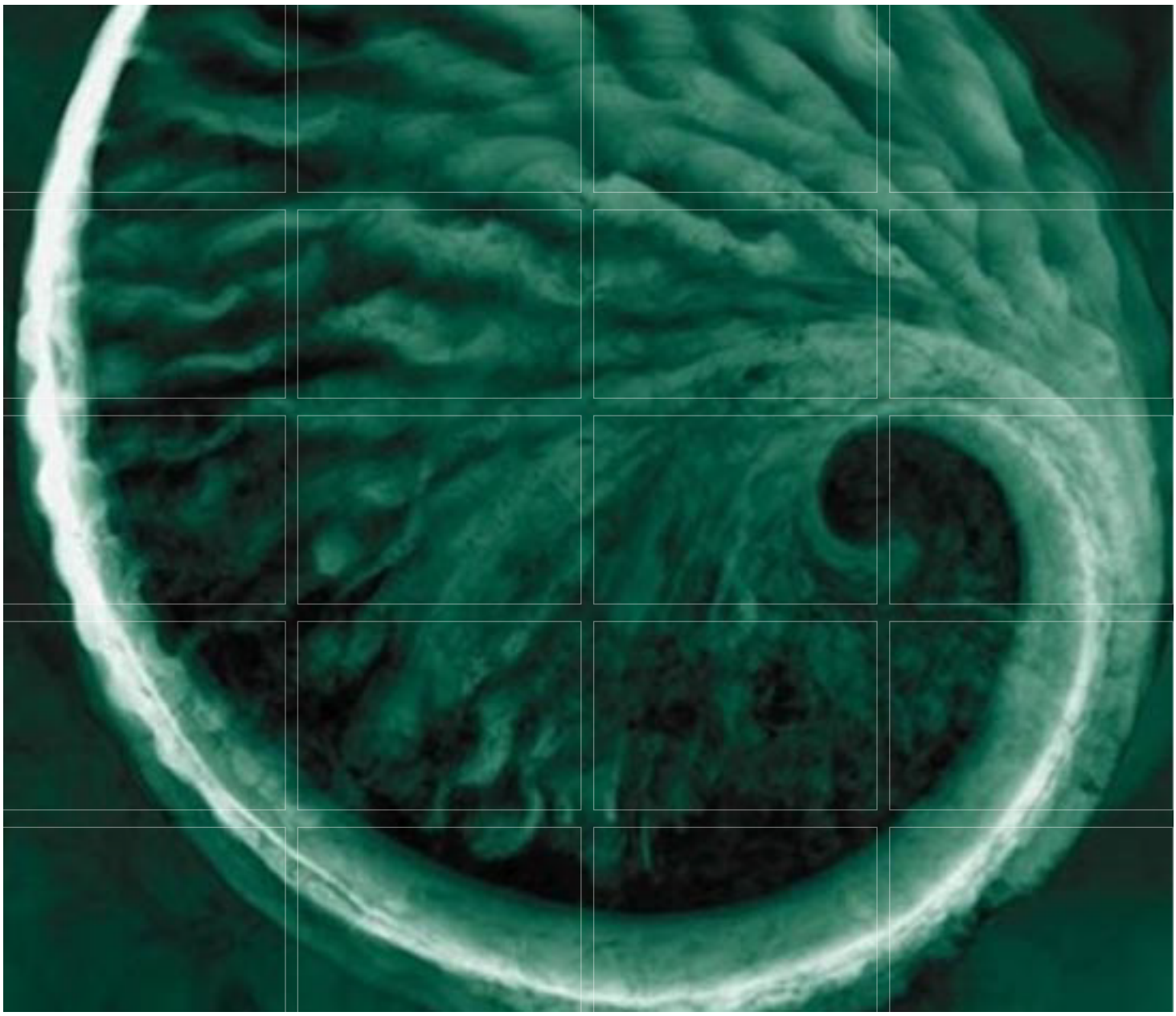


Prepared for:

newgold

BLACKWATER GOLD PROJECT

Assessment of Alternatives for the Blackwater Gold Project Tailings Storage Facility

October 2015

ERM

The world's leading sustainability consultancy

New Gold Inc.

BLACKWATER GOLD PROJECT

Assessment of Alternatives for the Blackwater Gold Project Tailings Storage Facility

October 2015

Project #0215644-0001

Citation:
ERM. 2015. *Blackwater Gold Project: Assessment of Alternatives for the Blackwater Gold Project Tailings Storage Facility*. Prepared for New Gold Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.

ERM
ERM Building, 15th Floor
1111 West Hastings Street
Vancouver, BC
Canada V6E 2J3
T: (604) 689-9460
F: (604) 687-4277

ERM prepared this report for the sole and exclusive benefit of, and use by, New Gold Inc.. Notwithstanding delivery of this report by ERM or New Gold Inc. to any third party, any copy of this report provided to a third party is provided for informational purposes only, without the right to rely upon the report.

EXECUTIVE SUMMARY

BLACKWATER GOLD PROJECT INTRODUCTION

The purpose of this document is to report on the Tailing Storage Facility (TSF) alternatives assessment process undertaken for the Blackwater Gold Project (the Project) proposed by New Gold Inc (New Gold). The Project lies in central BC, approximately 112 km southwest of Vanderhoof and 446 km northeast of Vancouver. The Project is accessible by vehicle from the Kluskus Forest Service Road (FSR), which originates approximately 100 km west of Prince George, and 10 km west of Vanderhoof, off Highway 16 (Yellowhead Highway). At km 146.5 on the Kluskus FSR, an 18 km road, built in 1986 and improved in 2009, provides access to the Project site and exploration camp. The current driving time from Vanderhoof to the Project is approximately 2.5 hours. The area is sparsely inhabited; two ranches, three lodges and Tatelkuz Lake Indian Reserve #28 are found within an approximately 20 km radius of the Project site. Although not connected by road directly to the site, Kluskus Indian Reserve #1 is approximately 22 km to the southeast. Some services are available in Vanderhoof, but Prince George is the regional hub with air service from major centres and is located 165 km from the Project.

CONTEXT OF THE TAILING STORAGE FACILITY ALTERNATIVES ASSESSMENT

Where possible fish-bearing waterbodies are avoided when considering TSF alternative candidates' locations, the challenges of identifying feasible sites near the Mine Area require that fish-bearing waterbodies be considered for TSF placement. In Canada, under the *Fisheries Act* (1985) the capacity to use a natural fish-bearing waterbody as a TSF is only possible through obtaining a regulatory amendment to have the proposed waterbody designated as a tailing impoundment area and listed under Schedule 2 of the Metal Mining Effluent Regulations (MMER; SOR/2002-222).

A project proponent must undergo a predetermined process when considering TSF options that would trigger a Schedule 2 amendment. This process includes: (1) preparing an environmental assessment (EA); (2) preparing a TSF alternatives assessment; (3) preparing a fish habitat offsetting plan for consideration as part of the EA; and (4) participating in public and Aboriginal consultations on the EA, including on the possible amendment to the MMER.

This report focuses on step 2 of this process: preparing a TSF alternatives assessment. To accomplish this, New Gold followed the transparent and standardized process described in the *Guidelines for the Assessment of Alternatives for Mine Waste Disposal* (the *Guidelines*) published by Environment Canada (2011). These *Guidelines* delineate the alternatives assessment process required to identify, assess, evaluate, rank, and select the best overall TSF from the options identified.

Under the recently released *Streamlining the Approvals Process for Metal Mines with Tailings Impoundment Areas* (Environment Canada 2012), a Project's application for a Schedule 2 Amendment to the MMER may be exempted from pre-publication in *Canada Gazette*, Part I, if:

> "1. The environmental assessment considered: public and stakeholder comments on the water body listed; an assessment of alternatives to the proposed TIA, including costs and public comments; consultations on the fish habitat compensation plan; Aboriginal consultation (to meet all obligations that may exist in relation to Aboriginal rights or Treaty rights protected by section 35 of the *Constitution Act* (1982); 2. The federal government has determined, based on the environmental assessment, that, taking into account the implementation of appropriate mitigation measures, the project is not likely to cause significant adverse environmental effects, and 3; Consultations on the MMER amendment … have met the Treasury Board *Guidelines for Effective Regulatory Consultations*".

If a proposed TIA authorization meets the above conditions for exemption, then the authorization may move directly to *Canada Gazette*, Part II.

THE TAILING STORAGE FACILITY ALTERNATIVES ASSESSMENT PROCESS

As described in the *Guidelines* (Environment Canada 2011), the TSF alternatives assessment process involves seven steps to select a TSF site by a process of systematic analysis and elimination.

Step 1: Identify Candidate Alternatives

This step is to identify preliminary TSF candidates near the Mine Area deemed feasible based on basic physiographic and technical threshold criteria. Sites that do not meet these criteria are eliminated at this stage in the process. Step 1 involves the following activities:

i. Identify candidate alternatives for potential TSF site locations;
ii. Establish basic threshold criteria based on topographic/geologic conditions, accessibility, and established technological precedent;
iii. Analyze candidates based on basic threshold criteria;
iv. Eliminate candidates that do not meet threshold criteria; and
v. Deliver summary table and maps of remaining alternatives.

Step 2: Pre-Screening Assessment

In this step the number of candidate alternatives are further narrowed by applying a fatal flaw analysis to eliminate candidate alternatives that are not feasible. Analyzed deficiencies are based on legislative, physiographic, and technical site selection criteria; no values-based criteria are applied as a fatal flaw. Step 2 involves the following activities:

i. Develop a list of project-specific, pre-screening criteria (or fatal flaws, which are characteristics so unfavourable that, if taken singly, would eliminate a site as a candidate);
ii. Conduct a pre-screening evaluation (fatal flaw analysis) of the alternatives remaining from Step 1 using the project-specific site selection criteria;
iii. Eliminate candidates that do not meet the pre-screening selection criteria; and
iv. Deliver a summary table that outlines the selection process.

Step 3: Alternative Characterization

Step 3 identifies and employs a set of descriptive parameters as a basis for further evaluation of the remaining candidates. Step 3 involves the following activities:

i. Develop a list of descriptive parameters (characterization criteria) based on four broad categories (accounts): environmental, technical, socio-economic, and project economic criteria;

ii. Thoroughly characterize remaining alternatives based on characterization criteria; and

iii. Deliver summary tables listing the descriptive characterization criteria for each account.

Step 4: Multiple Accounts Ledger

Step 4 involves systematic evaluation of the characterization criteria developed in Step 3 based on a valuation system developed from professional judgment of relevant experts, as well as consultations with Aboriginal groups, First Nations, local, provincial, and federal government agencies, stakeholders, and New Gold. Step 4 involves the following activities:

i. Develop evaluation criteria (sub-accounts) to help differentiate among the four main characterization criteria identified in Step 3;

ii. Develop indicators (also called measurement criteria or sub-sub-accounts) to allow qualitative/quantitative measurement of the benefit or loss associated (impact) within the sub-accounts for each remaining alternative;

iii. Conduct a multiple accounts evaluation by developing and applying qualitative value scales to analyze the sub-accounts and indicator criteria; and

iv. Deliver summary tables: table of sub-accounts with rationale behind each and an expansion of the sub-accounts table that includes indicators.

A Multiple Accounts Analysis (MAA) is the recommended decision-making tool under the *Guidelines*, and consists of developing a multiple accounts ledger to facilitate evaluation. A multiple accounts ledger is an explicit list of all the impacts associated with each TSF alternative, which generates a clear and measurable description of those impacts.

Step 5: Value-based Decision Process

Step 5 involves a final value-based evaluation to identify the preferred TSF candidate. This is done by scoring and weighting the indicators developed in Step 4, and applying a quantitative analysis to develop weighted merit ratings for each TSF candidate. Step 5 involves the following activities:

i. Develop a qualitative values-based weighting scale for every indicator;

ii. Apply a value-based weighting factor to every indicator and develop a base case from weightings;

iii. Conduct a quantitative analysis to generate weighted merit ratings (MAA); and

iv. Deliver a summary table listing the final candidate value-based weighting, which identifies the best potential TSF candidate.

Step 6: Sensitivity Analysis

Step 6 considers different value systems when weighting accounts, sub-accounts, and indicators. Step 6 involves the following activities:

i. Develop alternate ranking systems based on professional judgment and stakeholder input;

ii. Re-analyze the data using a MAA as presented in Step 5; and

iii. Deliver a summary table of the results.

Step 7: Document Process (Entire Document)

Step 7 involves transparently reporting on the TSF alternatives analysis process using the preceding steps, and consists of the following:

i. Write report documenting all steps undertaken, and their results; and

ii. Deliver report to present Aboriginal Groups, local, provincial, and federal government agencies, and stakeholders for consideration of final TSF site selection.

RESULTS OF THE BLACKWATER GOLD PROJECT TAILINGS STORAGE FACILITY ALTERNATIVES ASSESSMENT

For the Blackwater Gold Project, New Gold followed the *Guidelines* (Environment Canada 2011) as outlined in Steps 1 through 7. The results of this process are as follows:

Step 1: Identify Candidate Alternatives

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 not feasible due to basic topographic, accessibility/cost, and technological 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 & D TSF

Step 2: Pre-Screening Assessment

Of the above eight candidate alternatives for potential TSFs, five potential tailings storage facility alternatives—four individual sites and one combination of two sites—met all the TSF siting pre-screening criteria:

1. Option C
2. Option D
3. Option D/PAG OL
4. Option E
5. Option FS

Step 3: Alternative Characterization

Step 3 identifies and characterizes TSF 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*. 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 in Table 1.

Table 1. Accounts and their Evaluation Criteria

Account	Evaluation Criteria (Sub-Account)	Rationale
Technical	PAG Waste Rock Stored On-Land	Options with less storage of potentially acid generating (PAG) Waste Rock stored on-land are preferred due to less complex water management, and decreased environmental risk
	Tailings Dam Characteristics	Options with less complex or fewer tailings dams characteristic are preferred due to lower engineering and environmental risk
	Supporting Infrastructure	Options with less complex supporting infrastructure are preferred due to lower engineering and environmental risk
	Containment Structure Design	Options with less complex containment structure designs are preferred due to lower engineering and environmental risk
	Water Management System	Options with less complex water management requirements are more preferred because of lower engineering risk, lower costs, potentially greater success at closure, and lower environmental risk
	Construction, Operation and Closure Approaches	Options with higher construction, operation, and closure requirements are generally less desirable from a cost perspective, and may have a higher long-term risk of failure
	Surface Water Quality	Options that have high potential impacts to surface water quality are less desirable due to higher potential effects to the receiving environment and increased requirements for long-term water treatment.

(continued)

Table 1. Accounts and their Evaluation Criteria (completed)

Account	Evaluation Criteria (Sub-Account)	Rationale
Technical *(cont'd)*	Surface Water Quality	Options that have high potential impacts to surface water quality are less desirable due to higher potential effects to the receiving environment and increased requirements for long-term water treatment.
	Hydrology	Options with higher potential impacts to surface water hydrology are less preferable due to the higher associated impacts to the aquatic environment, and the potential increased engineering challenges.
	Hydrogeology	Options with highly complicated hydrogeology (e.g., depth to groundwater) are less preferable due to the increased engineering challenges and risks associated with minimizing impacts to groundwater.
	Climate and Atmosphere	Options that have high potential for fugitive dust or greenhouse gas emissions are less desirable due to higher associated risks to human health, vegetation and wildlife habitat, and global climate change.
	Aquatic Habitat	Options with greater effects to aquatic habitat are less desirable due to the high ecological importance of aquatic habitat and the corresponding riparian ecosystems.
	Fish and Fish Habitat	Options with greater effects to fish and fish habitat are less desirable due to the high ecological, social, and economic importance of fish and fish habitat.
	Wildlife	Options that affect rare ecosystems or high quality habitat for valued or at-risk wildlife species are less desirable due to higher associated costs to biodiversity and traditional use values.
	Vegetation and Ecosystems	Options that affect rare ecosystems or areas of high biodiversity are less desirable due to higher associated costs to biodiversity and traditional use values.
	Terrain and Soils	Options able to use terrain features for containment (e.g., U-shaped valleys) are preferred due to reduced engineering challenges and environmental risk, and lower costs to the Proponent.
Socio-economics	Current Use of Lands and Resources for Traditional Purposes – Ulkatcho First Nation	Current use of lands and resources for traditional purposes may be affected by the location of TSF options.
	Non-Traditional Land and Resource Use	The economic interests of commercial tenure holders may be affected by the location of TSF option.
	Recreational Land Uses	The enjoyment of recreational land users may be affected by the location of TSF options.
	Archaeology	Archaeological sites are protected under the *Heritage Conservation Act* (1996b) and non-protected heritage sites may hold cultural and social value.
Project Economics	Proponent Costs	Options with lower overall costs are more preferred.

The summary tables delivered for this step present the characterization criteria for each site, the rationale for the selection of each criterion, the descriptions corresponding to each criterion, and

whether or not a characterization criterion will be carried forward to the next step—the multiple accounts ledger—as an evaluation criterion (sub-account).

Step 4: Multiple Accounts Ledger

The Blackwater TSF MAA considered factors (accounts) in four primary categories: (1) environmental, (2) technical, (3) socio-economic, and (4) project economics. A multidisciplinary team of technical experts selected evaluation criteria (sub-accounts) and measurement criteria (indicators) under each of the four primary categories (Table 2).

Table 2. Blackwater Tailing Storage Facility Alternatives Analysis Multiple Accounts Ledger

Account	Sub-Account (Evaluation Criteria)	Indicator (Measurement Criteria)
Technical	PAG Waste Rock Stored On-Land	Quality of PAG rock stored on-land
		Quantity of PAG rock stored on-land
		Complexity of containment
	Tailings Dam Characteristics	Distance from deposit
		Complexity of containment
		Maximum TSF embankment heights
		Total TSF embankment volume
		Number of impoundment dams
		Storage efficiency
		Dam foundation conditions
	Supporting Infrastructure	Number of starter dams
		PAG waste rock delivery and placement
		Tailings delivery and placement
		Reclaim pipeline length
	Containment Infrastructure Design	Containment Infrastructure Design
		Ability to handle extreme events
	Water Management System	Complexity of seepage collection
		Potential for long-term water treatment
		Potential for active versus passive water treatment
		Complexity of diversion structures
	Construction, Operation and Closure Approaches	Ease of construction
		Closure requirements
Environmental	Surface Water Quality	Water quality of receiving environment
		Potential for ARD / ML generation (construction material)
		Water quality of pond discharge
	Hydrology	Size of watersheds effected
		Potential catchment loss to toe of TSF
	Hydrogeology	Potential impacts to groundwater quantity and quality
		Seepage management

(continued)

Table 2. Blackwater Tailing Storage Facility Alternatives Analysis Multiple Accounts Ledger (completed)

Account	Sub-Account (Evaluation Criteria)	Indicator (Measurement Criteria)
Environmental *(cont'd)*	Climate and Atmosphere	Climate effects on water management
		Dust emissions
	Fish and Fish Habitat	Extent of permanent alteration to or destruction of fish habitat
		Loss of Fish Habitat
		Downstream Kokanee values
		Downstream Rainbow Trout values
	Wildlife	Presence of species of conservation concern other than grizzly bear, caribou, moose, American marten, myotis bats, western toad, olive-sided flycatcher and red-tailed hawk
		Direct loss or disturbance to grizzly bear habitat
		Direct loss or disturbance to caribou habitat
		Direct loss or disturbance to moose habitat
		Direct loss or disturbance to American marten habitat
		Direct loss or disturbance to myotis spp. habitat
		Direct loss or disturbance to western toad habitat
		Direct loss or disturbance to terrestrial bird habitat
		Direct loss or disturbance to raptor habitat
	Vegetation and Ecosystems	Wetland ecosystems
		Rare and endangered wetland associations
		Riparian ecosystems
		Mature forest ecosystems
	Terrain and Soils	Relief, complexity of topography
		Soil
Socio-Economics	Current Use of Lands and Resources for Traditional Purposes - Ulkatcho First Nation	Use of Cultural/Traditional Sites
	Non-Traditional Land and Resource Use	Guide outfitting tenures
		Agriculture and range tenures
		Trapline tenures
	Recreational Land Uses	Recreational sensitivity
	Archaeology	Effects to known archaeological sites
Project Economics	Proponent Costs	Capital cost
		Operation cost
		Closure cost
		Fish habitat compensation costs

Step 5: Value-based Decision Process

The value-based decision process involves the creation of scoring and weighting scales for all relevant criteria (account, sub-account, and indicators). This value-based ranking methodology was

done in concordance with the *Guidelines* in order to differentiate the benefit or loss associated with each site. The results of the MAA for the Blackwater TSF alternatives assessment is shown in Table 3.

Table 3. Multiple Accounts Analysis Results

	Option C TSF	Option D TSF	Option D/ PAG OL TSF	Option E TSF	Option FS TSF
Base Case	4.0	3.8	2.3	3.7	4.3

The Option FS TSF is the most appropriate TSF alternative, as it resulted in the highest value (4.3) in the Multiple Accounts Analysis.

Step 6: Sensitivity Analysis

A sensitivity analysis was performed for the Blackwater TSF alternatives assessment according to the *Guidelines* (Environment Canada 2011). For the Blackwater TSF MAA, the following sensitivity analyses were performed:

1. all accounts were assigned an equal weighting (i.e., a value of 1);
2. all accounts and sub-accounts are assigned equal weightings (i.e., a value of 1);
3. all accounts, sub-accounts and indicators are assigned equal weighting (i.e., a value of 1);
4. the technical and Project economics accounts are removed from the analysis (i.e., assigned a value of 0);
5. only the environmental account is considered (i.e., all other accounts assigned a value of 0)
6. only the technical account is considered (i.e., all other accounts assigned a value of 0)
7. only the Project economics account is considered (i.e., all other accounts assigned a value of 0).

The result of all the sensitivity analyses runs was that the Option FS TSF alternative remained the most appropriate option for the majority of the analyses (Table 4). The exceptions generally indicate the higher rankings Option C had for socio-economic and Project economic considerations.

Table 4. Results of Sensitivity Analyses

Sensitivity Run	Option C TSF	Option D TSF	Option D/ PAG OL TSF	Option E TSF	Option FS TSF
1 - all accounts given equal weighting	4.4	3.9	2.4	3.6	4.4
2 – all accounts and sub-accounts given equal weighting	4.5	4.0	2.7	3.7	4.3
3 – all accounts, sub-accounts and indicators given equal weightings	4.4	4.1	2.8	4.0	4.6

(continued)

Table 4. Results of Sensitivity Analyses (completed)

Sensitivity Run	Option C TSF	Option D TSF	Option D/ PAG OL TSF	Option E TSF	Option FS TSF
4 – technical and Project economics accounts removed from the analysis	3.9	3.1	2.4	4.0	3.8
5 – only environmental account considered	3.4	4.0	2.8	3.2	4.0
6 – only socio-economic account considered	4.9	1.5	1.6	5.5	3.3
7 – only technical accountconsidered	4.0	5.1	1.7	3.3	5.4
8 – only Project economics account considered	5.3	5.1	3.4	2.3	5.0

Step 7: Document Results

This report documents the TSF alternative assessment process that was undertaken by New Gold for the Blackwater Gold Project, in conjunction with consultation with First Nations, and local, provincial, and federal government agencies.

ACKNOWLEDGEMENTS

ERM would like to acknowledge Knight Piésold Ltd, AMEC Earth and Environmental (AMEC), pHase Geochemistry, and Ferguson Sustainability Engineering for the provision of baseline data summaries, mapping and habitat data, general guidance and feedback, and technical summaries to support this Tailings Storage Facility Alternatives Assessment Report. In particular, the following individuals provided the technical summaries utilized as the basis of this assessment:

- Daniel Fontaine, P.Eng. Senior Engineer, Knight Piésold Ltd
- Bruno Borntraeger, P.Eng., Specialist Engineer, Knight Piésold Ltd

Assessment of Alternatives for the Blackwater Gold Project Tailings Storage Facility

TABLE OF CONTENTS

Executive Summary i

Acknowledgements xi

Table of Contents xiii

List of Figures xvii

List of Tables xviii

List of Appendices xxii

Glossary and Abbreviations xxv

1. Introduction 1-1

1.1 Background and Objectives 1-1

1.2 Project Proponent 1-3

1.3 Project Description and Location 1-3

1.4 Background to TSF Alternatives Assessment 1-7

1.5 Tailings Storage Facility Design Criteria 1-7

1.6 Waste Rock Classification 1-8

1.7 Non-Acid Generating Waste Rock Dump and Low Grade Ore Stockpile Alternatives Assessment 1-9

1.8 Environmental Setting 1-9

1.8.1 General Setting 1-10

1.8.2 Geology and Topography 1-10

1.8.3 Surface Water 1-13

1.8.4 Groundwater 1-19

1.8.5 Geochemistry 1-19

1.8.6 Climate 1-23

1.8.7 Air Quality 1-24

1.8.8 Vegetation 1-25

1.8.9 Terrestrial Wildlife and Habitat 1-25

1.8.10 Aquatic Life and Habitat 1-26

1.8.11 Wetlands 1-36

1.9 Human Environment Setting 1-39
1.9.1 Parks and Protected Areas 1-39
1.9.2 Non-Traditional Land Use 1-40
1.9.3 Heritage 1-40
1.10 Aboriginal Context and Consultation 1-49
1.10.1 Lhoosk'uz Dene Nation 1-50
1.10.2 Ulkatcho First Nation 1-55
1.10.3 Nazko First Nation 1-58
1.10.4 Nadleh Whut'en First Nation 1-58
1.10.5 Saik'uz First Nation 1-60
1.10.6 Skin Tyee Nation 1-62
1.10.7 The Cooperation Agreement Stellat'en First Nation 1-64
1.10.8 Tsilhqot'in National Government 1-66
1.10.9 Métis Nation British Columbia 1-67

2. Environmental Assessment Regulatory Process and Consultation 2-1
2.1 *Fisheries Act* Metal Mining Effluent Regulations 2-4

3. Tailings Storage Facility Selection Process – Multiple Accounts Analysis 3-1

4. Pre-Feasibility Alternatives 4-1
4.1 Candidate Alternatives 4-6
4.1.1 Candidate Options Description 4-29
4.2 Pre-Screening Assessment 4-29
4.2.1 Results of Pre-Screening Assessment 4-30
4.2.1.1 Would the Tailings Storage Facility Preclude Future Exploration or Mining of a Potential Resource? 4-30
4.2.1.2 Is Any Part of the Mine Waste Disposal System Unproven Technology? 4-30
4.2.1.3 Does the Tailings Storage Facility Have Insufficient Capacity for Storage of Tailings Produced during the Entire Proposed Mine Life? 4-32
4.2.1.4 Will the Tailings Storage Facility Result in Negative Life of Project Economics? 4-33
4.2.1.5 Will the Tailings Storage Facility be Located within the Blackwater Watershed? 4-33
4.2.1.6 Will the Tailings Storage Facility be Located in the Ungulate Winter Range? 4-33
4.2.2 Short List of Tailings Management Alternatives that Passed the Pre-Screening Criteria 4-34

5. Alternative Characterization 5-1
5.1 Data Sources for Alternatives Characterization 5-5
5.1.1 Surface Water Quantity 5-6
5.1.2 Surface Water Quality 5-7
5.1.3 Hydrogeology 5-8
5.1.4 Aquatic Habitat 5-8
5.1.4.1 Rare and Endangered Non-Fish Aquatic Organisms 5-8
5.1.5 Fish and Fish Habitat 5-8
5.1.5.1 Extent of Permanent Alteration to or Destruction (PAD) of Fish Habitat 5-9
5.1.5.2 Quality of Fish Habitat Affected by PAD 5-9
5.1.5.3 Number of Fish Species Directly Affected within the TSF Footprint 5-10
5.1.5.4 Presence of Rare and Endangered Fish Species 5-10
5.1.6 Downstream Fisheries Values 5-10
5.1.6.1 Downstream Rainbow Trout Values 5-10
5.1.6.2 Downstream Kokanee 5-11
5.1.6.3 Downstream Mountain Whitefish Values 5-11
5.1.7 Wildlife Habitat 5-12
5.1.8 Vegetation, Ecosystems and Wetlands 5-13
5.1.9 Terrain and Soils 5-13
5.1.10 Socio-economic 5-17
5.1.10.1 Current Use of Lands and Resources for Traditional Purposes 5-18
5.1.10.2 Heritage 5-18
5.1.11 Technical 5-18
5.1.12 Economic 5-18
5.2 Detailed Description of TSF Alternatives 5-18
5.2.1 Option C 5-18
5.2.1.1 Technical Summary of Option C 5-19
5.2.1.2 Environmental Summary of Option C 5-20
5.2.1.3 Socio-Economic Summary of Option C 5-27
5.2.1.4 Project Economics Summary of Option C 5-28
5.2.2 Option D 5-30
5.2.2.1 Technical Summary of Option D 5-30
5.2.2.2 Environmental Summary of Option D 5-31
5.2.2.3 Socio-Economic Summary of Option D 5-38
5.2.2.4 Project Economics Summary of Option D 5-39

5.2.3 Option D/PAG OL 5-41
5.2.3.1 Technical Summary of Option D/PAG OL 5-41
5.2.3.2 Environmental Summary of Option D/PAG OL 5-43
5.2.3.3 Socio-Economic Summary of Option D/PAG OL 5-49
5.2.3.4 Project Economics Summary of Option D/PAG OL 5-50
5.2.4 Option E 5-52
5.2.4.1 Technical Summary of Option E 5-52
5.2.4.2 Environmental Summary of Option E 5-54
5.2.4.3 Socio-Economic Summary of Option E 5-60
5.2.4.4 Project Economics Summary of Option E 5-62
5.2.5 Option FS 5-62
5.2.5.1 Technical Summary of Option FS 5-62
5.2.5.2 Environmental Summary of Option FS 5-64
5.2.5.3 Socio-Economic Summary of Option FS 5-71
5.2.5.4 Project Economics Summary of Option FS 5-71
5.3 Characterization Summary Tables 5-73
6. Multiple Accounts Ledger 6-1
6.1 Sub-Accounts (Evaluation Criteria) 6-1
6.2 Measurement Criteria (Indicators) 6-3
6.2.1 Technical Indicator Quantitative Value Scales 6-4
6.2.2 Environmental Indicator Quantitative Value Scales 6-4
6.2.3 Socio-Economic Indicator Quantitative Value Scales 6-4
6.2.4 Project Economic Indicator Quantitative Value Scales 6-4
7. Value-based Decision Process 7-1
7.1 Indicator Weighting 7-1
7.1.1 Technical Indicators 7-1
7.1.2 Environmental Indicators 7-4
7.1.3 Socio-Economic Indicators 7-7
7.1.4 Project Economics Indicators 7-8
7.2 Sub-Account Weighting 7-9
7.3 Account Weighting 7-11
7.4 Quantitative Analysis 7-11
8. Sensitivity Analysis 8-1
9. Conclusion 9-1
References R-1

LIST OF FIGURES

Figure 1.1-1. Environment Canada Guidelines for the Assessment of Alternatives for Mine Waste Disposal Flowchart....1-2

Figure 1.3-1. General Location of the Blackwater Gold Project....1-4

Figure 1.8-1. Blackwater Gold Project: Topographic Relief....1-11

Figure 1.8-2. Blackwater Gold Project: Watershed Boundaries and Major Waterbodies....1-15

Figure 1.8-3. Blackwater Gold Project: Location of Hydrometric and Surface Water Quality Monitoring Stations....1-17

Figure 1.8-4. Blackwater Gold Project: Vegetation Local and Regional Study Areas and Locations of Identified Species of Conservation Concern....1-27

Figure 1.8-5. Blackwater Gold Project: Terrestrial Ecology Local and Regional Study Areas....1-29

Figure 1.8-6. Blackwater Gold Project: Aquatics Local and Regional Study Areas, Fish Species Distribution, and Identified Aquatic Species of Conservation Concern....1-31

Figure 1.8-7. Blackwater Gold Project: Wetlands Mine Site, Local, and Regional Study Areas and Wetlands Resources....1-37

Figure 1.9-1. Blackwater Gold Project: Socio-Economic Setting....1-41

Figure 1.9-2. Blackwater Gold Project: Guide Outfitter and Trapline Tenures....1-43

Figure 1.9-3. Blackwater Gold Project: Range Tenures and Recreational Sensitivity and Significance Ratings....1-45

Figure 1.9-4. Blackwater Gold Project: Mineral Tenures....1-47

Figure 1.10-1. Blackwater Gold Project: Aboriginal Setting....1-51

Figure 4-1. Pre-Feasibility Alternatives Step....4-1

Figure 4-2. Blackwater Gold Project: Potential Dry-Stack Locations....4-3

Figure 4.1-1. Blackwater Gold Project: Tailings Storage Facility Candidate Alternatives....4-13

Figure 4.1-2. Detailed View of Option A Tailings Storage Facility....4-15

Figure 4.1-3. Detailed View of Option B Tailings Storage Facility....4-17

Figure 4.1-4. Detailed View of Option C Tailings Storage Facility....4-19

Figure 4.1-5. Detailed View of Option D Tailings Storage Facility....4-21

Figure 4.1-6. Detailed View of Option D – Potentially Acid Generating On-Land Dump Tailings Storage Facility....4-23

Figure 4.1-7. Detailed View of Option E Tailings Storage Facility....4-25

Figure 4.1-8. Detailed View of Option Feasibility Study Tailings Storage Facility....4-27

Figure 4.2-1. Pre-Screening Assessment Step....4-29

Figure 5-1. Alternative Characterization Step....5-1

Figure 5.1-1. Soil Map Unit and Productivity Class Distribution within the Entire TSF Option Area....5-15

Figure 6-1. Multiple Accounts Ledger Step....6-1

Figure 7-1. Value-based Decision Process Step....7-1

Figure 8-1. Value-based Decision Process Step....8-1

LIST OF TABLES

Table 1. Accounts and their Evaluation Criteria....v

Table 2. Blackwater Tailing Storage Facility Alternatives Analysis Multiple Accounts Ledger....vii

Table 3. Multiple Accounts Analysis Results....ix

Table 4. Results of Sensitivity Analyses....ix

Table 1.6-1. Median Neutralization Potential Ratios and Metals for Waste Rock (Acid-Base Accounting Database)....1-9

Table 1.8-1. Summary of Characterization Program....1-20

Table 1.8-2. Acid Rock Classification of Project Samples....1-21

Table 1.8-3. Background Concentrations for Criteria Air Contaminants....1-24

Table 1.8-4. Biogeoclimatic Variants Identified within the Project Vegetation Local Study Area....1-25

Table 1.8-5. Wildlife Species of Conservation Concern Recorded within the Project Mine Site Terrestrial Ecology Local and Regional Study Areas....1-33

Table 1.10-1. Lhoosk'uz Dene Nation Aboriginal Rights and Interests....1-53

Table 1.10-2. Ulkatcho First Nation Aboriginal Rights and Interests....1-56

Table 2-1. Community Consultations General Blackwater Gold Project Concerns....2-3

Table 4.1-1. Initially Considered Tailings Storage Facility Candidate Alternatives....4-7

Table 4.2-1. Pre-Screening Assessment for Blackwater Tailings Storage Facility Candidate Alternatives....4-31

Table 4.2-2. Proposed Tailings Storage Facility Locations and their Respective Capacity Limitations....4-32

Table 5-1. Valued Components for the Blackwater Gold Project....5-2

Table 5.1-1. Criteria for Rating Habitat Quality for Salmonids in Streams....5-9

Table 5.1-2. Soil Productivity Ratings (Site Index Values) 5-14

Table 5.1-3. Extent (ha) of Soil Type (SMU) and Range of Productivity within the Entire TSF Option Areas....5-14

Table 5.1-4. Summary of Estimated Soil/Site Productivity Class Extent (ha) and Percentages (%) within the Entire TSF Option Area and Individual TSF Option Areas 5-17

Table 5.1-5. Summary of Extent of Estimated Soil Productivity Class within Each TSF Option Area....5-17

Table 5.2-1. Potential Changes to Surface Water Hydrology for Option C TSF....5-21

Table 5.2-2. Rainbow Trout Values Downstream of Option C TSF 5-23

Table 5.2-3. Kokanee Values Downstream of Option C TSF....5-24

Table 5.2-4. Wildlife Implications of Option C TSF....5-25

Table 5.2-5. Amounts of High Value Habitat from Habitat Suitability Mapping for Grizzly Bear Affected by the Option C TSF, with and without 100 m Buffer....5-26

Table 5.2-6. Amounts of High Value Habitat from Habitat Suitability Mapping for Caribou Affected by the Option C TSF, with and without 100 m Buffer 5-26

Table 5.2-7. Amounts of High Value Habitat from Habitat Suitability Mapping for Moose Affected by the Option C TSF, with and without 100 m Buffer 5-26

Table 5.2-8. Amounts of High Value Habitat from Habitat Suitability Mapping for Marten, Myotis, Western Toad, Birds, and Raptors Affected by the Option C TSF, with and without 100 m Buffer 5-26

Table 5.2-9. Potential Effects of Option C on Aboriginal Current Use of Lands and Resources for Traditional Purposes....5-29

Table 5.2-10. Potential Changes to Surface Water Hydrology for Option D TSF 5-32

Table 5.2-11. Rainbow Trout Values Downstream of Option D TSF 5-34

Table 5.2-12. Kokanee Values Downstream of Option D TSF 5-35

Table 5.2-13. Wildlife Implications of Option D TSF 5-36

Table 5.2-14. Amounts of High Value Habitat from Habitat Suitability Mapping for Grizzly Bear Affected by the Option D TSF, with and without 100 m Buffer 5-37

Table 5.2-15. Amounts of High Value Habitat from Habitat Suitability Mapping for Caribou Affected by the Option D TSF, with and without 100 m Buffer 5-37

Table 5.2-16. Amounts of High Value Habitat from Habitat Suitability Mapping for Moose Affected by the Option D TSF, with and without 100 m Buffer 5-37

Table 5.2-17. Amounts of High Value Habitat from Habitat Suitability Mapping for Marten, Myotis, Western Toad, Birds, and Raptors Affected by the Option D TSF, with and without 100 m Buffer 5-37

Table 5.2-18. Potential Effects of Option D on Aboriginal Current Use of Lands and Resources for Traditional Purposes....5-40

Table 5.2-19. Potential Changes to Surface Water Hydrology for Option D/PAG OL TSF....5-43

Table 5.2-20. Rainbow Trout Values Downstream of Option D/PAG OL TSF....5-45

Table 5.2-21. Kokanee Values Downstream of Option D/PAG OL TSF....5-46

Table 5.2-22. Wildlife Implications of Option D/PAG OL TSF....5-47

Table 5.2-23. Amounts of High Value Habitat from Habitat Suitability Mapping for Grizzly Bear Affected by the Option D/PAG OL TSF, with and without 100 m Buffer....5-48

Table 5.2-24. Amounts of High Value Habitat from Habitat Suitability Mapping for Caribou Affected by the Option D/PAG OL TSF, with and without 100 m Buffer....5-48

Table 5.2-25. Amounts of High Value Habitat from Habitat Suitability Mapping for Moose Affected by the Option D/PAG OL TSF, with and without 100 m Buffer....5-48

Table 5.2-26. Amounts of High Value Habitat from Habitat Suitability Mapping for Western Toad, Marten, and Myotis Affected by the Option D/PAG OL TSF, with and without 100 m Buffer....5-48

Table 5.2-27. Potential Effects of Option D/PAG OL on Aboriginal Current Use of Lands and Resources for Traditional Purposes....5-51

Table 5.2-28. Potential Changes to Surface Water Hydrology for Option E TSF....5-54

Table 5.2-29. Rainbow Trout Values Downstream of Option E TSF....5-56

Table 5.2-30. Kokanee Values Downstream of Option E TSF....5-57

Table 5.2-31. Wildlife Implications of Option E TSF....5-58

Table 5.2-32. Amounts of High Value Habitat from Habitat Suitability Mapping for Grizzly Bear Affected by the Option E TSF, with and without 100 m Buffer....5-58

Table 5.2-33. Amounts of High Value Habitat from Habitat Suitability Mapping for Caribou Affected by the Option E TSF, with and without 100 m Buffer....5-58

Table 5.2-34. Amounts of High Value Habitat from Habitat Suitability Mapping for Moose Affected by the Option E TSF, with and without 100 m Buffer....5-59

Table 5.2-35. Amounts of High Value Habitat from Habitat Suitability Mapping for Marten, Myotis, Western Toad, Birds, and Raptors Affected by the Option E TSF, with and without 100 m Buffer....5-59

Table 5.2-36. Potential Effects of Option E on Aboriginal Current Use of Lands and Resources for Traditional Purposes....5-61

Table 5.2-37. Potential Changes to Surface Water Hydrology for Option FS TSF....5-64

Table 5.2-38. Rainbow Trout Values Downstream of Option FS TSF....5-66

Table 5.2-39. Kokanee Values Downstream of Option FS TSF....5-67

Table 5.2-40. Wildlife Implications of Option FS TSF....5-69

Table 5.2-41. Amounts of High Value Habitat from Habitat Suitability Mapping for Grizzly Bear Affected by the Option FS TSF, with and without 100 m Buffer....5-69

Table 5.2-42. Amounts of High Value Habitat from Habitat Suitability Mapping for Caribou Affected by the Option FS TSF, with and without 100 m Buffer....5-69

Table 5.2-43. Amounts of High Value Habitat from Habitat Suitability Mapping for Moose Affected by the Option FS TSF, with and without 100 m Buffer....5-70

Table 5.2-44. Amounts of High Value Habitat from Habitat Suitability Mapping for Western Toad, Marten, and Myotis Affected by the Option FS TSF, with and without 100 m Buffer....5-70

Table 5.2-45. Potential Effects of Option FS on Aboriginal Current Use of Lands and Resources for Traditional Purposes....5-72

Table 5.3-1. Technical Characterization Criteria Summary....5-75

Table 5.3-2. Environmental Characterization Criteria Summary....5-85

Table 5.3-3. Socio-Economic Characterization Criteria Summary....5-101

Table 5.3-4. Project Economic Characterization Criteria Summary....5-107

Table 6.1-1. Evaluation Criteria (Sub-Account) and Supporting Rationale for their Selection....6-2

Table 6.2-1. Multiple Accounts Ledger....6-5

Table 6.2-2. Quantitative Value Scales for Technical Indicators....6-8

Table 6.2-3. Quantitative Value Scales for Environmental Indicators....6-16

Table 6.2-4. Quantitative Value Scales for Socio-Economic Indicators....6-26

Table 6.2-5. Quantitative Value Scales for Project Economics Indicators....6-28

Table 7.1-1. PAG Waste Rock Stored On-Land Indicator Weighting....7-2

Table 7.1-2. Tailings Dam Characteristics Indicator Weighting....7-2

Table 7.1-3. Supporting Infrastructure Indicator Weighting....7-3

Table 7.1-4. Containment Infrastructure Design Indicator Weighting....7-3

Table 7.1-5. Water Management System Indicator Weighting 7-4

Table 7.1-6. Construction, Operation, and Closure Approaches Indicator Weighting 7-4

Table 7.1-7. Surface Water Quality Indicator Weighting....7-5

Table 7.1-8. Hydrology Indicator Weighting 7-5

Table 7.1-9. Climate and Atmosphere Indicator Weighting 7-5

Table 7.1-10. Fish and Fish Habitat Indicator Weighting....7-6

Table 7.1-11. Wildlife Indicator Weighting 7-6

Table 7.1-12. Vegetation and Ecosystems Indicator Weighting....7-7

Table 7.1-13. Terrain and Soils Indicator Weighting....7-7

Table 7.1-14. Current Use of Lands and Resources for Traditional Purposes – Lhoosk'uz Dene Nation Indicator Weighting....7-8

Table 7.1-15. Current Use of Lands and Resources for Traditional Purposes – Ulkatcho First Nation Indicator Weighting....7-8

Table 7.1-16. Non-Traditional Land and Resource Use Indicator Weighting 7-8

Table 7.1-17. Estimated Costs Indicator Weighting 7-9

Table 7.2-1. Technical Sub-Account Weighting 7-9

Table 7.2-2. Environmental Sub-Account Weighting....7-10

Table 7.2-3. Socio-economic Sub-Account Weighting....7-10

Table 7.3-1. Account Weighting for Base-case Value Scenarios 7-11

Table 7.4-1. Multiple Accounts Analysis Results 7-11

Table 8-1. Results of Sensitivity Analyses 8-2

LIST OF APPENDICES

Appendix A. Calculation Tables

Appendix B. Guidelines for the Assessment of Alternatives for Mine Waste Disposal

Appendix C. Blackwater Gold Project: TSF Multiple Accounts Analysis – Design Alternatives Information

Appendix D. Blackwater Gold Project: Non-Acid Generating Waste Rock Disposal Alternatives Assessment

Appendix E. Blackwater Gold Project: Low Grade Ore Stockpile Alternatives Assessment

Appendix F. Blackwater Gold Project: Notice under Section 79(1) of the *Species at Risk Act*

Appendix G. Poster: Alternatives Considered for Mine Waste Management

Appendix H. Project Consultation History Relating to Mine Waste

GLOSSARY AND ABBREVIATIONS

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

AA	Alternatives assessment
Account	One of four broad categories: Environmental, Technical, Socio-Economic, and Economic
Alluvium	Sediment deposited by flowing water
AIA	Archaeological impact assessment
Alternatives characterization	The thorough characterization of the short-listed TSF candidate alternatives. Site-specific characterization criteria should be developed for each project, but should be developed within four Accounts: Environmental, Technical, Economic, and Socio-Economic. Characterization criteria should be designed to provide a factual, objective basis for comparison among the remaining alternatives.
ARD	Acid rock drainage
ALSA	Aquatic local study area
ARSA	Aquatic regional study area
Basal till	Dense deposit of low permeability, strong glacial sediments compressed by weight of glacier
BC	British Columbia
BCFWG	British Columbia Guidelines for the Protection of Fresh Water Aquatic Life
BC MOE	British Columbia Ministry of Environment
Biogeoclimatic Ecosystems Classification (BEC)	A classification system that groups BC's ecosystems using three levels of integration: regional, local, and chronological. The system incorporates vegetation, soils, and topography to classify ecosystems in a hierarchical manner. The Project is located within the Interior Cedar Hemlock (ICH), Boreal Altai Fescue Alpine (BAFA), and Engelmann Spruce - Subalpine Fir (ESSF) BEC zones.
Blue-list(ed)	A provincial conservation status ranking for BC species and ecosystems. The blue list includes any ecological community, and indigenous species and subspecies considered to be of special concern (formerly vulnerable) in British Columbia.
Bog	A peat landform, the surface of which is raised or level with the surrounding terrain, and is virtually unaffected by runoff waters or groundwaters from the surrounding mineral soils.

bgs	Below ground surface
BMP	Best management practices
Bt	Metric billion tonnes
CAC	Criteria air contaminants
Catchment	An extent or area of land where surface water from rain and melting snow or ice converges to a single point
CCTC	Carrier-Chilcotin Tribal Council
Characterization Criteria	Criteria used to describe and compare short-listed TSF alternatives. These criteria are project-dependent, and when selecting them it may be useful to pose the following question: "What would be reasonable questions that an Aboriginal group, Treaty First Nation, stakeholder, regulator, or technical reviewer might ask about any of the proposed mine waste disposal alternatives?"
Characterization Criteria Summary Table	A deliverable according to the Environment Canada *Guidelines* (2011), which should ideally be a series of summary tables that list the selected characterization criteria for each account for each of the alternatives under consideration.
Climate	Long-term statistical trends of temperature, precipitation, humidity, atmospheric pressure, wind, atmospheric particle count, etc.
Colluvium	Material that has been mobilized downslope chiefly by gravity
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CMT	Culturally modified tree
CSTC	Carrier Sekani Tribal Council
Cut-off Wall	Excavation in foundation filled with low permeability material to reduce seepage.
Debris flow	Torrent of sediment, woody material, and mud mobilized by water
Deleterious substance	Under the federal *Fisheries Act* (1985), a deleterious substance is defined as a substance that alters or degrades water quality to the point where it becomes harmful to fish, fish habitat, or human use of fish.
Dry stacking	Dewatering tailings to higher degrees than paste produces a filtered wet (saturated) and dry (unsaturated) cake that cannot be transported by pipeline due to its low moisture content. These filtered tailings are normally transported by conveyor or truck, deposited, spread and compacted to form an unsaturated tailings deposit.
Ecosystem	A community of organisms, interacting with one another, plus the environment in which they live and with which they interact.
EC	Environment Canada

Environmental Characterization	This account describes the local and regional environment surrounding each proposed TSF. Elements such as climate, geology, hydrology, hydrogeology, water quality, and potential effects on fish and wildlife are considered.
Evaluation criteria	See *Sub-Account*
Fatal flaw	A site characteristic that is so unfavourable or severe that, if taken singly, it would eliminate that site as a TSF alternative.
Feasible	Constructible and operable within precedents of existing designs and prudent engineering practice guidelines, considering technical, risk, and economic factors.
Fish	"includes parts of fish, shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals." (federal Fisheries Act [1985] s.2).
Fish habitat	Spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes (federal Fisheries Act [1985] s.34[1]).
Fisheries Act	In Canada, the *Fisheries Act* (1985) applies to any development project with potential impacts to a natural body of water frequented by fish, and prohibits the deposit of any deleterious substance into natural fish-bearing bodies of water.
Flotation	Process for removing sulphides and other minerals
Fluvial	Sediment deposited by river in an alluvial setting
Freeboard	The height of the dam crest above the water or tailing surface
Geohazard	Hazardous effect of setting on a project – avalanche, landslides, floods
the *Guidelines*	*Guidelines for the Assessment of Alternatives for Mine Waste Disposal*, published by Environment Canada (2011)
Groundwater	Water that collects or flows beneath the Earth's surface, filling the porous spaces in soil, sediment, and rocks
Groundwater discharge zone	Refers to the area where groundwater discharges, it is generally located in higher elevations
Groundwater recharge zone	Refers to the area where groundwater receives recharge, it is generally located in lower elevations and valley bases
ha	Hectare or 10,000 m^2

Habitat quality for wildlife	In British Columbia, habitat quality for wildlife is rated according to a provincial benchmark. The benchmark is the highest capability habitat for the species in the province – all other habitats in the province are rated against the benchmark. The benchmark is an actual location in the province that has been identified as providing the best quality food/shelter/cover/etc., for the species – there are different benchmarks for different seasons, even for the same species. The highest quality winter habitat for moose is not in the same location as the highest quality summer habitat. The benchmark takes into consideration what the species' particular needs are for the season – denning, growing, hibernation, predator escape, etc. (RIC 1999). **High quality habitat** – A value assigned to habitat that, in its current condition, provides the best attributes and conditions (e.g., vegetation types, terrain, climate, forest age) for the species for a particular season and life requisite. This value is rated against a provincial benchmark.
Habitat suitability mapping	Habitat suitability mapping is based on provincial standards for TEM, which is determined through desk-based mapping and field surveys, and complies with RISC standards.
Hydrology	The movement, distribution, and quality of water
Immediate receiving environment	Streams that would receive discharge from a TSF
Indicator	To allow qualitative or quantitative measurement of the impact (i.e., benefit or loss) associated with each alternative for any given sub-account, the sub-account needs to be measurable. Sub-Accounts by nature are often not directly measurable, and need to be sufficiently decomposed to allow measurability. This decomposition takes the form of sub-sub-accounts, which in the language of MAA are called indicator, or measurement criteria.
IR	Indian Reserve
IRR	Internal Rate of Return
km	Kilometre(s)
Lacustrine	Soft, weak, silty to clayey sediments deposited in lakes
LGO	Low Grade Ore
Lithic	Stone
LDN	Lhoosk'uz Dene Nation
LPS	Low-permeability subgrade
LRMP	Land and Resource Management Plan – provincially approved plans that provide broad direction for the sustainable use of Crown land and resources in British Columbia.

MAA	Multiple Accounts Analysis – one of the tools that have been successfully used to conduct assessments of alternatives for mine waste disposal and other mining-related decision processes. MAA consists of the development of a multiple accounts ledger, which is an explicit list of accounts (and sub-accounts) of the impacts from various alternatives and for each account indicator, which gives a clear understandable measurable description of those impacts. This is followed by a value-based decision process whereby indicator values are scored and weighted in a systematic, transparent manner such that the value basis for the effects impacting them is readily apparent.
m	Metre(s)
masl	Metres above sea level
Marsh	A wetland that has shallow water, and has levels that usually fluctuate daily, seasonally or annually due to tides, flooding, evapotranspiration, groundwater recharge, or seepage losses.
Mass wasting	Erosion by loss of material from a slope by rock fall or sediment loss
MAL	Multiple Accounts Ledger – a decision-making tool that seeks to identify those elements that differentiate alternatives, and provides the basis for scoring and weighting the TSF alternatives. The multiple accounts ledger consists of sub-accounts and their corresponding indicators.
Measurement criteria	See *Indicator*
Mine Area	The area surrounding the Project's open pit , tailings storage area, plant site, waste rock dumps, low grade stockpiles and other associated infrastructure.
ML	Metals leaching
Mid-field receiving environment	The receiving environment downstream of a TSF that receives inputs from other tributaries as well as the stream receiving TSF discharge.
Mm^3	Million cubic metres
MMER	Metal Mining Effluent Regulations (SOR/2002-222). The MMER currently apply to approximately 80 metal mines across Canada. The MMER impose limits on the releases of arsenic, copper, cyanide, lead, nickel, zinc, radium-226 and total suspended solids, and prohibit the discharge into water bodies of effluent that is acutely lethal to fish. The MMER also include provisions to designate natural fish-bearing waters as TSFs, because at some sites the disposal of mine waste in natural water bodies may be the preferred disposal option for improved pollution prevention and reduction of long-term environmental risks. Under the MMER, the use of a natural body of water frequented by fish as a TSF is only possible by obtaining a Schedule 2 amendment.
MNBC	Métis Nation British Columbia
Moraine	Glacial deposit of loose sand and gravel

NAG	Non-acid-generating
NWFN	Nadleh Whut'en First Nation
New Gold	New Gold Inc.
NFN	Nazko First Nation
NP	Neutralization potential
NPR	Neutralization potential ratio
NPV	Net present value
PAD	permanent alteration to, or destruction of fish habitat, Section 35.2 of the *Fisheries Act* (1985)
PAG	Potentially acid-generating
Paste tailing	Tailings that have been significantly dewatered to a point where they do not have a critical flow velocity when pumped, and do not segregate as they deposit; also known as thickened tailing.
Permeability	A measure of hydraulic conductivity of soil or rock. High permeability allows movement of groundwater, low permeability prevents movement.
PGA	Peak ground acceleration
The Project	The Blackwater Gold Project
Project economic characterization	The account describes the life of project economics. All aspects of the mine waste management plan are considered including investigation, design, construction (inclusive of borrow development and royalties where applicable), operation, closure, post-closure care and maintenance, water management, associated infrastructure (including transport and deposition systems), compensation payments, and land use or lease fees.
PMF	Probable maximum flood
ppm	Parts per million
Pre-Screening assessment	This entails screening the list of TSF candidate alternatives to create an appropriate and manageable set of sufficiently detailed alternatives. The assessment involves excluding alternatives that do not meet unique minimum specifications, which have been developed for the Project. This process is also referred to as a "fatal-flaw analysis."
Red-list(ed)	A provincial conservation status ranking for BC species and ecosystems. The red list includes any ecological community, and indigenous species and subspecies that is extirpated, endangered, or threatened in British Columbia.
Return period	Time for an event of a given magnitude to statistically re-occur. For example, a 1-in-200-year flood occurs on average at 200-year intervals but may occur at any time.

Richfield	Richfield Ventures Corp.
Riparian habitat	Habitat occurring along margins of waterbodies. These are characterized by water-adapted vegetation and are often areas of high biodiversity value.
SARA	*Species At Risk Act* (2002d)
Schedule 2 Amendment	The use of a natural body of water frequented by fish as a TSF is only possible by obtaining a *Schedule 2* amendment under the MMER (SOR/2002-222).
SFN	Saik'uz First Nation
STN	Skin Tyee Nation
SMU	Soil mapping unit
StFN	Stellat'en First Nation
Socio-Economic characterization	This account describes how each proposed TSF may influence local and regional land users. Elements considered include characterization and valuation of land use, cultural significance, presence of archaeological sites, and employment and/or training opportunities.
Scoring	In an MAA, scoring is done by developing qualitative value scales for every indicator, including those that appear to be readily measurable.
Section 11 Order	It is an order issued by the BC EAO in accordance with Section 11 of the BC *Environmental Assessment Act* (2002a). The Order establishes the scope, procedures, and methods for undertaking the environmental assessment.
Sensitivity analysis	The alternatives assessment and subsequent value-based decision-making process described in the *Guidelines* (Environment Canada 2011) is specifically tailored to be transparent, and to the extent practicable eliminate bias and subjectivity. However, the reality is that any decision-making process is subject to bias and subjectivity, and the goal is to manage that bias and subjectivity to the point where an external reviewer would agree that the decision is justifiable and reasonable, irrespective of their own value system. The way to test the sensitivity of the value-based decision-making process is to assign different weightings to those indicators, sub-accounts, and accounts according to a range of value systems representative of the perceived disparity.
Slurry	A mixture of fine particles and water
Sub-Account	Created using the characterization criteria developed for each account. The characterization criteria is factual and has been developed with no a priori judgements regarding any of the alternatives being considered, while sub-accounts consider only the material impact (i.e., benefit or loss) associated with any of the alternatives being evaluated. Also referred to as evaluation criteria.

Subaqueous storage	Underwater storage of tailing; saturated storage
TDS	Total dissolved solids
TELSA	Terrestrial ecology local study area
TERSA	Terrestrial ecology regional study area
Till	Sediments deposited by glaciers, typically chaotically mixed clay, sand, silt and gravel.
Technical Characterization	This account describes the engineered elements of each alternative such as storage capacity, dam size and volume, diversion channel size and capacity, dumping techniques, haul distances, seepage dam requirements, tailing discharge methods, pipeline grades and routes, closure design, discharge and/or water treatment infrastructure and supporting infrastructure such as access roads.
Tenure	Any interest in Crown land that is granted or otherwise established under a prescribed instrument; or a prescribed designation or other status that, under an enactment, is given to, conferred on, or made or otherwise established in relation to Crown land (BC *Land Act* (Keeley E.R., Slaney P.A., and D. Zaldokas 1996)).
TEM	Terrestrial Ecosystem Mapping - Ecosystem mapping is the stratification of a landscape into map units, according to a combination of ecological features, primarily climate, physiography, surficial material, bedrock geology, soil, and vegetation. It is a methodology that requires direct air photo interpretation of ecosystem attributes by a mapper(s). This approach is typically used at larger scales where detailed information is required.
Threatened	COSEWIC ranking; a species that is likely to become endangered if limiting factors are not reversed.
TLUOS	Traditional Land Use and Occupancy Study
TLUS	Traditional Land Use and Ecological Knowledge
TSF	Tailing Storage Facility
Tpd	Tonnes per day
TK/TLU	Traditional Knowledge and Traditional Land Use
Threshold criteria	A basic set of criteria that are used to establish the regional boundaries for selecting TSF candidate alternatives under an MAA. These criteria should be as broad as possible and must be fully described and rationalized to ensure transparency. These criteria are project-dependent.
Value-based decision process	This process entails taking the list of accounts, sub-accounts, and indicators and assessing the combined impacts for each of the alternatives under review. This entails scoring and weighting of all indicators, sub-accounts, and accounts and quantitatively determining merit ratings for each alternative.

