Grade Distribution – Section 5893500 N

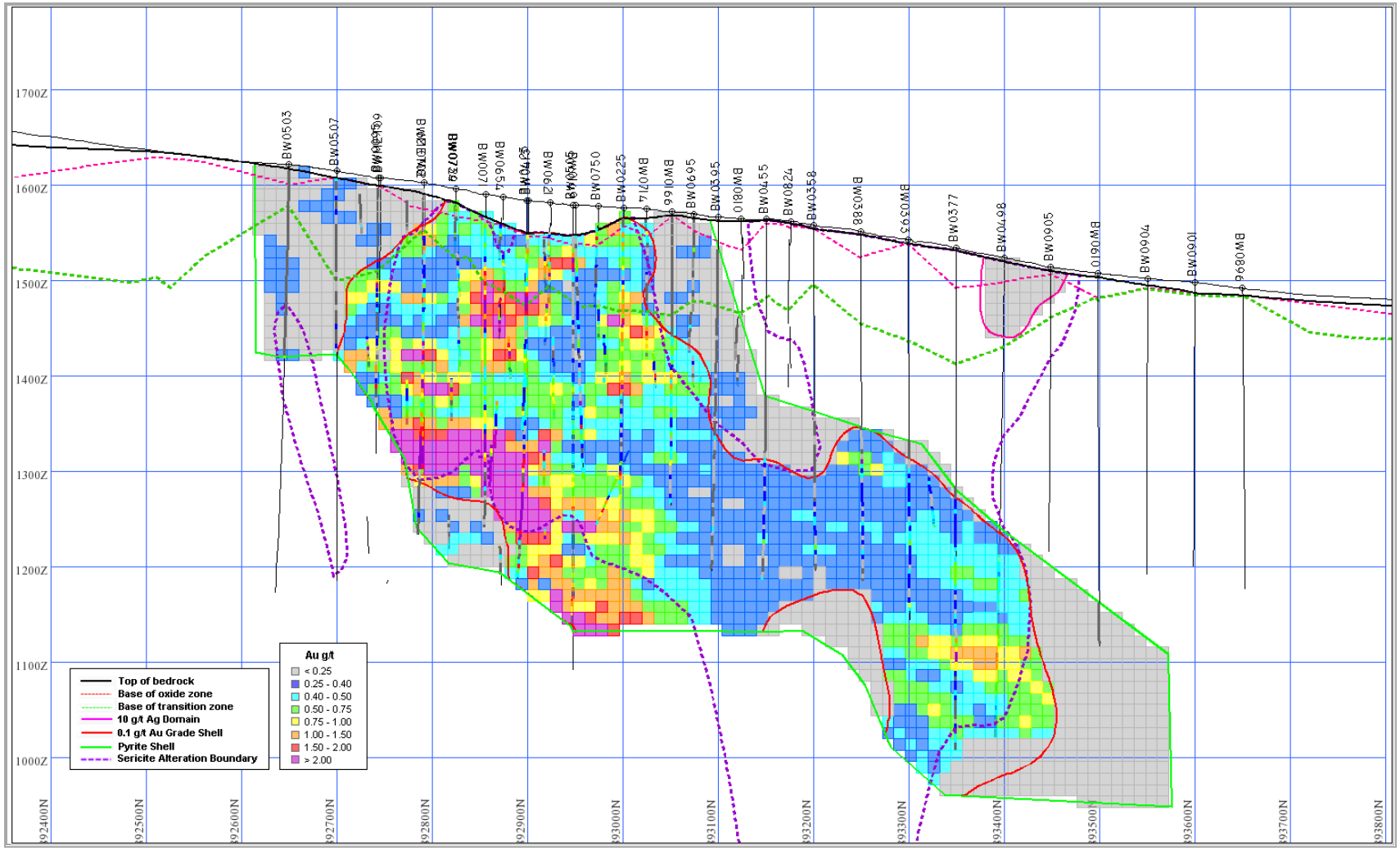


Figure 2.2.3-28: Gold Block Grade Distribution – Section 375000 E

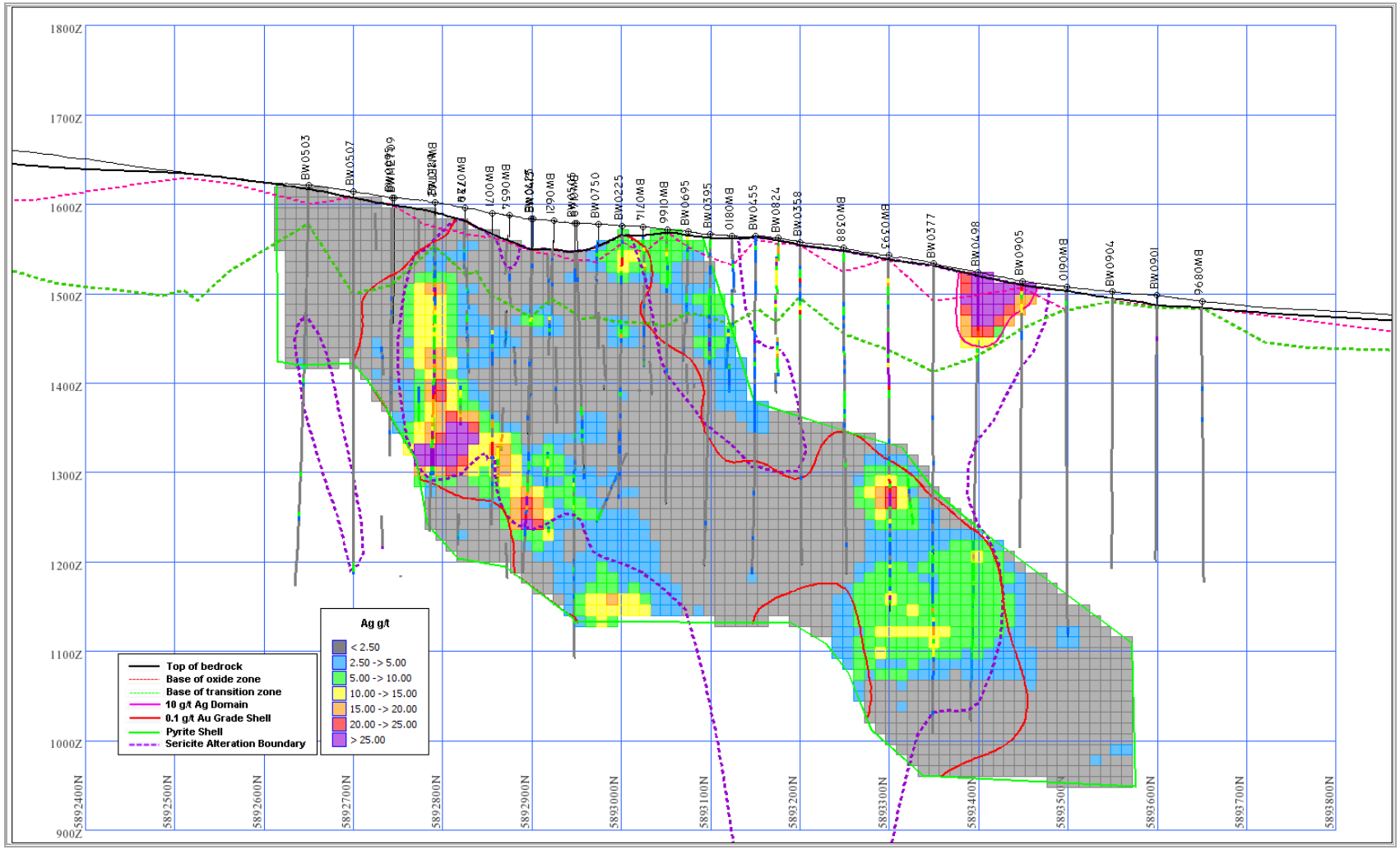


Figure 2.2.3-29: Silver Block Grade Distribution – Section 375000 E

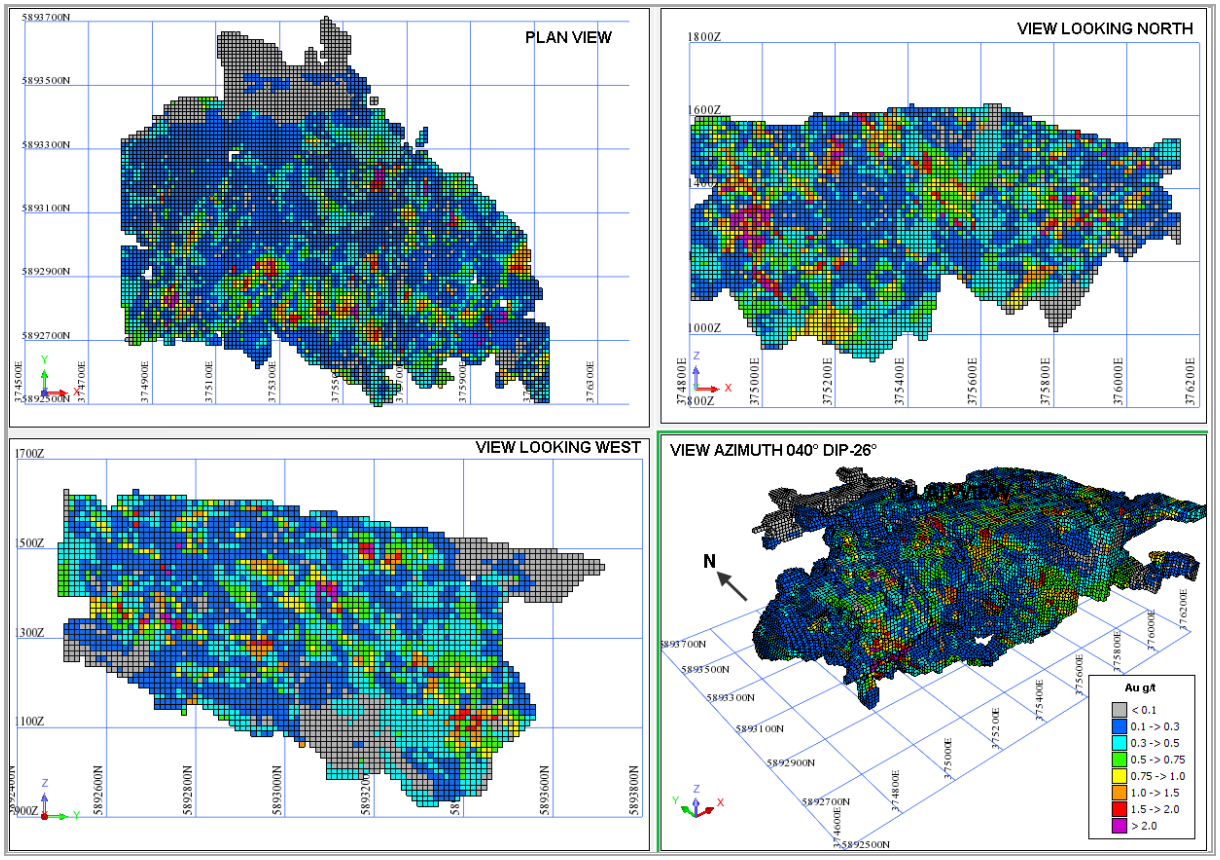


Figure 2.2.3-30: Gold Block Grade Distribution

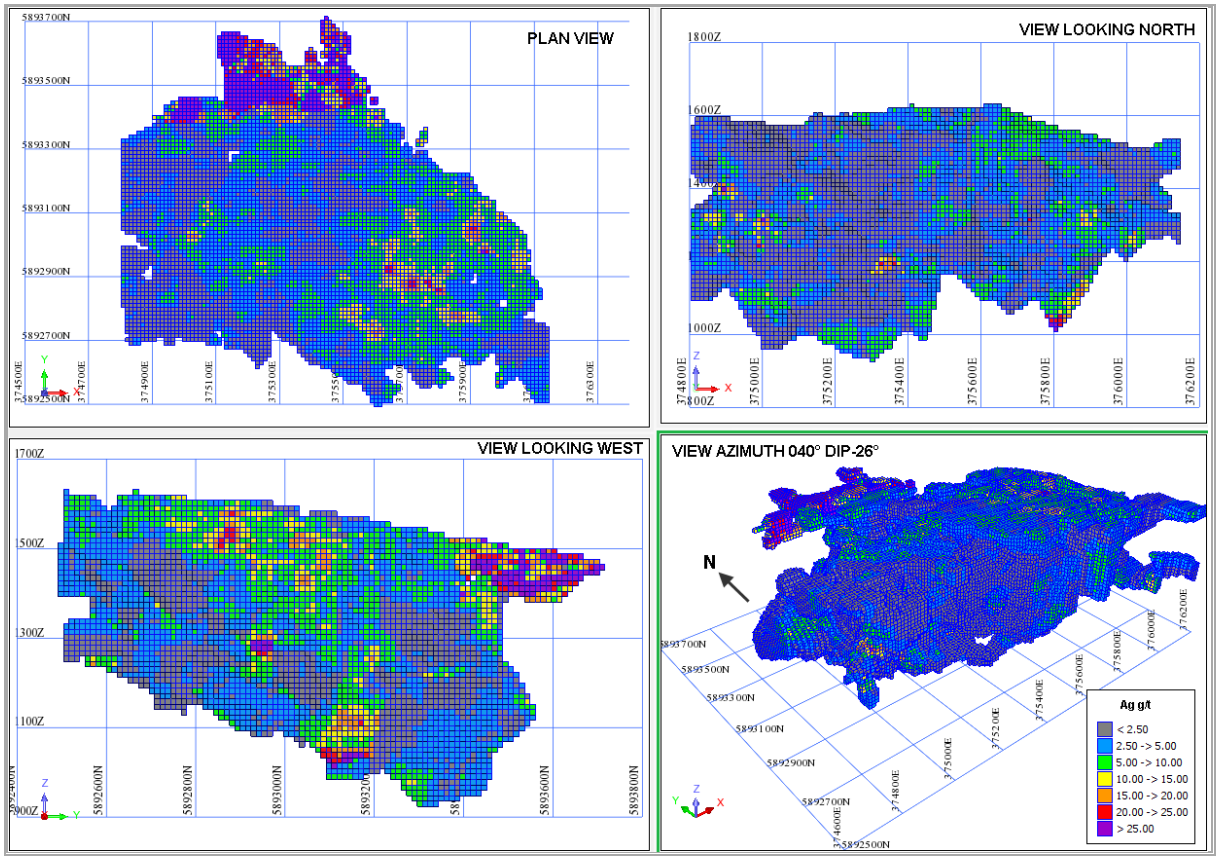


Figure 2.2.3-31: Silver Block Grade Distribution

2.2.3.1.15 Resource Classification

2.2.3.1.15.1 Definitions

Resource classifications used in the FS conform to the following definitions from NI 43-101 (New Gold, 2014).

Blocks were assigned preliminary classifications based on drill hole spacing. Blocks falling within the 25 m x 25 m drill hole spacing pattern were assigned a tentative Measured classification. Blocks not meeting these conditions were classified as Indicated if they were within the area drilled with 50 m x 50 m spacing. All other estimated blocks were assigned to the Inferred category.

For Measured mineral resources, blocks falling outside a 0.2 g/t AuEq grade shell were downgraded to Indicated because continuity of economic grades outside the grade shell cannot be demonstrated.

Blocks falling within the high-grade silver grade shell were classified as Indicated and Inferred categories using a nominal drill-hole spacing of 50 m.

A smoothing algorithm was used to remove isolated Measured blocks within areas of Indicated blocks, isolated Indicated blocks within areas of Measured, Indicated blocks within areas of Inferred, and isolated blocks of Inferred within areas of Indicated.

Block classification is illustrated on **Figure 2.2.3-32** to **Figure 2.2.3-34**.

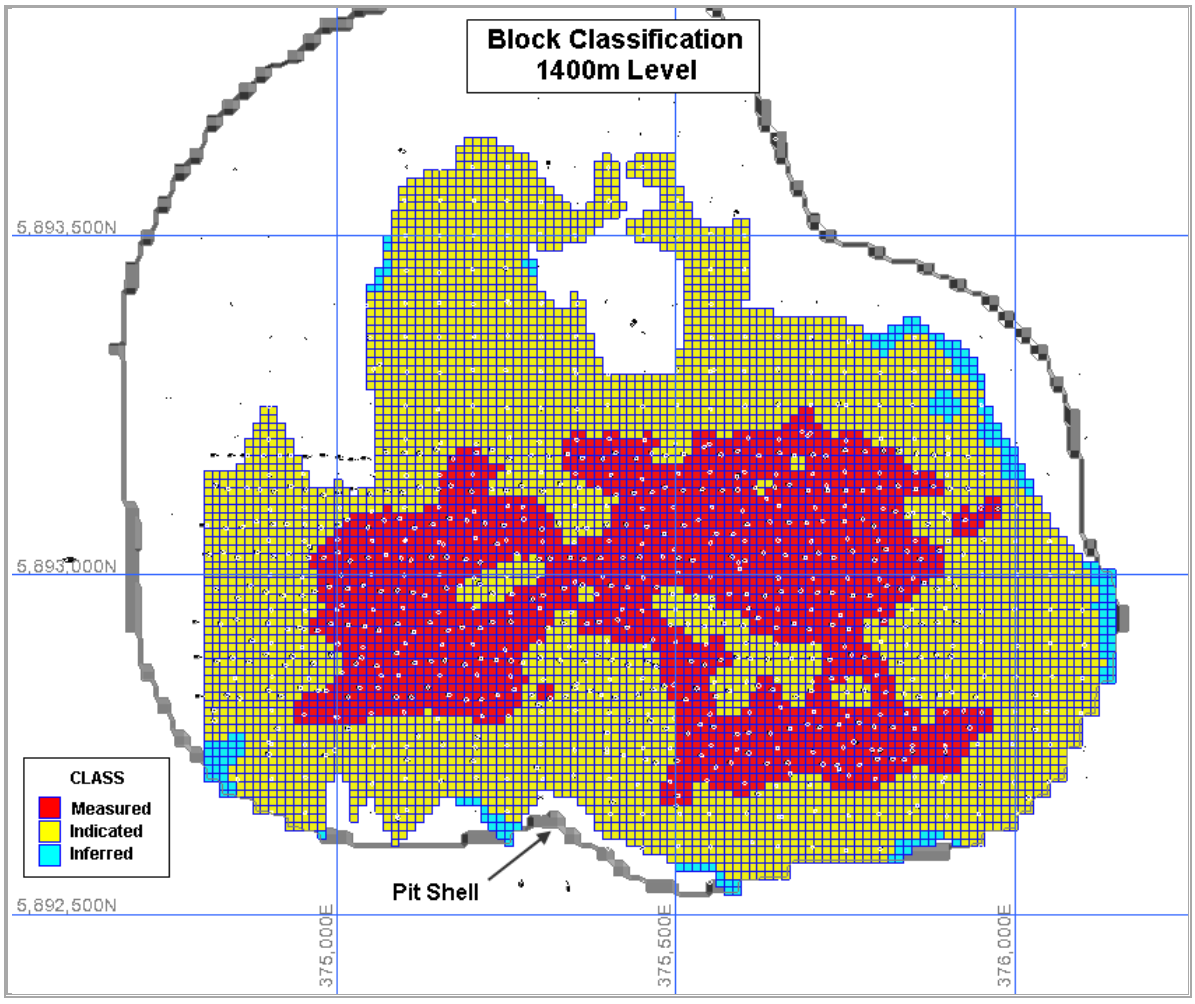


Figure 2.2.3-32: Block Classification – Plan View

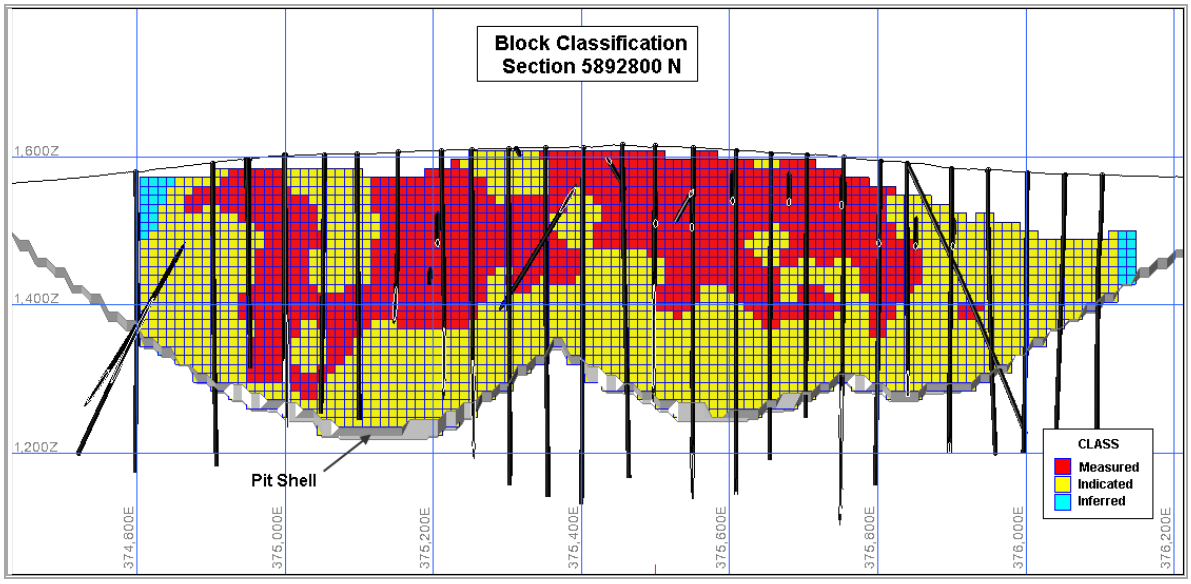


Figure 2.2.3-33: Block Classification – Section 5892800 N

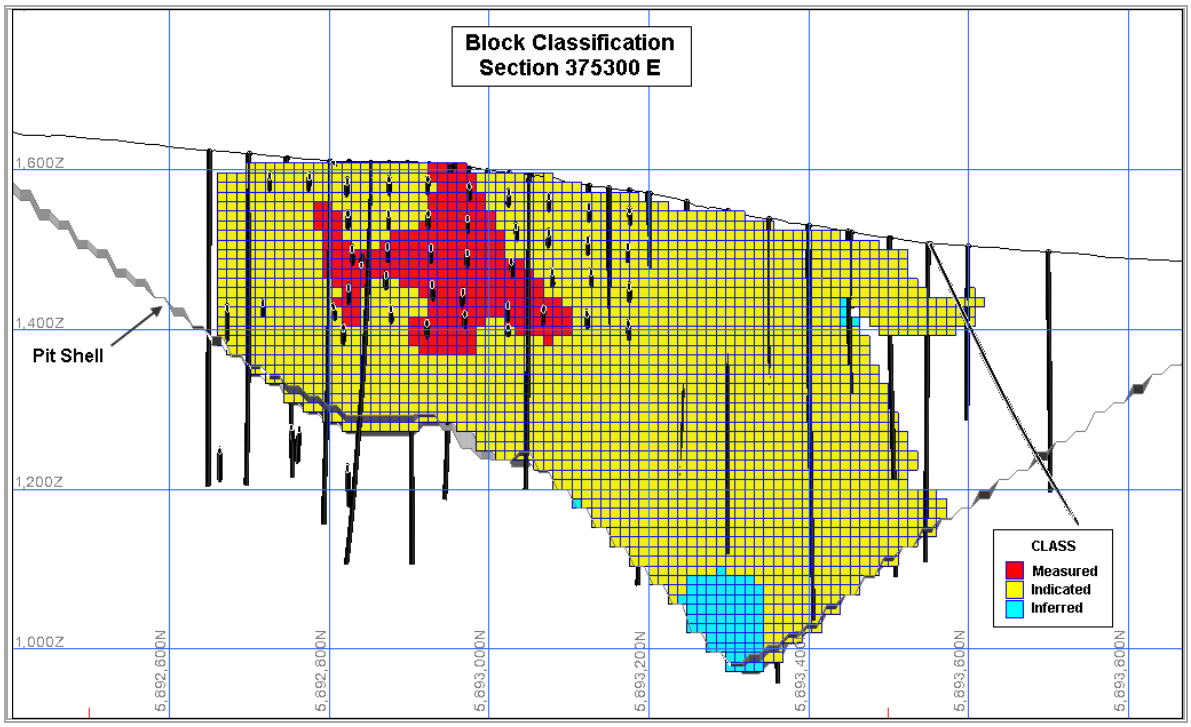


Figure 2.2.3-34: Block Classification – Section 375300 E

Measured, Indicated, and Inferred resources are listed in **Table 2.2.3-6**.

Table 2.2.3-6: Measured, Indicated, and Inferred Resources

Classification	Ore (kt)	Au (g/t)	In-Situ Au (kg)	In-Situ Au (koz)	Ag (g/t)	In-Situ Ag (kg)	In-Situ Ag (koz)
Measured	144,844	0.888	128,632	4,136	5.246	759,919	24,432
Indicated	199,601	0.629	125,569	4,037	5.672	1,132,116	36,398
Inferred (waste)	2,691	0.516	1,388	45	3.760	10,118	325

Note: g/t = grams per tonne; kg = kilogram; koz = thousand ounces; kt = thousand tonnes

2.2.3.2 Mine Plan

2.2.3.2.1 General Physiography and Geotechnical Setting

Knight Piésold Ltd. (Knight Piésold) carried out extensive geotechnical investigations at the Project site, to provide critical information for facilities siting and construction required for mining and processing ore, and handling mining wastes. This section summarizes Knight Piésold's investigations, and provides a detailed description of the geotechnical setting at the Project site. Geotechnical information pertaining to specific facilities is discussed under each of the facilities headings, i.e., open pit, waste rock, process plant site, and TSF including dams.

2.2.3.2.1.1 Physiography

The Project site is located on BC's Nechako Plateau, part of the Interior Plateau, east of the Coast Mountains (Coast Range), in an area of moderate relief characterized by gently undulating, northwest-trending hills cut by small- to medium-sized drainages. The Project elevation ranges from just over 1,000 masl—in low-lying areas northeast of the proposed mine site—to 1,800 masl at the summit of Mount Davidson, on the southwest side of the property. Mount Davidson is the highest peak in the Fawnie Range: the Blackwater deposit is on the mountain's northern flank. Most of the proposed TSF, waste dump, and mine site infrastructure areas lie within the Davidson Creek watershed, with the open pit and East Dump crossing into the catchment of Creek 661.

The Davidson Creek valley is incised locally and flows northeast from the site toward Chedakuz Creek downstream of Tatelkuz Lake. Creek 661 flows to Tatelkuz Lake. The footprint of the proposed TSF lies within the upper reaches of the Davidson Creek catchment. Terrain within this footprint is gently inclined, except along the incised portions of Davidson Creek. These areas are between the site of the proposed Site C Main Dam and the Site D Main Dam, where the slopes adjacent to the drainage are moderately to moderately steeply inclined (**Figure 2.2.2-1**).

2.2.3.2.1.2 Regional Geomorphology

The surficial deposits in the Project area are from the Fraser Glaciation, the last glacial period in BC. The Cordilleran ice sheet covered the Interior Plateau between approximately 20,000 and 12,000 years ago, reaching elevations of 2,500 masl. At the last glacial maximum in the Project area, localized ice flowed toward the northeast, as evidenced by drumlins, eskers, and other streamlined glacial landforms.

Deglaciation commenced approximately 15,000 to 16,000 years ago, with an ice-frontal retreat to the west and southwest toward the Coast Mountains. Rather than retreating, glacial ice appears to have stagnated in the Davidson Creek valley during late deglaciation, with downwasting producing ice-stagnation landforms such as kettles and kames. Further evidence for ablation is seen in the pattern of ice-margin and subglacial meltwater channels: areas of higher elevation near the mine site became ice-free before the lower elevations. A large volume of glacial meltwater was channelled along Davidson Creek and other valleys in the area, producing eskers and meltwater channels.

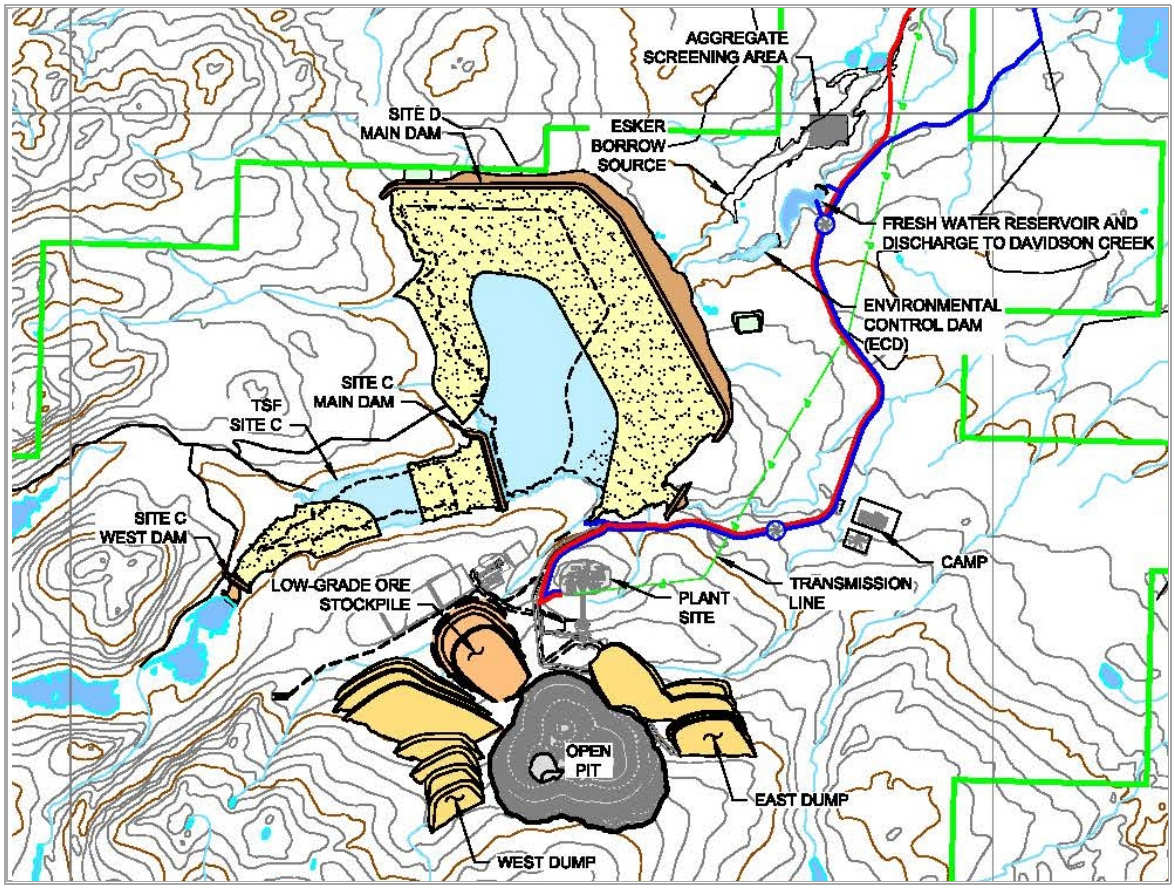
Geomorphological evidence of glaciation suggests that at the height of the Fraser Glaciation, the ice elevation exceeded 2,500 masl, higher than the tallest peaks in the region. An estimated 80% of the surficial sediments in the Davidson Creek valley are classified as lodgement glacial till (Mate and Levson, 2000), with the other 20% are ablation till, glaciofluvial, glaciolacustrine, fluvial, and organic materials. Glacial till in the region ranges up to 100 m in thickness; it is extremely rare to encounter large areas of naturally exposed bedrock outcropping (Levson et al., 1995). Uncommon ablation till is predominantly found at higher elevations on the valley sides, while dominant deposits of lodgement till are found in the valley basin.

2.2.3.2.1.3 Site Investigations

In 2012 and 2013, Knight Piésold conducted an evaluation of the geotechnical and hydrogeological conditions of the Project site, through extensive site investigation programs. These programs support engineering studies for the proposed tailings and water management systems, process plant site, and other mine site infrastructure in the Davidson Creek watershed, and for the open pit design on the slopes of Mount Davidson. A number of technical reports were prepared from geotechnical studies and are available upon request from the Proponent:

- Knight Piésold Open Pit Slope Design Report (**Appendix 2.2A-9** – 2 volumes);
- Knight Piésold Plant Site Geotechnical Design Report;
- Knight Piésold 2012 and 2013 Geotechnical Site Investigation Reports; and
- NorWest Feasibility Level Mine Study.

Figure 2.2.3-35 shows the proposed mine site general arrangement.



Source: New Gold, 2014

Figure 2.2.3-35: Mine Site General Arrangement

Knight Piésold's 2012 and 2013 investigations were conducted in phases, and extensive geological, hydrogeological, and geotechnical data were collected. No geotechnical or hydrogeological information had been available before that time. Drill hole, ground geophysics, and test pit locations were adjusted as the program progressed and site conditions became better understood. The 2012 and 2013 site investigations included:

- Excavating 305 test pits to investigate near-surface material characteristics and foundation conditions;
- Drilling 27 geotechnical holes using ODEX™ drilling techniques, with standard penetration tests (SPTs) in the surficial materials, and diamond drill coring (HQ3) with packer permeability tests in bedrock;
- Drilling 67 geotechnical holes using sonic drilling;
- Drilling 16 geotechnical holes in the open pit using geomechanical logging techniques;

- In-situ packer hydraulic conductivity testing (Lugeon single packer), permeability tests during rock mass drilling in ODEX™ drill holes, and geomechanical open pit investigations;
- Installing 21 standpipe piezometers and five vibrating-wire piezometers in select geotechnical drill holes to investigate static groundwater levels and evaluate the rock mass permeability in the TSF area;
- Installing multiple vibrating wire piezometers in 12 observation holes and 12 geomechanical drill holes in the open pit;
- Installing 28 monitoring wells developed for long-term groundwater quality monitoring;
- Conducting 34 response tests in the screened completion zone of standpipe piezometers and monitoring wells;
- Conducting down-hole seismic surveys at five process plant site drill holes;
- Laboratory testing of surficial materials and rock core samples to determine geotechnical parameters for the different types of materials encountered;
- Rock strength laboratory testing on selected representative core samples, to evaluate strength properties and verify rock mass classification;
- Completing 35.3 km of seismic refraction surveys, to develop profiles of subsurface bedrock and the saturated water table elevations;
- Completing 5.2 km of high-resolution resistivity and IP profiling to develop bedrock and the saturated water table profiles; and
- Two pumping wells to assess hydrogeology in the open pit.

Table 2.2.3-7 summarizes the number of geotechnical drill holes, test pits, and soil index tests completed at each main location. The 2012 and 2013 drill hole locations are shown in a simplified general arrangement of the overall Project site on **Figure 2.2.3-36**, and the test pit locations are shown on **Figure 2.2.3-37**.

Table 2.2.3-7: Summary of 2012 and 2013 Site Investigations

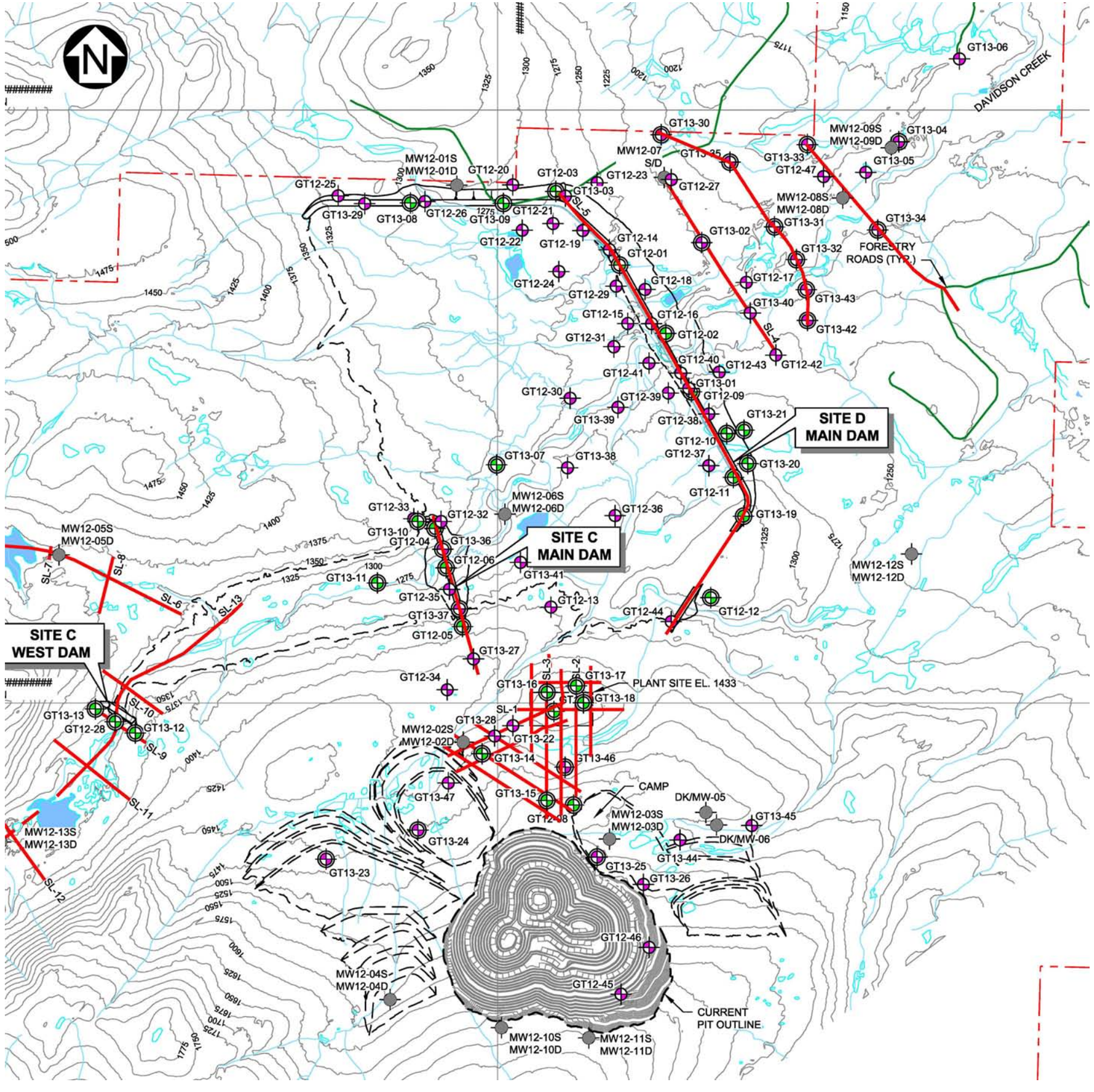
Area	Infrastructure	No. of Drill Holes	No. of Test Pits	No. of Soil Index Tests[1]
Site D	Site D Main Dam	24	24	61
	Site D Basin	17	68	106
	Downstream of Site D Dam	13	41	93
Site C	Site C Main Dam	11	8	46
	Site C Basin	1	9	3
Site C West Dam	Site C West Dam	3	8	8
Process Plant Site	Process Plant	7	46	37
	Coarse Ore Stockpile	1	-	2
	Truck Shop	1	5	4
ECD	Environmental Control Dam	6	5	61
Waste Dump	West Dump	3	23	33
	East Dump	4	7	36
General Characterization/ Borrow Areas	Geotechnical Characterization	3	60	13
Open Pit		30[2]	-	50
Total		**124**	**304**	**553**

Note: [1] Soil index testing includes the following tests: Particle size analysis, hydrometer, Atterberg limits, and natural moisture content.
[2] Open pit drill holes included the following drilling techniques: 2 overburden drill holes, 16 geomechanical orientated drill holes, 2 pump wells, and 11 observation drill holes.
ECD = Environmental Control Dam

2.2.3.2.1.4 Stratigraphy of Surficial Materials and Bedrock

Dr. John Clague, P.Geo. of the Department of Earth Sciences at Simon Fraser University, developed a surficial material geomorphology model of the Project area from the results of the 2012 and 2013 site investigation programs, and a technical review of the 2012 terrain assessment. Stratigraphy of the surficial materials and bedrock from surface downward is as follows:

- Holocene deposits;
- Fraser glaciation:
  - glaciofluvial deposits;
  - glacial till deposits; and
  - glaciolacustrine deposits.
- Interglacial fluvial deposits;
- Older glacial deposits (predominantly glacial till from an earlier period of glaciation);
- Reworked regolith (reworked, completely weathered bedrock);
- In-situ regolith (completely weathered bedrock); and
- Intact bedrock.



Legend

- GEOTECHNICAL SONIC DRILLHOLE (50)
- GEOTECHNICAL SONIC DRILLHOLE WITH PIEZOMETER (16)
- GEOTECHNICAL ODEX DRILLHOLE WITH PIEZOMETER (28)
- MW12-01 MONITORING WELLS (30)
- EXISTING ROAD
- SEISMIC LINES (32.08 km)
- NEW GOLD PROPERTY BOUNDARY

Source
Knight Piésold Engineering and Environmental Services
http://www.knightpiesold.com/en/

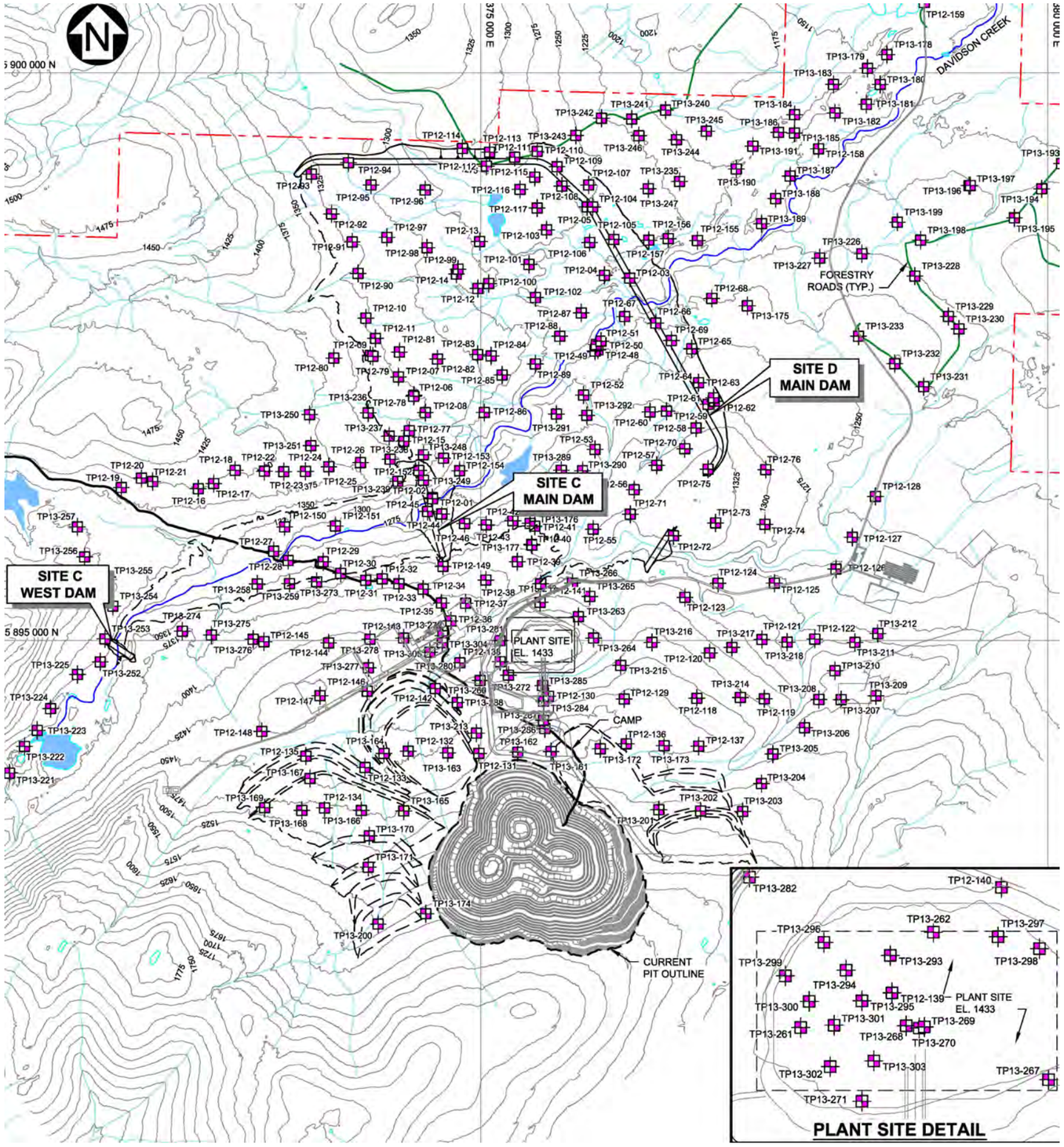
CLIENT: newgold™

PROJECT: Blackwater Gold Project

Drilling Location Plan for 2012 and 2013 Site Investigations

DATE: May, 2014	ANALYST: KP	**Figure** 2.2.3-36
JOB No: VE52420	QA/QC: WR	PDF FILE: Drilling Location Plan.pdf
AI FILE: Drilling Location Plan.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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Legend

- TP-174 — TEST PITS
- EXISTING ROAD
- NEW GOLD PROPERTY BOUNDARY

Source
Knight Piésold Engineering and Environmental Services
http://www.knightpiesold.com/en/

CLIENT: newgold™

PROJECT: Blackwater Gold Project

Tests Pit Location Plan for 2012 and 2013 Site Investigations

DATE: May, 2014	ANALYST: KP	**Figure** 2.2.3-37
JOB No: VE52420	QA/QC: WR	PDF FILE: Tests Pit Location Plan.pdf
AI FILE: Tests Pit Location Plan.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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Distribution of the surficial materials at the Project site is illustrated on **Figure 2.2.3-38**, and the material geotechnical properties are summarized in **Table 2.2.3-8**.

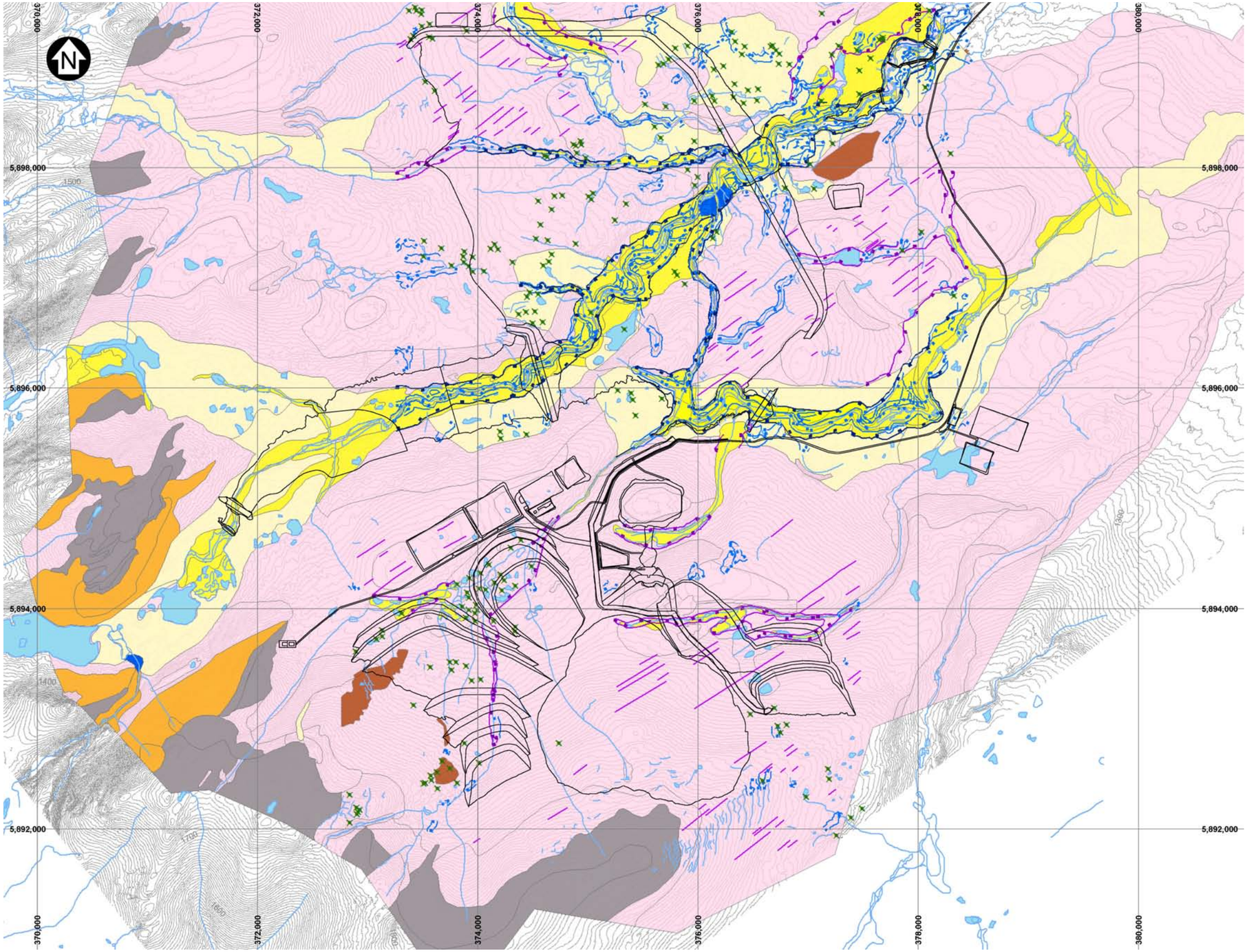
Foundation conditions and soil properties for on site facilities are discussed under each of the facilities:

- Waste rock dumps: **Sections 2.2.3.2.9 and 2.2.3.3.4.5**;
- Topsoil will be placed in two small stockpiles south of the plant site and east of Dam D; slopes will be stabilized by seeding;
- LGO stockpile: **Section 2.2.3.2.11**;
- Plant site: **Section 2.2.3.3.3.10**;
- Process buildings: **Section 2.2.3.3.4**; and
- TSF and embankments: **Section 2.2.3.3.4.8**.

2.2.3.2.1.5 Holocene Deposits

The Davidson Creek watershed comprises meandering streams and wetlands. Floodplains contain deposits of fine sands, silts, and organic material. Valley bottom landscapes are dominated by marshes and shallow lakes filled with organic sediments formed from decaying marsh vegetation. Peat accumulations occur where drainage was restricted during the postglacial period.

Peat deposits will need to be stripped from the tailings embankment footprint areas. Peat and other geotechnically unsuitable surficial materials excavated from the embankment footprint(s) will be stockpiled in stable configurations and retained for use in reclamation and closure activities.



Legend

- KAME
- RIVER/CREEK
- CONTOUR (5m)
- FLUTING
- INCISED MELTWATER CHANNEL
- MAJOR MELTWATER CHANNEL
- MELTWATER CHANNEL
- PRO-GLACIAL MELTWATER CORRIDOR
- SUB-GLACIAL MELTWATER CORRIDOR
- GLACIOFLUVIAL DEPOSITS (CHANNELIZED)
- GLACIOFLUVIAL DEPOSITS (NON-CHANNELIZED)
- LODGEMENT TILL
- ABLATION TILL
- GLACIOLACUSTRINE
- COLLUVIUM DEPOSITS
- BEDROCK
- LAKE
- PROPOSED MINE FACILITY

Source
Knight Piésold Engineering and Environmental Services
http://www.knightpiesold.com/en/

CLIENT: newgold™

PROJECT: Blackwater Gold Project

Surficial Materials

DATE: May, 2014	ANALYST: KP	**Figure** 2.2.3-38
JOB No: VE52420	QA/QC: WR	PDF FILE: 38 Surficial Materials Map.pdf
AI FILE: 38 Surficial Materials Map.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

\\Bby-fs2\bby-ee-gis\GIS\Projects\VE\VE52095_Richfeld_Blackwater\Mapping\Other\ProjectDescription\KP\38 Surficial Materials Map.mxd

Table 2.2.3-8: Surficial Material Geotechnical Properties

Surficial Material Type		Glacial Till Deposits	Glaciofluvial Deposits – High Energy	Glaciofluvial Deposits – Low Energy	Glaciofluvial Esker Deposits	Glaciolacustrine Deposits	
Laboratory Testing		**Sandy Silt to Silty Sand with Some Gravel**	**Coarse Grained Sand and Gravel with Some Fines**	**Sand with Some Silt and Trace Gravel**	**Sand and Gravel with Some Cobbles**	**Sandy Silt to Silt**	**Completely Weathered Bedrock**
Particle Size Analysis	Gravel	25%	46%	7%	52%	3%	13%
	Sand	41%	37%	71%	39%	21%	45%
	Silt	27%	14%	19%	8%	62%	32%
	Clay	7%	3%	3%	0%	13%	10%
Moisture Content %	Natural	1 – 26 (11)	2 – 28 (9)	8 – 23 (15)	4 – 8	6 – 36 (18)	4 – 32 (17)
Atterberg Limits for <200# Sieve	Liquid Limit	8 – 44 (24)	13 – 39 (24)	12 – 39 (24)		9 – 67 (28)	11 – 60 (33)
	Plastic Limit	5 – 31 (15)	6 – 29 (15)	7 – 32 (20)		6 – 33 (19)	7 – 32 (17)
	Plasticity Index	0 – 33 (9)	NP – 28 (9)	NP – 16 (8)		NP – 43 (11)	3 – 33 (17)
Seismic	Refraction Velocities	2,000 – 2,300 m/s	200 – 800 m/s	200 – 800 m/s			1,900 – 2,500 m/s
Specific Gravity	Specific Gravity	2.7 – 2.8					
Pinhole Dispersion Test						Slightly dispersive	
X-Ray Diffraction						90% smectite at -2 µm fraction	
Compaction Testing (Std. Proctor)	Maximum Dry Density	2,008 – 2,158 kg/m^3	2,015 – 2,090 kg/m^3				
	Optimum Moisture Content	7% – 11%	9% – 10%				
Compaction Testing (Mod. Proctor)	Maximum Dry Density	2,028 – 2,286 kg/m^3	2,159 kg/m^3				
	Optimum Moisture Content	10% – 11%	8.6%				
Triaxial Testing	Cohesion (c)	13 kPa					
	Friction Angle (Ø)	37°					

Surficial Material Type		Glacial Till Deposits	Glaciofluvial Deposits – High Energy	Glaciofluvial Deposits – Low Energy	Glaciofluvial Esker Deposits	Glaciolacustrine Deposits	
Laboratory Testing		**Sandy Silt to Silty Sand with Some Gravel**	**Coarse Grained Sand and Gravel with Some Fines**	**Sand with Some Silt and Trace Gravel**	**Sand and Gravel with Some Cobbles**	**Sandy Silt to Silt**	**Completely Weathered Bedrock**
Permeability Laboratory Test	Constant head	10^{-7} – 10^{-11} m/s					
	Falling head	10^{-6} – 10^{-8} m/s					
Bulk and Dry Density	Moisture Content	7% – 11%					
	Dry Density	1,789 – 2,417 kg/m^3					
	Bulk Density	2,061 – 2,622 kg/m^3					

Note: Moisture Content and Atterberg Limits results in brackets (12) are the average; NP = Non-plastic; Values in brackets signify weighted average
kg/m^3 = kilograms per cubic metre; % = percent; m/s = metres per second.

2.2.3.2.1.6 Fraser Glaciation Deposits

2.2.3.2.1.6.1 Glaciofluvial Deposits

Glaciofluvial deposits—including eskers, kames, kettles, and meltwater channels—consist predominantly of coarse-grained sand and gravels with trace fines and cobbles. Three types of glaciofluvial deposits have been defined:

- High-energy glaciofluvial deposits (GW-GP, SW-SP) – These were formed by meltwater runoff from the advancing and retreating ice sheet and within subglacial cavities and channels. They were encountered in the hummocky kame topography and were formed from non-channelized glaciofluvial deposits. The kame deposits have a significant proportion of silt and are inferred to have lower permeability than channel deposits. Kame deposits of various thicknesses occur around Davidson Creek in areas of shallow relief above the creek valley. Meltwater channel deposits form terraces between 10 m and 18 m thick on either side of Davidson Creek. The deposits contain coarse-grained sand and gravel with some fines; 43% of samples tested had more than 15% fines fraction content (silt and clay);
- Low-energy glaciofluvial deposits (GM-GL, SM-SL) – These are fine-grained meltwater channel deposits, and are uncommon on site. They are classified as sand with some silt and trace gravel; 29% of samples tested had less than 15% fines; and
- Glaciofluvial esker deposits (GW-GP) – These extend north in the Chedakuz valley and on the western margin of the Top Lake valley as it cuts through the Fawnie Range. The depositional pattern suggests they were formed subglacially as meltwater flowed out of the Top Lake valley. The materials are well-graded, coarse-grained sand and gravels with trace fines, and had the lowest proportion of fines (200 mesh) of all surficial materials in the area.

2.2.3.2.1.6.2 Glacial Till Deposits

Glacial till deposits are the dominant surficial material in the region, and consist of compact to very dense lodgement till with uncommon loose-to-compact ablation till. Glacial till thickness is variable, ranging from a few to tens of metres. The material is predominantly hard and well-graded, stiff to very dense, sandy silt to silty sand, with some gravel and trace clay. These deposits also have subrounded to subangular cobbles and boulders. Lodgement till is dense or stiff, and contains a high percentage of fines (silt and clay) that greatly lower the permeability. Ablation till is less dense and may contain fewer fines. However, this distinction is hard to distinguish in Platea silt loam (PSA) results, and easier to identify in landform mapping. Lodgement till is the dominant material in the Davidson Creek watershed valley basin, and ablation till is found in a few locations at higher elevations on the valley sides.

2.2.3.2.1.6.3 Glaciolacustrine Deposits

Glaciolacustrine sediments (ML-CL) were identified in most of the drill holes in the TSF basin, and northeast of the TSF Site D Dam up to 20 m thick. They consist of massive silts with trace clay,

sand, and poorly graded gravel. Glaciolacustrine layers consistently lie below (underneath) the Fraser glacial till deposits. Glaciolacustrine sediments were deposited locally in an ephemeral lake that formed between the advancing Cordilleran ice sheet and higher ground to the west and south. Sediment-laden meltwater flowing along the margin of the ice sheet entered the lake, and silt-sized particles settled out of suspension onto the lake bed. The lake was then overridden by the advancing ice sheet, which ended glaciolacustrine deposition and compacted the deposits. The glaciolacustrine deposits are very dense, massive sandy silt, and did not exhibit any finely laminated layers or weaker clayey laminations.

2.2.3.2.1.7 Interglacial Fluvial Deposits

During the “interglacial” period, Davidson Creek deposited fluvial sediments consisting of sands and gravels. An unconformity exists between the two glacial periods, as evidenced by localized, absent, or thin interglacial fluvial deposits in drill core from the Project site. Interglacials intervals resulted in deposition of a layer of permeable glaciofluvial material. This layer should be located sequentially overlying the Fraser glacial till, but in most of the drill holes it is absent. The absence of these deposits cannot be explained by subsequent glacial erosion, as the overlying glaciolacustrine sediments would have also been eroded. Localized, discontinuous lenses of glaciofluvial deposits indicate that Davidson Creek was a minor stream with limited extent during the interglacial period.

2.2.3.2.1.8 Older Glacial Till Deposits

An older glacial till deposit lies stratigraphically below the Fraser glacial deposit sequence, or locally below the interglacial deposits—composed of predominantly glacial till, with rare, interbedded glaciofluvial and glaciolacustrine deposits. These glacial deposits are similar in composition to the Fraser glacial till deposits and are indistinguishable by field description and laboratory particle size testing.

2.2.3.2.1.9 Reworked and In-situ Regolith

The older glacial sequence rests on reworked and in-situ regolith (i.e., a completely weathered bedrock horizon). The reworked and in-situ regolith ranges in thickness from a few metres to over 30 m. The regolith is thin or absent in topographically high areas, and thicker in low areas, indicating that the Davidson Creek watershed may have been shielded from glacial erosion. A wide range of gradation is observed, indicative of the various states of decomposition of the weathered bedrock. The original bedrock texture or fabric is evident in the majority of samples.

The boundary between the reworked and in-situ regolith is difficult to discern in all drill holes. The reworked regolith comprises poorly graded sediments containing abundant, weathered, bedrock clasts. It is presumed that gravitational processes and recorded landscape instability controlled the deposition, potentially during the onset of cold climatic conditions during the early Pleistocene, ca. 2.6 Ma. In-situ regolith is the deepest surficial material unit. The extent of weathering indicates a stable landscape with a humid, warm climate that persisted for potentially millions of years during the Pliocene and/or Miocene. The presence of this stratum is unusual in BC, as it is typically scoured by the process of glaciation.

2.2.3.2.1.10 Intact Bedrock

Intact bedrock exposure is rare and restricted to higher elevations in the Project area. Glacial surficial deposits vary from 40 m to 50 m thick at higher elevations to 108 m in the valley bottoms, and cover the bedrock almost everywhere. Two bedrock lithologies were encountered in the TSF area: an andesite from the Cenozoic Ootsa Lake Formation, and fragmental volcanics from Cretaceous volcaniclastics and flows.

The andesite and fragmental units are highly to moderately weathered to approximately 20 m depth, becoming slightly weathered below this. The andesite is a light-grey to purple-grey, fine-grained, porphyritic volcanic rock. The rock mass rating (RMR) and RQD were FAIR to GOOD, with intact rock strength ranging from medium strong to very strong (70 MPa to 275 MPa). The fragmentals unit encompasses felsic lapilli tuff, andesite breccia, and volcaniclastic rocks. The RMR and RQD of this unit were also FAIR to GOOD, with intact rock strength ranging from medium strong to very strong (60 to 189 megapascal [MPa]). Compressional wave velocities range from 2,550 metres per second (m/s) to 5,460 m/s and most exceed 3,500 m/s. Narrow isolated bedrock zones have lower velocities varying from 2,500 m/s to 3,460 m/s, and have been interpreted as shear or fault zones, which correlate with topographically low areas.

2.2.3.2.2 Mining General Description

2.2.3.2.2.1 Selection of Preferred Mining Method

Selection of a mining method and equipment configurations was based on a number of factors, including:

- Topography and site access;
- Desired production levels; and
- Project economics.

An evaluation of these factors and a review of the Preliminary Economic Assessment (PEA) (AMEC, 2012) led to the decision to use standard truck-shovel open pit mining.

2.2.3.2.2.2 Preferred Option

Conventional truck-shovel open pit mining methods will be employed for the Project. The mine is planned to produce 344 Mt of ore and 690 Mt of waste over its life. Material from the LGO stockpile will be reclaimed and processed for the last three years. Production will peak at 91 Mt/y, with a consistent plant feed of 21.9 Mt/y. The process plant is scheduled to produce a total of 7.1 Moz of Au and 30 Moz of Ag.

In the PEA, the base mill production was 60,000 t/d, or 21.9 Mt/y. Following the PEA, trade-off studies on production rate were conducted. Furthermore, Whittle Consulting Limited conducted a production optimization study. These studies evaluated production rates ranging from 30,000 t/d

to 75,000 t/d. Results showed that the best capital to cash-flow ratio and Net Present Value (NPV)[2] would be achieved with 60,000 t/d, an elevated cut-off grade strategy, and a stockpile limit of approximately 50 Mt.

2.2.3.2.3 Geotechnical Conditions – Open Pit

The open pit design is based on geomechanical data collected from three site investigation programs in 2012 and 2013, laboratory test results, the updated pit shell, and characterization of geological, rock mass structure, rock mass quality, and hydrogeological data. Open pit geotechnical conditions are based on a review of geomechanical information, stability analyses results, the mining equipment to be used, and experience from similar open pit operations in the Project region.

The geotechnical model for the proposed pit included five separate components:

1. Geology model: intercalated volcanic and volcaniclastic felsic to intermediate lapilli and ash tuff, volcanic breccia, and andesitic flows.
2. Alteration model: sericite in the centre of the deposit and POT alteration surrounding the deposit with an oxidized weathered zone encountered below the bedrock surface.
3. Structure model: several inactive fault zones and smaller-scale rock mass fabric and structural domains in the main, northwest, and southeast structural domain.
4. Rock mass characteristics model: RMR and RQD logging parameters.
5. Hydrogeology model: groundwater levels near surface in the upper southern slopes and artesian flows on the lower northern slopes. The competent rock mass has low to moderate permeability and a moderately steep groundwater drawdown cone. The broken zone areas have the potential to be a large-scale, high-permeability zone.

Three geotechnical domains were defined for the purposes of the slope stability analyses:

- Surficial material: Glacial till deposits predominantly range from 5 m to 20 m thick across the open pit. Surficial material thickness increases up to 110 m along the eastern side of the deposit;
- Broken zone: This domain is recognized in the RQD block model as zones with RQD of less than 40% and was encountered in all deposit rock types; and
- Competent rock: Defined as all zones with RQD greater than 40% and a rock mass quality of FAIR to GOOD.

[2] NPV is a way of comparing the value of money now with the value of money in the future. A dollar today is worth more than a dollar in the future, because inflation erodes the buying power of the future money, while money available today can be invested and will grow.

Pit phases are discussed in **Section 2.2.3.2.12** and illustrated in **Figure 2.2.3-43** to **Figure 2.2.3-48** and in **Appendix 2.2A-9**.

2.2.3.2.4 Pit Optimization

2.2.3.2.4.1 Pit Optimization Studies

The 3D block model the Proponent provided (19 March 2013) was used for development and evaluation of the Project pit shells. This section reviews the work carried out to develop detailed pit designs, starting with a discussion of the initial pit shell optimization process and the design parameters and constraints used.

A series of economic pit shells was created using the pit optimization tools in MineSight© by varying the base gold price of US$1,300/oz. For the base case, the selected pit shell was generated at 85% of the base gold price. Only Measured and Indicated resources were used in the pit optimization. In addition, a sensitivity analysis was carried out by generating a second suite of pit shells based on varied cost inputs and pit wall angles.

A gold price of $1,400/oz and silver price of $28/oz were used for actual resource estimation.

2.2.3.2.4.2 Pit Slope Design

The slope stability analyses for each pit design sector found few geotechnical controls for the pit slope design, other than rock mass failure through the broken zone and associated slope depressurization requirements. The achievable slope geometry is controlled by the location and extent of the broken zone for all phases of the proposed pit development. Site-specific geotechnical information has been used to characterize each geotechnical domain, to identify specific design sectors for both the proposed interim and final pits, and to develop the required slope design parameters.

The pit slope design parameters for all pit phases include:

- Surficial Material: Inter-ramp slope angles of 27° are recommended, with a maximum inter-ramp slope height of 30 m with 20 m wide step-outs;
- Broken Zone: Bench face angles of 60° and inter-ramp slope angles of 40° should be achievable. Maximum inter-ramp height should be limited to 150 m. Slope depressurization of up to 40 m will be required in these areas; and
- Competent Rock: Bench face angles of 70° and inter-ramp slope angles of 48° should be achievable. Maximum inter-ramp heights should be limited to 200 m. The competent rock domain will be stable without groundwater depressurization.

Exceptions to the above include:

- Southeast Sector: Overall slope angles for this sector should include flatter surficial material slopes. This sector has an extensive broken zone and will require greater slope depressurization to achieve the design inter-ramp angles;

- Southwest Sector: Structural controls in this sector limit the inter-ramp slope angles to 43° in the competent rock; and
- North Sector: The broken zone in this area may be over 200 m deep. This will require a shallower 35° inter-ramp slope angle with a 35 m step-out and extensive slope depressurization.

The open pit area has been divided into seven design sectors with overall slope angles as shown on **Figure 2.2.3-39**.Detailed information on pit slope design is provided in Knight Piésold Feasibility Open Pit Slope Design report attached in **Appendix 2.2A-9**. A summary follows.

2.2.3.2.4.2.1 Blasting Practices

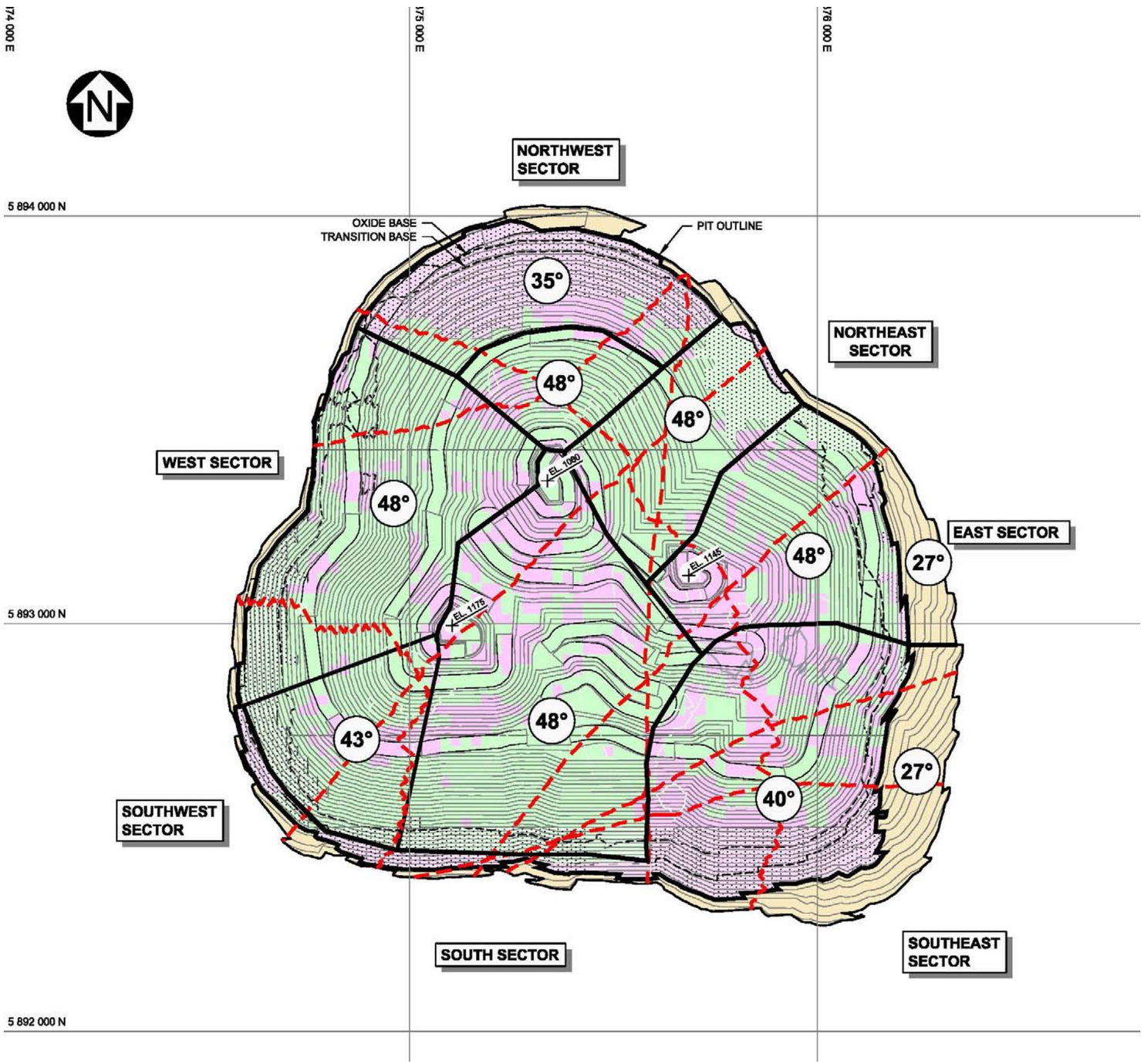
Slope instabilities at open pit mines are often triggered by the progressive deterioration of the wall face. Such deterioration starts with the detachment of small rock blocks (key blocks) defined by rock mass discontinuities. Under these circumstances, the preservation of rock mass integrity during mining will be critical for the development of the steepest possible pit slopes. Low damage controlled blasting methods will facilitate steeper final pit slopes where mechanical excavation is not possible or practical.

A “controlled production blasting” or “buffer blasting” practice will be used for Final pit wall development at the Blackwater Pit. Trial blasts are recommended wherever there is a substantial change in rock mass conditions. Detailed blasting patterns will be discussed in the next stage of study.

It is important that blast holes be staggered so the bottom of the hole does not intercept the crest of the bench below. Otherwise, highly fragmented bench crests will develop leading to considerable ravelling. Bench crest and face scaling will be conducted after blasting when equipment access is still available to these areas. Regular raveling and rock fall cleanup should be performed throughout the mining operations.

2.2.3.2.4.2.2 Pit Dewatering and Slope Depressurization

Groundwater dewatering within the pit walls is expected to occur as the pit excavation progresses. Slope depressurization will be required for all geology units in order to achieve the designed slope angle. The slope depressurization measures include in-pit and perimeter vertical pumping wells, as well as diversion ditches along the pit crest of the slopes. Pit dewatering and slope depressurization designs are discussed in the Open Pit Water Management Report (**Appendix 2.2A-10**).



Legend

- OVERBURDEN
- COMPETENT ROCK
- COMPETENT ROCK (INFERRED)
- BROKEN ZONE (RQD - POOR)
- BROKEN ZONE (INFERRED)
- DESIGN SECTOR

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 10 U.
2. RQD MODEL PROVIDED BY NEW GOLD, FEBRUARY 2013.
3. OVERBURDEN CONTOURS PROVIDED BY NEW GOLD, FEBRUARY 2013.
4. OPEN PIT DESIGN FROM NORWEST, FEBRUARY 2013.

Source
Knight Piésold Engineering and Environmental Services
http://www.knightpiesold.com/en/

CLIENT: newgold™

PROJECT: Blackwater Gold Project

Pit Slope Recommendations

DATE:	ANALYST:	Figure 2.2.3-39
May, 2014	KP	
JOB No: VE52420	QA/QC: WR	PDF FILE: PitSlope.pdf
AI FILE: PitSlope.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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The open pit depressurization system has been designed for the “best estimate” of required pumping. The well installations will be required to intersect productive fracture systems and be functional. The drilling and development of successful and useful dewatering wells can be highly variable in bedrock and wells with insufficient yield will need to be replaced. Ongoing observations and results from the slope depressurization system will be actively monitored.

If critical dewatering wells become inoperable during mining activity due to incorrect blasting practices, unforeseen slope deformations, or other reasons then an investigation determining the cause of failure will be completed. Replacement dewatering wells will be installed if ensuing investigations indicate that it is critical for ongoing high wall stability. Pore pressure conditions will adversely influence pit slope stability in areas where the Broken Zone is present, and therefore it has been assumed that backup dewatering wells will be required in select areas.

2.2.3.2.4.2.3 Geotechnical Monitoring

Pro-active geotechnical monitoring for all stages of pit development will be undertaken. The monitoring program will be implemented as a staged approach and include detailed geotechnical and tension crack mapping, as well as a suitable combination of surface displacement monitoring (surface prisms and wire extensometers) and piezometers. All seeps and springs will be inspected, mapped and photographed. Large-scale structures will be characterized and monitored as they have the potential to develop into tension cracks.

Vibrating wire piezometers (VWPs) were installed in all geomechanical drill holes except GM12-12 due to artesian conditions within the drill hole. Details of the VWP installations are provided in the Feasibility Open Pit Slope Design Report (**Appendix 2.2A-9**). VWPs were installed in each of the observation wells to obtain hydraulic head measurements within the proposed open pit area. Five VWPs were installed in each observation well along the southern pit wall and three VWPs were installed in each observation well in the remainder of the deposit area. The existing VWPs (72) will be used for monitoring of groundwater conditions during early construction.

2.2.3.2.4.2.4 Wider Bench below Overburden Slope

Twenty metre wide stepouts will be placed in the overburden slopes and 35 m wide stepouts/haul ramps will be placed in the bedrock slope just below the overburden contact to provided additional capacity for containment of ravelling materials due to weathering.

2.2.3.2.4.2.5 Bench Mapping

Bench mapping is especially important during initial pit development to give quality structural information. Drillhole orientation data have shadow zones, noise, and cannot be characterized as to persistence, planarity and aperture as compared to detailed bench mapping. Additionally, orientations are more difficult to capture in poor quality rock masses, which has implications for data uncertainty in the Broken Zone. Bench mapping will take the form of cell mapping to capture discontinuity parameters in statistically valid ways. Kinematic stability analyses will be revised as these new data are developed, which will permit the quantification of shear modes likely to be

found in the pit walls. Rock mass characterization will be applied to all exposed benches in conjunction with discontinuity mapping.

2.2.3.2.4.2.6 Initial Broken Zone Excavations

Studies of the Broken Zone during Phase 1 pit development will give a better understanding of the rock mass quality of this zone. There is currently a lack of data in some areas due to difficulties in obtaining reliable parameters from the broken core retrieved in the drillholes. Opportunities to develop trial pit walls at steeper bench faces and for steeper inter-ramp angles will be evaluated as this may allow for steeper pit walls in later pit development phases, particularly in the North and Southeast walls. This will require increased monitoring efforts and may result in an increased risk to interruption of mining operations due to potential multi-bench instabilities.

2.2.3.2.5 Haul Roads

Dozers will pioneer mine service roads as single-lane, 15-m wide, balanced cut/fill accesses with a collector ditch and soil salvage windrowed upslope locally. Where appropriate, double lanes will be constructed. Surfacing material will be sourced locally when available; otherwise, suitably sized waste rock from the pit will be used.

The existing exploration road network can e incorporated into the pit's access development. In areas where rock outcrops are present, drilling and blasting will be required ahead of road construction. During the pre-development stage, access road construction will likely be carried out following the spring melt and high runoff period.

The access roads will be expanded into mine haul roads, and subsequently widened as required, by means of end-dumping with suitable NAG4 or NAG5 waste rock from the pit (refer to **Section 2.2.3.4** for geochemical characterization of waste rock). Most of the mine haul roads will be built on relatively gently sloping terrain, where the design width will allow for a berm on either side of the road and a drainage ditch on the upslope side. In areas of upslope cut, only a single berm on the downslope side is required. Areas where road fill is less than 3 m high do not require a berm. Mine haul roads have been designed in accordance with the following criteria, which meet BC mine regulatory requirements. The haul road widths are based on a 290-ton (930E-4SE) size haul truck with a width of 8.7 m:

- One-way haul – 2 times maximum truck width + berm + ditching = 29 m;
- Two-way haul (in pit) – 3 times maximum truck width + berm + ditching = 37 m;
- Two-way haul (ex-pit) – 3 times maximum truck width + berms + ditching = 40 m;
- Berms designed at ¾ maximum wheel height (2.7 m berm height);
- Target maximum grade for all ex-pit haul road designs = 8%;
- Target maximum grade for all in-pit haul road designs = 10%;
- Maximum grade for all haul road designs = 10%;

- Ditches incorporated into road designs as required;
- Road fills placed at 37°; and
- Ex-pit road cuts at 2H:1V in overburden and 45° for rock cuts up to 30 m.

2.2.3.2.6 Ore/Waste Parameters

In-situ dry density values for ore and waste rock were included in the geologic block model (based on testwork carried out on rock samples from site). In-situ overburden density in the block model was not used because updated information was available.

The in-situ dry density averages 2.70 t/m³ for rock and 2.10 t/m³ for overburden.

In addition to separating ore and waste based on grade, waste materials were classified according to their neutralization potential ratio (NPR) and Zn content. **Table 2.2.3-9** shows the waste classifications used. PAG1 and PAG2 are classified as PAG and require special handling, while NAG3 to NAG5 and overburden are classified as NAG. NAG3 waste rock is defined as potentially metal leaching and also requires special handling.

Table 2.2.3-9: Waste Classifications

Classification	Neutralization Potential Ratio	Zinc (ppm)
PAG1	≤1.0	N/A
PAG2	>1.0 to ≤2.0	N/A
NAG3	>2.0	≥1,000
NAG4	>2.0	≥600, <1,000
NAG5	>2.0	<600
OVB	N/A	N/A

Note: PAG = potentially acid-generating; NAG = non-acid-generating; OVB = overburden; ppm = parts per million; N/A = not applicable

2.2.3.2.7 Waste Handling Strategy

Knight Piésold provided a staged construction plan for the TSF (New Gold, 2014), which included a listing of minimum annual material requirements. This plan is the key driver of the waste handling strategy, considering that a large proportion of the NAG (non-PAG) waste is required to construct the TSF.

Table 2.2.3-10 lists the different types of waste materials and corresponding destinations. The basis for waste classification is discussed in **Section 5.1.3.1**. Geochemical testwork and resultant classification dictate that PAG1, PAG2, and NAG3 rock can be used only for internal (captured drainage) TSF disposal or for construction of the TSF dam shells due to acid generation potential and/or metal leaching potential.

Table 2.2.3-10: Waste Materials and Destinations

Waste Type	Destination
PAG1	Site C and Site D Storage Facility (PAG Subaqueous Storage)
PAG2	Site C and Site D Storage Facility (PAG Subaqueous Storage)
NAG3	Used for upstream Site C and Site D TSF Construction and PAG Subaqueous Storage
NAG4	Used for Site C and Limited Site D TSF Construction, and West Dump
NAG5	Used for Site C and Site D TSF Construction, and West and East dumps
OVB	Used for Site C and Site D TSF Construction, and West and East dumps

Note: A small amount of waste rock will be left in the open pit at the conclusion of mining.

In addition to TSF construction, several other considerations affected the waste mining schedule:

- Minimizing overburden mining in wet periods (nominally April, May, and September);
- Maximizing overburden mining in frozen periods (nominally December to February);
- Placing overburden on the outer layers of dump lifts to simplify reclamation;
- Providing adequate low-reactivity rock for use as plating material for trafficability while working with the overburden and other weaker materials;
- Maintaining an overburden dump as a source of reclamation material; and
- Creating an overburden stockpile for TSF construction in the later years.

2.2.3.2.8 Waste Dump Design Criteria

Dump design guidelines are based on guidance from Knight Piésold. Waste dump design criteria are shown in **Table 2.2.3-11**.

Table 2.2.3-11: Waste Dump Design Criteria

Item	Unit	Value
Maximum Slope Angle	degrees	37 (1.3H:1:V)
Maximum Reclaimed Slope Angle	degrees	18 (3H:1V)
Maximum Dump Lift Height[(1)]	metres	40
Maximum Foundation Grade	degrees	15

Note: [(1)] Maximum dump lift height is the maximum vertical distance from the dump crest to the toe of the lift.

The general design goals and constraints for the waste management plan are summarized below:

- Maximize backfill in mined-out areas of the open pits;
- Minimize the footprint of the waste rock piles outside the pit limits;

- Minimize the number of affected drainage basins;
- Leave final slopes composed of overburden to facilitate reclamation;
- Segregate overburden in the East Dump to preserve overburden for future potential use as reclamation material;
- Minimize haul distances/times for waste haulage to manage trucking costs; and
- Provide progressive reclamation opportunities where practical.

2.2.3.2.9 External Waste Rock Disposal

2.2.3.2.9.1 Geotechnical Conditions

Two waste rock dumps will be constructed, the West Dump to the west of the open pit and the East Dump to the east. The West Dump will be in a low-gradient area sloping to the northwest. Surficial materials range from 18 m to 75 m thick, thickest at lower elevations. Several eskers and localized kames and ablation till were identified in the footprint area of the West Dump. Static groundwater levels range from 3 m to 4 m below surface and mirror the subsurface surficial topography.

The East Dump will be in a low-gradient area that slopes to the northeast. The geotechnical conditions in this area are characterized by a surficial material sequence ranging from 24 m to 108 m thick, with the thickest deposits at the lower elevations. A subglacial meltwater corridor was identified in the footprint area of the East Dump. Static groundwater levels range between artesian conditions to a depth of 12 m. Bedrock geology consists of andesitic volcanic rocks that are highly weathered at less than 5 m depth.

An assessment of the stability rating for the East Dump, West Dump, and LGO stockpile has been carried out using the waste and stockpile stability rating system as described in the interim guidelines provided by the B.C. Mine Waste Rock Pile Research Committee (BCMWRPRC 1991). All three areas have been classified as "Class II" low failure hazard dumps (rating of 500).

Stability analyses for each of the dump facilities and the LGO Stockpile have been carried out in accordance with the recommended level of effort indicated in the guidelines. The stability analyses were carried out using the limit equilibrium computer program SLOPE/W. The stability of each dump was assessed for a deep seated failure surface propagating a minimum of 100 m from the crest of the pile, a mid-sized failure surface propagating a minimum of 50 m from the crest, and a smaller scale failure surface allowed to form just at the crest of the pile. The results of the stability analyses satisfy the requirements for factors of safety as indicated in the guidelines. The seismic analyses indicate that any embankment deformations during earthquake loading from the OBE and MDE would be minor and would not result in significant displacement in the piles. Stability ratings are provided in **Table 2.2.3-12**. Detailed results of the dump stability analyses are provided in **Appendix 2.2A-2**.

Table 2.2.3-12: Waste Dump and LGO Stockpile Stability Rating Summary

Key Factors Affecting Stability	Point Rating					
	West Dump		Low Grade Ore Stockpile		East Dump	
	Condition	Point Rating	Condition	Point Rating	Condition	Point Rating
Dump Height	75	50	70	50	90	50
Dump Volume	Medium	50	Medium	50	Medium	50
Dump Slope	Flat	0	Flat	0	Flat	0
Foundation Slope	Flat	0	Flat	0	Flat	0
Degree of Confinement	Moderately Confined	50	Moderately Confined	50	Moderately Confined	50
Foundation Type	Competent	0	Competent	0	Competent	0
Dump Material Quality	Moderate	100	Moderate	100	Moderate	100
Method of Construction	Mixed	100	Mixed	100	Mixed	100
Piezometric & Climatic Conditions	Intermediate	100	Intermediate	100	Intermediate	100
Dumping Rate	Slow	0	Slow	0	Slow	0
Seismicity	Moderate	50	Moderate	50	Moderate	50
Dump Stability Rating		**500**		**500**		**500**
	Class	**Failure Hazard**	**Class**	**Failure Hazard**	**Class**	**Failure Hazard**
Dump Stability Class	II	Low	II	Low	II	Low

The guidelines (BC Mine Waste Rock Pile Research Committee [BCMWRPRC], 1991) specify the following recommended level of effort for investigation and design of mine rock and overburden piles with a low failure hazard rating:

- Thorough site investigation;
- Test pits, sample may be required and limited lab index testing;
- Basic stability analyses required; and
- Routine visual and instrument monitoring.

The level of effort completed to date for the East Dump, West Dump, and LGO stockpile meets the effort level suggested in the guidelines. In accordance with the guidelines, routine visual and instrument monitoring of the waste rock dumps and LGO stockpile will be required during construction, operation, and closure of the facilities to confirm design assumptions, document behavior and establish loading limits. Instrumentation will be required in critical locations of the dump including; steep areas, near the toe of the dump, areas with potential for increased piezometric pressures, zones of rapid or steep dump placement, or weak foundation soils observed during construction. The instrumentation will include:

- Piezometers to measure pore water pressures in the foundation and waste rock and overburden;
- Surface movement monuments to monitor for deformations, and
- Surface extensometers to monitor any tension crack development, as required.

Protocols for visual monitoring and review of instrumentation and monitoring data, and subsequent action will be developed as part of a waste rock management or monitoring plan during a subsequent phase of project design. Observation and recording of information will be completed systematically and consistently using staff familiar with the work. The plan will include the following elements:

- Construction logs including material source and quantity;
- Photographic records and written inspection reports;
- Physical surveys of the extent of the dump using traditional or GPS methods to detect any;
- surface movements and to record the rate of dump placement;
- Laboratory test work of fill materials including index properties, shear strength and durability;
- testing to confirm design assumptions;
- Regular monitoring of instrumentation and analysis, and
- Periodic review and inspection by a qualified external geotechnical engineer.

See also **Section 2.2.3.4.6**.

2.2.3.2.9.2 Design Overview

NAG waste (NAG4 and 5) and overburden not used for TSF construction will be placed in either the East or West Dump locations. All NAG4 material will be placed in the West Dump to more readily capture the dump runoff in the TSF due to the somewhat higher metal leaching potential of this material. Drainage from the East Dump will also be captured and directed to the TSF but may be returned to Creek 661 if of acceptable quality.

The mined overburden will be distributed between the two dumps based on the ratio of rock to overburden placed in a given period. A minimum of 10% of waste rock will be placed with the overburden to provide plating and maintain the overall integrity of the waste dumps.

2.2.3.2.10 Backfill Waste Disposal

During the final year of mining (Year 14) approximately 8 Mt of PAG material will be backfilled in the southwestern part of the pit.

2.2.3.2.11 Low-Grade Ore Stockpile Design

2.2.3.2.11.1 Geotechnical

Sand and gravel deposits comprising a meltwater corridor and kame complex were identified in the footprint of the stockpile. Glaciofluvial surficial deposits up to 18 m thick characterize the foundation materials overlying the highly weathered andesitic bedrock. Static groundwater level is at approximately 13 m depth below ground surface.

Stability analysis was similar to that for external waste rock dumps and was previously discussed in **Section 2.2.3.2.9**.

2.2.3.2.11.2 Design Overview

The LGO stockpile will be directly northwest of the pit. It will be constructed from the bottom up in 20 m lifts. Lower lifts will be resloped to 3:1 as they are completed, to maintain stability until the stockpiled material is processed.

In the preproduction period, the stockpile area will be split into higher and lower grade areas to allow higher grade ore to be fed to the process plant in the initial years of operations. Material will also be split into sulphide, transition, and oxide ore types.

The LGO stockpile location has been optimized to minimize the risk of impacts to the surrounding environment, and limit surface water control requirements to the maximum extent practical. Surface drainage and seepage from the LGO would flow toward the TSF. During detailed design, consideration will be given to optimizing the layout and construction of the LGO stockpile by rotating the pad 90° to the west to simplify LGO placement and the drainage water collection system.

Additional discussion of on-land waste rock and LGO is provided in **Appendix 2.2A-2**.

2.2.3.2.12 Phase Development and Reserves

2.2.3.2.12.1 Pit Phasing

Pit phasing was based on four key guidelines:

- Pit optimization results for lower gold prices;
- Maintaining good working widths for pushbacks to maintain productivity (nominally 200 m);
- Maximizing access and working areas to allow selecting specific material types to maximize grade and provide construction material for the TSF; and
- Knight Piésold geotechnical guidance.

Six phases and sub-phases were developed and incorporated into the mine production schedule. Many of these phases are of short duration, usually to increase ore grade or to produce material suitable for the TSF dam construction. Pit phases are described in **Appendix 2.2A-9**.

2.2.3.2.13 Mine Production Schedule

The mine production schedule is summarized in **Table 2.2.3-14**. The mine operations fleet is scheduled to start in Q4 Year –2 and end in Year 14. The stockpile is reclaimed from Year 15 to Year 17. Multiple constraints, such as ramp-up considerations, TSF dam construction requirements, and metal production went into developing the production schedule.

2.2.3.2.13.1 Production Scenario

The design plant feed rate is 21.9 Mt/y, with an overall mining capacity of approximately 90 Mt/y. Several analyses were conducted to determine the optimum mine production level and ramp-up schedule. **Table 2.2.3-13** summarizes the mill production ramp-up.

Table 2.2.3-13: Mill Ramp-Up Schedule

Period	Tonnes	% of Full Production
Month 1	367,000	20
Month 2	550,000	30
Month 3	642,000	35
Month 4	1,100,000	60
Month 5	1,375,000	75
Month 6	1,558,000	85
Month 7	1,650,000	90
Month 8	1,742,000	95
Month 9	1,833,000	100

A strategy of elevated cutoff grade (COG), with the LGO stockpiled for later processing, was used to increase the mill head grade in the early years and to maximize NPV.

2.2.3.2.13.2 Scheduling Considerations

Main drivers for the mine schedule include:

- Overall Project timing – The initial mining fleet is assembled and operational by the start of Q4 Year -2. The process plant is commissioned in April Year 1;
- TSF construction – TSF construction requires specific material types to be produced from the mine on a defined schedule. Much of the final schedule is driven by the need to release the better-quality (NAG5) waste rock;
- Elevated grade/stockpile – Ore grade is maximized in the early years of the Project to shorten the payback period. LGO is stockpiled and processed in later years; and

- Equipment erection and ramp-up – The rate at which equipment can be commissioned and ramped up to full productivity is a key consideration.

2.2.3.2.13.3 Ore Tonnages and Types

As shown in **Table 2.2.3-14** and on **Figure 2.2.3-40**, plant feed increases from approximately 10.8 Mt during Year 1 to approximately 21.9 Mt once full production is reached. Excess LGO above this level, ranging from 2 Mt to 7 Mt annually, will be stockpiled until Year 11 and fed to the process plant from Year 15 to Year 17.

The release of gold and silver over the Project life is summarized in **Table 2.2.3-15**. Gold production peaks in Year 3 at approximately 618,000 ounces (oz) Au, and again in Year 8 at approximately 581,000 oz Au. These peaks illustrate the effect of the heterogeneous nature of ore deposit geology on mine production, where large tonnages of ore are encountered in only some zones of the pit rather than being dispersed evenly throughout. This effect is also increased by the requirement to provide certain waste types to the TSF.

All ore processed is in the Measured and Indicated resource categories. The Inferred resource is treated as waste (2.7 Mt at 0.516 g/t Au and 3.760 g/t Ag).

Table 2.2.3-16 summarizes annual plant feed schedule, including the tonnages sent directly to the process plant, ore reclaimed from the stockpile, and the ore types. **Table 2.2.3-16** also shows the annual cut-off grade for ore and for plant feed.

Table 2.2.3-14: Summary of Mine Production Schedule

	Items	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant Feed	Tonnes			10,806,000	21,900,000	21,900,000	21,900,000	21,900,000	21,903,000	21,903,000	21,903,000	21,903,000	21,903,000	21,902,000	21,902,000	21,902,000	21,902,000	21,900,000	21,900,000	5,121,000
	Au grade (g/t)			0.900	0.906	1.000	0.710	0.750	0.827	0.803	0.936	0.839	0.688	0.609	0.634	0.687	0.879	0.399	0.399	0.399
	Au (g)			9,721,000	19,832,000	21,894,000	15,554,000	16,432,000	18,114,000	17,598,000	20,491,000	18,385,000	15,071,000	13,339,000	13,880,000	15,042,000	19,255,000	8,742,000	8,742,000	2,044,000
	Au (oz)			312,000	637,000	703,000	500,000	528,000	582,000	566,000	659,000	591,000	485,000	429,000	446,000	484,000	619,000	281,000	281,000	66,000
	Cumulative Au (oz)	0	0	312,000	949,000	1,652,000	2,152,000	2,680,000	3,262,000	3,828,000	4,487,000	5,078,000	5,563,000	5,992,000	6,438,000	6,922,000	7,541,000	7,822,000	8,103,000	8,169,000
	Au Recovered grade (g/t)			0.763	0.782	0.877	0.612	0.647	0.723	0.701	0.826	0.737	0.592	0.522	0.544	0.592	0.764	0.337	0.337	0.337
	Au Recovered (g)			8,245,000	17,130,000	19,214,000	13,397,000	14,176,000	15,826,000	15,347,000	18,086,000	16,145,000	12,967,000	11,425,000	11,911,000	12,960,000	16,726,000	7,380,000	7,380,000	1,726,000
	Au Recovered (oz)			266,000	551,000	617,000	431,000	456,000	509,000	493,000	581,000	519,000	417,000	367,000	383,000	417,000	538,000	237,000	237,000	55,000
	Ag grade (g/t)			5.545	5.383	5.842	5.416	4.958	6.155	4.255	6.706	6.123	3.835	3.400	2.982	3.272	2.351	10.282	10.282	10.283
	Ag (g)			59,916,000	117,898,000	127,937,000	118,603,000	108,576,000	134,821,000	93,192,000	146,877,000	134,103,000	83,995,000	74,459,000	65,307,000	71,669,000	51,496,000	225,186,000	225,186,000	52,657,000
	Ag Recovered grade (g/t)			3.193	2.859	3.137	2.921	2.523	3.147	1.935	3.059	2.746	1.677	1.483	1.295	1.421	1.010	5.200	5.200	5.200
	Ag Recovered (g)			34,502,000	62,618,000	68,709,000	63,975,000	55,245,000	68,922,000	42,386,000	67,002,000	60,148,000	36,742,000	32,485,000	28,358,000	31,128,000	22,123,000	113,873,000	113,873,000	26,628,000
	Ag Recovered (oz)			1,110,000	2,013,000	2,209,000	2,056,000	1,776,000	2,216,000	1,363,000	2,154,000	1,934,000	1,181,000	1,044,000	912,000	1,001,000	711,000	3,661,000	3,661,000	856,000
Stockpile	Tonnes		1,612,000	6,250,000	4,386,000	3,633,000	3,143,000	5,678,000	2,987,000	7,384,000	6,801,000	3,126,000	5,183,000							
	Au (g/t)		0.538	0.620	0.461	0.460	0.296	0.317	0.326	0.406	0.367	0.305	0.374							
	Au (g)		867,000	3,876,000	2,021,000	1,670,000	931,000	1,798,000	974,000	2,996,000	2,495,000	954,000	1,938,000							
	Ag grade (g/t)		5.361	5.842	4.704	5.196	16.796	14.235	9.998	3.156	22.450	21.855	3.569							
	Ag (g)		8,642,000	36,514,000	20,630,000	18,877,000	52,790,000	80,827,000	29,865,000	23,307,000	152,685,000	68,320,000	18,496,000							
Direct Feed	Tonnes			10,286,000	21,159,000	21,900,000	21,900,000	21,900,000	21,903,000	21,903,000	21,903,000	21,903,000	21,903,000	21,902,000	21,902,000	21,902,000	21,902,000			
	Au (g/t)			0.905	0.910	1.000	0.710	0.750	0.827	0.803	0.936	0.839	0.688	0.609	0.634	0.687	0.879			
	Au (g)			9,313,000	19,249,000	21,894,000	15,554,000	16,432,000	18,114,000	17,598,000	20,491,000	18,385,000	15,071,000	13,339,000	13,880,000	15,042,000	19,255,000			
	Ag (g/t)			5.507	5.352	5.842	5.416	4.958	6.155	4.255	6.706	6.123	3.835	3.400	2.982	3.272	2.351			
	Ag (g)			56,646,000	113,245,000	127,937,000	118,603,000	108,576,000	134,821,000	93,192,000	146,877,000	134,103,000	83,995,000	74,459,000	65,307,000	71,669,000	51,496,000			
PAG (tonnes)	to Site C Storage (tonnes)	144,000	5,488,000	13,813,000	0	0	0	0	0	0	0	0	0	0	0	0	0			
	to Site D Storage (tonnes)	0	0	0	26,936,000	27,497,000	37,004,000	31,017,000	39,175,000	44,082,000	37,925,000	35,793,000	26,581,000	14,515,000	10,741,000	9,027,000	0			
	Backfilled (tonnes)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,961,000			
NAG3 (tonnes)	to D Dam Construction (tonnes)	0	800,000	2,500,000	2,000,000	2,435,000	4,008,000	3,696,000	3,245,000	2,013,000	3,029,000	2,598,000	1,527,000	1,470,000	983,000	978,000	1,025,000			
	to Site C Storage (tonnes)	0	987,000	2,090,000	0	0	0	0	0	0	0	0	0	0	0	0	0			
	to Site D Storage (tonnes)	0	0	0	1,548,000	820,000	1,391,000	3,904,000	4,630,000	1,144,000	7,049,000	12,246,000	8,369,000	1,911,000	417,000	245,000	0			
	Backfilled (tonnes)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	278,000			
NAG4 (tonnes)	to C Dam Construction (tonnes)	0	1,000,000	997,000	0	0	0	0	0	0	0	0	0	0	0	0	0			
	to D Dam Construction (tonnes)	0	0	0	1,500,000	0	2,445,000	0	0	0	0	0	0	0	0	0	0			
	to West Dump (tonnes)	45,000	1,015,000	1,647,000	1,083,000	3,682,000	1,219,000	3,578,000	3,804,000	3,108,000	3,789,000	6,036,000	5,865,000	1,224,000	1,205,000	651,000	278,000			
NAG5 (tonnes)	to C Dam Construction (tonnes)	0	5,800,000	1,500,000	0	0	0	0	0	0	0	0	0	0	0	0	0			
	to D Dam Construction (tonnes)	0	200,000	2,412,000	6,768,000	7,500,000	9,100,000	5,000,000	4,897,000	3,904,000	2,881,000	1,830,000	552,000	554,000	41,000	771,000	151,000			
	to East Dump (tonnes)	259,000	2,282,000	582,000	1,106,000	2,893,000	2,325,000	1,647,000	1,500,000	718,000	2,279,000	3,189,000	7,002,000	3,889,000	754,000	129,000	8,000			
	to West Dump (tonnes)	1,274,000	703,000	1,780,000	614,000	0	0	0	1,634,000	718,000	2,279,000	3,189,000	7,002,000	3,889,000	754,000	129,000	8,000			
OVB (tonnes)	to C Dam Construction (tonnes)	0	2,000,000	2,499,000	0	380,000	380,000	380,000	0	0	0	0	0	0	0	0	0			
	to D Dam Construction (tonnes)	0	1,200,000	3,500,000	9,232,000	8,864,000	3,480,000	4,265,000	933,000	2,075,000	2,023,000	0	0	0	0	0	0			
	to East Dump (tonnes)	337,000	3,583,000	1,756,000	3,364,000	2,300,000	1,636,000	3,331,000	2,000,000	924,000	268,000	0	0	0	0	0	0			
	to West Dump (tonnes)	1,930,000	5,590,000	5,994,000	1,100,000	3,899,000	0	3,915,000	1,449,000	924,000	268,000	0	0	0	0	0	0			
	OVB to Stockpile	0	0	0	0	0	400,000	0	3,500,000	1,913,000	0	0	0	0	0	0	0			
Total Waste tonnes		3,989,000	30,648,000	41,070,000	55,251,000	60,270,000	63,388,000	60,733,000	66,767,000	61,523,000	61,790,000	64,881,000	56,898,000	27,452,000	14,895,000	11,930,000	8,709,000	0	0	0
Total Ore tonnes		0	1,612,000	16,536,000	25,545,000	25,533,000	25,043,000	27,578,000	24,890,000	29,287,000	28,704,000	25,029,000	27,086,000	21,902,000	21,902,000	21,902,000	21,902,000	0	0	0
Total tonnes		3,989,000	32,260,000	57,606,000	80,796,000	85,803,000	88,431,000	88,311,000	91,657,000	90,810,000	90,494,000	89,910,000	83,984,000	49,354,000	36,797,000	33,832,000	30,611,000	0	0	0

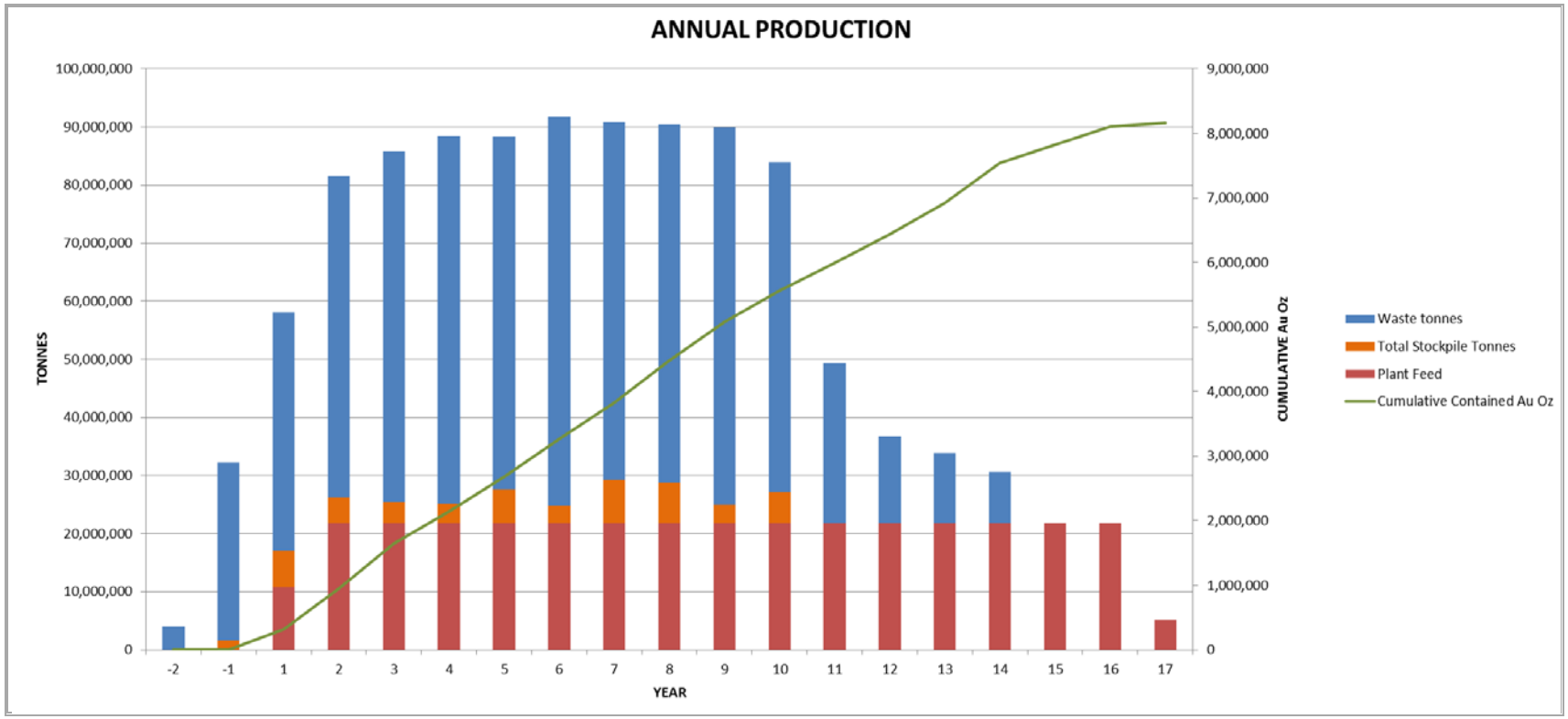


Figure 2.2.3-40: Annual Mine Production Levels

Table 2.2.3-15: Annual Gold and Silver Production

Year	Au Contained (oz)	Au Produced (oz)	Ag Contained (oz)	Ag Produced (oz)
Year -2	-	-	-	-
Year -1	-	-	-	-
Year 1	313,000	265,000	1,926,000	1,109,000
Year 2	638,000	551,000	3,790,000	2,013,000
Year 3	704,000	618,000	4,113,000	2,209,000
Year 4	500,000	431,000	3,813,000	2,057,000
Year 5	528,000	456,000	3,491,000	1,776,000
Year 6	582,000	509,000	4,335,000	2,216,000
Year 7	566,000	493,000	2,996,000	1,363,000
Year 8	659,000	581,000	4,722,000	2,154,000
Year 9	591,000	519,000	4,312,000	1,934,000
Year 10	485,000	417,000	2,700,000	1,181,000
Year 11	429,000	367,000	2,394,000	1,044,000
Year 12	446,000	383,000	2,100,000	912,000
Year 13	484,000	417,000	2,304,000	1,001,000
Year 14	619,000	538,000	1,656,000	711,000
Year 15	281,000	237,000	7,240,000	3,661,000
Year 16	281,000	237,000	7,240,000	3,661,000
Year 17	66,000	55,000	1,693,000	856,000
Total	**8,171,000**	**7,074,000**	**60,825,000**	**29,859,000**

Note: Ag = silver; Au = gold; oz = ounce

Table 2.2.3-6 lists Measured, Indicated, and Inferred resources.

Table 2.2.3-16: Annual Plant Feed and Ore Tonnages

	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Plant Feed (t)	-	-	10,804,000	21,899,000	21,899,000	21,899,000	21,899,000	21,903,000	21,903,000	21,903,000
Au (g/t)	-	-	0.900	0.906	1.000	0.710	0.750	0.827	0.803	0.936
Ag (g/t)	-	-	5.546	5.384	5.842	5.416	4.958	6.155	4.255	6.706
Ore to Stockpile (t)	-	1,611,000	6,249,000	4,386,000	3,633,000	3,144,000	5,677,000	2,987,000	7,384,000	6,801,000
Ore to Mill (t)	-	-	10,284,000	21,159,000	21,899,000	21,899,000	21,899,000	21,903,000	21,903,000	21,903,000
Stockpile to Plant (t)	-	-	520,000	740,000	-	-	-	-	-	-
Cut-off grade for ore (AuEq g/t)	-	0.320	0.320	0.320	0.320	0.320	0.320	0.320	0.320	0.320
Approximate Annual Cut-off grade for plant feed (AuEq g/t)	N/A	N/A	0.37	0.35	0.35	0.37	0.38	0.34	0.38	0.38
Ore Oxide (%)	-	17%	11	7	11	8	5	6	2	-
Ore Transition (%)	-	83%	65	37	19	18	11	13	2	3
Ore Sulphide (%)	-	-	24	57	69	75	84	81	96	97
	Year 9	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**	**Year 15**	**Year 16**	**Year 17**	**Total**
Plant Feed (t)	21,903,000	21,903,000	21,902,000	21,902,000	21,902,000	21,902,000	21,900,000	21,900,000	5,121,000	344,445,000
Au (g/t)	0.839	0.688	0.609	0.634	0.687	0.879	0.399	0.399	0.399	0.738
Ag (g/t)	6.123	3.835	3.400	2.982	3.272	2.351	10.282	10.282	10.282	5.493
Ore to Stockpile (t)	3,126,000	5,183,000	-	-	-	-	-	-	-	50,181,000
Ore to Mill (t)	21,903,000	21,903,000	21,902,000	21,902,000	21,902,000	21,902,000	-	-	-	294,264,000
Stockpile to Plant (t)	-	-	-	-	-	-	21,900,000	21,900,000	5,121,000	50,181,000
Cut-off grade for ore (AuEq g/t)	0.320	0.320	0.260	0.260	0.260	0.260	-	-	-	-
Approximate Annual Cut-off grade for plant feed (AuEq g/t)	0.34	0.38	0.27	0.27	0.27	0.27	-	-	-	-
Ore Oxide (%)	-	-	-	-	-	-	7	7	7	4
Ore Transition (%)	2	-	-	-	-	-	22	22	22	11
Ore Sulphide (%)	98	100	100	100	100	100	71	71	71	85

Note: AuEq = gold equivalent; g/t = grams per tonne; t = tonne

2.2.3.2.13.4 Waste Tonnages and Types

Table 2.2.3-17 and **Figure 2.2.3-40** show the waste production schedule over the life of the Project. Similar to the ore production profile, the amount of waste mined annually ramps up during the first two years of production and reaches a relatively constant level of around 60 Mt/y until ramping down in the final three years of mining, Year 12 to Year 14.

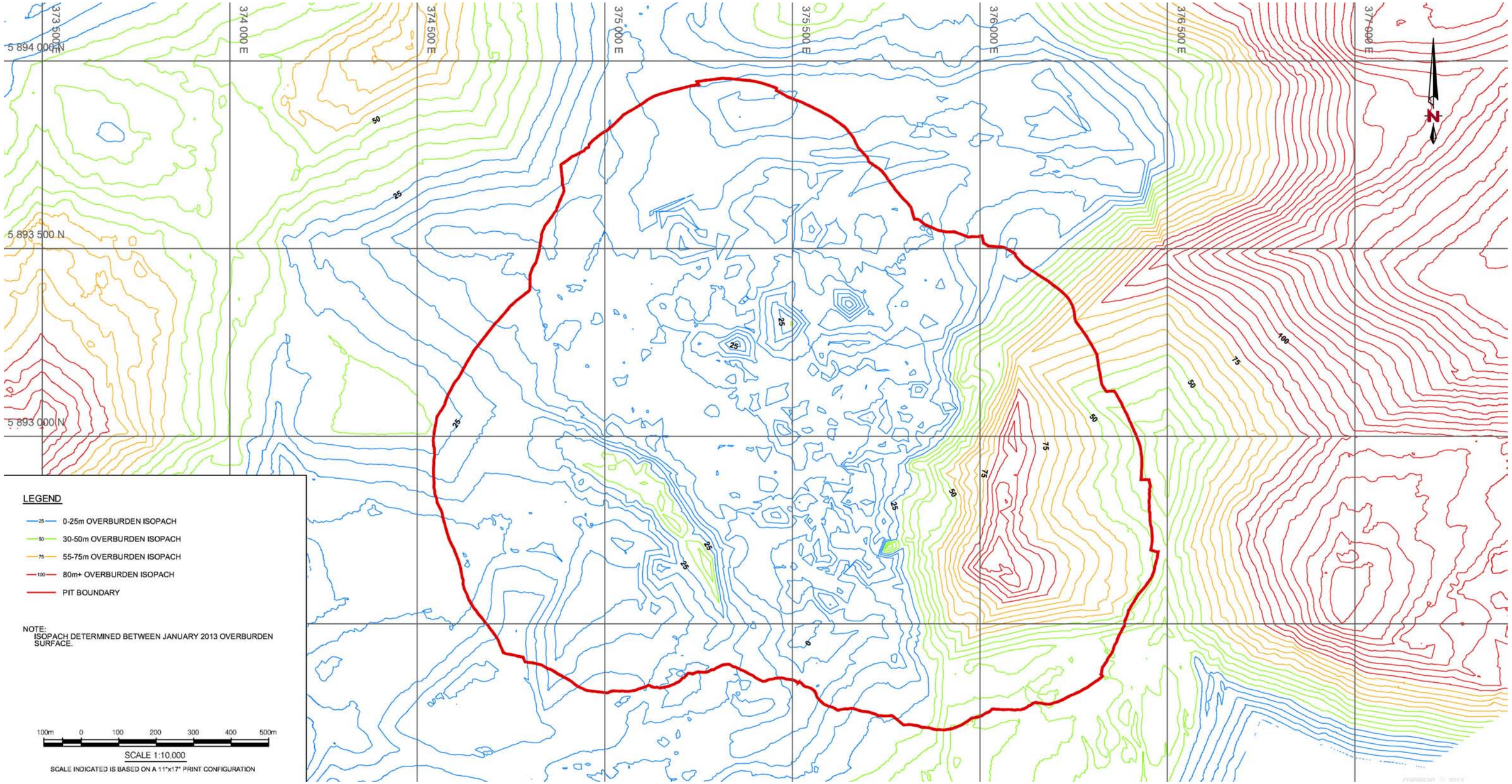
Table 2.2.3-17: Waste Production by Material Type (tonnes)

Year	PAG1 and PAG2	NAG3	NAG4	NAG5	OVB	Total
Year -2	144,000	-	45,000	1,534,000	2,267,000	3,990,000
Year -1	5,488,000	1,787,000	2,015,000	8,985,000	12,373,000	30,648,000
Year 1	13,813,000	4,590,000	2,646,000	6,274,000	13,749,000	41,072,000
Year 2	26,936,000	3,548,000	2,583,000	8,488,000	13,697,000	55,252,000
Year 3	27,497,000	3,255,000	3,682,000	10,393,000	15,443,000	60,270,000
Year 4	37,004,000	5,400,000	3,664,000	11,425,000	5,896,000	63,389,000
Year 5	31,017,000	7,600,000	3,578,000	6,647,000	11,891,000	60,733,000
Year 6	39,175,000	7,875,000	3,804,000	8,031,000	7,882,000	66,767,000
Year 7	44,082,000	3,157,000	3,108,000	5,340,000	5,836,000	61,523,000
Year 8	37,925,000	10,078,000	3,789,000	7,440,000	2,558,000	61,790,000
Year 9	35,793,000	14,844,000	6,036,000	8,208,000	-	64,881,000
Year 10	26,581,000	9,895,000	5,865,000	14,556,000	-	56,897,000
Year 11	14,515,000	3,380,000	1,224,000	8,332,000	-	27,451,000
Year 12	10,741,000	1,400,000	1,205,000	1,550,000	-	14,896,000
Year 13	9,027,000	1,223,000	651,000	1,029,000	-	11,930,000
Year 14	6,961,000	1,303,000	278,000	167,000	-	8,709,000
Total	**366,699,000**	**79,335,000**	**44,173,000**	**108,399,000**	**91,592,000**	**690,198,000**

2.2.3.2.13.5 Overburden

The Proponent's geology group provided overburden thicknesses. Data on overburden thickness were sourced from field observations, test pits, drill hole information, and terrain mapping carried out as part of the Proponent's geological and Knight Piésold's geotechnical investigations. Within the pit limits, the overburden depth ranges from 1 m to in excess of 75 m on the eastern edge of the pit. The Proponent developed an overburden–bedrock contact surface based on the available data, and this was used to calculate overburden volumes in the pit. **Figure 2.2.3-41** shows the location and thickness of the overburden in the pit area.

Table 2.2.3-17 summarizes the annual overburden quantities. Overburden includes the limited volumes of topsoil and subsoil present within the pit limits. Additional soil material to be salvaged outside the pit limits will include some material of high reclamation value within the footprints of the planned haul road, stockpile, and infrastructure.



Reference:

DataBC Data Distribution Service
Open Government License
(http://www.data.gov.bc.ca/)

Knight Piésold Engineering and Environmental Services
http://www.knightpiesold.com/en/

CLIENT: newgold™

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ANALYST:	WR
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COORDINATE SYSTEM:	
SCALE:	
PAGE SIZE:	11in X 17in

PROJECT: Blackwater Gold Project

TITLE: Overburden Isopach 5 m Plan View

PROJECT NO:	VE52420
REVISION NO:	
DATE:	May, 2014
SHEET NO:	N/A
DRAWING NO:	**Figure** 2.2.3-41

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2.2.3.2.13.6 Aggregate and Borrow Sources for Construction

2.2.3.2.13.6.1 Borrow Source Identification

The following areas were considered for use in the Project development:

- Process plant site;
- Site C south borrow source;
- Site D south borrow source, and
- Aggregate screening area.

These potential borrow source locations are shown on **Figure 2.2.3-42**, and the material types are summarized below. To reduce borrow haul distances, additional on-site borrow sources for suitable bulk and structural fill materials will be evaluated during detailed design.

The plant site design indicates a finished surface elevation of 1,433 m. Bulk excavation at the site will generate more than 500,000 cubic metres (m^3) of material, and sub-excavation could provide additional overburden or shot rock. Site investigations encountered sand and gravel with a variable fraction of fines (10% to 30%) and some cobbles and boulders. The excavated material will be suitable for use as backfill but may require some processing to be used as structural fill or in mechanically stabilized earth (MSE) wall construction.

The Site C south borrow source will be located between the process plant site and Site C Main dam, within 2 km of the process plant site. Site investigations indicated that the surficial material comprises sand and gravel with some silt (10% to 25%) and a variable proportion and distribution of cobbles and boulders. Some 400,000 m^3 of suitable borrow materials may be available, if required.

The Site D south borrow source will be located approximately 5 km down the proposed mine access road from the process plant site, just beyond the construction camp. The borrow site will be located on a prominent knoll. Terrain mapping interprets this area as glacial till with narrow deposits of esker sand and gravel skirting the west and north toe of the slope. Excavation of a 15 m bench of this area could provide in excess of 3 million cubic metres (Mm^3) of materials suitable for use as sub-base material or for processing to produce other well-graded materials.

The aggregate screening area will be located farther down the mine access road, approximately 10 km from the process plant site. The esker deposit is estimated to contain approximately 100,000 m^3 of sand gravel materials. This esker field will be used to develop dam construction aggregates. The volume of borrow materials in this area is substantial and expected to be more than 3 Mm^3. These materials will need to be crushed and/or screened to produce the desired quantities and grain size distributions.

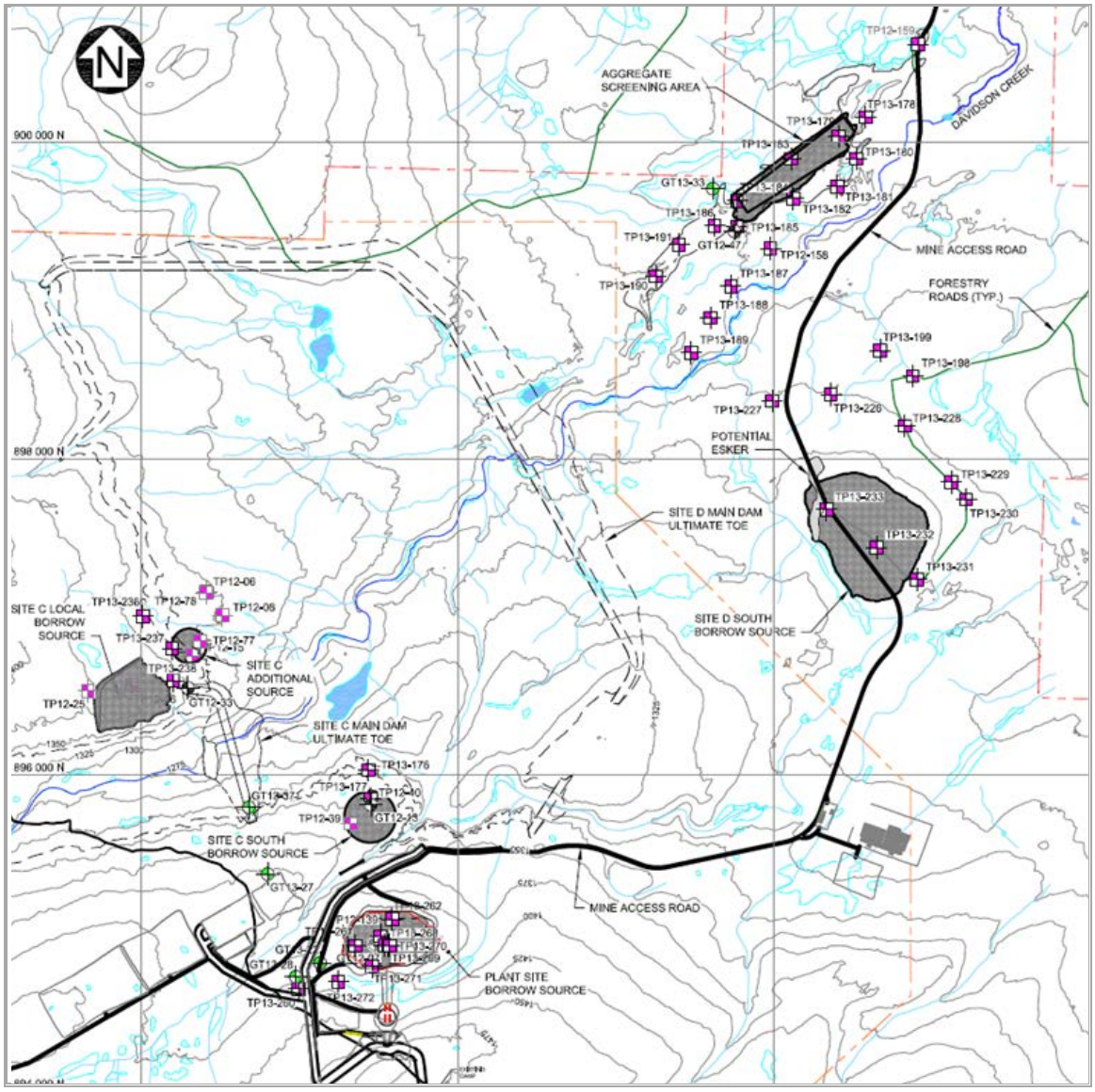


Figure 2.2.3-42: Identified Borrow Source Locations

2.2.3.2.13.6.2 Aggregate Suitability Testing

In June 2013, Knight Piésold commissioned Levelton Consultants Ltd. to undertake concrete aggregate suitability testing on two samples collected during the 2013 geotechnical site investigations:

1. A sandy gravel bulk sample recovered from test pit TP160 within the esker complex; and
2. Slightly weathered andesite made up of combined drill core samples recovered from drill holes GT13-16 to GT13-18 within the plant site platform.

The samples were tested for rock suitability in accordance with the applicable test methods for acceptance of concrete aggregates as described in Section 4.2.3 of the Canadian Standard Association (CSA) A23.2-09 – Test Methods and Standard Practice for Concrete. The materials were found to be in compliance, with the exception of the testing for alkali-silica reactivity in the Mortar Bar test described in CSA A23.2-25A. The standard recommends that where the expansion of the Mortar Bar sample exceeds 0.150%, but is less than 0.400%, additional testing should be undertaken according to the Concrete Prism tests as described CSA A23.2-14A to determine the degree of alkali-silica reactivity. The addition of supplementary cementing materials such as fly-ash mitigates against the potential for alkali-silica reactivity expansion by neutralizing the excessive alkalinity of the cement with silicic acid at the early stage of the cement setting.

2.2.3.2.13.7 East Waste Dump

The East waste dump is the primary storage location for overburden and NAG5 waste not required for TSF construction. Some areas of this dump will consist primarily of overburden (80%) that can be used to reclaim the TSF and other mine facilities at closure. The dump configuration and sequencing are designed to accommodate the use of overburden for reclamation. The overall dump has a capacity of approximately 33 Mt and will be constructed in a series of lifts to enhance stability and minimize resloping requirements at closure.

2.2.3.2.13.8 West Waste Dump

The West waste dump is the primary storage location for overburden and NAG4 waste not required for TSF construction. The dump has a capacity of approximately 60 Mt and, similar to the East Dump, will be constructed in a series of lifts to enhance stability and minimize resloping requirements at closure. Some of the West Dump lifts will be progressively reclaimed during operations.

2.2.3.2.13.9 Backfill Waste Rock Disposal

Approximately 8 Mt of PAG waste rock produced in the last year of operations will be backfilled within the pit.

2.2.3.2.13.10 Topsoil and Subsoil

The dump foundations will be cleared in preparation for fill placement. A 30 m strip along the advancing dump toe will be stripped and the topsoil will be spoiled in a windrow at the toe. Selective stripping of topsoil in other areas within the dump foundations will be completed to remove thick areas of topsoil that would be valuable for reclamation or in apparent drainages where increased pore pressures or weak foundation materials could affect dump stability. Based on an evaluation of suitability for reclamation, soils in the waste dump areas were generally classified as not suitable (see **Section 2.6.6.3.1** for further discussion). Some topsoil is expected to be stripped from the ore stockpile footprint. Work will entail dozer stripping, removal by backhoe, and truck haulage to the stockpile locations.

2.2.3.2.13.11 PAG Storage

PAG material will be stored in the TSF. All PAG materials will be submerged within one year of placement. NAG3 ML waste rock will be submerged within three to five years. Interactions between

the tailings deposition, PAG placement, and water levels will be a key driver for determining the details of the placement method for PAG. Placing it simultaneously with the tailings may require the use of small temporary retaining berms, and/or it may be placed over soft tailings.

2.2.3.2.14 Mine Equipment

This section describes the mining equipment selected for the Project, and reviews the operating parameters and assumptions used to estimate equipment productivities and unit requirements over the life of the operation. Equipment selection was based on pit geology and configuration, required production levels, and mining constraints. The production schedule and pit phasing require use of three primary mining shovels with a large loader as backup.

Table 2.2.3-18 lists the total annual equipment requirements over the mine life.

Table 2.2.3-18: Primary and Support Mining Equipment

Description/Year	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Loading																			
56 m^3 Cable shovel	1	1	1	1	1	1	1	1	1	1	1								
40 m^3 Hydraulic shovel (diesel +electric)	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1
28 m^3 Front-end loader (FEL)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Drills																			
250 mm Drill (diesel)	1	2	4	4	4	4	4	4	4	4	4	4	3	3	3	3	0	0	0
250 mm Drill (electric)	1	2	2	2	2	2	2	2	2	2	1								
120 mm Drill	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
Trucks																			
290-ton Haul truck	8	14	19	22	23	23	23	27	27	27	27	27	27	24	24	24	8	8	8
36-ton Haul truck	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Excavator																			
300 kW – Utility	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
150 kW – Utility	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dozers																			
650 kW	2	2	2	2	2	2	2	2	2	2	2	1	1	1					
450 kW	3	5	5	5	5	6	6	6	6	6	7	5	5	3	3	3	2	1	1
153 kW, 21-ton – Utility	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
370 kW Wheeled	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Grader																			
397 kW, 66-ton, 7.3 m blade	1	2	3	3	3	3	3	4	4	4	4	4	3	2	2	2	1	1	1
200 kW, 4.9 m blade	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Other																			
7 m^3 buck FEL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Water truck (150-ton truck)	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1
Fuel/lube truck	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1
Lowboy	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Description/Year	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Light plant	6	7	9	9	10	10	9	9	9	9	9	8	6	5	5	5	4	4	2
Crew bus	1	2	3	4	4	4	4	4	4	4	4	4	3	2	2	2	1	1	1
Pickup trucks	20	20	21	20	20	20	20	20	20	20	20	20	20	20	20	20	10	10	3
Maintenance																			
Mechanics truck	2	3	4	4	4	4	4	4	4	4	4	4	3	2	2	2	1	1	1
Welding truck	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
HIAB (9 t)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mobile crane – 55-ton	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Integrated tool handler	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tire handler FEL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

The production schedule is based on 24-hour, year-round mining operations with limited weather delays and shutdowns. The total annual schedule is 355 operating days, or 8,520 hours. The mine will operate on two 12-hour shifts per day.

2.2.3.2.14.1 Primary Loading

Loading will be carried out by a combination of hydraulic and cable shovels backed up by a large front-end loader. Where unconsolidated overburden consisting of till and sand/gravel material is less than 4 m in true thickness, it will be windrowed to the bench toe and then loaded out by the primary loading equipment. Additional dozer assistance will be required while mining the overburden during wet periods to minimize the number of shovel movements.

2.2.3.2.14.2 Primary Haulage

To meet targeted production levels, the mine plan relies on sufficient truck capacity to maintain loading unit productivity. The changing configuration of the mine over the Project life means that haul distances for both ore and waste will vary significantly, and consequently the truck fleet requirements will also vary.

Trucks of 290-ton capacity have been selected for the range of loading equipment, permitting three- to five-pass loading for the shovels.

2.2.3.2.14.3 Drilling and Blasting

Drill operations will be carried out continuously as part of the normal mining operation. Once full mine production is reached, drilling and blasting of approximately 7 Mt (dry) per month will be required to maintain production levels. Selected drills are sized for 200 mm and 250 mm drill holes and are capable of both rotary and hammer drilling.

Drills will be required to drill to a depth of approximately 13.4 m in a single pass to allow for blasting benches up to 12 m high.

Blast patterns and loading parameters are based on 12-m bench heights. The selected blasthole diameters are 200 mm in ore and strong rock, and 250 mm in weak to medium strength rock.

Where blastholes are wet, a mix of 70% emulsion/30% ammonium nitrate/fuel oil (ANFO) will be used for blasting. Dry blastholes in weak- to medium-strength rock will use 100% ANFO, whereas dry blastholes in ore and strong rock will use a 25% emulsion/75% ANFO blend for improved fragmentation. Where necessary, dewatering and hole liners will be employed to prevent the loss of explosives and to improve blasting performance. On average, an estimated 25% of blastholes are expected to be wet.

Cushion blasting will be used for any blast patterns adjacent to an interim or final pit wall to prevent overbreakage of the wall and to maintain its overall stability and integrity. This will also reduce the surface area of the ultimate walls and limit acid production and metal leaching. All cushion blasts will use a 200-mm hole diameter. Estimates are that wall-control blast patterns will be used for 14% of the total tonnage blasted. This percentage was derived from the total area of interim pit walls. Revised geotechnical requirements, which will be developed during detailed design and operations for some shorter, interim walls, should allow this proportion to be reduced, leading to lower drill-and-blast requirements and therefore reduced costs.

Frost blasts may be required to break up overburden sufficiently when daytime high temperatures do not exceed freezing. Overburden typically has a high moisture content, which makes it susceptible to developing significant frost zones in the upper parts of the bench. These zones are difficult to dig and tend to fall from the dig face in large pieces that are difficult to load, and thus need secondary breakage. To limit the size of these frozen pieces of overburden, a frost blast is required.

2.2.3.2.15 Support Equipment

Support equipment will be required for the following tasks:

- Cleanup and supporting in-pit waste and ore loading;
- Moving waste on rock dumps and dump spotting;
- Spreading PAG rock in the TSF;
- Maintaining haul roads;
- Supporting drilling and blasting operations;
- Pioneering haul roads;
- Maintaining ditches;
- Constructing temporary water management (ditches, sumps);
- Removing snow;
- General maintenance; and
- Fuelling.

The exact size and configuration of the support equipment fleet will be finalized during the detailed engineering stage.

2.2.3.2.16 Mine Development and Phasing

A description of the development sequence for construction, operations and decommissioning are summarized in this section.

Development and phasing of the Blackwater deposit are described below. Phased mine plans illustrating pit, dump, and road development for Years –1, 1, 3, 5, 10, and 17 are included at the end of this subsection (Note: Q = quarter, M = month).

2.2.3.2.16.1 Year -2 Q4

Initial pit development starts at the southern pit margin, and is mined to the final pit wall. The pit is mined in a stepped fashion from west to east, with four 12-m benches from elevation 1,620 m to 1,656 m. The west side of the pit is mined ahead of the east side to balance the rock versus overburden release for the TSF construction. Pit and dump areas are cleared. NAG5 and overburden waste is placed in the West and East dumps, NAG4 waste is placed only in the West Dump, and NAG3 and PAG waste is placed in the Site C TSF. The PAG waste is placed such that it will be flooded in the year following placement. Approximately 500,000 tonnes (t) of NAG5 are used initially to construct roads.

2.2.3.2.16.2 Year -1 Q1-Q2

Mining continues to the southern extent of the final pit wall from the 1,608-m bench to the 1,632-m bench. PAG waste continues to be placed in the Site C TSF. Two separate ore stockpiles are established immediately west of the process plant site for both high-grade ore and LGO. Approximately two-thirds of the final ore-stockpile footprint will be cleared and prepared for future stockpile placement. NAG material is hauled down to the Site C main dam for construction as required, which the mine fleet starts placing in Q1 Year -1. Of the remaining overburden and NAG material, most is placed in the West Dump, and a smaller percentage in the East Dump to manage haul times.

2.2.3.2.16.3 Year -1 Q3

Overburden mining is advanced at the eastern extent of the pit to the 1,620 m bench while the southwestern half of the pit is accelerated along the final pit wall to increase NAG5 release. PAG waste is placed in the Site C TSF. The access road to the bottom of the Site D Dam is established to prepare for dam construction, to start Q4 Year -1.

2.2.3.2.16.4 Year -1 Q1 to Year 1 M03

Mining continues in a similar pattern, with the west half of the pit being advanced one to two benches ahead of the east half, while targeting the NAG5 zone along the southwestern pit wall. External dump waste continues to be split between the East and West dumps. The Site C saddle dam access road is upgraded to approximately the midway point to accommodate PAG waste placement in the upper part of the Site C TSF. NAG material is hauled down to the Site D TSF dam as required, which starts construction in Q4 Year –1. PAG waste is placed in the Site C TSF. All ore continues to be stockpiled, with high-grade ore stockpiling ending in March Year 1, as the process plant starts up in April. Refer to **Figure 2.2.3-43**.

2.2.3.2.16.5 Year 1 M04 – Year 1 M12

A higher-grade zone in the centre of the pit is mined down to the 1,548 m bench to maximize grades. The south extent of the pit continues to be mined in a staggered pattern from west to east to meet the various material release requirements and maintain the minimum rock/overburden split. External dump waste is predominantly placed in the West Dump and a smaller amount in the East Dump. Reclamation of the top lift (1,590 m) of the West Dump starts in April Year 1. PAG waste continues to be placed in the Site C TSF. The access road for PAG placement in the Site D TSF is established in Q3 in preparation for PAG placement at the start of Year 2. The process plant starts production in April Year 1. LGO continues to be stockpiled while the high-grade stockpile starts to be reclaimed to maintain plant feed. Refer to **Figure 2.2.3-44**.

2.2.3.2.16.6 Year 2 – Year 3

The pit is mined down to the 1,512 m bench elevation in the main part, with the higher-grade core zone mined to 1,404 m elevation. The southeast side of the pit, which consists mostly of overburden, is mined down to an elevation of 1,536 m to 1,548 m. All PAG waste is now placed in the Site D TSF. Material from the high-grade ore stockpile is reclaimed during the first four months of Year 2, after which plant feed is maintained by direct ore release from the pit. LGO continues to be stockpiled. External dump waste is split between the West and East dumps. The 1,570 m and 1,550 m lifts on the West Dump are reclaimed in Q1 of Year 2 and Year 3, respectively. All PAG material is now placed in the Site D TSF. Refer to **Figure 2.2.3-45**.

2.2.3.2.16.7 Year 4 – Year 5

The pit is mined down to the 1,452 m to 1,464 m bench and the higher-grade ore zone down to 1,392 m elevation. The southern part of the pit is mined down to the 1,488 m bench, leaving a final major package of overburden along the east wall, which is mined down to the 1,524 m bench. External dump waste is split between the West and East dumps. A lower lift is placed on the East Dump ahead of the continuation of the upper lifts, to manage the maximum dump lift height. An overburden stockpile is established in Q4 Year 4 at the south end of the Site D Dam to provide an overburden supply for the final years of dam construction. Overburden is also sent to the Site C TSF to complete reclamation. Refer to **Figure 2.2.3-46**.

2.2.3.2.16.8 Year 6 – Year 7

The southwest part of the pit is mined down to the 1,344 m bench and the southern part of the 1,428 m bench. The overburden package on the east side of the pit is mined down to the 1,464 m bench and is nearly mined out. The excess overburden is placed in the overburden stockpile near the TSF to meet the remaining overburden requirements for the final years of dam construction. More than 50% of the waste rock released during this period is classified as PAG, and as such is placed in the Site D TSF. Waste for the East Dump is placed in the valley directly to the northeast of the final pit ramp entrance, and ties into the existing bottom lift of the East Dump. The West Dump will have been advanced to the bottom lift to accommodate further waste placement on the two lifts above it, while maintaining the maximum lift height of 40 m. Progressive reclamation of the West Dump 1,530 m lift is completed in Year 6. Stockpiling of LGO continues, and reaches the final elevation of 1,480 m.

2.2.3.2.16.9 Year 8 – Year 9

The pit is mined to the final wall along the entire perimeter, and all overburden is now mined out. The southwest part of the pit is mined down to the 1,296 m bench and the rest of the pit to the 1,380 m to 1,392 m bench. The final ramp on the west side of the pit, as well as access to the top lifts of the Site D Dam, is also established.

2.2.3.2.16.10 Year 10

Mining in the southwest part of the pit is postponed while the rest of the pit is mined down to the 1,332 m bench. Once stockpiling of LGO is completed, all LGO will be direct fed to the process plant in subsequent years. External dump waste is split between the East and West dumps, and waste going to the East Dump is placed directly off the pit ramp entrance tying in to the crusher access. Refer to **Figure 2.2.3-47**.

2.2.3.2.16.11 Year 11 – Year 13

The southwest part of the pit is completed as the rest of the pit is mined down to the 1,224 m to 1,236 m bench. Waste release becomes minimal by the end of Year 13 as most material mined is now ore and mine production starts to ramp down.

2.2.3.2.16.12 Year 14

All mining is completed this year. PAG waste is backfilled into the Phase 2 west pit.

2.2.3.2.16.13 Post-Year 14

The LGO stockpile is mined out and processed through the end of Year 17. During this period, the bottom three lifts of the West Dump are reclaimed. Once all ore is processed, the east half of the East Dump is mined out to provide overburden for reclamation of the Site D TSF and the waste dumps. Reclamation is also carried out in all other previously unreclaimed areas. Refer to **Figure 2.2.3-48**.

Figure 2.2.3-48 shows a full pit lake, but the lake will not be completely filled until about 20 years after open pit mining ceases (about 18 years after cessation of process plant operations).

Commencing in Year 18, water will be pumped from the TSF to the open pit. This operation is expected to continue until the Open Pit fills, initially consisting of tailings supernatant water and subsequently with catchment runoff once the supernatant water has been depleted.

Once ore processing is completed in Year 17, reclamation of the Site D TSF will commence with addition of topsoil and vegetation as discussed in **Section 2.6**. A wetland will be established downslope of Dam D. Prior to TSF discharge in approximately Year 35 the Environmental Control Dam will be decommissioned and a discharge structure for TSF overflow constructed at the site. The freshwater reservoir and Tatelkuz Lake pumping system will be decommissioned when no longer required (in about Year 35).

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EARTHWORK CONTRACTOR LAY DOWN AND OFFICES
TRUCK SHOP
CONSTRUCTION LAY DOWN
CONSTRUCTION CAMP
OPERATIONS CAMP
PLANT SITE
ACCESS ROADS
CRUSHER
1420
LOW GRADE STOCKPILE
STOCKPILE LINER
1460
HIGH GRADE STOCKPILE
EXPLOSIVE FACILITIES
SCP #5
EL. 1425.0m
EAST DUMP
1515
1535
WEST DUMP
1550
1570
1590
1596
1608
1620
LEGEND
5m CONTOURS (FEB 2013)
PIT BOUNDARY
PIT 5m CONTOURS
DUMP CREST
DUMP TOE
ROADS
TSF ULTIMATE BOUNDARY
STOCKPILE CREST
STOCKPILE TOE
ACCESS ROAD AREAS
OVERBURDEN
RECLAIMED AREA
STOCKPILE LINER AREA
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SCALE INDICATED IS BASED ON A 11"x17" PRINT CONFIGURATION
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Kilometers

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PROJECT: Blackwater Gold Project

TITLE: Phased Mine Plan End of Year -1

PROJECT NO:	VE52420
REVISION NO:	
DATE:	May, 2014
SHEET NO:	N/A
DRAWING NO:	**Figure** 2.2.3-43

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EARTHWORK CONTRACTOR LAY DOWN AND OFFICES
TRUCK SHOP
CONSTRUCTION LAY DOWN
CONSTRUCTION CAMP
OPERATIONS CAMP
PLANT SITE
CRUSHER
ACCESS ROADS
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LOW GRADE STOCKPILE
STOCKPILE LINER
HIGH GRADE STOCKPILE
EXPLOSIVE FACILITIES
SCP #5
EL. 1425.0m
EAST DUMP
1515
1535
ACCESS ROADS
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ACCESS ROADS
WEST DUMP
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1548
1572
1584
1596
ACCESS ROADS
1584

LEGEND

- 5m CONTOURS (FEB 2013)
- PIT BOUNDARY
- PIT 5m CONTOURS
- DUMP CREST
- DUMP TOE
- ROADS
- TSF ULTIMATE BOUNDARY
- STOCKPILE CREST
- STOCKPILE TOE
- ACCESS ROAD AREAS
- OVERBURDEN
- RECLAIMED AREA
- STOCKPILE LINER AREA

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SCALE INDICATED IS BASED ON A 11"x17" PRINT CONFIGURATION

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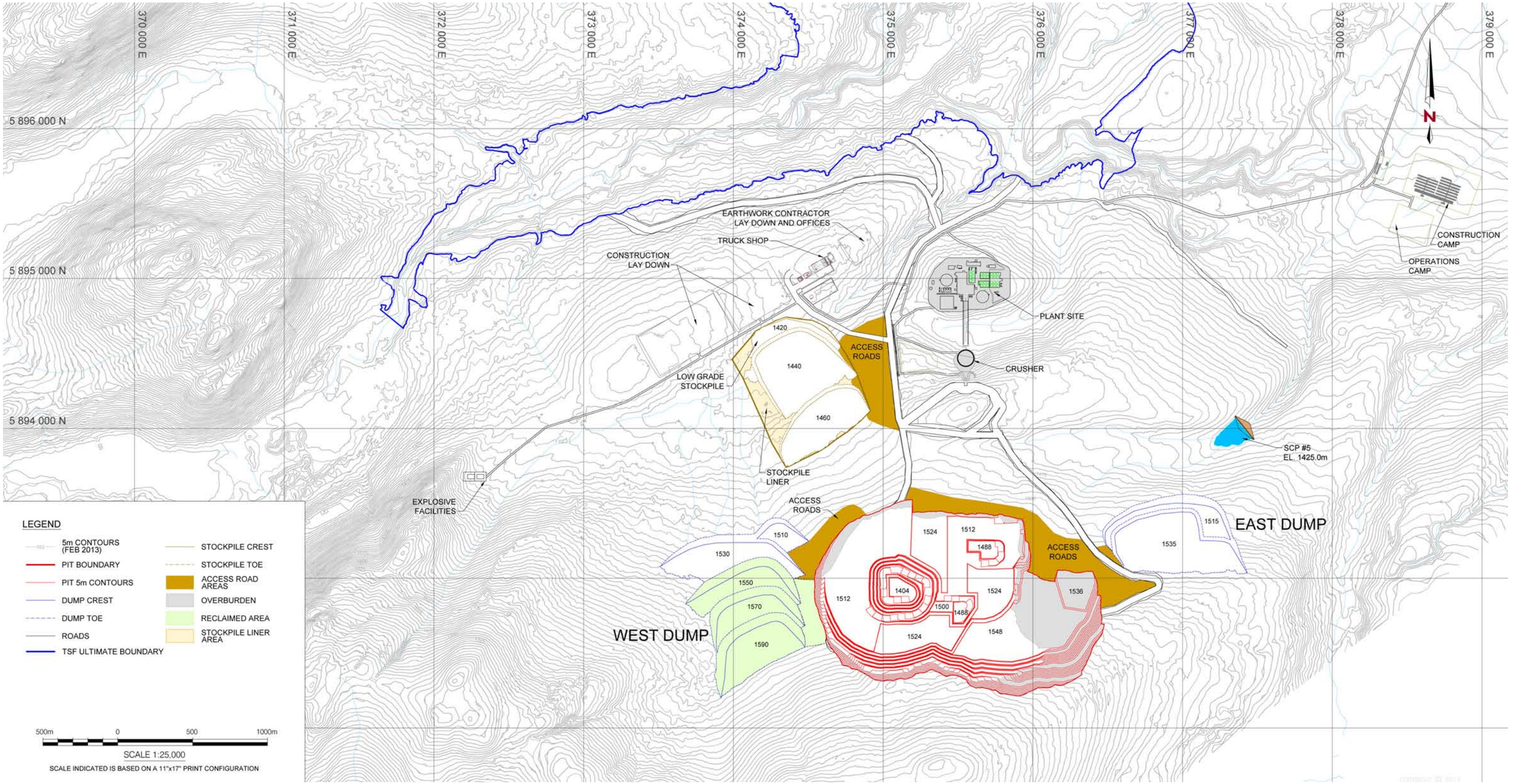
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PROJECT: Blackwater Gold Project

TITLE: Phased Mine Plan End of Year 1

PROJECT NO:	VE52420
REVISION NO:	
DATE:	May, 2014
SHEET NO:	N/A
DRAWING NO:	**Figure** 2.2.3-44

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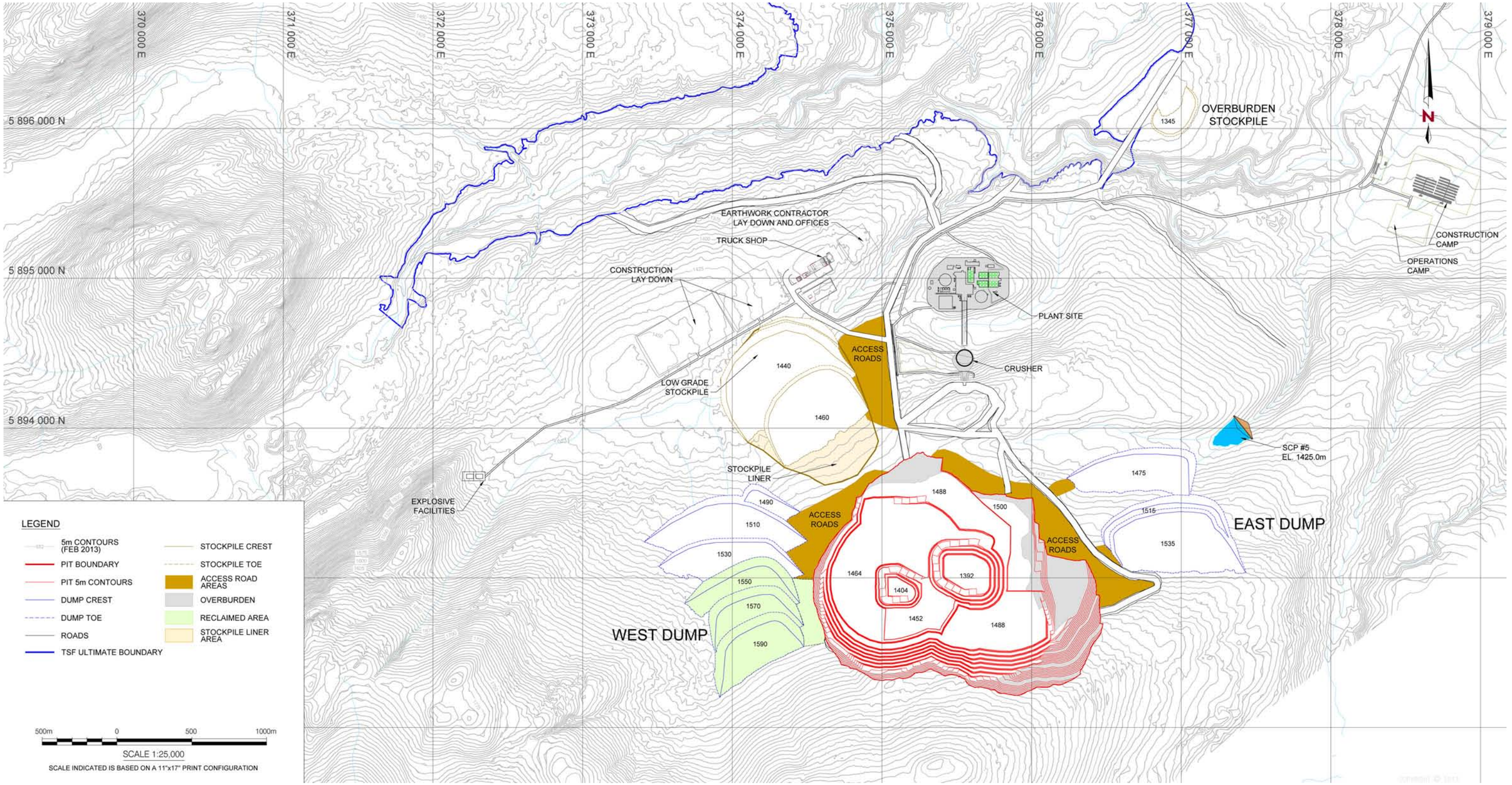
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PROJECT: Blackwater Gold Project

TITLE: Phased Mine Plan End of Year 3

PROJECT NO:	VE52420
REVISION NO:	
DATE:	May, 2014
SHEET NO:	N/A
DRAWING NO:	**Figure** 2.2.3-45

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PROJECT: Blackwater Gold Project

TITLE: Phased Mine Plan End of Year 5

PROJECT NO:	VE52420
REVISION NO:	
DATE:	May, 2014
SHEET NO:	N/A
DRAWING NO:	**Figure** 2.2.3-46

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OVERBURDEN STOCKPILE
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CONSTRUCTION CAMP
OPERATIONS CAMP

EARTHWORK CONTRACTOR LAY DOWN AND OFFICES
TRUCK SHOP
CONSTRUCTION LAY DOWN
PLANT SITE
CRUSHER
ACCESS ROADS
LOW GRADE STOCKPILE
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1298
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1550
1570
1590
EXPLOSIVE FACILITIES
WEST DUMP
EAST DUMP
SCP #5
EL. 1425.0m

LEGEND

- 5m CONTOURS (FEB 2013)
- PIT BOUNDARY
- PIT 5m CONTOURS
- DUMP CREST
- DUMP TOE
- ROADS
- TSF ULTIMATE BOUNDARY
- STOCKPILE CREST
- STOCKPILE TOE
- ACCESS ROAD AREAS
- OVERBURDEN
- RECLAIMED AREA
- STOCKPILE LINER AREA

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SCALE INDICATED IS BASED ON A 11"x17" PRINT CONFIGURATION

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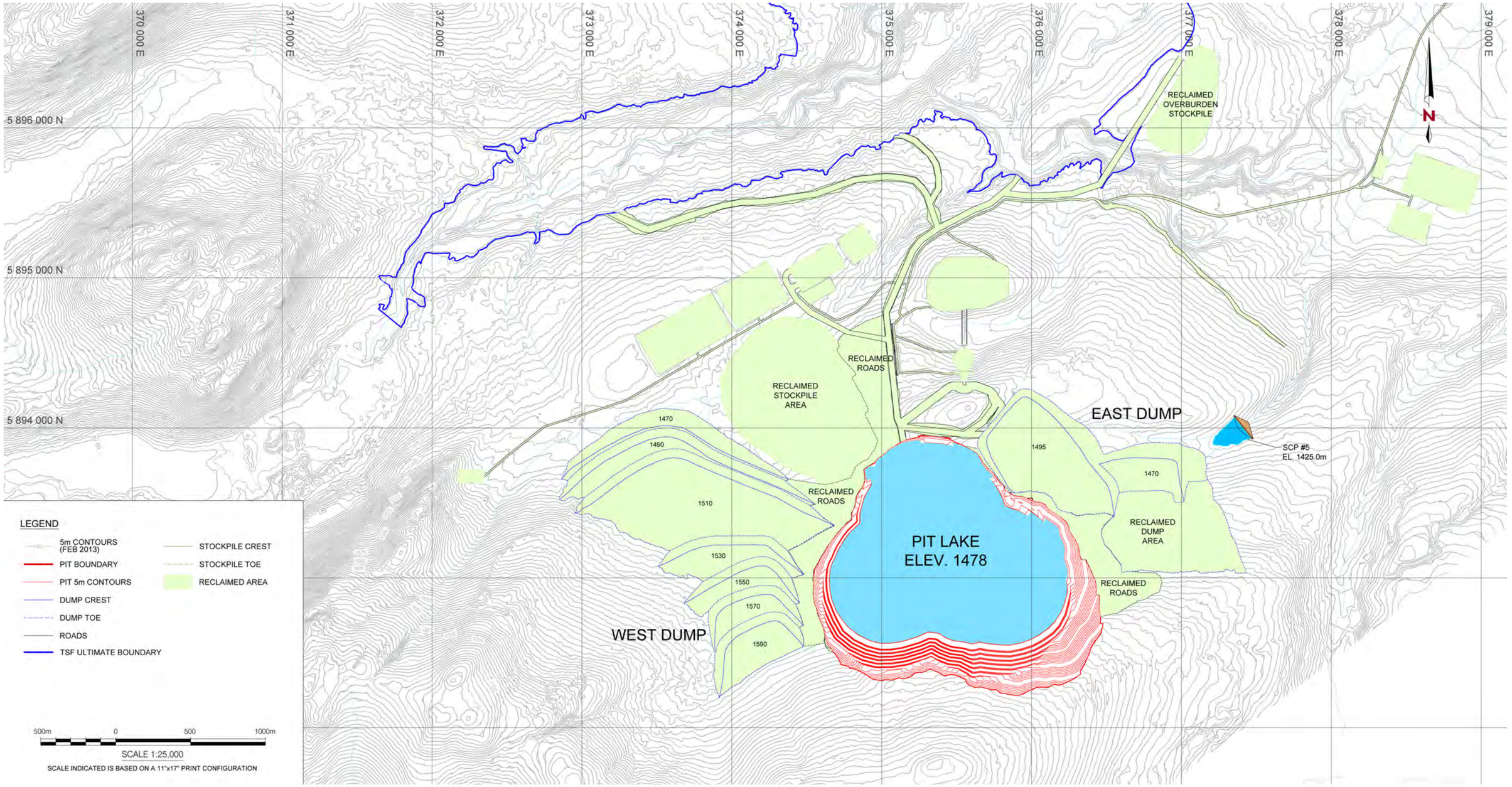
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PROJECT: Blackwater Gold Project

TITLE: Phased Mine Plan End of Year 10

PROJECT NO:	VE52420
REVISION NO:	
DATE:	May, 2014
SHEET NO:	N/A
DRAWING NO:	**Figure** 2.2.3-47

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PROJECT: Blackwater Gold Project

TITLE: Phased Mine Plan End of Year 17

PROJECT NO:	VE52420
REVISION NO:	
DATE:	May, 2014
SHEET NO:	N/A
DRAWING NO:	**Figure** 2.2.3-48

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2.2.3.2.16.14 Explosives Storage Facility

A range of blasting agents is planned for use over the life of the Project. Waste will typically be blasted with ANFO in dry holes and a mix of 70% emulsion/30% ANFO in wet holes. Ore will typically be blasted with a mix of 25% emulsion/75% ANFO in dry holes and with a mix of 70% emulsion/30% ANFO in wet holes. A powder factor of 0.20 to 0.30, depending on rock type, was used to estimate explosives consumption. Total estimated consumption averages 21,000 t/y, including 5% wastage, during peak production years.

Table 2.2.3-19 shows the anticipated annual explosives use (assuming ANFO is 94% ammonium nitrate [AN]).

The full-service vendor will provide the main explosives plant and storage, mobile manufacturing unit, loading personnel, and support vehicles. The explosives plant and storage facility will be located northwest of the pit (**Figure 2.2.3-43**).

Table 2.2.3-19: Anticipated Annual Explosives Use

Mining Year	-2	-1	1	2	3	4	5	6
Explosives								
AN (kg)	511,176	3,461,983	5,082,483	7,071,834	7,568,424	8,972,051	8,134,398	9,265,424
25/75 (kg)	7,238	425,662	3,694,599	5,705,568	5,716,611	5,663,792	6,176,075	5,636,658
70/30 (kg)	96,261	1,140,449	2,753,912	4,217,832	4,399,783	5,070,793	4,775,712	5,137,255
Total Tonnes	647	5,249	11,855	17,447	18,168	20,279	19,605	20,631
Mining Year	7	8	9	10	11	12	13	14
Explosives								
AN (kg)	8,716,903	9,040,684	9,651,715	8,499,726	4,062,187	2,255,186	1,808,326	1,390,308
25/75 (kg)	6,575,174	6,463,823	5,691,805	6,103,849	4,900,391	4,848,436	4,835,588	4,823,569
70/30 (kg)	5,285,030	5,439,777	5,482,443	5,189,289	3,136,438	2,445,495	2,274,629	2,114,792
Total	**21,134**	**21,521**	**21,442**	**20,335**	**12,358**	**9,693**	**9,034**	**8,417**

Note: AN = ammonium nitrate; 25/75, 70/30 = emulsions; kg = kilogram

2.2.3.3 Process Plant Site Facilities

2.2.3.3.1 Geotechnical Conditions – Process Plant Site

The process plant site is located on a topographic high-point between the open pit and the TSF at elevation 1,433 m. **Figure 2.2.3-49** shows the general configuration of the process plant site components.

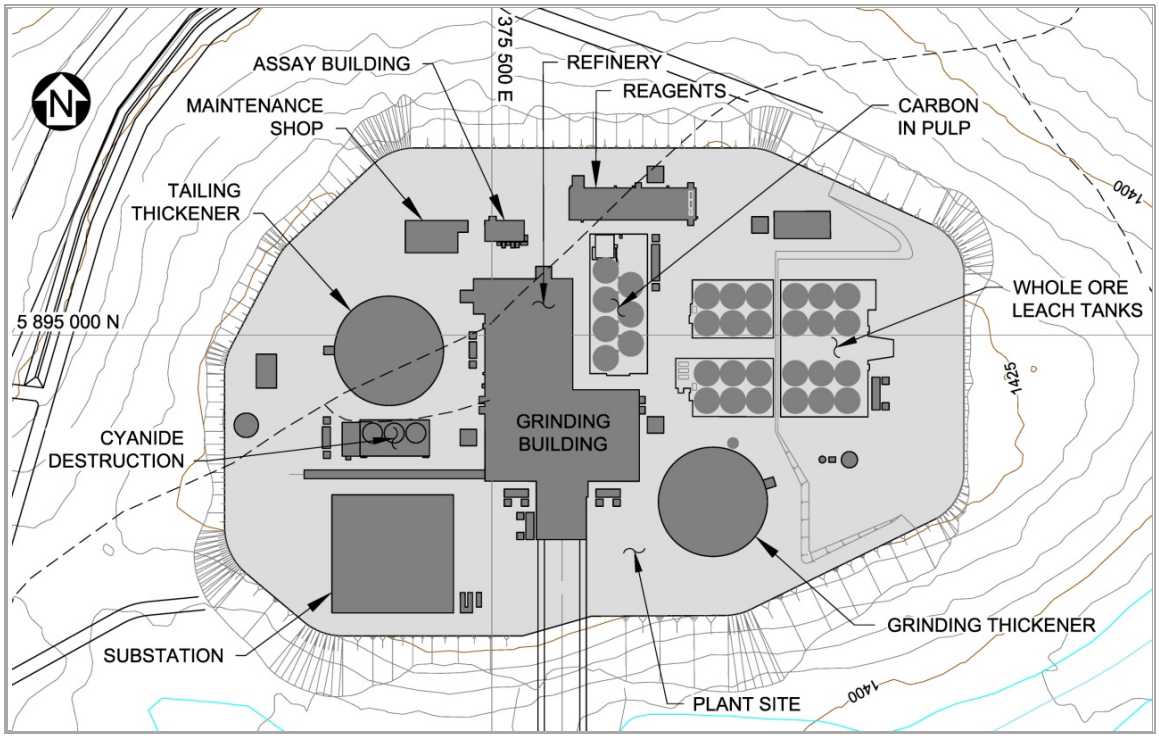


Figure 2.2.3-49: General Configuration of the Process Plant Site

The surficial materials at the process plant site are primarily glaciofluvial deposits composed of sand and gravel and interbedded silty sand and silty gravel materials. Deposits range in thickness from 1 m to 44 m, being thinnest across the topographic high of the process plant site and increasing on the flanks of the hill. The material is dense to very dense below 5 m. The static groundwater table was encountered at approximately 7 m below ground surface in the sand and gravel unit.

Andesite bedrock is highly weathered for approximately the first 5 m above moderately to slightly weathered bedrock. The RQD is greater than 60% and RMR is classified as FAIR to GOOD. Rock compressive strength testing ranged from 70 MPa to 275 MPa indicating very strong rock. Hydraulic conductivity of the rock mass was low and ranges from 1 x 10^{-7} m/s to 3 x 10^{-8} m/s.

The geotechnical conditions underlying the major structures of the process plant were assessed individually to further refine the proposed layout. A summary of the surficial materials for each proposed plant site structure is provided in **Table 2.2.3-20**.

Figure 2.2.3-50 shows the inferred stratigraphy in the process plant site.

Table 2.2.3-20: Process Plant Site Surficial Geology Summary

Structure	Stratigraphy		
	Depth [(1)]	**Description**	**Compactness/Consistency/ SPT/UCS**
Primary Crusher	0 – 3 m	Silty sand and gravel	Loose to dense
	3 – 5 m	Highly weathered bedrock	-
	>5 m	Moderately weathered bedrock	91 – 275 MPa
Grinding Mill, Refinery, CIP Tanks	0 – 9 m	Sand and gravel/silty gravelly sand/sandy gravel	Dense to very dense (N34 – N100[R])
	>9 m	Moderately weathered bedrock	71 – 92 MPa
Reagents Building	0 – 12 m	Sandy silt interbedded with silty Sand	Dense to very dense (N31 – N100[R])
	>12 m	Slightly weathered bedrock	110 – 160 MPa
Tailings Thickener, Maintenance Shop, Assay Building, and CN Destruction Building	Up to 12 m	Interbedded silty sand and gravel or sandy silt	Loose/firm to compact/very stiff (N8 – N26)
	>6 to 12 m	Slightly weathered bedrock	40 – 243 MPa
	0 – 5 m	Silty sand/gravel or silt	Loose becoming dense
	>5 m	Highly weathered rock (excavated to 5 m depth)	-
Whole Ore Leach Tanks	0 – 5 m	Silty sand, sand and gravel and silt and sand	Very dense (N46 – N100[R])
	5 – 11 m	Sandy silt	Very dense (N100[R])
	>11 m	Slightly weathered bedrock	100 – 105 MPa
Grinding Thickener	0 – 5 m	Surficial material	-
	>5 m	Bedrock	-
Truck Shop and Administrative Building	0 – 2 m	Topsoil	-
	2 – 38 m	Silty sand	Dense to very dense
	38 – 76 m	Silty sandy gravel, silt, clay and silt, and sandy gravelly silt	Stiff to hard/dense to very dense
	>76 m	Highly weathered bedrock	-

Note: [(1)] Depth ranges are approximate
SPT = standard penetration test; UCS = unconfined compressive strength; CIP = carbon-in-pulp; CN = cyanide; m = metre; MPa = MegaPascal

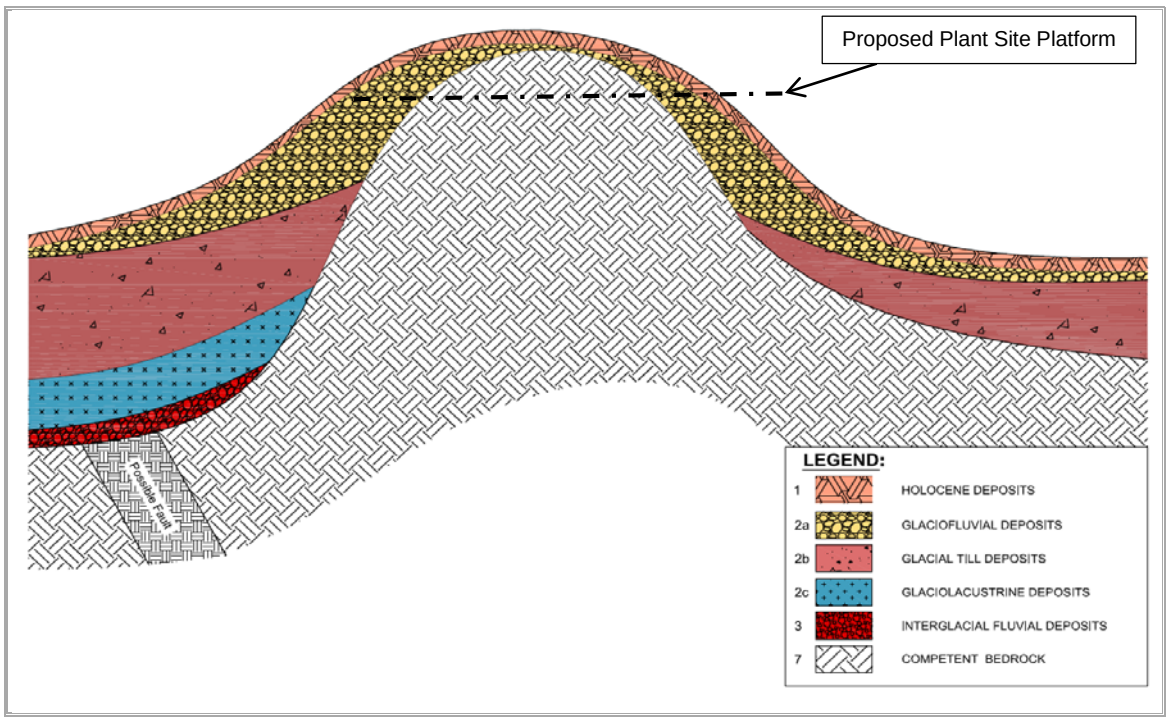


Figure 2.2.3-50: Schematic of Process Plant Site Inferred Stratigraphy

2.2.3.3.2 Flowsheet Alternatives

A process trade-off study incorporating four potential flowsheets was completed to determine the best method for extracting the gold. The following four options were considered:

- Option 1 – whole ore leach (WOL);
- Option 2 – flotation, concentrate regrind, and leach (FCL);
- Option 3 – hybrid: flotation with concentrate leach for sulphide ore, and WOL for oxide and transition ore (Hybrid); and
- Option 4 – heap leach (HL).

An initial assessment of the predicted gold and silver recoveries, plus capital and operating costs, and pre-tax NPV for the four options, showed the HL option to have a pre-tax NPV of approximately $700 million less than the milling options. However, the study determined that HL was not a viable process option for treatment of the overall Blackwater ore, due mainly to:

- Low sulphide gold recovery;
- Limited ability to reduce capital cost because of the need for a fine crushing circuit, and high infrastructure costs; and
- Potential operating risks associated with a large-scale, year-round HL in a cold, high snowfall climate.

Further studies of metallurgical data resulted in revised recovery assumptions for Hybrid, WOL, and Flotation flowsheets. They showed the WOL flowsheet delivered higher life-of-mine recoveries (**Table 2.2.3-21**). Capital and operating costs for the alternative milling options were also assessed. Costs and recoveries were input in a financial model, which showed the WOL flowsheet gave the best Project economics.

Table 2.2.3-21: Economic Summary of FCL and WOL Flowsheet Options

Item	Unit	FCL 200 µm 60 h	WOL 150 µm 30 h
Throughput	Mt/y	21.9	
Average Gold Grade	g/t	0.81	
Average Silver Grade	g/t	5.31	
Gold Recovery	%	82.0	83.0
Silver Recovery	%	41.4	47.5
CAPEX, initial	$M	1,726	1,801
Total OPEX	$/oz	659	627
IRR	%	15.8	17.5
Pre-tax NPV, 2015*2	$M	1,576	1,837
Payback	years	5.0	4.5

Note: FCL = flotation, concentrate regrind, and leach; WOL = whole ore leach; CAPEX = capital expenditure; OPEX = operating expenditure; IRR = Internal Rate of Return; NPV = Net Present Value; µm = microns; h = hour; Mt/y = million tonnes per year; g/t = grams per tonne; % = percent; $M = million dollars; $/oz = dollars per ounces

Given that it has the highest pre-tax NPV and recoveries, the WOL processing option was selected as the base flowsheet to treat 60,000 t/d at a target grind of 150 µm. This processing option provides a more optimal balance between high metallurgical extractions and marginally higher operating costs and thus offers the best returns.

2.2.3.3.3 Process Plant Design

2.2.3.3.3.1 Introduction

Metallurgical testwork reports provided by the Proponent (New Gold, 2014) were the primary sources for developing process trade-off studies and economic assessments. Design criteria are based on JKTech testwork, JKSimMet grinding simulations, and laboratory leaching, settling, and carbon absorption tests carried out by various laboratories, consultants, and vendors.

The concentrator will be a nominal 60,000 t/d facility employing the conventional whole-ore CN leach process to produce Au and Ag doré. It will consist of a primary crushing plant, a coarse ore stockpile (COS), a SAG/ball mill/crusher (SABC) grinding circuit, pre-leach thickening, CN leaching, carbon-in-pulp (CIP) adsorption, elution and carbon regeneration, CN destruction, and tailings thickening.

2.2.3.3.3.2 Process Description Overview

The process plant facility will consist of a primary crushing plant, a COS, a SABC grinding circuit, pre-leach thickening, whole ore CN leaching, CIP recovery of precious metals from solution, elution of precious metals from carbon, and recovery of precious metals by electrowinning followed by smelting to doré (**Figure 2.2.3-51**). The process plant will also have facilities for carbon regeneration, tailings thickening, and CN destruction.

Run-of-mine ore will be transported in 290 t mine haul trucks to a gyratory crusher, where each truck will dump from one of two dumping positions into the crusher feed pocket. The crushed ore will be transferred to an apron feeder and fed to a conveyor for delivery to a COS.

Reclaimed ore from the COS will be conveyed to feed two primary grinding semi-autogenous grind (SAG) mills, each with its own separate reclaim and lime addition systems. Each SAG mill will be in closed circuit with a vibrating screen and a pebble crusher and will feed an associated ball mill. Each ball mill will operate in closed circuit with a dedicated cyclone cluster to produce a product size of 80% passing 150 microns (µm).

The ore will be ground with CN solution recycled from the pre-leach thickener to the cyclone feed pumpbox; this will initiate the gold leaching process. After classification by the cyclone system, the thickened cyclone underflow at 50% solids, will report to the leach circuit, where lime will be added to maintain the pH to the range of 10.5 to 11 to prepare for CN leaching. The slurry will be split between four trains of leach tanks to achieve a leach residence time of 30 hours. Discharge from the leach trains will be recombined and sent to two lines of 400 m^3 CIP tanks for gold and silver adsorption.

The loaded carbon generated from the CIP tanks will be pumped to a pressure elution circuit with two 20 t capacity stripping vessels. Once gold has been desorbed, the carbon will be sent for regeneration in two electric kilns, each operating at 1.25 tonnes per hour (t/h). Quenching and screening will prepare the reactivated carbon for reintroduction into the CIP circuit.

Gold eluate, meanwhile, will be sent to electrowinning cells to produce a gold–silver precipitate sludge. Loaded cathodes will be pressure-washed in place to produce a sludge containing the precious metals. The sludge will be filtered and dried, then mixed with fluxes and smelted on site to produce gold–silver bars.

Slurry discharged from the CIP tanks will report to a CIP tails thickener before being sent to CN destruction. Cyanide-bearing liquid overflow recovered from the thickener will be recycled back to the process to lower the CN consumption as well as CN destruction costs. Slurry will be thickened to 60% solids in a tailings thickener before being introduced into the CN destruction circuit.

Reclaimed water will be used to dilute the slurry fed into the CN destruction process to 45%. A one-stage SO_2/air process will be employed, via three parallel reactors. The system will include SO_2 generation and storage as well as feed systems for SO_2, lime, and copper sulphate. **Figure 2.2.3-52** provides a process plant general arrangement.

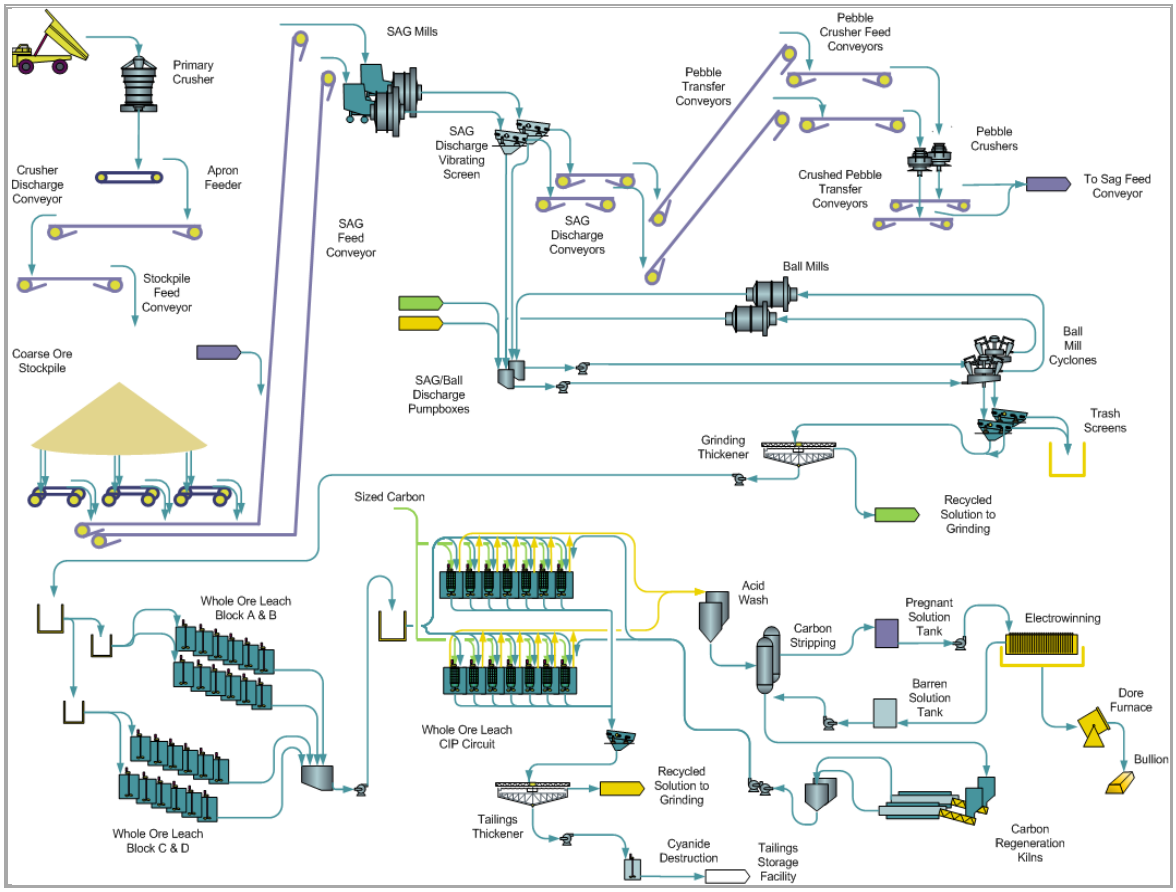


Figure 2.2.3-51: Overall Process Flow Diagram

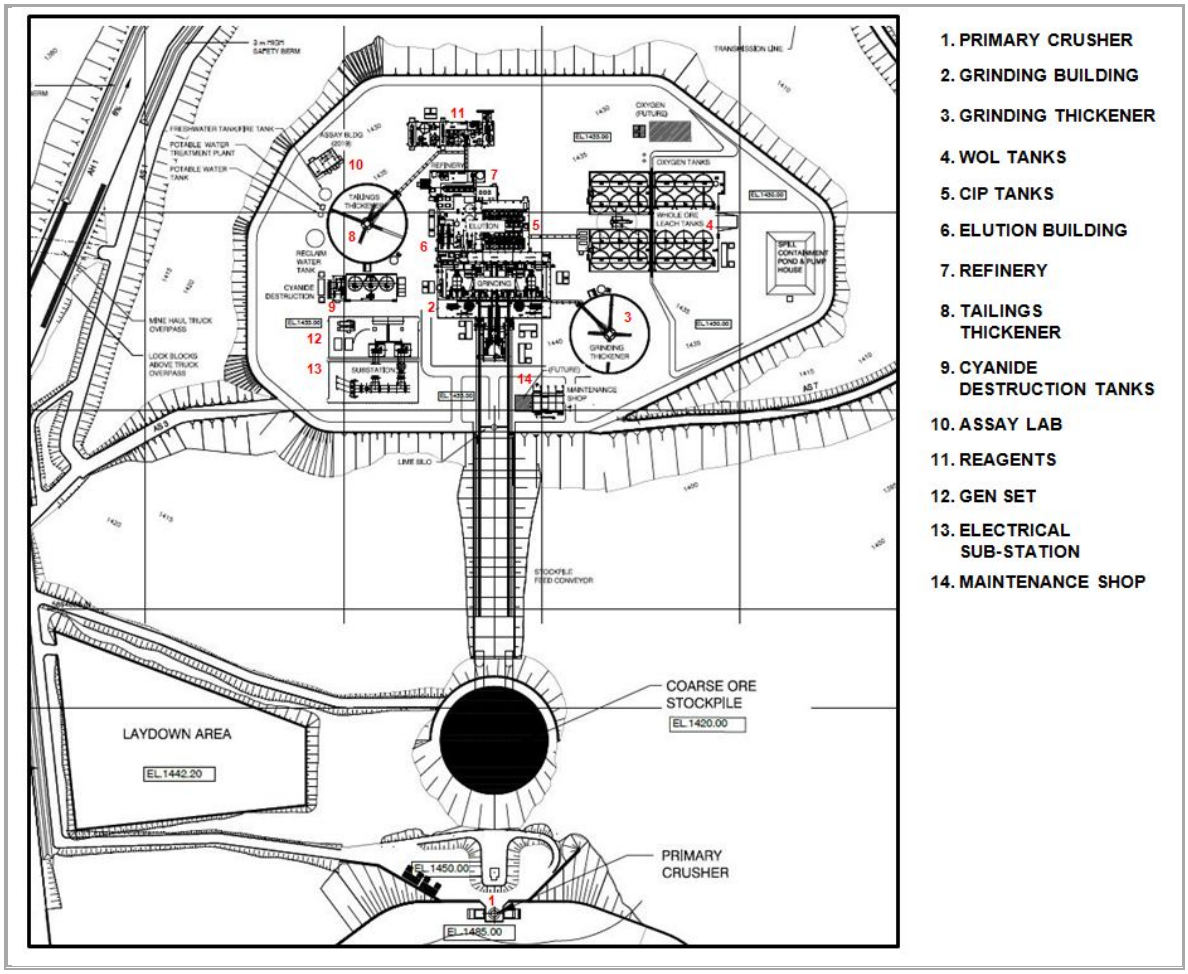


Figure 2.2.3-52: Process Plant General Arrangement

2.2.3.3.3.2.1 Primary Crushing and Coarse Stockpiling

JKSimMet output for comminution equipment sizing, installed power, and product sizing is listed in **Table 2.2.3-22**. The associated conveyors are listed separately in **Table 2.2.3-23**.

The primary crusher is a gyratory-type crusher designed to crush at an average rate of 3,333 t/h to a P_{80} of 133 mm.

The dump pocket capacity is 650 t (live capacity of 406 m^3), twice the size of an average truckload, to reduce the waiting time for trucks. Normal practice is for trucks to dump only when ore levels in the pocket are low. The surge pocket under the crusher will also have the capacity of two truckloads.

Table 2.2.3-22: Main Comminution Circuit Equipment

Equipment	Unit	Value
Primary Gyratory Crusher		
Throughput	Dry t/h	3,333
Installed motor	kW	1000
Primary crushing product, F_{80}	mm	133
Recommended gyratory crusher size	-	One of 60 x 110
SAG Mill		
Number of SAG mills	#	2
Throughput	t/h	2,717
Dimensions	m (ø x length EGL)	10.97 x 6.7
	ft (ø x length EGL)	36 x 21.5
Installed motor	MW	8.5
Motor/mill	-	2
Drive type	-	Dual Pinion
T_{80}	mm	2.1
Pebble Crusher		
Number of crushers	#	2
Throughput	t/h	1,054
Power draw (Bond)	kW	1,966
Crusher Product, P_{80}	mm	9.1
Ball Mill		
Number of ball mills	#	2
Throughput	t/h	2,717
Dimensions	m (ø x length EGL)	8.23 x 12.6
	ft (ø x length EGL)	27 x 42”
Installed motor	MW	8.5
Motor/mill	-	2
Drive type	-	Dual Pinion
Cyclone O/F, P_{80}	µm	150

Note: t/h = tonnes per hour; kW = kilowatt; mm = millimetre; m = metre; ø = diameter; ft = foot; MW = megawatt; SAG = semi-autogenous grind; µm = micron

Table 2.2.3-23: Main Comminution Circuit Conveyors

Conveyor/Feeder	Width (mm)	Length (m)	Motor (kW)	Average Transport Rate (t/h)
Gyratory Crusher Discharge Conveyor	1,829	41.5	200	4,640
Stockpile Feed Conveyor	1,829	137.5	600	4,640
SAG Mill No's Feed Conveyor	1,219	471.0	350	2,200
SAG Mill No. 2 Feed Conveyor	1,219	471.0	350	2,200
Pebble Crusher No. 1 Feed Conveyor	1,219	8.5	60	520
Pebble Crusher No. 2 Feed Conveyor	1,219	8.5	60	520
Pebble Transfer Conveyor No. 1	1,067	70.7	20	520
Pebble Transfer Conveyor No. 2	1,067	70.7	20	520
Pebble Crusher No's Discharge Conveyor	1,067	39.7	60	520
Crushed Pebble Transfer Conveyor No. 1	1,219	11.5	20	520
Pebble Crusher No. 2 Discharge Conveyor	1,067	39.7	60	520
Crushed Pebble Transfer Conveyor No. 2	1,219	11.5	20	520
SAG Mill No. 1 Discharge Conveyor	1,219	17.5	20	520
SAG Mill No. 2 Discharge Conveyor	1,219	17.5	20	520

Note: mm = millimetre; m = metre; kW = kilowatt; t/h = tonnes per hour; SAG = semi-autogenous grind;

The dump pocket will be equipped with a water spray, an agglomerative dust suppression, or a "fogging" system. The apron feeder discharge chute will be equipped with a baghouse-type dust collector.

Crushed ore will be transferred from the surge pocket to the crusher discharge conveyor at an average rate of 3,333 t/h. The apron feeder under the crusher will be equipped with a variable speed drive (VFD), allowing it to control the loading on the crusher discharge conveyor. The feeder will be set at a withdrawal angle of 60°.

Figure 2.2.3-53 shows a side-profile view of the general arrangement of the crusher.

The crusher discharge conveyor will feed the COS feed conveyor, which will be an uncovered conveyor structure constructed with a standard walkway on both sides. The belt will be equipped with a rip detection system that will automatically stop the conveyor in the event any tearing is detected.

The COS will have a live capacity of 60,000 t, which translates to 24 hours of nominal process plant operation. The total live and dead storage capacity will be 300,000 t, equivalent to about five days of normal operation. With the use of a bulldozer, this allows the process plant to continue operating for the duration of a complete crusher concave/mantle relining, when necessary.

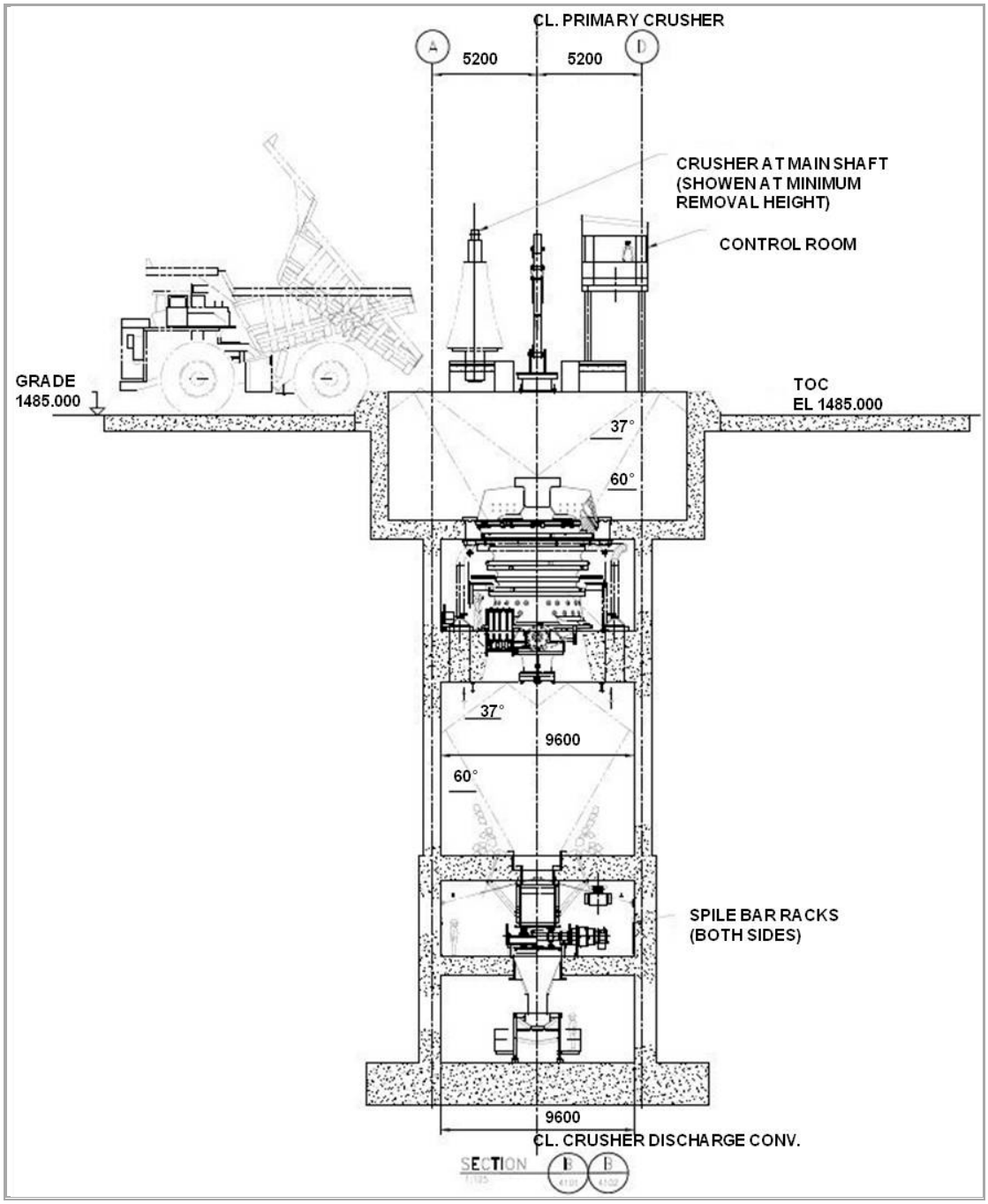


Figure 2.2.3-53: Crusher General Arrangement – Side View

The COS will be equipped with two lines of three reclaim apron feeders sized such that two feeders per line can deliver the design rate. The apron feeder discharge chutes will be equipped with a baghouse-type dust collector to control dust in the tunnel.

2.2.3.3.3.2.2 Grinding

The simulation results established that the base case flowsheet to achieve 60 kilotonne per day (kt/d) at P_{80} 150 µm and 75th percentile hardness is two parallel lines, each with one SAG mill, pebble crusher, and ball mill, as shown on **Figure 2.2.3-54**. For simplicity, only one of the two lines or trains is shown. The equipment and conveyors in this area are listed in **Table 2.2.3-22** and **Table 2.2.3-23**.

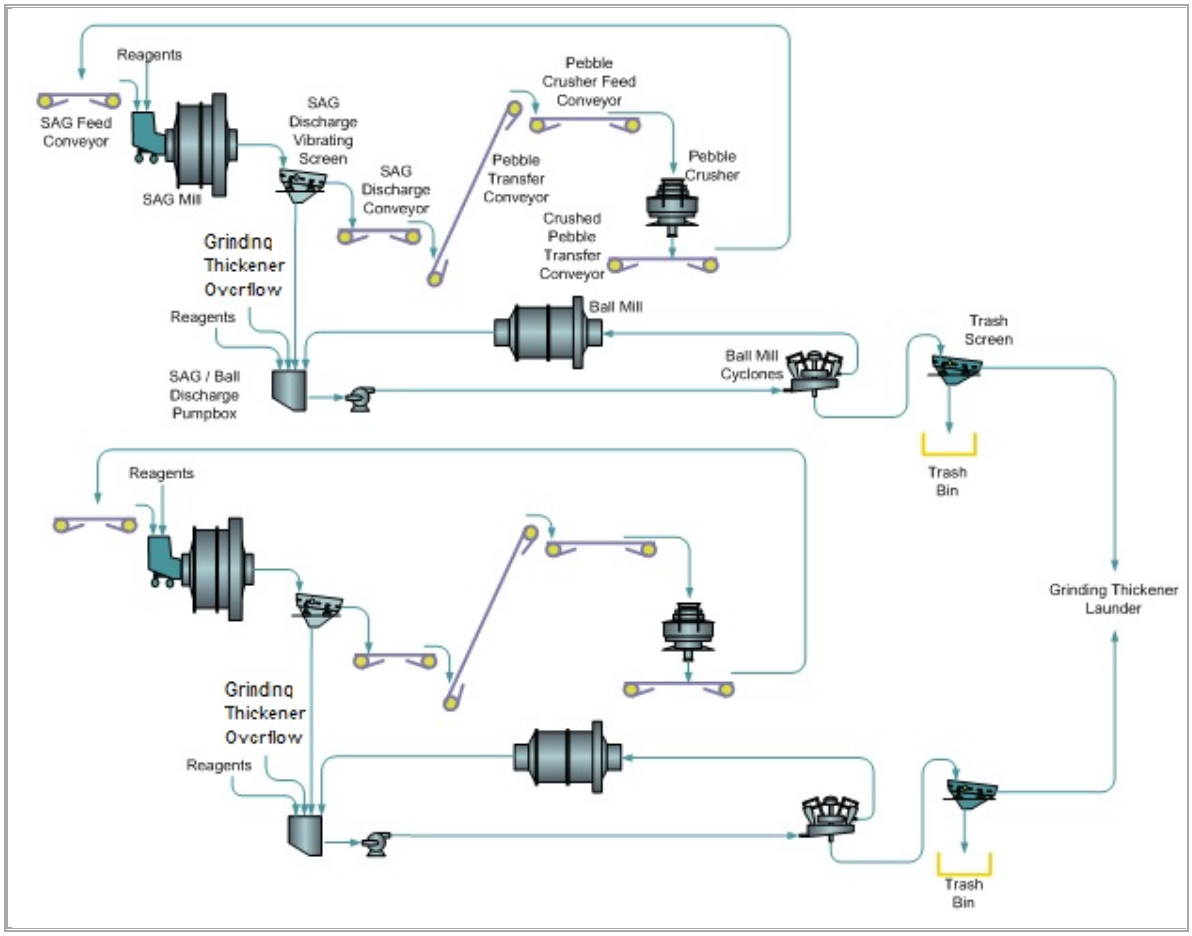


Figure 2.2.3-54: Grinding Circuit Flowsheet

Each SAG mill feed conveyor will be equipped with a rip detection device to alert personnel of belt problems.

The SAG mill itself will be trunnion-supported and driven by two variable-speed motors. The SAG mill will discharge to a dedicated vibrating scalping screen with 13 mm square apertures to achieve a SAG transfer P_{80} of 2.1 mm. Oversized material will be diverted to pebble crushers, whereas the transfer undersize will be sent to the SAG/ball mill discharge pumpbox for classification via the ball mill cyclones.

Lime (1 kilogram per tonne [kg/t]) will be added to the SAG mill, along with 140 mm (5.5") size steel ball grinding media.

The ball mill coupled with each SAG mill will operate in closed circuit configuration with cyclones to produce a P_{80} of 150 µm. The ball mill will generally use standard 2.5" balls, but these can be increased to 4" as required. Each ball mill will rotate unidirectionally in the opposite direction to the other. Trommel magnets will be installed on the ball mills to remove balls and ball chips from the ball mill discharge slurry. (Operating experience has shown that removing the ball chips significantly increases the grinding efficiency and the life of pump wear parts.) After discharge from the ball mill, the slurry will pass through a grizzly to pick out any remaining large steel before entering the cyclone feed pumpbox.

The strategy for the design of the SAG mill liners for the FS was primarily to ensure that the grate size and open area enabled consistent production in the comminution circuit. After a JKSimMet simulation of the grinding circuit, the SAG mill grates were adjusted to provide 12% open area and all 3.5" pebble ports for the mass transfer of critical size material out of the SAG mill to the pebble cone crusher; this pebble port size is at the maximum for industry-accepted design parameters and is required to ensure the SAG mill meets the production target, particularly considering the hardness of the ore.

The design of the SAG mill liners will be developed further during the detailed engineering phase based on recommendations from the mill manufacturer and liner manufacturer with regard to number of rows, liner profile, face angle, etc. Steel liners are the specified material. The recommended liner design will be reviewed for aspects of space between liners, face angle, lifter height, and type of steel to ensure proper performance. Charge motion simulations will be performed.

The ball mill liner design will be carried out during detailed engineering. Steel has been specified as the material of fabrication for the ball mill liners. Composite liners may offer a potential opportunity to improve liner life and will be evaluated during the next stage of design.

The cyclones used to classify ball mill feed versus leach feed will operate at a feed density of 55% solids by weight to produce a circuit product size P_{80} of 150 µm.

The grinding area will be equipped with two overhead cranes for mill relining, SAG mill screen replacement, and other maintenance. In addition, a sump pump will be installed for cleanup of the basement floor in case of spills.

Oversized SAG discharge will be sent to a pebble crusher to manage a circulating load as high as 30%. The pebble crusher will have a retractable VFD belt feeder to allow for changes in feed rate as well as to provide easy access for relining and maintenance.

A bypass system on the pebble crushing facility will automatically divert uncrushed pebbles to an emergency stockpile or to a conveyor for return to the SAG mill feed conveyor. The pebble crusher will also be protected from tramp metal by a metal detector on the pebble conveyor that will automatically activate the diverter gate to the bypass position when metal is detected on belt. A

surge bin ahead of the crusher will ensure that the feed rate can be controlled and to enable choke-feeding.

A dust collection system will be provided at the crusher discharge chute to manage dust generated by the crusher.

This area will be equipped with an overhead crane for crusher relining and other maintenance, and a sump pump will be installed for cleanup of the basement floor.

Figure 2.2.3-55 shows the operating floor plan for the grinding plant, which illustrates the grinding configuration: grinding trains are set in mirror image, spanning a ground floor and an operating floor. The two trains are side by side to share access to the cyclone feed pumpbox as well as to replicate the ease of pumping and line arrangement with regard to serviceability. This arrangement also allows the pebble crushers to be in the same building as the grinding area, minimizing the structural costs of having the circuit span multiple buildings.

Figure 2.2.3-56 is a side profile view of the two crushing areas, with the service cranes labelled to indicate how maintenance and accessibility to larger equipment is managed.

2.2.3.3.3.2.3 Leach Feed Thickening

Ground ore from the SAG/ball mill circuit will flow from the cyclone clusters by gravity to two trash screens for the removal of organic materials, metal, and other miscellaneous tramp materials. The undersize from the two trash screens will flow by gravity to the leach feed thickener, whereas the oversize will be diverted to a trash screen bin, which will be emptied periodically.

The leach feed thickener preliminary sizing indicates an 80 m diameter high-rate type with an auto-diluting feed well. The feed slurry density of 30% solids will be increased to a target of about 55% solids in the underflow after thickening. The speed of the underflow pumps underneath the thickener will be varied to control the solids density of the feed to the leach circuit.

Thickener overflow water will be sent to the cyclone feed pump boxes.

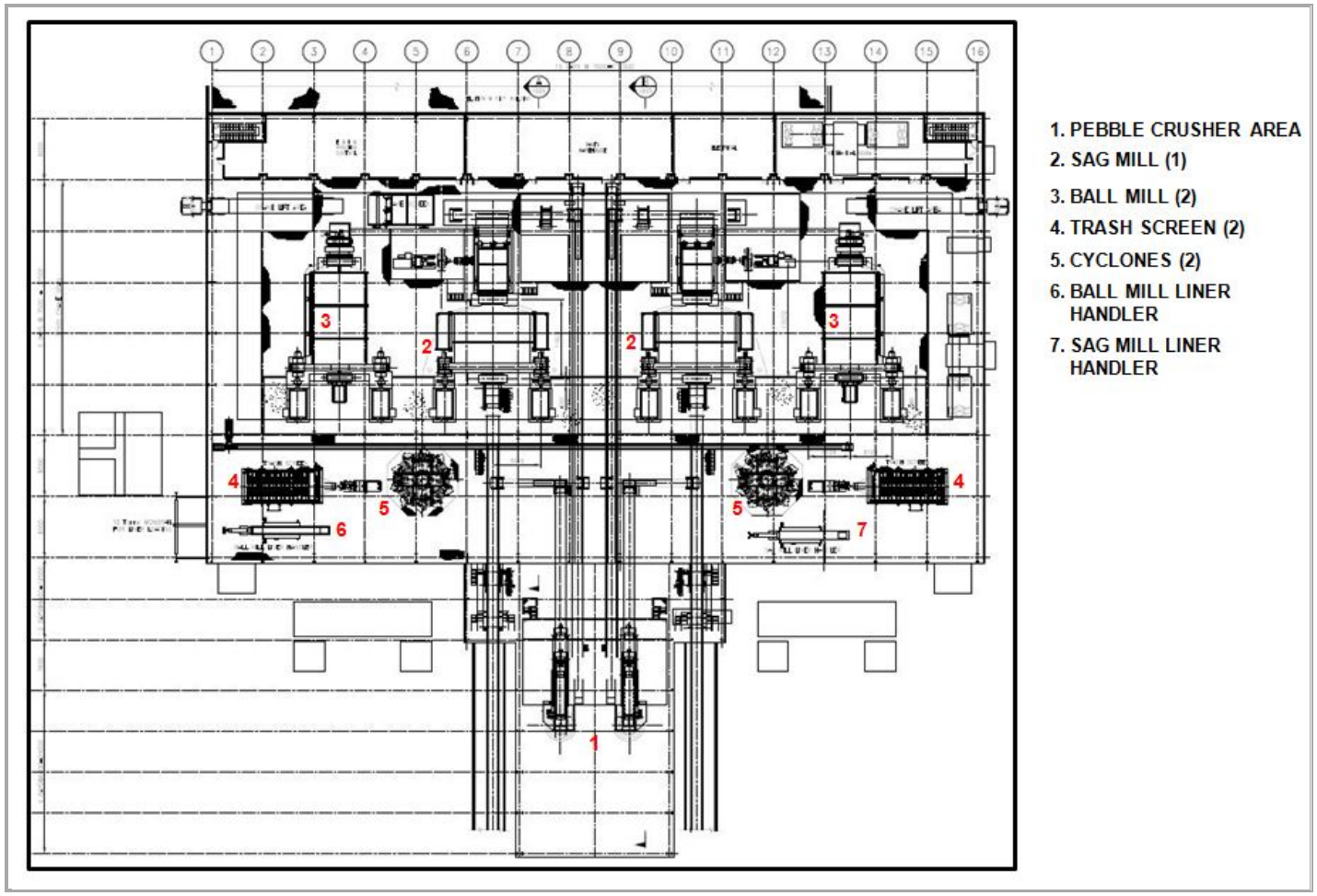


Figure 2.2.3-55: Grinding Plant Operating Floor – General Arrangement

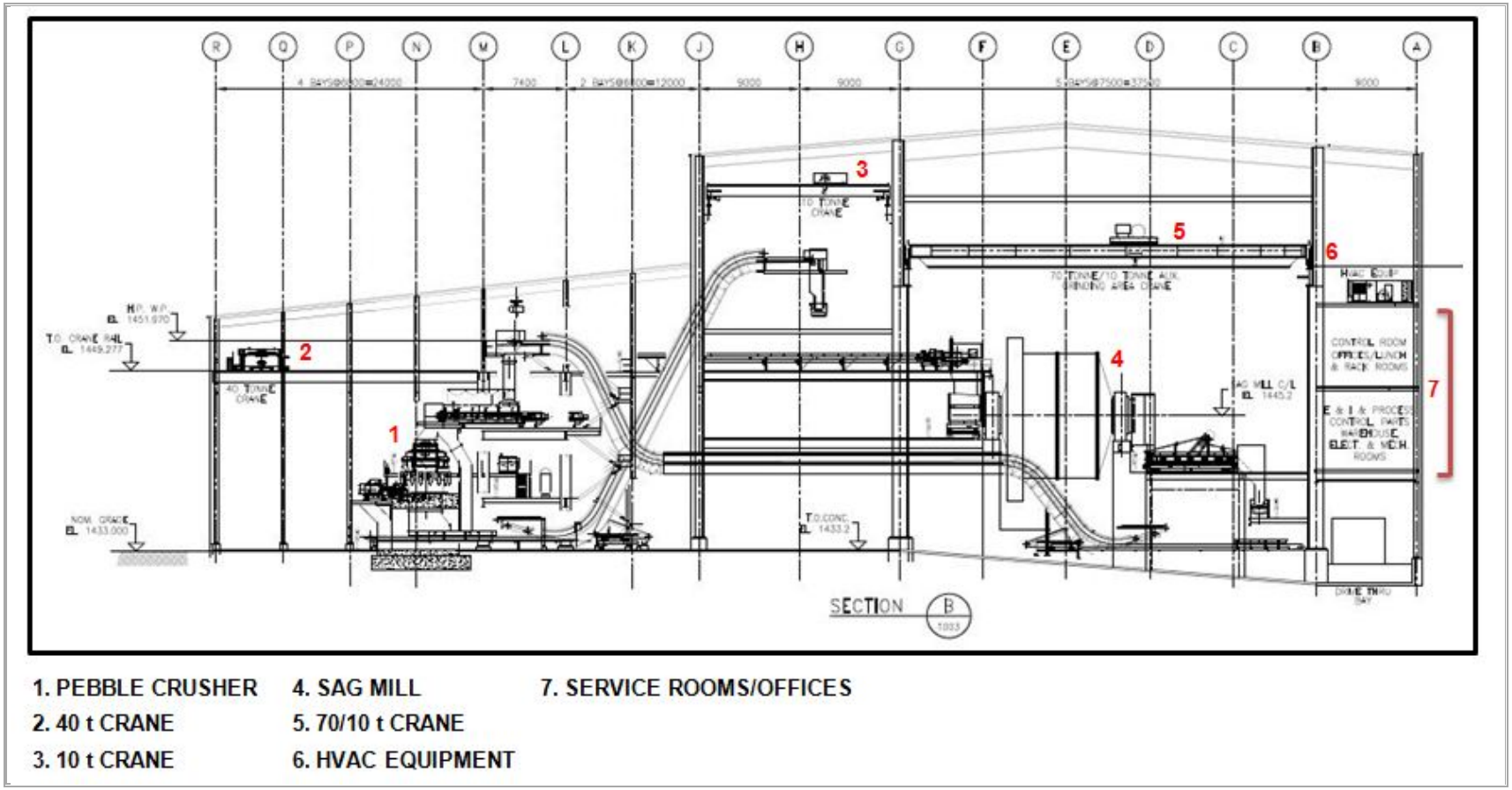


Figure 2.2.3-56: Grinding and Pebble Crushing Areas – Side Profile

2.2.3.3.3.2.4 Whole Ore Leach and Carbon-In-Pulp

The grinding thickener underflow stream will be diverted to a leach feed tank where it will be mixed with CN to achieve a concentration of 500 grams per litre (g/L).

The slurry will be diverted between two distribution tanks, each of which will provide feed to two WOL lines (**Figure 2.2.3-57** and **Figure 2.2.3-58**). Thus, there are four identical parallel leach lines, designated as lines A, B, C, and D. For ease of discussion, only one line is described below.

The WOL line will consist of four blocks of six tanks in series, each 18 m diameter x 20 m high. Slurry will overflow from one tank to the next as it makes its way through the line. Each tank will be equipped with manual bypass valves and a bypass line traversing the tank to allow for isolation of a specific tank as required.

Mechanical agitators in the tanks will maintain the slurry in suspension. Air will be injected into the tank from a gas sparger system at the base to maintain the solution oxygen level needed for process kinetics. To prevent the generation of hydrogen cyanide (HCN), the slurry pH will be maintained at a minimum of 10.5 by feeding milk-of-lime to the first five tanks.

Once leaching is completed, the slurry from all four leach lines will be recombined in the CIP tank pumpbox and pumped to the CIP tanks.

The pump-cell CIP circuit arrangement will consist of two lines of seven 400 m^3 tanks operating in carousel mode. In this mode of operation each tank has its own discrete batch of carbon, which spends a definite period of time in the circuit before the entire batch is removed to elution. Gold loadings are expected to be more uniform, with gold-in-carbon and gold-in-solution profiles easier to manage and predict, thus improving the accuracy of gold accounting.

Since the activated carbon is not transferred from contactor to contactor, no transfer pumps are required, and the interstage screens are sized to suit the flow. This reduction in carbon pumping is expected to reduce carbon consumption.

The circuit will operate at a carbon concentration of 50 g/L of slurry and will need a total of approximately 280 t of carbon. It is anticipated that 40 t/d of loaded carbon will be generated.

Two 30-ton overhead cranes will be located in the area for maintenance access as needed.

The general arrangement of the CIP circuit is shown on **Figure 2.2.3-59**.

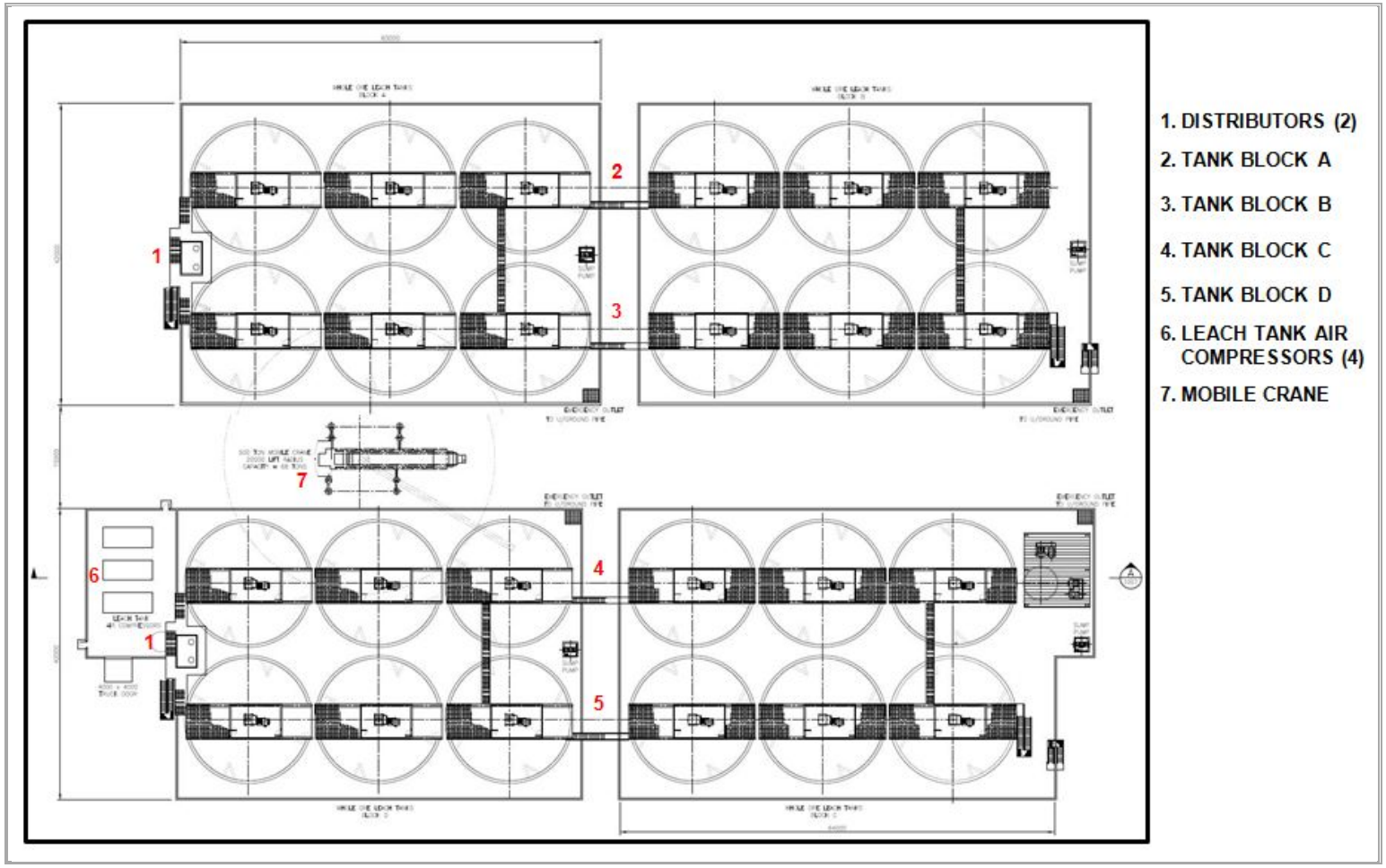


Figure 2.2.3-57: Whole Ore Leach General Arrangement – Plan View

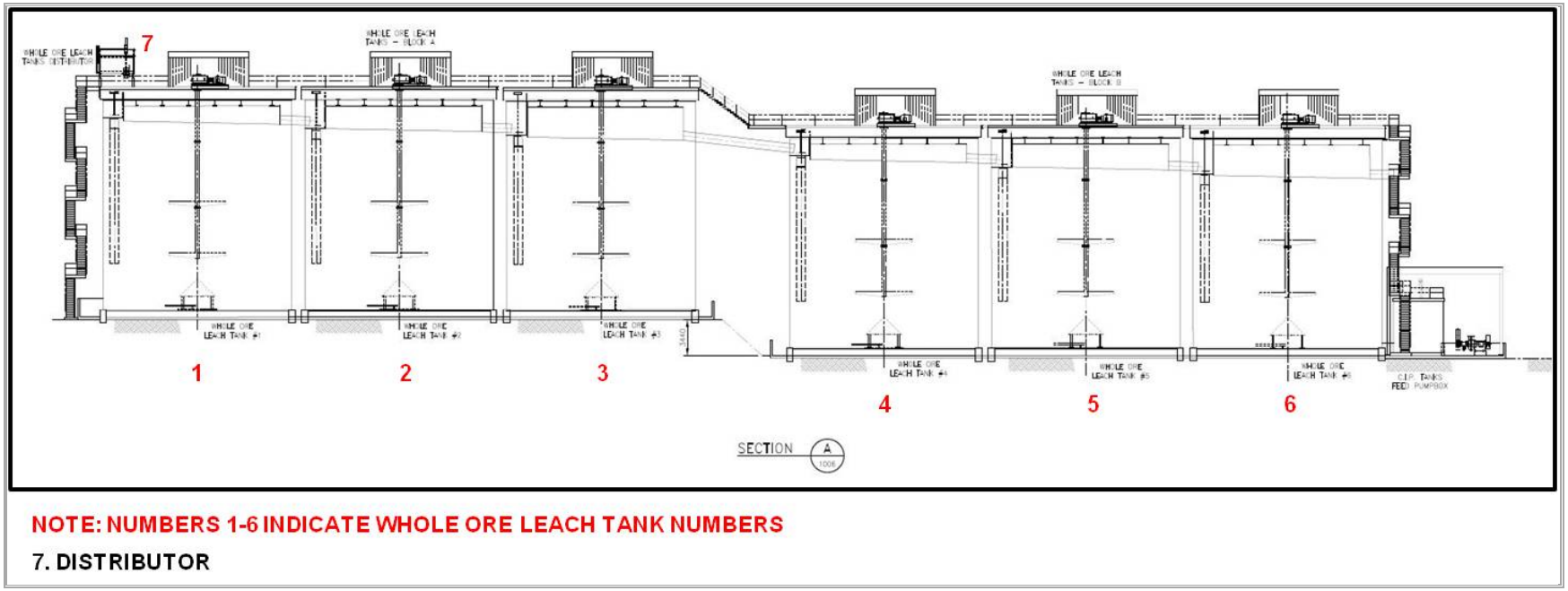


Figure 2.2.3-58: Whole Ore Leach General Arrangement – Section View

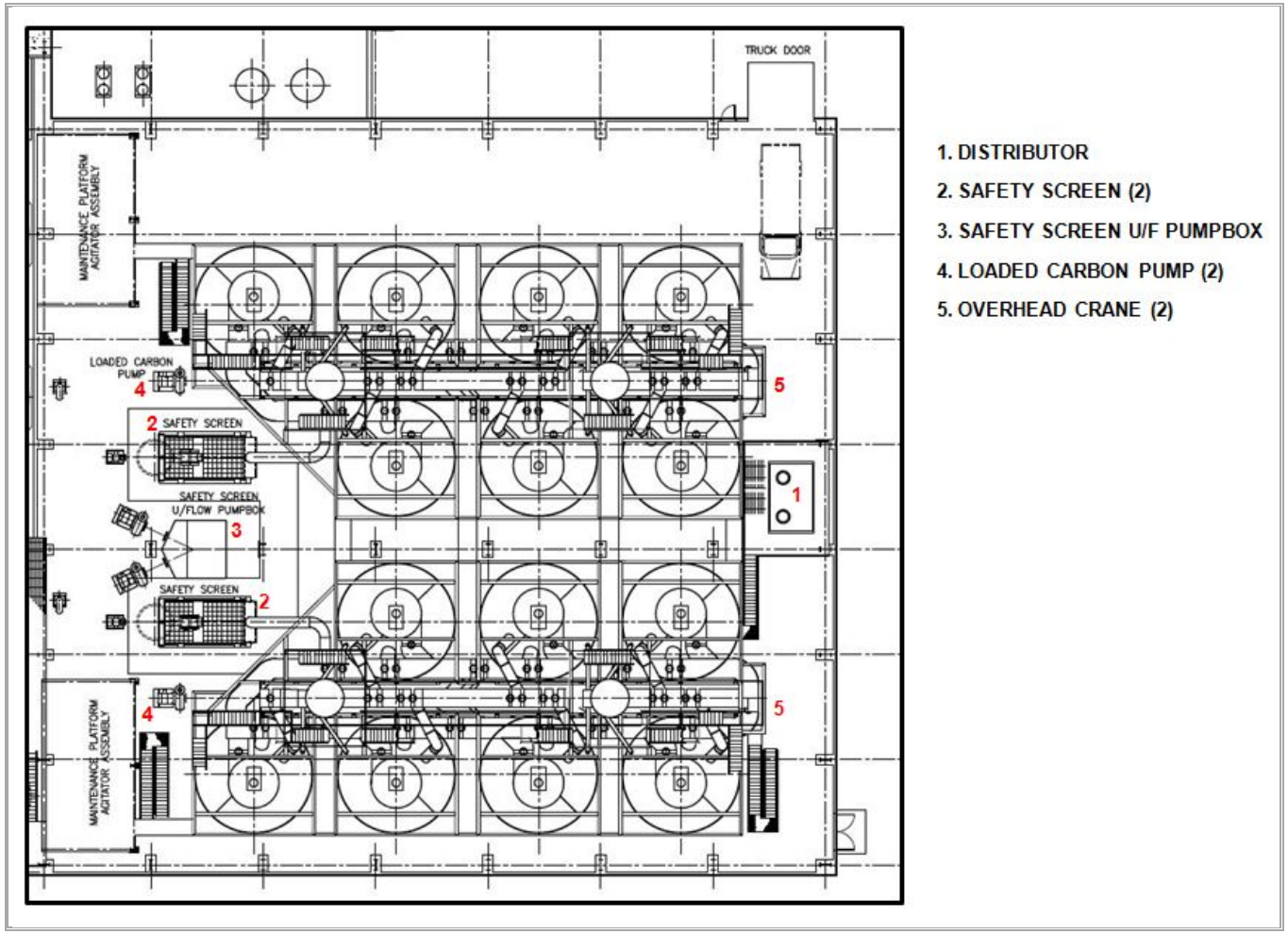


Figure 2.2.3-59: CIP Circuit General Arrangement

2.2.3.3.3.2.5 Stripping Circuit

The slurry containing loaded carbon from the CIP circuit will be pumped to a vibrating carbon recovery screen. The carbon washed from the screen will fall through a chute into two acid wash vessels. The remaining slurry on the recovery screen will flow through the screen deck to be collected in a screen undersize launder and pumped back to the CIP feed.

Pressure Zadra technology will be applied for the carbon stripping process. In addition to the two acid wash vessels, the circuit will consist of two carbon stripping vessels, one pregnant solution tank, and one barren solution tank. Carbon will be processed in batches of 20 t, such that two elution cycles can be achieved per day. Thus, with each strip cycle having a duration of 11 hours, it will be possible to strip 80 t/d of carbon during high silver feed grade periods.

Each strip cycle consists of three distinct phases. The first is acid washing, where a 4% w/w (percent weight/weight) concentration of hydrochloric acid is used to fill the vessel containing the loaded carbon from the bottom up. The acid is recirculated for 1.5 hours at a maximum solution contact rate of two bed volumes per hour.

This is followed by a neutralization rinse in the same vessel. A 1% w/w solution of sodium hydroxide is circulated through the carbon over a period of 1.5 hours; the maximum solution contact rate for this phase is two bed volumes per hour.

The last phase is elution, where the carbon is transferred to two carbon stripping/elution vessels. Here, the carbon is subjected to an upflow of strip solution, consisting of fresh water, 1% sodium hydroxide, and 0.1% sodium cyanide (NaCN). This phase is carried out at a pressure of 500 kilopascals (kPa) and a temperature of 150°C. It lasts 8 hours and produces a solution strip volume of 640 m^3.

Eluate is bled out of the stripping vessel at a constant rate to a pregnant solution tank capable of holding all 640 m^3 of strip solution per cycle. This pregnant solution is cooled by inline heat exchangers installed in downstream eluate piping. After the heat exchangers, the solution will flow directly to electrowinning cells in the gold room.

After stripping, the barren carbon is cooled by a water rinse step lasting an hour in the strip vessel. This carbon is then pumped from the strip vessel to two carbon regeneration circuits, each consisting of a 1.5 m x 3.6 m vibrating carbon dewatering screen and a regeneration kiln. The screened carbon is sent to the carbon regeneration kiln while the undersize is sent to a fines tank. The material from the fines tank is pumped through a carbon fines filter press, and captured carbon is stored in bags. Periodically, the carbon fines will be treated in an off-site smelter to recover credit for residual gold and silver values contained therein.

Both carbon regeneration kilns will be indirectly heated electric kilns, each rated at a nominal production of 30 t/d at an availability of 75%. The normal operating temperature for these kilns is 675°C. After heating, the carbon drops into two carbon quench tanks where it is cooled with water and from where it is sent to the carbon sizing screen. Oversized carbon from this screen will be

stored in a dedicated storage tank before being pumped back into the CIP circuit as needed. Undersize will join the other carbon fines in the carbon fines tank prior to filtration.

Figure 2.2.3-60 and **Figure 2.2.3-61** show the process flowsheet and the general arrangement of the relevant portion of the elution building. The layout of this area of the building was dictated by process flow and the desire to minimize piping over the given footprint.

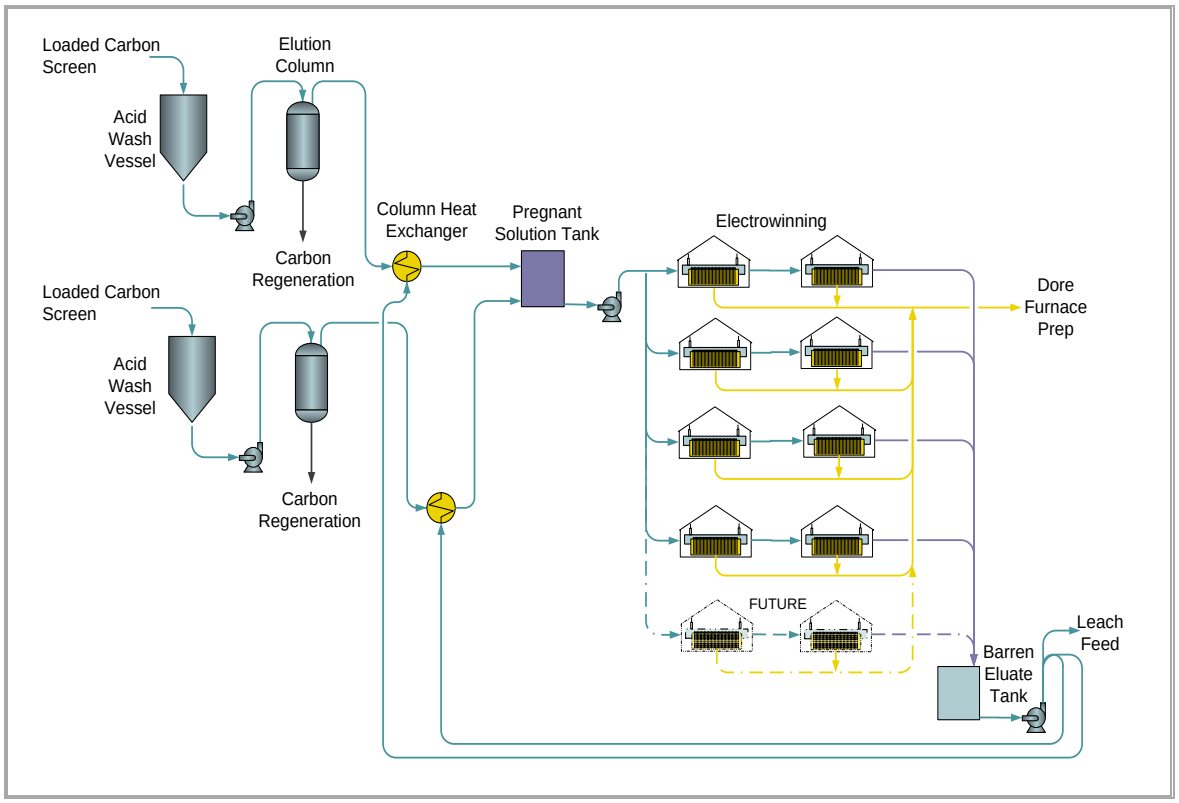


Figure 2.2.3-60: Stripping Circuit Flowsheet

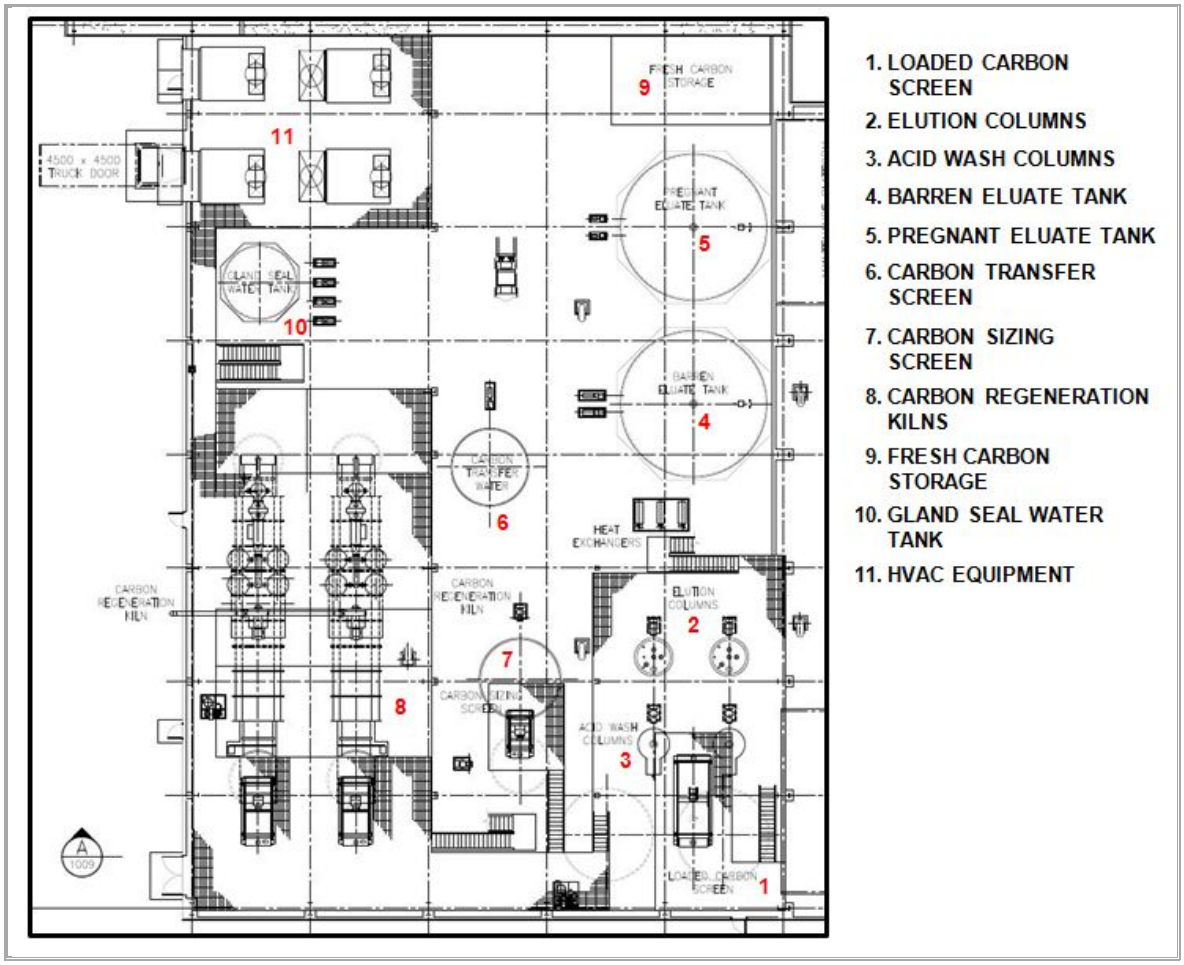


Figure 2.2.3-61: Stripping Circuit General Arrangement

2.2.3.3.3.2.6 Electrowinning and Refining

Solution will be pumped directly from the 9.1 m diameter x 9.1 m high pregnant solution tank to ten 150 cubic feet (ft^3) electrowinning sludging cells, arranged in five lines of two, at an overall feed solution flow rate of 96 cubic metres per hour (m^3/h). The cells will have 304 stainless steel perforated plate cathodes and punch plate anodes. After electrowinning, the eluate will flow to the barren solution tank and be recycled to elution as part of the carbon stripping process. The target metal concentration for the barren solution is ≤1.8 g/t Au and 4.9 g/t Ag.

The air in the electrowinning room will be treated by an overhead scrubber and fan assembly before being released to the atmosphere. The fan will be capable of moving 15,000 m^3/h of air.

Three times per week, a set of three or four electrowinning cells will be cleaned to recover gold into sludge dislocated from the cathodes. This will be performed by washing the cathodes in place with a high-pressure washer to dislodge as much sludge as possible. The sludge will flow to the electrowinning sludge pumpbox and be pumped to two sludge filter presses for dewatering. Cake

produced by these presses will be transferred to pans and placed in an electric drying oven at 600°C before being mixed with a prescribed flux to prepare for charging the refining furnace.

The nominal flux formula will be an industry-typical mixture of borax, potassium nitrate, and silica, at the respective ratios of 0.4, 0.3, and 0.3 in grams per gram (g/g) of gold.

The furnace will be an induction-style unit, 750 kilowatts (kW), supplied complete with a power pack, power ramping control, and fume collection. A high-temperature baghouse will collect fumes from the furnace. The gas will be cleaned further through a high-temperature dust collector carbon filter.

The melted metal will be poured into a series of moulds to produce doré bars, while the slag produced will be poured into slag moulds. After cooling, the slag will be broken up, with the high-grade slag material being re-poured to increase recovery and low-grade slag recycled to the grinding circuit.

Upper and ground floor plan views of the refinery area are shown on **Figure 2.2.3-62** and **Figure 2.2.3-63**. The upper floor houses the electrowinning cells and the rectifiers, whereas the ground floor has the electrowinning sludge pumpbox, and barren solution discharge tank. This area also has showers, laundry, lunchroom, and office space for workers.

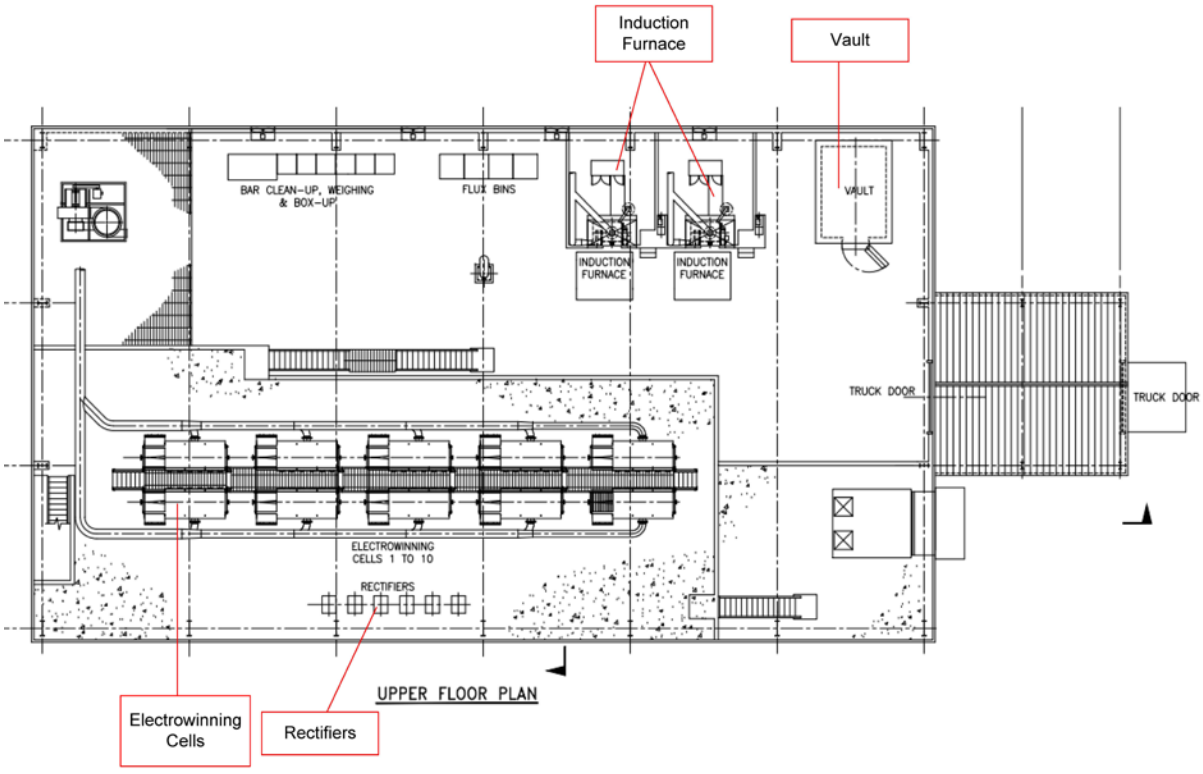


Figure 2.2.3-62: Electrowinning and Refining General Arrangement – Upper Floor

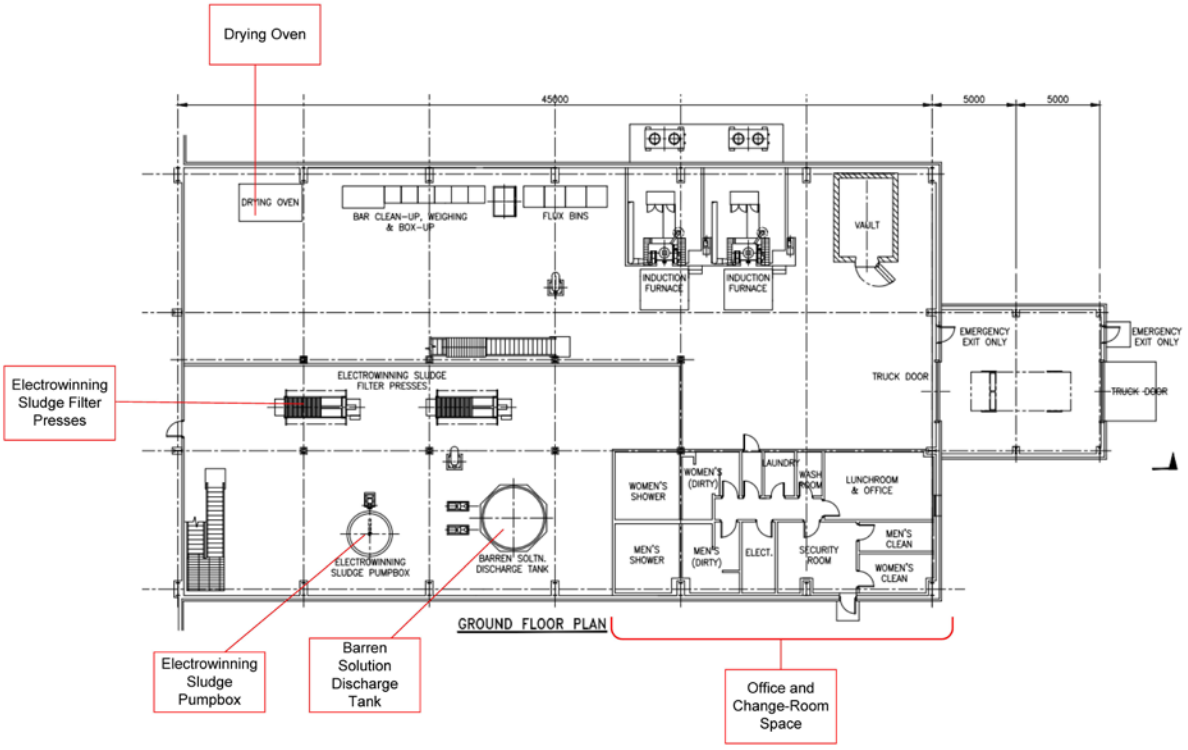


Figure 2.2.3-63: Electrowinning and Refining General Arrangement – Ground Floor

A dust-collection system will be provided at the crusher discharge chute to manage dust generated by the crusher. This area will be equipped with an overhead crane for crusher relining and other maintenance, and a sump pump will be installed for cleanup of the basement floor.

2.2.3.3.3.3 Trade-off Overview

A series of trade-off studies were conducted to establish the best economical options, considering alternative processes. The recommendations have been implemented in the process flow diagrams in the FS. **Table 2.2.3-24** presents the trade-off studies completed, together with conclusions.

Oxide/transition ore processed in the early years is softer; therefore, mill production may be higher than 60,000 t/d. During detailed design, previous grinding testwork will be re-evaluated to assess the effect of softer ore on throughput (i.e., potential to increase throughput in the early years to 66,000 t/d to 69,000 t/d).

Although not part of the current design, pre-crushing the SAG mill feed to a finer feed size could increase throughput by about 20% and reduce ball mill liner and media cost compared to a standard SABC circuit. A pre-crush circuit would have higher capital and power costs, SAG ball wear, layout space requirements, and SAG mill maintenance. However, it is a relatively new process configuration. The potential for pre-crushing will be examined during the detailed design phase.

Table 2.2.3-24: Trade-off Studies List and Summary of Outcomes

TDM No.	Description	Decision
TDM 001	CIP vs. CIL	Implement CIP
TDM 002	SO_2/air vs. Caro's Acid for CN Destruction	Implement SO_2/air
TDM 003	SO_2 Supply Sources	SO_2 plant to use molten sulphur
TDM 004	CN Recovery and Re-use	Implement tailings thickener and ball milling in CN and consider a CIC circuit to recover metal values leached during grinding.
TDM 005	Comminution Circuit – Calculation and Simulations	SAG mill size: 36 ø' x 24' F/F Ball mill size: 27' ø x 44' F/F Installed power: 34 MW
TDM 006	Carbon Adsorption vs. Merrill Crowe (WOL)	Implement CIP
TDM 007	Comminution – SABC vs. HPGR	Implement SABC
TDM 008	Gravity Recoverable Gold Testing and Modelling	Allow for gravity concentration as a retrofit option to be implemented should the need arise
TDM 010	Conventional CIP vs. Carrousel CIP	Implement conventional CIP arrangement using pumping screens
TDM 011	Carbon Loading Modelling	Implement six CIP stages, with a carbon concentration of 25 g/L and elution rate of 40 t/d
TDM 015	Throughput Optimization	Review of overall Project economics indicated better return for 60 kt/d over 30 kt/d and 45 kt/d
TDM 016	Process Optimization	Financial evaluation of the process plant facilities indicated that WOL is the preferred option.
FS-TDM 001	Ag Loading on Carbon	To deal with peak Ag grades in the order of 10 g/t to 12 g/t it is recommended to implement: • seven-stage CIC circuit on grinding thickener overflow • seven-stage CIP circuit • two strip and regeneration circuits, each line with 20 tonne carbon processing capacity
FS-TDM 002	Electrowinning vs. Zn Precipitation	Implement electrowinning

TDM No.	Description	Decision
FS-TDM 003-Update	Oxygen vs. Process Air	Scoping oxygen addition testwork indicated a potential increase in precious-metal leach extraction as well as an increase in CN consumption. Additional testwork is recommended, to confirm the magnitude of the increase in leach extraction and CN consumption. No implementation of oxygen addition
FS-TDM 004-Update	CN recovery and reuse	CIC and tails thickener benefit analysis using FS design criteria and CAPEX No implementation of CIC Implement tails thickener
FS-TDM 010-Update	Conventional CIP vs. AAC Pump-cell Circuit	Comparison between conventional CIP and the AAC Pump-cell using FS design criteria, CAPEX, and OPEX Implement the AAC pump-cell type circuit.

Note: ø = diameter; Ag = silver; CIC = carbon in columns; CIL = carbon in leach; CIP = carbon-in-pulp; CN = cyanide; FS = feasibility study; g/L = grams per litre; g/t = grams per tonne; HPGR = high pressure grinding rolls; kt/d = kilotonnes per day; MW = megawatt; SABC = SAG/ball mill/crusher; SAG = semi-autogenous grinding; SO_2 = sulphur dioxide; t = tonne; WOL = whole ore leach; Zn = zinc

2.2.3.3.3.4 Tailings Thickening

Tailings generated in the CIP circuit will initially be screened through the carbon safety screens to capture any attritioned carbon particles that remain in the discharge slurry. The undersize from the screens will be sent to the tailings thickener, while the oversize will be stored for later processing through the carbon sizing screen.

The tailings thickener preliminary sizing indicates an 80 m diameter high-rate type with an auto-diluting feed well. The feed slurry density of 50% solids will be increased to a target of about 60% solids in the underflow after thickening. The speed of the underflow pumps beneath the thickener will be varied to control the solids density of the thickened tailings. Flocculant will be added at a nominal rate of 0.02 kg/t of feed solids to assist with the tailings thickening.

Overflow water from the tailings thickener will be recycled back to the grinding cyclone feed pumpboxes so that the CN recovered with this solution can be reused. Underflow solids will be sent to CN destruction.

2.2.3.3.3.5 Cyanide Destruction and Tailings

The CN destruction process will take place in three parallel tanks, each 14 m diameter x 14 m high. Each tank will have a high-power agitator to assist with gas dispersion in the slurry. The gas will be a mixture of SO_2 and air supplied through a sparging system. The slurry will be fed into the system at a density of 45% solids diluted from 60% solids with TSF reclaim water. The circuit will have a residence time of 60 minutes at the rated throughput.

The anticipated CN feed concentration of 100 milligrams per litre (mg/L) will be reduced to less than 1 mg/L in the TSF. SO_2 will be fed at a rate of 5 g/g of CN in solution, or an estimated 1,661 kilograms per hour (kg/h). To maintain the slurry at the required pH level of 8.5, milk-of-lime will be added at a level of 1.4 kg per kilogram of SO_2. It will also be necessary to add copper sulphate at a concentration of 15 mg/L, or 33 kg/h, to maintain the reaction kinetics.

After CN destruction, all three tanks will discharge into a tailings tank, from where the slurry will be routed to the TSF.

Oxygen can be used instead of compressed air for CN leaching and CN detoxification. Although high purity oxygen is not required for the Project, early-stage testing found it improved kinetics and potentially increased metal recovery; this could lead to a reduction in the number of leach tanks required and/or increased metal recoveries. Oxygen could be supplied by an on-site cryogenic plant (99% pure oxygen), a vacuum swing adsorption (VSA) oxygen system (90% pure oxygen), or by trucking to site (liquid oxygen). Further testing of oxygen sparging might be conducted in the operating plant or in a large-scale continuous pilot plant.

2.2.3.3.3.6 Plant Water Systems

The bulk of the process plant's water requirements will be met with water reclaimed from air compressors, column heat exchangers, the thickeners, and the TSF. The reclaim water tank at

the plant site will be 18 m diameter x 20 m high, and will use a combination of low-pressure process water pumps and booster pumps to distribute water to the points required.

Fresh water obtained from Tatelkuz Lake will be stored for use in both a gland seal water tank, 4.5 m diameter x 5.8 m high, and as fire water stored in the freshwater/fire water tank, 12 m diameter x 14 m high. Three fire water pumps will be installed on the fire water section of the tank: one diesel, one electric, and one jockey. Pumps will also be installed to forward water as needed to the process building and the truck shop. A portion of the water from the fire water tank will be treated in a potable water treatment plant, and stored in a small, 5 m diameter x 6 m high potable water tank.

2.2.3.3.3.7 Reagent Preparation

The reagent preparation area includes receiving systems and mixing/preparation/metering systems for flocculant, caustic, CN, copper sulphate, sodium metabisulphate, antiscalant, and lime. Hydrochloric acid will be handled in the strip area. These systems will all be located in a separate reagent building designed for easy access for transport trucks delivering bulk and packaged reagents.

- Flocculant will be delivered to the plant in super sacs. The bags will be stored indoors, and a 7- to 10-day supply will be kept in the mixing area. The sacs will be lifted and fed into a hopper/screw feeder for transfer into a wetting device (water spray funnel) and discharge into a mix tank, where it will be further diluted. The flocculant will then be transferred to a holding tank for distribution to the thickeners by four flocculant metering pumps (two active, two spare);
- Caustic soda will be delivered in liquid form in bulk transport trucks, each carrying approximately 35 t. In the reagent building, the caustic will be unloaded into a storage tank, from where it will be pumped through a filter/strainer to a holding tank for further make-down. The final solution will be pumped to use areas in the process plant;
- NaCN will be delivered in solid bulk form, in ISOtainers, by trucks carrying approximately 20 t each. Smaller bags/boxes of sodium CN will also be available at all times as a contingency. Bulk CN will be dissolved within the ISOtainers and transferred to a mix tank for further dilution with warm reclaim water. The solution will then be pumped to a holding tank for distribution to the WOL circuits, the barren eluate tank, and the cyclone feed pumpbox, as required. A spare standby pump will also be provided at the holding tank. Transport, management, and storage of CN will be consistent with the ICMC. CN management is discussed further in **Section 12.2.1.18.4.19**, Cyanide Management Plan (CYMP);
- Lime will be delivered in bulk by trucks containing approximately 40 t each, equipped with a pneumatic unloading system. Lime will be unloaded into a 300-ton capacity silo equipped with dust collectors, a pneumatic unloading system, and an unloading hopper at the bottom. A screw feeder will convey the lime from the bottom hopper of the silo to a vertical lime slaker, where water will be added to dissolve the quicklime and produce a slurry. The lime slurry will flow to a holding tank, equipped with an agitator, for

distribution by two distribution pumps (plus a spare) to the various WOL lines, the grinding circuit, the tailings thickener launder, and the CN destruction circuit. The distribution system will be configured in a loop so that excess lime returns to the holding tank. An estimated 28,600 t will be required annually;

- Copper sulphate will be delivered in powdered form in 1,000 kilogram (kg) super sacs. Sacs will be emptied onto the feed bin of an agitated tank, where the powder will be mixed with water to the required concentration. The solution mixture will then be pumped to a holding tank, and from there to the CN destruction trains as needed;
- Hydrochloric acid will be delivered in bulk liquid form by truck, pumped to a dilute acid tank, and distributed as needed;
- Sulphur will be delivered in bulk molten form by tanker trucks, and processed in a sulphur burner package provided by a vendor to produce SO_2 for the CN destruction circuit. In the burner package, the molten sulphur passes through a filter, enters a combustion chamber, and is burned to produce SO_2. The gas is cooled and fanned into the CN destruction circuit in the quantities required. Any acid found when draining the sulphur quench vessel will be pumped to the CN destruction trains;
- Sodium metabisulphite will be delivered in super sacs, which will be unloaded into a dedicated mix tank, complete with an agitator, a dust collector, and an exhaust fan. The contents of the mix tank will be forwarded to a storage tank and pumped from there to the CN destruction tank as needed. The sodium metabisulphite system is a backup system to the generation of SO_2 from molten sulphur; and
- Antiscalant will be delivered to site in liquid totes, transferred to a mix tank, and pumped to use areas.

2.2.3.3.3.8 Cyanide Management

ISOtainers containing solid or liquid sodium cyanide (NaCN) for storage will be offloaded from trucks parked on a bermed concrete pad and stored within the reagent storage area. When NaCN is required, an ISOtainer will be moved to a concrete, bermed area near the mixing tank, where pH-adjusted water will be added to dissolve the solid NaCN, and from there pumped to the mixing tank; liquid CN will be transferred directly to the mixing tank. Both the unloading and storage areas will include sumps, sloped concrete pads, and other engineered features to facilitate recovery of any spilled materials before pumping them back to the mixing tank.

Bulk CN will be dissolved within the ISOtainers and transferred to a mix tank for further make-down with reclaim water. The solution will then be pumped to a holding tank for distribution to the WOL circuits, the barren eluate tank, and the cyclone feed pumpbox, as required. A spare standby pump will also be provided at the holding tank. The mixing tank will be installed in the mill reagent building within a secondary containment area constructed with concrete walls and floor providing sufficient capacity to hold at least 110% of the largest tank within the containment as well to any piping that drains back to the tank. This area will be covered to protect sump capacity from precipitation. Secondary containment will also be implemented in the leach and CIP areas.

ISOcontainers are double-walled tanks that provide a greater degree of environmental security. At the plant site, the full ISOtainers will be off-loaded into secure storage for use in the CN make-up facilities. Trained operators will mix the solid CN with water to form a solution of a predetermined concentration, which will be metered directly into the process use areas. Empty ISOcontainers will be backhauled to the terminal facility for reuse.

In addition to these containment measures, one emergency spill pond will be available adjacent to the processing facilities for use in the unlikely event of a large spill. The pond will be designed to receive a spill and a design storm, and will be fully lined. It should be noted that the process plant facilities are located upslope of the TSF, so all potential spills will flow by gravity to that containment facility.

All fixed piping for reagent/processing CN solutions will be constructed from materials known to be compatible with high pH CN-containing solutions. Double-walled piping will be used at concentrated addition points. CN solutions of greater than 1% (10,000 ppm) will require steel piping.

A fixed unit HCN gas detector will be located at each end of the off-loading and storage area. The detector will be designed to sound a highly audible evacuation alarm and to initiate a flashing beacon if the airborne CN concentration reaches 4.7 ppm. It will also send an electronic alert signal to the appropriate operations control room. Personnel working in designated high-potential areas will be required to carry portable HCN gas detectors triggered to alarm at 4.7 ppm.

The Project is expected to consume approximately 1,825 t/month or 22,000 t/y of NaCN. All transport, unloading, and storage will be in accordance with the ICMC of the International Cyanide Management Institute—a voluntary program for the gold mining industry, that promotes responsible management of CN to enhance protection of human health and to reduce the potential for environmental impacts.

Table 2.2.3-25 lists the primary and secondary containment measures to be implemented at the Project site for all areas that contain CN or use CN products.

Table 2.2.3-25: Cyanide Containment Measures

Area	Primary Containment	Secondary Containment
Grinding	Grinding mills, cyclones, pumpboxes, and piping	Sump (O/F) drains reporting to lined ponds
Pebble Crushing	Not required	Not required
Grinding Thickener	Thickener, overflow tank, and associated piping	Sumps and concrete berms (110% of thickener volume)
Leach and CIP	Tanks, pumpboxes, and associated piping	Sumps, LDPE liner, concrete berms (110% of one tank volume)
Carbon Operations	Carbon columns, elution vessels, preg and barren tanks, heat exchanges, and piping	Sumps and concrete berms
Tails Thickener and CN Destruction	Thickener, overflow tank, CN destruction tanks, and associated piping	Sumps and concrete berms
Refining	Electrowinning cells, tanks, pumpboxes, and associated piping	Sumps and concrete berms
Reagents	Mix and distribution tanks and associated piping	Sumps and concrete berms
Tailings Line	Drop box, piping within a ditch system	TSF

Note: CIP = carbon-in-pulp; CN = cyanide; O/F = overflow; LDPE = Low Density Polyethylene; TSF = Tailings Storage Facility

2.2.3.3.3.9 Low-Grade Ore Processing

The mine production schedule calls for LGO to be stockpiled for processing in the process plant at the end of the mine life. Limited test data are currently available for metallurgical treatment of ores with feed grades expected in this LGO stockpile (0.3 to 0.4 g/t Au). However, the lowest grades of sulphide ore tested to date do not show a decline in extraction, falling within the average.

2.2.3.3.3.10 Process Plant Site Selection and Foundation Design

A number of options were studied for the arrangement and orientation of plant facilities, taking into consideration earthworks requirements, conveyor alignments, and process flow, with the intent of maintaining gravity flow through the system where practical. Based on the WOL process, seven alternative plant arrangements were developed. Mass earthworks quantities were generated for two that seemed the most favourable. Analysis was further refined, based on routing of haul trucks to select, the most favourable option (labelled Option 1A in **Figure 2.2.3-64**).

2.2.3.3.3.10.1 Site Preparation and Development

2.2.3.3.3.10.1.1 Soil and Foundation Conditions

The information in this section is based on reports and memoranda prepared by Knight Piésold (**Appendix 2.2.A-4**), which summarize the geotechnical assessment.

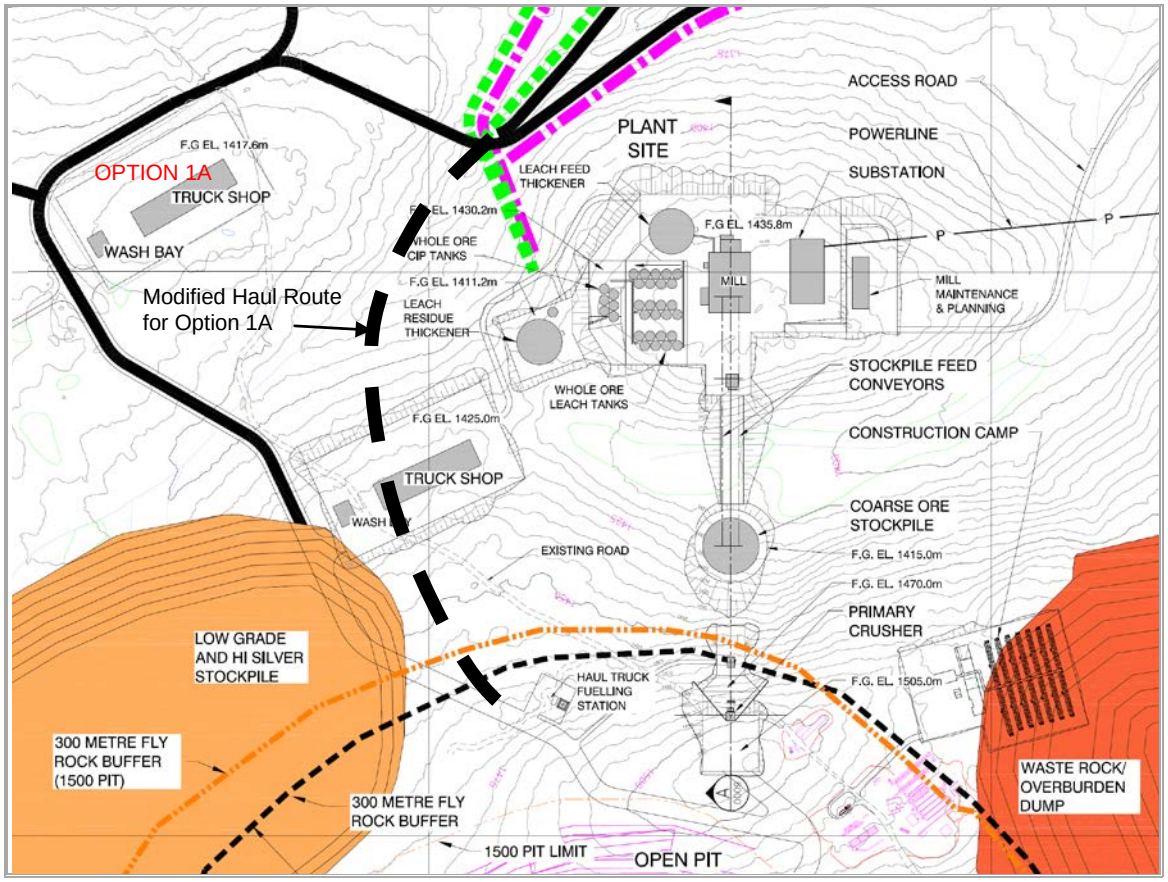


Figure 2.2.3-64: Plant Site Location

2.2.3.3.3.10.1.1.1 Bedrock

Six types of material were found in the area: topsoil, silty sand and gravel, sandy glacial till, dense glacial lodgement till, completely weathered bedrock, and competent bedrock.

Competent bedrock was typically encountered below overburden in the plant site area and below completely weathered bedrock in other areas. There was some slight weathering near the overburden interface, but the material transitioned to fresh bedrock with depth. Bedrock in the slightly weathered zone may be rippable, but a typical thickness could not be estimated from the available information. Unconfined compressive strength (UCS) testing was completed on four competent bedrock samples in the plant site area. These UCS values had a range of 70 MPa to 190 MPa with a median value of 90 MPa.

Table 2.2.3-26 provides a summary of the interpreted stratigraphy for the mine site infrastructure.

Table 2.2.3-26: Summary of Interpreted Stratigraphy for Mine Site Infrastructure

Infrastructure	Depth	Description
Primary crusher	0 – 0.15 m	Topsoil
	0.15 – 5 m	Silty sand and gravel
	5 – 30 m	Competent bedrock
Coarse ore stockpile	0 – 0.15 m	Topsoil
	0.15 – 3 m	Silty sand and gravel
	3 – 13 m	Dense glacial till
	Below 13 m	Competent bedrock
Process plant site	0 – 0.15 m	Topsoil
	0.15 – 3 m	Silty sand and gravel
	3 – 6 m	Dense glacial till
	6 – 36 m	Competent bedrock
Truck shop	0 – 0.15 m	Topsoil
	0.15 – 82 m	Dense glacial till
	Below 82 m	Completely weathered bedrock

2.2.3.3.3.10.1.1.2 Frost Penetration Depth

A frost penetration depth of approximately 3.5 m has been estimated for the process plant site, based on the following criteria:

- Freeze degree days index = 1,000°C–days;
- Freeze days = 167 days;
- Mean annual temperature = 0°C; and
- Dry backfill soil density = 21.0 kN/m^3 with moisture content of 7%.

Frost depth was estimated using the Canadian Foundation Engineering Manual methodology (Canadian Geotechnical Society, 2006), and assuming that the area was clear of snow. A depth of 3.5 m applies to the foundations of unheated structures, and of heavily insulated structures, where heat transfer from building to foundation subgrade level is restricted.

For permanently heated structures bearing on soil that allow heat to transfer from the building to foundation subgrade in winter:

- The perimeter foundations will need to be either below the frost penetration depth of 3.5 m, or 2.0 m below grade if sufficient insulation is installed;
- Interior foundations in heated buildings will not require insulation and can be founded with minimum embedment depths of roughly 1.0 m.

For unheated structures bearing on soil, depending on the method of construction and season, foundations need to be either below the frost-penetration depth, or provided with sufficient insulation to avoid future frost-jacking issues.

For structures bearing on bedrock, the minimum frost-penetration depth is not applicable.

2.2.3.3.3.10.1.2 Foundation Type

Based on the bearing capacity of various soil types and the relatively shallow depth of bedrock in some locations, shallow foundations such as spread, strip, or raft/mat type footings will be used.