Undiverted catchment	The total amount of water reporting to a TSF; or the total catchment area of a TSF less the water diverted around the TSF.
UFN	Ulkatcho First Nation
UWR	Ungulate Winter Range; defined as an area that contains habitat that is necessary to meet the winter habitat requirements of an ungulate species. Formal legal establishment of UWR and associated objectives began under the Forest Practices Code and continue under the *Forest and Range Practices Act* (2002b).
VLSA	Vegetation local study area
VRSA	Vegetation regional study area
Weighting	Involves comparing indicators, sub-accounts ,and accounts among TSF alternatives by introducing value bias by applying a weighting factor to each indicator, sub-account, or account. Weighting factors allow the analyst to assign relative importance from one criterion as compared to another. The Environment Canada (2011) *Guidelines* recommend using a weighting range from 1 to 6.
Wetland	Land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation, and various kinds of biological activity, which are adapted to a wet environment (National Wetlands Working Group 1988)
Wetland Function	The processes or series of processes a wetland carries out such as its ability to regulate water levels to attenuate flow, filter water to improve water quality, and provide aquatic and terrestrial habitat for aquatic and semi-aquatic species.
WOL	Whole Ore Leach mineral processing method
WLSA	Wetland local study area
WRSA	Wetland regional study area

1. INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

New Gold Inc. (New Gold) is proposing to develop the proposed Blackwater Gold Project (the Project) in north central British Columbia (BC), approximately 160 kilometers (km) southwest of Prince George, 446 km northeast of Vancouver, and 110 km (straight-line) southwest of Vanderhoof (Figure 1.1-1). The mine site is centred at 53° 11' 22.872"N 124° 52' 0.437"W (5893000 N and 375400 E), and is located in National Topographic System (NTS) sheet 93F/02. The Project will span a two-year pre-production (construction) phase followed by a 17 year operation phase with a nominal ore production capacity of 60,000 tonnes per day (tpd). The current resource estimate indicates combined Indicated and Inferred resources of 7.1 Moz Au and 30 Moz Ag at a 0.32 g/t Au equivalent (AuEq) cut-off grade. The Feasibility Study mine 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 of material (AMEC 2014a).

The Project will involve on-site development at the 4,400 hectare (ha) mine site of the Blackwater deposit in the Cariboo Regional District, as well as off-site components. On-site components will include the open pit mine, an ore processing plant, a tailings storage facility (TSF), waste rock dumps, stockpiles, borrow areas, a construction camp, an operation camp, and a truck shop. Off-site components will include a transmission line, a mine access road (MAR), a freshwater supply system, an air strip, a new 16 km road to the Project site at approximately km 126 of the Kluskus FSR, and fish habitat compensation sites. The Kluskus-Ootsa FSR and transmission line also cross into the Bulkley-Nechako Regional District. The Project is subject to a coordinated provincial-federal EA review process under section 16 of the BC *Environmental Assessment Act* (BC EAA; 2002c) and the *Canadian Environmental Assessment Act* (CEAA; 1992).

The assessment presented in this report documents the TSF alternatives assessment process undertaken by New Gold and identifes the most suitable candidate alternative to situate a mine tailings waste facility and associated infrastructure for the Project.

In Canada, the *Fisheries Act* (1985) applies to any development project with potential impacts to a natural body of water frequented by fish. Section 35 (1) of the *Fisheries Act* (1985) states that "No person shall carry out any work that, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational, or Aboriginal fishery, or to fish that support such a fishery." Section 36(1) of the *Fisheries Act* (1985) prohibits the deposit of any deleterious substance into natural fish-bearing waterbodies: "… no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish …". Section 34 of the *Fisheries Act* (1985) defines a "deleterious substance" as "any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered deleterious to fish or fish habitat or to use by man of that frequent that water"; e.g., tailings or waste rock.

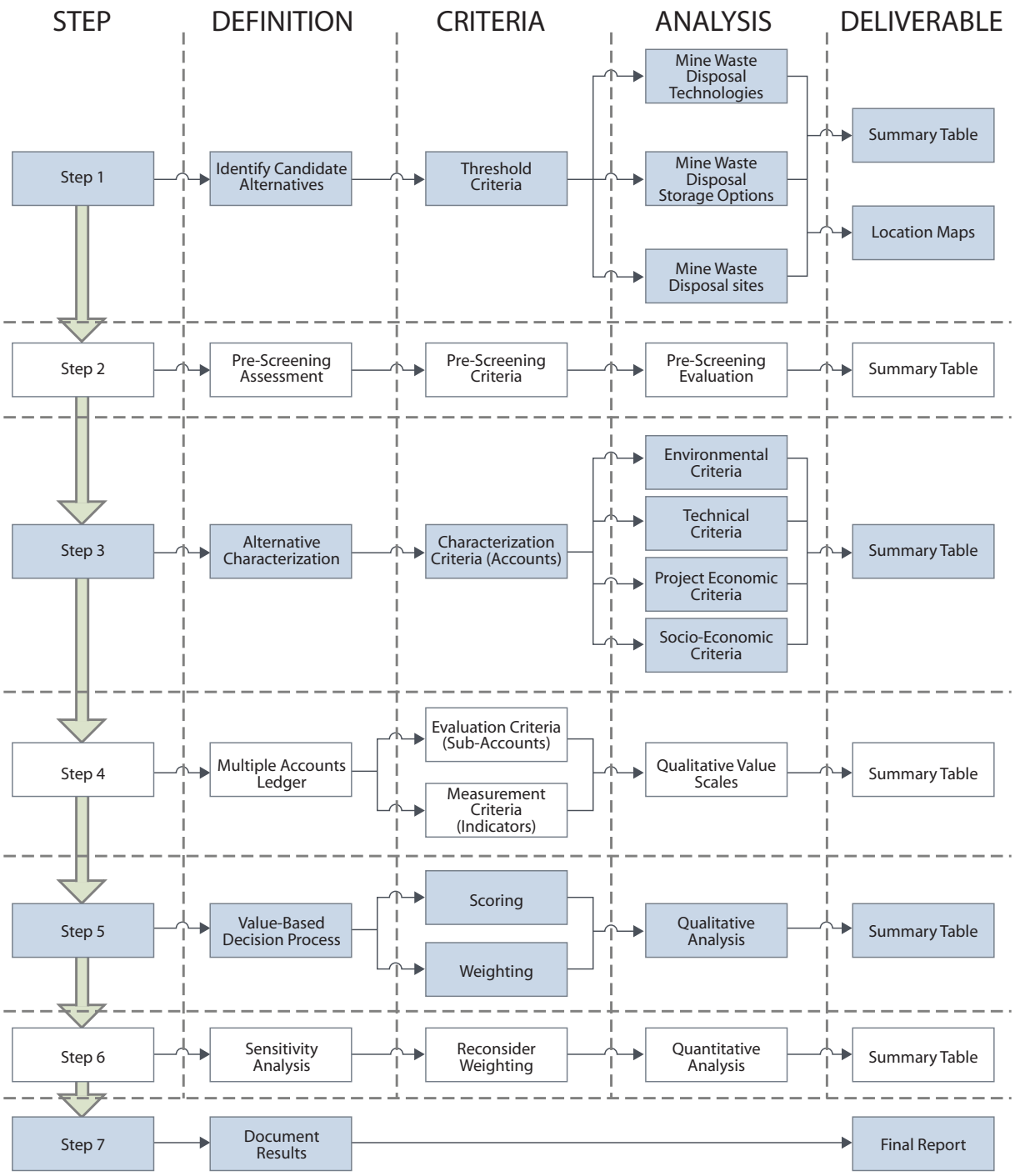


Figure 1.1-1

Environment Canada Guidelines for the Assessment of Alternatives for Mine Waste Disposal Flowchart

Rescan an ERM company

Under the *Metal Mining Effluent Regulations* (MMER; SOR/2002-222) of the *Fisheries Act* (1985), use of a natural fish-bearing waterbody as a TSF (i.e., deposition of a deleterious substance in a fish bearing water for the purposes of mine waste management and storage) is only possible by obtaining a *Schedule 2* amendment to the MMER. Obtaining a Schedule 2 amendment is only possible by executing the following steps: (1) undergoing an environmental assessment (EA) for the proposed Project; (2) preparing a TSF alternatives assessment; (3) preparing a fish habitat compensation plan (now referred to as an offsetting plan under the *Fisheries Act (*1985)) as per Section 27.1 of the MMER for consideration as part of the EA; and (4) undertaking public and Aboriginal consultation during the EA, including consultation on the possible amendment to the MMER (SOR/2002-222).

New Gold is undertaking all of the above four steps in order to develop the Blackwater Gold Project. Note that all calculation tables relevant to this analysis are included in Appendix A. Step 2 of this process is the focus of this report; the procedures describing the approach to the alternatives asessment are presented in the *Guidelines for the Assessment of Alternatives for Mine Waste Disposal* (the Guidelines; Environment Canada 2011; Appendix B). The *Guidelines* indicate the purpose of the alternatives assessment is to objectively and rigorously assess feasible options for mine waste disposal. A project proponent must demonstrate throughout the EA and the alternatives assessment that the proposed use of the waterbody as a TSF is the most appropriate option for mine waste disposal from an environmental, technical, and socio-economic perspective. The alternatives assessment should also demonstrate that the selected option offers the greatest overall benefit to current and future generations of Canadians, as per the Canadian Cabinet Directive on Streamlining Regulation (Government of Canada 2007).

The *Guidelines* (Environment Canada 2011) delineate the alternatives assessment process required to identify, assess, evaluate, rank, and select the best overall TSF, based on environmental, socio-economic, technical, and Project economics considerations. Figure 1.1-1 illustrates the seven steps involved to select the preferred candidate TSF site, as presented in the *Guidelines* (Environment Canada 2011).

1.2 PROJECT PROPONENT

New Gold is an international gold producer with operations in Canada, United States (US), Mexico, and Australia, and development projects in Canada and Chile. New Gold was incorporated under the laws of the Province of British Columbia (BC) on 31 January 1980. New Gold 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.

1.3 PROJECT DESCRIPTION AND LOCATION

The Project lies in central BC, approximately 112 km southwest of Vanderhoof and 446 km northeast of Vancouver (Figure 1.3-1). The Project site is 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). At km 146.5 on the Kluskus FSR, an 18 km mine road built in 1986 and improved in 2009, provides access to the Project site and exploration camp. The current driving time from Vanderhoof to the Project site is approximately 2.5 hours. The area is sparsely inhabited; two ranches, three privately-held lodges (Laidman Lake Ecolodge, Tatelkuz Lake Ranch Resort; and Moose Lake Lodge) and Tatelkuz Lake Indian Reserve (IR) #28 are found within a 20 km radius of the Project site. Although not connected by road directly to the site, Kluskus IR #1 approximately 22 km to the southeast. Some services are available in Vanderhoof, but Prince George is the regional hub with air service from major centres and is located 165 km from the Project.

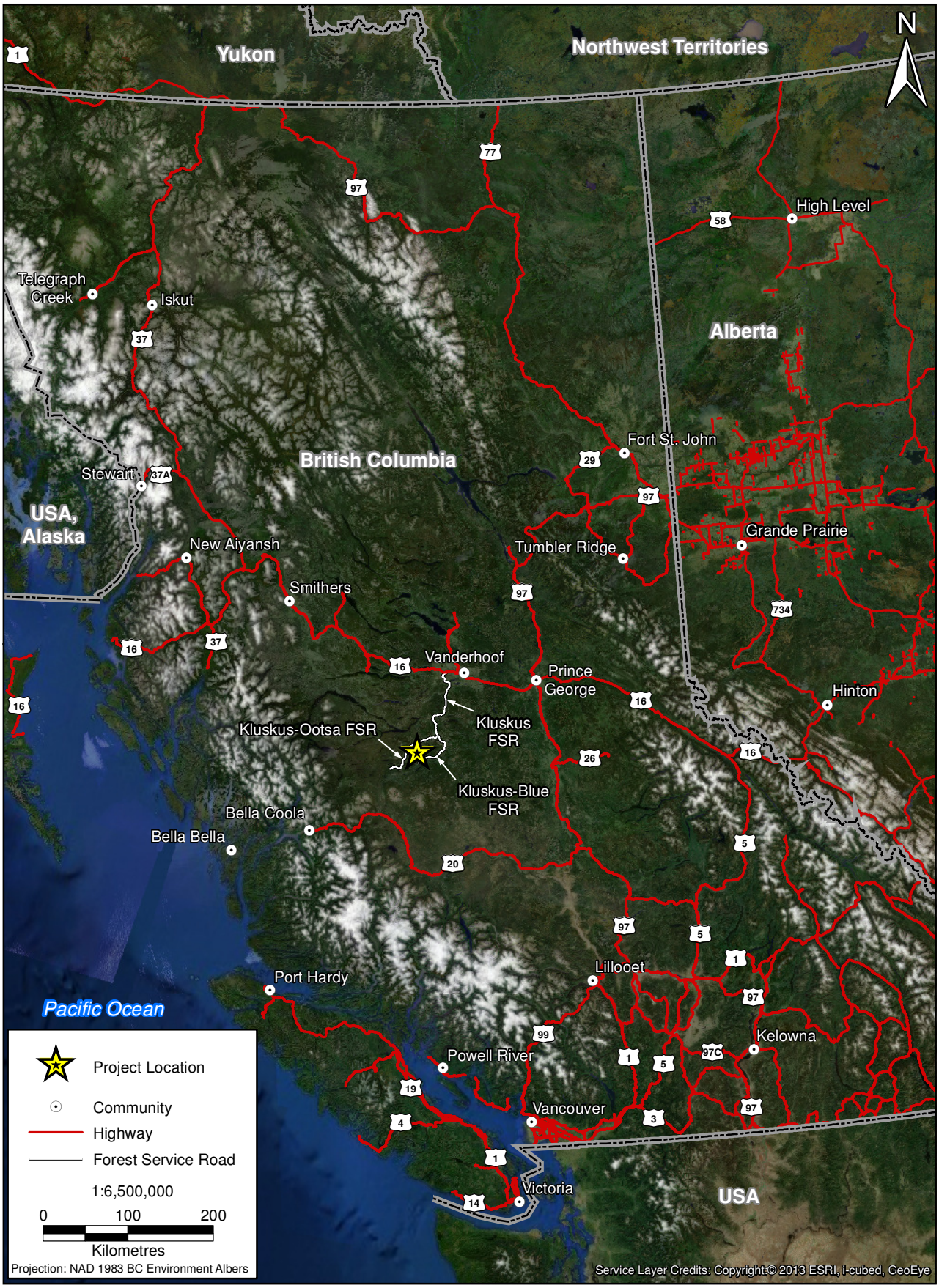


Figure 1.3-1

newgold

General Location of the Blackwater Gold Project

Rescan an ERM company

Mineral exploration activities in the Project area started in 1973 by Granges Exploration Ltd. and continue to this day. Richfield Ventures Corp. (Richfield) acquired the Blackwater mineral claims in 2009 and conducted additional drilling. New Gold purchased Richfield in 2011, acquiring the Blackwater mineral claims and continuing major exploration drilling, metallurgical test work and engineering, and environmental studies.

The Blackwater deposit consists of a sulphidation epithermal gold-silver deposit, in which the gold and silver are mainly associated with sulphide minerals (primarily pyrite). Measured and Indicated Mineral Resources amenable to direct processing are reported at a gold equivalent cut-off grade of 0.4 g/t Au equivalent (Eq) total 306.0 Mt grading 0.88 g/t Au and 5.8 g/t Ag (AMEC Earth & Environmental 2013). Measured and Indicated Mineral Resources that are amenable to being stockpiled for future treatment, are reported at a gold equivalent cut-off grade of 0.3 g/t AuEq, with a total of 90.9 Mt grading 0.3 g/t Au, and 4.3 g/t Ag (New Gold 2014). Proven and Probable Mineral Reserves total 344.4 Mt grading 0.74 g/t Au and 5.5 g/t Ag. The Blackwater deposit is amenable to conventional truck-shovel open pit mining with a proposed nominal 60,000 tonnes per day (t/d; 22 Mt/y) ore processing plant.

The exploration phase of the Project has already provided significant economic benefits to local communities with the creation of 137 jobs and approximately $US 40 million invested during 2011. Investment in 2012 was $US 130 million, of which 70-75% was invested regionally. Investment in 2013 was $US 76 million; again 70-75% of which was invested regionally. In June 2012, New Gold opened a project community office employing three staff and containing an ore-crushing laboratory, which employs approximately 30 full-time staff. Both the community office and laboratory are located in Vanderhoof. The exploration camp was expanded through 2012 and has a 400 person capacity.

New Gold is committed to maximizing benefits to local communities and Aboriginal groups. Two Exploration Agreements with Aboriginal groups have been signed. and conversations are well advanced with other Aboriginal groups potentially affected by the Project. A Community Liason Committee with local community leadership representation has been established to help build a long-term, continuing relationship with local communities.

The approach for designing the Project incorporates environmental principles intended to avoid, minimize, mitigate, and compensate where appropriate, potential effects of the Project on the biophysical, economic, social, heritage, and health environments. To this end, the following design principles will be applied to optimize the environmental performance of the Project and to achieve the requirements for environmental protection, given the demands of construction and operation:

- massing (see below for definition);
- clustering (see below for definition);
- implementing a robust and transparent Aboriginal and community engagement program;
- incorporating Traditional Knowledge/Traditional Land Use (TK/TLU);
- identifying key environmental constraints and opportunities;
- preventing surface water discharge during operations;

- designing for closure; and
- ongoing risk assessment and decision-making.

`Massing' consists of early identification and avoidance of key sensitive areas in the region where the Project is located, and moving facilities to avoid these areas. For the Project, these sensitive areas include:

- the Blackwater River drainage, which will be avoided by the Project mine site;
- the designated Ungulate Winter Range (UWR) for caribou, which is the winter habitat for the Tweedsmuir-Entiako Caribou herd and which will be avoided by the Project mine site; and
- primary growth areas for whitebark pine (*Pinus albicaulis*), which is a blue-listed[1] species in BC (BC CDC 2013) and which was recently added to Schedule 1 of the federal *Species at Risk Act* (2002d) as endangered. A management plan has been developed to avoid to the extent possible and to mitigate potential effects on whitebark pine.

`Clustering' of Project facilities minimizes the overall footprint of the Project and ensures that the mine waste management facilities such as the TSF and the waste rock dumps are located in close proximity to the open pits and within the same or adjacent sub-drainages. Maximizing use of the new exploration road for accessing the proposed mine site also minimizes the effect on the caribou UWR and overall footprint and has been included in the Project design.

A key environmental consideration for the Project is the presence of fish-bearing water bodies. Fish habitat values are higher in the lower reaches of Davidson Creek, where Kokanee (*Oncorhynchus nerka*) spawning habitat has been identified; the Project footprint is designed to avoid these lower reaches.

An important objective of the Project is to prevent surface water discharge during the operations and closure phases. This includes diverting water to the TSF pond and collecting potential seepage from mine water facilities. Process water will also be recycled as much as possible to minimize the requirements for freshwater makeup. The Project also takes advantage of local topography; all proposed Project facilities are located within a single watershed, providing relatively simple drainage control.

Designing for closure ensures that the long-term potential effects of the Project are avoided, minimized, and mitigated appropriately. This involves early consultation with stakeholders and Aboriginal groups regarding closure objectives as well as applying mine waste management criteria that involve segregation, encapsulation, or underwater disposal to minimize the potential for long-term effects associated with acid drainage and metal leaching. In consideration of this principle, the waste rock dumps and open pit will be designed to drain towards the TSF with constructed wetlands used for polishing treatment.

[1] The designation of species as Blue-listed by the BC CDC does not confer any legal protection.

1.4 BACKGROUND TO TSF ALTERNATIVES ASSESSMENT

In general, a TSF should be situated where siting and deposition methods meet applicable government regulations, meet engineering technical and safety codes, and minimize deleterious effects on the environment. A TSF candidate must also be economically viable, and alternative selection and design should include engagement with local community stakeholders and Aboriginal groups.

The first step to meet these requirements is to conduct a preliminary screening of the Project area and identify potential candidate sites based on technical and economic feasibility. New Gold conducted a preliminary survey of a 10 km radius area centred on the open pit to identify potential feasible sites for TSF construction, operation, and closure. The results of this preliminary site assessment are provided in Appendix C: *TSF Multiple Accounts Analysis – Design Alternatives Information* (Knight Pièsold 2014). This report provides a technical description of the alternatives described here.

Based on a comprehensive regional review, New Gold identified seven candidate alternatives for the TSF. Summarized descriptions of these seven candidate alternatives are provided in Section 4 of this report; these candidates are discussed in more detail in Appendix D.

1.5 TAILINGS STORAGE FACILITY DESIGN CRITERIA

The primary objectives for designing a TSF, associated with the proposed Project, are for the facility to:

- have minimal long-term environmental effects;
- provide reliable and durable long-term containment with low maintenance and monitoring requirements; and
- be able to safely and effectively contain tailings and Potentially Acid Generating / Metal Leaching (PAG/ML) waste rock produced over the life of the mine.

In order to achieve these objectives, New Gold adopted basic design criteria for the conceptual design of the candidate alternative TSFs:

- use the water within the Project area to the maximum practicable extent by collecting and managing site runoff from disturbed areas, maximizing the recycle of process water, and storing surplus water within the TSF;
- pump water as required from Tatelkuz Lake through a water supply pipeline to a water reservoir downstream of the TSF main dam to provide fresh water and make-up water for the process plant and to maintain in-stream flow needs for fish in Davidson Creek;
- operate the TSF with no surface water discharge during operations;
- collect all drainage from the mine by gravity into the TSF to simplify water management, spill control, and mine closure;
- collect all (except minimal) TSF seepage downstream of the main dam during operations and post-closure until the pit lake overflows or the water is of acceptable quality for direct discharge to Davidson Creek;

- manage sediment mobilization and erosion by installing sediment controls prior to land disturbance, limiting land disturbance to the minimum practicable extent, reducing water velocities across the ground, progressively rehabilitating disturbed land, ripping areas to promote infiltration, and restricting access to rehabilitated areas;
- install appropriate temporary erosion and sediment control measures or follow best management practices (BMPs) before and during the implementation of ongoing environmental protection strategies;
- maintain fish habitat, develop compensatory fish habitat, and reclaim disturbed areas; and
- monitor surface and groundwater quality and quantity to verify pre-mining predictions.

Tailing slurry from the mill will be treated using the SO_2/air process for cyanide destruction and metal precipitation. Laboratory testwork has shown that this process will be effective in producing low residual cyanide and metal concentrations in the discharge to the TSF. Copper will be used as a catalyst in the treatment process and may initially have elevated levels in the TSF supernatant, but these will decrease rapidly due to "post-reaction" effects, natural degradation, and dilution. New Gold will operate the Project in accordance with the International Cyanide Management Code (International Cyanide Management Institute 2012), as it does at all its other gold mines.

1.6 WASTE ROCK CLASSIFICATION

Classification of mine wastes to be produced by the Project was based on the results from a Metal Leaching / Acid Rock Drainage (ML/ARD) test program, BC government and international guidance, and best mining industry practice (BC MEM and BC MELP 1998; Price and Errington 1998; MEND 2009; Price 2009).

Mine waste was classified based on whether it is predicted to be PAG or Non-Acid Generating (NAG), as shown by the calculated neutralization potential ratio (NPR). NAG waste rock was further classified as to its metal leaching potential based on zinc content. Classification criteria are as follows (New Gold 2014):

- overburden (NAG);
- waste rock;
  - PAG1 – NPR $\leq$ 1.0 (PAG);
  - PAG2 - 1.0 < NPR $\leq$ 2.0 (PAG);
  - NAG3 – NPR > 2.0 and Zn $\geq$ 1,000 ppm (PAG);
  - NAG4 – NPR > 2.0 and 600 $\leq$ Zn <1,000 ppm (NAG);
  - NAG5 – NPR > 2.0 and Zn < 600 ppm (NAG);
- ore and tailings (PAG); and
- low grade ore (PAG).

Median NPR values for PAG waste rock (particularly PAG1) are relatively low, indicating a relatively short lag time to acid production (Table 1.6-1), which was verified in laboratory kinetic (humidity cells) and field tests (field bins). PAG waste rock requires subaqueous disposal to prevent ARD formation.

Table 1.6-1. Median Neutralization Potential Ratios and Metals for Waste Rock (Acid-Base Accounting Database)

Waste Rock Type	NPR	Total S (%)	Zn (ppm)	Cd (ppm)
PAG1	0.3	0.6	1,720	10.4
PAG2	1.5	0.3	878	5.6
NAG3	3.6	0.14	1,600	9.9
NAG4	6.1	0.12	767	5.0
NAG5	6.8	0.04	128	0.25

In contrast, median NPR values for NAG waste rock are relatively high indicating very little potential for acid production. Segregation of waste rock with zinc greater than 1,000 ppm (NAG3) results in high NPR and relatively low zinc and cadmium 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 is preferably stored subaqueously in the TSF to minimize metal leaching.

1.7 NON-ACID GENERATING WASTE ROCK DUMP AND LOW GRADE ORE STOCKPILE ALTERNATIVES ASSESSMENT

The Project's NAG waste rock dumps and low grade ore (LGO) stockpile locations are proposed to overlap with fish-bearing waterbodies and will require inclusion in the Project's Schedule 2 amendment to the MMER. As the PAG material (both tailings and waste rock) has significantly greater ML/ARD potential than the NAG waste rock and, thus, has greater potential for effects to the environment, the locations and disposal methodologies for placement of the PAG material are much more constrained than for the NAG waste rock. In order not to confound the importance of the placement of PAG material (in the TSF), the NAG disposal assessment has been performed only for the selected TSF option, and is included in Appendix D. The Project's LGO stockpile is designed to be temporary, and will be fully depleted by the end of the Project's operations phase and reclaimed during the Project's closure phase. In the unlikely event that it is not processed through the mill for economic reasons, the LGO material will be removed and placed in the TSF or open pit where it will be permanently submerged. As the TSF and NAG waste rock dumps will be permanent structures, the management of these wastes will have a much more significant temporal effect than for the LGO stockpile. The LGO stockpile assessment has been performed based on the selected TSF and NAG waste rock dump locations, and is included in Appendix E.

1.8 ENVIRONMENTAL SETTING

The *Guidelines* stipulate that both environmental and socio-economic, including Aboriginal, considerations, be included in the multiple accounts analysis (MAA) for selection of a TSF. To provide an understanding of these considerations, environmental and socio-economic baselines are briefly described here, with emphasis given to those areas of most importance to TSF selection.

1.8.1 General Setting

The mine site is located in the Nechako Plateau, within the Interior Plateau east of the Coast Mountain Range, along the northern flanks of Mt. Davidson. The Nechako Plateau topographic landscape consists of moderate relief mountains with wide, gently sloping glacial valleys. Topographic features are largely associated with glacial deposition and erosion and include flutings, parallel ridges, eskers, melt water channels, and localized moraines. The elevation of the Blackwater property ranges from just over 1,000 m in low-lying areas northeast of the mine site to 1,800 m at the summit of Mt. Davidson, the highest peak in the Fawnie Range. The Project area spans two ecoregions, the Fraser Plateau and Fraser Basin; and three ecosections, the Nazko Upland, Bulkley Basin and Nechako Lowland (AMEC 2012a).

The climate in the Project area 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°C in winter to a maximum of 32°C in summer. Average annual precipitation is 636 mm/a, with 310 mm falling as rain and the rest 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 direction is from the southwest (AMEC 2012a). Long-term climate and streamflow records indicate no notable climate change effects on climatic or hydrologic conditions near the Project, with the exception of possibly decreasing peak annual peak flows (Knight Pièsold 2013b).

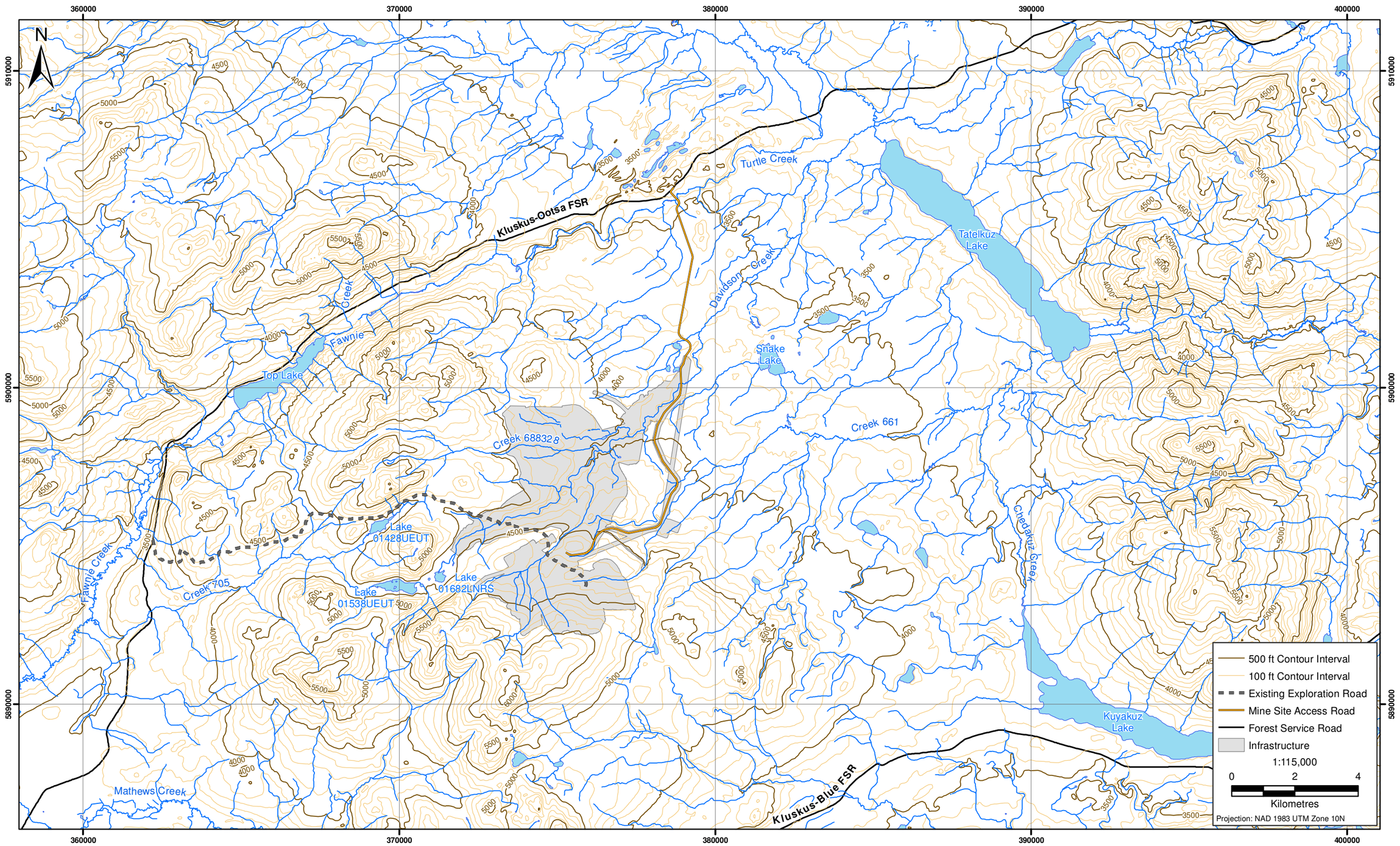
1.8.2 Geology and Topography

Local topographic and geological factors considered for conventional TSF siting are bedrock type and condition, overburden type and depth, slope characteristics, and valley geometry. Bedrock and overburden affect dam foundation conditions, associated earthquake risks, and potential seepage. Steepness of slopes and valley geometry affect containment dam construction, and magnify the risks of local geohazards such as debris chutes, rock falls, avalanches, and landslides.

The Project is located on the northern flanks of Mount Davidson within the Nechako Plateau of the Interior Plateau physiographic region. The topographic form of the region is controlled by volcanic uplift of bedrock and subsequent erosion by glacial ice during the last glaciations (Diakow and Levson 1997). The Nechako Plateau topographic landscape is generally described as moderate relief mountains intersected by wide, gently sloping glacial valleys. Topographic features are largely associated with glacial deposition and erosion and include flutings, parallel ridges, eskers, meltwater channels, and localized moraines.

The local topography is moderately steep to steep and has been shaped by glacial erosion. Average elevations vary from approximately 1,200 masl to approximately 1,900 masl, with the Project area located on one of the higher points in the region, reaching approximately 1,860 masl (Figure 1.8-1).

The Project area's regional geology is defined by the uplifted Nechako block. The Nechako Uplift juxtaposes older Jurassic arc-related rocks of the Hazelton and Bowser Lake groups with younger Eocene extensional-related rocks of the Ootsa Lake and Endako groups. The Nechako uplift is a structurally raised block bounded to the north and south by two faults, which provides a window through younger cover rocks into older rocks. Quaternary glacial overburden, colluvial, and fluvial deposits mask the majority of bedrock within the Project mine site.



newgold

Rescan an ERM company

Figure 1.8-1

Blackwater Gold Project: Topographic Relief

The Project area is underlain by the "Blackwater wedge," a laterally discontinuous wedge of intercalated volcanic and volcaniclastic felsic to intermediate lapilli and ash tuff, volcanic breccias, and andesitic flows. The Blackwater deposit has characteristics of a low sulphidation epithermal gold-silver deposit. Mineralization occurs in volcanic rocks of Late Cretaceous age emplaced through and on Hazelton Group strata. Gold grains are between 5 and 50 microns in size and are mainly associated with sulphide minerals (AMEC 2011).

The surficial sediments in the Project area consist of Quaternary and Holocene deposits, with localized areas of bedrock outcroppings near the flanks and peak of Mount Davidson. Morainal, glaciofluvial, and glaciolacustrine deposits are Quaternary in age, with deposition associated with the last glacial period. Holocene sediments include materials that were deposited since the end of glaciation to the present, and include fluvial, colluvial, eolian, and organic (peat) deposits (AMEC 2013n). The thickness of the till in the Project area is described as till blankets (bedrock controlled but masking bedrock outcrops) along the lower mountain slope positions, and till veneers, of variable thickness and generally less than 1 m, over higher elevations. On steeper slopes, colluvial deposits are identified. These deposits are generally derived from local till or bedrock outcrop sources (Plouffe, Levson, and Mate 2004). The sediments tend to occur in the valley bottom locations where glacial meltwater flowed throughout deglaciation. Localized occurrences of modern sediments, including fluvial and organic deposits, also occur in the Project area.

The Project is located in an area of low seismic activity (the southern Cordillera seismic region), with the closest major fault line (the Queen Charlotte fault system) approximately 500 km to the west along the west coast of Haida Gwaii (New Gold 2014). The results of a site-specific seismic hazard assessment indicate a range of Peak Ground Acceleration (PGA) for various return periods at the Project area. The assessment shows that the 10,000-year return period mean PGA of 0.11g could be associated either with a randomly located earthquake of magnitude 8.5 along the Queen Charlotte fault system or a magnitude 7.5 earthquake along the BC coast (approximately 300 km west of the Project area). The largest earthquake recorded in the southern Cordillera region was an event of about magnitude 6.0 in 1918, located in the Valemount area of the Rocky Mountain trench. More recently, a magnitude 5.4 earthquake occurred near Prince George in 1986 (New Gold 2014).

1.8.3 Surface Water

Activities associated with the TSF construction, operation, and closure can alter surface water hydrology and quality with consequent effects on hydrological features (e.g., streams, lakes and wetlands) as well as terrestrial and aquatic species and habitat. The natural hydrological regime of a TSF's catchment affects the safe construction, operation and closure of the facility. Surface water factors such as catchment size, precipitation, and runoff affect the water flows in and out of a TSF site, influencing water quality, surplus water, and flood risks. These effects are key parameters for consideration in the TSF alternatives assessment.

The Project area is located entirely within the Nechako sub-basin north of the Euchiniko Lake watershed of the Blackwater sub-basin. Both the Nechako and the Blackwater sub-basins are part of the greater Fraser River Basin, with relevant regional catchment areas provided in Figure 1.8-2 (New Gold 2012).

The surface hydrology of the Project area includes the Turtle Creek, Davidson Creek, Creek 661, Creek 705, and Chedakuz watersheds. The Project would be sited predominantly in the Davidson Creek watershed with Davidson Creek draining northeast toward Chedakuz Creek. The Chedakuz Creek basin, in turn, drains toward the northwest via the Nechako River system into the Nechako Reservoir, which was created by the construction of the Kenney Dam in 1952. Turtle Creek parallels Davidson Creek to the north, and several other smaller streams run parallel to the south, all of which contribute to the Chedakuz Creek drainage basin (New Gold 2012).

Hydrological data were collected within the Project area from the spring of 2011 through the winter of 2013. These data were used in conjunction with regional data to develop baseline hydrological estimates of monthly, annual, peak, and low flows for the Project (Knight Pièsold 2013b). Project hydrometric monitoring stations are shown in Figure 1.8-3.

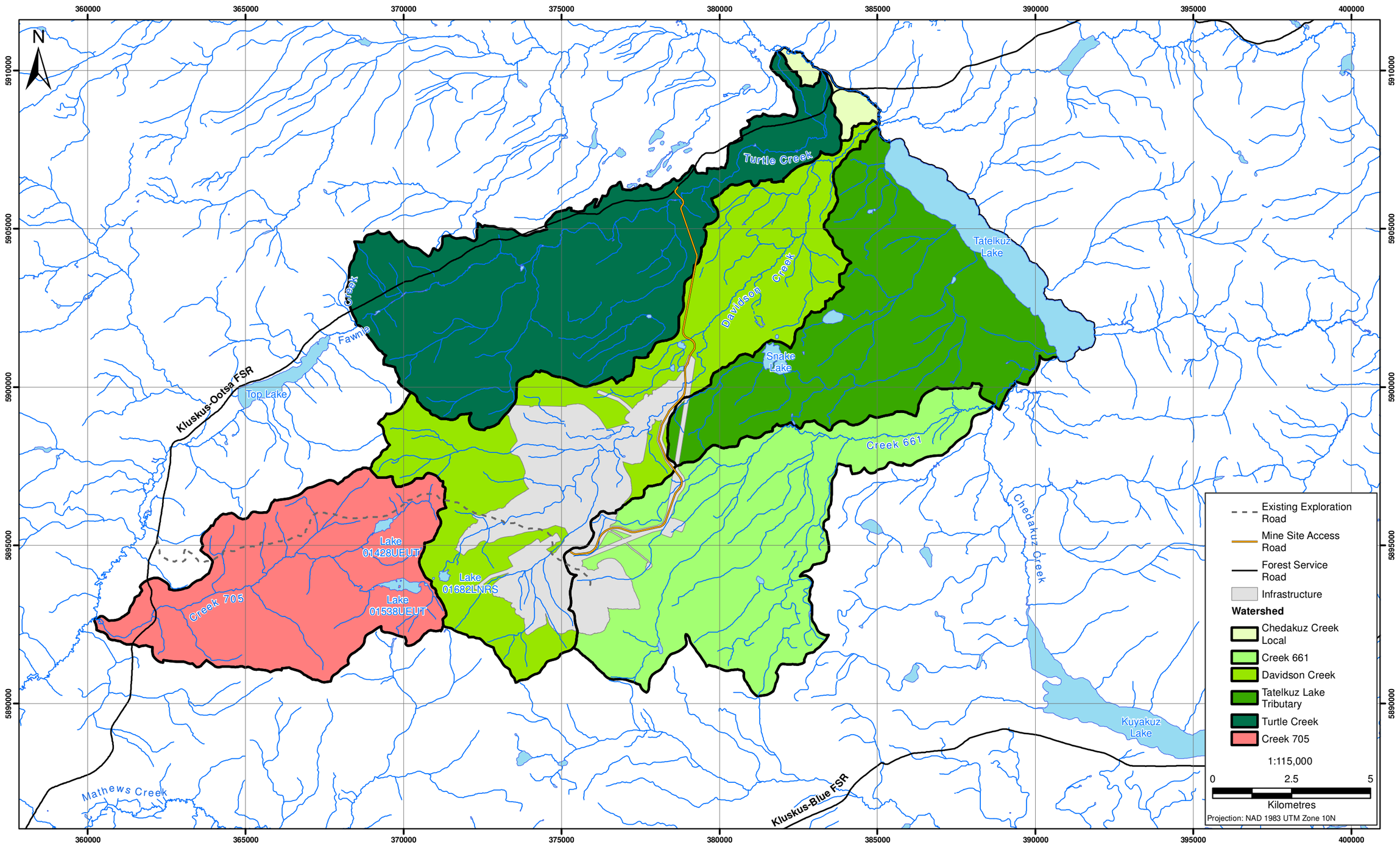
Streams in the area were generally characterized by high flows in late spring and early summer due to rain and snowmelt, and low flows in the winter. The long-term mean annual unit runoff for the Project area was estimated to be 5.8 litres per second per square kilometre ($L/s/km^2$), which equates to a watershed average runoff of 184 mm. The effective annual runoff coefficient for the natural drainage areas in the Project was estimated to be 0.29 (Knight Pièsold 2013b).

Surface water quality within the Project area was monitored in 2011 and 2012 to provide baseline water quality prior to Project development (AMEC 2013h). Water and sediment quality samples were collected at a number of sites within the Project area that could potentially be affected by mine development (see Figure 1.8-3). Results were compared against the BC Ministry of Environment (MOE) water quality guidelines (British Columbia Ministry of Environment 2006a) and working or approved water quality guidelines (BCFWG; British Columbia Ministry of Environment 2006b). Based on the mean water quality monitoring result, the Project area water has circum-neutral pH and low hardness; alkalinities are also low, consistent with low hardness and conductivity. Metals concentrations are low, typically one to several orders of magnitude below their respective 30-day BCFWG. The few exceptions are listed below (AMEC 2013h).

- Total cadmium: Cadmium naturally occurs in the earth's crust and can enter surface water through weathering and erosion of rocks and soils. Two monitoring sites (WQ1 and WQ7) exceeded the 30-day guidelines. The results for cadmium indicate that some cadmium is being leached from country rock at the site; therefore, a site-specific objective may be required by the BC MOE.
- Total zinc: One monitoring site (WQ4) near the deposit was anomalous for zinc (above the 30-day guidelines), which indicates that a site-specific objective for zinc may be required.
- Dissolved aluminum: Four monitoring sites (WQ3, WQ7, WQ12 and WQ17) exceeded the 30-day guideline, while five exceeded the maximum guideline (WQ1, WQ4, WQ10, WQ11 and WQ16). The results for aluminum are not unusual and reflect the country rock and a generally high background in Project area relative to guidelines.

In addition to the above, some sites exceeded BC MOE 95th percentile guidelines for turbidity (sites WQ4 and WQ8), total chromium (sites WQ3 and WQ7), and total copper (site WQ1), with these exceedances linked mainly to erosion and weathering of soils and rocks (Figure 1.8-3).

PROJECT #0215644-001 GIS # BLW-10-009 February 27, 2014



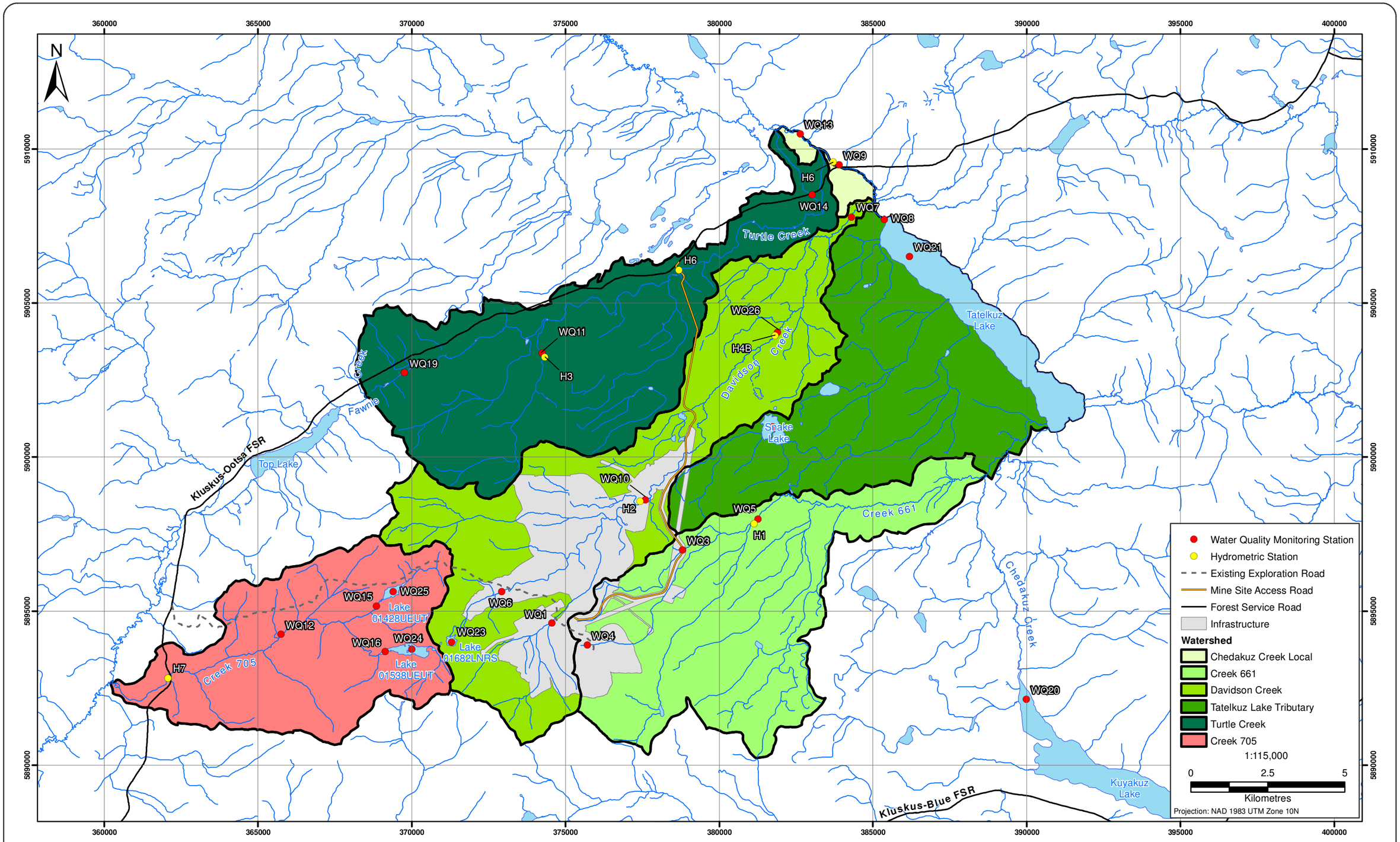
newgold

Rescan an ERM company

Figure 1.8-2

Blackwater Gold Project:
Watershed Boundaries and Major Waterbodies

PROJECT #0215644-001 GIS # BLW-10-010 February 27, 2014



newgold

Rescan an ERM company

Figure 1.8-3

Blackwater Gold Project:
Location of Hydrometric and Surface Water Quality Monitoring Stations

1.8.4 Groundwater

Activities associated with TSF construction, operation, and closure can alter groundwater flows and water quality with consequent effects on hydrological features (e.g., streams, lakes and wetlands) as well as terrestrial and aquatic species and habitat. These effects are key parameters for consideration in the TSF alternatives assessment.

The groundwater baseline program is based on 130 boreholes as part of geotechnical, geomechanical and hydrogeological site investigations. The groundwater program includes measurements of hydraulic head from a minimum of 18 monitoring wells (at 11 locations), 22 vibrating wire piezometers (at six locations), and baseflows at 11 locations.

Understanding of the groundwater site conditions is based on investigations that began in mid-2012 and are still underway (Knight Pièsold 2013a). Typically, the groundwater table in the Project area exhibits a muted form of topography (Section 1.8.2) and is recharged from surface infiltration (New Gold 2012). Groundwater levels vary greatly across the Project area and range from surface level to 36 m below ground surface (m bgs). The majority (20 of 26) of initial groundwater levels measured were shallower than 18 m bgs (Knight Pièsold 2013a). Groundwater flows from higher elevations to lower-lying areas where it discharges to streams and small wetland areas (New Gold 2012).

The Project's deposit area is situated on a groundwater subcatchment divide and near the upper reaches of Davidson Creek and Creek 661 catchments. In the western portion of the deposit area, groundwater flows downslope towards the Davidson Creek catchment. Groundwater from the eastern portion of the deposit area flows downslope towards the northeast in the Creek 661 subcatchment. Seasonal variation in groundwater levels is expected given the climate conditions in the area with groundwater levels highest during periods of snowmelt (New Gold 2012).

Groundwater quality samples were collected from 13 sets of wells. The wells were strategically placed to provide baseline results up-gradient of the proposed mine site as well as from downstream for capturing potential future mine activity–impacted groundwater. The sampling started in May 2012 and has been ongoing on a quarterly basis (AMEC 2013e).

Most of the analytical results show typical groundwater quality with no anomalies regarding potential groundwater effects. Except for measured concentrations of aluminum, lead, arsenic, iron, and manganese, the measured substance concentrations in the groundwater baseline samples meet the applicable BC MOE water quality guidelines (AMEC 2013f).

Analyzed groundwater pH values range between pH 6.4 and pH 8.9 and average pH 7.8 pH. Groundwater from the Project area ranges from soft to hard (hardness ranges between 13 and 167 mg/L; average 77 mg/L as calcium carbonate) and has a wide ranging total alkalinity (20 to 206 mg/L; average 87 mg/L as calcium carbonate; AMEC 2013f).

1.8.5 Geochemistry

Activities associated with TSF construction, operation, and closure can alter geochemistry and water quality with consequent effects on terrestrial and aquatic species and habitat. TSF construction

materials as well as the tailings and waste rock stored in the impoundment may be potential sources of ML/ARD to the receiving environment. These effects are key parameters for consideration in the TSF alternatives assessment.

Geology

The Blackwater Project site is located on the northern flank of Mt. Davidson within the uplifted Nechako block. In the region the Hazelton Group is overlain by the Bowser Lake Group and both groups are intruded by late Cretaceous felsic plutons. The two groups and felsic pluton are overlain by Eocene Ootsa Lake and Endako groups and the entire package is capped by Chilcotin Group basalts. There is very low potential for carbonate units in the region and the majority of the host rock is a laterally discontinuous wedge of intercalated volcanic and volcaniclastic felsic to intermediate lapilli and ash tuffs with volcanic breccias and andesitic flows.

Characterization Program

Geochemical sampling was conducted from 2011 to 2013. The program design incorporated existing assay rejects, drill core from 2009 through 2013 drilling, surface grab samples, and from metallurgical testing programs (AMEC 2014b; Table 1.8-1).

Table 1.8-1. Summary of Characterization Program

Test	Waste Rock [1]	Ore [1]	Tailings [2]	Overburden [3]
Static Tests				
Acid Base Accounting	890	72	18	95
Exploration ICP Database	≈285,000	≈70,000	-	-
Multi-element Chemistry	617	87	18	95
Mineralogy / Petrography	25	48	-	2
Shake Flask Extraction	58	8	5	14
Net Acid Generation (NAG) Test	587	36	8	29
NAG 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 NAG	4	-	-	-
Kinetic NAG	6	-	-	-
Humidity Cell pH Neutralization	5	1	-	-
Sequential Extraction	10	-	-	-

(continued)

Table 1.8-1. Summary of Characterization Program (completed)

Test	Waste Rock [1]	Ore [1]	Tailings [2]	Overburden [3]
Project Specific Tests (cont'd)				
Adsorption Experiments	6	-	-	-
Scanning Electron and Optical Microscopy	5	-	2	-
SO_2 Air/Cyanide Destruction	-	-	23	-

Note: Sample numbers from AMEC (2014b).
[1] Samples of waste rock and ore include 10 m composites.
[2] Tailings samples were obtained from metallurgical testing.
[3] Overburden samples were selected from core and test pits.

Acid potential (AP) was calculated from the measured total sulphur value, neutralization potential (NP) was measured using the modified Sobek method, and the net potential ratio (NPR) was calculated as the ratio of NP to AP (AMEC 2014b).

Waste Rock

AMEC (2014b) identified five classes of waste rock based on NPR and zinc content (Table 1.8-2).

Table 1.8-2. Acid Rock Classification of Project Samples

Classification	NPR	Metal Content
PAG 1	NPR <1	-
PAG 2	NPR 1-2	-
NAG 3	NPR >2	zinc > 1,000 mg/kg
NAG 4	NPR >2	zinc 600 to 1,000 mg/kg
NAG 5	NPR >2	zinc < 600 mg/kg

Note: mg/kg = milligram per kilogram; NAG = non-acid generation; NPR = neutralization potential ratio; PAG = potentially acid generating

Sulphide mineral phases identified in waste rock samples included pyrite or pyrrhotite (0.3 to 4.0%) and sphalerite (0.1 to 0.8%). Carbonate mineral phases were reported, with calcite and siderite reported as the most frequently occurring mineral phases; calcite abundances ranged from 0.7 to 3.3%. AMEC (2014b) reported that siderite was found only in the PAG1, PAG2, and NAG samples, while calcite was more commmonly found in the NAG4 and NAG5 samples. The median NPR values of the five waste rock classifications according to the ARD block model were: PAG1 NPR=0.22, PAG2 NPR=1.4, NAG3 NPR=3.9, NAG4 NPR=5.5, and NAG5 NPR=7.4.

The ML potential of the waste rock samples was assessed through elemental content, NAG test leachate analyses, and shake flask extractions (SFE). The elemental content indicated that Ag, As, Bi, Cd, and P were elevated and had a positive correlation with sulphide sulphur. The 77 NAG test leachate analyses indicated that the majority of samples had elevated parameters including Ag, Al, Cd, Co, Cu, Pb, and Zn. SFE leachate concentrations indicate the potential for elevated Al, Cd, and Zn.

Ore and Tailings

Ore material contained pyrite (1.2 to 15.0%), sphaleraite (0.5 to 1.6%) and detectable carbonate abundances (less than 1.0%). AP values ranged from 0.3 to 278.0 kg $CaCO_3$/t and NP values ranged from 0 to 22 kg $CaCO_3$/t. Ore material was classified as PAG as 92% of ore samples had a NPR value less than 2.0 (AMEC 2014b).

Elemental abundance of the ore material demonstrated elevated Ag, As, Bi, Cd, P, Pb, S, Sb, and Zn (AMEC 2014b) with elevated values of Ag, Al, Cd, Cu, Fe, Mn, Pb, and Zn in the majority of NAG leachate or SFE tests.

A variety of tailings samples were selected from the metallurgical test program representing:

- flotation rougher tails;
- flotation cleaner tails;
- cyanide leach tails; and
- head ore.

The whole ore leach was selected as the processing methodology of the Project and characterization focused on that method. In the whole ore leach process the tailings would have similar ABA characteristics as the ore since sulphide mineral separation is not included in the processing. Ore at Blackwater is divided into oxide, transition and sulphide facies Pyrite (3.0%), pyrrhotite (1%) and sphalerite (0.5%) comprised the major sulphide phases in the sulphide facies. Carbonate phases were detected in trace amounts (AMEC 2014b). According to the ARD block model, median total sulphur in the oxide ore was very low at 0.08% (majority expected to be sulphate sulphur) compared to 0.55% and 1.11% for transition and sulphide ore respectively. The median NPR of the oxide, transition, and sulphide ore facies was 0.3, 0.1 and 0.1 respectively.

The ML potential of the tailings material was assessed through solid phase elemental content and SFE. Elemental content suggested elevated concentrations of: Ag, As, Bi, Cd, P, Pb, S, Sb, and Zn in the transition and sulphide tailings samples. The whole ore leach transition and sulphide tailings had elevated As, Cd, and Zn in the solid phase. The results of the SFE analyses on the whole ore leach transition and sulphide tailings indicate elevated potential for ML of Cd, Co, Mn, and Zn, although the detection limits of some parameters were above screening criteria. The leachate from the NAG leach tests typically had elevated As, Cr, and Tl. Humidity cell results suggest that the lag time to the onset of ARD for some transition and sulphide tailings could be less than one year (based on lab conditions) with a longer period expected in the field if the tailings were left exposed (New Gold 2015, Section 5).

Overburden

The AP and NP values for overburden samples was low (0.31 to 20.2 and 1 to 127 kg $CaCO_3$/t respectively). Calculated NPR values were greater then 2.0 for 95% of overburden samples indicating that overburden was non-PAG (AMEC 2014b).

The metal content of overburden samples indicated elevated Bi, Cd, Pb, Sb, Se, and Zn, while the SFE results indicated elevated Al, Cd, and Fe.

Summary

Some of the waste rock and most of the ore samples within the proposed open pit had high ARD potential and elevated concentrations of several elements, which suggests that oxidation of some waste rock and tailings from the whole ore leach process could cause these elements to be released if left exposed in an unsaturated condition. Waste rock from the open pit will be segregated and managed according to its ML/ARD potential. Tailings also will be managed by maintaining them in a saturated state in the TSF.

Overburden samples are non-PAG with low concentrations of trace metals. Overburden at the Project is not expected to be a source of acidic drainage or metal leaching.

1.8.6 Climate

Climate consists of the long-term statistical trends of temperature, precipitation, humidity, atmospheric pressure, wind, atmospheric particle count, and other meteorological elements in a given region. Climate conditions, particularly precipitation events (e.g., 1:200 year flood in a wet year), contribute strongly to TSF design for safe construction, operation, and closure. TSF siting with respect to the prevailing wind direction can also influence a TSF's influence on air quality through fugitive dust emissions.

The climate in the Project area 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 (AMEC 2012b).

Climate data have been collected from two meteological stations at the Project site since early 2011. Data collected on site were combined with historical data from the Meteorological Services of Canada (MSC) branch of Environment Canada and the BC Forestry Service to develop long-term meteorological estimates for the Blackwater Gold Project (Knight Pièsold 2013b).

The results of the climate analyses for elevation 1,470 masl are as follows (Knight Pièsold 2013b):

- The mean annual temperature at the site is estimated to be 3°C, with minimum and maximum mean monthly temperatures of -4.7°C and 12.0°C occurring in January and July, respectively.
- The mean annual precipitation for the site is estimated to be 636 mm, with about 50% falling as rain and 50% falling as snow. Precipitation is fairly 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;
- The mean annual lake evaporation (potential evapotranspiration) at the site is estimated to be 430 mm; and
- The mean annual wind speed on site is approximately 2.4 m/s (8.6 km/h), with the wind direction being predominantly from the southwest.

A review of long-term climate[2] and streamflow records[3] indicates no notable climate change effects on climatic or hydrologic conditions near the project, with the exception of possibly decreasing peak annual peak flows (Knight Pièsold 2013b).

1.8.7 Air Quality

Activities associated with TSF construction, operation, and closure can alter air quality with consequent effects on wildlife and surrounding ecosystems. These effects are important parameters for consideration in the TSF alternatives assessment.

Availability of reliable, public domain air quality data covering remote areas of central and northern BC allows the determination of the most likely baseline concentrations of relevant air contaminants near the Project.

Several databases were identified and analyzed using such references as the number of monitored criteria air contaminants (CACs), instrumentation, location, the monitoring period, and the relevance to the Project with respect to level of development (AMEC 2013c). The final selection was narrowed to the following four data sources (AMEC 2013c):

- Canadian Air and Precipitation Monitoring Network (CAPMoN);
- National Air Pollution Surveillance Program (NAPS);
- BC MOE Monitoring Network; and
- On-site Blackwater particulate monitoring.

Based on relevant data available at the above sources, values of the background concentrations for the Project site for relevant contaminants are presented in Table 1.8-3 (AMEC 2013c).

Table 1.8-3. Background Concentrations for Criteria Air Contaminants

Source	Concentration
Particulate matter 2.5 µm diameter ($PM_{2.5}$)	4 µg/m^3
Particulate matter 10 µm diameter (PM_{10})	9 µg/m^3
Nitrogen dioxide (NO_2)	8 µg/m^3
Sulphur dioxide (SO_2)	1 µg/m^3
Ozone (O_3)	48 µg/m^3
Carbon monoxide (CO)	120 µg/m^3

As the Project is located in a remote area with no existing anthropogenic emission sources, the background concentrations are low compared to ambient air quality objectives.

[2] Ootsa climate station operated by Environment Canada has the longest climate record available in the region (46 years of complete data). This dataset was used to analyze long-term regional climate trends applicable to the Project area.
[3] Data reviewed from flow records for the Dean River (1973 to 2010) and Van Tine Creek (1975 to 2005).

1.8.8 Vegetation

The construction and operation of a TSF may affect ecosystems through direct loss or degradation. In particular, the loss of rare and endangered ecosystems and the presence of rare and endangered plants are significant factors that are considered in the TSF candidate alternative selection process.

Vegetation baseline surveying was conducted over a period of three years, from July 2011 to July 2013. These surveys included three terrestrial ecosystem mapping studies and four species at risk surveys (AMEC 2013b).

The Project area spans two ecoregions, the Fraser Plateau and Fraser Basin; and three ecosections, the Nazko Upland, Bulkley Basin and Nechako Lowland. There are four biogeoclimatic variants within the Project vegetation mine site local study area (VLSA; Figure 1.8-4), presented in Table 1.8-4 (AMEC 2013b).

Table 1.8-4. Biogeoclimatic Variants Identified within the Project Vegetation Local Study Area

Biogeoclimactic Code	Biogeoclimactic Unit	General Description	Elevation (masl)
SBSmc2	Sub-Boreal Spruce Moist Cold Babine variant	Low elevation interior forests and wetlands	900 to 1,250 m
SBSmc3	Sub-Boreal Spruce Moist Cold Kluskus variant	Low elevation interior forests and wetlands	975 to 1,300 m
ESSFmv1	Engelmann Spruce – Subalpine Fir Moist Very Cold Nechako variant	High elevation interior forest and wetlands	1,300 to 1,620 m
ESSFmvp	Engelmann Spruce – Subalpine Fir Moist Very Cold Nechako Parkland variant	High elevation subalpine parkland; rolling landscape tree islands interspersed with herbaceous meadows	1,620 to 1,660 m (cool aspect); 1,660 to 1,800 m (warm aspect)

Sensitive ecosystems in the Project mine site VLSA include riparian and mature forest (AMEC 2013b).

Four plant species of conservation concern were documented within the mine site VLSA: whitebark pine (*Pinus albicaulis*), meesia moss (*Meesia longiseta*), sickleleaf tomentypnum moss (*Tomentypnum falcifolium*), small-flowered lousewort (*Pedicularis parviflora subsp. parviflora*). All species are Blue-listed in BC (BC CDC 2013), with the whitebark pine also listed as Status 1 endangered under the *Species at Risk Act* (2002d) and endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2010). All of the confirmed plant species at risk are found in wetlands with the exception of whitebark pine (AMEC 2013b; Figure 1.8-4). Whitebark pine was identified as an at-risk species under the Project's Section 79(1) notice under the *Species at Risk Act* (SARA; 2002d; Appendix F).

1.8.9 Terrestrial Wildlife and Habitat

Terrestrial wildlife are characterized and considered in the TSF alternatives assessment process. In particular, the loss of rare and endangered ecosystems and the presence of rare and endangered wildlife are significant factors that are considered in the TSF candidate alternative selection process.

Wildlife field surveys were conducted within the terrestrial ecology local study area (TELSA) and terrestrial ecology regional study area (TERSA; Figure 1.8-5) according to modified Resources Information Standards Committee (RISC) protocols. Targeted studies for songbirds, diurnal and nocturnal raptors, waterbirds, common nighthawks (*Chordeiles minor*), sharp-tailed grouse (*Tympanuchus phasianellus columbianus*), pond-breeding amphibians, ungulates, furbearers, bats, butterflies, and dragonflies were undertaken in 2011 and 2012 (AMEC 2013p).

Thiry-five species of conservation concern[4] were identified as having the potential to be affected by the Project under the Project's Section 79(1) notice under the *Species at Risk Act* (2002d; Table 1.8-5; Appendix F).

Note that while Northern Goshawk laingi (*Accipter gentilis langii*) subspecies is red-listed in BC, and is a species at risk under SARA and COSEWIC, this subspecies does not occur in the Project area. The Northern Goshawk laingi subspecies is found west of the Coast Mountains and would not occur further east of Terrace, BC. The wildlife baseline report provided in Appendix 5.1.3.4A of the Application/EIS (New Gold 2015) states in Section 3.4.2.5 *Raptors* that with respect to the mine site LSA "The most frequently detected raptor was the red-tailed hawk *(Buteo jamaicensis),* followed by the northern goshawk". This statement refers to the *atricapillus* subspecies, which is yellow-listed in BC and not considered a species of concern under SARA or COSEWIC.

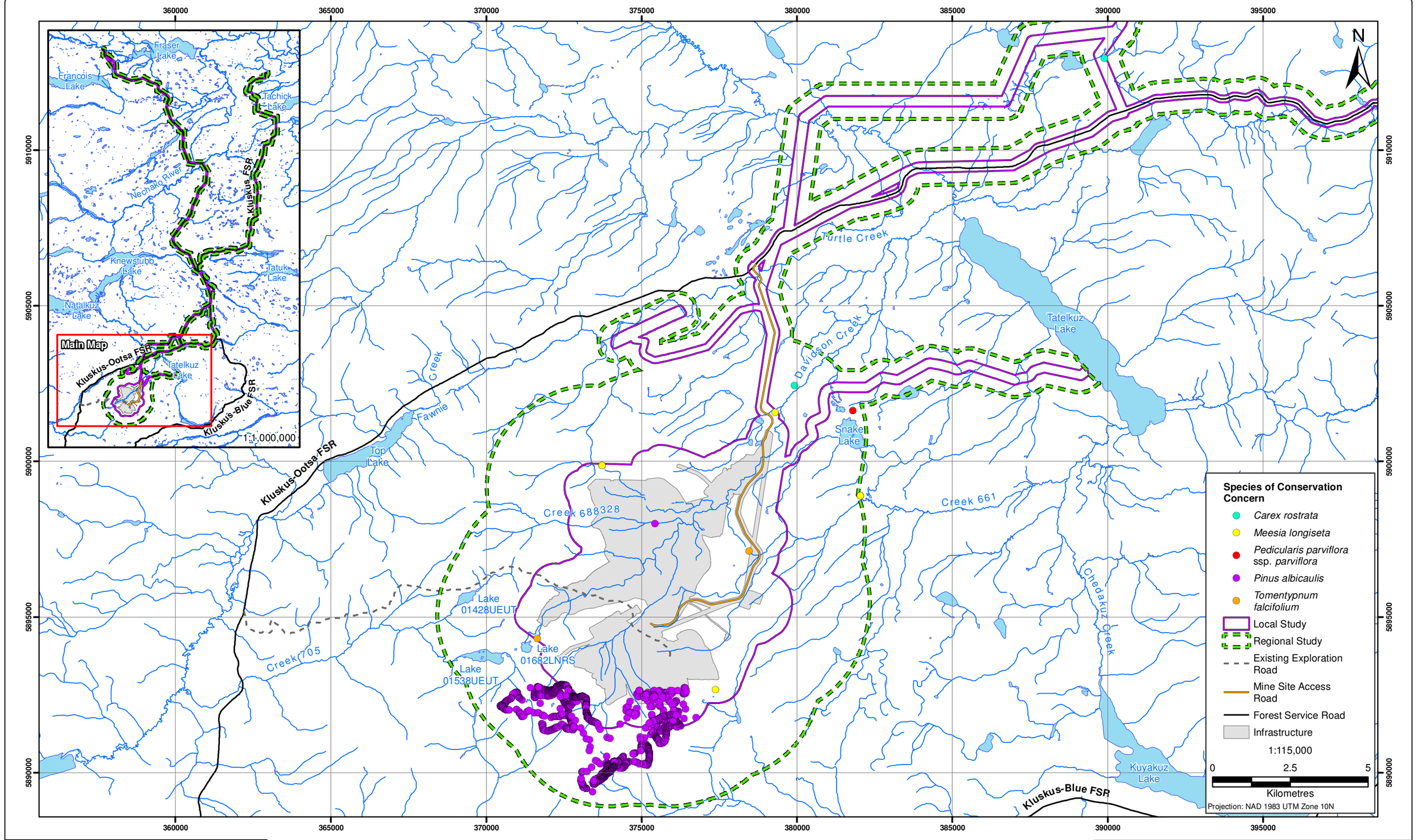
1.8.10 Aquatic Life and Habitat

Activities associated with TSF construction, operation, and closure can cause alterations in the water chemistry, water quality, and hydrology of streams and lakes. In turn, these changes can impact fish and other aquatic organisms, including the aquatic food web resources upon which fish depend for growth and reproduction (Vander Zanden and Vadeboncoeur 2002). The greatest potential environmental hazards caused by mine tailings involve effects arising from one or more of the following sources: metals and other trace elements leaching from tailings and waste rock; residual chemicals remaining from the ore extraction process; and/or waterbody acidification resulting from the oxidation of exposed sulfide minerals (Scott and Sloman 2004; Di Giulio and Hinton 2008; Besser and Rabeni 2009; Lottermoser 2010). Given the potential environmental consequences, mitigating these possible effects of mine tailings on fish, fish habitat, and other aquatic resources are primary considerations in the evaluation of TSF alternatives.

Fresh water systems in the Project area contain habitat such as riparian zones, wetlands, and stream channels that support aquatic life, including several species of fish. The key streams and lakes that have the potential to be affected by the Project include (Figure 1.8-6):

- Tatelkuz Lake;
- Lake 01682LNRS in the Davidson Creek watershed;
- Lakes 01538UEUT and 01428UEUT in the Creek 705 watershed;
- Snake Lake in the Tatelkuz Lake tributaries watershed;

[4] COSEWIC; Federal *Species at Risk Act* (200m2c); and BC provincially listed species.



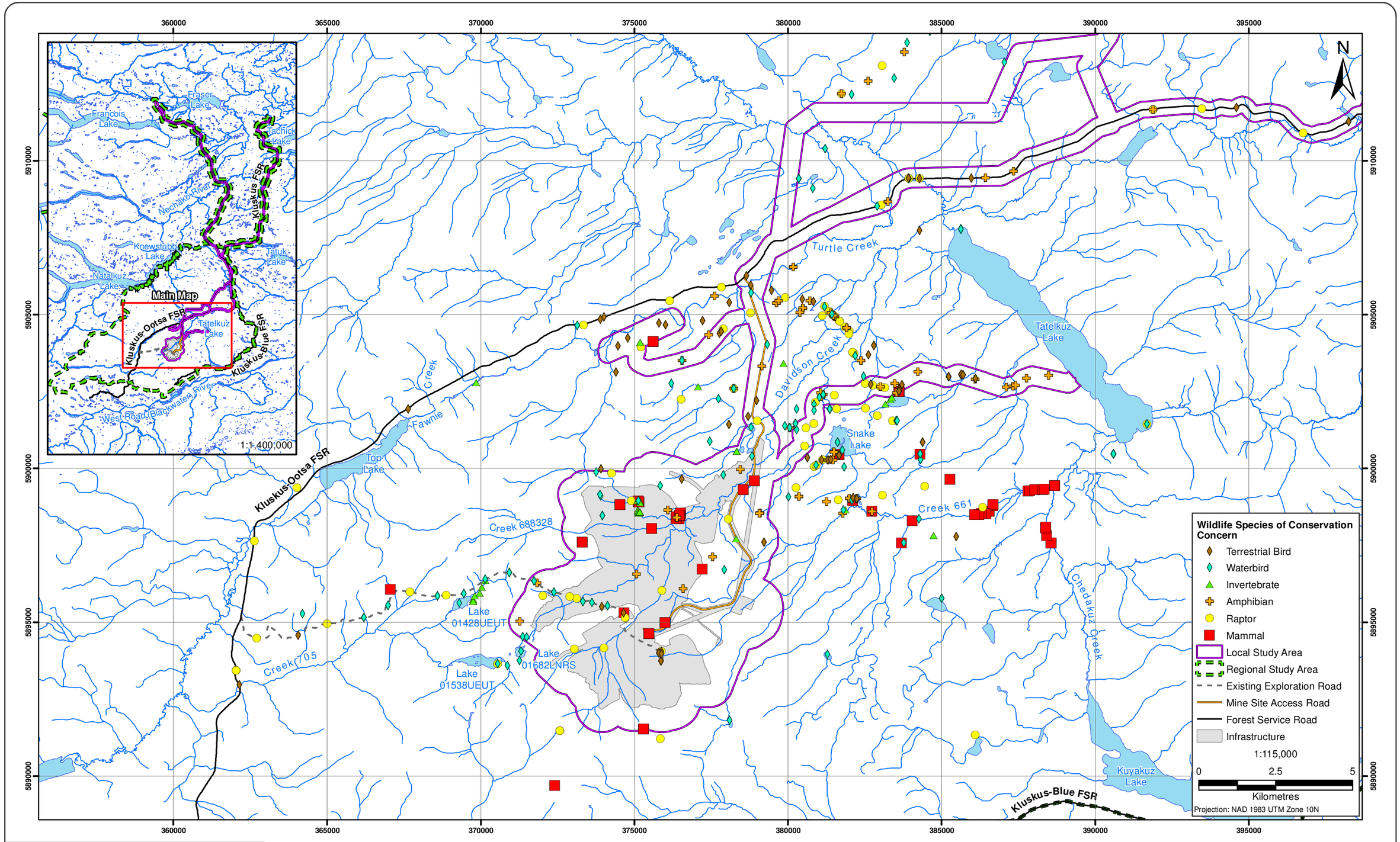
newgold

Rescan an ERM company

Figure 1.8-4

Blackwater Gold Project: Vegetation Local and Regional Study Areas and Locations of Identified Species of Conservation Concern

PROJECT #0215644-001 GIS # BLW-23-006 February 27, 2014

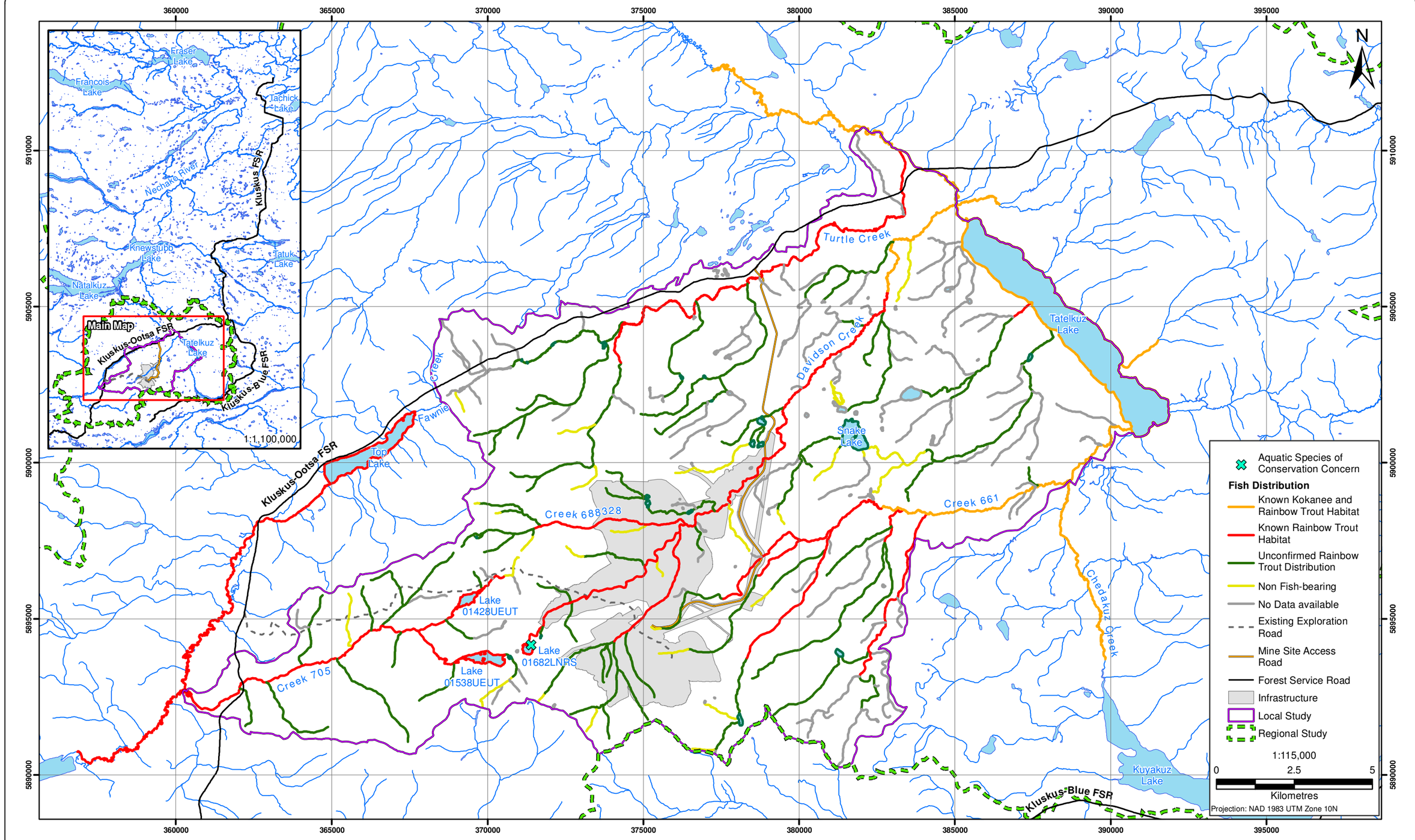


newgold

Rescan an ERM company

Figure 1.8-5

Blackwater Gold Project: Terrestrial Ecology Local and Regional Study Areas



newgold

Rescan an ERM company

Figure 1.8-6

Blackwater Gold Project: Aquatics Local and Regional Study Areas, Fish Species Distribution, and Identified Aquatic Species of Conservation Concern

Table 1.8-5. Wildlife Species of Conservation Concern Recorded within the Project Mine Site Terrestrial Ecology Local and Regional Study Areas

Species	Status		
	COSEWIC	SARA	Provincial
Western toad (*Anaxyrus boreas*)	Special Concern	Special Concern, Schedule 1	Blue
Olive-sided flycatcher (*Contopus cooperi*)	Threatened	Threatened, Schedule 1	Blue
Common nighthawk (*Chordeiles minor*)	Threatened	Threatened, Schedule 1	Yellow
Short-eared owl (*Asio flammeus*)	Special Concern	Special Concern, Schedule 1	Blue
Rusty blackbird (*Euphagus carolinus*)	Special Concern	Special Concern, Schedule 1	Blue
Long-billed curlew (*Numenium americanus*)	Special Concern	Special Concern, Schedule 1	Blue
Yellow Rail (*Coturnicops noveboracensis*)	Special Concern	Special Concern, Schedule 1	Red
Barn swallow (*Hirundo rustica*)	Threatened	Not listed	Blue
Horned grebe (*Podiceps auritus*)	Special Concern	Not listed	Yellow
Sharp-tailed grouse columbianus subspecies (*Tympanuchus phasianellus columbianus*)	Not listed	Not listed	Blue
Peregrine falcon (*Falco peregrinus*)	Special Concern	Not listed	No status
Western screech owl (*Megascops kennicottii kennicottii*)	Threatened	Special Concern, Schedule 1	Blue
Lewis's woodpecker (*Melanerpes lewis*)	Threatened	Threatened, Schedule 1	Red
American bittern (*Botaurus lentiginosus*)	Not listed	Not listed	Blue
American golden-plover (*Pluvailis dominica*)	Not listed	Not listed	Blue
California gull (*Larus californicus*)	Not listed	Not listed	Blue
Caspian tern (*Hydroprogne caspia*)	Not listed	Not listed	Blue
Wolverine (*Gulo gulo luscus*)	Special Concern	Not listed	Blue
Grizzly bear western population (*Ursus arctos*)	Special Concern	Not listed	Blue
Fisher (*Pekania pennanti*)	Not listed	Not listed	Blue
Woodland caribou (Northern Mountain population) (*Rangifer tarandus caribou*)	Threatened	Special Concern, Schedule 1	Blue
Woodland caribou (Southern Mountain population) (*Rangifer tarandus caribou*)	Threatened	Threatened, Schedule 1	Red
Little brown myotis (*Myotis lucifugus*)	Endangered	Not listed	Yellow
Northern myotis *(Mytois septentrionalis*)	Endangered	Not listed	Blue
Hagen's bluet (*Enallagma hageni*)	Not listed	Not listed	Blue
Beaverpond baskettail (*Epitheca canis*)	Not listed	Not listed	Blue
Quebec emerald (*Somatochlora brevicincta*)	Not listed	Not listed	Blue
Forcipate emerald (*Somatochlora forcipata*)	Not listed	Not listed	Blue
Kennedy's emerald (*Somatochlora kennedyi*)	Not listed	Not listed	Blue
Assiniboine skipper (*Hesperia assiniboia*)	Not listed	Not listed	Red
Checkered skipper (*Pyrgus communis*)	Not listed	Not listed	Blue
Jutta arctic (*chermocki* subspecies) (*Oeneis jutta chermocki*)	Not listed	Not listed	Blue
Northern tightcoil (*Pristiloma arcticum*)	Not listed	Not listed	Blue
Black-footed tightcoil (*Pristiloma chersinella*)	Not listed	Not listed	Blue

Note: COSEWIC = Committee on the Status of Endangered Wildlife in Canada; SARA = Species at Risk Act (2002d); Provincial = BC provincially listed species.

- Davidson Creek, which flows into Chedakuz Creek downstream of Tatelkuz Lake;
- Chedakuz Creek immediately downstream of Tatelkuz Lake;
- Turtle Creek, an ungazetted stream that flows into Chedakuz Creek downstream of Tatelkuz Lake;
- Creek 661, an ungazetted stream that flows into Chedakuz Creek upstream of Tatelkuz Lake;
- Creek 705, an ungazetted stream that flows down the west side of Mt. Davidson into Fawnie Creek; and
- Ungazetted tributaries to the streams listed above.

Fish and aquatic life baseline studies were conducted within the Aquatics Local Study Area (ALSA) and Aquatics Regional Study Area (ARSA) specifically for the project from 2011 to 2013. One set of baseline studies focussed on fish communities and the aquatic resources that are important to fish habitat in the lakes and streams of the Project area (AMEC 2013k; 2013j; Figure 1.8-6). The investigated biological resources included primary and secondary producers (periphyton and macroinvertebrates in streams; phytoplankton primarily, zooplankton, and macroinvertebrates in lakes), many of which serve as important food items for fish or key trophic links sustaining the growth, reproduction, and other life processes of fish (Vander Zanden and Vadeboncoeur 2002). A second set of baseline studies focussed on physical and chemical characteristics, water quality, and sediment quality of selected streams and three headwater lakes in the ALSA and ARSA (AMEC 2013h). Mine tailings can potentially affect these aspects of stream and lake habitats (Lottermoser 2010), which in turn can possibly result in direct impacts to fish, or indirect impacts to fish via direct effects on biological resources such as primary and secondary producers. Results of the two sets of 2011 – 2012 baseline studies are summarized as follows:

- Stream temperatures: Measured stream temperatures within the ARSA and ALSA fall below the BC MOE optimal temperature ranges (BC MOE 2001) for the full life history (i.e., spawning, rearing, over-wintering, and migration) of Rainbow Trout (*Oncorhynchus mykiss*) and Kokanee (*Oncorhynchus nerka*), the two most common fish species in the region. Hence, low temperatures rather than high temperatures limit aquatic biological processes in the ARSA and ALSA.
- Periphyton density and biomass: Mean periphyton density and biomass (as indexed by chlorophyll a concentration) within the ALSA both showed substantial variation among sites, but different spatial distributions. This variation was associated with differences in taxonomic composition among sites. Overall, periphyton communities tended to be dominated by diatoms and cyanobacteria. Diatoms were predominant at 10 of the 14 sites and cyanobacteria at the other four sites. Relatively high proportions of cyanobacteria in streams are generally associated with high nutrient concentrations.
- Phytoplankton: Mean phytoplankton cell density and biomass were highest in Lake 01682LNRS (the headwater lake of Davidson Creek) and lowest in Lake 01538UEUT (one of two headwater lakes in the Creek 705 Watershed). Mean densities and biomasses were similar among depths I n each of the three lakes within the ALSA and ARSA. Different taxa of Chrysophyta (i.e., golden algae and diatoms) were predominant in lakes 01428UEUT and 01538UEUT and in the surface

and deep samples from Lake 01682LNRS. In contrast, Cryophyta was the predominant taxon of phytoplankton below the thermocline of Lake 01682LNRS. Green algae (Chlorophyta) were present in all of the lakes, but never made up more than 29% of total the total number of cells in a sample. Chlorophyta are often preferred food for higher aquatic organisms that feed on plankton, and heavy phytoplankton grazing may be one reason for its lack of numerical dominance in the Project area. Blue-green algae (cyanobacteria) were not abundant in any of the samples, and dinoflagellates and euglenoids were uncommon to rare.

- Zooplankton: Mean zooplankton density and biomass were highest in Lake 01428UEUT and lowest in Lake 01682LNRS. Both density and biomass were similar between Lake 01538UEUT and Lake 01682LNRS. Lake 01428UEUT has the lowest mean Secchi depth (3.5 m; i.e., highest turbidity), followed by Lake 01538UEUT (4.8 m) and Lake 01682LNRS (5.6 m). This suggests that zooplankton abundance in these headwater lakes is driven by lake morphometry and transparency. Rotifers were the predominant zooplankters by density in all three lakes.
- Benthics macroinvertebrates (BMI): BMI communities within the streams and lakes varied significantly across years, across sites, and within sites. For streams, among-site variation is most pronounced, followed by interannual variation, while within-site variation is lowest. The BMI communities within the ALSA and ARSA closely reflect site conditions related to altitude, productivity (i.e., periphyton density and biomass), stream size, and the amount of silt in the stream.
- Fish and fish habitat: Surveys of stream fish habitat were conducted to identify, characterize, and quantify the available habitat for fish within the ALSA, and at stream crossings along the transmission line and road access corridors. This revealed a habitat distribution pattern typical of the central BC interior—steep, sub-alpine headwaters of naturally poor quality fish habitat, in general, draining to lower gradient reaches of higher quality habitat that flow into large, overwintering lakes (e.g., Tatelkuz Lake). No major fish barriers were identified during the surveys (some partial impediments were identified, e.g. steep cascades), with fish habitat widely distributed and access available into headwater drainages within the ALSA and affected drainages.

The quality of overwintering habitat for fish was assessed at 25 stream sites and in three headwater lakes in 2012 and 2013. Sites in the lower reaches of streams tended to have good overwintering habitat (e.g., Davidson Creek mainstem and a ponded section of Turtle Creek) but other sites at higher elevations were rated as poor (e.g., surveyed headwater sites in Davidson Creek and Turtle Creek). The lake surveys revealed that overwintering fish habitat in Lake 01682LNRS is poor quality below 4.0 m due to the presence of low DO concentrations, yet the quality improves at shallower depths. Snake Lake offers poor overwintering habitat owing to its shallow depth and low DO concentrations. In contrast, overwintering habitat in Lake 01538UEUT is good at all depths. Two years of sampling show that there is a range of overwintering habitat quality in streams and lakes in the ALSA, and that the quality of overwintering habitat at most sites varies between years.

Twelve species of fish were captured in the ALSA and ARSA, including Kokanee (*Oncorhynchus nerka*), Rainbow Trout (*Oncorhynchus mykiss*), Lake Chub (*Couesius plumbeus*), Longnose Sucker (*Catostomus catostomus*), Brassy Minnow (*Hybognathus hankinsoni*), Mountain Whitefish (*Prosopium*

williamsoni), Burbot (*Lota lota*), Longnose Dace (*Rhinichthyes cataractae*), Slimy Sculpin (*Cottus cognatus*), Northern Pikeminnow (*Ptycheilus oregonensis*), Largescale Sucker (*Catostomus macrocheilus*), and White Sucker (*Catostomus commersonii*).

The Brassy Minnow is a blue-listed species in BC and is classified as sensitive or vulnerable (BC CDC 2013). Blue-listed taxa are at risk, but are not extirpated, endangered or threatened. Brassy Minnow is not ranked by the COSEWIC or listed under the *Species at Risk Act* (2002d). This species has not been identified in the Project's Section 79(1) notice under the *Species at Risk Act* (2002d; Appendix F).

Kokanee, Rainbow Trout, Burbot, and Mountain Whitefish are fished recreationally in many parts of BC. Kokanee and Rainbow Trout were the most common species counted, however sampling methods (e.g. Kokanee spawner surveys) targeted these species. Data on the geographic distribution of fish in the study area are summarized in Figure 1.8-6. For the purposes of this assessment it is assumed fish are present the areas where fish presence/absence hasn not been assessed.

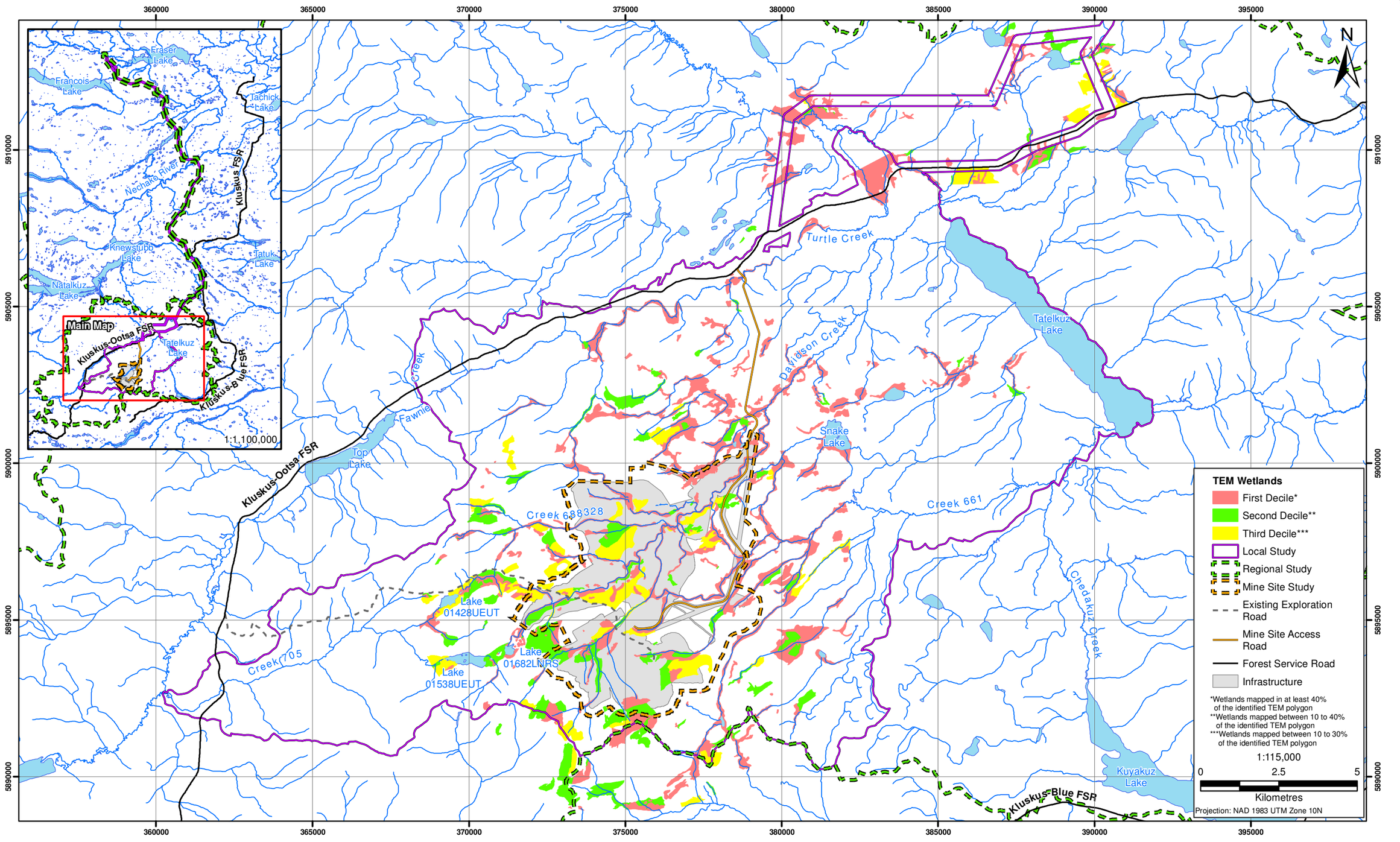
Different populations of Kokanee and Rainbow Trout were identified on the basis of four factors: genetic relatedness; proximity to overwintering habitat; location of partial impediment to fish migration; and geograhic disribution, including that of young-of-the year fish, which indicates spawning areas. The Project area contains three populations of Kokanee: one population inhabits Kuyakuz Lake and spawns in tributaries of the lake and the main channel of Chedakuz Creek downstream from the lake (Figure 1.8-6); two populations inhabit Tatelkuz Lake, one spawning in August in one set of creeks and the other spawning in September in a different set of creeks (AMEC 2013j, 2013k). Whereas immature Kokanee are mainly found in lakes, Rainbow Trout are the predominant species in streams of the Project area. Seven possibly distinct populations of Rainbow Troutwere proposed in the baseline studies, however, they are all closurely related (AMEC 2013j, 2013k): one population from the lower reaches of Davidson Creek near Tatelkuz Lake; one population from the headwater reaches of Davidson Creek; one population each in Turtle Creek and Creek 661; and three populations in Creek 705. During the baseline surveys, Rainbow Trout were also found in Tatelkuz Lake, the headwater lake of Davidson Creek (Lake 01682LNRS), and the two headwater lakes of Creek 705 (Lake 01538UEUT and Lake 01428UEUT; Figure 1.8-6). Rainbow Trout do not inhabit Snake Lake owing to a low concentration of dissolved oxygen in winter and poor surface drainage connectivity.

1.8.11 Wetlands

Wetlands and associated ecosystems are characterized and considered in the TSF alternatives assessment process. In particular, the loss of wetland habitat/ecosystems and the presence of rare and endangered plants/wildlife associated with the wetlands are significant factors that are considered in the TSF candidate alternative selection process.

As part of wetland mapping and classification for the Project, 127 wetland-related field surveys within the wetland local study area (WLSA) and wetland regional study area (WRSA) were completed in 2011 and 2012. Wetland resources comprised approximately 3,333 ha (12% by area) of the WLSA (AMEC 2013o). Approximately 453 ha (14% by area) of the mine site footprint were classified as wetlands with the most common wetland class identified as swamps (approximately 11%; Figure 1.8-7).

PROJECT #0215644-001 GIS # BLW-22-001 February 12, 2014



newgold

Rescan an ERM company

Figure 1.8-7

Blackwater Gold Project:
Wetlands Mine Site, Local, and Regional Study Areas and Wetlands Resources

Twenty-one distinct wetland ecosystems were classified within the WRSA. Of the 21 wetland types encountered within the WRSA, 11 are listed as threatened (red-listed) or of special concern (blue-listed) in BC, with six (blue-listed) identified within the mine site footprint (representing 2.3% of the mine site footprint; AMEC 2013o). A Wetland Compensation Plan will be required if any of threatened or special-concern wetlands are affected by the Project.

1.9 HUMAN ENVIRONMENT SETTING

The construction, operation and closure of the Project's TSF has the potential to affect the socio-economic environment, including the use of Crown tenures. These activities may also interfere with heritage sites, including sites of archaeological, historical and paleontological significance.

The Project and its components extend through areas accessed by commercial interests or tenure holders, the public, and Aboriginal groups. The Project has been designed to avoid private land and, through consultation with stakeholders, the Project footprint has been modified to minimize effects on range, guide outfitter, and trapping tenures. The mine site area does not cross or overlap any federal or provincial parks,protected areas or Agricultural Land Reserves. The socio-economic setting of the Project is shown in Figures 1.9-1 through 1.9-4.

The Project is located in the Central Interior of British Columbia (BC) in Electoral Area "I" of the Cariboo Regional District. The Project area is sparsely inhabited, with two ranches found within a 20 km radius of the Project site. The communities nearest to the Project are dependent on forestry and the public sector for income and employment, with less reliance on mining and agriculture. Prince George is the regional hub with air service from major centres.

The transmission line and the Kluskus FSR extend from the mine site to Highway 16 (Yellowhead Highway), which connects more populated areas, including Vanderhoof and Fraser Lake. Vanderhoof is a district municipality with a population of approximately 4,500 residents (Figure 1.9-1). The major industries are lumber and agriculture. Community facilities include schools,health centre, Royal Canadian Mounted Police (RCMP) detachment, and fire hall. Vanderhoof also provides regional services for smaller rural communities nearby.

The village of Fraser Lake between Burns Lake and Vanderhoof along the Yellowhead Highway has approximately 1,300 residents. Fraser Lake is close to the Endako mine, which suspended operation in December 2014 due to weak molybdenum prices. Forestry is the main industry in the area. Community services include a school, health centre, RCMP detachment, and fire hall.

1.9.1 Parks and Protected Areas

There are no designated National Historic Sites, Marine Conservation Areas, Wildlife Areas, or migratory bird sanctuaries in the vicinity of the Project, nor any overlap with national and provincial parks or protected areas (Figure 1.9-1). The closest park to the proposed Project, Entiako Provincial Park, is located approximately 26 km northwest of the mine site (Figure 1.9-1).

1.9.2 Non-Traditional Land Use

The Project mine site footprint is located within the Vanderhoof Land and Resource Management Plan (LRMP), approved by the BC government in 1997 (Minister of Forests 1997). The LRMP covers 1.38 million ha of Crown land and includes provisions relating to commercial and recreational access and uses. The Vanderhoof LRMP establishes several Resource Management Zones (RMZs). The Project mine site footprint is located mostly in the Davidson Creek RMZ 17, which is designated as "Resource Development Emphasis", and borders on Multi-value Emphasis Zones (AMEC 2013l). The intent of the Davidson RMZ 17 is to: balance resource development with wildlife, Aboriginal, and recreational values through appropriate access management; limit access to the whole area south of the Kluskus-Ootsa FSR (which is associated with resource development); and manage the northwest zone to restrict access and provide a buffer for critical caribou winter range that lies further west (Minister of Forests 1997).

There are four guide outfitting tenures in the general Project area; certificate No601039 overlaps the Blackwater deposit (Figure 1.9-2). There are five provincially registered traplines in the general Project area; TR0512T027 overlaps the Blackwater deposit (Figure 1.9-2).

Four range tenures occur in the Project area, although none of them overlap the Blackwater deposit (Figure 1.9-3). The recreational sensitivity and significance has also been classified for the general project area; although the Blackwater deposit occurs within an area of unknown recreational sensitivity and significance. The area immediately to the south of the deposit is classified as having moderate sensitivity and high significance for recreation (Figure 1.9-3).

The general project area is overlapped by multiple mineral tenures; however, the Blackwater deposit and surrounding areas occur exclusively on New Gold's mineral tenures (Figure 1.9-4).

1.9.3 Heritage

An archaeological impact assessment (AIA) was conducted for the Project under *Heritage Conservation Act* (*HCA;* 1996b) Heritage Inspection Permit 2012-0295; the findings of the AIA have been summarized in AMEC (2013d). In addition, a paleontological assessment was conducted for the Project, the results of which have also been summarized in AMEC (2013d).

During the AIA of the mine site footprint a total of 1,423 subsurface tests were conducted within 77 areas which had been identified as having moderate or high archaeological potential. Subsurface testing and pedestrian surveys throughout this area resulted in the identification of three prehistoric archaeological sites: FhSe-73, FhSe-74, and FhSf-4. In addition, historic features, including the remains of a historic cabin, 73 blazed trees, and eight culturally modified trees post-dating 1846 AD were also observed; these features are not protected by the *HCA*. Protected archaeological site FhSe-73 consists of an isolated artifact (a chalcedony flake) and a cache pit, FhSe-74 consists of an artifact scatter of dacite and obsidian flakes and shatter, and FhSf-4 consists of a single chert scraping tool. No paleontological sites were identified within the Project mine site.

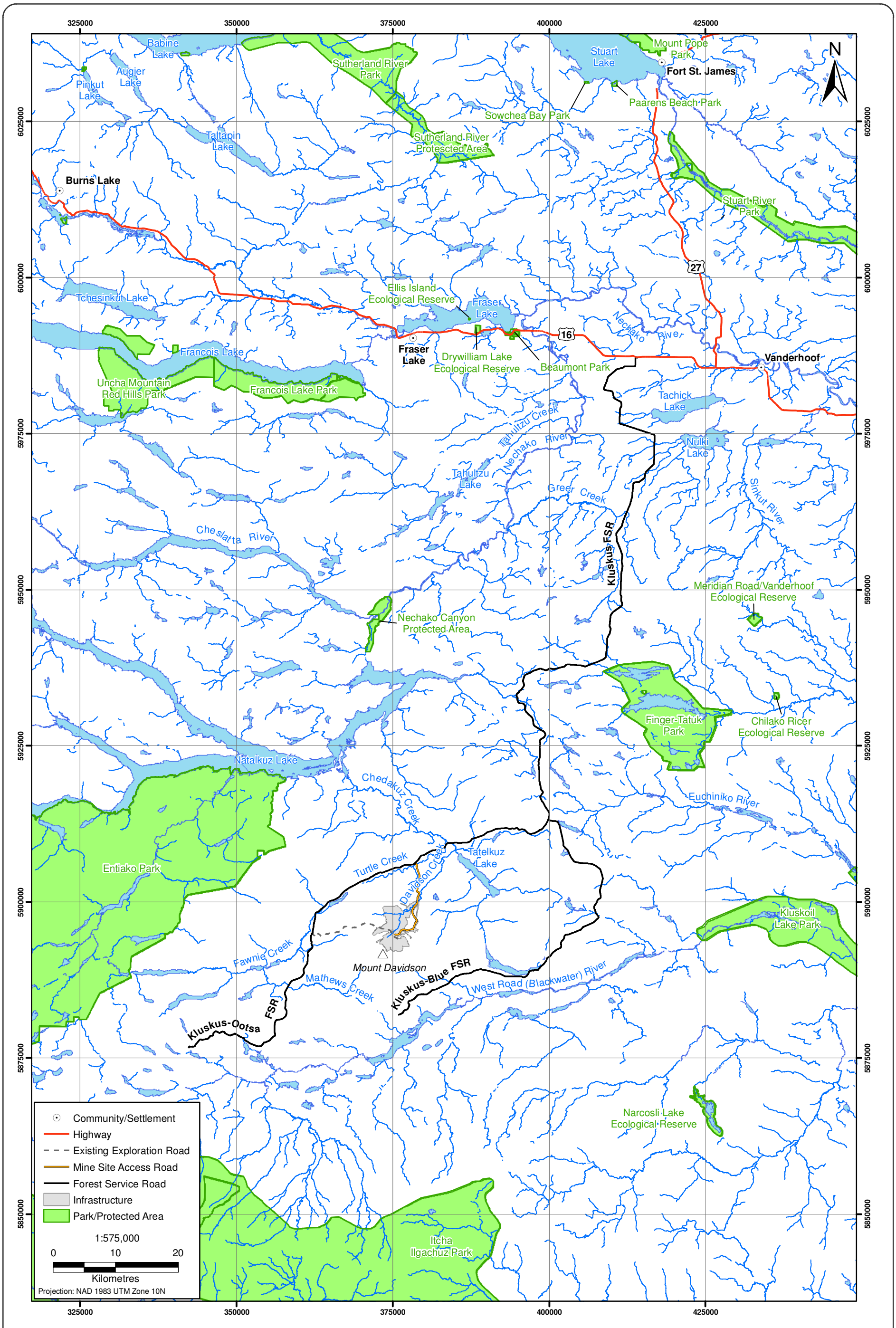


Figure 1.9-1

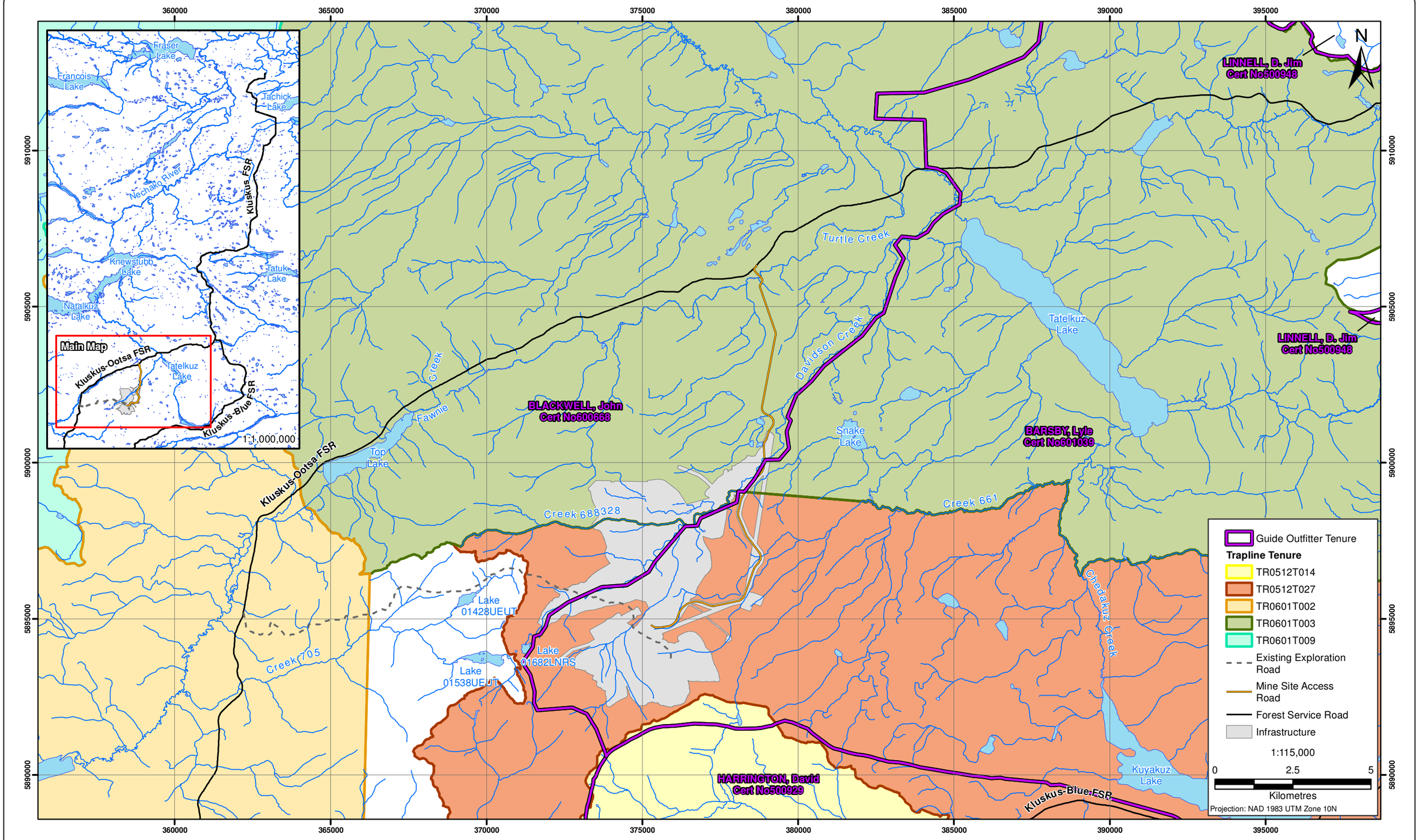
newgold

Blackwater Gold Project: Socio-economic Setting

Figure 1.9-1

Rescan an ERM company

PROJECT #0215644-001 GIS # BLW-16-008 February 27, 2014



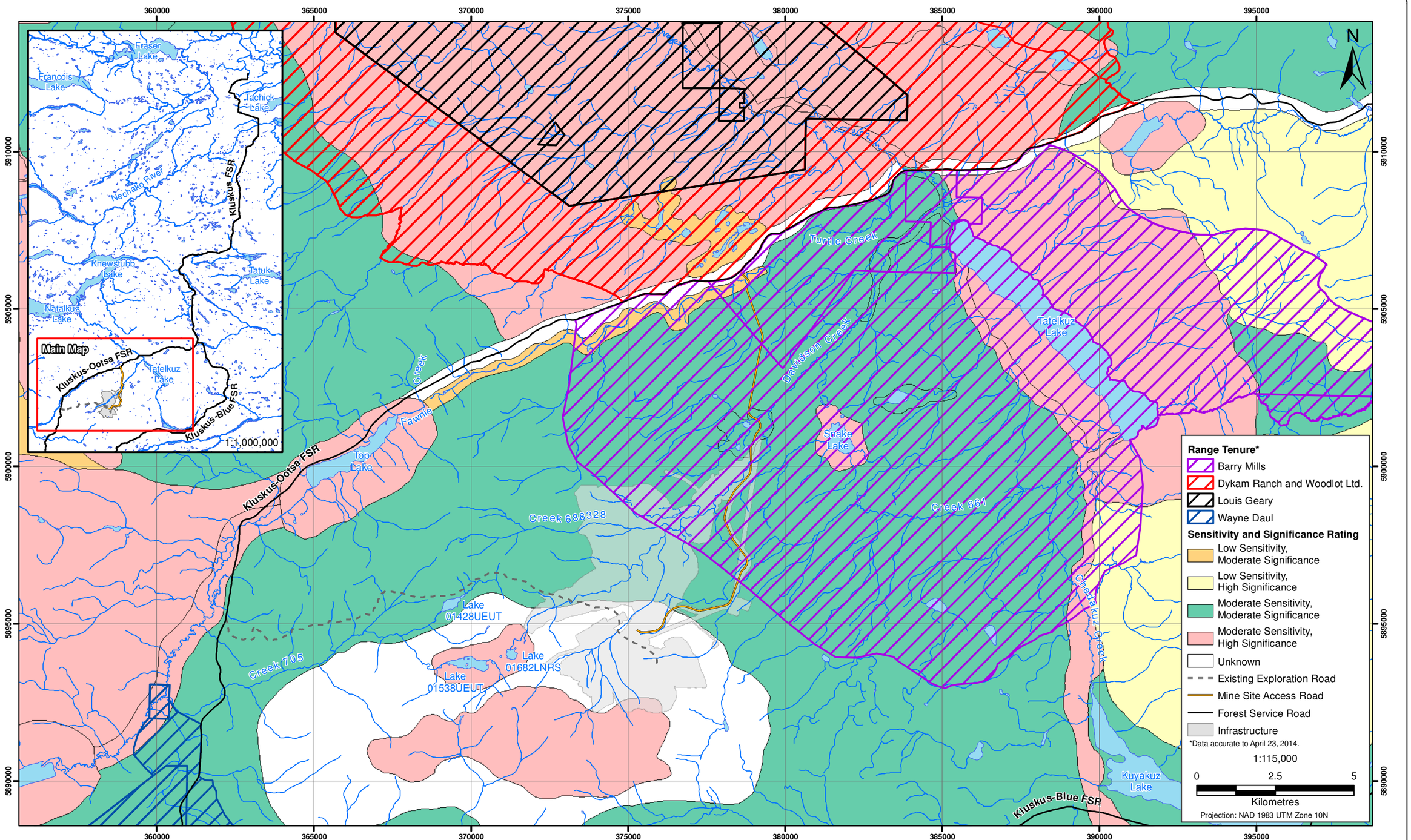
newgold

Rescan an ERM company

Figure 1.9-2

Blackwater Gold Project:
Guide Outfitter and Trapline Tenures

PROJECT #0215644-001 GIS # BLW-16-009 August 7, 2014

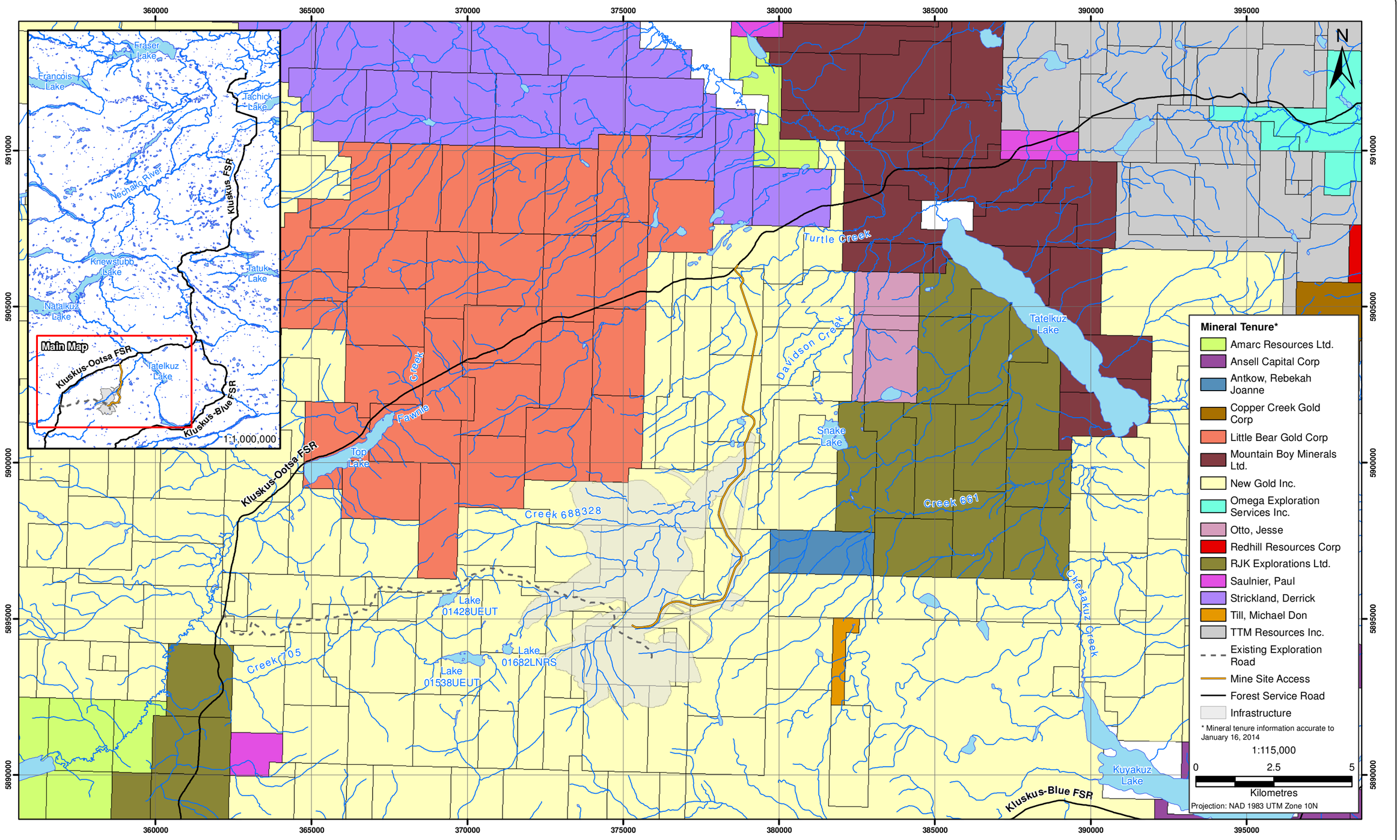


newgold

Rescan an ERM company

Figure 1.9-3

Blackwater Gold Project: Range Tenures and Recreational Sensitivity and Significance Ratings



newgold

Rescan an ERM company

Figure 1.9-4

Blackwater Gold Project: Mineral Tenures

1.10 ABORIGINAL CONTEXT AND CONSULTATION

The proposed mine site is located within the asserted traditional territories of the Ulkatcho First Nation (UFN), the Lhoosk'uz Dene Nation (LDN), and Skin Tyee Nation (STN; Figure 1.10-1). The southern edge of the traditional territory of the Saiku'z First Nation (SFN) is approximately 18 km downstream of the mine site. The LDN Tatelkuz Lake IR #28 is located approximately 17 km northeast of the mine site. Portions of the proposed transmission line right of way cross through the asserted traditional territories of the Nadleh Whut'en First Nation (NWFN), Saik'uz First Nation (SFN), LDN, STN, Nazko First Nation (NFN), Stellat'en First Nation (StFN), and the Tsilhqot'in National Government (TNG).

The Métis, as represented by Métis Nation BC (MNBC), also has a presence in the area. However, the extent of their land use is not available at this time.

Aboriginal groups in the Project are primarily speakers of the *Dakelh* language, which means "people who travel upon water" (CSTC 2011). The traditional Dakelh way of life was based on what is commonly called the seasonal round, where small extended family groups harvested animals, food and medicinal plants, and fish during different seasons and in different locations. Each extended family group had used and managed a particular territory, known as a *keyoh*, which was passed down from generation to generation.

Consultation and engagement activities undertaken by the Proponent with each Aboriginal group, during the pre-Application stage of the EA process includes:

- Leadership meetings with Chief, Council, and community representatives
- Research that included previous EAs and ethnographic studies, legal cases, and other publicly available information from Aboriginal sources;
- Correspondence between the Proponent (letters and email) and Aboriginal groups;
- Community open houses;
- Primary research, such as interviews with Aboriginal community members;
- Site visits and tours;
- Traditional land and resource use studies;
- Telephone discussions; and
- Letters and comments submitted to the Canadian Environmental Assessment Agency (Agency) and the British Columbia Environmental Assessment Office (BC EAO).

The Proponent has presented and discussed the proposed waste management plans for the Project, including the TSF, NAG dumps and LGO stockpile alternatives. The Project design principles have been influenced by comments received during consultations with Aboriginal groups. For example, in response to comments from Aboriginal groups and stakeholders, one design principle is to avoid ungulate winter range and critical habitat.

Consultation specific to the MAA has included the use of poster boards at open houses and community meetings with Aboriginal groups (see Appendix G). For additional detail on

consultation activities conducted with each Aboriginal group during the pre-Application stage, refer to Section 17 of the EA Application (New Gold 2015).