2.2.3.3.3.10.1.3 Foundation Insulation

Insulated foundations will be protected with rigid insulation boards extending laterally from the foundation per the following minimum length:

Lateral Projection = Frost Penetration Depth - Soil Cover above Insulation

Minimum soil cover for the rigid insulation boards will be 400 mm. Rigid insulation boards will be wrapped in polyethylene to provide protection against hydrocarbons.

2.2.3.3.3.10.1.4 Buried Services

Given the design frost depth of 3.5 m, buried services piping will be installed 2 m deep and incorporate insulation board for frost protection. Where services need to be above the insulation board, the pipe will be insulated and heat-traced.

2.2.3.3.3.10.2 Site Layout and Preparation

Design of the processing facilities layout was based on constraints imposed by the ore body's location, the location selected for the TSF, and the need for waste dumps to be in close proximity to the open pit. Facilities placement design focused on the process flow of ore material from the pit, through the process plant, and on to the TSF, taking advantage of the natural topography to minimize earthworks' requirements.

The process plant begins at the primary crusher, where the elevation of the dump pad is set at 1,485 masl to match the exit ramp from the pit and avoid any additional uphill haulage once the haul trucks have left the pit. The orientation of the crusher makes use of the northern slope of the hillside, thereby minimizing the amount of excavation for the crusher tower and the MSE wing walls required to create the lower pad for the crusher discharge and feed conveyors to the COS. Based on the initial geotechnical assessment, the primary crusher will to be founded on bedrock, minimizing foundation requirements.

From the discharge of the crusher, a stacking conveyor feeds the 42-m-high COS farther down the hillside; the arrangement minimizes conveyor length and permits it to operate at a relatively level grade of 6.5°. The COS base is set at 1,420 masl, and the reclaim tunnels beneath at

1,410 masl. Reclaim tunnels will be constructed within a cut zone of overburden material, and are not designed to be founded on rock but rather to rest on a layer of structural fill over undisturbed native material.

Reclaim conveyors exiting the tunnels will cross the valley bottom horizontally, supported on a rockfill embankment, before an 11° incline up the opposite hill slope, and into the process plant building at approximately 1,450 masl. For constructing the support embankment, the conveyor footprint will need to be cleared of organic material, assumed to be approximately 2 m thick through the valley floor. The area will be backfilled either with rock from the open pit or excess cut material from the crusher area. To reduce potential settling, select fills will be used for the top 2 m. Using rockfill in the base of the embankment will allow water to seep through; no ponding is anticipated on the upstream side.

The layout of the actual plant structures balances the need for efficient movement of equipment and material around the site with the desire to keep the facilities as compact as possible to minimize process interconnections and earthworks requirements.

An emergency spill containment pond will be constructed at the east end of the process plant site to collect any major spills from the process areas, such as the grinding mills, the CIP tanks, and the WOL tanks. In each area, a sump will be connected to a 600-mm buried collection drain line that discharges directly into the pond. The pond will be lined with high density polyethylene (HDPE), and a pump house will move any collected fluids to the grinding-thickener feed box for reuse in the process. Because the pond will be kept empty at all times, the pumped out fluids will include natural runoff that accumulates in the pond.

Two access roads will lead to the process plant site to facilitate traffic flow and economical building construction. The access roads will connect to a perimeter road that will provide adequate access of service and delivery vehicles to the various buildings and key facility areas.

Locating the truck shop and the administration building at 1,415 masl on the ridge northwest of the plant site makes use of the relatively flat ground in the area to minimize earthwork. Based on the geotechnical investigations, the truck shop will be founded on a zone of silty sand on the order of 50 m to 100 m thick. Building foundations will rely on simple strip footings and slabs-on-grade to distribute the load from the superstructure.

2.2.3.3.4 Process Plant Buildings

The process plant site will include ore crusher and conveyors, main mill building with SAG and ball mills, elution/CIP building, refinery, reagent building, CN destruction area, sulphur burner building, WOL area, tailings and grinding thickener tanks, electrical substation area, and assay laboratory. All reagents and tanks containing toxic substances, including those classified as hazardous substances under the federal and provincial *Transportation of Dangerous Goods Act*, (Government of BC, 1996b; Government of Canada, 1992) will be housed in areas with secondary containment. Only trained employees will handle hazardous substances.

Figure 2.2.3-52 shows the proposed general layout of the process plant.

2.2.3.3.4.1 Primary Crusher Tower

The primary crusher tower will be a 15-m long x 11-m wide x 35-m high, cast-in-place concrete and steel structure approximately 1,000 m due south of the main mill building. Floors will be concrete, complete with openings and all required embedded steel inserts. Three sides of the concrete structure will be earth-filled and retained by a proprietary MSE backfilled wall system.

A laydown slab beside dump pocket will serve as a storage area for the main shafts of the crusher. Another apron slab, together with a rock breaker pad and concrete walls as required, will be provided between the crushing chamber and the access/lifting well tower.

A weather-tight, prefabricated modular control room with attached stair access will overlook the dump pocket and house instrument controls to monitor dumping activities. The control room will include an enclosed toilet and wash basin. Water will be supplied from the process plant site, and sewage will be returned by a pressure main along the conveyor corridor.

2.2.3.3.4.2 Crusher Discharge and Stockpile Feed Conveyors

The crusher discharge conveyor will be approximately 41.5 m long and extend from the primary crusher tower (tail pulley) to the stockpile feed conveyor (head pulley). The stockpile feed conveyor will be approximately 137.5 m long and extend from the crusher discharge conveyor (tail pulley) to the COS (head pulley). Both conveyors will be 1,800 mm wide with a material flow rate of 4,640 t/h. The drive station for the stockpile feed conveyor will be approximately 66 m north of the primary crusher and 110 m south of the COS. The drive station for the shorter crusher discharge conveyor will be incorporated into the conveyor works.

2.2.3.3.4.3 Coarse Ore Stockpile Reclaim and Service Tunnels

Two parallel reclaim tunnels and one service tunnel will run beneath the COS. The reclaim tunnels will be 7 m wide x 49 m long x 10 m high. The service tunnel will be 2 m wide x 22 m long x 3 m high. The service tunnel will connect with the reclaim tunnels at their southern ends. All three tunnels will be constructed with cast-in-place concrete roofs, walls, and raft/mat foundations supported on native sand-gravel soil. The reclaim tunnels will have steel floors with supports for equipment and monorails, complete with openings and all required embedded steel inserts.

2.2.3.3.4.4 Grinding and Pebble Crushing Feed Conveyors

These conveyors will be approximately 390 m long and extend from below the COS to the grinding and pebble-crushing building. Conveyor sections under the centre of the COS will be enclosed within the concrete reclaim tunnel, which transitions into a multi-plate steel tunnel near the pile's perimeter. The conveyors then run to the grinding and pebble-crushing building on grade, under cover, to trussed conveyor supports on steel bents rising above ground.

2.2.3.3.4.5 Pebble-Crushing Building

The pebble-crushing building will be an insulated steel structure 22 m wide x 43 m long x 23 m high, attached to the grinding building at the north end. Equipment will include two pebble crushers, the pebble-crusher feed conveyors, a transfer conveyor and chute works, 40 t crane, access stairways, and platforms. Building floors will be concrete and steel, complete with openings and all required embedded steel inserts.

2.2.3.3.4.6 Grinding Building

The grinding building is the main mill building for the mine. It will be an insulated, site-built, steel structure consisting of a 65 m wide x 113 m long x 35 m high grinding area with the pebble-crushing building attached at the southern side. The ridge line of the grinding building's roof will be oriented east-west, parallel to the two bridge cranes that will service the SAG and ball mills.

The grinding area will include two SAG mills, two ball mills, two cyclones, and associated conveying and support equipment, complete with access stairways and platforms. The SAG and ball mills will be founded on concrete piers and raft/mat foundation. Floors will be concrete and steel, complete with openings and all required embedded steel inserts. The area will include two cranes—70 t and 10 t—sized to erection, operations, and maintenance duties.

2.2.3.3.4.7 Elution/CIP Circuit Building

The elution/CIP circuit building will be an insulated, pre-engineered, steel structure attached to the north side of the main mill building, containing two separate equipment areas:

- The main carbon equipment area will be approximately 38 m wide x 56 m long x 23 m high and contain tanks, kilns, heating, ventilation and air conditioning (HVAC) equipment, and two 5-ton overhead bridge cranes; and
- The adjacent area, 54 m wide x 50 m long x 30 m high, will contain the CIP circuit and a small enclosed area for the plant air compressors.

Floors will be steel, complete with openings and all required embedded steel inserts. The primary structural steel framing and bracing will be pre-engineered, while the internal platforms and secondary framing will be stick-built. Structural steel platforms and associated steelwork will support the elevated equipment and provide access where required.

The building will be founded on spread footings. Equipment and tanks will be founded on cast-in-place pads and foundations supported on bedrock or compacted backfill.

2.2.3.3.4.8 Refinery Building

The refinery will be attached directly to the north side of the elution/CIP circuit building. It will be an insulated, pre-engineered, steel structure, 25 m wide x 45 m long x 19 m eave height, housing the refining process equipment, including electrowinning cells, induction furnaces, a drying oven, and a vault for the final product. On the west side of the building, an adjunct secure airlock will be

provided for secure transport truck access, 8 m wide x 10 m long, complete with a truck door and personnel doors at either end.

The refinery will be founded on spread footings. Equipment and tanks will be founded on cast-in-place pads and foundations supported on native sand-gravel soil.

2.2.3.3.4.9 Reagents Building

The reagents building will be an insulated, pre-engineered, steel structure, 23 m wide x 78 m long x 20 m eave height, directly north of the grinding/refinery area. It will be used to store and mix chemical reagents for the refining process in holding tanks of various sizes. The building will have two drive-through aisles for unloading the reagents, and will have a small enclosure on the ground floor for the compressors.

2.2.3.3.4.10 Cyanide Destruction Area

The CN destruction area will contain unenclosed CN destruction storage tanks and a tailings discharge box. On the west side, an enclosed sulphur burner package building will house a molten sulphur storage tank and related equipment.

2.2.3.3.4.10.1 Cyanide Destruction Storage Tanks

The CN destruction storage tanks and the tailings discharge box will be supported on cast-in-place raft/mat foundations surrounded by containment walls and a liner for spillage. The foundations will be supported on granular structural backfill to mitigate frost-jacking and provide sufficient bearing capacity for the tank loading.

2.2.3.3.4.10.2 Sulphur Burner Building

The sulphur burner building will be an insulated, pre-engineered, steel structure, 12 m wide x 24 m long x 10 m eave height, with an overhead bridge crane.

Floors will be concrete and steel, complete with openings and all required embedded steel inserts. The primary structural steel framing and bracing will be pre-engineered, while the internal platforms and secondary framing will be stick-built. Structural steel platforms and associated steelwork will support the elevated equipment and provide access where required.

The building will be founded on spread footings. Equipment and tanks will be founded on cast-in-place concrete pads and foundations supported on granular structural backfill.

2.2.3.3.4.11 Whole Ore Leach Tank Area

The WOL tank area will consist of four blocks of six tanks each, stair towers, and an air-compressor building. Based on geotechnical information, the ground in this area is covered with layers of overburden ranging in thickness from 5 m to 17 m. Under full design load, for these thicknesses overburden settling is estimated to be approximately 40 mm to 85 mm, respectively. Assuming a uniform, sloped rock profile, for each block overburden under the foundations varies in thickness

by approximately 1.5 m between adjacent tanks. Based on this difference, the differential settling between adjacent tanks in a six-tank block should be approximately 6 mm, which poses no issue for the design of the WOL tank area.

The foundation design takes into account the frost penetration depth of 3.5 m, by removing the top 4 m of frost-susceptible overburden material in this area and replacing it with compacted granular structural fill. This eliminates the need to place the tank foundations below the frost depth, and allows them to be constructed nearer to the surface.

2.2.3.3.4.11.1 Whole Ore Leach Tanks

Each of the four leach tank blocks will be 42 m wide x 64 m long, supported on individual cast-in-place concrete pads surrounded by slab-on-grade with containment walls for spillage. The top of each leach tank will be enclosed with a stick-built, cladded structural steel frame 5 m wide x 8 m long x 4 m high to protect the tank agitator from the elements.

2.2.3.3.4.11.2 Air-Compressor Building and Stair Towers

The air-compressor building will be a 14 m wide x 22 m long x 6 m high insulated pre-engineered steel structure founded on cast-in-place concrete spread footings. The equipment and tanks will be founded on cast-in-place concrete pads and foundations.

Four stair towers, 2 m wide x 7 m long x 22 m high, will be installed, one in each of the four leach-tank blocks. Stairways will be open, stick-built steel structures, exposed to the elements and supported on cast-in-place concrete spread footings.

2.2.3.3.4.12 Tailings and Grinding Thickener Tanks

The thickeners will be 80 m in diameter with 5-m high side walls constructed of cast-in-place concrete slabs. Thickener floors will be lined to provide spill containment. A 100-mm skim coat of concrete will be poured over the liner systems to provide protection against possible damage from the thickener rake mechanisms.

The underflow tunnel and chamber below the thickener tanks will be cast-in-place concrete. The thickener bridge and platforms will be founded on cast-in-place concrete spread footings. A secondary means of egress from the underflow tunnels will be provided up through the central underflow chambers, with a climb up onto the thickener bridges.

The thickeners and the underflow tunnels will be supported on granular structural backfill to mitigate frost-jacking and provide sufficient bearing capacity. The underflow chambers in the middle of the thickener tanks will be supported on bedrock.

2.2.3.3.4.13 Assay Laboratory

The laboratory will be constructed northwest of the main mill building and the tailings thickener. The building will be an insulated, pre-engineered, steel structure, 16 m wide x 31 m long x 5 m eave height, housing the assay lab, metallurgical lab, and environmental lab.

2.2.3.4 Waste Rock and Tailings Management

2.2.3.4.1 Introduction

The principal design objectives for the waste rock facility and TSF are to ensure protection of the regional groundwater and surface water during both operations and in the long term (after closure), and to achieve effective reclamation at mine closure. Design and location of the waste rock facility and TSF has taken into account the following requirements:

- Massing the TSF and waste rock facility away from sensitive environmental features including the lakes, Blackwater drainage, and nearby UWR;
- Clustering the facilities to minimize overall footprint;
- Ensuring permanent, secure, and total confinement of all solid waste materials within engineered disposal facilities;
- Controlling, collecting, and removing free-draining liquids from the waste and tailings facilities during operations for recycling as process water to the maximum practical extent;
- Preventing ARD and minimizing ML from reactive tailings and waste rock;
- Including monitoring features for all aspects of the facility, to ensure performance goals are achieved, and design criteria and assumptions are met;
- Applying a staged development of the facility over the life of the Project; and
- Discussions with Aboriginals and regulators to review alternatives.

Waste management alternatives are discussed in **Section 2.5.4, 2.5.5, 2.5.9 and 2.5.10**. PAG waste rock storage and TSF alternatives are further elaborated in a Multiple Accounts Analysis, **Appendix 2.5A**. Seven TSF alternatives were initially examined, two in the Blackwater River drainage, one in Creek 661 drainage and four in the Davidson Creek drainage. Dry stacking in multiple locations was also considered but that alternative was not technically or economically feasible. The most favourable technical alternative (combined TSF Site C and Site D) with the lowest potential environmental impact was chosen. The selected alternative fit in the Davidson Creek drainage along with other mine facilities; addressing concerns expressed by Aboriginals and regulators about affecting other drainages.

PAG rock alternatives included storage in the TSF, storage on land or backfilling in the open pit on closure. Storage on land or backfilling in the open pit after mine closure would result in the potential need to treat acidic drainage during mining and an increase in metal leaching due to oxidation during on land storage. For that reason storage in the TSF was chosen.

Five alternatives for disposal of low containing NAG waste rock (**Appendix 2.5A**) were considered:

1. Combined East and West Facility;

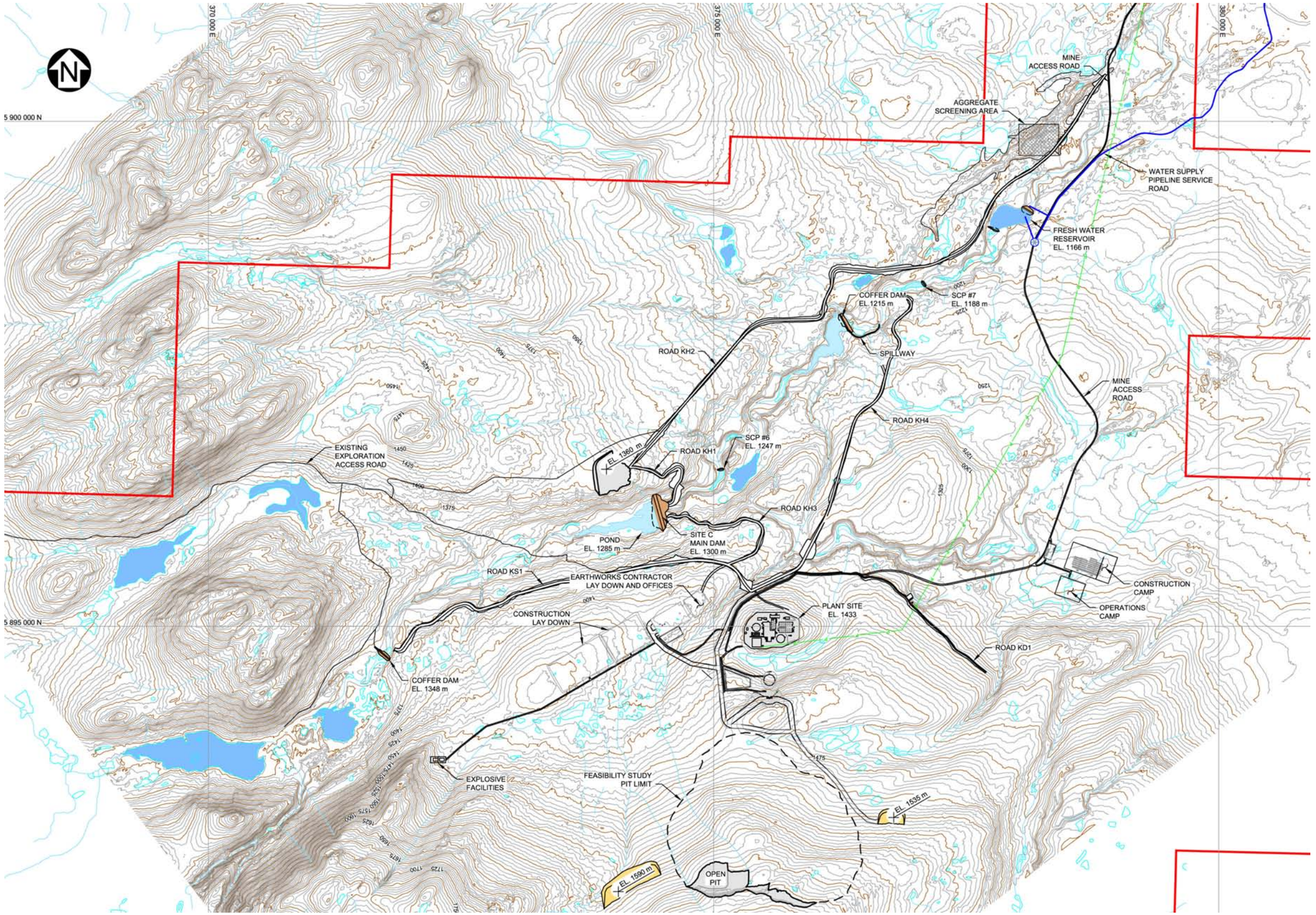
2. Expanded East Facility;
3. Expanded West Facility;
4. North Facility; and
5. South Facility.

The North Facility (north of Turtle Creek) was screened out based on the haul distance and the resultant expansion of the proposed Project footprint. The South Facility was also screened out based on it being in the Blackwater River drainage, a heritage river. One of the key design philosophies of the proposed Project is to avoid the Blackwater River drainage. The NAG waste rock disposal alternatives are anticipated to affect fish-bearing waters, and hence, it was desirable to minimize the effects on those waters. Based on that criterion, the combined East and West Facility is the preferred option.

General arrangement plan views illustrating the staged development are shown in Years -2, -1, 1, 3, 8, 17, and post-closure (**Figure 2.2.3-65** to **Figure 2.2.3-70**).

2.2.3.4.2 Option for Site C Supernatant Water Storage

The TSF water management plan requires an annual minimum supernatant pond allowance of 10 Mm^3 to be stored in Site D. Upon review with the Proponent, it was determined that there may not be enough capacity on an annual basis in Site D without raising the water level above the level of the tailings spillway. Site C has additional capacity available and could be used as the primary water storage location. Site C has excess capacity due to the 16-m freeboard in the design. Placing material up to a 3-m freeboard would provide an additional 20 Mm^3 of capacity. **Figure 2.2.3-71** illustrates this concept on full capacity of Site C. Water, tailings, and waste rock storage for the TSF sites will be optimized during detailed design for the Project.



Legend

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- BORROW AREA (ZONES S, C, AND ROCKFILL)
- NAG WASTE ROCK / OVERBURDEN
- BORROW AREA (ZONES F AND T)
- PUMPSTATION
- WATER SUPPLY PIPELINE SERVICE ROAD
- TRANSMISSION LINE
- NEW GOLD PROPERTY BOUNDARY

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. SCP STANDS FOR SEDIMENT CONTROL POND.

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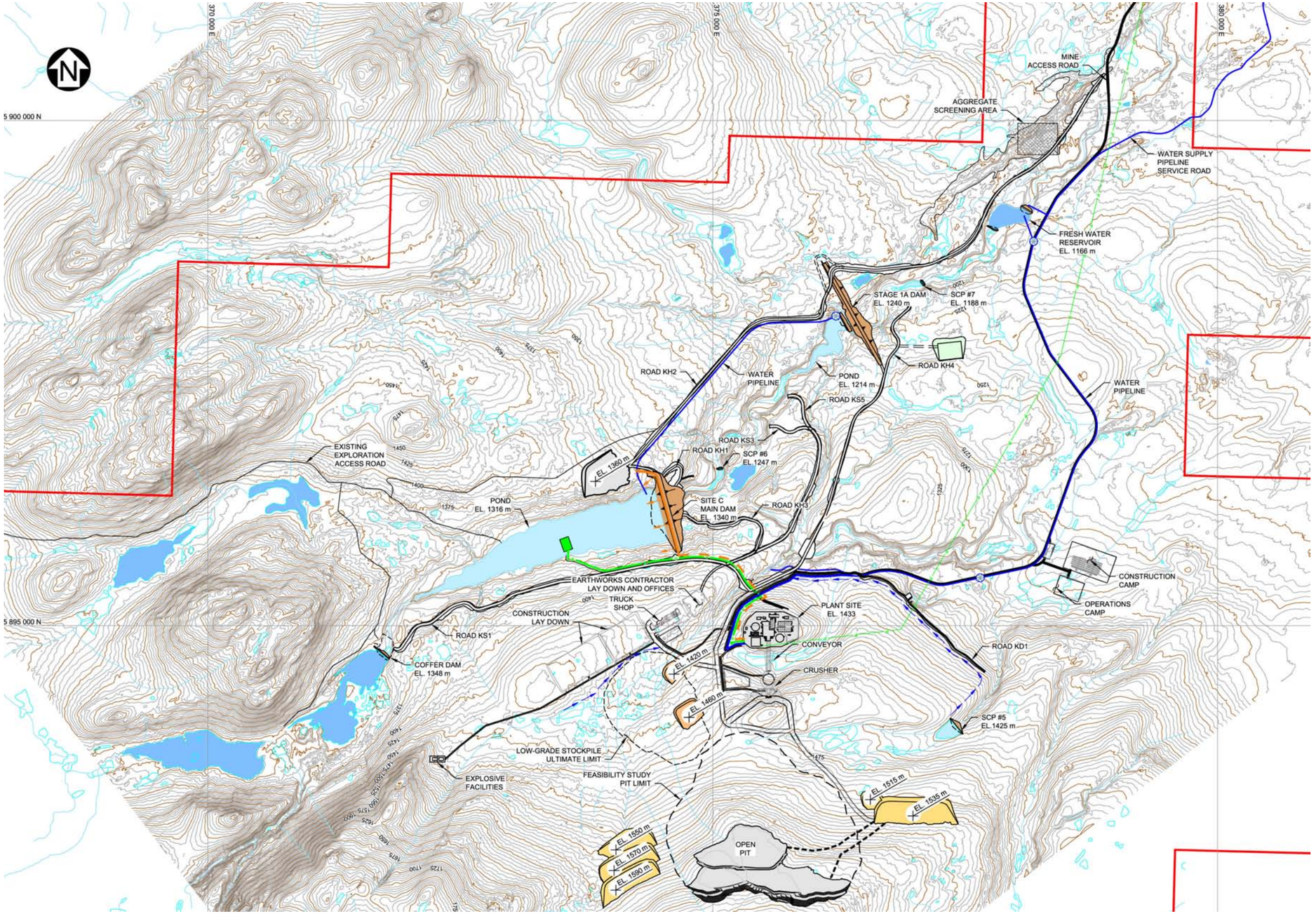
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PROJECT: Blackwater Gold Project

General Arrangement End of Year -2 Plan

DATE: May, 2014	ANALYST: KP	**Figure** 2.2.3-65
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AI FILE: End of Year -2 Plan.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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Legend

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- NAG WASTE ROCK / OVERBURDEN
- LOW-GRADE ORE
- TOPSOIL
- BORROW AREA (ZONES S, C, AND ROCKFILL)
- RECLAIM SYSTEM
- PUMPSTATION
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- EXISTING ACCESS TRAILS
- WATER RECLAIM PIPELINE
- TRANSMISSION LINE
- NEW GOLD PROPERTY BOUNDARY
- TAILINGS PIPELINE
- TAILINGS DEPOSIT
- DIVERSION CHANNEL

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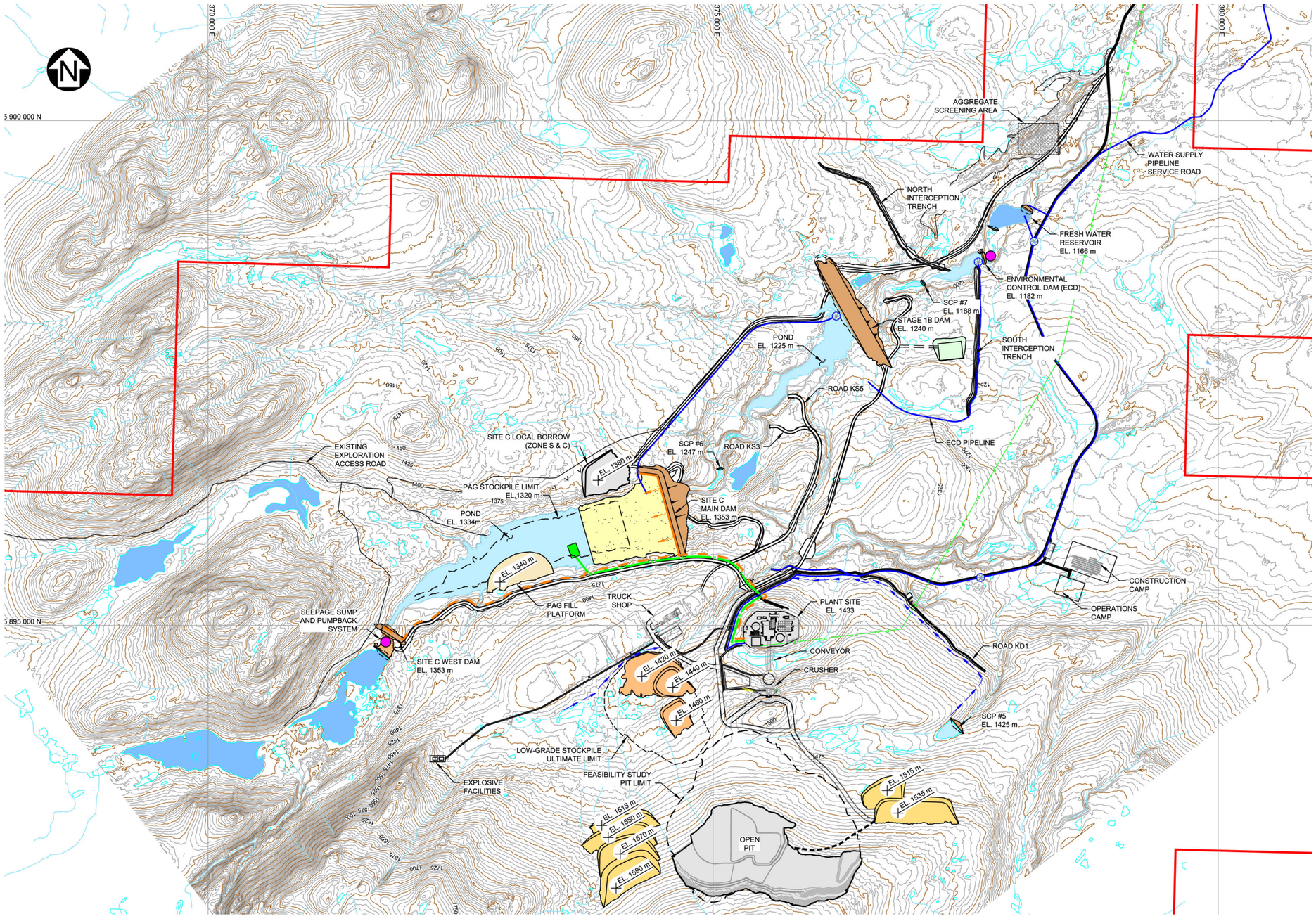
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PROJECT: Blackwater Gold Project

General Arrangement End of Year -1 Plan

DATE: May, 2014	ANALYST: KP	**Figure** 2.2.3-66
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Legend

- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT
- PAG WASTE ROCK
- NAG WASTE ROCK / OVERBURDEN
- LOW-GRADE ORE
- TOPSOIL
- BORROW AREA (ZONES S, C, AND ROCKFILL)
- RECLAIM SYSTEM
- PUMPSTATION
- SEEPAGE SUMP AND PUMPBACK SYSTEM
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- EXISTING ACCESS TRAILS
- DIVERSION CHANNEL
- WATER RECLAIM PIPELINE
- NEW GOLD PROPERTY BOUNDARY
- TAILINGS PIPELINE
- TAILINGS DEPOSIT

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. SCP STAND FOR SEDIMENT CONTROL POND.

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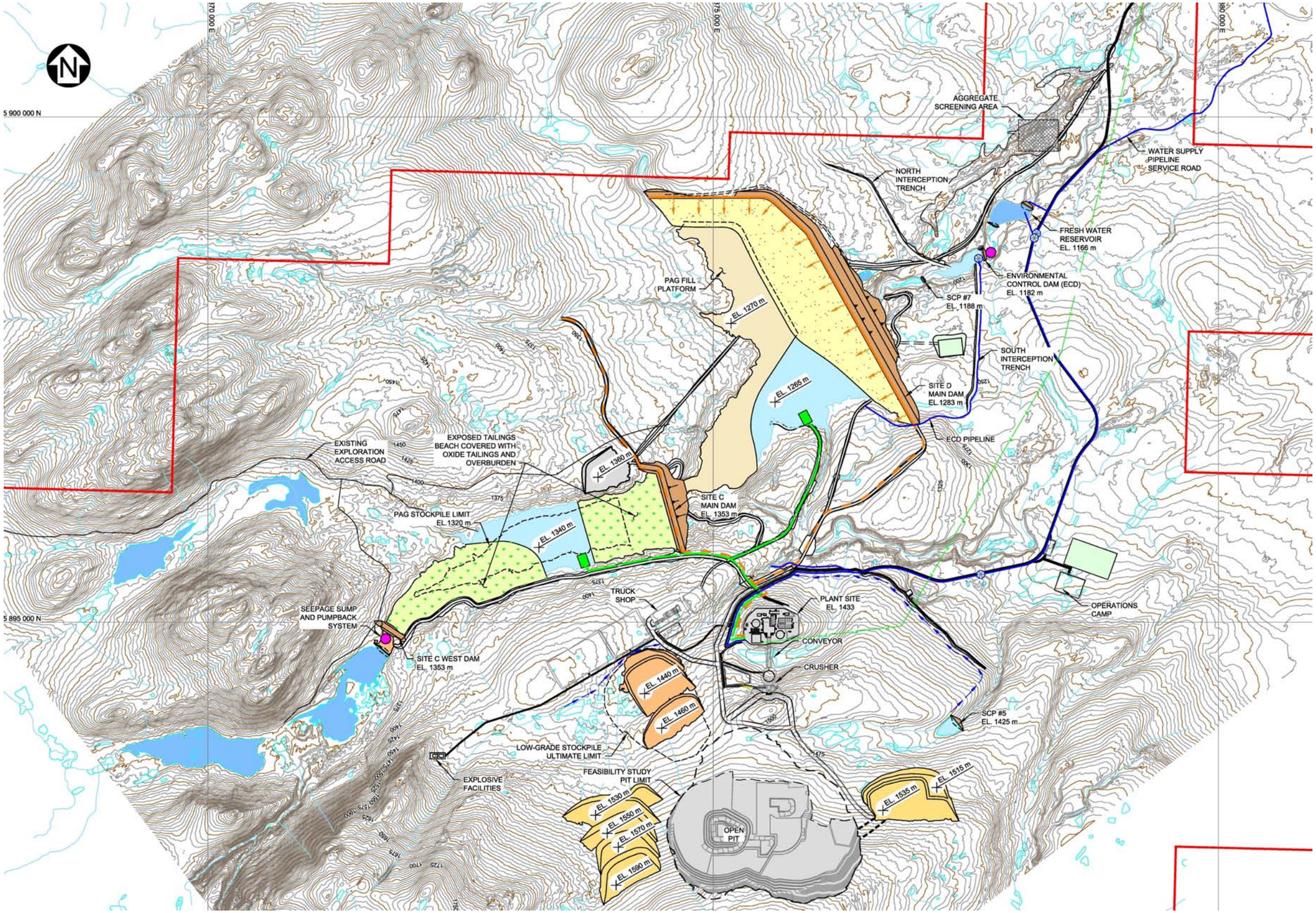
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PROJECT: Blackwater Gold Project

General Arrangement End of Year 1 Plan

DATE: May, 2014	ANALYST: KP	**Figure** 2.2.3-67
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Legend

- UPLAND BEACH
- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT
- PAG WASTE ROCK
- NAG WASTE ROCK / OVERBURDEN
- LOW-GRADE ORE
- TOPSOIL
- BORROW AREA (ZONES S, C, AND ROCKFILL)
- RECLAIM SYSTEM
- PUMPSTATION
- SEEPAGE SUMP AND PUMPBACK SYSTEM
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- EXISTING ACCESS TRAILS
- DIVERSION CHANNEL
- WATER RECLAIM PIPELINE
- TRANSMISSION LINE
- NEW GOLD PROPERTY BOUNDARY
- TAILINGS PIPELINE
- TAILINGS DEPOSIT

NOTES:

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2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. SCP STANDS FOR SEDIMENT CONTROL POND.

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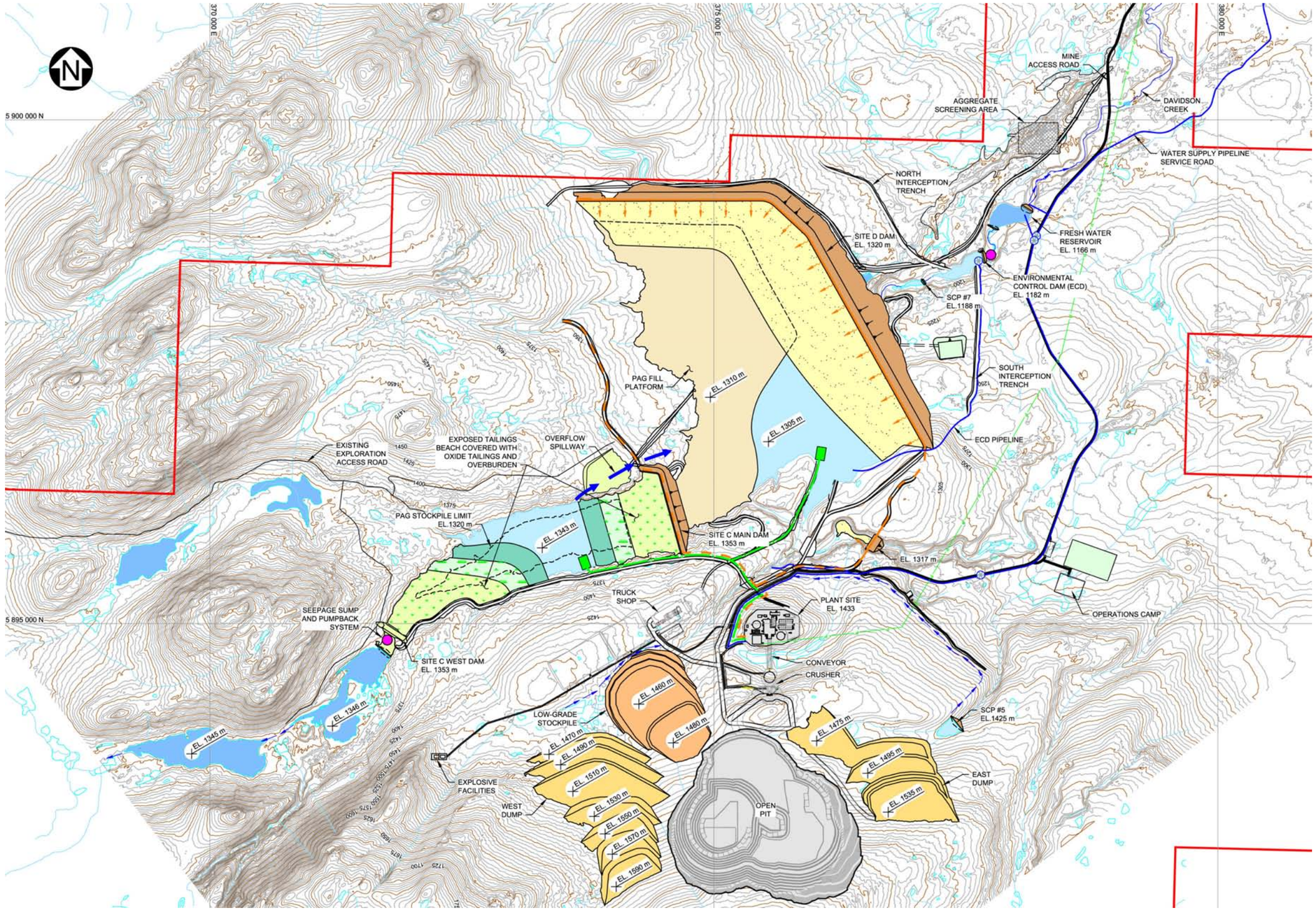
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PROJECT: Blackwater Gold Project

General Arrangement End of Year 3 Plan

DATE: May, 2014	ANALYST: KP	**Figure** 2.2.3-68
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Legend

- UPLAND BEACH
- BOG / WETLAND AREA
- EMERGENT VEGETATION WETLAND
- UPLAND SLOPE
- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- PAG WASTE ROCK
- NAG WASTE ROCK / OVERBURDEN
- LOW-GRADE ORE
- TOPSOIL
- BORROW AREA (ZONES S, C, AND ROCKFILL)
- RECLAIM SYSTEM
- PUMPSTATION
- SEEPAGE SUMP AND PUMPBACK SYSTEM
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- DIVERSION CHANNEL
- WATER RECLAIM PIPELINE
- NEW GOLD PROPERTY BOUNDARY
- TRANSMISSION LINE
- SPILLWAY
- TAILINGS PIPELINE
- TAILINGS DEPOSITION

Source
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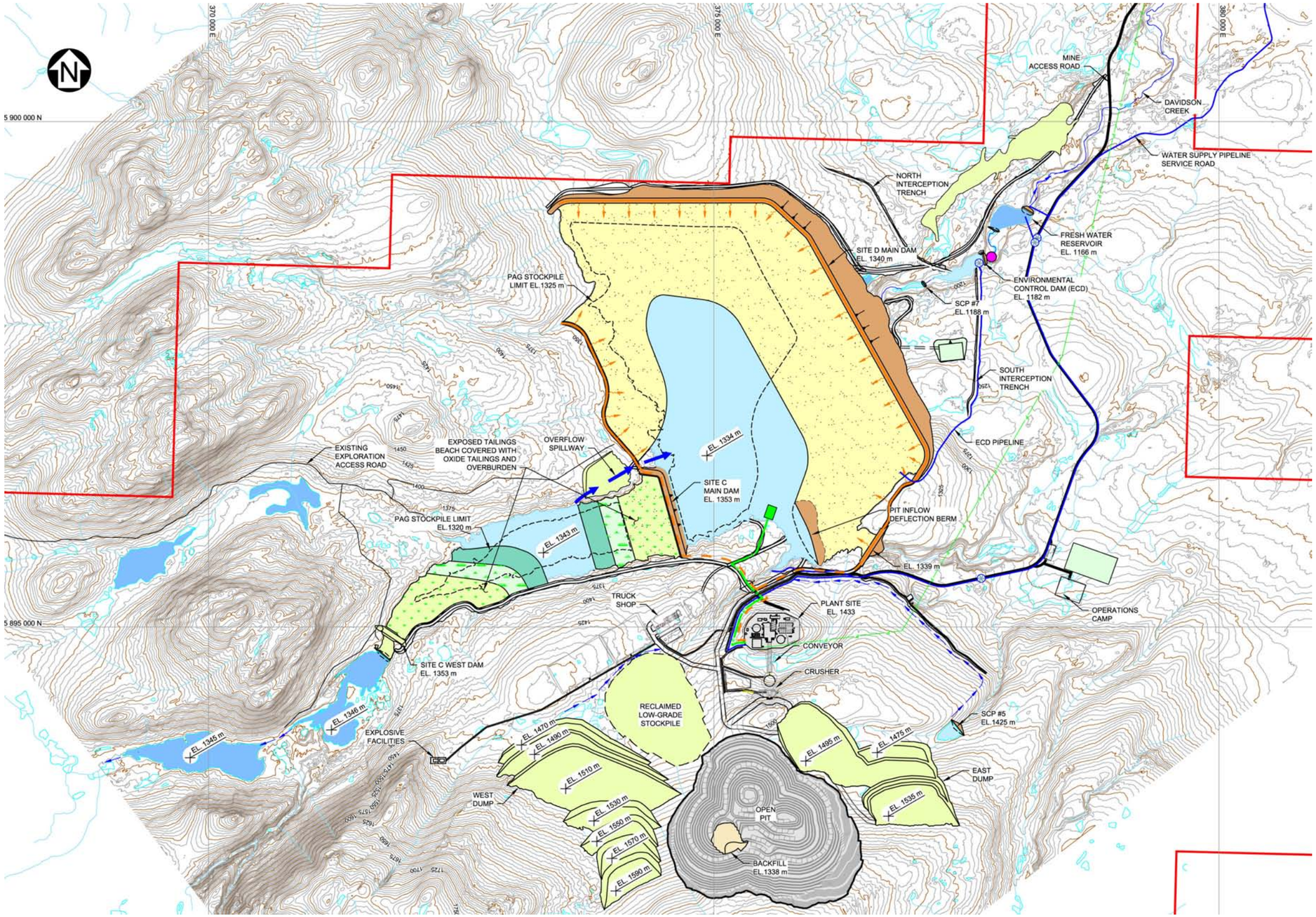
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PROJECT: Blackwater Gold Project

General Arrangement End of Year 8 Plan

DATE: May, 2014	ANALYST: KP	**Figure** 2.2.3-69
JOB No: VE52420	QA/QC: WR	PDF FILE: End of Year 8 Plan.pdf
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Legend

- UPLAND BEACH
- BOG / WETLAND AREA
- EMERGENT VEGETATION WETLAND
- UPLAND SLOPE
- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- PAG WASTE ROCK
- TOPSOIL
- RECLAIM SYSTEM
- PUMPSTATION
- SEEPAGE SUMP AND PUMPBACK SYSTEM
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- DIVERSION CHANNEL
- WATER RECLAIM PIPELINE
- NEW GOLD PROPERTY BOUNDARY
- TRANSMISSION LINE
- SPILLWAY
- TAILINGS PIPELINE
- TAILINGS DEPOSITION

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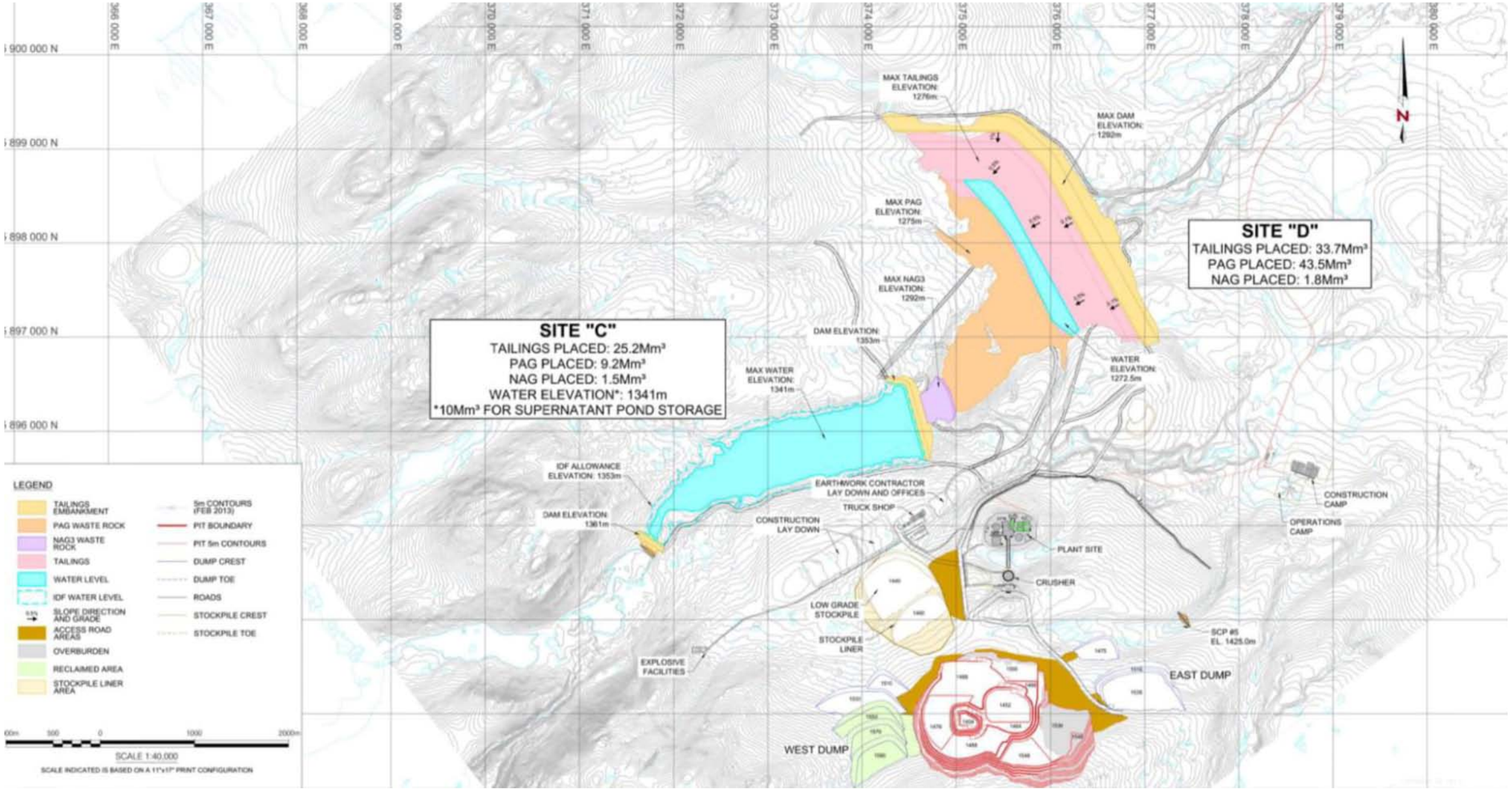
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PROJECT: Blackwater Gold Project

General Arrangement End of Year 17 Plan

DATE: May, 2014	ANALYST: KP	**Figure** 2.2.3-70
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Kilometers

Reference:

DataBC Data Distribution Service Open Government License (http://www.data.gov.bc.ca/)

Knight Piésold Engineering and Environmental Services http://www.knightpiesold.com/en/

CLIENT: newgold™

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2.2.3.4.3 Waste Rock Classification

2.2.3.4.3.1 ML/ARD Geochemical Testing Program

The Project mine wastes are classified using results from a ML/ARD test program, BC government and international guidance, and best mining industry practice (BC MEM, 1998; INAP, 2009; MEND, 2009; Price, 1997).

The ML/ARD program was conducted in three phases, and included both static and kinetic testing. Geochemical test data are summarized in **Table 2.2.3-27**. As part of the exploration geological program, sulphur and metal inductively coupled plasma (ICP) assays following aqua regia digestion) were completed at one metre intervals on exploration drill cores. This database provides extensive coverage of the Project applicable to the ML/ARD assessment and includes over 250,000 sulphur and Zn assays. Zn is elevated in some of the waste from the Project, and that waste may be metal leaching.

Table 2.2.3-27: Samples in Static and Kinetic Geochemical Test Program

Test	Waste Rock	Ore	Tailings[(2)]	Overburden
Static Tests				
ABA[(1)]	890	72	18	74
Exploration ICP Database	≈285,000	≈70,000	-	-
Multi-element Chemistry	617	87	18	74
Mineralogy/Petrography	25	48	-	2
Shake Flask Extraction	58	8	5	14
Net Acid Generation Test	587	36	8	29
Net Acid Generation Leachate	78	7	5	5
Kinetic Tests				
Humidity Cells	19	2	5	-
Modified Humidity Cells	3	1	-	-
Saturated Columns	2	-	-	-
Kinetic Field Bins	6	2	-	-
Project Specific Tests				
Oxygen Consumption	1	-	-	-
Acid Buffering Characteristic Curve	12	-	-	-
Sequential Net Acid Generation	4	-	-	-
Kinetic Net Acid Generation	6	-	-	-
Humidity Cell pH Neutralization	5	1	-	-
Selective Extraction	5	-	-	-

Note: [(1)] Samples of waste rock and ore were 10 m composites.
[(2)] Tailings samples obtained from metallurgical testing. Overburden samples selected from core.
≈ = approximate

2.2.3.4.3.2 Waste Classification

Mine waste was classified based on its predicted acid-generation potential into PAG or NAG, as shown by the calculated NPR. NAG waste rock was further classified as to its metal leaching potential based on Zn content. Classification criteria are as follows:

- Overburden (NAG);
- Waste Rock:
  - PAG1 – NPR ≤ 1.0 (PAG);
  - PAG2 – 1.0 <NPR ≤ 2.0 (PAG);
  - NAG3 – NPR >2.0 and Zn ≥ 1,000 ppm (NAG-ML);
  - NAG4 – NPR >2.0 and 600 ≤ Zn <1,000 ppm (NAG); and
  - NAG5 – NPR >2.0 and Zn <600 ppm (NAG).
- Ore and Tailings (PAG); and
- LGO (PAG).

Median NPR values for PAG waste rock (particularly PAG1) are relatively low, indicating a relatively short lag-time to acid production, and was verified in laboratory kinetic (humidity cells) and field tests (field bins). PAG waste rock requires subaqueous disposal to prevent ARD formation.

In contrast, median NPR values for NAG waste rock are relatively high, indicating very little potential for acid production. Segregation of NAG3 waste rock results in high NPR and relatively low Zn and Cd concentrations in the remaining NAG4 and NAG5 waste rock. NAG4 and NAG5 waste rock can be stored in out-of-pit waste dumps, while NAG3 will be stored subaqueously in the TSF to minimize metal leaching.

Sometimes LGO is classified as PAG with a relatively short lag time, and the LGO stockpile is expected to generate acidic drainage with elevated metals until the ore is processed. For that reason, the LGO will be placed on a compacted till liner with a drainage collection system. Acidic drainage will be neutralized with lime prior to discharge to the TSF.

Oxide ore contains very low sulphur, significantly less than transitional and sulphide ore types, and most of the sulphur is expected to be NAG sulphate sulphur. Zn, Cd, and As are also lower in the oxide ore compared to transitional and sulphide ore types. Lead is higher in oxide ore but has low mobility at the neutral pH expected in the TSF. Oxide ore tailings will be placed, as the final lift, over transitional and sulphide ore tailings in the TSF Site C, to reduce the potential for ARD and metal leaching.

Additional discussion is provided in **Section 5.1.3.1**, Geology and Geochemistry, and in the Geochemical Characterization Report (**Appendix 5.1.3.1A**).

2.2.3.4.4 Waste and Ore Classification Block Model

2.2.3.4.4.1 Neutralization Potential Ratio Calculations

GeoSim Services Inc. developed a block model based on the ABA test results and exploration geological metal dataset to classify waste rock and ore blocks. The same criteria for waste rock described above were used for ore blocks.

The acid generation potential of the waste and ore was estimated using the calculated NPR (where NPR = NP/AP) values derived from sulphur and neutralization potential (NP) assays and estimates. Sulphur from the geological metal dataset was found to be consistent with sulphur measured by Leco Furnace for ABA, and therefore both datasets were combined. Concentrations of sulphur were converted to acid potential (AP) values for use in the NPR calculation. Values for NP were determined directly in ABA or estimated from the Ca assay from the larger geological metal dataset; the latter assumed Ca was only present as calcium carbonate and was the sole source of acid neutralization capacity. Separate sulphur and NP block models were prepared and then the estimates combined to determine the NPR for ore and waste rock blocks.

Overburden was classified as NAG based on ABA testing. The overburden/rock interface mapped during the exploration program was used to identify overburden blocks.

ABA data were available for 805 samples of drill core, mainly representing 10-m intervals. Three duplicate intervals were excluded. A total of 281,826 intervals were analyzed by ICP for Ca and sulphur. These data were aggregated into 12 m (bench height) down-hole intervals, and the resulting Ca and sulphur aggregate concentrations were used to calculate NP and AP values.

In holes with continuous ABA data, those results were used in place of the calculated NPR values (representing 386 samples). In holes with isolated ABA analyses, NPR data from 434 of the samples were merged with 15,636 calculated NPR composites. Duplicates of the merged ABA data were inserted to double the weight of these samples.

AP and NP values were estimated from three passes using the inverse-distance-squared method. The first pass used a 50-m isotropic search with no hard boundaries. Estimating a block required a minimum of three and a maximum of eight composites from at least two drill holes. The second pass used a minimum of three and a maximum of eight composites, treated the main north-south fault structure as a hard boundary, and used a 200-m isotropic search for blocks not estimated in the first pass. A third pass used a minimum of three and a maximum of eight composites with no restriction on the number of holes required, treated the fault as a hard boundary, and used a 500-m isotropic search for blocks not estimated in the first two passes. A minimum of two and maximum of eight composites were required to estimate a block, with no restriction on the number of holes required.

NPR values were calculated from the estimated AP and NP values. In three areas of very low Ca and sulphur (< 0.02%) an NPR value of three was assigned.

2.2.3.4.4.2 Zinc Block Model

Samples of core drilling from 2010 to January 2013 were analyzed by ICP methods for 36 elements, including Zn, to characterize a total of 291,437 m of drill core.

Zn concentrations were estimated using the inverse distance squared in three passes. Search parameters were identical to the NPR block model runs described in **Section 2.2.3.4.4.1**.

Results of the waste and ore classification block model were used to develop the mine waste production schedule and the Mine Waste Management Plan described in **Section 12.2.1.18.4.17**.

2.2.3.4.5 Waste Rock and TSF Storage Alternatives

In January 2011, Knight Piésold conducted a preliminary assessment of TSF site alternatives for the Project (Knight Piésold, 2011a). Five potential locations for storing 300 Mm^3 of tailings, plus PAG waste rock, were identified within 10 km of the deposit area. The alternatives assessment considered economic, operational, and environmental factors, and concluded that Sites C and D were the best options due to:

- Relatively high storage efficiency and low embankment volumes;
- Close proximity to the mineral deposit area;
- Ability to collect all mine site drainage; and
- Location within the headwaters of Davidson Creek with minimal external upslope catchment area, simplifying operational water management.

TSF Sites C and D were compared further as Project studies continued in 2011 (Knight Piésold, 2011b). The study considered a Base Case mine plan that contemplated a 15-year mine life producing approximately 220 Mt of ore at a mill throughput of 40,000 t/d and with 702 Mt of waste materials, which included 192 Mt of NAG waste and 510 Mt of PAG waste. An Expansion Case mine plan was evaluated that considered a 21-year mine life producing 308 Mt of ore at a mill throughput of 40,000 t/d and with 985 Mt of waste materials, including an estimated 271 Mt of NAG waste and 714 Mt of PAG waste. Results of the comparative economic analysis indicated that, from an economic perspective, the preferred TSF was Site C. TSF Site C was marginally better than TSF Site D for both the Base Case and the Expanded Case, due to the lower initial capital cost for development.

Later in 2011 and into 2012, Knight Piésold further evaluated locations and methods for the mine waste facilities for the Project (Knight Piésold, 2012a). Conceptual plans assumed that tailings would be deposited around the perimeter of the TSF from the embankment crests. The NAG waste

was to be disposed of in a waste dump near the pit and/or used to construct the TSF embankment. The PAG waste rock was to be managed using one of two methods:

1. Co-disposal within the TSF in such a manner that the PAG rock becomes progressively saturated by the supernatant pond to prevent oxidation and subsequent acid generation; and
2. Storage in a surface engineered stockpile with a compacted soil liner foundation and cover system.

Four mine development concepts were considered in the alternatives assessment. The study considered a Base Case mine plan that contemplated a 10-year mine life producing approximately 210 Mt of ore at a mill throughput of 60,000 t/d, and with 501 Mt of waste materials, including 142 Mt of NAG waste and 359 Mt of PAG waste. An Expansion Case mine plan was evaluated that considered a 15-year mine life that produced 320 Mt of ore at a mill throughput of 60,000 t/d, and with 867 Mt of waste materials, including an estimated 200 Mt of NAG waste and 667 Mt of PAG waste.

The concept of a hybrid Site C and D TSF was first evaluated in this alternatives assessment. The hybrid TSF C/D option with subaqueous PAG disposal was compared with a Base Case using TSF Site C for the on-land disposal of PAG waste, and an Expansion Case using TSF Site D for on-land disposal of PAG waste. Results of the alternatives assessment indicate that the preferred mine development concept for future studies should be based on subaqueous disposal of PAG waste rock in the TSF, to minimize environmental risk, reduce engineering complexity, lessen corporate liability, and lower overall costs.

The design of the hybrid TSF Site C/D mine development concept was developed further during the PEA (AMEC, 2012), with subaqueous disposal of PAG waste and on-land disposal of NAG waste. The TSF design for the PEA considered a 17-year mine life producing approximately 356 Mt of ore at a mill throughput of 60,000 t/d, and with 839 Mt of waste materials that included 321 Mt of NAG waste and 518 Mt of PAG waste.

The PEA contemplated five types of open pit waste materials: overburden and four types of waste rock. Overburden and NAG4 waste rock were considered NAG and were used preferentially in dam construction, or disposed of in an on-land dump. NAG3 waste rock exhibits greater metal leaching potential because of elevated Zn and Cd content, despite being considered NAG. This material was planned for use in the Site C Main Dam or as a construction material for the upstream zone of the Site D Main Dam, below the final TSF Site D pond elevation. Alternatively, it could be placed in an on-land waste dump adjacent to the open pit. The foundation platform for the on-land dump would consist of low-permeability overburden, with drainage directed toward the open pit. PAG1 and PAG2 waste rock were considered PAG waste slated for subaqueous disposal in the TSF.

The FS considers a similar waste disposal concept to the PEA with one major exception: NAG3 potentially metal leaching waste rock will be disposed of subaqueously in the TSF, or used in construction of the TSF Site D Main Dam's upstream zone to reduce the potential for metal

leaching. The FS also introduces the classification of NAG5 waste rock, a low-Zn-containing waste rock—the most benign and best available waste rock material for constructing the downstream shell zones of the TSF embankments, with excess stored in the East waste rock dump.

Subaqueous disposal of PAG and NAG3 rock was selected as the preferred method of waste rock disposal due to reduced environmental risk, reduced engineering complexity, reduced corporate liability, and lower overall costs.

2.2.3.4.6 Waste Rock, TSF Design, and Operating Criteria

This section provides a design overview. Additional information is provided in Knight Piésold's Mine Waste and Water Management Design Report (**Appendix 2.2A-2**).

Table 2.2.3-28 presents the design and operating criteria for the Project.

Table 2.2.3-28: Design and Operating Criteria

Item	Design Criteria
1.0 General	
Site Coordinates	Approximately 375 000 E, 5 895 000 N (UTM NAD 83) and in NTS sheet 93F/02
Site Elevation	Approximately 1,000 to 1,700 masl
Codes and Standards	Health Safety and Reclamation Code for Mines in British Columbia (BC MEM, 2008), *Mines Act* (Government of BC, 1996a), ASTM, Dam Safety Guidelines (CDA, 2007) and related codes
Mine Production	Total ore milled = 344 Mt
	Throughput = 60,000 t/d
	Open pit stripping ratio = approximately 2:1 (excluding rehandle)
	Mine life = approximately 17 years
Climate Conditions	Mean annual precipitation = 636 mm
	Mean annual evaporation for the project site = 443 mm
Rainfall Storm Events (Peak Flood)	1:10 year 24 hour precipitation = 50 mm
	1:50 year 24 hour precipitation = 61 mm
	1:200 year 24 hour precipitation = 71 mm
	PMP 24 hour rainfall = 195 mm
2.0 Mine Waste Management	
2.1 Waste Properties	
Tailings	Total tailings production = 344 Mt
	Dry density = 1.30 t/m^3
	Specific gravity of solids = 2.79
PAG Waste Rock –	PAG co-disposed with tailings = 366 Mt
	Waste rock specific gravity = 2.7

Item	Design Criteria
PAG1 and PAG2	Dry density = 2.2 t/m^3
Potentially Metal Leaching Waste Rock – NAG3	NAG3 (Total 79 Mt) – co-disposed with tailings = 47 Mt and Used to construct upstream zone of TSF embankments = 32 Mt
	Waste Rock Specific Gravity = 2.7
	Dry density = 2.2 t/m^3
NAG Waste Rock – NAG4 and NAG5	NAG4 (Total 44 Mt) – Disposed in stockpiles = 42 Mt and used to construct TSF embankments = 2 Mt
	NAG5 (Total 108 Mt) – Disposed in stockpiles = 54 Mt and used to construct TSF embankments = 54 Mt
	Waste rock specific gravity = 2.7
	Dry density = 2.2 t/m^3
NAG Overburden	Overburden (Total 87 Mt) – Disposed in stockpiles = 47 Mt and used to construct TSF embankments = 40 Mt
	Overburden Specific Gravity = 2.7
	Dry density = 1.9 t/m^3 to 2.0 t/m^3
LGO	50 Mt stockpiled in an engineered facility for processing during Years 15 to 17
	Specific gravity = 2.7
	Dry density = 2.2 t/m^3
2.2 TSF	
Function	Two impoundments (Site C and D) provides for secure and permanent storage of tailings and management of decanted water for reuse in the process
Concept	Total tailings storage codisposed with 366 Mt of PAG and 79 Mt NAG-ML waste rock within two impoundments formed by three embankments. Embankments raised in stages and constructed using the centreline method
Storage Capacity	Site C – 2 years of tailings production and co-disposed waste rock, allowance for minimum 10 Mm^3 process water pond, plus IDF and freeboard
	Site D – remaining tailings production and co-disposed waste rock, allowance for minimum 10 Mm^3 process water pond, plus IDF and freeboard
	Raised embankment – next year of tailings and co-disposed waste rock, 10 Mm^3 process water pond, plus IDF and freeboard
	Ultimate Embankment at Closure – Total tailings production and co-disposed waste rock plus storage and freeboard to attenuate
CDA Consequence	Very high
IDF	2/3 between the 1/1,000 year and PMF, calculated in accordance with CDA Guidelines – Section 6.4
Flood Management –	Site C catchment area = approximately 7.1 km^2
	Site D catchment area = approximately 41.5 km^2

Item	Design Criteria
Catchment Areas	
IDF Volumes	Site C = 5 Mm^3 (based on catchment area and 681 mm IDF runoff depth)
	Site D = 28 Mm^3 (based on catchment area and 681 mm IDF runoff depth)
Design Freeboard	Minimum 1 m above design storage capacity for wave runup; assumes tailings beaches developed at 0.5% slope from dam crest
Operational Criteria	Flood management: Inflows are contained within the impoundment. The storage volume assumes any diversion systems are non-functional during the IDF
	Supernatant water reclaimed for reuse in mineral processing
	Excess water monitored and TSF raises managed appropriately
Closure Criteria	Surface runoff of non-contact water routed to natural streams
	TSF Closure Spillways: Pass PMF sized for the 24 hour PMP and 1/100 year snowmelt (459 mm) without consideration of the runoff attenuation provided by storage below the spillway crest
Seepage	Measures to control seepage include: • lower permeability core zone with filter/transition zones for raised embankments; • lower permeability tailings deposit; and • downstream seepage collection ponds, interception trenches and wells, and pump-back systems Collected seepage is monitored and managed appropriately
Seismic	Magnitude = 8.5
	Peak horizontal ground acceleration = 0.08 g (mean hazard value)
	EDGM = 1/5,000 year event
Embankment Stability	Permanent embankment slopes to be no steeper than 2H:1V to facilitate reclamation, and achieving the minimum required factors of safety (FOS_{min}) for the following loading conditions: • End of construction (starter dam and dam raises) FOS_{min} = 1.3; • Long term (at closure) FOS_{min} = 1.5; • Seismic (Pseudo-static loading condition) FOS_{min} = 1.0; and • Seismic (Post-earthquake loading condition; full liquefaction of tailings FOS_{min} = 1.5
Embankment Crest Width	Minimum 30 m during contractor construction periods and 50 m during mine fleet construction periods to facilitate 2-way haul traffic and reduce turn and dump time
	Minimum 40 m working surfaces during downstream stepouts

Note: PAG = Potentially Acid Generating; NAG = Non-Acid Generating; LGO = low-grade ore; TSF = Tailings Storage Facility; CDA = Canadian Dam Association; IDF = Inflow Design Flood; NTS = National Topographic System; masl = metres above sea level; Mt = million tonne; t/d = tonnes per day; mm = millimetre; PMP = Probable Maximum Precipitation; t/m^3 = tonnes per cubic metre; km^2 = square kilometre; Mm^3 = million cubic metre; PMF = Probable Maximum Flood; m = metre; g = gram; EDGM = Earthquake Design Ground Motion; FOS_{min} = minimum Factor of Safety

Key considerations for developing the TSF design are summarized as follows:

- TSF located on the Blackwater claims;

- Annual staging of the TSF dam lifts to allow for storage of the next year of tailings and waste rock disposal, an operational pond volume of 10 Mm^3, and storage of the inflow design flood (IDF) during operations with at least 1 m of freeboard for wave runup;
- Conventional, thickened tailings disposal with tailings solids content of 50% by weight;
- TSF filling schedule based on the detailed mine schedule, including material movements to dam construction and waste disposal;
- Overburden dry density of 1.9 tonnes per cubic metre (t/m^3) when placed in on-land dumps and in the embankment shell zones, and 2.0 t/m^3 when placed and compacted in the dam core zone; and
- Water for the process plant sourced from the TSF supernatant ponds at a flow rate of 3,200 cubic metre per hour (m^3/h) closure spillway from TSF Site C constructed in Year 5 to allow passage of the probable maximum flood (PMF) without consideration for attenuation provided by storage below the spillway crest.

Waste management concepts for the various site materials are as follows:

- Topsoil:
  - Temporary stockpiles for use in reclamation.
- NAG4 and NAG5 waste rock and overburden:
  - Used to construct the TSF embankments as indicated in the detailed mine schedule. About 5% of the downstream dam D shell is estimated to be NAG 4 due to shortfalls in NAG5 and overburden production from the pit. If less low ML/ARD potential waste (NAG5 and overburden) is available than anticipated, then the mine plan may need to target this better-quality material more specifically or to accept more NAG4 waste rock for dam construction. Geochemical testing has found little difference in the leaching potential of the NAG4 waste. If used in the Dam D shell it would be placed in the interior of the shell, covered with NAG5 and overburden;
  - Surplus and geotechnically unsuitable materials disposed of in the East or West waste dumps near the pit; and
  - Progressive reclamation of the West waste rock dump during operations, and final revegetation of both dumps at closure.
- NAG3 waste rock (potentially metal leaching):
  - Used to construct the upstream zone of the TSF Site D embankment; and
  - Surplus co-disposed of within the TSF in such a manner that supernatant pond inundates it within five years.
- PAG1 and PAG2 waste rock:
  - Co-disposed of within the TSF in such a manner that it is saturated within one year by the supernatant pond to prevent oxidation and subsequent acid generation.

- Tailings:
  - Conveyed by pipelines and discharged from embankment crests into TSF Sites C and D.

An assessment of the stability rating for the East Dump, West Dump, and LGO stockpile was carried out using the waste and stockpile stability rating system as described in the interim guidelines provided by the BC Mine Waste Rock Pile Research Committee (BCMWRPRC, 1991). Areas have been classified as “Class II” low failure hazard dumps (rating of 500).

2.2.3.4.7 Geohazards

This section discusses terrain stability and seismicity. Geohazards are further discussed in **Sections 11.3 to 11.6** and **Appendix 11A**.

Terrain Stability Maps have been developed for the Study Area and are presented as Drawings G0040 to G0042 (**Appendix 11A**). The terrain stability mapping indicates the majority of the Study Area is ‘stable’, having a ‘negligible’ to ‘low’ likelihood of landslides in relation to road construction and timber harvesting. The mapping indicates there are small, local areas of ‘potentially unstable’ and ‘unstable’ terrain. The footprints of the proposed facilities are generally outside the identified areas of ‘potentially unstable’ and ‘unstable’ terrain, with the exception of the proposed tailings embankment footprints. These footprints include local areas of moderately steep to steep terrain adjacent to Davidson Creek and Creek 505659 that were mapped as ‘potentially unstable’ terrain. In addition, a local area of ‘potentially unstable’ terrain was identified in a gully on the north side of Davidson Creek, which lies within the footprint area of the proposed TSF. The limited localized areas of unstable terrain in the TSF area will be addressed by stabilizing slopes by grading, dewatering and buttressing as necessary during construction of the facility. No areas of ‘potentially unstable’ terrain were identified along the proposed Main Access Road alignment. The terrain stability analysis indicates the area of the proposed pit is not susceptible to landslides.

A seismicity assessment was carried out for the Project, including a review of the regional seismicity and a probabilistic seismic hazard analysis, to provide seismic design parameters for the TSF and other facilities at the Project site, including mine waste dumps and water management dams. Design ground motion parameters provided by the seismic hazard analysis include peak ground acceleration, spectral acceleration (defining the uniform hazard spectrum), and earthquake magnitude.

2.2.3.4.7.1 Regional Tectonics and Seismicity

The Project is situated within central BC where the level of recorded historical seismic activity has been low. The maximum earthquake magnitude for this region of central BC is estimated to be about magnitude 7.0, based on historical earthquake data and the regional tectonics (Adams and Halchuk, 2003). There is potential for larger earthquakes of up to about magnitude 7.5 along the coastal region of mainland western BC, including the Coast Mountains.

2.2.3.4.7.2 Seismic Hazard Analysis

The seismic hazard for the Project has been defined using probabilistic methods of analysis. Historical earthquake data and regional tectonics were examined to identify potential seismic sources and maximum earthquake magnitude for each source.

A design earthquake magnitude 8.5 has been selected for earthquake return periods of 500, 5,000, and 10,000 years, based on the review of regional tectonics and historical seismicity, and the findings of deaggregation of the probabilistic seismic hazard. This represents large-magnitude earthquakes along the Queen Charlotte fault system and Cascadia subduction zone. The potential for shallow crustal earthquakes closer to the Project site was also considered for longer return period events of 5,000 and 10,000 years, representing earthquakes of up to about magnitude 7.5 along coastal BC.

2.2.3.4.7.3 Tailings Dam Hazard Classification

The Canadian Dam Association (CDA) Dam Safety Guidelines (CDA, 2007) were used to determine the dam classification, suggested minimum IDF, and earthquake design ground motion (EDGM) for the Project tailings dams. The tailings dams were classified by considering the potential incremental consequences of a failure. Project tailings dam safety classification is VERY HIGH. The following suggested design flood and earthquake levels were adopted from the CDA guidelines for the construction and operational phases of the Project:

- IDF – 2/3 between 1:1,000 year and PMF; and
- EDGM – 1:5,000 year return period.

A draft bulletin released in 2013 (CDA, 2013) indicates that a mining dam with a dam safety classification of VERY HIGH should be designed for the PMF and maximum credible earthquake (MCE) in the closure phase. The following design flood and earthquake levels were adopted for the closure phase of the Project:

- IDF – PMF; and
- EDGM – MCE (1:10,000-year event).

Additional discussion of seismicity is provided in **Appendix 2.2A-4**. Additional discussion of overall risk of accidents and malfunctioning of the TSF is provided in **Section 10.7**, Accidents and Malfunctions.

2.2.3.4.8 Tailings Storage Facility

In this section “Site” and “Cell” are used interchangeably and have the same meaning.

2.2.3.4.8.1 Geotechnical Conditions – Tailings Storage Facility Area

2.2.3.4.8.1.1 General

TSF geotechnical design parameters were developed from an extensive geotechnical database, which incorporates geological and geotechnical data from the 2012 and 2013 site investigations to support tailings facility dam and disposal area design (New Gold, 2014). Characteristics of surface and subsurface materials at the main construction sites in TSF areas are described below, followed by a summary of interpreted potential seepage pathways in the main surficial material layers.

2.2.3.4.8.1.2 Site D Main Dam

The Site D Main Dam alignment was established to optimize use of the Davidson Creek watershed's natural topography, allowing for efficient and long-term storage of mine waste. The foundation is characterized by a surficial glacial sequence ranging from 4 m to 96 m thick, overlying bedrock. These deposits are thickest in the centre of the Davidson Creek valley. Surficial materials at the north abutment are particularly thick, ranging from 14 m to 96 m. The completely weathered bedrock horizon ranges in thickness from approximately 2 m to 30 m. Static groundwater levels range from 7 m to 32 m below ground surface, mirroring surface topography. Groundwater depth is consistent with the saturated zone identified by seismic refraction survey lines.

The dominant surficial material type in the Site D Main Dam area is low-permeability lodgement glacial till. Glaciofluvial sand and gravel deposits overlie the glacial till to form meltwater channel terraces between approximately 10 m and 20 m thick on either side of Davidson Creek. A large esker overlies the glacial till to the northeast and downstream of the tailings facility.

Detailed investigations found no lateral continuity of glaciofluvial deposits between adjacent drill holes. The Site D Main Dam site intersects Davidson Creek's proglacial meltwater corridor. A glaciofluvial kame complex extends beneath approximately half of the Site D Main Dam on the north side of Davidson Creek. Meltwater channels, a few small eskers, and meltwater erosional scarps were mapped on the south side of Site D Main Dam. Laboratory testing of these interglacial glaciofluvial deposits found that most contain more than 15% fines (silt and/or clay). **Figure 2.2.3-72** is a schematic of the inferred stratigraphy at the Site D Main Dam.

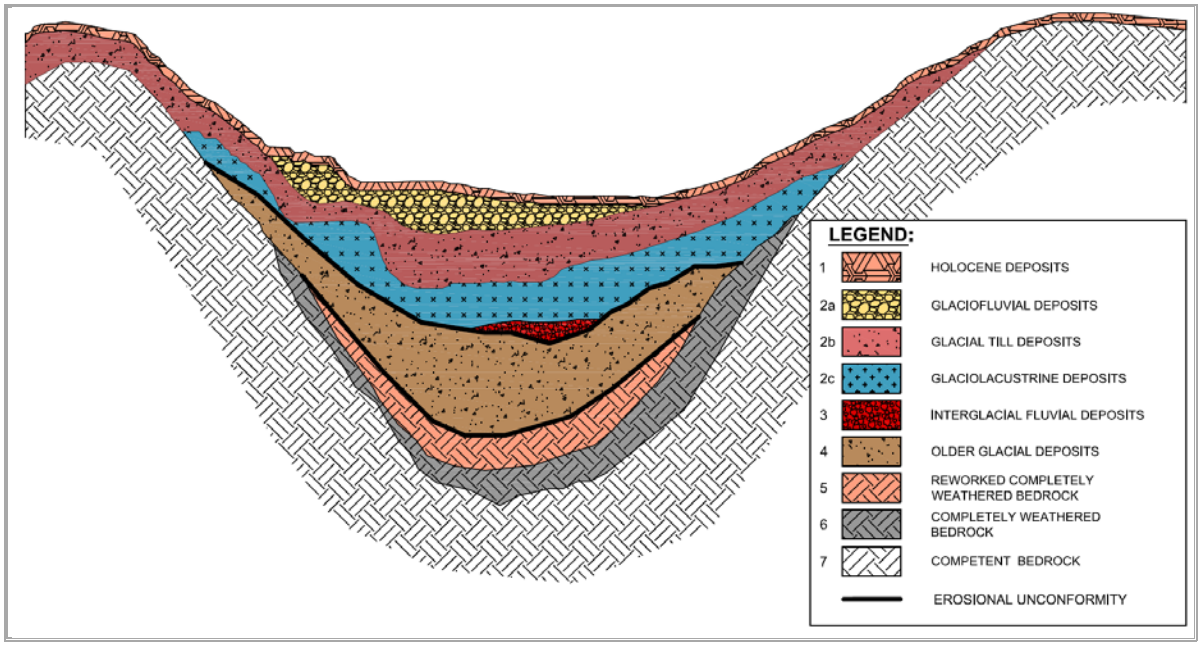


Figure 2.2.3-72: Schematic of Site D Main Dam Inferred Stratigraphy

The bedrock geology consists of andesitic volcanic rocks that are highly to moderately weathered to approximately 20 m depth. In-situ hydraulic conductivity testing demonstrates the rock mass has low permeability ranging from $1x10^{-6}$ m/s to $1x10^{-9}$ m/s. Based on the 2012 site investigation results, an inactive fault was inferred on the south side of Davidson Creek. During the 2013 site investigations, two drill holes targeted the fault to collect information on hydraulic conductivity and attempt to determine its orientation. The fault zone was found to have a low permeability ranging from $6x10^{-7}$ m/s to $9x10^{-9}$ m/s.

2.2.3.4.8.1.3 TSF Site D Basin

Drilling and test pits were completed in the TSF Site D basin to evaluate the near-surface conditions for potential seepage pathways. The conditions here are characterized by a surficial glacial sequence ranging from 3 m to 94 m thick, and overlying bedrock, which is deepest in the centre of the Davidson Creek valley. Here, completely weathered bedrock ranges from approximately 3 m to 30 m thick. Static groundwater levels range from 4 m to 25 m depth, mirroring the surface topography.

The dominant surficial material type in the Site D basin is low-permeability glacial till. As was the case for the dam location, glaciofluvial meltwater channel deposits overlie the glacial till deposits to form terraces between approximately 10 m and 20 m thick on either side of Davidson Creek. Here, interglacial fluvial deposits were identified within the glacial till; these zones were found to be discontinuous, and displayed no lateral continuity between adjacent drill holes. The Davidson Creek basin contains a succession of meltwater channels that are expressed by a series of up to six glaciofluvial terraces that provide evidence of sequential erosion by meltwater streams.

The bedrock geology consists of andesitic volcanic rocks that are highly to moderately weathered to a depth of approximately 20 m. In-situ hydraulic conductivity testing has shown the rock mass has low permeability ranging from 4 x 10^{-6} m/s to 7 x 10^{-8} m/s.

2.2.3.4.8.1.4 Site C Main Dam

The dominant surficial material type at the Site C Main Dam is low-permeability glacial till ranging in thickness from 27 m to 89 m. Glaciofluvial sand and gravel deposits are also prevalent in this area, and overlie the glacial till to form meltwater channel terraces between approximately 10 m and 35 m thick on either side of Davidson Creek. A completely weathered bedrock horizon was identified on the south side of the valley, ranging from approximately 12 m to 35 m in thickness. The completely weathered bedrock horizon was not encountered on the north side of the valley.

Static groundwater levels range from 3 m to 31 m, mirroring topography. Kames, meltwater channels, and meltwater erosional scarps occur immediately north and southwest. These interglacial glaciofluvial deposits contain more than 15% fines (silt and/or clay). Potentially high-permeability interglacial fluvial deposits were identified within the glacial till; however, the deposits are discontinuous and display no lateral continuity between adjacent drill holes. The TSF Site C Main Dam also crosses the Davidson Creek pro-glacial meltwater corridor. **Figure 2.2.3-73** is a schematic of the inferred stratigraphy at Site C Main Dam.

The bedrock geology consists of andesitic volcanic rocks that are highly to moderately weathered to approximately 25 m depth. In-situ hydraulic conductivity testing indicates the rock mass has low permeability with typical values of 9 x 10^{-7} m/s to 6 x 10^{-9} m/s.

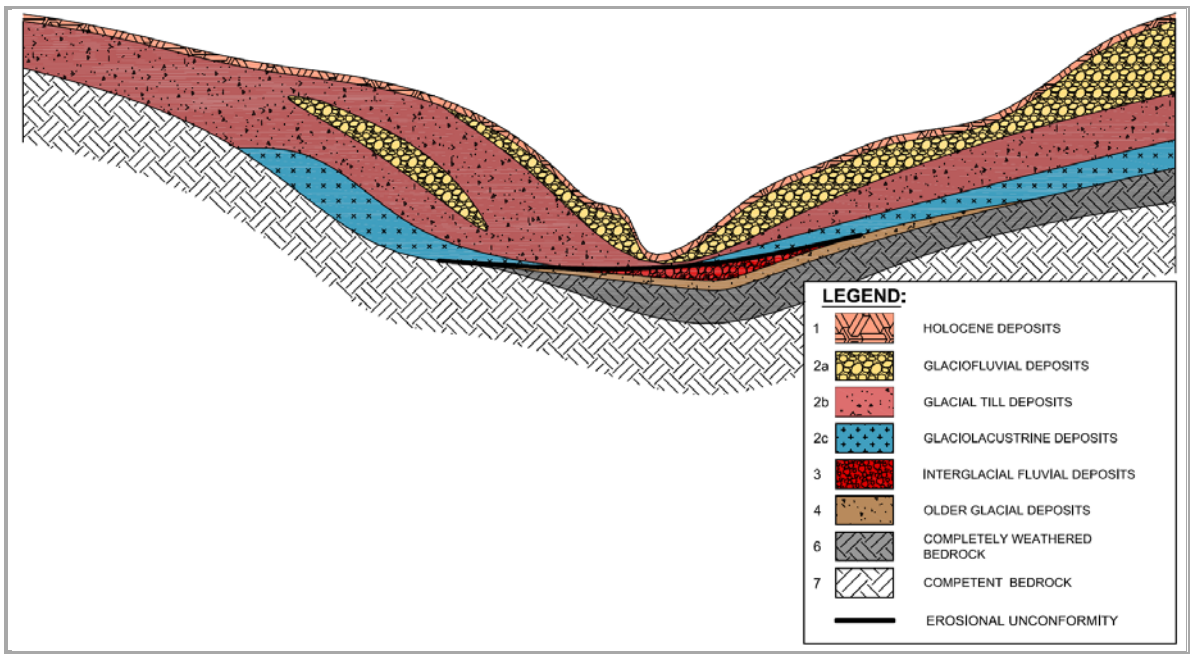


Figure 2.2.3-73: Schematic of Site C Main Dam Inferred Stratigraphy

2.2.3.4.8.1.5 TSF Site C Basin

Drilling and test pits were completed within the TSF Site C basin to evaluate the near-surface conditions for potential seepage pathways. The conditions are characterized by glaciofluvial sand and gravel deposits ranging from 1 m to 7 m thick overlying the bedrock. Static groundwater levels range from 1 m to 4 m, and mirror the surface topography. The bedrock geology consists of slightly weathered andesitic volcanic rocks. In-situ hydraulic conductivity testing indicates the rock mass has low permeability.

2.2.3.4.8.1.6 Site C West Dam

The Site C West Dam is located at the west end of TSF Site C. Drill holes and seismic lines have been completed in this area to investigate the subsurface conditions and optimize the dam alignment. To avoid slope instability and environmental concerns (small lake to the dam's west) identified farther upstream at the drainage divide, the dam location was shifted downstream to its current position approximately 100 m to the northeast; seismic refraction surveys indicated this was a more favourable site. Surficial materials are approximately 5 m thick at this location and are composed of dense fluvial sand and gravel deposits with more than 15% fines content. This composition and the bedrock properties are believed to be consistent with those at the previously proposed dam site.

Bedrock here is fragmentals (e.g., felsic tuff and felsic lapilli tuff). The completely weathered bedrock horizon was not encountered. Hydraulic conductivity in the bedrock is low with values ranging from $4x10^{-7}$ m/s to $3x10^{-8}$ m/s. Static groundwater is shallow, at 3 m. **Figure 2.2.3-74** is a schematic of the inferred stratigraphy at the Site C West Dam.

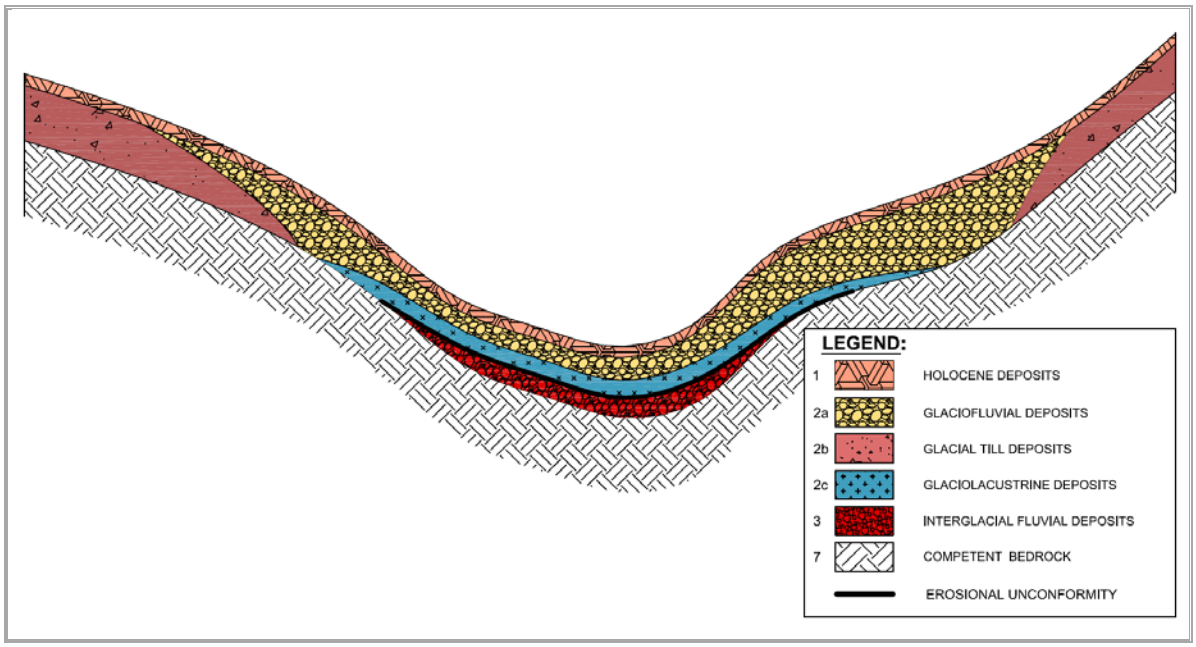


Figure 2.2.3-74: Schematic of Site C West Dam Inferred Stratigraphy

2.2.3.4.8.1.7 Environmental Control Dam and Interception Trench

The Environmental Control Dam (ECD) and interception trenches will be approximately 1 km downstream of the Site D Main Dam. A surficial material sequence ranges from 24 m to 108 m thick, which is deepest in the centre of the Davidson Creek valley. Here, the completely weathered bedrock horizon ranges from approximately 2 m to 30 m thick. The static groundwater level reflects the surficial topography and ranges from 21 m to 53 m.

The dominant surficial material types encountered in the ECD and interception trench are low-permeability glacial till and relatively high-permeability glaciofluvial sand and gravel. Glacial lodgement till is prevalent to the south of Davidson Creek. The glaciofluvial materials overlie the glacial deposits, and form thick deposits extending toward the north; the ECD was sited to avoid these thick, unconsolidated deposits. Design of the ECD is discussed further in **Section 2.2.3.4.8.6**, TSF Seepage Control Measures. The northern glaciofluvial deposits are found on the southwestern edge of a large esker and kame deposit. The bedrock geology consists of andesitic volcanic rocks that are highly to moderately weathered to approximately 20 m depth.

2.2.3.4.8.1.8 Potential Seepage Pathways within Tailings Facility Area

2.2.3.4.8.1.8.1 Davidson Creek Meltwater Channel

The Davidson Creek basin contains a succession of glaciofluvial meltwater channels indicated by a series of up to six terraces. In 2012, a site investigation program identified a deep, discontinuous interglacial fluvial deposit as a potential seepage pathway. Therefore, at the Site C and D tailings facility basins, Knight Piésold investigated the thickness and extent of Davidson Creek's surficial meltwater-channel sands and gravels to discover if they were hydraulically connected to the interglacial fluvial deposits found elsewhere on the Project site. Drilling and mapping of the surficial glaciofluvial sediments within the TSF basin revealed broad areas of glaciofluvial kame deposits but no continuity with, nor hydraulic connection to, the more permeable interglacial fluvial deposits.

2.2.3.4.8.1.8.2 Highly Weathered Bedrock

Highly weathered bedrock was encountered in most drill holes but was found close to ground surface in only one hole on the northern extent of Site D Main Dam. Site investigations in 2012 identified the highly weathered bedrock as a possible seepage pathway beneath the TSF. Assessment of the hydraulic conductivities of the highly weathered bedrock in 2013 yielded values of $3x10^{-5}$ to $7x10^{-8}$ m/s, indicating that the highly weathered bedrock has the potential to be a seepage pathway beneath the TSF, and would daylight downstream of the Site D Main Dam. Subsequently, seepage control measures have been incorporated in the Project design to mitigate the potential seepage using the ECD and seepage interception trenches.

2.2.3.4.8.1.8.3 Depth to Low-Permeability Subgrade at Dam Embankments

Extensive drilling, test pitting, and lab testing was completed along the Site D Main Dam alignment to determine the depth to low-permeability subgrade for designing a cut-off trench (COT). Drill holes encountered suitable low-permeability foundation materials at depths ranging from 5 to 15 m

along the Site D Main Dam centreline. These can be keyed in to the base of the trench. Depths to suitable low-permeability subgrade materials were greater adjacent to Davidson Creek and on the northeastern side of the dam alignment where glaciofluvial meltwater channel sediments have been eroded down to the less-permeable lodgement till, and subsequently infilled with surficial sands and gravels. As such, the COT will be deeper in these areas.

The primary COT for control will be constructed beneath the Site D Main Dam. Unsuitable soils will be removed from the Site C Main Dam's foundation, and the upstream low-permeability zone will be keyed below the surficial sand and gravel. Seepage from the Site C Main Dam will be captured and contained in TSF Site D. The Site C West Dam will require a 5-m COT to key the dam into bedrock.

2.2.3.4.8.2 Tailings Storage Facility Design Overview

The TSF is designed to permanently store tailings, PAG1 and PAG2 waste rock, and NAG3 potentially non-acid-generating waste rock (NAG/ML) generated during the mine's operation. The TSF has two adjacent sites, Site C and Site D (**Figure 2.2.3-35**).

The filling schedule for TSF Site C and Site D was based on the detailed mine schedule for the Project. A filling curve was developed for each site that takes into account the storage characteristics of the facility, and includes the approximate rate of rise of the tailings and waste rock horizon, supernatant pond allowance, and IDF freeboard. The filling curves for Sites C and D are presented on **Figure 2.2.3-75** and **Figure 2.2.3-76**, respectively.

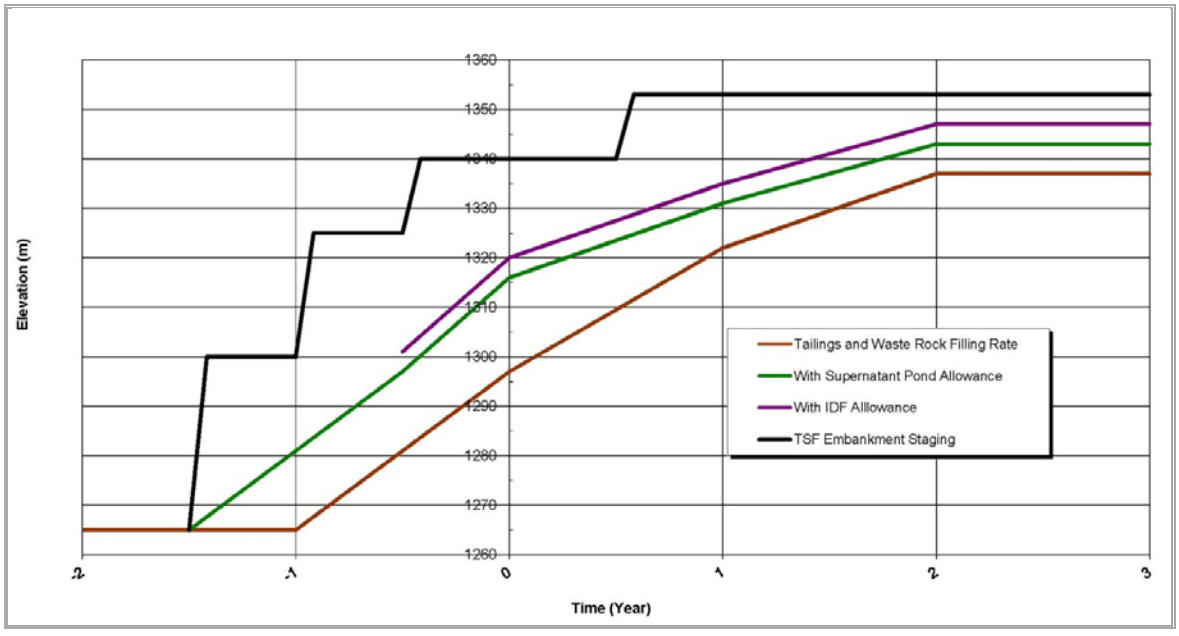


Figure 2.2.3-75: Filling Curve for Site C

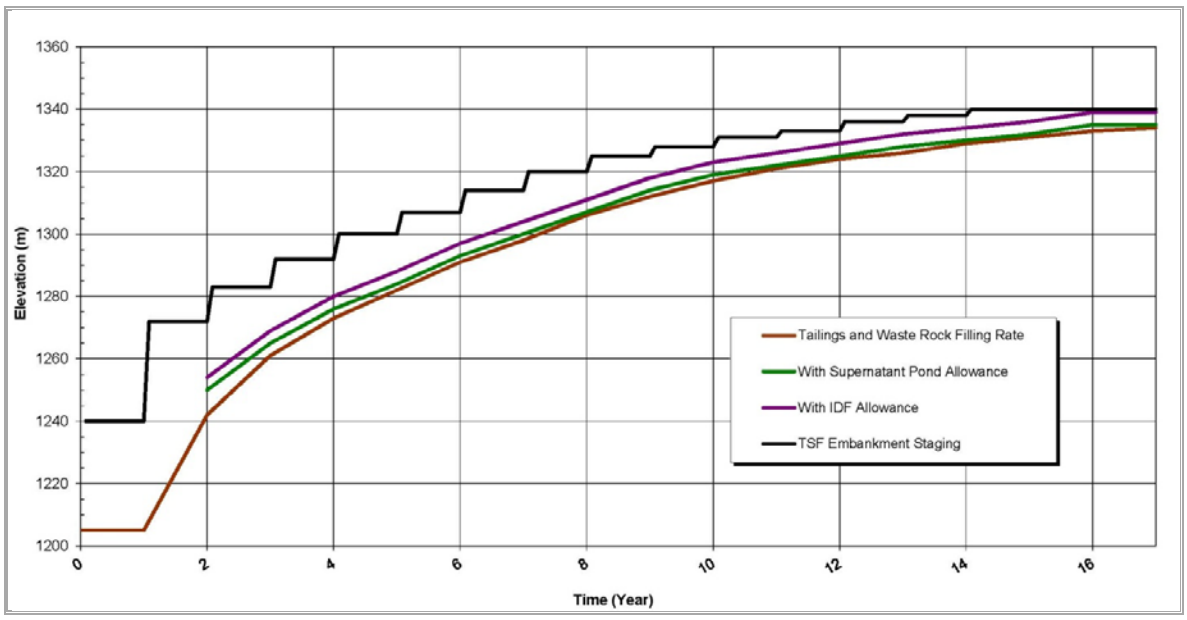


Figure 2.2.3-76: Filling Curve for Site D

Specific overall features of the TSF include:

- Cofferdams and sediment ponds to manage water during construction, either by routing water around the TSF or directing it to the TSF for collection;
- Three zoned, water-retaining earth-rockfill dams referred to as the Site C Main Dam, Site C West Dam, and Site D Main Dam;
- Designated PAG/NAG3 waste storage areas within the TSF;
- ECD and interception trenches to capture seepage downstream of the Site D Main Dam, and direct water to the TSF;
- Collection channels that route water to the TSF;
- Tailings distribution system;
- Reclaim water system;
- Tailings beaches; and
- Supernatant water pond.

2.2.3.4.8.3 PAG and NAG3 Disposal Area

To provide a location within the TSF footprint for PAG (i.e., PAG + NAG/ML waste rock) disposal from pit stripping to expose the ore body, a PAG disposal area will be developed as part of pre-production construction. The PAG disposal area will be developed at the same or a similar rate of rise as the TSF's filling level but will be several metres higher to provide a dry, stable surface

for truck traffic. The design objective is to flood the PAG area's waste rock within one year of placement (up to 5 years for NAG3). The maximum elevation of the waste storage area will be low enough to be flooded by the supernatant pond in case of premature mine closure. At closure, the PAG storage area will be covered by 0.3 m of overburden and inundated by the final (closure) tailings elevation.

The PAG disposal area during preproduction and Year 1 of operations will be within and near the centre of TSF Site C. The disposal area will expand as a fill platform with overall slopes at angle of repose. The tailings beaches will provide a low-permeability barrier between the coarse, permeable waste rock and the tailings embankments.

The PAG disposal area beginning in Year 2 will be within TSF Site D. Waste placement will commence near the upstream zone of the TSF Site D Main Dam below an elevation of approximately 1,240 m and will extend west up the valley as a lobe. Beginning in Year 3, the PAG fill platform will be located in the east and north areas of the facility. The fill platform will rise slightly above and with the TSF filling level from Year 3 until Year 14, when mining ceases. The PAG disposal fill platform will typically rise at a rate that stays at least 5 m below the current dam crest elevation. The fill platform will typically meet the advancing tailings beach approximately 500 m to 1,000 m away from the dam.

Tailings and the supernatant pond between Year 15 and Year 17 will progressively cover the surface of the PAG disposal area during LGO processing when waste rock production has ceased.

2.2.3.4.8.4 Tailings Storage Facility Construction and Operating Methodology

2.2.3.4.8.4.1 Construction Materials

The TSF Site C Main Dam will be constructed to elevation 1,353 m and the TSF Site D Main Dam to elevation 1,340 m. The total fill requirement for the tailings dam construction is 73.9 Mm^3, of which 8.1 Mm^3 is required for TSF Site C and 65.8 Mm^3 is required for TSF Site D.

The top of the TSF Site C Main Dam will be 1,353 masl, and the top of the TSF Site D Main Dam will be 1,340 masl. Total fill requirement for tailings dam construction is 73.9 Mm^3 to 8.1 Mm^3 for TSF Site C and 65.8 Mm^3 for TSF Site D.

The earth-rockfill dams will comprise the following zones:

- The core zone (Zone S) will be constructed from low-permeability till from nearby borrows and from pit stripping;
- The filter zone (Zone F) will be constructed with clean, fine to coarse sand. It will be placed adjacent to and downstream of the core zone to prevent piping of the core zone material and to reduce pore pressures within the embankment;
- The transition zone (Zone T) will be constructed adjacent to and downstream of the filter Zone F. It will be constructed with processed non-reactive fluvial, colluvial, or selected NAG5 waste rock;

- Shell zones (Zone C) will be constructed on both the upstream and downstream sides of the dam with random fill consisting of overburden and specific waste rock material types. Compaction will be done with trucks across the main fill by routing haul truck patterns to produce a uniformly compacted lift. A vibratory smooth drum roller will be used on the edges of lifts with a minimum four to six passes. The lift thickness and specified maximum particle sizes will be based on the truck placement fleet as follows:
    - Contractor fleet: placed and spread in maximum 1,000 mm lifts with a maximum particle size of 1,000 mm; and
    - Mine fleet: placed and spread in maximum 2,000 mm lifts with a maximum particle size of 2,000 mm.

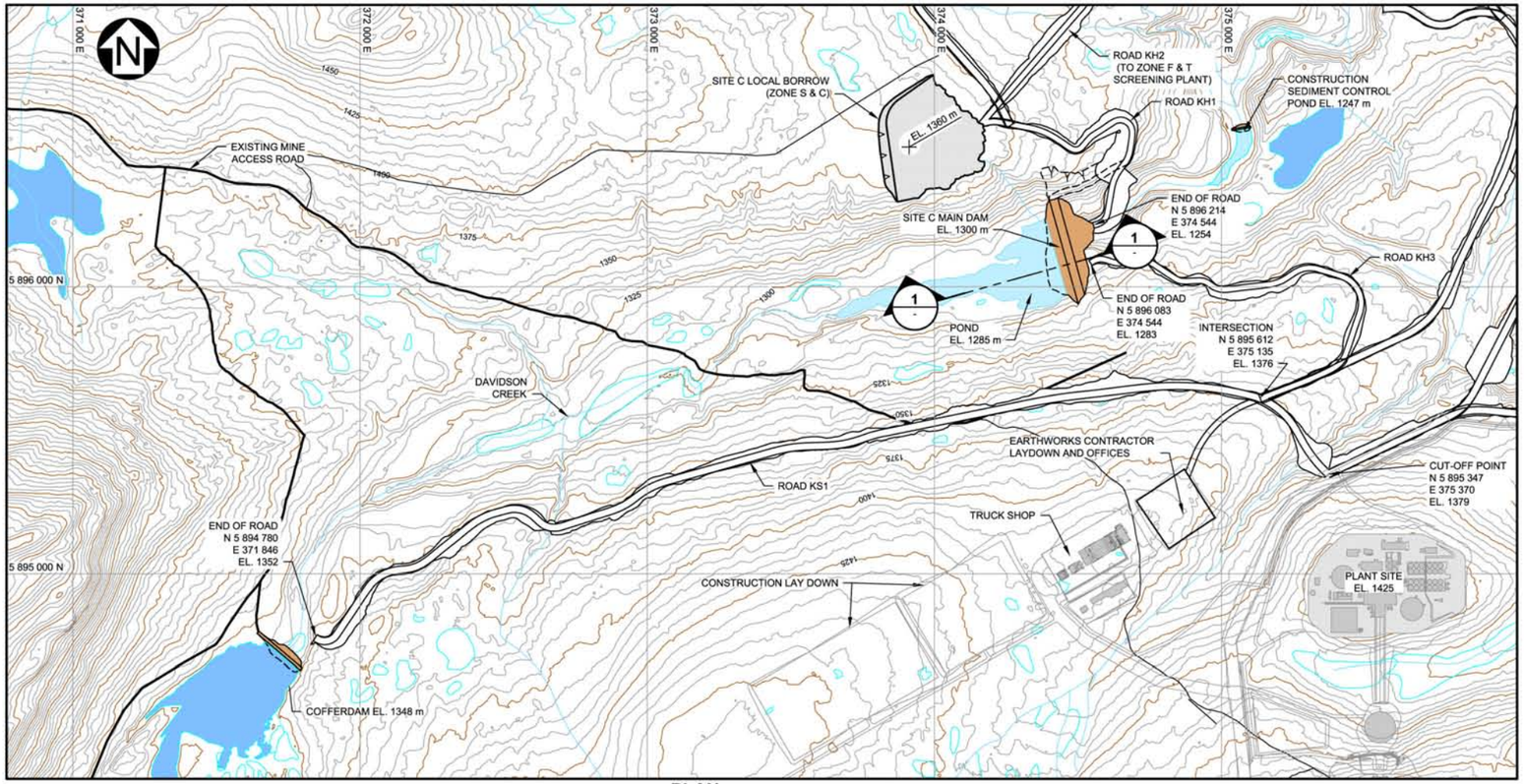
2.2.3.4.8.4.2 TSF Site C

TSF Site C will be constructed first to provide storage capacity for the process plant start-up. The facility was designed to contain the first two years of tailings and PAG waste rock. Embankment foundations will be cleared and stripped in preparation for fill placement for each stage.

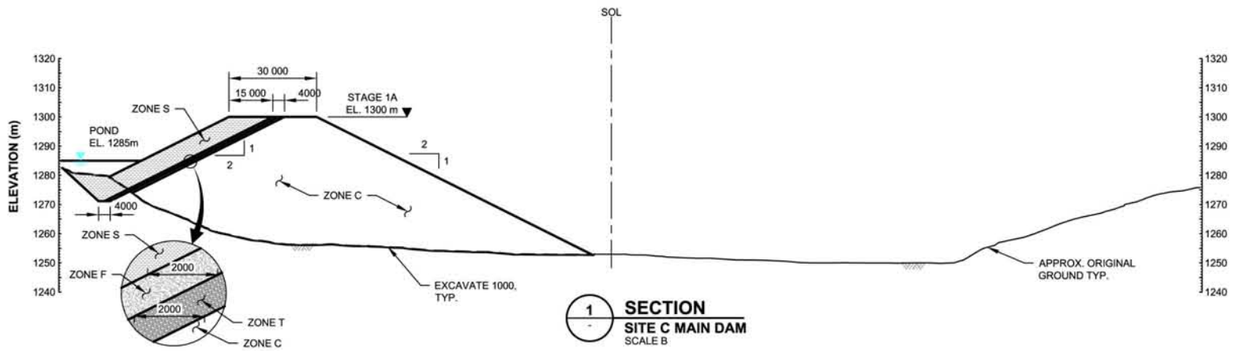
Initially, two cofferdams and a downstream sediment pond will be constructed. The first cofferdam for the Site C Main Dam will be built into the dam footprint and sized to contain flows from a 1:10 year wet August through October period and a 1:10 year, 24-hour storm, with 2 m of additional freeboard. A sediment pond will be constructed downstream of the Site C Main Dam footprint to allow for collection and pumpback of sediment laden construction runoff. The second cofferdam will be constructed upstream of the Site C West Dam, and will create and isolate the TSF from the fish compensation pond and channel to be constructed in the upstream part of the catchment.

Construction of the Stage 1A dam will commence following completion of the sediment and erosion control features. The dam will be built to 1,300 masl by the end of Year –2, as shown in **Figure 2.2.3-77**. Construction of Stage 1A will require 820,000 m^3 of construction material from nearby external borrow sources.

Construction of the Stage 1B dam will begin in early Year –1, immediately following completion of Stage 1A. The dam will be raised to 1,325 masl to provide sufficient capacity to impound PAG waste rock generated during preproduction pit stripping, a start-up pond with a volume of up to 10 Mm^3, with additional capacity to contain the IDF. Construction of Stage 2 will commence thereafter and will be completed by the end of Year –1. The dam will be raised to 1,340 masl, providing the additional capacity required to contain the first year's tailings and PAG waste rock. Year –1's construction plan is shown on **Figure 2.2.3-78**. Stages 1B and 2 will require 4.4 Mm^3 of construction material—4.0 Mm^3 from pit stripping and 0.4 Mm^3 from external borrow sources.



PLAN
SITE C ELEVATION 1300 m
SCALE A



1 SECTION
SITE C MAIN DAM
SCALE B

ROAD VOLUMETRICS

ROAD	CUT (m^3)	FILL (m^3)	LENGTH (m)
KH1	217,200	163,100	1,259
KH2	754,800	535,400	6,636
KH3	100,900	68,300	1,581
KS1	240,800	477,500	3,927

ROAD GRADING

ROAD	WIDTH (m)	FROM	TO	LENGTH (m)	GRADE (%)
KH1	20	0+000	1+023	1,023	-9.7
KH1	20	1+023	1+259	236	-0.4
KH2	20	0+000	4+458	4,458	-5.4
KH2	20	4+458	6+636	2,178	-2.5
KH3	20	0+000	0+997	997	-5.7
KH3	20	0+997	1+581	584	-6.2
KS1	25	0+419	2+163	1,744	-1.2
KS1	25	2+163	4+346	2,183	-0.2

LEGEND:

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- BORROW AREA (ZONE S & C)

NOTES:

1. CONTOUR INTERVAL IS 5 m.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. CHAINAGE FOR ROADS KH1 AND KH2 BEGINS AT SITE C LOCAL BORROW.
4. CHAINAGE FOR ROAD KH3 BEGINS AT INTERSECTION WITH ROAD KS1
5. CHAINAGE FOR ROAD KS1 BEGINS AT KP SCOPE CUT-OFF POINT AND IS PRECEDED BY AMEC ROAD AS7.

20 10 0 20 40 60 80 100 m
SCALE A
200 100 0 200 400 600 800 1000 m
SCALE A

0 0.5 1 2
Kilometers

Reference:
DataBC Data Distribution Service Open Government License (http://www.data.gov.bc.ca/)

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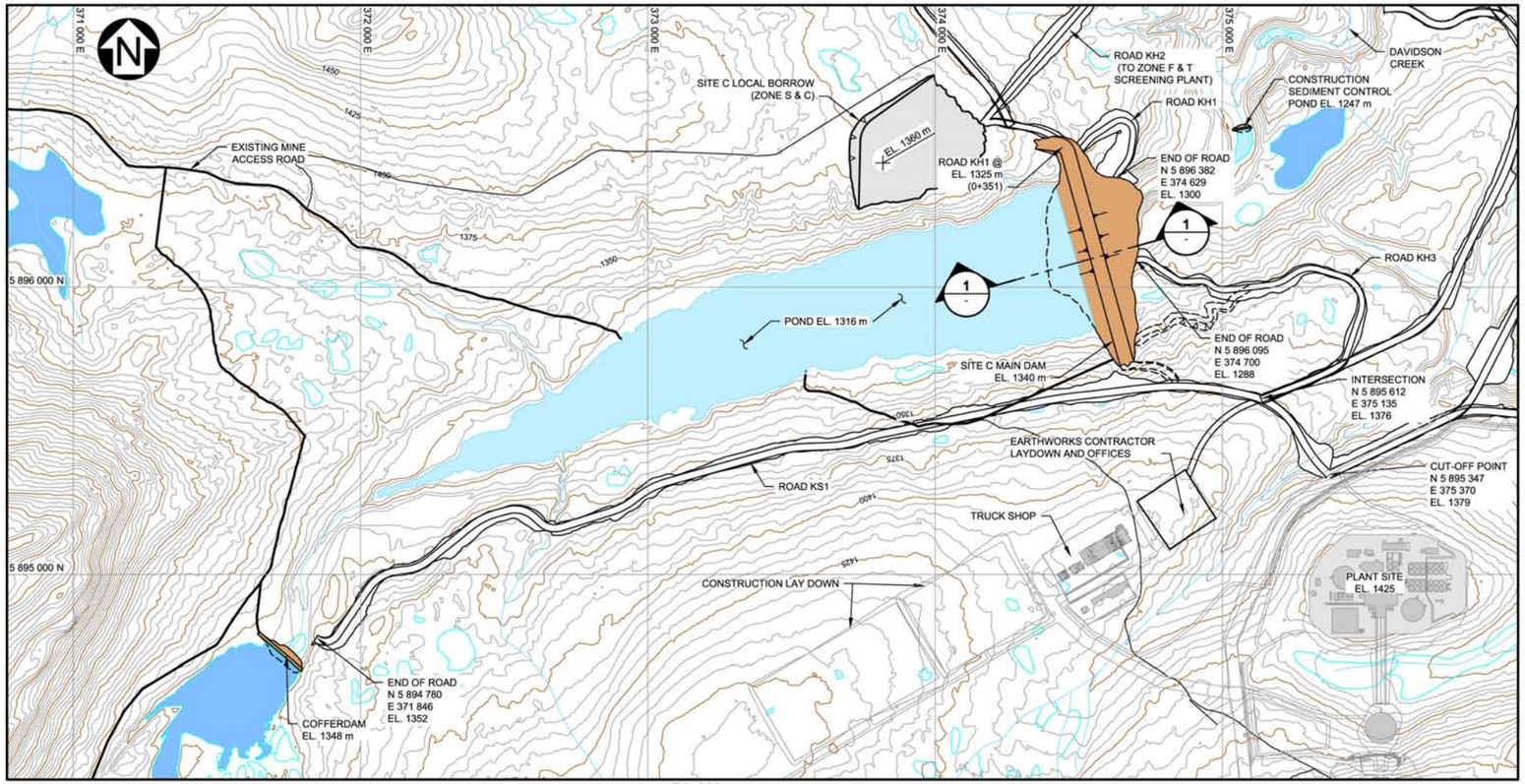
AMEC Environment & Infrastructure
Suite 600 - 4445 Lougheed Highway, Burnaby, B.C., V5C OE4
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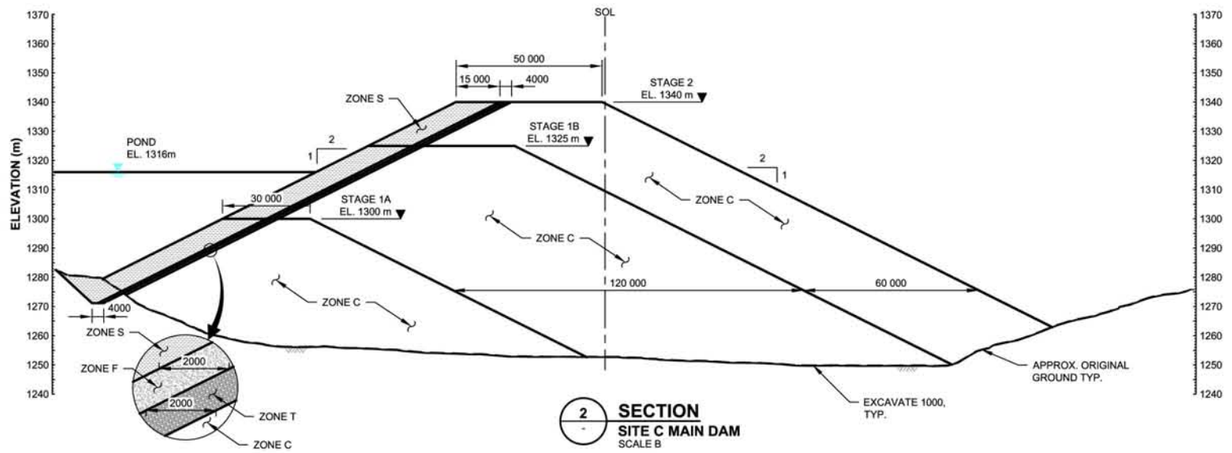
PROJECT: Blackwater Gold Project

TITLE: TSF Site C Year -2 Construction Plan

PROJECT NO:	VE52420
REVISION NO:	
DATE:	May, 2014
SHEET NO:	N/A
DRAWING NO:	**Figure** 2.2.3-77



PLAN
SITE C ELEVATION 1340 m
SCALE A



2 SECTION
SITE C MAIN DAM
SCALE B

ROAD VOLUMETRICS

ROAD	CUT (m^3)	FILL (m^3)	LENGTH (m)
KH1	217,200	163,100	1,259
KH2	754,800	535,400	6,636
KH3	100,900	68,300	1,581
KS1	240,800	477,500	3,927

ROAD GRADING

ROAD	WIDTH (m)	FROM	TO	LENGTH (m)	GRADE (%)
KH1	20	0+000	0+351	351	-9.7
KH1	20	0+351	0+781	410	-9.7
KH2	20	0+000	4+458	4,458	-5.4
KH2	20	4+458	6+636	2,178	-2.5
KH3	20	0+000	0+977	977	-5.7
KH3	20	0+977	1+418	441	-6.2
KS1	25	0+419	2+163	1,744	-1.2
KS1	25	2+163	4+346	2,183	-0.2

LEGEND:

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- BORROW AREA (ZONE S & C)

NOTES:

1. CONTOUR INTERVAL IS 5 m.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. CHAINAGE FOR ROADS KH1 AND KH2 BEGINS AT SITE C LOCAL BORROW.
4. CHAINAGE FOR ROAD KH3 BEGINS AT INTERSECTION WITH ROAD KS1
5. CHAINAGE FOR ROAD KS1 BEGINS AT KP SCOPE CUT-OFF POINT AND IS PRECEDED BY AMEC ROAD AS7.

20 10 0 20 40 60 80 100 m
SCALE A
200 100 0 200 400 600 800 1000 m
SCALE A

0 0.5 1 2
Kilometers

Reference:
DataBC Data Distribution Service Open Government License (http://www.data.gov.bc.ca/)

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PROJECT: Blackwater Gold Project

TITLE: TSF Site C Year -1 Construction Plan

PROJECT NO:	VE52420
REVISION NO:	
DATE:	May, 2014
SHEET NO:	N/A
DRAWING NO:	**Figure** 2.2.3-78

In the first year of operations, the final lift (Stage 3) on the Site C Main Dam will be completed to 1,353 masl. Construction of the final lift will commence in early 2017 with a downstream Zone C step-out of approximately 50 m. The mine fleet will construct the step-out during the first three quarters of that year, with the actual dam raise taking place late in the year. Stage 3 will require 2.7 Mm^3 of construction material, with 2.5 Mm^3 coming from pit stripping and the balance (0.2 Mm^3) from external borrow sources. In addition, the Site C West Dam will be built to 1,353 masl. The West Dam will require approximately 200,000 m^3 of material obtained entirely from external borrow sources, including a 5-m deep COT down to bedrock. The COT will be backfilled with 39,000 m^3 of Zone S material and 2,500 m^3 of Zone F.

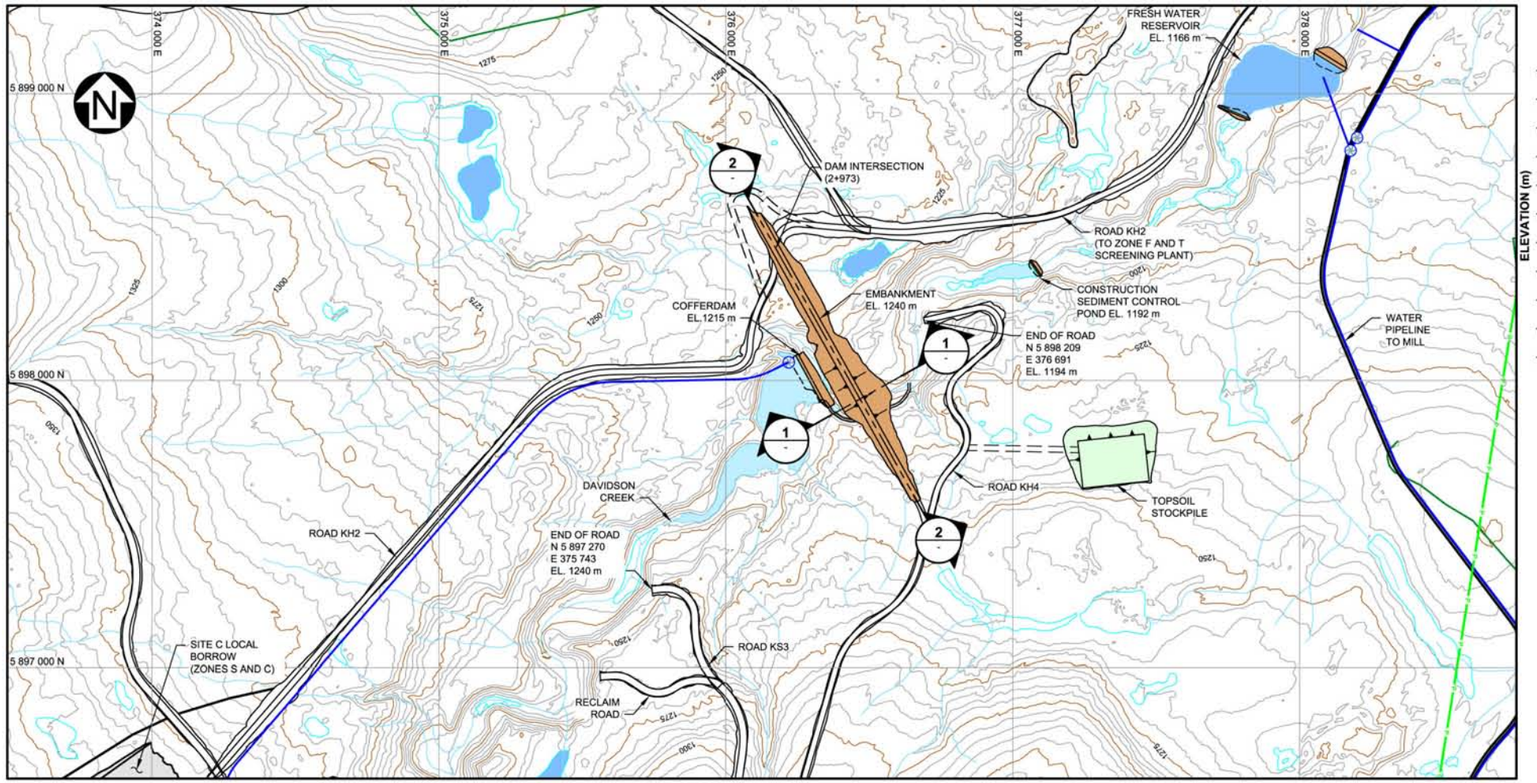
2.2.3.4.8.4.3 TSF Site D

TSF Site D will be built to provide storage capacity for the remainder of the Project's operational life—Year 3 to Year 17. The facility is designed to contain tailings, PAG waste rock, and an operational supernatant pond of at least 10 Mm^3, with additional capacity to contain the IDF. Embankment foundations will be cleared and stripped in preparation for fill placement for each stage. A COT will be excavated through the surficial sands and gravels and keyed into the low-permeability foundation soil horizon. The COT will be 7 m wide at the base and will typically range from 5 m to 20 m deep, averaging approximately 15 m. The total excavation requirement for the COT is approximately 6 Mm^3. The COT excavation will be backfilled with approximately 5.8 Mm^3 of Zone S backfill and 0.2 Mm^3 of Zone F material.

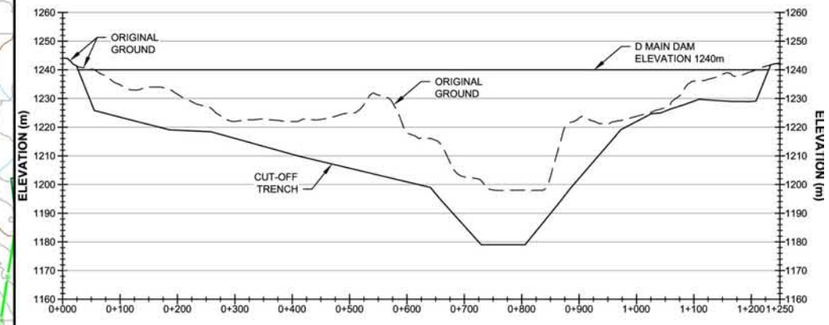
Initially, a cofferdam and a downstream sediment pond will be constructed to manage the water. The cofferdam will be built into the ultimate dam footprint and sized to contain flows from a 1:10 year wet October through December period and a 1:10 year 24-hour storm, with 1 m of additional freeboard. A spillway to bypass the construction area has been sized to manage a 1:200-year storm event. The cofferdam and spillway will be constructed in late Year -2 to allow for water collection from the TSF Site D drainage area. A temporary pump system and pipeline sized to move 1,500 m^3/h of water has been designed for this location to route the spring and summer high flows up to TSF Site C to build the start-up water pond.

Construction of Stage 1A for TSF Site D will commence in Year -1. The COT will be excavated on the abutments first during the earlier months, with in-creek works taking place during the summer low flow period beginning in August. The dam will be built to elevation 1,240 m by the end of Year -1, as shown on **Figure 2.2.3-79**. Construction of Stage 1A will require 2.1 Mm^3 of construction material, provided from pit stripping (1.1 Mm^3) and external borrow sources (1.0 Mm^3).

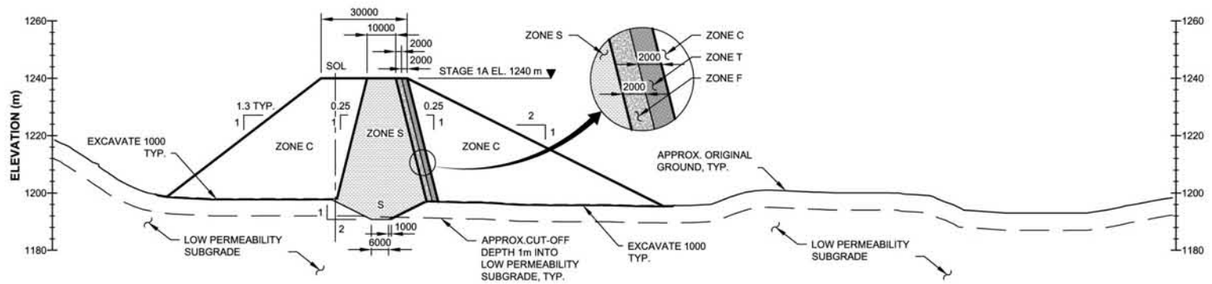
Construction of the Stage 1B dam will commence in early Year 1, immediately following completion of Stage 1A. Dam expansion will consist of upstream and downstream step-outs of Zone C at 1,240 masl. The step-outs will be constructed in approximately 65-m wide sections and completed by the mine fleet using material selected from pit stripping. The detailed mine plan (New Gold, 2014) shows the mine fleet delivering 4.1 Mm^3 of pit material during Year 1. Stage 1B will require 2.7 Mm^3 of pit material. The remaining 1.4 Mm^3 will be used to begin construction of the next downstream step-out, to support later dam construction stages.



PLAN
SITE D ELEVATION 1240 m
SCALE A



2 SECTION
SITE D MAIN DAM PROFILE
HORIZONTAL: SCALE C
VERTICAL: SCALE D



1 SECTION
SITE D MAIN DAM
SCALE B

ROAD GRADING					
ROAD	WIDTH (m)	FROM	TO	LENGTH (m)	GRADE (%)
KH2	20	0+000	2+178	2,178	-5.39
KH2	20	2+178	2+973	795	-2.46
KH2	20	2+973	6+636	3,663	-2.46

LEGEND:
- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- TOPSOIL

NOTES:
1. CONTOUR INTERVAL IS 5 m.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. CHAINAGE FOR ROAD KH2 BEGINS AT SITE C LOCAL BORROW.

SCALE B: 20 10 0 20 40 60 80 100 m
SCALE A: 200 100 0 200 400 600 800 1000 m

0 0.5 1 2
Kilometers

Reference:
DataBC Data Distribution Service Open Government License (http://www.data.gov.bc.ca/)

Knight Piésold Engineering and Environmental Services http://www.knightpiesold.com/en/

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PROJECT: Blackwater Gold Project

TITLE: TSF Site D Year -1 Construction Plan

PROJECT NO:	VE52420
REVISION NO:	
DATE:	May, 2014
SHEET NO:	N/A
DRAWING NO:	**Figure** 2.2.3-79

\\Bby-fs2\bby-ee-gis\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\Other\ProjectDescriptionKP\TSF Site D Year -1.mxd Last updated by willem.van-riet

TSF Site D Stage 2 will commence in Year 2; the dam will be raised to 1,272 masl to provide enough capacity to impound PAG waste rock generated during Year 2, tailings and PAG waste rock generated during Year 3, and a pond of up to 10 Mm^3 with additional capacity to contain the IDF. Stage 2 will require a total of 7.2 Mm^3 of construction material—6.2 Mm^3 from pit stripping, and 1 Mm^3 from reuse of COT excavation material and other external borrow sources.

The tailings dam will be raised annually thereafter to maintain the storage capacity of the TSF. Each raise is designed to provide enough storage for the following year of tailings and PAG waste rock, and to maintain a pond allowance of at least 10 Mm^3 with additional capacity for storage of the IDF. The staged expansion of the Site D Main Dam is shown on **Figure 2.2.3-80**.