The Proponent continues to consult with communities to gather additional information about how the Project may impact Aboriginal traditional land and resource use and Aboriginal rights and interests, and to discuss ways to mitigate or accommodate potential impacts. The Proponent presented an overview of the methodology used in this report to NFN on September 26, 2014. During the formal review of the EA Application, Aboriginal groups will have an opportunity to review and comment on this report. New Gold will also organize and attend community meetings to discuss the Application, including the findings in this report.

Aboriginal current use of lands and resources for traditional purposes, where this information has been provided by Aboriginal groups, is described below for each Aboriginal group. Current use information is taken from Section 7.2.7 of the Blackwater Project's Application for an Environmental Assessment Certificate/Environmental Impact Statement (EA Application; New Gold 2015) and a memorandum prepared by New Gold which summarizes current land and resource use for traditional purposes for the NWFN, StFN, SFN, LDN, UFN, STN, TNG and Métis (ERM 2015a). This report focuses on the potential effects of TSF alternatives on LDN, UFN and STN based on New Gold's understanding of Aboriginal uses in the mine site area.

1.10.1 Lhoosk'uz Dene Nation

Lhoosk'uz is a Dakelh word meaning "half a Whitefish". The Lhoosk'uz Dene Nation is also known as the Kluskus First Nation. The LDN is affiliated with the Carrier-Chilcotin Tribal Council (CCTC), and they reside in Kluskus Village (IR #1), located 173 km west of Quesnel, British Columbia.

Historically, the LDN territories were owned by four primary descent family groups (*sadeku*). The territories were split into four family Keyoh that were the exclusive traditional use areas that sustained each family under the direction of the most senior family male (*detso*). Others who wished to use the Keyoh had to seek permission from, or be invited by, the *detso*. The Keyoh were used for all traditional use activities, including hunting, trapping, fishing, and plant harvesting. The Keyoh were inherited primarily through male descendants.

Consultation activities with LDN have been carried out under an Exploration Agreement (the Agreement) negotiated between LDN and the Proponent in November 2011. The Agreement defines a consultation process to address project-related issues and specifies the frequency and location of community and leadership meetings to share information.

The Agreement also includes provisions regarding the collection of Traditional Land Use (TLU) information to support the EA, data confidentiality, and funding to undertake the TLU study. A TLU study was completed in September 2013 although the data are not available to include in this report due to confidentiality concerns. However, the report was reviewed for potential inclusion in this analysis which indicated typical patterns of use consistent with major waterbodies (e.g., Tatelkuz Lake, Chedakuz Creek and to the immediate south and east of the peak of Mt. Davidson to and along the Blackwater River). The report included no site-specific data pertaining to the TSF alternatives considered in this report. The Proponent has committed to integrate TLU information into the final project design, execution, management plan development, permitting and monitoring, as available and appropriate.

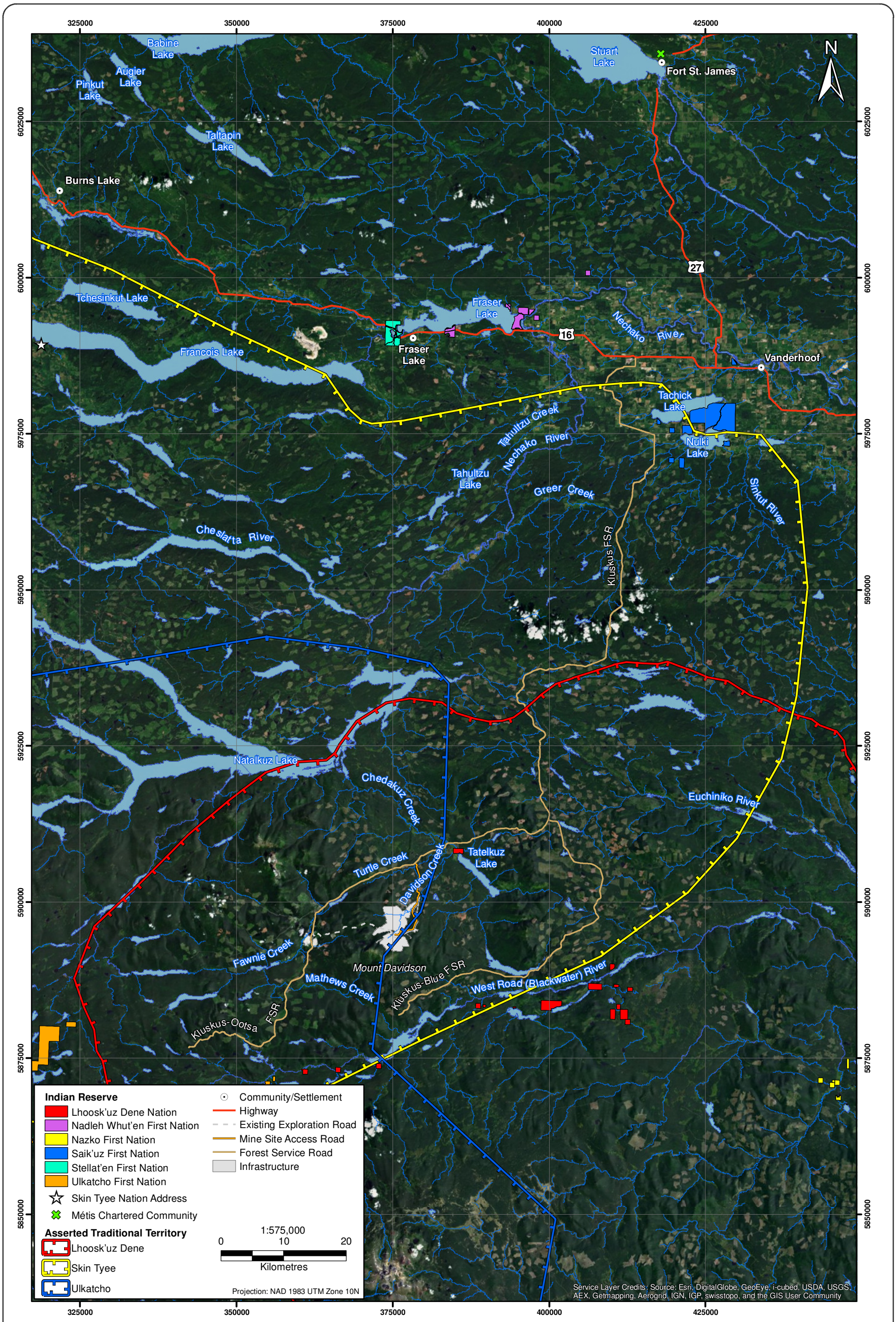


Figure 1.10-1

newgold

Blackwater Gold Project: Aboriginal Setting

Figure 1.10-1

Rescan an ERM company

Based on consultation and engagement activities with LDN, the Proponent has gained an understanding of LDN Aboriginal rights and interests related to the Project, which are summarized in the EA Application (New Gold 2015, Chapter 15; Table 1.10-1). Consultation reports, which summarize consultations undertaken with LDN by New Gold, and issues raised by LDN and the Proponent responses to the issues, was sent to LDN in April 2014 and November 2014, for review and comment. No comments were provided by the LDN on these reports.

Table 1.10-1. Lhoosk'uz Dene Nation Aboriginal Rights and Interests

Current Use	Potential Issue	Potential Environmental Effect	Relevant MAA Sub-Account: indicators
Hunting	Effects on caribou	Changes in migration patterns or habitat that may affect abundance and distribution of caribou.	**Wildlife**: direct loss or disturbance to caribou habitat.
	Effects on migratory birds and mammals that may access water in the tailings ponds	Changes in habitat or populations of trapped species that may reduce resources.	**Wildlife**: direct loss or disturbance to terrestrial bird habitat; direct loss or disturbance to moose habitat; **Surface water quality**: potential for ARD/ML generation.
Trapping	Effects on registered traplines and LDN trapping areas	Potential reduction in access or availability of land for trapping.	**Wildlife**: direct loss or disturbance to American marten habitat; The effects on traplines were not found to be differentiating among TSF alternatives and were not carried forward in the MAA (see Table 5.3-3).
Fishing	Effects on fish and fish habitat from water quality changes; Effects from changes in water quality on furbearers and animals trapped for food	Changes in water quality or sediment that may affect fish populations or animals that rely on these resources.	**Fish and fish habitat**: downstream Kokanee values, downstream Rainbow Trout values (indicators); **Surface water quality:** potential for ARD/ML generation, water quality of receiving environment.
	Effects on LDN fishing from the loss of fish and fish habitat	Loss of fish and fish habitat on the mine site and loss of access by fish to the headwaters of Davidson Creek and Creek 661	**Fish and fish habitat**: extent of permanent alteration to or destruction of fish habitat, loss of fish habitat.

(continued)

Table 1.10-1. Lhoosk'uz Dene Nation Aboriginal Rights and Interests (completed)

Current Use	Potential Issue	Potential Environmental Effect	Relevant MAA Sub-Account: indicators
Harvest of traditional plants	Potential displacement and contamination of berry-picking sites	Potential loss or change in access to areas for plant harvesting and potential contamination from dust.	**Climate and atmosphere**: dust emissions; Areas of specific traditional plant harvest not disclosed given the sensitive nature; however, address through calculation of footprint area which was not differentiating among options; was not carried forward in the MAA (see Table 5.3-3).
Use of cultural and traditional sites	Effects on cultural and traditional use sites	Potential disturbance or changes in access to traditional and archaeological sites.	**Heritage**: effects to known archaeological sites; the effects on use of cultural/ traditional sites was not found to be differentiating among TSF alternatives and was not carried forward in the MAA (see Table 5.3-3).

A poster board related to the MAA (Appendix G) was displayed at a community meeting in Kluskus Village (IR #1) on August 6, 2014. No comments relating to the MAA were received from LDN at the meeting. Based on consultations undertaken during the pre-Application stage of the EA process, LDN has expressed concerns about the potential effects of the Project on downstream water quality and effects on water users, and fish and fish habitat in Tatelkuz Lake, Tascha Lake, Davidson Creek and Nechako Reservoir (New Gold 2015, Chapter 17). The LDN have advised New Gold that Davidson Creek provides water for IR #28. To address these concerns, potential effects to surface and groundwater quality have been considered in Section 5 of this report, and have been weighted as an important consideration in Section 6. The importance of downstream Kokanee Salmon, rainbow Trout, and Mountain Whitefish habitat have also been considered in the characterization summaries in Section 5 of this report; downstream Kokanee Salmon and Rainbow Trout habitat were considered differentiating among alternatives and were carried forward into the multiple accounts ledger described in Section 6.

The LDN has expressed concern regarding potential effects on LDN trapping (New Gold 2015, Chapter 17). In the early twentieth century the provincial government began to licence trappers and record locations and extent of traplines. Some provincially-registered traplines followed the boundaries of the Keyoh. However, provincially-registered traplines and Keyoh are not identical. There are two registered traplines (TR0512T014 and TR0512T027) held by members of LDN that overlap the mine site area. The relative amount of the trapping area affected by each TSF alternative has been considered in the characterization summaries in Section 5, and has been weighted as an important consideration in the multiple accounts ledger described in Section 6.

Additionally, the LDN has identified potential effects to heritage sites as an issue of concern (New Gold 2015, Chapter 17). Potential effects to heritage sites have been considered in the characterization summaries in Section 5, and, where differentiating among TSF alternatives, have been weighted as an important consideration in the multiple accounts ledger described in Section 6.

No identified heritage sites occur within the footprints of any of the TSF alternatives. Table 15.2-2 of the EA Application (New Gold 2015) identifies potential effects on LDN Aboriginal rights and interests and proposed measures to mitigate effects.

1.10.2 Ulkatcho First Nation

Ulkatcho is a Carrier name meaning "the people of the fat of the land". What was called Anahim Lake is known today as Ulkatcho Lake, and is located 350 km west of Williams Lake. Historically, the people of Ulkatcho lived on the shore of Gatcho Lake. The main community and Band office is located at Anahim Lake, which is about 350 km west of Williams Lake.

The South Carrier and Chilcotin First Nations inhabited Anahim Lake and the Interior Plateau before European exploration. The Ulkatcho people are a subgroup of the Carrier, and are related extensively by intermarriage to both the Nuxalk of Bella Coola and Chilcotins, and share territory with the Nuxalk. Many distinctively Ulkatcho family names, such as Cahoose, Capoose, Sill, Squinas, and Stilas, are Nuxalk in origin.

The UFN continue to participate in fishing, trapping, hunting, berry and mushroom picking, as well as plant gathering. These activities have continued for generations, as evidenced in the Ulkatcho First Nation Traditional Land Use and Ecological Knowledge of the proposed New Gold Inc. Blackwater Project. The UFN TK/TLU study indicates that hunting and trapping activity continues today with some intensity near Kuyakuz Lake, Mount Davidson, and Moose Lake as well as near Tatelkuz Lake and Chedakuz Creek. The UFN have identified lynx, squirrel, timber wolf, beaver, moose, caribou, and deer as species that are hunted and trapped. The TLU study reports beaver trapping along Chedakuz Creek and at Kuyakuz Lake. Ducks and geese are hunted within the surrounding Project area.

The UFN website notes the moose and caribou (traditional sources of food and trade for the Ulkatcho people) populations have recently declined, due to increases in predatory animals such as wolves and grizzly bears.

The UFN TK/TLU study reports Chedakuz Creek, Tatelkuz Lake, Kuyakuz Lake, Moose Lake, and Johnny Lake as areas of fishing use near the Project area.The UFN indicate they have a fish camp at the north end of Kuyakuz Lake. Species fished include suckers, lingcod, salmon, and trout. Steelhead is also taken, likely in the Blackwater River.

The UFN TK/TLU indicates UFN members pick berries (especially raspberries and blueberries), mushrooms and food plant gathering (wild celery) around Moose Lake, Johnny Lake, Tatelkuz Lake, Kuyakuz Lake and Tsacha Lake. The UFN specifically identified wild celery and blueberries as gathered around the Project area, although specific locations where species are collected were not provided.

A trail, campsite, and a place name are identified within the Project area. The precise locations of the trail and campsite are not identified. A trail in the vicinity of Tatelkuz Lake is identified in the TLUS, and may refer to the Messue Wagon Trail, although it is not named in the TLUS. A trail on the east side of Tatelkuz Lake is also identified, which connects with the Messue Wagon Trail. Mount Davidson, named Tillie by the UFN, is the location of trails and campsites considered by UFN to be sensitive either cultural or economically.

An Exploration Agreement between the Proponent and the UFN includes provisions for consultation and meeting protocols, and data confidentiality. As a result of the consultation activity initiated in 2011 (which included community meetings, written correspondence, and presentations) the Proponent has gained an understanding of UFN Aboriginal rights and interests related to the Project, which are summarized in the EA Application (New Gold 2015, Chapter 15; Table 1.10-2). The Proponent held community meetings to present Project information, the results of environmental studies, and to obtain concerns or issues with respect to Aboriginal interests and rights. At these meetings, UFN confirmed the importance of protecting confidential information in UFN reports provided to the Proponent. Consultation reports, which summarize consultations undertaken with UFN by New Gold, issues raised by UFN, and the Proponent responses to the issues were sent to UFN in April 2014 and November 2014 for review and comment. No comments were provided by the UFN on these reports.

Table 1.10-2. Ulkatcho First Nation Aboriginal Rights and Interests

Current Use	Potential Issue	Potential Environmental Effect	Relevant Sub-Account: indicators
Hunting	Effects on caribou	Effects on caribou herds and the UWR and impacts on caribou habitat	**Wildlife**: Direct loss or disturbance to caribou habitat.
	Effects on ungulate hunting (other than caribou)	Reduction in habitat or changes in herds and ranges and increased access for non-Aboriginal hunters	**Wildlife**: direct loss or disturbance to moose habitat.
Trapping	Effects on UFN trapping	Potential reduction in access or availability of land for trapping.	No traplines held by UFN members overlap the mine site area (see Table 5.3-3)
Fishing	Concerns were raised regarding changes in drainage patterns, flows and volumes of water, redirection of watercourses and waterbodies, degradation of water quality (and related effects on fish, fish habitat, potable water users, and wildlife).	Potential change in water and sediment quality; Potential change in surface water flow	**Fish and fish habitat**: downstream Kokanee values, downstream Rainbow Trout values; **Surface water quality**: potential for ARD/ML generation water quality of receiving environment; **Hydrology**: size of watersheds affected, potential catchment loss to toe of TSF.
	Concerns were raised regarding environmental damage from chemical spills or leaching.	Potential change in water and sediment quality.	**Water management system** : complexity of seepage collection; surface water quality: potential for ARD/ML generation; **Hydrogeology** : Seepage management.

(continued)

Table 1.10-2. Ulkatcho First Nation Asserted Aboriginal Rights and Interests (completed)

Current Use	Potential Issue	Potential Environmental Effect	Relevant Sub-Account: indicators
Harvest of traditional plants	Mushroom collection	Potential loss or change in access to areas for morel mushroom and plant harvesting	Areas of specific traditional plant harvest not disclosed given the sensitive nature; however, address through calculation of footprint area which was not differentiating among options; was not carried forward in the MAA (see Table 5.3-3).
Use of cultural / traditional sites	Burial sites potentially impacted by the Project	Burial sites disturbed or destroyed by ground disturbance	**Heritage**: effects to known archaeological sites; **Current use of lands and resources for traditional purposes – Ulkatcho First Nation**: use of spiritual/traditional sites
Use of cultural / traditional sites *(cont'd)*	Concerns regarding loss of UFN peoples' ability to practice seasonal rounds during exploration and development and of older generations to transfer traditional culture and knowledge to younger generations due to disruption of traditional rounds.	Disruption of ability to practice seasonal rounds and transfer traditional cultural knowledge to younger generations	**Current use of lands and resources for traditional purposes – Ulkatcho First Nation**: use of cultural/traditional sites
	Interest in protecting historic areas, such as CMTs and unmarked graves, interest in protecting Tzelbeguz Lake (a sacred fish gathering site)	Potential disturbance to historic and sacred sites.	**Heritage**: effects to known archaeological sites; **Current use of lands and resources for traditional purposes – Ulkatcho First Nation**: use of cultural/traditional sites

The UFN have expressed concerns about the potential effects of the Project on mountain caribou and the designated UWR and the consequent impact on their right to hunt (UWR; New Gold 2015, Chapter 17). To address this concern, potential TSF alternatives that overlapped with designated UWR was considered a fatal flaw in siting the TSF in Section 4 of this report. Potential effects on high quality caribou habitat is a characterization criteria considered in Section 5 (characterization of TSF options), and as these were differentiating criteria among alternatives, this indicator was carried forward to the multiple accounts ledger described in Section 6. Table 1.10-2 provides additional detail with respect to issues and concerns raised during consultation with UFN related to potential effects of the Project on UFN Aboriginal rights and interests. Table 15.6-2 of the EA Application (New Gold 2015) identifies potential effects on UFN Aboriginal rights and interests and proposed measures to mitigate effects.

1.10.3 Nazko First Nation

The Nazko First Nation (NFN) are a First Nation of the Dakelh people residing near the community of Nazko, BC, located 120 km west of Quesnel. Nazko is located on the Nazko River and means "river flowing from the south."

The Euchiniko and Blackwater watersheds are areas used by the NFN, as noted in a letter to the BC EAO in 2013 (NFN 2013). The letter notes that Nazko people have a long-standing history of use in the northwest corner of their traditional territory.

Members of NFN identified that moose were actively hunted, but there has been a decline in their populations. NFN members also actively fish within their traditional territory, and members identified that kokanee is a sustenance resource.

Based on consultations and engagement activities, the Proponent has gained an understanding of NFN Aboriginal rights and interests related to the Project, which are summarized in the EA Application (New Gold 2015, Chapter 15). The NFN have raised concerns related to effects on Chinook Salmon fishing, trapping and hunting by the Trout Lake community. These activities occur outside the Project area and will not be affected by the Project.

In a letter to the BC EAO, dated 19 September 2013, the NFN raised concerns related to asserted title and rights over components of the Project based on archaeological resources and historic documentation of the occupancy of the land. The NFN asserts that it should be consulted on the potential effects from the Project that could affect the resources that are critically important for NFN traditional practices.

The NFN expressed concerns about effects from dust on the watershed and more specifically on Kokanee Salmon—a sustenance resource—and on medicinal plants. The group also expressed concern about moose mortality and declining populations as a further decline may compromise their availability for hunting. Table 15.7-2 of the EA Application (New Gold 2015) identifies potential effects on NFN Aboriginal rights and interests and proposed measures to mitigate potential effects. Consultation efforts with NFN to date have not identified NFN current uses within the area of the proposed mine site.

1.10.4 Nadleh Whut'en First Nation

The Nadleh Whut'en are a First Nation of the Dakelh people. The Nadleh Whut'en Band, formerly the Fraser Lake Band, was renamed Nadleh Whut'en in 1990. Nadleh refers to where the salmon return every year, and Whut'en refers to where you come from.

The NWFN traditional territory covers approximately 534,479 ha. The NWFN occupies seven IRs totalling 969 hectares but primarily reside on three reserves located between Fraser Lake and the Nechako River, along the banks of the Nadleh River, and another reserve on the south shore of Fraser Lake (ERM 2015b).

Fishing is an important NWFN activity (Carrier Sekani Tribal Council 2006; Coastal Gaslink 2014; Firelight Group 2014); fish, specifically sockeye salmon, is a staple food for NWFN (Hudson 1983; Cranny 1986; PTP ASEP Training Society 2010). Species fished by NWFN members include salmon, Steelhead Trout, Dolly Varden, and Rainbow Trout. Several NWFN IRs are located at the sites of historical fish harvesting locations, including Canyon Lake IR #7, Ormonde Creek IR #8, Fraser Lake IR#2, Nautley IR#1, and Seaspunkut IR#4 correspond to historic fishing stations of the NWFN people.

NWFN members hunt throughout their traditional territory (Carrier Sekani Tribal Council 2006; PTP ASEP Training Society 2010; Coastal Gaslink 2014). Hunting provides food staples for the NWFN people. Animals hunted include moose, deer, bears and small game (Hudson 1983; Cranny 1986; PTP ASEP Training Society 2010). The NWFN appears to direct a high degree of hunting effort in areas to the north of Highway 16, including areas such as the Sutherland River Valley and Ormond Lake (Carrier Sekani Tribal Council 2006; Firelight Group 2014).

In addition to general trapping activities undertaken throughout NWFN traditional territory, one NWFN member holds a provincially-registered trapline (TR0712T036) that overlaps the transmission line by 0.67% (i.e., overlapped area/total trapline area).

NWFN members use their traditional territory to gather plants, primarily berries which help to sustain them over the winter (Carrier Sekani Tribal Council 2006; Coastal Gaslink 2014; Firelight Group 2014). Berries harvested include raspberries, soapberries, black currents, Saskatoon berries, thimble berries and huckleberries (Carrier Sekani Tribal Council 2006). Service berries are a mainstay but other plants are collected for their leaves, bulbs and roots (Hudson 1983). Other plants harvested include, but are not limited to, fir, aspen, red willow, sage, fireweed, wild rose. Many of these plants are used for medicinal purposes (Carrier Sekani Tribal Council 2006). A review of available information identified NWFN plant gathering sites to the north and outside of the RSA, including an area to the north of Fraser Lake, Barlow Road, Ormond Creek, Ormond Lake, Sutherland River/Valley, Angly Lake, and Top Lake (Carrier Sekani Tribal Council 2006; Coastal Gaslink 2014).

A review of secondary sources identified a number of trails, habitations, and sacred sites to the north and outside of the RSA (Coastal Gaslink 2014). One trail, the Cheslatta Trail (or Tset'ladak t'seti in Carrier), crosses through NWFN traditional territory and the proposed transmission line (Figure 4.1-12). The Trail is an ancient land route from the Dakelh villages of Belhk'achek and Sdughachola on Cheslatta Lake to Nadleh Village on Fraser Lake. It was used by the Dakelh people as a major trade, travel and communication line, until the construction of the Alcan Kenney Dam in 1952 caused flooding of the Cheslatta River and Cheslatta Lake, forcing the Cheslatta people from their lakeside villages. From Nadleh, the trail would have passed through the modern day Beaumont Provincial Park and across Highway 16, then south of Drywilliams Lake (Snipview.com 2009).

The Proponent has met with NWFN representatives to provide project updates and discuss capacity funding, proposed agreements and the proposed transmission line. The NWFN raised concerns related to potential impacts on NWFN food fish (e.g., Spring Salmon) due to water flow as it leaves the Project. In response, the Proponent provided NWFN with shape files of the Project and a map

outlining the water flow direction. While the water flow from the Project area does travel in the direction of NWFN IRs and traditional territory, no effects are expected from the Project due to the distance of the Project from the Nechako River, which is approximately 45 km downstream where the river joins the Nechako reservoir.

Based on consultation and engagement activities with NWFN, the Proponent has gained an understanding of NWFN Aboriginal rights and interests related to the Project, which are summarized in the EA Application (New Gold 2015, Chapter 15). Consultation efforts with NWFN to date have not identified current uses within the area of the proposed mine site. Consultation reports, which summarize consultations undertaken with NWFN by New Gold, and issues raised by NWFN and the Proponent responses to the issues, was sent to NWFN in April 2014 and November 2014, for review and comment. NWFN provided comments on the consultation activities identified in the November 2014 report in a December 8, 2014 letter to the EAO. In the letter, the NWFN requested a revision to the description of the July 4, 2014 and October 27, 2014 meetings in the November 2014 consultation report, and indicated there were insufficient resources to conduct a TK/TLU study, and a lack of resources and consultation to determine potential adverse effects and proposed mitigation measures including accommodation. Consultation efforts with NWFN (including technical consultants) to date have not identified NWFN current uses within the area of the proposed mine site.

1.10.5 Saik'uz First Nation

The SFN traditional territory covers approximately 982,510 ha. The SFN is a Dakelh nation and their main community is located on Stony Creek IR #1, located 9 kilometres (km) southeast of Vanderhoof. The Clustalach IR#5 (SFN) is located approximately 1.8 kilometres to the east of the Kluskus FSR (ERM 2015b). The name Saik'uz means "on the sand," and refers to the sandy soil upon which the main community is located. In June 2015, the SFN provided the Proponent with the Saik'uz Traditional Land Use and Occupancy Study (TLUOS, Thomas 2015), which provides a "robust preliminary description of the use of the lands and resources by the SFNs' members" (Thomas 2015). At a meeting on June 29 2015, the SFN agreed to provide shape files and a map legend which will provide additional details to the map of land use and occupancy contained in the TLUOS report.

Based on a report prepared by the Upper Fraser Fisheries Conservation Alliance (2009), SFN primary food sources include salmon, moose, caribou, deer, small game, and nuts and berries. White sturgeon in the Nechako River is also an important food fish. Elders provided information on specific waterbodies where fishing has occurred. The lakes identified in the report will not be affected by the Project.

Traditional land use and subsistence living is of great importance to SFN members residing in the area. Members participate in hunting, fishing, and gathering (SFN Chief and Council representatives pers. comm.; SFN member pers. comm.). Representatives noted that, for many people, participating in the traditional economy is necessary to their ability to sustain themselves.

A registered trapline (trapline TR0711T007) and larger keyoh (approximately 77 square kilometres [km^2] in size) is located near Big Bend Meadow and the Kenney Dam (Keyoh holder pers. comm.).

The keyoh has been used for generations and holds special value for its owners, who refer to the keyoh as a "bank book" or a "store." The keyoh owners consider themselves as stewards with a responsibility to take care of the keyoh in a sustainable way. The keyoh provides its owners with a connection to both culture and history. A second provincially-registered trapline (TR0712T009) is held by an SFN member and the Kluskus FSR crosses through it.

SFN members hunt and trap throughout their traditional territory. Animal kill sites identified in the SFN TLUOS include moose, caribou, elk, deer, black bear, porcupine, muskrat, rabbit, beaver and lynx. Based on the map in the TLOUS, densities of moose kill sites appear to occur around and to the south of SFN reserves, as well as along waterways, including Greer Creek. The kill sites represent only a portion of the larger habitat required to maintain healthy wildlife populations (Thomas 2015). Grouse, geese, grebes ducks are also harvested, along with the eggs of these birds. SFN members do not typically hunt grizzly bears. Caribou used to be harvested but they are no longer in the area (SFN Elder pers. comm.). Animals trapped include marten, squirrel, lynx, black bear, muskrat, rabbit, fisher, wolf, coyote, and weasels. SFN members also harvest smaller animals in the keyoh, including squirrels. Saddle blankets are made from the moose hair. Interviewees noted that the moose population is being affecting by excessive hunting pressure from non-Aboriginal hunters. A SFN member noted that the hunting of calves has added additional pressure on populations. The Saik'uz TLUOS (Thomas 2015) notes a total of 275 trapping sites within the study area. Different species are harvested depending on the season, including beaver, mink, lynx, marten, muskrat, wolverine, rabbit, porcupine and squirrel.

Although salmon fishing has slowed down due to poor salmon returns and regulatory limitations, salmon (particularly sockeye) continue to be a species of importance to the SFN (SFN Chief and Council representatives pers. comm.; SFN Elders pers. comm.). Elders and youth fish for spring, sockeye and pink salmon at Wedgewood and Finmoore (to the north and outside of the RSA). One SFN member owns a salmon fishing camp at Wedgewood. Favoured fishing locations include Nechako River, Greer, Swanson Creek, Big Bend Creek, Ormond Lake, Oona Lake, Fraser Lake and Nautley River (all to the north and outside of the RSA (Cranny 1986; Carrier Sekani Tribal Council 2006; Coastal Gaslink 2014)). Fishing for whitefish, trout, suckers, and char was reported to occur in and around Cluculz Lake (to the east and outside of the RSA) in the mid-1980s (Cranny 1986).

The SFN TLUOS (Thomas 2015) identifies additional fish species that are harvested, including Dolly Varden, kokanee, Arctic grayling, ling cod and sturgeon; the fishing locations for these species is not specified in the report. Over 1,000 fish kill sites are identified in the SFN TLUOS report (Thomas 2015). The Nechako River, which is crossed by the Project's proposed transmission line, is a popular river to catch spring and other types of salmon, while Kokanee are fished in a variety of lakes.

Based on the TLUOS and consultations with SFN, SFN members gather plants throughout their traditional territory. The TLUOS identifies 968 plant and wood gathering sites. Plant gathering is important throughout the year, especially in the spring, as a cleanse, when large amounts of greens are consumed, including nettles and fiddleheads. During the winter, stinging nettles (which are high in iron) and fresh grasses are consumed. SFN members also gather huckleberries, soapberries, strawberries, and medicinal plants such as elderberry. Indian tea is typically harvested in marshy areas, and Labrador tea is made by members. Labrador tea is used to thin the blood and reduce high

blood pressure. Spruce, pine, and alder are harvested. These plants must be harvested from areas that are untouched, and a smudge ceremony must be held before these plants can be picked. Smudge ceremonies are used to cleanse areas of physical or cultural negative energy, and typically involve the burning of certain herbs. The smoke is rubbed or brushed over the body and/or area to be cleansed.

The SFN TLUOS report (Thomas 2015) identifies fixed cultural sites, including but not limited to birth sites, settlements, burial sites, death sites, gathering places, cache pits, Cottonwood-canoe sites, ceremonial sites and sacred sites. Areas near Corkscrew Road are considered to have sacred water for spiritual cleansing, as well as drinking water.

SFN members engage in medicine gathering and culture camps at Wedgewood and Finmoore (to the north and outside of the RSA (Carrier Sekani Tribal Council 2006). A number of historic trails are located to the north and outside of the RSA, including a trail from Vanderhoof airport north to Stuart River Trail from Laketown IR #3 to Tatuk Lake, a trail from Nulki Lake to Bella Coola (Grease Trail), a trail from Nulki Lake to Cluculz Lake to Fort George, and a trail from Tatuk Lake to Bobtail Lake (Coastal Gaslink 2014).

The SFN TLUOS report (Thomas 2015) identifies the collection of earth materials at 48 sites, as well as drinking water locations.

Based on consultation and engagement activities with SFN, the Proponent has gained an understanding of SFN Aboriginal rights and interests related to the Project, which are summarized in the EA Application (New Gold 2015, Chapter 15). Consultation reports, which summarize consultations undertaken with SFN by New Gold, and issues raised by SFN and the Proponent responses to the issues, was sent to SFN in April 2014 and November 2014, for review and comment. The SFN and technical advisors have been meeting with New Gold to discuss and address their concerns with the Project. Consultation efforts with SFN to date have not identified SFN current uses within the area of the proposed mine site.

1.10.6 Skin Tyee Nation

The Skin Tyee Nation (STN) is located in the Central Interior of BC near Francois Lake, to the west of Prince George. In 1960, the Decker Lake, Francois Lake, Maxim Lake, and Skin Tyee Bands merged to form the Omineca Band. The Omineca Band divided into the Nee-Tahi-Buhn and Broman Lake Bands in 1984, and in 2000, the Skin Tyee Band separated from the Nee-Tahi-Buhn Band. In September 2015, the STN provided the Proponent with the Skin Tyee First Nation Traditional Land Use Study for New Gold Inc's Proposed Blackwater Project (SFN TLUS, DMCS 2015) (DM Cultural Services Ltd. 2015) (DM Cultural Services Ltd. 2015), which documents STN knowledge and use of lands and resources near the Project.

STN members fish in the Morice River and its tributaries, which are not within the Current Aboriginal Use RSA or LSA (Enbridge, 2010). The STN TLUS also identifies fishing locations at Nadina River and Owen Creek. At Uncha Lake (not within the Current Aboriginal Use RSA or LSA), nets are used to catch char (STN representatives pers. comm.). The TLUS notes that Tsacha Lake and Johnny Lake are fishing areas. No fishing areas are identified within the Current Aboriginal

Use LSA. Fish harvested by STN include, but are not limited to, bull trout, lake trout, char, Chinook, Kokanne and Coho salmon, Dolly Varden, ling cod, rainbow trout, steelhead, suckers, northern pikeminnow, prickly sculpin, slimy sculpin and whitefish (DM Cultural Services Ltd., 2015). STN indicated that spring salmon are caught with nets, and that trout fishing is done with rods or nets. Fish are typically preserved by drying, canning, or smoking (STN representatives pers. comm.).

Plant gathering is noted to be quite important to the STN, who rely on a wide variety of plants for traditional purposes. Commonly used food plants include soapberry, huckleberry, silkberry, blueberry, raspberry, strawberry, gooseberry, high bush cranberry, wild rice, wild onion, cow parsnip, black tree lichen, and rosehips. Plants used for medicine include birch, Labrador tea, juniper, kinnikinnick, choke cherries, devil's club, spruce gum/pitch, pine, bulrushes, Sitka alder, red alder or mountain alder, yarrow, bearberry or black twinberry, tamarack, fireweed, strawberry, spruce, moss, and Indian hellebore. Plants used for other cultural purposes include cottonwood, red willow, spruce, poplar, birch, and moss. The STN TLUS identifies gathering areas for rosebush/rose hips, raspberries, huckleberries, and medicinal plants near Chedakuz Creek and Tatelkuz Lake, as well as near Johnny Lake. Transportation routes are also sites of food and medicinal plant gathering.

The STN TLUS indicates that STN currently hunt and trap moose, deer, lynx, badger, coyote, fox, rabbit, grizzly bear, beaver and otter within the Current Aboriginal Use RSA (DMCS Ltd., 2015). The STN TLUS identifies up to 6 hunting areas[5] within the Project footprint. The STN TLUS identifies hunting and trapping locations including areas around Davidson Creek and Chedakuz Creek, Tsacha Lake, Johnny Lake, Tatelkuz Lake, Moose Lake, Top Lake, Laidman Lake, and Klukus Lake. STN indicate that deer and moose are hunted in the region between Tatelkuz Lake and Laidman Lake. Regions in the western and southern shores of Tatelkuz Lake support several land use sites. It is common practice to share meat among members. In addition to providing food, community members use animal hides to create moccasins and other crafts. No STN registered traplines were identified in the Current Aboriginal Use LSA or RSA.Skin Tyee representatives noted that, while fish is important, the Skin Tyee "are more moose people than fish people". It has been noted that trapping is no longer a viable livelihood due to the decline of furbearers. Similarly, representatives noted that trapping was a traditional way of life, but that this activity has decreased substantially.

The STN TLUS notes that transportation routes are an intrinsic part in the trapping, hunting and seasonal harvesting. The transportation corridors include overland routes as well as routes via rivers, lakes and creeks.

A transportation route is identified by STN between Tatelkuz Lake and Kuyakuz Lake, as well as between Johnny Lake and Fawnie Dome. The TLUS indicates that transportation routes near Tatelkuz Lake are used to access moose hunting areas in the southern part of the STN traditional territory. Other transportation routes are noted in areas around Davidson Creek and Chedakuz Creek. Trails and transportation routes are also noted around Moose Lake, Laidman Lake, Euchiniko

[5] The TLUS indicates that many of the sites overlap and may be displayed in multiple grids, therefore it is not possible to get an accurate number of recorded sites.

Lake, Top Lake and Tsacha Lake. Historic tails are identified near these lakes, as well as near Kuyakuz Lake, Tatelkuz Lake Mount Kuyakuz, and Fawnie Creek.

Campsites and gathering areas are identified around Tatelkuz Lake, Tsacha Lake, Johnny Lake and Top Lake, Fawnie Dome and Mount Tatelkuz. Fishing and hunting occur near campsites and gathering locations. One culturally significant named place[6] in the Project footprint is noted in the STN TLUS.

None of the specific locations or routes of trails, campsites, gathering areas, place names are noted in the STN TLUS.

New Gold's approach to consultation with STN is based on their Cooperation Agreement, which commits to regular meetings between the Proponent and the community, including an annual presentation to the community as well as meetings with leadership. The Agreement also describes how information will be shared between the two parties, and provides a framework to guide the collection and use of confidential information provided by STN. The Proponent continues to provide Project information and updates on an ongoing basis and to meet with the STN to further discuss potential effects and concerns.

1.10.7 The Cooperation Agreement Stellat'en First Nation

The StFN traditional territory covers approximately 696,285 ha, and the StFN community of Stellako is located 160 km to the west of Prince George. Stellat'en, which means "people of Stella," live in Stellako, located on the western shore of Fraser Lake (Nadleh Bun).Archaeological evidence suggests that the Stellat'en people have lived in this territory for at least 10,000 years (PTP ASEP Training Society 2012). Traditionally, the economic mainstay in this area was fish, especially the several varieties of salmon, which were smoked and stored for the winter in large numbers. Hunting and trapping of deer, caribou, moose, elk, black bear, beaver, and rabbit provided meat, fur for clothing, and bones for tools.

StFN members hunt throughout their traditional territory and hunting trips are used to both "optimally and opportunistically" harvest species (e.g., grouse or rabbit may be harvested on a moose hunting trip (Triton 2014:46; Firelight Group 2015)). There are many species currently targeted by the StFN hunters; some of the most important include moose, deer, and black bear (Triton 2014). Despite arriving relatively recently to the area, "moose is predominant and is the most sought after animal" (Triton 2014:46). Additionally, various species of birds – used for both subsistence and ceremonial purposes – are culturally valued and sought (Triton 2014). Interview respondents noted that hunting has been adversely affected by forestry practices and other activities, such as the development of roads (Triton 2014). Some respondents were concerned that pipelines may negatively affect prime areas by destroying habitat or facilitating access (Triton 2014).

[6] Once a space or geographic area receives a placename that is connected to a person, event, story or legend, it is recognized within the cultural landscape of the STN (DMCS Ltd., 2015).

The StFN LRUS (Triton 2014) does not identify specific hunting locations. The Proponent is consulting with StFN about its preferred methods to share information about hunting practices that may be affected by the Project and to develop methods to mitigate any potential adverse effects.

Beaver and muskrat were trapped in the marshy areas surrounding the Abuntl'at. These species were used for both food and fur. Additionally, wolverine is an important fur-bearing species (Triton 2014). Ducks and geese, in addition to small game, are also trapped (Triton 2014). Interviews conducted with the holder of trapline TR0712T039 (which overlaps the northern section of the proposed transmission line alignment) indicate that some Stellat'en members continue to trap. Economic benefits from trapping are low, but representatives noted that it provides opportunities to engage in traditional and cultural activities (Holders of trapline TR0712T039 pers. comm.). The StFN LRUS (Triton 2014) does not identify specific trapping locations.

Fishing remains important to the StFN. Triton (2014:47) noted "there were slightly more references to fishing than to hunting" during interviews. Fishing and fish processing are important subsistence activities, but also constitute important social practices as they are often associated with social gatherings and interactions (Triton 2014). The importance of fishing and wealth of aquatic resources in the area make preservation of water quality a concern for the StFN (Triton 2014).

StFN members use a variety of fishing practices (e.g., hook and line fishing, netting, traps, barricades). They harvest many different species. Salmon, char, whitefish and trout – with salmon being the most important – were most referenced during interviews in relation to subsistence fisheries. However, other species (e.g., suckers and minnows) are also harvested and used (e.g., for bait or food for domestic animals). StFN communities use rivers (e.g., the Nechako, the Endako and Stellako rivers) and lakes (e.g., Fraser and Francois lakes) to support fishing practices (Triton 2014). The StFN LRUS (Triton 2014) does not identify specific fishing locations.

Plants are an important cultural resource for the StFN and are used for both food and medicine (Triton 2014). There are many important species of berries (e.g., soapberries, huckleberries, blueberries, raspberries, thimbleberries, blackberries, currants, gooseberries, saskatoon berries, and cranberries), bulbs and stems (e.g., various species of lily, water plantain, bulrush, cattail, and spring-beauty), and, historically, edible tree lichens (Triton 2014). These species provide many different nutrients to the StFN diet. Triton (2014:39) note "there are many areas of contemporary and intense use that lie within the proposed transmission line due to the proximity of the alignment to the Stellaquo reserve and the habitat quality it crosses." The StFN LRUS (Triton 2014) does not identify specific plant gathering locations. The Proponent is consulting with StFN about its preferred methods to share information about gathering practices that may be affected by the Project and to develop methods to mitigate any potential adverse effects.

There are a number of sacred sites in the StFN traditional territory listed on their website including the following:

- Grandfather's Trails (Atsiyan Buhati): these trails are networks around the Carrier (Dakelh) land that connect to the Grease Trails where the Carrier would meet coastal Aboriginal groups to trade for oolichan and coastal goods.

- Women's Song Place (Tse Koo Shun K'ut): this is a sacred site for women to use when attaining their spiritual powers. These sites are treated with great respect by Stellat'en people, and were used by Stellat'en ancestors to acquire spiritual powers for the betterment of the Stellat'en people and their environment. This site is believed to be near Fraser Lake.
- Red Rock (Tselkin K'ut): near Tse Koo Shun K'ut, is an extinct volcano, complete with a lava cone. This is where Stellat'en men go to attain their spiritual powers to become shaman or dreamers. This site is believed to be near Fraser Lake.
- Binta Lake: a part of the network of lakes and rivers that Stellat'en people used to hunt and fish on their territory.

The StFN LRUS also identifies cultural uses including culturally modified trees and minerals. The Cheslatta Trail crosses through StFN traditional territory and the StFN LRUS indicates that the trail was an important travel, information and trade route (Proponent Version; Triton 2014; Figure 7.2.7-6 of the 2014 EA Application).

The Proponent has met with StFN to discuss potential project effects and identify opportunities for participation in the EA. Based on StFN concerns related to the proposed Stellako River transmission line crossing, the crossing was adjusted to reduce impacts on sensitive wildlife habitat. The StFN have raised concerns about potential effects on caribou and their winter range, and are seeking compensation for trappers whose traplines may be affected by the Project.

Based on consultation and engagement activities with StFN, the Proponent has gained an understanding of StFN Aboriginal rights and interests related to the Project, which are summarized in the EA Application (New Gold 2015, Chapter 15). Consultation reports, which summarize consultations undertaken with StFN by New Gold, and issues raised by StFN and the Proponent responses to the issues, was sent to StFN in April 2014 and November 2014, for review and comment. No comments were provided by StFN on the reports. Consultation efforts with StFN to date have not identified StFN current uses within the area of the proposed mine site.

1.10.8 Tsilhqot'in National Government

The Tsilhqot'in National Government (TNG) represents the Tlet'inqox (Anaham), Tsi Del Del (Alexis Creek), Yunesit'in (Stone), ?Esdilagh (Alexandria), Xeni Gwet'in (Nemiah), and the Tl'esqox (Toosey).

Important sources of Tsilhqot'in ethnography include Teit (1909), Farrand (1899, 1910), Ray (1942), and Lane (1953, 1981). Traditionally, the Tsilhqot'in people occupied and utilized lands and resources in the Chilcotin River drainage and the upper reaches of the Homalco, Klinaklini, and Dean Rivers (Lane 1981). They engaged in hunting, trapping, fishing, and plant gathering for their subsistence. Elk, deer, caribou, mountain goats and sheep were primarily hunted, though moose has replaced elk more recently in their territory. Trapped species include marmot, hare, beaver, muskrats and porcupine. They also harvested ducks, geese, ptarmigan and grouse. Important fish include trout, whitefish, suckers, and Kokanee and sockeye salmon. The sockeye salmon run on the Chilcotin River occur in mid-July, when Tsilhqot'in people gathered at fishing sites along the Chilcotin and Chilko rivers. Plant foods were important diet supplements, and berries and roots

were gathered in sufficient quantities for winter storage. A number of the Tsilhqot'in practice, to varying degrees, their traditional subsistence lifestyle based on hunting, fishing, and gathering.

The Proponent has met with TNG to discuss the Project, made presentations to TNG and met with members in accordance with TNG engagement process requirements. Based on consultations undertaken with TNG to date, TNG have not identified Tsilhqot'in use of lands and resources in the area of the proposed mine site.

1.10.9 Métis Nation British Columbia

Métis people are of mixed First Nations and European ancestry, and are recognized as a distinct Aboriginal population in Canada (Métis Nation British Columbia n.d.). Métis people trace their descent to the 18th century fur trade, which resulted in the intermarrying of European men and Aboriginal women. Their children, a mixed-race population, grew and formed separate communities distinct from both other Aboriginal groups and Europeans. The collective Métis groups refer to themselves as the Métis Nation.

The Métis population in BC numbers approximately 59,000, scattered across the province. The majority of BC Métis people reside in urban areas, and they represent approximately 30% of the total Aboriginal population in British Columbia (Métis Nation British Columbia n.d.).

The Métis Nation BC (MNBC) is the governing Nation for Métis people living in British Columbia, and represents one of five governing members of the Métis National Council. MNBC provides governance and support for 35 Chartered Communities in seven regions: Vancouver Island, Lower Mainland, Thompson/Okanagan, Kootenays, North Central, Northwest, and Northeast. A Regional Director leads each region.

In the North Central Region of BC, where the Project is located, there are four Métis Chartered Communities: the Cariboo Chilcotin Métis Association, North Cariboo Métis Association, Prince George Métis Community Association, and the New Caledonia Métis Association. Engagement and consultation activities with the MNBC began in October 2012. The Proponent has and continues to provide the MNBC with Project information including any updates. The MNBC asserted harvesting rights around the proposed Project area in letters to the Agency on 23 November 2012 and on 20 January 2013. The MNBC expressed concerns regarding current traditional harvesting activities (hunting, fishing, and plant harvesting) occurring in the proposed Project area that could be negatively affected by the Project (MNBC 2012); however, no specific information was provided.

2. ENVIRONMENTAL ASSESSMENT REGULATORY PROCESS AND CONSULTATION

The proposed Blackwater Gold Project is subject to a coordinated provincial and federal environmental assessment (EA) review under the *Canadian Environmental Assessment Act, 2012* (2012) and the British Columbia *Environmental Assessment Act* (BC EAA; 2002a). On December 21, 2012, the Canadian Environmental Assessment Agency (CEA Agency) determined that an EA of the Project is required and commenced an environmental assessment by a responsible authority (i.e., CEA Agency). On November 05, 2012, the BC Environmental Assessment Office (EAO) issued an Order under Section 10 of the BC EAA, stating that the Project requires an Environmental Certificate.

Environmental Impact Statement Guidelines

The scope, methods and procedures for undertaking the EA are identified in the Environmental Impact Statement Guidelines for the Blackwater Gold Project (EIS Guidelines; Canadian Environmental Assessment Agency 2013a), issued on February 19, 2013 by the CEA Agency. The EIS Guidelines also identify government agency, Aboriginal groups, and public consultation requirements.

The EIS Guidelines identify the following nine Aboriginal groups that the Proponent must engage with (as described above):

- Lhoosk'uz Dene Nation;
- Ulkatcho First Nation;
- Nazko First Nation;
- Nadleh Whut'en First Nation;
- Saik'uz First Nation;
- Skin Tyee Nation;
- Stellat'en First Nation;
- Tsilhqot'in National Government; and,
- Métis Nation of British Columbia

There are no Treaty Nations in the Project area.

Section 11 Order

The Project's Section 11 Order (July 9, 2013) issued by BC EAO requires New Gold to consult with the following five Aboriginal groups: the LDN, the NWFN, the SFN, the StFN, and the UFN. BC EAO has also identified the NFN, STN and TNG as Aboriginal groups to be notified with relevant information at key milestones (BC EAO 2013).

New Gold also continues to engage in discussions with the Carrier (Dakelh) Chilcotin Tribal Council and the Carrier Sekani Tribal Council.

Blackwater Gold Project Working Group

A Working Group, chaired by the BC EAO and CEA Agency, comprised of representatives of local, provincial and federal government agencies, and Aboriginal Groups, has been in place since the EA review was initiated. The role of the Working Group is to provide technical review and advice on issues related to the assessment of the Project.

Environmental Assessment and Regulatory Consultation Activities

In order to address potential concerns surrounding mine waste disposal and siting, New Gold decided to advance the assessment of alternatives for the disposal and siting of mine waste into the EA process. Historically, an alternatives assessment is completed after the federal Minister of Environment reaches an EA decision.

Under the recently released *Streamlining the Approvals Process for Metal Mines with Tailings Impoundment Areas* (Environment Canada 2012), a Project's application for a Schedule 2 Amendment to the MMER may be exempted from pre-publication in *Canada Gazette*, Part I, if: "1. The environmental assessment considered: public and stakeholder comments on the water body listed; an assessment of alternatives to the proposed TIA, including costs and public comments; consultations on the fish habitat compensation plan; Aboriginal consultation (to meet all obligations that may exist in relation to Aboriginal rights or Treaty rights protected by section 35 of the *Constitution Act* (1982); 2. The federal government has determined, based on the environmental assessment, that, taking into account the implementation of appropriate mitigation measures, the project is not likely to cause significant adverse environmental effects, and 3; Consultations on the MMER amendment … have met the Treasury Board *Guidelines for Effective Regulatory Consultations".*

If a proposed TIA authorization meets the above conditions for exemption, then the authorization may move directly to *Canada Gazette*, Part II.

New Gold presented an overview of the TSF alternatives assessment to the EA Working Group on April 30, 2013. This Working Group includes Lhoosk'uz Dene Nation, Ulkatcho First Nation, Nadleh First Nation, Stellat'en First Nation, and Saik'uz First Nation. New Gold also provided a more detailed overview of this assessment to Environment Canada (EC) and the CEA Agency on June 13, 2013 and April 25, 2014. During a site visit on September 26, 2013, New Gold discussed TSF site alternatives with EC. New Gold again presented the updated alternatives assessment to EC on October 25, 2013.

All community consultations related to mine waste are presented in Appendix H. The proponent has developed a community liaison committee which meets approximately quarterly to support an understanding of potential effects and provide information about the project. Further, a poster related to mine design and alternatives assessment was included in proponent- and BC EAO-led open houses (Appendix G). These open houses were advertised in local papers prior to the event as described in Section 3 of the Project's Application/EIS. Consistent with First Nations consultation, while no specific information was received related to TSF alternatives discussed in this report, issues raised were documented (see Section 3 of the Application/EIS) and reflected in the sub-accounts and indicators (Table 2-1) where applicable to the assessment.

Table 2-1. Community Consultations General Blackwater Gold Project Concerns

Potential Issue Raised	Potential Environmental Effect	Relevant Sub-Account: Indicators
Employment and business	Focus on providing local jobs and local capacity building	Concerns over the 'providing local jobs and local capacity building' aspect of mining would primarily be in relation to the entire Project; the selection of TSF alternative would not affect this aspect of mine planning. This concern is not discussed further here.
	Desire for economic diversification and stabilization	Concerns over the 'desire for economic diversification and stabilization' aspect of mining would primarily be in relation to the regional economic conditions, and mineral prices. These aspects of the Project are not relevant to the selection of a TSF alternative and this concern is not discussed further here.
Potential Effects to Fish and fish habitat	Potential Effects to Fish and fish habitat	**Fish and fish habitat**: extent of permanent alternation to or destruction (PAD) of fish habitat; quality of fish habitat affected by PAD; number of fish species directly affected within the TSF footprint; present of rare and endangered fish species; downstream Kokanee values, downstream Rainbow Trout values; downstream Mountain Whitefish values **Surface water quality**: potential for ARD/ML generation water quality of receiving environment; **Hydrology**: size of watersheds affected, potential catchment loss to toe of TSF; potential impacts to timing and distribution of flows;
Land use	The potential for disruption to land used by trappers, guides, ranchers and lodge owners	**Non-traditional land and resource use**: forestry tenures; guide outfitting tenures; trapline tenures; commercial recreation tenures
	Potential negative effects to livestock and cattle in the area (e.g., improper gating and fencing, increased traffic on nearby roads, attraction of grizzly bears, effects related to the transmission line)	**Non-traditional land and resource use**: agricultural and range tenures
Mine cycle/ socio-economics	The short-term 'boom and bust' aspect of mining	Concerns over the 'boom and bust' aspect of mining would primarily be in relation to the life of the mine, the amount of ore mined, and prevailing economic conditions and mineral prices. These aspects of the Project are not relevant to the selection of a TSF alternative and this concern is not discussed further here.
	Scheduling of work and shifts affecting community benefits	Concerns over the 'scheduling of work and shifts affected community benefits' aspect of mining would primarily be in relation to the entire Project; the selection of TSF alternative would not affect this aspect of mine planning. As such, this concern is not discussed further here.
	Concern over Project delays or cancellation	Concern over Project delays or cancellation may be more likely to occur for TSF options with higher overall costs. **Proponent Costs**: initial capital costs; sustaining capital and operating costs; closure costs; fish habitat compensation costs

(continued)

Table 2-1. Community Consultations General Blackwater Gold Project Concerns (completed)

Potential Issue Raised	Potential Environmental Effect	Relevant Sub-Account: Indicators
Community Well-Being	Potential for increased social pressures in the communities from increased presence of workers	Concerns over the 'potential for increased social pressures in the communities from increased presence of workers' aspect of mining would primarily be in relation to the entire Project; the selection of TSF alternative would not affect this aspect of mine construction or operation. As such, this concern is not discussed further here.
Mine Closure and Reclamation	Concerns about permanent effects on the environment after reclamation	**Construction, Operation and Closure Approaches, and Precedent**: closure requirements
Potential Effects from Increased Access	Increased traffic on nearby roads and road safety	Although Project traffic will largely be independent of which TSF is selected, TSF alternatives which do not have sufficient local material available for construction may result in an increase in traffic to transport construction material to the site. **Tailings dam characteristics**: availability of local borrow materials for construction of embankments
	Improved access facilitated by the Project may increase presence of outside hunters, particularly in areas of outfitter tenures	**Non-traditional land and resource use**: guide outfitting tenures; trapline tenures; commercial recreation tenures
Potential Effects on Wildlife	Impact of the TSF on birds, particularly related to intoxication	**Wildlife:** presence of species of conservation concern other than western toad, caribou, grizzly bear, American marten, and myotis bats; direct loss or disturbance (indirect loss = 100m buffer) to terrestrial bird habitat; direct loss or disturbance (indirect loss = 100 m buffer) to raptor habitat **Surface water quality**: potential for ARD/ML generation, water quality of receiving environment
Water	Water quality and control of seepage	**Water management system:** complexity of seepage collection; potential for long-term water treatment; potential for active versus passive treatment; **Surface water quality:** potential for ARD/ML generation, water quality of receiving environment; **Hydrogeology**: Potential impacts to groundwater quantity and quality; seepage management

By capturing the potential issues raised during public consultation in relevant sub-account indicators it's intended to address regional community response, i.e., by reflection of public concern in the assessment of alternatives.

2.1 *FISHERIES ACT* METAL MINING EFFLUENT REGULATIONS

The Project is subject to the federal *Fisheries Act* (1985) MMER (SOR/2002-222), which currently apply to approximately 80 metal mines across Canada. The MMER impose limits on the releases of arsenic, copper, cyanide, lead, nickel, zinc, radium-226, and total suspended solids, and prohibit the

discharge of effluent into waterbodies that is acutely lethal to fish. The MMER also include provisions to designate natural fish-bearing waters as a tailings impoundment areas.

Section 27.1 of the MMER requires the development and implementation of a fish habitat compensation plan, which requires approval from the Minister of Fisheries and Oceans. This section is based on the Fisheries and Oceans Canada (1991) *Policy for the Management of Fish Habitat*. This policy ensures there is no net loss of fish habitat as a result of development projects. Section 27.1 of the MMER states that:

> 27.1(1): The owner or operator of a mine shall submit to the Minister for approval a compensation plan and obtain the Minister's approval of that plan before depositing a deleterious substance into a tailings impoundment area that is added to Schedule 2 after coming into force for this action.
>
> 27.2(2): The purpose of the compensation plan is to offset the loss of fish habitat resulting from the deposit of a deleterious substance into the tailings impoundment area.

The Fisheries Mitigation and Offset Plan is provided in an Appendix to Section 5.3.9 of the Blackwater Project's Application/EIS (New Gold 2015). This plan provides information for both the Fisheries authorization and Schedule 2 Amendment to the MMER. With respect to First Nations consultation on the Fisheries Mitigation and Offset Plan (FMOP), interviews with First Nations and traditional use studies have been initiated to define the location and extent of Aboriginal fisheries near the Project area. Meetings with First Nations were initiated in 2011 and have been ongoing. Further consultations and community meetings with First Nations are planned to gain input and discuss mitigation and offsetting options. In September 2013 and October 2014, offsetting measure options were discussed with the Saik'uz First Nation. Discussion included possible projects that are of interest in the Saik'uz First Nation. In July, 2014, an overview of the FMOP was presented to Lhoosk'uz Dene Nation. Information on mitigation and offsetting measures will also be presented in upcoming open houses and community meetings to solicit feedback. Offsetting measures were also discussed with Nadleh Whut'en First Nation in September of 2014.

3. TAILINGS STORAGE FACILITY SELECTION PROCESS – MULTIPLE ACCOUNTS ANALYSIS

This TSF alternatives assessment follows the process outlined in the *Guidelines* (Environment Canada 2011). The seven assessment steps outlined by the *Guidelines* include (Figure 1.1-1):

- Step 1 – identification of candidate alternatives;
- Step 2 – pre-screening assessment;
- Step 3 – alternative characterization;
- Step 4 – multiple accounts ledger;
- Step 5 – value-based decision process;
- Step 6 – sensitivity analysis; and
- Step 7 – documentation of results.

Each of these steps is briefly described below.