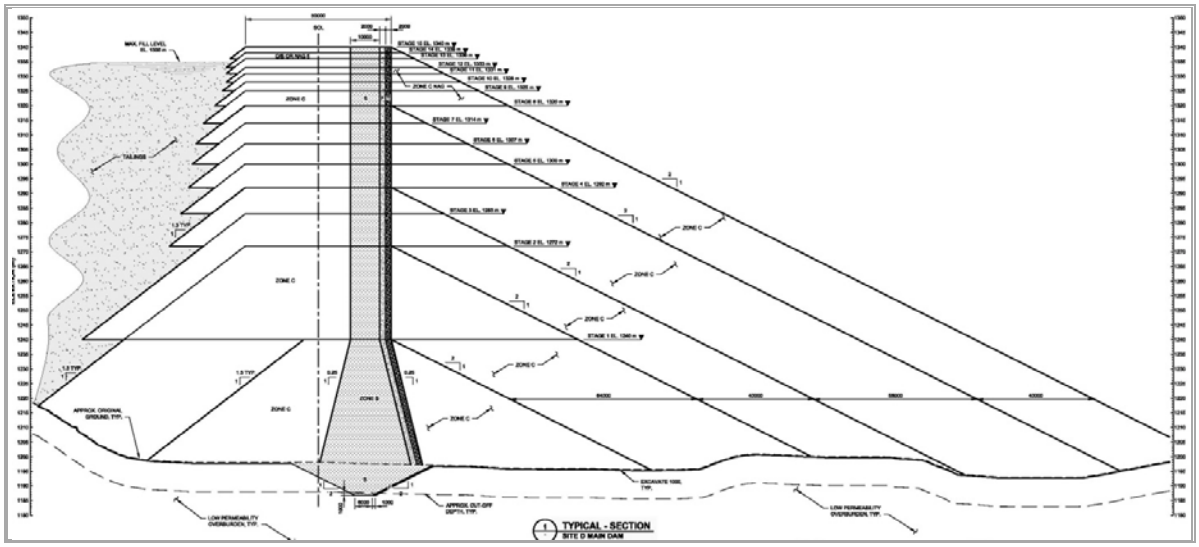


Figure 2.2.3-80: TSF Site D Main Dam Staged Expansions

The mining fleet will provide material from pit stripping for all Zone S and Zone C requirements for raising the dam. Material for Zones F and T will come from the aggregate screening area downstream of the TSF. Overburden will be stockpiled near the TSF during the first eight years of pit stripping and be rehandled by the mine fleet in the later years of dam expansion to provide material for Zone S and COT.

2.2.3.4.8.4.3.1 Static Stability and Seismic Deformation

Analyses were carried out to investigate the stability of the embankment under both static and seismic loading 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); and
- Post-earthquake conditions using residual (post-liquefaction) tailings strengths.

Stability analyses used the limit equilibrium computer program SLOPE/W™. This program performs a systematic search to obtain the minimum safety factor from a number of potential slip surfaces. Safety factors have been computed using the Morgenstern–Price method.

In accordance with international recommendations (ICOLD, 1995) and standard industry practice, the minimum acceptable factor of safety for the tailings embankment under static conditions is 1.3 for short-term operating conditions and 1.5 for the long-term (steady-state and post-closure) of the TSF. A factor of safety of less than 1.0 is acceptable under earthquake loading conditions if calculated embankment deformations resulting from the seismic loading are not significant and the post-earthquake stability of the embankment maintains a factor of safety greater than 1.2, implying there is no flow slide potential.

The seismic stability assessment of the TSF dam included an estimation of seismically induced deformations from the OBE and MDE events. The OBE has been defined as the 1:500-year earthquake, with a mean peak ground acceleration of 0.04 g and design earthquake magnitude of 8.5. The MDE corresponds to the 1:5,000-year earthquake with a mean peak ground acceleration of 0.08 g and design earthquake magnitude of 8.5. To demonstrate the robustness of the embankment design to seismic loading, the 1:10,000-year earthquake was also considered. The peak ground acceleration for the 1:10,000-year event is 0.11 g.

Results of the stability analyses satisfy the 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, MDE, and 1:10,000-year event would be minor and would not have a significant impact on the available embankment freeboard or result in any loss of embankment integrity. The results also show that the embankments are not dependent on tailings strength to maintain overall stability and integrity.

Additional information on TSF dam design can be found in **Appendix 2.2A-2**. Other geohazards that could potentially affect the TSF and other proposed Project facilities are discussed in **Section 2.2.3.4.7**.

2.2.3.4.8.4.3.2 Winter Construction Considerations

Open pit mining will be a continuous process, and the construction of the tailings embankments will reflect this process. Winter construction will be necessary to reduce material rehandle and to maintain the required crest elevation from year to year. Zone C material will be placed upstream and downstream during the winter. The Zones S, F, and T materials will be placed in the summer months as much as possible, but from time to time will be done in the winter if delays are encountered during summer construction.

Precedent exists for constructing earthfill structures in freezing conditions with special considerations. These include construction of the Mt. Polley Mine TSF and, more recently, the Mt. Milligan TSF, both of which are located in central BC.

To meet density requirements, embankment fill, particularly in the core, filter, and transition zones, must be compacted before it freezes. Haul time and compaction methods will address this priority. For example, sheep's foot packers leave depressions in the fill that increase the rate of heat loss and collect snow, and it may be more efficient to have loaded haul trucks make several passes over a lift before dumping.

It is possible for a lift to freeze after it has been compacted without significantly reducing its density. Material may be placed on top of a frozen lift if ice, snow, and loose frozen material are removed first and the density has not been significantly altered. An acceptable fill surface is 90% free of ice and snow, with the remaining 10% consisting of small discontinuous patches. Small areas will be prepared immediately in front of the advancing lift and covered as quickly as possible.

Borrow areas require careful management in freezing conditions, as frozen material must be separated and spoiled. Snow and frozen material will be removed only from the immediate work area to minimizing refreezing of exposed surfaces.

Haul roads will require extra attention in winter, to maintain safety and prevent haul time from increasing dramatically. Extra equipment such as sand trucks and graders will be used, along with a supply of road sand.

Spoil factors and equipment downtime could increase as temperatures decrease. The loss of efficiency during winter can be reduced by clearly outlining a set of construction procedures in advance. All quality assurance staff, operators, and supervisors will be aware of the procedures. It may not be possible to place core zone material properly in temperatures below approximately -15°C, even with quality procedures in place. It may be more efficient to place coarse rockfill in the embankment shell zones during these times and to schedule overburden material removal from the pit in the summer months so it can be used efficiently in embankment construction.

2.2.3.4.8.4.3.3 Instrumentation and Monitoring

Geotechnical instrumentation will be installed along one plane through the Site C West Dam, Site C Main Dam and Fresh Water Reservoir, and in five planes through the Site D Main Dam. The instrumentation will be installed during construction and over the life of the project. The geotechnical instrumentation will be comprised of vibrating wire piezometers, slope inclinometers and surface movement monuments, and will be installed in the foundations, embankment fill, and on the embankment crests. An instrumentation plan was developed for the project as part of the study, which indicates the eight proposed monitoring planes. A section for each plane was prepared showing preliminary instrumentation requirements. The location, types, and number of instrumentation will be further evaluated during detailed design of the project. Movement monuments will be spaced 100 to 200 m apart. A summary of the instrumentation in each plane is

provided in **Table 2.2.3-29**. The instrumentation for the ECD will be similar to Plane 8 for the Fresh Water Reservoir. The plan and sections are included in the drawings in **Appendix 2.2A-2**.

Table 2.2.3-29: TSF Instrumentation Summary

Instrumentation Plane (and Location)	Vibrating Wire Piezometers			Slope Inclinometer
	Foundation	Fill	Tailings	
1 (Site C West Dam)	2	3	0	0
2 (Site C Main Dam)	8	6	0	0
3 (Site D Main Dam)	2	9	1	0
4 (Site D Main Dam)	2	9	1	2
5 (Site D Main Dam)	2	13	3	2
6 (Site D Main Dam)	2	7	0	2
7 (Site D Main Dam)	1	8	0	0
8 (Fresh Water Reservoir)	6	7	N/A	0
Total	**25**	**62**	**5**	**6**

Instrumentation monitoring will be routinely completed during construction and operations. Measurements during construction will be taken and analysed on a routine basis to monitor the response of the embankment fill and the foundation from the loading of the embankment fill. The frequency of monitoring for the piezometers and inclinometers may be decreased once the effects of initial construction have dissipated. Surface monuments will be surveyed at least twice per year during operations. An Operations Maintenance and Surveillance (OMS) Manual will be prepared following initial construction and prior to commissioning of the TSF, and will provide comprehensive operating instructions for the TSF and related facilities. Additional discussion of TSF construction is provided in **Appendix 2.2A-4**. An Instrumentation Plan and a Section for each instrument plane specified in the plan is included in **Appendix 2.2A-2,** Appendix A in the design drawing package that was created for the project (Drawings D0180 through D0186).

2.2.3.4.8.5 Tailings Handling

2.2.3.4.8.5.1 Tailings Properties

AMEC conducted laboratory tests to determine the geotechnical and physical characteristics of the Project tailings—Index Testing to enable geotechnical classification of the materials, and slurry settling, air-drying, consolidation, and permeability testing to determine the tailing's characteristics for a range that represents expected field conditions.

The specific gravity of the tailings solids was determined to be 2.79. The material can be described as non-plastic sandy-silt with trace clay. Particle size distribution was approximately 44% fine sand, 46% silt, and 10% clay.

Undrained settling, drained settling, and air-drying tests were carried out to provide information on the effect of initial slurry solids content on the settling and permeability characteristics of the material and the effect on water recovery and achieved density. Slurry settling (sedimentation)

tests provide an estimate of the density to which the tailings slurry will settle in a subaqueous environment, under drained and undrained conditions. These tests provide an indication of the tailings dry density achieved in a storage facility after settling and before any significant consolidation occurs. The air-drying tests were carried out to determine the effect of air drying after initial slurry settling and removal of supernatant water.

The tests were performed for a target solids content equal to 50%; the main findings are as follows:

- Undrained settling dry density is 1.19 t/m^3;
- Drained settling dry density is 1.35 t/m^3;
- Supernatant water recovery is expected to be around 52% for undrained conditions and 62% for drained settling conditions; and
- Air dried final dry density is 1.49 t/m^3 and took approximately four days to complete.

Laboratory tests conducted to determine the consolidation and permeability characteristics of the tailings included slurry consolidometer testing, a low-stress slurry consolidation test, and a falling head permeability test (conducted on settled tailings after completion of drained settling). Relationships between coefficient of consolidation, void ratio, and vertical coefficient of permeability to effective stress were developed for the tailings. The calculated coefficients of consolidation for the tailings range from 20 square metres per year (m^2/y) at very low stresses (representing unconsolidated of fresher tailings near surface) to over 1,000 m^2/y at high stresses (representing more-consolidated or deeper tailings within the deposit). The permeability of the tailings ranges from 3x10^{-5} centimetres per second (cm/s) at low stresses to about 4x10^{-6} cm/s at high stresses, corresponding to a reduction in void ratio.

Rheology testing of the tailings slurry was conducted to determine the slurry flow characteristics for the design of the tailings pipelines. The tailings rheology characterized the slurry as a non-Newtonian, Bingham plastic slurry typical of tailings slurries. It is fairly coarse and clean with good packing density and low rheology. The rheology results were used to establish depositional velocities and frictional pressure losses in the tailings pipeline design.

2.2.3.4.8.5.2 Tailings Deposition Plan

Tailings from the process plant will be thickened and delivered by gravity through a pipeline from the thickener to either the TSF Site C or the TSF Site D TSF. The pipeline will be laid parallel to a service road from the process plant to an energy-dissipating drop box where the tailings distribution pipelines to TSF Sites C and D will diverge. The tailings drop box is designed to reduce the extra head for early stages, or for discharge at closer locations along the dams. The design includes a bypass pipeline around the tailings drop box to ensure sufficient head is available for delivery of tailings to the far ends of Site C and Site D.

The tailings pipelines are sized to ensure gravity flow for the entire duration of the mine life while dissipating as much energy head through friction as possible. Energy dissipation is necessary

because of the substantial elevation difference between the process plant site and the TSF, which varies from 161 m to 80 m throughout operations.

Additional pipelines extending from the drop box to either TSF Site C or D will be constructed to allow for emergency discharge to each TSF area. Discharge locations will be far enough away from the reclaim barges to ensure that the reclaim water intakes are free of sediment.

The tailings distribution pipeline will initially extend along a service road to the Site C Main Dam where tailings will be deposited during the first two years of operations. Spigots will be placed every 150 m along the dam crest. The tailings beach will provide a low-permeability transition zone between the coarse, permeable waste rock in the centre of the TSF and the tailings embankments, and will provide seepage control.

The pipeline to Site C will be extended to the West Dam in Year 1. Spigots will be placed every 150 m along the Site C West Dam and along the service road on the south perimeter of the TSF to enable tailings deposition around the perimeter of the TSF. Selective tailings distribution methods will be used to hydraulically separate the supernatant pond from the West Dam with the benign oxide tailings, and to cap the PAG tailings and waste rock with more benign oxide tailings in Years 2 and 3.

The tailings pipeline will be extended from the drop box to the Site D Main Dam along a service road in Year 2 of operations to allow for deposition of tailings at Site D beginning in Year 3. Spigots will be placed every 150 m along the dam crest. The tailings beach will provide a low-permeability transition zone between the coarse, permeable waste rock fill platform in the center of the TSF and the tailings embankments and will provide seepage control.

The pipeline that runs to the Site C West Dam will be decommissioned in Year 4, removed, and installed along a service road on the west side of TSF Site D, extending to the north of the Site C Main Dam. This will allow for the distribution of tailings on the west side of the facility during dam raises on the Site D Main Dam and for selective tailings distribution to manage the size and location of the supernatant pond.

The tailings distribution pipeline along the Site D Main Dam will typically be raised with each stage of dam construction. The dam crest elevation will reach 1,300 masl in Year 5 of operations, and the tailings pipeline will be extended fully around TSF Site D to allow for deposition along the majority of the perimeter. In Year 8 of operations, part of the service road and tailings distribution pipeline running from the drop box to the Site D Main Dam will be relocated to allow access to the advancing dam crest elevation along the southeast side of the facility. This service road will then allow for the expansion of the TSF to the ultimate dam crest elevation of 1,340 masl.

Additional information on tailings handling is provided in **Appendix 2.2A-2**.

2.2.3.4.8.6 TSF Seepage Control Measures

Seepage will be controlled primarily by the low-permeability Zone S constructed prior to developing the tailings beach, the COTs, and the low-permeability foundation materials. TSF seepage 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.

Special design provisions to minimize tailings dam seepage losses include developing extensive tailings beaches to isolate the supernatant pond from the dam, hydraulic barriers, embankment drainage collection systems, and toe drains at the downstream toe of the dams to reduce seepage gradients. Additional seepage collection ditches constructed along the toe of the embankments will direct seepage and surface runoff to the pumpback systems.

Seepage analyses were completed for TSF Site C and Site D. Results indicate that approximately 55 litres per second (L/s) of seepage is expected to pass through the embankment and foundations of the Site D Main Dam at the maximum extent of the TSF in Year 17. The majority of the embankment seepage (53 L/s) will flow through the main section of the dam that faces downstream along Davidson Creek; most of this seepage is expected to be recoverable based on the special design provisions discussed above and the secondary downstream collection systems associated with the ECD, as discussed below. The seepage modelling found a negligible amount of seepage (0.2 L/s) could pass from the foundation of the Site D Main Dam beyond the ECD, approximately 1 km downstream of the tailings dam. Virtually all of the seepage was predicted to daylight to surface or within the surficial sand and gravel zone upstream of the ECD.

The remaining 1.5 L/s of total seepage leaving the TSF is expected to pass through the north and south abutments in weathered and fractured bedrock and may be unrecoverable.

Secondary seepage collection at the ECD will be achieved by constructing a collection dam approximately 1 km downstream at a topographic low point in Davidson Creek. A pumpback system will manage seepage and storm water inflows. Recovered water will be pumped to TSF Site D, and the collection pond will be kept dewatered to the maximum extent practical. Seepage through this dam will be captured in an embankment drain system and sump and be pumped back to the ECD pond.

Two seepage interception trenches, one on each side of Davidson Creek, will be excavated through the surficial sand and gravel terraces downstream of the Site D Main Dam and will re-port to the ECD pond. Locations of the seepage interception trenches are based on the results of geotechnical drilling along the proposed alignments. The trenches will be excavated and keyed into the low-permeability overburden horizon, and will be approximately 3.3 km long and typically 5 m to 15 m deep. The ECD and interception trench layout are shown on **Figure 2.2.3-81.** Embankment seepage from TSF Site C Main Dam is predicted to be approximately 21 L/s during Years 1 and 2, which will be captured at the downstream construction-sediment control pond (SCP) and recycled back to the TSF Site C pond, with one exception. A small amount of seepage will be captured at TSF Site D. This capture and pumpback system will be decommissioned at Year 3, and all subsequent seepage will be captured by TSF Site D.

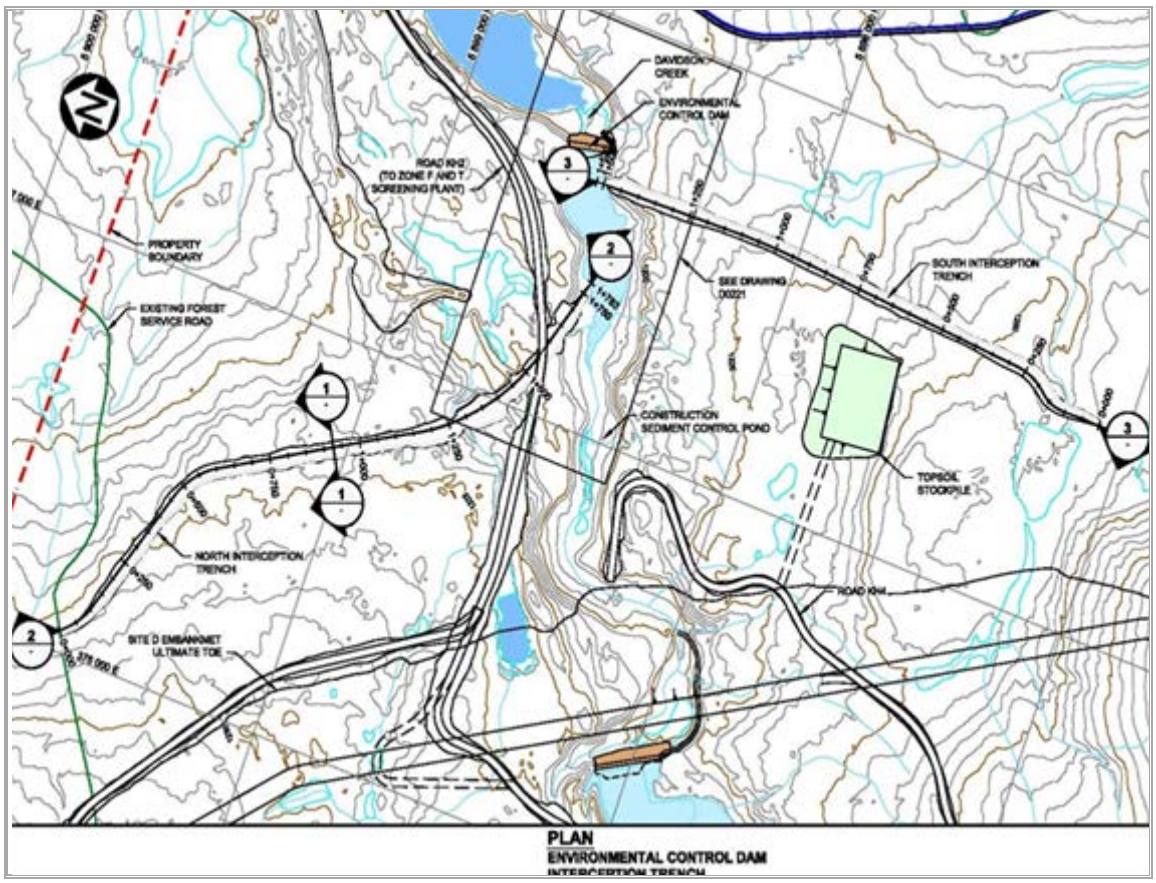


Figure 2.2.3-81: Environmental Control Dam and Interception Trenches

Groundwater monitoring wells have been installed in the areas downstream of Site D, and could be converted to recovery wells, if required, to recover any foundation seepage. Additional monitoring wells will be installed as required before Site D is commissioned.

Site C West Dam seepage will be controlled in the long term by constructing a pond upstream of the TSF at a higher elevation than the TSF supernatant pond, and by selectively discharging the benign oxide tailings to hydraulically separate the supernatant pond from the West Dam (**Figure 2.2.3-82**). The elevation of the supernatant pond in Site C will be controlled passively by the closure spillway for the facility. The freshwater pond upstream of the TSF will create a hydraulic barrier, forcing freshwater seepage toward the TSF. The area between the two dams will be backfilled and graded toward the freshwater pond. A seepage sump and pumpback system will be constructed between this pond and the TSF, which will be used for monitoring water quality.

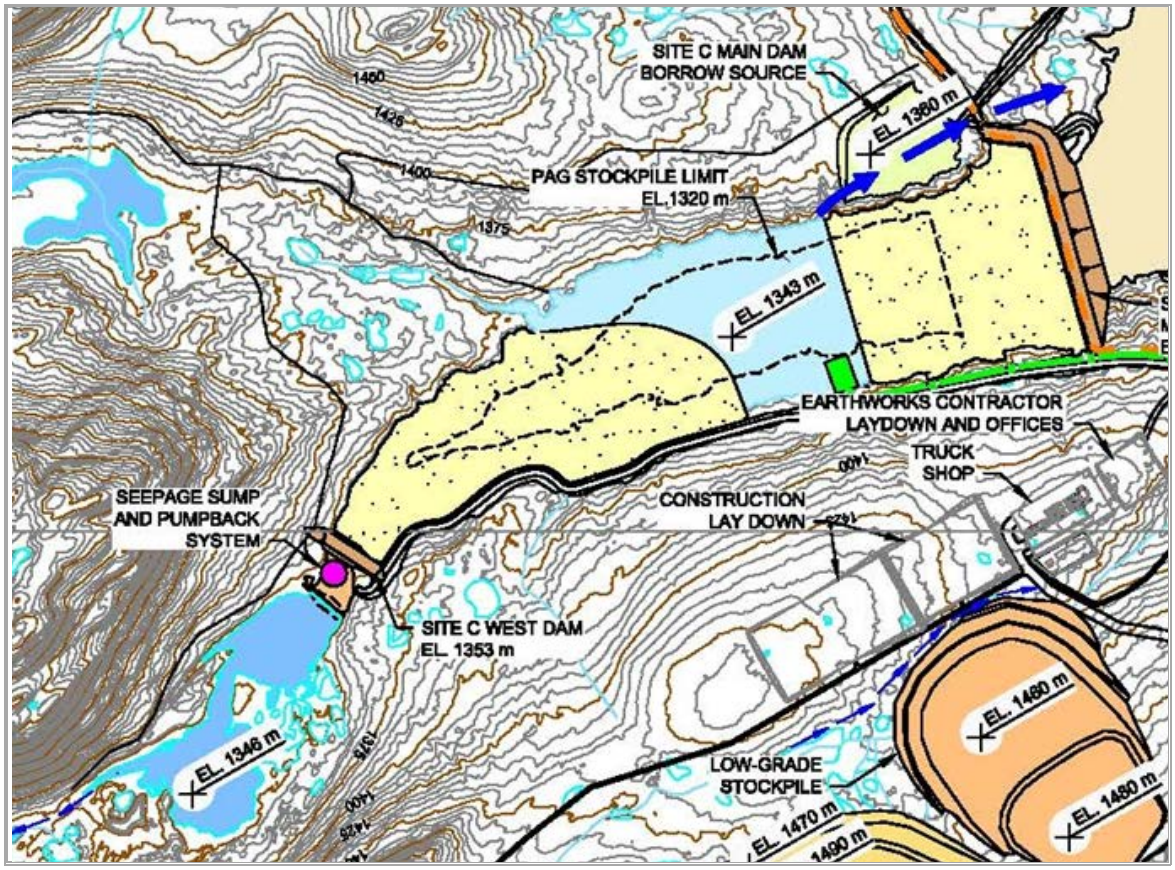


Figure 2.2.3-82: Site C West Dam Seepage Control

2.2.3.5 Water Management

2.2.3.5.1 Water Management Objectives

The overarching water management objective is to provide sufficient water to support process plant water requirements and maintain PAG materials in the TSF in a subaqueous state, while mitigating environmental impacts to downstream receiving waters. Water will be controlled to minimize erosion in areas disturbed by construction and to prevent release of sediment-laden water to the receiving environment. This includes collection and diversion of surface water runoff and constructing and operating SCPs, seepage collection systems, and pumpback systems. The key facilities requiring water management planning include:

- Open pit;
- Process plant site, truck shop, and laydown areas;
- Construction camp;
- Roads;
- TSF;

- East and West waste rock dumps; and
- LGO stockpile.

The key elements for water management are:

- Spillways;
- Collection and diversion ditches;
- ECD;
- Freshwater reservoir;
- Seepage collection and pumpback systems;
- Freshwater supply system;
- Surface and groundwater monitoring systems; and
- Sediment and erosion control measures, including SCPs for the facilities listed above.

Water within the Project area will be recycled and used to the maximum practical extent by collecting runoff from the mine site area. Site runoff will be collected and stored within the TSF, and used to inundate the PAG waste rock and tailings solids to prevent acid-rock drainage and minimize metal leaching. Excess water will be stored in the supernatant ponds within the TSF and recycled to the process plant for use in mineral processing. Water supply sources for the Project will include:

- Runoff from the catchment above the Project site;
- Direct precipitation onto the TSF and runoff from the mine site facilities;
- Water recycled from the TSF supernatant ponds;
- Groundwater from open pit dewatering and depressurization;
- Water extracted from two wells east of the camp area for potable and fire water use;
- Fresh water pumped from Tatelkuz Lake for process plant fresh water needs and to mitigate flow reductions in lower Davidson Creek for downstream fisheries; and
- Periodic water supply from Tatelkuz Lake to supplement requirements for mineral processing or to saturate PAG waste rock within the TSF, if required.

The following sections describe the water management strategies, design elements, and facilities through all phases of the Project.

2.2.3.5.2 Construction Water Management and Erosion Control Plan

2.2.3.5.2.1 Sediment and Erosion Control

Knight Piésold prepared a construction phase Sediment and Erosion Control Plan (SECP) for the Project (**Appendix 2.2A-5**) as part of the FS. The SECP outlines the objectives and strategies that

will be implemented to manage water and mitigate erosion throughout the construction phase of the Project between Year -2 and Year 1. The key objectives of the SECP are the following:

- Minimize the extent of land disturbance;
- Isolate disturbed areas and contain sediment-laden water; and
- Collect water for storage within the TSF for use during operations.

Six discrete areas of development have been identified within the Project boundary for the SECP:

- Construction laydown, truck shop, and earthworks contractor laydown and offices;
- Process plant site and crusher;
- Construction camp;
- Aggregate screening area;
- TSF; and
- Open pit and waste dumps.

Specific surface water control elements and measures will be implemented to minimize erosion and prevent sediment discharge into surrounding areas. Surface water sediment mobilization and erosion will be managed throughout the site by:

- Installing sediment controls prior to construction activities;
- Limiting disturbance to the minimum practical extent;
- Reducing water velocity across the ground, particularly on exposed surfaces and in areas where water concentrates;
- Progressively rehabilitating disturbed land and constructing drainage controls to improve the stability of rehabilitated land;
- Scarifying the surface in rehabilitation areas to promote infiltration;
- Protecting natural drainages and watercourses by constructing appropriate sediment control devices such as collection and diversion ditches, sediment traps, and sediment ponds;
- Restricting access to rehabilitated areas; and
- Constructing surface drainage controls to intercept surface runoff.

Subsurface water will be controlled using sumps, wells, or removable pump-stations to draw down the natural water table and provide dry, stable construction areas. Excavations will be kept stable and workable by pumping water collected in the excavation sump pits to sediment control devices such as temporary holding ponds, sediment basins, or sediment filter bags where required.

The Project will implement an adaptive management approach that allows field-fitting sediment and erosion control works to suit conditions encountered during construction. Best management practices (BMPs) will be implemented before and during construction. Regular monitoring and maintenance of implemented BMPs will ensure success of the SECP. Temporary sediment and erosion control features will be reclaimed after soils and sediments have stabilized. The following is a summary of BMPs that may be used at the Project site, depending upon conditions encountered:

- Vegetation management and revegetation;
- Mulching;
- Rolled erosion control products;
- Surface roughening;
- Recontouring;
- Silt fencing;
- Temporary sediment traps and sediment basins;
- Filter bags;
- Flocculants[3];
- Collection or diversion ditches;
- Culverts; and
- Exfiltration areas.

In addition to the BMPs described above, SCPs have been designed for each area of major disturbance.

2.2.3.5.2.2 Design Criteria

SCPs were designed in accordance with BC's Guidelines for Assessing the Design, Size and Operation of Sedimentation Ponds Used in Mining (BC Ministry of Environment, Land and Parks [MOELP], 1996). Ponds were designed to accommodate a live storage equal to the 1:10 year, 24-hour storm, with 0.5 m of freeboard, and to settle out sediment particles sized 0.01 mm (and larger) while providing a retention time of at least 24 hours. Each pond and pond outlet spillway was designed to withstand a 1:200-year, 24-hour storm event, as per these guidelines. Additional design information can be found in **Appendix 2.2A-5**, SECP report by Knight Piésold. See also **Appendix 2.2A-5** Drawings D0136, D0137 and D0138 for illustration of design concepths to prevent and mitigate erosion.

[3] To aid in the design of SCPs, AMEC conducted flocculant tests on water from the Project receiving streams. The report is attached with Knight Piésold's SECP in **Appendix 2.2A-5**.

2.2.3.5.2.3 Sediment Control Phases

Sediment control will be phased to match construction. Three main phases are planned:

- Early sediment control activities;
- TSF construction; and
- Open pit sediment control.

Table 2.2.3-30 lists the SCPs, operating periods, and discharge points. Four of the seven ponds are designed to discharge to permeable glaciofuvial deposits. All but two of the seven ponds will be removed by the end of construction and those two ponds are designed to discharge to permeable glaciofluvial deposits.

Table 2.2.3-30: Sediment Control Pond Locations and Discharge Strategies

Pond	General Area	Start of Construction	Discharge Strategy	Date of Decommissioning	Post Decommissioning Runoff Routing
SCP#1	Construction laydown and truck shop	Beginning of Year -2	Permeable glaciofluvial deposits	End of Year -2	To TSF Site C basin via West Ditch
SCP#2	Plant site	Beginning of Year -2	Permeable glaciofluvial deposits	End of Year -2	To TSF Site C basin via West Ditch
SCP#3	Camp	Beginning of Year -2	Permeable glaciofluvial deposits	N/A	N/A
SCP#4	Aggregate screening area	Beginning of Year -2	Permeable glaciofluvial deposits	N/A	N/A
SCP#5	East waste dump area	Late Year -2	Creek 661	End of Year -1	To TSF Site C basin via collection ditch
SCP#6	Downstream of Site C cofferdam	Late Year -2	Davidson Creek	End of Year -1	SCP is in TSF basin footprint, water stays in TSF basin
SCP#7	Downstream of Site D cofferdam	Late Year -2	Davidson Creek	End of Year -1	SCP becomes obsolete, structure is in place and can be used if needed

Note: N/A = not applicable; SCP = sediment control pond

For SCP#5 to SCP#7, which will be designed to discharge to receiving streams, flocculants, and lime will be available to add to the ponds as a contingency to increase settling.

2.2.3.5.2.4 Operations and Closure Water Management

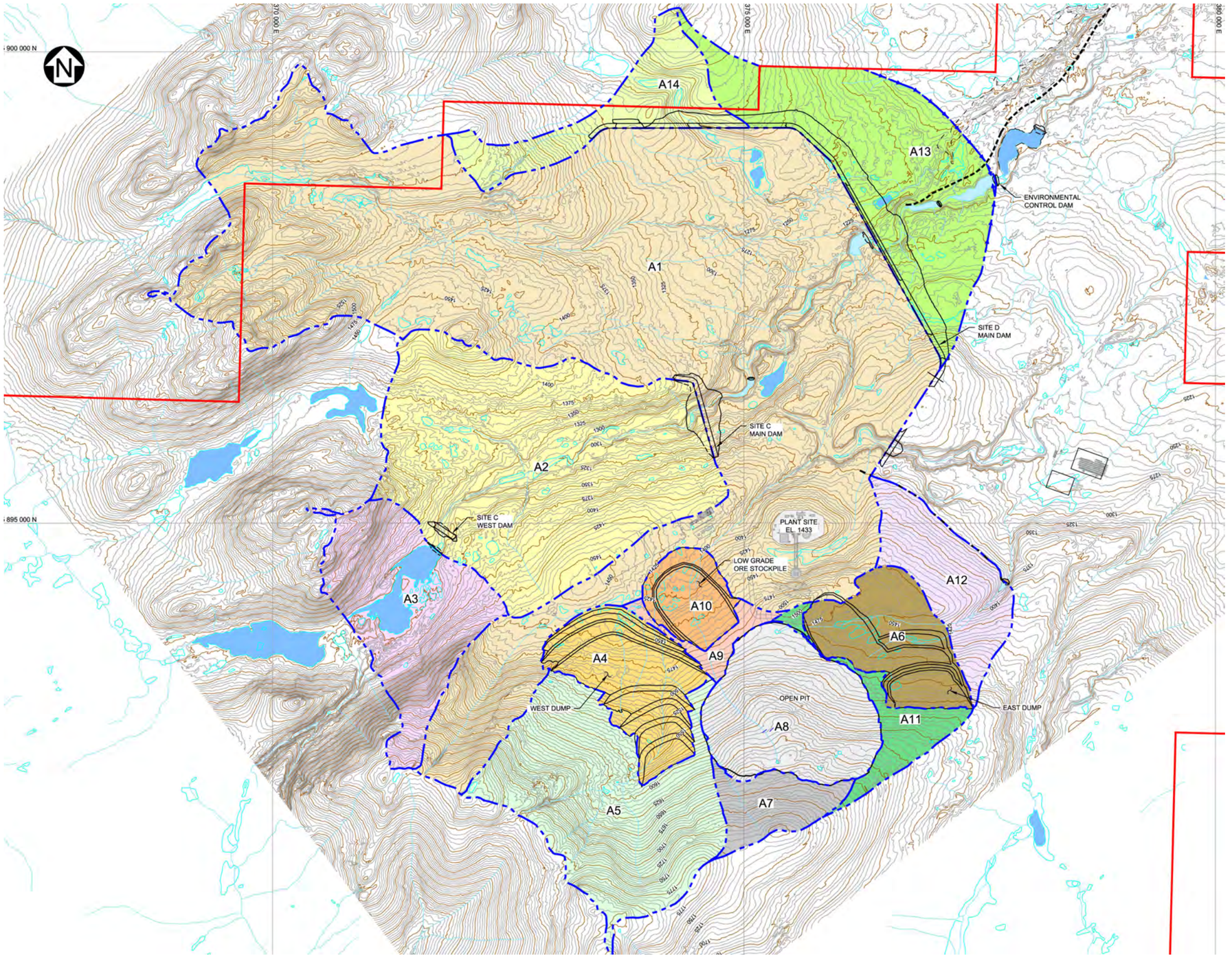
The Project's construction, operations, and closure phase water management strategies have been developed by identifying the size and position of the planned mine site facilities, and establishing estimated catchment area boundaries based on the mine site development concept. All site drainage during operations and closure will drain by gravity to the TSF. Virtually all seepage

from the TSF and waste rock dumps will be collected and directed to the TSF. This simplifies water management, spill control, and closure in addition to providing water for the process. Proposed facilities and resulting catchment boundaries are shown on **Figure 2.2.3-83**.

The TSF Site C Main Dam will be constructed in the upper Davidson Creek catchment and capture runoff from the upstream catchment A2, as shown on **Figure 2.2.3-83**. Catchment A3, upstream of the TSF Site C West Dam, will be redirected to Creek 705 to the southwest, away from TSF Site C, by a cofferdam built in Year -2, which will permanently change the natural catchment divide in this area. Catchment A3 does not contribute to the water balance for the mine site.

As described above, in Year -1 a cofferdam will be constructed on Davidson Creek within the TSF Site D Main Dam footprint to capture runoff from catchments A1 and A14. Water accumulated behind the TSF Site D cofferdam will then be pumped to the TSF Site C start-up pond beginning in the second quarter of Year -1.

The starter dam for the TSF Site D Main Dam will be completed at the start of operations in Year 1, and will begin to capture catchment runoff from the contributing areas of the West Dump (A4), East Dump (A6), and LGO stockpile (A10), as well as the corresponding upstream catchment areas (A5, A9, and A11) and area downstream of the East Dump (A12) (**Figure 2.2.3-83**). The ECD will be constructed in Year 1 to capture seepage and surface runoff (A13) from the TSF Site D Main Dam (**Figure 2.2.3-83**). Unless of acceptable quality for direct discharge, the recoverable seepage (about 96% of TSF seepage by the end of operations) and surface runoff will be collected at the ECD and pumped back to TSF Site D during mine operations and into closure until the open pit is full and TSF Site D spills to Davidson Creek via the closure spillway and discharge channel.



Legend

ID	CATCHMENT AREA (m²)
A1	23,493,258
A2	7,203,864
A3	2,745,670
A4	1,716,662
A5	4,041,717
A6	1,584,807
A7	778,163
A8	2,380,000
A9	308,576
A10	759,710
A11	701,998
A12	1,507,979
A13	4,143,515
A14	1,567,691

LEGEND:

- CATCHMENT AREA A1
- CATCHMENT AREA A2
- CATCHMENT AREA A3
- CATCHMENT AREA A4
- CATCHMENT AREA A5
- CATCHMENT AREA A6
- CATCHMENT AREA A7
- CATCHMENT AREA A8
- CATCHMENT AREA A9
- CATCHMENT AREA A10
- CATCHMENT AREA A11
- CATCHMENT AREA A12
- CATCHMENT AREA A13
- CATCHMENT AREA A14
- CATCHMENT BOUNDARY
- NEW GOLD PROPERTY BOUNDARY

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

Source
Knight Piésold Engineering and Environmental Services
http://www.knightpiesold.com/en/

CLIENT: newgold™

PROJECT: Blackwater Gold Project

Project Catchment Area Boundaries

DATE: May, 2014	ANALYST: KP	**Figure** 2.2.3-83
JOB No: VE52420	QA/QC: WR	PDF FILE: Project Catchment Area Bnds.pdf
AI FILE: Project Catchment Area Bnds.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

\\Bby-fs2\bby-e-gis\GIS Projects\VE\VE52095_Richfield_Blackwater\Mapping\Other\Project\Description\KP\Project Catchment Area Bnds.mxd

The water stored in the TSF Site C start-up pond will serve as the primary process water source at the start of process plant operations until the end of Year 2, with additional water drawn from the TSF Site D pond (via the pump system at the cofferdam), as necessary. Once tailings deposition in TSF Site D commences in Year 3, and until the end of mining operations in Year 17, the TSF Site D pond will be the primary source of process water. Additional makeup water, if required during that time, will be provided by the TSF Site C pond. The pond in TSF Site C, as of Year 3, will accumulate naturally to the closure spillway elevation at or below 1,343 m and then overflow into the pond of TSF Site D in approximately Year 27. Fresh water required for the process plant (e.g., gland and reagent mixing water) and any additional water to ensure PAG waste rock and tailings in the TSF remains inundated will be supplied by the freshwater supply pipeline from Tatelkuz Lake.

Groundwater inflow and surface runoff to the open pit, including water from the vertical depressurization wells, will be collected and discharged to TSF Site D and recycled for use in mineral processing until the cessation of open pit mining by Year 15. The pit dewatering system will be decommissioned in Year 15 and the pit will begin to fill with water while the LGO is processed through the plant from Year 15 to Year 17. Once operations cease in Year 17, the surplus inflow to TSF Site D (inflow minus losses) will be pumped to the open pit to accelerate pit filling and associated flooding of PAG rock exposed in the ultimate pit walls. Water will also continue to be pumped from Tatelkuz Lake to augment pit filling. Once the open pit is full, predicted in Year 35, it will overflow via a spillway to the TSF Site D pond. Subsequently, the TSF Site D pond will overflow via the closure spillway and discharge channel to a plunge pool in Davidson Creek downstream of the ECD (which will be removed post-closure).

Passive treatment wetlands will be constructed on the surface of TSF Site C in Years 4 and 5, and on the surface of TSF Site D in Years 18 and 19. To polish TSF seepage during closure, as a contingency, passive treatment wetlands could be constructed in the SCP, ECD, and water reservoir downstream of TSF Dam D.

2.2.3.5.2.5 Post-Closure Extreme Dry Conditions

Knight Piésold conducted an analysis of extreme dry conditions to determine the risk that PAG rock stored in the TSF would be exposed. The objective was to determine what hydrometeorological and hydrogeological conditions would be required to decrease the pond elevation enough to expose PAG waste rock. The effect of the planned 30 cm overburden cover over the PAG waste rock was not included in the assessment and is therefore conservative. As the PAG will be deposited subaqueously, exposure of the PAG waste rock would require that the outflows from the pond exceed its inflows.

In order to provide a conservative estimate, two scenarios were considered. These scenarios represent the most extreme conditions for the Project area:

1. No precipitation over the entire Site D catchment area.
2. A 1:200 year dry precipitation over the Site D catchment area (0.5% probability of exceedence).

Both scenarios assume a constant seepage flow out of the TSF of 55 L/s.

The result of the first scenario is that it would take approximately eight years for the PAG waste rock to be exposed, which equates to a drawdown of 1.3 metres per year (m/y). This scenario represents a statistical case for which there is no reasonable return period: where absolutely no precipitation occurs within the entire TSF catchment for all eight years required for the drawdown to occur.

The result of the second scenario is that the volume of runoff and direct precipitation (inflows) contributing to the TSF under the 1:200 year dry annual precipitation condition (6.5 Mm^3/y), is greater than the losses due to seepage and evaporation (2.65 Mm^3/y). The surplus inflow would contribute to the TSF pond and discharge through the TSF spillway to Davidson Creek even under these dry conditions. Consequently, the PAG waste rock is not predicted to be exposed in the post-closure scenario. The PAG sulphide tailings will be stored in the TSF at an elevation lower than the TSF spillway and covered with oxide tailings and overburden. It can be inferred that the sulphide tailings would also not be exposed since the spillway remains active even under these dry conditions.

The results show that exposure of the PAG waste rock is extremely unlikely, given the design and hydrometeorological and hydrogeological characteristics of the Project site.

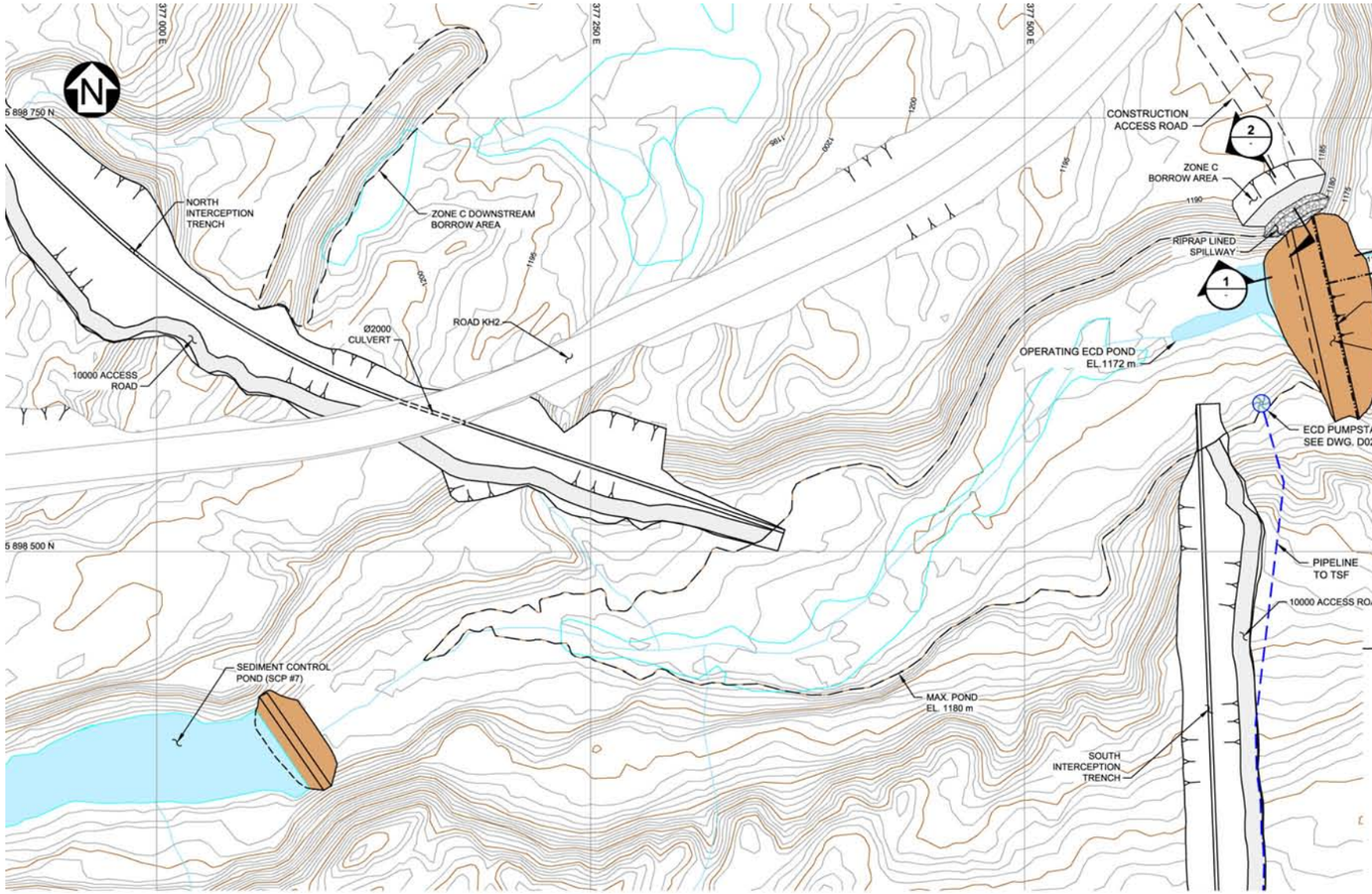
2.2.3.5.2.6 Water Management Systems

This section provides a summary of the site water management systems. Further discussion is provided in **Appendix 2.2A-2**.

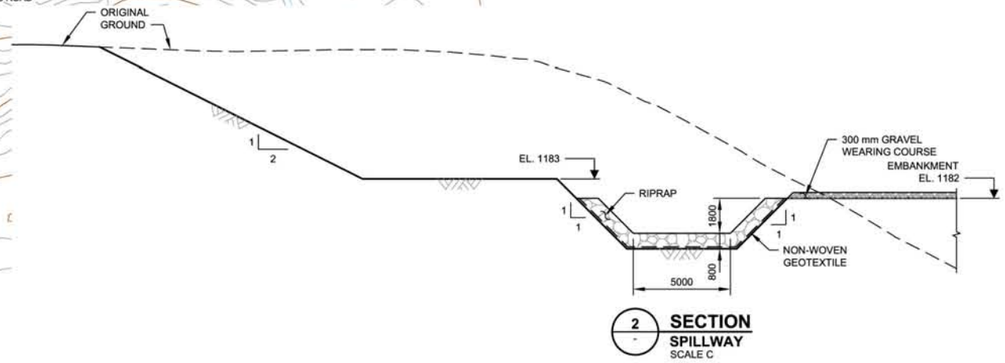
2.2.3.5.2.6.1 Environmental Control Dam

The primary seepage collection point for the TSF will be approximately 1 km downstream at a topographic low point in Davidson Creek. A 12-m high ECD across Davidson Creek will create the collection pond. The dam is designed to contain continuous seepage and runoff from events up to the 1:100 year, 24-hour storm. A spillway is designed to pass any outlflow resulting from a 1:200 year, 24-hour storm. Two interception trenches will feed the pond, as discussed in **Section 2.2.3.4.6**, TSF Seepage Control Measure. The ECD concept, shown on **Figure 2.2.3-84**, will have an embankment drain system, a seepage collection sump and monitoring device, and a secondary pumpback system to collect and recycle seepage.

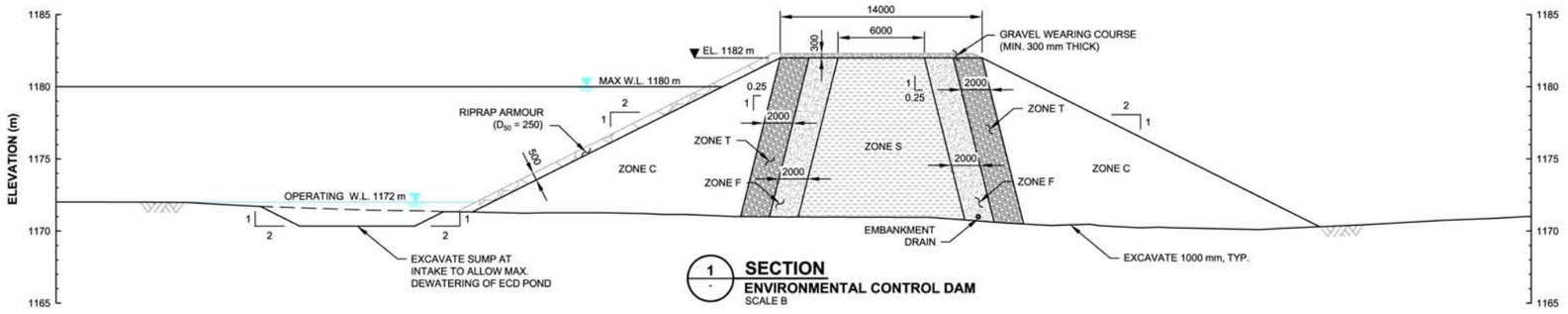
The primary pumpback system at the ECD is designed to maintain the pond at a minimum water level. The intake is a concrete structure equipped with stoplogs and trash racks, and is set at 1,170 masl. The pumpback system consists of four 375 kW vertical turbine pumps (three operating, one installed spare), and needs water at least 2 m deep. The pumping system would normally operate intermittently, using one or more pumps whenever the ECD pond exceeds the minimum operating depth of 2 m but remains at less than maximum capacity.



PLAN
ENVIRONMENTAL CONTROL DAM
SCALE A



2 SECTION
SPILLWAY
SCALE C



1 SECTION
ENVIRONMENTAL CONTROL DAM
SCALE B

SCALE C: 3 1.5 0 5 10 15 m
SCALE B: 4 2 0 4 8 12 16 20 m
SCALE A: 50 25 0 50 100 150 200 250 m

LEGEND:

- MINE WATER
- EMBANKMENT FILL
- EMBANKMENT FILL
- PUMPSTATION
- ECD PIPELINE

NOTES:

1. CONTOUR INTERVAL IS 1 METRES.
2. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS IN METRES, UNLESS OTHERWISE NOTED.
3. UPSTREAM ZONE C MUST BE FREE DRAINING SAND AND GRAVEL.
4. DOWNSTREAM ZONE T WILL INCLUDE DRAIN PIPE AND OUTLET EXTENDING BEYOND THE DAM TOE TO A COLLECTION SUMP AND PUMPBACK SYSTEM.
5. SPILLWAY CREST ELEVATION SET AT 1:100 YEAR 24 hr STORM EVENT MAXIMUM WATER LEVEL.
6. MAXIMUM WATER LEVEL SHOWN IN THIS DRAWING (1180m) REPRESENTS 1:100 YEAR 24 hr STORM EVENT.
7. INTERCEPTION TRENCHES EXCAVATED TO LOW PERMEABILITY SUBGRADE.

0 0.5 1 2
Kilometers

Reference:
DataBC Data Distribution Service Open Government License (http://www.data.gov.bc.ca/)

Knight Piésold Engineering and Environmental Services http://www.knightpiesold.com/en/

CLIENT: newgold™

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ANALYST:	WR
QA/QC:	N/A
COORDINATE SYSTEM:	
SCALE:	
PAGE SIZE:	11in X 17in
PROJECT:	Blackwater Gold Project
TITLE:	Environmental Control Dam
PROJECT NO:	VE52420
REVISION NO:	
DATE:	May, 2014
SHEET NO:	N/A
DRAWING NO:	**Figure** 2.2.3-84

2.2.3.5.2.6.2 Water Reclaim System

Water reclaimed from the tailings ponds at TSF Sites C and D will be delivered to the reclaim water tank at the process plant. Within the reporting catchment areas, water collected will be made up of supernatant from the settled tailings, and runoff from precipitation and snowmelt.

The reclaim water system will initially use a barge-mounted pump station equipped with four 750 kW vertical turbine pumps delivering 3,200 m^3/h of water. The reclaim barge will be anchored in TSF Site C during Years 1 and 2 of operations, and then moved to TSF Site D late in Year 2 for the remainder of mine operations and closure. A reclaim structure will be built at 1,337 masl in TSF Site C during Year 2. Its design will be similar to the ECD pump station design, with a concrete intake structure with stoplogs and trash racks. This facility will require 3 m of submergence to operate.

2.2.3.5.2.6.3 Pit Dewatering System

This section summarizes pit water management. A detailed discussion can be found in **Appendix 2.2A-10**.

Water inflows to the open pit will include both groundwater and surface water runoff. The contributions from groundwater will progressively increase as the pit extends below the groundwater table. The contributions from surface water will be direct precipitation into the pit and runoff from the limited contributing catchments around the pit excavation. The inflows from direct precipitation will increase with increasing pit area in conjunction with groundwater inflows as the pit increases in depth.

2.2.3.5.2.6.3.1 Pit Dewatering and Slope Depressurization

Groundwater dewatering within the pit walls is expected to occur as the pit excavation progresses. Slope depressurization will be required for all geology units in order to achieve the designed slope angle. The slope depressurization measures include in-pit and perimeter vertical pumping wells, as well as diversion ditches along the pit crest of the slopes. Pit dewatering and slope depressurization designs are discussed in the Open Pit Water Management Report (**Appendix 2.2A-10**).

The open pit area increases over time to a maximum size of approximately 240 ha. At this maximum extent, the undisturbed catchment area providing potential surface water inflows to the open pit is only approximately 80 ha.

The 1:100-year return period storm has been used to design the pit surface water dewatering system and was estimated to be approximately 142,000 m^3. The estimated runoff coefficient inside the open pit surface area was conservatively assumed to be 100%.

The groundwater model of the open pit takes into account baseline hydrometeorology monitoring, extensive geotechnical and hydrogeological site investigations, field observations, and in-situ

hydraulic testing. The model was used to evaluate groundwater flow into the open pit. The configuration of the groundwater model is summarized as follows:

- In general, the pit's low-permeability overburden will not contribute substantial groundwater flow into the pit;
- High- and low-permeability bedrock are present. The high-permeability rock is generally limited to the deposit area, has a hydraulic conductivity of $5x10^{-6}$ m/s, and is surrounded by a lower-permeability zone with a hydraulic conductivity of $1x10^{-7}$ m/s;
- The groundwater table is relatively close to ground surface and flows to the northwest. Groundwater levels within the highly permeable zone are relatively flat and currently are 1,540 masl; and
- Recharge to groundwater is estimated at up to 120 millimetres per year (mm/y).

The pit dewatering design is based on lowering the groundwater table within the highly permeable zone to approximately 15 m below the pit base elevation, considering both removal of groundwater from storage and from recharge.

A combination of in-pit and perimeter pumping wells will depressurize slopes and dewater the pit. All pumping wells will be dug to a nominal depth of approximately 350 m below ground level. In-pit wells will remove water from storage in the highly permeable ore zone, and draw down water in the surrounding rock mass as the groundwater flows toward the highly permeable zone. Perimeter dewatering wells along the south high wall will lower and extend the cone of depression beyond the pit walls, where drainage to the permeable zone is not adequate to depressurize slopes. Approximately 10 dewatering wells spaced at 200 m to 250 m intervals will achieve an adequate cone of depression.

A summary of the dewatering system stages and sequence of development is shown on **Figure 2.2.3-85**, including the perimeter dewatering wells and pipeline (green), in-pit dewatering well and pipeline (red), and in-pit surface dewatering system (blue).

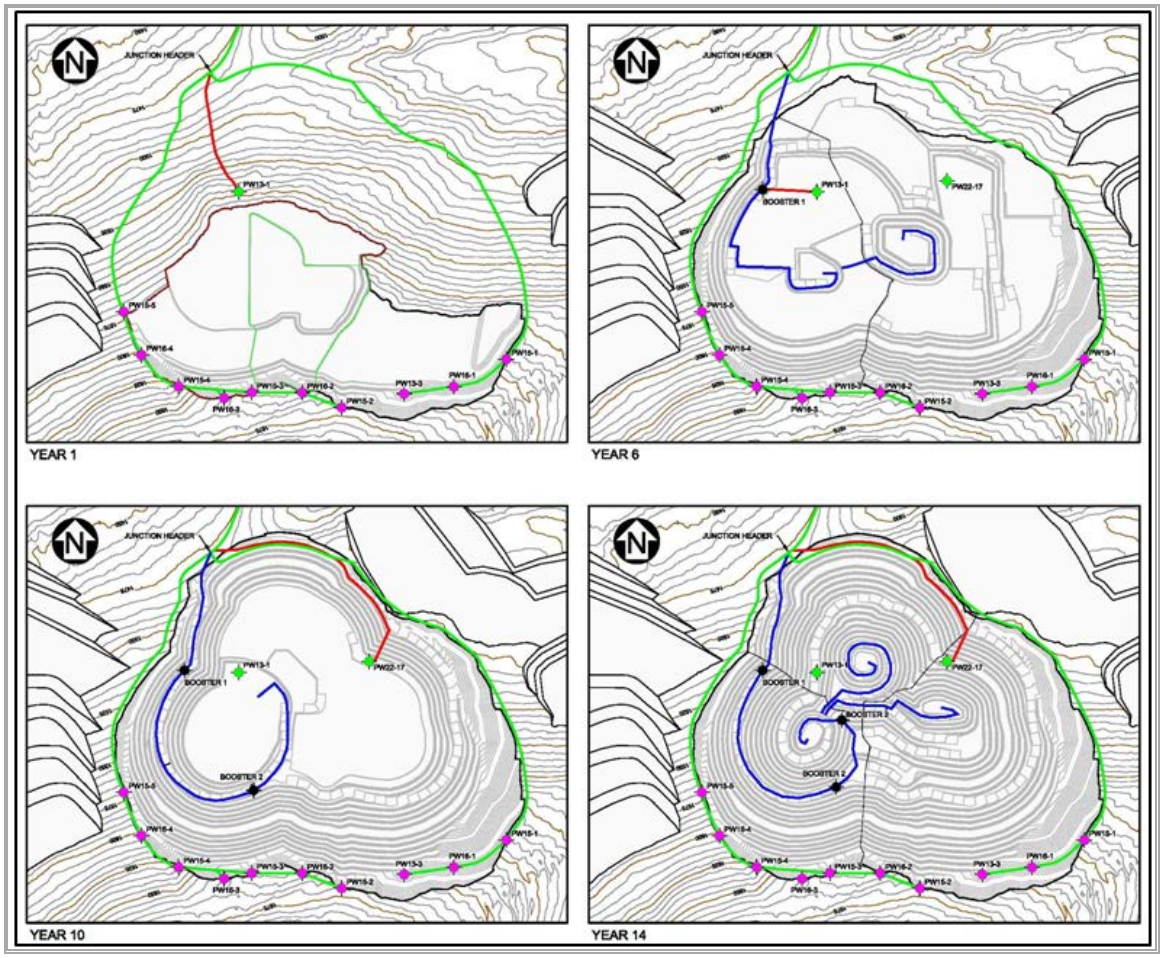


Figure 2.2.3-85: Pit Dewatering System

The sequence of the pit dewatering well development is provided below.

2.2.3.5.2.6.3.2 Year -2

- Redevelop existing pumping wells PW13-1 and PW13-3 for inclusion in the dewatering system;
- Install five perimeter pumping wells in Year -2 (PW15-1 to PW15-5) along the south wall;
- Install 11 observation wells to measure groundwater water levels around the open pit perimeter (OW1 to OW10 and OW19); and
- Commission dewatering wells PW15-1 to PW15-5 and PW13-3 in the last quarter of Year -2.

2.2.3.5.2.6.3.3 Year -1

- Install four perimeter pumping wells in Year -1 (PW16-1 to PW16-4) along the south wall; and
- Commission in-pit well PW13-1: Year -1.

2.2.3.5.2.6.3.4 Years 1 to 3

- Install backup pumping wells for all pre-existing perimeter pumping wells; and
- Install remaining observation wells (OW11 to OW18) around the northern sections of the ultimate open pit.

2.2.3.5.2.6.3.5 Year 6

- Install secondary in-pit well PW22-17 and decommission PW13-1.

2.2.3.5.2.6.4 Low-Grade Ore Stockpile

The LGO stockpile will be developed over a prepared low-permeability foundation with surface water and seepage collection, and monitoring systems. Drainage from the LGO stockpile is expected to be acidic and contain elevated metals; therefore, the drainage will be collected, neutralized by lime treatment, and discharged to the TSF. The water management plan is shown on **Figure 2.2.3-86**.

Runoff from the upslope undisturbed catchment will be diverted around the stockpile to the TSF by a 3-m wide diversion channel excavated adjacent to a 6-m wide access road. Foundation drains will be installed where there are existing drainage lines, and in any areas of seepage encountered during topsoil stripping. A 500 mm layer of compacted Zone S material from overburden stripping in the pit will be placed on the LGO stockpile foundation. The subgrade treatment will extend approximately 10 m beyond the stockpile edge to allow for collection of runoff from the stockpile. A collection drain will be placed above the low-permeability subgrade in the low point of the pad to facilitate collection of seepage. The collection drain and foundation drains will report to their respective seepage sumps near the edge of the stockpile. Seepage quality of both systems can be monitored at this location before discharge to an equalization pond. A perimeter diversion ditch 1 m wide will encircle the planned final extent of the stockpile to divert non-contact water around the stockpile. The LGO stockpile foundation will be prepared in three stages. The first stage, during Years –2 and –1, will cover approximately 50% of the stockpile's planned area. The second and third stages, in Years 2 to 4, will add the remainder.

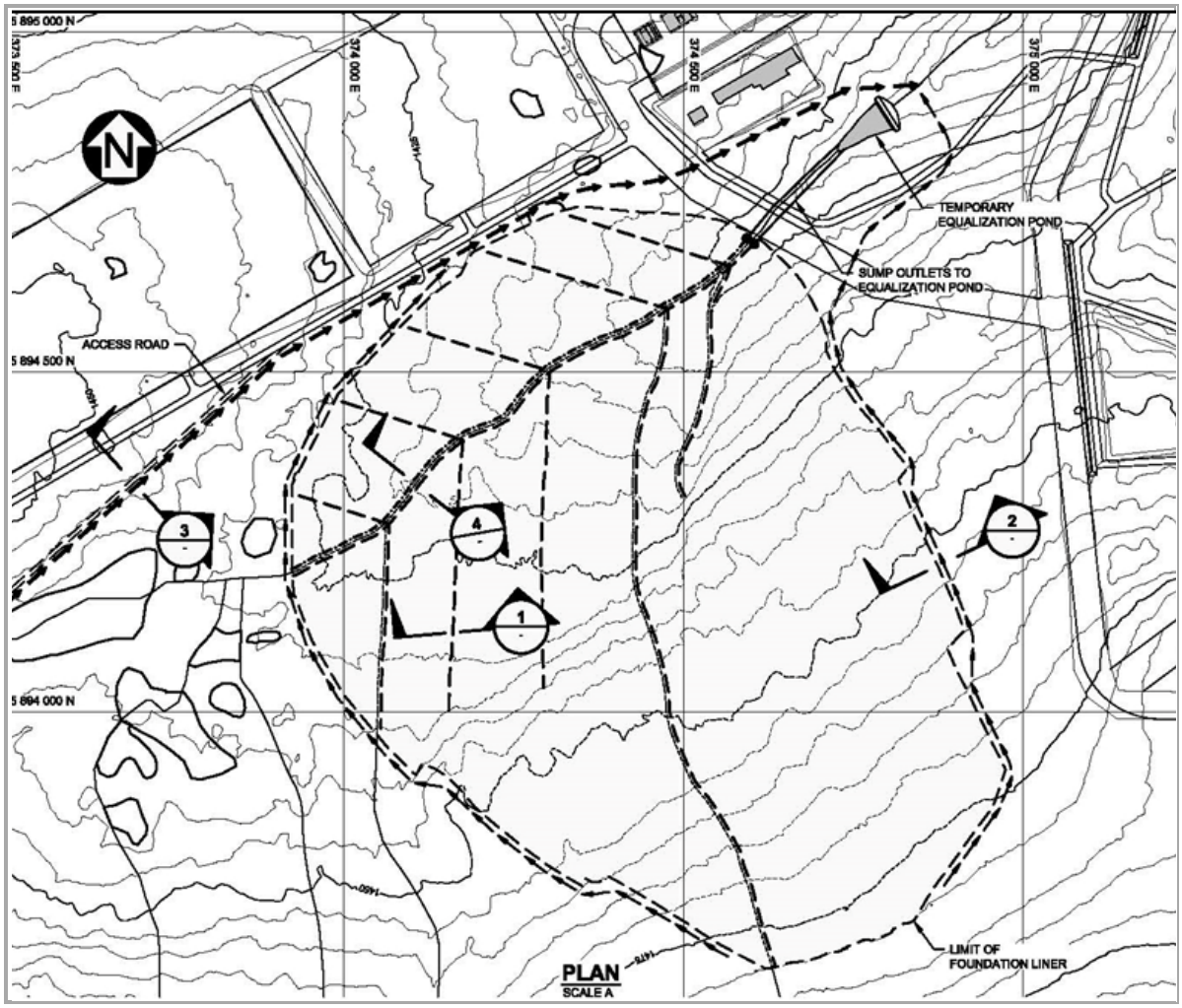


Figure 2.2.3-86: Low-Grade Ore Stockpile Water Management

2.2.3.5.2.6.5 NAG Disposal Areas

Waste dump areas have been identified and subsequently refined and optimized to minimize surface and seepage water control requirements. NAG4 waste rock and overburden will be placed in the West Dump and NAG5 waste rock and overburden will be placed in the East Dump. The dump foundations will be cleared in preparation for fill placement. A 30 m strip along the advancing dump toe will be stripped and the topsoil will be spoiled in a windrow at the toe. Selective stripping of topsoil in other areas within the dump foundations will be completed to remove thick areas of topsoil that would be valuable for reclamation or in apparent drainages where increased pore pressures or weak foundation materials could affect dump stability. The toe of the dump will be keyed into competent sub-grade with oversized material to enhance dump stability. A total of 63 Mm^3 of material will be stored in these waste rock dumps outside of the TSF. Water that infiltrates through the East dump will be collected at the base of the dump in a collection pond and directed by gravity to the TSF. The dumps will be developed with overall slopes to facilitate reclamation

with growth media at closure. Surface water runoff during operations and at closure will be diverted around the dump to the TSF. Temporary surface water ditches will be field fit with the advancing fill platforms within the footprint of the dumps to manage surface water runoff and seepage.

2.2.3.5.2.6.6 Freshwater Supply System

A freshwater supply system has been designed to convey water via pipeline to the mine site from Tatelkuz Lake, approximately 20 km to the northeast. The freshwater supply system includes the following major components:

- Tatelkuz Lake intake and pumps;
- Freshwater supply pipeline;
- Booster pump stations; and
- Freshwater reservoir.

The freshwater supply system is designed to provide:

- Continuous freshwater supply from Tatelkuz Lake for the process plant, and to mitigate flow reductions in lower Davidson Creek, and
- Occasional water supply from Tatelkuz Lake to supplement requirements for mineral processing, or to saturate PAG waste rock within the TSF, if required.

The design and operating criteria of the system and specifications of major components are described in **Section 2.2.4.3**, Freshwater Supply System, under Off-site Infrastructure.

2.2.3.5.3 Water Balance

This section provides a water balance summary. Further discussion is provided in the Knight Piésold water balance model letter report (**Appendix 2.2A-6**).

2.2.3.5.3.1 Introduction

A monthly operational and closure water balance was developed for the Project using the GoldSim™ software package. The model estimates the magnitude and extent of any water surplus and/or deficits in the TSF based on a range of possible climatic conditions. The model period included one year of preproduction (Year –1), 16.2 years of operations (Year 1 to 17.2) at a nominal milling rate of 60,000 t/d dry, and 18 years of closure before the TSF discharges to Davidson Creek. The Project layout and catchment areas used in the model are shown on **Figure 2.2.3-83**. The model incorporates the following proposed major Project components:

- Open pit;
- Process plant;
- LGO stockpile;
- TSF Site D;

- TSF Site C; and
- East and West NAG waste rock and overburden dumps.

2.2.3.5.3.2 Results

The water balance model assumed that a start-up pond of at least 6 Mm^3 (under average conditions) will accumulate in TSF Site C in the year before process plant start-up. Of this amount, based on runoff from its contributing upslope catchment (7.1 km^2), 1.0 Mm^3 will accumulate behind the TSF Site C Main Dam. The other 5.0 Mm^3 will come from undisturbed contributing catchments (25 km^2) at TSF Site D. This latter runoff will be collected behind a cofferdam at the TSF Site D Main Dam location and will be pumped to the TSF Site C pond until the start of operations. The minimum operating pond volumes for TSF Sites C and D were assumed 3.0 Mm^3 and 7.5 Mm^3, respectively. **Figure 2.2.3-87** presents the predicted pond volumes available from construction to closure for both facilities, based on average precipitation conditions.

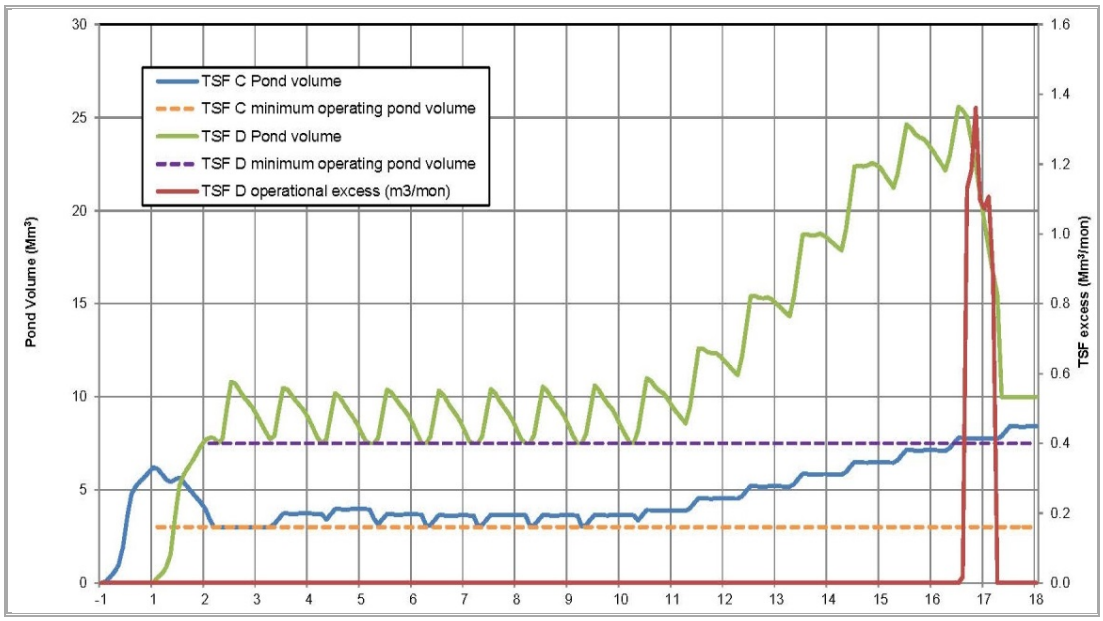


Figure 2.2.3-87: Predicted Pond Volumes for TSF C and D Ponds – Average Conditions

The facilities are in a balance or surplus condition throughout operations, given that the water accumulated within the supernatant ponds in TSF Sites C and D, including from open pit dewatering, will satisfy the process requirements under average precipitation conditions. Fresh water required for the process plant (1.05 Mm^3/y) will be pumped from Tatelkuz Lake. From Year 5 to Year 10, when tailings are being deposited in TSF Site D, reclaim water will be withdrawn from both the supernatant ponds of both TSF Site D and Site C to meet the process water requirements. The additional process water requirement from TSF Site C will be largely needed during winter when precipitation falls as snow.

TSF Site C continues to overflow naturally into TSF Site D via a closure spillway in Year 27. Based on average precipitation conditions, from the end of mining—Year 17—the open pit takes until approximately Year 35 to fill. TSF Site D is predicted to begin discharging via the closure spillway in that same year. Therefore, it will take a total of 18 years after the end of operations before the system discharges to Davidson Creek.

A stochastic analysis was completed to analyze the range of possible cumulative pond volumes available in TSF Site C and TSF Site D over the mine life, as defined by the 95th percentile wet and dry values (5% and 95% chance of being equalled or exceeded in any month, respectively). This range of volumes also indicates possible active or live storage capacity in the TSF ponds for a reasonably large range of anticipated climatic conditions. The stochastic water balance highlights the sensitivity of the TSF pond volumes to the assumed climatic inputs and pond minimum/maximum operating capacities. The stochastic results indicate that for extreme conditions (5th percentile), the accumulated TSF ponds, open pit, and associated contributing catchments are not able to supply enough water to meet the process water requirements until Year 11, and the system will operate in a deficit condition until that time (**Table 2.2.3-31**).

The stochastic analysis indicates that under extreme dry conditions the supplemental makeup water requirement to support operation of the mine is less than 3 Mm^3/y. The freshwater supply system has enough design capacity to augment this deficit.

The TSF operational pond capacity is sufficient to manage a reasonable range of surplus water conditions. Water levels will be monitored to ensure that the water balance assumptions are accurate and that an operational surface water discharge from the TSF does not occur until closure. As a contingency, non-contact surface water diversions can be created to divert runoff around the TSF, and the TSF dams can be raised more frequently, if required.

Table 2.2.3-31: Annual Stochastic Volume of Makeup Water Requirement

Mine Life	Annual Volume of Makeup Water Required to Supplement TSF Reclaim (m^3/y)			Annual Volume of Makeup water Required from Freshwater Source (m^3/y)
	5th Percentile	50th Percentile (Median)	95th Percentile	
-1	-	-	-	-
1	-	-	-	1,051,200
2	2,000,400	-	-	1,051,200
3	2,389,900	-	-	1,051,200
4	2865,800	-	-	1,054,080
5	2,655,700	-	-	1,051,200
6	2,918,600	-	-	1,051,200
7	2,903,800	-	-	1,051,200
8	2,741,400	-	-	1,054,080
9	2,708,800	-	-	1,051,200
10	1,801,800	-	-	1,051,200
11	979,120	-	-	1,051,200
12	-	-	-	1,054,080
13	-	-	-	1,051,200
14	-	-	-	1,051,200
15	-	-	-	1,051,200
16	-	-	-	1,054,080
17	-	-	-	259,200

2.2.3.6 Air and Noise Emissions and Vibration

2.2.3.6.1 Air Emissions

An emissions inventory for the Project was established based on design data, construction plans, and operational scenarios. The activities considered for the emissions inventory include ore and waste rock transportation within the mine site, transport of materials and products outside the mine site by road, transportation of staff to and from the site (by air or road), materials handling, and incinerator point source emissions. Wherever possible, engineering data and manufacturers' specifications were used to estimate emission rates. Where necessary, this information was supplemented by emission factors from United States Environmental Protection Agency (US EPA) AP-42 (US EPA, 1996).

2.2.3.6.1.1 Construction

Most particulate matter (PM) emissions occur from vehicle travel on unpaved roads (e.g., mine haul roads), and from materials handling (e.g., bulldozers, graders, truck dumping). This will be

mitigated using a combination of administrative, design, and emission control strategies. During construction, only fugitive emissions and exhaust from mobile equipment will result.

Mitigation measures for SO_2, nitrogen dioxide, and cobalt relate to engine emission controls, as those substances are entirely generated as combustion byproducts. Off-road vehicles (such as the mine fleet) will meet the most recent and stringent emission standards, commonly referred to as Tier 4. All off-road vehicles will use ultra-low sulphur diesel (15 ppm maximum). Additional discussion is provided in **Section 5.2.4.4**, Air Quality Effects Assessment.

2.2.3.6.1.2 Operations

Emission controls applied during construction will also be applied (where applicable) during operations. Water, or approved wetting agents, will be used to control dust on roads. Additionally, controlling speed on unpaved roads will reduce fugitive dust from vehicle tires.

2.2.3.6.1.2.1 Process Plant Dust and Fume Control

Air emissions from the process plant site will consist of fugitive dust from crushers, the reclaim area, and the lime silo and slaker system. Minor emission of hydrogen cyanide (HCN) and ammonia (NH_3) will be produced at the agitation leach area, CIP area, CN destruction area, and grinding thickener. Minor amounts of fugitive SO_2 will be generated from burning molten sulphur for the SO_2/air CN destruct plant. Dust control systems will be employed to limit dust generation as described below; HCN and NH_3 gases will be limited to a typical 1 ppm or less level of HCN and 10 ppm for NH_3. SO_2 levels will be limited to a typical <2 ppm level. CN, NH_3, hydrogen sulphide (H_2S), and SO_2 levels will be monitored both inside and outside areas where they may be generated. These concentration values are emission point estimates.

Dust control systems will include hoods, ductwork, dust collectors, and enclosures designed to prevent fugitive dust or fume emissions at their source. Dust collectors will be designed and selected to reduce particulate emissions from discharged air to meet the applicable air-pollution control regulations. All contaminated fume discharges will be treated as required to mitigate and reduce the concentration levels of the chemicals present to below the criteria specified in applicable air pollution control regulations.

2.2.3.6.1.2.2 Incinerator

The incinerator currently at the Project site supports up to 250 people and is planned to be expanded to service a 400-person camp. For the purposes of the air quality modelling assessment found in **Appendix 5.2.4A**, it was assumed that 2 incinerators would operate continuously. This would provide waste incineration capacity for a 1,500 person camp. While this size of camp is not proposed, it is used as a conservative assumption for air quality assessment purposes.

The incinerator is a Westland Model CY-2050-FA-D and has the following features: a double chamber, refractory lined, auxiliary fuel-fired incinerator equipped with a combustion control system. Incinerator ash, which may represent up to 5% to 10% of the original weight prior to incineration, is landfilled at the site, as authorized by the issued permit. Ash volume from this type

of incinerator is variable, with the 10% estimate being on the higher limit. Combustion controls include auxiliary fuel, under- and over-fire forced air jets, and a cycle timer interconnected to the air supply and auxiliary fuel burner control to provide a high temperature environment to efficiently oxidize combustion products. The stack is equipped with a stainless steel spark arrester (screen). The incinerator will be operated to minimize smoke emissions and is required to meet a 20% opacity level (for periods longer than 3 minutes in a 30 minute period), except during startup when levels may increase to 40%. The incinerator is currently located in a cleared area within the footprint of the Project site and is planned to be moved approximately 100 m downwind of the exploration camp.

The primary refuse generated and disposed of at the site during construction, operations, and closure phases will be putrescible food wastes from the camp kitchen facility. No such waste is expected post-closure because personnel will be on site only intermittently. Secondary waste streams that may be incinerated include inert non-putrescible items such as cardboard boxes, packaging materials, and wooden shipping materials. All putrescible wastes will be incinerated, and plastics will be excluded.

The incinerator is currently operating within factory specifications and will continue to be operated in this manner at the expanded camp. A permit application for the new incinerator location and operation is under review.

2.2.3.6.1.2.3 Generator Emissions

Diesel generators will be used during the construction phase until the transmission line is constructed to the camp; after that time, grid power will be used and generators will provide power only when the grid is temporarily interrupted. The transmission line is scheduled to be energized Q2 of Year -1. Generators will be maintained to factory specifications and emissions will meet factory specifications. Low sulphur diesel will be used when available. Emissions (based on EPA AP42 [1996] tables) assuming a 3 megawatt (MW) genset running at full power are provided in **Table 2.2.3-32**. Standby generators will be used only during emergencies. Low-sulphur diesel will be used when available and emissions will meet factory specifications.

Table 2.2.3-32: Estimated Gas Emission Rate for 3 MW Camp Generator

Gas	Emission (kg/h)
PM-2.5	4.0
NOx	56.5
SOx	3.7
CO	12.2
CO_2	2,098

Note: kg/h = kilograms per hour

2.2.3.6.1.3 Closure

During the first few years of closure, emission sources will be similar to those of the construction phase, except that the incinerator will be used much less as the number of people on the site declines.

2.2.3.6.1.4 Post-Closure

The post-closure phase will involve limited site work and all emissions are expected to remain at or near background.

2.2.3.6.2 Noise Emissions

The Project will generate noise while conducting the following activities:

- Construction;
- Pre-stripping;
- Open pit mining;
- Ore hauling from the pit to the process plant;
- Tailings and waste rock disposal; and
- Ore processing and gold recovery at the process plant.

Noise emissions were evaluated for the Project site as a whole and modelled by adding estimates of the proposed sources to background noise measured as part of baseline studies. The SPM9613 model developed by Power Acoustics Inc. was used; **Section 5.2.2** provides a discussion.

Mitigation measures designed to limit negative effects of noise include:

- Locating the construction camp away from major noise sources;
- Insulating camp sleeping unit walls;
- Limiting blasting to daylight hours and ensuring blast design conforms to best practices to limit noise and vibration;
- Enclosing noise sources such as the process plant, where practical;
- Maintaining mobile and stationary equipment to manufacturers' specifications, including noise abatement devices; and
- Ensuring employees have and use adequate personal protective equipment (PPE).

2.2.3.6.2.1 Construction

Construction noise will arise from site preparation and building construction. It will be periodic and short term (lasting over about a 2-year period).

2.2.3.6.2.2 Operations

Most operations-related noise will derive from mining, as discussed in **Section 5.2.2**. All noise sources for the Project operations were modelled and noise contours developed. The modelling results reveal that the major noise sources within the Project site will be inside the pit, where equipment (e.g., shovels, loaders, trucks, drills, etc.) will be simultaneously removing overburden and waste ore, and extracting the high-grade ore. Due to the close proximity of the major equipment, the combined noise level will be higher than the individual equipment noise levels. Because of the mitigation effect of the pit walls, noise levels on the surface near the pit will be much lower, descending outward.

2.2.3.6.2.3 Closure

Closure noise sources and management will be similar to construction. However, noise effects will be lower because high-level noise sources such as drills and blasting will be absent. Most noise in the process plant site will occur during demolition of buildings, which is expected to be completed over approximately two years.

2.2.3.6.2.4 Post-Closure

After closure is completed, noise at the Project site will fall to ambient, as there will only be occasional equipment operation.

2.2.3.6.3 Vibration

Vibration sources include those that produce proximate effects such as rock drills, pile drivers, and blasting, which can result in propagation of vibration beyond the immediate source. Operating equipment causing vibration-related occupational stress will use engineering controls, such as shock absorbers, isolation mounts, and PPE to limit negative effects on operators. Blasting will be the only probable source of the latter at the Project site. Blasting vibration could adversely affect mine employees and wildlife; the nearest fish-bearing waterbody is too far from the open pit to be affected (over 3 km). The practices employed to limit blasting noise will also minimize vibration from blasting.

2.2.3.7 Support Facilities

This section provides a description of on-site support facilities.

2.2.3.7.1 Site Electrical Systems and Distribution

2.2.3.7.1.1 Power Supply Requirements

Power for the Project will be delivered at 230 kV by a 140 km long transmission line originating at BC Hydro's Glenannan substation near Endako, BC. BC Hydro has completed a System Impact Study and determined that the proposed connection to its power grid is technically feasible, that the system has sufficient capacity, and that it can meet the proposed in-service date of Year 1. BC Hydro is currently undertaking a Project Facilities Study, the next step to providing power at site on schedule.

The incoming transmission line, described in **Section 2.2.4.4**, will terminate at the site main substation adjacent to the main process facilities. The substation will have incoming circuit breakers, motorized isolating disconnect switches, power transformers, switchgear, and protective equipment for transforming power from 230 kV to the site distribution/use level of 25 kV.

Emergency power will be available from a standby power station sized to provide power to the process and ancillary electrical equipment in the event of a utility power failure. The temporary construction power-generation equipment will be used as the source of backup power for the permanent camp.

2.2.3.7.1.2 Open Pit Mine Power Supply

The primary power supply to the open pit will be a single 25 kV feed pole line running from the power distribution centre at the main substation. Portable substations will transform the power to 7.2 kV for the mine shovels and drills. The system will initially consist of two portable substations for two electric shovels and two electric drills, and has been sized to allow for installation of a third portable substation in the future. Additional portable substations, also powered from the mine 25 kV pole line, will be used for mine dewatering operations.

2.2.3.7.1.3 Emergency Standby Power

Emergency power for the process plant site will be provided from a standby power plant rated for the maximum power required in the event of a utility power failure. The plant will consist of a minimum of two modular gensets rated at a nominal 3.0 MW.

2.2.3.7.2 Ancillary Buildings

2.2.3.7.2.1 Administration Building/Change Facilities

The administration building and change facilities will be a modular complex adjacent to the emergency services building and south of the truck shop area.

2.2.3.7.2.2 Truck Shop and Warehousing Facilities

The main truck shop and warehouse complex will be an insulated, pre-engineered, sprinklered building approximately 1,000 m west of the main mill building. Associated facilities will include a truck wash, tire shop, and cold storage building, in separate structures. The truck shop's primary function will be to maintain mine vehicles. Six bays will be provided for heavy mine-vehicle repair and preventative maintenance. Four of the bays will be serviced by two 50/10 t overhead bridge cranes. Another four smaller bays, equipped with one 20/5 t capacity overhead bridge crane, will be provided for repairing light/medium-duty vehicles. A truck wash facility will be to the west of the truck shop. Provision will be made to contain wash water, pass through an oil water separator if necessary, and route to the TSF. A separate tire shop will be provided by a tire maintenance contractor.

A fire-rated wall will separate the warehouse area at the east end of the building. The warehouse will be used for storing equipment, parts, and consumables, and will have internal forklift access to the truck shop. An annex to the warehouse, also separated by a fire-rated wall, will be used to

store lube and waste oils. To the north of the annex, a truck bay with a sloped concrete slab and local sump will be provided to load and unload the fluids housed in the lube-oil storage area.

A cold-storage building will be an uninsulated, fabric structure east of the main truck shop. The building will be used to store material and equipment that are not temperature-sensitive but need to be protected from the weather. This structure will be erected early in the Project development for use during the construction phase.

2.2.3.7.2.3 Process Plant Maintenance Shop

The primary function of the process plant maintenance shop is to maintain the equipment associated with the main mill building and any process equipment in the immediate vicinity; it will be due south of the main mill building and constructed in Year 2. Facilities will include one main repair bay for equipment repair and preventative maintenance, equipped with a 5-ton overhead, under-slung crane, as well as an electrical shop, a small warehouse space, tool crib, toolbox storage, compressor, and electrical rooms.

2.2.3.7.3 Camp Facilities

2.2.3.7.3.1 Construction Camp

There will be two construction camps. The existing 250 person exploration camp will be expanded to accommodate 400 people (**Photo 2.2.3 1**). A second one storey camp will be established to house 1,000 construction workers. It will be located about 3 km east of the plant site, adjacent to the main access road (**Figure 2.2.2-2**).

The 1,000 person construction camp will include rented/leased one-storey modular units with dormitory wings, kitchen/dining complex, administration block, commissary, and recreation area. Modular units will be added in phases, as required during the construction phase.

During construction, hourly workers will work a 3-week-in and 1-week-out rotation, and senior management staff will work a 4-day-in and 3-day-out rotation.



Photo 2.2.3-1: Existing Exploration Camp

2.2.3.7.3.2 Operations Camp

The 1,000 person construction camp will be used house operations staff until the 500 person operations camp is constructed in Year 2. The operations camp will be located southwest of the 1,000 person construction camp (**Figure 2.2.2-2**). The operations camp will utilize existing auxiliary services (e.g., power and water supply and waste disposal including waste water/sewage). The operations camp will include modular units with five dormitory wings; four will be three storeys high and one will be two storeys high. There will be a kitchen/dining complex, recreation rooms, movie rooms, and exercise and weight rooms. There will also be a camp check-in/administration, commissary, and personal effects storage locker area. During operations, hourly workers will work a 2-week-in and 2-week-out rotation, and senior management staff will work a 4-day-in and 3-day-out rotation.

2.2.3.7.4 Security Gatehouse

The gatehouse will be on the main access road at the entrance to the Project site. Space will be provided for two offices, training room, coffee station, PPE storage room, and unisex washroom.

2.2.3.7.5 Emergency Services Building

An emergency services building will be constructed close to the administration building. The building will house one bay for an ambulance, one bay for a fire truck, and another bay for the first-

aid clinic. Other space will be available for storage of mine rescue and firefighting equipment, paramedic rooms, unisex washroom, and waiting area.

2.2.3.7.6 Site Services and Utilities

This section provides a description of site services and utilities.

2.2.3.7.6.1 Fire and Potable Water Supply and Distribution

Two wells approximately 1 km east of the camp area will be the source of water for the construction and operations camps. A test well in the area indicated that a single well would have the potential for a flow rate of more than 16 m^3/h, which meets the estimated average demand for the camps at their peak occupancy during construction. With both wells operating, the system will be able to refill the fire water tank within 8 hours, in accordance with fire water requirements. Water from the wells will be pumped initially to a 560 m^3 fire/freshwater storage tank at the operations camp site. Well pumps will be sized to meet the average daily potable water demand for the workforce.

2.2.3.7.6.1.1 Fire Water

The fire/freshwater storage tank for the construction and operations camps will have a reserve supply of 170 m^3 of fire-protection water. This will be capable of providing 114 m^3/h (500 US gallons per minute [gpm]) for 1.5 hours, in accordance with National Fire Protection Association (NFPA) requirements for ordinary-hazard occupancies. A fire pump module consisting of one diesel pump and one jockey pump will be installed in a prefabricated modular building complete with all internal piping and controls. Fire water ring mains will encircle the two camps, with fire hydrants strategically placed around the Project site. Branch lines running to camp buildings will feed the internal camp fire-protection systems.

Tatelkuz Lake will feed the fire/freshwater tank for the process plant area. The tank will have a 510 m^3 fire-water reserve, sufficient to provide 340 m^3/h (1,500 US gpm) for 1.5 hours. A fire pump module consisting of one electric pump, one backup diesel pump, and one jockey pump will be used for fire protection at the mine site. These pumps will be installed in a prefabricated modular building, complete with all internal piping and controls. Fire water ring mains will encircle the process plant site, with branch lines out to the truck shop and administration area, and to the primary crusher area. Branch lines from the ring mains will run to the various buildings to feed internal fire-protection systems. To minimize the need for yard hydrants, exterior wall hydrants will be provided to facilitate fire protection of adjacent buildings.

Given the design frost depth of 3.5 m, all fire-water piping will be buried 2 m deep and protected from frost using insulation board. Where services need to be above the insulation board, the pipe will be insulated and heat-traced. Whenever practical, water piping will be installed in heated spaces to minimize the use of insulation and heat-tracing.

2.2.3.7.6.1.2 Potable Water Supply

Potable water for the construction and operations camps will be supplied from boreholes, and treated in modular potable water treatment plants (PWTPs). Treated water will be stored in a 560-m^3 storage tank that will provide more than 24 hours of water needed during construction, and more than 4 days of storage during operations. Potable water will be distributed to the camps through buried HDPE piping covered with insulation board, and insulated and heat-traced as required to make surface connections.

Potable water requirements for the existing and expanded exploration camp will increase as the camp is expanded from 250 to 426 beds. A 150-person PWTP will therefore be procured to augment the existing systems. At the end of construction, the PWTP will be relocated to the process plant site to provide potable water for the mine dry and domestic use.

The PWTPs will be prefabricated steel modules with insulated walls, floor, and roof, placed on a granular base. Each will be configured to accommodate the manufacturer's proprietary potable water treatment process equipment, including tanks, pumps, and controls. The two remaining in operation after construction will be sized to supply a total volume of 280 litres (L) per person per day.

2.2.3.7.6.2 Heating, Ventilation, and Air Conditioning

2.2.3.7.6.2.1 Heating

In general, the Project site buildings and modules will be heated with electric and makeup air units, often provided by vendors as part of modular building packages. Heating will be needed in the truck shop, maintenance, warehouse facilities, water-treatment plants, effluent/sewage-treatment plants, primary crushing ore handling, reclaim, crushing, storage, and transfer areas. Remote buildings with a lower heat demand, such as the pump houses and the primary crushing and ore handling area, will be heated with electric heaters.

2.2.3.7.6.2.2 Ventilation

Continuous ventilation will be provided for all occupied and selected unoccupied spaces. Ventilation rates will vary depending upon the level of occupancy and the intended use of the space as per American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE), Occupational Safety and Health Administration (OSHA), and the BC Building Code and standards. Ventilation systems will include makeup air units, mixing air-handling units for continuous supply of tempered air, fans to provide extra cooling during the warmer months, and exhaust fans.

2.2.3.7.6.2.3 Air Conditioning

Offices, electrical rooms, control and rack rooms, administration building, and other select areas will be provided with air-cooled air conditioning systems. Air conditioning for all E-houses, the

primary crushing control room, and the assay laboratory will be part of the modular vendors' design and supply package.

2.2.3.7.7 Fuel Storage and Distribution

2.2.3.7.7.1 Mine Site Fuel

Fuel will be delivered by tanker truck to the main storage tanks at the mine site. These tanks are designed to hold approximately 1 million L, to meet surface and mining requirements for up to seven days in the event of weather-related delays in fuel delivery.

At the main fuel-storage area, fuel will be dispensed directly from the tanks to haul trucks and fuel-transport trucks by means of high-flow (Wiggins-type) nozzles and receivers. Fuel transfer trucks will deliver to mobile equipment, and to various other smaller tanks at the process plant site. This truck delivery system was selected instead of hard piping between tanks.

Equipment in the main fuel-storage area will consist of:

- Ten 100,000 L horizontal API-650 diesel storage tanks: six tanks for the initial phase of preproduction mining, and four tanks added once the full mining fleet is mobilized;
- One mine site fuelling station;
- Various diesel dispensers for vehicles;
- One 34,000 L gasoline storage tank; and
- Two gasoline dispensers.

The ten diesel tanks will be placed within an HDPE-lined bunded area to provide secondary containment.

Low-sulphur diesel will be used when it is available. Standard temperature diesel will be used during the summer months, and standard winter-grade diesel during the winter months, because the winter design low temperatures are above the clouding temperature of the winter grade fuel.

Selection of diesel-burning equipment will depend on the supplier/refinery product specifications.

2.2.3.7.7.2 Camp Area Fuel

Fuel is required at the camp areas to operate light vehicles, for power generation during construction, and for backup power during operations. The diesel fuel farm will consist of two 34,000 L tanks to supply the diesel gensets, and installed within an HDPE-lined bunded area for secondary containment. The fuel farm will be used during both the construction and operations phases of the Project.

2.2.3.7.7.3 Containment and Control

For leak control and environmental protection, all unenclosed fuel storage tanks larger than 454 L will be installed within bunded areas for secondary containment of any spillage. The bunded areas

will be constructed of earthen berms lined with HDPE geomembrane extending underneath the fuel pump modules and under ramps where fuel is unloaded or dispensed, from where fuel will drain back to the containment area. Tanks inside buildings will be protected by curb and building floor systems. The secondary containment systems will be designed in accordance with the FM Data Sheet 7-88 and BC Fire Code. Additional protection will be incorporated as required based on environmental and permitting requirements.

Where fuelling equipment cannot be installed inside the containment areas, drip trays will be provided to contain any and all spills that might occur.

The containment(s) will be sized to contain 110% of the volume of largest tank in the group, or the volume of the largest tank plus 10% of the aggregate volume of the other tanks, whichever is greater. An additional 10% allowance is made for snow and rain accumulation. If drains are installed, they will be equipped with a lockable valve that would normally be kept closed.

Containment area floors will be sloped away from the fuel storage tanks and will incorporate sumps and drainage control valves for removal of accumulated rainwater and melted snow. Accumulated water will be monitored, and if determined to be clean will be allowed to discharge to the environment. If the water is contaminated with oil, it will be cleaned prior to discharge.

2.2.3.7.7.4 Propane

Liquid propane will be required for heating the temporary camp facilities and as fuel for food-preparation appliances. Propane tanks will be installed, complete with pump and vaporizer assembly. A backup set will be provided to ensure sufficient vapour flow regardless of outside temperature. Final tank sizing will be determined when the propane consumption rate is available from the camp vendor.

2.2.3.7.8 Explosives Storage

The explosives storage facility (ESF) will be west of the mine site, roughly 2 km away from any substantial structures to meet regulatory safety clearance guidelines. The facility will store up to 160 t of AN in prill form, 80 t of bulk emulsion in three 80-t silos, one container for booster storage, and one for detonators. Containers will be modified shipping containers approved for explosives storage, and separated by earthen mounds as a safety precaution. The ESF will be situated within a secure area, with a gated entry, and fenced, as necessary.

Explosives and AN will be trucked to site and stored at the explosives facility site until required. The quantities noted above are sufficient for only a few days' supply of AN prill and emulsion during peak periods. Therefore, regular deliveries will be needed to meet demand. In anticipation of supply delays that result in shortages, a one- to two-week volume of shot ore will always be available in the pit to prevent down time.

An overhead line will carry power from the main substation to the ESF, and a dedicated freshwater well is planned. Trucks will deliver potable water and diesel fuel to the ESF; sewage from a holding tank will be transported to the sewage treatment plant (STP), discussed below.

2.2.3.7.9 Sewage Treatment and Disposal

The sewage treatment system for the construction and operations camps will consist of an aerated sewage lagoon and two temporary package plants, each sized for use by 500 persons. During construction, all three systems will be used to treat planned peak flow. During operations, the package plants will be taken off line and all sewage will flow to the aerated sewage lagoon. The lagoon will provide a long-term treatment option that is robust and simple to operate. Sludge from the package plants will also be disposed of in the lagoon, eliminating the need for a separate process to manage the sludge. Treated effluent will be pumped to a Rapid Infiltration Basin for final disposal to ground as per BC regulatory requirements (*Municipal Wastewater Regulation*) (Government of BC, 2012).

The expanded exploration camp will make use of the existing sewage treatment system, consisting of two rotating biological contactor (RBC) packaged treatment plants and an infiltration field. The system will require only slight modification to accommodate the increase from 250 to 426 beds at this camp. Once the exploration camp is decommissioned, the two RBC treatment plants will be relocated to the process plant area to service the plant, administration, and truck shop buildings. Sewage will be collected in sewage lift stations and pumped to the treatment plants via buried force mains covered with insulation boards for freeze protection, and heat-traced as necessary. The treated effluent will be discharged to the tailings pond for final disposal. Additional discussion is provided in **Appendix 2.2A-7**.

2.2.3.7.10 Industrial, Domestic, and Hazardous Waste Management

2.2.3.7.10.1 Overview

Industrial waste includes inert bulk wastes other than mining wastes generated by ore extraction (overburden, rock) and processing (tailings), which are discussed in separate management plans. This section outlines waste management principles for the Project site during all Project phases. A detailed industrial, domestic, and hazardous materials management plan will be developed prior to construction as part of detailed construction engineering. This section focuses on the physical facilities and general principles. Additional information on management philosophy and implementation is provided in **Section 12.2.1.18.4.11**, Industrial and Domestic Waste Management Plan (IDWMP), and **Section 12.2.1.18.4.12**, Hazardous Materials Management Plan (HMMP).

Based on end treatment, five types of waste are anticipated over the life of the Project:

1. Food and other putrescibles;
2. Combustible (non-putrescible);
3. Non-combustible;
4. Recyclable; and
5. Hazardous.

In the IDWMP (**Section 12.2.1.18.4.11**), waste will be managed following the hierarchy below, adopted as Project policy:

- Avoid/Reduce – take action to reduce or avoid waste generation;
- Reuse/Recycle – reuse or recycle wastes where practical; and
- Treat/Dispose of wastes appropriately – treat or dispose of waste in an environmentally responsible manner that meets regulatory requirements and manages environmental liabilities appropriately.

2.2.3.7.10.2 Site Waste Management Facilities

Designated temporary waste storage and collection areas will be sited adjacent to key sources of waste production, including the process buildings, laydown area, camps, etc. As necessary, for each Project phase, locations will be specified by the environmental department, with input from the Project Management Team (PMT). All stored wastes will be appropriately contained, in metal bins, barrels, mini-bulk bags, and pails.

Waste will be transported from collection points for sorting, further treatment, and/or disposal at one of three end points:

1. Incinerator;
2. On-site landfill; or
3. Off-site, hauled by appropriate contractors to an approved waste or recycling facility.

The existing exploration camp uses an incinerator, and ash is disposed in the existing landfill. Incineration will continue during construction, operations and into early closure. Ash and other wastes that cannot be recycled, and that are not hazardous, will be deposited in the landfill. The landfill will be located in the overburden zone of the West waste rock dump. Any surface runoff and seepage from the landfill will drain by gravity to the TSF. The landfill will be constructed in cells to coincide with ongoing construction of the West waste rock dump. Only one cell will be used at any given time. The cells will be constructed by placing approximately 3 m of compacted overburden (till). An additional 5 m of overburden will be placed and a landfill cell dug to a depth of approximately 3 m with a backhoe. After filling, the cell will be covered with a minimum of 2 m of compacted overburden. Since surface water and seepage will drain to the TSF, no dedicated leachate collection or monitoring system will be required although runoff and seepage from the West waste rock dump will be monitored. Signs will be erected at the landfill to identify the site and to remind construction and mine workers of the acceptable and prohibited wastes.

Some recyclables may be backhauled off site in outgoing delivery vehicles and donated to a local charity for their redemption value. A Project recycling program will be planned accordingly, to include separation of key recyclables that are part of the BC deposit/refund program.

2.2.3.7.10.3 The Proponent's Recycling Policy

The Proponent's corporate policy will support active involvement of all mine personnel and contractors in achieving the environmental goals of waste minimization, materials conservation, and recycling. Recyclables will be disposed of in the following manner:

- Scrap iron and steel will be placed in marked bins;
- Scrap copper will be stockpiled separately, as it is of greater value than steel and iron. Copper wire and brass scrap will be placed in marked scrap copper bins;
- Mixed recyclables include paper, cardboard, glass, tins, aluminum cans, and plastics marked 1 through 7. Recyclables will be placed in marked recycling bins located throughout the Project site. Since waste may contain food residues, these bins will be equipped with wildlife exclusion measures, such as clamping lids;
- Vehicle batteries must be stored on a containment pallet or in designated bins and held for pickup by a licensed contractor;
- General, domestic use battery types (e.g., alkaline, nickel-cadmium [NiCad], etc.) will be placed in marked bins;
- Fluorescent lights (e.g., tubes/compact fluorescent lights [CFLs]) will be placed in marked bins and held for pickup and removal to a specialized recycling facility;
- Printer or toner cartridges will be placed in marked containers in various office locations;
- Mobile phones and electronic equipment (e-waste) may contain recyclable materials. E-waste will be placed in designated and marked containers for recycling;
- Metal drums that cannot be reused (e.g., for storage of used fuel filters) will be crushed and disposed of as scrap metal; and
- Plastic drums with a recycling mark numbered 1, 2, 4, or 5 will be rinsed out and placed in marked recycling bins. Oil-contaminated plastic containers will be disposed of as hazardous waste (**Section 12.2.1.18.4.12**, HMMP).

Disposing of plastic through reuse and recycling will eliminate a major potential source of carcinogenic dioxins.

2.2.3.7.10.4 Industrial Waste Management

Procedures for handling industrial wastes, and segregation effectiveness, will be tested and reviewed during the construction phase. Standard operating procedures will be modified if indicated.

Combustible (non-putrescible) wastes, such as clean, untreated wood will be incinerated. Wherever possible, pallets will be stockpiled and reused and those that cannot be reused will be incinerated.

Non-combustible solid wastes are those that do not readily burn and those for which burning is inappropriate, e.g., conveyor belts and tires. These materials will be stored in marked bins located throughout the Project site. Waste such as scrap metal, timber, and unsalvageable equipment will be sorted in steel recycle bins either for on-site reuse or off-site recycling.

Bulk wastes that cannot be recycled or reduced in volume with incineration will be transferred to the landfill. Discharge to the landfill will also include non-combustible camp refuse and inert industrial refuse that cannot be incinerated. This waste may consist of plywood, rubber, non-recyclable scrap metal and machinery parts (cleaned of any petroleum residues), building construction debris, and plastic. Options for disposal of these materials are shown in **Table 2.2.3-33**.

Table 2.2.3-33: Non-Combustible Solid Wastes

Waste Description	Storage Actions and Location	Disposal Method
Conveyor Belts and Tires	• Retain in storage yard outside truck shop	• Reuse and recycle • Examples of reuse include, where possible, reusing tires for haul-road berms, turning area road protection, and as bunks for laydown of stock material
Unusable Vehicles	• Stored in a designated laydown area	• Driven or backhauled for refurbishment or recycling
Glass	• Stored in labelled bins	• Reuse and recycle • Non-reusable and non-recyclable glass (windows etc.) will be disposed of in the landfill
Plastics	• Stored in labelled bins	• Reuse and recycle types 1 to 7 • All other plastic will be disposed of in the landfill
Car- and Truck-Wash Sump Sludge	• Stored in labelled drums	• Dewater, then landfill
Scrap Metal	• Restock and reuse scrap metal pieces for other projects where possible • Stored in a designated laydown	• Reuse, recycle, and sell where possible
Welding Rods	• Stored in labelled bins	• Recycle via an approved off-site facility
Electronic and Electrical Equipment	• Electronics waste will be collected and stored in watertight containers • Equipment that may contain polluting substances, such as heavy metals, will not be disposed of in the landfill • Placed in dry storage	• Reuse and recycle

2.2.3.7.10.4.1 Construction

Prior to construction of the West Dump overburden stockpile and designated area for the landfill, wastes destined for the landfill will be placed in the existing exploration landfill or if in larger quantity temporarily placed in a laydown area, likely in dumpsters, pending transfer to the landfill. As mentioned above, during this phase, planned industrial waste disposal procedures will be monitored for effectiveness, and modified if necessary.

2.2.3.7.10.4.2 Operations

During operations, the procedures outlined above will be followed for handling and storage of industrial wastes (modified if required). Periodic reviews will be conducted by the mine health and safety committee.

2.2.3.7.10.4.3 Closure/Post-Closure

Industrial wastes will continue to be handled as indicated above during the closure phase. At an appropriate time near the end of closure, the landfill will be closed by covering with overburden, and revegetating.

At post-closure, no permanent staff are expected to be on site. All discarded material—likely to be minimal—will be backhauled to Vanderhoof for disposal.

2.2.3.7.10.5 Domestic Waste Management

Domestic (kitchen) wastes will be treated similarly for all Project phases: domestic wastes will be incinerated daily or periodically, depending on accumulated volume. According to Project policy, plastics will be reused or recycled, not incinerated, which will eliminate a major potential source of dioxins in compliance with the Canada Wide Standard for dioxins/furans (Environment Canada, 2006). Ash will be landfilled in the exploration landfill and in the on-site landfill proposed for the overburden part of the West Dump when available. Ash will be covered with overburden to limit fugitive emissions. Any leachate from the landfill will flow by gravity to the TSF.

Food, food-covered packaging, and other combustible (non-recyclable) office wastes will be collected and stored in sealed, wildlife-resistant containers. Options for disposal of these wastes are shown in **Table 2.2.3-34** and **Table 2.2.3-35**.

Table 2.2.3-34: Putrescible Wastes

Waste Description	Storage Actions and Location	Disposal Method
Food Waste and Packaging	• Dedicated steel collection bins and dumpsters will be provided where people eat, including the camp kitchen and remote offices • Used oil and grease will be stored in the kitchen until transferred to the incinerator for immediate disposal	• Bag lunches and kitchen food waste and packaging will be stored in plastic bags, collected, and incinerated to minimize the attraction of wildlife • Ash will be deposited in the landfill and covered intermittent with overburden to reduce fugitive dust
General Camp Waste (collected from offices, camp rooms, and leisure and recreation areas)	• Sort general waste into specific containers provided for recyclables or for substances requiring additional processing • Use clear trash bags to allow cleaning staff to perform regular cursory inspections of camp waste and confirm sorting	• General camp waste will be incinerated and the ash deposited in the landfill

Table 2.2.3-35: Combustible (Non-Putrescible) Wastes

Waste Description	Storage Actions and Location	Disposal Method
Corrugated Cardboard	• Procure materials in bulk when possible to reduce packaging volume • Stacked or bundled, placed in containers, and protected from the weather	• Reused as packaging for backhauled materials • Incinerated
Paper	• Have printers set to use both sides of paper when printing or photocopying • Encourage use of online viewing • Containers will be set up in offices and common rooms on site specifically to collect waste paper	• Collected and incinerated
Waste Lumber	• Promote restocking and reusing lumber products for future projects or as backhaul packaging • Place in an appropriate collection bin	• Collected and incinerated

2.2.3.7.10.5.1 Construction

For initial construction, the existing exploration camp incinerator will be used for domestic waste. Once the construction camp is completed, and the incinerator installed, domestic waste will be sent to a dedicated incinerator.

2.2.3.7.10.5.2 Operations

During operations, the existing incinerators will continue to be employed.

2.2.3.7.10.5.3 Closure/Post-Closure

During closure, most of the mine infrastructure will be removed. At that time, a reduced staff will remain on site. A reduced kitchen will operate, and incineration of kitchen waste practices will continue as per operations with a reduced volume and less use required of the incinerator. Not providing attractants for wildlife may dictate the frequency of use of the incinerator during this period.

At post-closure, all remaining infrastructure not specifically required to be on site will be removed and any required services operated from Vanderhoof.

2.2.3.7.10.6 Hazardous Waste Management

Hazardous wastes will be handled in a similar manner for all Project phases; only the nature and quantities will change depending on the phase.

Hazardous and non-hazardous wastes will be stored separately, and will be segregated according to classifications provided in the *Hazardous Waste Regulation* (HWR) (Government of BC, 2009). Segregation will ensure both that there is no contact between hazardous materials, and that sufficient storage space between containers will be maintained for safe access and handling. Other provisions for safe storage and disposal of hazardous wastes will include:

- Drums, containers, and storage areas will be properly labelled, marked, placarded, and secured;
- Storage areas will contain any spills, and secondary containment measures will be dictated by the nature of the containers' contents, size, and capacity. These may include:
  - Drip trays;
  - Metal and plastic bins;
  - Double or redundant packaging;
  - Impervious liners and dike systems; and
  - Prefabricated hazardous waste structures with containment floors.
- Spill kits sufficient in content and quantity will be located in free and unobstructed proximity wherever hazardous materials are stored;

- Fire-prevention systems appropriate and adequate for the materials being stored will be provided; and
- Hazardous wastes will be protected from the weather.

Guidelines for disposal of hydrocarbon wastes and chemical wastes are shown in **Table 2.2.3-36** and **Table 2.2.3-37**, respectively. These guidelines will be updated when wastes and waste quantities are specifically characterized. At that time, wastes will be checked for potential control under the *Transportation of Dangerous Goods Act, 1992* and *Transportation of Dangerous Goods Regulation* (TDGR) (Government of Canada, 1992, 2001). For example, certain hazardous wastes such as batteries and waste oil may be dangerous goods under the *Act* and TDGR, and waste oil used for fuel must not exceed limits specified in the HWR for several substances (e.g., total As and total Cd).

The Proponent will obtain a hazardous waste generator number if required by the anticipated quantities of hazardous wastes temporarily stored on site.

2.2.3.7.10.6.1 Construction

During the construction phase, hazardous waste storage facilities will be constructed, and procedures for handling hazardous wastes tested and refined as required. Standard operating procedures will be updated during this phase to reflect lessons learned from early experience. Most hazardous wastes will consist of petroleum product containers, waste oil, and lead-acid batteries.

2.2.3.7.10.6.2 Operations

The bulk of hydrocarbon and chemical hazardous wastes, as previously listed, will be generated during the operations phase. Storage facilities and handling procedures will continue to be monitored to ensure effective operation. Modifications to facilities and operating procedures will be made and recorded as required. The main vehicle to enable changes will be periodic review by the mine health and safety committee.

2.2.3.7.10.6.3 Closure/Post-Closure

There will be limited hazardous wastes generated at the mine after the first few years of closure when all demolition has been completed. Hazardous wastes will be mostly limited to containers of petroleum products required by the equipment and vehicles that remain on site during the closure phase, waste oil and used lead-acid batteries.

Table 2.2.3-36: Hydrocarbon Waste

Waste Description	Storage Actions and Location	Disposal Method
Used Oil, includes waste lubricating oils from services vehicles, mobile or stationary equipment generators, and pumps	• Stored in empty bulk lubricant cubes. • Cubes will be stored at a designated site.	• Reuse as incinerator fuel. • Excess waste oil, or waste oil not fit for combustion, will be backhauled to the product supplier or to a registered hazardous waste receiver for recycling.
Hydraulic Fluid	• Where possible, filter and reprocess hydraulic fluid for reuse in site equipment. • Transferred to clearly labelled, tightly sealed, sound containers, such as steel drums, and grouped for storage at a designated site.	• Hydraulic fluid that cannot be reprocessed will be combusted in the waste oil burner. • Fluid not fit for combustion, will be backhauled to the product supplier or to a registered hazardous waste receiver for recycling.
Used Oil and Fuel Filters	• Waste oil and fuel filters must be drained prior to disposal. • The filters will then be crushed to release additional oil and reduce disposal volume. • Placed in clearly labelled, tightly sealed, sound containers, such as steel drums, located near the drainage area. • Full drums or oily waste bins will be stored at a designated site.	• Crushed and stored in drums. • Excess will be backhauled to supplier or registered hazardous waste receiver.
Oil and Water Separator Sludge	• Retain in sump prior to removal.	• Recycle to process (operations) or approved off-site treatment or disposal facility.
Used Rags and Absorbent Pads	• Used rags and sorbents will be stored in a well-ventilated area in clearly labelled steel drums. • Drums will be located as close as practicable to the waste generating source. • Granular sorbent will be collected in drums stored at a designated site.	• Rags and sorbent pads will be incinerated on site. • Backhaul to supplier or registered hazardous waste receiver for recycling.
Contaminated or Expired Fuels, such as Jet B Aviation Fuel	• Retain in clearly labelled, tightly sealed, sound original containers in the fuel storage area.	• Fuel may be combusted in a waste oil burner or transported to a designated storage site until it can be backhauled to a registered hazardous waste receiver.
Empty Petroleum Hydrocarbon Containers and Drums	• Empty bins, drums, or pails will be stored at a designated site.	• Returned to the supplier during the backhaul, or • Remove to landfill if deemed “empty.”
Hydrocarbon Contaminated Debris and Soil from Spills	• Contaminated soil bins will be strategically placed at laydown areas and/or other designated sites for use in temporary storage of small amounts of contaminated soils until such soils can be removed or treated. • A bioremediation pit may be constructed onsite to treat hydrocarbon soaked soils.	• Tested and removed off site by a hazardous waste services provider to an approved facility; or • Placed in the bioremediation pit

Table 2.2.3-37: Chemical Wastes

Waste Description	Storage Actions and Location	Disposal Method
Glycol/Antifreeze	• Waste glycol will be stored in clearly labelled, tightly sealed drums. • Placed in a secondary containment structure within a designated site. • Unused and waste glycol will be stored in an enclosed area capable of deterring wildlife.	• Backhaul to supplier or registered hazardous waste receiver for recycling.
Excess or Waste Solvents	• Packaged in clearly labelled, original, tightly sealed, sound containers and stored in a designated site.	• Backhauled to a registered hazardous waste receiver.
Waste Batteries dry cell)	• Small containers will be placed in offices and common rooms for collection.	• Backhauled to a recycling facility.
Waste Pb Acid Batteries and Rechargeable Batteries	• Sealed for temporary storage at a designated site, in labelled metal containers or 205 L plastic drums.	• Backhauled to a registered hazardous waste receiver.
Aerosol Cans	• Wherever possible, aerosol cans will be substituted with refillable type pump or spray bottles. • Collected in specific containers placed around the site and stored at a designated site for collection and backhaul.	• If feasible, puncture, depressurize, and drain the cans to allow on-site disposal in the landfill. • Backhauled to a registered hazardous waste receiver.
Paints	• Excess and waste paint will be tightly sealed and clearly labelled (WHMIS) in original containers. • Unopened paint containers and waste paints should be stored at a designated site for collection and backhaul.	• Return to supplier or backhaul to a paint recycler or registered hazardous waste receiver. • Small quantities of unwanted paint up to 5 L can be discarded in the landfill after being allowed to dry thoroughly.
Fluorescent Lamp Tubes Containing Mercury	• Tubes will be packaged in their original shipping box (or equivalent). • Tubes are considered hazardous waste if broken and should be handled accordingly. • Stored at a designated enclosed site for collection and backhaul.	• Shipped to an approved hazardous waste recycling or disposal company.
Floor Wash/Equipment Wash	• Sump around site.	• Recycled to process water (operations).
Drilling Muds from Drilling Core Holes	• Drill sumps or tanks around site.	• Mine pit.
Waste Chemical Containers	• Many chemical containers are not safe to dispose of directly and must be recycled, or require handling precautions identical to full containers.	• Dispose of in accordance with requirements listed in the MSDS for each chemical.

Waste Description	Storage Actions and Location	Disposal Method
Laboratory Chemical Wastes (spent acids, caustics, solvents, washings, and solutions)	• Stored in appropriately marked containers at a designated site. • Chemical users must be familiar with safe handling and storage procedures provided by the manufacturers in their MSDS.	• Safely incinerated (no sharps) or landfilled on site. • Returned to registered laboratory chemical waste receiver.
Waste Organic and Inorganic Chemicals Including Lab Packs	• Stored in appropriately labelled containers at a designated site for collection and backhaul.	• Returned to supplier or to approved off-site disposal facility.
Hazardous Biological Waste	• Properly contained and labelled as a biohazard. • Stored in a secure area of the first aid centre. • Hazardous biological waste should remain under the direct supervision of medical staff.	• Disposed at a registered hazardous biological waste receiver (not incinerated).
Waste Pb from Laboratory Assays	• Lead waste will be contained and stored as per HWR	• Disposed using registered hazardous waste contractor.

Note: HWR = Hazardous Waste Regulation; MSDS = Material Safety Data Sheet; Pb = lead

2.2.3.7.11 Security System

The Project site will employ a number of systems to ensure the security of personnel, materials, and product. Wherever possible security systems will be automated or computerized to reduce requirements for security staff. Primary access to site will be regulated by swipe cards, which will be issued to all employees. This system will control access to highly sensitive areas on site, such as the process control server room. A network of internet protocol (IP)-enabled closed-circuit television (CCTV) cameras installed throughout the Project site will provide visual security. Camera imagery will be fed to the central security control room and the process plant control room. Security staff will be provided with radios for wireless communication and may be provided with tablets for access to the CCTV camera system.

2.2.3.7.12 Communications System

2.2.3.7.12.1 Proposed Mine Site

The site-wide communications system will be based on a fibre optic backbone connected to the following systems:

- Information Technology network (Voice over IP [VoIP] telephone and local area network);
- Control system network;
- Security network;
- CCTV network; and
- Fire alarm network.

2.2.3.7.12.2 Communications Service to Site

TELUS currently provides telecommunications service from an existing microwave tower at the Project site. The bandwidth is 150 megabits per second (Mbps), which will be expanded to 250 Mbps for Project construction and normal operations. At present, a 3G (third generation) wireless communication system with full cellular or data service is available on site. Plant personnel and contractors can use their own personal cell phones as long as they have an account with TELUS.

2.2.3.8 Transportation and Access

2.2.3.8.1 Introduction

This section discusses transport of goods and personnel to and from the site during all Project phases. The main mode of movement of goods and people will be by road from Vanderhoof, principally along the Kluskus FSR. The Kluskus FSR is discussed in **Section 2.2.4.2**. The following sections discuss the transportation considerations for each Project phase, with special emphasis on construction, during which oversized loads will bring large pieces of equipment to the site, such as dozers, haul trucks, and the SAG and ball mills for the process plant.

Access management is critical for safety and mine security, and for preventing potential effects to local and regional wildlife populations and habitats. Only mine employees, contractors, and visitors on mine business will be allowed on the Project site. All activities along the transportation route and operation of on- and off-road vehicles, snowmobiles, heavy equipment, airplanes, and helicopters must be conducted in a safe and responsible manner to ensure that impacts to wildlife and wildlife habitat are minimized.

2.2.3.8.2 Traffic Control Plan

The purpose of the Traffic Control Plan is to ensure that all traffic movement on a project site or within a specified corridor conforms to a standard set of rules and guidelines, with the intention of protecting the public, enhancing driver safety, and protecting the environment. The Traffic Control Plan will include but may not be limited to:

- A description of activities within the Project site or specified corridor;
- Identification of key personnel and contact information, such as traffic control personnel and security;
- A “Road Use Handout,” which will describe the rules that are to be followed by all traffic travelling on the existing access roads;
- A “Road Use Contract” that all users are to sign prior to driving on the existing access roads for the purpose of the Project. This contract will generally be filled out during employee/contractor orientation. Project employees and contractors will adhere to the Traffic Management Plan on all roads, not just the existing access roads. At a minimum, the road use handout will be provided;

- Characteristics and requirements identified in the logistics study for individual segments of the route between the mine and the highway; and
- A road map, radio frequency map, and signage map.

2.2.3.8.3 Construction

An assessment of inbound logistics for the construction Year -2 through Year 1 was conducted for the FS, and summarized below.

2.2.3.8.3.1 Inbound Volumes

Between Q1 Year -2 and Q2 Year 1 inbound logistics volumes for mining, construction, and fuel will total approximately 180,330 t (**Table 2.2.3-38**). The volume of inbound loads will peak at approximately 30,000 t per quarter in Q2 of Year -1 (**Figure 2.2.3-88**).

Table 2.2.3-38: Inbound Volumes by Project Area

Project Area	Volume (t)	Percentage (%)
Mining	5,957	3
Construction	91,513	51
Fuel	82,860	46
Total	**180,330**	**100**

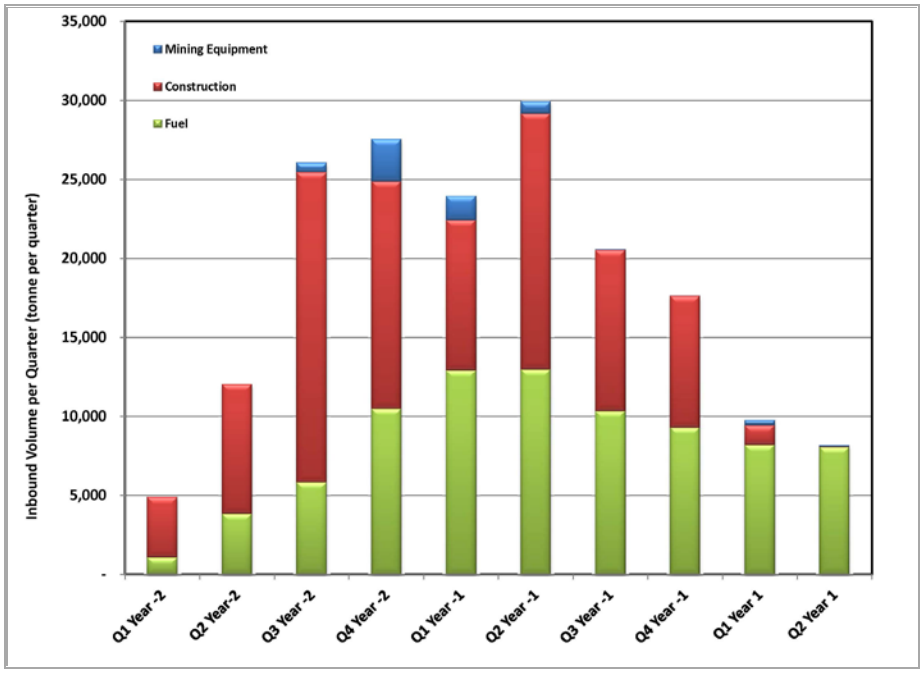


Figure 2.2.3-88: Inbound Volumes by Quarter

2.2.3.8.3.2 Mining Equipment

Loading equipment and the haul truck fleet account for approximately 84% of the total volume of mining equipment to be received between Q3 of Year -2 and Q2 of Year 1 (**Table 2.2.3-39**). Inbound volumes of mining equipment will peak in Q4 Year -2 with the arrival of the loading equipment and six units for the haul truck fleet (**Figure 2.2.3-89**).

Table 2.2.3-39: Inbound Volumes – Mining Equipment

Mining Equipment	Inbound Volume	
	(t)	(%)
Loading Equipment	1,758	30
Drills	335	6
Trucks	3,225	54
Dozers and Graders	495	8
Other	144	2
Total	**5,957**	**100**

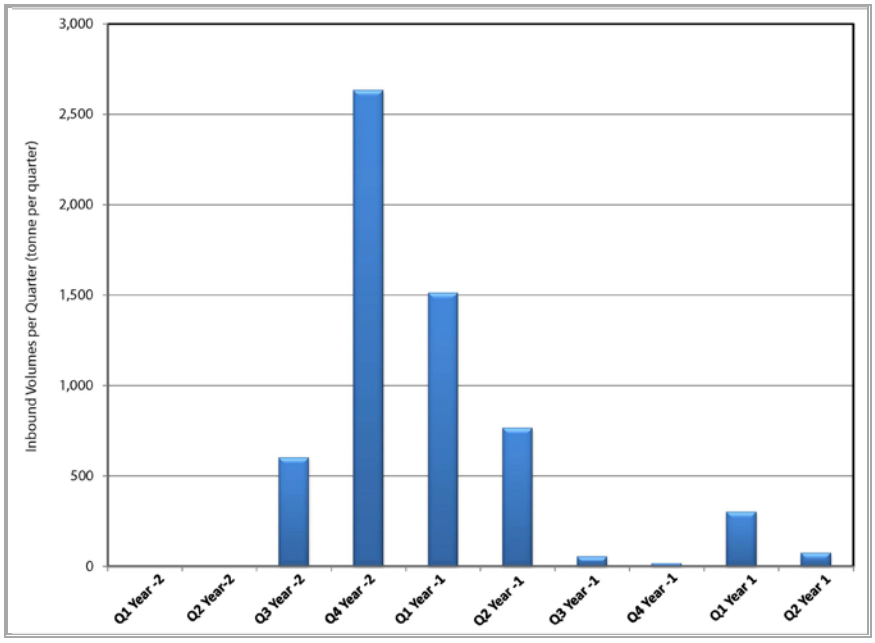


Figure 2.2.3-89: Inbound Volumes – Mining Equipment

2.2.3.8.3.3 Construction Materials and Equipment

Estimates of the volumes of construction materials and equipment by area are summarized in **Table 2.2.3-40**. Approximately 32,983 t, or 36%, of the total volume of construction materials is required for concrete. The peak month for inbound volumes for construction materials and equipment will be Q3 Year -2 because of the volume of concrete scheduled to be poured this period and the arrival of the steel for the process plant (**Figure 2.2.3-90**).

Table 2.2.3-40: Inbound Volumes – Construction Materials and Equipment

Area	Volume (t)	Percentage (%)
Infrastructure – Piping	4,870	5
Concrete	32,983	35
Structural Steel	8,794	10
Architectural	8,702	10
Mechanical	13,326	14
Infrastructure – Tanks	7,503	8
Electrical	3,218	4
Other Disciplines	4,119	5
Indirects(1)	8,000	9
Total	**91,515**	**100**

Note: (1) Indirects = all the temporary infrastructure, facilities, and services required during construction: camps, mobile equipment, fuel depots, mobile generating plants. These are the materials and equipment that will be taken from site on completion of their task.

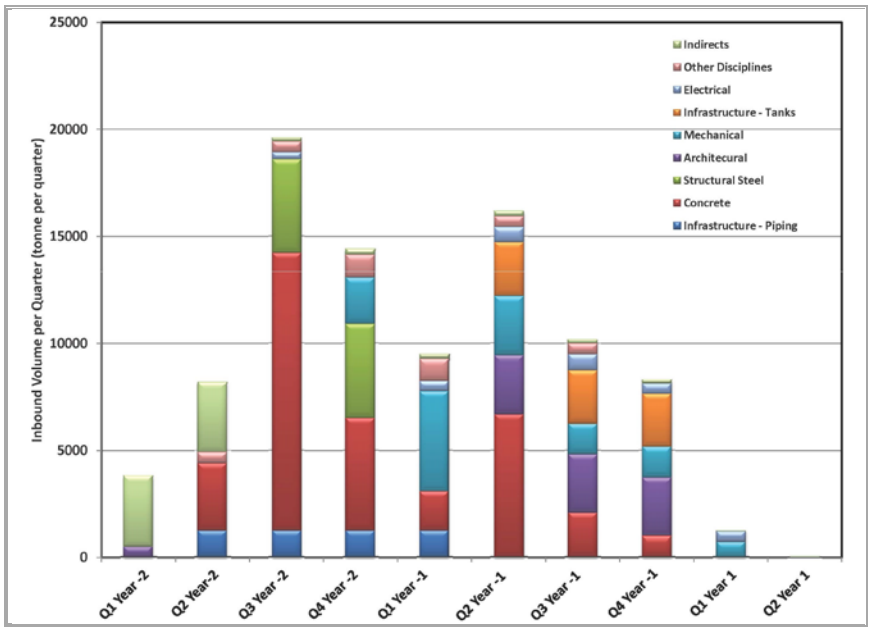


Figure 2.2.3-90: Inbound Volumes by Quarter – Construction Materials and Equipment

2.2.3.8.3.4 Fuel

Estimated demand for fuel between Q1 Year -2 and Q2 Year 1 will total approximately 82,860 tonnes or 98,643,051 L (**Table 2.2.3-41**).