- Step 1: **Identification of Candidate Alternatives** entails developing a list of possible (i.e., reasonable, conceivable, and realistic) tailings disposal alternatives for the Project. This list should include different tailings disposal technologies, different disposal storage options, and different disposal locations. At this step no *a priori* judgments are made about any of the alternatives. Threshold criteria may be used to establish the regional boundaries for selecting candidate alternatives. These threshold criteria should be as broad as possible and must be fully described and rationalized to ensure transparency. Examples of threshold criteria include exclusion based on the presence of protected areas, exclusion based on the presence of legal boundaries, and exclusion based on distance. The level of detail presented about each tailings disposal alternative at this stage is highly conceptual.
- Step 2: **Pre-Screening Assessment** entails screening the list of candidates identified in Step 1 to create a set of appropriate and manageable, sufficiently detailed alternatives. The objective of this step is to optimize the decision making process by not evaluating alternatives that have obvious deficiencies. This process involves excluding those alternatives identified in Step 1 that are "non-compliant," in that they do not meet certain unique minimum specifications that have been developed for the Project. This process is also referred to as a fatal-flaw analysis. A fatal flaw is defined as any site characteristic that is so unfavourable or severe that it would eliminate that site as a TSF alternative. The fatal flaw criteria are project-specific, and a thorough qualification and justification of the rationale must be provided. Examples of fatal flaws include: would the TSF preclude future exploration or mining of a potential resource; will the TSF capacity be too small to store the proposed upper limit of tailing; and, is any part of the mine waste disposal system based on unproven technology?
- Step 3: **Alternatives Characterization** entails the thorough characterization of the remaining alternatives. While there is no ideal number of alternatives remaining at this stage, the

Guidelines (Environment Canada 2011) suggest that at least three candidates remain under consideration at this stage. At least one of these alternatives should not impact a natural water body that is frequented by fish, unless it can be demonstrated that this possibility does not reasonably exist based on site-specific circumstances. Site-specific characterization criteria should be developed for each project, but should be developed within four broader categories: environmental, technical, economic, and socio-economic. These four categories are known as "accounts." Characterization criteria should be designed to provide a factual, objective basis for comparison among the remaining alternatives.

- Step 4: **Multiple Accounts Ledger** entails the development of a ledger that seeks to differentiate among alternatives and provides the basis for scoring and weighting of criteria as described in Step 5. At this stage, sub-accounts and indicators are chosen and described based on the characterization criteria presented in Step 3. Sub-Accounts are described based on the material impact (i.e., benefit or loss) associated with any of the alternatives being evaluated, and only those sub-accounts that differentiate TSF alternatives are presented for evaluation. Selected sub-accounts must comply with the following criteria: be impact driven, differentiating, value relevant, understandable, non-redundant, and capable of judgmental independence. Indicators are a sub-level that often allows sub-accounts to be decomposed to a degree that allows measurability. For example, the socio-economic sub-account may have multiple indicators including effects on fishing, effects on hunting, and effects on berry harvesting. Like sub-accounts, indicators should be objectively chosen, and only those indicators that differentiate TSF alternatives should be chosen.
- Step 5: **Value-based Decision Process** entails taking the list of accounts, sub-accounts, and indicators and assessing the combined impacts for each of the alternatives under review. At this stage, all indicators, sub-accounts, and accounts are scored and weighted and merit ratings for each alternative are quantified. Scoring involves the development of qualitative scales for each indicator, such that each indicator can be assigned a rank on the scale. Weighting involves comparing indicators, sub-accounts, and accounts among TSF alternatives by introducing value bias by applying a weighting factor to each indicator, sub-account, or account. Weighting factors allow the ability to assign relative importance from one criterion as compared to another. The *Guidelines* (Environment Canada 2011) recommend using a weighting range from one to six.
- Step 6: **Sensitivity Analysis**. The alternatives assessment and subsequent value based decision making process described in the *Guidelines* (Environment Canada 2011) is specifically tailored to be transparent and to the extent practicable, eliminate bias and subjectivity. However, any decision making process is subject to bias and subjectivity, and the goal is to manage that bias and subjectivity to the point where an external reviewer would agree that the decision is justifiable and reasonable, irrespective of their own value system. To test the sensitivity of the value-based decision making process, different weightings are assigned to those indicators, sub-accounts, and accounts according to a range of value systems representative of the perceived disparity.
- Step 7: **Documentation of Results** entails the preparation of a comprehensive technical report, which describes the outcome of each step as presented in the preceding section.

4. PRE-FEASIBILITY ALTERNATIVES

The first step of the TSF selection process involves using threshold criteria, such as geographic, economic, or technical boundaries, to select an initial set of potential TSF options. These options are then progressively narrowed in future steps of the assessment. The initial candidate alternatives are briefly described at a highly conceptual level to facilitate the next step, the pre-screening assessment, as per Section 2.2 of the *Guidelines* (Environment Canada 2011; Figure 4-1).

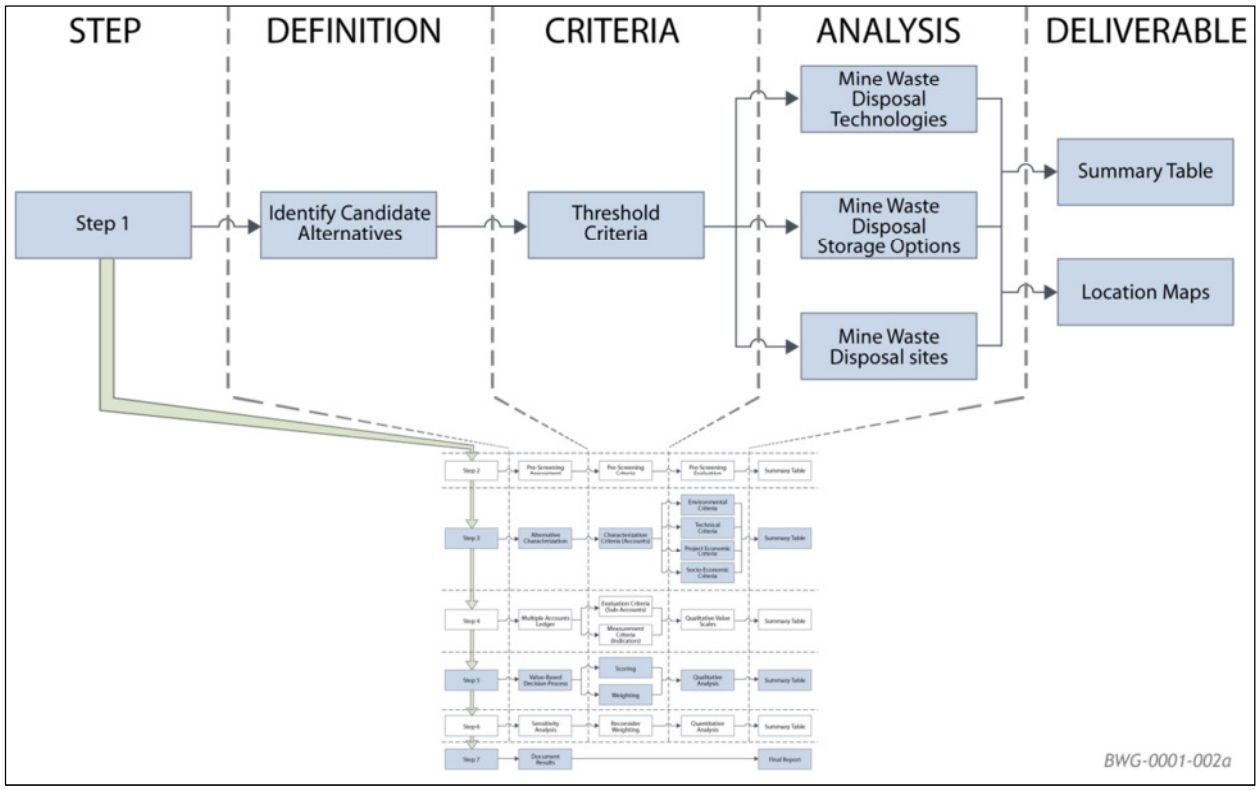


Figure 4-1. Pre-Feasibility Alternatives Step

The following threshold criteria were applied to determine reasonable potential TSF options for the Project.

- *Exclusion based on distance* – An original screening distance of 10 km was applied to the selection of initial disposal sites due to the cost of hauling waste rock to the facility for both co-disposal with tailings and for TSF dam construction. Any potential facility beyond this distance was not considered in this analysis.
- *Exclusion based on technological limitations* – Tailings disposal technologies considered as options included conventional impoundments, subaqueous or saturated storage. Underground storage was not considered, because no underground mining will occur over the life of the Project.

In Pit Tailings Disposal

In-pit tailings disposal was considered only for the last 2.5 years of mill operations as the pit will be mined during the first 14 years of the mine life. Stockpiled low grade ore will be processed for the last 2.5 years. In-pit disposal was rejected for that relatively short period because of difficulties in recovering large amounts of tailings supernatant required for mill processing from the bottom of the pit.

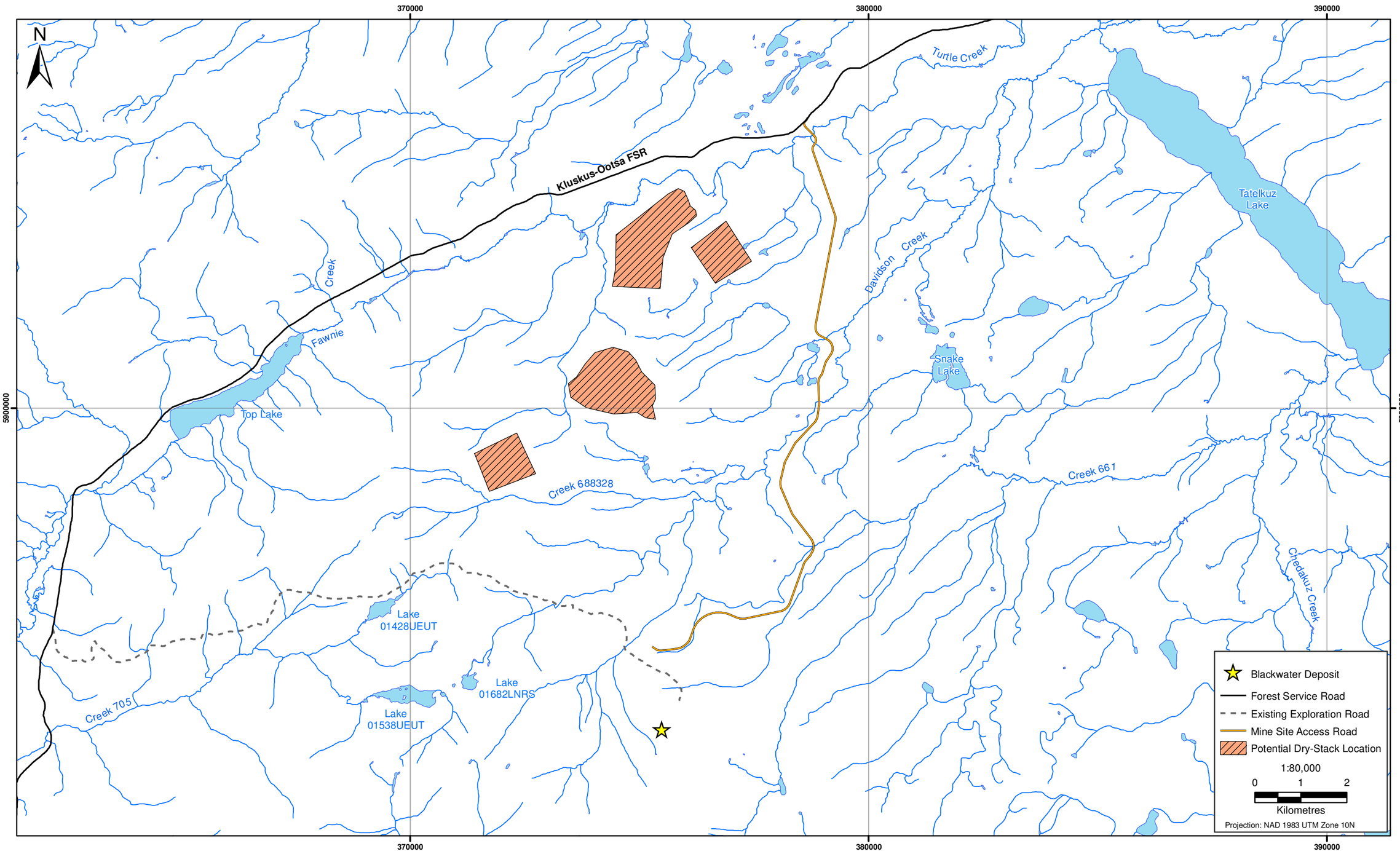
Dry Stacking

Dry stack tailings disposal has been used for low tonnage mines, typically in flat topography and dry climates. The tailings are dewatered to greater than 85% solids by weight with vacuum or pressure filters and placed in a storage area using trucks or conveyors. Water recovered is recycled within the mill. In general, the method relies on the tailings being dry enough to be largely self-supporting with minimal containment structures. The tailings typically are unsaturated and exhibit lower permeability and have a higher density than conventional tailings. The challenges for the Project, which is a high tonnage mine located in a mountainous relatively wet environment, include the following:

- the generally low water content of the tailings allows oxygen diffusion and increases the potential for development of ML/ARD;
- storage of large volumes of dewatered tailings in the topography of the Project area requires a very large footprint and very high storage piles;
- dewatered tailings are susceptible to erosion and slide failures and would require containment dams to ensure stability of the piles. Dewatered tailings piles would require very large flat areas to minimize heights of the containments dams. Such areas are not available near the open pit. The closest area identified by New Gold would involve multiple dry stack impoundments located approximately 12 km from the mine site, and does not meet the exclusion based on distance criteria (Figure 4-2);
- management and collection of process-affected seepage water from the pile requires perimeter diversions and seepage cut-offs for control of neutral leaching; and
- extensive erosion-control measures would be necessary for dry stacking the required volumes of tailings in a safe manner in this relatively high precipitation environment.

The placement of dewatered tailings within a TSF would require the following works:

- diversion of surface water around the TSF executed in stages as the dewatered tailings footprint increases;
- dewatering the tailings in the process plant;
- transport of dewatered tailings to the TSF either with conveyors or trucks (or a combination);
- construction of a TSF dam(s) built from borrow materials to contain the dewatered tailings;
- collection of surface runoff off the top of the dewatered tailings with the water being recycled to the process plant and/or treated and released to the environment;
- collection of seepage water at the toe of the facility and pumping the water to the process plant;



newgold

Rescan an ERM company

Figure 4-2

Blackwater Gold Project:
Potential Dry-Stack Locations

- progressive reclamation of a portion of the downstream TSF dam;
- final closure and reclamation of the complete TSF; and
- collection of seepage water and water treatment for seepage water on closure.

Therefore, for the reasons discussed above, especially the distance to a suitable site, unproven technology for high mill throughputs and the increased potential for ML/ARD, dry stacking disposal technology is not considered feasible for the Project.

Paste Tailing

Paste tailings disposal is commonly used for underground mines as backfill support and has occasionally been used for surface disposal of tailings at mines with low mill throughput. Paste tailings are produced by partial dewatering of the tailings to produce a thick slurry (i.e., a toothpaste consistency consisting of about 70 to 85% solids by weight) that can still be pumped.

Paste tailings differ from thickened tailings in that higher densities and lower water contents are achieved. The Project already proposes the use of tailings thickening. The tailings thickener preliminary sizing indicates an 80 m ø 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 use of paste tailings for surface storage is not common, as it presents additional operational constraints (e.g., consistent operation of dewatering facilities), is not proven at high mill throughputs and often has higher associated pumping costs (tailings.info 2013). Paste tailings are not self-supporting and storage of paste tailings for the Project requires containment dams, which would be similar to the dams required for conventional tailings storage.

Surface storage of paste tailings would include the following works:

- collection of seepage water and water treatment for seepage water on closure;
- construction of a paste plant, which would include an ultra-high density thickener to produce tailings which could be pumped with positive displacement pumps to the TSF;
- the lower water content of the tailings allows oxygen diffusion and increases the potential for development of ML/ARD;
- collection of consolidation water and runoff with the water being recycled to the process plant and/or treated and released to the environment;
- collection of seepage water at the toe of the facility and pumping of the water to the process plant;
- progressive reclamation of a portion of the downstream structural fill;
- final closure and reclamation of the complete TSF; and
- collection of seepage water and water treatment for seepage water on closure.

The main observations of a paste tailings TSF include:

- no precedent exists for such a large scale paste tailings project;

- concern with ML/ARD of the tailings would be similar to those of conventional saturated tailings disposal; and
- concern with surface water management and water treatment and water release would be similar to those of conventional saturated tailings disposal.

Therefore, for the reasons discussed above, paste tailings disposal technology is not considered feasible for the Project.

4.1 CANDIDATE ALTERNATIVES

Based on the threshold criteria above, New Gold reviewed all potential tailings storage sites over a screening area of about 10 km by 10 km, centering on the mine site. An initial set of seven candidate alternatives for the TSF was identified (Table 4.1-1; Figure 4.1-1).

1. Option A: Upper Blackwater River Sub-basin TSF;
2. Option B: Upper Matthews Creek Sub-basin TSF;
3. Option C: Upper Davidson Creek Sub-basin 1 TSF with underwater PAG co-disposal;
4. Option D: Upper Davidson Creek Sub-basin 2 TSF with underwater PAG co-disposal;
5. Option D/PAG OL: Upper Davidson Creek Sub-basin 2 TSF with on-land PAG storage;
6. Option E: Upper Creek 661 Sub-basin TSF with underwater PAG co-disposal; and
7. Option FS: Combined C & D TSF with underwater PAG co-disposal.

Knight Piesold was retained by New Gold to conduct detailed technical assessments of the alternative TSF sites, which are presented in the following reports:

- *Blackwater Gold Project: TSF Multiple Accounts Analysis – Design Alternatives Information* (Knight Pièsold 2014);
- *Blackwater Gold Project: Conceptual Waste and Water Management Planning* (Knight Pièsold 2011a);
- *Blackwater Gold Project: Preliminary Mine Development Concept Alternatives Study* (Knight Pièsold 2011b);
- *Blackwater Gold Project: Tailings Disposal Options Conceptual Planning and Cost Estimates* (Knight Pièsold 2011c);
- *Blackwater Gold Project: Tailings Storage Facility Site Alternatives Assessment* (Knight Pièsold 2011d);
- *Blackwater Gold Project: Updated Mine Development Concept Evaluation Considering Potentially Acid Generating (PAG) Disposal On-land and Subaqueously in the Tailings Facility* (Knight Pièsold 2012); and
- *Blackwater Gold Project: Feasibility Study* (New Gold 2014).

Table 4.1-1. Initially Considered Tailings Storage Facility Candidate Alternatives

TSF Option	Construction Approach	Operational Approach		Closure Approach
		General	Waste Rock Disposal	
Option A	The Option A TSF would be located on the south side of Mount Davidson within the headwaters of the Blackwater River sub-basin, approximately 9 km south of the Blackwater deposit (Figure 4.1-2). The location is constrained by high ground along the north, west, and south margins, and would require impoundment along the east and part of the west margins. Option A would require construction of two dams (main east dam and a smaller west dam) using the centerline construction method with a central vertical till core for seepage control. One starter embankment would be constructed to impound surface water run-off for initial start-up. The starter embankment would then be progressively raised to provide storage for the first two years of tailings disposal. A combination of local borrow, overburden, and NAG materials would be used for embankment raises. The embankments would be progressively expanded to the ultimate heights of the dams. PAG waste rock would be placed in an on land stockpile with an engineered low-permeability foundation and drainage collection system that would collect and convey seepage to a collection point after which it would be directed to the TSF or routed to a water treatment plant.	Tailings would be generated from the WOL gold-silver recovery plant, with conventional slurry sub-aqueous tailings disposal. Active pumping of tailings over the life of mine would likely be necessary. Seepage from the dams would be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the main embankment would be collected in embankment drains and conveyed to an Environmental Control Dam downstream of the main embankment. Seepage would be recycled back to the TSF. The total TSF storage volume for Option A is estimated to be 300 Mm^3, which is sufficient to store the entire life-of-mine tailings.	PAG waste rock would be stored separately from the TSF in an on land stock pile. A non-ML NAG fill platform would be built at the base of the PAG stockpile area to direct drainage to the TSF or pit. The location of the PAG stockpile area would be close to the pit to maximize facility clustering and minimize haulage costs. The area would be sufficient to hold life-of-mine PAG waste rock material. Seepage from the PAG stockpile area would be collected and sent to a water treatment plant for treatment.	A rock closure spillway would be constructed to direct water from the TSF dams to Davidson Creek. A 0.3 m overburden layer would be used as cover for tailings within the TSF dams to provide physical separation from the water column, thereby minimizing contamination of surface water discharged from the TSF dams post closure. The tailings areas of the dams would maintain a 1 m freeboard. The PAG on land stockpile would be capped with a 3 m thick low permeability till cover. Surface water runoff would be diverted around the PAG stockpile to the TSF or pit. Infiltration through the soil cover would be collected and treated in perpetuity at the water treatment plant.
Option B	The Option B TSF would be located on the west side of Mount Davidson within the upper Matthews Creek sub-watershed, approximately 8 km south-west of the Blackwater deposit (Figure 4.1-3). The location is contained by high ground along the east and west margins, and would require significant impoundment along the south margin and minor impoundment along the north margin. Option B would require construction of two dams (main south dam and a smaller north dam) using the centerline construction method with a central vertical till core for seepage control. One starter embankment would be constructed to impound surface water run-off for initial start-up. The starter embankment would then be progressively raised to provide storage for the first two years of tailings disposal. A combination of local borrow, overburden, and NAG material would be used for embankment raises. The embankments would be progressively expanded to the ultimate heights of the dams. PAG waste rock would be placed in an on land stockpile with an engineered low-permeability foundation and drainage collection system that would collect and convey seepage to a collection point after which it would be directed to the TSF or routed to a water treatment plant.	Tailings would be generated from the WOL gold-silver recovery plant, with conventional slurry sub-aqueous tailings disposal. Active pumping of tailings over the life of mine would likely be necessary. Seepage from the dams would be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the main embankment would be collected in embankment drains and conveyed to an Environmental Control Dam downstream of the main embankment. Seepage would be recycled back to the TSF. The total TSF storage volume for Option B is estimated to be 300 Mm^3, which is sufficient to store the entire life-of-mine tailings.	PAG waste rock would be stored separately from the TSF in an on land stock pile. A non-ML NAG fill platform would be built at the base of the PAG waste rock stockpile area to direct drainage to the TSF or pit. The location of the PAG stockpile would be close to the pit to maximize facility clustering and minimize haulage costs. The area would be sufficient to hold life-of-mine PAG waste rock material. Seepage from the PAG stockpile area would be collected and sent to a water treatment plant for treatment.	A rock closure spillway would be constructed to direct water from the TSF dams to the Blackwater River. A 0.3 m overburden layer would be used as cover for tailings within the TSF dams to provide physical separation from the water column, thereby minimizing contamination of surface water discharged from the TSF dams post closure. The tailings areas of the dams would maintain a 1 m freeboard. The PAG on land stockpile would be capped with a 3 m thick low permeability till cover. Surface water runoff would be diverted around the PAG stockpile to the TSF or pit. Infiltration through the soil cover would be collected and treated in perpetuity at the water treatment plant.
Option C	The Option C TSF would be located on the north slope of Mount Davidson within the upper portion of the Davidson Creek watershed, approximately 4 km northwest of the Blackwater deposit (Figure 4.1-4). The location is constrained by high ground along its north and south sides, and would require impoundment along the west and east sides of the basin, with a minor diversion of upstream drainage to the northwest. Option C would require construction of three dams (main dam and two saddle dams) which would all be zoned earthfill and rockfill dams, expanded over the life of the project using the centreline method of construction. A starter embankment would be constructed to impound surface water run-off for initial start-up, with the embankment to provide storage for the first two years of tailings disposal. The starter embankments would be constructed with local borrow material initially and then from the pre-stripping of the open pit. The embankments would be rapidly expanded to the ultimate heights of the dams, using NAG waste materials from the open pit and processed filter and transition zone material from local borrow areas.	Tailings would be generated from the WOL gold-silver recovery plant, with conventional slurry sub-aqueous tailings disposal. Tailings discharge during operations would initially be by gravity, but requires pumping later in mine life when the TSF elevation approaches the elevation of the plant site. Seepage would be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the main embankment would be collected in embankment drains and conveyed to the Environmental Control Dam downstream of the main embankment. Seepage would be recycled back to the TSF. The total TSF storage volume for Option C is estimated to be 515 Mm^3, which is sufficient to store the entire life-of-mine tailings and PAG waste rock.	PAG waste would be co-disposed within the TSF in such a manner that it is progressively encapsulated by the tailings and saturated by the supernatant pond to prevent oxidation and subsequent acid generation.	An overburden cover of at least 0.3 m would be established over the PAG waste rock dump and tailings. Wetlands would be established and upland beaches would be vegetated. The tailings supernatant pond would be maintained at its final level while pumping excess inflows to the open pit to accelerate filling of the pit lake. A riprap lined closure spillway sized for the Probable Maximum Flood (PMF) would be established towards Davidson Creek with an additional emergency spillway for each of the saddle embankments.

(continued)

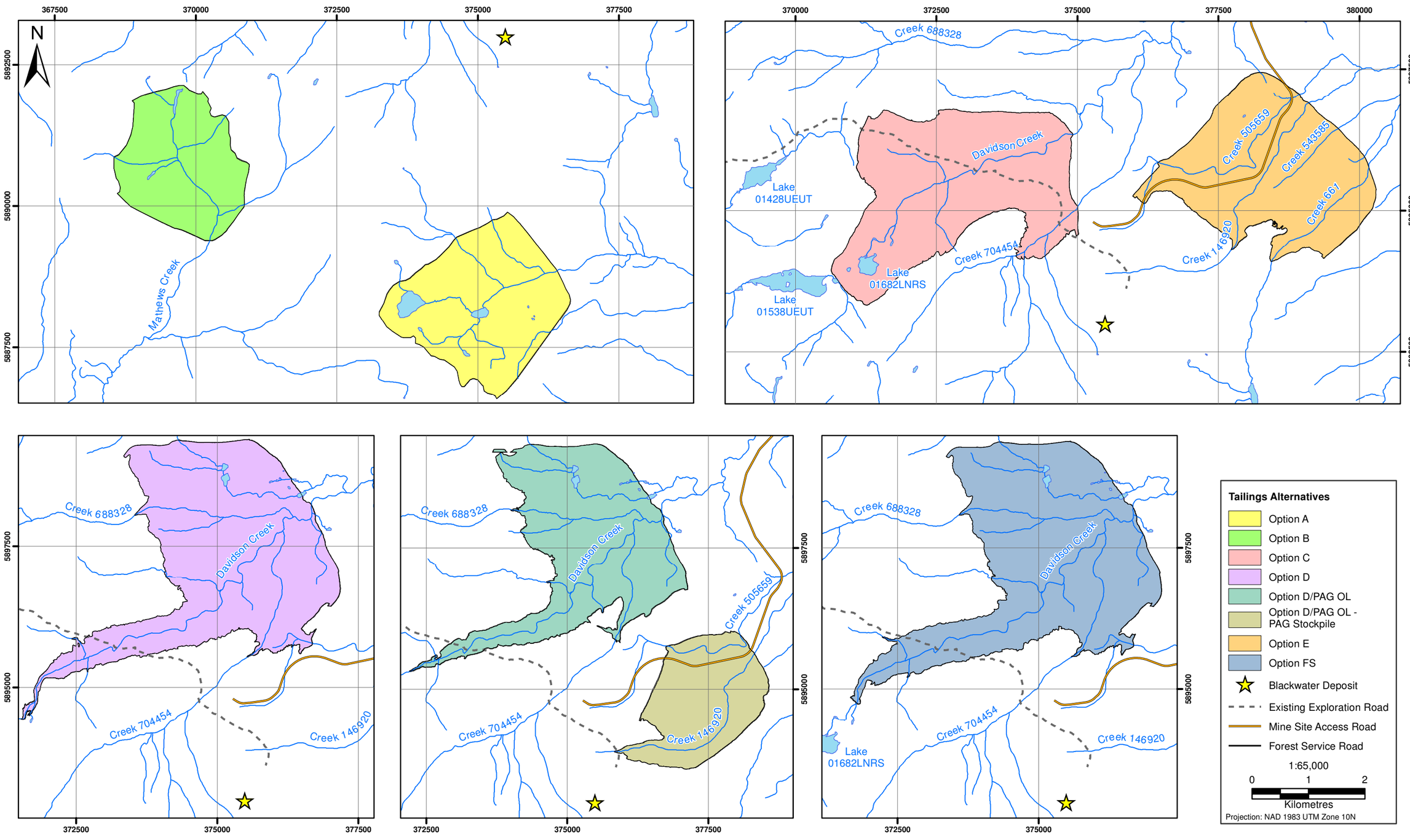
Table 4.1-1. Initially Considered Tailings Storage Facility Candidate Alternatives (continued)

TSF Option	Construction Approach	Operational Approach		Closure Approach
		General	Waste Rock Disposal	
Option D	The Option D TSF would be located on the north slope of Mount Davidson within the Davidson Creek sub-basin, approximately 4.5 km north of the Blackwater deposit. Option D is immediately downstream and partially overlaps with the proposed Option C (Figure 4.1-5). The location is constrained by high ground along its north, west and south margins, and would require major impoundment along the east margin with minor impoundments to the north and west later in the life of the mine. Option D would require construction of two dams (main dam and smaller west dam) which will be zoned earthfill and rockfill dams, expanded over the life of the project using the centreline method of construction. A starter embankment would be constructed to impound surface water run-off for initial start-up, with the embankment to provide storage for the first two years of tailings disposal. The starter embankments will be constructed with local borrow material initially and then from the pre-stripping of the open pit. The embankments would be rapidly expanded to the ultimate heights of the dams, using NAG waste materials from the open pit and processed filter and transition zone material from local borrow areas.	Tailings would be generated from the WOL gold-silver recovery plant, with conventional slurry sub-aqueous tailings disposal. Tailings discharge during operations will be by gravity for the entire mine life. Some energy dissipation measures may be required for the tailings stream in the early years of tailings deposition. Seepage would be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the main embankment will be collected in embankment drains and conveyed to the Environmental Control Dam downstream of the main embankment. Seepage will be recycled back to the TSF. The total TSF storage volume for Option D is estimated to be 520 Mm^3, which is sufficient to store the entire life-of-mine tailings and PAG waste rock.	PAG waste will be co-disposed within the TSF in such a manner that it is progressively encapsulated by the tailings and saturated by the supernatant pond to prevent oxidation and subsequent acid generation.	An overburden cover of at least 0.3 m would be established over the PAG waste rock dump and tailings. Wetlands would be established and upland beaches would be vegetated. The tailings supernatant pond would be maintained at its final level while pumping excess inflows to the open pit to accelerate filling of the pit lake. A riprap lined closure spillway sized for the PMF would be established towards Davidson Creek with an additional emergency spillway for each of the saddle embankments.
Option D/ PAG OL	The Option D/PAG OL TSF would be located on the north slope of Mount Davidson within the Davidson Creek sub-basin, approximately 6 km north of the Blackwater deposit. Option D/ PAG OL is immediately downstream and partially overlaps with the proposed Options C, D, and E (Figure 4.1-6). The location is constrained by high ground along its north, west and south margins, and would require major impoundment along the east margin. TSF Site D involves storing tailings in a TSF located approximately 4.5 kilometres north of the deposit. The dam would be a zoned earthfill and rockfill dam, expanded over the life of the project using the centreline method of construction. A starter embankment would be constructed to impound surface water run-off for initial start-up, with the embankment to provide storage for the first two years of tailings disposal. The starter embankments will be constructed with local borrow material initially and then from the pre-stripping of the open pit. The embankments would be rapidly expanded to the ultimate heights of the dams, using NAG waste materials from the open pit and processed filter and transition zone material from local borrow areas. PAG waste will be stored in an engineered containment up-gradient of the TSF and northeast of the open pit at the location of the TSF Site E alternative. A NAG fill platform of approximately 50 Mm^3 is required at the base of the PAG stockpile area to raise the topography to direct PAG stockpile drainage into the TSF impoundment by gravity. The fill platform will have an engineered soil liner constructed on top of compacted overburden from the open pit. This area is approximately 4 km to the northeast of the open pit.	Tailings would be generated from the WOL gold-silver recovery plant, with conventional slurry sub-aqueous tailings disposal. Tailings discharge during operations will be by gravity for the entire mine life. Some energy dissipation measures may be required for the tailings stream in the early years of tailings deposition. Seepage would be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the main embankment will be collected in embankment drains and conveyed to the Environmental Control Dam downstream of the main embankment. Seepage will be recycled back to the TSF. The total TSF storage volume for Option D/PAG OL is estimated to be 315 Mm^3, which is sufficient to store the entire life-of-mine tailing.	Seepage from the PAG stockpile area would be collected and sent to a water treatment plant for treatment. Unrecovered seepage from the PAG stockpile has the potential to affect Creek 661. A total of 203 Mm^3 storage would be provided for on-land PAG	An overburden cover of at least 0.3 m would be established over the tailings. Wetlands would be established and upland beaches would be vegetated. The tailings supernatant pond would be maintained at its final level while pumping excess inflows to the open pit to accelerate filling of the pit lake. A riprap lined closure spillway sized for the Probable Maximum Flood (PMF) would be established towards Davidson Creek with an additional emergency spillway for each of the saddle embankments. The PAG waste rock dump would be capped with a 3 m-thick low permeability overburden cover capped with a 30 cm growth medium cover. Surface water runoff will be diverted around the PAG dump to the TSF or downstream environment depending on water quality. Infiltration through the soil cover would be collected as seepage and conveyed to the TSF for dilution or treated during post-closure with an on-site water treatment plant depending upon quantity and quality.

(continued)

Table 4.1-1. Initially Considered Tailings Storage Facility Candidate Alternatives (completed)

TSF Option	Construction Approach	Operational Approach		Closure Approach
		General	Waste Rock Disposal	
Option E	The Option E TSF would be located on the east slope of Mount Davidson within the upper Creek 661 sub-basin, approximately 4 km northeast of the Blackwater deposit (Figure 4.1-7). The location is contained by high ground in the south-west direction and would require significant surrounding impoundment in the north-east direction. The Option E impoundment will be created by constructing a three-sided main dam wrapping the facility. The impoundment is constrained by topography to the southwest. The impoundment will be a zoned earthfill and rockfill dam, expanded over the life of the project using the centreline method of construction. A starter embankment would be constructed to impound surface water run-off for initial start-up, with the embankment to provide storage for the first two years of tailings disposal. The starter embankments will be constructed with local borrow material initially and then from the pre-stripping of the open pit. The embankments would be rapidly expanded to the ultimate heights of the dams, using NAG waste materials from the open pit and processed filter and transition zone material from local borrow areas.	Tailings would be generated from the WOL gold-silver recovery plant, with conventional slurry sub-aqueous tailings disposal. Tailings discharge during operations will be by gravity for the entire mine life. Some energy dissipation measures may be required for the tailings stream in the early years of tailings deposition. Seepage will be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the embankment will be collected in embankment drains and conveyed to the seepage collection ponds at a minimum of four locations downstream of the embankment. Seepage will be recycled back to the TSF. Seepage control would be the most challenging of the options. The total TSF storage volume for Option E is 515Mm^3, which is sufficient to store the entire life-of-mine tailings and PAG waste rock.	PAG waste rock will be co-disposed with the tailings sub-aqueously in the TSF. The waste rock will be progressively inundated and submerged below the final closure tailings elevation.	An overburden cover of at least 0.3 m would be established over the PAG waste rock dump and tailings. Wetlands would be established and upland beaches would be vegetated. The tailings supernatant pond would be maintained at its final level while pumping excess inflows to the open pit to accelerate filling of the pit lake. A riprap lined closure spillway sized for the Probable Maximum Flood (PMF) would be established towards Creek 661.
Option FS	The Option FS TSF, a combination of the Options C and D, is located on the north slope of Mount Davidson within the Davidson Creek sub-basin, approximately four km north of the Blackwater deposit (Figure 4.1-8). The location is contained by high ground along its north, west and south margins, and would require impoundment along the east and part of the west margins. Option FS would require construction of three dams (a main Site-D Dam, a main Site-C Dam and a smaller Site-C saddle Dam) using the centerline construction method with a central vertical till core for seepage control. Two starter embankments would be constructed to impound surface water run-off for initial start-up. These embankments would provide storage for the first two years of tailings disposal. A combination of local borrow, overburden, and NAG material would be used for embankment raises. The embankments would be progressively expanded to the ultimate heights of the main dam and two saddle dams.	Tailings would be generated from the WOL gold-silver recovery plant, with conventional slurry sub-aqueous tailings disposal. Tailings discharge during operations will initially be by gravity, but requires pumping later in mine life when the TSF elevation approaches the elevation of the plant site. Seepage would be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the main embankment will be collected in embankment drains and conveyed to the Environmental Control Dam downstream of the main embankment. Seepage will be recycled back to the TSF. The total TSF storage volume for Option FS is estimated to be 525 Mm^3, which is sufficient to store the entire life-of-mine tailings and PAG waste rock.	PAG waste rock will be co-disposed with the tailings sub-aqueously in the TSF. The waste rock will be progressively inundated and submerged below the final closure tailings elevation. The Option FS TSF has sufficient capacity for sub-aqueous disposal of life-of-mine PAG material.	An overburden cover of at least 0.3 m would be established over the PAG waste rock dump and tailings. Wetlands would be established and upland beaches would be vegetated. The tailings supernatant pond would be maintained at its final level while pumping excess inflows to the open pit to accelerate filling of the pit lake. A riprap lined closure spillway sized for the Probable Maximum Flood (PMF) would be established towards Davidson Creek with an additional emergency spillway for each of the saddle embankments.



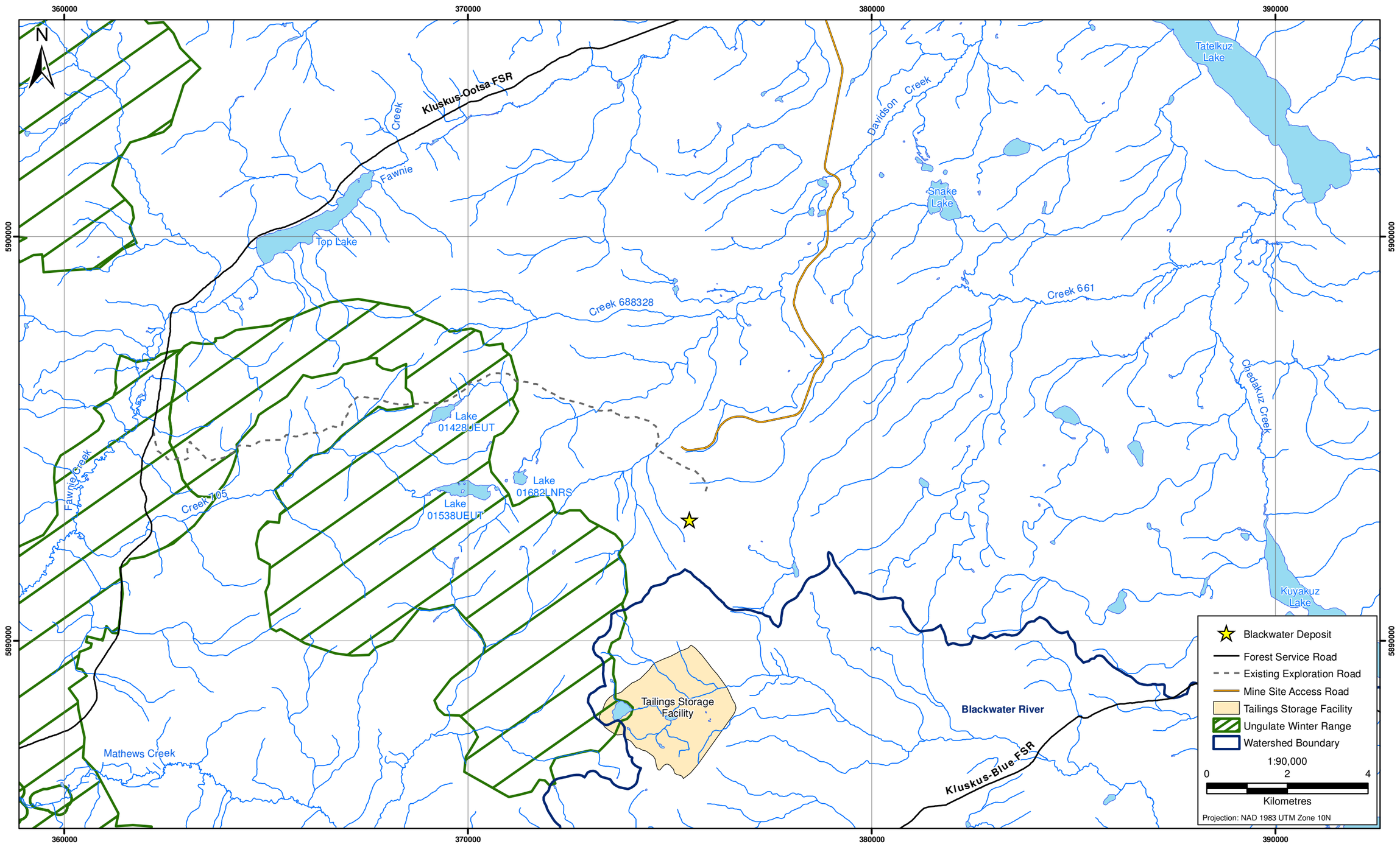
newgold

Rescan an ERM company

Figure 4.1-1

Blackwater Project: Tailings Storage Facility Candidate Alternatives

PROJECT #0215644-001 GIS # BLW-15-011 February 27, 2014



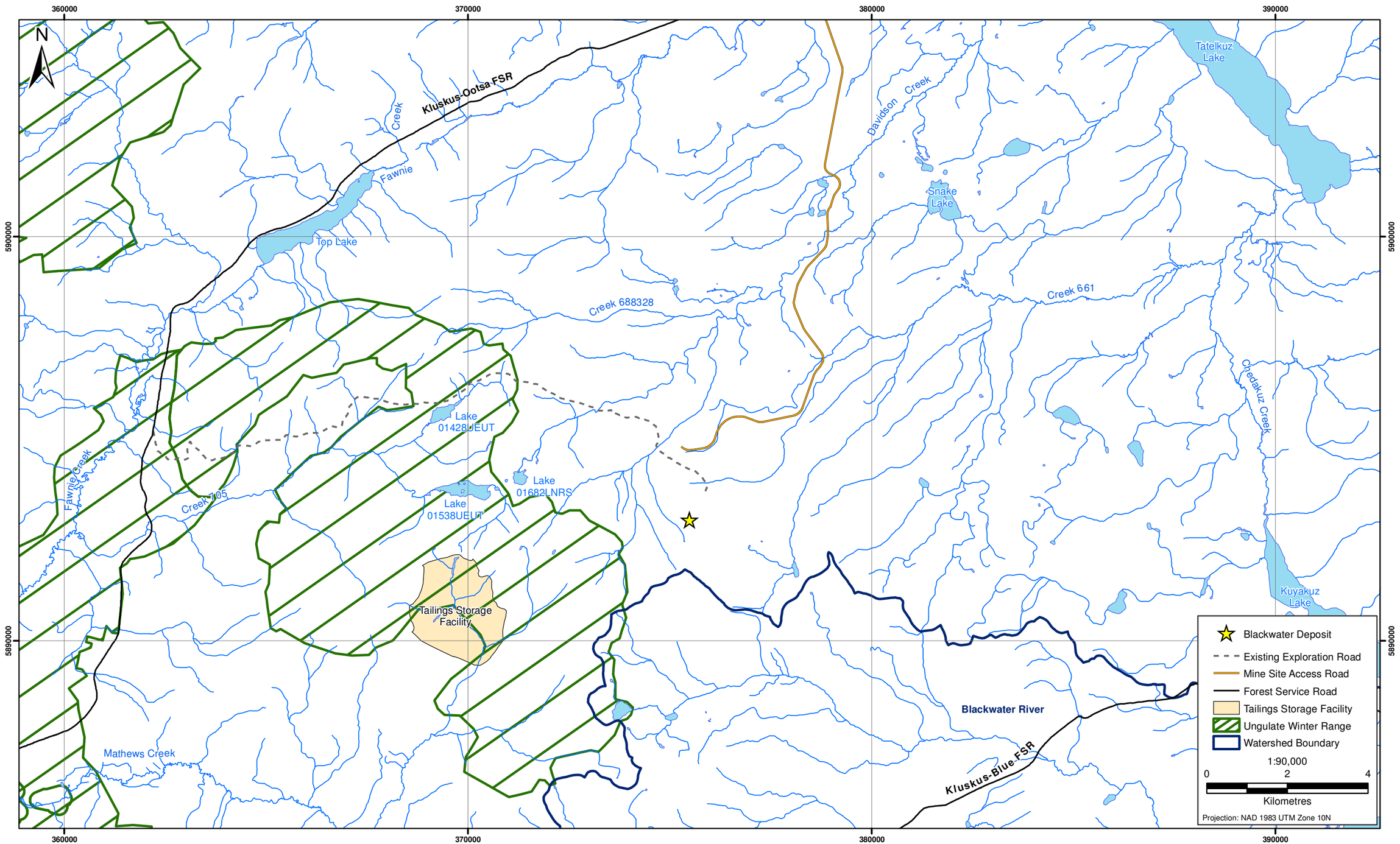
newgold

Rescan an ERM company

Figure 4.1-2

Detailed View of Option A Tailings Storage Facility

PROJECT #0215644-001 GIS # BLW-15-010 February 27, 2014

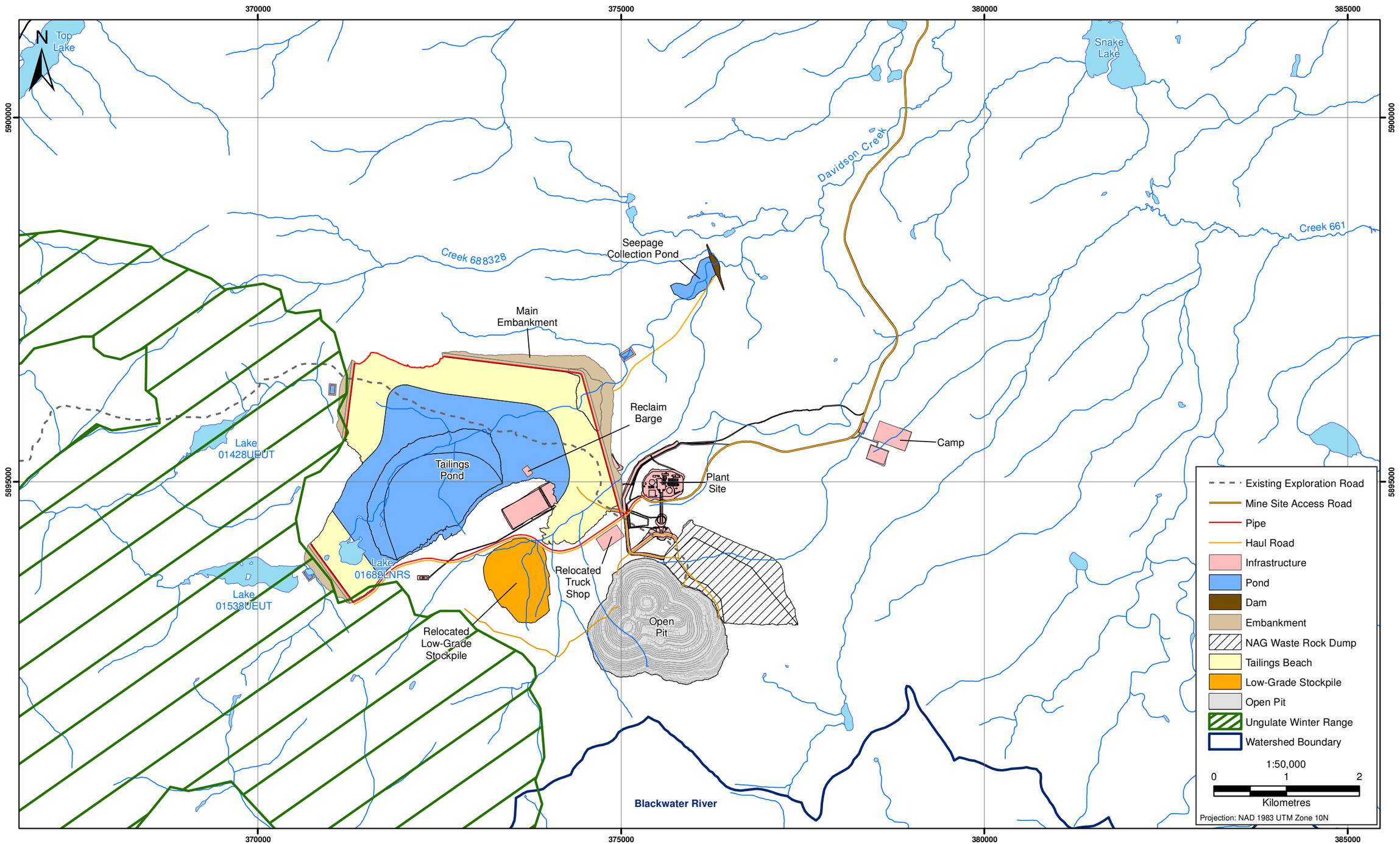


newgold

Rescan an ERM company

Figure 4.1-3

Detailed View of Option B Tailings Storage Facility

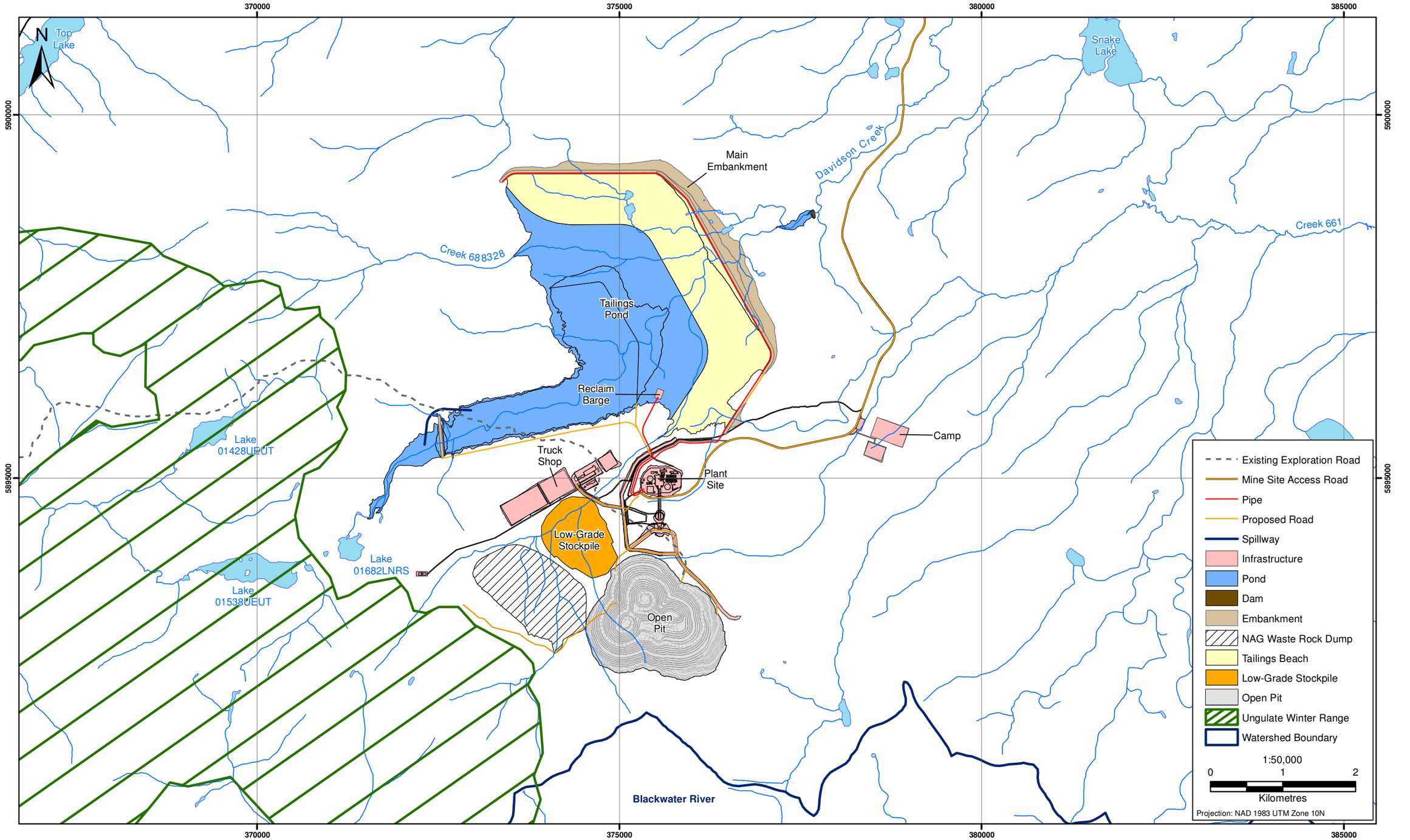


newgold

Rescan an ERM company

Figure 4.1-4

Detailed View of Option C Tailings Storage Facility

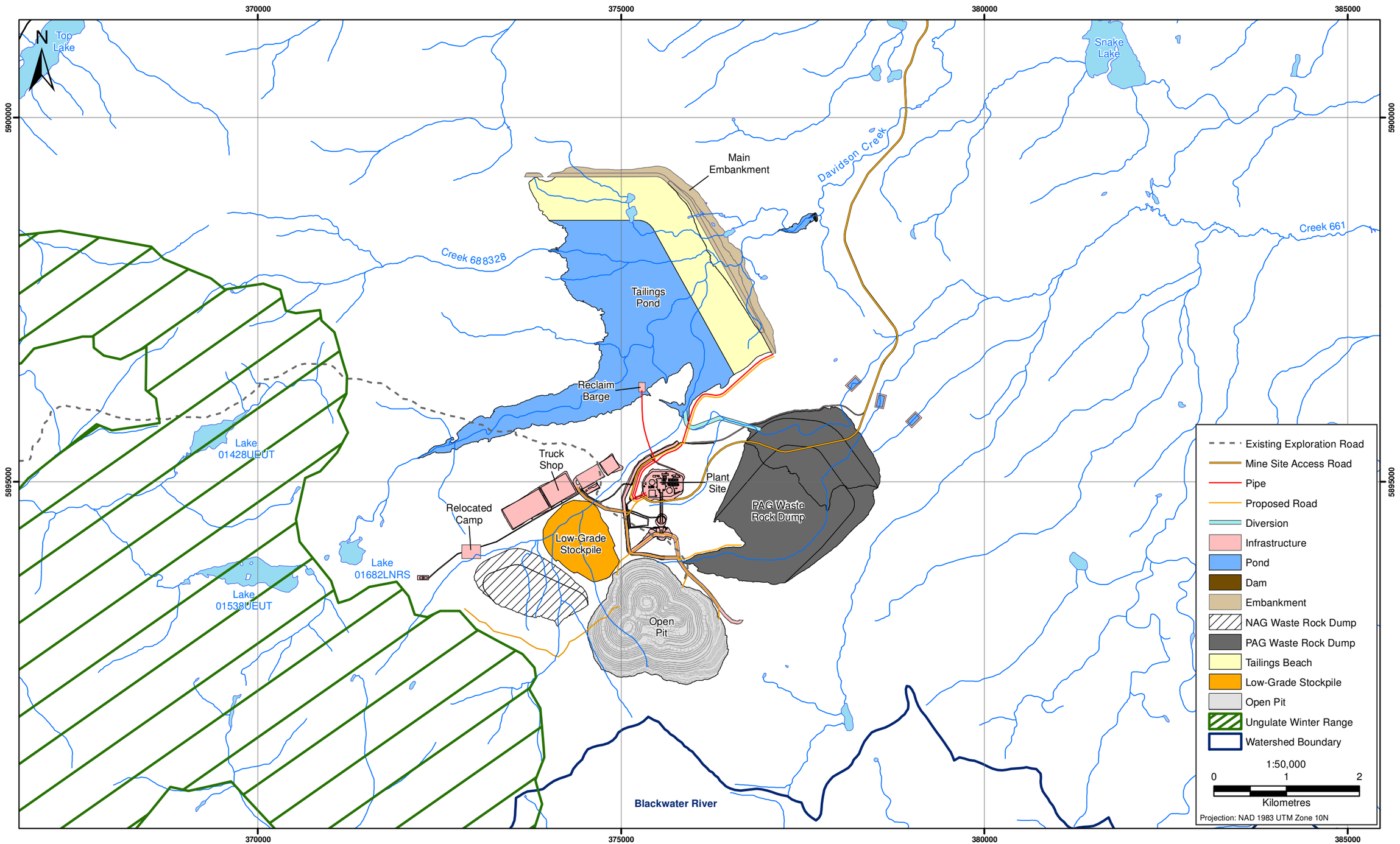


newgold

Rescan an ERM company

Figure 4.1-5

Detailed View of Option D Tailings Storage Facility

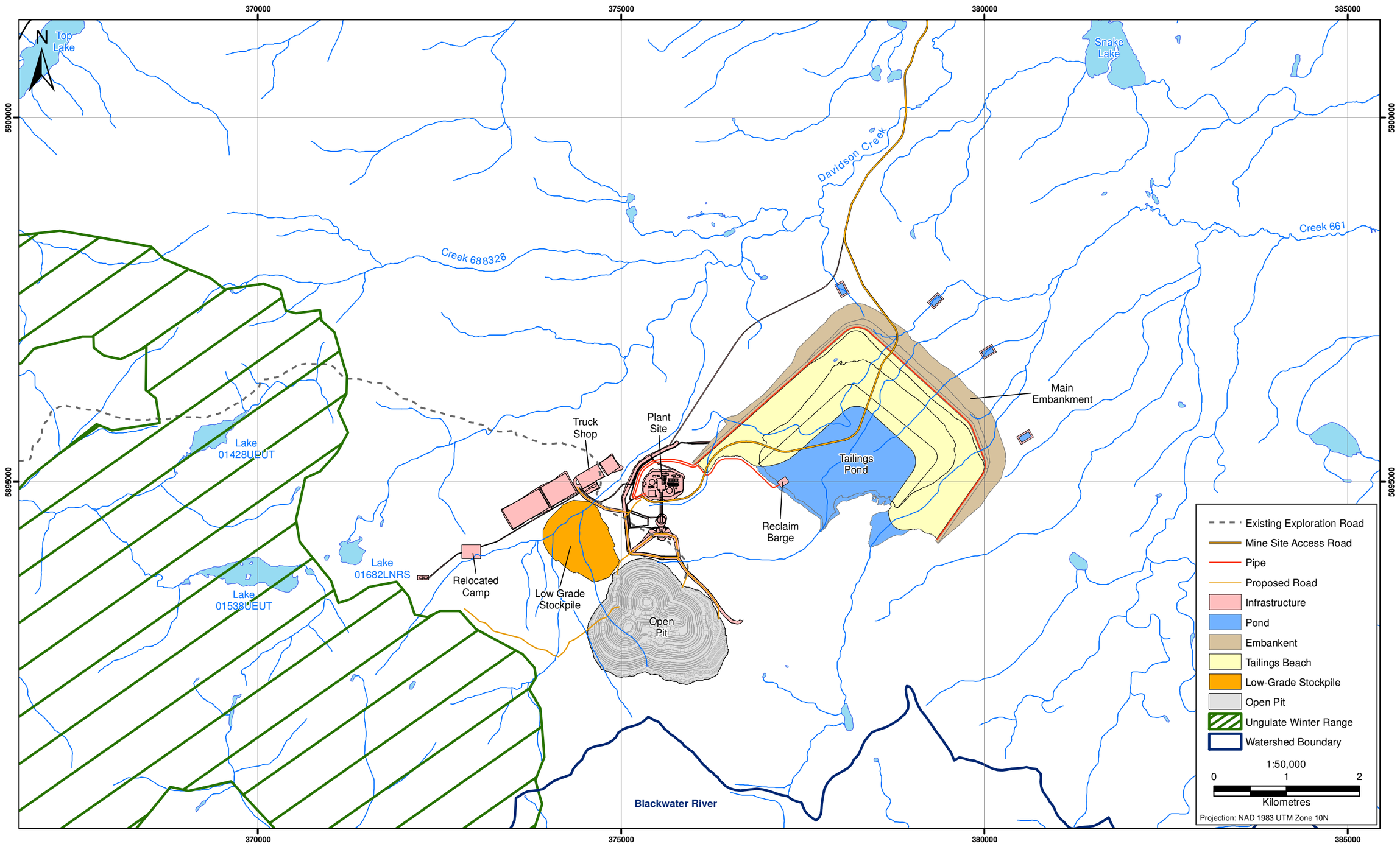


newgold

Rescan an ERM company

Figure 4.1-6

Detailed View of Option D - Potentially Acid Generating On-Land Dump Tailings Storage Facility

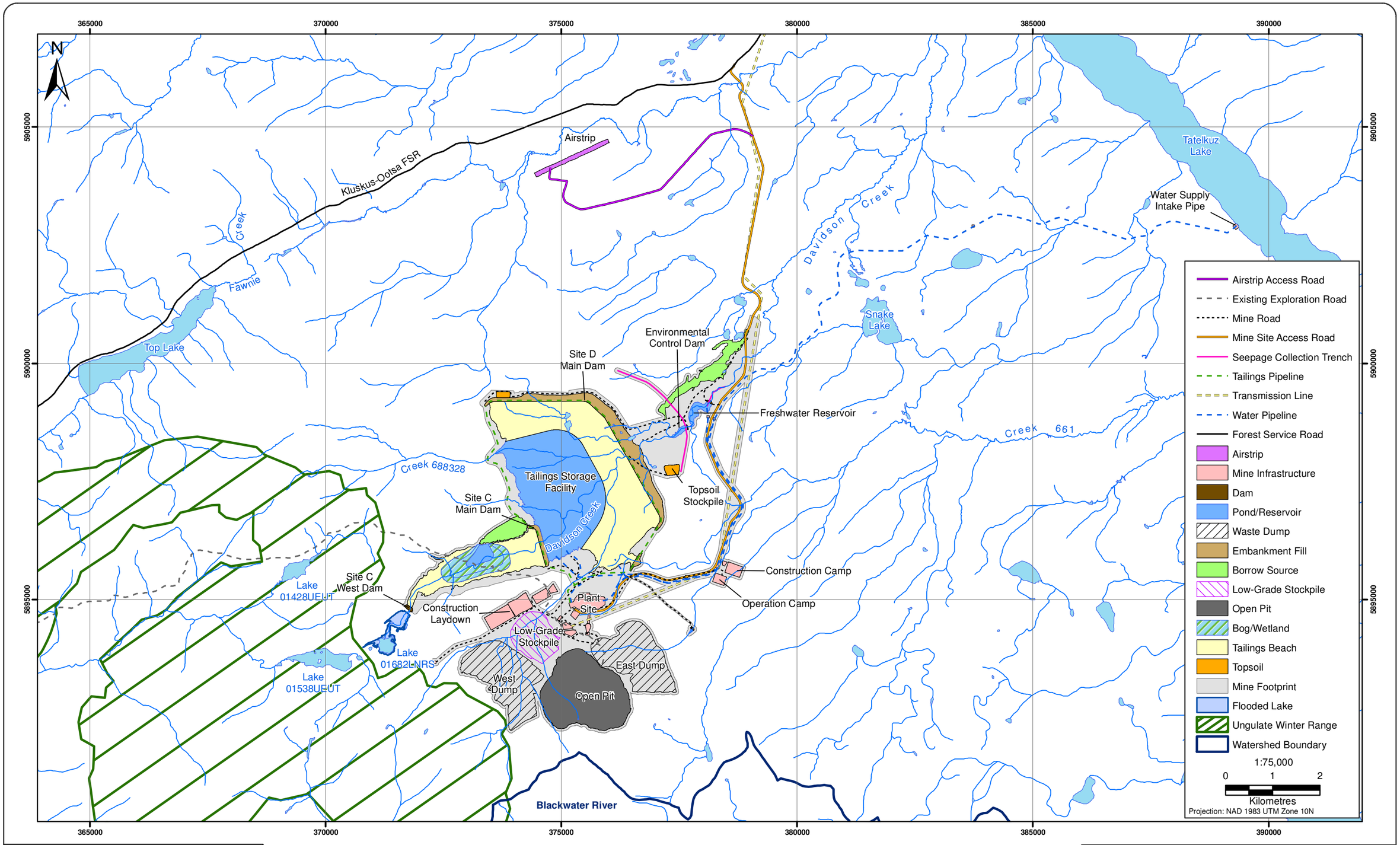


newgold

Rescan an ERM company

Figure 4.1-7

Detailed View of Option E Tailings Storage Facility



newgold

Rescan an ERM company

Figure 4.1-8

Detailed View of Option Feasibility Study Tailings Storage Facility

Descriptions of the seven alternatives (summarized from the above-listed reports) are provided in Section 4.1.2. The descriptive information provided in this section is relevant to the pre-screening assessment conducted in Section 4.2. Further characterization of the remaining TSF options is presented in Section 5.