Table 2.2.3-41: Estimated Fuel Consumption

Area	Inbound Fuel Volume[(1)]		Percentage (%)
	(t)	(L)	
Mining	36,438	43,378,858	44
On-site Construction	20,964	24,957,360	25
Tailings Facility	9,545	11,362,952	12
Off-site Construction	4,522	5,383,176	5
Owners	1,393	1,657,739	2
Power Generation	6,124	7,290,914	7
Mobile Equipment	3,874	4,612,052	5
Total	**82,860**	**98,643,051**	**100**

Note: [(1)] Includes 15% contingency

Approximately 43.4 million L or 44% of the total of fuel volume will be consumed by mining and support equipment. Fuel consumption will peak at 13 million L of fuel per quarter in Q2 Year -1, which will be just prior to energizing the 230 kV power line (**Figure 2.2.3-91**).

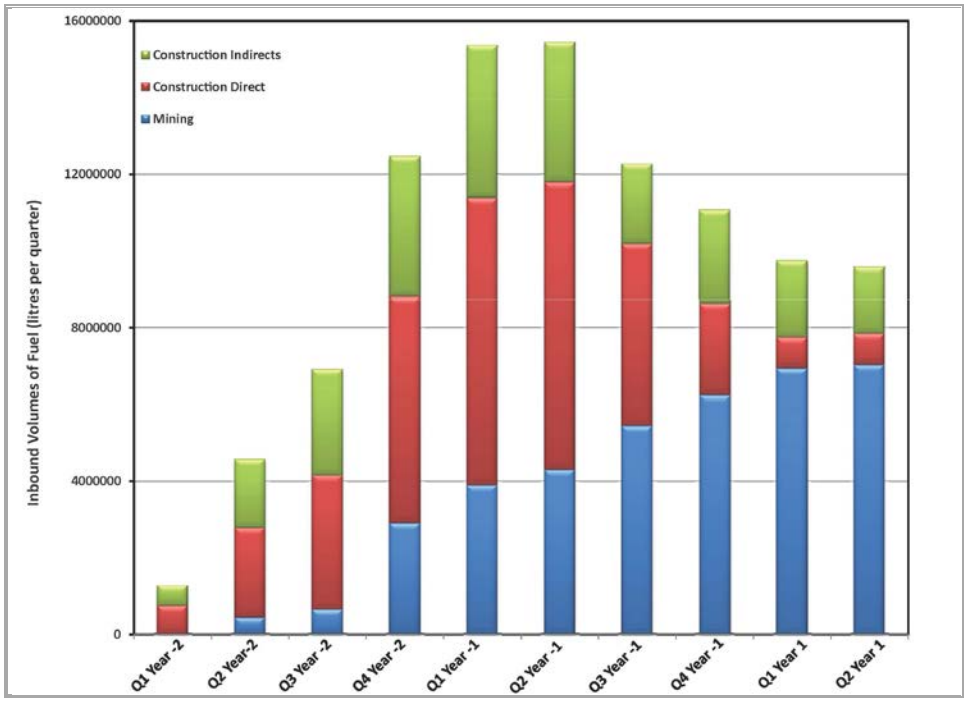


Figure 2.2.3-91: Inbound Volumes of Fuel per Quarter

2.2.3.8.3.5 Road Transport

The scope of the Application includes road transport on the Kluskus FSR and mine access road.

2.2.3.8.3.5.1 Gross Vehicle Weight and Dimensional Restrictions

Limits on maximum gross vehicle weight (GVW) and load length, width, and height vary by vehicle design and configuration, as well as by community, region, and province. The maximum load that might be shipped to site by road transport without a permit will, therefore, depend on its origin and any physical barriers or limitations along the route.

In BC, loads may be either legal loads or oversized loads. Furthermore, oversized loads may be classified as:

- A heavy-haul load for an unapproved route;
- A heavy-haul load for an approved route; and
- An extraordinary load, one that exceed the limits for heavy-haul loads.

The limits for each type of load are listed in **Table 2.2.3-42** and apply to a non-reducible load, which in BC is defined as one that is not reasonably reducible.

Table 2.2.3-42: Road Transport – Limits on Load Description (m)

Criteria	Unit	Legal Load	Heavy Haul		Extraordinary Load
			Unapproved Routes	Approved Routes	
Overall Length	m	12.50	32	32	50
Overall Height	m	4.15	4.15	4.88	No limit-dependent on route
Overall Width	m	2.60	4.40	5.00	No limit-dependent on route
Gross Vehicle Weight	t	64	Governed by vehicle configuration, route, and structures crossed	85	Governed by vehicle configuration, route, and structures crossed

Permits for loads that comply with the legal limits for unapproved and approved routes may be obtained from a local provincial permit centre, without special authorization or approval from other highways departments. Requests for road permits for loads that exceed the legal limits must be submitted to the Commercial Transport program and must include a detailed transport plan.

A list of oversized loads for mining equipment is provided in **Table 2.2.3-43**. The total weight of these loads is approximately 3,600 t. The heaviest extraordinary loads will be those for the superstructures for the PC 8000 shovels, which each will weigh 89 t.

Table 2.2.3-43: Oversized Loads – Mining Equipment

Description	Weight (t)	Dimensions (m)			No. Loads
		Length	Width	Height	
PC8000 Shovel – 1 off					
Crawler Frames w/o Tracks	55.0	10.20	1.52	2.45	2
Carbody	59.0	5.73	5.06	2.45	1
Superstructure	89.0	11.30	4.75	4.00	1
Counter Weight	52.3	5.75	1.25	3.85	1
Main Machine House	59.0	8.00	5.00	3.90	1
Boom	64.8	12.00	2.70	5.10	1
Arm	45.2	7.75	3.52	2.60	1
Bucket	45.5	5.20	4.87	4.50	1
PC 8000 Shovel-Electric					
Crawler Frames w/o Tracks	55.0	10.20	1.52	2.45	2
Carbody	59.0	5.73	5.06	2.45	1
Superstructure	89.0	11.30	4.75	4.00	1
+5+9+5 Counter Weight	52.3	5.75	1.25	3.85	1
Main Machine House	59.0	8.00	5.00	3.90	1
Boom	64.8	12.00	2.70	5.10	1
Arm	45.2	7.75	3.52	2.60	1
Bucket	45.5	5.20	4.87	4.50	1
Le Tourneau L-1850 FEL – 1 off					
Chassis	55.125	12.287	3.735	3.445	15
Body – Half	14.091	13.689	4.360	4.040	30
Body – Full (option)	32.555	13.720	8.308	3.887	15
PV271 Diesel Drill – 4 off					
Undercarriage	62.0	13.00	4.26	4.16	4
Tower	27.0	25.00	2.00	2.00	4
Dozer 450 kW – 4 off					
Dozer Main Body with Tracks	68.51	6.20	3.25	3.40	4

A list of engineered materials and equipment extraordinary loads requiring heavy-haul transport, along with associated load details are provided in **Table 2.2.3-44**. The total weight of these loads is approximately 4,252 t. The heaviest extraordinary load for engineered equipment will be for the two main transformers, which will weigh 97 t each.

Table 2.2.3-44: Oversized Loads – Engineered Materials and Equipment

Description	Weight (t)	Dimensions (m)			No. Loads
		Length	Width	Height	
Primary Crusher – 1,600 x 290 TS Crusher – 1 off					
Main Shaft	41.540	7.71	1.50	1.50	1
Bottom Shell	66.741	5.46	5.46	2.01	1
Top Shell	63.582	6.21	6.21	2.49	1
+ 6 + 8 + 16 + 14 Middle Shell	74.130	5.46	5.46	2.46	1
Main Shaft Core	33.402	3.38	0.231	0.231	1
Pebble Cone Crusher MP 1,000 – 2 off					
Main Frame	48.182	4.064	3.302	4.064	2
Adjustment Ring	28.845	4.978	1.651	4.318	2
Bowl Assembly	33.782	3.912	2.499	3.581	2
SAG Mill – 36 ft x 24 ft Dual Pinion					
Shell Sections	58.410	11.59	3.66	5.79	8
Head Segments	27.375	8.16	4.43	1.16	16
Trunnions	40.455	4.38	4.38	1.90	4
Gear Segments	21.960	9.38	2.61	0.84	8
Rock Feed Box	32.400	4.19	1.56	3.12	2
Ball Mill – 27 ft x 42 ft Dual Pinion – 2 off					
Shell Section	60.60	8.97	4.27	4.48	12
Head Segments	35.45	8.97	4.48	1.03	8
+12 + 8 + 4 + 9 + 18 + 2 + 1 Trunnions	58.30	4.86	4.86	2.07	4
SAG and Ball Mill Drives					
Induction Motor Drive Unit option – without Fan Housing	57.00	5.048	3.510	3.00	9
Synchronous Motor Drive Unit Option – Largest Piece only	21.364	4.699	4.547	2.692	18
Transformers					
Main Transformers	97.0	6.096	3.556	4.572	2
Distribution Transformers (largest item)	32.8	3.734	3.587	3.302	1

Equipment that will be partially assembled off site includes the camps, tanks with maximum diameter under 6 m, and conveyor galleries.

2.2.3.8.3.5.2 Kluskus Forest Service Road

The Kluskus FSR is a two-lane gravel road used daily by logging trucks and light vehicles. BC Forest Service has primary responsibility for the governance of the FSR.

The design speed of the Kluskus FSR is 60 kilometres per hour (km/h). The road is approximately 9 m wide with additional pull-outs. The maximum grade is 8%. Vehicles travelling the road will be

radio-equipped and carry spare fuel. Drivers must maintain radio contact with other drivers and announce their location every kilometre marker.

While the Kluskus FSR falls under the jurisdiction of the BC Forest Service, Canfor Forest Products (Canfor) has primary responsibility for its operation, maintenance, and repair. The Proponent has entered into a Road Management Agreement with Canfor for the use and maintenance of the Kluskus FSR, and contributes to the recovery of these costs. Under this agreement, Canfor has the right to close or restrict the use of the FSR during spring breakup; due to adverse weather conditions, forest closures, restrictions imposed by government authorities, or to minimize the costs of maintenance and repairs.

The main season for hauling logs usually extends from June 1 to late March, as axle load restrictions for spring breakup are usually imposed for most of April and the first two weeks of May. The forecast for average daily traffic volume during the haul season for 2013 calls for approximately 28 two-way trips each day with 21 of these being for transporting logs. While industrial traffic operates only during daylight for most of the year, as spring breakup approaches in March it will continue in the night shift.

BC Forest Service regulations limit the maximum width of a load to 3.5 m. Extraordinary loads must be assessed for road and structure limitations and their transport approved not only by BC Forest Service, but also by the road owners group. There are no height or length restrictions for the Kluskus FSR, but a preliminary road survey indicated that loads up to 37 m long could be transported from km 1 to site. The Proponent has obtained permission from Canfor to use its site to avoid using the Bearhead and Keith Road when moving extraordinary loads from Highway #16 to the Kluskus FSR.

2.2.3.8.3.6 Air Freight

Air freight will be used primarily for transporting materials required urgently on site. The nearest airports served directly by express parcel carriers such as FedEx and DHL are Calgary, Edmonton, and Vancouver. Arrangements will be made with regional carriers and air charter companies to ferry materials from these airports to the Project site. Specially chartered aircraft will transport loads that exceed the parcel carriers' weight or size limits.

Routine use of aircraft is currently (January 2014) planned only for the 2-year construction period.

2.2.3.8.3.7 Hazardous and Dangerous Goods

The Proponent PMT Logistics will have overall responsibility for preparing and implementing processes and procedures for transport, handling, and storage of hazardous and dangerous goods, and records related to their movement during the construction phase.

During the construction phase, there will be an estimated three truck trips per day carrying fuel and propane to the Project site. In Year 1, an estimated additional one truck trip per day carrying NaCN prills and an estimated one truck per day carrying explosives (AN and emulsion) are expected. During operations, the number of fuel loads is estimated to increase to three per day.

Deliveries of NaCN and explosives deliveries will increase to two truck loads each per day on average. See **Section 2.2.3.8.4** for additional details.

Contractors and third parties who notify construction management and traffic control of an intent to transport hazardous and dangerous materials must submit for review a logistics plan, accompanied by material safety data sheets and an emergency or accident response plan. All parties will submit to construction management and emergency services a record of the volumes, storage medium, and location of hazardous materials stored on site, which will be stored in clearly marked areas. Where required by the regulations and Project, they will be stored in a secure fenced area where the access is restricted only to authorized personnel.

2.2.3.8.3.8 Truck Movements

Estimates of inbound and outbound volumes were converted to truck movements using the assumption for vehicle type and net capacity listed in **Table 2.2.3-45.**

Table 2.2.3-45: Truck Traffic Volumes (two-way trips per day)

Area	Truckloads	Percentage (%)
Mining	298	4
Construction	5,262	68
Fuel	2,192	28
Total	**7,752**	**100**

Inbound truckload volumes using the Kluskus FSR during construction will average approximately 11 truckloads per day; this traffic will peak at about an average of 22 truckloads per day in the Q3 Year -2 (**Figure 2.2.3-92**). An estimated 14 truck trips per day will carry non-hazardous cargo during the two years of construction and the first year of operations, when mine construction activities will be completed, including 175 oversized loads during the 2.5-year construction period, carrying machinery and process plant parts.

Based on experience on other projects, peak daily volumes will be about twice the average number of truckloads per day.

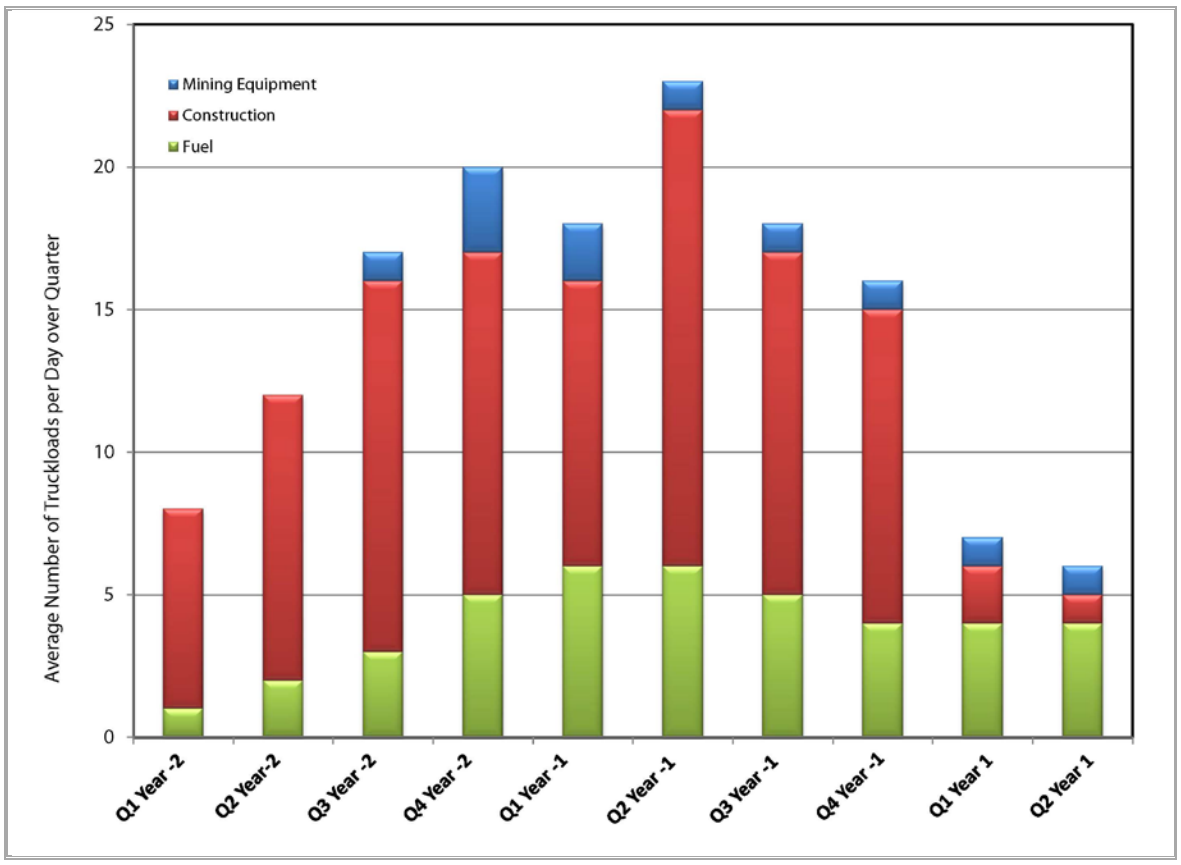


Figure 2.2.3-92: Truck Traffic

2.2.3.8.3.9 Extraordinary Load Parameters

Figure 2.2.3-93 shows representative truck dimensions for extraordinary load.

2.2.3.8.3.10 Personnel Transport

Company or contractor buses will transport most personnel. Construction contractors will also use pickups and light service vehicles. Private vehicles will be discouraged from using the Kluskus FSR. Senior contractor and Proponent management staff may fly in and out from the Project site during the construction phase.

Buses will transit the Kluskus FSR to and from the Project site daily during the construction phase. Extraordinarily, additional bus round trips may be required.

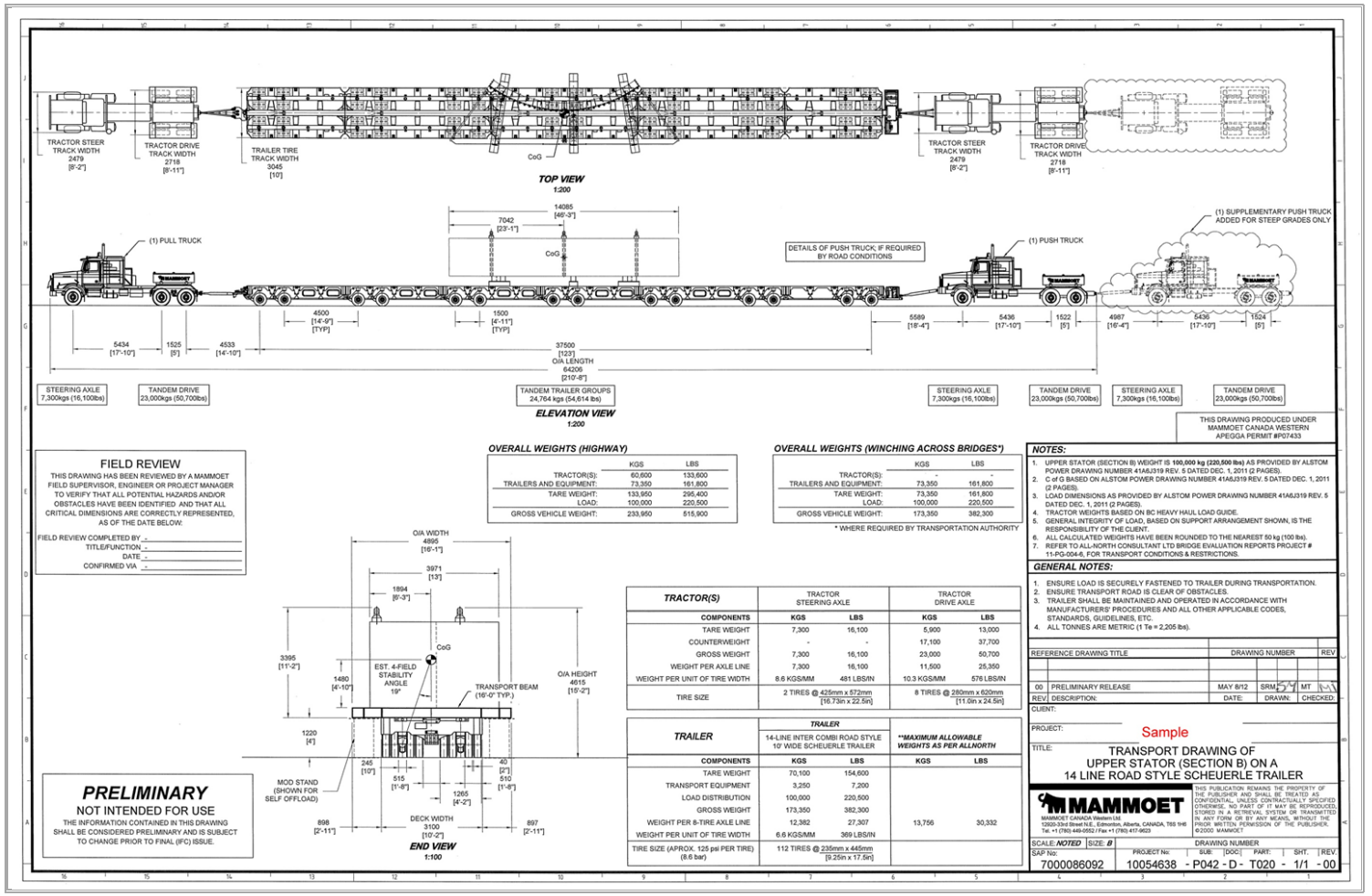


Figure 2.2.3-93: Representative Extraordinary Truck Load Parameters

2.2.3.8.4 Operations

Table 2.2.3-46 is a summary of estimated average one-way trips per day during Project operations. An average of six in-bound trucks per day will carry non-hazardous goods, and one truck per day will backhaul waste to be disposed off site.

Table 2.2.3-46: Average One-Way Trips per Day during Operations

Description	Operations
Bus	1
Garbage	1
Processing Consumable (carbon, flocculant, flux, copper sulphate, hydrochloric acid, caustic, antiscalent, grinding media)	2
Sodium cyanide	1
Bulk lime	2
Ammonium nitrate	3
Fuel	3
Propane	1
Food	1
Equipment	1
Finished Product	1
Miscellaneous	0.3(1)

Note: (1) One truck every 3 days

2.2.3.8.4.1 Typical Truck Configurations

Materials will be transported to the Project site during operations mostly by 68,865 kg GVW B-train tractor-trailers with a 40-ton payload, 8 axles, and estimated maximum of 550 horsepower (excluding oversized loads). Some loads will be transported in 40,000 kg GVW semi-tractor trailer vans, typically with a 13.7-m (45 ft) trailer. Fuel will be transported by 40,000 L capacity tanker trucks. Some one-off or speciality materials may be delivered in smaller trucks. During spring breakup between April and the mid May, smaller loads will be required to meet weight restrictions (50% to 70% of axle weight).

2.2.3.8.4.2 Personnel Transport

Crew buses will continue in use during the operations phase.

2.2.3.8.5 Closure

Outbound logistics for closure have not been developed in detail. The nature and number of outbound loads will differ from construction inbound loads in the following way:

- Outbound mining equipment will be similar to inbound;
- There will be no outbound construction materials;
- Recyclables such as construction steel, fuel storage tanks, will be shipped out; and

- There will be no outbound fuel; inbound fuel to support closure operations will be required.

The preponderance of closure activities will occupy the first two to three years after completion of milling, with a pattern of traffic volume expected to be similar to that of construction.

2.2.3.8.6 Post-Closure

At post-closure, only light truck traffic will use the Kluskus FSR. Trucks will likely be limited to pickups, up to 5-ton vans, unless repair of earthworks is required. Transport of heavy equipment such as dozers or excavators will require lowboys.

2.2.3.9 Construction Phase Activities

2.2.3.9.1 Construction Camp

There will be two construction camps. The existing 250 person exploration camp will be expanded to accommodate 400 people. A second one storey camp will be established to house 1,000 construction workers. It will be located about 3 km east of the plant site, adjacent to the main access road (**Figure 2.2.2-2**). The 1,000 person construction camp will include rented/leased one-storey modular units with dormitory wings, kitchen/dining complex, administration block, commissary, and recreation area. Modular units will be added in phases, as required during the construction phase.

2.2.3.9.2 Construction Sequence and Water Management

Refer to **Section 2.2.3.5.2** for a complete discussion of facilities construction and construction water management.

2.2.3.9.3 Construction Traffic

Refer to **Section 2.2.3.8.3** for a discussion of construction traffic.

2.2.3.10 Operations Phase Activities

The progressive development of the tailings impoundment, open pit and waste rock dumps is outlined, with figures, in **Section 2.2.3.2.16**. Mining of the open pit will require approximately 14 years. The last three years of operation will consist of milling of the low grade ore.

2.2.3.11 Closure and Post Closure Activities

Closure and post closure activities are summarized in **Section 2.2.3.2.16.13**. Detail of activities for these phases are discussed in **Section 2.6**, Reclamation and Closure Plan. Once mining in the open pit ceases water will be pumped from the TSF to commence filling the pit which is estimated to require approximately 18 years. Maintenance of in stream flows in Davidson Creek will continue through this period. Once the pit lake overflows to the reclaimed TSF, Dam D will discharge through a constructed channel to Davidson Creek. Seepage from Dam D will be treated in a

constructed wetland and also discharge to Davidson Creek and pumping of water from Tatelkuz Lake for in stream flow needs in Davidson Creek will cease.

2.2.4 Off-Site Infrastructure

Activities included with off-site infrastructure include:

- Mine access road construction;
- Kluskus FSR upgrades;
- Temporary and permanent transmission line access roads;
- Construction of an airstrip and access road;
- Construction of a helipad; and
- Construction of a FSS.

These activities are detailed in the following subsections. Off-site works to mitigate and offset potential impacts to fish are discussed in **Appendix 5.1.2.6C**.

2.2.4.1 Mine Access Road

A new 16 km mine access road will replace the existing exploration access road to the Project site. The mine access road will originate at km 124.5 on the Kluskus-Ootsa FSR and extend south to the mine site (**Figure 2.2.4-1**). Some sections of the freshwater supply pipeline and the transmission line will parallel the mine access road. The road ROW will therefore be wide enough to accommodate these structures. The freshwater supply pipeline joins the access road ROW approximately 7.2 km from the mine site, and the transmission line parallels the access road ROW all the way from the Kluskus-Ootsa FSR.

The mine access road will be used for heavy traffic during mine construction and has been designed for year-round all-weather access. The road will be 10 m wide, two-lane, have a design speed of 60 km/h, and incorporate five bridges of varying lengths and types, as listed in **Table 2.2.4-1**. The road design includes ditching to control erosion as well as culverts and cross drains as required.

Table 2.2.4-1: Bridges along Mine Access Road

Bridge	Location	Length (m)	Description
Bridge 1	0.5 km	18.3	Steel concrete composite on precast spread footing
Bridge 2	5.2 km	13.0	Slab girder bridge on precast spread footing
Bridge 3	6.7 km	18.3	Steel concrete composite on precast spread footing
Bridge 4	10.3 km	14.0	Slab girder bridge on precast spread footing
Bridge 5	13.8 km	12.0	Slab girder bridge on precast spread footing

2.2.4.1.1 Cross Drains

The typical cross drain will be a corrugated steel pipe with a minimum diameter of 600 mm, and will be installed as specified in the Handbook of Steel Drainage & Highway Construction Products. Cross drains will be used to minimize the distance that water in the ditch travels before being dissipated away from the road prism. Typical locations for culvert placement will be as follows:

- At the bottom of steep gradients;
- In seepage zones;
- At natural drainage pattern disruptions; and
- At low points in the road profile where the existing ground topography does not allow the water to dissipate away from the road prism.

Cross drains will be skewed to the road centreline by 3º for each 1% of road gradient that the road exceeds 3% (to a maximum of 45º).

2.2.4.1.2 Ditching

The road design includes flat bottom ditches with the invert a minimum depth of 300 mm below the sub-base and a minimum width of 1,000 mm. Rip-rap and sediment control devices have been incorporated in the design.

2.2.4.1.3 Erosion Control

Rip-rap and hydro-seeding will be used to protect erodible fills. Ditch block, inlet/outlet culvert armoring, etc. will be built with rip-rap. The rip-rap source is assumed to be Special Use Permit 25624 located at approximately 2.5 km on the existing access road.

2.2.4.1.4 Road Geometry

No signs of potential slope instability have been observed for the Project. However, if unstable slopes are encountered during construction, a geotechnical engineer will be consulted and the road design will be reviewed and possibly modified to incorporate additional recommendations from the geotechnical engineer.

It is anticipated that a medium weight, nonwoven polypropylene geotextile on the subgrade surface will be utilized, followed by a layer of biaxial geogrid for all glaciolacustrine and lacustrine road sections. It is anticipated that approximately 240 m of roadway will need geosynthetic materials in these sections.

If soft and wet conditions exist at the time of construction, additional geosynthetic materials may be required. It is anticipated that approximately 500 m (4%) of the total length of the mine access road may need geosynthetic materials and this has been included in the cost estimate.

For the road structure over the glaciofluvial deposits, where the gradation of subgrade matches that of select granular sub-base (SGSB), the separate 200 mm thick layer of SGSB can be omitted from the road structure.

All road structure layers will be shaped to a minimum of 2% crossfall from the centerline.

2.2.4.1.5 Construction Methodology

2.2.4.1.5.1 Right-of-Way Clearing

The width of the ROW will vary to accommodate the cut and the fill. The width will also vary where the transmission line and the freshwater supply pipeline will be located adjacent to the road. **Table 2.2.4-2** presents the minimum widths of the ROW.

Table 2.2.4-2: Mine Access Road Right-of-Way Width

Chainage	Water Line	Transmission Line	ROW Width (m)	Length (m)	Area (m^2)
0 to 0+460	N/A	N/A	30	460	13,800
0+460 to 0+900	N/A	LEFT	40	440	17,600
0+900 to 1+060	N/A	LEFT	40	160	6,400
1+060 to 5+200	N/A	LEFT	40	4,140	165,600
5+200 to 5+360	N/A	N/A	30	160	4,800
5+360 to 5+640	N/A	LEFT	40	280	11,200
5+640 to 5+680	N/A	N/A	30	40	1,200
5+680 to 5+780	N/A	N/A	30	100	3,000
5+780 to 6+270	N/A	N/A	30	490	14,700
6+270 to 6+600	N/A	N/A	30	330	9,900
6+600 to 7+200	N/A	LEFT	40	600	24,000
7+200 to 10+700	LEFT	N/A	35	3,500	122,500
10+700 to 12+730	LEFT	LEFT	55	2,030	111,650
12+730 to 13+650	LEFT	N/A	35	920	32,200
13+650 to 13+873	N/A	N/A	30	223	6,690
Total					**545,240**

Note: N/A = not applicable

A total of 54.52 ha of ROW clearing will be required. Clearing will consist of removing trees a minimum of 3 m from the toe of the fill or from the crest of the cut.

Timber will be felled and decked by logging/clearing crew, then sold to the local forest licensees. Timber will be loaded and hauled from site by log purchaser at no cost to the Proponent. Non-merchantable timber, slash, and other debris will be piled, buried, or mulched. The Proponent could burn debris along the ROW between October 15 and April 15 each year.

A preferred slash/debris disposal method has not been selected, and may include burning, burying, and/or mulching.

2.2.4.1.5.2 Stripping

It is anticipated that the thickness of the stripping material will be approximately 300 mm. The stripping material will be disposed of inside the ROW between the toe of the fill and the treeline or between the crest of the cut and the treeline.

2.2.4.1.5.3 Subgrade Preparation

2.2.4.1.5.3.1 Areas of Cut

To construct the subgrade, all organic material, heavily rooted, and wet and loose soil across the road footprint will be removed.

If disturbed, the top 300 mm of subgrade below the road prism should be compacted to 100% Standard Proctor Density (SPD). The surface of the prepared subgrade will be tested for uniformity of density to locate soft spots. The top surface will be shaped to match the cross fall of overlying asphalt or gravel pavement structure.

The excavated material will be placed directly in the embankment. However, if it is more economical the excavated material will be disposed within the ROW limits. Where the cut will be used, the areas of fill will have to be ready and approved for fill placement.

Once the above is completed as per Project specifications and accepted by the Proponent's geotechnical engineer, the placement of the SGSB or the well grade base (WGB) will commence.

2.2.4.1.5.3.2 Areas of Fill

As outlined in the Blackwater Project Preliminary Geotechnical Recommendations for Road Structure Designs of Proposed Mine Access Road Report (Allnorth, 2013), the acceptable embankment fill will consist of mineral soil that has similar gradation to that adjacent subgrade soil. The moisture content of the material will be monitored, so its specified compaction can be achieved. The material used for embankment will contain no organic material or particles larger than 150 mm diameter.

It is assumed that 80% to 90% of the volume generated by the cut will be reusable to build the road embankment. This percentage of reusable material will partially depend on the weather conditions at the time of construction. The till is particularly sensitive to moisture and may become unusable during wet weather. Borrow pits with an acceptable quality of fill material will have to be developed to achieve the construction of the embankment.

Culvert and cross drains will be corrugated steel pipe installed at the locations shown on the design drawings. Where the outlet of the pipe spills on the slope of the embankment, rip-rap will be placed to prevent erosion. Prior the placement of the bedding material, the base underneath the culvert will be approved by the geotechnical engineer. The compaction of the base underneath the culvert will vary from 95% to 100% SPD. Its level of compaction will depend on the culvert elevation relative to the subgrade. The backfilling and compaction around the culvert will also vary with the culvert elevation relative to the subgrade.

Prior to commencing the placement of embankment fill, all debris and unsuitable soil within the footprint of the road will be removed. Once the condition of prepared ground is accepted by the Proponent's geotechnical engineer, the placement of embankment fill will commence.

Embankment fill will be placed in lifts of 300 mm loose thickness or less and compacted to 95% SPD. Where sliver fills will be required, the subgrade will be benched to accommodate the compaction of the fill material. The top 300 mm of subgrade will be compacted to 100% SPD.

The surface of the prepared subgrade will be tested for uniformity of density to locate soft spot.

It is not possible at this stage of the Project to identify the sections of road with soft spots or wet subgrade conditions. It is assumed that geotextile and geogrid will only be used where the road crosses glaciolacustrine and lacustrine geological landform.

The top surface will be shaped to match the cross fall of overlying asphalt or gravel pavement structure.

A study was conducted to assess the optimal routing of the mine access road and to provide a detailed engineering design and cost estimate for construction and operations. Geotechnical investigations identified potential borrow sources for construction. The detailed design of the road has been completed, and "issued for construction" drawings have been prepared.

2.2.4.2 Kluskus Forest Service Road Upgrades

A portion of the Kluskus FSR will be upgraded to handle the addition of mining traffic. The Kluskus FSR was built in the early 1970s and is currently maintained by Canfor. As with most FSRs in northern BC, heavy traffic is restricted during the spring breakup, which is typically April to mid May, with industrial traffic limited to reduced loads for most of April and May. To meet the future year-round operations at the mine site, the Proponent requires a portion of the FSR to be upgraded and includes both the Kluskus FSR mainline and Kluskus-Ootsa FSR branch (**Figure 2.2.4-1**). The Proponent's objectives for this upgrade include:

- Re-gravelling the road from 101+650 to 123+973 km (mine access road junction);
- Maintaining the current road width, horizontal alignment, and vertical alignment of the existing road;
- Realigning the road from 104+900 to 106+738 km corner and establishing an 8-m running surface and 60 km/h design speed;
- Determining the design speed of the final design (this information will be used by the Proponent to post new speed limits on the upgraded road);
- Improving the existing ditch line or establishing a new ditch line where required; and
- Replacing damaged culverts or establishing culverts where required.

Local forest licensees are, and will continue to be, the principal users of the roads accessing the Project.

2.2.4.2.1 Right-of-Way

The ROW of the Kluskus FSR is assumed to be a minimum of 30 m wide. The width of the ROW will vary to accommodate the road realignment section and the proposed transmission line of the road and the dimensions of the cut and the fill.

2.2.4.2.2 Drainage

The drainage system is deficient at several locations on this section of the Kluskus FSR. Consequently, the road structure becomes saturated during spring breakup and cannot properly support the traffic loads. Their exact locations and limits cannot be determined at this stage of the Project.

2.2.4.2.3 Cross Drains

The typical cross drain will be a corrugated steel pipe with a minimum diameter of 600 mm. The ground in this area is relatively dry and the topography of the terrain is favorable to drain the water away from the road prism. Cross drains will be used to minimize the distance that water in the ditch travels before being dissipated away from the road prism. Typical locations for culvert placement will be but not limited to the following:

- At top of step gradient;
- In seepage zone;
- At natural drainage pattern disruption; and
- At low point in the road profile where the existing ground topography does not allow the water to dissipate away from the road prism.

2.2.4.2.4 Culverts

The conditions of the existing culverts are unknown; however, they are assumed to be in good condition. Damaged culverts will be replaced and new culverts installed where required. An allowance for 14 new cross drain culverts have been added to the proposed works.

2.2.4.2.5 Ditching

Much of the existing ditch line has been filled with sediments and/or grown over with vegetation. For this reason, the design and the cost estimate will include the re-ditching of the entire Project area.

The design will include flat-bottom ditches with a minimum depth of 1,000 mm and a minimum width of 600 mm. Rip-rap and sediment control devices will be incorporated in the design where required.

320000 360000 400000 440000

6000000 5960000 5920000 5880000

Endako
Endako
Stellako
Fraser Lake
Nadleh Whuten
Fort Fraser
Engen
Vanderhoof
Weneez
Sinkut River
Saik'uz
Nulki
Mapes
François Lake
Southbank
Cheslatta Carrier
Danskin
Skin Tyee
Uncha Lake
Takysie Creek
Binta Lake
Nithi River
Tahultzu Lake
Hallett Lake
Cheslatta River
Cheslatta Lake
Knapp Creek
Cheslatta
Bird Creek
Targe Creek
Creer Creek
Nechako River
Tachick Lake
Nulki Lake
Corkscrew
Sinkut River
Khai
Cluculz Lake
Cluculz Creek
Stuart River
Lucas Lake
Lucas Creek
Knewstubb Lake
Big Bend Creek
Finger Lake
Tatuk Lake
Chilako River
Natalkuz Lake (Nechako Reservoir)
Tetachuck River
Entiako River
Entiako Lake
Johnny Lake
Laidman Lake
Fawnie Creek
Moose Lake
Top Lake
Chedakuz Creek
Tatelkuz Lake
Kuyakuz Lake
Taiuk Creek
Batnuni Lake
Euchiniko River
Nataniko Creek
Euchiniko Lakes
Blackwater River
Kushya
Tsacha Lake
Kluskus
Kluskus
Proposed Transmission Line (Stellako Re-route)
Kluskus FSR
Proposed Transmission Line
Proposed Transmission Line (Mills Ranch Re-route)
Kluskus-Ootsa FSR Upgrade
Proposed Airstrip
Kluskus-Ootsa FSR
Proposed Fresh Water Pipeline
Kluskus-Blue FSR

N

Legend

- Populated Place
- Highway
- Kluskus FSR
- Kluskus-Blue FSR
- Kluskus-Ootsa FSR
- Existing Transmission Line
- Stream
- Waterbody
- Indian Reserve
- Parks & Protected Areas

Project Components

- Exploration Road
- Proposed Mine Access Road
- Kluskus-Ootsa FSR Upgrade
- Proposed Transmission Line
- Proposed Transmission Line (Mills Ranch Re-route)
- Proposed Transmission Line (Stellako Re-route)
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Proposed Airstrip
- Proposed Mine Site

Scale: 1:500,000
0 5 10 20
Kilometres

Reference
BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Kluskus-Ootsa FSR Upgrade

DATE: April, 2014	ANALYST: WR	**Figure** 2.2.4-1
JOB No: VE52277	QA/QC: GH	PDF FILE: Other-100-097_kluskus_upgrade_v2.pdf
GIS FILE: Other-100-097_kluskus_upgrade_v2.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\Other\Other-100-097_kluskus_upgrade_v2.mxd

2.2.4.2.6 Erosion Control

Hydro-seeding will be used to protect erodible fills. The use of rip-rap for additional erosion control has been discussed with the Proponent and it has been determined that rip-rap for ditch blocks, inlet/outlet culvert armoring, etc. will not be used.

2.2.4.2.7 Construction Methodology

Construction methodology will be, for the main road, identical to that previously discussed for the mine access road (**Section 2.2.4.1**).

Figure 2.2.4-1 shows the proposed realignment section of the Kluskus-Ootsa FSR.

2.2.4.2.8 Transmission Line Access Roads

From the connection point at Glenannan, the transmission line runs approximately 140 km south to the termination point at the Blackwater Substation. Two types of road are proposed for the transmission line: branch roads and access roads. Branch roads are defined as those roads accessing the transmission line ROW, and access roads are those roads located inside the ROW that are used to access proposed pole locations.

These roads will be designed to provide temporary access to the transmission line ROW and/or pole locations for the purpose of construction. The design road construction standard will be the minimum required for safe and efficient construction of the transmission line. Branch and access road specifications are listed below.

The transmission line ROW is accessible at numerous points through a combination of existing and proposed new roads. Existing roads have been developed to support local timber harvesting activities, and are generally considered acceptable for use on the Project. Where necessary, new roads will be proposed to provide additional access. All roads will be constructed using native soil by a combination of push Cat and end haul construction methods. Where ground conditions warrant, roads will be ditched and capped with local pit run gravel.

Proposed roads are intended to support temporary access for all construction activities including the removal of ROW timber and transmission line installation. Roads and drainage structures will be located and designed to meet Ministry of Transportation and Infrastructure and Ministry of Forests and Range design specifications for BCL-625 load ratings. Stream crossing structures will comply with similar load ratings and include temporary roads and culverts. The transmission line will not be fenced. The final location of the branch and access roads are yet to be determined.

Appendix 2.2A-8 contains a transmission line FS conducted by Knight Piésold that is summarized in this section.

2.2.4.2.8.1 Branch and Access Road Specifications

- 30 km/h design speed;
- 4 m stabilized road width, widen to 6.5 m on curves;

- Single lane roads with additional 3-m-wide pullouts developed at locations that permit minimal site disturbance, target one per km;
- 25 m long x 5 m wide x 7.5 m taper turnout size;
- Max grade Adverse: 15% (18% for short pitch to <100 m);
- Max grade Favourable: 18% (20% for short pitch to <150 m);
- Cut/fill slopes at 1.5:1;
- ≥0.3 m deep ditch lines where required;
- ≥0.3 m cap of good quality pit run surface gravel where required;
- 0.5 m metal culverts with a minimum of 0.3 m subgrade coverage ROW access roads only; and
- Minimum road ROW is 15 m on level terrain, preferred average width is 20 m.

2.2.4.2.9 Air Transport

An airstrip will be constructed approximately 15 km north of the process plant site. The airstrip will be 1.7 km long and 100 m width wide. The proposed schedule is for three flights per week, 52 weeks/year. Both Boeing 737-200 and Dash 8 Q100 class aircraft will be accommodated. Air transport will be used for air-transportable materials and supplies where appropriate, and personnel when air transport is desired for the construction phase.

Additional discussion is provided in **Section 2.2.3.8.3.6,** Transportation and Access Management, Air Freight. A permanent helipad will be constructed early in the construction phase. The location of the pad will be field fit. Selection criteria include safety for helicopters and mine personnel, location away from potentially interfering infrastructure and active work areas. The pad will be timber or concrete construction and nominally 10 m square or less. Final construction design will be in consultation with helicopter companies and/or air safety experts. The location of the helipad has not been determined, but will be in an otherwise disturbed area. The ground disturbance caused by the construction of the helipad will be small (10 m^2) and is covered by the conservative assumptions made to estimate soil and vegetation losses for the assessment of residual effects of the Project on the terrestrial valued components. The reclamation and revegetation measures proposed in **Section 2.6** will also be applied to the area where the helipad will be located.

2.2.4.3 Freshwater Supply System

2.2.4.3.1 Introduction

Water supply for the Project will be sourced from Tatelkuz Lake, approximately 20 km northeast, and delivered to the Project site by a pipeline. The FSS will include the following major components:

- Tatelkuz Lake intake;
- Freshwater supply pipeline;
- Booster pump stations;

- Freshwater reservoir; and
- Temperature and flow control system.

The FSS was designed to provide:

- Constant water supply from Tatelkuz Lake for plant water needs, and to mitigate flow reductions in lower Davidson Creek; and
- Occasional water supply from Tatelkuz Lake to supplement requirements for mineral processing or to saturate PAG within the TSF, if required.

The estimated total annual freshwater requirement for the Project is 7.61 Mm^3. **Table 2.2.4-3** presents a breakdown of process water requirements at the mine site and instream flow needs for Davidson Creek.

Table 2.2.4-3: Mine Site and IFN Freshwater Requirements

Date	Mine Site Requirements (L/s)	Davidson Creek IFN Requirements		
		Type of Flow	Flow (L/s)	Implementation
10 - 12 May	33	Channel Flushing Flow	1,123	400% mean annual discharge (MAD = 281 L/s)
16 May - 30 Jun	33	Rainbow Trout - Spawning	560	Rainbow Trout spawning IFN
4 Jul - 15 Jul	33	Rainbow Trout – Incubation and Rearing	300	Maintains redds constructed at depths of 10 cm or greater at rainbow trout spawning flows (560 L/s)
19 Jul - 31 Aug	33	Rainbow Trout – Rearing Kokanee - Spawning	150	Kokanee spawning IFN
2 Sep - 30 Nov	33	Rainbow Trout – Rearing Kokanee - Incubation	115	Rainbow trout rearing IFN; maintains redds constructed at depths of 4 cm or greater at kokanee spawning flows (150 L/s)
2 Dec - 6 May	33	Rainbow Trout - Overwintering	125	Minimum of monthly mean annual flows for winter period
Annual total (Mm^3)	**1.05 Mm^3**		**6.56 Mm^3**	**Total requirement = 7.61 Mm3**

Notes: Transitional conditions between each of the defined Davidson Creek flows have been determined to avoid potential effects during flow changes (**Appendix 5.1.2.6D**).
Channel Flushing Flows (10-12 May) can be reduced to 200% MAD (560 L/s) for drier than average water years. Potential requirements for supplemental flows to flood the TSF under extreme dry conditions early in the Project are not included here.

A feasibility design for the FSS was prepared in sufficient detail to support cost estimating, the Environmental Impact Assessment, and subsequent permitting of the Project.

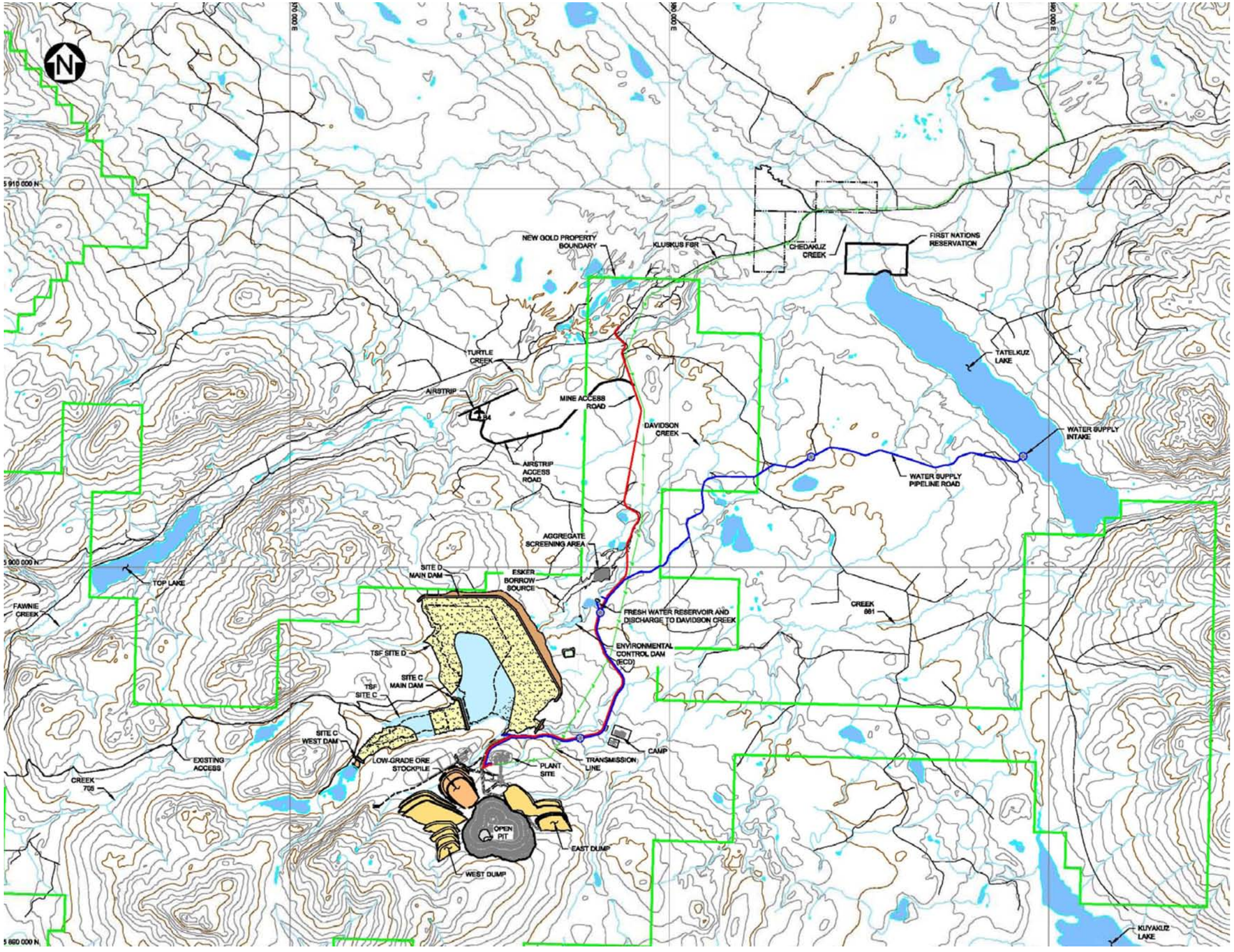
2.2.4.3.2 Lake and Route Selection

Knight Piésold conducted a trade-off study to identify potential long-term water sources for the Project. The study indicates that Tatelkuz Lake is the most practical option, has the lowest environmental impact, and has the lowest risk with regard to security of water supply.

Due to the presence of a pre-existing forestry clearcut near the lake, the local stakeholders preferred this as the selected water intake location on the Tatelkuz Lake; consultation with local stakeholders on the location is continuing. The pipeline route from Tatelkuz Lake to the freshwater reservoir will follow existing forestry roads to the maximum practical extent; the route from the freshwater reservoir to the plant site and TSF Site D will be along a pipeline service corridor adjacent to the mine access road.

2.2.4.3.3 Water Balance Considerations

Three primary waterbodies were considered during the design of the freshwater supply system: Tatelkuz Lake, Davidson Creek, and Chedakuz Creek. The flows in all three waterbodies are interrelated and essential to the system design. The general arrangement of the FSS is shown on **Figure 2.2.4-2**. Tatelkuz Lake is northeast of the Project site and is fed by a watershed of approximately 395 km^2.



Legend

- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- NAG WASTE ROCK / OVERBURDEN
- LOW GRADE ORE
- TOPSOIL
- SURVEYED PARCELS
- WATER SUPPLY PUMPSTATION
- MINE HAUL ROAD
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- NEW GOLD PROPERTY BOUNDARY
- FIRST NATIONS RESERVATIONS
- EXISTING FORESTRY ROAD
- TRANSMISSION LINE

Source
Knight Piésold Engineering and Environmental Services
http://www.knightpiesold.com/en/

CLIENT: newgold™

PROJECT: Blackwater Gold Project

Project Area General Arrangement

DATE: May, 2014	ANALYST: KP	**Figure** 2.2.4-2
JOB No: VE52420	QA/QC: WR	PDF FILE: Mine Site General Arrangement.pdf
AI FILE: Mine Site General Arrangement.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

\\Bjv-fs2\bjv-ee-gis\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\Other\ProjectDescription\KP\Mine Site General Arrangement.mxd

2.2.4.3.4 Design Basis and Operating Criteria

The mine water requirements included the following:

- Davidson Creek in-stream flow needs;
- Davidson Creek flushing flows;
- Process plant and site fresh water needs (e.g., gland water, reagent mixing, etc.);
- Reclaim water to support mineral processing in extreme dry conditions (minimum surplus capacity); and
- Additional water for flooding waste rock in the TSF, if required.

A design flow rate of 2,400 m^3/h was selected to minimize the required storage capacity for normal operation of the system. Standard pipe sizes of 610 mm steel or 750 mm HDPE will accommodate this flow rate.

Storage will be needed as a contingency in the event of system repair or maintenance. Minimum surplus capacity has been sized to ensure the system will have additional pumping capacity and availability to provide an additional 3 Mm^3 of water per year as a contingency against a series of extremely dry years. The derivation of the required minimum surplus capacity is discussed in **Section 2.2.3.5.3**.

The design flow rate of the system is largely driven by the instream flow needs (IFN) for fish in lower Davidson Creek. IFN will be supplied to Davidson Creek from the preproduction period, when Davidson Creek is cut off at TSF Site D, through the operational life of the Project and closure phase until post-closure, when the open pit and TSF will be discharging water of suitable quality for release to Davidson Creek.

2.2.4.3.5 Tatelkuz Lake Intake

Three lake intake structure options were considered in the design of the FSS:

- A submersible pump unit;
- A floating barge structure; and
- A land-based wet-well structure.

Submersible motors have limited power capacity and, given the high flow rate and elevation increase requirements, were considered impractical. The floating barge structure was a viable option, however the wet-well concept was considered superior and was selected for the feasibility design for the following reasons:

- The lake level variation analysis determined that it operates within a relatively small and manageable range;
- The wet-well offers simple year-round maintenance access;

- The wet-well will have less impact on the riparian zone and be more aesthetically pleasing, since the intake screens would be below lake level and the intake pipelines would be underground; and
- The cost is lower than the other alternatives.

For the FS design, the wet-well will be a permanent, two-level concrete structure constructed on the shore of Tatelkuz Lake. The lower level will be an 8 m to 12 m deep wet well chamber, with a plan area of approximately 6 m x 10 m, fed by two 610 mm directionally drilled HDPE pipeline intakes, each approximately 50 m long and equipped with a fish screen. The upper level concrete structure will serve as the pump house floor and is twice the size in plan as the wet-well chamber. Four 525 kW vertical turbine pumps (three operating, one installed spare) will be mounted on the pump house floor and will draw a continuous supply of water from the wet-well chamber. The water will be pumped to booster station 1.

2.2.4.3.6 Freshwater Supply Pipeline and Booster Pump Stations

The pipeline to the mine site will be a combination of 610 mm diameter standard steel pipe, to be used for the initial high-pressure sections closest to the booster pump station, and 710 mm diameter HDPE DR17 pipe for the rest. The pipeline will be buried with a nominal cover of 600 mm of random fill, either by excavation or soil-mounding above grade, for basic protection from fire and tampering.

The section of pipeline from the lake to the freshwater reservoir will be approximately 13.6 km long. One booster pump station (booster station 1) will be required to reach the reservoir. The segment from the intake to booster station 1 will comprise 3,000 m of steel pipe and 3,000 m of HDPE pipe, and the segment from the booster station to the freshwater reservoir will comprise approximately 3,900 m of steel pipe and 3,800 m of HDPE pipe. Booster station 1 will be approximately 6 km from the lake.

Reclaim water to mitigate deficit conditions in the TSF will be drawn directly from the freshwater pipeline when surplus capacity is available in the system. Water will be taken from the main line with a booster pump station. This pump station will be operated only as a contingency in the event of extreme dry conditions at the mine site, or if additional water is required to saturate the PAG waste in the TSF. Electrical power to pumps will by via a 25 kV overhead line and step down transformers.

2.2.4.3.7 Freshwater Reservoir

The freshwater reservoir will be an in-creek waterbody downstream of the final seepage collection point at the ECD. The reservoir will be created by constructing a dam approximately 14 m high across Davidson Creek. The embankment is designed as a water-retaining structure and will have a low-permeability Zone S with appropriate filter zones and random fill in Zone C. The freshwater reservoir will have a storage capacity of approximately 400,000 m^3. A spillway will route storm flows through the reservoir and around the dam. The spillway is designed to manage the 1:200-

year, 24-hour storm in accordance with Dam Safety Guidelines (CDA, 2007) for a SIGNIFICANT consequence dam.

Reservoir slopes will be covered with rip-rap or otherwise protected to prevent sediment-laden water from being released downstream. Appropriate sediment control BMPs will be implemented on natural drainages entering the reservoir to ensure the success of the water management plan. The size of the reservoir was based on an estimate of contingency storage required for a reasonable range of possible malfunctions in the FSS.

2.2.4.3.8 Temperature and Flow Control System

Water will be discharged from the freshwater reservoir to Davidson Creek through two pipelines near the downstream toe of the dam: a 150 mm diameter pipe for the IFN flows and a concrete-enclosed 610 mm diameter steel pipe for flushing flows (channel maintenance). The discharge outlet will be equipped with a fish screen and filter diaphragm and will discharge to a rip-rap-lined outfall channel to dissipate energy and to assist with aeration to raise dissolved oxygen levels in the discharged water.

2.2.4.3.9 Water Supply Access Road

A route study and cost estimate was completed for road access to support the freshwater supply pipeline and ancillary 25 kV power line. The route considers a combination of the shortest road distance using existing road infrastructure and construction of an all-season forestry road. The road will parallel the freshwater supply pipeline for a total of 13.3 km, of which 1.6 km will be new construction and 11.7 km existing. The remainder of the pipeline will parallel the mine access road. The finished road will be 6 m wide and gravel-surfaced, suitable for year-round access to the FSS.

2.2.4.4 Transmission Line

The Project will require up to 120 MW of power. A 140 km, 230 kV overland transmission line will be constructed to connect the Project to the BC Hydro grid at the Glenannan substation located near the existing Endako Mine, 65 km west of Vanderhoof. This option is consistent with the BC Hydro Draft System Impact Study commissioned by BC Hydro and presented in **Annex 8** of **Appendix 2.2A**: Proposed Blackwater Gold Project – Project Description Supporting Reports. The study identifies upgrades that would be required to the substation as well as requirements for system reinforcement, which have been incorporated into the costs of the Project. The transmission line is briefly described in this section, and further details are provided in **Appendix 2.2A-8**.

The width of the transmission line ROW will vary depending on the area traversed by the line as discussed in **Appendix 2.2A-8**, and listed in **Table 4.1** of the Appendix:

- 40 m for standard spans;
- 50 m for long spans; and
- 30 m within private parcels.

The effects assessment is based on a width of 40 m for the ROW with a footprint of 560 ha. A buffer of 50 m from either side of the edge of the ROW was used to define a 140 m wide corridor to provide the engineering team with the flexibility to adjust the transmission line alignment during preparation of the final engineering design. The transmission line ROW and corridor are illustrated in **Figure 4.3-1** (**Section 4** – Assessment Methodology). For the effects assessment, it was assumed that the whole width of the transmission line ROW will be disturbed to accommodate the transmission line poles and access roads that run the entire length of the ROW. This assumption is considered conservative because not all of the vegetation will be removed and the Proponent will make efforts to avoid the removal of sensitive ecosystems.

A supplemental effects assessment was completed in June 2015 to provide discussion and analysis of the potential effects of the transmission line access roads on VCs that could be affected by upgrading or new construction (**Appendix Supplemental Report**). The VCs discussed included: fish and fish habitat; heritage; wildlife and wildlife habitat; soils, terrain and surficial geology; vegetation; wetlands; Non-traditional Land and Resource Use (NTLRU) and Current Land and Resource Use for Traditional Purposes (CLRUTP). Assessment methodology followed that of the Application (**Section 4.0**).

In the Tatelkuz Lake Ranch Resort area, the transmission line alignment will be constructed as close as possible to the Kluskus FSR through this area in order to avoid crossing private lands (PID 010105255, 010105352 and 009280481) located to the north of Tatelkuz Lake. There is a private airstrip located at the northern end of PID 010105255 close to the FSR. Steel towers and short spans will be used to avoid effects to aircraft due to the height of the towers (**Appendix 2.2.A-8**).

Potential effects on private land as a result of the transmission line are described in **Section 7.2.6.4.5.7** Land Ownership in the NTLRU Valued Component.

The transmission line has been routed to use existing road access (such as the Kenney Dam Road) and cross recently logged areas as much as practical along its alignment (**Figure 2.2.1-1**). The major water crossings and connections to existing FSRs include:

- km 6: crossing at Stellako River;
- km 25: joining the Holy Cross FSR;
- km 37: crossing north of Tahultzu Lake;
- km 48: crossing at Nechako River;
- km 52: crossing at Kenney Dam Road;
- km 57: joining the East Swanson Road; and
- km 79: joining the Kluskus FSR.

No bridges will need to be constructed to cross the Nechako or Stellako rivers, and the transmission line will be clear span across these rivers.

2.2.4.4.1 Transmission Line Access Roads

Figures 2.1 to 2.18, in **Appendix 2.2A-8**, identify proposed new access roads and access road upgrades that will be required to construct and maintain the transmission line. All temporary roads will be deactivated once construction is completed; permanent roads will be required for on-going maintenance throughout the mines life.

The proposed location of the permanent and temporary access roads required for the construction and maintenance of the transmission line is based on engineering information contained in **Appendix 2.2A-8**.

Approximately 92.43 km of new roads and 41.6 km of exisiting roads requiring upgrades will be constructed at the following locations along the transmission line:

- km 7 to km 11 several access tracks;
- km 17 to km 19 several access tracks;
- km 23 to km 25 several access tracks;
- km 32 to km 43 several access tracks; and
- km 55 to km 80 several access tracks.

Assuming the width of the transmission line access road ROW will average 20 m, permanent new roads will disturb approximately 185 ha. The existing roads requiring upgrades will disturb approximately 83 ha. The estimate of surface disturbance is considered to be conservative as the actual design width of the roads will be 15 m with an optimal width of 20 m.

All access roads (except active drive surfaces) will be hydroseeded after construction. As prescribed in the Vegetation Management Plan, **Section 12.2.1.18.4.4** commitment, no herbicides will be used. Temporary roads are not normally expected to require maintenance (outside of repairs from frost heaves or unexpected temporary flooding); permanent roads will be periodically graded to maintain running surface integrity.

The final location of the transmission line access roads are to be determined during the detailed engineering and permitting stage, and will consider traditional knowledge and traditional use information provided by Aboriginal groups (**Section 17.1.3**), as such information becomes available.

2.2.4.4.2 Transmission Line Re-Routes

Two potential reroute sections are being considered. Potential reroutes are shown in green (Mills Ranch re-route (also referred to as the Tatelkuz Lake Ranch re-route) and orange (Stellako re-route) on **Figure 2.2.1-1**.

As stated in **Section 7.2.6.3.7.11**, the Mills Ranch re-route alternative of the current transmission line alignment is located at the southern end of the transmission line near the Chedakuz Creek and Tatelkuz Lake. The re-route was chosen to create a suitable buffer between the transmission line and the Tatelkuz Lake airstrip.

The primary advantage of the Mills Ranch re-route option (green line) would be to avoid affecting an airstrip on private property, the Tatelkuz Lake Ranch Resort (also referred to as the Mills Ranch) on Chedakuz Creek (refer to Figure 3.9-2 in **Appendix 7.1.2A** Non-Traditional Land Use 2013 Baseline Report). The primary disadvantage of this route is that it will disturb a larger area and cross through a series of wetlands. If this option is not chosen, minor realignments may still occur at the Chedakuz Creek crossing along the Kluskus-Ootsa FSR to avoid wetlands. This reroute option has a total footprint of 563 ha and would be 141 km in length.

The primary purpose of the Stellako re-route option (orange line) would be to minimize the area of the Stellako River Wildlife Management Area that would be crossed by the transmission line. However, as described in **Section 7.2.6.3.7.11** Transmission Line Re-Route Alternatives in the Non-traditional Land and Resource Use Valued Component, this option runs through private land parcel (PID 015135233). Potential effects and mitigation are discussed in **Section 7.2.6.3.7.11** Transmission Line Re-Route Alternatives in the Non-Traditional Land and Resource Use Valued Component section of the Application. This reroute option has a total footprint of 563 ha and is 141 km long.

These two transmission line re-route sections were considered in the effects assessment as potential alternatives to the base case transmission line alignment. The total footprint of the transmission line applying both reroutes is 565 ha and is 141 km long. Finalization of the transmission line alignment will occur prior to the permitting stage.

2.2.4.4.3 Tree Management Zone

The tree management zone refers to the area where trees will be removed in unlogged areas to construct the transmission line and where clearings will be maintained to protect the integrity of the line. The anticipated amount of clearing required accounts for the widths quoted above for the transmission line ROW.

Appendix 2.2A-8 discusses this tree clearing requirements and illustrated in Figure 4.17 of that Appendix. Where hazard trees are encountered (as determined by a qualified arborist) Worksafe BC regulations for hazard tree removal will be followed as outlined in Guideline G26.11. In general, BC Hydro guidelines for right-of-way maintenance will be followed for work in riparian zones and for vegetation management (BC Hydro 2003, 2010). The Vegetation Management Plan (**Section 12.2.1.18.4.4**) is consistent with BC Hydro 2010.

2.2.4.5 Transportation of Dangerous Goods

Table 2.2.4-4 presents a summary of the currently proposed on-hand volumes (i.e., on-site storage capacity) and transportation volumes for the main dangerous goods that will be used during the construction and operation phases of the Project. If changes to these volumes are required, as determined during detailed engineering, the permits required for the transportation and storage of these goods will be adjusted accordingly.

Table 2.2.4-4: On Hand and Transportation Volumes for Dangerous Goods

	On-Hand Volumes (On-Site Storage Capacity)		Transportation Volumes[3]	
	Construction	**Operations**	**Construction**	**Operations**
Fuel[1]				
Diesel	600,000 L in six 100,00 L storage tanks	1,000,000 L in ten 100,000 L storage tanks	Two to three trucks per day	Three trucks per day
Gasoline	Three 34,000 L tanks	Three 34,000 L tanks		Less than one truck per day
Explosives[2]				
Ammonium Nitrate (AN)	160 tonnes	160 tonnes	n/a	Three trucks per day
Emulsion	80 tonnes	80 tonnes		
Ore Processing Materials[2]				
Sodium Cyanide (NaCN)	n/a	200 tonnes in ISO tainers and some back-up bag and boxes	n/a	Two trucks per day
Bulk Lime	n/a	300 tonnes in one silo	n/a	Two trucks per day
Molten Sulphur	n/a	150 tonnes	n/a	One truck a day
Copper Sulphate	n/a	10 tonnes	n/a	Less than one truck a day

Notes: n/a = not applicable or not used during the Project phase;
(1)Fuel will be transported by 40,000 L capacity tanker trucks;
(2)Explosives and Ore Processing Materials will be transported in 20 tonne to 40 tonne trucks;
(3)During Spring breakup between April and the mid May or as road conditions allow, smaller loads will be required to meet weight restrictions (50% to 70% of axle weight)

Goods to be transported on highways and FSRs will be checked against federal TDG classifications under the Canadian *TDG Act* and operation phases of the Project. If changes to this is required, as determined during detailed engineering, the required permits for the transportation and storage of these goods will be obtained accordingly. TDGs will be undertaken according to applicable international, federal, and provincial; guidelines, acts and regulations including, but not limited to, the ICMC (2012); EC's Environmental Code of Practice for Metal Mines (EC, 2009); Canadian *TDG Act* and Regulations, and BC *TDG Act* and Regulations. The manufacturing, transport, storage, and use of CN will adhere to the ICMC and follow EC's Environmental Code of Practice for Metal Mines. A HMMP (**Section 12.2.1.18.4.12**) and the CYMP (**Section 12.2.1.18.4.19**) address the management of dangerous goods and provide details of the applicable standards that the Project will adhere to.

2.2.5 Environmental Management System and Adaptive Management Approach

An Environmental Management System (EMS) will be used for planning and implementing Project activities in accordance with applicable environmental regulations and those specific requirements identified in the Project certificate of approval to operate. The EMS is summarized in this section and discussed in detail in **Section 12.1** of the Application. The environmental management plans and the adaptive management approach will be developed to ensure consistent management of the following materials associated with the Project and described in greater detail in the **Section 12.1**.

The scope of the EMS covers all aspects of mining and processing activity:

- Mining: designing and evaluating the ore reserve, and coordinating mining and waste. Waste will be used in constructing the TSF, and the ore delivered to stockpiles or directly to the crusher;
- Process Plant: crushing and ore processing, maintenance and deposition of tailings;
- Finance and Administration: Finance, Procurement, Warehouse, Information Technology, and Administration;
- Safety: Project site safety;
- Security: Project site security;
- Human Resources: employee recruitment and training, medical services, catering and personnel;
- Environment: monitoring, waste management, and Project site rehabilitation;
- Site Services: transmission line, freshwater supply pipeline, airstrip, and FSRs;
- Worker Health: workplace exposures and occupational disease; and
- Community Health: community exposures and other determinants of health and well-being.

The Proponent's operations are bound by its Health, Safety, Environment and Corporate Social Responsibility (HSE & CSR) Policy, and its HSE & CSR 15 Guiding Principles, which assist in developing a high level of environmental, safety, and community performance.

The Proponent's HSE & CSR Policy requires:

- Identifying, eliminating, or mitigating risks;
- Encouraging and supporting employees and maintaining a positive culture for health, safety, and the environment;
- Preparing adequately for emergencies or crises;
- Preparing and regularly updating closure plans;
- Providing appropriate training and development;

- No tolerance for discrimination or harassment;
- Identifying communities of interest and actively engaging them in an appropriate and transparent manner;
- Respecting cultures, custom, and rights of host communities; and
- Working with communities of interest to promote local sustainable development.

The Proponent will develop Project site policies and procedures that will meet the requirements of its corporate policies and principles.

The Proponent's EMS is based on its corporate 15 HSE & CSR Guiding Principles, Toward Sustainable Mining (TSM) standards, best practices, and ISO14001 requirements. The EMS is structured in a way that will encourage continual improvement and adaptability throughout the Project construction, operations, and closure phases. The EMS is based on a cyclical process of "Plan, Do, Check, and Act."

The EMS framework is based on ten elements illustrated on **Figure 2.2.5-1** and elaborated in **Section 12.1.5**.

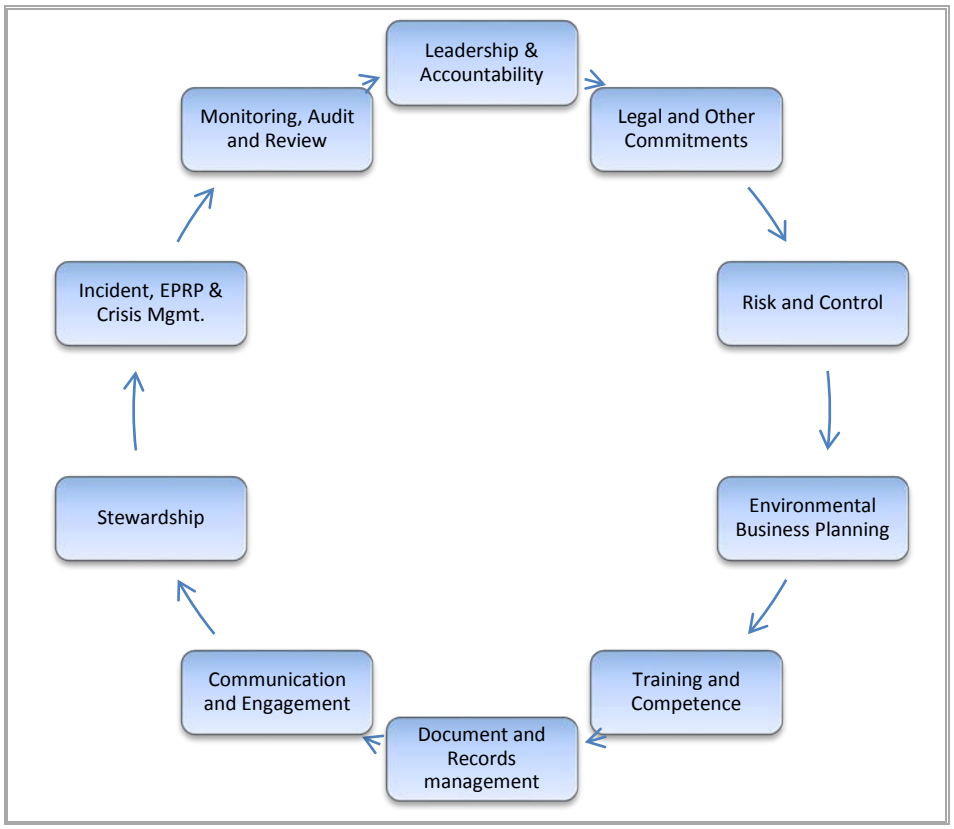


Figure 2.2.5-1: EMS Framework

2.2.5.1 Summary and Cross Reference

Atmospheric emissions management is summarized in **Section 2.2.3.6**; the air quality management plan can be found in **Section 12.2.1.18.4.9**. Emissions from fixed sources (incinerator, standby generators, refinery) will meet applicable guidelines. Fugitive dust will be controlled by watering or application of approved dust suppressants.

Mine water management is discussed in **Section 2.2.3.5**; the mine water management plan can be found in **Section 12.2.1.18.4.18**. Mine water will be controlled during construction with sedimentation control ponds to limit export of suspended sediment to meet *Metal Mine Effluent Regulations* standard of 15 mg/L average, 30 mg/L maximum. During operation and early closure the principal facility for treatment of mine water will be the TSF which will have no surface discharge and very limited seepage (uncaptured seepage estimated at 2 L/s). All site contact water including that from external waste rock dumps will be directed to the TSF. At post closure when receiving environment guidelines or site-specific water quality objectives are met, surface water will be discharged from the TSF.

Management of waste water (domestic sewage and grey water) is discussed in **Section 12.2.1.18.4.10**. Two sewage treatment plants are planned for operations: the existing camp sewage treatment plant will be moved during operations to service the process plant and mine site area, and a new plant established to service the construction and operations camps. Discharge of treated sewage from the construction and operations camp will be to a rapid infiltration basin which will discharge to ground and is assessed not to affect surface waters. Treated sewage from the process plant and other mine site facilities will be discharged to the TSF.

Management of solid waste (non-hazardous) is discussed in **Section 12.2.1.18.4.11**. Kitchen wastes will be incinerated; industrial waste will be recycled to the extent possible and the remainder landfilled at a site located within the West Dump or backhauled from the site.

Management of solid mine waste is summarized in **Section 2.2.3.4**; the mine waste management plan can be found in **Section 12.2.1.18.4.17**. PAG rock as well has NAG rock with a significant potential to leach Zn will be submerged in the TSF or left in the bottom of the pit. Other waste rock will be placed on land in the East and West Dumps where drainage will be directed to the TSF. Overburden will be placed in the on-land waste dumps with a portion from the East Dump used in final reclamation.

Management of hazardous wastes is discussed in **Section 12.2.1.18.4.12**. Hazardous wastes will be collected in secure areas and either returned to suppliers (e.g., lead batteries) or shipped with a hazardous waste contractor to a licensed hazardous waste treatment facility.

2.2.6 Project Schedule

The Proponent completed a FS in Q4 of 2013 (New Gold, 2014). The Application for the Project will be submitted in Q2 of 2014. Provincial and federal EA approvals are expected during 2014.

The construction phase of the Project is expected to take two years. With the current resource estimates, approximately 344 Mt of ore will be mined and processed at a rate of 60,000 t/d (22 Mt/y). A duration of 17 years is expected for the operations phase. The closure phase will start once the operations are finished and will take approximately six to seven years, and the post-closure phase will begin once the closure activities are completed. **Table 2.2.6-1** shows the schedule for the Project.

Table 2.2.6-1: Project Schedule

Activity	Expected Timeframe
Pre-construction	
Announcement of the Project	
Filing of the Project Description to initiate Environmental Assessment	
Start of field studies	May 2011
Submission of Application for the Environmental Assessment Certificate to BC Environmental Assessment Office	Q3 2014
Submission of Environmental Impact Statement to Canadian Environmental Assessment Agency	Q3 2014
Receipt of Provincial and Federal Environmental Assessment approvals	Q2 2015
Receipt of construction related permits	Q4 2015

Table 2.2.6-2 and **Table 2.2.6-3** provide more details on the Project schedule itemizing what activities will be carried out for the mine site and off-site facilities and in which phase.

Construction activities will be year round, but temporarily halt for storm precipitation events if required. Operation activities will be year round. Adjustments to transportation will take into account road restrictions during breakup (reduced loads). Requirements for freshwater will vary seasonally to maintain instream fish needs in Davidson Creek. Revegetation activities for progressive reclamation will be timed to the appropriate season for planting (usually mid to late spring). Closure activities will be year round with the same considerations as for operations. Decommissioning activities that involve surface disturbance will be avoided during storm precipitation events where possible. Post closure activities will be periodic and not seasonal dependent.

Table 2.2.6-2 : Project Activities by Phase Associated with the Mine Site

Project Phase	Project Component	Project Activity
Construction (Years -2 and -1)	Site Infrastructure and Site Roads	Clearing, grading and topsoil salvage, construction and laydown areas, surface drainage controls, construction of site infrastructure (fuel site, warehousing and materials storage, construction laydown area, truck stop, camp and maintenance buildings, explosives facility), camp waste management system (site landfill and domestic sewage system), initial starter pit construction.
	Process Plant Site	Clearing and construction of ore processing area (plant site, mill and processing area, core logging area) foundations and building construction, crusher, and conveyor and LGO stockpile.
	Waste Rock Area	Mine waste rock dumps construction
	TSF	Clearing, grading and topsoil salvage, construction of TSF (tailings and return water lines), construct dams and collect water, Site C west dam, Site C main dam, Site D main dam and embankment
	Wetland and Water Management System, Freshwater Reservoir	Construction of water management system (site surface drainage management, erosion and sediment control, water recovery and recycle system from TSF)
	Borrow Sites	Development of borrow sites (Site C main dam, esker borrow source and screening plant)
Operations (Years 1 to 17)	Site Infrastructure and Roads	Worker accommodations operation, hazardous materials management (waste, explosives, spills), camp and offices waste management
	Mine Pit	Drill, blast, excavate, transport ore
	Ore Processing Area	Process area operations
	Waste Rock Area	Mine waste rock dump placement
	TSF	TSF ongoing development and operations
	Wetland and Water Management System, Freshwater Reservoir	Water management system operation and maintenance
Closure (Years 18 to 35)	Site Infrastructure and Roads	Decommission, dismantle and remove equipment (conveyors, crusher, warehousing, fuel storage, truck stop), reclaim areas of soil contamination, implement reclamation plan (grade and level site, implement erosion and sediment control features and spread OVB and topsoil)
	Mine Pit	Construct rock safety berm, spillways, and channel to TSF, OVB in bench flats, fertilize pit water while filling if required
	Ore Processing Area	Decommission, dismantle, and remove equipment
	Waste Rock Areas	Regrade, construct drainage control swales, cover, and revegetate

Project Phase	Project Component	Project Activity
	TSF	Area C: Remove pumps/pipelines, cover, wetland and upland beach revegetation, outlet connection, reseed downstream slope, and decommission seepage sump Area D: Pump supernatant and Tatelkuz Lake water to pit, construct spillways, cover, deflector berm, outlet connection
	Wetland and Water Management System, Freshwater Reservoir	Monitor water quality
Post-Closure (Years 35+)	Site Infrastructure and Roads	Monitor reclamation
	Mine Pit	Discharge pit water overflow to TSF
	Ore Processing Area	Monitor reclamation
	Waste Rock Area	Monitor reclamation
	TSF	Monitor reclamation
	Wetland and Water Management System, Freshwater Reservoir	Fill seepage ponds and ditches, and revegetate ECD and Water Reservoir: Breach dams and construct rip-rap channel, regrade dams, revegetate, reshape basins and wetlands for seepage treatment. Monitor water quality.

Table 2.2.6-3: Project Activities by Phase Associated with Off-Site Facilities

Project Phase	Project Component	Project Activity
Construction (Years -2 and -1)	Mine Access Road	Site clearing, grading and topsoil salvage, road and laydown area construction including transfer and placement of granular materials and stream crossings. Transportation of workforce and materials.
	FSR	Road upgrades. Transportation of workforce and materials.
	FSS	ROW clearing and grading, timber salvage and soil management, facilities construction (pumphouse, water intake, electrical hook-up), road construction, installation of water pipeline and freshwater reservoir. Transportation of workforce and materials.
	Airstrip	Site clearing and grading, timber and soil salvage, construction of runway and construction of airstrip ancillary facilities (service road installation and site infrastructure). Transportation of workforce and materials.
	Transmission Line[(1)]	ROW clearing and preparation, vegetation clearing, construction of access roads, installation of power line (pole foundations, poles and cable stringing). Transportation of workforce and materials.
Operations (Years 1 to 17)	Mine Access Road	Transportation of workforce and materials and maintenance
	FSR	Maintenance and transportation of workforce and material
	FSS	Pumping of water and maintenance of system
	Airstrip	No regular scheduled flights
	Transmission Line	Maintenance
Closure (Years 18 to 35)	Mine Access Road	Maintenance
	FSR	Maintenance
	FSS	Pumping of water and maintenance of system
	Airstrip	No regular scheduled flights
	Transmission Line	Decommissioning and removal of cables and poles, implement reclamation plan (recontouring and revegetation)
	Airstrip	Decommissioning of the airstrip (unless responsibility assumed by a third party) by implementation of the reclamation and closure plan, including ripping the surface and revegetating
Post-Closure (Years 35 +)	Mine Access Road	Maintenance and occasional transportation of people
	FSR	Occasional transportation of people
	FSS	Decommissioning of the freshwater reservoir
	Airstrip	None
	Transmission Line	None

Note: [(1)] Possible small modifications of the transmission line ROW will be carried forward in the effects assessment (discussed in **Section 2.2.4.4**) and would be finalized through the assessment process prior to construction. Major alternatives to the Project base case are discussed in **Section 2.5**.

2.2.7 Human Resources

2.2.7.1 Human Resources Policies

The Proponent human resources policies are discussed below.

2.2.7.1.1 Procurement Policy

All the Proponent's operations and projects preferentially hire locally and engage local services wherever possible as a means to create local direct and indirect economic benefits. Local hiring and purchasing generally makes good business sense. In addition, the Proponent provides apprenticeship training and education opportunities, and supports training programs locally and regionally, all to develop career options in mining for local community members.

Where possible, contracts will be broken into discrete parts manageable by local contractors. For those contracts amendable to division, preference will be given to local contractors who can provide competitive pricing and deliver the quality required for the contract.

2.2.7.1.2 Hunting, Fishing, and Firearms Policy

As a condition of employment, employees on the Project site will not be allowed hunting and fishing. Firearms will not be allowed on site, and use of firearms on the mine site will be considered cause for dismissal.

2.2.7.1.3 Alcohol and Drugs Policy

The Proponent has a policy of no drug and alcohol use on the Project site, which will be rolled into mining phases. Drug testing is required of all employees and contractors on the Project site. Drug testing is carried out by a service in Prince George, or can be arranged by the employee or contractor at another location. Proof of testing is required prior to entry to the Project site.

Consumption of alcohol at the Project site will be considered cause for dismissal.

2.2.7.1.4 Workplace Harassment Policy

A zero-tolerance policy will be in effect with respect to discrimination, workplace harassment, and violence. Project employees will be informed of the Proponent's Diversity and Fair Labour practices as stated in its Corporate Responsibility.

Employees will be encouraged and obliged to report any potential or suspected violations of the code either through Human Resources or the Proponent Whistleblower Hotline. The Whistleblower Hotline is anonymous and handled by a third party to encourage employees who may not file reports otherwise. The specific methods for reporting a grievance will be communicated in a broad manner to all employees.

2.2.7.2 Organization

The Proponent's operations management structure for the Project is illustrated on **Figure 2.2.7-1**. Information on corporate management is provided in **Section 12.1**. At this stage of the Project, mine site staff have not been engaged.

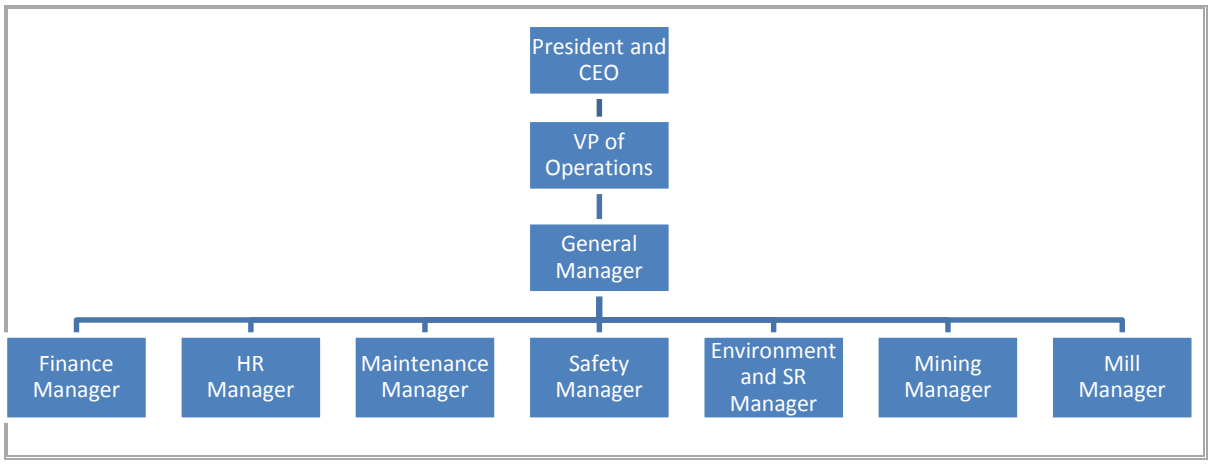


Figure 2.2.7-1: Proposed Operations Management Structure

2.2.7.3 Construction Workforce

The construction workforce is forecast to peak at about 1,500 people at Year -1. About 20% of the construction workforce will consist of construction managers and supervisors. Another 30% will be tradespeople, including electricians, plumbers, pipefitters, welders, instrumentation specialists, and insulators. About 40% will be equipment operators and labourers, with the remaining 10% being indirect employment associated with operating the camp and other temporary activities. **Figure 2.2.7-2** shows the estimated workforce numbers through the construction phase.

Figure 2.2.7-2 is based on an earlier workforce estimate of about 1,200, but the proportions will not be different with a 1,500-person workforce.

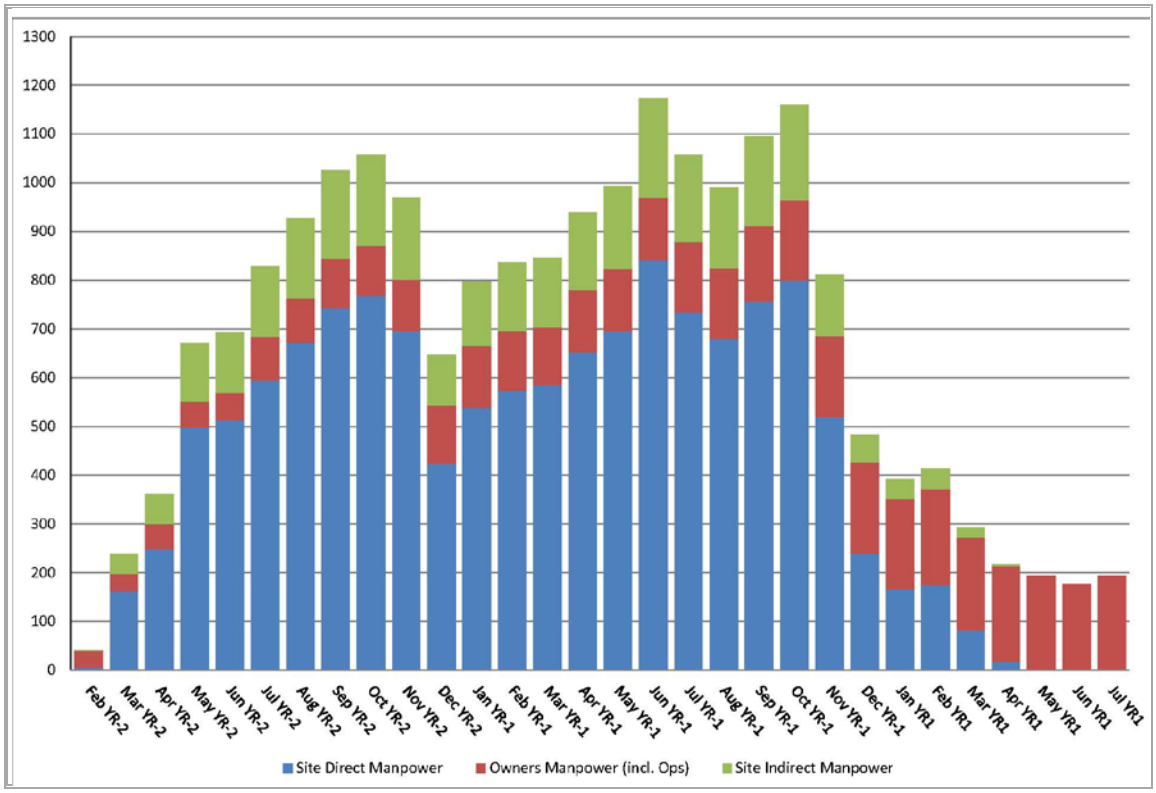


Figure 2.2.7-2: Construction Workforce

2.2.7.4 Operations Workforce

The workforce required to support mine operations includes personnel for mine operations, mine maintenance, mine engineering, and geology. Other areas such as plant operations/maintenance and environmental management are covered in their respective sections.

2.2.7.4.1 Salary Personnel

The Proponent's salaried personnel will be responsible for management and technical aspects of the operation, including mine management, mine engineering, mine maintenance, geology, and mine operations. During full production, the number of salaried mine personnel on site will typically be 44. A small number of salaried personnel will be hired in the year prior to production to assist during the construction phase of the Project.

Table 2.2.7-1 provides a breakdown of the positions and estimated numbers of staff required for the operation.

Table 2.2.7-1: Operations Mine Personnel

General and Administrative	No.	Process	No.
General Manager	1	Mine Operations	32
General Manager Administrator	1	Operations Supervisor	4
Administration Superintendent/Controller	1	Day Crew/Refinery/Tailings	12
Mine Accountant	1	Mill Trainer	2
Accounts Payable Clerk	2	Reagent Crew	4
Information Technology (IT) Supervisor	1	Superintendent	1
IT Technician	2	Mill Manager	1
Human Resources (HR) Manager	1	Senior Metallurgist	1
HR Supervisor	1	Metallurgist	2
HR Assistant	1	Administrator	1
Community Relations Advisor	1	Maintenance Crew	20
Logistics Superintendent	1	Maintenance Supervisor	1
Purchasing Officer	2	Maintenance Planner	2
Warehouse Supervisor	1	Electrical/Instrument Technician	4
Warehouse Technician	4	Process Control/Electrical Engineer	1
Safety Manager	1	Maintenance Superintendent	1
Medical Officer/Emergency Response	2	Laboratory Technician	15
Security Officer	5	Chief Chemist	1
Trainer	1	**Total**	**105**
Environmental Manager	1		
Environmental Officer	2		
Total	**33**		
Salaried Mining	**No.**	**Hourly Mining**	**No.**
Mine Manager	1	***Mine Operations***	
Secretary	1	Drill Operator	24
Mine Operations		Shovel Operator	12
Mine Superintendant	1	Loader Operator	4
General Foreman	1	Haul Truck Driver	120
Mine Shift Foreman	4	Track Dozer Operator	20
Blasting Foreman	1	Wheel Dozer Operator	8
Mine Clerk	1	Grader Operator	12
Mine Trainer	2	Service Crew	12
Mine Maintenance		Blasting Crew	8
Maintenance Superintendant	1	Dispatch Operator	4
Maintenance General Foreman	1	Laborer	4

General and Administrative	No.	Process	No.
Salaried Mining	**No.**	**Hourly Mining**	**No.**
Maintenance Shift Foreman	4	***Mine Maintenance***	
Maintenance Planner	1	Mechanic	57
Maintenance Trainer	2	Mechanic's Helper	29
Maintenance Clerk	1	Welder	24
Mine Engineering		Electrician	20
Senior Mine Engineer	1	Fuel & Lube Worker	8
Mining Engineer	3	Tire Worker	8
Geostatistician	0	Labourer	4
Surveyor	1	Utility Worker	38
Surveyor Helper	2	**Total**	**416**
Clerk	1		
Mine Geology			
Senior Mine Geologist	1		
Mine Geologist	3		
Senior Geotechnical Engineer	1		
Geotechnical Engineer	1		
Sampler	4		
Clerk	1		
Total	**41**		

2.2.7.4.2 Hourly Personnel

Hourly personnel will be responsible for direct mine and process operations, including ore and waste excavation and haulage, mine maintenance, and mine support. It is expected that personnel will be employed directly by the Proponent.

The Proponent plans to hire most operations employees from the local area, although a smaller percentage of personnel are expected to be brought in from elsewhere to meet the demand for skilled workers. Training will be required as new personnel are hired.

Hourly personnel will typically work 12-hour shifts, with the exception of shovel operators who work 12.5-hour shifts to assure loading equipment availability.

2.2.7.5 Work Schedule and Transportation

The shift schedule for salary personnel will depend on their position. Mine operations supervisors will work with the production crews; supervisors and production crews are responsible for a 12.5-hour shift. Most of the engineering staff, superintendents, and administrative/clerical personnel will work a 12-hour shift.

Hourly workers will work a 2-weeks-in and 2-weeks-out rotation, and senior management staff will work a 4-days-in and 3-days-out rotation.

Buses will transport personnel to and from the Project site via the Kluskus FSR. During construction when there will be up to 1,500 people at the peak, there will be up to three buses per day. During operations, when numbers will drop to about 500, there will be on average one bus per day. These numbers are estimates and subject to change. Transportation of personnel is discussed in detail in **Section 2.2.3.8.3.10**. On-site accommodations for personnel are discussed in **Section 2.2.3.7.3**.

2.2.7.6 Recruitment and Training

A number of strategic objectives related to recruitment, training, and employment have been developed in alignment with expectations of potentially affected communities and other stakeholders, as well as legislated requirements. These objectives include:

- Working with educational partners to provide training programs to develop a pool of skilled local employees, providing long-term sustainable benefits to the community and its members;
- Developing ongoing and collaborative working relationships to support future economic opportunities in the region;
- Providing a safe work environment for employees and contractors;
- Respecting cultural and regional diversity;
- Demonstrating fairness and mutual respect in all employment and business practices; and
- Upholding the Proponent values of “Integrity, Creativity, Commitment, Develop our Employees and Teamwork.”

In addition to meeting the regulatory and corporate requirements, the Recruitment, Training, and Employment Plan will be designed to:

- Mitigate potential direct and indirect adverse impacts identified in the impact assessment;
- Enhance opportunities related to potential positive direct and indirect impacts identified in the effects assessment; and
- Provide opportunities for local and regional communities as well as Aboriginal groups.

The Proponent recognizes that employment opportunities are a key social and/or economic benefit that the Project will bring to the region, and is committed to optimal use of local human resources in all phases of mine activity. To the extent possible, the Proponent will follow a transparent hiring policy and procedure that supports recruitment from Aboriginal groups and local communities.

Various mechanisms will be used by the Proponent to communicate available employment opportunities. These may include but not be limited to:

- Local and regional newspapers;
- Social media (e.g., Facebook, LinkedIn etc.);
- Posting opportunities in Aboriginal offices;
- Posting opportunities in Aboriginal group newsletters; and
- Career fairs held in Aboriginal and local communities.

Training efforts will be focussed on pre-employment training and training of Project employees, as well as the contractor workforce.

Training goals that guide developing and implementing the training strategy will include:

- Developing a workforce that meets recognized industry standards, competencies, and best practices;
- Developing the skills and capacity of Aboriginal workers and other local/regional workers;
- Developing transferable skills;
- Creating strong alliances and partnerships with community partners, learning institutions, and training providers; and
- Creating performance development plans for all employees that are linked to job competency requirements, personal development, and career aspirations.

The Proponent will implement two training strategies, pre-employment training, and on-the-job training.

2.2.7.6.1 Pre-Employment Training Strategy

A comprehensive training strategy and plan will be developed as operational planning progresses, negotiations with Aboriginal groups continue, and a skills inventory has been completed for the targeted local and regional hiring areas. Pre-employment training efforts will be based on an understanding of the employability skills and technical competencies required for Project construction and operations. The principles on which the training strategy will be based may include but not be limited to:

- Developing local and regional capacity to participate in mining employment;
- Developing locally involves training local people who do not have the skills required. Some ideas being considered include but are not limited to:
    - Working with training institutions such as College of New Caledonia and BC Aboriginal Mine Training Association to provide training programs;

- Partnering with local contractors to provide the Proponent's apprenticeship programs;
- Sourcing and training under-represented groups; and
- Offering scholarships as an incentive to graduate from high school.

- Hiring locally involves hiring local people who already have the skills to work in mining. Some ideas being considered include but are not limited to:
  - Advertising all positions locally, in addition to the Proponent's common advertising sites (e.g., New Gold website, Infomine, MABC careers page, Facebook, LinkedIn, and Twitter);
  - Advertising jobs on the Proponent's Intranet to attract internal candidates; and
  - Asking existing employees if they are aware of suitable candidates.
- Relocating to the region:
  - Relocating staff to supplement the local labour force provide skills not available locally, or when the local talent pool is exhausted.

Developing an understanding of the Proponent's labour requirements in relation to the potentially available local labour force will help to inform the training plan. This understanding will be aided through information gathered about LSA and RSA social and economic conditions during the EA process, as well as detailed information obtained through the skills database initiative.

The Proponent's corporate and site policies, work practices, and training standards will be shared with all contractors to ensure alignment of safe and equitable work practices.

2.2.7.6.2 On-The-Job Training

A variety of mandatory and elective training initiatives is proposed for employees of the Project. All employees will undertake certain training programs as part of their conditions of hire. These may include but not be limited to:

- Cross-cultural awareness training;
- Site-specific orientations; and
- A variety of short courses and training initiatives designed to meet occupational health and safety requirements (such as confined space, fall protection, or CN awareness training).

When appropriate and feasible, employees who join the Project as apprentices will be able to continue their apprenticeship program and be supported to complete their apprenticeships. New apprenticeship opportunities will be offered to employees as Project workforce requirements permit.

Each employee of the Project will participate in a performance development reviews and development plan sessions with senior staff or a designate of senior staff. This will result in a performance development plan that identifies future career goals and outlines training requirements. These plans will be tied to organisational succession planning efforts to ensure that the Project workforce continues to grow and develop as the Project progresses.

2.2.7.7 Employee Orientation

All employees, contractors, and visitors will be required to complete employee orientation. Employees and contractors will complete a full orientation that provides detailed information about health, safety, and the environment. If employees or contractors are continually away from site for a designated period, they will be required to repeat the orientation.

The health and safety portion of the orientation will focus around those requirements in the BC Health, Safety and Reclamation Code (*Mines Act*, 1996a). It will cover information such as policy requirements, emergency response, zero-tolerance, muster areas, legal and other requirements, safety requirements and procedures, and communication.

The environment and sustainability orientation will demonstrate employee and contractor requirements to maintain a high level of environmental performance on site. This orientation will provide employees and contractors with the basic required information in the environmental management plans. Environmental training will include details on the Proponent's Environmental Policy and their responsibilities under it, major risks in the workplace, and potential consequences for non-compliance with internal and external requirements.

2.2.7.8 Communications and Dialogue

2.2.7.8.1 Community

The Proponent begins to engage with local communities while a project is still in the development stage, and then continues to foster open communication with local residents and leaders, and other communities of interest throughout the mine's life and long after the mine's closure. At all times, the Proponent works to be a full partner in the long-term sustainability of the communities and regions in which the Proponent operates.

Wherever the Proponent's operations interact with indigenous peoples, the Proponent endeavours to understand and respect traditional values, customs, and culture. The Proponent takes meaningful actions to serve their development needs and priorities through collaborative agreements aimed at creating jobs, training, and lasting socio-economic benefits.

Shortly after the Proponent's acquisition of the Project, the Proponent began a comprehensive engagement planning process, working with experienced professionals to meaningfully engage with local communities including First Nations, governments, and regulators. The Proponent is actively engaged in dialogue with group leaders and representatives, working closely with them to make information on the Project available to all. The Proponent opened a local office in Vanderhoof and developed a Project policy that is supportive of a local hiring policy that includes local First

Nations. The Proponent has successfully demonstrated commitment to employing local and Aboriginal people during the exploration phase. In December 2012, 70% of employees were from the local area and 21% were Aboriginal persons.

To support local communities and share the benefits of company activities, the Proponent has developed a Community Donation and Sponsorship Policy, and distributed information on the policy. The Proponent is working with training institutions such as the BC Aboriginal Mine Training Association, the College of New Caledonia, and local school districts to create training programs that are tailored to Aboriginal people and future mine workers.

2.2.7.9 Sustainability Management Plan

A Project-specific sustainability management plan will be developed, based on the Proponent's corporate policies and principles and in engagement with local communities and First Nations prior to commencement of construction. The Project-specific sustainability policy will be an evolving guide to principles of operation for the Project and be congruent to the extent possible with the specific circumstances of the Project and the wishes and desires of the communities near the Project. Guiding principles for the Proponent's sustainable development policy are provided below.

The Proponent understands Social Responsibility as the way the Proponent contributes to sustainable development by acting ethically and with integrity, and by taking responsibility for the impacts of company decisions and actions on communities and the environment. The Proponent's Social Responsibility strategy includes commitments to excellence in the management of health, safety, environment, labour practices and community engagement and development through the mine life cycle, from early exploration through to development, operations, decommissioning, and mine closure. The Proponent's directors and senior managers support philanthropic and charitable organizations using their personal resources, and the Proponent makes significant contributions to all of its host communities in the form of donations and sponsorships to support education, health and wellness, economic diversification, job creation, and food bank initiatives.

The Proponent's HSE & CSR Policy describes the company's high-level commitments in these areas. The 15 HSE & CSR Guiding Principles provide a framework for the application of the HSE & CSR Policy and provide clear direction for developing and applying the company's HSE & CSR Management Systems at all levels. In 2012, the Proponent completed a review of these guiding principles and began implementing them through the development of management system standards. In 2012, the Proponent developed the Health and Safety Management System, and has recently developed the EMS and the Community Engagement and Development Management System. These are intended to provide clear and consistent guidance to sites in relation to the implementation of the HSE & CSR Policy.

2.2.7.9.1 Traditional Knowledge

The Proponent intends to seek and use Traditional Knowledge (TK) that is held by First Nations people who live and use the land and resources within the study area, to the extent practicable. In consultation with and permission from the First Nations groups, TK will be sought throughout the life of the Project. TK will be incorporated into the EA and permitting process. In particular,

information on biophysical, historical and other information as determined by the First Nations will help identify potential environmental effects, and lead to better decisions for improved Project design, construction, operations, closure, and remediation.

TK has the potential to strengthen mitigation measures; contribute to the building of enhanced relationships between the Proponent, First Nations groups, and/or responsible authorities; lead to better decisions; and contribute to the building of EA and TK capacity within First Nations communities.

2.2.8 Project Economics

2.2.8.1 Initial Capital Cost

Table 2.2.8-1 provides the estimated capital cost for the Project.

Table 2.2.8-1: Feasibility Study Project Development Capital Cost

Description	Cost ($ M)
Direct Costs	
Mining equipment and pre-production development	272
On-site infrastructure (Truck shop, Warehousing, Earthworks, etc.)	158
Process plant	600
Tailings facilities and water reclaim	86
Off-site infrastructure (transmission line, freshwater supply system, airstrip, etc.)	121
Access corridor	11
Total Direct Costs	**1,248**
Owner's Costs and EPCM	
Owner's costs	74
Engineering, Procurement and Construction Management	108
Indirect Costs	
Construction services, support and utilities	97
Construction camp and facilities	78
Freight and logistics	42
Other indirect costs	28
Total Indirect Costs	**245**
Total Owner's Costs, EPCM and Indirect Costs	**427**
Subtotal	1,675
Contingency	190
Total Project Development Capital Costs	**1,865**

2.2.8.2 Operating Costs

The estimated operating cost of the Project is summarized in **Table 2.2.8-2**.

Table 2.2.8-2: Base Case Feasibility Study Operating Costs

Description	Costs	
	(C$/t milled)	(C$/oz u produced)
Mining	5.33	247
Processing	7.2	333
G&A	1.43	67
Royalties	0.27	12
Refining	0.21	10
Transport and insurance	0.05	2
Cash costs	14.49	671
Silver byproduct sales at $22.00/oz	(2.01)	(93)
Total cash costs	12.48	578
Sustaining capital	1.99	92
All-in sustaining costs	14.47	670

Note: G&A = General and Administrative; C$ = Canadian dollars; C$/t = Canadian dollars per tonne; C$/oz = Canadian dollars per ounce

2.2.8.3 Sustaining Capital

The estimated sustaining capital cost for the Project is shown in **Table 2.2.8-2**.

2.2.8.4 Labour Costs

Annual labour costs for positions listed in **Table 2.2.7-1** are summarized in **Table 2.2.8-3**.

Table 2.2.8-3: Annual Labour Cost Summary

Department	Number of Employees	Annual Cost (C$M)
Mining salaried	up to 44	6.1
Mining hourly	up to 348	39.4
Processing (all)	105	12.8
Total	**497**	**58.3**

Note: C$M = million Canadian dollars

2.2.8.5 Economic Evaluation

An economic evaluation was prepared for the Project based on a pre-tax financial model. For the 16.4-year mine life and 344 Mt mill feed, the following Base Case financial parameters were calculated:

- Development capital cost C$1,865 million inclusive of a C$190 million contingency;

- First nine years – average annual gold production of 485,000 oz at total cash costs of C$555/oz and all-in sustaining costs of C$685/oz; and
- Base case economics – at C$1,300/oz Au, C$22.00/oz Ag and a 0.95 US$/C$ foreign exchange rate, the Project has a pre-tax 5% NPV of $991 million, an internal rate of return of 11.3% and a payback period of 6.2 years.

Table 2.2.8-4 provides a summary of commodity price and foreign exchange scenarios, with the following assumptions constant:

- Electricity rate of C$0.051/kWh; and
- Diesel cost of C$1.04/L.

Table 2.2.8-4: Summary of Feasibility Study Project Economics

Au Price ($/oz)	Ag Price ($/oz)	Foreign Exchange (US$/C$)	Pre-tax		
			5% NPV ($M)	IRR (%)	Payback Period (y)
1,150	20.00	0.93	403	7.8	7.5
1,300	22.00	0.95	991	11.3	6.2
1,450	24.00	0.97	1,582	14.4	5.1
1,600	26.00	1.00	2,120	16.8	4.5

Note: NPV=net present value; IRR=internal rate of return; $/oz = dollars per ounce; US$ = United States dollars; C$ = Canadian dollars; $M = million dollars; % = percent; y = years

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2.3 Provincial Scope of the Proposed Project

The scope of the proposed Blackwater Gold Project (the Project) for the purposes of the Environmental Assessment (EA) includes the components and activities described in the Project Description accepted by British Columbia Environmental Assessment Office (BC EAO) (AMEC, 2012). New Gold Inc. (Proponent) has considered all the components and activities identified with **Section 2.2** of the Application for an EA Certificate/Environmental Impact Statement (Application) and the Project Description document as part of the effects assessment.

BC EAO determined that the Project is reviewable under the *Reviewable Projects Regulation* as it has the potential for significant adverse effects. Therefore, an order was issued under section 10 (1)(c) of the BC *Environmental Assessment Act* (BC *EAA*), which determines that the Project requires an EA Certificate; and that the Proponent may not proceed with the Project without an assessment (BC EAO, 2012, **Appendix 2.3A**).

A section 11 Order was issued by BC EAO on 9 July 2013 (BC EAO, 2013a, **Appendix 2.3B**). Based on this section 11 Order, BC EAO defines the scope of the Project as consisting of the following on-site and off-site components and activities:

- Mine site;
- Open pit;
- Overburden and waste rock dumps;
- Ore and low grade ore stockpile;
- Topsoil stockpiles, borrow pits;
- Construction laydown area;
- Tailings Storage Facility (TSF) and associated structures;
- Water management structures, including site runoff, ditches, diversion, and sediment and erosion control;
- Plant site and facilities, including mill, conveyors, crushers;
- Construction and operations camps;
- Core logging area;
- Explosives manufacturing and storage facilities;
- Hazardous material storage and distribution;
- On-site roads;
- On-site infrastructure, facilities and services including:
    - Electrical substation and distribution;
    - Mine haul and access roads;
    - Truck shop;
    - Equipment and fuel storage areas and facilities;

  - Communications network;
  - Laboratories;
  - Safety and environmental control;
  - Potable water distribution and treatment;
  - Sewage treatment and disposal facilities;
  - Waste disposal facilities;
  - Non-hazardous waste incinerator;
  - Backup power generation facilities;
  - Gravel washing;
  - Screening and cement batch plants;
  - Maintenance;
  - Administration and warehouse facilities;
  - Emergency response facilities; and
  - Fire water distribution;
- Off-site Infrastructure:
  - Water supply intake, pump stations, pipeline, equipment and associated access roads;
  - Electric transmission line connecting the mine site with an existing substation and related access roads;
  - Upgrades to Kluskus and Ootsa Forest Service Roads (FSRs);
  - Transportation of workers, materials, and equipment along the FSRs to the mine site;
  - Site access roads, and new road to connect mine site with the existing FSRs; and
  - Other transportation infrastructure to service the Project including airstrip, helicopter pad, and related facilities.

A section 13 Order was issued by BC EAO on 13 March 2014 (BC EAO, 2014; **Appendix 2.3C**), which states that an off-site transload facility and rail spur lines that were originally part of the project components in the section 11 Order are no longer considered as Project components.

The Table of Concordance of this Application identifies where provincial requirements of the Application Information Requirements (AIR) (BC EAO, 2014a) have been addressed.

2.4 Federal Scope of Assessment of the Proposed Project

The Project Description for the Project was provided to the Canadian Environmental Assessment Agency (Agency) on 24 October 2012. The Agency determined the Project meets the definition of a designated project under the *Canadian Environmental Assessment Act, 2012* (*CEAA, 2012*) (Government of Canada, 2012) and that the Project Description meets the requirements of the *Prescribed Information for a Description of a Designated Project Regulations* (Agency, 2012a; **Appendix 2.4A**). On 20 December 2012, the Agency determined that a federal environmental assessment was required for the Project (Agency, 2012b).

Based on the Environmental Impact Statement (EIS) Guidelines (Agency, 2013; **Appendix 2.4B**), the Agency defines the scope of the Project to be assessed as the construction, operations, closure, and post-closure of the following project components:

- An open-pit mine;
- Waste rock and overburden dumps (non-acid generating (NAG) and potentially acid generating [PAG]);
- Low-grade ore (LGO) stockpile;
- Sewage water management facilities;
- Construction laydown area;
- Truck shop;
- Fuel storage facilities;
- Storage of dangerous goods other than oils and gas;
- TSF;
- Processing plant facility;
- Explosives manufacturing and storage facility;
- Construction and operations camps;
- Top soil stockpiles;
- Core logging area;
- Airstrip and air transportation service buildings;
- Water supply intake, pump stations, pipeline, and associated access roads;
- Temporary or permanent water diversions;
- Waste storage and disposal (hazardous and non-hazardous);
- Sedimentation/settling ponds;
- Power generator;
- Transmission line and right-of-way (ROW) and associated access roads;
- Temporary access roads during construction; and
- Mine access road.

The principles of the Canada-BC Agreement for Environmental Assessment Cooperation (BC EAO and Agency, 2004) will be carried out for the Project in the form of a coordinated federal – provincial process. On 6 May 2013, a project specific agreement between the Agency and BC EAO was published by the Major Projects Management Office (MPMO, 2014). Under the terms of this specific agreement for the Project, the Agency and BC EAO will coordinate to the extent possible the federal and provincial EAs in matters such as joint work planning for the review of the Application and consultation with Aboriginal groups and the Public. The federal assessment process is described in **Section 3.2** of this Application. **Section 2.9** provides the applicable federal approvals and decisions needed for the Project.

The Table of Concordance of this Application identifies where federal requirements of the EIS Guidelines (Agency, 2013) have been addressed.

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Appendix 2.5A: ERM Rescan Assessment of Alternatives for the Blackwater Gold Project Tailings Storage Facility

2.5 Alternative Means of Undertaking the Proposed Project

This section describes the methods used for assessing alternatives means for undertaking several components of the proposed Blackwater Gold Project (the Project) and presents the results on the assessment of alternatives.

2.5.1 Methodology

This assessment of alternative means of carrying out the Project considers alternatives to the following project aspects:

- Project itself (no project alternative);
- Mining;
- Mine Water Management – part of tailings disposal and management – Multiple Accounts Analysis (MAA) summary;
- Overburden and Low Metal Leaching non-acid generating (NAG) Mine Rock – MAA summary;
- Metal leaching (ML) and potentially acid generating (PAG) Mine Rock Disposal – MAA summary;
- Ore and mine rock transportation;
- Ore processing;
- Process plant effluent management;
- Tailings disposal/management – MAA summary;
- Fresh water supply;
- Solid waste management;
- Power supply;
- Aggregate sources;
- Site access and transportation routes;
- Airstrip location;
- Transmission line routing;
- Worker accommodations; and
- Worker transport.

2.5.1.1 Identification of Alternative Means to Carry Out the Project

Alternative means of carrying out the Project were initially screened against the following criteria (British Columbia Environmental Assessment Office [BC EAO], 2013):

- Alternative provides a viable solution to the problem or opportunity to be addressed;
- Alternative is practical, financially realistic and economically viable;
- Alternative uses or relies upon proven technologies at the scale required;

- Alternative is technically feasible at the scale required;
- Alternative is within the ability of New Gold Inc. (Proponent) to implement;
- Alternative can be implemented within the defined study area (where applicable) and required time frame; and
- Alternative has a reasonable expectation of being consistent with relevant environmental and planning objectives, policies, and decisions.

Only alternatives that meet all of the above screening criteria were brought into the detailed assessment of alternatives, as there is no merit in providing a more detailed evaluation of alternatives, which are, for example, not financially viable, not technically feasible, or not within the ability of the Proponent to implement.

A summary list screening of potential alternatives relative to the above criteria is provided in **Table 2.5.1-1**.

2.5.1.2 Assessment of Alternative Means Methodology

Evaluations of alternatives presented in this section are based on the development of a series of performance objectives and evaluation criteria. Performance objectives are meaningful attributes that are essential for Project success. The following performance objectives (or a subset thereof, as appropriate) have been used in the evaluations:

- Cost effectiveness;
- Technical applicability and/or system integrity and reliability;
- Ability to service the site effectively;
- Effects on the natural environment;
- Effects on the socio-economic environment; and
- Amenability to closure, reclamation, and post-closure management (if applicable).

For each performance objective, a set of three criteria is defined corresponding to preferred, acceptable, and unacceptable ratings, described in the following subsections.

Table 2.5.1-1: Screening Assessment of Potential Aspect Alternatives

Aspect	Alternative	Screening Criteria[1]							
		Provides Viable Solution to Problem	Practical and Economically Viable	Proven Technology	Technically Feasible	Within Ability of Proponent to Implement	Can be Implemented within Study Area	Consistency with Environmental and Planning Objectives	Retained for Detailed Assessment
Alternatives to the proposed Project	Proceed with the Project as planned	x	x	x	x	x	x	x	Y
	Delay development of the Project indefinitely			x	x	x	x		Y
	Do not proceed with the Project				x	x	x		Y
Mining Method	Open pit	x	x	x	x	x	x	x	Y
	Underground			x		x	x	x	N
Mine Water Management	Integrate mine water with TSF water management system	x	x	x	x	x	x	x	Y
	Separate dedicated mine water management system	x		x	x	x	x	x	N
Overburden and Low Metal Leaching NAG Mine Rock Management	Use for construction/reclamation	x	x	x	x	x	x	x	Y
	Place and manage adjacent to open pit	x	x	x	x	x	x	x	Y
	Place and manage remote from open pit	x	x	x	x	x	x	x	Y
	Establish a temporary stockpile and place back in the open pit at closure	x		x	x	x	x	x	N
PAG and Metal Leaching Mine Rock Management	Co-disposal with tailings in the TSF	x	x	x	x	x	x	x	Y
	Place and manage adjacent to open pit	x	x	x	x	x	x	x	Y
	Place and manage remote from open pit	x	x	x	x	x	x	x	Y
Ore and Mine Rock Transport	Haul truck	x	x	x	x	x	x	x	Y
	Conveyor			x		x	x	x	N
	Rail			x		x	x	x	N
Ore Processing	Whole ore cyanidation with or without gravity concentration	x	x	x	x	x	x	x	Y
	Flotation concentration in combination with cyanidation	x	x	x	x	x	x	x	Y
	Heap leach			x	x	x	x		N
	Use of lixiviants other than cyanide					x	x	x	N

Aspect	Alternative	Screening Criteria[1]							
		Provides Viable Solution to Problem	Practical and Economically Viable	Proven Technology	Technically Feasible	Within Ability of Proponent to Implement	Can be Implemented within Study Area	Consistency with Environmental and Planning Objectives	Retained for Detailed Assessment
Process Plant Effluent Management	In-plant SO_2/Air treatment of mill slurry	x	x	x	x	x	x	x	Y
	Natural degradation		x	x	x	x	x		N
	Natural degradation with hydrogen peroxide treatment	x	x	x	x	x	x	x	Y
	Acid volatilization re-neutralization (recovery) of cyanide			x		x	x	x	N
Tailings Disposal/Management	Alternative A: Upper Blackwater River sub-basin			x		x	x		N
	Alternative B: Upper Mathews Creek sub-basin			x		x	x		N
	Alternative C: Upper Davidson Cr. sub-basin 1			x		x	x	x	N
	Alternative D: Upper Davidson Cr. sub-basin 2	x	x	x	x	x	x	x	Y
	Alternative E: Upper Cr. 661 sub-basin			x		x	x		N
	Combined Alternatives C/D	x	x	x	x	x	x	x	Y
Freshwater Supply	Tatelkuz Lake	x	x	x	x	x	x	x	Y
	Kuyakuz Lake		x	x	x	x	x		Y
	Top Lake		x	x	x	x	x		N
Solid Waste Management	On-site landfill	x	x	x	x	x	x	x	Y
	Incinerator/landfill	x	x	x	x	x	x	x	Y
	Re-use/recycle			x		x	x	x	N
	Transmission connection to grid	x	x	x	x	x	x	x	Y
Power Supply	On site diesel	x		x	x	x	x		N
	Wind			x	x	x		x	N
	Solar			x	x	x		x	N
	Biomass			x	x				N
	Local hydro-electric generation			x	x				N

Aspect	Alternative	Screening Criteria[1]							
		Provides Viable Solution to Problem	Practical and Economically Viable	Proven Technology	Technically Feasible	Within Ability of Proponent to Implement	Can be Implemented within Study Area	Consistency with Environmental and Planning Objectives	Retained for Detailed Assessment
Aggregate Sources	Low metal leaching NAG mine rock	x	x	x	x	x	x	x	Y
	Mine site area pits and quarries	x	x	x	x	x	x	x	Y
	Off-site pits and quarries	x	x	x	x	x	x	x	Y
Site Access and Transportation Routes	Utilization and upgrading of existing access via Kluskus FSR and Ootsa FSR	x	x	x	x	x	x	x	Y
	Develop new access route from Highway 20, connecting south via Highway 97			x	x		na	?	N
Airstrip	T1 – Tatelkuz		x	x	x		x		N
	T3 – Site		x	x	x		x		N
	B4 – Site	x	x	x	x	x	x	x	Y
	S2 – Site	x	x	x	x	x	x	x	Y
	S8 – Site	x	x	x	x	x	x	x	Y
Transmission Line Routing	Option 1	x	x	x	x	x	x	x	Y
	Option 2	x	x	x	x	x	x	x	Y
	Option 3	x	x	x	x	x	x	x	Y
	Option 3a			x	x	x	x	x	N
	Option 4	x	x	x	x	x	x	x	Y
	Option 5	x	x	x	x	x	x	x	Y
Worker Accommodations	East of TSF Site	x	x	x	x	x	x	x	Y
	Snake Lake Site	x	x	x	x	x	x	x	Y
Worker Transport	Busing	x	x	x	x	x	x	x	Y
	Private vehicles	x		x	x	x	na	?	N
	Air	x	x	x	x	x	x	x	Y

Note: [1] The evaluation of alternatives considers Aboriginal groups interests as described in **Section 2.5.1.2.7.**

2.5.1.2.1 Cost Effectiveness

- Facilitates a competitive return on investment (preferred);
- Facilitates an acceptable return on investment (acceptable); and
- Cannot be financially supported by the Project (unacceptable).

Cost effectiveness relates to overall Project costs, including capital, operation, maintenance, and closure/reclamation costs. Each aspect of the Project has cost implications and thus cost effectiveness is a performance objective common to all Project aspects.

2.5.1.2.2 Technical Applicability and/or System Integrity and Reliability

- Predictably effective with contingencies if the alternative does not perform as expected (preferred);
- Appears effective based on modelling/theoretical results; contingencies are available if the alternative fails to perform as expected (acceptable); and
- Effectiveness appears dubious or relies on unproven technologies (unacceptable).

“Technical applicability” and “system integrity and reliability” are used interchangeably, as appropriate to the issue, to describe the suitability or expected performance of a given alternative.

2.5.1.2.3 Ability to Service the Site Effectively

- Provides guaranteed access/supply to the site with a low risk of interruption (preferred);
- Provides the required access/supply to the site with contingency method(s) of delivery available (acceptable); and
- Cannot reliably provide sufficient access/supply, or involves an unacceptable level of risk without contingencies (unacceptable).

This performance objective is relevant for those aspects of the Project dealing with the provision of consumables or access to the Project site. The reliable (guaranteed) supply of consumables, such as fuel, is critical to the uninterrupted operation of the mine.

2.5.1.2.4 Effects on the Natural Environment

- Minimizes adverse effects on the natural environment without, or with limited, need for mitigation (preferred);
- Minimizes adverse effects on the natural environment with mitigation (acceptable); and
- Likely to cause significant adverse effects on the natural environment that cannot be reasonably mitigated (unacceptable).

The "natural environment" referred to in this performance objective is a broad term used to describe the air, bedrock, soil, water (surface and ground), and biological organisms. Primary considerations are in regard to Valued Components (VCs).

2.5.1.2.5 Effects on the Socio-economic Environment

- Minimizes adverse effects on the socio-economic environment without mitigation, or provides positive effects (preferred);
- Minimizes adverse effects on the socio-economic environment with mitigation (acceptable); and
- Likely to cause significant adverse socio-economic effects that cannot reasonably be mitigated (unacceptable).

The potential for negative socio-economic effects, such as the reduction of land use by Aboriginal members, is evaluated where appropriate for the alternatives for the various aspects of the Project.

2.5.1.2.6 Amenability to Reclamation

- Causes disturbance to the natural environment that requires limited reclamation (preferred);
- Causes disturbance to the natural environment that requires moderate to extensive reclamation (acceptable); and
- Mitigation of disturbance to the natural environment is not practical or feasible (unacceptable).

This performance objective relates to the decommissioning or reclamation of the various Project aspects at closure. It is relevant to those aspects of the Project that alter the landscape (e.g., roads and stockpiles), and/or require dismantling and either removal from site, or disposal on site (e.g., buildings).

2.5.1.2.7 Consideration of Aboriginal Groups

The interests of Aboriginal groups were considered in the assessment of alternatives by considering the issues raised during consultations as well as biophysical factors related to Aboriginal use and harvest of natural resources. **Section 3** and **Section 17** identify the comments provided by Aboriginal groups, including their concerns related to the Project.

Issues raised by Aboriginal groups related to the location of Project components or the footprint included, but were not limited to:

- Effects on fisheries resources, fish habitat and water quality;
- Effects on caribou and moose movements and habitat;
- Effects on vegetation including plants such as berries, mushrooms, medicinal plants and sensitive habitats; and

- Effects on archaeological, sacred, spiritual, and grave sites.

Wherever possible, the Project footprint has been minimized by clustering the Project facilities based on economic, technical and environmental considerations. Specific examples of how Aboriginal interests have been considered in relation to the evaluation of alternatives relating to mine site access and transmission line alignment are provided below..

With respect to the evaluation of alternatives to access the mine site, Aboriginal interests related to caribou and moose habitat were taken into account by selecting an option that will avoid Ungulate Winter Range (UWR). The preferred option is to develop new access to the mine site.

Aboriginal interests were taken into account in assessing the six options related to the transmission line alignment by considering the number of streams crossings, registered traplines held by individual First Nation members, the amount of sensitive habitats (e.g., old growth forests), location of habitat suitable for berries, and available information on spiritual and other culturally important areas. The route chosen, pursuant to further discussion with Aboriginal groups and other stakeholders, is the shortest route that also followed existing access roads to the extent practical. Thus new disturbance will be limited.

2.5.1.2.8 Overall Evaluation

Once the criteria to evaluate individual performance objectives have been applied, an overall (or summary) evaluation for the specific alternatives under investigation is required. Various approaches to this summation task are possible, involving either numerical or qualitative processes. A qualitative summary is used herein, which is based on the following premises:

- All performance objectives are essential to Project success and the decision making process;
- For an alternative to be preferred, it must, as a minimum, obtain preferred or acceptable ratings for all performance objectives; **an alternative is therefore rejected if it attains an unacceptable rating for any single performance objective;** and
- The alternative that receives the greatest number of preferred ratings is not necessarily the best, or most preferred, overall alternative, as it may be that one or two performance objectives are more important and override all other objectives, so long as a minimum rating of acceptable is attained for the less important objectives.

The final evaluation of alternatives is therefore a reasoned process, in which the basis for the final selection of a given alternative is easily understood at all levels.

The alternatives assessment methodology described above is applied to all aspects of the Project listed above. However, to meet the requirements of *Metal Mining Effects Regulations* (*MMER*), Schedule 2 listing requirements, where it is proposed to place a deleterious substance within waters frequented by fish, additional more detailed evaluations of alternatives are required. This more detailed assessment is referred to as MAA. This methodology is prescribed by Environment Canada (EC) (2011). Project aspects subject to MAA alternatives assessment are:

- Tailings disposal/management;
- Low grade stockpile (LGS);
- Overburden and low ML NAG mine rock; and
- ML and PAG mine rock.

MAA alternatives assessments for these four aspects are provided separately. Results of alternatives assessments provided herein, are consistent with results of the MAA assessment process, in that the alternatives selected for going forward with both processes are the same (i.e., both processes came to the same end point). The MAA alternative assessment report is presented in **Appendix 2.5A** and summarized in this section.

2.5.2 Alternatives to the Project

2.5.2.1 Alternatives and Initial Screening

Unlike other types of projects for which a number of project alternatives might be available, such as the development of transportation systems, mines are unique because ore bodies have a fixed location, and the only way to proceed with a mining venture is to mine the ore body in place. Consequently, the only project alternatives for the Project are to:

- Proceed with the project in the near-term, as planned;
- Delay the project until circumstances are more favourable, or
- Abandon the project.

With some mining operations, consideration may also be given to mining the ore body on site and transporting the ore to another location for processing. This is not a viable alternative for the Project because of the relatively low grade of the deposit and weight and bulk of run-of-mine (ROM) ore and the distance to the nearest milling operation that could conceivably handle gold ore (Kames). As a result, this alternative was not considered.

This section focuses on the consideration of proceeding with the Project. Later sections deal with specific parts of the Project

2.5.2.1.1 Performance Objectives and Evaluation

Of the six performance objectives and evaluation criteria outlined in **Section 2.5.1.2**, four are applicable to the assessment of the three project alternatives as follows:

- Cost effectiveness;
- Minimizes effects on the natural environment;
- Minimizes effects on the socioeconomic environment; and
- Amenability to reclamation.

2.5.2.1.1.1 Performance Objective – Cost Effectiveness

- Preferred — facilitates a competitive return on investment;
- Acceptable — facilitates an acceptable return on investment; and
- Unacceptable — cannot be financially supported by the project.

The Project will employ up to 1,500 people during construction and will create about 400 permanent positions during operations. Economic parameters for the project were presented in Volume I (Introduction). In terms of cost effectiveness, proceeding with the Project in the near-term as planned would provide a competitive return on investment and is the preferred alternative. Delaying the Project until circumstances become more favourable would be an acceptable alternative.