4.1.1 Candidate Options Description

The seven candidate TSF alternatives are described in Table 4.1-1, which focuses on the construction, operational, and closure approaches for each TSF candidate alternative, and are shown in Figures 4.1-1 through 4.1-8.

4.2 PRE-SCREENING ASSESSMENT

The preceding section describes the seven TSF candidate alternatives in sufficient detail to support a pre-screening assessment, or "fatal flaw analysis". This "fatal flaw analysis" removes the TSF candidate options from further consideration that are non-compliant with certain minimum specifications developed for the Project, as per Section 2.3 of the *Guidelines* (Environment Canada 2011; Figure 4.2-1). A fatal flaw is defined as any site characteristic that is so unfavourable or severe that, if taken singly, it would eliminate an option as a candidate mine waste disposal alternative.

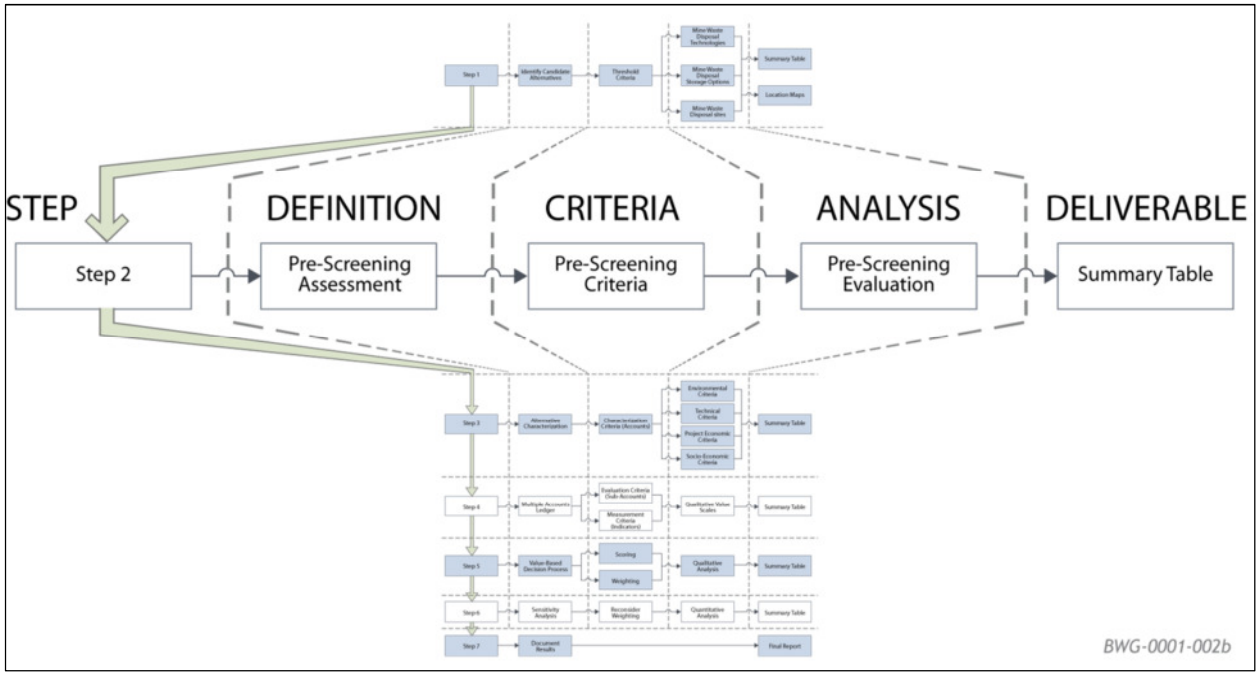


Figure 4.2-1. Pre-Screening Assessment Step

The following pre-screening criteria were applied to each of the initial seven TSF candidate alternatives:

- Would the TSF preclude future exploration of mining of a potential resource?
- Is any part of the mine waste disposal system based on unproven technology?

- Does the TSF have insufficient capacity for storage of tailings produced during the entire proposed mine life?
- Will the TSF result in negative life of Project economics?
- Will the TSF be located within the Blackwater watershed?
- Will the TSF be located in a designated Ungulate Winter Range?

4.2.1 Results of Pre-Screening Assessment

Table 4.2-1 provides the rationale for each pre-screening criteria and applies these criteria to each candidate alternative. Explanations of why candidate alternatives meet certain criteria are provided below.

4.2.1.1 Would the Tailings Storage Facility Preclude Future Exploration or Mining of a Potential Resource?

If a tailings disposal facility were to preclude future exploration or mining of a potential resource, that option should be excluded from further assessment. Based upon exploration and condemnation drilling conducted to date, none of the TSF options lie above known economic mineral resources.

4.2.1.2 Is Any Part of the Mine Waste Disposal System Unproven Technology?

If any part of the mine waste disposal system is based on unproven technology, this option may provide unmanageable engineering, economic, or environmental risks. All seven tailings disposal options are based on conventional centerline TSF dam design with subaqueous storage of tailings, which is a common disposal method for tailings likely to produce ML/ARD (1985).

For Options C, D, E, and FS, tailings and ML/PAG waste rock would be subaqueously co-disposed in the TSF. Co-disposal refers to the disposal of tailings and waste rock streams in one integrated disposal facility (Knight Pièsold 2014). This method of mine waste disposal can be a preferred method of disposal of PAG or ML waste rock, as the subaqueous nature of the waste deposition limits exposure to oxygen and thus limits ML/ARD generation. As well, the inclusion of waste rock into an impoundment can improve the stability of the facility, accelerate tailings consolidation and facilitate earlier closure, and reduce the erodibility of tailings (Knight Pièsold 2014). Waste streams can be actively mixed with the intention of filling void space with tailing. This technology has been used infrequently for coal mine wastes and is the subject of ongoing research for possible application to relatively small metal mines. Alternatively, waste streams can be deposited together so that some degree of mixing takes place by virtue of the deposition process. This technology has been successfully implemented in an abandoned open pit at the Kidston Mine in Queensland Australia and is being practiced in tailings impoundments at the Mt. Milligan Mine in BC and the Pueblo Viejo Mine in Dominican Republic.

For Options A, B and D/PAG OL, PAG and ML waste rock would be stored in a dry on-land dump. The construction, operation, and closure of on-land waste rock dumps are well-established technologies with virtually all open pit mines in the world employing such dumps, particularly for NAG and non-ML waste rock. However successful closure of on-land PAG/ML waste rock dumps can be challenging to restrict oxygen and or water contact with reactive waste rock.

Table 4.2-1. Pre-Screening Assessment for Blackwater Tailings Storage Facility Candidate Alternatives

Prescreening Criteria	Rationale	A	B	C	D	D / PAG OL	E	FS
Would the TIA preclude future exploration or mining of a potential resource?	If a specific storage facility interferes with future exploration or mining of resources, which is illegal, the alternative should be excluded from further consideration.	No	No	No	No	No	No	No
Is any part of the mine waste disposal system unproven technology?	If a specific deposition method has no precedent of being successfully implemented in the region, then it could justifiably be argued that the alternative should be excluded from further consideration.	No	No	No	No	No	No	No
Does the TSF have insufficient capacity for storage of tailings produced during the entire proposed mine life?	If a specific storage facility does not have sufficient capacity to store the entire mine-life tailings, then it could be justifiably argued on economic grounds that the alternative should be excluded from further consideration.	No	No	No	No	No	No	No
Will the TSF result in negative life of project economics?	If a specific deposition method requires long haul distances, then it could justifiably be argued on economic grounds that the alternative should be excluded from further consideration.	No	No	No	No	No	No	No
Will the TIA be located partially within the Blackwater watershed?	If a specific storage facility will impact the watershed of the Blackwater River, a heritage river, the alternative should be excluded from further consideration.	Yes	No	No	No	No	No	No
Will the TIA be located in an Ungulate Winter Range?	If a specific storage facility overlaps with the designated Ungulate Winter Range for Northern Caribou, the alternative should be excluded from further consideration.	Yes	Yes	No	No	No	No	No
Should alternative be excluded from further assessment?	If any of the pre-screening criteria are met, the alternative is excluded from further assessment.	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**

Thus, no option will utilize unproven technology, and no options can be excluded from the analysis based on this consideration.

4.2.1.3 Does the Tailings Storage Facility Have Insufficient Capacity for Storage of Tailings Produced during the Entire Proposed Mine Life?

Due to the high waste rock quantity and haulage costs, (estimated at $0.16/(tonne x km)) TSF sites used for co-disposal must be located within about 10 km of the deposit for the Project to be economically viable. Moreover, large quantities of NAG waste rock and overburden would be used for TSF dam construction for all Options so the 10 km distance restriction applies to Options with on-land waste rock dumps. This limitation, coupled with constraints due to topography, restricted potential TSF siting to seven potential options.

The life of mine tailings and PAG/ML waste rock requiring storage are as follows (Knight Pièsold 2014):

- 265 Mm^3 tailings
- 167 Mm^3 PAG waste rock; and
- 35 Mm^3 NAG3 (ML) waste rock (henceforth considered to be PAG for this analysis).

Of the viable TSF options, two of them (A and B) have the required capacity for storage of life-of-mine tailing only, although no specific storage facility has been identified for PAG waste rock (Table 4.2-2). One of the options (D/PAG OL) has sufficient capacity for storage of life-of-mine tailing, with PAG waste rock stored in a separate waste rock dump. Four of the options (C, D, E, and FS) have sufficient capacity for both tailings and PAG waste rock in one impoundment.

Table 4.2-2. Proposed Tailings Storage Facility Locations and their Respective Capacity Limitations

TSF	Capacity (million cubic metres)	Conclusion
Option A	300	Sufficient for life-of-mine tailings; separate onland PAG facility required
Option B	300	Sufficient for life-of-mine tailings; separate onland PAG facility required
Option C	515	Sufficient for life-of-mine tailings and PAG WR
Option D	520	Sufficient for life-of-mine tailings and PAG WR
Option D/PAG OL	315 (Option D) + 203 (PAG OL)	Sufficient for life-of-mine tailings and PAG WR
Option E	515	Sufficient for life-of-mine tailings and PAG WR
Option FS	525	Sufficient for life-of-mine tailings and PAG WR

Although Options A and B do not have a PAG waste rock disposal location identified, it is assumed that an appropriate location would be available that would store life-of-mine PAG WR. Thus, all TSF options have sufficient capacity to store life-of-mine tailings and PAG WR, and no facility can be excluded based on this consideration.

4.2.1.4 Will the Tailings Storage Facility Result in Negative Life of Project Economics?

If an option involves excessive costs, for example construction of very large dams or multiple tailings facilities, major scheduling issues that delay the Project schedule, or involves very long haulage or pumping distances, then the Project may not provide positive economic returns to the Proponent. If this is the case, then the option would be excluded from further consideration. As the Options presented here are all within 10 km of the mine site (set as the distance for economic exclusion in Section 4) and no other economic concerns have been identified, no options presented here are deemed to be uneconomical to the Proponent. No options are excluded from further consideration.

4.2.1.5 Will the Tailings Storage Facility be Located within the Blackwater Watershed?

The Blackwater River is listed as a Heritage River under the BC Heritage Rivers System by the BC Ministry of Environment (BC MOE 2010). The BC Heritage Rivers System showcases outstanding examples of a representative range of BC's most important waterways. Heritage status gives these rivers a greater public profile and focus. Heritage Rivers represent the diversity of river landscapes in terms of their natural characteristics, their historical and cultural importance to the human story of the province, and the spectrum of recreational opportunities they support (BC MOE 2010).

A Heritage River proclamation does not carry legal or regulatory power. Rather, the designation serves each river by (BC MOE 2010):

- providing a greater emphasis on river-related values during land-use planning processes;
- raising awareness of the importance of healthy river systems;
- helping to protect the special values of the river; and
- helping to build stronger public support for, and involvement in, stewardship of the river.

New Gold respects the intended purpose of a Heritage River designation and has chosen not to develop any mine infrastructure within the Blackwater River drainage (AMEC 2012c). Thus, if any portion of a TSF option lies within the Blackwater River drainage, then this option should be excluded from further consideration. Option A lies partially within this watershed (see Figure 4.1-2) and is therefore not considered further in this assessment. All other options are not located within this catchment area.

4.2.1.6 Will the Tailings Storage Facility be Located in the Ungulate Winter Range?

Ungulate Winter Range (UWR) is defined as an area that contains habitat that is necessary to meet the winter habitat requirements of an ungulate species. Sections 9 and 12 of the *Government Actions Regulation* (BC Reg 582/2004) of the *Forest and Range Practices Act* (1996a) outline the regulatory authority for establishing UWR. Caribou UWRs have legally established objectives with which most commercial and industrial operations must be consistent.

The Project area is adjacent to the Tweedsmuir-Entiako Northern Caribou UWR, which is key winter habitat used by the Tweedsmuir-Entiako Northern Caribou herd (Ecofor 2013). These Northern Caribou are listed on Schedule 1 of the Canadian *Species at Risk Act* (2002d) as Threatened.

The legal direction for the Tweedsmuir-Entiako Northern Caribou herd comes from the document *Order – Ungulate Winter Range #U-7-012* dated December 30, 2005 (the Order). Mineral exploration and development activities are exempt from requirements to manage Northern Caribou through Section 6 of the Order:

> *[T]he general wildlife measures outlined in Schedule 1 do not apply for the purposes of exploration, development and production activities when these activities have been authorized for the purpose of subsurface resource exploration, development or production by the Mineral Tenure Act, the Coal Act, the Mines Act, the Petroleum and Natural Gas Act, the Pipeline Act or the Geothermal Resources Act.*

In concordance with the Northern Caribou Management Plan (Ecofor 2013) developed by New Gold, New Gold has chosen to eliminate any TSF Option that overlaps with UWR from further consideration. Options A and B overlap this UWR (see Figures 4.1-2 and 4.1-3), and are thus excluded from further consideration in this analysis. All other options do not intersect with any legally established UWR.

4.2.2 Short List of Tailings Management Alternatives that Passed the Pre-Screening Criteria

The pre-screening analysis accepted tailings management alternatives that passed all of the pre-screening criteria, leaving five options to be further considered:

- Option C;
- Option D;
- Option D/PAG OL;
- Option E; and
- Option FS.

The five options listed above all contain fish-bearing habitat. The only proposed option that did not contain fish-bearing habitat was the identified locations for dry stacking of mine waste (see Figure 4-2), and dry stacking of waste was eliminated from further consideration in this analysis for both economic and technical considerations.

5. ALTERNATIVE CHARACTERIZATION

The alternative characterization describes the five TSF alternatives short-listed by the prefeasibility assessment using project specific characterization criteria.

These five alternatives are generally described at the beginning of this chapter and described in detail in the Characterization Criteria Summary tables (see Tables 5.3-1 through 5.3-4; Figure 5-1). The general description includes information that may not be comparable among options. This information provides a thorough characterization of the five options with no a priori judgement assumed. Only the characterization criteria that can be directly compared among the five alternative options are presented in Tables 5.3-1 through 5.3-4 in Section 5.3.

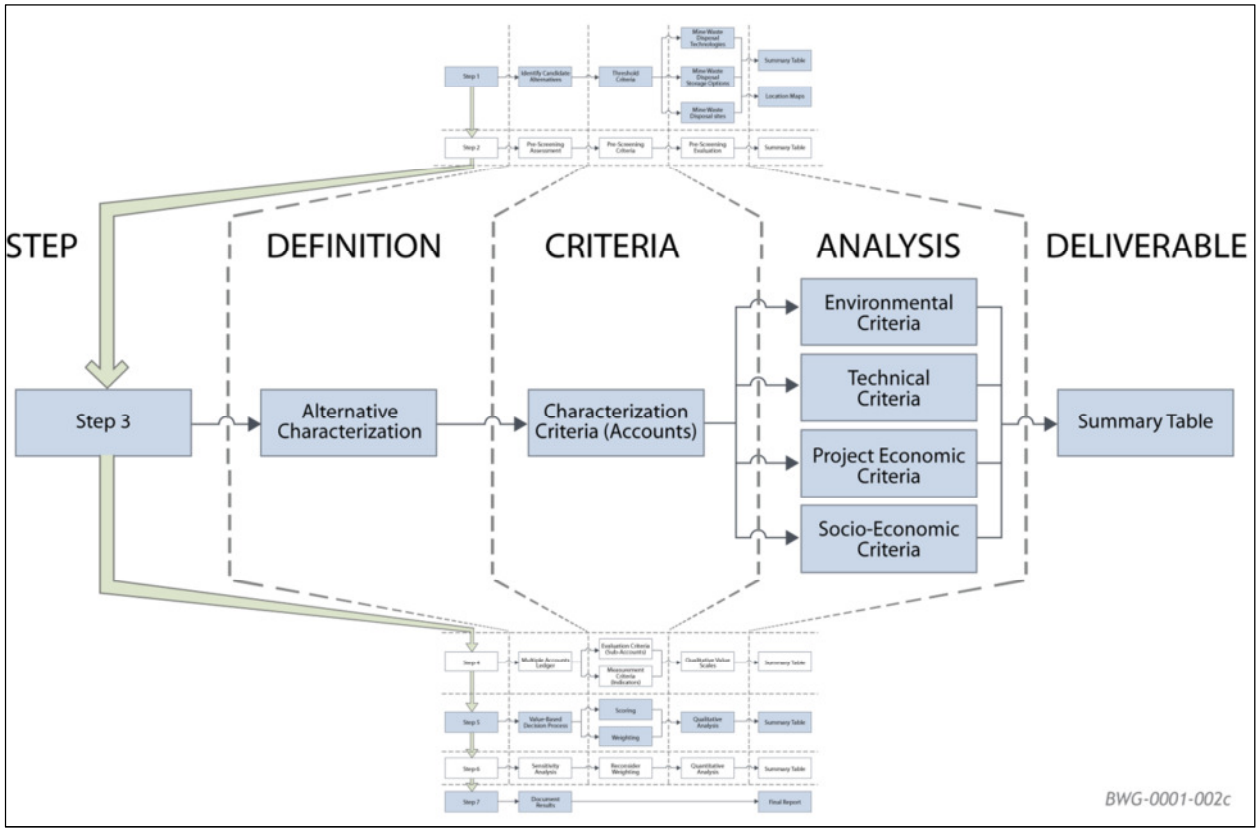


Figure 5-1. Alternative Characterization Step

The Characterization Criteria Summary tables are the primary deliverables of the Alternatives Characterization step as per section 2.4 of the *Guidelines* (Environment Canada 2011). They provide the characterization criteria, the rationale for the selection of each criterion, the descriptions corresponding to each criterion for each alternative, and information on whether or not a characterization criterion will be carried forward to the next step, the multiple accounts ledger, as an evaluation criterion.

This assessment is administered by Environment Canada and follows the multiple accounts analysis as defined in the *Guidelines*. However, the *Guidelines* do not prescribe a method for the selection of characterization criteria. The Proponent has decided to follow the direction provided in the Canadian Environment Assessment Agency's (2013b) *Operational Policy Statement Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012.* This guidance suggests that the effects of Project alternatives be assessed for each of the Project's Valued Components (VCs) by "Identify[ing] the VCs potentially affected by each alternative means", and "Examin[ing] briefly the potential effects on the VCs for each alternative means". Table 5-1 provides a list of the Project's selected VCs (New Gold 2015). As these VCs were selected to evaluate the potential effects of the entire Project on environmental, social, economic, heritage, and health aspects, not all of these VCs are relevant to the evaluation of TSF alternatives. Rationale for excluding Project VCs from these analyses are provided in Table 5-1. If the VCs are included in this analysis, then Table 5-1 provides a list of indicators that were used to evaluate the VCs.

Table 5-1. Valued Components for the Blackwater Gold Project

Blackwater Gold Project Valued Component	Included in Assessment of TSF Alternatives	Rationale for Exclusion or Description of How Valued Component is Considered in the Analysis
Environment Valued Components		
Noise and vibration	No	The primary source of noise and vibration from the Project is the open pit. Noise effects from the TSF construction and operation are expected to be within daytime sound permissible levels of 55 dBA and within 1 km meeting nighttime sound permissible levels of 45 dBA. No human receptors are within this distance from any alternative, therefore noise is not differentiating among alternatives.
Climate change	Yes	Climate effects on water management; ability to adapt to wetter conditions (i.e., the effects of the environment on the Project); ability to handle extreme events.
Air quality	Yes	Dust emissions
Surface water flow	Yes	Number of watersheds affected; size of watersheds affected; potential catchment loss to toe of TSFs in the Davidson Creek and Creek 661 watersheds; potential impacts to the timing and distribution of flows.
Surface water quality	Yes	Water quality of the receiving environment; potential for ARD/ML generation (dam construction material and unconfined PAG material).
Groundwater flow	Yes	Potential impacts to groundwater quantity and quality; seepage management
Groundwater quality	Yes	Potential impacts to groundwater quantity and quality; seepage management
Wetlands	Yes	Loss of wetland extent; loss of listed wetlands
Fish Habitat	Yes	Extent of permanent alteration to or destruction (PAD) of fish habitat; quality of fish habitat affected by PAD.
Fish	Yes	Number of fish species directly affected within the TSF footprint; presence of rare and endangered fish species; distance from toe of containment dam(s) to first occurrence of downstream spawning Kokanee; downstream Kokanee values; downstream Rainbow Trout values; and downstream Mountain Whitefish values.

(continued)

Table 5-1. Valued Components for the Blackwater Gold Project (continued)

Blackwater Gold Project Valued Component	Included in Assessment of TSF Alternatives	Rationale for Exclusion or Description of How Valued Component is Considered in the Analysis
Environment Valued Components (cont'd)		
Physiography and topography	Yes	The effects of physiography and topography on the proposed TSF options (i.e., the effects of the environment on the Project).
Surficial geology and soil cover	Yes	Terrain and soil.
Soil quality	Yes	Terrain and soil.
Ecosystem composition	Yes	Sparsely vegetated ecosystems; riparian ecosystems; and mature forest ecosystems.
Plant species and ecosystems at risk	Yes	Rare and endgangered ecosystems; rare and endangered plant species.
Amphibians	Yes	Direct loss or disturbance to western toad habitat.
Water birds	Yes	Presence of species of conservation concern other than western toad, caribou, grizzly bear, American marten, and myotis bats.
Forest and grassland birds	Yes	Direct loss or disturbance to high-quality terrestrial bird habitat.
Moose	Yes	Direct loss or disturbance to high-quality moose habitat.
Caribou	Yes	Direct loss or disturbance to high-quality caribou habitat.
Grizzly bear	Yes	Direct loss or disturbance to high-quality grizzly bear habitat.
Furbearers	Yes	Direct loss or disturbance to high-quality American marten habitat.
Bats	Yes	Direct loss or disturbance to high-quality myotis spp. habitat.
Invertebrates	Yes	Presence of species of conservation concern other than western toad, caribou, grizzly bear, American marten, and myotis bats.
Social Valued Components		
Demographics	No	Any potential changes to demographics resulting from the various TSF options are unlikely to be differentiating among alternatives as the alternatives considered here utilize relatively similar technologies and occupy similar footprints.
Regional and community infrastructure	No	Any potential changes to regional and community infrastructure resulting from the various TSF options are unlikely to be differentiating among alternatives as the alternatives considered here utilize relatively similar technologies and occupy similar footprints.
Regional and local services	No	Any potential changes to regional and local services resulting from the various TSF options are unlikely to be differentiating among alternatives as the alternatives considered here utilize relatively similar technologies for construction, operation, and closure and occupy similar footprints (i.e., are not geograhically dispersed).

(continued)

Table 5-1. Valued Components for the Blackwater Gold Project (continued)

Blackwater Gold Project Valued Component	Included in Assessment of TSF Alternatives	Rationale for Exclusion or Description of How Valued Component is Considered in the Analysis
Social Valued Components (cont'd)		
Family and community well-being	No	Any potential changes to family and community well-being resulting from the various TSF options are unlikely to be differentiating among alternatives as the alternatives considered here utilize relatively similar technologies for construction, operation, and closure and occupy similar footprints (i.e., are not geograhically dispersed).
Non-traditional land and resource use	Yes	Forestry tenures; agriculture and range tenures; guide-outfitting tenures; trapline tenures; commercial recreation tenures; mineral claims; recreational sensitivity; parks and protected areas
Current land use for traditional purposes	Yes	Traditional territories overlapped; Current use of lands and resources for traditional purposes – Lhoosk'uz Dene Nation; Current use of lands and resouces for traditional purposes – Ulkatcho First Nation; Current use of lands and resouces for traditional purposes – Skin Tyee Nation;
Visual resources	No	As the Project is relataively isolated (>15 km) from local communities, including Indian Reserves, provincial parks, protected areas, and recreational areas, visual resources are not anticipated to be different among alternatives. Further no alternatives are within established areas of visual quality objectives (VQOs) which are derived from the physical characteristics and the social concern for the area and identified under the *Forest Practices and Range Act* (2002b).
Heritage Valued Components		
Archaeological sites	Yes	Effects to known archaeological sites
Historic heritage sites	Yes	Effects to known heritage sites
Paleontological resources	No	No known paleontological resources exist in the Project area
Human Health Valued Components		
Environmental exposures	No	Project activities will adhere to all applicable laws and standards including the provincial *Mines Act* (1996c) and Health Safety and Reclamation Code (BC MEMPR 2008). No new or novel construction, operational or closures practices are proposed for any alternative; as such public and worker health and safety concerns are not expected to be differentiating among TSF alternatives
Workers health and safety	No	Project activities will adhere to all applicable laws and standards including the provincial *Mines Act* (1996c) and Health Safety and Reclamation Code (BC MEMPR 2008). No new or novel construction, operational or closures practices are proposed for any alternative; as such worker health and safety concerns are not expected to be differentiating among TSF alternatives

(continued)

Table 5-1. Valued Components for the Blackwater Gold Project (completed)

Blackwater Gold Project Valued Component	Included in Assessment of TSF Alternatives	Rationale for Exclusion or Description of How Valued Component is Considered in the Analysis
Economic Valued Components		
Provincial economy	Yes	Initial capital costs; sustaining capital and operating costs; closure costs, fish habitat compensation costs
Regional and local employment and businesses	Yes	During construction and operation, the Project will source much labour and good and services from the regional area (estimated 485 person-years of employment during the 2 year construction period, and 420 person-years for operations, and $75M of goods and services. The impact on the regional and local employment and businesses from the TSF alternatives will be directly related to Project costs: initial capital costs; sustaining capital and operating costs; closure costs, fish habitat compensation costs
Regional and local government finance	No	Overall, Project construction and operations will have net positive effects on regional and local finances. During operations, the Project would pay annual taxes of $2.3 million per year to the BC Surveyor of Taxes, with these funds being used to support the activities of the three regional districts in the Project area, as well as other regional districts in BC. These taxes will largely be independent of the TSF alternative selected for the Project and this valued component will not be discussed further in this report.

For the technical and Project economics account, the *Guidelines* (Environment Canada 2011) were used as guidance for characterization criteria selection.

5.1 DATA SOURCES FOR ALTERNATIVES CHARACTERIZATION

No data were collected specifically for the purpose of this assessment.

Information to support the characterization of each proposed TSF options was drawn from the following studies listed below and from the experience and professional judgement of the scientists and engineers who completed the research:

- *Blackwater Gold Project, British Columbia – Project Description* (New Gold 2012);
- *Blackwater Gold Project, British Columbia – 2011 - 2012 Vegetation Baseline Report* (AMEC 2013a);
- *Blackwater Gold Project, British Columbia – 2013 Vegetation Baseline Report* (AMEC 2013b);
- *Blackwater Gold Project, British Columbia – Reconnaissance Terrain and Terrain Stability Mapping, Rev. 0* (Knight Pièsold 2013c);
- *Blackwater Gold Project, British Columbia – Archaeology 2013 Baseline Report* (AMEC 2013d);
- *Blackwater Gold Project, British Columbia – Draft Aboriginal Baseline* Report (AMEC 2013e);
- *Blackwater Gold Project, British Columbia – Groundwater Quality 2012 – 2013 Baseline Report, Draft* (AMEC 2013f);
- *Blackwater Gold Project, British Columbia – Social Baseline Report, Draft* (AMEC 2013g);

- *Blackwater Gold Project, British Columbia – Water and Sediment Quality Baseline Report* (AMEC 2013h);
- *Blackwater Gold Project, British Columbia – Economic Health 2011-2012 Baseline Report* (AMEC 2013i);
- *Blackwater Gold Project, British Columbia – Fish and Aquatic Resources 2011-2012 Baseline Report* (AMEC 2013j);
- *Blackwater Gold Project, British Columbia – Fish and Aquatic Resources 2013 Baseline Report* (AMEC 2013k);
- *Blackwater Gold Project, British Columbia – Non-traditional Land Use Baseline Report, Draft* (AMEC 2013m);
- *Blackwater Gold Project, British Columbia - Soils, Terrain, and Surficial Geology 2011-2012 Baseline Report* (AMEC 2013n);
- *Blackwater Gold Project, British Columbia – Wetlands 2011 - 2012 Baseline Report* (AMEC 2013o);
- *Blackwater Gold Project, British Columbia – Wildlife and Wildlife Habitat 2011 - 2012 Baseline Report* (AMEC 2013p);
- *Blackwater Gold Project, British Columbia – Baseline Report Geochemistry, version 2* (New Gold 2015);
- *Blackwater Gold Project, British Columbia – Updated Mine Development Concept Evaluation Considering Potentially Acid Generating (PAG) Disposal On-land and Subaqueously in the Tailings Facility* (Knight Pièsold 2012)*;*
- *Blackwater Gold Project, British Columbia – TSF Multiple Accounts Analysis – Design Alternatives Information* (Knight Pièsold 2014)*; and*
- *Blackwater Gold Project, British Columbia - Blackwater Gold Project, British Columbia - NI 43-101 Technical Report on Feasibility Study* (New Gold 2014).

The following sections (5.1.1 through 5.1.10) describe the data sources and analyses performed for the purposes of this assessment. Sections 5.2 and 5.3 present the characterization summaries for the five short-listed TSF options.

5.1.1 Surface Water Quantity

Surface water quantity analysis presented in this report is based on Geographical Information Systems (GIS) and mapping data to qualitatively compare the alternatives. Hydrometric monitoring stations that are in the area of the TSF options are as follows: stations H2 and H4B (downstream of Options C, D, D/PAG OL and FS), and H1 (downstream of Option E, and D/PAG OL). Hydrometric monitoring station H2 is immediately downstream of the Project site, near the location of the Site D dam (Figure 1.8-3). The other hydrometric monitoring sites are further downstream from the alternatives being assessed. Alternative options were not assessed using this station data since sufficient coverage of all of the options did not exist.

The potential impacts to downstream sediment transport were assessed by evaluating channel morphology underneath each TSF footprint. This evaluation allowed for the determination of

present sediment loading in the channel via the presence and size of elevated regions of sediment within the channel. Hillslope sediment contribution was also evaluated based on existing sediment sources visible in aerial photographs.

Both the potential catchment loss to the toe of the containment dam and the effect of the physical removal of the surface area occupied each proposed TSF were evaluated. It was assumed during these analyses that the area occupied by a TSF footprint would be isolated from the downstream environment; thus the water contained therein would not flow downstream in the near- to mid-term. It was also assumed that any diversion infrastructure would operate at 100% efficiency. In cases where there was potential catchment loss to more than one watershed, the values were added to provide a combined total potential runoff loss area.

The number and size of the watersheds affected were also considered for each TSF option. For TSF options located in smaller watersheds, the Project water needs have the potential to have a larger impact on instream flows due to water diversion and storage.

The potential impact to timing and distribution of flows were evaluated by determining the presence of lakes (including intermittent lakes) or wetlands within a proposed TSF footprint which would either affect attenuation of flows or are storage features of event flows which would then contribute to baseflows throughout the year. It was assumed that the roughness in the diversion channels would be less than those in the current channels; thus, concentration of peak flows would be greater and occur quicker.

5.1.2 Surface Water Quality

The potential effect on surface water quality for the five TSF options was assessed by comparing the water quality of potential discharge and comparing the water quality of the near-field or immediate receiving environment. Collection pond water quality is affected by the quality of process water discharged to the pond and ML/ARD from PAG material exposed to oxidizing environments. Further, depending on containment dam design and availability of appropriate material, TSF options require varying quantities of NAG material for embankment construction. Where larger quantities of NAG material are required, there is potential that there is not sufficient NAG material to build embankments requiring borrow pits that expand footprint effects and increase construction costs. Process plant water was assumed to have the same chemistry independent of the tailings storage option. Therefore, the potential differences in water quality of the collection ponds for the TSF options was determined based on the differences in the proportion of PAG material that is proposed to be stored subaerially. The two dimensional surface area of material exposed to oxidizing conditions, i.e. tailings beaches and on land PAG waste rock, was compared to the two dimensional surface area of material submerged under a water cover. A lower ratio indicates that a greater proportion of PAG material will be covered, which would increase the likelihood that ML/ARD will be minimized.

To assess the existing water quality of the immediate receiving environment three parameters were chosen: sulphate, cadmium, and zinc. Cadmium and zinc were chosen as baseline water concentrations were noted as exceeding the 30-day guidelines for the protection of freshwater aquatic life (AMEC 2013h). Sulphate was chosen as it is a well-recognized parameter released during the oxidation of sulphide minerals and may be used as an environmental tracer. Mean annual cadmium

and zinc values at water quality monitoring stations were noted as above BC 30-day mean guidelines and sulphate is indicative of sulphide oxidation. If multiple baseline water quality sites were applicable for a TSF option then the mean of the annual means was calculated. If receiving environment water quality is better, i.e., low background concentrations, then there is a higher likelihood that discharge would cause a measurable change in baseline conditions, potentially resulting in a greater water treatment requirements.

Larger embankments require more NAG construction material to complete. If there is insufficient NAG material for construction then there is an increased risk that material classified as having an uncertain acid generating potential will be used, resulting in an increased likelihood that water quality in the receiving environment will be negatively affected.

5.1.3 Hydrogeology

Baseline information for geology, hydrogeology baseline and current groundwater flow and quality conditions at the Project site are available for the alternative TSF options. The groundwater quality baseline study at the site shows that typical groundwater quality with no anomalies regarding potential groundwater pollution. The summaries provided here are largely qualitative in nature, and are based on professional judgment.

5.1.4 Aquatic Habitat

5.1.4.1 Rare and Endangered Non-Fish Aquatic Organisms

All of the TSF options considered here are within the Project's mine site ALSA and data collected for the Project's baseline studies is sufficient to compare the effects of the TSF options on fish and fish habitat.

The presence of any species of concern in the baseline sampling program was used as a criterion for the characterizing of the TSF options. Species of special concern, due to their conservation status in lakes and streams within and downstream from the TSF alternatives, were identified by screening the baseline information on the phytoplankton, zooplankton, and benthic invertebrate communities with the BC Conservation Data Centre on-line database (BC CDC 2013). The taxonomy lists reported in the *Blackwater Gold Project: Fish and Aquatic Resources 2011-2012 Baseline Repor*t (AMEC 2013j) were cross-referenced with the lists of organisms with special conservation status in the Bulkey-Nechako, Central Coast, and Kitimat-Stikine regional districts. The BC Conservation Data Centre on-line database contains the current species listings under the *Species at Risk Act* (2002d), and for COSEWIC.

5.1.5 Fish and Fish Habitat

The disposal of tailings and PAG material removes any fish habitat within a TSF footprint, isolates any upstream fish habitat, and potentially alters flows, sedimentation, and habitat of downstream fish habitat.

All of the TSF options considered here are within the Project's mine site ALSA and data collected for the Project's baseline studies are sufficient to compare the effects of the TSF options on fish and fish habitat (AMEC 2013j; Figure 1.8-6).

5.1.5.1 Extent of Permanent Alteration to or Destruction (PAD) of Fish Habitat

The *Fisheries Act* (1985) prohibits serious harm to fish that are part of a commercial, recreational, or Aboriginal fishery, or to fish that support such a fishery. Serious harm is defined in Section 35(2) of the *Fisheries Act* (1985), as death of fish, or any permanent alteration to, or destruction of, fish habitat (PAD). Fish habitat includes areas on which fish depend directly or indirectly to carry out their life processes (spawning grounds and nursery, rearing, food supply and migration areas). The extent of permanent alteration to, or destruction of, fish habitat was determined to be the area of confirmed or presumed (based on habitat assessments and lack of barriers) fish bearing waterbodies within the footprints of TSF options. The area was calculated from the length of each stream reach determined from BC Freshwater Atlas (GeoBC 2014)1:20,000 maps and the stream width. Stream widths were the average wetted width of stream reaches determined from stream fish habitat surveys conducted between 2011 and 2013 (AMEC 2013j, 2013k) by two methods Fish Habitat Assessment Procedures (Johnston and Slaney 1996) and Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures (BC Fisheries Information Services Branch 2001).

5.1.5.2 Quality of Fish Habitat Affected by PAD

Fish habitat areas that would be removed with the construction of each TSF option were classified as Critical, Important, or Marginal based on the fish species present and definitions of fish habitat type in the BC Ministry of Forests, Lands and Natural Resource Operations (2012) *Fish-stream Crossing Guidebook*. Critical habitat is required for sustaining a fishery, and includes high-value spawning and rearing habitat. Important habitat is used by fish for feeding, growth and migration but is not deemed to be critical. Important habitats have important migration corridors, suitable spawning areas and moderate rearing potential. Marginal habitat has low productive capacity and is usually determined by the absence of suitable spawning habitat and the presence of habitat with low rearing potential.

The quality of habitats used by different life stages including spawning, rearing, migration, and overwintering was determined from assessments performed as part of Reconnaissance 1:20,000 Fish and Fish Habitat Inventories carried out between 2011 and 2013 (AMEC 2013j, 2013k). In these assessments habitat quality was ranked as none, poor, fair, or good based on the professional judgment of field crews and known salmonid life history requirements. Salmonid criteria were used because Rainbow Trout were the dominant fish species in streams of the ALSA. The evaluation criteria for rating habitat quality are presented in Table 5.1-1. Where habitat inventories were performed in several reaches the mode of all assessments was used to determine whether habitat was critical, marginal, or important.

Table 5.1-1. Criteria for Rating Habitat Quality for Salmonids in Streams

Habitat Quality Rating	Criteria
None	No habitat present for any life history stage
Poor	Most of the necessary physical/biological components of the habitat are missing or severely deficient (e.g., no pools, little stream cover, fast flow, little spawning gravel)
Fair	Some of the necessary physical/biological components of the habitat are present, but a key component is missing
Good	All of the necessary physical/biological components of the habitat are present

Source: AMEC (2013j).

Fisheries Resources

Kokanee and Rainbow Trout were the dominant species observed in fish communities downstream of TSF options and (AMEC 2013j) were given the greatest consideration in the development of Characterization Criteria Indicators.

Fisheries values related to fish that will be directly affected by the construction of TSF options were included as Characterization Criteria Indicators.

5.1.5.3 Number of Fish Species Directly Affected within the TSF Footprint

The number of fish species whose known or presumed distribution areas within the footprints of the TSF options was used as a criterion for characterizing the TSF options. The number of fish species directly affected by each TSF option was determined by examining results from spawning surveys and summer stream and lake inventories performed in the ALSA between 2011 and 2013 (AMEC 2013j, 2013k).

5.1.5.4 Presence of Rare and Endangered Fish Species

Fish species of conservation concern within and downstream of the TSF alternatives were identified by determining the conservation status of each species captured in any fisheries survey performed in the ARSA and ALSA in 2011, 2012 and 2013 (AMEC 2013j, 2013k). The conservation status of each species was determined by obtaining species-specific information from the BC CDC on-line database (2013).

5.1.6 Downstream Fisheries Values

Fisheries values related to fish that occur downstream of the TSF options and that may be affected by their construction, operation, and closure were also included as Characterization Criteria Indicators. These downstream fisheries values were assessed for Rainbow Trout, Kokanee, and Mountain Whitefish. The susceptibility to potential effects of fish in watersheds downstream of each TSF option was also qualified in downstream fisheries value indicators because the susceptibility to effects varies with the type and extent of potential influences upstream. Major effects may occur where a large portion of the upstream watershed lies within a TSF footprint, and stream flow alterations or potential contamination from tailings containment failure would be extensive. In these cases fish in the downstream watershed were considered predominantly susceptible to effects. Minor effects may occur where a smaller portion of the upstream watershed lies within the TSF footprint area, or where effects would mainly be caused by failure to contain groundwater seepage. In these cases fish in the downstream watershed were considered potentially susceptible to effects.

5.1.6.1 Downstream Rainbow Trout Values

Downstream Rainbow Trout Values were determined by describing the distribution of Rainbow Trout in areas downstream of the TSF options, the quality of Rainbow Trout habitat in these areas, and the density of rearing fish. The Downstream Rainbow Trout Values indicator also qualified Kokanee in each watershed based on their susceptibility to potential effects.

The distribution of Rainbow Trout was determined based on where Rainbow Trout were present or presumed to be present during spring spawning surveys, summer stream inventories and stream habitat assessments, and winter dissolved oxygen measurements (AMEC 2013j, 2013k). As in the "Loss of Fish Habitat" Indicator, the quality of habitat for different life stages of Rainbow Trout including spawning, rearing, migration, and overwintering was determined from assessments performed as part of Reconnaissance 1:20,000 Fish and Fish Habitat Inventories carried out between 2011 and 2013 (AMEC 2013j, 2013k). Where habitat inventories were performed in several reaches, the mode of all assessments was used to define whether there was no habitat, or habitat was poor, fair or good.

The density of rearing fish was determined from the mean electrofishing density from sites surveyed in summer stream inventories performed in August and September of 2011, 2012, and 2013 (AMEC 2013j, 2013k). The density of Rainbow Trout was calculated as the total number fish caught per unit of area surveyed (m^2). The density of Rainbow Trout was considered equivalent to the density of rearing Rainbow Trout because, with few exceptions, Rainbow Trout sampled in summer stream inventories were juveniles between the ages of 0 and 3 and were less than 100 mm in length (AMEC 2013j, 2013k).

5.1.6.2 Downstream Kokanee

Kokanee are typically a lake-dwelling species but they enter streams to spawn. Downstream Kokanee values were determined by describing the distribution and quality of Kokanee spawning habitat in streams below the TSF options, the distribution of Kokanee rearing and overwintering habitat in lakes downstream of the TSF options, and the linear density of spawning fish. The Downstream Kokanee Values indicator also qualified Kokanee in each watershed based on their susceptibility to potential effects from the TSF options.

Kokanee spawning surveys were performed in Davidson Creek and Creek 661 in fall of 2011, 2012 and 2013 and in Chedakuz Creek in fall of 2012 and 2013 (AMEC 2013j, 2013k). The distribution of Kokanee spawning habitat in these streams was defined as the area between residence lakes and the furthest upstream distance where spawning Kokanee were observed during fall spawning surveys. The quality of spawning habitat was determined from fish habitat assessment procedures data where the quality and quantity of spawning gravels was described (AMEC 2013j, 2013k). The linear density of Kokanee spawners in the surveyed areas was determined from the total number of fish observed over the total linear distance of the spawning survey.

5.1.6.3 Downstream Mountain Whitefish Values

Downstream Mountain Whitefish Values were determined by describing the Mountain Whitefish spawning areas that were identified in surveys performed in 2012 and the density of fish captured in these surveys (AMEC 2013j). Hydroacoustic surveys conducted during summer 2013 in Tatelkuz Lake indicate Mountain Whitefish account for 3% of fish in the Lake with Kokanee and Rainbow Trout the dominant species (93%). The downstream Mountain Whitefish Values indicator also qualified Mountain Whitefish in each watershed based on their susceptibility to potential effects.

5.1.7 Wildlife Habitat

Habitat suitability modeling provides valuable information on the availability of high-quality habitat for important wildlife species at various life stages and seasons within an area. Important wildlife species were identified as species of conservation concern, species of regional importance, and keystone species (Aboriginal cultural and traditional use). Key life stages and seasons include feeding winter, summer, spring, and security thermal – growing/living, and/or hibernating) and the habitat suitability models were based on Terrestrial Ecosystem Mapping (TEM).

The disposal of tailings and PAG material removes any high quality wildlife habitat within a TSF footprint, and indirectly affects any adjacent high quality habitat through effects such as noise, fugitive dust, and habitat isolation. No wildlife habitat suitability modeling was performed exclusively for this assessment; the assessment made use of modeling performed for the Project's environmental assessment (New Gold 2015). All of the TSF options considered here are within the Project's habitat suitability modeling areas, and data available are sufficient to compare the effects of the TSF options on high quality wildlife habitat.

The potential effect on wildlife habitat for the five TSF options was assessed by calculating the amount high-quality habitat impacted for each option. Habitat suitability modeling was conducted for several wildlife species that use the area during various life stages and seasons. Habitat modeling was conducted for grizzly bear (feeding spring, feeding summer, feeding fall, security/thermal – growing, and hibernating); caribou (feeding winter, feeding spring, feeding summer, security/thermal – winter, and security/thermal – growing); moose (feeding winter, feeding growing, security/thermal – winter, security/thermal – growing); American marten (living – winter and living – growing); myotis spp. (high-quality habitat); western toad (high-quality habitat), terrestrial (forest and grassland) birds (high-quality habitat for olive-sided flycatcher); aquatic birds (yellow rail and ring-necked duck) and raptors (high-quality habitat – red-tailed hawk). These models are applicable to other wildlife species: wolverine (grizzly bear model), grey wolf (moose model), furbearers (American marten model), rusty blackbird (western toad model), common nighthawk (terrestrial birds model), short-eared owl (terrestrial birds model), long-billed curlew (terrestrial birds model), and beaver (western toad and aquatic bird models).

To assess the potential effect on high-quality habitat impacted by the five tailings options the direct and indirect losses were summed. Direct loss included the high-quality habitat intersected with each tailings option area. Indirect loss included the high-quality habitat within 100m buffer of each tailings option to account for loss of habitat due to sensory disturbance (noise/light). Total high-quality habitat loss was calculated for each species and for each life stage and season. In addition, total high-quality habitat loss was summed for each species, taking all life stages and seasons into account; as there is inevitable overlap between the high-quality habitat for various life stages and seasons, the overall loss was not a direct summation, but included only unique values.

Although waterbirds are an important group for assessing potential effects of all TSF options, the results from the habitat suitability modeling calculated less than 1% high-quality habitat loss for waterbirds (represented by yellow rail and ringed-necked duck habitat suitability modelling) for all options. In addition, no observations of the red-listed yellow rail or ring-necked duck were recorded at any option. Other waterbirds (one or more of the following: greater yellowlegs, common loon,

Wilson's snipe, Barrow's goldeneye, and/or common merganser) were observed and recorded at all options. Therefore for this assessment, inclusion of waterbirds would have no impact on the final TSF assessment weightings or any sensitivity analyses and are not discussed further in the assessments.

For wildlife species of conservation concern where habitat suitability modeling was not available, comparisons of wildlife observations were derived from data collected during the Project's baseline studies (AMEC 2013p). Species identified as being of conservation concern in the Section 79(1) notification under the *Species at Risk Act* (2002d), although the status listings of these species were cross-checked against the BC CDC on-line database (BC CDC 2013). All of the TSF options are within the Terrestrial Ecology LSA (Figure 1.8-5), and data collected for the Project's baseline studies are sufficient to compare the effects of the TSF options on observed wildlife species.

5.1.8 Vegetation, Ecosystems and Wetlands

The construction, operation, and closure of TSF options may affect vegetation and ecosystems, including wetlands, through direct loss from the TSF footprint. All of the TSF options considered here are within the Project's mine site VLSA and VRSA (Figure 1.8-4), and data collected for the Project's baseline studies are sufficient to compare the effects of the TSF options on vegetation and ecosystems (AMEC 2013o, 2013b).

To estimate the ecosystem areas that would be removed within each TSF option's footprint, the TEM shapefiles were clipped to the boundaries of the TSF, and proportional areas of each ecosystem were calculated based on the decile provided within the TEM data.

The presence of any species or ecosystems of concern in the baseline sampling program were used as criteria for the characterization of the TSF options. Species of special concern, due to their conservation status within the TSF footprints, were identified by screening the baseline information on the invertebrate communities with the BC CDC on-line database (BC CDC 2013). The identified species and ecosystems reported in the *Blackwater Gold Project: 2013 Vegetation Baseline Repor*t (AMEC 2013b) and *Blackwater Gold Project: Wetlands 2011 – 2012 Baseline Report* (AMEC 2013o) were cross-referenced with the plant species and ecosystems with special conservation status occurring in the Vanderhoof Forest District. The BC CDC on-line database contains the current species listings under the *Species at Risk Act* (2002d), and for COSEWIC.

5.1.9 Terrain and Soils

Soils have been mapped for the TSF option area as part of the overall project soils resource baseline mapping (AMEC 2013n). Soils within the option area are presented in Figure 5.1-1. These soil map units 'SMUs' are described in the soil baseline report (AMEC 2013n). The soil units are based on terrain map polygons and other land features (primarily slope gradient, drainage). A range of SMU types are defined within the area of various TSF options. The soil mapping is at a reconnaissance scale and has been supplemented with TEM site series mapping to better define land characteristics (primarily drainage differences), which influence soil productivity, within the mapped soil polygon.

The primary impact associated with the loss of soil is interpreted as the loss of potential land/soil productivity as related to forest site productivity. The majority of the TEM polygons occur within

defined soil polygons. Site productivity relationships with TEM site series have been developed by the Province and can be found in Site Index estimates by Site Series (SIBEC) correlation tables. As noted in Figure 5.1-1, each TEM polygon, within individual soil polygons is rated in terms of its relative productivity, using a four class system, developed for the Project (Table 5.1-2). Individual site series within each TEM polygon are rated, and pro-rated for extent, by polygon decile attributes.

Table 5.1-2. Soil Productivity Ratings (Site Index Values)

Soil Productivity Class[1]	Site Index (m)[2]
1 – High	14.8 to 19.9
2 - Moderate	11.1 to 14.8
3 – Low	>0 to 11.1
0 – None	0

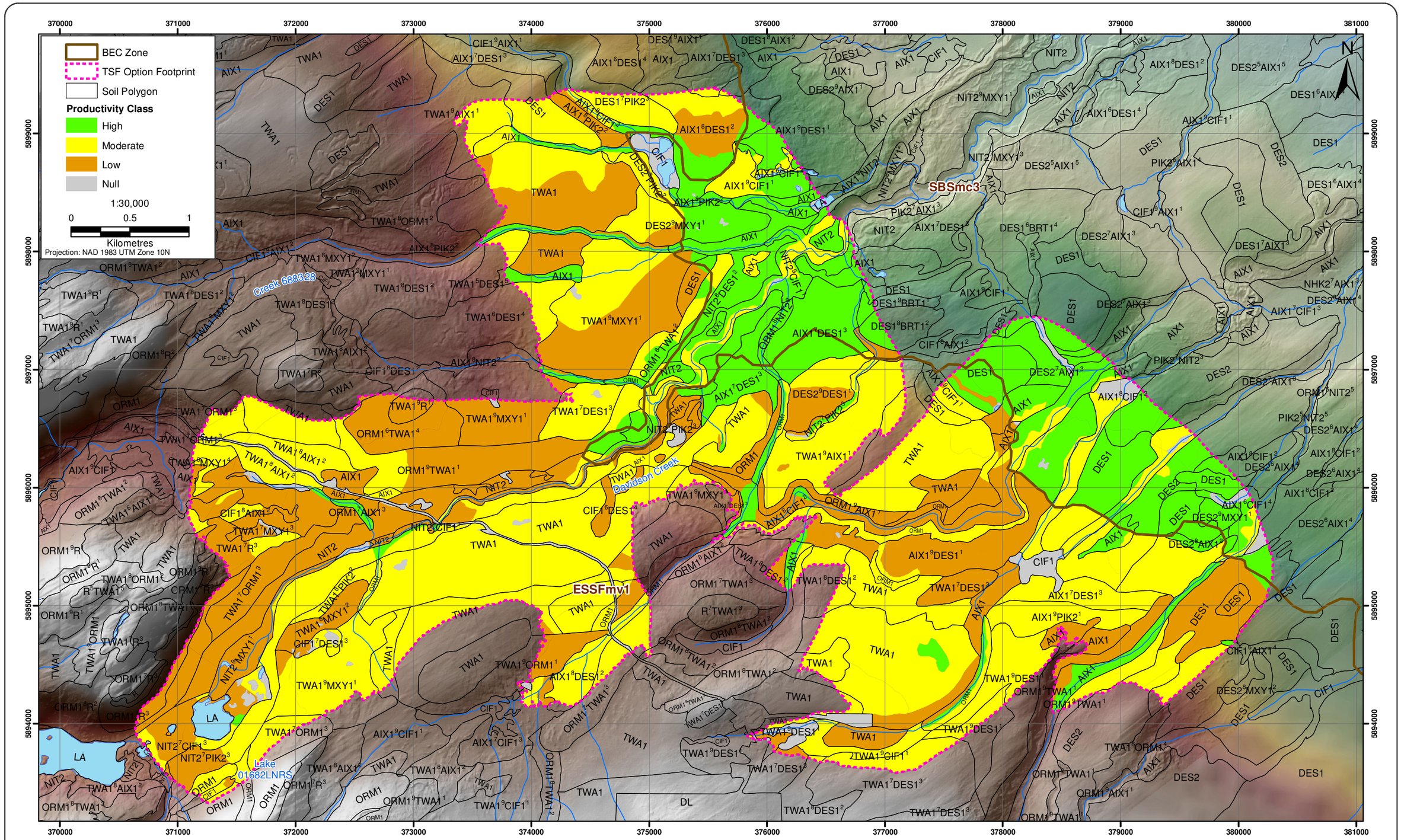
Note:
[1] Site Index rating classes are averages for the original TEM polygon.
[2] Site Index values are an estimate of site productivity for tree growth (mean tree height in metres at breast height age of 50 years).