However, future conditions are difficult to predict. Mining is a capital-intensive industry and short-term metal prices are critical to recover capital investments during the “pay-back” period. Once built, mines can operate very efficiently through normal business cycles.

Precious metal prices are currently relatively low and inflation low. There can be no assurance that future economic conditions would equally or more strongly support a decision to proceed with mine development than currently exists.

Similarly, the size of the Project, i.e., ore reserve and mill throughput, has been optimized for economic return. As with other relatively low-grade deposits, Project economics are sensitive to the price of gold. Moreover, the basic elements of design for environmental protection and worker and community health and safety do not change significantly for the Project with changes in the mine size. Therefore, variations in mine size were not evaluated as a Project alternative.

2.5.2.1.1.2 Performance Objective – Minimize Effects on the Natural Environment

- Preferred — minimizes adverse effects on the natural environment without mitigation;
- Acceptable — minimizes adverse effects on the natural environment with mitigation; and
- Unacceptable — likely to cause significant adverse effects on the natural environment that cannot be mitigated.

The potential for adverse effects from project-related activities can be controlled through design and operation technologies and through application of Best Management and Adaptive Management Practices. Best Management Practices (BMPs) include erosion and drainage control; dust suppression and air emission controls; environmental monitoring programs – including long-term surface water and groundwater monitoring – progressive reclamation; and regular inspections and audits. Adaptive Management Practices involve changing management as indicated from monitoring to address any performance issues.

The Project may cause adverse environmental effects that can be mitigated during construction, operation, closure, and post-closure. Abandoning the Project will limit adverse environmental

effects to those that have occurred to date as a result of exploration and other Project investigations.

2.5.2.1.1.3 Performance Objective – Minimize Effects on the Socio-economic Environment

- Preferred — minimizes negative effects on the socio-economic environment without mitigation; provides positive effects;
- Acceptable — minimizes negative effects on the socio-economic environment with mitigation; and
- Unacceptable — likely to cause significant negative socio-economic effects that cannot be mitigated.

With the current severe downturn in the forestry industry, there is a significant surplus of trained workers in the Vanderhoof region. The Proponent received extensive enquiries regarding employment opportunities during the pre-Application consultation period for the Project. The Proponent expects that sufficiently large numbers of workers can be found locally and regionally for the Project.

The positive socio-economic effects from developing the Project as planned (slightly less than $2 billion in royalties and taxes over the life of mine) are anticipated to outweigh adverse socio-economic effects that may occur, and that will be mitigated through various means including training, counselling, and capacity building. The Project could represent a critical bridge for employment for local community residents who have lost their jobs in the forestry industry because of the effects of the mountain pine beetle (MPB) and low lumber prices. The option of proceeding as planned is therefore preferred. The alternative of delaying the Project indefinitely until circumstances are more favourable would be acceptable.

2.5.2.1.1.4 Performance Objective – Amenability to Reclamation

- Preferred — causes disturbance to the natural environment that requires limited reclamation;
- Acceptable — causes disturbance to the natural environment that requires moderate to extensive reclamation; and
- Unacceptable — mitigation of disturbance to the natural environment is not practical or feasible.

The largest potential single impact of project development will be the permanent loss of the upper reaches of Davidson Creek. On closure, the drainage will be restored to the extent practical. During operations and closure, flows required by fish will be maintained in Davidson Creek through pumping of water from Tatelkuz Lake. The fish habitat lost will be compensated through an offsetting plan negotiated with Fisheries and Oceans Canada (DFO) with input from the provincial BC Ministry of Environment (BC MOE) and Aboriginal groups. Through offsetting, more fish habitat will be created than is lost.

Land disturbance that will result from the development of the Project cannot be completely avoided, but is acceptable. Disturbance will, however, be minimized to the extent practical by the proactive project design proposed, including designing a compact site arrangement, and conducting progressive reclamation to the extent practical.

The alternative of abandoning the Project would limit the amount of reclamation required to that associated with advanced exploration and other investigations at the Blackwater site and surrounding area (and is preferred).

2.5.2.2 Summary Evaluation

2.5.2.2.1 Technical and Economic Feasibility

The proposed Project as described in **Section 2** of the Environmental Assessment (EA) is technically and economically feasible.

2.5.2.2.2 Rationale for Selection of the Preferred Alternative

Abandoning the Project would not fulfill the project purpose and provide a competitive return on investment; employment wages, tax, and royalty revenues will be foregone and business opportunities for communities and BC in general will not occur. Project abandonment is considered an unacceptable alternative. The Proponent recognizes that for the Project to precede, all applicable permits, approvals and authorizations would have to be obtained from the relevant regulatory authorities, in consultation with affected Aboriginal groups and communities.

Delaying the Project cannot be ruled out, depending on circumstances related to future project economics, further project investigations and permitting processes.

Proceeding with the Project in the relatively near-term as planned is the preferred alternative, being rated as preferred in two categories and acceptable in the remaining two categories. Delaying the Project indefinitely is acceptable in all categories but poses a risk because there cannot be any certainty that the Project will proceed in the medium-term future; abandoning the Project does not meet the Project purpose and is rejected because it attained an unacceptable rating. An unacceptable rating for any performance objective requires rejection of the alternative.

Taking the above perspectives into consideration, the object of the Proponent is to proceed with the permitting and development of the Project in a timely manner, as described in the Project Description (**Section 2.2**).

2.5.3 Mining

2.5.3.1 Alternatives and Initial Screening

The possible alternatives to mining the Blackwater ore body are open pit mining and underground mining—shaft access or ramp access.

2.5.3.1.1 Open Pit Mining

Open pit mining requires the removal of surface materials to expose the ore body, followed by the stepwise development of concentric levels (benches or rings) into the deposit, with an inclined roadway, or ramp, connecting the various mining levels or benches. Open pit mining methods are best suited to:

- Shallow ore deposits that are exposed at surface, or are near surface covered by comparatively shallow overburden;
- Large deposits that have a more uniformly distributed resource or scattered, often randomly distributed pockets, that are not readily traceable by underground mining methods; and
- High tonnage, low grade deposits which are uneconomic using underground mining techniques.

In contrast to underground mining techniques, open pit mining typically generates larger quantities of mine rock (mined rock which is not ore) and stripped overburden that require disposal.

The mine will be an open pit gold mine with a nominal production of 60,000 t/d and a mine life of 17 years. The Project has proven and probable reserves of 344.4 million tonnes (Mt) grading 0.74 gram gold (g Au) and 5.5 grams silver (g Ag), for 7.07 million ounces of gold (Moz Au) and 30 million ounces of silver (Moz Ag). The open pit mining method meets all of the **Table 2.5.1-1** criteria. This alternative is consequently retained for further consideration.

2.5.3.1.2 Underground Mining – Shaft or Portal Access

Shaft or portal access requires the construction of a vertical, underground passage (shaft) from surface to the targeted depth of a portal with a ramp (usually a decline) into the ore body. Horizontal tunnels (drifts) are then driven from the shaft, at strategic levels, to access the ore body. Mining takes place off these drifts by drilling and blasting, and ore is transported to surface using a hoist. Ramp access is a second type of underground mining suited to higher grade, frequently smaller deposits, and involves the use of a tunnel or ramp from surface, with drifts driven from the ramp at various levels to access the ore. Ramp mining is more suited to shallower deposits compared with shaft mining, because of the time it takes to truck ore and mine rock up the ramp to surface.

Both underground mining methods are best suited to smaller ore bodies, which are of higher grade, and easily traceable underground. Where the ore is near surface and/or is not covered by host rock, underground mining must leave a substantial portion of the ore body in place (crown pillar) to maintain ground stability. Underground mining techniques typically produce comparatively limited quantities of mine rock because mining is targeted specifically to well-defined ore zones.

The Blackwater gold resource is too disseminated and low in grade to be mined by underground mining methods and any such mining method would be uneconomic. This alternative therefore fails to meet the first two criteria listed in **Table 2.5.1-1**, and the alternative is removed from further consideration.

2.5.3.2 Summary Evaluation

2.5.3.2.1 Technical and Economic Feasibility

Open pit mining is the only technically and economically feasible way of exploiting the Blackwater ore body.

2.5.3.2.2 Rationale for Selection of the Preferred Alternative

Open pit mining is the only cost-effective and technically viable alternative for mining the Blackwater deposit. Underground mining alternatives are simply not economically feasible. A more detailed evaluation of the alternatives is therefore not warranted.

2.5.4 Overburden and Low Metal Leaching NAG Mine Rock Management

The overburden, LGS, and low-metal leaching NAG mine rock management alternatives assessment process (EC, 2011) involves seven steps to select candidate sites by a process of systematic analysis and elimination:

- Step 1: Identify candidate alternatives;
- Step 2: Pre-screening assessment;
- Step 3: Alternatives characterization;
- Step 4: Multiple accounts ledger;
- Step 5: Value-based decision process;
- Step 6: Sensitivity analysis; and
- Step 7: Document process.

Initial screening by the Proponent (Step 1) identified five sites for overburden and NAG rock storage:

1. Combined East and West Facility;
2. Expanded East Facility;
3. Expanded West Facility;
4. North Facility; and
5. South Facility.

Pre-screening assessment (Step 2) applied the following criteria:

- Would the NAG WRS facility preclude future mining exploration or extraction of a potential deposit?
- Is any part of the NAG facility WRS system using unproven technology?

- Does the NAG WRS facility have insufficient capacity to store the proposed upper limit of NAG waste rock?
- Will the NAG WRS facility result in negative life of project economics?
- Will the NAG WRS facility be located partially within the Blackwater watershed?
- Will the NAG WRS facility be located in an UWR?

Of the above five candidate alternatives, three potential NAG rock alternatives met all the NAG disposal siting pre-screening criteria listed above:

1. Alt NAG E/W: Combined East and West Facility;
2. Alt NAG W: Expanded West Facility; and
3. Alt NAG E: Expanded East Facility.

Step 3 identifies and characterizes NAG alternatives in preparation for the following evaluative steps. The thorough characterization in this step was necessary to ensure that every potential material impact relating to each alternative would be incorporated for further analysis, and to ensure transparency. Step 3 expands the scope and detail of the characterization of each candidate alternative using project-specific characterization criteria as recommended in the Guidelines (EC, 2011). These factual criteria were developed with no assumed a priori judgements placed upon them, and categorized under four “accounts” and their evaluation criteria (sub-accounts), as presented below:

- Technical;
- Dump characteristics;
- Supporting infrastructure;
- Foundation conditions;
- Water collection and treatment;
- Construction, operation, and closure;
- Environmental;
- Surface water;
- Groundwater;
- Air quality;
- Fish and aquatic habitat;
- Wildlife;
- Vegetation;
- Ecosystems and wetlands;
- Socio-economics;
- Commercial land use;
- Recreational land use;

- Aboriginal interests;
- Archaeology;
- Project economics; and
- Proponent costs.

A multi-disciplinary team selected the multiple accounts ledger (step 4) from the above accounts based on several measurement criteria:

- Complexity of containment;
- Physical characteristics of waste;
- Area footprint;
- Waste haulage distance;
- Potential water treatment;
- Operation flexibility;
- Closure risk;
- Watersheds affected;
- Reduction in catchment areas;
- Surface water quality;
- Groundwater quality;
- Vehicle emissions;
- Fugitive dust;
- Rare and endangered ecosystems;
- Wetlands;
- Wildlife habitat;
- Aquatic resources affected;
- Traditional territory overlap;
- Guide outfitting and trapline tenures;
- Capital and operating costs;
- Closure costs; and
- Fish habitat compensation costs.

The Combined East and West Facilities (Alt NAG E/W) is the most appropriate NAG WRS alternative, as it resulted in the highest number in the MAA. The technical and economic feasibility and rationale for selection of the preferred alternative are detailed in the MAA.

2.5.5 PAG and Metal Leaching Mine Rock Management

The two alternatives to PAG rock storage: on land and submerged in the Tailings Storage Facility (TSF) are considered in the TSF MAA (**Appendix 2.5A**). The technical and economic

feasibility and rationale for selection of the preferred alternative (TSF storage) are detailed in the MAA.

2.5.6 Low Grade Ore Stockpile

A low grade ore (LGO) stockpile is planned for processing near the end of mine life. Alternatives for stockpiling this ore are discussed in the MAA (**Appendix 2.5A**) and include processing as mined and directing to waste as mined. The technical and economic feasibility and rationale for selection of the preferred alternative are detailed in the MAA.

2.5.7 Ore and Mine Rock Transportation

2.5.7.1 Alternatives and Initial Screening

The commonly used means of transporting ore and mine rock are by:

- Haul truck;
- Conveyor; and
- Rail.

2.5.7.1.1 Haul Truck Transport

Ore and mine rock transport around mine sites is most commonly carried out using appropriately sized haul trucks, which in the case of large tonnage operations such as the Project, can include trucks with up to 300 tonne load capacity. Haul truck transport has the primary advantage of economies of scale and flexibility in as much as materials of any reasonable size can readily be picked up at one location and transported to any other location on the mine site. In the case of the Project, ROM ore would be hauled to either the mill for processing, or to the LGS; and ROM waste rock would be hauled to one of two NAG stockpiles, or to the TSF for use as tailings dam construction material, or for permanent underwater disposal in the case of PAG and NAG3 wastes.

Haul truck transport also has the advantage of temporal flexibly because if one or more trucks become disabled and require maintenance, mine operations can continue uninterrupted. It is typically assumed by design that a small percentage of the mine fleet will be undergoing maintenance at any one time. The mine haul truck fleet can also be ramped up in stages, as required, to support mining demands at any given time during the mine life, such that it is not necessary to purchase the entire haul truck fleet at the outset of operations. Individual 300 tonne haul trucks cost between $6 million and $7 million, so deferrals in equipment costs can be important to overall Project economics.

Haul truck transport meets all of the **Table 2.5.1-1** criteria, and is retained for further more detailed analysis.

2.5.7.1.2 Conveyor Transport

Conveyors provide a low cost and effective transport alternative between fixed locations, if the material being transported is of a suitable size. For example, conveyors are the transport method of choice for transporting ore from the crusher to the mill building, where there is a fixed transport path and there is no oversized material. For some operations, such as in parts of the Virginia coal fields, conveyors are used to transport crushed product over long distances of up to 10 km or more, for example between mine sites and rail loading (docking) stations.

Conveyors do not lend themselves well to situations of local ore and mine rock transport, such as from open pits, where the pit geometry is constantly changing, and where the mined materials can be transported to any of several destinations, as described above in connection with haul truck transport. The classification of rock into either ore, LGO, NAG or PAG, is often a blast-by-blast decision, so optimal operational flexibility is required. Conveyors simply do not lend themselves to this type of flexibility. Conveyors also suffer from the problem of "bottlenecking," wherein if a conveyor goes down for serious maintenance, the entire mining operation can be brought to a halt.

In addition, in the assessment the Proponent carried out looking at the feasibility of using conveyors, the company determined that one of the most important issues at the mine site was the need to ensure the PAG waste rock was submerged within one year. To ensure that this happened, the Proponent determined that it would mean that the conveyors had to be repositioned frequently making this option very costly and impractical.

For all of the above reasons conveyors do not provide a viable solution to the problem of material transport (except as described above for more controlled transport), and they are neither practical nor economically viable (**Table 2.5.1-1**). The conveyor alternative is therefore rejected from further consideration.

2.5.7.1.3 Rail Transport

Rail transport is also used in mining (particularly for concentrate), but again in situations where the transport route is fixed, and generally where much longer transport distances are involved, for prolonged timelines, such as from a remote long-term mine site to a centralized milling facility. Rail transport also requires low gradient landscapes to be effective. Rail transport does not fit with Project material transport needs (i.e., multiple disposal locations) and is therefore rejected as a viable alternative worthy of further consideration.

2.5.7.2 Summary Evaluation

2.5.7.2.1 Technical and Economic Feasibility

Use of haul trucks is technically feasible and is economically feasible for a viable project.

2.5.7.2.2 Rationale for Selection of the Preferred Alternative

The only viable ore and mine rock transport alternative is the use of haul truck transport. No other alternatives warrant detailed evaluation.

2.5.8 Ore Processing

2.5.8.1 Alternatives and Initial Screening

Various methods are theoretically available for liberating gold from gold-bearing ores, but only a limited number of alternatives are viable and proven at a commercial scale. Methods such as mercury amalgamation, aqua regia gold dissolution, and ammonium thiosulphate (or thiosulfate) dissolution are not considered viable alternatives. Other possible alternatives such as chloride and bromide leach are even less viable.

The historic use of mercury amalgamation has caused serious environmental pollution concerns in some gold mining camps and is no longer used in modern industry. Aqua regia is a mixture of concentrated hydrochloric and nitric acids which is commonly used in small scale operations for recovering gold from scrap metal and other such sources, but it is not a commercially viable method for recovering gold from large scale gold ore processing facilities. Thiosulphate-based gold recovery technologies are being investigated for gold ore processing and are among the more promising alternatives for carbonaceous (preg. robbing) ores[1]; however, to date this and related technologies are not suitable, as per the following:

Marsden and House (2006):

> *Despite showing considerable promise, the development of an effective thiosulfate-based process remains elusive because of the high reagent consumption and costs (due to thiosulfate oxidation) and difficulties with metal recovery from the leach solution.*

Hilson and Monhemius (2006):

> *It is concluded that, in spite of the vociferous opposition to the use of cyanide in the gold mining industry by sections of the environmental movement, unless further research and development makes one or more of the alternative lixiviants [thiourea, thiosulphate, etc.] economically competitive, it will continue to be the only practical leach reagent in large-scale gold extraction processes.*

Chloride and bromide leach alternatives suffer from poor gold recovery, very high reagent consumption, resultant brine disposal problems, and workplace handling problems associated with handling chlorine (or bromine) gas. Chlorination has been used historically to pre-treat refractory ores in plants in the United States in the 1980s and was used for gold recovery prior to the development of

[1] pyrite and chalcopyrite will adsorb gold strongly in preference to activated carbon in the absence of cyanide, thus rendering impractical economic recovery of gold without cyanidation (Rees and van Derventer 2000).

cyanide technologies, but there is currently little if any current use of this technology in the industry, because of the disadvantages listed above (Hilson and Monhemius, 2006).

Other process modifiers are applicable to refractory ores, i.e., gold ores where a substantive portion of the gold is structurally bound to sulphides. However, by themselves, modifiers are not a complete process. These process modifiers include roasting, pressure oxidation and bioleach processes, all of which are designed to oxidize the sulphide matrices to liberate the attached gold to support further processing. The Blackwater ore is not refractory and therefore does not require the use of refractory gold process modifiers.

As a result, the only potentially applicable, commercially viable methods for recovering gold from Project ores are cyanidation, with or without gravity concentration, or in combination with flotation concentration. Cyanide is the reagent of choice for gold dissolution from gold ores at commercial scales. Cyanide is combined with alkaline earth metals, typically sodium, potassium, or calcium, with sodium cyanide being the typical reagent. Cyanide is toxic and its handling requires extreme care to protect both workers and the environment. Cyanide use is the industry standard for gold processing and safe procedures for cyanide handling and subsequent detoxification are well established. The Proponent is a signatory to and will implement the International Cyanide Management Code.

Alternatives considered for the Project ore processing are the following:

- Whole ore cyanidation, with or without gravity concentration;
- Flotation concentrate recovery followed by cyanidation of the flotation concentrate; and
- Heap leaching.

The use of lixiviants other than cyanide, for gold recovery, is addressed above and is not considered further.

2.5.8.1.1 Whole Ore Cyanidation, with or without Gravity Concentration

Whole ore cyanidation refers to the process whereby the ore is crushed and ground prior to being leached with cyanide. Cyanide leaching occurs in large tanks (or vats) where cyanide dissolves gold in accordance with the following reaction:

$$4Au^{o} + 8\ NaCN + 2\ H_2O = O_2 \rightarrow 4\ Na[Au(CN)_2] = 4\ NaOH$$

Sodium cyanide is stable in solution at pH values above 10. At lower pH values cyanide will begin to volatize to the atmosphere as cyanide gas. Lime is used in the leach circuit to maintain an elevated pH. Gold dissolved with cyanide is recovered by adsorption onto activated carbon (or more rarely, and more commonly historically, through zinc precipitation, in what is referred to as the Merrill-Crowe Process). Gold adsorbed onto activated carbon is stripped using a high strength cyanide solution, with gold from this concentrated solution being recovered through electrowinning and induction furnace recovery. Process details are described in **Section 2.2**.

Cyanide (CN) is comprised of one carbon (C) atom and one nitrogen (N) atom, and is inherently unstable (except at high pH) and is easily destroyed. For example, if cyanide solutions are discharged to tailings ponds, cyanide will volatilize to the atmosphere as low concentration cyanide gas (HCN). Once it enters the atmosphere, HCN will react with hydroxyl (OH^-) radicals and oxygen in the presence of sunlight (photolysis) through a series of reactions, to form carbon monoxide and nitrous oxide (Lary, 2004). Cyanide is also easily oxidized (destroyed) by chemical means such as by sulphur dioxide addition to form the much less toxic compound cyanate (CNO), (**Section 2.2**). CNO will further degrade in tailings ponds to ammonia and carbon dioxide. The use of cyanide in ore processing is rigorously managed for worker safety using industry standard methods and protocols, and is easily detoxified (**Section 2.2**).

Gravity concentration is frequently used in combination with whole ore cyanidation as a means of improving overall rates of gold recovery. Gold has a very high specific gravity of 19.3 compared to the ore host rock, which has a specific gravity of approximately 2.8. This gravity differential can be used to separate free gold from the host rock. To separate the free gold the ore is first crushed and ground to free up the gold particles. The ground ore in water slurry is then passed over shaking tables or similar apparatus to concentrate the gold particles through gravity separation. Gravity separation is a common gold recovery method, and for some placer deposits can be used as the sole method for gold recovery. For more conventional hard rock gold mining, gravity separation is typically only capable of recovering a small portion of the gold hosted in the ore. For the Project, metallurgical testing indicates that approximately 20% to 30% of the available gold can be recovered by gravity separation but even this material will need to undergo cyanidation of the gravity concentrate to form product.

Whole ore cyanidation, with or without gravity concentration, is an industry standard gold recovery process that is in widespread use for over 100 years throughout the world, and meets all of the **Table 2.5.1-1** criteria. This alternative is therefore retained for further evaluation.

2.5.8.1.2 Flotation Concentrate Recovery followed by Cyanidation of the Flotation Concentrate

Flotation concentrate recovery followed by cyanidation of the flotation concentrate is another standard method of gold recovery. This process involves crushing and grinding the ore to a very fine grind (finer than that typically used for gravity concentration or whole ore cyanidation), followed by the use of flotation chemicals and air in a sequence of water vats, to preferentially float a gold-bearing sulphide concentrate. An amount in the order of 10 to 15% of the ore feed will typically be recovered as a gold-bearing flotation concentrate. Cyanidation is then required to separate the gold from the concentrate. Cyanidation can be accomplished on-site or off-site, depending on quantity of concentrate and the availability of external processing sites and costs. Flotation concentrate production with off-site gold recovery is not commonly practiced except occasionally for some small-scale operations where other larger nearby mills are available to receive custom ores and concentrates. Flotation concentrate recovery is more commonly used with refractory ores, where autoclave or bioleach processes are used to separate the gold from strong sulphur bonds, to improve overall recovery.

Power demands are high with the flotation concentration process, because of the need to achieve very fine grinds necessary for efficient flotation. The total amount of cyanide used to leach the flotation concentrate is often not that different from the total amount of cyanide needed to leach whole ore. And in some cases the total amount of cyanide needed to leach the flotation concentration can be greater than that required to leach whole ore. More critically, recoveries from flotation-cyanide processes are often lower than from whole ore cyanidation because the flotation process does not fully separate all the gold bearing minerals resulting in gold losses to tailings.

An advantage of flotation concentration is that two types of tailings are produced: high sulphide tailings and low sulphide tailings. Where the whole ore is PAG, only the flotation concentrate portion of the tailings (which concentrates the sulphide minerals) might be PAG depending upon the residual sulphur content of the flotation tailings. The generation of PAG and NAG tailings streams can facilitate a greater range of tailings management options for closure.

Flotation concentrate recovery followed by cyanidation of the flotation concentrate is a viable and commonly used method of recovering gold through worldwide operations, and is retained for further consideration. However, metallurgical studies for Blackwater demonstrated significantly lower recoveries and poorer project economics for the flotation process. This is further discussed in the Project Description, **Section 2.2**.

2.5.8.1.3 Heap Leaching

Cyanide processing can also be undertaken without the use of leach tanks in a process known as heap leaching, wherein large stockpiles of crushed (gravel sized) ore are placed on lined pads, and cyanide solution is trickled into the pad from above. The cyanide solution then percolates downward through the pad dissolving the gold. The pregnant cyanide solution, containing the dissolved gold, is collected from the base of the lined pad and routed to the activated carbon recovery system. The leaching process can take many weeks, and multiple pads are used in rotation for large operations.

Heap leaching is usually practiced in warmer and drier climates such as in Nevada, and particularly for some ore types where gold is concentrated on surface fracture planes. This process has received limited, primarily experimental use in Canada and is not suited to cold wet climate environments. Vat leaching is the norm in Canada, and is both better suited to the Canadian climate and also easier to manage from an environmental perspective. Gold recovery rates with heap leaching are also lower than for vat leaching. Heaps typically occupy large land areas and must be detoxified and reclaimed at closure. Studies conducted by The Proponent of heap leaching showed it would achieve low gold recoveries for the Project. This is further discussed in the Project Description (**Section 2.2**).

Heap leaching does not provide a viable solution to efficient gold recovery, is not practical and economically viable, and is therefore, not carried forward as a viable alternative.

2.5.8.2 Performance Objectives and Evaluation

Alternatives carried forward into the detailed evaluation are whole ore cyanidation, with or without gravity concentration, and flotation concentrate recovery followed by cyanidation of the flotation concentrate.

Performance objectives applicable to these two-ore processing alternatives are the following:

- Cost effectiveness;
- Technical applicability and/or system integrity and reliability;
- Effects on the natural environment;
- Effects on the human environment; and
- Amenability to reclamation.

2.5.8.2.1 Cost Effectiveness

Project specific test work has shown that whole ore cyanidation, with gravity concentration, is expected to provide an 83% gold recovery rate. Flotation concentrate recovery followed by cyanidation of the concentrates has been shown to yield an expected 82% percent recovery rate. This differential recovery rate applied to a gold resource of 7.07 Moz, measured at US$1,300/oz Au, and a C$0.97, translates to a life-of-mine (LOM) cost differential of $261 million. Additional costs for the flotation concentrate alternative would also be incurred because of the added capital costs for installing the flotation equipment, and the added power costs for grinding, as a finer grind is required for flotation operations, compared with whole ore cyanidation.

Therefore from an overall cost perspective, whole ore cyanidation is rated as preferred, and the flotation concentration alternative with follow-up cyanidation is rated as being unacceptable.

2.5.8.2.2 Technical Applicability and/or System Integrity and Reliability

Both gold recovery alternatives considered in this section are technically sound and reliable methods that are used worldwide, and are ranked as preferred technologies.

2.5.8.2.3 Effects on the Natural Environment

Mill effluent discharged to the TSF will be treated with SO_2/Air for cyanide destruction and heavy metal precipitation, and will be contained within the TSF without release to the environment during operations, irrespective of the selected gold recovery method. Additional water quality treatment will occur within the TSF as a result of natural degradation processes. Therefore, from an effluent and environmental protection perspective, both gold recovery processes are considered equivalent, and are rated as preferred for effects on the natural environment.

2.5.8.2.4 Minimize Effects on the Human Environment

Tailings pond waters and tailings seepage waters will be contained and managed. As such, there will be no adverse effects on human health or to fish and wildlife resources, irrespective of the ore-processing alternative. Both alternatives are therefore rated as being preferred.

2.5.8.2.5 Amenability to Reclamation

The primary consideration for reclamation related to ore processing is tailings management area reclamation. With the use of either cyanidation process, the tailings pond water quality would be acceptable for discharge following pumping to the pit to facilitate pit filling and associated post-operational natural degradation. The only consideration relating to the type of ore processing is whether there is an advantage to having segregated PAG and NAG tailings. The flotation-processing alternative would provide segregated NAG and PAG tailings, with the bulk of the tailings, likely 85% to 90%, containing lower sulphur contents. However, given the low content of carbonate minerals and elevated zinc and cadmium in the Blackwater ore, the flotation tailings might be PAG during some periods and ML. The whole ore cyanidation alternative would generate uniform PAG tailings.

The current TSF reclamation plan is to flood most of the deposited tailings and to maintain groundwater levels in the tailings beach at the interface at the transition/sulphide tailings elevation. In addition, the entire tailings and PAG waste rock will be covered by about 0.3 m of overburden. The transition zone between covered and flooded tailings will be developed as a wetland. Under this scenario, the potential for post closure ARD development would be controlled.

The flotation concentrate recovery followed by cyanidation alternative is therefore rated as preferred, based on being able to better segregate NAG and PAG tailings, and the whole ore cyanidation alternative is rated as acceptable.

2.5.8.3 Summary Evaluation

2.5.8.3.1 Technical and Economic Feasibility

Whole ore cyanidation, with or without gravity concentration uses proven technology and is preferred because it provides improved gold recovery and project economics.

2.5.8.3.2 Rationale for Selection of the Preferred Alternative

The overall preferred alternative is whole ore cyanidation, with or without gravity concentration, based on a preferred rating for four of the five performance objectives, and an acceptable rating for the remaining performance alternative. The flotation concentrate recovery followed by cyanidation alternative was ranked preferred for four of the five performance objectives, but was rated unacceptable for cost, based on a projected life-of-mine cost differential in excess of $261 million. The flotation concentration alternative is therefore rated as unacceptable.

2.5.9 Process Plant Effluent Management

2.5.9.1 Alternatives and Initial Screening

Cyanide will be used in the Project process plant for gold dissolution and recovery as per standard industry practice (**Section 2.2.3.3.3.1**). The effluent generated by this process will contain both free cyanide (cyanide that is not complexed with any other elements or compounds) and cyanide complexed with heavy metals (metallo-cyanide complexes), and will require treatment prior to any potential release to the environment. Cyanide and metallo-cyanide complexes are inherently unstable and will degrade to simpler components under appropriate conditions. However, rates of cyanide degradation can be greatly accelerated by chemical oxidation and other means.

Tailings slurry from the process plant effluent will be directed to the TSF, where water will collect in the tailings ponds for subsequent re-use in processing without release of surface water to the environment. Tailings ponds containing cyanide can pose a potential concern to wildlife, such as waterfowl, if cyanide levels are excessively elevated. Weak acid dissociable cyanide concentrations of <50 mg/L are generally considered safe for wildlife exposure (Donato et al., 2007). However, it is considered good practice to manage tailings pond cyanide concentrations to much lower levels to better control risks associated with surface water and seepage management.

Proven alternative technologies considered for process plant effluent treatment include:

- In-plant cyanide destruction and heavy metal precipitation using the SO_2/Air treatment process, followed by natural degradation in the TSF;
- Process plant tailings slurry discharge to the TSF with use of natural degradation in the TSF ponds as the sole means of cyanide destruction and heavy metal precipitation;
- Process plant tailings slurry discharge to the TSF with use of natural degradation for initial destruction/removal of cyanide and the precipitation of heavy metals, coupled with hydrogen peroxide destruction of residual cyanide; or in-plant cyanide destruction and heavy metal precipitation using hydrogen peroxide; and
- Acid volatilization re-neutralization for the recovery and re-use of free cyanide.

Other cyanide destruction and recovery technologies are also available, but the above methods are the most commonly used, and have been proven for use at commercial scales.

2.5.9.1.1 In-plant SO_2/Air Treatment Coupled with Natural Degradation

In-plant SO_2/Air treatment involves the destruction of cyanide and metallo-cyanide complexes through oxidative processes in tailings slurry, with cyanide being converted to cyanate, and metals liberated through cyanide oxidation being subsequently precipitated as insoluble metal hydroxides (**Section 2.2**). The oxidizing agent of the process can be either SO_2 gas or other related oxidizing agents such as sodium metabisulphite ($Na_2S_2O_5$). Cyanate formed through this process reacts with water (hydrolyzes) within the tailings pond to form ammonia and carbon dioxide. The SO_2/Air treatment process is a relatively more costly alternative compared to most of the other options

considered herein, and has the advantage of discharging a low strength cyanide solution to the TSF. Post-treatment total cyanide values in the order of 1 to 2 mg/L are attainable with this technology.

The SO_2/Air treatment system has the significant added advantage of being able to effectively treat slurries, as opposed to just clear solutions. Metal hydroxide precipitates formed during the treatment process thereby have the opportunity to adsorb onto tailings solids, which improves their settling performance in the TSF. This adsorption process typically results in lower metals concentrations in the tailings pond and in the TSF seepage compared with that achieved using other treatment technologies considered herein. Post treatment effluent aging in the TSF ponds will further reduce residual cyanide and heavy metal concentrations to very low levels.

In-plant SO_2/Air treatment of cyanide and heavy metals is considered to be a cost effective, well proven, environmentally sound method of mill effluent treatment which meets all screening criteria listed in **Table 2.5.1-1**, and is therefore retained for more detailed analysis.

2.5.9.1.2 Natural Degradation

Cyanide and metallo-cyanide complexes are inherently unstable. If effluent is retained in a pond for a sufficient length of time under the right conditions of temperature and ultraviolet light, the cyanide and metallo-cyanide complexes will naturally break down to simpler compounds without the use of chemical reagents. The principal cyanide loss mechanism in natural degradation is volatilization of hydrogen cyanide gas to the atmosphere. Once hydrogen cyanide enters the atmosphere, it reacts with hydroxyl radicals and oxygen in the presence of sunlight (photolysis) through a series of reactions to form carbon monoxide and nitrous oxide (Lary 2004). Cyanide concentrations in the atmosphere generated by this process are too low to pose an environmental or heath risk. The removal of hydrogen cyanide from the system through volatilization causes a shift in metallo-cyanide complex equilibrium, liberating the metal ions previously bound to cyanide. The liberated metal ions in the tailings pond are then free to react with hydroxyl ions in the tailings pond water to form insoluble metal hydroxide precipitates, or to otherwise adsorb onto suspended or precipitated solids.

Natural degradation has been used historically with some Canadian operations with varying degrees of success depending on ore type, tailings pond retention times, production rates, and other factors. The principal limitations to use of this technology are elevated cyanide levels in tailings ponds, which seasonally can reach values of greater than 20 mg/L total cyanide, concerns for seepage quality, and concerns over downstream impacts in the unlikely event of a tailings dam failure.

In comparison to **Table 2.5.1-1** criteria, this alternative fails to provide a robust solution to the problem of full spectrum effluent management, and is unlikely to be viewed by government regulators and the general public as providing a progressive solution to mill effluent management given that better, proven technologies are in widespread use in the mining industry. The natural degradation alternative is therefore rejected from further consideration.

2.5.9.1.3 Hydrogen Peroxide Oxidation Coupled with Natural Degradation

Hydrogen peroxide oxidation treatment is similar in concept to SO_2/Air oxidation, except that hydrogen peroxide, rather than SO_2/Air, is used as the oxidizing agent to convert cyanide to cyanate. The hydrogen peroxide process can also be used to breakdown metallo-cyanide complexes, similar to the SO_2/Air process.

The hydrogen peroxide process has been shown to work well on clear solutions, but is much less effective for treating tailings slurries. The result is that hydrogen peroxide is generally used in combination with natural degradation, where the tailings slurry is first discharged to a tailings storage facility and after the slurry solids have settled, the remaining clear solution is treated with hydrogen peroxide, often with the loss of a significant portion of the available cyanide through natural degradation during the intervening period.

The hydrogen cyanide process when used following natural degradation has the advantage of allowing a substantial portion of the available cyanide to be removed from the system through volatilization, which reduces the amount of cyanate (and ammonia) contained in a final effluent; but has the same disadvantages inherent with use of natural degradation on its own (i.e., higher tailings pond cyanide concentrations and hence higher risks associated with seepage and tailings dam failures). These risks can be reduced by treating the mill slurry with hydrogen peroxide before it is discharged to the TSF, recognizing that the treatment efficiency is inferior to that attained using the SO_2/Air process. In the case of the Project, where there is no intent to discharge a final effluent to the environment, due to a negative system water balance, reduced efficiency of the hydrogen peroxide process for treated slurries, compared with the efficiency of the SO_2/Air process, is not as critical as it might be to other operations.

Hydrogen peroxide oxidation is a well proven, environmentally sound method of mill effluent treatment which meets all the screening criteria listed in **Table 2.5.1-1**, and is consequently retained for more detailed analysis.

2.5.9.1.4 Acid Volatilization Re-neutralization for Cyanide Recovery

The acid volatilization re-neutralization (AVR) process is the only cyanide recovery process, which has been successfully used in commercial scale mining for cyanide recovery (SGS Mineral Services, 2009). The process works by acidifying a cyanide-bearing solution to release molecular cyanide, or hydrocyanic acid (HCN), in a controlled manner, which is then recovered in alkaline solution for re-use in the gold recovery process. Free cyanide remains in solution as cyanide ion (CN^-) at elevated pH (generally > pH 10.5 for mineral processing), but is liberated as molecular cyanide at lower pH values.

The advantage of this process is that it is able to recover a portion of the available free cyanide in the mill effluent for re-use in the mill process. However, the process has a number of serious disadvantages, as per the following:

- High costs;
- Only free, as opposed to complexed cyanide is recovered;

- Recovery rates of free cyanide are inefficient at levels below 20 to 50 mg/L;
- Stripping cyanide from slurries is even less efficient; and
- Risk of worker exposure to toxic available HCN.

For the above reasons, the AVR process is in very limited commercial use for mining, worldwide, and it is not considered for more detailed assessment herein, as it does not meet all of the **Table 2.5.1-1** criteria.

2.5.9.2 Performance Objectives and Evaluation

Alternatives carried forward into the detailed evaluation are:

- In-plant cyanide destruction and heavy metal precipitation using the SO_2/Air treatment process, followed by natural degradation in the TSF; and
- Hydrogen peroxide oxidation coupled with natural degradation.

Performance objectives applicable to the detailed assessment of process plant effluent treatment alternatives, carried over from the screening analysis, are the following:

- Cost effectiveness;
- Technical applicability and/or system integrity and reliability;
- Effects on the natural environment;
- Effects on the human environment; and
- Amenability to reclamation.

2.5.9.2.1 Cost Effectiveness

Of the two treatment alternatives considered for detailed assessment, the SO_2/Air treatment process on tailings slurry generally carries the highest overall cost. This is because cyanide and metallo-cyanide metal complex concentrations are greatest at the outlet from the processing plant, therefore requiring increased reagent use for cyanide destruction and heavy metal precipitation at this point. In contrast, hydrogen peroxide is generally added after a period of natural degradation, during which time a large portion of the available cyanide is lost from the system, thereby substantively reducing overall reagent costs. If on the other hand hydrogen peroxide is added up front, to treat slurry before the slurry is discharged from the mill, then the per unit cyanide destruction costs are higher with hydrogen peroxide, compared with SO_2/Air, because of system inefficiencies for treating slurries (Kilborn Inc./Environmental Applications Group Ltd., 1992).

Equally or more important from a cost perspective, is consideration of Project financing and risk. Investors are increasingly more inclined to support projects that employ progressive technologies which lower overall environmental risk, so long as these technologies are financially viable. From a financial risk perspective, destroying cyanide in the process plant before discharge to the TSF presents the lowest overall environmental risk and is therefore the most attractive alternative to investors.

Therefore, from an overall cost perspective, including consideration of financial risk, the SO_2/Air treatment process followed by extended effluent aging in the TSF, is regarded as the preferred alternative, with the hydrogen peroxide treatment being regarded as acceptable.

2.5.9.2.2 Technical Applicability and/or System Integrity and Reliability

Both treatment technologies considered herein have the potential to break down cyanide and metallo-cyanide complexes and to precipitate heavy metals. The main technical considerations are cyanide and heavy metal concentrations in the tailings pond, and cyanide and dissolved metal concentrations in the tailings pore water related to long-term seepage quality.

The only way to ensure low cyanide and metallo-cyanide complex concentrations in the TSF ponds and in the tailings pore water is to destroy these compounds in the process plant before they are discharged to the TSF. The SO_2/Air treatment process is the most effective process for achieving this end. The SO_2/Air treatment technology is therefore rated as preferred.

The hydrogen peroxide process is capable of destroying cyanide and cyanide metal complexes, but is less efficient, and carries more risk, and is therefore rated as being acceptable, but not preferred.

2.5.9.2.3 Effects on the Natural Environment

In-plant cyanide destruction using the SO_2/Air cyanide treatment technology is the best means of protecting the environment under all possible circumstances (wildlife protection from exposure to tailings ponds, improved seepage quality and improved final effluent quality) and is preferred. The use of hydrogen peroxide treatment is rated as acceptable for reasons discussed above. This conclusion is supported by a general trend within the industry to greater use of SO_2/Air, compared with use of hydrogen peroxide, including a number of plants, which have switched from hydrogen peroxide to SO_2/Air, to achieve superior environmental performance.

2.5.9.2.4 Effects on the Human Environment

In-plant cyanide destruction using the SO_2/Air alternative is the best means of protecting the environment and minimizing overall risk. Aboriginal people and community stakeholders are anticipated to feel more comfortable with the SO_2/Air treatment alternative because it carries less environmental risk, compared with other technologies.

Therefore, from a human use perspective, the SO_2/Air treatment alternative is rated as preferred, and the use of hydrogen peroxide is rated as acceptable.

2.5.9.2.5 Amenability to Reclamation

Use of in-plant cyanide destruction using the SO_2/Air cyanide oxidation technology will minimize the potential for accumulation of cyanide and metallo-cyanide complexes in the tailings pore water. Use of hydrogen peroxide in the mill to treat slurry would achieve a similar effect, but not to the same level, as hydrogen peroxide oxidation is a less efficient process for slurry treatment, and is

particularly so when it comes to treating metallo-cyanide complexes. The SO_2/Air process is therefore rated as preferred, and the hydrogen peroxide process as acceptable. Use of hydrogen peroxide to treat clear solution, following natural degradation in the TSF is not regarded as acceptable, as this process would result in higher strength cyanide and metallo-cyanide concentrations in the tailings pore water that would persist for decades.

2.5.9.3 Summary Evaluation

2.5.9.3.1 Technical and Economic Feasibility

Use of in-plant SO_2/Air is proven technology for cyanide destruction and is economically feasible for the proposed Project.

2.5.9.3.2 Rationale for Selection of the Preferred Alternative

The overall preferred alternative is use of in-plant SO_2/Air treatment to reduce cyanide and associated heavy metals to low levels in the tailings slurry coming out of the process plant, followed by natural degradation (as a polishing step) in the TSF to achieve further supernatant and porewater improvement. Use of this technology was considered superior for all performance objectives. The use of hydroxide treatment is considered acceptable if this technology is used to treat tailings slurry before it is discharged from the mill. The Proponent has chosen to implement the superior SO_2/air treatment of tailings slurry alternative.

2.5.10 Tailings Disposal and Management

A MAA methodology was used to assess tailings disposal and management alternatives. A summary of the Rescan (2014) alternatives assessment is provided in this section; the MAA is included in **Appendix 2.5A**.

The TSF alternatives assessment process (Environment Canada, 2011) involved seven steps to select a TSF site similar to overburden and NAG rock (**Section 2.5.4**):

New Gold conducted an initial screening of all potential tailing sites within a basic economic radius of 10 km of the mineral deposit. Threshold criteria were used by New Gold to exclude sites in the area that were no feasible due to basic topographic, accessibility/cost, and technology limitations. The result was the identification of eight potential TSF candidate alternative sites for the Project:

1. Option A: Upper Blackwater River Sub-basin TSF;
2. Option B: Upper Mathews Creek Sub-basin TSF;
3. Option C: Upper Davidson Creek Sub-basin 1 TSF with underwater PAG codisposal;
4. Option C-OL: Upper Davidson Creek Sub-basin 1 TSF with on-land PAG storage;
5. Option D: Upper Davidson Creek Sub-basin 2 TSF with underwater PAG codisposal;
6. Option D/PAG OL: Upper Davidson Creek Sub-basin 2 TSF with on-land PAG storage;
7. Option E: Upper Creek 661 Sub-basin TSF; and

8. Option FS: Combined C and D TSF.

Pre-screening resulted in five alternatives being further considered:

1. Option C;
2. Option D;
3. Option D/PAG OL;
4. Option E; and
5. Option FS.

The Option FS TSF resulted in the highest value for all multiple accounts and sensitivity analyses. The Option FS TSF is similar to the Option D TSF, primarily due to both options occupying largely the same footprints and both involving the sub-aqueous co-disposal of tailings and PAG waste rock into a single impoundment (a nested impoundment for Option FS TSF). However, the Option FS TSF represents a technical optimization over the Option D FS, as its design facilitates the early closure of a significant portion of the facility and has lower ultimate main and saddle TSF dams. In addition, the starter tailings dam for Site C in the Option FS is simpler to construct than the starter dam for Option D, as the latter would involve early construction of a relatively deep cut-off trench. Construction of the Option FS Site D TSF dam can be sequenced over a longer time period in concert with construction and operation of the Site C TSF facility.

Option FS TSF is superior to Option C as the former has lower ultimate TSF dams, probable less seepage, simpler subaqueous disposal of PAG waste rock during operations and superior closure attributes (pit water can be routed to the TSF Site D facility; allows for early closure of TSF Site C facility).

The MAA concluded Option FS TSF should be adopted for the Project.

The TSF will not discharge for 35 years from start of mining (first full year of tailings supernatant discharge Year 36). At that time the open pit will overflow to the TSF. The final discharge point alternatives include Davidson Creek, Creek 661, or Creek 705.

2.5.10.1 Davidson Creek

Davidson Creek is immediately downstream of TSF adopted for the Project through the MAA described above. Locating the final discharge to Davidson Creek reconnects the pre-mining catchment and returns flow to Davidson Creek similar to the flows that occur at pre-mining. This final discharge point will allow cessation of the Tatelkuz Lake freshwater pumping system. It simplifies discharge compared to other options by relying only on gravity through the TSF spillway and a connecting channel; no pumping will be required.

A sub alternative for discharge from the TSF to Davidson Creek would be to route water from the East NAG Dump to Creek 661 at post closure instead of to the TSF. This would return baseline flows in Creek 661 and eliminate a long ditch downslope of the East NAG Dump to the TSF.

2.5.10.2 Creek 661

Choosing Creek 661 required a connecting ditch from the TSF to a Creek 661 headwater tributary. Discharge to Creek 661 would significantly increase flows in the creek compared to baseline and could result in stream bed scouring. Use of Creek 661 would also mean perpetual operation of the Tatelkuz Lake freshwater pumping system to Davidson Creek to maintain flows. Similar to the Davidson Creek discharge option, no pumping would be required.

2.5.10.3 Creek 705

Locating the final discharge point to Creek 705 would require pumping from the TSF to the creek and would significantly increase the flow in Creek 705 compared to baseline; stream bed scouring is a potential negative effect of this option. Perpetual operation of the Tatelkuz Lake freshwater pumping system to Davidson Creek would be required to maintain flows for in-stream fish needs.

2.5.10.4 Summary

2.5.10.4.1 Technical and Economic Feasibility

Final discharge to Davidson Creek is technically and economically feasible given the preferred location of the TSF.

2.5.10.4.2 Rationale for Selection of the Preferred Alternative

Davidson Creek is the most practical and environmentally acceptable alternative for TSF final discharge point in post-closure. The major factor is ability to return flows to near baseline conditions in Davidson Creek and cessation of pumping freshwater from Tatelkuz Lake. The sub-alternative of discharging drainage from East waste rock dump to Creek 661 will be pursued if water quality acceptable.

2.5.11 Fresh Water Supply

2.5.11.1 Alternatives and Initial Screening

Preliminary site water balance calculations show the TSF will be in balance under average precipitation conditions, with no surface water discharge to the environment during operations. The principal reason for this projected balance is the permanent storage of a large volume of water within the tailings and reactive mine rock void space, estimated at 15.7 Mm^3 annually at full production. The process plant will also require a small amount of freshwater for gland and reagent mix water. In addition, water is required to maintain the flows of water adequate for fish in Davidson Creek downstream of the TSF. The catchment of Davidson Creek is reduced by 58%[2] due to construction of the TSF. Most of the fresh water required for the project is in fact needed to maintain flows for fish in Davidson Creek as discussed below.

[2] Baseline 76.2 km^2; at full build out of TSF 31.9 km^2

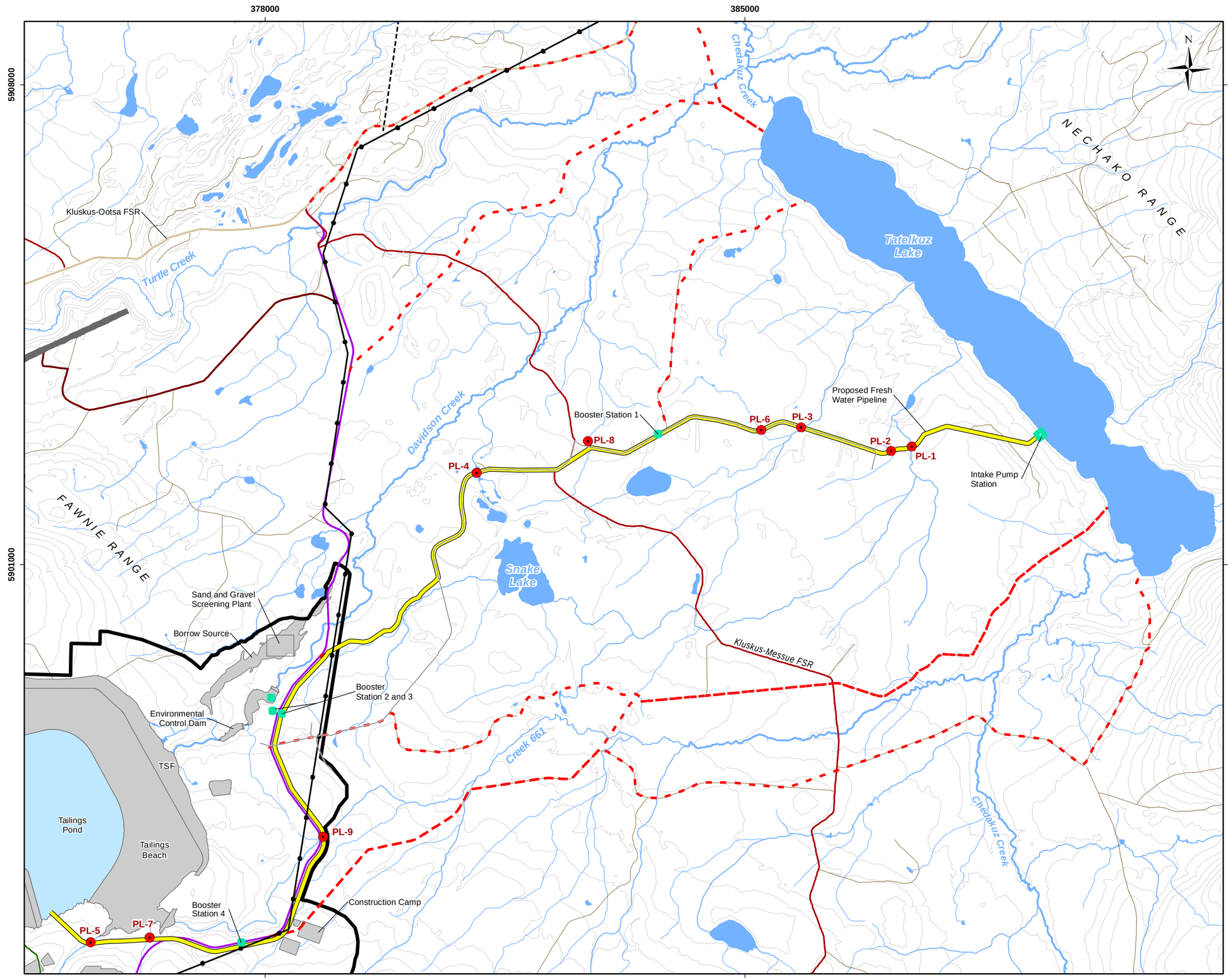
It was determined that an external water source will be required to provide the required freshwater. Knight Piésold (2012) identified three potential local water sources, namely Tatelkuz Lake, Kuyakuz Lake, and Top Lake. Knight Piésold (2012) initially reviewed groundwater sources but the potential drawdown of groundwater aquifers would negatively affect surface water flows in Davidson Creek and this alternative was abandoned.

The potential freshwater sources considered in this assessment are therefore:

- Tatelkuz Lake;
- Kuyakuz Lake; and
- Top Lake.

2.5.11.1.1 Tatelkuz Lake

Tatelkuz Lake has a watershed area of 395 km^2 and a surface area of 9.1 km^2. The average annual lake outflow is estimated at 453 Mm^3. A variable rate of water withdrawal is required to maintain instream fish needs of 198 to 2,329 m^3/h or 27.3 Mm^3/y. At maximum makeup requirement for the process plant will be 1.05 Mm^3/y. Over an annual cycle the maximum water withdrawal from Tatelkuz Lake would be 28.4 Mm^3. A water take of 28.4 Mm^3 represents 6% of this outflow, which is within natural variability of the lake. Taking water from Tatelkuz Lake would require an approximate 15.7 km long, 24" (61 cm) diameter steel pipeline **Figure 2.5.11-1**). An annual average flow reduction of 6% can be readily supported by most aquatic systems and this alternative is consequently retained for further more detailed consideration.



Legend

- Pipeline Stream Crossings
- Kluskus-Ootsa FSR
- Other FSRs
- Existing Road
- Contour (20 m)
- Stream
- Waterbody
- Watersheds

Project Components

- Exploration Road
- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Freshwater Supply Pipeline
- Freshwater Supply Pipeline Alternatives
- Proposed Airstrip Access Road
- Proposed Airstrip
- Fresh Water Pumpstations
- Proposed Mine Site
- Proposed Mine Site Facilities
- Tailings Pond

Scale:1:55,000

0 1 2 3

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold™

PROJECT: Blackwater Gold Project

Freshwater Supply Pipeline Alternatives

DATE:	ANALYST:	
September, 2014	WR	**Figure** 2.5.11-1
JOB No: VE52420	QA/QC: MY	PDF FILE: 10-200-165_PipelineLSA_v3.pdf
GIS FILE: 10-200-165_PipelineLSA_v3.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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2.5.11.1.2 Kuyakuz Lake

Kuyakuz Lake has a watershed area of 10.2 km^2 and a surface area of 7.6 km^2. The average annual lake inflow is estimated at 23 Mm^3. A water take of 28.4 Mm^3 represents more than this inflow. This alternative is consequently rejected from further consideration because it is unlikely to be consistent with environmental and planning objectives.

2.5.11.1.3 Top Lake

Top Lake has a watershed area of 3.6 km^2 and a surface area of 0.15 km^2. The average annual lake inflow is estimated at 7 Mm^3. The required water input is greater than the estimated lake inflow and thus, this alternative is consequently rejected from further consideration.

2.5.11.2 Summary Evaluation

2.5.11.2.1 Technical and Economic Feasibility

Water supply from Tatelkuz Lake is the only technically and economically feasible alternative.

2.5.11.2.2 Rationale for Selection of the Preferred Alternative

Analysis of available water to support withdrawal at the required rate indicates, for lakes in the general area of the Project, only Tatelkuz Lake is suitable.

2.5.12 Solid Waste Management

2.5.12.1 Alternatives and Initial Screening

Solid wastes are herein defined to include non-hazardous wastes including such items as food scraps, refuse, metal tins, scrap metal, glass, plastic, wood, and paper, and other such items. Hazardous wastes would be shipped off site by licensed carriers to licensed facilities, and are not considered here. Over the LOM it is expected that in the order of 100,000 m^3 of non-hazardous solid wastes would be generated, excluding demolition wastes at closure, which are considered separately (**Section 2.2**).

The available alternatives for non-hazardous solid waste disposal are:

- On-site landfill;
- Off-site existing landfill; and
- Incineration with ash disposal in an on-site landfill.

Waste reduction, re-use, and recycling would be practiced to the extent practicable; but in and of themselves, these strategies are considered supportive of other alternatives, and are not considered as waste disposal alternatives.

2.5.12.1.1 On-Site Landfill

The on-site landfill would be positioned a minimum distance of 500 m from the construction and operations camps within an overburden portion of the West waste rock dump, at a location up-gradient from the TSF, such that all runoff and seepage from the landfill would report to the TSF. An on-site landfill will be operated as a trench and fill system, in accordance with applicable provincial regulations and guidelines. The on-site landfill would be used for bulk wastes that cannot be recycled, or reduced in volume with incineration. Other wastes that would go to the landfill include non-combustible camp refuse and inert industrial refuse that cannot be incinerated. This waste may consist of plywood, rubber, non-recyclable scrap metal and machinery parts, building construction debris, and plastics.

Use of an on-site landfill is standard practice for remote industrial operations such as mine sites, and this alternative meets all of the screening criteria listed in **Table 2.5.1-1** and is therefore retained for more detailed consideration.

2.5.12.1.2 Incineration with Ash Disposal in an On-site Landfill

Incineration involves the burning of selected wastes at very high temperatures, with the ash to be deposited within an on-site landfill. Combustible (non-putrescible) wastes such as clean, untreated wood waste such as pallets would be stockpiled and reused wherever possible. Pallets that cannot be reused would be incinerated and the ash disposed of in the on-site landfill. Food, food-covered packaging, and other combustible (non-recyclable) office wastes would be collected and stored in sealed, wildlife-resistant containers and incinerated with the ash being deposited in the landfill and covered with fill intermittently to reduce fugitive dust. The primary benefits of incineration include volume reduction and permanent disposal of waste (with the exception of ash and items mentioned above). Incineration also provides a safe and effective means for the disposal of food wastes that might otherwise be attractive to problem wildlife.

Incineration of suitable non-hazardous solid waste meets all of the screening criteria shown in **Table 2.5.1-1**, recognizing that stringent environmental controls are attached to the operation and monitoring of such facilities. The incineration alternative is therefore retained for further more detailed consideration.

2.5.12.2 Performance Objectives and Evaluation

All three alternatives were brought forward for more detailed evaluation depending on the wastes needing disposal:

- On-site landfill;
- Incineration with ash disposal in an on-site landfill; and
- Backhaul off site with appropriate contractors to an approved waste or recycling facility.

Some recyclables may be backhauled off site in outgoing delivery vehicles and donated to a local charity. A designated recycling program would be established to accommodate this, and will include separation of key recyclables that are part of the BC deposit/refund program.

Performance objectives applicable to the disposal of non-hazardous solid waste are:

- Cost effectiveness;
- Technical applicability and system reliability;
- Ability to service the site effectively;
- Effects on the natural environment; and
- Amenability to reclamation.

2.5.12.2.1 Cost Effectiveness

Development of an on-site landfill is considered the most cost-effective alternative. Incineration has higher capital costs, and operating costs, particularly for monitoring. Development of an on-site landfill is therefore preferred from a cost effectiveness performance perspective, and use of an on-site incinerator is rated as acceptable. While expensive, off-site disposal of some wastes is the only feasible option for items such as welding rods, electronics, batteries, and other materials that contain heavy metals because these cannot be disposed of in the on-site landfill or incinerated. These wastes can be stockpiled on site in appropriate containers and taken off site on back-hauls when there is sufficient quantity to justify the costs.

2.5.12.2.2 Technical Applicability and System Reliability

Operation of the trench and fill landfill system is a standard technology that is reliable and predictably effective for the management of non-hazardous solid waste. Any runoff and seepage from the facility would report to the TSF that is contained. Incinerators are also effective but can be more difficult to operate to consistently achieve end-of-stack compliance standards. Development of an on-site landfill is therefore preferred from a technical applicability and system reliability performance perspective, and use of an on-site incinerator is rated as acceptable.

2.5.12.2.3 Ability to Service the Site Effectively

Both alternatives (on-site landfill or incinerator) are able to service the site effectively; but incineration has the ability to destroy food wastes, which is an advantage when it comes to discouraging wildlife (particularly bears) from coming to the site. Properly operated landfills limit the exposure of food wastes, but are less effective than incineration. The incineration alternative is therefore preferred for this performance objective and land filling is rated as acceptable.

2.5.12.2.4 Effects on the Natural Environment

Both non-hazardous waste disposal alternatives require effective source separation for leachate and/or air emissions control. Materials such as batteries and computer components, and other such materials, containing heavy metals (e.g., cadmium and lead) should be segregated out for suitable off-site disposal to licensed facilities. With proper controls, either waste disposal system is capable of providing the required level of environmental protection. Incineration, as mentioned above, is the more effective alternative when it comes to non-interference with wildlife, and with personnel/bear safety issues. Incineration generates immediate GHG emissions, but the gradual

long-term breakdown of landfill wastes generates methane which is a stronger GHG. Based on a search of various internet articles there does not appear to be any consensus regarding which alternative is preferable in terms of GHG, as there are a large number of variables to consider. Both options are rated as acceptable for this performance objective because each will handle different wastes.

2.5.12.2.5 Amenability to Reclamation

Incineration removes much bulk of generated solid wastes, but both alternatives are consistent with modern reclamation standards. Landfills require long-term monitoring, but such monitoring will be required for the site in any event. Both alternatives are therefore rated as preferred for this performance objective.

2.5.12.3 Summary Evaluation

2.5.12.3.1 Technical and Economic Feasibility

Use of an on-site landfill is a technically and economically feasible method of disposing of inert industrial waste that cannot be recycled.

2.5.12.3.2 Rationale for Selection of the Preferred Alternative

A variety of wastes will be produced on site, viz., food and other putrescible, combustible (non-putrescible), non-combustible, and recyclable (as noted above hazardous wastes are not considered in this evaluation). Each of these has to be treated in a different way. An incinerator would be suitable for handling combustible wastes such as clean, untreated wood waste and food, food-covered packaging, and other combustible (non-recyclable) office wastes. An on-site landfill would be suitable for treating non-combustible, non-recyclable wastes such plywood, rubber, non-recyclable scrap metal and machinery parts, building construction debris, and plastics that cannot be reduced in volume with incineration. Some wastes such as welding rods, electronics, and batteries, which contain heavy metals, cannot be treated on site, and will have to be taken off site for disposal at an approved off-site facility.

2.5.13 Power Supply

2.5.13.1 Alternatives and Initial Screening

Proposed activities during the operations phase will require approximately 120 MW of available power, with the majority of this power being required for mill processing. Alternatives considered for the Project power supply include:

- Transmission line connection to grid;
- On site diesel generation;
- Wind power;
- Solar power;

- Biomass power; and
- Local Hydroelectric generation with transmission line connection.

2.5.13.1.1 Transmission Line Connection to the Grid

Engineering studies have concluded that a 230 kV line would provide a reliable energy source for the processing plant. The closest existing 230 kV transmission line to the Project site is the 230 kV line (2L353) extending between Vanderhoof in the east (TAC Substation) to Endako in the west (GLN Substation). There is also an existing 500 kV transmission (5L61, 5L62, and 5L63) that extends from Prince George in the east to Terrace in the west, with a connector substation (GLN) at Endako. The most expedient alternative would be to connect with the existing 230 kV substation at either Endako or Vanderhoof.

Transmission line connection to the existing grid is a standard and preferred practice within the mining industry and this alternative meets all of the criteria listed in **Table 2.5.1-1**, and is retained for further more detailed consideration.

2.5.13.1.2 On-Site Diesel Generation

The necessary power plant for diesel generation would comprise a large number of mid-size generators (e.g., typical 1.5 MW generator banks used for construction and back-up power at many mine sites), to a lesser number of very large generators. Caterpillar is reportedly the world's largest manufacturer of diesel generators, and manufactures units up to 17.46 MW in size. Providing 120 MW with mid-sized generators would not be practicable. With the largest size generators available from Caterpillar, it would take eight of these units (7 operating and 1 on standby) to provide the required level of power.

Fuel usage for on-site diesel fired generation for the operation phase of the Project would be in the order of 200 million litres per year (ML/y). Tandem fuel trucks are typically able to carry 30,000 L. It would consequently take 6,667 tanker truckloads per year, or 18.3 loads per day, 365 days per year (d/y), to supply the required fuel for diesel power generation alone, not counting fuel required for heavy equipment operation. Diesel power generation would also result in substantive GHG gas emissions compared with all other alternatives.

Diesel power generation for an operation the size of this Project would cost approximately three times that of transmission line power, or approximately $276 million, and would require the transport of excessive quantities of fuel. The on-site diesel power generation alternative is therefore not economically practical, and nor is it consistent with provincial and federal planning objectives, and is therefore rejected from further consideration.

2.5.13.1.3 Wind Power

Wind power cannot consistently deliver reliable power for Project operations under any practicable scenario, irrespective of nameplate capacity, as suitable battery storage technologies are not available to provide power during low wind conditions. This alternative is rejected from further consideration.

2.5.13.1.4 Solar Power

The use of solar power is similarly problematic as a Project power source, considering both the scale of the Project operation (120 MW power demand), and its location in north-central BC. The largest operating photovoltaic solar power stations in the world are in the order of 150 MW, and all of the very large plants are located in southern sunny climates such as in the California, Spain, Australia, and the Middle East. The climate in these locations is much more conducive to this type of installation compared with north-central BC. There are also insurmountable issues with power storage for night time and low sun conditions.

The solar power alterative is rejected from further consideration.

2.5.13.1.5 Biomass Power

The viability of the Project depends upon relatively inexpensive grid power supplied by BC Hydro. Forest biomass power of the capacity required is not a reliable source given the uncertainty of wood supply over the project life of the mine. As well, the capital cost for a biomass plant would rival or exceed the cost of the proposed transmission line. While combustion of biomass is considered carbon neutral, greenhouse gas emissions due to Project operations would increase with the wood fuel supply trucking requirement.

The forest biomass power alterative is therefore rejected from further consideration.

2.5.13.1.6 Local Hydroelectric Generation with Transmission Line Connection

Similar to the case for a large-scale forest biomass power plant, there are no hydroelectric generation projects proposed in the area of sufficient capacity to service the Project.

The hydroelectric power generation alterative is therefore rejected from further consideration.

2.5.13.2 Summary Evaluation

2.5.13.2.1 Technical and Economic Feasibility

Connection to the provincial power grid with a dedicated transmission line is technically feasible for the proposed Project and provides the only viably economic means of supply power.

2.5.13.2.2 Technical and Economic Feasibility

The only power supply alternative for the Project is a transmission line connection to the provincial grid. No other alternatives warrant detailed evaluation. **Section 2.5.14** discusses the options for routing the transmission line from the main power grid to the mine site and provides the rationale for choosing the most preferred routing.

2.5.14 Aggregate Sources

2.5.14.1 Alternatives and Initial Screening

Aggregates are required for concrete manufacture, TSF dam filter zones, road construction, development of laydown areas, and other incidental needs. Aggregate materials required for these needs will consist of sand, gravel, and crushed rock. The bulk of the TSF dams will be constructed with overburden and ROM low metal leaching NAG rock, recovered from open pit operations, which for the purpose of this EA stripped overburden and ROM NAG rock are not regarded as aggregate.

Aggregate materials (sand, gravel, and crushed rock) can be obtained from NAG mine rock, mine site area aggregate pits, and quarries, and/or from off-site sources.

Aggregate source alternatives considered for the Project are:

- Low metal leaching NAG5 mine rock;
- Mine site area pits and quarries; and
- Off-site pits and quarries.

2.5.14.1.1 Low Metal Leaching NAG Mine Rock

Where quarried rock is required for aggregate (either as granular or rock fill) the material of choice would be NAG mine rock with a low metal leaching potential, as this material will be removed and available in any event as part of mining operations. It is consequently more cost effective and environmentally responsible to use this material for construction, rather than to develop alternative quarry sites. Current mining plans provide for the removal of 11 Mt of low metal leaching NAG (NAG5) rock during the mine construction phase, and a total of 108.9 Mt of low metal leaching NAG over the entire mine life. These quantities are sufficient to meet Project construction and operations needs for crushed rock including early Dam C (5.8 Mt) and early Dam D construction (200,000 tonnes). High zinc containing NAG rock is suitable for rock fill for the construction of upstream portions of the TSF dams where the rock will be flooded and encapsulated by tailings.

Low metal leaching NAG rock is a readily available aggregate resource, which meets all of the **Table 2.5.1-1** screening criteria, and is therefore retained for more detailed consideration.

2.5.14.1.2 Mine Site Area Pits and Quarries

The following areas were considered for use in the development of the Project:

- Plant site area;
- Site C south borrow source;
- Site D south borrow source, and
- Aggregate screening area.

These potential borrow source locations are shown in **Figure 2.5.14-1**, and the material types are summarized below.

The plant site design indicates a finished surface elevation of 1,433 m. Bulk excavation at the site would generate more than 500,000 m^3 of material, and sub-excavation could provide additional overburden or shot rock. The site investigations encountered sand and gravel with a variable fraction of fines (10% to 30%) and some cobbles and boulders. The excavated material would be suitable for use as backfill but may require some processing to be used as structural fill or in MSE wall construction.

A screening plant is proposed to sort the sand and gravel into useable size fractions. No other suitable sand and gravel deposits have been identified on the site.

The identified on-site aggregate resource meets all of the **Table 2.5.1-1** screening criteria, and is retained for more detailed consideration.

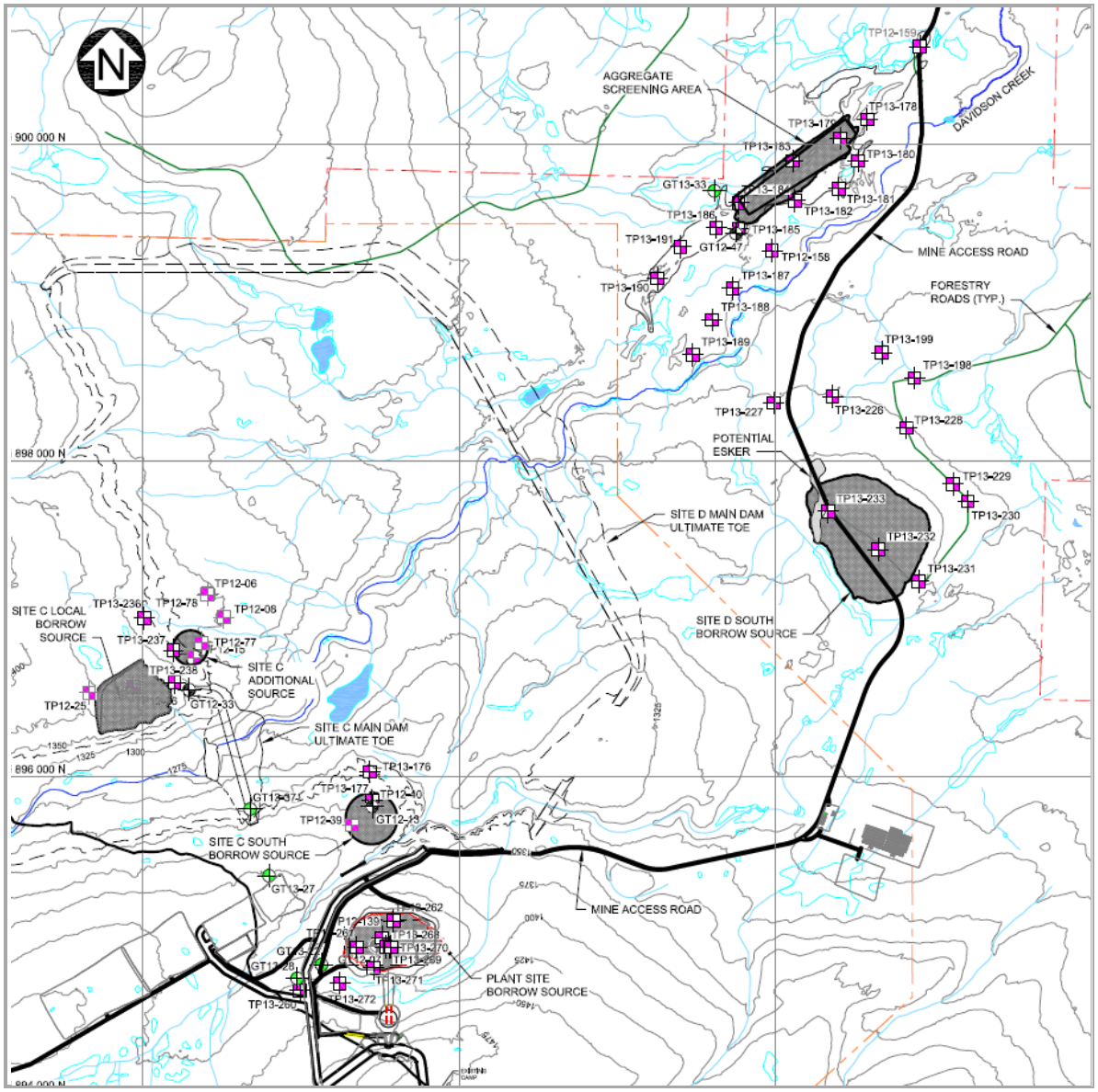


Figure 2.5.14-1: Identified Borrow Source Locations

2.5.14.1.3 Off-Site Pits and Quarries

Off-site pits and quarries would only be used to facilitate mine site development if suitable on-site aggregate resources were not available. This is not the case, such that off-site pit and quarry development is neither required, nor proposed for site development. The only instance where off site pits and quarries would be needed would be for mine access road upgrade and maintenance needs; aggregate sources have been located from geotechnical investigations within the right-of-way (ROW) of the new access road. Existing borrow sources previously and currently being used

to maintain the Kluskus and Ootsa FSRs would be used for this purpose; hence no new pits or quarries are proposed for off-site areas.

The use of off-site pits and quarries is carried forward for further more detailed consideration only within the context of supplying materials for mine access road upgrades and maintenance.

2.5.14.2 Performance Objectives and Evaluation

Alternatives carried forward into the detailed evaluation are:

- Low metal leaching NAG mine rock;
- Mine site area pits and quarries; and
- Off-site pits and quarries (mine access road upgrades and maintenance only).

Performance objectives applicable to domestic sewage treatment are:

- Cost effectiveness;
- Technical applicability and system reliability;
- Ability to service the site effectively;
- Effects on the natural environment; and
- Amenability to reclamation.

2.5.14.2.1 Cost Effectiveness

Low metal leaching NAG mine rock will be available as a mining waste suitable for most of the Project's quarried rock needs. Re-use of this waste material is an industry standard and will avoid the need for additional quarry sites.

Use of the identified on-site esker (and other borrow) resource for sand and gravel needs is cost-effective as these resources are of high quality, offer sufficient volumes and material, and are readily accessible.

The use of off-site pits and quarries is cost effective for mine access road upgrades and maintenance because of closer proximity to the point of end use. It is expected that most, if not all, off-site aggregate resource needs can be supplied by existing or former aggregate pits used to construct and maintain this road network.

Use of low metal leaching NAG mine rock from pit stripping, the identified on-site in-pit and borrow area aggregate resources, and off site aggregate pits for mine access road upgrades and maintenance, are all rated as preferred alternatives, with each having specific advantages for their selective and complimentary uses.

2.5.14.2.2 Technical Applicability and/or System Integrity and Reliability

All alternatives are comparable with regard to this performance objective, and all are rated as preferred.

2.5.14.2.3 Ability to Service the Site Effectively

The critical parameters associated with this performance objective are material quantity and quality, proximity to the area of end use, scheduling, and land tenure. The identified on site resources (low metal leaching NAG5 mine rock and borrow pit aggregate) are present in sufficient quantity and quality to meet all Project aggregate needs, and are also located in close proximity to the locations of end use. These materials are also all located with lands to which The Proponent holds surface and mining rights. Production of low metal leaching NAG mine rock and esker and borrow source aggregate is expected to be able to meet Project scheduling needs. All alternatives are rated as being preferred, for their respective and complimentary selective uses.

2.5.14.2.4 Effects on the Natural Environment

Use of the low metal leaching NAG mine rock alternative will result in minor additional and temporary/intermittent air emissions associated with crushing (as needed). Otherwise, this alternative will have no adverse environmental effects, and its use would have a small positive effect on reducing the total quantity of mine rock left on the site at closure, compared with bringing in additional materials from outside sources.

Use of the on-site esker aggregate resource would be potentially disruptive to Davidson Creek and its associated valley system; however the Davidson Creek valley system upstream of the esker will be totally overprinted and displaced by the proposed TSF, such that any addition system disruptions caused by development of the esker borrow source would be minor.

Adverse environmental effects related to the use of off-site aggregate resources for mine access road upgrades and maintenance will be limited by using existing and former borrow sources to the extent feasible.

Therefore, from a natural environment perspective, all alternatives are rated as being preferred for their respective and complimentary uses.

2.5.14.2.5 Amenability to Reclamation

There are no substantive differences between any of the alternatives in terms of their amenability to reclamation. All alternatives are rated as preferred for this alternative.

2.5.14.3 Summary Evaluation

2.5.14.3.1 Technical and Economic Feasibility

All of the aggregate supply alternatives considered is technically and economically feasible for the proposed Project.

2.5.14.3.2 Rationale for Selection of the Preferred Alternative

All of the aggregate supply alternatives considered for more detailed evaluation are preferred for their respective and complimentary uses, such that the use of all alternatives is proposed, as appropriate. The only limitation to the use of low metal leaching NAG5 mine rock is that crushing will be required which is an additional cost, such that wherever esker or other on-site borrow is the better material choice in preference to crushed NAG5 mine rock, esker or borrow source material would be used.

2.5.15 Project Access and Transportation Routes

2.5.15.1 Alternatives and Initial Screening

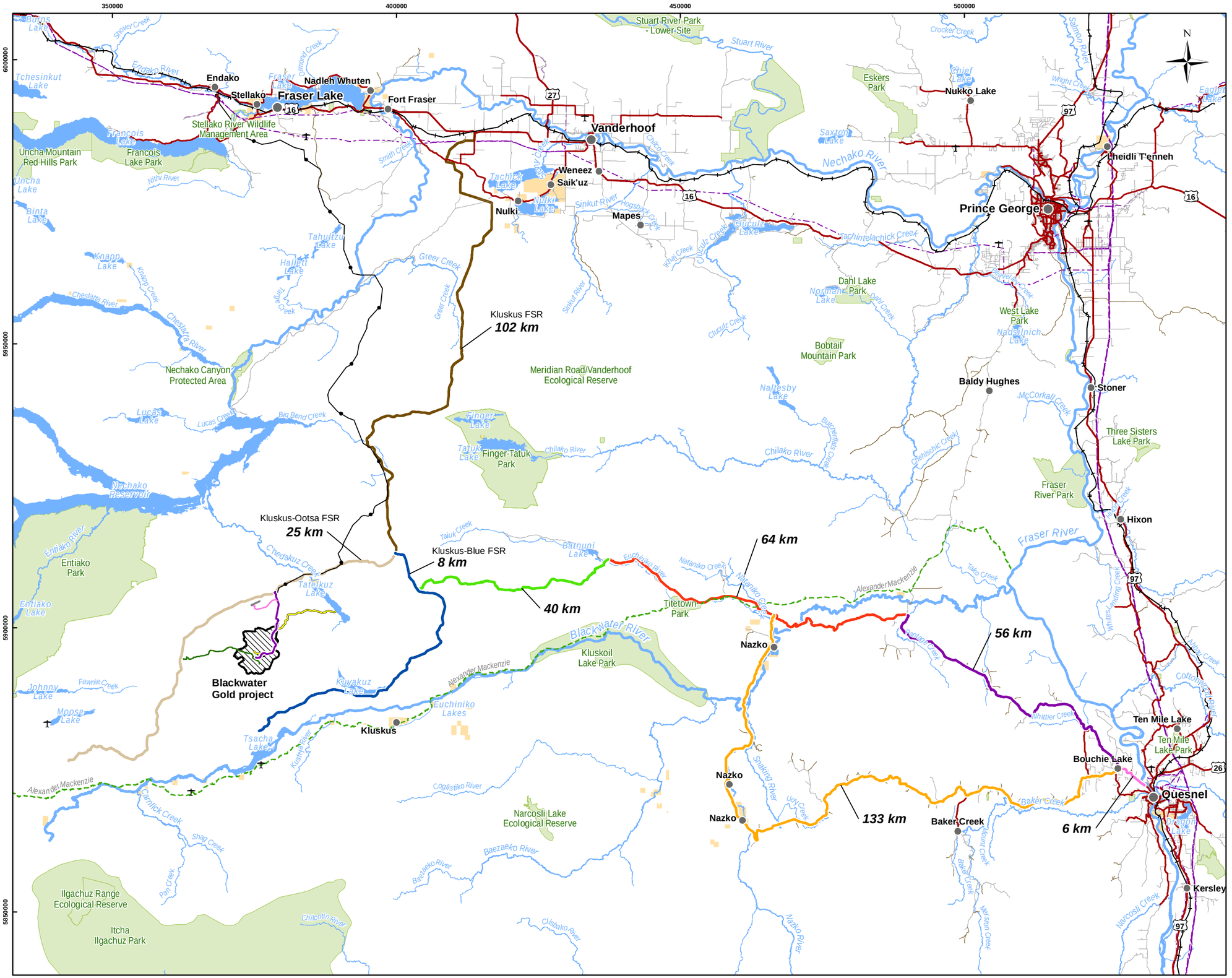
The possible alternatives for site access and transportation routes are:

- Utilization and upgrading of existing access via the Kluskus and Ootsa FSRs;
- Developing a new access route from Highway 20, connecting south via Highway 97; and
- Upgrade existing FSRs from Quesnel, Highway 97 to the Kluskus-Blue FSR connecting from there to the Kluskus-Ootsa FSR.

Air transport can provide site access and transport for selected service needs, but is not suitable for meeting general Project access and transportation needs, and is not considered herein within this context. Air transport is considered separately in **Section 2.2**.

2.5.15.1.1 Utilization and Upgrading of Existing Access via the Kluskus and Ootsa FSRs

The existing Kluskus and Ootsa FSRs connect the Project site to Highway 16 at Engen, which in turn connects to Vanderhoof and Prince George (**Figure 2.5.15-1**). The route to the site can be improved, as proposed, by developing a more direct north-south connection between the Project site and the Ootsa FSR. The total travel distance from Engen to the mine site along the proposed route involves travelling 103 km along the Kluskus FSR, 24 km along the Ootsa FSR, and 16 km along the proposed new north-south alignment, for a total distance of 143 km.



Legend

- Populated Place
- Transmission Line
- Railway
- Highway/Arterial.
- Resource/Recreation
- Other
- Heritage Trail
- Stream
- Waterbody
- Park or Protected Area
- Indian Reserve

Project Components

- Proposed Transmission Line
- Exploration Road
- Proposed Mine Access Road
- Proposed Fresh Water Pipeline
- Airstrip Access Road
- Airstrip Extent
- Mine Site

Access Road Alternatives

- Blackwater Road 1 (6 km)
- Blackwater Road 2 (56 km)
- Nazko Road (133 km)
- Batnuni Road (64 km)
- Other (40 km)
- Kluskus FSR (102km)
- Kluskus-Ootsa FSR (25km)
- Kluskus-Blue FSR (8 km)

Scale: 1:650,000

0 5 10 20 30

Kilometers

Reference
Context layers:
BC Government GeoBC Data Distribution

CLIENT: newgold™

PROJECT: Blackwater Gold Project

TITLE: Project Access Alternatives

DATE:	ANALYST:	QA/QC:	
September, 2014	WR	MY	**Figure** 2.5.15-1

GIS FILE: 14-100-030_Road_v2

JOB No: VE52420

COORDINATE SYSTEM: NAD 1983 UTM Zone 10N

amec

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The Kluskus-Ootsa FSR is a two-lane gravel surface forest access road, with 100 water crossings, up to the point of the proposed north-south connection. The Proponent has Road Use Agreements in place with Canfor and L&M Lumber Ltd. for use of the Kluskus and Ootsa FSRs for exploration work, and is pursuing agreements for use of these FSRs for mine construction and operation. The current agreements provide for contributions to road maintenance by the Proponent.

To provide longer-term service to the Project site, the following road upgrades would be required:

- Re-gravelling the road from 101+650 to 123+973 km (Mine Access Road junction);
- Maintaining the current road width, horizontal alignment, and vertical alignment of the existing road;
- Realigning the road from 104+900 to 106+738 km corner and establishing an 8-m running surface and 60 km/h design speed;
- Determining the design speed of the final design (this information will be used by The Proponent to post new speed limits on the upgraded road);
- Improving the existing ditch line or establishing a new ditch line where required; and
- Replacing damaged culverts or establishing a culverts where required.

Use of the Kluskus and Ootsa FSRs meets all of the **Table 2.5.1-1** criteria for initial alternative screening; hence, this alternative is retained for further more detailed consideration.

2.5.15.1.2 Developing a new Access Route from Highway 20, Connecting South via Highway 97

Developing a new access from the south via Highways 20 and 97 would require the construction of a minimum 75 km (straight-line distance) of new road through difficult terrain from approximately Anahim Lake on Highway 20.

Such development would be excessively costly and would unnecessarily expand the effects of the Project footprint including crossing the Grease Trail and the Blackwater River. Support for an alternative, southern access route is also unlikely to be provided by Aboriginal groups and government regulators when there is already existing Project access from the north. A southern access route would also direct socioeconomic benefits away from the more northern communities, which are resource dependant.

This alternative therefore fails to meet the first two criteria listed in **Table 2.5.1-1** (i.e., it fails to provide a viable solution to the problem; and it is not practical, financially realistic and economically viable). It may also not be within the ability of the Proponent to implement, and it is unlikely to be consistent with environmental and planning objectives, given that property access already exists. For all of the above reasons this alternative is rejected from further consideration.

2.5.15.1.3 Upgrading Existing FSRs from Quesnel Highway 97

A network of FSRs exist connecting Highway 97 at Quesnel with the Kluskus-Blue FSR which would provide access to the Kluskus-Ootsa FSR and the proposed Blackwater Project (**Figure** 2.5.15-1). Employing the most direct route would result in an access road for the mine of approximately 178 km. If the Nazko FSR would need to be used the distance increases to approximately 225 km. The condition of the Blackwater Road, the Nazko FSR and other connecting FSRs is unknown at the present. As well, the condition, of the bridge across the Blackwater River is also unknown. This route (based on map interpretation) will not likely require upgrades as far as Nataniko Creek where it joins the Alexander Mackenzie Trail. The FSRs progressively degrade from there west to the Kluskus-Blue FSR.

From environmental and social perspectives this route is less desirable than a route south from Vanderhoof because (1) it parallels the Alexander Mackenzie (Grease) Trail for part of its length and (2) is dotted with recreational sites all along the route. From an economic perspective, the route is considerably longer than that from Vanderhoof with attendant increased capital costs for road improvements and operating costs for road maintenance. AMEC understands that a major upgrade would be required for the Blackwater River bridge which would add considerably to capital costs if the mine proponent would have to bear the costs of the upgrade.

2.5.15.2 Summary Evaluation

2.5.15.2.1 Technical and Economic Feasibility

The existing Kluskus and Ootsa FSRs are technically and economically feasible for the proposed Project.

2.5.15.2.2 Rationale for Selection of the Preferred Alternative

The only site access and transportation route alternative retained for the Project is use of the Kluskus and Ootsa FSRs, with a new north-south terminal connection. No other alternatives warrant detailed evaluation. Other alternatives would require additional travel distance or new road construction.

2.5.16 Mine Access Alternatives

Two options were considered:

- Option 1: continue to use the existing exploration road which branches off the Kluskus-Ootsa FSR northwest of the Blackwater site; and
- Option 2: construct a new 16 km long access road branching off the FSR at KM 125 northeast of the Blackwater site.

The two options are shown on **Figure 2.5.16-1**.

2.5.16.1 Performance Objectives and Evaluation

2.5.16.1.1 Cost Effectiveness

A cost estimate for upgrade of the existing exploration road versus new access road construction was not undertaken as environmental considerations outweighed others. The actual difference in costs is likely not great since the transmission line and water supply pipeline would share all (transmission line) or part (freshwater supply line) of the mine access road right-of-way although the type of road required would be lower grade than a main access road. The greater length of Option 1 would increase operating costs somewhat. Based on a qualitative cost analysis considering access only, use of the existing exploration road is preferred.

2.5.16.1.2 Ability to Service the Site Effectively

Either option would be effective. While the existing exploration road is longer, the incremental increase over the total distance (approximately 140 km) is not significant. Both options are acceptable.

2.5.16.1.3 Effects on the Natural Environment

Option 1 crosses UWR, specifically caribou, and this option is not supported given this issue. Option 2 would result in increased new disturbance, but as previously mentioned, new disturbance will be required for the transmission line and freshwater supply pipeline. Option 1 is considered unacceptable and Option 2 is acceptable.

2.5.16.1.4 Effects on the Socio-Economic Environment

Option 1 would increase traffic in the UWR for caribou and has been identified as a concern by local First Nations. Option 2 avoids the winter range and is therefore preferred.

2.5.16.1.5 Summary Evaluation

2.5.16.1.6 Technical and Economic Feasibility

Both options are technically and economically feasible for the proposed Project.

2.5.16.1.7 Rationale for Selection of the Preferred Alternative

Two alternatives were evaluated for mine access: upgrade the existing exploration road, or, construct a new access. Economics probably favour Option 1, but it is unacceptable from environmental and socio-economic considerations due to crossing ungulate winter range for caribou. Therefore, Option 2, a new mine access road, was chosen as the base case.

360000 375000 390000 405000

5925000 5910000 5895000 5880000

Natalkuz Lake (Nechako Reservoir)
Entiako River
Mount Swannel 1768m
Capoose Lake
Erhorn Creek
Big Bend
Euchiniko River
Brewster Lake
Proposed Transmission Line
Kluskus FSR
Chedakuz Creek
Lake 113
Mills Lake
Chutanli Lake
Tauk Creek
FAWNIE RANGE
NECHAKO RANGE
Fawnie Nose 1926m
Kluskus-Ootsa FSR
Proposed Airstrip
Proposed Mine Access Road
Turtle Creek
Davidson Creek
Fawnie Dome 1726m
Tatelkuz Lake
Tatelkuz Mountain 1611m
Kluskus-Blue FSR
Proposed Airstrip Access Road
Proposed Fresh Water Pipeline
Top Lake
Snake Lake
Suscha Lake
Exploration Road
Lake 01428UEUT
Lake 01682LNRS
Lake 01538UEUT
Creek 705
Kuyakuz Mountain 1734m
Fawnie Creek
Laidman Lake
Mount Davidson 1856m
Mathews Creek
Kuyakuz Lake
Euchiniko Lakes
Tsacha Mountain 1781m
Blackwater River
Kluskus
Kluskus Creek
Williamson Lake
Tsacha Lake
Kushya River

N

Legend

- Populated Place
- Spotheights
- Kluskus FSR
- Kluskus-Blue FSR
- Kluskus-Ootsa FSR
- Stream
- Waterbody

Project Components

- Exploration Road
- Proposed Transmission Line
- Mills Ranch Reroute
- Proposed Mine Access Road
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Proposed Airstrip
- Proposed Mine Site

Watersheds

- Chedakuz Creek Local
- Creek 661
- Creek 705
- Davidson Creek
- Tatelkuz Lake Tributaries
- Turtle Creek
- Kuyakuz Lake
- Top Lake

Fish and Aquatic Resources

- Local Study Area
- Regional Study Area

Scale:1:200,000

0 2.5 5 10

Kilometres

Reference

BC Government GeoBC Data Distribution
AMEC 2013 Baseline Report - Fish and Aquatic Resources

CLIENT: newgold™

PROJECT: Blackwater Gold Project

Mine Site Access Options

DATE: May, 2014	ANALYST: WR	**Figure 2.5.16-1**
JOB No: VE52420	QA/QC: BM	PDF FILE: 09-100-022_kuyakuz_toplake_v2.pdf
GIS FILE: 09-100-022_kuyakuz_toplake_v2.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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2.5.17 Airstrip

2.5.17.1 Alternatives and Initial Screening

Allnorth (2013) carried out a study of airstrip alternatives for the Project, and initially identified 28 potential sites from local knowledge, previous work, and preliminary terrain analysis. These 28 sites were screened against a preliminary set of criteria as follows:

- Existing airstrip;
- ≤3% airstrip gradient;
- Elevation variance;
- Constructability;
- ≥2,500 m clear approach length;
- ≤3,000 ft (900 m) strip length;
- ≤3,800 ft (1150 m) strip length; and
- ≤5,500 ft (1,675 m) strip length.

Based on this screening, eight sites were selected for further field investigation, and the remaining 20 sites were discarded. Of the eight sites selected for field investigation, five were retained for further more detailed analysis, namely sites T1, T3, B4, S2,and S8 (**Figure 2.5.17-1**). The further analysis considered application of the initial set of criteria listed above, together with the following additional criteria, as well as costs:

- Ground distance to the site;
- New road construction requirements;
- Existing road and/or upgrade requirements;
- Bridge requirements; and
- Logging requirements.

Discussions of the five sites are provided below. The five sites were considered in relation to their being able to accept three standard aircraft types: King Air (minimum 900 m long strip requirement), Dash 8 (minimum 1,300 m long strip requirement), and Boeing 737-200 (minimum 1,675 m long strip requirement).

2.5.17.1.1 T1 – Tatelkuz Lake Site

The Tatelkuz Lake Site is an existing 884 m long, private active gravel airstrip that is used to service the Tatelkuz Lake Ranch Resort. The airstrip is located adjacent to the Kluskus FSR, 1.5 km north of Tatelkuz Lake, and 21.9 km from the Project site (**Figure 2.5.17-1**). This site has a good approach from the southeast, but the approach from the north would be restricted by the Project proposed transmission line. A principal concern with this site is possible interference with the ranch resort. Following its field investigation Allnorth recommended against use of this site because of proximity to the Project proposed transmission line and proximity to the Tatelkuz Lake

Ranch Resort. In addition, the T1 site would not lend itself to development of an airstrip with sufficient length to accommodate Boeing 737-200 aircraft. The T1 alternative is therefore screened out as not providing a viable solution for air access, is not consistent with planning objectives, and may not be within the ability of the proponent to implement, unless the Tatelkuz Lake Ranch Resort were to be acquired.

Therefore, the T1 site is rejected from further consideration.

2.5.17.1.2 T3 – Alternate Tatelkuz Site

The T3 site would be a new airstrip constructed at the same location as the existing T1 site, but with a direct north-south orientation. The T3 site alternative, if constructed, would displace the functioning of the existing Tatelkuz Lake site airstrip. The T3 alternative suffers from the same limitations as the T1 site and is rejected from further consideration.

365000 370000 375000 380000 385000 390000

5915000 5910000 5905000 5900000 5895000

N

Erhorn Creek
Chedakuz Creek
Proposed Transmission Line
Mills Ranch Reroute
Kluskus-Chedakuz FSR
Turtle Creek
Davidson Creek
Tatelkuz Lake
NECHAKO RANGE
Kluskus-Ootsa FSR
Proposed Airstrip
Access Road
Kluskus-Messue FSR
Snake Lake
FAWNIE RANGE
Top Lake
Kluskus-Malaput FSR
Fawnie Creek
Creek 661
Exploration Road
Creek 705
Chedakuz Creek
Kuyakuz Lake

S8 S7 Tatelkuz Airstrip T3 S10 S9 S11 S3 S4 B4 B7 S2 S1 B8 B3 R2 S6 B2 S5 B1 R1 S13 B6 B5

Legend

- Kluskus-Ootsa FSR
- Other FSRs
- Existing Road
- Contour (20 m)
- Stream
- Waterbody

Project Components

- Exploration Road
- Proposed Airstrip Access Road
- Proposed Mine Site Access Road
- Proposed Transmission Line
- Proposed Transmission Line (Mills Ranch re-route)
- Proposed Fresh Water Pipeline
- Proposed Mine Footprint
- Proposed Mine Site

Proposed Mine Site Facilities

- Bog / Wetland Area
- Borrow Source
- Construction Site
- Embankment fill
- Emergent Vegetation Wetland
- Esker Borrow Source
- Fresh Water Reservoir
- Low-Grade Stockpile
- NAG Waste Rock / Overburden
- Open Pit
- Pond
- Reclaim System
- Tailings Beach
- Top Soil
- Upland Beach

Airfield Candidate Locations

- Potential Location
- Excluded Location
- Proposed Airstrip Extent Alternatives

Scale:1:100,000

0 1 2 4 6

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold™

PROJECT: Blackwater Gold Project

Airstrip Candidate Locations

DATE: May, 2014	ANALYST: WR	**Figure 2.5.17-1**
JOB No: VE52420	QA/QC: MY	PDF FILE: Other-100-101_airstrip_Alternatives_v3.pdf
GIS FILE: Other-100-101_airstrip_Alternatives_v3.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095 Richfield BlackwaterMapping\Other\Other-100-101_airstrip_Alternatives_v3.mxd

2.5.17.1.3 B4 – Site

The B4 site is located northwest of the Project site and runs parallel to, and south of, the Ootsa FSR. The separation distance between the road and the proposed airstrip alternative is 1 km. This site has good approaches from west and the east, has flat to gently rolling terrain, and is positioned within a previously logged area. The site is positioned 19.8 km to the Project site.

The B4 site is capable of accommodating the full range of aircraft types considered for the Project, and does not appear to have any significant limitations that would prevent its use, and is therefore retained for further consideration.

2.5.17.1.4 S2 – Site

The S2 site is located 14.9 km directly north of the Project site adjacent to the proposed site access road, and is the closest of the five alternatives. The terrain is flat to gently rolling, and the site has been previously logged. The most serious limitation to the S2 site is that this site would not be able to accommodate Boeing 737-200 aircraft, but would be able to accommodate the two smaller aircraft types.

This S2 site is retained for further evaluation.

2.5.17.1.5 S8 – Site

The S8 site is located parallel to the west side of Red Road, approximately 30.8 km north of the Project site. Similar to other sites considered here, the terrain is flat to gently rolling, but tree clearing would be required to develop this site. There are no major limitations to the development of the S8 site, including its ability to accommodate all three aircraft types.

Therefore, the S8 site is retained for further consideration.

2.5.17.2 Performance Objectives and Evaluation

Alternatives carried forward into the detailed evaluation are the:

- B4;
- S2; and
- S8 sites.

Performance objectives applicable to selection and development of a site service airstrip are:

- Cost effectiveness;
- Ability to service the site effectively; and
- Effects on the natural environment.

2.5.17.2.1 Cost Effectiveness

Construction costs for alternatives B4, S2 and S8 were estimated at $10.96 million, $9.24 million and $14.13 million, respectively, and all sites have, or are near, existing road access (Allnorth, 2013). The S8 alternative is considerably more distant than either the B4 or S2 sites; 30.8 km compared with 19.8 km and 14.9 km; which over the life of the Project would add considerable additional costs, in terms of both time and money. Over the longer term, the added distance related cost would outweigh construction cost differentials. Consequently, from an overall cost perspective, the S2 alternative is rated as preferred, the B4 alternative as acceptable, and the S8 alternative as unacceptable. A 60 km round-trip distance is just too far for a local service airstrip, when other closer alternatives are available.

2.5.17.2.2 Ability to Service the Site Effectively

The B4 and S8 sites can both be developed to accommodate the full range of considered aircraft up to and including Boeing 737-200 aircraft. The S2 site can accommodate the two smaller aircraft types (King Air and Dash 8), but cannot accommodate the larger Boeing 737-200 aircraft. The B4 and S8 alternatives are therefore rated as preferred and the S2 site as acceptable.

2.5.17.2.3 Effects on the Natural Environment

All sites are located very near to existing access. The B4 and S2 sites are attractive, as both sites have already been logged. Consequently, their development would involve limited additional direct environmental disturbance. The S8 site, in contrast, is forested and would have to be logged. With regard to plant and wildlife species-at-risk and species of concern, no such species have been noted in association with any of the three alternative sites considered herein for development of an airstrip. The B4 and S2 sites are regarded as being preferred from the perspective of minimizing effects on the natural environment as both sites have already been logged. The S8 site is rated as acceptable.

2.5.17.3 Summary Evaluation

2.5.17.3.1 Technical and Economic Feasibility

Site S8 is economically unattractive due to the greater travel distance to the camp. Site B4 and S2 are economically feasible but B4 is technically preferred due to ability to accommodate a longer airstrip.

2.5.17.3.2 Rationale for Selection of the Preferred Alternative

The S8 alternative received an unacceptable rating for cost and is therefore rejected. The remaining two alternatives each received two preferred ratings and one acceptable rating. The B4 alternative while being more expensive than the S2 alternative because of distance to the Project site (i.e., 19.8 km vs. 14.9 km), was determined to be the overall preferred alternative based on serviceability, because this site has the capability of accommodating all three types of aircraft, whereas the S2 site is only able to accommodate the smaller aircraft.

2.5.18 Transmission Line Routing

2.5.18.1 Alternatives and Initial Screening

An examination of power supply alternatives determined that the preferred power supply alternative was 230 kV transmission line connection to the provincial grid (**Figure 2.5.18-1**). Knight Piésold (2013) conducted a review of six transmission line alternatives that would achieve connection with the grid, as per the following:

- Option 1 – alignment alternative connecting to the TAC 230 kV substation at Vanderhoof;
- Option 2 – central east alignment alternative requiring a new substation connection to 230 kV line segment 2L353 east of Fort Fraser;
- Option 3 – westmost alignment alternative connecting to the GLN 230 kV substation at Endako;
- Option 3a – same routing as Option 3, but connecting to the GLN 138 kV substation at Endako;
- Option 4 – a shorter variant of the Option 3 routing requiring a new substation connection to 230 kV line segment 2L353 west of Fort Fraser; and
- Option 5 – central west alignment requiring a new substation connection to 230 kV line segment 2L353 near Fort Fraser.

Alignment alternatives are shown in **Figure 2.5.18-1**. Alternative descriptions provided below are adapted from Knight Piésold (2013). The term “option” is mainly used in this section, as opposed to “alternative” for consistency with supporting background materials where the alternatives are identified as Option 1, Option 2, etc.

The Stellako- re-route and Mills Ranch-reroute are route refinements and are not considered as alternatives to be described in **Section 2.5**.

2.5.18.1.1 Option 1 – Connection to the TAC 230 kV Substation at Vanderhoof

The Option 1 corridor was identified during the 2011 PEA study, with efforts made to avoid private lands where practical. The point of interconnection with the BC Hydro grid with this alternative would be at the TAC substation, located in Vanderhoof. The approximate length of this option is 135 km and the line would be operated at a voltage of 230 kV. Approximately 11 km of this alignment would affect private land from the TAC substation heading south (i.e., 27 parcels of land held by 20 individuals or groups). The remainder of the line would be located on unsurveyed Crown land and is aligned as much as practicable with existing roads for ease of access and to reduce impacts to the land base.

This alternative meets all of the **Table 2.5.1-1** screening criteria and is retained for further more detailed evaluation.

2.5.18.1.2 Option 2 – Connection to 230 kV Line Segment 2L353 east of Fort Fraser

The Option 2 corridor was also previously identified during the 2011 PEA study, also with efforts made to minimize the crossing of private lands where practical. The point of interconnection with the BC Hydro grid would require a new substation connection east of Fort Fraser to existing the existing 230 kV transmission line segment 2L353 that runs from the GLN substation near Endako to the TAC substation near Vanderhoof. The approximate length of this option is 112 km and the line would be operated at a voltage of 230 kV. Approximately 5 km of this alignment would impact private land from the 2L353 tap heading south (i.e., 7 parcels of land held by five individuals or groups). The remainder of the line would be located on unsurveyed Crown land and is aligned as much as practicable with existing roads for ease of access and to reduce impacts to the land base.

This alternative meets all of the **Table 2.5.1-1** screening criteria and is retained for further more detailed evaluation.

2.5.18.1.3 Option 3 – Connection to the GLN 230 kV Substation at Endako

The Option 3 corridor is the westernmost of the six alternatives, and would connect with the BC Hydro grid at the GLN substation at Endako. This alignment is approximately 140 km in length and would be operated at a voltage of 230 kV. The alignment is entirely located on unsurveyed provincial Crown lands and is aligned, as much as practicable, with existing roads for ease of access and to reduce impacts to the land base.

This alternative meets all of the **Table 2.5.1-1** screening criteria and is retained for further detailed evaluation.

2.5.18.1.4 Option 3a – Connection to the GLN 138 kV Substation at Endako

Option 3a follows the same alignment as for Option 3, with the only difference between the two alternatives being that Option 3a would be operated at a voltage of 138 kV. A 138 kV capacity was determined to be inadequate and unreliable for meeting all Project power needs and is therefore not carried forward into the more detailed alternatives assessment.

320000 360000 400000 440000

6000000 5960000 5920000 5880000

François Lake
Endako
Stellako
Fraser Lake
Nadleh Whuten
Fort Fraser
Engen
Nechako River
Vanderhoof
Weneez
Sinkut River
Saik'uz
Nulki
Nulki Lake
Mapes
Cheslatta Carrier
Danskin
Skin Tyee
Uncha Lake
Takysie Creek
Binta Lake
Nithi River
Tachick Lake
Tahultzu Lake
Hallett Lake
Cluculz Lake
Cluculz Creek
Sinkut River
Corkscrew
Khai
Cheslatta River
Knapp Creek
Cheslatta
Targe Creek
Bird Creek
Lucas Lake
Lucas Creek
Knewstubb Lake
Big Bend Creek
Finger Lake
Tatuk Lake
Chilako River
Natalkuz Lake (Nechako Reservoir)
Tetachuck River
Entiako River
Entiako Lake
Cheddakuz Creek
Taluk Creek
Batnuni Lake
Euchiniko River
Nataniko Creek
Euchiniko
Nazko
Johnny Lake
Fawnie Creek
Laidman Lake
Moose Lake
Top Lake
Tatelkuz Lake
Kuyakuz Lake
Euchiniko Lakes
Blackwater River
Kluskus
Tsacha Lake
Kushya
Baezaeko

SAVORY RIDGE
NECHAKO FLOODPLAINS
NULKI HILLS
NECHAKO RANGE
FAWNIE RANGE
NAGLICO HILLS

Option 1
Option 2
Option 3/3A
Option 4
Option 5
Southern Portion
Southern Portion Alternative Route
Kluskus-Ootsa FSR
Proposed Airstrip
Exploration Road
Proposed Water Pipeline Route
Kluskus-Blue FSR
Alexander Mackenzie Heritage Trail

N

Scale: 1:500,000
0 5 10 20
Kilometres

Legend

- Populated Place
- Railway
- Existing Transmission Line
- Highway
- Kluskus FSR
- Kluskus-Blue FSR
- Kluskus-Ootsa FSR
- Alexander Mackenzie Heritage Trail
- Stream
- Waterbody
- Parks & Protected Areas
- Indian Reserve

Project Components

- Exploration Road
- Existing Transmission Line
- Proposed Airstrip Access Road
- Proposed Airstrip
- Proposed Mine Site

Transmission Line Routing Alternatives

- Proposed Transmission Line - Option 1
- Proposed Transmission Line - Option 2
- Proposed Transmission Line - Option 3\3A
- Proposed Transmission Line - Option 4
- Proposed Transmission Line - Option 5
- Proposed Transmission Line - Southern Portion

Reference
BC Government GeoBC Data Distribution

CLIENT: newgold™

PROJECT: Blackwater Gold Project

Transmission Line Routing Alternatives

DATE:	ANALYST:	
May, 2014	WR	**Figure 2.5.18-1**
JOB No: VE52277	QA/QC: MY	PDF FILE: Other-100-019_v8_TL_Options.pdf
GIS FILE: Other-100-019_v8_TL_Options.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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2.5.18.1.5 Option 4 – Connection to 230 kV Line Segment 2L353 West of Fort Fraser

Option 4 was identified as a result of the land title search completed on Options 1, 2, and 3. This alignment commences at a new proposed substation on BC Hydro's 2L353 230 kV line approximately 6 km to the west of Option 2. This alignment would be approximately 114 km long and traverses some difficult terrain for the first 28 km where it joins up with the Option 2 alignment. Option 4 would be operated at a voltage of 230 kV. The entire alignment would be located on unsurveyed Crown land and is aligned, as much as practicable, with existing roads for ease of access and to reduce impacts to the land base.

Option 4 meets all of the **Table 2.5.1-1** screening criteria and is retained for further more detailed evaluation.

2.5.18.1.6 Option 5 – Connection to 230 kV Line Segment 2L353 near Fort Fraser

Option 5 was also identified as a result of the land title search completed on Options 1, 2, and 3. This alignment commences at a new proposed substation on BC Hydro's 2L353 230 kV line approximately 17 km to the west of Option 2. This alignment would be approximately 114 km long and traverses some difficult terrain for the first 14 km where it joins up with the Option 3 alignment. Option 5 would be operated at a voltage of 230 kV. The entire alignment would be located on unsurveyed Crown land and is aligned, as much as practicable, with existing roads for ease of access and to reduce impacts to the land base.

Option 5 meets all of the **Table 2.5.1-1** screening criteria and is retained for further more detailed evaluation.

2.5.18.2 Performance Objectives and Evaluation

Alternatives carried forward into the detailed evaluation are the:

- Option 1 – Connection to the TAC 230 kV substation at Vanderhoof;
- Option 2 – Connection to 230 kV line segment 2L353 east of Fort Fraser;
- Option 3 – Connection to the GLN 230 kV substation at Endako;
- Option 4 – Connection to 230 kV line segment 2L353 West of Fort Fraser; and
- Option 5 – Connection to 230 kV line segment 2L353 near Fort Fraser.

Performance objectives applicable to selection and development of a transmission line connection to the provincial grid are:

- Cost effectiveness;
- Technical applicability and system integrity and reliability;
- Ability to service the site effectively;
- Effects on the natural environment;

- Effects on the socioeconomic environment; and
- Amenability to reclamation.

2.5.18.2.1 Cost Effectiveness

Knight Piésold (2013) carried out a cost comparison of the various alternatives. Capital costs associated with all alternatives, including interconnection costs to tie into the provincial grid, were comparable for the five alternatives, being calculated at:

- Option 1 – $57.2 million to $58.2 million;
- Option 2 – $51.8 million to $59.8 million;
- Option 3 – $57.2 million to $69.5 million;
- Option 4 – $52.6 million to $60.6 million; and
- Option 5 – $52.6 million to $60.6 million.

Options 1 and 2 would also involve additional costs for land acquisition. Operating costs would be slightly greater for Options 1 and 3 because of greater line losses associated the increased length.

Considering all aspects, the cost differentials between the five options are minimal and all alternatives are rated as preferred for cost effectiveness.

2.5.18.2.2 Technical Applicability and System Integrity and Reliability

All alternatives are considered technically feasible and reliable, and are therefore all rated as being preferred for this performance objective.

2.5.18.2.3 Ability to Service the Site Effectively

All other aspects being equal, longer transmission lines carry an inherently greater risk because possible damage due to tree falls, lightning strikes, ice storms, vandalism, and other perturbations. The tree fall risk can be minimized by selecting an appropriate ROW width, and by culling danger trees on the outside of the ROW.

The greater concern relative to being able to service the site effectively is scheduling. Options 2, 4, and 5 all require new substation connections to the BC Hydro grid. The approval and construction of such substations is time consuming and is likely to unnecessarily extend the overall Project timelines, resulting in an anticipated overall delay in Project start-up. This is a serious consideration. Options 1 and 3 are therefore rated as preferred and Options 2, 4 and 5 are rated as unacceptable.

2.5.18.2.4 Effects on the Natural Environment

Potential effects on the natural environment were assessed based on high-level regional data. Factors considered included: wildlife habitat, wetlands, old forest (>140 years) growth, SAR and ecological communities, and watercourse crossings. From the perspective of wildlife habitat

(minimizing disturbance to closed forest areas, wildlife corridor habitat, and habitat associated with riparian systems) Option 2 was considered the least intrusive of the available alternatives and the other options were all considered to be similar in their overall net effect.

With regard to wetlands and old growth forest, Options 1 and 5 resulted in the greatest overprinting of wetlands, and Options 3 and 4 the least overprinting. Option 1 also resulted in the greatest overprinting of old growth forest. The shorter options (Options 2, 4, and 5) would have the least effect on old growth forests; and Option 3 would be intermediate in its effects.

Effects on SAR and ecological communities were inferred from the extent of alignment overprinting of the Sub-Boreal Spruce (SBS) and Engelmann Spruce (ESSF) zones within the Vanderhoof Forest District. The SBS is associated with 8 SAR and 33 ecological community types, whereas the ESSF is associated with 4 SAR and 9 ecological community types. Alignments passing through a greater area of SBS were therefore considered more likely to be disruptive to SAR and ecological communities of interest. Areas of overlap with SBS are greatest for Options 1 and 3, and least for Options 2, 4, and 5, with the general extent of overlap being more or less directly proportional to alignment length.

Numbers of water course crossings also tended to be directly proportional to overall alignment length, with the two longer options (Options 1 and 3) being associated with the greatest number of crossings.

Option 3 would require crossing the Stellako Wildlife Management Area which has the potential to affect this habitat during the construction phase and possibly to a lesser extent throughout the time the transmission line is in place. A small route alternative would minimize the linear length of the wildlife management area crossed.

Taking all of the above into consideration, inferred net adverse effects on the environment were mainly influenced by alignment length, with shorter routes having a lesser effect. To the extent practicable, all alternatives were positioned along or near to existing access roads to both improve access for construction and to minimize overall disturbance to the environment. Options 2, 4, and 5 are rated as preferred for minimizing adverse effects on the natural environment and Options 1 and 3 are rated as being acceptable.

2.5.18.2.5 Effects on the Socioeconomic Environment

Options 1 and 2 would require the purchase (or other contractual arrangement) of rights to private lands. Option 1 would be particularly challenging in this regard because the route for this alternative crosses 27 private parcels of land held by 20 individuals or groups. Option 2 crosses seven private parcels of land held by five individuals or groups.

All options traverse First Nation traditional lands, with Options 1, 2, and 5 likely involving the traditional lands of three First Nations, and Options 3 and 4 appearing to traverse the traditional lands of four First Nations. Traditional land boundaries would have to be confirmed through further discussion with the affected First Nations.

Negotiating potential land acquisitions with 20 landowners is problematic and could lead to serious scheduling issues if arrangements cannot be concluded in a timely manner. Such limitations would be potentially less onerous with Option 2, as there are fewer landowners involved, but it would depend on the specific perspectives of the involved landowners.

Further discussion with the involved First Nations would be required to determine any specific limitations, such as traditional land uses, that might favour one alternative over another.

In the absence of further data, Option 1 is rated as unacceptable because of extensive private landowner concerns; Option 2 is provisionally rated as being acceptable pending possible landowner perspectives; and Options 3, 4, and 5 are rated as acceptable.

2.5.18.2.6 Amenability to Reclamation

All alternatives lend themselves to moderate reclamation efforts, which would effectively mean removing the transmission line following the completion of mine, closure unless another user such as BC Hydro or other was willing to take over responsibility for line maintenance. All alternatives are consequently rated as being acceptable for this performance objective.

2.5.18.3 Summary Evaluation

2.5.18.3.1 Technical and Economic Feasibility

All options are technically and economically feasible for the proposed Project.

2.5.18.3.2 Rationale for Selection of the Preferred Alternative

Option 1 received one unacceptable rating for socioeconomic considerations relating to land acquisition concerns, and is therefore rejected. Options 2, 4, and 5 received unacceptable ratings for ability to service the site effectively because of anticipated timing constraints related to new interconnecting substation requirements to tie into the BC Hydro grid. Option 3 received three preferred ratings and three acceptable ratings, and no unacceptable ratings, and is therefore the overall preferred choice.

2.5.19 Operations Worker Accommodations

2.5.19.1 Alternatives and Initial Screening

The main camp site for the rest of the construction workforce, and eventually for permanent staff, will be about 3 km east of the plant site, adjacent to the main access road.

The construction camp will consist of rented or leased modular units consisting of dormitory wings, a kitchen/dining complex, administration block, a commissary, and a recreation area, all one storey in height. This group of buildings is intended to be erected in a phased configuration as required over the construction period of the Project. The camp will be maintained for operations staff until the operations camp is constructed during the initial years of operations. The construction camp will have a capacity for about 850 people.

The operations camp will consist of modular dormitory wings, a kitchen / dining complex, and a recreation area. It will be constructed in Year 2 of operations to house the operations staff of about 500 persons. Of the five dormitory wings, four will be three storeys high and one will be two storeys high. Areas will be provided for food preparation and storage, a dining room, recreation rooms, movie rooms, and exercise and weight rooms. Other core services will include camp check-in/administration, a commissary, and a personal effects storage locker area.

Figure 2.5.19-1 shows the proposed camp layout.

The Proponent made the decision to have an operations workers camp because commuting from Vanderhoof and other communities in the region is impractical resulting in long drives to and from work along with the hazards associated with road travel, increased.

The alternatives for worker accommodations are:

- Proposed location approximately 2.3 km east of the proposed plant site; and
- A more remote location – Snake Lake.

2.5.19.1.1 Proposed Operations Camp Location

The proposed operations camp is located approximately 2.3 km east of the proposed plant site and about 1.6 km northeast of the East Dump. The site is well positioned to service the site and to link in to general site service facilities and far enough that noise levels will not be sufficiently high to cause undue disturbance. Night shift workers will be roomed on the side of the camp furthest from the mine facilities and thus would be provided with the quietest rooms.

Construction noise will arise from site preparation and building construction. It will be periodic and short term (lasting over about a two-year period). Construction noise levels outside of camp buildings are estimated to be approximately 40 dBA, or below guidelines of 45 dBA night time and 55 dBA day time.

Most operations-related noise will derive from mining; the major noise sources within the proposed Project area will be inside the pit, where equipment (e.g., shovels, loaders, trucks, drills, etc.) will be simultaneously removing overburden and waste ore, and extracting high-grade ore. Because of the mitigation effect of the pit walls, noise levels on the surface near the pit will be much lower, descending outward. Noise outside the operations camp is expected to be at, or lower, than that during construction.

It is most efficient for mining camps to be positioned in the general proximity to mine operations for ease of servicing and transport, and to maintain a smaller overall mine footprint. The proposed mine campsite is therefore retained for further consideration.

371000 378000 385000

5908000 5901000 5894000

N

Proposed Transmission Line

Kluskus-Chedakuz FSR

Kluskus-Ootsa FSR

Fawnie Dome 1726m

Turtle Creek

Tatelkuz Lake

Proposed Mine Access Road

Proposed Fresh Water Pipeline

Top Lake

Snake Lake

Proposed Camp

Kluskus-Messue FSR

F A W N I E R A N G E

Davidson Creek

Creek 661

Chedakuz Creek

Proposed Camp

Lake 01428UEUT

Lake 01682LNRS

Lake 01538UEUT

Existing Exploration Camp

Mount Davidson 1856m

Legend

- Existing Exploration Camp
- Proposed Camp
- Kluskus-Ootsa FSR
- Other FSRs
- Existing Road
- Contour (20 m)
- Stream
- Waterbody

Project Components

- Exploration Road
- Proposed Mine Access Road
- Proposed Transmission Line
- Mills Ranch Reroute
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Proposed Airstrip
- Proposed Mine Site

Scale:1:75,000

0 1 2 4

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold™

PROJECT: Blackwater Gold Project

Existing and Proposed Camps

DATE: May, 2014	ANALYST: WR	**Figure 2.5.19-1**
JOB No: VE52420	QA/QC: MM	PDF FILE: 09-200-001_ConstructionCampLoc_v2.pdf
GIS FILE: 09-200-001_ConstructionCampLoc_v2.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\09_water-quality\EIA\09-200-001_ConstructionCampLoc_v2.mxd

2.5.19.1.2 Snake Lake Alternative

The Snake Lake site is positioned approximately 5.5 km from the nearest mine work area (the main tailings dam), and 2.2 km from the mine access road. The west side of the lake is also positioned on lands held by the Proponent. Development of this alternative would require additional infrastructure compared with the proposed operations camp location, inclusive of a separate sewage treatment facility, and a transmission line for power supply. The water pipeline route passes to within about 600 m of the site, such that limited new road access would be required. The primary advantage of this site compared with the proposed site is that it would be subject to less general disturbance. The Snake Lake campsite alternative is therefore also retained for further consideration.

2.5.19.2 Performance Objectives and Evaluation

Alternatives carried forward into the detailed evaluation are the:

- Proposed operations camp location; and
- Snake Lake site.

Performance objectives applicable to selection and development of a site service airstrip are:

- Cost effectiveness;
- Ability to service the site effectively;
- Effects on the natural environment;
- Effects on the socioeconomic environment; and
- Amenability to closure.

2.5.19.2.1 Cost Effectiveness

The proposed camp site is the most cost effective alternative, as it would be developed from the construction camp such that all services (power, water, sewage, etc.) would already be in place. It would also be comparatively inexpensive to move workers from this camp to work areas, mainly the plant site, open pit, and stockpiles. The Snake Lake camp is more removed and would require separate new services, and travel distance to and from work areas would be more costly. These associated costs are measurable, but within the overall scope of the Project would not be considered large. The proposed camp location is therefore rated as preferred and Snake Lake site is rated as acceptable for cost effectiveness.

2.5.19.2.2 Ability to Service the Site Effectively

The travel distance from the Snake Lake site to the central work area would be approximately 7 km further, one way, compared with the proposed camp site, which would add about one half hour to the work day of each worker during operations. In addition, as stated above, increased service infrastructure would be required to support the new facility. On the other hand, the purpose

of the camp is to accommodate workers in as comfortable and attractive environment as reasonably practicable, to assist with worker attraction and retention. Both alternatives are able to service the site effectively, but the perception of the relative effectiveness of that service is likely to vary from person to person, depending on their values and sensitivities. Experience with other mines suggests that most workers are more likely to value the shorter travel distance over aesthetics of a more remote site. The existing site is therefore assessed as preferred and the Snake Lake site as being acceptable.

2.5.19.2.3 Effects on the Natural Environment

Positioning the operations camp at the proposed location would have negligible added environmental effect as this location is within the general mine footprint and immediately adjacent to other planned facilities (construction camp and associated infrastructure, mine access road, transmission line). Positioning the operations camp at Snake Lake would expand the overall Project footprint, create an additional treated sewage discharge point, add a new water taking point, as well as additional infrastructure (access road and minor transmission line hook-up).

Overall, environmental effects associated with the Snake Lake could be minimized by positioning the camp within the clear-cut zone at the north end of the lake. This location is also closest to proposed water pipeline route (and associated service road) that would bring make-up water to the mill from Tatelkuz Lake.

From an overall natural environment effect perspective, the proposed location at the mine site is preferred, and the Snake Lake site is regarded as being acceptable.

2.5.19.2.4 Effects on the Socioeconomic Environment

Effects on the socioeconomic environment are essentially embodied in discussions presented above in relation to serviceability. The Snake Lake site alternative would add additional travel time to the workday, but for some workers (though likely a minority) the more tranquil setting of the Snake Lake site may more than offset this inconvenience. The evaluation here is essentially one of personal preference, with reduced travel time likely being the key factor for most workers. The existing site is therefore assessed as preferred and the Snake Lake site as being acceptable.

2.5.19.2.5 Amenability to Closure

Both alternatives are readily amenable to reclamation at modest cost, and are therefore both rated as preferred.

2.5.19.3 Summary Evaluation

2.5.19.3.1 Technical and Economic Feasibility

Both alternatives evaluated are technically and economically feasible for the proposed Project.

2.5.19.3.2 Rationale for Selection of the Preferred Alternative

Both alternatives received preferred or acceptable rating in all categories, with the proposed location adjacent to the proposed exploration camp being preferred for all performance objectives, and therefore being the overall preferred alternative. In addition, the preferred site is provides the shortest commuting distance and therefore is likely to be preferred by the workers. The Snake Lake alternative is given an acceptable overall summary rating.

2.5.20 Worker Transport

2.5.20.1 Alternatives and Initial Screening

Alternatives considered for worker transport are:

- Busing;
- Private vehicles; and
- Air transport (construction phase only).

2.5.20.1.1 Busing

By road, the Project site is located approximately 125 km from Engen, 150 km from Vanderhoof, and 250 km from Prince George. With the busing alternative, the intent would be to have workers arrive at Vanderhoof, and to be bused from there to the mine site. Company long-term parking facilities would be made available in Vanderhoof. The advantage of busing over the use of private vehicles is reduced road traffic, improved safety, better overall mine security, and reduced space (yard area) development at the mine site.

Busing within a reasonable distance (up to 4 hours one way) is standard practice for many mining sites. This alternative is consequently retained for further consideration.

2.5.20.1.2 Private Vehicles

The use of private vehicles for worker transport to and from the site would suffer from all of the disadvantages described immediately above, namely: increased road traffic, reduced worker safety, increased mine security complexity, and increased need for mine site parking space, as well as an unnecessary increase in GHG emissions.

For all of these reasons, the use of private vehicles as a general mode of mine site access is not proposed, and this alternative is removed from further consideration.

2.5.20.1.3 Air Transport

A number of more remote mine sites across the country provide air transport for their workforces. In this case, the closest full service commercial airport is in Prince George. Company-based worker transport air service between Prince George and the mine site would be consistent with expected workforce origins. The air transport alternative also has much greater flexibility compared

with other transport alternatives, such that transport from other locations, such as Vancouver could also be accommodated if worker origins supported such connections. Air transport is therefore retained as a viable alternative for further consideration, but is only being considered for the construction phase (other than for emergencies).

2.5.20.2 Performance Objectives and Evaluation

Workforce transport alternatives carried forward into the detailed evaluation are busing and air transport.

Performance objectives applicable to selection and development of a site service airstrip are:

- Cost effectiveness;
- Ability to service the site effectively;
- Effects on the natural environment; and
- Effects on the socioeconomic environment.

2.5.20.2.1 Cost Effectiveness

Cost effectiveness is a complex question when it comes to workforce transport, as there are a number of factors to consider beyond the actual cost of providing transport. The ability to attract and retain a committed workforce under varying economic conditions is off equal or greater importance. The easier and more convenient it is for workers to get to the mine site, the more likely they will be attracted to work at the Project. Busing from Vanderhoof to the mine site, where workers are responsible for getting themselves to Vanderhoof, is a more cost-effective transportation alternative for the Proponent, compared with the cost of air transport, if considerations of worker attractiveness and retention are excluded. This is especially the case since buses will still be required in any event to shuttle workers from the airstrip to the mine site.

However, the air connection alternative to Prince George, or to Vancouver, or elsewhere increases the flexibility in point of origin/hire of workers, which may be important for the construction period where many specialized trades' people will be required. Air transport is the more costly and the more weather-dependent alternative than bus transport but is considered necessary for construction.

Taking both aspects into consideration (i.e., the direct costs of transport, and worker point of origin) air transport for specialized trades during construction is somewhat preferred over busing. Overall, from a cost perspective, busing is preferred and air transport is acceptable.

2.5.20.2.2 Ability to Service the Site Effectively

The ability to service the site effectively involves consideration of the same aspects of worker point of origin/hire described immediately above, as well as considerations relating to worker safety. Part of the process of getting workers to the site, is developing a transport system that makes it attractive for them to work at the Project site. Air transport is best able to do this, as it would provide

the capability to draw a workforce from a much wider area. Air transport safety is also better than ground transport based on person/distance travel statistics[3].

Therefore, to service the site effectively, air transport is preferred for the construction phase and busing is considered acceptable.

2.5.20.2.3 Effects on the Natural Environment

Adverse effects on the natural environment linked to workforce transportation are limited the potential for wildlife collisions with busing, and to considerations relating to GHG emissions. Avian collisions with aircraft do occur, but their frequency is too low to be a factor in this assessment. For wildlife collisions, only the potential for large mammal collisions is considered.

With bus travel, there may be the potential for wildlife collisions, and a small number of such collisions may be expected over the course of the mine life. Mitigation measures to reduce the potential for wildlife collisions include such aspects as reduced speed limits, where possible limiting driving at dusk and at night, driver training and awareness programs, and maintaining adequate lines of sight along roadways. With regard to GHG emissions, aircraft travel emits considerably more greenhouse gases per person/km, compared with bus travel (Borken-Kleefeld et al., 2013).

On balance, both travel methods are considered as being preferred relative to adverse effects on the natural environment.

2.5.20.2.4 Effects on the Socioeconomic Environment

Neither travel method is considered to have an adverse socioeconomic effect; however, air transport provides greater overall worker convenience and is therefore viewed as being preferred, whereas busing is viewed as being acceptable.

2.5.20.3 Summary Evaluation

2.5.20.3.1 Technical and Economic Feasibility

Busing and air transport are both technically and economically feasible for the proposed Project; use of private vehicles would present an unacceptable liability risk for the proposed Project.

2.5.20.3.2 Rationale for Selection of the Preferred Alternative

Air transport received preferred ratings in three performance categories, and busing received two preferred ratings and two acceptable ratings. Air transport is therefore regarded as the overall preferred alternative, with busing being an acceptable alternative. The differentials between air travel and busing are primarily business driven, and not environmental per se. There are also timing issues as to when suitable air transport could be arranged and weather-dependence, such

[3] http://en.wikipedia.org/wiki/Aviation_safety

that the Proponent will use busing in combination with air transport during construction, as providing support for a better business model.

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2.6 Reclamation and Closure Plan

2.6.1 Introduction

The proposed Blackwater Gold Project (the Project) consists of a gold and silver open pit mine and ore processing facilities. The Project is located 110 kilometres (km) southwest of Vanderhoof in central British Columbia (BC). New Gold Inc. (Proponent) has the mineral rights. The process plant is expected to have a nominal milling rate capacity of 60,000 tonnes per day (t/d) (22 million tonnes per year [Mt/y]), and to process ore over 17 years.

The ore will be extracted from the open pit mine and will be processed on site. Off-site infrastructure will be built to service the mine, including a transmission line, mine access road, freshwater supply system, and airstrip. Although the expected life of mine is 17 years, reclamation activities will occur progressively, where possible, throughout the operations phase, and will continue into the closure (Years 18 to 35) and post-closure phases (Years 35+).

The conceptual reclamation plan has been prepared to propose strategies and preliminary concepts for the successful reclamation and closure of the mine. The plan will provide a basis for detailed reclamation planning and bonding discussions with the BC Ministry of Energy, Mines and Petroleum Resources (BC MEMPR) as part of the Environmental Assessment (EA) application and permitting process of the Project.

The following Environmental Management Plans (EMPs) cover aspects and facilities relevant to the Reclamation and Closure Plan (RCP):

- Mine waste management: **Section 12.2.1.18.4.17**;
- Water quality and liquid discharges management: **Section 12.2.1.18.4.10**;
- Landscape, soils and vegetation management and restoration: **Section 12.2.1.18.4.4**;
- Sediment and erosion control: **Section 12.2.1.18.4.1**;
- Wetland management: **Section 12.2.1.18.4.3**; and
- Wildlife management: **Section 12.2.1.18.4.6**.

Other components of the Construction and Operations Management Plan (CMP) and Fisheries Mitigation and Offsetting Plan (FMOP) are not referenced because these plans will be implemented before the Closure Management Plan (CLMP) and RCP. At the end of the operations phase, the CLMP will supersede the CMP.

2.6.2 End Land Use and Reclamation Objectives

The Project will be decommissioned and reclaimed in accordance with an approved reclamation program under the *Mines Act* (Government of BC, 1996a). The proposed end land use after mine closure is wildlife habitat, and traditional use by Aboriginal groups.

The specific objectives include:

- Providing for long-term stability of engineered structures and mine related landforms in the mine site;
- Providing measures for soil management and control of erodible substrates in the Project area;
- Decommissioning and removal of mine and off-site infrastructure not required after mine closure;
- Preserving water quality and flow, and fish habitat downstream from the mine site;
- Integrating disturbed land, including engineered structures and mine-related landforms, into the natural landscape by re-establishing self-sustaining plant communities similar to pre-disturbance ecosystem units and wetlands;
- Establishing native plant communities similar to pre-disturbance ecosystem units, which include plant species with value for wildlife and traditional use, and for species at risk naturally occurring in the mine site;
- Establishing whitebark pine (*Pinus albicaulis*) populations using seedlings and transplants from local gene pool, including rust-resistant species; and
- Creating a diversity of habitat and microhabitat conditions for wildlife use.

2.6.3 Regulatory Framework

2.6.3.1 Introduction

The BC Ministry of Energy and Mines (BC MEM) issues permits under the *Mines Act* (Government of BC, 1996a) for mines to operate in the province. In its Health, Safety and Reclamation Code for Mines it specifies the conditions for operations and reclamation, and provides guidelines for mine safety and reclamation standards. According to these documents, the land surface shall be reclaimed to an end land use that considers previous and potential uses. The average land capability to be achieved on the remaining lands shall not be less than the average that existed prior to mining, unless the land capability is not consistent with the approved end land use, and long-term stability of land, watercourses, and access roads shall be provided.

2.6.3.2 Guidelines for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia

The primary objectives of the Guidelines for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia (Price and Errington, 1998) and the complementary Prediction Manual (Price, 1997) are to describe generic requirements and outline common errors, omissions, and constraints. This information assists mining companies in developing comprehensive proposals that include the necessary documentation and consideration of risk for sound environmental

management. The document contains information on characteristics of metal leaching and acid rock drainage (ML/ARD) and processes leading to their formation.

The Proponent adheres to the guiding principles, has undertaken extensive prediction studies, and has developed mitigation and monitoring programs for ML/ARD. The mitigation strategies adopted by the Proponent include the full range of strategies, including avoidance of exposure of problematic material, underwater storage of potentially acid-generating (PAG) and ML materials, chemical treatment of collected drainage from acid generating sources (low-grade and coarse ore stockpiles), covers, and waste segregation. Contingency measures have also been developed, and are described in **Section 12**.

2.6.3.3 Species at Risk Act

The *Species at Risk Act (SARA*) exists for the prevention of the extinction or extirpation of listed at-risk species, to provide for their recovery and to manage species of special concern to prevent them from becoming endangered or threatened (Government of Canada, 2002). Although the Project is not located on federal lands, the Proponent will use *SARA* as a guideline regarding wildlife habitat of species at risk.

2.6.3.4 Seeds Act

The Canadian regulations pertaining to the purchase and sale of seeds are part of the *Seeds Act* (Government of Canada, 1985). Seeds must meet the minimum standards for testing of purity, germination, quality, and disease. Seeds purchased for reclamation of the Project will be certified, and transported and stored in a secure and planned manner. Seed purchase records will be maintained.

2.6.3.5 Weed Control Act

The *Weed Control Act* imposes a duty on all land occupiers to control designated noxious plants (Government of BC, 1996b). It provides a list of weeds classified as noxious within all regions of BC and within regional districts. The Proponent will provide an Invasive Species Management Plan to monitor and control weeds within the Project area.

2.6.3.6 Canadian Environmental Quality Guidelines

The Canadian Environmental Quality Guidelines comprise a large body of science-based criteria for contaminants of air, land, and water, providing guidance at a national level for contamination remediation targets (Canadian Council of Ministers of the Environment (CCME), 2012). The guidelines are available for the contamination media of air, land, or water, or by chemical contaminant. The guidelines can be used to help determine risk levels associated with, and management of, contaminated sites in Canada.

2.6.3.7 Vanderhoof Land and Resource Management Plan

The Vanderhoof Land and Resource Management Plan (LRMP) is a full-consensus strategic plan for all aspects of land and resource management within an area of approximately 13,800 square kilometres (km^2), built through participation by the public, local industry, and government resource agencies (Integrated Land Management Bureau [ILMB], 1997). The LRMP includes potential for mineral exploration and extraction of minerals and precious metals.

2.6.4 Environmental Baseline Information

Understanding of the biophysical and social environment of the Project area prior to development of the mine is necessary to adequately plan for reclamation of the Project. A summary of baseline information is presented in this section and detailed baseline information in **Section 5**.

2.6.4.1 Climate

The area has a typical sub-continental climate, resulting in long, cold winters and warm summers. The mean annual temperature is 3°C, with minimum and maximum mean monthly temperatures of -4.7°C in January and 12°C in July. The mean annual wind speed is approximately 2.4 metres per second (m/s), with the wind direction being predominantly from the west. The mean annual precipitation is estimated at 636 millimetres (mm) and evenly distributed throughout the year, with mean monthly values ranging from a low of 20 mm in April to a high of 74 mm in November.

2.6.4.2 Topography

The Project is located within the glaciated landscape of the Nechako Plateau, and is characterized by gently to moderately sloping topography, primarily composed of glacially-eroded volcanic bedrock, with average elevations ranging from 1,200 to 1,900 metres above sea level (masl). The majority of the mine site is characterized by poorly-sorted sand and silt-based glacial till of variable thickness, although widespread variability has been identified in composition (i.e., colluvial and glaciofluvial outwash sand and gravel deposits). The majority of the Project area is rated as stable in terms of slope stability and accelerated erosion, although potentially unstable slopes and localized landslides occur in the area.

2.6.4.3 Hydrology and Water Quality

The Project is located within the Nechako River basin and five catchment areas: Turtle Creek Watershed (not affected by the mine), Davidson Creek Watershed, Creek 661 Watershed, Creek 705 Watershed, and Chedakuz Creek Watershed. Most of the proposed mine site is located in the upper extents of the Davidson Creek and Creek 661 Watersheds. The water quality parameters were within typical ranges, although dissolved aluminum often exceeded BC 30-day guidelines, and, in some samples, turbidity, copper, mercury, and zinc exceeded guidelines.

2.6.4.4 Soils

Soils in the Project area mainly belong to the Brunisolic and Luvisolic Orders, with a shallow A soil horizon (Ah <10 cm). Morainal parent materials are most abundant, with variable thickness ranging from a few centimetres to over 6 m. Deserters, Twain, and Barrett soil associations derived from the local morainal parent materials occupy the majority of the Project area. The Alix soil association, derived from glaciofluvial deposits, is common throughout all of the Project area, occurring in valley bottom locations. Minor inclusions of soil associations derived from other parent materials can be found interspersed throughout the area.

2.6.4.5 Vegetation

Forested Sub-Boreal Spruce (SBS) and Engelmann Spruce – Subalpine Fir (ESSF) ecosystems predominate in the Project area in seven biogeoclimatic (BGC) units: SBSdk (Sub-Boreal Spruce Dry Cool subzone); SBSdw3 (Sub-Boreal Spruce Stuart Dry Warm variant); SBSmc2 (Sub-Boreal Spruce Babine Moist Cold variant); SBSmc3 (Sub-Boreal Spruce Kluskus Moist Cold variant); ESSFmv1 (Engelmann Spruce – Subalpine Fir Nechako Moist Very Cold variant); ESSFmvp (Engelmann Spruce – Subalpine Fir Moist Very Cold Parkland variant); and BAFAun (Boreal Altai Fescue Alpine Undifferentiated subzone). The distribution of BGC units in the Project area is shown on **Figure 2.6-1**.

The SBSdk subzone occurs at lower elevations (700 m to 1,050 m) along the proposed transmission line and access road. Young and mature serial forests predominate, due to recurrent disturbances such as forest fire and insect outbreaks. Lodgepole pine (*Pinus contorta* var. *latifolia*) and trembling aspen (*Populus tremuloides*) typically dominate forested areas. Old forests (>140 years) are dominated by hybrid white spruce (*Picea glauca x engelmannii*). Douglas fir (*Pseudotsuga menziesii*) is restricted to drier sites, and black spruce (*Picea mariana*) is limited to wetlands. Black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) is found along streams and rivers, and often associated with active floodplain sites.

The SBSdw3 variant occurs at lower elevations (750 m to 1,100 m) along upper portions of the proposed transmission line and access road. Forests tend to be diverse for the region, and include tree species such as Douglas fir, lodgepole pine, and hybrid white spruce on zonal sites. Deciduous forests are most commonly dominated by trembling aspen, with localized patches of paper birch (*Betula papyrifera*). Black cottonwood is common along rivers and streams, while black spruce is common in wetlands.

360000 400000 440000

6000000 5960000 5920000

Endako
Endako
Stellako
Fraser Lake
Fraser Lake
Nadleh Whuten
Fort Fraser
Nechako River
Engen
Engen
Vanderhoof
Weneez
Sinkut River
Saik'uz
Nulki
Nulki Lake
Mapes
Stuart River
Cluculz Lake
Cluculz Creek
Khal
Sinkut River
Corkscrew
Tachick Lake
Stony
Smith Creek
Nechako River
Tahultzu Lake
Hallett Lake
Greer Creek
Target Creek
Knapp Creek
Chesla tta
Bird Creek
Lucas Lake
Lucas Creek
Knewstubb Lake
Big Bend Creek
Finger Lake
Tatuk Lake
Chilako River
Natalkuz Lake (Nechako Reservoir)
Tatuk Creek
Batnuni Lake
Euchiniko River
Nataniko Creek
Euchiniko Lakes
Chedakuz Creek
Entiako River
Top Lake
Tatelkuz Lake
Kuyakuz Lake
Fawnie Creek
François Lake
Binta Lake
Nithi River
Stellako

Proposed Transmission Line (Stellako Reroute)
Proposed Transmission Line
Kluskus FSR
Proposed Transmission Line (Mills Ranch Reroute)
Kluskus-Ootsa FSR
Proposed Airstrip
Proposed Fresh Water Supply System
Kluskus-Blue FSR
Exploration Road
Proposed Mine Access Road

BGC Code	BGC Unit
SBSdk	Sub-Boreal Spruce Dry Cool subzone
SBSdw3	Sub-Boreal Spruce Dry Warm Stuart variant
SBSmc2	Sub-Boreal Spruce Moist Cold Babine variant
SBSmc3	Sub-Boreal Spruce Moist Cold Kluskus variant
ESSFmv1	Engelmann Spruce – Subalpine Fir Moist Very Cold Nechako variant
ESSFmvp	Engelmann Spruce – Subalpine Fir Moist Very Cold Nechako Parkland variant
BAFAun	Boreal Altai Fescue Alpine Undifferentiated subzone

N

Legend

- Populated Place
- Highway
- Kluskus FSR
- Kluskus-Blue FSR
- Kluskus-Ootsa FSR
- Exploration Road
- Existing Transmission Line
- Stream (>= 4th Order)
- Waterbody (>= 100 Ha)
- Proposed Mine Access Road
- Proposed Water Pipeline Route
- Proposed Transmission Line
- Proposed Transmission Line (Stellako Reroute)
- Proposed Transmission Line (Mills Ranch Reroute)
- Proposed Airstrip
- Proposed Mine Site

Terrain, Soils, and Vegetation

- Regional Study Area
- Local Study Area

Biogeoclimatic Zone

- BAFAun
- ESSFmc
- ESSFmv1
- ESSFmvp
- SBPSdc
- SBPSmc
- SBPSmk
- SBSdk
- SBSdw2
- SBSdw3
- SBSmc2
- SBSmc3
- SBSmk1

0 5 10 20
Kilometres
Scale: 1:450,000

Reference
BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Distribution of Biogeoclimatic Subzones and Variants

DATE: October, 2013	ANALYST: AA	**Figure 2.6-1**
JOB No: VE52277	QA/QC: LR	PDF FILE: 06-100-059_BGC_v2.pdf
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PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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SBSmc2 variant occurs at elevations from 900 m to 1,250 m. On mesic sites, hybrid white spruce, subalpine fir (*Abies lasiocarpa*), and lodgepole pine make up the canopy, while black huckleberry (*Vaccinium membranaceum*), sweet coltsfoot (*Petasites frigidus* var. *palmatus*), dwarf red raspberry (*Rubus pubescens*), heart-leaved arnica (*Arnica cordifolia*), and mosses characterize the understory. Plants associated with more xeric site conditions include lodgepole pine, kinnikinnick (*Arctostaphylos uva-ursi*), dwarf blueberry (*Vaccinium caespitosum*), red-stemmed feathermoss (*Pleurozium schreberi*), and lichens. Moist site indicators include common horsetail (*Equisetum arvense*), common mitrewort (*Mitella nuda*), three-leaved foamflower (*Tiarella trifoliata*), and oak fern (*Gymnocarpium dryopteris*) (DeLong et al., 1993).

SBSmc3 is the most common variant in the Project area, and has an elevation range from 975 m to 1,300 m. Lodgepole pine and hybrid white spruce are the dominant canopy species on gentle terrain, and in areas of cool exposure with average moisture availability. Lodgepole pine is prominent in areas of dry, warm exposure. Hybrid white spruce can be dominant on moist to wet seepage sites and flood plains. Typical SBSmc3 understory vegetation on mesic sites includes regenerating subalpine fir, black huckleberry, one-sided wintergreen (*Orthilia secunda*), bunchberry (*Cornus canadensis*), heart-leaved arnica, and feathermosses. Common juniper (*Juniperus communis*), prickly rose (*Rosa acicularis*), kinnikinnick, black huckleberry, twinflower (*Linnaea borealis*), dwarf blueberry, and lichens are indicative of drier sites. Characteristic species on moist to wet sites include willows (*Salix* spp.), black gooseberry (*Ribes lacustre*), sweet coltsfoot, common mitrewort, and leafy mosses (*Mnium* and *Rhizomnium* spp.).

ESSFmv1 is the most common variant at the proposed mine site, and occurs above the SBSmc3 and SBSmc2 from approximately 1,300 m to 1,620 m. Subalpine fir and Engelmann spruce are dominant trees in mesic sites. Lodgepole pine is prominent on submesic sites, and is a serial species in young stands and on warm exposures. Characteristic understory species on average moisture sites are black huckleberry, five-leaved bramble (*Rubus pedatus*), heart-leaved arnica, bunchberry, and red-stemmed feathermoss. White-flowered rhododendron (*Rhododendron albiflorum*), black huckleberry, crowberry (*Empetrum nigrum*), and liverworts are dominant in areas of cool exposure, while lichens occur on warm slopes. Moist site indicators include willows, Sitka valerian (*Valeriana sitchensis*), common horsetail, Indian hellebore (*Veratrum viride*), and leafy mosses.

The ESSFmv1p variant is transitional with the Engelmann Spruce – Subalpine Fir Very Dry Very Cold Chilcotin Parkland variant (ESSFxvp1). For the purposes of this report and ecosystem mapping, the variant will remain classified as ESSFmv1. The parkland area (ESSFmv1p) is characterized by gentle, rolling terrain composed of a mosaic of tree islands, grasslands, scrub birch (*Betula nana*), heather (*Phyllodoce* spp.) pockets, and wet herbaceous seepage areas. Clumps of stunted and snow-pressed subalpine fir, Engelmann spruce, and whitebark pine make up the tree layer within the tree islands. Grouseberry (*Vaccinium scoparium*), altai fescue (*Festuca altaica*), and mountain sagewort (*Artemisia norvegica*) are very common, low vascular plants. Heron's-bill moss (*Dicranum* spp.), red-stemmed feathermoss (*Pleurozium schreberi*), reindeer lichens (*Cladonia* spp.), Sitka valerian *(Valeriana sitchensis*), and globeflower (*Trollius albiflorus*) occur on moist and rich sites.

The BAFAun subzone is an alpine zone characterized by very cold, long winters, and brief, cool summers. A thin, windblown snowpack is typical, but deeper snowpacks occur in some areas. This subzone occurs as an elevational band from approximately 1,800 m to the highest point of the Project area, at Mt. Davidson's peak, of 1,865 m. In the Regional Study Area (RSA), the BAFAun subzone occurs south of the mine site.

The terrain is a mosaic of rolling grassland interspersed with boulder fields, exposed soil, talus slopes, mountain heather meadows, scrub birch, and wet seepage meadows. Convex microsites are dry and windblown, and dominated by lichens, dwarf willows, and moss, while concave microsites are characterized by a greater accumulation of soil, resulting in a rich assemblage of plant species, including grasses, dwarf shrubs, and herbs.

Sensitive ecosystems in the Project area include old-growth forests, sparsely vegetated areas, riparian ecosystems, and wetlands. A *SARA*-listed tree species, whitebark pine, was identified in and around the mine footprint. The distribution of whitebark pine occupies the southern portion of the footprint at the higher elevations of the mine site, and an isolated occurrence was recorded north of the mine site.

2.6.4.6 Wetlands

Wetlands are distributed across the Project area. Within the mine site, approximately 575 ha were classified as wetlands, or 13% of the total mine site area, consisting of six wetland classes: bog, fen, marsh, swamp, shallow open water, and pond. Swamp wetlands are the most common wetland class in the mine site (421 ha, 9.5%). Provincially Blue-listed wetland ecosystems cover approximately 39 ha (0.9%). Two Red-listed and several Blue-listed wetland ecosystems were identified. Mapped wetlands occur on approximately 3,039 ha (12%) of the mine site, and 5,848 ha (5%) of the RSA. Three species Blue-listed in BC were identified: swollen-beaked sedge *(Carex rostrata*), small-flowered lousewort *(Pedicularis parviflora, ssp. parviflora*), and meesia moss *(Meesia longiseta*).

2.6.4.7 Wildlife

A diverse wildlife community exists in the Project area, including species of conservation concern. Surveys confirmed that 39 butterfly, 28 dragonfly, 4 amphibian, 1 reptile, 21 mammal, and 100 bird (including 14 raptor, 69 landbird, and 17 waterfowl) species were present within the Project study area. The highest diversity of birds was detected within the proposed access road area, and all amphibian species were detected breeding within this area, as was the only detection of a common garter snake. Fourteen species of conservation concern were confirmed to occur within the study area. Most of the detections of species of conservation concern were in areas located immediately to the northeast and east of the mine site. Within the mine site caribou, common nighthawk, barn swallow (including nesting), and Hagen's bluet were detected.

2.6.4.7.1 Amphibian and Reptile Community

All of the amphibian species expected to occur within the region were detected in the Project area. The long-toed salamander was found in parts of the Project area, but it was not found

within the freshwater pipeline area; however, the salamander is expected to use the area, and is believed to have not been detected due to a lower survey effort in this area. Western toads were detected breeding in the Project area. Waterbodies within any of the study areas that provide suitable pH and temperature for amphibians could be used by the western toad, since the species is found in a wide variety of habitats, including forests, grasslands, and subalpine meadows.

2.6.4.7.2 Bird Community

A total of 100 forest and grassland songbird species were detected in the Project area, including species of conservation concern, such as the olive-sided flycatcher and rusty blackbird in wetlands, and barn swallows near anthropogenic features. Species diversity was highest along the Kluskus-Ootsa Forest Service Road (FSR), where several points located in a mix of wetland, mature forest, and riparian areas had much higher diversity. Sixteen species of water birds were detected across the Project area. The four most frequently detected species were Wilson's snipe, greater yellowlegs, bufflehead, and common loon. Raptors were also identified in the area, including osprey and bald eagle. Clark's nutcrackers, a species dependent on whitebark pine cone crops in northwestern BC, was detected within the mine site footprint.

2.6.4.7.3 Mammal Community

Seven species of mammals that are of conservation concern were detected within the Project area. Sign from caribou was detected seven times within the Project area, all detections were of scat found within the mine site. Recent historical research on the nearby Tweedsmuir-Entiako herd has found that their areas of primary use are within Entiako Park during the winter and Tweedsmuir Park in the summer. Wolverine was detected once within the SBSmc subzone at the edge of an old-growth forest and mature forest. Fisher was also detected only once, when an individual was observed crossing the Kluskus FSR chasing after a snowshoe hare. Grizzly bears were detected infrequently within the Project area, primarily along salmon-bearing streams near Tatelkuz Lake, however, one was detected within the mine site. Three species of bat that are of conservation concern, little brown myotis, northern myotis, and eastern red bat, were detected on multiple occasions throughout the Project area.

2.6.4.7.4 Invertebrate Community

Three species of conservation concern and listed invertebrate species (Hagen's bluet, jutta Arctic, and Assiniboine skipper) were detected within the Project area during the 2011 to 2013 surveys.

2.6.4.8 Pests and Invasive Species

The Mountain Pine Beetle (MPB) (*Dendroctonus ponderosae*) is a major problem affecting pine forests in the Project area, where large sections of standing dead pine and interspersed dead trees exist. Invasive plant species are a potential problem. Two invasive plant species, the yellow salsify (*Tragopogon dubius* Scop.) and orange hawkweed (*Hieracium aurianticum*), were found

within the Project area. Yellow salsify was noted within the mine site, and orange hawkweed was noted along the transmission line corridor. The Invasive Alien Plant Program (IAPP) (BC Ministry of Forests, Lands and Natural Resource Operations, 2013) identified a total of 24 invasive plants and 232 records within 20 km of the RSA (**Table 2.6-1**).

2.6.4.9 Social Environment

Fraser Lake and Vanderhoof are the two main urban centres closest to the Project. These areas act as regional service hubs, providing education facilities, healthcare, emergency support units, and social services for those living in the communities and nearby rural lands. Approximately 14% of the population in the area is Aboriginal, 3% are visible minorities, and the remaining population is Euro-Canadian.

Although the Project footprint does not overlap with any Indian Reserves, it is located within the Traditional Territories of seven Aboriginal groups:

- Lhoosk'uz Dene Nation (LDN);
- Nadleh Whut'en First Nation (NWFN);
- Nazko First Nation (NFN);
- Saik'uz First Nation (SFN);
- Skin Tyee Nation (STN);
- Stellat'en First Nation (StFN); and
- Ulkatcho First Nation (UFN).

Traditional Land Use (TLU) in the area includes fishing (e.g., whitefish, suckerfish, and trout species), hunting game (e.g., moose), trapping furbearers (e.g., beaver, marten, mink, lynx, muskrat, and wolverine), and gathering plants for food and medicine (e.g., various berries, willows, and alder) (**Section 14**, Aboriginal Groups Background Information). Non-traditional land use (NTLU) includes private ranches, commercial wilderness resort ranches, and logging. Recreational pastimes engage residents and tourists in off-road touring, angling and hunting, backcountry hiking, wildlife viewing, and historical/cultural interpretation.

Table 2.6-1: Invasive Plants Documented by the Invasive Alien Plant Program (IAPP)*

Common Name	Scientific Name with Author	WCA[1]	FRPA[2]	CCA[3]	IAPP[4]	CCCIPC[5]	NWIPC[6]
Brown knapweed	*Centaurea jacea* L.	-	X	-	X	-	X
Bull thistle	*Cirsium vulgare* (Savi) Tenore	-	X	-	X	-	X
Canada thistle	*Cirsium arvense* (L.) Scop.	X	X	X	X	-	X
Field scabious	*Knautia arvensis* (L.) Coult.	Bulkley–Nechako	X	X	X	-	X
Annual hawksbeard	*Crepis tectorum* L.	-	-	-	X	-	X
Hawkweed species	*Hieracium* spp.	-	-	-	X	-	-
Leafy spurge	*Euphorbia esula* L.	X	X	X	X	-	X
Meadow hawkweed	*Hieracium caespitosum* Dumort.	-	X	-	X	-	-
Meadow knapweed	*Centaurea debeauxii* = *Centaurea* x *moncktonii* C.E. Britton	Columbia–Shuswap	-	-	X	X	-
Mountain bluet	*Centaurea montana* L.	-	-	-	X	-	X
Marsh thistle	*Cirsium palustre* (L.) Scop.	Bulkley–Nechako	X	X	X	-	X
Oxeye daisy	*Leucanthemum vulgare* Lam.	Cariboo	X	X	X	-	X
Orange hawkweed	*Hieracium aurantiacum* L.	Bulkley–Nechako and Cariboo	X	X	X	-	-
Perennial peppergrass	*Lepidium latifolium* L.	East Kootenay, Thompson–Nicola	X	X	X	-	-
Queen-devil hawkweed	*Hieracium praealtum* Vill. ex Gochnat	-	-	-	X	-	-
Scentless chamomile	*Matricaria perforata* = *Tripleurospermum inodorum*	X	X	X	X	X	X
Spotted knapweed	*Centaurea biebersteinii* [*stoebe* ssp. *micranthos* L. (Gugler) Hayek]	X	X	X	X	X	X
Sowthistle	*Sonchus* spp.	-	-	-	X	-	X
Common tansy	*Tanacetum vulgare* L.	Bulkley–Nechako	X	-	X	-	X
Tall hawkweed	*Hieracium piloselloides* Vill.	-	-	-	X	-	-
White cockle	*Lychnis alba* = *Silene latifolia* ssp. *alba* (P. Mill.) Greuter & Burdet	-	-	-	X	-	X
Yellow-devil hawkweed	*Hieracium glomeratum* Froel.	-	-	-	X	-	-
Yellow hawkweed	*Hieracium pratense* = *Hieracium caespitosum* Dumort.	-	-	-	X	-	-
Butter-and-eggs	*Linaria vulgaris* P. Miller	X	X	X	X	-	X
Yellow salsify	*Tragopogon dubius* Scop.	-	-	X	X	-	X

Note: [1]*WCA = Weed Control Act* (Part I or II of Schedule A; 1996); [2]*FRPA = Forest & Range Practices Act* (2004); [3]*CCA = Community Charter Act* (Sections 1 or 2; 2004); [4]IAPP = Invasive Alien Plant Program (2013); [5]CCCIPC = Cariboo Chilcotin Coast Invasive Plant Committee (Appendix 2.6A; 2012); [6]NWIPC = Northwest Invasive Plant Council (Table 3; 2012). Species is included (X) or not included (-) in the specific document.
*Modified from Vegetation Baseline (AMEC, 2013)

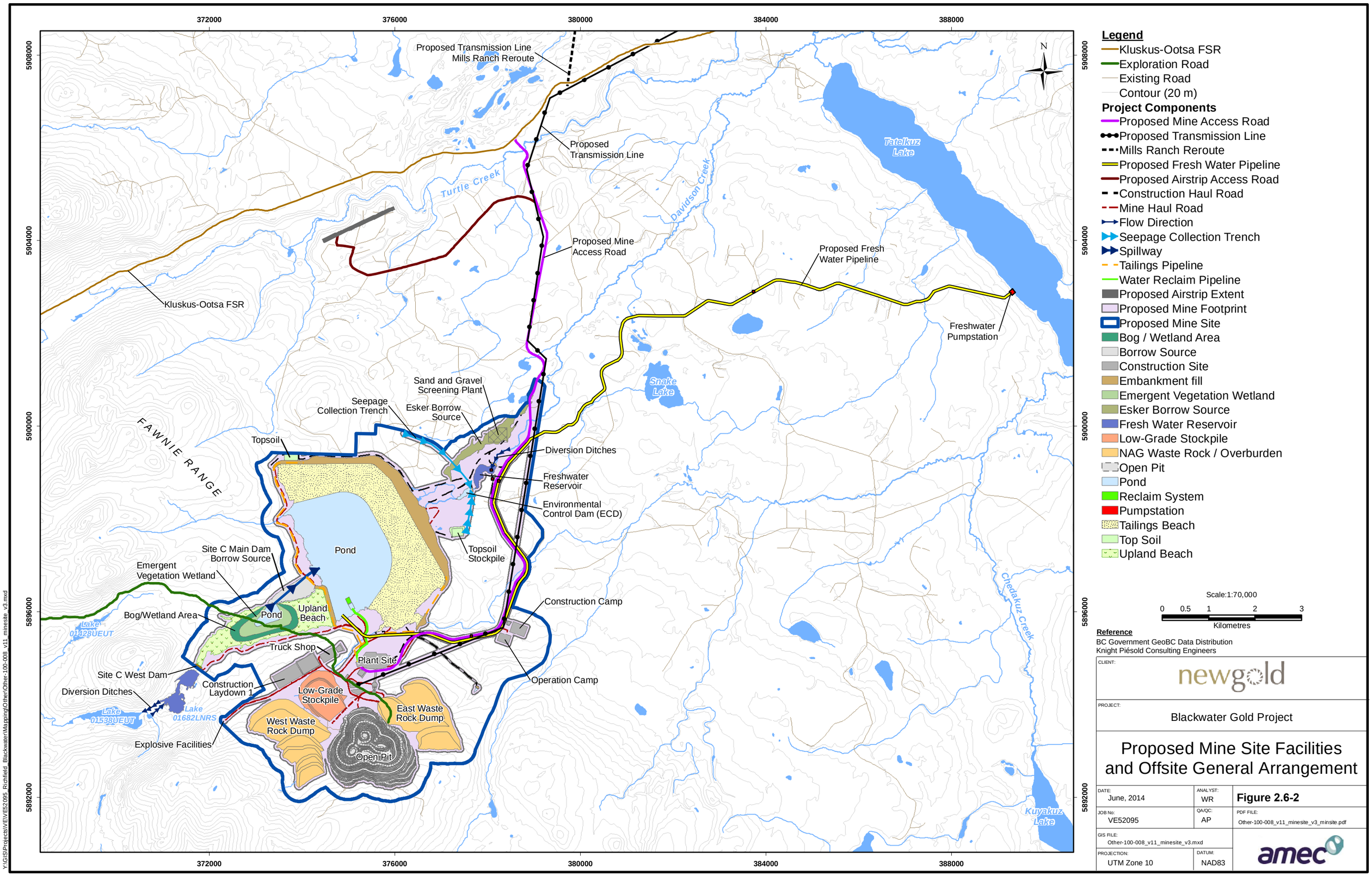
2.6.5 Project Land Use

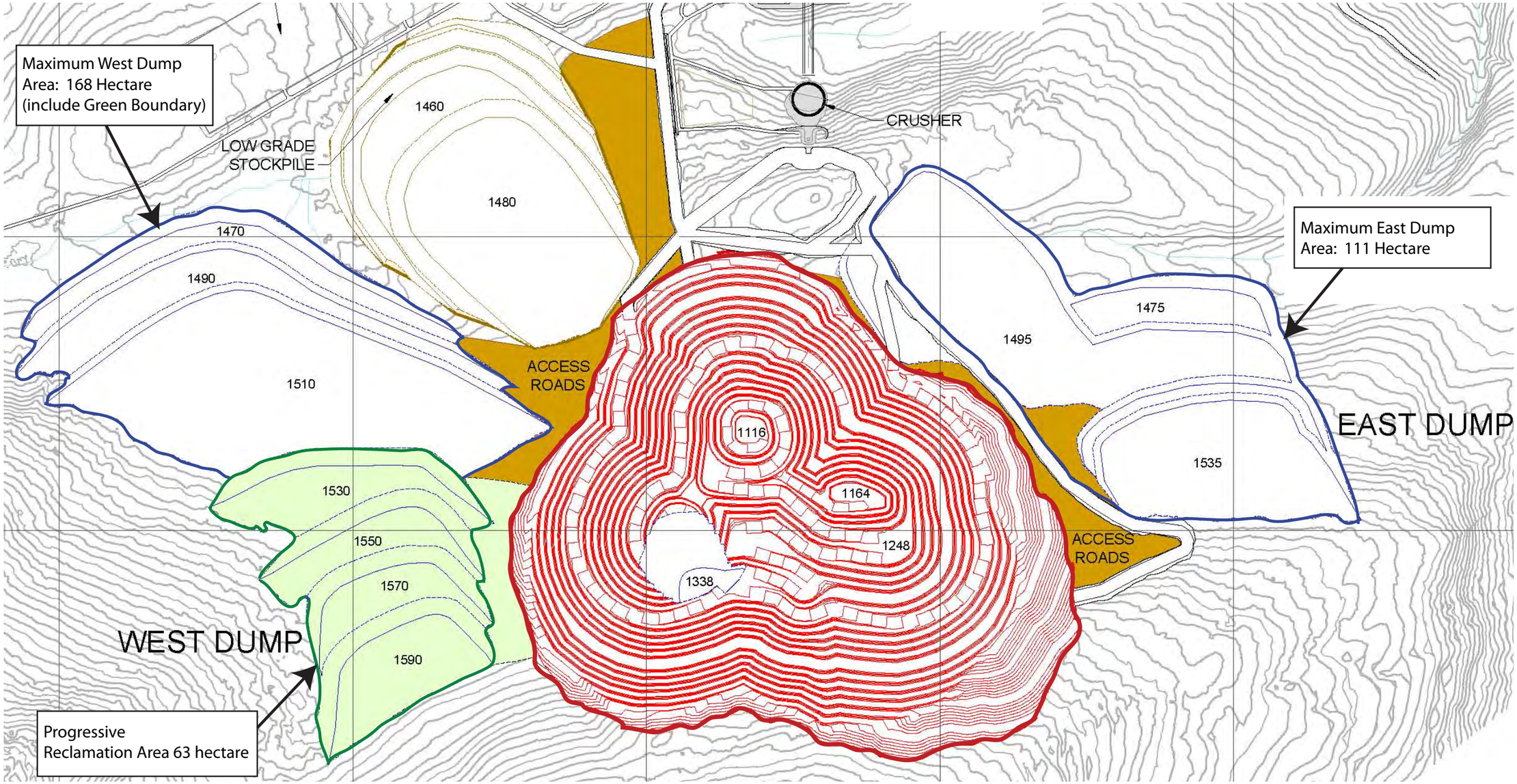
The area within the mine site boundary is approximately 4,100 ha (**Figure 2.6-3**). The mine footprint will be approximately 1,956 ha, consisting of the open pit, the Tailings Storage Facility (TSF), the waste dumps, and various buildings and infrastructure (**Table 2.6-2**, **Figure 2.6-2**). Off-site infrastructure will occupy approximately 620 ha, and includes a transmission line to supply energy for operations, a freshwater supply pipeline to transport water to the mine site from Tatelkuz Lake, an access road, and an airstrip with associated access road to transport materials and workers. Differences in disturbance characteristics for the development of each Project component will define their reclamation needs, and thus individual components are considered reclamation units within the RCP.

Figure 2.6-2 shows the general arrangement of the components within the proposed mine site and the off-site components, including the access road, freshwater supply pipeline, airstrip, airstrip access road, and the southern portion of the transmission line.

Table 2.6-2: Estimated Areas of Blackwater Gold Mine On-site and Off-site Project Components

Project Component	Area in Plan (ha)
On-site Components	
Open pit	238
Tailings Storage Facility Site C	192
Tailings Storage Facility Site D	925
East waste rock dump	158
West waste rock dump	172
Low-grade ore stockpile	76
Mine buildings and infrastructure	86
Site C main dam borrow area	30
Esker borrow area	43
Topsoil stockpiles	10
Environmental Control Dam and reservoir	15
Water reservoir	11
Total Area	**1,956**
Off-site Components	
mine site access road	28
transmission line right-of-way	550
Freshwater supply pipeline	21
Airstrip	15
Airstrip access road	6
Total Area	**620**


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Proposed Transmission Line
Mills Ranch Reroute
Proposed
Transmission Line
Turtle Creek
Davidson Creek
Tatelkuz
Lake
Proposed Mine
Access Road
Proposed Fresh
Water Pipeline
Kluskus-Ootsa FSR
Freshwater
Pumpstation
Snake
Lake
Sand and Gravel
Screening Plant
Seepage
Collection Trench
Esker Borrow
Source
FAWNIE RANGE
Topsoil
Diversion Ditches
Freshwater
Reservoir
Environmental
Control Dam (ECD)
Site C Main Dam
Borrow Source
Pond
Topsoil
Stockpile
Emergent
Vegetation Wetland
Upland
Beach
Bog/Wetland Area
Pond
Lake
01428UEUT
Truck Shop
Plant Site
Construction Camp
Site C West Dam
Construction
Laydown 1
Low-Grade
Stockpile
Operation Camp
Diversion Ditches
Lake
01538UEUT
Lake
01682LNRS
West Waste
Rock Dump
East Waste
Rock Dump
Explosive Facilities
Open Pit
Chedakuz Creek
Kuyakuz
Lake
Legend
Kluskus-Ootsa FSR
Exploration Road
Existing Road
Contour (20 m)
Project Components
Proposed Mine Access Road
Proposed Transmission Line
Mills Ranch Reroute
Proposed Fresh Water Pipeline
Proposed Airstrip Access Road
Construction Haul Road
Mine Haul Road
Flow Direction
Seepage Collection Trench
Spillway
Tailings Pipeline
Water Reclaim Pipeline
Proposed Airstrip Extent
Proposed Mine Footprint
Proposed Mine Site
Bog / Wetland Area
Borrow Source
Construction Site
Embankment fill
Emergent Vegetation Wetland
Esker Borrow Source
Fresh Water Reservoir
Low-Grade Stockpile
NAG Waste Rock / Overburden
Open Pit
Pond
Reclaim System
Pumpstation
Tailings Beach
Top Soil
Upland Beach
Scale:1:70,000
0 0.5 1 2 3
Kilometres
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CLIENT:
newgold
PROJECT:
Blackwater Gold Project
Proposed Mine Site Facilities
and Offsite General Arrangement
DATE:
June, 2014
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Figure 2.6-2
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VE52095
QA/QC:
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NAD83
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Note:
All areas are plan areas

CLIENT: newgold

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DWN BY:	MY
CHK'D BY:	JK
DATUM:	N/A
PROJECTION:	N/A
SCALE:	N/A

PROJECT: Blackwater Gold Project

TITLE: Year 14 Prior to Final Reclamation

DATE:	January 2014
PROJECT NO:	VE52277
REV. NO.:	A
FIGURE No.	2.6-3

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2.6.5.1 On-Site Infrastructure

2.6.5.1.1 Open Pit

The open pit will have a footprint of 238 ha, with approximate dimensions of 2 km from east to west, and 1.5 km from north to south. The anticipated depth is 550 metres below ground surface (mbgs). The open pit will be located on the south side of the mine site (**Figure 2.6-2**). The blast patterns and loading parameters will be based on a 12 m bench height.

2.6.5.1.2 Tailings Storage Facilities

The TSFs will occupy a footprint area of approximately 1,117 ha, comprising Site C, which will occupy 192 ha, and Site D, which will occupy 925 ha (**Figure 2.6-2**). The maximum elevation of the main dam for Site D is 1,340 masl (about 150 m high). The TSF is designed to store a total of 789 Mt of both tailings and PAG and ML waste rock. Approximately 32 Mt of the ML waste rock (NAG3) will be used to construct the upstream shell of the TSF dams or placed directly into the TSF ponds, where the rock will be submerged. In addition, a portion of the NAG3 may be used to construct the downstream shell/buttress of TSF dam C, where the waste rock will also be flooded within 5 years. The PAG and NAG3 waste rock will be stored in the tailings pond, and will be kept under water to prevent ARD formation and to minimize ML.

The TSFs will be built on a section of Davidson Creek. Water flow in downstream Davidson Creek will be maintained to support fish habitat. Water will be pumped from Tatelkuz Lake and transported to the mine site through the freshwater supply pipeline, and stored in a freshwater reservoir for ongoing release to the Creek. A small lake in the upper reaches of Davidson Creek will be enhanced to create additional fish habitat, outside the mine site, to the west of the TSF Site C, and will discharge to Creek 705 (**Section 5.3.9**).

2.6.5.1.3 Waste Rock Dumps

Two waste rock dumps (East and West) will hold non-acid generating NAG4 and NAG5 waste rock along with overburden, and will be located at each side of the open pit (**Figure 2.6-2**). The initial waste rock dump design, as indicated in **Table 2.6-2**, considered a West Dump size of 172 ha and an East Dump size of 158 ha. These areas are conservatively assumed for all purposes in this Reclamation Plan and throughout this Application, but a smaller footprint is being developed with a reduced waste rock dump size.

The West Dump in the new design will have a footprint of 168 ha, and will store 78 Mt of NAG4, NAG5, and overburden, with a top elevation of 1,590 masl (160 m high). At the end of mining, the East Dump will have a footprint of 111 ha to store 57 Mt of NAG5 and overburden, with a top elevation of 1,535 masl (105 m high). Overburden in the West and East Dumps will comprise about 50% and 46%, respectively, of the total dump mass. However, at the end of mining the footprint of the East Dump will be reduced from 111 ha to 72 ha as overburden is relocated from the dump for use in reclamation of the TSF and waste dumps surfaces (**Figure 2.6-3** and **Table 2.6-4**). Approximately 63 ha of the West Dump will be progressively reclaimed during mining operations. The remaining portion of the West Dump will be reclaimed in Year 15, and the

East dump will be reclaimed in Year 17 and Year 18, after the overburden required for reclamation is removed.

2.6.5.1.4 Low-Grade Ore Stockpile

The low-grade ore (LGO) stockpile will have a footprint of approximately 79 ha, with a top elevation of 1,480 m (80 m high), to store approximately 58 Mt of LGO. The LGO will consist of approximately 5% oxide, 12% transition, and 83% sulphide oxidation facies. To the extent feasible, these oxidation facies will be stored separately in the stockpile, so that oxide can be processed at the end of mill operations to create a partial cover over the transition and sulphide tailings in TSF Site D. The LGO will be stockpiled over a 0.5 m liner of compacted overburden. It will be located to the northwest of the open pit (**Figure 2.6-2**). LGO will be processed by the end of the mine life or, if not processed, placed underwater in the TSF or flooded pit.

2.6.5.1.5 Design Criteria for Long-Term Stability of Geotechnical Structures

The Canadian Dam Association's (CDA) Dam Safety Guidelines (2007) were used to determine the dam classification and suggested minimum Inflow Design Flood (IDF) and Earthquake Design Ground Motion (EDGM) for the Project's tailings dams. Classification of the tailings dams was carried out by considering the potential incremental consequences of a failure. The dam safety classification for the Project tailings dams is Very High. The following suggested design flood and earthquake levels were adopted from the CDA guidelines for the design of the Project:

- IDF = 2/3 between 1/1,000 year and Probable Maximum Flood (PMF); and
- EDGM = 1/5,000 year return period.

A draft bulletin was released by the CDA in 2012 entitled Application of 2007 Dam Safety Guidelines to Mining Dams – Design Considerations. This bulletin specifies that in closure of the TSF, the closure spillway for a mining dam should be designed for the PMF regardless of dam classification.

All geotechnical structures and works, including the waste rock dumps and tailings dams, are designed considering factors for long-term closure consistent with BC MEM requirements and the CDA Guidelines. The geotechnical performance will be monitored following Project closure. Any remaining spillways and ditches will be designed to pass the PMF.

2.6.5.1.6 Acid Rock Drainage Prevention and Metal Leaching Control Systems

The mine was designed as a contained system to prevent ARD, and minimize ML. Drainage from the pit; waste dumps, temporary coarse ore and LGO stockpiles, and the process plant site will flow to the TSF. Waste rock is classified according to its geochemical characteristics, as follows:

- PAG1: PAG waste rock with Neutralization Potential Ratio (NPR) ≤1;
- PAG2: PAG waste rock with 1 <NPR ≤2;

- NAG3: NAG waste rock with NPR >2 and Zinc concentrations ≥1,000 ppm;
- NAG4: NAG waste rock with NPR >2 and Zinc concentrations between 600 ppm and 1,000 ppm; and
- NAG5: NAG waste rock with NPR >2 and Zinc concentrations <600 ppm.

Waste segregation and special management will be conducted during mine operations as the primary means to prevent ARD and minimize ML. The waste production schedule and destination of mine wastes is shown in **Table 2.6-3**.

PAG waste rock (PAG1 and PAG2) and high metal-containing waste rock (NAG3) will be stored underwater in the TSF (**Appendix 5.1.3.1A,** Section 7.2). PAG1 and PAG2 waste rock will be inundated within one year of mining, and NAG3 within five years of mining. Approximately 8 Mt to 12 Mt of both PAG and NAG3 waste will be left in the bottom of the pit near the end of mining and flooded.

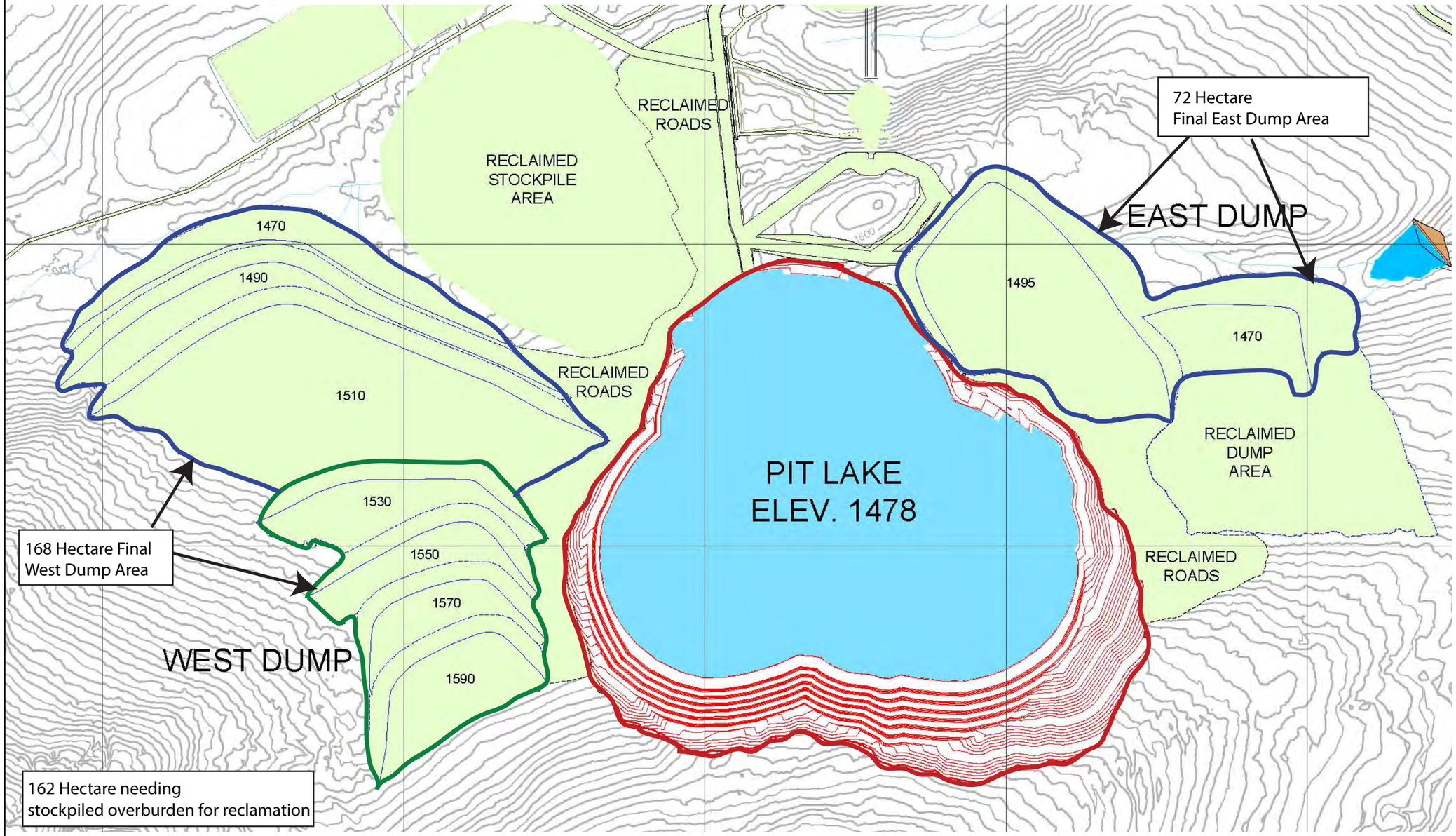
A water cover has been demonstrated to significantly reduce the transfer of oxygen, such that the rates of sulphide oxidation are at very low levels (Price and Errington, 1998). In addition, wetlands that will be constructed on the TSF surface at closure will promote oxygen consumption by organic matter and sulphate reduction that will further reduce oxygen transfer and enhance metal precipitation.

Since perpetual cover of PAG rock will be important to mitigate against acid generation and ML, an analysis was conducted to predict effects of extremely dry conditions on water levels in the TSF. Since water will be controlled until post-closure, these scenarios only apply to the post-closure phase. **Figure 2.6-4** shows the conceptual final reclaimed Waste Dumps, LGS and Pit Lake Area.

The mean annual precipitation for the Project area during baseline conditions was estimated at 636 mm with potential evapotranspiration of 445 mm (Knight Piésold Ltd., 2013a). Potential evapotranspiration is approximately equivalent to lake evaporation as it is determined assuming an unlimited supply of water. As the PAG will be deposited sub-aqueously, exposure of the PAG waste rock will require that the outflows from the pond exceed its inflows.

Table 2.6-3: Waste Production Schedule and Destinations

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Site C Construction															
NAG4 (tonnes)	1,650,000	2,810,000													4,460,000
NAG5 (tonnes)	4,290,000	1,590,000													5,880,000
OVB (tonnes)	2,050,000	2,050,000													4,100,000
Site C Storage															
PAG 1 (tonnes)	2,240,000	8,390,000	14,140,000												24,770,000
PAG 2 (tonnes)	940,000	3,400,000	4,370,000												8,710,000
Low Grade Waste (tonnes)	910,000	4,390,000	5,690,000												10,990,000
Site C Saddle Dam															
NAG4 (tonnes)	0	0													0
NAG5 (tonnes)	0	210,000													210,000
OVB (tonnes)	0	0													0
Site D Construction															
NAG 3 (tonnes)	1,160,000	4,890,000	2,450,000	3,040,000	3,370,000	3,580,000	2,710,000	2,680,000	1,800,000	1,790,000	1,400,000	1,900,000	1,460,000	1,720,000	33,950,000
NAG 4 (tonnes)	0	0	2,000,000	1,000,000	3,000,000	6,000,000	1,000,000	3,000,000	3,000,000	3,000,000	500,000	500,000	500,000	10,000	23,510,000
NAG 5 (tonnes)	2,610,000	5,360,000	3,770,000	7,000,000	6,450,000	6,220,000	570,000	4,880,000	4,820,000	3,810,000	400,000	2,000,000	2,000,000	30,000	49,920,000
OVB (tonnes)	2,050,000	4,100,000	1,230,000	5,130,000	1,850,000	5,130,000	0	1,230,000	0	0	0	0	0	0	20,720,000
Site D Storage															
PAG 1 (tonnes)	0	0	0	11,550,000	21,110,000	20,030,000	27,970,000	24,150,000	23,710,000	16,720,000	14,790,000	14,810,000	9,660,000		184,500,000
PAG 2 (tonnes)	0	0	0	3,910,000	6,320,000	9,470,000	8,700,000	5,560,000	5,050,000	5,340,000	4,090,000	2,480,000	1,080,000		52,000,000
NAG 3 (tonnes)	0	0	0	1,210,000	1,250,000	3,910,000	2,440,000	7,170,000	5,190,000	13,430,000	6,930,000	680,000	40,000		42,250,000
Low Grade Waste (tonnes)	0	0	0	8,960,000	8,120,000	5,020,000	9,740,000	7,170,000	10,840,000	8,000,000	8,730,000	9,970,000	5,480,000		82,030,000
West Dump															
NAG4 (tonnes)	0	0	1,320,000	5,180,000	1,720,000	690,000	4,300,000	2,780,000	990,000	5,000,000	5,920,000	790,000	990,000	720,000	30,400,000
NAG5 (tonnes)	0	640,000	2,700,000	1,500,000	210,000	560,000	0	0	0	0	2,000,000	1,000,000	0	260,000	8,870,000
OVB (tonnes)	8,800,000	4,860,000	4,000,000	3,000,000	4,000,000	3,000,000	3,000,000	5,000,000	3,000,000	0	0	0	0	0	38,660,000
Total Dump (tonnes)	8,800,000	5,500,000	8,020,000	9,680,000	5,940,000	4,250,000	7,300,000	7,780,000	3,990,000	5,000,000	7,920,000	1,790,000	990,000	980,000	77,940,000
East Dump															
NAG4 (tonnes)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NAG5 (tonnes)	0	0	650,000	2,510,000	600,000	2,040,000	4,960,000	290,000	350,000	5,610,000	10,990,000	2,370,000	0	30,000	30,400,000
OVB (tonnes)	0	2,880,000	5,570,000	4,530,000	5,780,000	2,000,000	4,100,000	90,000	1,330,000	0	0	0	0	0	26,280,000
Total Dump (tonnes)	0	2,880,000	6,220,000	7,040,000	6,380,000	4,040,000	9,060,000	380,000	1,680,000	5,610,000	10,990,000	2,370,000	0	30,000	56,680,000
In-Pit Backfilled															
PAG1 (tonnes)	0	0	0	0	0	0	0	0	0	0	0	0	0	7,800,000	7,800,000
PAG2 (tonnes)	0	0	0	0	0	0	0	0	0	0	0	0	0	900,000	900,000
NAG3 (tonnes)	0	0	0	0	0	0	0	0	0	0	0	0	0	60,000	60,000
Low Grade waste (tonnes)	0	0	0	0	0	0	0	0	0	0	0	0	0	2,900,000	2,900,000



	CLIENT: newgold	DWN BY: MY	PROJECT: Blackwater Gold Project	DATE: January 2014	
		CHK'D BY: JK		PROJECT NO: VE52277	
	AMEC Environment & Infrastructure 4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4 Tel. 604-294-3811 Fax 604-294-4664	DATUM: N/A	TITLE: Final Reclaimed Waste Dumps, LGS and Pit Lake Area	REV. NO.: A	
		PROJECTION: N/A		FIGURE No. 2.6-4	
		SCALE: N/A			

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The following assumptions were used:

- The only losses experienced by the TSF pond are evaporation and seepage;
- The runoff coefficient incorporates any losses due to evaporation and sublimation experienced by the contributing TSF pond catchment area;
- The runoff coefficient is estimated to be 0.31 (Knight Piésold, 2013a);
- The TSF spillway elevation and PAG elevation during post-closure were determined to be 1,336 and 1,325 masl, respectively (Knight Piésold, 2013c);
- Seepage from the TSF is estimated to be 55 L/s (Knight Piésold, 2013b);
- The TSF catchment area, including the pond, is estimated to be 39 km^2;
- Surface area of the TSF pond is estimated to be 2.05 km^2;
- Lake evaporation is estimated to be 445 m (Knight Piésold, 2013a); and
- The 1:200-year dry precipitation is estimated to be 478 mm (Knight Piésold, 2013a).

In order to provide a conservative estimate, two scenarios were considered, which represent the most extreme conditions for the Project area:

- No precipitation over the entire Site D catchment area; and
- A 1:200-year dry precipitation over the Site D catchment area (0.5% probability of exceedance).

Both scenarios assume a constant seepage flow out of the TSF of 55 L/s.

The result of the first scenario is that it will take approximately 8 years for the PAG waste rock to be exposed, which equates to a drawdown of 1.3 m/y. This scenario represents a statistical case for which there is no reasonable return period: where absolutely no precipitation occurs within the entire TSF catchment for all 8 years required the drawdown to occur.

The result of the second scenario is that the volume of runoff and direct precipitation (inflows) contributing to the TSF under the 1:200-year dry annual precipitation condition (6.5 Mm^3/y), is greater than the losses due to seepage and evaporation (2.65 Mm^3/y). The surplus inflow would contribute to the TSF pond and discharge through the TSF spillway to Davidson Creek even under these dry conditions. Consequently, the PAG waste rock is not predicted to be exposed in this post-closure scenario. The PAG sulphide tailings will be stored in the TSF at an elevation lower than the TSF spillway and covered with oxide tailings and overburden. The sulphide tailings will also not be exposed since the spillway remains active even under these dry conditions.

The results of both scenarios show that exposure of the PAG waste rock is extremely unlikely, given the design and hydrometeorological and hydrogeological characteristics of the Project site.

The West and East waste rock dumps will hold NAG materials with elevated NPR and relatively low metal concentrations. The East Dump will hold only NAG5 waste rock and overburden, while the West Dump will have NAG5, overburden, and approximately 30 Mt of NAG4. Both dumps comprise a substantial quantity of overburden, as discussed previously, facilitating progressive reclamation and reducing infiltration. Drainage from these dumps is predicted to be neutral to alkaline, with low metal concentrations (**Section 5.1.2.2**), and will flow by gravity to the TSF.

NAG/low metal containing waste rock (primarily NAG5, with approximately 5% NAG4) and overburden will be used to construct the TSF Dam D downstream shell, such that runoff and infiltration through the dam is expected to be alkaline with low metal concentrations (**Section 5.3.3**, Surface Water Quality).

Relatively limited exposed PAG pit walls will remain after the pit lake is full. A pit lake model predicted relatively low metal concentrations that will meet BC water quality guidelines for wildlife (**Section 5.3.3**, Surface Water Quality).

2.6.5.1.7 Water Management System

During the first year of construction, runoff occurring within the mine site will be contained and treated for total suspended solids in settling ponds, with flocculant addition if required prior to discharge to the environment. Thereafter, the mine site will be managed to prevent surface water discharges during the operations phase. All surface contact water will be contained within the TSF. Site C will operate during the first three years of operations until it reaches its maximum capacity. A spillway will be constructed on the north abutment of Site C (**Figure 2.6-2**). The spillway will transfer TSF supernatant from Site C to Site D. A secondary spillway will be constructed at a higher elevation as a shoulder to the primary spillway, to transfer supernatant in the event the primary spillway becomes blocked. Both spillways will be lined with rip-rap where required and designed to meet the requirements for PMF. TSF Site C will be used mainly as a water reservoir while tailings are deposited into TSF Site D. Tailings supernatant will therefore be stored in both TSF Sites C and TSF Site D during this period (Year 3 to Year 17).

The berm on the saddle dam of Site C will create a hydraulic barrier, such that seepage will flow towards the east and be captured in Site C. Runoff from the saddle dam itself will be pumped back to Site C until it meets water quality requirements for discharge.

During operations, the tailings effluent from the cyanide destruction circuit will be pumped to the TSF. Water from the TSF will be reclaimed and recycled to the concentrator. No surface water effluent will be discharged to the environment from the TSF during operations.

Drainage from the larger topsoil stockpile will flow by gravity into the TSF. Drainage from the upper, smaller TSF topsoil stockpile will be collected by Dam D, and drainage from the lower, smaller TSF topsoil stockpile in the Environmental Control Dam (ECD), and then pumped back to the TSF.

At the end of operations (Year 17), the supernatant of Site D will be pumped to the open pit. This site will be filled with runoff from the mine site, and the discharge of the open pit once it has been flooded to its maximum capacity. A spillway will be constructed on Dam D during about Year 18 to drain the TSF supernatant towards Davidson Creek during the post-closure phase. The spillway will connect to a discharge channel bypassing the wetlands constructed in the former ECD and water reservoir basins. The discharge channel will terminate in a constructed plunge pool in Davidson Creek to prevent erosion of the streambed. Further discussion of the closure Water Management System is presented in **Section 2.6.6.2.4.**

2.6.5.1.8 Mine Buildings and Infrastructure

The mine buildings and infrastructure will occupy an area of 86 ha, distributed across the mine site. For the construction phase, a laydown area (31 ha), and a construction camp (8 ha) with capacity to accommodate 800 to 1,200 personnel, will be required. An operations camp (5 ha), with buildings to accommodate up to 400 personnel during the operations phase, will also be built. The construction and operations camps will be located to the east of the mine site (**Figure 2.6-2**).

The process plant site will occupy 35 ha, with industrial buildings located between the TSF and the LGO stockpile. This surface area includes the crusher and the conveyor. The process plant site will have an area for storage of hazardous materials (e.g., cyanide), and will also include the core logging area. Inside the mill building, process liquid sumps will be established, including a grinding area sump, acid wash sump, elution area sump, electrowinning area sump, and carbon regeneration area sump. Outside the mill building will be the agitation leach area sump, Carbon-in-Pulp (CIP) area sump, cyanide destruction sump, grinding thickener, and the leach tails thickener. The truck shop will have an area of 6 ha.

2.6.5.1.9 Borrow Areas

Two main borrow areas will be the source of rock, sand, and gravel for construction of the TSF dam, access road, and other mine infrastructure. The Site C main dam borrow source will be located adjacent to TSF Site C, to the northwest of the main dam (**Figure 2.6-2**), and will have an area of 30 ha. The esker borrow source will be located northwest of the freshwater reservoir (**Figure 2.6-3**), and will have an area of 43 ha. The vast majority of the material used to construct the TSF dams will be sourced from the open pit. Other smaller borrow areas may be accessed on the mine site for construction materials.

2.6.5.1.10 Soil and Overburden Stockpiles

Salvaged soil for reclamation will be stockpiled in two locations outside the TSF Site D embankment fill, one in the northwest corner (4 ha), and the other near the east corner (6 ha). Overburden for reclamation will be stockpiled in the West and East waste rock dump areas (**Figure 2.6-2**). A small overburden pile will be established during operations adjacent to Dam D to facilitate reclamation in that area.

2.6.5.1.11 Plant Stock Nursery

A plant nursery will be installed and operated around Year 3. The nursery will provide plants reducing the cost of native plant stock used for revegetation. The nursery will focus on propagation of native species to be used in reclamation of on-site and off-site mine facilities, and the plants will be grown from seeds and propagules ethically harvested within the Project area. Rust-resistant whitebark pine will be propagated from seeds harvested from the existing whitebark pine population, following practices outlined in the Whitebark Management Plan (**Section 12.2**). The nursery will provide a positive benefit to the Aboriginal and community, as a source of training and employment for plant production and revegetation activities.

For propagation of seedlings of woody species, a semi-controlled structure with retractable roof will be used, allowing plants to be gradually acclimatized to outside conditions, while still being protected from weather extremes (Landis, 1995). Semi-controlled structures, such as tunnels and cold frames, allow easy and quick modification of the growing environment, are less expensive than greenhouses, and can be outfitted with any or all of the standard greenhouse environmental control equipment. If the structures are equipped with portable heaters, seedlings can be germinated in place.

The plant nursery will consist of a gothic cold frame, double-poly structure, which will easily shed snow and provide optimal insulation capabilities. The nursery will start with one freestanding structure (e.g., FarmTek's Clear Span Gothic Cold Frame, 34' W x 12' H x 96"), but a second structure could be added if needed to increase plant production or to provide different growing environments for a diversity of species. In addition, an area will be designated as an open growing compound, which would be appropriate for producing inexpensive container seedlings well acclimated to the environment. The compound will be graded for good drainage, and covered with weed barrier fabric and gravel. Containers may be placed on benches or pallets (Landis, 1995).

The nursery could be located on the mine site property, but more likely will be located near the construction and operations camps, where it would not be disturbed by mining activities. The optimum location will be determined during detailed design of the Project and in consultation with First Nations and the community.

2.6.5.2 Off-Site Infrastructure

2.6.5.2.1 Mine Site Access Road

The mine access road will be built to connect the existing Kluskus–Ootsa FSR, starting at KM 25, with the mine site. The new road will occupy approximately 30 ha, and will be 15 km long, over a right-of-way (ROW) 20 m wide (**Figure 2.6-3**; **Figure 2.6-5**).

320000 360000 400000 440000

5960000 5920000 5880000

François Lake
Cheslatta Carrier
Danskin
CHESLATTA 1
Skin Tyee
Uncha Mountains Red Hills Park
Francois Lake Park
Uncha Lake
Takysie Creek
Binta Lake
BINTA LAKE 2
Cheslatta
KNAPP LAKE 6
Knapp Creek
BAPTISTE LOUIS 8
Cheslatta River
Cheslatta Lake
TARGE CREEK 15
ALEXIS THOMAS 1A
HOLY CROSS LAKE 3
Cheslatta
MURRAY LAKE 4
Bird Creek
Nechako Canyon Protected Area
Lucas Lake
Lucas Creek
Knewstubb Lake
Big Bend Creek
LEON 14
Natalkuz Lake (Nechako Reservoir)
Tetachuck River
Entiako River
Entiako Park
Entiako Lake
Tweedsmuir Park
ULKATCHO 6
Johnny Lake
Laidman Lake
Fawnie Creek
Moose Lake
TSETZI LAKE 11
TSACHLA LAKE 8
Tsacha Lake
Kushya
KUSHYA CREEK 12
KUSHYA CREEK 7
Blackwater River
Kluskus
CHIEF MORRIS 13
BISHOP BLUFFS 5
BISHOP BLUFFS 6
BISHOP BLUFFS 10
KLUSKUS 14
SUNDAYMAN'S MEADOW 3
YALADELASSLA 4
KLOYADINGLI 2
KLUSKUS 1
UPPER KLUSKUS LAKE 9
Kuyakaz Lake
Euchiniko Lakes
Kluskus-Blue FSR
Exploration Road
Proposed Fresh Water Pipeline
Proposed Mine Access Road
Top Lake
Tatelkuz Lake
TATELKUS LAKE 28
Kluskus-Ootsa FSR
Mills Ranch Reroute
Chedakuz Creek
Tatuk Creek
TATUK LAKE 7
Finger Lake
Tatuk Lake
Finger Tatuk Park
Chilako River Ecological Reserve
Chilako River
Batnuni Lake
Euchiniko River
Nataniko Creek
Alexander Mackenzie Heritage Trail
EUCHINICO CREEK 19
TROUT LAKE JONNY 15
Nazko
EUCHINICO CREEK 17
EUCHINICO CREEK 18
TROUT LAKE ALEC 16
Kluskoil Lake Park
Euchiniko
Baezaeko
REDWATER CREEK 30
Nazko
Kluskus FSR
Meridian Road (Vanderhoof) Ecological Reserve
Hallett Lake
Greer Creek
Targe Creek
Cheslatta River
Knapp Creek
Cheslatta
Bird Creek
Tahultzu Lake
Nechako River
Nithi River
Smith Creek
Stellako
Stellako River
Stellako WMA
Stellako Reroute
Endako
Stellako
Fraser Lake
FRASER LAKE 2
Nadleh Whuten
YENSISCHUCK 3
Fort Fraser
NAUTLEY 1
STELLAQUO 1
SEASPUNKUT 4
Fraser Lake
Engen
Nechako River
Engen
NOONLA 6
Vanderhoof
Weneez
Sinkut River
Stuart River
Stuart River Park
STONY CREEK 1
Saik'uz
Tachick Lake
CLUSTALACH 5
Nulki
OLD COUNTRY MEADOW 4
LAKETOWN 3
Nulki Lake
SINKUT LAKE 8
SACKANITECLA 2
Mapes
CORKSCREW CREEK 10
CORKSCREW CREEK 9
Sinkut River
Corkscrew
Cluculz Lake
Cluculz Creek
Khai
16
27
35

N

Legend

- Populated Place
- Highway
- Kluskus FSR
- Kluskus-Blue FSR
- Kluskus-Ootsa FSR
- Railway
- Existing Transmission Line
- Alexander Mackenzie Heritage Trail
- Stream
- Waterbody
- Parks and Protected Areas
- Indian Reserve

Project Components

- Exploration Road
- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Transmission Line Reroute
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Proposed Airstrip Extent
- Proposed Mine Site

KEY MAP



Scale: 1:500,000

0 5 10 20
Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Location of Proposed Mine Site, Mine Access Road, Transmission Line, and Freshwater Supply Pipeline

DATE:	ANALYST:	
May, 2014	WR	**Figure 2.6-5**
JOB No: VE52277	QA/QC: AP	PDF FILE: Other-100-028_v14_Overview.pdf
GIS FILE: Other-100-028_v14_Overview.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\Other\Other-100-028_v14_Overview.mxd

Figure 2.6-5 shows the location of mine site and off-site facilities. The transmission line will run from the interconnection at Glennanon Substation near Fraser Lake to the mine site. The existing Kluskus-Ootsa FSR will be connected to the mine site with a new access road. The airstrip road and freshwater supply pipeline will be directed to the mine site.

2.6.5.2.2 Transmission Line

The transmission line will occupy an area of approximately 560 ha, and will be a 133 km long, 230 kV line, with a ROW 40 m wide (**Figure 2.6-3; Figure 2.6-5**).

2.6.5.2.3 Freshwater Supply System

Freshwater requirements will be met by pumping water from Tatelkuz Lake via a 20 km pipeline to a freshwater reservoir located below the ECD in Davidson Creek. This water will be used for mill freshwater (e.g., pump gland and reagent make-up water), TSF make-up if required, and flow maintenance in Davidson Creek. The pipeline will be placed adjacent to a road approximately 5 m to 10 m wide, depending on local ground conditions. An area of 21 ha has been considered for the pipeline, assuming a 10 m wide corridor (**Figure 2.6-3**, **Figure 2.6-5**). The pumping station will be located on the shores of Tatelkuz Lake. During construction, a small laydown area of approximately 100 m x 100 m will be required to support the construction activities. A dam will be constructed to create a freshwater reservoir. The area occupied by the freshwater reservoir will be approximately 11 ha, and is expected to hold 400,000 m^3 of water. The freshwater reservoir will hold water pumped from Tatelkuz Lake.

2.6.5.2.4 Airstrip

An airstrip will be constructed approximately 18 km from the Project camp for the transportation of personnel to and from the mine site during the construction phase (**Figure 2.6-5**). The facilities will include an access road, airstrip/taxiway, and small terminal building. The airstrip location was selected after reviewing a number of potential sites based on LiDAR imaging information, weather data, and environmental and geotechnical assessments. In addition to meeting the technical requirements, the selected location is closest to the mine site.

The airstrip will accommodate Dash 8 type aircraft. The runway will be 1,706 m (5,600 ft) long x 30 m (100 ft) wide, gravel-surfaced, and include a 7.5 m graded area along each edge and a 60 m long graded area beyond each end. The aircraft-parking apron off the taxiway will be sized to allow two Dash 8 sized aircraft to manoeuvre and park.

2.6.6 Conceptual Reclamation Plan

The reclamation approach for the Project includes the incorporation of mine-related landforms into the landscape and the re-establishment of natural landforms in the remaining sites. Mine-related landforms derived from mining activities (i.e., open pit, TSFs, waste rock dumps) will be reclaimed into rocky slopes, slopes with upland beach, wetlands, permanent ponds, and a pit lake (**Figure 2.6-6**; **Figure 2.6-7**) (3D layouts are conceptual only – refer to drawings for general arrangements). The natural landforms will have characteristics and reliefs similar to the pre-mining conditions. These will include the areas of decommissioned mine buildings and infrastructure, transmission line, and freshwater system, including the freshwater supply pipeline.

The reclamation design of mine-related and natural landforms will target the reclamation of pre-disturbance ecosystems on natural landforms and the regeneration of whitebark pine forest within the mine site. The reclamation design will incorporate features designed to provide wildlife habitat to target species. The habitat will benefit a wide variety of species, although emphasis will be given to habitat for target valued components (VCs) including mammals (e.g., caribou, moose, marten, grizzly bear, bats), birds (e.g., water birds, Clark's nutcracker), amphibians (e.g., western toad) and invertebrates (**Section 5.4**).

Figure 2.6-6 shows the conceptual mine site features without reclamation: open pit, waste rock dumps, LGO stockpile, process plant and operations camp buildings, and TSF.

Figure 2.6-7 shows conceptual reclaimed mine site (rough layouts only) after reclamation: open pit, waste rock dumps, and LGO stockpile. The process plant and operations camps would have been decommissioned. The blue arrows indicate the spillways flow direction.

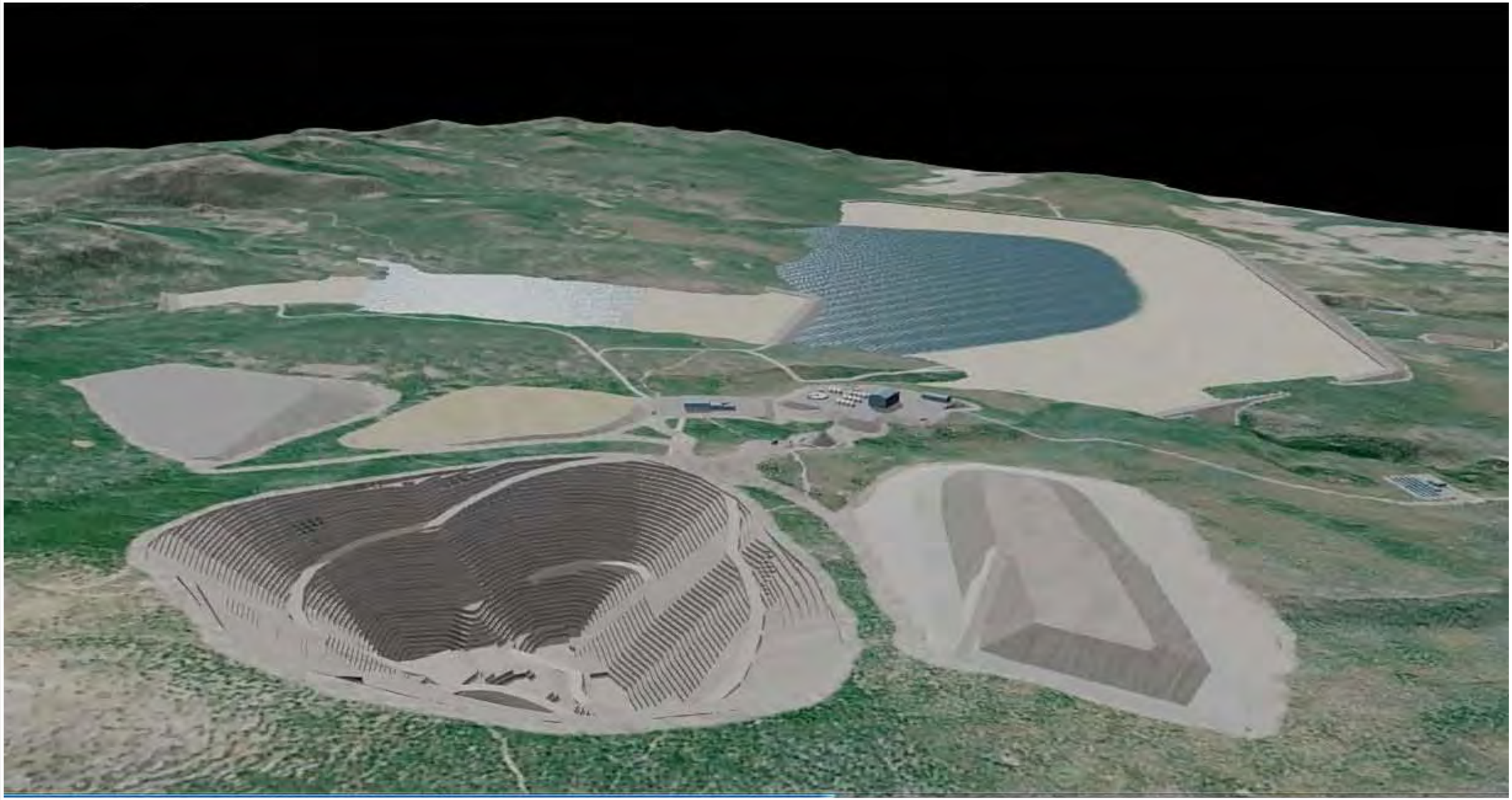
2.6.6.1 Open Pit

The open pit will be reclaimed to rock slopes with benches[1], and a permanent pool (pit lake) and an overburden slope (primarily on the east side) (**Figure 2.6-8**). To reduce the reactive surface area of unconsolidated materials, care will be taken to minimize the production of potentially problematic talus and remove previously blasted material with the potential for generating ML/ARD before access is cut-off. To reduce the potential of ARD production, fracture and talus will be reduced following these guidelines (Price and Errington, 1998):

- Controlling blasting near final pit walls; and
- Decreasing the angle of final pit slopes to the extent feasible.

The relatively thick, 27-degree sloped overburden unit exposed on the east/southeast side of the pit will be resloped and ripped, if necessary, and then revegetated (**Figure 2.6-9**) (note the design results in a reduction in area of the rock slopes, concentrated in the southeast side of the pit, when compared to the pit as shown on **Figure 2.6-8**).

[1] **Figure 2.6-8** shows full East Dump without removal of overburden for reclamation



Notes:

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amec

DWN BY:	AA
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DATUM:	N/A
PROJECTION:	N/A
SCALE:	N/A

PROJECT: Blackwater Gold Project

TITLE: Year 17 - Conceptual End of Operations

DATE:	January 2014
PROJECT NO:	VE52277
REV. NO.:	A
FIGURE No.	2.6-6

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Notes:

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DATUM:	N/A
PROJECTION:	N/A
SCALE:	N/A

PROJECT: Blackwater Gold Project

TITLE: **Conceptual Post Closure with Spillways**

DATE:	January 2014
PROJECT NO:	VE52277
REV. NO.:	A
FIGURE No.	2.6-7

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369000 372000 375000 378000

5898000 5895000 5892000

Esker Borrow Source
Proposed Fresh Water Pipeline
Plunge Pool 1
Upland Beach 2
Marsh Wetland 2
Shallow Water Wetland 2
Pond 2
Downstream Wetland Area
Proposed Transmission Line
Site C Main Dam Borrow Source
Exploration Road
Pond 1
Upland Beach 1
Shallow Water Wetland 1
Proposed Mine Access Road
Proposed Mine Access Road
Marsh Wetland 1
Lake 01428UEUT
Pit Inflow Deflection Berm
Site C West Dam 1
Site C East Dam 1
Site C Eastt Dam 2
Conveyor
Crusher
Plant Site 5
Flooded Lake
Low-Grade Stockpile
Dam 1
Dam Pond 1
Lake 01538UEUT
Lake 01682LNRS
East Dump
West Dump
Pit Lake Pond
Open Pit

N

Legend

- Contour (20 m)
- Stream
- Waterbody
- Exploration Road
- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Fresh Water Pipeline
- Diversion Channel
- Seepage Collection Trench
- Spillway
- Natural Landform

Mine Related Landform

- Upland Beach
- Rock Slope
- Marsh Wetland
- Shallow Water Wetland
- Pond
- Upland Slope

Scale:1:37,000

0 500 1000 2000

Meters

Reference

BC Government GeoBC Data Distribution

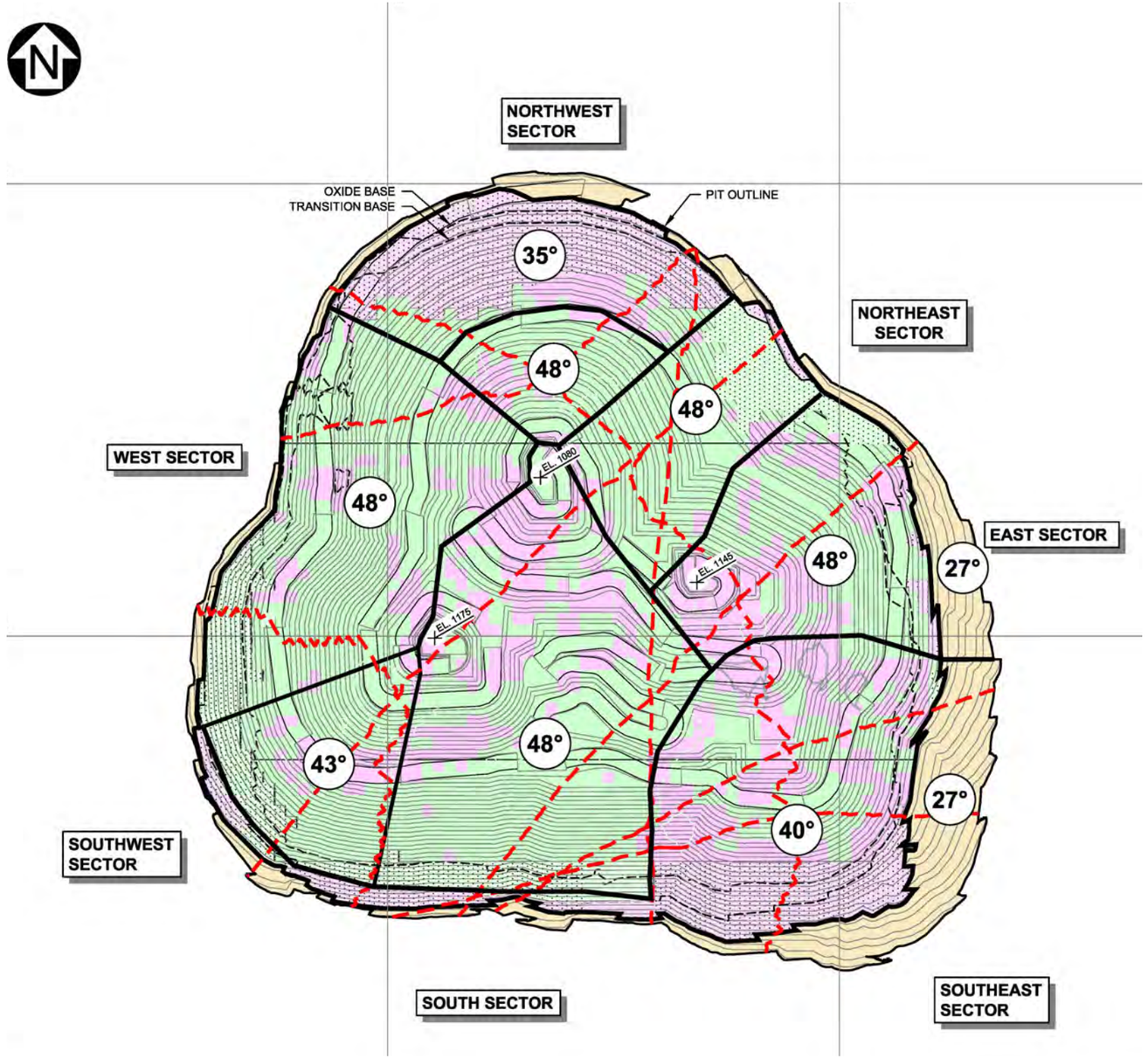
CLIENT: newgold

PROJECT: Blackwater Gold Project

General Arrangement Closure End of Year 352

DATE:	ANALYST:	**Figure 2.6-8**
March, 2014	AA	
JOB No: VE52095	QA/QC: MY	PDF FILE: 01-100-008_site_suitability_yr45_v3.pdf
GIS FILE: 01-100-008_site_suitability_yr45_v3.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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REFERENCE:
Figure base on Knight
Piesold drawing October 2013

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 10 U.
2. RQD MODEL PROVIDED BY NEW GOLD, FEBRUARY 2013.
3. OVERBURDEN CONTOURS PROVIDED BY NEW GOLD, FEBRUARY 2013.
4. OPEN PIT DESIGN FROM NORWEST, FEBRUARY 2013.

LEGEND:

- OVERBURDEN
- COMPETENT ROCK
- COMPETENT ROCK (INFERRED)
- BROKEN ZONE (RQD - POOR)
- BROKEN ZONE (INFERRED)
- DESIGN SECTOR

CLIENT: newgold

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DWN BY:	MY
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DATUM:	N/A
PROJECTION:	N/A
SCALE:	N/A

PROJECT: Blackwater Gold Project

TITLE: Inter-Ramp Slope Angles Final Pit

DATE:	January 2014
PROJECT NO:	VE52277
REV. NO.:	A
FIGURE No.	2.6-9

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2.6.6.1.1 Pit Lake

The pit will be a permanently inundated pit lake. The process of pit filling is expected to last about 20 years from the end of mining, accelerated by pumping TSF supernatant and water from Tatelkuz Lake to the pit starting in about Year 17 (once the overburden layer is placed on the tailings beach and submerged PAG rock).

The quality of the TSF supernatant at the end of operations is expected to be suitable for transfer to the pit, but if required, it could be first recycled through the closed mill, where lime could be added to precipitate residual metals, and then discharged to the pit. An additional SO_2/air treatment could also be applied in the closed mill circuit to remove cyanide and metal-cyanide species. Finally, nutrients (i.e., fertilizer) could be added to enhance algal growth in the filling pit lake, thereby supporting biological treatment.

The TSF supernatant is expected to be near background quality about two years after the end of operations, as the supernatant will be exchanged with catchment and reclaimed mine site freshwater (influenced slightly by the ECD pump back) flowing into the closed TSF. Wetlands will be established on the TSF surface to further polish water transferred to the pit lake during the closure phase.

Water quality of the pit lake after closure (Year 35) is predicted to meet BC wildlife guidelines (**Section 5.3.3.3.6**). At the conclusion of pit filling, anchored floating logs or other artificial structures will be introduced to provide resting sites for water birds.

2.6.6.1.2 Tailings Storage Facilities

2.6.6.1.2.1 Tailings Appurtenances

At closure, the tailings delivery pipelines will be flushed clean, drained, and then removed. Salvageable pipe will be removed from site and sold for salvage value. Pipe with no salvage value will be disposed of in the open pit or waste rock dumps and covered with waste rock or overburden. Similarly, all tailings delivery pipelines, power lines, and associated infrastructure will be decommissioned and cleaned of potentially hazardous materials.

Access roads to the tailings impoundment area will be decommissioned, unless required to provide access to facilitate post-closure inspection, maintenance, and monitoring of the tailings impoundment.

2.6.6.1.2.2 Tailings Storage Facility Reclamation

Tailings beaches will be sluiced to an overall surface slope of 0.3% for the final tailings configuration at each of the two tailings sites. This will reduce the total volume of oxide tailings to be placed above water. The TSF Site C will have a layer of oxide tailings up to 3 m in depth near the TSF dams. The level of the transition/sulphide PAG tailings will be at or below the spillway invert elevation, ensuring that the PAG tailings remain saturated. A final 0.3 m overburden layer will be used as cover for submerged tailings and PAG waste rock. The purpose of this layer will

be to provide physical separation of underlying metal leaching materials from the pond water column, thereby minimizing contamination of surface water discharges from the TSF.

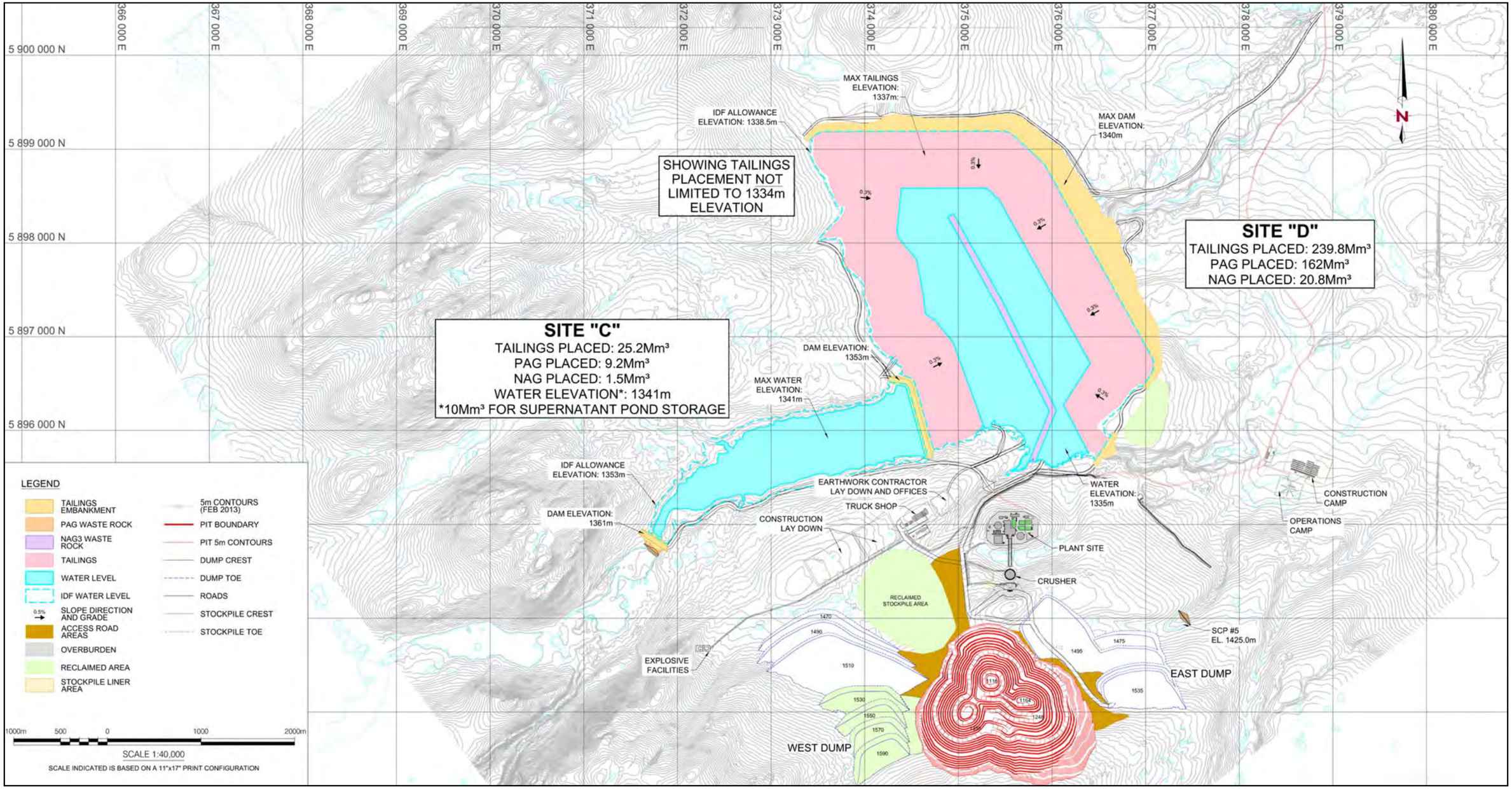
The overburden layer will minimize the influences from tailings and PAG waste rock on water cover chemistry. The hydraulic gradients through the TSF are predicted to be vertically downward. The tailings and waste rock porewater will be transported downward through the bottom of the TSF, with the discharge reporting as seepage. The 0.3 m thick overburden layer will provide an effective barrier to the upward migration of dissolved solutes from underlying tailings and waste rock porewater via molecular diffusion. Since diffusional transport is only relevant over short pathways (i.e., a few centimetres), a 0.3 m barrier will effectively curtail the potential for diffusive loadings into the water cover. The vertically downward hydraulic gradients will also serve to minimize the potential for upward diffusional transport.

For higher elevation exposed tailings beaches, overburden will be placed by small, wide-track equipment. In saturated areas where access could be difficult, overburden will be placed as slurry, through the tailings pipelines and spigots, or via sluice boxes from stations located around the TSF perimeter. The tailings areas will maintain a minimum 1 m freeboard at the crest of the dam, and the perimeter back from the dam crest will be graded to support drainage to the lowest elevation.

To maximize the tailings placement volume in TSF Site D, a causeway will be built in Year 9, using the last of the NAG3 material, followed by a top lift of NAG5 (**Figure 2.6-10**). Tailings will then be spigotted off this causeway, in order to achieve a more uniform height within the TSF leading to closure.

After cessation of pit operations, sulphide LGO will be processed, followed by the transition and oxide ores. The oxide LGO is expected to be NAG, with relatively low metal concentrations. A final layer of overburden will be placed over the exposed tailings beach at TSF Dam D, to produce an expected 5 m deep layer (combined oxide tailings and overburden). The spillway elevation will be at the oxide/transition tailings interface elevation to ensure that the PAG tailings are kept saturated.

The causeway constructed at TSF D in Year 9 will support the construction at closure of a sinuous, U-shaped wetland (not shown in **Figure 2.6-8**) that will maximize polishing treatment and ensure that the pit lake inflow during post-closure fully mixes with the TSF contents prior to its discharge through the TSF Dam D spillway to Davidson Creek. The ECD pump back pipeline will be extended at mine closure to also discharge at the inlet of the TSF Site D wetland to maximize polishing treatment of that relatively small-volume inflow.



REFERENCE:
Figure reference from
Norwest November 27, 2013

CLIENT:
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DWN BY:	MY
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PROJECTION:	N/A
SCALE:	N/A

PROJECT
Blackwater Gold Project

TITLE
Site D Tailings Placement Year 17
Site C Water Reservoir Option

DATE:	January 2014
PROJECT NO:	VE52277
REV. NO.:	A
FIGURE No.	2.6-10

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2.6.6.1.2.3 Upland Slopes

The outside edge of the TSF dams will be reclaimed into upland slopes. The top third of the outer dam face will be covered with up to 0.3 m of overburden for revegetation, and the bottom third of the outer dam face will comprise NAG waste rock to reduce erosion.

Rock along the bottom of the dam will be separated during dumping mimicking a talus slope (e.g., finer rocks near the top of the slope, grading to larger boulders at the bottom). The rock will not be continuous, and will not present a barrier to the movement of wildlife up and down the slope. Coarse gravel and cobbles could be selectively dumped into the crevices of the larger rocks to create periodic wildlife trails up the side of the former TSF dams. Rock piles could be placed every 500 m (minimum separation distance) around the dam perimeter, or disconnected rock ridges could be created (minimum 500 m in length) using surplus NAG rock; the surplus rock used would be sized, to the extent feasible, to mimic naturally occurring rock piles and talus slopes (e.g., piles with significant gaps between unevenly sized rocks, rather than compact piles of uniformly sized rock). These rock piles will offer protection for a variety of wildlife, including large mammals transiting the area.

The TSF dam upland slope will be a long feature in the landscape. To prevent wildlife crossing the area being exposed to predators, rock piles, and woody debris will be placed to act as temporary cover, perches, small mammal habitat, and shelter. Coarse woody debris will be placed on the surface of the upland slopes, between rocks, along the slope, and parallel and perpendicular with the slope to provide habitat features for small mammals, furbearers, and ground-feeding and nesting songbirds.

Bat hibernacula houses and nest boxes for secondary cavity nesters will be placed in the areas between upland slopes and the undisturbed surroundings to create new breeding habitats. Nest boxes can also be placed in forest edge areas. Large piles of rocks suitable for use as a bear den could be placed near the surrounding forest edge after mine closure.

2.6.6.1.2.4 Upland Tailings Storage Facility Beach

The upland TSF beach will extend from the inner edge of the TSF dam approximately 400 m down slope to the edge of the wetland. After sluicing and covering the tailings, the upland beach will have a slope of approximately 1% for the first 100 m, 0.5% for the next 500 m to the waterline, and 4% below the waterline. The tailings will be capped with up to 5 m of oxide tailings and overburden near the dam grading, towards the saturated tailings. The overburden cover will be revegetated. Rock and coarse woody debris placed in piles and scattered around the beach could be used to create wildlife habitat. Woody debris may be used to create a variety of microsites for plant establishment and wildlife. Using branches with cones and seeds may be an additional source of vegetation propagules (Brown and Naeth, 2014). Preferably, logs of at least 12 cm diameter and of deciduous and coniferous tree species will be used. Some coarse woody debris would lead into the wetland.

2.6.6.1.2.5 Tailings Storage Facility Pond Wetland

The TSF pond wetland will extend from the edge of the upland beach to the edge of the permanent pool, separated by the causeway constructed in Year 9. The water table in this area will be high, and the silts will remain saturated. The pH is expected to be slightly alkaline; about pH 8.0 during the early closure phase, becoming near neutral pH over time due to catchment runoff and direct precipitation. Wetlands will be constructed in the Site C and Site D TSF ponds.

The degree of active revegetation in this area will be dictated by accessibility constraints associated with the low load-bearing capacity of the saturated silts. Access points for small equipment (e.g., Bobcats or wide-track loaders) may be required to facilitate revegetation. The saturated silty substrate associated with this area will make it unsuitable for use by large wildlife species; therefore, amphibians, small mammals, and water birds (e.g., ducks and shorebirds) are the target for habitat. Osprey nest stands can be placed in the wetland.

2.6.6.1.2.6 Permanent Ponds

Permanently inundated ponds will be located in TSF Site C (1,346 masl) and Site D (1,336 masl). The introduction of submerged woody debris along the shoreline and anchored floating logs (or other artificial structures) will provide special features for water birds and amphibians. Fertilization of TSF supernatant with organic matter may be considered. Re-suspension of the overburden cover particles will be reduced by submerged and floating vegetation.

2.6.6.1.2.7 Spillway

The spillway will be built during Year 18 to drain TSF Site D. The elevation of the spillway will be 1,336 masl, and it is expected that the spillway will start discharging during Year 35 once the pit lake is full and discharges to the TSF.

2.6.6.1.2.8 Environmental Control Dam and Water Reservoir Wetlands

Wetlands will be constructed in the former ECD and water reservoir basins to polish the seepage discharge from the TSF (**Section 2.6.6.2.4**). The perimeter of the freshwater reservoir will be regraded and revegetated with native species suitable for swamp sites of ESSFmv1, and, if an open-water area is established, it could include species suggested for the TSF pond and marsh wetlands, according to water depths. The freshwater reservoir may be regraded to 1:15 in order to support a fringe of marsh wetland vegetation.

2.6.6.1.3 Waste Rock Dumps

The embankments of the West and East waste rock dumps will be constructed to a 3H:1V slope and reclaimed into upland slopes. As previously discussed, much of the waste rock in the West Dump will be reclaimed progressively during mine operations as the final slopes are constructed. A minimum cover of 0.3 m of overburden will be placed on each dump to reduce infiltration and

possible metal leaching, and to function as a reclamation substrate for revegetation. Both flat areas and slopes will be revegetated.

2.6.6.1.4 Borrow Areas

The Site C borrow area will be reclaimed by recontouring steep areas and benches. The area will be ripped and revegetated. Rocks and coarse woody debris will be used to create microsites for vegetation and wildlife establishment. Bat houses will be installed, preferably on poles along forest or water edges, at least 6 m from the nearest tree branches, and in south- or southeast-facing locations.

2.6.6.2 Natural Landforms

2.6.6.2.1 Low-Grade Ore Stockpile

The LGO will be processed during the last years of operations, or, if not processed for economic reasons, placed underwater in the TSF and/or open pit, where the material will be submerged. The LGO is expected to be acidic near the end of the mine life. If dumped in the TSF or pit, lime may be added as required to the stockpile material and to the TSF supernatant and pit water to prevent acidic conditions and metal release. The compacted overburden liner under the LGO stockpile will be checked for metal contamination, and if contaminated, will be excavated and placed into the TSF or pit. The drainage collection ditch and sump will be cleaned and material placed into the TSF or pit. The area will be covered with 0.3 m of soil and revegetated.

2.6.6.2.2 Mine Buildings and Infrastructure

Reclamation of areas with mine buildings and infrastructure will begin with removal of hazardous materials and decommissioning of facilities, including removal of equipment and structures, the mill building, maintenance shops, camp, explosives storage, power lines, pump house, and other facilities (**Section 12.2.1.18.4.17** and **Section 12.2.1.18.4.12**, Mine Waste Management Plan [MWMP] and Hazardous Materials Management Plan [HMMP]). After decommissioning, the areas will be regraded, covered with 0.3 m of soil or overburden, and revegetated.

2.6.6.2.2.1 Decommissioning of Infrastructure

2.6.6.2.2.1.1 Construction Camp and Associated Facilities

The construction camp will be leased. It will be erected before construction begins, and removed at the end of the construction period (**Section 12.2.1**, Construction and Operations Management Plan). The area will be ripped, regraded as necessary, and revegetated during the second year of operations.

At the operations camp, buildings, utilidors, walkways, sewers, water piping, and external electrical equipment will be removed at the end of mine life. The sewage treatment lagoons at the operations camp will be cleaned and filled in after all equipment is removed. The existing exploration camp and Rotating Biological Contractor sewage treatment plant modules would

have been connected to the mill, warehouse, administration, assay lab, and other on-site buildings to service mine operations; the treatment plant will be cleaned, sold, and removed from the site. Aboveground water and sewage pipes for the construction camp will be cut and removed. Belowground pipes will be flushed with freshwater and left buried. The holes created at the termination points will be appropriately backfilled. After the camp trailer units and associated facilities have been removed, the yard area under and around the camp will be scarified, regraded as necessary, have its natural drainage patterns re-established, and be revegetated.

2.6.6.2.2.1.2 Laydown and Construction Sites

Site laydown and construction areas have good potential to be restored to pre-disturbance conditions. The site will be regraded as required, have its natural drainage patterns re-established, and be ripped and revegetated.

2.6.6.2.2.1.3 Process Plant

At mine closure, all ore stockpiles adjacent to the crusher will be removed and processed through the mill. The crushed ore stockpile and underlying dead stockpile base load will be dozed into the reclaim tunnel feeders and processed through the mill. Once all of the ore stockpiles have been milled, the process plant will be decommissioned.

All in-process material will be washed through the circuit as tailings reporting to the tailings impoundment. Once cleaned of in-process materials, the following reclamation measures will be initiated to decommission and remove the milling facilities:

- Process equipment and building systems will be inspected and cleaned of all potentially hazardous materials, e.g., lubricating oil, hydraulic fluid, glycol, batteries. Potentially hazardous materials will be packaged in appropriate containers and shipped off site for recycling or disposal at a government-approved facility. Any instruments containing nuclear materials (e.g., nuclear density gauges, gamma detectors, etc.) will be decommissioned in accordance with government requirements and shipped off site for appropriate removal and disposal of the nuclear materials. Once cleaned, equipment and material with a salvage value will be removed from the site and sold. Equipment and material with no salvage value will be removed and disposed of in the open pit or waste dumps and covered with waste rock or overburden;
- Once all of the equipment and wiring has been removed from the mill, work will commence on demolition of the internal and external structures and tanks, followed by demolition of the building shell. Material with salvage value will be shipped off site and sold for salvage value. Material with no salvage value will be removed and disposed of in the open pit or waste dumps and covered with waste rock or overburden;
- The primary crusher, the associated surge bin, feeder, and conveying equipment, and the building structure will be removed and disposed of in a similar manner to that described for the milling equipment. The crusher foundation and excavation will be

backfilled with NAG waste rock or overburden material and sloped to conform to local topography;

- The crushed ore stockpile conveyor will be removed and disposed of in a similar manner to that described for the milling equipment; and
- All above-grade concrete foundations within the mill (e.g., pump bases and grinding mill foundations) will be backfilled or broken up using a backhoe-mounted concrete breaker. The concrete debris will be removed and disposed of in the open pit or waste dumps, or used to backfill in-plant sumps.

2.6.6.2.2.1.4 Heavy Equipment Maintenance Shop, Warehouse, and Administration Building

At closure, the heavy equipment maintenance shop, warehouse, and administration building will be removed.

Once cleaned of in-process materials, the following reclamation measures will be initiated to decommission and remove the facilities:

- All equipment and building systems will be inspected and cleaned of all potentially hazardous materials, e.g., lubricating oil, hydraulic fluid, glycol, batteries. Potentially hazardous materials will be packaged in appropriate containers and shipped off site for recycling or disposal at a government-approved facility. Once cleaned, equipment and material with a salvage value will be removed from the site and sold. Equipment and material with no salvage value will be removed and disposed of in the open pit or waste dumps, and covered with waste rock or overburden;
- Once all of the equipment and wiring have been removed from the buildings, work will commence on demolition of the internal and external structures, followed by demolition of the building shell. Material with salvage value will be shipped off site and sold for salvage value. Material with no salvage value will be removed and disposed of in the open pit or waste dumps and covered with waste rock or overburden;
- All above-grade concrete foundations of the buildings will be backfilled or broken up using a backhoe-mounted concrete breaker, covered with topsoil or overburden, and revegetated, if feasible. Concrete debris will be removed and disposed of in the open pit or waste dumps, and covered with waste rock or overburden;
- All at-grade concrete floor slabs will be broken up in situ to prevent ponding. The area will be regraded and covered with topsoil or overburden. Any excess concrete will be removed and disposed of in the open pit or waste dumps, or used to backfill in-plant dumps; and
- Soils around the maintenance shop building will be sampled at surface to a depth of 1 m using a series of test pits. The soil samples will be analyzed for a full range of metals and hydrocarbon contamination to determine whether any soils will require remediation. A soil remediation plan for the areas around the maintenance building will be developed based on this assessment, and then implemented. Metal- or hydrocarbon-contaminated

soils will be excavated and moved to the tailings impoundment, and then clean fill will be hauled and placed to restore site drainage.

2.6.6.2.2.1.5 Assay Laboratory

The assay lab will be decommissioned, cleaned, and dismantled using procedures similar to those previously described for the mill. All residual chemicals and reagents will be packaged and returned to the original supplier, shipped off site for use at a similar facility, or shipped off site for recycling or disposal at an appropriate government-approved facility.

Once cleaned of in-process materials, the following reclamation measures will be initiated to decommission and remove the assay laboratory facilities:

- All equipment and the building systems will be inspected and cleaned of all potentially hazardous materials, e.g., assay chemicals and wastes. Potentially hazardous materials will be packaged in appropriate containers and shipped off site for recycling or disposal at a government-approved facility. Any instruments containing nuclear materials (e.g., nuclear density gauges, gamma detectors, etc.) will be decommissioned in accordance with government requirements and shipped off site for appropriate removal and disposal of the nuclear materials. Once cleaned, equipment and material with a salvage value will be removed from the site and sold for salvage value. Equipment and material with no salvage value will be removed and disposed of in the open pit or waste dumps, and covered with waste rock or overburden;
- Once all of the equipment and wiring has been removed from the building, work will commence on demolition of the internal and external structures, followed by demolition of the building shell. Material with salvage value will be shipped off site and sold. Material with no salvage value will be removed and disposed of in the open pit or waste dumps, and covered with waste rock or overburden;
- Any above-grade concrete foundations of the building will be backfilled or broken up using a backhoe-mounted concrete breaker, covered with topsoil or overburden, and revegetated. Concrete debris will be removed and disposed of in the open pit or waste dumps, and covered with waste rock or overburden;
- All at-grade concrete floor slabs will be broken up in situ to prevent ponding. The area will be regraded with local soils as required. Any excess concrete will be removed and disposed of in the open pit or waste dumps, or used to backfill in-plant sumps; and

- Soils around the assay lab building will be sampled at surface to a depth of 1 m using a series of test pits. The soil samples will be analyzed for a full range of metals and hydrocarbon contamination to determine whether any soils will require remediation. A soil remediation plan for the areas around the assay lab building will be developed, based on this assessment, and implemented. Metal contaminated soils can be excavated and moved to the tailings impoundment, and then clean fill will be hauled and placed to restore site drainage.

2.6.6.2.2.1.6 Explosives Manufacturing Plant

The explosives manufacturing plant will be a single-storey structure located on a concrete slab. Associated structures will include a storage silo for ammonium nitrate, and a diesel storage tank. All structures will be the property of the explosives contractor.

The explosives contractor will remove all structures. The contractor will clean the site of all residual products. Any non-hazardous material generated during take-down of structures will be disposed of in the pit or waste dumps. The concrete slab will be broken and covered with topsoil or overburden, recontoured to approximate natural contours, covered with overburden, and revegetated.

2.6.6.2.2.1.7 Fuel Tanks

The on-site fuel storage facilities will be drained, and the remaining fuel will be transferred to a tanker truck and shipped off site for use elsewhere. The fuel tanks will then be cleaned using an experienced fuel tank cleaning contractor. The contractor will clean by power-washing the inside of the storage tanks, separating the oil from the wash water, and packaging the oil in drums for off-site shipment and disposal. Once cleaned, the tanks will either be shipped off site and sold for salvage value, or dismantled, with the demolition debris being disposed of in the open pit or waste dumps, and covered with waste rock or overburden. Fuel piping and distribution equipment will be similarly cleaned and then dismantled. The diked fuel tank containment area will be similarly cleaned and then breached. The liner will be cut up and then removed, with the cleaned demolition debris placed in the open pit or waste dumps, and covered with waste rock or overburden.

A similar procedure will be used to decommission the waste oil storage tank and burner unit on the domestic waste incinerator. Any remaining inventory of waste oil will be transferred into drums or into a tank truck and shipped off site for use elsewhere, or for disposal through a government approved facility.

2.6.6.2.2.1.8 Landfill and Incinerator

When no longer required, the on-site non-hazardous waste landfill, located near the West Dump, will be covered with a minimum of 2 m of truck-compacted overburden and revegetated. The incinerator will be decommissioned and sold, or recycled as scrap metal.

2.6.6.2.2.1.9 Site Landfarm

Petroleum contaminated soils may be bio-remediated on site in a landfarm to be located in or near the West Dump. If a landfarm is used, it will be decommissioned after closure when all petroleum-contaminated soils have been remediated. The remediated soils will be moved from the site and used as growth media or used as cover for foundations or other reclaimed facilities. The underlying barriers and landfarm area will then be placed in the TSF or pit.

2.6.6.2.2.1.10 Watercourse Reclamation

All culverts will be removed from road crossings (unless the roads are required for post-closure activities) and watercourses will be returned to their natural channels to the extent practical, or new, stable watercourses established. All crossings will be back-sloped and rip-rapped as appropriate to minimize potential for erosion. All permanent ditches and channels will be designed to pass the PMF.

2.6.6.2.3 Acid Rock Drainage Prevention and Metal Leaching Control Systems

Potential sources of ML/ARD at closure are:

- Surface waste rock (NAG4 and NAG5) and overburden dumps;
- Submerged waste rock in the TSF (PAG1, PAG2, and NAG3);
- Whole ore leach tailings;
- Ore stockpiles;
- LGO stockpile (if not processed during mining); and
- Pit walls.

Waste segregation and special management will be conducted during mine operations as the primary means to prevent ARD and minimize ML.

The NAG4, NAG5, and overburden dumps (East and West Dumps) will be NAG with elevated NPR and relatively low metal concentrations. Drainage from these dumps is predicted to be alkaline with low metal concentrations. A minimum of 30 cm of overburden will be placed on the dumps to reduce infiltration and facilitate revegetation.

NAG and low metal-containing overburden and NAG5 waste rock with limited NAG4 (about 5% by mass) will be used to construct the TSF Dam D, such that runoff and infiltration through the dam is expected to be alkaline with low metal concentrations.

PAG waste rock (PAG1 and PAG2) and high metal-containing waste rock (NAG3) will be stored underwater in the TSF. A water cover has been demonstrated at numerous other mines worldwide to significantly reduce the transfer of oxygen, such that the rates of sulphide oxidation are at very low levels. In addition, wetlands to be constructed on the TSF surface at closure will promote oxygen consumption by organic matter and sulphate reduction that will further reduce oxygen transfer and enhance metal precipitation.

Sulphide and transition ore tailings will similarly be stored underwater or within the capillary fringe within the tailings impoundment. A low metal-leaching oxide tailings layer will be placed on Site C such that the sulphide and transition tailings are submerged or are within the capillary groundwater fringe. A final 0.3 m layer of overburden will be placed onto the TSF beach, submerged tailings, and PAG/NAG3 waste rock to isolate the supernatant from the underlying rock. Overburden will be placed on the final PAG/NAG3 waste rock surface prior to submergence. For higher elevation exposed tailings beaches, the overburden will be placed by small, wide-track equipment. In saturated areas where access may be difficult, the overburden will be placed as slurry, through the tailings pipelines and spigots, or hydraulically monitored sluice boxes from stations located around the TSF perimeter.

Any run-of-mine or coarse ore stockpiles will be small by the end of mining and processed through the mill prior to closure. Compacted till liners under the stockpiles will be checked for metal contamination, and if contaminated will be excavated and placed into the TSF or pit. The drainage collection ditch will be cleaned, and material placed into the TSF or pit.

The pit lake model expects water quality to meet BC guidelines for wildlife. Relatively limited exposed PAG pit walls will remain after the pit lake is full. TSF supernatant and Tatelkuz Lake water will be pumped to the pit to reduce the time to flood most exposed PAG walls. Flooding time is expected to be about 20 years from the cessation of mining.

2.6.6.2.4 Water Management System

At closure, site drainage will continue to report to TSF Site D, with the exception of the water in the open pit until it is full, because the pit dewatering system will be decommissioned and the pit will be allowed to flood. Water from the seepage collection ponds and ECD will be pumped back to the TSF until the water quality is suitable for release to the environment.

A spillway will be constructed on the north abutment of Site C around Year 3 of operations when Site C TSF is full. The spillway will transfer TSF supernatant to Site C. A secondary spillway will be constructed at a higher elevation as a shoulder to the primary spillway, to transfer supernatant in the event that the primary spillway becomes blocked. Both spillways will be lined with rip-rap where required, and designed to withstand the PMF.

TSF supernatant from Site D will be pumped to the pit for natural degradation and to reduce the time to flood the pit. The supernatant will be isolated from the underlying tailings and PAG rock by a 0.3 m overburden layer (**Section 2.6.2**). The TSF pond supernatant will be replaced in the first two years with non-contaminated catchment drainage, and direct precipitation during the estimated 20 years until pit is filled, as discussed previously.

Once full, the pit lake will discharge via a constructed spillway and discharge ditch to the TSF pond and mix with the supernatant. The spillway and ditch will have rip-rap where required, and be designed to withstand the PMF. A secondary spillway will be constructed as a shoulder at a higher elevation than the primary spillway.

The pit water will mix with the TSF supernatant, be treated in the Site D TSF surface wetland, and the combined flow then discharged via a constructed spillway on the south abutment of the TSF Dam D to the downstream wetland/bypass system to Davidson Creek. The water from the spillway will discharge through a constructed ditch to the downstream wetland/bypass system and then to Davidson Creek. The discharge ditch will be lined with rip-rap where necessary, and be designed to withstand the PMF.

Water quality in the TSF supernatant pumped to the pit will improve due to the dilution and natural degradation of cyanide and ammonia. Data from the closed Equity Silver Mine TSF show that cyanide concentrations decreased rapidly following mine closure (Price and Aziz, 2012). Ammonia concentrations will reduce more slowly but are expected to be very low by the time the pit lake reaches its discharge level. Predicted metal and other contaminant concentrations in the pit lake are discussed in **Section 5.3.3**, Surface Water Quality. By the time the pit lake is full, the TSF supernatant quality is expected to be at or very near catchment baseline conditions.

Seepage and runoff from the East waste rock dump will continue to be collected and discharged to the TSF, unless water quality is acceptable for direct discharge to Creek 661. If acceptable, the collection ditch will be breached and reclaimed, and the runoff and seepage allowed to flow to Creek 661, thus restoring natural drainage patterns. The potential effects and management, including monitoring and contingency measures of potentially unrecovered seepage from the East waste rock dump and pit lake to Creek 661, is discussed in **Section 5.3.3**. Down slope groundwater monitoring wells will be installed to monitor seepage from waste management structures so that corrective action, such as recovery wells or ditches and pump back systems, can be initiated should assessment predictions prove incorrect and seepage be higher and/or of poorer quality than expected. If, especially during post-closure, monitoring confirms this prediction, the pit lake water level could be lowered, thus diverting the potential East Dump seepage away from Creek 661. Additional wetlands could be constructed further downstream to where the seepage surfaces.

Seepage and runoff from the West waste rock dump will be collected and continue to discharge to the TSF via the constructed ditch used during operations. This ditch will be upgraded as required to withstand the PMF.

2.6.6.2.4.1 Water Treatment Wetlands

Metals might be present in the pit lake overflow in concentrations requiring removal in the wetlands constructed on the surface of the TSF. Marsh and shallow open water wetlands will be constructed in each of Site C TSF and Site D TSF, occupying areas of approximately 32 ha and 59 ha, respectively.

Wetlands will also be constructed below Dam D in the ECD and water reservoir basins, with a total combined area of approximately 26 ha. A 4 ha test wetland in the former sediment control pond below TSF D dam will be established during the mine life (about Year 8) to demonstrate the effectiveness of wetland treatment and to confirm design parameters.

Both a surface flow and a subsurface flow wetland will be used to remove loads of ammonia, nitrate, cadmium, and zinc present in TSF seepage. Cadmium and zinc removed by the wetlands will be retained within sediments. Ammonia and nitrate would be taken up by the wetland plants.

A literature and case studies review supports the use of wetlands to treat mine drainage at closure for the predicted flows and metal concentrations (**Appendix 2.6C**). The surface area required for year-round treatment of the predicted flows of seepage from the TSF is approximately 8.3 ha, an area that is substantially less than the combined ECD and water reservoir wetlands. Both a surface flow and a subsurface flow wetland will be used to remove the ammonia and nitrate loads predicted at closure, as well as the cadmium and zinc present in TSF seepage. A 4.9 ha subsurface flow wetland could treat lower predicted ammonia and nitrate loads, as well as all the predicted cadmium and zinc loads, under the worst-case scenario.

Additional wetlands could be constructed, if required as a contingency, downstream of the water reservoir wetland before the compliance point at the mine access road crossing of Davidson Creek.

Cadmium and zinc removed by the wetlands will be stabilized within sediments. In addition, metals will not be taken up by vegetation and enter the food chain. The treatment wetlands will protect both the aquatic and terrestrial ecosystems downstream from the TSF from metals present in seepage (**Appendix 2.6C**).

Both mercury and selenium are relatively low in waste rock and overburden (**Table 2.6-4**). Median selenium in ore was slightly above ten times the average earth crustal value. However, ore will be converted to tailings in the mill, and stored in an anoxic state in the TSF, separated by an overburden layer from the tailings pond supernatant and surface wetlands. This disposal method will inhibit selenium mobilization and flux.

Table 2.6-4: Median Concentrations of Hg and Se in Mine Waste and Ore (ABA Database)

Waste/Ore	Hg[(1)]		Se[(1)]	
	Median	10 x AEC[(2)]	Median	10 x AEC[(2)]
Waste rock (n=552)	0.01	0.85	0.4	0.5
Overburden (n=42)	0.02		0.4	
Ore (n=57)	0.02		0.7	

Note: [(1)] units are ppm
[(2)]10 x AEC – 10 times average earth crust (Price, 1997)
ABA = acid base accounting; Hg = Mercury; Se = Selenium

In general, any mercury and selenium in TSF seepage is expected to be retained in the wetlands in the ECD/water reservoir and remain immobilized in the sediments, as long as they remain anaerobic (**Appendix 2.6C**). These metals might be remobilized from the surface flow wetland but not from the subsurface flow wetland, which will remain permanently anaerobic. Any constituent released by the surface flow wetland will be captured by the subsurface flow wetland

located downstream. Ingestion of mercury will be prevented by the subsurface wetland, ensuring that it will not enter the food chain.

Removal of selenium from the wetlands may not be significant. The formation of dissolved organic-Se species (e.g., selenocysteine or selenomethionine) in wetland porewaters may sustain low levels (possibly 1 to 5 parts per billion (ppb)) in seepages. These organic species can remain mobile even under reducing conditions, but the overall flux is expected to be small. Monitoring of the constructed wetlands during the closure period, when TSF seepage is still recycled to the TSF, will be conducted to confirm this prediction. Given the relatively low selenium concentrations in ore and in solutions from the SO_2/air testwork, selenium is not expected to be of concern.

Testwork, including a pilot scale wetland, will be conducted during mine operations to better define treatment wetlands design parameters, as mentioned above. These tests will take approximately two years to complete. Experience from constructing the wetland in Site C (Year 3 and Year 4) and subsequent performance data will be invaluable in the design and construction of the wetlands in Site D, the ECD, and the water reservoir.

2.6.6.2.4.2 Tailings Storage Facility Seepage and Supernatant Contingency Management

If required as a contingency measure, seepage from the TSF during pit filling or post-closure will continue to be pumped back to the TSF. Following pit lake filling, seepage pumped to the TSF will be diluted with the supernatant, thus reducing concentrations of metals. If required, TSF seepage will be pumped to the pit lake, providing additional dilution. Fertilizer could be added to the pit lake to facilitate metal and nutrient removal via algal growth (see below). Seepage and tailings pond supernatant could also be treated in a lime neutralization treatment plant to remove metals. Neutralization tests of acidic humidity TSF leachate showed that lime addition will effectively lower metal concentrations (**Section 5.1.3.1**).

As a further contingency, a permeable reactive barrier could be installed to reduce contaminant concentrations in seepage and groundwater (**Appendix 2.6D**). A permeable reactive barrier could be very effective in treating the relatively small seepage flows, and would not be affected by higher surface flows that would discharge via the TSF spillway post-closure.

2.6.6.2.4.3 Pit Lake Water Contingency Treatment

Pit lake treatment has been successfully employed at other mine sites in North America, and offers a useful water treatment contingency for the Project (**Appendix 2.6E**).

In situ bioremediation of mine site pit lakes typically involves the addition of nutrients and/or organic matter to create conditions conducive to contaminant removal. Given the low Phosphorus concentrations in background surface waters near the Project, and the predicted elevated levels of nitrate-N in the pit resulting from the leaching of residual blasting residues, algal productivity in the lake will likely be limited by the availability of phosphorus.

Both zinc and cadmium are amenable to bioremediation via lake fertilization, although treatment for zinc is more favourable. However, both cadmium and zinc show strong associations with organic matter in natural systems.

The duration of nutrient amendments to achieve effective in situ treatment will depend in part on the response of native algal communities, the degree of metal removal, and the water quality targets for lake surface waters. At a minimum, it can be assumed that amendments will be applied on a weekly basis for a minimum of two months during the growing season (May through September). Due to the high rate of nutrient assimilation by phytoplankton, nutrients added in one year will not be available in the following year, and therefore bioremediation in this form should be viewed as an annual occurrence as long as some form of treatment is required. However, depending on pit lake chemical evolution at the Project site, it is possible that such treatment may only be required for one or two seasons. For example, block modelling shows that only limited PAG exposures will be present above the water table of the flooded pit. This may imply that loadings from the pit walls will be significantly reduced following flooding, and that active bioremediation may only be required for a limited period.

2.6.6.2.5 Freshwater Supply System

The freshwater supply pipeline will be removed only after the TSF starts to discharge to Davidson Creek in Year 35 and sufficient flow is provided for downstream fisheries. Once it is no longer required, the freshwater supply pipeline from Tatelkuz Lake to the mine site will be removed, and either sold or buried in the West waste rock dump. The pumps will be removed and sold. The pump house building will be demolished, and the rubble trucked to the mine site and buried in the waste dumps. The soil will be ripped for de-compaction and seeded. The pump station access road may provide long-term recreational access to Tatelkuz Lake. If requested by First Nations or the local community, and subject to regulatory agency approval, it may be left for lake access. Otherwise, the roadbed will be ripped and revegetated. If jet fuel or other petroleum products are stored at the airstrip they will be removed when the airstrip is decommissioned. Any above-ground storage tanks will be removed, either sold or scrapped at a suitable facility. Any contaminated soils will be excavated and removed from site to an off-site landfarm or hazardous waste facility.

A wetland will be constructed in the basin area of the freshwater reservoir for seepage treatment, as previously discussed.

2.6.6.2.6 Mine Access Road

The mine access road within the mine site will be reclaimed to resemble pre-mining conditions during post-closure, once it is no longer needed for monitoring, unless it is retained to allow public access to the site area. If complete decommissioning of the road is chosen, constructed bridges and culverts will be removed, and stream banks reclaimed. Small rocks, logs, and leaf matter piles could be placed adjacent to the stream bank to provide climbing areas and hibernating habitat for amphibians. The road surface will be ripped and revegetated.

2.6.6.2.7 Transmission Line

The transmission line corridor and ROW will be returned to near pre-mining conditions. The majority of the power line poles will be removed, although poles adjacent to creeks and wetlands could be retained and augmented to provide potential nesting sites for raptors; the number of poles retained will be determined prior to closure. These poles may be particularly beneficial to raptors, given the extensive MPB-killed pine trees in the area. Amphibian habitat will be protected by keeping existing natural ponds, and if suitable locations are identified, habitat can be enhanced by augmenting the size of the ponds or constructing artificial ponds. Rocks, logs, and leaf matter piles will be placed to provide climbing areas and increase hibernating habitat.

2.6.6.2.8 Airstrip

If requested by First Nations or the local community, and subject to regulatory agency approval, the airstrip may be left in place. Otherwise, the airstrip will be ripped and revegetated. Other facilities at the airstrip will either be sold (e.g., emergency generator and lighting) or removed (e.g., buildings) and transferred to the mine site for disposal in the TSF or pit, or buried in the waste dump or non-hazardous landfill. If jet fuel or other petroleum products are stored at the air strip they will be removed and shipped off site. Storage tanks will be shipped off site to the fuel supplier. Any contaminated soil will be removed from the airstrip and remediated.

2.6.6.3 Soil Management for Reclamation

2.6.6.3.1 Soil Suitability for Reclamation

Soil suitable for reclamation will be salvaged within the Project area. Reclamation suitability of soils is described in the Soils and Terrain baseline (**Section 5.1.3.2**). In the mine site, 50% of the soil was rated as Poor for reclamation purposes. This rating was determined by the pH of the soil, the prevalence of coarse textured sediment, and the high coarse fragment content within the root zone occurring in the Twain soil association. Associations with Fair ratings (e.g., Ormond, Alix, and Deserters soil associations) accounted for greater than 41% of the Project area. The coarser textured sediments and higher coarse fragment content of these soil associations are commonly associated with low pH levels and low moisture-holding capacity, which further contributed to the Fair reclamation suitability ratings. Soils with high levels of acidity were determined, with an approximate average pH value of 4. Reclamation suitability was adjusted to reflect the natural state of these soils and the tolerances of the natural vegetation of the area (**Figure 2.6-11**).

2.6.6.3.2 Soil Available for Salvaging

The total estimated volume of potentially salvageable soil is 472,745 m^3, corresponding to 756,393 tonnes (t) of soil, assuming a soil weight of 1,600 kilogram per cubic metres (kg/m^3) (**Table 2.6-5**). The soil volume was estimated assuming the uppermost 0.5 m layer of Good and Fair soil will be salvaged together with the uppermost 1.0 m of organic soil in selected areas. Soil salvaging practices often target the topsoil or uppermost layer (A horizon). However, in the Project area, the depth of the A horizon was measured at less than 10 cm. The use of heavy

equipment limits the depth of soil salvage to about 0.5 m, therefore salvage will include topsoil (>0.1 m depth) and subsoil with Good and Fair reclamation suitability ratings. Soils with Poor suitability, or soils affected by anthropogenic activities (NR), are not considered for salvage due to their low suitability. Organic soils at the Project area occur in two different thickness classes: veneers (Ov), which contain less than 1.0 m of organic accumulation; and blankets (Ob), which contain between 1.0 m and 2.0 m of organic accumulation. An average salvaged depth of 1 m was considered appropriate for the calculation of available organic soils volumes.