The relationship between soil type (SMU) and site productivity is estimated by summarizing the range of site productivity data from individual soil polygons (GIS queries of Figure 5.1-1). The soil climate is indicated by the BEC boundary line, as noted in Figure 5.1-1. The cooler, ESSF zone is of lower productivity than the SBS zone as indicated by the ratings shift along this approximate boundary.

A summary of the extent of the SMUs included within the Entire TSF Option Areas footprint and their associated soil productivity ranges are provided in Table 5.1-3.

Table 5.1-3. Extent (ha) of Soil Type (SMU) and Range of Productivity within the Entire TSF Option Areas

SMU	Extent (ha) per Map Polygon Type		Subtotal	Extent (%)	Typical Soil Productivity Range
	Simple	Complex			
AIX1	206.1	463.4	669.5	23.5%	High-Moderate
CIF1	40.7	21.8	62.5	2.2%	Null
DES	282.6	124.4	407.0	14.3%	High-Moderate
DL	13.7		13.7	0.5%	Null
LA	11.7		11.7	0.4%	Null
NIT2	77.8	223.7	301.5	10.6%	Low
ORM1	77.5	213.8	291.3	10.2%	Low-Moderate
PIK		4.8	4.8	0.2%	Moderate
TWA	562.3	523.1	1,085.4	38.1%	Moderate-Low
Total	**1,272.4**	**1,574.9**	**2,847.3**	**100.0%**	



newgold

Rescan an ERM company

Figure 5.1-1

Soil Map Unit and Productivity Class Distribution within the Entire TSF Option Area Footprint

The summary of productivity classes, both in terms of hectares (ha) and percent of the site area, within the entire TSF Option Area footprint and each, individual TSF Option area is provided in Table 5.1-4.

Table 5.1-4. Summary of Estimated Soil/Site Productivity Class Extent (ha) and Percentages (%) within the Entire TSF Option Area and Individual TSF Option Areas

Site Options	Total Extent (ha)	Soil (Site) Productivity Class Extent (ha)			
		Class 1 - High	Class 2 - Moderate	Class 3 - Low	Class 0 - Nil
Entire Option Areas	2,847	559	1,337	866	85
TSF Option C	933	13	488	397	36
TSF Option D	1,111	308	457	323	23
TSF Option D / PAG_OL	1,176	290	527	322	37
TSF Option E	792	243	317	209	23
TSF Option FS	1,116	307	461	325	24

Soil productivity loss has been estimated using SiBEC attribution of TEM polygons, within soil polygons potentially impacted by each TSF option area. Impacts are both by absolute extent of loss (ha) and average productivity of the soil lost (Site Index 'm'). Table 5.1-5 provides a summary of both extent and average productivity across each of the five individual TSF option areas.

Table 5.1-5. Summary of Extent of Estimated Soil Productivity Class within Each TSF Option Area

TSF Option:	TSF Option C	TSF Option D	TSF Option D/ PAG OL	TSF Option E	TSF Option FS
Gross (ha-m)	10,071.6	13,554.7	14,165.7	10,048.6	13,593.6
Extent (ha)	933.3	1,110.5	1,175.6	791.6	1,116.1
Average 'M'	10.8	12.2	12.0	12.7	12.2
Soil Productivity code number	3	2	2	2	2
Soil Productivity	Low	Moderate	Moderate	Moderate	Moderate

5.1.10 Socio-Economic

Relative to commercial and recreational land use, data was drawn from a range of publicly available sources. This included use of the BC Government's Data BC and a review of existing reports and publications for the Project. Land use data presented in this report (i.e., forestry tenures, range tenures, recreational sensitivity, mineral claims, parks and protected areas) have been adjusted to reflect characteristics of the study area (AMEC 2013m).

5.1.10.1 Current Use of Lands and Resources for Traditional Purposes

Descriptions of the current use of lands and resources for traditional purposes were derived from information presented and reports referenced in Section 1.10. Potential effects to current use were only assessed for the Aboriginal groups whose asserted traditional territories overlap the TSF option footprints (i.e., LDN, UFN, and STN).

5.1.10.2 Heritage

The construction, operation, and closure of TSF options may affect archaeological sites, through direct loss from the TSF footprint. All of the TSF options considered here are within study areas for the Project's heritage and archaeological assessments, and data collected for the Project's baseline studies is sufficient to compare the effects of the TSF options on heritage resources (AMEC 2013d).

5.1.11 Technical

Technical descriptions for Options C, D, E, and D/PAG OL TSFs were derived from the *TSF Multiple Accounts Analysis – Design Alternatives Information* (Knight Pièsold 2014) report (attached as Appendix C). The technical description of the TSF Option FS was derived from the report entitled *Blackwater Gold Project, British Columbia - NI 43-101 Technical Report on Feasibility Study* (New Gold 2014).

5.1.12 Economic

Project economics data relating to the construction, operations and closure costs of each TSF alternative were derived as a result of a workshop, held February 07, 2014, where Project technical representatives discussed the primary factors driving the relative costs of each TSF. TSF option costs are provided as a qualitative comparison for initial capital costs, sustaining capital and operating costs, and closure costs. The primary factors behind this comparison are the volumes of construction and fill materials required, the number of locations that material for containment dams will be hauled to, the potential for long-term seepage pump back, and the potential for long-term active water management.

Fish habitat compensation costs were estimated from the proposed fish habitat compensation costs for the Option FS TSF. Costs for the remaining TSF alternatives were estimated by linearly scaling the Alt FS cost by the relative proportion of PAD in each TSF alternative. For the feasibility study, the fish habitat compensation costs were estimated to be approximately $4M for the fish habitat affected by the TSF footprint.

5.2 DETAILED DESCRIPTION OF TSF ALTERNATIVES

5.2.1 Option C

The Option C TSF is located on the north slope of Mount Davidson within the upper portion of the Davidson Creek watershed, approximately four km northwest of the Blackwater deposit (Figure 4.1-4). The TSF site is situated at the top of the Davidson Creek catchment and extends to the catchment divide with Creek 705 to the west. The impoundment would be created by constructing a

main dam across Davidson Creek on the east side and two saddle dams to the west at the top of the Creek 705 catchment. The impoundment is constrained by topography to the north and south, and between the two drainages that flow west and contribute to Creek 705.

5.2.1.1 Technical Summary of Option C

A general technical summary of the construction, operation and closure approaches of Option C is provided in Table 4.1-1. The proposed layout of the Option C TSF is provided in Figure 4.1-4. Further technical detail is provided here, and comparative data are summarized in Table 5.3-1 in Section 5.3.

TSF Option C involves storing tailings in a TSF located approximately four km northwest of the deposit, as measured from the centre of the open pit to the centre of the TSF. The ultimate Option C TSF footprint area is approximately 8.5 km^2.

The TSF starter embankments would be constructed with local borrow material initially and then from the pre-stripping of the open pit. The two starter dams required initially for the main and south saddle embankments would be 95 m and 5 m high, respectively.

The TSF embankments would be progressively expanded using NAG waste materials from the open pit, and processed filter and transition zone material from local borrow areas. The TSF ultimately includes three embankments – the main, south saddle and north saddle. The ultimate embankments would be 176 m, 86 m, and 61 m high, respectively, and require approximately 49 Mm^3 of material to construct. The embankments would all be zoned earthfill and rockfill dams, expanded over the life of the project using the centreline method of construction. The embankments would have crest widths of 50 m and downstream slopes of 2H:1V. The ultimate volumetric storage efficiency of the TSF Option C is considered to be good.

Foundation conditions at the embankment locations are characterized by a thick sequence of overburden underlain by competent bedrock. The surficial material has been classified as channelized and non-channelized glaciofluvial deposits. All of the embankments require cut-off trenches in excess of 10 m depth to limit potential seepage. The cut-off trench for the main embankment may need to intercept interglacial fluvial lenses in the foundation of the embankment. Additionally, an Environmental Control Dam (ECD) would be located downstream in Davidson Creek at a location approximately one km upstream of the FS location. The ECD location was selected to intercept possible seepage paths from the TSF embankment foundation.

The cut-off trench for the south saddle embankment is relatively complicated due to a thickening sequence of overburden at the embankment site. Limited geotechnical information is available in the exact location of this embankment, but the low-permeability subgrade (LPS) material appears to be less prevalent in this area. The south saddle embankment may require additional seepage monitoring and collection measures to be implemented downstream, likely in the form of groundwater monitoring and interception pumping wells.

Seepage would be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the embankment would be collected in embankment drains and conveyed to seepage collection ponds downstream of each embankment.

Seepage would be recycled back to the TSF. Unrecoverable seepage passing the collection and recycle systems could potentially affect two watersheds, Davidson Creek and Creek 705.

PAG waste will be co-disposed within the TSF in such a manner that it is progressively encapsulated by the tailings and saturated by the supernatant pond to prevent oxidation and subsequent acid generation. PAG haul distances would be in the order of six km downhill haulage. NAG waste rock and overburden in excess of the material required for dam construction is estimated to be 63 Mm^3 and stored in a waste dump approximately one km to the east of the open pit.

The catchment area for Option C without modification is 26 km^2. An additional 6 km^2 could be added to the catchment area by constructing approximately 3 km of collection ditches; however the total area reporting to the TSF would still fall well below of the 50 km^2 that is required to maintain a water balance under average conditions in the early years of mine waste disposal. Additional make-up water to supplement the process would be required from a dam lower down in the Davidson Creek catchment at the ECD or from external surface water sources. A collection system located at the ECD would allow for collection of runoff of up to an additional 9 km^2 for a total contributing area of 41 km^2, which still falls short of 50 km^2; thus, another supplementary water source will be required.

Tailings discharge during operations would initially be by gravity, but requires pumping later in mine life when the TSF elevation approaches the elevation of the plant site. A tailings spill collection system is required for the 500 m section of tailings pipeline outside the TSF catchment. Selective discharge of tailings around the facility during the final years of operations would establish and flatten final tailings beaches to facilitate surface water management and reclamation.

Upon mine closure, surface facilities would be removed in stages and full reclamation of the TSF would be initiated. An overburden cover of at least 0.3 m would be established over the PAG waste rock and tailings. Wetlands would be established and upland beaches would be vegetated. The tailings supernatant pond would be maintained at its final level while pumping excess inflows to the open pit to accelerate filling of the pit lake. A riprap lined closure spillway sized for the Probable Maximum Flood (PMF) would be established towards Davidson Creek with an additional emergency spillway for each of the saddle embankments. All roads, ponds, and ditches not required beyond mine closure would be removed and regraded.

5.2.1.2 Environmental Summary of Option C

A general summary of the environmental setting of Option C is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-2 in Section 5.3.

<u>Surface Water Hydrology</u>

The Option C TSF is located in the headwaters of Davidson Creek in the Davidson Creek Watershed. The Option includes three dams, one upstream of Lake 01682LNRS and another upstream of creek 667871, both on the boundary of the Davidson Creek and Creek 705 watersheds, and the main dam just upstream of the confluence of Davidson Creek with Creek 776798. An ECD is located upstream of the confluence of Creek 636713 with Davidson Creek. Other tributaries to Davidson Creek covered by the TSF footprint include Creek 899664 and Creek 896157.

The reach of Davidson Creek covered by the footprint of the TSF has a stream shape that wanders irregularly. Davidson Creek headwater streams contain reaches with riffle-pool morphologies and cobble and gravel substrates (AMEC 2013j).

The potential changes to surface water hydrology are considered for Davidson Creek and are summarized in Table 5.2-1. The potential impact to timing and distribution of flows are measured on a qualitative scale from negligible to extreme.

Table 5.2-1. Potential Changes to Surface Water Hydrology for Option C TSF

	Davidson Creek
Potential runoff loss to toe of TSF using watershed area	27.3%
Potential impacts to timing and distribution of flows	high

Surface Water Quality

The near-field or immediate receiving environment for discharge to the north from the proposed tailings impoundment is Davidson Creek, and discharge to the east from the proposed tailings impoundment is Creek 705 Three monitoring stations, WQ1, WQ15, and WQ16, were used for water quality analysis in the immediate receiving environment (AMEC 2013h; Figure 1.8-3). Data used in this analysis were collected at WQ1 from March 2011 to December 2012, and at WQ15 and WQ16 from June 2012 to December 2012. Mean annual water quality data from study sites on Creek 705 have no exceedances of BC 30-day mean guidelines. Mean annual water quality data from study sites on Davidson Creek have exceedances of BC 30-day mean guidelines for total cadmium and dissolved aluminum. The mean annual concentrations for the assessed parameters in the receiving environment for Option C are: sulphate 1.20 mg/L, cadmium 0.00001 mg/L, and zinc 0.003 mg/L. Based on existing baseline conditions Option C has the highest potential for water quality effects due to good baseline water quality (i.e., few natural exceedances of BC WQG) and the potential to impact two watersheds.

The expected volume of NAG material required to construct the embankments for Option C is 49 Mm^3.

Groundwater Quantity and Quality

The groundwater quality baseline study at the site shows that typical groundwater quality with no anomalies regarding potential groundwater pollution.

The layout for Option C shows the TSF on or close to the watershed divides to the west and southeast of the Project. This may potentially cause impacts to groundwater quantity and quality in several watersheds (Davidson Creek, Creek 705, and Creek 661) as the mounding water in the tailing cell may alter the watershed divides. The potential impacts to groundwater flow may be predominantly within the Davidson Creek watershed and to a minor extent in other watersheds such as Creek 661, here mostly due to pit dewatering.

Option C avoids the potential impacts of a separate on land PAG stockpile. However, in this option the TSF is located in the groundwater recharge zones at the headwaters and may pose seepage management challenges from migration of seepage through shallow and deep groundwater into the

receiving environment due to potentially less hydraulic containment. Seepage management challenges are potentially high; however from a water quality perspective the seepage travel times will probably be high. From laboratory studies on subsurface materials it has been found that the seepage will migrate through the subsurface with high absorptive and dispersive characteristics.

Aquatic Habitat

The BC blue-listed (BC CDC 2013) freshwater mollusc *Acroloxus coloradensis* was observed in the headwater 01682LNRS Lake, which will be removed by the construction of the Option C TSF. *Acroloxus coloradensis* is listed as a taxon of "Special Concern", which is assigned to organisms potentially sensitive or vulnerable to human activities or natural events. No aquatic species of conservation concern, including the aforementioned mollusc, were identified in the Section 79(1) notification under the *Species at Risk Act* (2002d).

Fish and Fish Habitat

The Option C TSF is located in the Upper Davidson Creek watershed. Upper Davidson Creek and its tributaries are fish bearing within the Option C TSF. Only one fish species, Rainbow Trout, is present in Upper Davidson Creek watercourses within the TSF. Two separate but overlapping Rainbow Trout populations are present in the Davidson Creek watershed, the Davidson Creek population and the Davidson Creek Headwaters population. The separate populations were identified based on the timing and location of upstream and downstream migration of spawners during spawning surveys, access to overwintering habitat, and the presence of a partial impediment to fish passage located in Reach 11 of Davidson Creek within the Option C TSF. A section of cascades are steep enough to constitute an impediment to upstream passage during summer low flows and possibly during freshet.

The majority of Rainbow Trout that use the watershed are from the Davidson Creek population. These fish overwinter in Tatelkuz Lake, Lower Davidson Creek, or Chedakuz Creek, and have unrestricted access for migration, spawning, and rearing in Davidson Creek up to the partial fish-passage impediment. The Davidson Creek Headwaters population of Rainbow Trout Rainbow Trout is mainly restricted to reaches above the partial impediment in Reach 11 and to headwater Lake 01682LNRS. Isolated pockets of suitable spawning gravels, to a cumulative amount of 9 m^2 are present in the stream reaches above the fish passage impediment, and the presence of relatively high numbers of juvenile Rainbow Trout suggest that spawning for the Headwaters population occurs just downstream of the outlet of Lake 01682LNRS. The lake provides critical overwintering habitat.

A small portion of the Option C TSF is located in the upper Creek 705 watershed. Rainbow Trout occupy the upper reaches of the stream and its tributary, Creek 606013, and overwinter in headwater lakes 0158UEUT and 01428UEUT. Reaches of Creek 705 located upstream of Lake 0158UEUT are in the Option C TSF. This includes spawning and rearing habitat that is likely utilised by Rainbow Trout.

There are no fish species of conservation concern present in the Option C TSF or in watersheds in the ALSA downstream of the Option C TSF.

Downstream Fisheries Values

Downstream of the Option C TSF, Rainbow Trout are present in Davidson Creek, its tributaries, and Lower Chedakuz Creek which are on the eastern side of the Option C TSF. The west dam of the Option C TSF is in the Creek 705 watershed and Rainbow Trout are present in Creek 705, its tributaries and headwater lakes 0158UEUT and 0142UEUT. Streams in the 661 watershed and Tatelkuz Lake and its tributaries may also be influenced by TSF construction due to groundwater seepage. Rainbow Trout distribution and habitat quality downstream of Option C are presented in Table 5.2-2.

Table 5.2-2. Rainbow Trout Values Downstream of Option C TSF

Watercourse	Susceptibility to Potential Downstream Effects	Distribution	Habitat Quality
Lower and Middle Davidson Creek	Predominantly susceptible	Chedakuz Creek confluence to Davidson Creek Reach 10	Good quality habitat for all life stages
Lower Chedakuz Creek	Predominantly susceptible	RSA boundary to confluence with Davidson Creek	Good quality habitat for all life stages
Creek 705	Predominantly susceptible	Fawnie Creek confluence to headwaters including headwater Lake 0158UEUT	Good quality rearing habitat, fair quality spawning and migration habitat, overwintering habitat confined to Lake 0158UEUT
Creek 606013	Predominantly susceptible	Creek 705 confluence to headwaters including headwater Lake 0142UEUT	Good quality rearing and migration habitat, fair quality spawning habitat, overwintering habitat confined to Lake 0142UEUT
Lower and Middle Creek 661	Potentially susceptible	Chedakuz Creek confluence to headwaters	Good quality rearing and migration habitat, fair quality spawning and overwintering habitat
Creek 661 tributaries	Potentially susceptible	All tributaries**	Good quality rearing and migration habitat, fair quality spawning and overwintering habitat
Middle Chedakuz Creek	Potentially susceptible	Tatelkuz Lake to confluence with Creek 661	N/A
Tatelkuz Lake	Potentially susceptible	Adult and overwintering fish from the Davidson Creek, Chedakuz Creek and Creek 661 populations	Critical overwintering habitat
Tatelkuz Lake tributaries	Potentially susceptible	Creek 579340 to headwaters including Snake Lake**, other unnamed tributaries**	Fair quality rearing habitat, poor quality migration habitat and no spawning or overwintering habitat.

N/A: Not sampled

** Mean electrofishing density from 2011 and 2012 surveys.*

*** Rainbow Troutare presumed to be present but were not captured in all tributaries in 2011 and 2012 summer inventory surveys.*

Downstream Kokanee Values

Kokanee are typically a lake-dwelling species; however, they spawn in streams. Davidson Creek and Lower Chedakuz Creek, located downstream of the Option C TSF, contain spawning habitat for Kokanee from Tatelkuz Lake. Creek 661 and Tatelkuz Lake also contain Kokanee habitat and are susceptible to impacts from the TSF by groundwater seepage. The distance between the toe of tailings containment dams associated with the Option C TSF and the first occurrence of downstream spawning Kokanee is 15.8 km in Davidson Creek.

The distribution and quality of Kokanee spawning habitat in areas downstream of the Option C TSF are presented in Table 5.2-3.

Table 5.2-3. Kokanee Values Downstream of Option C TSF

Watercourse	Susceptibility to Potential Downstream Effects	Spawning Habitat Distribution and Quality	Critical Rearing and Overwintering Habitat Distribution
Lower Davidson Creek	Predominantly susceptible	Chedakuz Creek confluence to Davidson Creek Reach 4 (5.2 km), high quality spawning habitat in Reaches 1 to 5	None*
Lower Chedakuz Creek	Predominantly susceptible	RSA boundary to confluence with Davidson Creek, high quality spawning habitat	None*
Lower Creek 661	Potentially susceptible	Chedakuz Creek confluence to Creek 661 Reach 3 (7.1 km), high quality spawning habitat in Reaches 1 to 4	Tatelkuz Lake
Middle Chedakuz Creek	Potentially susceptible	Tatelkuz Lake to confluence with Creek 661, high quality spawning habitat	Tatelkuz Lake

** Rearing and overwintering habitat is in Tatelkuz Lake, located upstream of Chedakuz Creek confluence with Davidson Creek.*

Downstream Mountain Whitefish Values

Fall spawning surveys downstream of the Option C TSF captured a total of 22 Mountain Whitefish. Eight Mountain Whitefish were captured in Lower Davidson Creek and the remaining 14 were captured in the downstream portion of Creek 705. The low numbers of fish caught indicate that the number of Mountain Whitefish using streams that may be affected by construction of the Option C TSF is very low compared to Rainbow Trout and Kokanee.

Potential Impacts on Fish and Fish Habitat

The construction of the Option C TSF would result in the permanent alteration to, or destruction (PAD) of, fish habitat in an area of approximately 12.2 ha.

The construction of Option C would result in the loss of all critical habitat (upper reaches of Davidson Creek and headwater Lake 01682LNRS) occupied by the Davidson Creek Headwaters population of Rainbow Trout and would likely eliminate the Davidson Creek Headwaters population. It would also result in the loss of areas in Davidson Creek that provide rearing habitat for the Davidson Creek Rainbow Trout population. Finally, portions of several reaches of Creek 705 upstream of Lake 0158UEUT that contain rearing habitat for Rainbow Trout would be lost.

Rainbow Trout in the Davidson Creek watershed and Kokanee spawning in Lower Davidson Creek and Lower Chedakuz Creek downstream could be affected by reductions in stream flow downstream of the Option C TSF. Rainbow Trout populations in the upper Creek 705 watershed and Rainbow Trout and spawning Kokanee in Davidson Creek could also be affected in the event of seepage or discharge of contaminated tailings water into Creek 705 and/or Davidson Creek. Finally, Rainbow Trout and spawning Kokanee in Creek 661 and its tributaries and in Tatelkuz Lake and its tributaries are potentially susceptible to effects from contaminated groundwater seepage into the Creek 661 watershed.

Terrestrial Wildlife

The mine site TELSA is characterized by mountainous topography with steep relief descending into Davidson Creek dominated by subalpine fir, Engelmann spruce, and lodgepole pine. The wildlife habitat is characterized by a mosaic of high elevation forest, wetlands, riparian, and mature forests with minor amounts of forestry impact.

Five species of conservation concern were recorded in Option C during baseline studies (see Table 1.8-3 for status designations; AMEC 2013p): western toad, grizzly bear, common nighthawk, olive-sided flycatcher, and northern goshawk. Four species listed under the *Species at Risk Act* (2002d) were recorded; two as special concern: western toad and grizzly bear, and two as threatened: common nighthawk and olive-sided flycatcher. The two threatened bird species were only recorded at Option C during baseline surveys (AMEC 2013p). Option C had the only grizzly bear observations made during baseline surveys (sighting plus two recorded dens; AMEC 2013p).

Habitat suitability modeling exercises identified high-quality habitat that would be directly removed by the TSF or indirectly affected (i.e., within a 100 m buffer of the TSF) by the TSF for the following species: grizzly bear, caribou, moose, American marten, myotis spp. western toad, olive-sided flycatcher, and red-tailed hawk. The areas affected for each species are provided in detail in Tables 5.2-4 through 5.2-8).

Table 5.2-4. Wildlife Implications of Option C TSF

Species	Total Direct and Indirect Loss of High-Quality Habitat[1]
Grizzly bear	390 ha (35.5% of the TSF footprint area)
Caribou	504.3 ha (46% of the TSF footprint area)
Moose	87.2 ha (8% of the TSF footprint area)
American Marten	80.9 ha (7.3% of the TSF footprint area)
Myotis spp.	933.8 ha (85.1% of the TSF footprint area)
Western toad	17.2 ha (1.6% of the TSF footprint area)
Terrestrial Birds (Olive-sided flycatcher)	910.3 ha (83% of the TSF footprint area)
Raptors (Red-tailed hawk)	799.3 ha (72.9% of the TSF footprint area)

[1] *Total loss of high-quality habitat represents the cumulative total amount of the various habitat requirements (e.g., grizzly bear = feeding spring, feeding summer, feeding fall, security thermal and hibernating; Table 5.2-5).*

Table 5.2-5. Amounts of High Value Habitat from Habitat Suitability Mapping for Grizzly Bear Affected by the Option C TSF, with and without 100 m Buffer

	Total Area (ha)	Grizzly Bear				
		Feeding Spring (ha)	Feeding Summer (ha)	Feeding Fall (ha)	Security/Thermal - Growing (ha)	Hibernating (ha)
TSF footprint only	933	0	0	153.3	111.7	340.7
TSF footprint plus 100 m buffer	1,097	0	0	164.8	123.2	390

Table 5.2-6. Amounts of High Value Habitat from Habitat Suitability Mapping for Caribou Affected by the Option C TSF, with and without 100 m Buffer

	Total Area (ha)	Caribou				
		Feeding Winter (ha)	Feeding Spring (ha)	Feeding Summer(ha)	Security/Thermal - Winter (ha)	Security/Thermal - Growing (ha)
TSF footprint only	933	318.8	318.8	275.5	273.3	273.3
TSF footprint plus 100 m buffer	1.097	381	381	334.7	320.1	320.1

Table 5.2-7. Amounts of High Value Habitat from Habitat Suitability Mapping for Moose Affected by the Option C TSF, with and without 100 m Buffer

	Total Area (ha)	Moose			
		Feeding Winter (ha)	Feeding Growing (ha)	Security/Thermal - Winter (ha)	Security/Thermal - Growing (ha)
TSF footprint only	933	11.8	37.4	2.4	72.8
TSF footprint plus 100 m buffer	1.097	12.8	50	2.7	77.1

Table 5.2-8. Amounts of High Value Habitat from Habitat Suitability Mapping for Marten, Myotis, Western Toad, Birds, and Raptors Affected by the Option C TSF, with and without 100 m Buffer

	Total Area (ha)	Marten		Myotis	Western Toad	Terrestrial Birds	Raptors
		Living Winter (ha)	Living Growing (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)
TSF footprint only	933	75.2	75.2	789.5	12.9	770.3	668.8
TSF footprint plus 100 m buffer	1,097	80.9	80.9	933.8	17.2	910.3	799.3

Vegetation, Ecosystems, and Wetlands

The Option C TSF would cause the direct removal of 37 ha of mature forest, 80 ha of riparian areas, and 7 ha of ecosystems at risk (all blue-listed wetlands). Additionally, baseline studies identified the BC blue-listed moss species *Tomentypnum falcifolium* at one location. No whitebark pine were

identified within the Option C TSF footprint, nor were any sparsely vegetated ecosystems identified during field surveys or TEM mapping.

The total wetland area that will be removed by the Option C TSF, including the previously mentioned blue-listed wetlands, will be 146 ha. Options that affect listed wetlands and are reviewed by Environment Canada will require a conservation plan to meet the federal policy on wetland conservation.

Air Quality

During construction and operation, the effect of Option C on air quality would be related to diesel-fuelled heavy equipment and fugitive dust from blasting associated with building the dams and TSF supporting infrastructure (i.e., roads, plant site, and water diversions infrastructure), and from tailings beaches and embankments. The volume of diesel emissions and amount of fugitive dust for the dams during the construction phase would be related to the haul distances and the volume of local material required for the starter dams and the core. The mean annual wind speed in the area is approximately 2.4 m/s (8.6 km/h) with the wind predominantly from the southwest. The emissions for the supporting infrastructure would directly relate to the length of the supporting infrastructure and the site-specific terrain challenges of building the infrastructure. During operations and closure, exposed areas of tailing and waste rock may be subjected to wind erosion, causing wind-blown fugitive dust. Reclamation and capping of the tailing and waste rock would minimize the potential for fugitive dust.

Option C TSF footprint area is approximately 8.5 km^2. The TSF would be large enough to eliminate on land waste rock stockpile and therefore reducing fugitive dust associated with wind erosion. If tailings beach is dry, fugitive dust emissions may be emitted. Since Option C is located west of the construction and operation camp, wind from the southwest may disperse dust emissions toward the camp; however, the camp is relatively far away from the tailings pond, which may indicate the effect from these sources may be limited. The TSF is approximately 4 km away from the deposit. Fugitive road dust and vehicle exhaust will be emitted when haul trucks travel from the open pit to the TSF. However, air quality models predict that fugitive dust from the TSF will not result in residual effects for the Project for TSF Option FS. As TSF Option C utilizes the same general construction, operations, and closure approaches to TSF Option FS, fugitive dust emissions from Option C are expected to be minimal.

5.2.1.3 Socio-Economic Summary of Option C

A general summary of the socio-economic setting of Option C is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-3 in Section 5.3.

Non-Traditional Land and Resource Use

The Option C TSF overlaps with 3 known commerical land use tenures. Option C is located within 1 trapline tenure, overlapping 916 ha of TR1205330 (2.43% of tenure) and has the potential to affect trapping due to potential displacement and a reduction in available wildlife. Option C is also located within two guide outfitting tenure licences, overlapping 490 ha of Tenure 484246 (0.15% of tenure) and 443 ha of Tenure 1206416 (0.82% of tenure). Option C does not overlap with any known Forestry, Agricultural/range or commerical recreation tenures; nor does it overlap with any mineral claims not held by New Gold.

Parks and Protected Areas

In terms of recreational land uses, Option C does not overlap with any parks or protected areas however; there are areas of overlap with features of recreational sensitivity. Option C transects with the following Recreation Feature Inventory attributes:

- RFI#10716, Medium Sensitivity-Medium Significance, 394 ha (2.23%);
- RFI# 10769, Unknown Sensitivity-Unknown Significance, 398 ha (8.08%); and
- RFI# 10784 Medium Sensitivity-High Significance, 142 ha (35.78%).

Heritage

Option C TSF does not overlap with any known archaeological sites or paleontological sites. Option C TSF does, however, overalp with 13 known heritage features, all consisting of blazed trees; these heritage features are not protected by the *HCA* (1996b).

Current Use of Lands and Resources for Traditional Purposes

Option C TSF is located entirely within the Lhoosk'uz Dene Nation, Skin Tyee Nation, and Ulkatcho First Nation traditional territories. For the three Aboriginal groups whose traditional territories overlap with the TSF (Llhoosk'uz Dene Nation, Skin Tyee Nations, and Ulkatcho First Nation), Table 5.2-9 presents potential effects of Option C on current use of lands and resources for traditional purposes.

5.2.1.4 Project Economics Summary of Option C

A general summary of the Project economics setting of Option C is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-4 in Section 5.3. The total undiscounted cost (including capital, operating, and closure costs) of Option C is estimated to be $417,000,000, or $0.53/tonne. This total cost does not include fish habitat compensation costs.

Initial Capital Costs

The Option C TSF has the smallest starter dam volume required (7.5 Mm^3) among the TSF options. The option requires the construction of the downstream ECD. It is anticipated that sufficient NAG material will be available for both facilities at start-up. The initial capital costs are estimated to be $89,000,000.

Sustaining Capital and Operating Costs

The Option C TSF has moderate to high sustaining capital and operating costs. Option C TSF will require ongoing raises to three relatively large dams, with a total volume: 42 Mm^3. However, sufficient NAG material should be available. This material must be hauled to three dam locations, which will increase operating costs. Active pumping of tailings will also be required over the life-of-mine. The sustaining and operating costs are estimated to be $281,000,000.

Table 5.2-9. Potential Effects of Option C on Aboriginal Current Use of Lands and Resources for Traditional Purposes

Concern or Issue	Potential Effect to Current Use of Lands and Resources for Traditional Purposes		
	Lhoosk'uz Dene Nation	Skin Tyee Nation	Ulkatcho First Nation
Hunting	No specified use of area for hunting. Option may overlap with hunting areas.	Hunting locations identified in the Project footprint; other hunting occurs in areas around Davidson and Chedakuz creeks and Tatelkuz Lake.	UFN hunting occurs on Mount Davidson, near Tatelkuz Lake and along Chedakuz Creek.
Trapping	Option overlaps trapline tenure held by a LDN member(TR0512T027), this tenure is not currently being used; and 81 ha of high-quality American marten habitat.	No trapping locations identified in the Project footprint. Trapping locations identified areas around Davidson and Chedakuz creeks and Tatelkuz Lake. No STN registered traplines identified in the area. .	No overlap with trapline tenures held by UFN members.
Fishing	No known fishing use in the Project footprint. LDN fish at Davidson and Chedakuz creeks and Tatelkuz and Kuyakuz lakes. LDN identified the lower reaches of Davidson Creek as having important fishing value.	No fishing use identified in the Project footprint.	No known fishing use in the Project footprint. UFN fish at Chedakuz Creek and Tatelkuz Lake, and have a fish camp at Kuyakuz Lake.
Harvest of Traditional Plants	No known gathering use in the Project footprint. Option may overlap areas for the harvest of traditional plants. LDN harvest plants around Tatelkuz and Kuyakuz Lake and along the Messue Wagon Trail.	The Project footprint was not identified as a harvesting area. STN harvest near Chedakuz Creek and Tatelkuz Lake, and along the Messue Wagon Road Trail. .	Harvesting areas have not been identified in the Project footprint. Option may overlap areas for the harvest of traditional plants while using the area for other purposes (camping, trail use).
Use of Spritual/ Traditional Sites	No known use of area for cultural or traditional purposes.	One culturally significant named place is located in the Project footprint. There are important transportation routes and trails between Tatelkuz Lake and Kuyakuz Lake. Campsites and gathering areas are identified around Tatelkuz Lake, Tsacha Lake, Johnny Lake and Top Lake, Fawnie Dome and Mount Tatelkuz	Option overlap with 13 known heritage features, all consisting of blazed trees. A trail, campsite, CMTs and a place name were identified within the area of the Project footprint.

Closure Costs

The Option C TSF has moderate to high closure costs. The TSF involves the closure of three relatively high dams, and seepage must be contained in two watersheds. The high dams will create a high pressure head that increases seepage at closure, and long-term pumpback of this seepage may be required. However, long-term water treatment costs will be minimal as it is anticipated that water treatment can occur through a fully passive system (i.e., wetlands). The closure costs are estimated to be $47,000,000.

PAD Compensation Costs

The Option C TSF will create approximately 12.2 ha of PAD, which is the highest amount of PAD among the TSF options. The approximate habitat compensation costs for this PAD is $5.39M.

5.2.2 Option D

The Option D TSF alternative is located on the north slope of Mount Davidson within the upper portion of the Davidson Creek watershed, approximately 4.5 km north of the Blackwater deposit (Figure 4.1-5). The site is situated in the upper half of the Davidson Creek catchment. The impoundment will be created by constructing a main dam across Davidson Creek on the east side and a small dam on the west side to isolate the facility and limit the disturbance to a smaller area at the top end of the catchment. The impoundment is constrained by topography to the north and south.

5.2.2.1 Technical Summary of Option D

A general technical summary of the construction, operation and closure approaches of Option D is provided in Table 4.2-1. The proposed layout of the Option D TSF is provided in Figure 4.1-5. Further technical detail is provided here, and comparative data are summarized in Table 5.3-1 in Section 5.3.

Option D TSF involves storing tailings in a TSF located approximately 4.5 kilometres north of the deposit, as measured from the centre of the open pit to the centre of the TSF. The ultimate TSF would have a footprint area of approximately 10 km^2.

The TSF starter embankment would be constructed with local borrow material initially and from the pre-stripping of the open pit. One starter dam would be required initially for the main embankment and would be 70 m high.

The TSF embankment would be progressively expanded using NAG waste materials from the open pit and processed filter and transition zone material from local borrow areas. The TSF ultimately includes two embankments – the main and the west. The ultimate embankments would be 141 and 31 m high, respectively, and require approximately 58 Mm^3 of material to construct (total). The embankments would be zoned earthfill and rockfill dams, expanded over the life of the Project using the centreline method of construction. The embankments have crest widths of 50 m and downstream slopes of 2H:1V. The ultimate volumetric storage efficiency of the Option D TSF is considered to be good.

Foundation conditions at the embankment locations are characterized by a thick sequence of overburden underlain by a completely weathered bedrock layer, and then competent bedrock.

The surficial material has been classified as channelized and non-channelized glaciofluvial deposits, and lodgement glacial till. The main embankment requires a cut-off trench ranging from 5 to 20 m deep.

The west dam for this option would be located in the upper part of Davidson Creek to limit the land footprint disturbed by the TSF, and to isolate the supernatant pond from the upper portions of the TSF catchment. This dam creates a fresh water pond that would be available to supply a portion of the mill fresh water requirements from a closer source. The fresh water pond would be filled to a higher elevation than the supernatant pond and would act as a hydraulic barrier to prevent seepage towards the west of the TSF. Bedrock is expected to be less than 10 m below surface in the area of the west dam. A cut-off trench, if required, would likely only need to be a few meters deep to reach below the natural creek bed.

Seepage would be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the main embankment would be collected in embankment drains and conveyed to the ECD downstream of the main embankment. Seepage would be recycled back to the TSF. Unrecoverable seepage passing the collection and recycle systems potentially affect two watersheds; Davidson Creek and Creek 661.

PAG waste would be co-disposed within the TSF in such a manner that it is progressively encapsulated by the tailings and saturated by the supernatant pond to prevent oxidation and subsequent acid generation. PAG haul distances would be in the order of seven km downhill haulage. NAG waste rock and overburden in excess of the material required for dam construction is estimated to be 54 Mm^3 and would be stored in a waste dump approximately 1.5 km to the west of the open pit.

The catchment area for the Option D TSF without modification is 49 km^2, sufficient to maintain a water balance under average conditions.

Tailings discharge during operations would be by gravity for the entire mine life. Some energy dissipation measures may be required for the tailings stream in the early years of tailings deposition. No tailings spill containment system would be required for the tailings pipeline as it is located entirely within the TSF catchment. Selective discharge of tailings around the facility during the final years of operations would establish and flatten final tailings beaches to facilitate surface water management and reclamation.

Upon mine closure, surface facilities would be removed in stages and full reclamation of the TSF would be initiated. An overburden cover of at least 0.3 m would be established over the PAG waste rock dump and tailings. Wetlands would be established and upland beaches would be vegetated. The tailings supernatant pond would be maintained at its final level while pumping excess inflows to the open pit to accelerate filling of the pit lake. A riprap-lined closure spillway sized for the Probable Maximum Flood (PMF) would be established towards Davidson Creek with an additional emergency spillway for the west dam. All roads, ponds, and ditches not required beyond mine closure would be removed and regraded.

5.2.2.2 Environmental Summary of Option D

A general summary of the environmental setting of Option D is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-2 in Section 5.3.

Surface Water Hydrology

The Option D TSF is located in the Davidson Creek Watershed. It includes one dam located upstream of the confluence of Creek 688328 with Davidson Creek. A portion of Davidson Creek, as well as some of the contributing tributaries in Upper Davidson Creek lie within the TSF footprint. Streams covered by portions of the footprint include; Creek 636713, Creek 688328, Creek 776798, Creek 758727 and Creek 704454.

Davidson Creek becomes more sinuous downstream of the headwaters and meanders irregularly throughout the reach where Option D is located. The dominant substrate size measured in Davidson Creek near the location of the toe of dam is cobbles followed by pebbles with cascade-pool and riffle-pool morphologies observed in contributing tributaries and upstream of the dam (AMEC 2013j).

The potential changes to surface water hydrology are considered for Davidson Creek and are summarized in Table 5.2-10. The potential impact to timing and distribution of flows are measured on a qualitative scale from negligible to extreme.

Table 5.2-10. Potential Changes to Surface Water Hydrology for Option D TSF

	Davidson Creek
Potential catchment loss to toe of TSF using watershed area	53.3%
Potential impacts to timing and distribution of flows	high

Surface Water Quality

The near-field or immediate receiving environment for discharge to the north from the proposed tailings impoundment is Davidson Creek. As small quantity of tailings beach extends in the Creek 661 watershed, this potential flow was not assessed as the volume would be insignificant compared to the potential flow into the Davidson Creek watershed. One monitoring station, WQ10, was used for water quality analysis in the immediate receiving environment (AMEC 2013g). Data used in this analysis were collected at WQ10 from March 2011 to December 2012. Mean annual water quality data from this study site on Davidson Creek have exceedances of BC 30-day mean guidelines for dissolved aluminum. The mean annual concentrations for the assessed parameters in the receiving environment for Option D are: sulphate 1.94 mg/L, cadmium 0.00001 mg/L, and zinc 0.002 mg/L. Based on existing baseline conditions Option D has a moderate potential for water quality effects due to good baseline water quality and one potentially affected watershed.

The expected volume of NAG material required to construct the embankments for Option D is 58 Mm^3.

Groundwater Quantity and Quality

The groundwater quality baseline study at the site shows typical groundwater quality conditions with no anomalies regarding the potential for groundwater pollution.

Option D is near or crosses the watershed divides to the north/northwest and southeast, and may potentially cause impacts to groundwater quantity and quality in several watersheds (Davidson Creek, Turtle Creek, Creek 661 and possibly further distant in the Tatelkuz Lake tributary

catchment) as the mounding water in the tailings cell may alter the watershed divides. The potential impacts to groundwater may be predominantly within the Davidson Creek watershed and less in other watersheds.

This Option avoids the potential impacts of a separate on-land PAG stockpile. However, the Option is located in the groundwater recharge zones at the headwaters and may pose seepage management challenges from migration of seepage through shallow and deep groundwater into the receiving environment due to potentially less hydraulic containment. Seepage management challenges are potentially high, although mitigation measures will significantly reduce these challenges. Option D is located further downstream in the Davidson Creek watershed than Option C, therefore potentially creating greater challenges with maintaining the flow regime and water quality in this creek.

Aquatic Habitat

No endangered or vulnerable non-fish aquatic organisms were observed in sites potentially affected by the Option D TSF.

Fish and Fish Habitat

The Option D TSF is located in the Upper Davidson Creek watershed. Upper Davidson Creek and its tributaries are fish bearing within the Option D TSF. Only one fish species, Rainbow Trout, is present in Upper Davidson Creek watercourses within the TSF.

Two separate but overlapping Rainbow Trout populations are present in the Davidson Creek watershed, the Davidson Creek population and the Davidson Creek Headwaters population. The separate populations were identified based on the timing and location of upstream and downstream migration of spawners during spawning surveys, access to overwintering habitat, and the presence of a partial impediment to fish passage located in Reach 11 of Davidson Creek within the Option D TSF. A section of cascades are steep enough to constitute an impediment to upstream passage during summer low flows and possibly during freshet.

The majority of Rainbow Trout that use the watershed are from the Davidson Creek population. These fish overwinter in Tatelkuz Lake, Lower Davidson Creek, or Chedakuz Creek, and have unrestricted access for migration, spawning, and rearing in Davidson Creek up to the partial fish-passage impediment. The Davidson Creek Headwaters population of Rainbow Trout is mainly restricted to reaches above the partial impediment in Reach 11 and to headwater Lake 01682LNRS. Isolated pockets of suitable spawning gravels are present in the stream reaches above the impediment, and the presence of relatively high numbers of juvenile Rainbow Trout suggest that spawning for the Headwaters population occurs just downstream of the outlet of Lake 01682LNRS. The lake provides critical overwintering habitat.

A small portion of the Option D TSF is located in the upper Creek 705 watershed. Creek 705 has two populations of Rainbow Trout (Headwaters North and Headwaters South) that occupy the upper reaches of the stream and its tributary, Creek 606013, and that overwinter in headwater lakes 0158UEUT and 01428UEUT, respectively. Reaches of Creek 705 located upstream of Lake 0158UEUT are in the Option D TSF.

There are no fish species of conservation concern present in the Option D TSF or in watersheds in the ALSA downstream of the Option D TSF.

Downstream Fisheries Values

Downstream of the Option D TSF, Rainbow Trout are present in Davidson Creek, its tributaries, and Lower Chedakuz Creek which are on the eastern side of the Option D TSF. The west dam of the Option D TSF is in the Creek 705 watershed and Rainbow Trout are present in Creek 705, its tributaries and headwater lakes 0158UEUT and 0142UEUT. Streams in the 661 watershed and Tatelkuz Lake and its tributaries may also be influenced by TSF construction due to groundwater seepage. Rainbow Trout distribution and habitat quality downstream of Option D are presented in Table 5.2-11.

Table 5.2-11. Rainbow Trout Values Downstream of Option D TSF

Watercourse	Susceptibility to Potential Downstream Effects	Distribution	Habitat Quality
Lower and Middle Davidson Creek	Predominantly susceptible	Chedakuz Creek confluence to Davidson Creek Reach 10	Good quality habitat for all life stages
Lower Chedakuz Creek	Predominantly susceptible	RSA boundary to confluence with Davidson Creek	Good quality habitat for all life stages
Creek 705	Predominantly susceptible	Fawnie Creek confluence to headwaters including headwater Lake 0158UEUT	Good quality rearing habitat, fair quality spawning and migration habitat, overwintering habitat confined to Lake 0158UEUT
Creek 606013	Predominantly susceptible	Creek 705 confluence to headwaters including headwater Lake 0142UEUT	Good quality rearing and migration habitat, fair quality spawning habitat, overwintering habitat confined to Lake 0142UEUT
Lower and Middle Creek 661	Potentially susceptible	Chedakuz Creek confluence to headwaters	Good quality rearing and migration habitat, fair quality spawning and overwintering habitat
Creek 661 tributaries	Potentially susceptible	All tributaries**	Good quality rearing and migration habitat, fair quality spawning and overwintering habitat
Middle Chedakuz Creek	Potentially susceptible	Tatelkuz Lake to confluence with Creek 661	N/A
Tatelkuz Lake	Potentially susceptible	Adult and overwintering fish from the Davidson Creek, Chedakuz Creek and Creek 661 populations	Critical overwintering habitat
Tatelkuz Lake tributaries	Potentially susceptible	Creek 579340 to headwaters including Snake Lake**, other unnamed tributaries**	Fair quality rearing habitat, poor quality migration habitat and no spawning or overwintering habitat.

N/A: Not sampled

** Mean electrofishing density from 2011 and 2012 surveys.*

*** Rainbow Trout are presumed to be present but were not captured in all tributaries in 2011 and 2012 summer inventory surveys.*

Downstream Kokanee Values

Kokanee are typically a lake-dwelling species; however, they spawn in streams. Davidson Creek and Lower Chedakuz Creek, located downstream of the Option D TSF, contain spawning habitat for Kokanee from Tatelkuz Lake. Creek 661 and Tatelkuz Lake also contain Kokanee habitat and are susceptible to impacts from the TSF by groundwater seepage. The distance between the toe of tailings containment dams associated with the Option D TSF and the first occurrence of downstream spawning Kokanee is 15.8 km in Davidson Creek.

The distribution and quality of Kokanee spawning habitat in areas downstream of the Option D TSF are presented in Table 5.2-12.

Table 5.2-12. Kokanee Values Downstream of Option D TSF

Watercourse	Susceptibility to Potential Downstream Effects	Spawning Habitat Distribution and Quality	Critical Rearing and Overwintering Habitat Distribution
Lower Davidson Creek	Predominantly susceptible	Chedakuz Creek confluence to Davidson Creek Reach 4 (5.2 km), high quality spawning habitat in Reaches 1 to 5	None*
Lower Chedakuz Creek	Predominantly susceptible	RSA boundary to confluence with Davidson Creek, high quality spawning habitat	None*
Lower Creek 661	Potentially susceptible	Chedakuz Creek confluence to Creek 661 Reach 3 (7.1 km), high quality spawning habitat in Reaches 1 to 4	Tatelkuz Lake
Middle Chedakuz Creek	Potentially susceptible	Tatelkuz Lake to confluence with Creek 661, high quality spawning habitat	Tatelkuz Lake

** Rearing and overwintering habitat is in Tatelkuz Lake, located upstream of Chedakuz Creek confluence with Davidson Creek.*

Downstream Mountain Whitefish Values

Fall spawning surveys downstream of the Option D TSF captured a total of 22 Mountain Whitefish. Eight Mountain Whitefish were captured in Lower Davidson Creek and the remaining 14 were captured in Creek 705. The low numbers of fish caught indicate that the number of Mountain Whitefish using streams that may be affected by construction of the Option D TSF is very low compared to Rainbow Trout and Kokanee.

Potential Impacts on Fish and Fish Habitat

The construction of the Option D TSF would result in the permanent alteration to, or destruction (PAD) of, fish habitat in an area of approximately 12.2 ha.

The construction of Option D would result in the loss of all critical habitat (upper reaches of Davidson Creek and headwater Lake 01682LNRS) occupied by the Davidson Creek Headwaters population of Rainbow Trout and would likely eliminate the Davidson Creek Headwaters population. It would also result in the loss of areas in Davidson Creek that provide rearing habitat for the Davidson Creek Rainbow Trout population. Finally, portions of several reaches of Creek 705 upstream of Lake 0158UEUT that contain rearing habitat for Rainbow Trout would be lost.

Rainbow Trout in the Davidson Creek watershed and Kokanee spawning in Lower Davidson Creek and Lower Chedakuz Creek downstream could be affected by reductions in stream flow downstream of the Option D TSF. Rainbow Trout populations in the upper Creek 705 watershed and Rainbow Trout and spawning Kokanee in Davidson Creek could also be affected in the event of seepage or discharge of contaminated tailings water into Creek 705 and/or Davidson Creek. Finally, Rainbow Trout and spawning Kokanee in Creek 661 and its tributaries and in Tatelkuz Lake and its tributaries are potentially susceptible to effects from contaminated groundwater seepage into the Creek 661 watershed.

Terrestrial Wildlife

The mine site TELSA is characterized by mountainous topography with steep relief descending into Davidson Creek dominated by subalpine fir, Engelmann spruce, and lodgepole pine. The wildlife habitat is characterized by a mosaic of high elevation forest, wetlands, riparian, and mature forest with minor amounts of forestry impact.

Six species of conservation concern were recorded in Option D during baseline studies (see Table 1.8-3 for status designations; AMEC 2013p): western toad, caribou, little brown myotis, northern myotis, Haget's bluet, and northern goshawk. Two species listed under the *Species at Risk Act* (2002d); one as special concern: western toad and one as threatened: caribou. Two observed species were listed as endangered by COSEWIC (COSEWIC 2012b) but not by the *Species at Risk Act* (2002d): little brown myotis and northern myotis.

Habitat suitability modeling exercises identified high-quality habitat that would be directly removed by the TSF or indirectly affected (i.e., within a 100 m buffer of the TSF) by the TSF for the following species: grizzly bear, caribou, moose, American marten, myotis spp. western toad, olive-sided flycatcher, and red-tailed hawk. The areas affected for each species are provided in detail in Tables 5.2-13 through 5.2-17).

Table 5.2-13. Wildlife Implications of Option D TSF

Species	Total Direct and Indirect Loss of High-Quality Habitat[1]
Grizzly bear	385.2 ha (28.8% of the TSF footprint area)
Caribou	658.3 ha (49.2% of the TSF footprint area)
Moose	135.4 ha (10.1% of the TSF footprint area)
American Marten	219.4 ha (16.4% of the TSF footprint area)
Myotis spp.	865.8 ha (64.7% of the TSF footprint area)
Western toad	353.9 ha (26.4% of the TSF footprint area)
Terrestrial Birds (Olive-sided flycatcher)	864.5 ha (64.6% of the TSF footprint area)
Raptors (Red-tailed hawk)	701.8 ha (52.4% of the TSF footprint area)

[1] *Total loss of high-quality habitat represents the cumulative total amount of the various habitat requirements(for example: grizzly bear = feeding spring, feeding summer, feeding fall, security thermal and hibernating; Table 5.2-13).*

Table 5.2-14. Amounts of High Value Habitat from Habitat Suitability Mapping for Grizzly Bear Affected by the Option D TSF, with and without 100 m Buffer

	Total Area (ha)	Grizzly Bear				
		Feeding Spring (ha)	Feeding Summer (ha)	Feeding Fall (ha)	Security/Thermal - Growing (ha)	Hibernating (ha)
TSF footprint only	1,110	0	0	115.9	97.5	309.8
TSF footprint plus 100 m buffer	1,338	0	0	147.1	121.3	385.2

Table 5.2-15. Amounts of High Value Habitat from Habitat Suitability Mapping for Caribou Affected by the Option D TSF, with and without 100 m Buffer

	Total Area (ha)	Caribou				
		Feeding Winter (ha)	Feeding Spring (ha)	Feeding Summer(ha)	Security/Thermal - Winter (ha)	Security/Thermal - Growing (ha)
TSF footprint only	1,110	464.4	464.4	371	279.7	279.7
TSF footprint plus 100 m buffer	1,338	536.9	536.9	427.8	343.6	343.6

Table 5.2-16. Amounts of High Value Habitat from Habitat Suitability Mapping for Moose Affected by the Option D TSF, with and without 100 m Buffer

	Total Area (ha)	Moose			
		Feeding Winter (ha)	Feeding Growing (ha)	Security/Thermal - Winter (ha)	Security/Thermal - Growing (ha)
TSF footprint only	1,110	104.4	74.7	102.7	135.5
TSF footprint plus 100 m buffer	1,338	109.1	81.3	105.7	148

Table 5.2-17. Amounts of High Value Habitat from Habitat Suitability Mapping for Marten, Myotis, Western Toad, Birds, and Raptors Affected by the Option D TSF, with and without 100 m Buffer

	Total Area (ha)	Marten		Myotis	Western Toad	Terrestrial Birds	Raptors
		Living Winter (ha)	Living Growing (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)
TSF footprint only	1,110	201	201	722.2	331.3	724.3	576.7
TSF footprint plus 100 m buffer	1,338	219.4	219.4	865.8	353.9	864.5	701.8

Vegetation, Ecosystems and Wetlands

The Option D TSF would cause the direct removal of 161 ha of mature forest, 147 ha of riparian areas, and 12 ha of ecosystems at risk (all blue-listed wetlands). Baseline studies identified no plant species of conservation concern, and no sparsely vegetated identified within the TSF footprint during field surveys or TEM mapping.

The total wetland area that will be removed by the Option D TSF, including the previously mentioned blue-listed wetlands, will be 197 ha. Options that affect listed wetlands and are reviewed by Environment Canada will require a conservation plan to meet the federal policy on wetland conservation.

Air Quality

During construction and operation, the effect of Option D on air quality would be related to fugitive dust and emissions from diesel-fuelled heavy equipment and blasting associated with building the dams and TSF supporting infrastructure (i.e., roads, plant site, and water diversions infrastructure), and to fugitive dust from tailings beaches and embankments. The volume of diesel emissions and fugitive dust for the dams would be related to the haul distances and the volume of local material required to for the starter dams and the core. The emissions for the supporting infrastructure would directly relate to the length of the supporting infrastructure and the site-specific terrain challenges of building the infrastructure. During operations and closure, exposed areas of tailing and waste rock may be subjected to wind erosion, causing wind-blown fugitive dust. Reclamation and capping of the tailing and waste rock would minimize the potential for fugitive dust.

Option D TSF footprint is 10 km^2. The TSF is large enough to eliminate on land waste rock stockpile and therefore reducing fugitive dust assocated with wind erosion. If tailings beach is dry, fugitive dust emissions may be emitted. Option D TSF will be located south of the open pit and northeast of the relocated camp, predominant wind from the southwest is less likely to affect the camp. The TSF is located approximately 4.5 km of the deposit. Fugitive road dust and vehicle exhaust will be emitted when haul trucks travel from the open pit to the TSF. However, air quality models predict that fugitive dust from the TSF will not result in residual effects for the Project for TSF Option FS. As TSF Option D utilizes the same general construction, operations, and closure approaches to TSF Option FS, fugitive dust emissions from Option D TSF are expected to be minimal.

5.2.2.3 Socio-Economic Summary of Option D

A general summary of the socio-economic setting of Option D is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-3 in Section 5.3.

Non-Traditional Land and Resource Use

The Option D TSF overlaps with five commerical land use tenures. Option D is located within 2 trapline tenures, overlapping 774 ha of Tenure 1205330 (2.05% of tenure) and 337 ha of Tenure 1314664 (0.33% of tenure). These interactions have the potential to affect trapping due to potential displacement and a reduction in available wildlife. Option D also overlaps with 168 ha of range Tenure RAN07515 (0.88% of tenure). Additionally, Option D is located within 2 guide outfitting tenures; overlapping 714 ha of Tenure 484246 (0.22% of tenure) and 396 ha of Tenure 1206416 (0.73% of tenure).

Option D does not overlap with any known Forestry or Commerical recreation tenures; nor does it overlap with any mineral claims not held by New Gold.

Parks and Protected Areas

In terms of recreational land uses, Option D does not overlap with any parks or protected areas however; there are areas of overlap with features of recreational sensitivity. Option D transects with the following Recreation Feature Inventory attributes:

- RFI#10716, Medium Sensitivity-Medium Significance, 1,056 ha (5.97%);
- RFI# 10769, Unknown Sensitivity-Unknown Significance, 50 ha (1.02%); and
- RFI# 10784 Medium Sensitivity-High Significance, 4 ha (0.97%).

Heritage

Option D TSF does not overlap with any known archaeological sites or paleontological sites. Option D TSF does, however, overlap with 34 known heritage features, including 31 blazed trees and three culturally modified trees; these heritage features are not protected byt the *HCA* (1996b).

While this option does not overlap with any known archaeological sites, the site boundaries for archaeological site FhSf-4 are approximately 50 m from the small tailings pond component situated along Davidson Creek. This site is therefore at increased risk of impacts during construction.

Current Use of Lands and Resources for Traditional Purposes

Option D TSF is located entirely within the LDN, STN and UFN traditional territories. For the three Aboriginal groups whose traditional territories overlap with the TSF (LDN, STN, and UFN), Table 5.2-18 presents potential effects of Option D on traditional land use.

5.2.2.4 Project Economics Summary of Option D

A general summary of the Project economics setting of Option D is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-4 in Section 5.3. The total undiscounted cost (including capital, operating, and closure costs) of Option D is estimated to be $415,000,000, or $0.53/tonne. This total cost does not include fish habitat compensation costs.

Initial Capital Costs

The Option D TSF has a moderate starter dam volume required (11 Mm^3) among the TSF options. The option requires the construction of the downstream ECD. It is anticipated that sufficient NAG material will be available for both facilities at start-up. The initial capital costs are estimated to be $118,000,000.

Sustaining Capital and Operating Costs

The Option D TSF has low to moderate sustaining capital and operating costs. Option D TSF will require ongoing raises to one relatively large dams, with a total volume of 66 Mm^3. However, sufficient NAG material should be avaible. This material must only be hauled to one dam locations, which will decrease operating costs. The sustaining and operating costs are estimated to be $254,000,000.