Table 2.6-5: Soil Volume (m^3) Available for Salvaging at the Mine Footprint, Rated According to Suitability for Reclamation

Project Component	Description	Good Soil (m^3)	Fair Soil (m^3)	Organic Soil (m^3)	Total (m^3)
1	Open Pit	0	0	9,399	9,399
2	Tailings Storage Facility Site C*	264	1,362	2,319	3,946
3	Tailings Storage Facility Site D*	2,891	42,686	3,081	48,658
4	Waste Rock Dumps	ns	ns	ns	ns
5	Low-Grade Stockpile	0	226,642	4,178	230,820
6	Water Management Facilities**	337	0	0	338
7	Mine Buildings and Infrastructure	0	87,385	43,605	130,990
8	Borrow Areas	0	48,589	0	48,589
9	Topsoil Stockpiles	ns	ns	ns	ns
Subtotal Soil (m^3)		3,493	406,668	62,584	
Total Soil (m^3)					**472,745**
Total Soil (t)					**756,393**

Note: *Soil salvaged under dams only; ** includes freshwater reservoir; ns = soil will not be salvaged
m^3 = cubic metre; t = tonne

372000 375000 378000 381000

5901000 5898000 5895000 5892000

N

Esker Borrow Source
Topsoil
Embankment Fill 2
Proposed Fresh Water Pipeline
Freshwater Reservoir Dam
Freshwater Reservoir
Tailings Beach
Pump Station 4
Pump Station 2
Pump Station 1
Environmental Control Dam (ECD) Dam
Environmental Control Dam (ECD)
Pond 1
Topsoil Stockpile
Proposed Transmission Line
Embankment Fill 1
Site C Main Dam Borrow Source
Exploration Road
Emergent Vegetation Wetland
Upland Beach
Proposed Mine Access Road
Pond 2
Unknown Building 2
Unknown Building 1
Bog/Wetland Area
Plant Site 3
Plant Site 2
Embankment Fill 3
Construction Camp
Site C West Dam
Site C East Dam 1
Site C East Dam 2
Unknown Building 3
Truck Shop
Unknown Building 4
Plant Site 1
Conveyor
Construction Laydown 1
Crusher
Operation Camp
Plant Site 5
Low-Grade Stockpile
Dam 1
Dam Pond 1
Plant Site 4
East Dump
Explosive Facility
West Dump
Open Pit

Legend

- Exploration Road
- Proposed Mine Site Access Road
- Proposed Fresh Water Pipeline
- Proposed Transmission Line

Site Facility and Reclamation Suitability

Reclamation Suitability Ratings

- Fair
- Good
- Poor
- Organic
- Not Rated
- Diversion Channel
- Seepage Collection Trench
- Spillway

Scale:1:37,000

0 250 500 1000 1500

Meters

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Soil Quality and Mine Components Year 1 to 17

DATE: March, 2014	ANALYST: AA	**Figure 2.6-11**
JOB No: VE52095	QA/QC: MY	PDF FILE: 05-100-005_site_suitability_yr17.pdf
GIS FILE: 05-100-005_site_suitability_yr17.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_BlackwaterMapping\05_terrain-geology-soils\Baseline\05-100-005_site_suitability_yr17.mxd

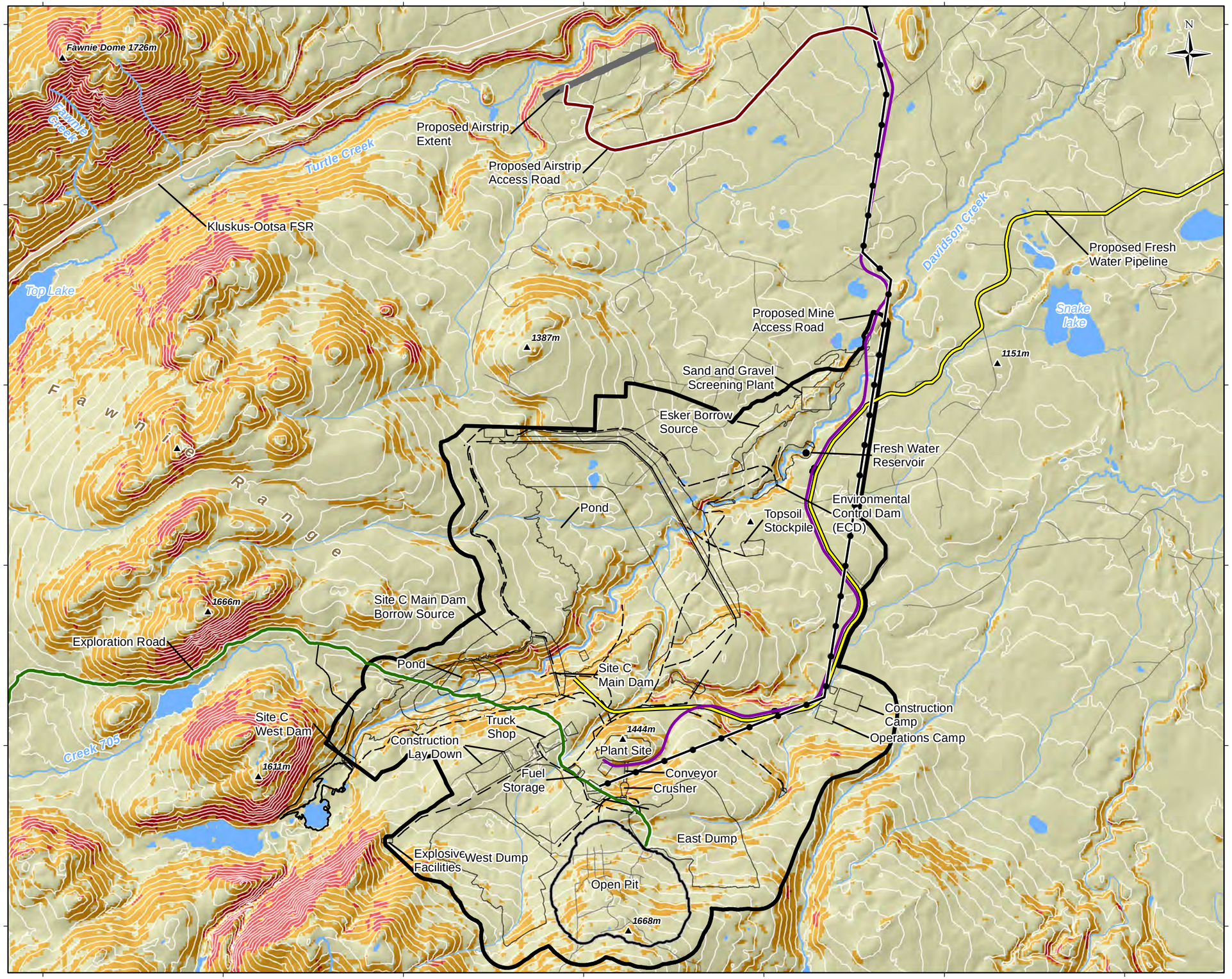
Table 2.6-11 shows the distribution of soils at the mine footprint according to reclamation suitability.

Areas considered for soil salvage include the mine pit, the LGO stockpile, mine infrastructure (e.g., operations camp, process plant site, truck shop), and the Site C borrow area. Soil under the TSF (except where excavated for dam construction) or under the waste rock dumps will not be salvaged to avoid creating potential seepage conduits. In addition, organic soil left on the TSF basin floor and waste rock dump foundation may promote sulphate-reducing bacteria that will further reduce sulphate and metal concentrations in any TSF basin or waste rock seepage. A small portion of soils will be excavated to construct the tailings dams, and will be salvaged. Estimated volumes of suitable and unsuitable soil are detailed in **Appendix 2.6A**. Steep topography does not constitute a limitation for soil salvage in the areas selected for salvaging, except in the TSF. Areas that could limit soil salvage due to topographic steepness were identified by overlapping the footprint plan with a topographic image ranked by slope inclination degree (**Figure 2.6-12**). The ranks represent ranges of slope inclination where use of machinery for soil salvage may pose a risk for operators. The inclination ranks are 0 to 10, 11 to 20, and 21 to 30 degrees. Soil salvaged will be limited to areas up to 20 degrees of inclination. The TSFs occupy the steeper areas within the mine site; however, when safe to do so, efforts will be made to salvage soil as much as possible while constructing the dams.

Soil salvage and stockpiling will not be considered for other components of the Project, such as the freshwater supply pipeline, transmission line, mine access road, berms, diversion ditches, and airstrip. Rather, soil may be windrowed where applicable, and used for reclamation of adjacent areas.

2.6.6.3.3 Soil Volume Requirements

The estimated amount of required soil capping material assumes using a capping depth of 0.3 m across the mine footprint. Salvaged soil will be prioritized for use for Project components that will be reclaimed into natural landforms, such as the LGO stockpile, mine buildings and infrastructure, and water management infrastructure, such as the wetlands in the ECD and freshwater reservoir (**Table 2.6-6** and **Appendix 2.6B**). Overburden will be used in constructing the TSF embankments and other mine site structures, and for reclamation of mine-related landforms, TSF Site C and TSF Site D, waste rock dumps, freshwater reservoir dam, and ECD (**Table 2.6-6**, **Figure 2.6-10**, and **Appendix 2.6B**). A few subcomponents, such as the topsoil stockpiles, esker borrow area, or features that will be water-inundated after mine closure (such as the open pit), will not require a soil cover. Project components where soil will not be removed but be windrowed nearby (i.e., construction camp, transmission line, mine access road, freshwater supply pipeline, and airstrip) are not considered in the estimation of soil or overburden capping requirements.



Legend

- Spotheights
- Kluskus-Ootsa FSR
- Logging Roads
- Contour (20 m)

Project Components

- Exploration Road
- Proposed Mine Site Access Road
- Proposed Transmission Line
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Proposed Airstrip Extent
- Proposed Mine Site

Slope (degrees)

- 21 - 30
- 11 - 20
- 0 - 10

Scale:1:53,000

0 0.5 1 2 3

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Slope Steepness in the Mine Site Study Area

DATE:	ANALYST:	
March, 2014	AA	**Figure 2.6-12**
JOB No: VE52095	QA/QC: MY	PDF FILE: 05-100-005_slopeDegrees.pdf
GIS FILE: 05-100-005_slopeDegrees.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\05_terrain-geology-soils\Baseline\05-100-005_slopeDegrees.mxd

Table 2.6-6: Capping Material Requirements

Component	Description	Area (ha)	Overburden (m^3)	Soil (m^3)
1	Open Pit	-	-	-
2	Tailings Storage Facility Site C	192	600,000	-
3	Tailings Storage Facility Site D	925	6,756,000	-
4	Waste Rock Dumps(1)	329	990,441	-
5	Low-grade Ore Stockpile	76	-	227,913
6	Water Management Facilities	15	958	22,314
7	Mine Buildings and Infrastructure	85	-	125,435
8	Borrow Areas	73	-	-
9	Topsoil Stockpiles	10	-	-
Total (m^3)			**8,347,399**	**375,661**
Total (t)			**15,860,059**	**713,756**

Note: (1) Conservative value. Waste rock dumps may be 50 ha smaller in final design thus requiring 150,000 m^3 less overburden for capping.
ha = hectare; m^3 = cubic metre; t = tonne

2.6.6.3.4 Soil Salvage and Stockpiling Strategies

Soil will be salvaged in a single lift and then stockpiled. To assist future reclamation strategies, soil with different textures will be stored in separate sections of a stockpile (e.g., fine texture materials mixed with overburden to improve water-holding capacity). The salvaged soil will be placed in two separate large soil stockpiles located in the Dam D catchment near Dam C, and between Dam D and the ECD (**Figure 2.6-11**). The amount of soil expected to be salvaged is 410,161 m^3 of soil (rated Good and Fair) and 62,584 m^3 of Organic soil. Drainage from the larger topsoil stockpile will flow by gravity into the TSF. Drainage from the smaller TSF topsoil stockpile will be collected in Dam D, and from the lower larger TSF topsoil stockpile in the ECD, and then pumped back to the TSF.

The surface area of stockpiles should be maximized to maintain higher levels of biological activity (BC MEM, 2009). Stockpiles will be constructed at a maximum slope of 3H:1V and seeded with the recommended erosion control seed mix described in **Section 2.6.7.1**, or with an erosion control seed mix approved by the BC Ministry of Forests and Range.

Overburden will be located in stockpiles separate from mineral soil and organic soil materials. Overburden near the oxide/weathered rock boundary will be visually inspected for the presence of clasts that might be mineralized. If a high density of clasts is found, the overburden will be handled as oxide/weathered rock and stored in the TSF.

2.6.6.3.5 Soil Replacement Strategies

The amount of soil salvaged will not be sufficient to cover the Project's soil reclamation requirements, but will be sufficient for reclamation of high priority areas. The soil deficit will be offset using overburden, available from the open pit and borrow areas, as capping material. Therefore, salvaged soil will be prioritized for reclamation of the natural landforms to provide better opportunities for the establishment of vegetation similar to pre-disturbance conditions. The areas with high priority for soil replacement will be the LGO stockpile, mine buildings, environmental control wetland, and freshwater reservoir wetland (**Table 2.6-6**).

Organic soils will be used for construction of the ECD and freshwater reservoir wetlands. The remaining material will be used alone or mixed at different proportions with salvaged soil prior to replacement (e.g., 50:50 mix ratio) to increase nutrients and water-holding capacities.

Prior to soil replacement, areas of the Project compacted by heavy equipment traffic will be ripped to promote water infiltration and root penetration. To increase soil break-up and to prevent soil degradation, ripping will be carried out when the ground is relatively dry or frozen. Some areas will require deep ripping prior to soil replacement, particularly where mine buildings and infrastructure will be decommissioned.

Soil will be hauled using the large mine fleet where feasible, and by a contractor where smaller equipment is required. Replaced soil will be left with a rough surface to reduce soil erosion, provide an adequate seed bed with microsites for seed germination and seedling growth, and capture seeds of wind-borne species.

2.6.6.3.6 Soil Erosion Control

Water and wind erosion on the soil stockpiles will be mitigated by establishing a quick vegetation cover with a proposed native seed mix of native annual and perennial grasses (**Section 12.2.1.18.4.4.6.3.2**). For best results, the seed mix will be applied with erosion control materials (e.g., Mulchmax). To minimize the potential for erosion at the base of the stockpiles, surface water will be diverted around them and directed to the TSF or ECD. Erosion control measures during operations are included in **Section 12.2.1.18.4.4**, Landscape, Soils, and Vegetation Management and Restoration Plan (LSVMRP), and in **Section 12.2.1.18.4.1**, Sediment and Erosion Control Plan (SECP).

Erosion of replaced soil in the reclaimed areas will be mitigated using a variety of strategies, including: roughening the soil surface by placing rocks and coarse woody debris on the surface; seeding and planting soon after soil placement to provide root stabilization; and using erosion control materials (e.g., Mulchmax). If erosion is identified, or gullies are formed in the TSF slopes, bioengineering techniques (e.g., waddles with willows) may be used along with coarse woody debris and rocks.

2.6.6.4 Fertilizer and Soil Amendments

The limited amount of soil that will be available for reclamation will require the use of overburden as a reclamation material. Overburden in the Project area will originate from morainal deposits. The texture is loamy sand, with coarse fragments and a mean pH of 7 to 8. The limited nutrient availability, coarse texture, and high pH may limit vegetation establishment, but these conditions can be ameliorated using fertilizer and organic soil amendments.

Fertilizer will be added to supply macronutrients to plants and to supplement other organic amendments, if added. A formulation that will provide a balanced combination of macronutrients is 19-19-19 N-P-K (i.e., Nitrogen-Phosphorous-Potassium). This formulation will stimulate root formation, which is important for soil stabilization. The Handbook for Mineral and Coal Exploration in British Columbia (BC MEM, 2009) recommends the use of a balanced fertilizer and an application rate suited to site conditions, considering 200 kilograms per hectare (kg/ha) a reference starting value for most sites. However, in a coarse, alkaline substrate, a minimum of 500 kg/ha^{-1} will be required to increase plant productivity (Cohen-Fernández and Naeth, 2013a). Although a final fertilizer application rate will be decided upon once the nutrient content of the soil or overburden for reclamation are determined, and whether and which organic amendment may be used, an application rate of 300 kg/ha is considered adequate. The fertilizer could be added in the hydro-seeding mix, be broadcasted, or mixed with soil or overburden before placement.

The use of organic amendments will simultaneously improve chemical, physical, and biological properties of the substrate (Land Resources Network, 1993). Several sources of organic amendments will be considered for reclamation of the site based on potential availability and site characteristics, including organic soil salvaged from the mine site, municipal biosolids from the district of Vanderhoof, or cattle manure. These amendments can be added to the hydro-seeding mix, or incorporated into the soil prior to seeding.

2.6.7 Revegetation Plan

The revegetation plan was designed for the establishment of native plant communities that will provide for wildlife habitat and First Nations' traditional use. Other criteria include establishment of plant species at risk, specifically the rust-resistant whitebark pine. Based on the plants identified in the Project area (**Section 5.1.3.3**, Vegetation Baseline), native species were selected based on their adaptability to site conditions expected after mining (e.g., limited soil nutrients and water availability, tolerance to high exposure to sun and wind, slopes), commercial availability, and/or propagation potential (**Appendix 2.6F**). Native species will be propagated in the on-site native plant nursery to be built around Year 3 of mine operations. Even though it is planned to propagate and use rust resistant whitebark pine for revegetation of the mine site, plants in the genus *Ribes* will not be planted together with whitebark pine to prevent the potential propagation of whitebark pine blister rust. A fungus that alternates between hosts causes the rust. Whitebark pine and *Ribes* are hosts of this complex pathosystem (Alberta Whitebark and Limber Pine Recovery Team, 2014).

2.6.7.1 Plant Species Selection

Six preliminary vegetation prescriptions were designed for revegetation of mine-related landforms, and four for natural landforms, considering the expected diversity of site conditions and the spatial distribution of Project components across BGC units. Prescriptions for mine-related landforms include native wetland and upland species (**Table 2.6-7**). Prescriptions for Project components to be reclaimed to natural landforms in dry/mesic and moist conditions include native species characteristic of SBS and ESSF zones (**Table 2.6-8**). Two native seed mixes for erosion control are proposed, one for the SBS zone and the other for the ESSF zone (**Table 2.6-9**). They can be used as interim seed mixes for erosion protection of soil stockpiles and soil windrows, and for final reclamation of the transmission line, roads, ditches, and airstrip.

The plant species were selected based on their ability to grow in a wide range of environmental conditions. Early successional species were included to increase plant establishment and protect the soil surface from erosion. Mid-to late-seral species were selected to speed up the establishment of the forest community. Food and medicinal plants traditionally used by First Nations and Aboriginal groups in the area were included, such as soapberry, kinnikinnick, wild strawberry, raspberries, high bush cranberry, cow parsnip, rose, lodgepole pine, alder, spruce, green and red willow, yarrow, juniper, and fireweed (**Section 14**, Aboriginal Groups Background Information). Species adequate for caribou forage were included, such as willows, Altai fescue, Rocky Mountain fescue, and fireweed (Himmer and Power, 1999). Nitrogen-fixing species, such as mountain alder, were included. Like other species in the genus *Alnus,* alders establish symbioses with Nitrogen-fixing actinomycetes in their root systems, which may increase Nitrogen and nutrient cycling on site (Resource Practice Branch, 2013; Wildflower Centre, 2012). Of special interest is the regeneration of whitebark pine, to increase the population of this species at risk in and to provide a food source to Clark's nutcrackers, which are dependent on whitebark pine cone crops in BC.

Only native species are included in the erosion control mixes, to avoid introducing highly competitive agronomic grass species, common in commercial seed mixes, and to promote re-establishment of native vegetation.

Use of a variety of native species in revegetation will help to retain biodiversity in the reclaimed areas, as each species will contribute differently to the community. A variety of shrubs and deciduous and coniferous trees will approximate undisturbed conditions of a forested area, and build functional diversity of the community. Positive effects of shrubs on tree establishment and of Nitrogen-fixing plants on neighbouring vegetation are well documented (Gomez-Aparicio, 2009).

Table 2.6-7: Preliminary Native Plant Species for Reclamation of Mine-Related Landforms

Prescription	Mine Landforms	Common Name	Scientific Name
1	TSF wetland (Ww) (shallow open water)	Rocky Mountain pond-lily	*Nuphar polysepala*
		emersed bur-reed	*Sparganium emersum*
	TSF wetland (Wm) (saturated zone-marsh)	willows	native *Salix* spp.
		swollen-beaked sedge	*Carex utriculata*
		water sedge	*Carex aquatilis*
2	TSF upland beach	bluejoint reedgrass	*Calamagrostis canadensis*
		willows	native *Salix* spp.
		hair bentgrass	*Agrostis scabra*
		black twinberry	*Lonicera involucrate*
		mountain alder	*Alnus incana*
		tufted hairgrass	*Deschampia cespitosa*
		red raspberry	*Rubus idaeus*
		cow-parsnip	*Heracleum maximum*
		bluejoint reedgrass	*Calamagrostis canadensis*
3	TSF upland and Site C borrow area	whitebark pine	*Pinus albicaulis*
		kinnikinnick	*Arctostaphylos uva-ursi*
		blue wildrye	*Elymus glaucus*
		Altai fescue	*Festuca altaica*
		Rocky Mountain fescue	*Festuca saximontana*
		fireweed	*Epilobium angustifolium*
		wild strawberry	*Fragaria virginiana*
		Scouler's willow	*Salix scouleriana* (or *Salix* spp.)
		yarrow	*Achillea millefolium*
4	Waste rock dumps (overburden upland)	whitebark Pine	*Pinus albicaulis*
		kinnikinnick	*Arctostaphylos uva-ursi*
		blue wildrye	*Elymus glaucus*
		Altai fescue	*Festuca altaica*
		Rocky Mountain fescue	*Festuca saximontana*
		wild strawberry	*Fragaria virginiana*
		fireweed	*Epilobium angustifolium*
		common juniper	*Juniperus communis*
		alpine timothy	*Phleum alpinum*
5	Open pit (east/southeast overburden slope)	alpine bluegrass	*Poa alpina*
		kinnikinnick	*Arctostaphylos uva-ursi*
		Altai fescue	*Festuca altaica*
		common juniper	*Juniperus communis*

Note: TSF = Tailings Storage Facility

Table 2.6-8: Preliminary Species Mix for Reclamation of Mine Components into Natural Landforms

Prescription	Disturbed Areas	Subzone/Variant	Site Types	Tree Components	Shrub and Herb Components
1	Mine site buildings, low-grade ore stockpile area, freshwater reservoir	SBSmc3	dry/mesic sites	lodgepole pine (*Pinus contorta*)	prickly rose (*Rosa acicularis)*
					soopolallie (*Shepherdia canadensis)*
					kinnikinnick (*Arctostaphylos uva-ursi)*
					rough-leaved ricegrass (*Oryzopsis asperifolia)*
			moist sites	hybrid white spruce (*Picea glauca x engelmannii*)	prickly rose (*Rosa acicularis)*
					black twinberry (*Lonicera involucrata)*
					bunchberry (*Cornus canadensis)*
					palmate coltsfoot (*Petasites frigidus*)
		ESSFmv1/ ESSFmv1p	dry/mesic sites	lodgepole pine (*Pinus contorta*) whitebark pine (*Pinus albicaulis*)	black huckleberry (*Vaccinium membranaceum*)
					twin flower (*Linnaea borealis*)
					spike trisetum (*Trisetum spicatum)*
					Sitka alder (*Alnus viridis*)
					highbush-cranberry *(Viburnum edule)*
					five-leaved bramble (*Rubus pedatus*)
					bunchberry (Cornus canadensis)
			moist sites	Engelmann spruce (*Picea engelmannii*) subalpine fir (*Abies lasiocarpa*)	rayless alkali aster (*Symphyotrichum ciliatum*)
					arrow-leaved groundsel (*Senecio triangularis)*
					bluejoint (*Calamagrostis canadensis*)
					common horsetail (*Equisetum arvens*e)
					black twinberry (*Lonicera involucrata*)
2	Airstrip	SBSmc3		Interim revegetation seeding mix for erosion control and prevention of invasive plants	
3	Transmission line	SBSdk		Preserve understorey vegetation, and use revegetation seeding mix for erosion control and prevention of invasive plants. Plant trees if required, following SBSmc3 and ESSFmv1 prescriptions according to dry/mesic and moist sites.	
		SBSdw3			
		SBSmc2			
		SBSmc3			
		ESSFmv1			
4	Mine access road and freshwater supply pipeline ROW	SBSmc3		Revegetation seeding mix for erosion control and prevention of invasive plants. Plant trees, if required, following SBSmc3 and ESSFmv1 prescriptions for dry/mesic and moist sites.	
		ESSFmv1			

Table 2.6-9: Proposed Species Composition for Erosion Control Seed Mixes

Biogeoclimatic Zone	Common Name	Scientific Name	% in Seed Mix
ESSF	Altai fescue	*Festuca altaica*	15
	red fescue	*Festuca rubra*	15
	alpine timothy	*Phleum alpinum*	20
	alpine bluegrass	*Poa alpina*	15
	fringed brome	*Bromus ciliatus*	15
	tufted hairgrass	*Deschampsia cespitosa*	10
	American vetch	*Vicia americana*	10
SBS	red fescue	*Festuca rubra*	25
	blue wildrye	*Elymus glaucus*	20
	fringed brome	*Bromus ciliatus*	20
	fowl bluegrass	*Poa palustris*	20
	American vetch	*Vicia americana*	15

Note: ESSF = Engelmann Spruce – Subalpine Fir zone; SBS = Sub-Boreal Spruce zone

2.6.7.2 Seeding and Planting

Commercial sources and locally propagated transplants will be the sources for vegetation. A plant nursery will be built (as previously discussed) to propagate selected plants from locally collected seeds and plants salvaged from mine site areas. Additional nursery stock and certified seeds will be purchased from commercial suppliers. Only certified seeds will be purchased and used in the revegetation seed mix. Care will be taken to avoid using seed mixes known as No's common, forage, or groundcover mixes, as per recommendations provided in the Handbook for Mineral and Coal Exploration in British Columbia (BC MEM, 2009), due to lower than desirable levels of pure, living seed.

Although seeding woody species can be considered, transplanting is the preferred method, to increase chances of plant establishment and seedling survival. Planting for upland vegetation will be done at a rate of 1,400 stems ha^{-1} for trees, and 1,000 stems ha^{-1} for shrubs. Wetland planting will be done targeting a density of three plants m^{-2} by the end of the closure phase when the pit lake overflows. Wetland plants will be introduced in clusters, in sections accessible by boat, and are expected to naturally disperse over the remaining wetland.

Kinnikinnick and willows are commonly obtained as stem cuttings. Transplant stock of coniferous species will be one to two years old and approximately 30 cm in height. To increase survival of coniferous trees when transplanting, a protective barrier against browsing, such as Vexar tubing, can be used. Some nurseries treat plants with browsing repellent before planting (USDA NRCS, 2013).

Seeding rates for interim soil erosion control and for final reclamation will be performed using reference value of 40 kg/ha of seed. This rate has been successfully used in other mine reclamation projects (Gardner et al., 2003; Cohen-Fernandez and Naeth, 2013b). Seeding rates

for specific areas will be refined when reclamation seeding trials are implemented. Reclamation trials are part of the site-specific reclamation research planned for the Project.

To keep seeds in place, improve microclimatic conditions of the seedbed, and provide erosion control, hydro-seeding with MulchMax Ultra (at a rate of 3,920 kg/ha) can be used. If used, tackifier can be added after hydro-seeding, to assist in keeping seed on the slopes. Although hydro-seeding and tackifier can be added as a single step, it has been suggested that a two-step procedure is more effective for vegetation establishment.

2.6.7.2.1 Mine-Related Landforms

2.6.7.2.1.1 Open Pit

After closure, the open pit will become a lake; however, the exposed overburden on the south side of the pit will be available for reclamation, and a native vegetation cover of shrubs and grasses will be established. The vegetation will be introduced by ground-based seeding (**Table 2.6-10**; **Figure 2.6-13**[2]). Revegetation of mine-related landforms will use plant species selected for upland slopes, upland beach, wetlands, and emergent vegetation. Natural landforms will be revegetated with plants suitable for dry/mesic and moist sites of SBSmc3 and ESSFmv1 BGC variants. Recommended species include alpine bluegrass, Altai fescue, and kinnikinnick (**Table 2.6-7**). Kinnikinnick may be better introduced as cuttings, where it is safe to do so, to increase its survival. Prior to the end of mining operations, the east slope of the open pit will become available for reclamation and may be suitable for whitebark pine after top dressing with overburden.

Table 2.6-10: Areas for Revegetation in Mine-Related Landforms

Mine Component	Reclamation Target	Revegetation Area (ha)
Open Pit		
Pit	Pit lake	0
Tailings Storage Facility Site C		
PAG Stockpile	Wetland marsh (Wm)	32
PAG Stockpile	Wetland shallow open water (Ww)	31
PAG Stockpile	Pond	16
Embankment Fill 1	Upland slope	9
East and West Dams	Upland slope	3
Tailings	Upland beach	102
Tailings Storage Facility Site D		
PAG Stockpile	Wetland marsh (Wm)	59
PAG Stockpile	Wetland shallow open water (Ww)	172
Embankment Fill 2	Upland slope	103
Embankment Fill 3	Upland slope	3

[2] **Figure 2.6-13** shows full East Dump without removal of overburden for reclamation.

Mine Component	Reclamation Target	Revegetation Area (ha)
Pit Inflow Deflection Berm	Exposed rock	0
Pond	Pond	0
Tailings	Upland beach	342
Waste Rock Dumps		
East Dump	Upland slope	158
West Dump	Upland slope	172
Borrow Areas		
Esker Borrow Source	Shrubs/grasses	43
Site C Main Dam Borrow Source	Upland slope	30
Topsoil Stockpiles		
Two Stockpiles	Interim grass/forbs	10
Total		**1,285**

Note: ha = hectare; PAG = potentially acid generating

2.6.7.2.1.2 Tailing Storage Facilities

2.6.7.2.1.2.1 Upland Slopes

A vegetation cover of native trees, shrubs, grasses, and forbs will be introduced to embankment fills and dams (**Table 2.6-10**; **Figure 2.6-13**). Planted species will include whitebark pine, kinnikinnick, willows, and wild strawberry. Seeded grasses may include fireweed and Altai fescue, among others. The vegetation will protect the slopes from wind and water erosion, and will provide habitat to a variety of wildlife species.

2.6.7.2.1.2.2 Upland Beach

Shrubs, grasses, and forbs will be used in the upland beach areas of TSF Site C and TSF Site D **Table 2.6-10; Figure 2.6-13**). Willows can be planted as cuttings and can also be used to provide erosion control to the slope as bioengineered wattles. Other suggested species include mountain alder and various berries.

372000 375000 378000 381000

5901000 5898000 5895000 5892000

Esker Borrow Source
Davidson Creek
Proposed Fresh Water Pipeline
Plunge Pool 1
Upland Beach 2
Marsh Wetland 2
Shallow Water Wetland 2
Proposed Mine Access Road
Proposed Transmission Line
Downstream Wetland Area
Pond 2
Site C Main Dam Borrow Source
Exploration Road
Pond 1
Upland Beach 1
Shallow Water Wetland 1
Davidson Creek
Proposed Mine Access Road
Marsh Wetland 1
Pit Inflow Deflection Berm
Site C West Dam 1
Site C East Dam 1
Site C Eastt Dam 2
Conveyor
Crusher
Plant Site 5
Dam 1
Flooded Lake
Low-Grade Stockpile
Dam Pond 1
East Dump
West Dump
Pit Lake Pond
Open Pit

N

Legend

- Contour (20 m)
- Stream
- Waterbody
- Exploration Road
- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Fresh Water Pipeline
- Diversion Channel
- Seepage Collection Trench
- Spillway
- Upland Beach Prescription
- Rock Slope
- Marsh Wetland
- Shallow Water Wetland
- Pond
- Upland Slope Prescription
- SBSmc3 and ESSFmv1 Prescriptions

Scale:1:37,000

0 500 1000 2000

Meters

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Mine Site Revegetation - Year 35

DATE: March, 2014	ANALYST: AA	**Figure 2.6-13**
JOB No: VE52095	QA/QC: MY	PDF FILE: 01-100-009_site_vegetation_yr32.pdf
GIS FILE: 01-100-009_site_vegetation_yr32.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\01_base-data\Baseline\01-100-009_site_vegetation_yr32.mxd

2.6.7.2.1.2.3 Marsh and Shallow Open Water Wetlands

The permanent/semi-permanent hydrology regime will provide transitional zones from inundated to saturated soils with mineral soils that can support shallow-rooting hydrophytic shrubs and herbaceous plants (MacKenzie and Moran, 2004). Once established, this community is expected to provide water purification, breeding, foraging, dispersal, and cover/refuge habitat for wildlife.

The shallow open water wetland will be located between the marsh wetland and the permanent pool. Rocky Mountain pond-lily and immersed bur-reed are suggested for this area (**Table 2.6-10**). Access to these areas for vegetation re-establishment can occur via the permanent pond and/or by the adjacent upland. Plant material may include emergent plants collected from adjacent ponds, or be propagated through a seed and plant propagation program. A $\geq$10% cover of emergent vegetation will be appropriate (MacKenzie and Moran, 2004). Vegetation will be introduced through planting or seeding.

2.6.7.2.1.2.4 Permanent Pond

The permanent pond will have a depth of approximately 2 m and will support submergent aquatics and emergent vegetation around its perimeter (**Figure 2.6-13**).

2.6.7.2.1.3 Waste Rock Dumps

The waste rock dumps will be revegetated with whitebark pine, kinnikinnick, common juniper, wild strawberry, and grasses. Seeded vegetation may include fireweed, alpine timothy, and Altai fescue. A total of 330 ha will be revegetated between the East and West Dumps (**Table 2.6-10**; **Figure 2.6-13**), of which 204 ha will include whitebark pine.

An adaptive management approach will be implemented to mitigate the potential Project effects on whitebark pine and to restore whitebark pine populations on new sites. Adaptive management is a process for continually improving the success of mitigation by learning from the outcomes of operational trials. Research trials will be necessary to re-establish whitebark pine on newly created landforms. General seeding and planting trials are discussed in **Section 2.6.7.2**.

2.6.7.2.1.4 Borrow Areas

The Site C borrow area (30 ha) will be revegetated with upland vegetation, including whitebark pine, kinnikinnick, willows, and wild strawberry. The esker borrow will be revegetated with grasses and shrubs across an area of 43 ha (**Figure 2.6-13**).

2.6.7.2.2 Natural Landforms

Areas of the Project not modified with mine-related landforms will be reclaimed into natural landforms, similar to pre-mining conditions (**Figure 2.6-11).** The area is naturally diverse, presenting a variety of dry/mesic sites and moist sites, according to the topography and hydrology of the area (**Figure 2.6-13**). Revegetation prescriptions for these diverse conditions have been proposed, and specific areas with these conditions will be identified on

commencement of reclamation activities. The vegetation includes native species characteristic of SBS and ESSF BGC zones.

2.6.7.2.2.1 Mine Buildings and Infrastructure

The mine buildings and infrastructure encompass 86 ha. Depending on the dry or moist characteristics, the areas will be revegetated with a self-sustaining coniferous forest, comprising Engelmann spruce, hybrid white spruce, subalpine fir, and lodgepole pine (**Figure 2.6-13**). The understorey vegetation may include prickly rose, various berries, soopolallie, or bluejoint reedgrass, among other species.

2.6.7.2.2.2 Low-Grade Ore Stockpile

A total of 76 ha will be revegetated after the LGO stockpile is processed. The areas will be revegetated with a self-sustaining coniferous forest, comprising Engelmann spruce, hybrid white spruce, subalpine fir, and lodgepole pine, depending on the dry or moist characteristics. The understorey vegetation may include prickly rose, various berries, soopolallie, or bluejoint reedgrass, among other species.

2.6.7.2.2.3 Environmental Control Dam and Freshwater Supply System

Wetlands will be established in the ECD and freshwater reservoir area; they could include species suggested for the TSF wetlands (**Table 2.6-10**; **Figure 2.6-13**) (**Appendix 2.6C**). The area of the pipeline ROW and pump stations will be revegetated with a mix of native annual and perennial grasses, common to both SBSmc3 and ESSFmv1 variants. Annuals will provide a quickly established vegetation cover, and perennials will provide a long-term cover. It can be expected that woody species will disperse naturally into these area, from adjacent vegetation.

2.6.7.2.2.4 Mine Access Road

Any sections of mine access road not retained for access to the area will be planted with SBSmc3 and ESSFmv1 prescriptions for dry/mesic and moist sites, and seeded with a mix of native annual and perennial grasses. The seed mix could be used for revegetation of hauling roads created within the mine site during operations.

2.6.7.2.2.5 Transmission Line

The transmission line will be revegetated through natural recovery, counting on preservation of the understorey, and seeding the erosion control seed mix in the access for the transmission line. If additional planting is required, the species selected will follow prescriptions for the BGC zone of the particular area needing extra planting. If areas of riparian vegetation need to be reclaimed, the following recommendations will be followed (BC Ministry of Environment, 2008):

- Planting density of woody species will be one plant per square metre;
- Planting will preferably be undertaken during fall (September to October) or spring (March to April) to increase the likelihood of plant survival;

- Coniferous trees will comprise not less than 10% or more than 25% of the tree stock planted;
- Whenever possible, tree stock will be a minimum of 1.2 m (4 ft) in height, and planted 1.5 m to 2.0 m apart; and
- A minimum of 50% of the trees and shrubs planted will be fruit-bearing species.

2.6.8 Progressive Reclamation Plan

Progressive reclamation allows for implementation and testing of reclamation activities prior to closure. Although mining and TSF construction will be ongoing until closure, there are several opportunities for progressive reclamation, beginning with soil and overburden salvage and stockpiling for reclamation. These stockpiles could be used for testing a variety of reclamation strategies, for example: fertilizer and organics amendment application rates; successful establishment of selected native species; seeding and planting densities; and propagation of native propagules from forest floor material containing litter, fermented and fragmented litter, and humus (LFH horizon).

The dismantlement of the construction camp will occur in about Year 2. The contractor will remove the modules of the construction camp, and the land will be scarified and revegetated.

TSF Site C will be filled by the end of Year 3, and reclamation will begin soon thereafter. However, TSF Site C may be used for water storage during the mine life; therefore, reclamation planting will initially be done only for final exposed areas. The following measures will be implemented:

- Oxide tailings from Year 3 of operations containing lower Zinc and Cadmium and higher NPR will be deposited as a final lift of tailings about 3 m deep at the Dam C and West Dam;
- Overburden to a height of 0.3 m will be placed on top of the PAG waste rock and oxide tailings, where accessible, to facilitate revegetation and isolate the supernatant from porewater;
- Wetland plants salvaged from the Site D footprint will be placed in appropriate areas of the TSF to initiate the development of the wetland plant community;
- The water in the TSF will be maintained at 1,346 masl elevation by constructing a discharge spillway and a secondary shoulder spillway and channel to Site D; and
- The saddle dam will be revegetated with an interim seed mix.

The above reclamation measures will provide valuable data and experience that will be applied in finalizing the closure of the much larger Site D in Year 15.

In order to prevent seepage, a hydraulic barrier will be established by a berm constructed in the fish compensation pond to the west of Site C. Seepage will flow towards Site C, as the

downstream pond will be at a higher elevation (1,347 m) than the Site C spillway invert. The seepage recovery system at the saddle dam will then be removed, as it will no longer be required. A wetland will be established in the seepage recovery pond. The expected configuration after reclamation of the TSF Site C is shown on **Figure 2.6-12.**

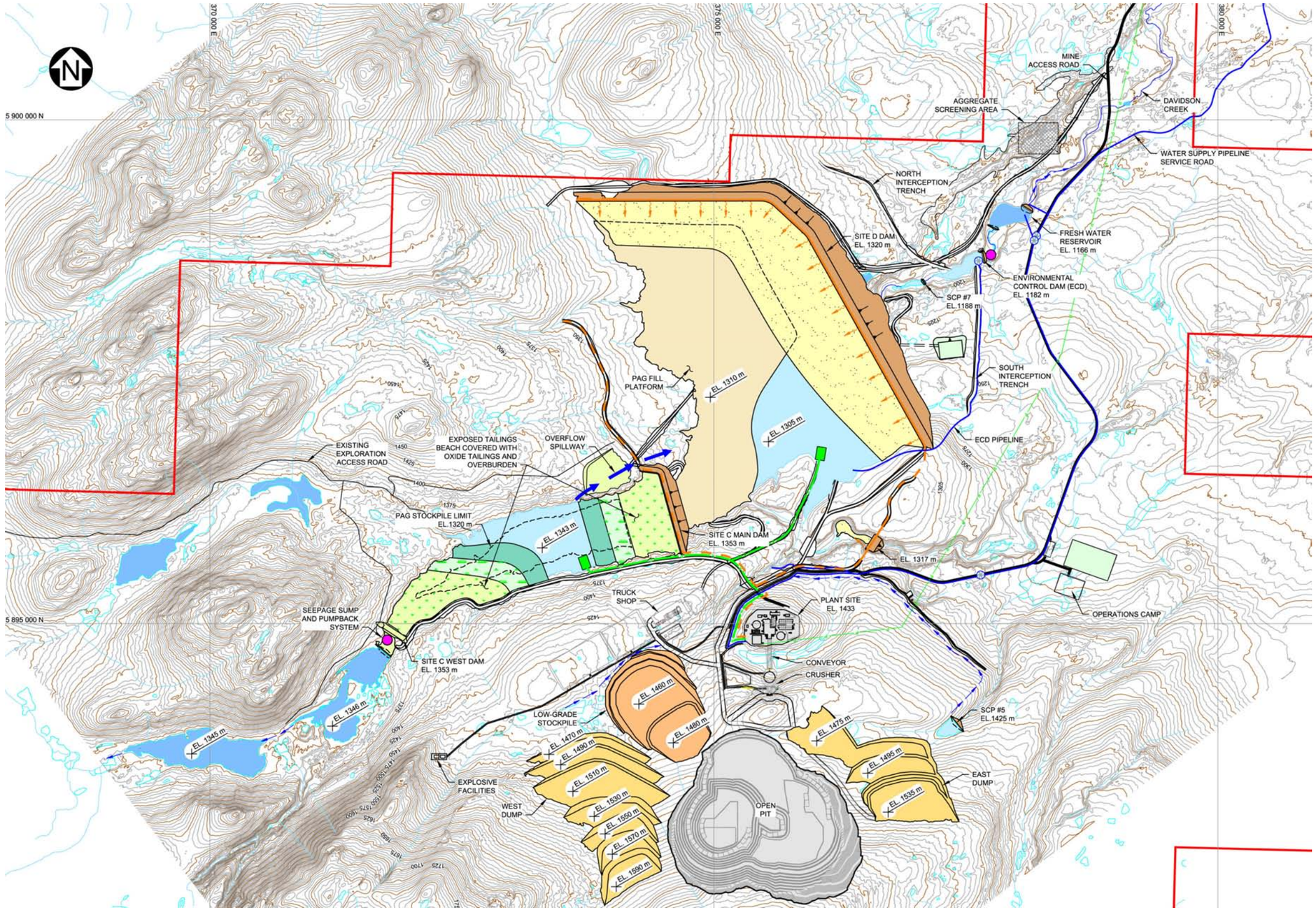
The Site C borrow area could be progressively reclaimed, regraded, and revegetated beginning in about Year 4. This area could be used for experimental trials on soil amendments, revegetation prescriptions, and propagation of lichen (specifically ground lichens) for caribou habitat. Tests for propagation of arboreal lichens could be implemented on standing trees within the mine site boundaries.

Progressive reclamation of approximately 63 ha of the West waste rock dump will be conducted as final surfaces are available. Revegetation trials to better establish rust-resistant whitebark pine will be implemented (e.g., determining the size of transplant, planting season, improvement of planting substrate, and seed selection). **Figure 2.6-14** shows the mine general arrangement at the end of Year 8 with the reclaimed Site C.

Reclamation of the open pit will commence in Year 14 after mining operations cease and will involve removing all equipment and pipelines from the pit. Pit flooding will begin at that time. The TSF supernatant and water from Tatelkuz Lake will be pumped to the pit to accelerate flooding at the end of mill operations in Year 17 (**Figure 2.6-15**[3]).

A detailed reclamation plan for the first five years will be provided prior to the start of mill operations. Content requirements of the reclamation plan will be determined between BC MEM, the Proponent, First Nations, and other stakeholders. This plan will be submitted as a separate document during initial mine development.

[3] **Figure 2.6-15** shows full East Dump without removal of overburden for reclamation.



Legend

- UPLAND BEACH
- BOG / WETLAND AREA
- EMERGENT VEGETATION WETLAND
- UPLAND SLOPE
- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- PAG WASTE ROCK
- NAG WASTE ROCK / OVERBURDEN
- LOW-GRADE ORE
- TOPSOIL
- BORROW AREA (ZONES S, C, AND ROCKFILL)
- RECLAIM SYSTEM
- PUMPSTATION
- SEEPAGE SUMP AND PUMPBACK SYSTEM
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- DIVERSION CHANNEL
- WATER RECLAIM PIPELINE
- NEW GOLD PROPERTY BOUNDARY
- TRANSMISSION LINE
- SPILLWAY
- TAILINGS PIPELINE
- TAILINGS DEPOSITION

Source
Knight Piésold Engineering and Environmental Services
http://www.knightpiesold.com/en/

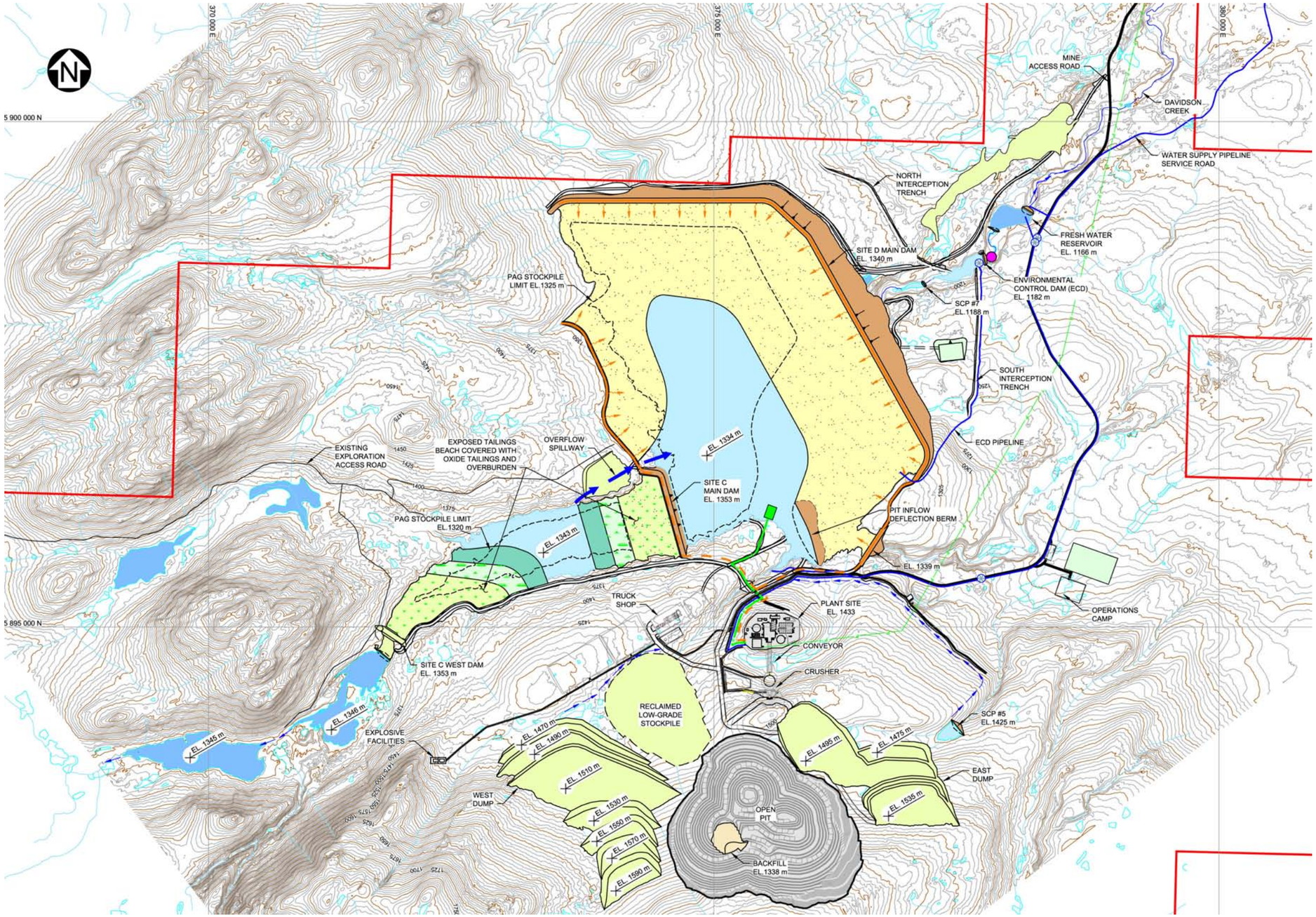
CLIENT: newgold™

PROJECT: Blackwater Gold Project

General Arrangement End of Year 8 Plan

DATE: May, 2014	ANALYST: KP	**Figure** 2.6-14
JOB No: VE52420	QA/QC: WR	PDF FILE: End of Year 8 Plan.pdf
AI FILE: End of Year 8 Plan.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Ridgfield_Blackwater\Mapping\Other\ProjectDescription\KP\End of Year 8 Plan.mxd



Legend

- UPLAND BEACH
- BOG / WETLAND AREA
- EMERGENT VEGETATION WETLAND
- UPLAND SLOPE
- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- PAG WASTE ROCK
- TOPSOIL
- RECLAIM SYSTEM
- PUMPSTATION
- SEEPAGE SUMP AND PUMPBACK SYSTEM
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- DIVERSION CHANNEL
- WATER RECLAIM PIPELINE
- NEW GOLD PROPERTY BOUNDARY
- TRANSMISSION LINE
- SPILLWAY
- TAILINGS PIPELINE
- TAILINGS DEPOSITION

Source
Knight Piésold Engineering and Environmental Services
http://www.knightpiesold.com/en/

CLIENT: newgold™

PROJECT: Blackwater Gold Project

General Arrangement End of Year 17 Plan

DATE: May, 2014	ANALYST: KP	**Figure** 2.6-15
JOB No: VE52420	QA/QC: WR	PDF FILE: End of Year 17 Plan.pdf
AI FILE: End of Year 17 Plan.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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2.6.9 Reclamation Performance Standards and Monitoring

2.6.9.1 Reclamation Performance Standards

The proposed reclamation performance standards during the operations (progressive reclamation), closure, and post-closure phases are detailed in **Table 2.6-11**.

Table 2.6-11: Reclamation Performance Standards during Construction, Operations, Closure, and Post-Closure Phases

Area	Reclamation Performance Standard
Construction and Operations	
Geotechnical stability of engineered structures and mine-related landforms	Geotechnical structures meet BC MEM requirements and CDA Guidelines
Soil quality and stability	473,000 m^3 of salvaged soil during construction and operations
	Adequate soil stability
	Adequate soil quality
	Minimum 30 cm depth capping of topsoil or overburden used for reclamation
Decommissioning of infrastructure	Construction camp removed (about Year 2) unless incorporated into operations camp, begins reclamation of pit by removing equipment and pipeline (Year 15)
Water quality and flow	Surface flow in Davidson Creek meets IFN
	Ground water quantity and quality within predictions
	ML minimized and mitigated/ARD prevented
	No discharge of surface water from mine into the environment during operations
Fish and fish habitat	Healthy fish, benthos, and periphyton
	Fish habitat compensation meets targets
Wetlands	Wetland functions maintained in remaining wetlands in mine footprint
	63 ha of swamp and marsh wetland habitat created around Pond in TSF Site C by end of Year 4 unless used for water reservoir
Vegetation	Total mine footprint does not exceed approximately 2,939 ha
	Maintain a viable population of whitebark pine by collecting cones, propagating and transplanting seedlings, rust screening
	Establish a new population of rust-resistant whitebark pine in designated reclaimed areas
	Identification of rare plants, salvaging and relocating during construction
	Prevention and management of invasive plants at mine site and along all linear corridors including transmission line
	Production of native plants for reclamation in the on-site plant nursery
	Production of rust-resistant whitebark pine seedlings in either the on-site nursery or a designated off-site nursery
	Establishment of plant communities on progressively reclaimed camp site, TSF Site C borrow area (experimental trials); whitebark pine on waste rock piles
	Avoid ecosystems at risk (Blue- and Red-listed) along transmission line

Area	Reclamation Performance Standard
Wildlife	Habitat maintained and created for mammals including bats, moose, deer, black bear, and marten
	Habitat maintained and created for birds including waterfowl and Clark's nutcracker
	Habitat maintained and created for amphibians, especially western toad
	Habitat maintained and created for invertebrates
Closure	
Geotechnical stability of engineered structures and mine-related landforms	Geotechnical structures meet BC MEM requirements and CDA Guidelines
Soil quality and stability	Adequate soil stability and erosion control
	Adequate soil physical and chemical quality
	Minimum 30 cm depth capping of topsoil or overburden used for reclamation
Decommissioning of infrastructure	Operations camp decommissioned
Water quality and flow	Surface flow in Davidson Creek meets IFN
	Ground water quantity and quality within predictions
	ARD prevented/ML minimized and mitigated
	No discharge of surface water from mine into the environment during closure unless meets water quality requirements
Fish and fish habitat	Healthy fish, benthos, and periphyton
	Fish habitat compensation meets targets
Wetlands	Wetland functions maintained in remaining natural wetlands in mine footprint
	Approximately 232 ha of swamp and marsh wetland habitat created around pond of TSF Site D by end of Year 32
	11 ha of riparian swamp wetland habitat restored when converting freshwater reservoir to wetlands by end of Year 32
Vegetation	Maintain a viable population of whitebark pine by collecting cones, propagating and transplanting seedlings, rust screening
	204 ha revegetated with whitebark pine including rust-resistant vegetation
	Maintain plant species at risk
	Prevention and management of invasive plants at mine site and along all linear corridors including transmission line
	Establishment of plant communities on reclaimed operations camp, TSF facilities, waste rock dumps, and any other decommissioned on-site and off-site facilities
End land use objective of self-sustainable native plant communities, wildlife habitat and traditional land use by First Nations	Wildlife habitat created on the mine site and off-site facilities as described in the Conceptual Reclamation Plan and used by target species
	Gathering of traditional plants by First Nations on reclaimed mine site and off-site facilities
	Hunting opportunities on the former mine site and off-site facilities due to constructed wildlife habitats
	Continued use of Davidson Creek for fishing; fish habitat compensation targets met

Area	Reclamation Performance Standard
Post-Closure	
Geotechnical stability of engineered structures and mine-related landforms	Geotechnical structures meet BC MEM requirements and CDA Guidelines
Soil quality and stability	Adequate soil stability and erosion control
	Adequate soil physical and chemical quality
Water quality and flow	Surface flow in Davidson Creek meets IFN
	Ground water quantity and quality within predictions
	Supernatant discharge from TSF meet standards
	ML minimized/ARD prevented
Fish and fish habitat	Healthy fish, benthos, and periphyton
Wetlands	Wetland functions maintained in remaining natural wetlands
Vegetation	Viable population of whitebark pine
	Minimal invasive plants along all linear corridors including transmission line
End land use objective of self-sustainable native plant communities, wildlife habitat and traditional land use by First Nations	Self-sustaining native plant communities established
	Wildlife habitat created on the mine site as described in the Conceptual Reclamation Plan and used by target species
	Gathering of traditional plants by First Nations on reclaimed mine site and off-site facilities
	Hunting opportunities on the former mine site due to constructed wildlife habitats
	Continued use of Davidson Creek for fishing

Note: ARD = acid rock drainage; BC MEM = BC Ministry of Energy and Mines; CDA = Canadian Dam Association; cm = centimetre; ha = hectare; IFN = instream flow needs; m^3 = cubic metres; ML = metal leaching; TSF = Tailings Storage Facility

2.6.9.2 Monitoring of Biophysical Parameters

Monitoring of the reclaimed mine site will be required to ensure that the reclamation objectives are met, along with environmental protection and quality of the natural resources in the Project area, including water, soil, wetlands, vegetation, wildlife, and fisheries. The closure phase is defined as being from the cessation of mining until the pit lake overflows (about 18 years after the cessation of milling; Year 35 from start of mining). The post-closure phase is defined as starting with the overflow of the TSF after the pit lake is full. The proposed monitoring program for biophysical parameters in the mine site and downstream during closure and post-closure is shown in **Table 2.6-12**.

Reporting will be undertaken in the form and at the frequency required under the *Mines Act* and *Environmental Management Act* permits (Government of BC, 1996a, 2003). Annual summary reports will also be prepared. All reports will be provided to, and discussed at, the Community Liaison Committee and with First Nations where requested.

Table 2.6-12: Proposed Closure and Post-Closure Biophysical Monitoring Program

Topic	Purpose	Location	Frequency	Parameters
Site water quality	To confirm predictions of source water quality	Pit lake while filling (3 depths)	Annual	pH, cond., SO_4, total and dissolved metals, ammonia, nitrate and nitrite; total and weak acid dissociable cyanide (WAD CN) for all sites except East and West Dump
		Tailings pond embankment seepage	Annual	
		Tailings pond shell runoff	Annual	
		East and West Dump runoff and seepage	Annual	
		TSF and ECD/water reservoir and wetland discharge (post-closure)	Quarterly, except final wetland discharge (monthly)	
Hydrogeology	To confirm impact predictions	Monitoring of relevant groundwater wells, and reporting, following the Water Management Plan	Quarterly (closure) annually (post-closure), unless circumstances require otherwise	Piezometric head for wells, pH, cond., SO_4, nutrients and dissolved metals
		ECD	Quarterly (closure)	
Hydrology	To confirm impact predictions	Hydrology stations on Davidson, Chedakuz, 705 and 661 Creeks	Daily during non-frozen conditions	Flow
		TSF and ECD/water reservoir wetland discharge (post-closure)		
Receiving water quality	To ensure protection of downstream water quality	Davidson Creek at compliance point(1) and 1-DC	Quarterly during closure and post-closure	pH, conductivity, SO_4, nutrients, total and dissolved metals and field temperature
		Chedakuz Creek at 15-CC and H5		
		Creeks 661 and 705 at H1 and 6-705		
Fish(2)	To ensure protection of aquatic species	Davidson Creek at compliance point(1) and 1-DC	Every three years during closure, and three years after closure (post-closure)	Species composition and abundance, metals in fish tissue (rainbow trout and white fish)
		Creeks 661 and 705		
		Lake 01682LNRS and Lake 01538UEUT		
Benthos	To ensure protection of aquatic species	Davidson Creek at compliance point(1) and 1-DC	Annually for first three years after closure, then every three years for at least nine years (i.e., three events)	Species and abundance
		Creeks 661 and 705		

Topic	Purpose	Location	Frequency	Parameters
Soil	To ensure soil stability and adequate revegetation	Test plots in TSF wetland and upland Test plots on waste dumps Test plots in selected locations of reclaimed natural landfoms	Annually for first three years after closure, then every three years for at least nine years (i.e., three events)	Erosion, organic matter, total and available nutrients, pH, EC, CEC
Vegetation	To ensure adequate revegetation and protection of species and ecosystems at risk	Test plots in TSF, including wetlands and upland beach Test plots on waste dumps Test plots in selected locations of reclaimed natural landforms	Annually for first three years after revegetation, then every three years for nine years (or three events)	Species composition, diversity, abundance, plant cover, and metal content; establishment of whitebark pine and rust-resistant vegetation
Wetlands	To ensure adequate revegetation and protection of species and ecosystems at risk	Sampling sites in TSF and environmental wetlands, and selected natural wetlands in upper Davidson Creek and Creek 661	Annually for first three years after revegetation, then every three years for at least nine years (or three events during closure) and one event three years after closure (post-closure, Year 40)	Species composition, abundance, plant cover, and metal content; water quality and levels
Wildlife	To ensure adequate revegetation and protection of species and ecosystems at risk	Transects on reclaimed TSF, including environmental wetlands, waste rock dumps, and linear components (transmission line, mine road, airstrip road, and water pipeline)	Every three years after revegetation during closure phase, and one event three years after closure (post-closure Year 38)	Species composition, abundance, area utilization, mortality related to Project, habitat availability for wildlife such as migrating birds

Note: (1) compliance point is Davidson Creek at mine access road crossing
(2) other sites will be chosen if fish do not occur in sufficient numbers to provide an adequate sample
EC=Electrical Conductivity; CEC=Cation Exchange Capacity; ECD = environmental control dam; SO_4 = Sulphate; TSF = tailings storage facility

2.6.9.2.1 Water Balance and Water Quality

2.6.9.2.1.1 Surface Flow and Groundwater Balance

The water balance model for the Project shows that IFN will be met in Davidson Creek downstream of the mine site during closure by continuing to pump from Tatelkuz Lake to Davidson Creek, and during post-closure (after the pit lake is full) by the discharge of seepage and TSF supernatant. Hydrology stations will be maintained in Davidson Creek, Chedakuz Creek, Creek 705, and Creek 661 until Year 50 to verify adequate flow into these surface waterbodies for the closure and post-closure phases.

2.6.9.2.1.2 Groundwater Quality

The purpose of groundwater monitoring is to provide early warning of any change in groundwater as a result of Project development. The proposed groundwater monitoring regime is to continue quarterly monitoring of the groundwater wells during the closure phase, and semi-annual monitoring during the post-closure phase until about Year 50. Detailed information is included in **Section 12.2.1.18.4.18.17**, Mine Water Management Plan. Parameters to be monitored include pH, electrical conductivity, anions, cations, and dissolved metals.

2.6.9.2.1.3 Surface Water Quality

The purpose of surface water monitoring is to provide early warning of any change in surface water as a result of Project activities. Parameters to be monitored include general chemistry, anions, cations, alkalinity, total and dissolved metals, and field temperature (**Section 12.2.1.18.4.10**, Water Quality and Liquid Discharges Management Plan (WQLDMP)).

2.6.9.2.2 Soil and Overburden

Soil and overburden will be monitored after reclamation for early detection of soil erosion. Chemical parameters will be analyzed, including organic matter, total organic and inorganic Carbon, total Nitrogen, available Phosphorus, Potassium, and Sulphur, Hydrogen Potential (pH) pH, electrical conductivity (EC), Sodium adsorption ratio (SAR), cation exchange capacity (CEC) and metals to detect any potential nutrient deficiency for plants or changes in metal concentrations for toxicity. The samples will be taken from the same test plots established to monitor vegetation. If excessive erosion is detected, measures such as reseeding with tackifier will be implemented. If low levels of nutrients are identified, fertilizer or organic amendments will be applied.

2.6.9.2.3 Vegetation

Vegetation will be monitored to quantify species composition and abundance, total percent plant cover, plant health by both visual and biomass assessments, and foliar metals concentrations. The plots will be located in the reclaimed TSFs (wetlands, upland beach, and upland slopes), waste rock dumps, environmental wetlands, and control sites, as well as in the transmission line, mine access road, airstrip road and freshwater supply pipeline corridors. In addition, presence of

weeds or invasive species will be monitored and managed according to the Invasive Species Management Plan (ISMP) (**Section 12.2.1.18.4.5**). Should any parameters be unsatisfactory, mitigation measures will be implemented such as plant species substitution, additional planting and seeding, soil amending, weed control, or herbivore control.

2.6.9.2.4 Wetlands

Wetlands in upper Davidson Creek and Creek 661 will be monitored for vegetation structure, water quality, and hydrologic conditions to document that wetland habitat and biochemical and hydrological functions have been maintained. Wetland conditions will be monitored via photographic documentation, water quality sampling, and visual inspections. Created wetlands around the TSF will be monitored for the same parameters to verify success in establishing the target plant communities and wetland functioning.

2.6.9.2.5 Wildlife

Wildlife will be monitored for species composition and abundance as well as utilization. Detailed survey strategies are included in the Wildlife Management Plan (WLMP) (**Section 12.2.1.18.4.6**). If conditions are deemed inadequate for wildlife use in any of the Project areas, physical (e.g., fences), chemical (e.g., Plantskyyd™), or audible (e.g., sound cannons) deterrents will be used to prevent wildlife use until conditions are corrected.

2.6.9.2.6 Fish, Benthos, and Periphyton

The fish, benthos, and periphyton populations will be monitored downstream of the mine site in Davidson Creek, Creek 661, and Creek 705, and fish populations in Tatelkuz Lake, Lake 01682LNRS, and Lake 01538UEUT, to verify protection of aquatic species. Species composition, abundance, and metals in fish tissue will be monitored. Results will be compared to baseline data.

2.6.9.2.7 Geotechnical Stability of Mine-Related Landforms

The monitoring of all dams, tailings slopes, waste rock dumps, and topsoil stockpiles will be conducted regularly during operations, with annual dam safety inspections. Upon closure, an updated survey of all mine-related landforms will be undertaken to verify stability. Annual inspections will continue during the closure and post-closure phases.

2.6.10 Temporary Shutdowns and Premature Closure

2.6.10.1 Temporary Shutdowns

Temporary shutdowns may be necessary due to e.g., extreme forest fire hazard, major flooding of the FSR or force majeure. For shutdowns less than one year, facilities will be secured and maintained in a condition such that they could be rapidly restarted. The following measures will be initiated to secure and maintain the facilities:

- Tanks that have a risk of sanding with ore or tailings slurry within the mill will be drained to the TSF;
- Fuel, chemicals, and reagents will be secured and kept in their original containers;
- Pumping systems, including the TSF seepage recovery and pit water pumps will continue to operate;
- Water from Tatelkuz Lake will continue to be pumped and discharged to Davidson Creek to maintain flows for downstream fisheries;
- If the TSF pond volume reaches the maximum safe level (minimum 2 m freeboard), the tailings pond supernatant will be pumped into the open pit;
- Mobile pit equipment, with the exception of shovels, will be parked near the mine maintenance building. The pit shovels will be secured and remain within the pit;
- Environmental monitoring will continue according to operating practices; and
- If a tailings dam lift was constructed at the time of shutdown, the need to continue constructing the lift during the expected shutdown will be evaluated and the lift completed if required.

For shutdowns of greater than one year, facilities will be secured and maintained such that they could be restarted after a short preparation period. In addition to the measures outlined above, the following will be completed:

- All chemicals and reagents will be removed from the site and either returned to the supplier or disposed of at a government-approved facility. Only sufficient fuel for maintenance and monitoring activities will be retained on site;
- A pipeline will be constructed from the reclaim barge in the TSF to the partially mined-out open pit to transfer tailings supernatant as required; and
- The PAG waste rock and tailings must be kept saturated in the event of temporary or early shutdown. Water will be added from the pit to the TSF to flood the PAG waste rock if required. However, the TSF catchment is large enough to maintain sufficient water to flood PAG wastes in the TSF. Water will be discharged via the tailings line spigots or sprayed by sprinklers to ensure that the tailings beaches remain saturated (defined as greater than 85% degree of saturation) to significantly restrict oxygen diffusion.

2.6.10.2 Premature Closure

Premature closure is the permanent closure of the mine before completion of the mine plan contemplated in the Application. In that case, the closure plan for scheduled closure described previously, modified as required for the waste facilities in place at that time, will be implemented. The following modifications will be implemented:

- A wedge of overburden will be placed (by truck or wide-track dozer) or slurried onto the TSF Site C and/or Site D tailings beaches and the water level rose to ensure that the water table plus capillary fringe covers the PAG tailings and waste rock;
- The invert elevation of the TSF spillway will be constructed at the same elevation as the bottom of the overburden minus the capillary fringe, in order to maintain a saturated cover over the PAG tailings;
- As required, an additional tailings dam lift will be placed to ensure sufficient freeboard for the PMF in the TSF and flood level for PAG tailings and waste rock;
- Treatment wetlands will be constructed in the ECD and water reservoir basins to improve seepage quality; and
- Any unprocessed stockpiled coarse ore or LGO will be deposited into the pit or TSF and flooded.

2.6.11 Reclamation Cost Estimate

Knight Piésold Ltd. (Knight Piésold) prepared the closure cost estimate. The basis of estimate is largely founded on neat line quantities for the proposed closure earthworks and water management activities, considering mine construction and reclamation costs for other, similar projects in northern BC and Knight Piésold's experience in the design and construction of waste and water management facilities.

The closure and reclamation costs are annual costs incurred during the mine life for progressive reclamation, and continue to Year 50. The estimated undiscounted reclamation cost for the Project is $104 million. The estimate includes the construction of drainage and seepage control systems, re-establishment of natural drainage, decommissioning of on-site and off-site infrastructure, removal and disposal of hazardous wastes, surface regrading, soil replacement, revegetation, and environmental monitoring.

Table 2.6-13 presents the summarized costs for reclamation activities during the operations, closure, and post-closure phases, including monitoring for 33 years after the cessation of mill operations.

A salvage value of $78 million has been estimated for Project assets upon closure. Mining equipment, major process equipment, and capital spares are assumed to be sold on an "as-is, where-is" basis. The value for scrap metal was based on the estimated reclaimed quantities to be sold to the scrap metals market. **Table 2.6-14** presents the breakdown of expected salvage value.

Table 2.6-13: Estimated Project Closure and Reclamation Cost

Component		Activity	Cost ($ '000s)
Mining	West Dump	Regrade, construct drainage control swales, collect and discharge seepage to TSF, cover, and revegetate	6,815
	East Dump	Regrade, construct drainage control swales/breach dam to Creek 661, cover and revegetate	4,442
	Coarse ore stockpile	Remove till liner and place in TSF, clean operations runoff ditch, and place material in TSF or open pit	166
	Low-grade ore stockpile	Remove till liner and drainage collection layer and place in open pit, clean drainage ditch, and place material in TSF or open pit	3,962
	Topsoil stockpile	Soil salvage and stockpiling, re-establish drainage system, rip-rap in drainage areas, regrade, and seed	148
	Open pit	Construct rock safety berm, spillways, and channel to TSF and remove equipment and pipelines	2,200
Concentrator Facilities	Mill/site infrastructure	Disconnect, demolish, and remove structures, dispose of and clean-up hazardous wastes and contaminated materials, scarify, cover, and revegetate	10,613
Tailings Facilities	Area C	Remove pumps and pipelines; cover, wetland and upland beach revegetation, outlet connection, reseed downstream slope, and decommission seepage sump	3,620
	Area D	Pump supernatant to pit, construct spillways, cover, deflector berm, outlet connection, seepage ponds and ditches, and revegetate	40,093
	Environmental control dam and water reservoir	Breach dams and construct rip-rap channel, regrade dams, revegetate, reshape basin, and construct wetland for seepage polishing treatment	6,990
Infrastructure	Roads	Scarify and seed, water bars at 100 m spacing, remove culverts, and re-establish drainage	115
	Camps	Remove modules, utilities, regrade, revegetate, and remove sewage plant and pipelines	127
	Transmission line	Remove poles and line, reclaim ROW, scarify, and seed spur roads	675
	Airstrip	Remove facilities, scarify, and seed	88
	Misc. off-site infrastructure	Remove facilities, scarify, and seed	395
	Esker borrow pit	Scarify and seed	73
Water Containment	Surface water	Re-establish non-contact drainage system to Davidson Creek, Creek 661; contact drainage system; pump Tatelkuz Lake to Davidson Creek and open pit until TSF discharges	15,890
Water Supply		Scarify, install waterbars and seed, and remove and rehabilitate Tatelkuz pipelines and pump station	1,060
Reclamation Infrastructure		Establish native plant nursery	30
Post-Closure	Closure management	Contract management three years	450
	Post-closure monitoring	Geotechnical and biophysical monitoring for 33 years after closure	6,600
Total			**104,552**

Note: m = metre; ROW = right-of-way; TSF = Tailings Storage Facility

Table 2.6-14: Salvage Value of Mining Equipment

Item	New Purchase Cost ($M)	Salvage Value (%)	Salvage Value ($M)
Mining Equipment	295.6	16	46.4
Grinding Mills	61.2	30	18.4
Crushers	15.0	30	4.5
Apron Feeders	2.8	15	0.4
Transformers	7.5	25	1.9
Capital Spares	8.3	30	2.5
Scrap Steel and Cable	58.6	7	4.3
Total	**449.0**		**78.4**

Note: $M = million dollars

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2.7 Proposed Project Land Use

This section summarizes land use in the Project area that could potentially be affected by the proposed Blackwater Gold Project (Project). Land use planning, private or fee simple land, provincial and federal Crown land, and third party interests or Crown-granted tenues are described. Details related to land use is provided in **Appendix 7.1.2A** (Non-Traditional Land Use 2013 Baseline Report). Aboriginal land use is described in **Section 7.2.7** (Current Land and Resource Use for Traditional Purposes). Potential future developments are also described. **Table 3.4-1** in **Section 3** summarizes consultations with tenure holders, including issues raised during these consultations and the Proponent's responses.

2.7.1 Land and Resource Management Plan

The Project is located within the Vanderhoof Land and Resource Management Plan (LRMP), approved by the Province in January 1997 and implemented in 1998. The Vanderhoof LRMP provides strategic level guidance for several values on approximately 1.38 million hectares (ha). The LRMP divides the 1.38 million ha into 20 different Resource Management Zones (RMZs) based on five categories: Settlement/Agriculture RMZ, Resource Development Emphasis RMZ, Multi-Value Emphasis RMZ, Special RMZ and Protected Areas. The LRMP provides three levels of management direction: general management direction (GMD), tailor-made resource management direction, and additional subzone direction.

The Vanderhoof LRMP encompasses the entire Project area included in the baseline and associated assessment and formed the basis for the selection of the Non-traditional Land and Resource Use (NTLRU) Regional Study Area (RSA) in **Section 7.2.6**.

The southern portion of the Project area, including the mine site, mine site access road, airstrip, and freshwater supply pipeline, falls within the Davidson Creek RMZ 17, and is bordered to the east and west by Multi-Value Emphasis Zones (Figure 2.2-2, **Appendix 7.1.2A**). The Davidson Creek RMZ 17 is a Resource Development Emphasis zone and the intent of the zone is to:

- Integrate the management of wildlife and recreational values and Aboriginal interests through appropriate access management;
- Limit vehicle access to the entire area south of the Kluskus Forest Service Road (FSR) to resource development activities; and
- Manage the northwest section of the RMZ to restrict access and provide a buffer between resource development and critical caribou winter range further west.

In addition to the Davidson Creek RMZ 17, the transmission line crosses the following RMZs (starting at the mine site and ending at the Glenannon substation near Endako; Sections 3.1.1.5 and 3.1.1.6, Figures 2.1-1 and 2.1-2, **Appendix 7.1.2A**):

- RMZ 5 – Nechako Valley Settlement/Agriculture Zone;
- RMZ 6 – Francois North;

- RMZ 8 – Nechako West Resource Development Emphasis Zone;
- RMZ 9 – Upper Nechako River Special Resource Zone;
- RMZ 10 – Crystal Lake Multi-value Emphasis Zone;
- RMZ 14 – Kluskus Resource Development Emphasis Zone; and
- RMZ 16 – Chedakuz Multi-value Emphasis Zone.

In addition to the Davidson Creek RMZ 17, the Kluskus FSR crosses the following RMZs (starting at the mine site and ending at Highway 16; Sections 3.1.1.5 and 3.1.1.6, Figures 2.1-1 and 2.1-2, **Appendix 7.1.2A**):

- RMZ 5 – Nechako Valley Settlement/Agriculture Zone;
- RMZ 10 – Crystal Lake Multi-value Emphasis Zone;
- RMZ 12 – Vanderhoof South Resource Development Emphasis Zone;
- RMZ 14 – Kluskus Resource Development Emphasis Zone; and
- RMZ 16 – Chedakuz Multi-value Emphasis Zone.

The northern portion of the mine site as well as the mine site access road, airstrip, and freshwater supply pipeline fall within an area designated as Non Road Accessible Recreation: Semi-primitive Non-motorized (Figure 3.3-1, **Appendix 7.1.2A**). The transmission line and FSR fall predominately within areas designated as Motorized Road Accessible under the Vanderhoof Access Management Plan (AMP; Figure 3.3-1, **Appendix 7.1.2A**).

The Province initiated a review of the Vanderhoof LRMP in 2005 to update and incorporate new information due to the impact of Mountain Pine Beetle (MPB) epidemic and accelerated salvage operations (BC Integrated Land Management Bureau [BC ILMB], 2007). A provincial-Level MPB model predicted that 83% of mature pine in the Vanderhoof Forest District was on the timber harvesting land base in 1999 would be killed by 2024 (BC Ministry of Forests, Lands and Natural Resource Operations [BC MFLNRO], 2013). The review focused on the GMD provided in the LRMP related to access management, recreation and tourism, wildlife, and biodiversity.

Due to the impacts of the MPB epidemic, changes in legislation and the increase in road development to support accelerated salvage operations, the AMP[1] was also updated as part of the review of the LRMP to better manage values on the changing land base. The review indicated a need to accommodate more motorized recreational activities (4x4, ATVs), certainty for a variety of recreation opportunities, management of access for wildlife values, and operational flexibility for effective management of MPB (BC ILMB, 2007). As a result, a new map was produced to identify recreation values and opportunities on the landscape. In 2008, the province released the revised Vanderhoof AMP for Forest Recreation to: align the existing patterns of recreational use with the

[1] The Vanderhoof Forest District has been implementing an Access Management Plan under the guidance of the original LRMP since 1998.

current situation regarding roads and access; manage for the continued integrity of the recreational experiences and opportunities provided; and ensure there is no impact to timber flow and supply.

2.7.2 Local Government Land Use Planning

The southern portion of the Project (mine site, mine site access road, airstrip, and freshwater supply) falls within the Cariboo Regional District Electoral Area (RDEA) I, West Fraser/Nazko (CRD, 2013). The North Cariboo Area Rural Land Use Bylaw No. 3505 applies to this area. The bylaw recognizes the importance of the region's forest, agriculture, and mineral resource land base.

The transmission line crosses RDEA D (Fraser Lake Rural) and F (Vanderhoof Rural) of the Regional District of Bulkley-Nechako (RDBN), and the FSR study area ends at Highway 16 within RDEA F (Vanderhoof Rural). There are no local government land use bylaws covering the area crossed by the transmission line.

2.7.3 Provincial and Federal Crown Land

The mine site, mine access road, airstrip, freshwater supply pipeline, and transmission line are located on provincial Crown land (Figure 3.9-2, **Appendix 7.1.2A**).

Federal Crown land in the Project area includes Indian reserves (IR) (Figure 3.9-1, **Appendix 7.1.2A**). The closest IR to the mine site is the Lhoosk'uz Dené IR, Tatelkus Lake #28, located approximately 15 km to the northeast. Other IRs located in the vicinity of the mine site include Kushya Creek (IR 7, 17 km southeast), Tsachla Lake (IR 8, 22 km, south), Kluskus (IR 1, 25 km southeast), and Tzetzi Lake (IR 11, 24 km southwest). The closest IRs to the proposed transmission line include the Stellaquo 1 Reserve (Stellat'en) (3 km to the northeast), and the Seaspunkut 4 Reserve (Nadleh Whut'en) (9 km to the northeast of the Kluskus FSR). The closest IR to the Kluskus FSR is the Clustalach Reserve 5 (Saik'uz) (approximately 1.8 km to the east).

There is a parcel of federal land adjacent to the transmission line (Figure 3.9-1, **Appendix 7.1.2A**).

2.7.4 Private or Fee Simple Land

The transmission line Stellako re-route intersects private land parcel (PID 015135233) (Figures 3.9-1 and 3.9-2, **Appendix 7.1.2A**).

2.7.5 Parks, Ecological Reserves and Protected Areas

Table 3.2-1 and Figure 3.2-1 in **Appendix 7.1.2A** describe the provincial parks, ecological reserves and protected areas within the NTLRU RSA. There are no national parks with the NTLRU RSA (Parks Canada, n.d.b); no National Historic Sites (Parks Canada, n.d.a.), National Marine Conservation Areas (Parks Canada, 2013), National Wildlife Areas (Environment Canada, 2013a), or migratory bird sanctuaries (Environment Canada, 2013b) are located proximate to the Project.

No Conservancy Areas overlap the Project. The closest conservancy is the Dean River Conservancy, which is located 104 km to the west of the Project along the western boundary of Tweedsmuir Park. Francois Lake Park and Francois Lake Protected Area are the closest park and protected area, but do not overlap the Project. The eastern boundary of the park is located approximately 5 km from the proposed transmission line. The Francois Lake Protected Area is located approximately 6 km from the proposed transmission line. In addition to the protected areas listed above, the Stellako River Wildlife Management Area (WMA) is located between Fraser Lake and François Lake, and is intersected by the transmission line.

2.7.6 Mining and Mineral Exploration

There is one past producer and one current producer in proximity to northern end of the transmission line (Figure 3.4-1, **Appendix 7.1.2A**).

Figures 3.4-2 and 3.4-3, **Appendix 7.1.2A** identify mineral tenures within the NTLRU study area as of January 2014. Mineral tenures held by Little Bear Gold Corp. overlap the mine site (Table 3.4-1, **Appendix 7.1.2A**) and airstrip study area (Table 3.4-2, **Appendix 7.1.2A**). Mineral tenures held by Mountain Boy Minerals Ltd., J. Otto and RJK Exploration Ltd, overlap the freshwater supply study area (Table 3.4-3, **Appendix 7.1.2A**). Tables 3.4-4, 3.4-5 and 3.4-6, **Appendix 7.1.2A** identify mineral tenures overlapping the transmission line study area and Stellako and Mills Ranch reroutes. Potentially affected mineral tenure holders will be contacted as the Project progresses to ensure issues are discussed and addressed.

2.7.7 Forestry

The Project falls within the Vanderhoof Forest District. The total volume of woodcut during 2011 in the Vanderhoof Forest District was 3,021,645 m^3 (Section 3.5, **Appendix 7.1.2A**). There are no tree farm licences or community forests proximate to the Project (Figures 3.5-2 and 3.5-3, **Appendix 7.1.2A**).

Active forestry operations proximate to the Project are performed by L&M Lumber who has developed a road system in the Davidson Creek drainage (AMEC, 2012) (Tables 3.5-1 to 3.2-4 in **Appendix 7.1.2A**). Several woodlots are intersected by the proposed transmission line study area (and Stellako and Mills Ranch re-routes Table 3.5-4 in **Appendix 7.1.2A**). Sixty-one forest tenures overlap the FSR study area (Table 3.5-7 and 3.5-8, **Appendix 7.1.2A**).

2.7.8 Hunting and Fishing

Different Project components overlap Wildlife Management Units (WMU) 5-13, 6-1, 6-4, 7-11, 7-12 and 7-13 (Table 3.6-1, Figure 3.6-1, **Appendix 7.1.2A**). Recreational, traditional, and commercial hunting and fishing occurs in the Project area. Wildlife species hunted by residents include moose, deer, wolf, and black bear, cougar, coyote, wolverine, lynx, and snowshoe hare. Hunting regulations for the regions overlapped by the Project are summarized in the 2012 to 2014 Hunting and Trapping Regulations Synopsis (BC Ministry of Forests, Lands and Natural Resource Operations [BC MFLNRO], 2012).

Section 3.6.3 of **Appendix 7.1.2A** describes non-resident hunting within the NTLRU RSA; Figure 3.3-1 identifies guide outfitter areas within the NTLRU RSA. The mine site study area overlaps three guide outfitter areas (500929, 600384 and 601039) and the transmission line crosses six guide outfitter areas (600384, 601039, 701166, 701156, 601048 and 701137) (Figure 3.6-1**, Appendix 7.1.2A**). Sections 3.6.3.2 – 3.6.3.4 and Section 3.6.3.6 of **Appendix 7.1.2A** identify guide outfitter areas overlapped by the mine site access road, airstrip and freshwater supply, and FSR study areas.

Section 3.6.4 and Table 3.6-6 of **Appendix 7.1.2A** identify species trapped in the NTLRU RSA. The mine site study area is overlapped by three provincially registered traplines (TR0512T027, TR0512T014 and TR0601T003 (Figure 3.6-2). Table 3.6-9 identifies the 13 traplines crossed by the transmission line study area. Sections 3.6.4.2 – 3.6.4-4 and Section 3.6.4.6 identify traplines overlapped by the mine site access road, airstrip and freshwater supply and FSR study areas.

There is recreational fishing as well as licenced angling supported by commercial fishing lodges within the NTLRU RSA. Fishing areas proximate to the Project include: Nechako River and Reservoir (Knewstubb Lake), Tatuk Lake, Finger Lake, Top Lake, Tatelkuz Lake, Stellako River, Chedakuz Creek, Big Bend Creek, and Euchineko River. A number of smaller lakes and streams are also found in the area and fished by anglers hiking in (Government of BC, 1997).

Stakeholder engagement (including resident hunters and fishing enthusiasts) is ongoing, and has included various open houses and opportunities to provide comments.

2.7.9 Agriculture and Range

The expansion of agricultural lands in the Vanderhoof Forest District has been substantial in the last two decades (L&M Forest Resource Solutions Ltd., 2011). Figure 3.8-1 identifies Agricultural Land Reserves (ALR) and range tenures within the NTLRU RSA. There are no ALRs within the mine site, mine site access road, airstrip, or freshwater supply pipeline study areas. The transmission line does not overlap with any ALRs. There are several ALRs located along the FSR.

There are eight active range tenures overlapped by the Project (Figure 3.8-1, Table 3.8-1 and 3.8-2, **Appendix 7.1.2A**). One range tenure (RAN075154 A) is intersected by all of the Project study areas except for the Stellako re-route. This range tenure occupies 27% of the mine site study area and 90% to 100% of the mine site access road, airstrip, and freshwater supply pipeline study areas. The transmission line study area intersects six range tenures.

2.7.10 Recreation and Tourism

The Project area is used year-round for a variety of recreational uses, including ATV use, snowmobiling, hiking, camping, cross-country skiing, horseback riding, fishing, hunting, interpretative cultural heritage experiences, and eco-tourism. Locations and facilities related to recreational and tourism activities include recreational areas and sites, campsites, trails, lodges, lakes, and rivers. There are no recreation sites or commercial lodges within 5 km of the mine site, mine site access road, or airstrip. There is a non-motorized recreational trail, the Messue Wagon Trail, 13 km directly east of the mine site, in a north-south direction, which will be crossed by the

proposed freshwater supply from Tatelkuz Lake to the mine site at an existing resource road crossing. Tatelkuz Lake Ranch Resort is 2 km south of the mine site access road study area, and transmission line study area, and approximately 8.5 km from the proposed mine site. The proposed freshwater supply at Tatelkuz Lake is between 600 and 900 m from two recreation sites. Two recreation sites, Big Bend Meadow and Brewster Lake, which are also proximate to the FSR study area, are intersected by the transmission line study area. The transmission line crosses the Nechako River, which has a designated canoe trail from Cheslatta Falls to Prince George.

2.7.11 Other Tenures

Figure 3.9-3 and Table 3.9-2 in **Appendix 7.1.2A** identifies non-forestry and non-mining tenures overlapping the NTLRU RSA (Note: Some of these tenures are discussed above). These tenures are largely granted under the *Land Act*.

2.7.12 Future Developments Potentially Overlapping the Project

Based on a review of publically available information and discussions with individuals familiar with the status of projects identified as potentially foreseeable, the following four projects were identified:

1. Nulki Hills Wind Project—Innergex Wind Energy Inc. proposes to develop and operate a wind power project, with a capacity ranging from 105 to 210 megawatts (MW), using up to 70 wind turbines. The project is located in the Nulki Hills, 30 km south of Vanderhoof and approximately 60 km north of the Blackwater mine site. The project is in the pre-Application stage of the BC Environmental Assessment (EA) process (commenced 26 November 2012).
2. Fraser Lake Sawmill Biomass Project— Fort St. James Green Energy LP, a partnership between Dalkia Canada Inc., a subsidiary of a French power firm, and Fengate Capital Management Ltd. is proposing to use sawmill waste to produce 12 MW (88 gigawatt-hour per year (GWh/y)). The project has been awarded a BC Hydro Electricity Purchase Agreement, and permitting is in progress. The project is located approximately 80 km north of the Blackwater mine site, with operations estimated to commence in the second or third quarter of 2014.
3. Coastal GasLink Pipeline Project— Coastal GasLink Pipeline Ltd. is proposing to construct and operate a 650 km natural gas pipeline (42-inch diameter), near Dawson Cree to the proposed LNG Canada liquid natural gas (LNG) export facility near Kitimat. The project received an EA certificate on October 23, 2014. The closest point of the project in relation to the Blackwater Project is Endako.
4. Pacific Northern Gas Looping Project—Pacific Northern Gas Ltd. is proposing to construct a 525 km, 24-inch diameter natural gas transmission pipeline between Summit Lake and Kitimat. The project is in the pre-Application stage of the BC EA process (commenced 24 July 2013). The closest point of the project in relation to the Blackwater Project is Endako.

Additional information regarding reasonably foreseeable projects potentially overlapping temporally and spatially with the Project is provided in **Appendix 4C**, Project Inclusion List.

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2.8 Proposed Project Benefits[1]

This section provides a summary of the following information:

- Initial capital construction costs estimates;
- Estimated operating costs;
- Employment estimates;
- Contractor supply services estimates; and
- Government revenues.

The information is summarized in the following text by these general categories. **Table 2.8-1** provides more details for each topic arranged by Project phase. Focus is placed on economic and social benefits in the regional and provincial contexts. In addition, there is a discussion of Project benefits that have been realized due to changes in the mine design.

The following is a list of references used in providing the information located within this section:

- BC Stats, Quarterly Regional Statistics (http://www.bcstats.gov.bc.ca/pubs/pr_qrs.asp);
- BC Stats, BC Input-Output Model (http://www.bcstats.gov.bc.ca/pubs/pr_pem.asp);
- BC Stats, Current Labour Force Data (http://www.bcstats.gov.bc.ca/pubs/pr_lfs.asp);
- BC Stats, Regional District Data (http://www.bcstats.gov.bc.ca/regions.asp);
- BC Stats, Socio-economic Profiles (http://www.bcstats.gov.bc.ca/data/sep/index.asp); and
- Statistics Canada – Community Profiles (http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E).

The Blackwater Gold Project (the Project) will make a major contribution to social and economic well-being in British Columbia (BC), especially in central BC, where Project spending on labour, goods, and services will provide opportunities for regional residents and bring additional workers and their families into the region. By providing well-paying jobs, reducing local unemployment levels, purchasing goods and services from regional businesses, and contributing to economic and population growth, the Project will improve economic and community stability and offset some of the employment losses that have recently occurred in the region (BC Stats, 2013; Statistics Canada, 2007, 2013).

The economic impetus provided by the Project will help to develop and diversify sustainable local employment and business opportunities. Direct Project employment will offset the loss of basic jobs that has occurred in the region since 2006 due to declines in the forestry industry. In addition, creating mining jobs will help to diversify basic employment and to support current non-basic employment in the region. These changes would make the regional economy less dependent on the forestry sector, which historically accounts for a large portion of basic jobs in both harvesting

[1] All dollar values in this section are in constant 2012 Canadian dollars.

and manufacturing (BC Stats 2012, Horne 2009), and would also reduce the economy's vulnerability to changes in the forest sector.

The District of Vanderhoof, the Village of Fraser Lake, and the City of Prince George will be the major beneficiaries of the Project, although Project benefits will spill over into other communities, both Aboriginal and non-Aboriginal, within central BC, the province of BC, and the rest of Canada.

Project Life

The Project will generate approximately 37 years of economic activity, including two years of construction activity, 17 years of operations, and 18 years of closure activities; monitoring will continue over an extended period.

Initial Capital Costs

The initial capital cost of construction is estimated at $1.814 billion over the two-year construction period, with approximately 88% of construction expenditures made within BC ($1.294 billion, excluding contingencies), including $398 million within central BC. The breakdown of the capital costs are presented in **Table 2.8-1**. The costs for land, buildings, and equipment are included in the costs for Project components such as the processing plant, construction camp, and on-site infrastructure.

The Project will be self-contained, with its own accommodations, water and sewage facilities, and a road and electrical transmission line to the site to be constructed as part of the Project. The only use of local or regional facilities will be the potential disposal of some Project-generated wastes. The payment of tippage fees will result in no net costs to the Regional Districts. The Project will have no other use of local or regional facilities and no direct costs for local or regional government infrastructure.

Operating Costs

The Project operating costs, excluding labour costs, will average $256 million per year of which $160 million per year will be expended in BC. With labour costs, the annual operation cost will be $314 million of which $2017 million will be expended in BC. **Table 2.8-1** provides a breakdown of annual operating costs.

Approximately $572 million in sustaining capital purchases will be made over the operating life of the Project. It is assumed that 100% of the sustaining capital purchases will be made in BC and 17% ($97 million) will be purchases from businesses in central BC. Closure activities begin during operations and continue for a forecast 50 year period. This would be considered closure and post-closure. Total closure costs are estimated to be $102 million. All (100%) of the closure costs are expected to be expended in BC. **Table 2.8-1** provides details on closure cost.

All costs reported in this report are stated as constant 2012 dollars.

Employment

The construction phase will create an estimated 3,480 person years (PYs) of direct employment at the mine, with 70% estimated for BC residents (2,435 PYs) and an estimated 20% for regional residents (485 PYs). At peak, the Project will have approximately 1,500 workers at the site. New Gold Inc. (Proponent) will hire approximately 20% of construction-related labour force; contractors will supply the other 80% of the construction workforce.

Project expenditures during construction will create 5,419 indirect and 1,807 induced jobs in BC. The indirect and induced Project effects reported here, and elsewhere in this section, were generated through a custom simulation of the BC Stats Input/Output Model (BC Stats, 2014).

During construction, the Project will generate $296 million of household income for people directly employed in the Project, with 20% or $59 million, generated in BC. During this phase, wages, including benefits, will average $120,000 per PY. The average wage rate is considered representative for this level of cost estimation.

During operations, the Project will employ approximately 495 people, with 80% of these (396) being BC residents, including 320 residents of central BC. These new jobs will partially offset the loss of basic jobs in central BC that occurred between 2006 and 2011 and will enhance economic diversity and decrease dependency on the forestry sector.

Project operations will create 8,415 person years of direct employment. Direct employment for BC residents during operations will total 6,732 person years; indirect employment of 9,078 person years; and induced employment of 3,400 person years.

During operations, household income for people directly employed in the Project will total $59 million per year, with 80% or $43 million, accruing to BC families annually. During this phase, wages, including benefits, will average $110,000 per PY. **Table 2.8-1** provides some indicative wages by job categories.

Project closure activities will create 363 person years of direct employment for BC residents; 479 person years of indirect employment; and 116 person years of induced employment.

During closure, the Project will provide an additional $15 million of direct household income, with average salaries of $75,000 per PY.

The Proponent's labour strategy seeks to maximize opportunities for local and regional hiring. The Proponent is committed to increasing the percentage of Aboriginal employees by working closely with the employment and training officers in Aboriginal communities as well as with Band Councils to establish conditions at the Project that support a multicultural workforce.

The Proponent is committed to developing a workforce that meets recognized industry standards, competencies, and best practices. The Proponent will work with educational partners to provide training programs to develop a skilled pool of employees, which will provide long-term sustainable benefits to the community and its members. In addition, the Project will provide opportunities for

on-the-job training through a variety of mandatory and elective training initiatives, including cultural awareness and occupational health and safety training.

Contractor supply services

The Project will provide benefits to a range of contractors supplying direct and indirect goods and services to the Project. The Proponent will endeavour to use local and regional suppliers, where qualified and practical. Opportunities will exist for local and regional businesses (e.g., restaurants, accommodations, recreational facilities, support services, service stations, etc.) to participate in induced benefits of the Project. The Proponent will work with local Aboriginal groups to increase the participation of Aboriginal-owned businesses in providing goods and services to the Project. The Project will help increase the demand for supply services lessened by the reduction in forest industry in recent years. **Table 2.8-1** provides information about the types of goods and services that will be required by the Project.

Government revenues

During construction, the Project will generate $66 million of Federal government revenues directly and $86 million when combined with indirect and induced effects. During operations, the federal revenue contribution will be $31 million per year directly and, when combined with indirect and induced effects, a total of $33 million per year. During closure, the direct effect on federal revenues will be $5 million and a total effect of $6 million.

During construction, the Project will generate $64 million of provincial government revenues directly and $82 million when combined with indirect and induced effects. During operations, the provincial revenue contribution will be $19 million per year directly and, when combined with indirect and induced effects, a total of $21 million per year. During closure, the direct effect on provincial revenues will be $5 million and a total effect of $7 million.

During construction, the Project will generate $3 million of local and regional government revenues directly and $13 million when combined with indirect and induced effects. During operations, the local and regional revenue contribution will be $2 million per year directly and, when combined with indirect and induced effects, a total of $4 million per year. During closure, the direct effect on local and regional revenues will total $1 million.

These estimates include personal and corporate income taxes, sales taxes and regional business and other taxes. During operations, the estimates also include property taxes.

The purchases will generate 405 PYs of indirect employment in BC, including 200 PYs for regional residents.

Estimates of economic Project impacts were calculated using the BC Stats Input/Output Model (BC Stats, 2014) to analyze Project cost contained in the Preliminary Economic Assessment (PEA) (AMEC, 2012).[2] All estimates are provided in undiscounted 2012 Canadian dollars.

Specific economic and employment information related to the economic impacts of the Project, as outlined in the Application Information Requirements (AIR), is presented in detail in **Section 6**. **Table 2.8-1** includes a summary of estimated Project economic effects based on the preliminary Project cost information and the modelling results.

[2] Project cost information is considered accurate to within ±25%. The BC Stats Input / Output Model was run in the summer of 2013 using cost estimates from the Preliminary Economic Assessment (PEA). These estimates are based on Inferred Mineral Resources that are considered speculative geologically and therefore cannot be categorized as Mineral Reserves. Project cost estimates were subsequently updated in the Blackwater Feasibility Study (FS) dated 12 December 2013, which are based on Proven and Probable Mineral Reserves. There are not significant changes in Project costs estimates contained in the PEA and the FS, and therefore Project impacts presented in this section are valid. Construction and operation cost estimates vary approximately 8% between the PEA and the FS, whereas closure cost estimates vary 15% between the two reports. These variations are within the expected accuracy of the PEA cost estimates and the accepted marginal error of the BC Stats Input / Output Model.

Table 2.8-1: Summary of Proposed Project Effects

Project Benefit Category		Proposed Project Effects
Construction		
Capital Cost Estimates	Total capital costs (**Figure 6.2.2-1**)	$1,814 million (which includes $346 million in contingencies) based on the following: • $539 million for construction of the processing plant (30% of total); • $215 million for various indirect costs (12%), which includes the construction camp and catering, freight, spare parts, etc.; • $208 million for surface preparation / mining activities (11%); • $181 million for on-site infrastructure (10%); • $112 million for engineering, procurement, and construction management (6%); • $74 million for construction of water/waste management facilities (4%); • $54 million for owners costs (3%); • $69 million for off-site facilities (4%); and • $16 million for the project access corridor (1%). Of the $1,814 million: • Direct labour costs will amount to $137 million (8%); • Subcontracts will total $956 million (53%), including $316 million in labour costs; • Materials will account for $282 million (16%); • Equipment will cost $40 million (2%); and • Other costs (owner's costs and contingencies) will account for $400 million (22%). Construction is expected to be completed within approximately 25 months. Approximately 40% of construction activities will be completed during the first year of construction, while the other 60% will be completed during the second year.
	Project purchases from provincial sources	88% of total construction-related expenditures ($1,294 million) will be made in BC; this includes 70% of labour costs. Some materials and services, valued at $174 million, will be imported from outside BC; this includes some concrete work, structural steel, mechanical equipment, and other items.

Project Benefit Category		Proposed Project Effects
Direct Employment	Total	There will up to 1,500 workers on site during peak construction.
		Total on-site construction employment is estimated to be 3,480 PYs over the 25-month period.
		Wages, including benefits, will average $120,000 per PY of employment.
	Number of full-time, part-time, and seasonal workers	As is typical, construction work will involve a series of workers with different skills being employed in a particular sequence over the entire period. Thus, most of the work for individuals will be short-term and seasonal.
	Provincial	The Project will provide 2,435 PYs of employment for BC residents over the 25-month period (70% of total employment).
		Household income for people directly employed will total $296 million.
	Regional	The Project will provide 485 PYs of employment for regional residents over the 25-month period (20% of total BC employment).
		Household income for regional residents directly employed will total $59 million.
	Relevant employment policies and practices	The Proponent will exert its best efforts to ensure that construction contractors hire local residents.
		The Proponent will exert its best efforts to ensure that contractors comply with the Proponent's policies related to recruitment, training, safety, procurement, and environmental responsibility.
		The Proponent will seek to recruit employees from central BC, particularly from communities within the RSA. The Proponent is committed to increasing the percentage of Aboriginal employees by working closely with the employment and training officers in Aboriginal communities as well as with Band Councils to establish conditions at the Project that support a multicultural workforce.
Contract and Business Opportunities[(1)]	Provincial	$998 million will be spent to procure goods and services from BC suppliers (96%).
		5,419 PYs of indirect employment will be created in BC.
		Household income for people indirectly employed will total $321 million.
		Income will average $59,195 for every PY of indirect employment.
	Regional	$339 million worth of goods and services will be purchased from regional suppliers (34% of purchases in BC).
		1,945 PYs of indirect employment will be created in regional businesses.
		Household income for regional residents indirectly employed will total $115 million.
	Relevant employment policies and practices	The Proponent will use local and regional suppliers when these suppliers can provide quality products and services at competitive prices and timeframes.

Project Benefit Category		Proposed Project Effects
Induced Employment[2]	Provincial	1,807 PYs of induced employment will be created in BC during construction.
		Household income for Project-related induced employment will total $92 million.
		Income will average $50,675 for every PY of induced employment.
	Regional	140 PYs of induced employment will be created in the region during construction.
		Total household income for regional residents during construction will be $7 million.
Estimated Government Revenues	Canadian government revenues	Federal tax revenues will directly increase by $66 million as a result of Project spending on labour, goods, and services.
		Total effects on federal taxes will be $86 million when induced and indirect effects are included.
	Provincial revenues	Provincial tax revenues will directly increase by $64 million as a result of Project spending on labour, goods, and services.
		Total effects on provincial taxes will be $82 million when induced and indirect effects are included.
	Local and regional government	Revenues for local and regional governments in BC will directly increase by $13 million as a result of Project spending on labour, goods, and services.
Operations[3]		
Operating Cost Estimates	Annual operating costs	The mine is expected to operate for 17 years. The LOM operating costs will total $5,334 million. Annual operating costs are estimated to total $314 million: • Labour $970 million (80% in BC) • Power and fuel $1,116 million (100% in BC) • Chemicals and explosives $1,363 million (31% in BC) • Grinding media and liners $662 million (80% in BC) • Maintenance $236 million (20% in BC) • Refining $81 million (100% in BC) • Camp and catering $68 million(100% in BC) • Tires, parts, and consumables $719 million 51% in BC) • Other operating expenses $119 million (90% in BC)
		Spending on replacement capital items (sustaining capital) will amount to $572 million over the LOM. This represents an average of $34 million per year, although this will vary from year to year.
	Project purchases from provincial sources	66% of annual operating expenditures ($207 million) will be made in BC. This includes 80% of labour costs. Some materials and services valued at$96 million will be imported from outside BC; this includes some chemical reagents and repair parts.
		All sustaining capital expenditures are expected to be sourced from BC suppliers.

Project Benefit Category		Proposed Project Effects
Direct Employment	Total	The mine will employ an average of 495 workers each year: • 72% will be employed in mining operations (357); • 21% will be employed in mineral processing (105); and • 7% will be employed in general and administrative positions (33).
		Labour costs will average $54 million per year.
		Wages, including benefits, will average $110,000 based on PEA (AMEC, 2012). Indicative wages by major job category as estimated in PEA (2012) will vary according to position and skill levels. • Mine manager $240,000 • Mill manager $200,000 • Superintendents $180,000 • Processing staff $70,000 to $90,000 • Equipment operators $90,000 • Mechanics and electricians $105,000 • Administration $40,000 to $90,000
	Number of full-time, part-time, and seasonal workers	All positions will be full-time. The remote nature of the Project, work schedules, and labour requirements in combination reduces and likely eliminates the option of part-time and/or seasonal work.
	Provincial	The Project will provide 396 jobs, or 80% of total direct employment, for residents of BC.
		Household income for people directly employed will total $43 million per year.
	Regional	The Project will provide 320 jobs, or 80% of total BC employment, for existing regional residents.
		Another 100 workers (mainly management) are expected to move to the region.
		The creation of 320 new jobs would reduce regional unemployment rates.
		Household income for existing and new regional residents directly employed will total $46 million.
	Relevant employment policies and practices	Workers from communities within the region will be recruited to work in the mine.
		The Proponent will work with training institutions to provide training programs.
		The Proponent will seek to recruit employees from central BC, particularly from communities within the RSA. The Proponent is committed to working closely with the employment and training officers in Aboriginal communities as well as with Band Councils to establish conditions at the operation that support a multicultural workforce.

Project Benefit Category		Proposed Project Effects
Contract and Business Opportunities[1]	Provincial	$186 million per year will be spent to procure goods and services from BC suppliers: • $152 million for operations (63% of total); and • $34 million for sustaining capital (100% of total).
		Of the $152 million spent on operations: • Power and fuel costs will average $62 million per year (41% of costs); • Mineral processing costs (grinding agents and chemicals) and explosives will average $53 million per year (35%); • Tires, parts, and consumables will cost $20 million per year (13%); and • Other goods and services will cost $17 million per year (11%).
		534 indirect jobs will be created in BC.
		Household income for people indirectly employed will total $32 million per year.
		Income will average $58,140 for every PY of indirect employment.
	Regional	$81 million per year will be spent to procure goods and services from BC suppliers: • $75 million for operations (50% of total); and • $6 million for sustaining capital (17% of total).
		222 jobs will be created in central BC.
		Household income for regional residents indirectly employed will total $13 million.
	Relevant employment policies and practices	The Proponent will endeavour to use local and regional suppliers when these suppliers can provide quality products and services at competitive prices and timeframes. The Proponent will work with local Aboriginal groups to increase the participation of Aboriginal-owned businesses in providing goods and services to the Project.
Induced Employment[2]	Provincial	200 induced jobs will be created in BC during operations.
		Household income for induced employment will total $10 million per year.
		Income will average $50,675 for every PY of induced employment.
	Regional	100 induced jobs will be created in the region during operations.
		Household income for regional residents will be $5 million per year.

Project Benefit Category		Proposed Project Effects
Estimated Government Revenues	Canadian government revenues	Federal tax revenues will directly increase by $31 million per year as a result of Project spending on labour, goods, and services.
		Total effects on federal taxes will be $33 million per year when induced and indirect effects are included.
	Provincial revenues	Provincial tax revenues will directly increase by $19 million per year as a result of Project spending on labour, goods, and services.
		Total effects on provincial taxes will be $21 million per year when induced and indirect effects are included.
		Annual royalty payments of $4 million will be made.
	Local and regional government	• Revenues for local and regional governments in BC will directly increase by $4 million as a result of Project spending on labour, goods, and services, including $2 million in annual property taxes; and • $2 million in other taxes.
Closure and Post Closure		
Closure and Post Closure Cost Estimates	Total closure and post closure costs	The majority of costs will be incurred during closure; post closure costs will be associated with on-going predominantly by monitoring. Total closure costs will be $101 million over a 50-year period after operations commence: • $26 million in pumping costs; • $21 million in constructing water management structures; • $19 million for earth moving; • $12 million for demolition and reconstruction; • $5 million for revegetation; • $8 million for employment and severance; • $6 million for monitoring; and • $6 million for other items. Of the $101 million: • $21 million will be spent during operations; • $47 million will be spent in the five years after operations cease; • $9 million will be spent in the subsequent five years; • $22 million will be spent in the third five-year period; and • $4 million will be spent in the final 13 years.
	Project purchases from provincial sources	100% of closure costs/purchases will be made in BC.

Project Benefit Category		Proposed Project Effects
Direct Employment	Total number of full time, part time and seasonal workers	There will up to 363 PYs of employment over 50 years, with an average of 33 PYs per year during for the five years after operations cease.
		Wages, including benefits, will total $28 million, with an average of $3 million per year for the five years after operations cease.
		Closure will involve a series of workers with different skills being employed in a particular sequence over the entire period. Thus, most of the work will be short-term and seasonal.
	Provincial	The Project will provide 363 PYs of employment for BC residents over 50 years; 100% of total employment.
		Household income for people directly employed will total $28 million over 50 years.
		Wages will average $75,000 per PY.
	Regional	The Project will provide 194 PYs of employment for regional residents over 50 years (55% of total BC employment), with an average of 18 PYs per year for the five years after operations cease.
		Household income for regional residents directly employed will total $15 million, with an average of $2 million per year for the five years after operations cease.
	Relevant employment policies and practices	The Proponent will exert its best efforts to ensure that closure contractors will hire local residents.
		The Proponent will exert its best efforts to ensure its contractors comply with the Proponent's policies related to recruitment, training, safety, procurement, and environmental responsibility.
Contract and Business Opportunities(1)	Provincial	$74 million will be spent to procure goods and services from BC suppliers over 50 years, with an average of $7 million per year for the five years after operations cease.
		479 PYs of indirect employment will be created in BC over 50 years, with an average of 44 PYs per year for the five years after operations cease.
		Household income for people indirectly employed will total $24 million over 50 years, with an average of $2 million per year for the five years after operations cease.
		Income will average $49,975 for every PY of indirect employment.
	Regional	$41 million worth of goods and services will be purchased from regional suppliers over 50 years (55% of purchases in BC), with an average of $4 million per year for the five years after operations cease.
		265 PYs of indirect employment will be created in regional businesses over 50 years, with an average of 24 PYs per year for the five years after operations cease.
		Household income for regional residents indirectly employed will total $13 million with an average of $1 million per year for the five years after operations cease.

Project Benefit Category		Proposed Project Effects
	Relevant employment policies and practices	The Proponent will endeavour to use local and regional suppliers when these suppliers can provide quality products and services at competitive prices and timeframes.
Induced Employment[(2)]	Provincial	116 PYs of induced employment will be created in BC over 50 years, with an average of 11 PYs per year for the five years after operations cease.
		Household income for Project-related induced employment will total $6 million with an average of $1 million per year for the five years after operations cease.
		Income will average $50,675 for every PY of induced employment.
	Regional	140 PYs of induced employment will be created in the region during construction, with an average of 4 PYs per year for the five years after operations cease.
		Total household income for regional residents during construction will be less than $1 million over 50 years.
Estimated Government Revenues	Canadian government revenues	Federal tax revenues will be $5 million over 50 years as a result of Project spending on labour, goods, and services.
		Total effects on federal taxes will be $6 million when induced and indirect effects are included.
	Provincial revenues	Provincial tax revenues will be $5 million over 50 years as a result of Project spending on labour, goods, and services.
		Total effects on provincial taxes will be $7 million when induced and indirect effects are included.
	Local and regional government	Revenues for local and regional governments in BC will be $0.8 million as a result of Project spending on labour, goods, and services.

Note: Some totals may not add due to rounding errors.
BC = British Columbia; LOM = life of mine; PEA = Preliminary Economic Assessment; PY = person years; RSA = Regional Study Area; % = percent.
(1) Provincial and regional indirect Project effects have been estimated based on the amount of Project-related purchases of goods and services, and impact estimates from the BC IOM customized simulation. See **Section 6.2** Economic Effects Assessment for further details.
(2) Estimates for induced Project effects assume that social safety net is in place. Provincial induced effects are estimated based on the BCIOM customized simulation. Regional induced effects were calculated using regional impact ratios that BC Stats developed for Local Economic Regions based on 2006 census information pertaining to the construction and mining industries in the SERSA (Horne 2009). See **Section 6.2** Economic Effects Assessment for further details.
(3) The numbers for direct employment presented in the operations phase is similar to the construction phase, except that some mine management positions may not be filled until part way through the construction period.

Over its life, the Project will directly and indirectly contribute $4,729 million to the economy of BC, as measured in terms of Gross Domestic Product (GDP). The distribution of GDP effects over time is shown on **Figure 2.8-1**.

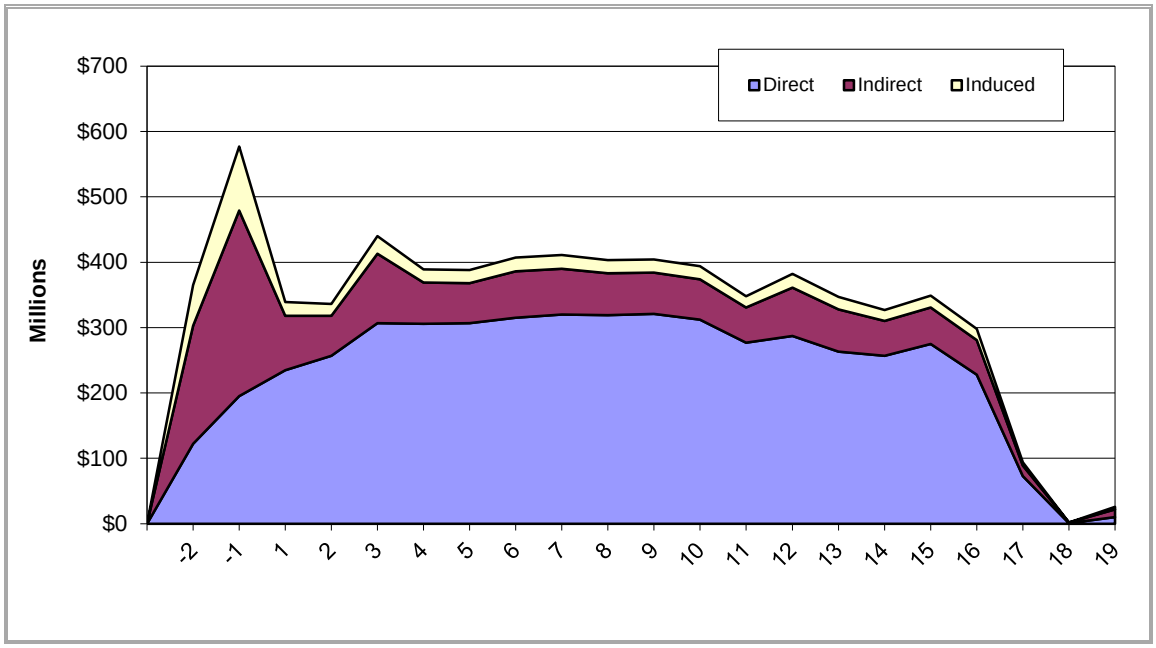


Figure 2.8-1: Project Effects on Provincial GDP over the Life of the Project

Over its entire life, the Project will create nearly 30,000 PYs of employment for BC residents. Total tax revenues over the life of the Project will amount to approximately $1.2 billion, of which $656 million will accrue to the federal government and $83 million will go to local governments. Total revenues for BC will be approximately $511 million, which includes $450 million in taxes and $61 million in royalties.

2.8.1 Investing in the Community

The Proponent has established a Community Liaison Committee (CLC) to facilitate discussion between community members and the Project to assist in the identification and understanding of issues of concern and interest to the surrounding communities, primarily focused on economic and social benefits from the Project. The CLC also offers valuable input to assist in the development of the Project policies, plans, and programs. The areas of focus are economic development, training, service provision, housing, education, environmental stewardship, health and social services, and attraction and retention of employees.

The Proponent intends to continue to operate the CLC during the duration of the Project, as well as work with local agencies to assist in monitoring community well-being in order to maximize the positive benefits and minimize the negative impacts of the Project throughout the mine cycle.

The Proponent is committed to developing sustainable long-term relationships with Aboriginal groups. The Proponent has successfully negotiated agreements with several First Nations affected by the Project. The Proponent is actively engaged in ongoing dialogue aimed at achieving meaningful and mutually beneficial agreements with other Aboriginal groups.

2.8.2 Benefits from Changes to Mine Design

A zero surface discharge Tailings Storage Facility (TSF) design was adopted which will result in no negative effects on water quality to Davidson Creek during operations and closure. At post closure when the TSF is completely reclaimed, discharge will occur through a downstream wetland to polish water to essentially background quality. Adopting a zero surface discharge design will mean no negative effects from mine surface discharge on Davidson Creek and preservation of use by Aboriginals and others for food or recreational fishing.

The TSF will occupy the upper reaches of Davidson Creek and watershed assessment indicated a significant reduction in the flow of Davidson Creek without augmentation. The Project design includes flow augmentation by pumping water from Tatelkuz Lake, a large, nearby lake, to Davidson Creek during mine operation and closure. The augmentation was carefully designed to mirror natural flow and temperature regimes in Davidson Creek as closely as practical and thus disrupt fish habitat and populations to the least possible extent. Flow augmentation of Davidson Creek will preserve traditional and non-traditional uses of this resource.

Six alternatives to power transmission line alignment were considered for the proposed Project. Through consultation with regulators, Aboriginals and the general public a preferred option was chosen that minimized requirements for new disturbance, maximized distance from Indian Reserves and private property, and avoided as far as possible wildlife reserves and protected areas. The potentially negative environmental and social effects were thus minimized to the greatest extent possible.

In discussion with regulators and the public two possible reroutes of portions of the power transmission line to avoid proximity to a Davidson Creek ranch and minimize the length of the line through the Stellako River Wildlife Reserve have been incorporated into proposed Project design for review through the EA process. Concern was expressed that proximity to the ranch would mean the power transmission line was visible from the ranch.

Five options for TSF siting were originally considered, one in the Blackwater River drainage, one in the Fawnie Creek drainage, one in Creek 661, a small headwaters stream flowing into Tatelkuz Lake and two in Davidson Creek. By selecting a combination of the two sites in Davidson Creek, effects of the proposed Project will be limited to one drainage basin, a zero surface discharge design is practical and where drainage control through flow augmentation is feasible. The environmental benefit is the limiting of project effects to one watershed where effects can be mitigated to the greatest extent.

Early in proposed Project design an access route from Anahim Lake was considered. This route would be shorter by about 30 per cent and was favoured by some but would have meant crossing the Blackwater River and constructing an entirely new route rather than making maximum use of

existing forest service roads. The southern route would have meant crossing the Blackwater River Grease Trail which is culturally important to Aboriginal groups as it is one of the main trails used to transport eulachon from the coast to the interior, and is an important heritage trail as it was used by Alexander Mackenzie on his expedition from central Canada to the Pacific Ocean. Access from Vanderhoof would also provide for a larger employment base for the proposed Project. On balance the environmental and social benefits of the northern route from Vanderhoof outweighed the southern route from Anahim Lake.

The existing exploration access road to the Blackwater site traverses part of the northern caribou winter range. One of the options considered for access to the proposed Project was to upgrade the existing road and continue use for mine operations; the alternate, which was chosen, is a new road that avoids the caribou winter range. Use of the existing road would have resulted in less new disturbance but consultation with Aboriginals and regulators indicated concerns about increased disturbance of the northern woodland caribou herd. The Tweedsmuir Herd is provincially of management concern and culturally important to Aboriginals and as a subsistence food source. The proposed new access road will keep mining traffic completely out of the northern caribou winter range thus alleviating Aboriginal and wildlife conservation concerns.

Concerns were expressed by the owners of a ranch on Matthews Creek about the potential of the proposed Project to affect water quality. The Proponent purchased the ranch property intended for wetland restoration and conservation, and fish habitat creation and enhancement. The Project cannot physically affect Matthews Creek because the proposed Project is in a separate drainage. Improving Matthews Creek where it currently passes through the ranch and is impacted by cattle grazing will add substantially to fish habitat.

Vanderhoof has been affected by loss of forest industry jobs in recent years, due in part to mountain pine beetle infestations. The proposed Project will add substantially to the economic and employment base of Vanderhoof and thus improve economic conditions in the region.

During construction and operation of the mine the majority of people working at the site will be bused from Vanderhoof. While less convenient than use of private vehicles, safety on the forest service and mine access roads will be increased and there will be an added benefit of some reduction in greenhouse gases and vehicle exhaust emissions with use of buses.

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2.9 Applicable Permits

This section presents applicable provincial, federal, regional, and municipal licences, permits, and/or approvals required for the construction, operations, closure, and post-closure phases of the proposed Blackwater Gold Project (Project), and the associated responsible regulatory agency and legislation.

2.9.1 Key Federal Permits

The federal Major Projects Management Office (MPMO) coordinates government reviews of project applications for federal approval under the *Canadian Environmental Assessment Act, 2012 (CEAA*, 2012) (Government of Canada, 2012) and for federal permits, and recommends applications for federal permits and authorizations be submitted with the Environmental Impact Statement (EIS). Once the federal Minister of the Environment approves the Project in principle, the Canada Environmental Assessment Agency (Agency) will transfer coordination of federal permitting to ministries responsible for administering federal acts and regulations.

For the Project, federal ministries include Fisheries and Oceans Canada (DFO), Environment Canada (EC), Transport Canada (TC), and Natural Resources Canada (NRCan). The MPMO will continue to oversee the application process and ensure federal responsibilities for timely review and Aboriginal consultation are fulfilled.

The Application for an Environmental Assessment Certificate/Environmental Impact Statement (Application) has been prepared to satisfy the conditions required for streamlining the approvals process for metal mines with tailings impoundment areas (EC, 2012). Following completion of the Environmental Assessment (EA), it is expected that EC, DFO, and TC will jointly determine if the conditions have been met and make recommendations to the Governor in Council regarding the Schedule 2 Amendment of the *Metal Mining Effluent Regulations (MMER)* and a Proclamation of exemption under section 24 of the *Navigation Protection Act* (Government of Canada, 1985).

The preparation of the permitting applications will be completed in parallel with the Application review process such that the critical path provincial bundled permit applications, DFO authorizations, and Navigable Waters exemption (if required) will be filed immediately following provincial and federal ministerial decisions. New Gold Inc. (Proponent) expects that key permits required for initial construction of the Project will be obtained by Q3 2015.

Table 2.9-1 presents a list of expected required permits, licences, authorizations, and certificates under federal regulations. Other approvals may be required depending on Project design.

Table 2.9-1: Potential Federal Permits, Licences, and Authorizations Required for the Project

Enabling Legislation	Authorization or Requirement	Agency	Project Phase			
			C	O	CL	PC
MMER under *Fisheries Act*	Compliance and Reporting	EC	√	√	√	√
Fisheries Act (last amended on 25 November 2013)	Authorizations under section 35(2) – Approval of final Fisheries Mitigation and Offsetting Plan	DFO	√	√	√	
	Authorization under section 36(3) – Schedule 2 Amendment under the *MMER*	DFO and EC		√		
Explosives Act Explosives Regulations	Licence under section 7(1)(a)	NRCan		√		
Explosives Act Ammonium Nitrate and Fuel Oil Order Regulation	Assemble and Blend Ammonium Nitrate & Fuel Oil			√		
Explosives Act Explosives Regulations	Mechanical Ammonium Nitrate & Fuel Oil Certificate			√		
Radio Communication Act	Licence	Industry Canada	√	√	√	
Transportation of Dangerous Goods Act Transportation of Dangerous Goods Regulations(1)	Transportation of Dangerous Goods Permit	TC	√	√	√	
Navigation Protection Act (Amended Navigable Waters Protection Act on 1 April 2014)	Order in Council is required for Proclamation of exemption under section 24 of the *Navigation Protection Act*	TC	√			

Note: (1) The Transportation of Dangerous Goods Permit will be required for any contractor transporting hazardous materials for the Project.
Agency = Canadian Environmental Assessment Agency; *CEAA, 2012* = *Canadian Environmental Assessment Act, 2012;* DFO = Fisheries and Oceans Canada; EC = Environment Canada; *MMER* = *Metal Mining Effluent Regulations;* NRCan = Natural Resources Canada; TC = Transport Canada; Project Phase: C (Construction), O (Operations), CL (Closure), PC (Post-Closure)

2.9.2 Key Provincial Permits

The provincial government will follow the "One P" process for the Project involving combined applications and reviews for all required provincial permits.

The "One P" process envisages that many of the permits required for constructing and operating the Project mine, transmission line, and other associated infrastructure will be applied for at approximately the same time, either in a "bundle" or separately at the discretion of the responsible agency. The referral process will be managed by the British Columbia Ministry of Forests, Lands and Natural Resource Operations (BC MFLNRO) (the coordinating provincial ministry), which will refer all provincial permit applications to other provincial and local

governments, Aboriginal groups, and interested stakeholders. The Proponent will ensure all required permitting level details are included with the Application.

A Mine Development Review Committee (MDRC) will be established prior to completion of the EA to engage in early permit pre-Application discussions (Government of BC, 2013). This advisory committee will review the Application for a *Mines Act* permit and make recommendations to the Chief Inspector within 60 days following application.

The permitting phase will officially start with the submission of the permit applications and after the EA Certificate and Conditions of BC Environmental Assessment Certificate have been provided by the BC Environmental Assessment Office (BC EAO) and other key applicable provincial permitting authorities (Government of BC, 2002a). During the EA review process, key draft permits (e.g., *Mines Act*) will be prepared for review.

Table 2.9-2 presents a list of expected required permits, licences, authorizations, and certificates under provincial regulations. Other approvals may be required depending on Project design.

2.9.3 Key Regional and Municipal Permits

No specific regional permits or licences need to be granted for the Project. Management objectives presented in Land and Resource Management Plans (LRMPs) will be considered for the construction, operations, closure, and post-closure phases of the Project, as described in **Section 2.6**.

No municipal permits are required for the Project.

2.9.4 Concurrent Permitting

The Proponent does not intend to apply for concurrent permitting under the Concurrent Approval Regulation (Government of BC, 2002).

Table 2.9-2: Potential Provincial Permits, Licences, and Authorizations Required for the Project

Statute	Authorization or Requirement	Agency	Project Phase			
			C	O	CL	PC
Environmental Management Act	Effluent Discharge Permit	BC MOE	√	√	√	√
Mines Act section 10	Mine and Reclamation Permit	BC MEM	√	√	√	√
Mineral Tenure Act	Mining Lease	BC MEM	√	√	√	√
Forest Act	Occupant Licence to Cut - section 47.4	BC MFLNRO	√			
Forest Practices Code Act, *Provincial Forest Use Regulations*, *Forest and Range Practice Act*	Special Use Permit	BC MFLNRO	√			
Forest Practices Code Act, *Provincial Forest Use Regulations, Forest and Range Practice Act*	Road Use Permit	BC MFLNRO	√	√	√	
Water Act, Water Regulation	Approval or Notification of "changes in or about a stream" (section 8 / section 9)	BC MFLNRO	√			
Water Act, Water Protection Act	Water Licence	BC MFLNRO	√	√	√	
Heritage Conservation Act	section 14 Inspection Permit	BC MFLNRO	√	√		
Heritage Conservation Act	section 14 Investigative Permit	BC MFLNRO	√	√		
Heritage Conservation Act	section 12 Site Alteration Permit	BC MFLNRO	√	√		
Environmental Management Act	Fuel Storage Permit	BC MOE	√	√	√	√
Environmental Management Act - Hazardous Waste Regulation	Hazardous Waste Registration	BC MOE	√	√	√	
Environmental Management Act	Air Discharge Permit	BC MOE	√	√	√	
Environmental Management Act	Refuse Permit	BC MOE	√	√	√	
Environmental Management Act - Municipal Wastewater Regulation	Sewage System Registration	BC MOE	√	√	√	
Wildfire Act	Burn registration number	BC MFLNRO	√			
Wildlife Act	Section 4 Authorization	BC MFLNRO	√	√		
Wildfire Act, Wildfire Regulation	Forest and Range Protection – Part 1, Authority of Government for Fire Prevention and Fire Control – Part 2	BC MOE	√	√	√	
Transportation Act, Motor Vehicles Act	Access Permit (MOTI-A)	BC MOTI	√	√	√	

Statute	Authorization or Requirement	Agency	Project Phase			
Motor Vehicles Act	Approvals for oversize loads or bulk haul	BC MOTI	√			
Drinking Water Protection Act and Regulation	Construction Permit - Section 2	NHA	√			
Drinking Water Protection Act and Regulation	Operating Permit – Part 2	NHA		√	√	
Health Act	Food Operating Permit (camp)	Northern Health Authority	√	√	√	
Land Act	Investigative Use Permit	BC MFLNRO	√			
Land Act	Part C #38 Lease of Crown Land (Lease of Crown Land subject to the terms and reservations the Minister considers advisable, including an option to purchase the land) Part C #39 Licence of Occupation (Licence to occupy and use Crown land, called a “licence of occupation,” subject to the terms and reservations the Minister considers advisable) Part C #40 Right-of-way and easement: (a) grant or otherwise create a right of way or easement over Crown land, and (b) grant or otherwise create over Crown land, the title to which is not registered under the Land Title Act, an easement without a dominant tenement for any purpose necessary for the operation and maintenance of the grantee's undertaking, including a right to flood.)	BC MFLNRO; BC Safety Authority	√	√		
Mines Act	Explosives Storage and Use Permit	BC MEM	√	√		

Note: BC MEM = British Columbia Ministry of Energy, Mines and Natural Gas and Responsible for Housing; BC MFLNRO = British Columbia Ministry of Forests, Lands and Natural Resource Operations; BC MOE = British Columbia Ministry of Environment; BC MOTI = British Columbia Ministry of Transportation and Infrastructure; FPC = Forest Practices Code; NHA = Northern Health Authority; Project Phase: C (Construction), O (Operations), CL (Closure), PC (Post-Closure)