Table 5.2-18. Potential Effects of Option D on Aboriginal Current Use of Lands and Resources for Traditional Purposes

Concern or Issue	Potential Effect to Current Use of Lands and Resources for Traditional Purposes		
	Lhoosk'uz Dene Nation	Skin Tyee Nation	Ulkatcho First Nation
Hunting	No specified use of area for hunting. Option may overlap with hunting areas.	Hunting locations identified in the Project footprint; other hunting occurs in areas Davidson and Chedakuz creeks and Tatelkuz Lake.	UFN hunting occurs on Mount Davidson, near Tatelkuz Lake and along Chedakuz Creek.
Trapping	Option overlaps trapline tenure held by a LDN member(TR0512T027), , this tenure is not currently being used; and 219 ha of high-quality American marten habitat	No trapping locations identified in the Project footprint. Trapping locations identified areas around Davidson and Chedakuz creeks and Tatelkuz Lake. No STN registered traplines identified in the area	No overlap with trapline tenures held by UFN members
Fishing	LDN fish at Davidson and Chedakuz creeks and Tatelkuz and Kuyakuz lakes. LDN identified the lower reaches of Davidson Creek as having important fishing value.	No fishing use identified in the Project footprint.	No known fishing use in the Project footprint. UFN fish at Chedakuz Creek and Tatelkuz Lake, and have a fish camp at Kuyakuz Lake.
Harvest of Traditional Plants	No known gathering use in the Project footprint. Option may overlap areas for the harvest of traditional plants. LDN harvest plants around Tatelkuz and Kuyakuz Lake and along the Messue Wagon Trail.	The Project footprint was not identified as a harvesting areas. STN harvest near Chedakuz Creek and Tatelkuz Lake, and along the Messue Wagon Road Trail.	Harvesting areas have not been identified in the Project footprint. Option may overlap areas for the harvest of traditional plants while using the area for other purposes (camping, trail use).
Use of Cultural/ Traditional Sites	No known use of area for cultural or traditional purposes	One culturally significant named place is located in the Project footprint. There are important transportation routes and trails between Tatelkuz Lake and Kuyakuz Lake. Campsites and gathering areas are identified around Tatelkuz Lake, Tsacha Lake, Johnny Lake and Top Lake, Fawnie Dome and Mount Tatelkuz.	Overlap with 34 known heritage features, including 31 blazed trees and three culturally modified trees. A trail, campsite, and a place name were identified within the area of the Project footprint

Closure Costs

The Option D TSF has the lowest closure costs. The TSF involves the closure of one relatively large dam, and seepage must be only be contained in one watersheds. Long-term water treatment costs will be minimal as it is anticipated that water treatment can occur through a fully passive system (i.e., wetlands). The closure costs are estimated to be $43,000,000.

PAD Compensation Costs

The Option D TSF will create approximately 9.2 ha of PAD. The approximate habitat compensation costs for this PAD is $4.1M.

5.2.3 Option D/PAG OL

The Option D/PAG OL TSF is located in the middle reaches of Davidson Creek with an on-land PAG dump in the upper portion of the Creek 661 catchment (Figure 4.1-6). The TSF impoundment would be created by constructing a main dam across Davidson Creek on the east side, where it is constrained by topography on all other sides. The on-land PAG dump would be situated on an engineered fill platform constructed with NAG waste rock and overburden with a soil liner foundation and cover system. Drainage from the PAG stockpile would be treated and conveyed towards the TSF for storage.

5.2.3.1 Technical Summary of Option D/PAG OL

A general technical summary of the construction, operation and closure approaches of the Option D/PAG OL TSF are provided in Table 4.4-1. The proposed layout of the Option D/PAG OL TSF is provided in Figure 4.1-6. Further technical detail is provided here, and comparative data are summarized in Table 5.3-1 in Section 5.3.

TSF Option D/PAG OL involves storing tailings in a TSF located approximately 4.5 kilometres north of the deposit, as measured from the centre of the open pit to the centre of the TSF. The ultimate TSF D has a footprint area of approximately 8 km^2.

The TSF starter embankment would be constructed with local borrow material initially and then from the pre-stripping of the open pit. One starter dam is required initially for the main embankment and would be 65 m high.

The TSF embankment would be progressively expanded using NAG waste materials from the open pit and processed filter and transition zone material from local borrow areas. The ultimate embankment would be 118 m high, and requires approximately 35 Mm^3 of embankment fill. The embankment would be a zoned earthfill and rockfill dam, expanded over the life of the project using the centreline method of construction. The embankment would have crest widths of 50 m and downstream slopes of 2H:1V. The ultimate volumetric storage efficiency of the TSF for Site D is considered to be good.

Foundation conditions at the embankment location are characterized by a thick sequence of overburden underlain by a completely weathered bedrock layer, and then competent bedrock.

The surficial material has been classified as channelized and non-channelized glaciofluvial deposits, and lodgement glacial till. The main embankment would require a cut-off trench ranging from 5 to 20 m deep, and would be a slightly shorter in profile length than the FS cut-off trench arrangement.

Tailings discharge during operations would be by gravity for the entire mine life. Some energy dissipation measures may be required for the tailings stream in the early years of tailings deposition. No tailings spill containment system would be required for the tailings pipeline as it is located entirely within the TSF catchment. Selective discharge of tailings around the facility during the final years of operations would establish and flatten final tailings beaches to facilitate surface water management and reclamation.

TSF seepage would be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the main embankment would be collected in embankment drains and conveyed to the ECD downstream of the main embankment. Seepage would be recycled back to the TSF. Unrecoverable TSF seepage passing the collection and recycle systems potentially affect Davidson Creek.

PAG waste would be stored in an engineered containment up-gradient of the TSF and northeast of the open pit at the location of the TSF Option E alternative. A NAG fill platform of approximately 50 Mm^3 is required at the base of the PAG stockpile area to raise the topography to direct PAG stockpile drainage into the TSF impoundment by gravity. The fill platform would have an engineered soil liner constructed on top of compacted overburden from the open pit. This area is approximately four km to the northeast of the open pit, and would cover a footprint area of approximately four km^2. Seepage passing through the soil liner and fill platform would be collected in one of at least three selection collection ponds and pumped to the TSF via a pipeline and water treatment plant. Unrecovered seepage from the PAG stockpile has the potential to affect Creek 661.

NAG waste rock and overburden in excess of the material required for dam and fill platform construction is estimated to be 27 Mm^3 and would be stored in a waste dump approximately 1.5 km to the west of the open pit.

The catchment area for Option D/PAG OL TSF without modification is in excess of 50 km^2, sufficient to maintain a water balance under average conditions. Since the PAG waste rock would not be disposed of subaqueously, it is expected that the TSF would operate in a surplus condition and the diversion of some of the area upslope of the TSF would be necessary to prevent a surface water discharge to receiving streams during the operations phase. A sufficient diversion channel could be constructed around the east and north perimeter of the TSF with approximately 5 km of diversion ditches.

Upon mine closure, surface facilities would be removed in stages and full reclamation of the TSF would be initiated. An overburden cover of at least 0.3 m would be established over the tailings. Wetlands would be established and upland beaches would be vegetated. The tailings supernatant pond would be maintained at its final level while pumping excess inflows to the open pit to accelerate filling of the pit lake. A riprap lined closure spillway sized for the PMF would be established towards Davidson Creek. All roads, ponds, and ditches not required beyond mine closure would be removed and regraded. The PAG waste rock dump would be capped with a

3 m-thick low permeability overburden cover capped with a 30 cm growth medium cover. Surface water runoff would be diverted around the PAG dump to the TSF or downstream environment depending on water quality. Infiltration through the soil cover would be collected as seepage and conveyed to the TSF for dilution or treated during post-closure with an on-site water treatment plant depending upon quantity and quality.

5.2.3.2 Environmental Summary of Option D/PAG OL

A general summary of the environmental setting of Option D/PAG OL TSF is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-2 in Section 5.3.

Surface Water Hydrology

Option D/PAG OL TSF is located in the same area as Option D TSF within the Upper Davidson Creek Watershed and covers portions of the same streams. The footprint of the D/PAG OL TSF covers 70% of the area of the Option D TSF footprint. The Option D/PAG OL TSF has additional on-land infrastructure where the PAG stockpile will be located, covering portions of Creek 505659 and Creek 146920 in the Creek 661 Watershed.

The potential changes to surface water hydrology are considered for Davidson Creek and are summarized in Table 5.2-19. The potential impact to timing and distribution of flows are measured on a qualitative scale from negligible to extreme.

Table 5.2-19. Potential Changes to Surface Water Hydrology for Option D/PAG OL TSF

	Davidson Creek
Potential catchment loss to toe of TSF using watershed area	52.5%
Potential impacts to timing and distribution of flows	high

Surface Water Quality

The near-field or immediate receiving environment for discharge to the north from the proposed tailings impoundment is Davidson Creek and from the on land PAG waste rock storage facility is Creek 661. Three monitoring stations, WQ10, WQ3, and WQ4, were used for water quality analysis in the immediate receiving environment (AMEC 2013g). Data used in this analysis were collected at WQ3, WQ4, and WQ10 from March 2011 to December 2012. Mean annual water quality data from the study site on Davidson Creek have exceedances of BC 30-day mean guidelines for dissolved aluminum. Mean annual water quality data from study sites on Creek 661 have exceedances of BC 30-day mean guidelines for total cadmium, total zinc, and dissolved aluminum. The mean annual concentrations for the assessed parameters in the receiving environment for Option D/PAG OL TSF are: sulphate 3.48 mg/L, cadmium 0.00004 mg/L, and zinc 0.017 mg/L. Based on existing baseline conditions Option D/PAG OL TSF has the lowest potential for water quality effects due to poorer baseline water quality and potential to impact one watershed; however, baseline conditions are derived from one monitoring station.

The expected volume of NAG material required to construct the embankments for the tailings impoundment at Option D/PAG OL is 35 Mm^3. This is the lowest quantity of NAG embankment material, however it does not incorporate the expected volume of NAG material required for the on-land PAG waste rock dump.

Groundwater Quantity and Quality

The groundwater quality baseline study at the site shows typical groundwater quality with no anomalies regarding potential groundwater pollution.

Option D/PAG OL is located near the watershed divides to the north and southeast, and includes a separate PAG stockpile location. Therefore, it may potentially cause impacts to groundwater quantity and quality in several watersheds (Davidson Creek, Turtle Creek, Creek 661 and possibly further distant in the Tatelkuz Lake tributary catchment) as the mounding water in the tailing cell may alter the watershed divides. The potential impacts to groundwater may be predominantly within the Davidson Creek and the Creek 661 watersheds and less in other watersheds.

This Option has a separate location for the TSF and the on land PAG stockpile. The water quality in Creek 661 will potentially be compromised due to challenges with groundwater seepage collection/control from the on land PAG dump. Both facilities are located in the groundwater recharge zones at the headwaters and may pose seepage management challenges from migration of seepage through shallow and deep groundwater into the receiving environment

Aquatic Habitat

No endangered or vulnerable non-fish aquatic organisms were observed in sites potentially affected by the Option D/PAG OL TSF.

Fish and Fish Habitat

Davidson Creek and its tributaries are fish-bearing within the Option D/PAG OL TSF; while tributaries to Creek 661 within the on-land PAG storage area of the Option D/PAG OL TSF have been assumed to be fish bearing for the purposes of this report. Rainbow Trout is the only fish species present in both areas. Two separate Rainbow Trout populations are present in Davidson Creek: the Davidson Creek Population, which overwinters in Tatelkuz Lake and Lower Davidson Creek, and the Davidson Creek Headwaters population, which overwinters in headwater Lake 01682LNRS. The populations are separated by a steep cascade section in Reach 11 of Upper Davidson Creek that creates an impediment to upstream fish passage. Rainbow Trout in Creek 661 are assumed to be part of a single lake-resident population that overwinters in Tatelkuz Lake. Rainbow Trout habitat quality is good for most life stages in Davidson Creek and Creek 661; overwintering habitat is suspected as limiting.

No fish species of conservation concern have been captured in the Option D/PAG OL TSF footprint. Brassy Minnow, a species classified by the BC CDC (2013) as "S2S3" (i.e., "Imperilled. Special concern. Vulnerable to extirpation or extinction.") inhabit Tatelkuz Lake, which is located in the ALSA downstream of the downstream of the Option D/PAG OL TSF in the Creek 661 watershed.

Downstream Fisheries Values

Downstream Rainbow Trout Values

Rainbow Trout are present in Davidson Creek and its tributaries and in Lower Chedakuz Creek downstream of the Option D/PAG OL TSF. Rainbow Trout are present in Creek 661 and its tributaries, in Middle Chedakuz Creek, and in Tatelkuz Lake downstream of the on-land PAG storage area. Streams in the Turtle Creek watershed may also be influenced by TSF construction due to groundwater seepage. Rainbow Trout distribution and habitat quality are presented in Table 5.2-20.

Table 5.2-20. Rainbow Trout Values Downstream of Option D/PAG OL TSF

Watercourse	Susceptibility to Potential Downstream Effects	Distribution	Habitat Quality
Lower and Middle Davidson Creek	Predominantly susceptible	Chedakuz Creek confluence to Davidson Creek Reach 10	Good quality habitat for all life stages
Lower Chedakuz Creek	Predominantly susceptible	RSA boundary to confluence with Davidson Creek	Good quality habitat for all life stages
Lower and Middle Creek 661	Predominantly susceptible	Chedakuz Creek confluence to Creek 661 Reach 4	Good quality rearing and migration habitat, fair quality spawning and overwintering habitat
Creek 661 tributaries	Predominantly susceptible	All tributaries**	Good quality rearing and migration habitat, fair quality spawning and overwintering habitat
Middle Chedakuz Creek	Predominantly susceptible	Tatelkuz Lake to confluence with Creek 661	N/A
Tatelkuz Lake	Predominantly susceptible	Adult and overwintering fish from the Davidson Creek, Chedakuz Creek and Creek 661 populations	Critical overwintering habitat
Turtle Creek	Potentially susceptible	Chedakuz Creek confluence to headwaters	Good quality rearing, migration and overwintering habitat, poor quality spawning habitat
Turtle Creek tributaries	Potentially susceptible	All tributaries**	Fair quality rearing habitat, poor quality spawning, migration and overwintering habitat

N/A: Not sampled
** Mean electrofishing density from 2011 and 2012 surveys.*
*** Rainbow Trout are presumed to be present but were not captured in all tributaries in 2011 and 2012 summer inventory surveys.*

Downstream Kokanee Values

Kokanee are typically a lake-dwelling species; however, they spawn in streams. Davidson Creek, Creek 661, and Chedakuz Creek, located downstream of the Option D/PAG OL TSF or the on-land PAG storage area, contain spawning habitat for Kokanee from Tatelkuz Lake and Kuyakuz Lake. Table 5.2-21 presents the distribution and quality of Kokanee spawning habitat downstream of the Option D/PAG OL TSF.

Table 5.2-21. Kokanee Values Downstream of Option D/PAG OL TSF

Watercourse	Susceptibility to Potential Downstream Effects	Spawning Habitat Distribution and Quality	Critical Rearing and Overwintering Habitat Distribution
Lower Davidson Creek	Predominantly susceptible	Chedakuz Creek confluence to Davidson Creek Reach 4 (5.2 km), high quality spawning habitat in Reaches 1 to 5	None*
Lower Chedakuz Creek	Predominantly susceptible	RSA boundary to confluence with Davidson Creek, high quality spawning habitat	None*
Lower Creek 661	Predominantly susceptible	Chedakuz Creek confluence to Creek 661 Reach 3 (7.1 km), high quality spawning habitat in Reaches 1 to 4	Tatelkuz Lake**
Middle Chedakuz Creek	Predominantly susceptible	Tatelkuz Lake to confluence with Creek 661, high quality spawning habitat	Tatelkuz Lake**

** Rearing and overwintering habitat is in Tatelkuz Lake, located upstream of Chedakuz Creek confluence with Davidson Creek.*
*** Spawning Kokanee in Middle Chedakuz Creek are presumed to rear and overwinter in Tatelkuz Lake or Kuyakuz Lake. Kuyakuz Lake is located upstream of the Creek 661 confluence with Chedakuz Creek.*

Downstream Mountain Whitefish Values

Fall spawning surveys downstream of the Option D/PAG OL TSF captured a total of eight Mountain Whitefish. All eight were captured in Lower Davidson Creek. The low number of fish caught indicates that the number of Mountain Whitefish using streams that may be affected by construction of the Option D/PAG OL TSF is very low compared to Rainbow Trout and Kokanee.

Potential Impacts on Fish and Fish Habitat

The construction of the Option D/PAG OL TSF would result in the permanent alteration to, or destruction (PAD) of, fish habitat in an area of approximately 8.5 ha.

The construction of the Option D/PAG OL TSF would result in the Davidson Creek Headwaters population of Rainbow Trout being cut off from the Davidson Creek population as the TSF area would create a complete permanent barrier in Upper Davidson Creek. The Headwaters population is assumed to be self-sustaining without substantial contributions from the Davidson Creek population; therefore, the long-term viability of the Headwaters population may not be affected by further isolation. However, loss of rearing habitat used by both Davidson Creek Rainbow Trout populations and critical spawning habitat used by the Davidson Creek Headwaters Rainbow Trout population in the Option D/PAG OL TSF area could influence population densities.

Rainbow Trout and spawning Kokanee in Lower Davidson Creek and Lower Chedakuz Creek, downstream of the Option D/PAG OL TSF, may be affected due to reductions in flow caused by the construction of the TSF in the Upper Davidson Creek watershed. Rainbow Trout and spawning Kokanee in Lower Creek 661 and Middle Chedakuz Creek, downstream of on-land PAG storage area may be affected due to alterations in flow caused by changes in local hydrology where PAG is stored.

Tatelkuz Lake contains critical rearing and overwintering habitat for the Creek 661, Chedakuz Creek, and Davidson Creek Kokanee populations and contains overwintering habitat for the Davidson Creek and Creek 661 Rainbow Trout populations. Tatelkuz Lake and other Rainbow Trout habitat downstream of the on-land PAG storage area in Creek 661 and Middle Chedakuz Creek could be affected by seepage containment failure from the on-land PAG storage area upstream. Finally, Rainbow Trout in Turtle Creek and its tributaries are potentially susceptible to effects from contaminated groundwater seepage into the Turtle Creek watershed.

Terrestrial Wildlife

The mine site TELSA is characterized by mountainous topography with steep relief descending into Davidson Creek dominated by subalpine fir, Engelmann spruce, and lodgepole pine. The wildlife habitat is characterized by a mosaic of high elevation forest, wetlands, riparian, and mature forests with minor amounts of forestry impact.

Seven species of conservation concern were recorded in Option D/PAG OL during baseline studies (see Table 1.8-3 for status designations; AMEC 2013p): western toad, caribou, little brown myotis, northern myotis, Haget's bluet, barn swallow, and northern goshawk. Two species listed under the *Species at Risk Act* (2002d) were recorded; one as special concern: western toad and one as threatened species: caribou. Two observed species were listed as endangered by COSEWIC (COSEWIC 2012b), but not by the *Species at Risk Act* (2002d): little brown myotis and northern myotis. Additionally, one observed species were listed as threatened by COSEWIC (COSEWIC 2012a), but not by the *Species at Risk Act* (2002d): barn swallow.

Habitat suitability modeling exercises identified high-quality habitat that would be directly removed by the TSF or indirectly affected (i.e., within a 100 m buffer of the TSF) by the TSF for the following species: grizzly bear, caribou, moose, American marten, myotis spp. western toad, olive-sided flycatcher, and red-tailed hawk. The areas affected for each species are provided in detail in Tables 5.2-22 through 5.2-26.

Table 5.2-22. Wildlife Implications of Option D/PAG OL TSF

Species	Total Direct and Indirect Loss of High-quality Habitat[1]
Grizzly bear	379.9 ha (25.8% of the TSF footprint area)
Caribou	656.6 ha (44.6% of the TSF footprint area)
Moose	159.7 ha (10.9% of the TSF footprint area)
American Marten	216.5 ha (14.7% of the TSF footprint area)
Myotis spp.	706.4 ha (48% of the TSF footprint area)
Western toad	343.5 ha (23.4% of the TSF footprint area)
Terrestrial Birds (Olive-sided flycatcher)	711.5 ha (48.4% of the TSF footprint area)
Raptors (Red-tailed hawk)	532.7 ha (36.2% of the TSF footprint area)

[1] *Total loss of high-quality habitat represents the cumulative total amount of the various habitat requirements (e.g., grizzly bear = feeding spring, feeding summer, feeding fall, security thermal and hibernating; Table 5.2-21).*

Table 5.2-23. Amounts of High Value Habitat from Habitat Suitability Mapping for Grizzly Bear Affected by the Option D/PAG OL TSF, with and without 100 m Buffer

	Total Area (ha)	Grizzly Bear				
		Feeding Spring (ha)	Feeding Summer (ha)	Feeding Fall (ha)	Security/Thermal - Growing (ha)	Hibernating (ha)
TSF footprint only	1,175	0	0	74.2	70.7	285.7
TSF footprint plus 100 m buffer	1,471	0	0	112.4	100.3	379.9

Table 5.2-24. Amounts of High Value Habitat from Habitat Suitability Mapping for Caribou Affected by the Option D/PAG OL TSF, with and without 100 m Buffer

	Total Area (ha)	Caribou				
		Feeding Winter (ha)	Feeding Spring (ha)	Feeding Summer(ha)	Security/Thermal - Winter (ha)	Security/Thermal - Growing (ha)
TSF footprint only	1,175	472	472	397.2	270.8	270.8
TSF footprint plus 100 m buffer	1,471	556.3	556.3	464.8	350.8	350.8

Table 5.2-25. Amounts of High Value Habitat from Habitat Suitability Mapping for Moose Affected by the Option D/PAG OL TSF, with and without 100 m Buffer

	Total Area (ha)	Moose			
		Feeding Winter (ha)	Feeding Growing (ha)	Security/Thermal - Winter (ha)	Security/Thermal - Growing (ha)
TSF footprint only	1,175	101.9	65.6	101.3	140.1
TSF footprint plus 100 m buffer	1,471	105.9	72	104.2	154

Table 5.2-26. Amounts of High Value Habitat from Habitat Suitability Mapping for Western Toad, Marten, and Myotis Affected by the Option D/PAG OL TSF, with and without 100 m Buffer

	Total Area (ha)	Marten		Myotis	Western Toad	Terrestrial Birds	Raptors
		Living Winter (ha)	Living Growing (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)
TSF footprint only	1,175	194.6	194.6	558.8	319.7	567.4	405
TSF footprint plus 100 m buffer	1,471	216.5	216.5	706.4	343.5	711.5	532.7

Vegetation, Ecosystems, and Wetlands

The Option D/PAG OL TSF would cause the direct removal of 93 ha of mature forest, 168 ha of riparian areas, and 16 ha of ecosystems at risk (all blue-listed wetlands). Baseline studies identified no plant species of conservation concern, and no sparsely vegetated identified within the TSF footprint during field surveys or TEM mapping.

The total wetland area that will be removed by the Option D/PAG OL TSF, including the previously mentioned blue-listed wetlands, will be 201 ha. Options that affect listed wetlands and are reviewed by Environment Canada will require a conservation plan to meet the federal policy on wetland conservation.

Air Quality

During construction and operation, the effect of Option D/PAG OL on air quality would be related to fugitive dust and emissions from diesel-fuelled heavy equipment and blasting associated with building the dams and TSF supporting infrastructure (i.e., roads, plant site, and water diversions infrastructure), and to fugitive dust from tailings beaches and embankments. The volume of diesel emissions and fugitive dust for the dams would be related to the haul distances and the volume of local material required to for the starter dams and the core. The emissions for the supporting infrastructure would directly relate to the length of the supporting infrastructure and the site-specific terrain challenges of building the infrastructure. During operations and closure, exposed areas of tailings and waste rock may be subjected to wind erosion, causing wind-blown fugitive dust. Reclamation and capping of the tailings and waste rock would minimize the potential for fugitive dust.

Option D/PAG OL TSF footprint is approximately 8 km^2. Waste rock will be stored at a PAG stockpile area. The on land stockpile is a potential source of fugitive dust which may contain acidic compounds and trace metals. If tailings beach is dry, fugitive dust emissions may be emitted. Option D/PAG OL TSF will be located south of the open pit and northeast of the relocated camp while the waste rock stockpile will be located east of the camp. Predominant wind from the southwest is less likely to affect the camp. The TSF is located approximately 4.5 km of the deposit. Fugitive road dust and vehicle exhaust will be emitted when haul trucks travel from the open pit to the TSF. However, air quality models predict that fugitive dust from the TSF will not result in residual effects for the Project for TSF Option FS. As the Option D portion of the Option D/PAG OL TSF utilizes the same general construction, operations, and closure approaches to TSF Option FS, fugitive dust emissions from the subaqueous disposal of tailings are expected to be minimal.

5.2.3.3 Socio-Economic Summary of Option D/PAG OL

A general summary of the socio-economic setting of Option D/PAG OL is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-3 in Section 5.3.

Non-Traditional Land and Resource Use

The Option D/PAG OL TSF overlaps with five known commerical land use tenures. Firstly, Option D/PAG OL is located within 2 trapline tenures, overlapping 900 ha of Tenure 1205330 (2.38% of tenure) and 276 ha of Tenure 1314664 (0.27% of tenure). These interactions have the potential to affect trapping due to potential displacement and a reduction in available wildlife. Secondly, Option D/PAG OL overlaps with 152 ha of Tenure RAN07515 (0.8% of tenure). Option D/PAG OL also overlaps two guide outfitting tenures, specifically 519 ha of Tenure 484246 (0.16% of tenure) and 657 ha of Tenure 1206416 (1.21% of tenure).

Option D/PAG OL does not overlap with any known Forestry or Commerical recreation tenures; nor does it overlap with any mineral claims not held by New Gold.

Parks and Protected Areas

In terms of recreational land uses, Option D/PAG OL does not overlap with any parks or protected areas however; there are areas of overlap with features of recreational sensitivity. Option D/PAG OL transects with the following two Recreation Feature Inventory attributes at both the North Polygon and South Polygon:

North Polygon:

- RFI#10716, Medium Sensitivity-Medium Significance, 774 ha (4.37%); and
- RFI# 10769, Unknown Sensitivity-Unknown Significance, 6 ha (0.12%).

South Polygon:

- RFI#10716, Medium Sensitivity-Medium Significance, 197 ha (1.11%); and
- RFI# 10769, Unknown Sensitivity-Unknown Significance, 198 ha (4.02%).

Heritage

Option D/PAG OL TSF does not overlap with any known archaeological sites or paleontological sites. Option D/PAG OL TSF does, however, overlaps with 34 known heritage features, including the remains of a historic cabin, 29 blazed trees and four culturally modified trees; these heritage features are not protected byt the *HCA* (1996b).

While this option does not overlap with any known archaeological sites, the site boundaries for archaeological site FhSf-4 are approximately 50 m from the small tailings pond component situated along Davidson Creek. This site is therefore at increased risk of impacts during construction.

Current Use of Lands and Resources for Traditional Purposes

Option D/PAG OL TSF is located entirely within the LDN, STN and UFN traditional territories. For the three Aboriginal groups whose traditional territories overlap with the Option D/PAG OL TSF (LDN, STN, and UFN), Table 5.2-27 presents the potential effects of this option on co current use of lands and resources for traditional purposes.

5.2.3.4 Project Economics Summary of Option D/PAG OL

A general summary of the Project economics setting of Option D/PAG OL is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-4 in Section 5.3. The total undiscounted cost (including capital, operating, and closure costs) of Option D/PAG OL is estimated to be $579,000,000, or $0.73/tonne. This total cost does not include fish habitat compensation costs.

Table 5.2-27. Potential Effects of Option D/PAG OL on Aboriginal Current Use of Lands and Resources for Traditional Purposes

Concern or Issue	Potential effect to current use of lands and resources for traditional purposes		
	Lhoosk'uz Dene Nation	Skin Tyee Nation	Ulkatcho First Nation
Hunting	No specified use of area for hunting. Option may overlap with hunting areas.	Hunting locations identified in the Project footprint; other hunting occurs in areas around Davidson and Chedakuz creeks and Tatelkuz Lake.	UFN hunting occurs on Mount Davidson, near Tatelkuz Lake and along Chedakuz Creek.
Trapping	Option overlaps on trapline tenure held by a member of LDN (TR0512T027), this tenure is not currently being used; 217 ha of high-quality American marten habitat	No trapping locations identified in the Project footprint. Trapping locations identified areas around Davidson and Chedakuz creeks and Tatelkuz Lake. No STN registered traplines identified in the area.	No overlap with trapline tenures held by UFN members
Fishing	LDN fish at Davidson and Chedakuz creeks and Tatelkuz and Kuyakuz lakes. LDN identified the lower reaches of Davidson Creek as having important fishing value.	No fishing use identified in the Project footprint.	No known fishing use in the Project footprint. UFN fish at Chedakuz Creek and Tatelkuz Lake, and have a fish camp at Kuyakuz Lake.
Harvest of Traditional Plants	No known gathering use in the Project footprint. Option may overlap areas for the harvest of traditional plants. LDN harvest plants around Tatelkuz and Kuyakuz Lake and along the Messue Wagon Trail.	The Project footprint was not identified as a harvesting areas. STN harvest near Chedakuz Creek and Tatelkuz Lake, and along the Messue Wagon Road Trail.	Harvesting areas have not been identified in the Project footprint. Option may overlap areas for the harvest of traditional plants while using the area for other purposes (camping, trail use).
Use of Cultural/ Traditional Sites	No known use of area for spiritual or traditional purposes	One culturally significant named place is located in the Project footprint. There are important transportation routes and trails between Tatelkuz Lake and Kuyakuz Lake. Campsites and gathering areas are identified around Tatelkuz Lake, Tsacha Lake, Johnny Lake and Top Lake, Fawnie Dome and Mount Tatelkuz.	Overlaps with 34 known heritage features, including the remains of a historic cabin, 29 blazed trees and four culturally modified trees. A trail, campsite, and a place name were identified within the area of the Project footprint.

Initial Capital Costs

The Option D/PAG OL TSF has the highest initial capital costs. Although the option has a relatively low starter dam volume (8.5 Mm^3), the option requires approximately 50 Mm^3 of material for the on-land PAG dump platform. The option requires the construction of the downstream ECD. The on-land PAG dump may require a high bonding cost from regulators. The initial capital costs are estimated to be $196,000,000.

Sustaining Capital and Operating Costs

The Option D/PAG OL TSF has the lowest sustaining capital costs. The option has one relatively large dam (46 Mm^3). The on-land PAG dump will require ongoing water treatment to meet discharge standards, but these costs will be offset by the shorter haul distance and simple placement of the PAG material. The sustaining capital and operating costs are estimated to be $217,000,000.

Closure Costs

The Option D/PAG OL TSF has the highest closure costs as closure of two facilities will be required. The on-land PAG dump will most likely require long-term water treatments to meet discharge standards. The closure costs are estimated to be $166,000,000.

PAD Compensation Costs

The Option D/PAG OL TSF will create approximately 7.9 ha of PAD. The approximate habitat compensation costs for this PAD is $3.55M.

5.2.4 Option E

The Option E TSF alternative is located on the north slope of Mount Davidson within the upper portion of the Creek 661 watershed, approximately four km northeast of the Blackwater deposit (Figure 4.1-7). The impoundment will be created by constructing a three-sided main dam wrapping the facility. The impoundment is constrained by topography to the southwest.

5.2.4.1 Technical Summary of Option E

A general technical summary of the construction, operation and closure approaches of Option E are provided in Table 4.4-1. The proposed layout of the Option E TSF is provided in Figure 4.1-7. Further technical detail is provided here, and comparative data are summarized in Table 5.3-1 in Section 5.3.

Option E TSF involves storing tailings in a TSF located approximately four kilometres northeast of the deposit, as measured from the centre of the open pit to the centre of the TSF. The ultimate TSF would have a footprint area of approximately 8 km^2. A temporary stockpile of NAG waste rock and overburden could be constructed on either side of the open pit; however the total construction material volume for the Site E embankment exceeds the available NAG waste rock and overburden produced by the feasibility study mine plan (New Gold 2014).

The TSF starter embankment would be constructed with local borrow material initially and then from the pre-stripping of the open pit. One starter dam would be required initially for the main embankment 52 m high.

The TSF embankment would be progressively expanded using NAG waste materials from the open pit and processed filter and transition zone material from local borrow areas. The TSF would ultimately include one three-sided embankment. The ultimate embankment would be 152 m high, and requires approximately 118 Mm^3 of embankment fill. The embankment would be a zoned earthfill and rockfill dam, expanded over the life of the project using the centreline method of construction. The embankment would have a crest width of 50 m and downstream slopes of 2H:1V. The ultimate volumetric storage efficiency of the TSF for Site D is considered to be poor.

Foundation conditions at the embankment locations are characterized by a very thick sequence of overburden underlain by a completely weathered bedrock layer, and then competent bedrock. The surficial material has been classified as channelized and non-channelized glaciofluvial deposits, and lodgement glacial till. The main embankment requires a cut-off trench expected to be in excess of 10 m deep.

Seepage would be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the embankment would be collected in embankment drains and conveyed to the seepage collection ponds at a minimum of four locations downstream of the embankment. Seepage would be recycled back to the TSF. Seepage control would be the most challenging of the options. The topography of the area is generally opening up with several meandering creeks emanating from the TSF basin area. Potential flow pathways would be less predictable than a TSF in Davidson Creek, which generally funnels flows towards the creek. Unrecoverable seepage passing the collection and recycle systems potentially affect two watersheds; Creek 661 and Davidson Creek.

PAG waste would be co-disposed within the TSF in such a manner that it is progressively encapsulated by the tailings and saturated by the supernatant pond to prevent oxidation and subsequent acid generation. PAG haul distances would be in the order of 5 km downhill haulage.

The catchment area for the Site E alternative without modification is 30 km^2. The total area reporting to the TSF falls well below the 50 km^2 required to maintain a water balance under average conditions in the early years of mine waste disposal. Additional make-up water to supplement the process would be required from a water supply dam in the Davidson Creek catchment or from other external surface water sources, such as Tatelkuz Lake.

Tailings discharge during operations would be by gravity for the entire mine life. Some energy dissipation measures may be required for the tailings stream in the early years of tailings deposition. A tailings spill collection system would be required for the section of 1,300 m of tailings pipeline outside the TSF catchment. Selective discharge of tailings around the facility during the final years of operations would establish and flatten final tailings beaches to facilitate surface water management and reclamation.

Upon mine closure, surface facilities would be removed in stages and full reclamation of the TSF would be initiated. An overburden cover of at least 0.3 m would be established over the PAG waste

rock dump and tailings. Wetlands would be established and upland beaches would be vegetated. The tailings supernatant pond would maintained at its final level while pumping excess inflows to the open pit to accelerate filling of the pit lake. A riprap lined closure spillway sized for the PMF would be established towards Creek 661. All roads, ponds, and ditches not required beyond mine closure would be removed and regraded.

5.2.4.2 Environmental Summary of Option E

A general summary of the environmental setting of Option E is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-2 in Section 5.3.

Surface Water Hydrology

Option E is located primarily in the Creek 661 watershed. A small portion of the TSF footprint is contained in the Davidson Creek Watershed; changes to the Davidson Creek watershed as a result of the Option E TSF are negligible with respect to those in Creek 661, and are not considered in this assessment. The design of Option E includes a three sided embankment that is located upstream of the confluence of Creek 661 and Creek 146920. Portions of Creek 661, Creek 543585, Creek 146920 and Creek 505659 lie within the footprint of the TSF.

Stream shapes within the footprint of the TSF vary from sinuous to irregularly wandering. Morphologies include Riffle-pool in Creek 505659 and riffle-pool with cobble in Creek 146920 Downstream of the TSF in the main channel of Creek 661 the dominant substrate size measured is pebbles followed by cobbles (AMEC 2013j).

The potential changes to surface water hydrology are considered for Creek 661 and are summarized in Table 5.2-28. The potential impact to timing and distribution of flows are measured on a qualitative scale from negligible to extreme.

Table 5.2-28. Potential Changes to Surface Water Hydrology for Option E TSF

	Creek 661
Potential catchment loss to toe of TSF using watershed area	36.1%
Potential impacts to timing and distribution of flows	high

Surface Water Quality

The near-field or immediate receiving environment for discharge to the north from the proposed tailings impoundment is Creek. One monitoring stations, WQ3, was used for water quality analysis in the immediate receiving environment (AMEC 2013g). Data used in this analysis were collected at WQ3 from March 2011 to December 2012. Mean annual water quality data from the study site on Creek 661 have exceedances of BC 30-day mean guidelines for total cadmium, total zinc, and dissolved aluminum. The mean annual concentrations for the assessed parameters in the receiving environment for Option E are: sulphate 1.47 mg/L, cadmium 0.00001 mg/L, and zinc 0.003 mg/L. Based on existing baseline conditions Option E has the moderate potential for water quality effects due to good baseline water quality and potential to impact one watershed.

The expected volume of NAG material required to construct the embankments for Option E is 118 Mm^3. This is a high potential for water quality effects as it is the highest volume of the proposed options.

Groundwater Quantity and Quality

The groundwater quality baseline study at the site shows typical groundwater quality with no anomalies regarding potential groundwater pollution.

Relative to other Options, the potential impacts of Option E to groundwater quantity and quality may be limited within the Creek 661 watershed. The potential impacts, including the changes in groundwater flow patterns and base flow discharge and the degradation of groundwater quality due to the poor quality of seepage, are potentially moderate.

This Option avoids the potential impacts of a separate on land PAG stockpile. Relative to other Options, seepage management challenges are potentially moderate.

Aquatic Habitat

No endangered or vulnerable non-fish aquatic organisms were observed in sites potentially affected by the Option E TSF.

Fish and Fish Habitat

Downstream reaches of Creek 661 and tributary Creek 505659 are fish bearing; however, they have not been sampled within the Option E TSF footprint, and are assumed to be fish bearing for this report. Rainbow Trout are the only species to be captured in upper Creek 661. The Creek 661 watershed has no barriers to upstream migration; therefore, it is assumed to support a single population of Rainbow Trout (a lake-resident population that overwinters in Tatelkuz Lake). Spawners migrate up Middle Chedakuz Creek and then into Creek 661 to spawn, while juveniles rear in Creek 661 and its tributaries. Rainbow Trout habitat quality in Creek 661 is fair for spawning and overwintering and good for rearing and migration. Rainbow Trout habitat quality in Creek 661 tributaries ranges from fair to good for spawning and overwintering and is good for rearing and migration.

No fish species of conservation concern have been captured in the Option E TSF footprint. Brassy Minnow, a species classified by the BC CDC (2013) as "S2S3" (i.e., "Imperilled. Special concern. Vulnerable to extirpation or extinction.") inhabit Tatelkuz Lake, which is located in the ALSA downstream of the Option E TSF, in the Creek 661 watershed.

Downstream Fisheries Values

Downstream Rainbow Trout Values

Rainbow Trout are present in Creek 661 and its tributaries, in Lower and Middle Chedakuz Creek and in Tatelkuz Lake downstream of the Option E TSF. Tributaries to Tatelkuz Lake may also be influenced by TSF construction due to groundwater seepage. Rainbow Trout distribution and habitat quality are presented in Table 5.2-29.

Table 5.2-29. Rainbow Trout Values Downstream of Option E TSF

Watercourse	Susceptibility to Potential Downstream Effects	Distribution	Habitat Quality
Lower and Middle Creek 661	Predominantly susceptible	Chedakuz Creek confluence to Creek 661 Reach 6.	Good quality rearing and migration habitat, fair quality spawning and overwintering habitat.
Creek 661 tributaries	Predominantly susceptible	All tributaries**	Good quality rearing and migration habitat, fair quality spawning and overwintering habitat.
Lower Chedakuz Creek	Predominantly susceptible	RSA boundary to Tatelkuz Lake.	Good quality habitat for all life stages.
Middle Chedakuz Creek	Predominantly susceptible	Tatelkuz Lake to confluence with Creek 661.	N/A
Tatelkuz Lake	Predominantly susceptible	Adult and overwintering fish from the Davidson Creek, Chedakuz Creek and Creek 661 populations.	Critical overwintering habitat
Tatelkuz Lake tributaries	Potentially susceptible	Creek 579340 to headwaters including Snake Lake**, other unnamed tributaries.**	Fair quality rearing habitat, poor quality migration habitat and no spawning or overwintering habitat.

N/A: Not sampled.
** Mean electrofishing density from 2011 and 2012 surveys.*
*** Rainbow Trout are presumed to be present but were not captured in all tributaries in 2011 and 2012 summer inventory surveys.*

Downstream Kokanee Values

Kokanee are typically a lake-dwelling species; however, they spawn in streams. Creek 661 and Lower and Middle Chedakuz Creek, located downstream of the Option E TSF, contain spawning habitat for Kokanee from Tatelkuz Lake. The distance between the toe of tailings containment dams associated with the Option E TSF and the first occurrence of downstream spawning Kokanee is 4.7 km in Creek 661.

Table 5.2-30 presents the distribution and quality of Kokanee spawning habitat in areas downstream of the Option E TSF.

Downstream Mountain Whitefish Values

Fall spawning surveys downstream of the Option E TSF in Creek 661 did not capture Mountain Whitefish. The lack of captures of spawning Mountain Whitefish in Creek 661 indicates that the number of Mountain Whitefish using streams that may be affected by construction of the Option E TSF is very low compared to Rainbow Trout and Kokanee.

Potential Impacts on Fish and Fish Habitat

The construction of the Option E TSF would result in the permanent alteration to, or destruction (PAD) of, fish habitat in an area of approximately 1.7 ha.

Table 5.2-30. Kokanee Values Downstream of Option E TSF

Watercourse	Susceptibility to Potential Downstream Effects	Spawning Habitat Distribution and Quality	Critical Rearing and Overwintering Habitat Distribution
Lower Creek 661	Predominantly susceptible	Chedakuz Creek confluence to Creek 661 Reach 3 (7.1 km), high quality spawning habitat in Reaches 1 to 4.	Tatelkuz Lake
Lower Chedakuz Creek	Predominantly susceptible	RSA boundary to confluence with Davidson Creek, high quality spawning habitat.	Tatelkuz Lake
Middle Chedakuz Creek	Predominantly susceptible	Tatelkuz Lake to confluence with Creek 661, high quality spawning habitat.	Tatelkuz Lake

The Creek 661 Rainbow Trout population would be affected by the construction of the Option E TSF primarily by the loss of good quality rearing and migration habitat in upper Creek 661 and its tributaries. This habitat loss may influence population density as the availability of rearing habitat for Rainbow Trout that spawn in Lower Creek 661 would be limited by direct habitat loss and because the TSF would act as a permanent barrier to upstream passage, preventing access to the upper reaches of Creek 661 where rearing habitat quality is good.

Additionally, downstream reductions in stream flow resulting from the construction of the Option E TSF may affect Rainbow Trout and spawning Kokanee in Lower Creek 661 and Chedakuz Creek. Tatelkuz Lake contains critical rearing and overwintering habitat for the Creek 661, Chedakuz Creek, and Davidson Creek Kokanee populations and also contains overwintering habitat for Rainbow Trout. Fish in Tatelkuz Lake and its tributaries, as well as Rainbow Trout in Chedakuz Creek and reaches of Creek 661 and its tributaries could be affected by seepage or discharge of contaminated tailings water into the downstream environment.

Terrestrial Wildlife

The mine site TELSA is characterized by mountainous topography with steep relief descending into Davidson Creek dominated by subalpine fir, Engelmann spruce, and lodgepole pine. The wildlife habitat is characterized by a mosaic of high elevation forest, wetlands, riparian, and mature forests with minor amounts of forestry impact.

Seven species of conservation concern were recorded in Option E during baseline studies (see Table 1.8-3 for status designations; AMEC 2013p): western toad, caribou, little brown myotis, northern myotis, Haget's bluet, barn swallow, and northern goshawk. Two species listed under the *Species at Risk Act* (2002d) were recorded: one as special concern: western toad and one as threatened species: caribou. Two observed species were listed as endangered by COSEWIC (COSEWIC 2012b), but not by the *Species at Risk Act* (2002d): little brown myotis and northern myotis. Additionally, one observed species were listed as threatened by COSEWIC (COSEWIC 2012a), but not by the *Species at Risk Act* (2002d): barn swallow.

Habitat suitability modeling exercises identified high-quality habitat that would be directly removed by the TSF or indirectly affected (i.e., within a 100 m buffer of the TSF) by the TSF for the following species: grizzly bear, caribou, moose, American marten, myotis spp. western toad, olive-sided flycatcher, and red-tailed hawk. The areas affected for each species are provided in detail in Tables 5.2-31 through 5.2-35).

Table 5.2-31. Wildlife Implications of Option E TSF

Species	Total Direct and Indirect Loss of High-quality Habitat[1]
Grizzly bear	173.1 ha (18.6% of the TSF footprint area)
Caribou	358 ha (38.5% of the TSF footprint area)
Moose	122.3 ha (13.1% of the TSF footprint area)
American Marten	280.1 ha (30.1% of the TSF footprint area)
Myotis spp.	507.2 ha (54.5% of the TSF footprint area)
Western toad	300.6 ha (32.3% of the TSF footprint area)
Terrestrial Birds (Olive-sided flycatcher)	507.4 ha (54.5% of the TSF footprint area)
Raptors (Red-tailed hawk)	360.4 ha (38.7% of the TSF footprint area)

[1] *Total loss of high-quality habitat represents the cumulative total amount of the various habitat requirements (e.g., grizzly bear = feeding spring, feeding summer, feeding fall, security thermal and hibernating; Table 5.2-29).*

Table 5.2-32. Amounts of High Value Habitat from Habitat Suitability Mapping for Grizzly Bear Affected by the Option E TSF, with and without 100 m Buffer

	Total Area (ha)	Grizzly Bear				
		Feeding Spring (ha)	Feeding Summer (ha)	Feeding Fall (ha)	Security/Thermal - Growing (ha)	Hibernating (ha)
TSF footprint only	791	0	0	20.6	20.6	147.7
TSF footprint plus 100 m buffer	930	0	0	21.8	21.8	173.1

Table 5.2-33. Amounts of High Value Habitat from Habitat Suitability Mapping for Caribou Affected by the Option E TSF, with and without 100 m Buffer

	Total Area (ha)	Caribou				
		Feeding Winter (ha)	Feeding Spring (ha)	Feeding Summer(ha)	Security/Thermal - Winter (ha)	Security/Thermal - Growing (ha)
TSF footprint only	791	293.6	293.6	253.4	144.5	144.5
TSF footprint plus 100 m buffer	930	336.2	336.2	295.9	169.9	169.9

Vegetation, Ecosystems, and Wetlands

The Option E TSF would cause the direct removal of 91 ha of mature forest, 121 ha of riparian areas, and less than one ha of ecosystems at risk (a blue-listed wetland). Additionally, baseline studies identified one representative of the BC blue-listed moss species *Tomentypnum falcifolium*. No whitebark pine were identified within the Option E TSF footprint, nor were any sparsely vegetated identified during field surveys or TEM mapping.

Table 5.2-34. Amounts of High Value Habitat from Habitat Suitability Mapping for Moose Affected by the Option E TSF, with and without 100 m Buffer

	Total Area (ha)	Moose			
		Feeding Winter (ha)	Feeding Growing (ha)	Security/Thermal - Winter (ha)	Security/Thermal - Growing (ha)
TSF footprint only	791	61.9	48.5	61.9	108.5
TSF footprint plus 100 m buffer	930	72.8	57.8	72.8	122.3

Table 5.2-35. Amounts of High Value Habitat from Habitat Suitability Mapping for Marten, Myotis, Western Toad, Birds, and Raptors Affected by the Option E TSF, with and without 100 m Buffer

	Total Area (ha)	Marten		Myotis	Western Toad	Terrestrial Birds	Raptors
		Living Winter (ha)	Living Growing (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)
TSF footprint only	791	239.6	239.6	437.4	259.5	437.6	308.9
TSF footprint plus 100 m buffer	930	280.1	280.1	507.2	300.6	507.4	360.4

The total wetland area that will be removed by the Option E TSF, including the previously mentioned blue-listed wetlands, will be 148 ha. Options that affect listed wetlands and are reviewed by Environment Canada will require a conservation plan to meet the federal policy on wetland conservation.

Air Quality

During construction and operation, the effect of Option E on air quality would be related to fugitive dust and emissions from diesel-fuelled heavy equipment and blasting associated with building the dams and TSF supporting infrastructure (i.e., roads, plant site, and water diversions infrastructure), and to fugitive dust from tailings beaches and embankments. The volume of diesel emissions and fugitive dust for the dams would be related to the haul distances and the volume of local material required to for the starter dams and the core. The emissions for the supporting infrastructure would directly relate to the length of the supporting infrastructure and the site-specific terrain challenges of building the infrastructure. During operations and closure, exposed areas of tailings and waste rock may be subjected to wind erosion, causing wind-blown fugitive dust. Reclamation and capping of the tailings and waste rock would minimize the potential for fugitive dust.

Option E TSF footprint is 6.5 km^2. The TSF is large enough to eliminate on land waste rock stockpile and therefore reduce fugitive dust associated with wind eroson. If tailings beach is dry, fugitive dust emissions may be emitted. Since the option E is located east of the construction and operation camp, wind from the southwest is less likely to affect the camp. The TSF is approximately 4 km away from the deposit. Fugitive road dust and vehicle exhaust will be emitted when haul trucks travel from the open pit to the TSF. However, air quality models predict that fugitive dust from the TSF will not

result in residual effects for the Project for TSF Option E. As TSF Option E utilizes the same general construction, operations, and closure approaches to TSF Option FS, fugitive dust emissions from Option E are expected to be minimal.

5.2.4.3 Socio-Economic Summary of Option E

A general summary of the socio-economic setting of Option E is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-3 in Section 5.3.

Non-Traditional Land and Resource Use

The Option E TSF overlaps with two known commerical land use tenures. Option E is located within 1 trapline tenure, overlapping 792 ha of TR1205330 (2.1% of tenure) and has the potential to affect trapping due to potential displacement and a reduction in available wildlife. Option E also overlaps 792 ha of guide outfitting tenure 1206416 (1.46% of tenure).

Option E does not overlap with any known Forestry or Commerical recreation tenures; nor does it overlap with any mineral claims.

Parks and Protected Areas

In terms of recreational land uses, Option E does not overlap with any parks or protected areas however; there are areas of overlap with features of recreational sensitivity. Option E transects with the following two Recreation Feature Inventory attributes:

- RFI#10716, Medium Sensitivity-Medium Significance, 768 ha (4.34%); and
- RFI# 10769, Unknown Sensitivity-Unknown Significance, 24 ha (0.49%).

Heritage

Option E TSF does not overlap with any known archaeological sites or paleontological sites. Option E TSF does, however, overlap with 11 known heritage features, including eight blazed trees and three culturally modified trees; these heritage features are not protected by the *HCA* (1996b).

Current Use of Lands and Resources for Traditional Purposes

The Option E TSF is located entirely within the LDN and STN territories. The Option partially overlaps the UFN territory (81 ha); however, a conservative approach was used for the for the purposes of this assessment, and it is assumed that the Ulkatcho First Nation may practice the current use of lands and resources for traditional purposes throughout all of the Option E TSF footprint. For the three Aboriginal groups whose traditional territories overlap with the TSF (LDN, STN, and UFN), Table 5.2-36 presents potential effects of Option E to current use of lands and resources for traditional purposes.

Table 5.2-36. Potential Effects of Option E on Aboriginal Current Use of Lands and Resources for Traditional Purposes

Concern or Issue	Potential Effect to Current Use of Lands and Resources for Traditional Purposes		
	Lhoosk'uz Dene Nation	Skin Tyee Nation	Ulkatcho First Nation
Hunting	No specified use of area for hunting. Option may overlap with hunting areas.	Hunting locations identified in the Project footprint; other hunting occurs in areas around Davidson and Chedakuz creeks and Tatelkuz Lake.	UFN hunting occurs on Mount Davidson, near Tatelkuz Lake and along Chedakuz Creek.
Trapping	Option overlaps on trapline tenure held by a member of LDN (TR0512T027), this tenure is not currently being used; and 280 ha of high-quality American marten habitat.	No trapping locations identified in the Project footprint. Trapping locations identified areas around Davidson and Chedakuz creeks and Tatelkuz Lake. No STN registered traplines identified in the area .	No overlap with trapline tenures held by UFN members.
Fishing	LDN fish at Davidson and Chedakuz creeks and Tatelkuz and Kuyakuz lakes. LDN identified the lower reaches of Davidson Creek as having important fishing value.	No fishing use identified in the Project footprint.	No known fishing use in the Project footprint. UFN fish at Chedakuz Creek and Tatelkuz Lake, and have a fish camp at Kuyakuz Lake.
Gathering	No known gathering use in the Project footprint. Option may overlap areas for the harvest of traditional plants. LDN harvest plants around Tatelkuz and Kuyakuz Lake and along the Messue Wagon Trail.	The Project footprint was not identified as a harvesting areas. STN harvest near Chedakuz Creek and Tatelkuz Lake, and along the Messue Wagon Road Trail.	Harvesting areas have not been identified in the Project footprint. Option may overlap areas for the harvest of traditional plants while using the area for other purposes (camping, trail use).
Use of Cultural and Traditional Sites	No known use of area for cultural or traditional purposes.	One culturally significant named place is located in the Project footprint. There are important transportation routes and trails between Tatelkuz Lake and Kuyakuz Lake. Campsites and gathering areas are identified around Tatelkuz Lake, Tsacha Lake, Johnny Lake and Top Lake, Fawnie Dome and Mount Tatelkuz.	Overlaps with 11 known heritage features, including eight blazed trees and three culturally modified trees. A trail, campsite, and a place name were identified within the area of the Project footprint.

5.2.4.4 Project Economics Summary of Option E

A general summary of the Project economics setting of Option E is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-4 in Section 5.3. The total undiscounted cost (including capital, operating, and closure costs) of Option E is estimated to be $832,000,000, or $1.05/tonne. This total cost does not include fish habitat compensation costs.

Initial Capital Costs

The Option E TSF has high initial capital costs, due to a large starter dam size of 15 Mm^3. The option requires the construction of the downstream ECD and likely a make-up water reservoir on Davidson Creek. The initial capital costs are estimated to be $170,000,000.

Sustaining Capital and Operating Costs

The Option E TSF has the highest sustainaing capital and operating costs, as the option has the largest dam volume of all the options (103 Mm^3). Insufficient NAG material is available for construction of this dam, and additional borrow sources will be required. The sustaining capital and operating costs are estimated to be $630,000,000.

Closure Costs

The Option E TSF has high closure costs, as closure of the large dam would be very challenging and may incur additional engineering costs. The high pressure head and broad seepage face caused by the large long dam would drive seepage and long-term active pumpback of seepage would be required. However, long-term water treatment costs will be minimal as it is anticipated that water treatment can occur through a fully passive system (i.e., wetlands). The closure costs are estimated to be $65,000,000.

PAD Compensation Costs

The Option E TSF will create approximately 1.7 ha of PAD, which is the lowest amount of PAD among the TSF options. The approximate habitat compensation costs for this PAD is $0.76M.

5.2.5 Option FS

The Option FS TSF, a combination of the Options C and D, is located on the north slope of Mount Davidson within the Davidson Creek sub-basin, approximately four km north of the Blackwater deposit (Figure 4.1-8). The location is contained by high ground along its north, west and south margins, and would require impoundment along the east and part of the west margins.

5.2.5.1 Technical Summary of Option FS

A general technical summary of the construction, operation and closure approaches of Option FS are provided in Table 4.1-1. The proposed layout of the Option FS TSF is provided in Figure 4.1-8. Further technical detail is provided here, and comparative data are summarized in Table 5.3-1 in Section 5.3.

Option FS would involve co-disposal of tailings and PAG waste rock in a conventional sub-aqueous impoundment. Tailings would be deposited around the perimeter of the TSF from the embankment crests. NAG5, overburden and limited NAG4 waste rock would be disposed of in a waste dump(s) near the pit and/or used to construct the TSF embankments. The PAG waste rock would be co-disposed in the impoundment in such a manner that it becomes progressively saturated by the supernatant pond to prevent oxidation and subsequent acid generation.

The Option FS TSF will be composed of three containment dams: a main Site-D Dam, a main Site-C Dam and a smaller Site-C saddle Dam (see Figure 4.1-8). The dams would be constructed primarily out of overburden and NAG5 material with 3H:1V slopes. The embankments would be progressively expanded to the ultimate heights of the two main dams (135 m and 88 m), however, due to a potential shortage of available NAG5 construction materials, limited NAG4 waste rock may be required for construction of the Site D Main Dam, resulting in a small increased ML risk. Geochemical testing to date has found little difference in ML potential of NAG4 vs NAG5 waste rock.

Two starter embankments will be required for the two main dams, which will be sized large enough to contain volumes from approximately two years of tailings and PAG waste rock production. The initial tailings embankments would be primarily constructed using a combination of local borrow sources and pit NAG overburden stripping.

The catchment area for Option FS would be approximately 50 km^2, which is approximately 60% of the total catchment area of the Davidson Creek Watershed. This option would incorporate the following water management strategies to protect the aquatic environment downstream of the TSF (e.g., minimize sediment transport and water quality effects from seepage) and provide sufficient process water:

- cofferdams and sediment ponds to manage water during construction by either routing water around the TSF or directing water to the TSF for collection;
- three zoned water-retaining earth-rockfill dams to minimize infiltration and seepage;
- designated PAG waste storage areas within the TSF to facilitate rapid subaqueous placement of PAG waste rock;
- ECD and interception trenches to capture seepage downstream of the Site-D main dam (approximately 1.4 km downstream) and return this water to the TSF;
- collection channels that route water to the TSF;
- diversion channels bordering the TSF to redirect surface runoff away from the impoundment and dams;
- reclaim water system to provide process water to the plant; and
- supernatant water pond to provide water cover of the TSF.

The footprint of the TSF would be approximately 11 km^2 and would cover a portion of the Davidson Creek Watershed starting at the headwaters and continuing downstream past the confluence of Upper Davidson Creek and Creek 688328. Under average precipitation conditions, Option FS would be subject to water surplus conditions during later years. However, Option FS would be managed

into a water balance condition by diverting portions of the upper Davidson creek drainage area around the TSF for later years depending upon the volume of water stored in the TSF at that time.

Foundation conditions for Option FS would require up to 15m of sand and gravel excavation for a seepage cutoff trench. A low permeability lodgemont till underneath Option FS will limit seepage under the TSF dam and from the TSF basin.

During operations, tailings would firstly be piped though gravity feed, and then pumped to the TSF when the embankment crest becomes higher than the plant site. Seventeen kms of tailings pipeline and 6.5 kms of reclaim pipeline would be required for the option.

The total TSF storage volume for Option FS is estimated to be 74 Mm^3.

During closure, a rock closure spillway directing water from the TSF to Davidson Creek would be constructed. A 0.3 m overburden layer will be used as cover for tailings and PAG waste rock. The purpose of this layer would be to provide physical separation of underlying metal leaching materials from the dam water column, thereby minimizing contamination of surface water discharges from the TSF. The tailings areas of the dams would maintain a 1 m freeboard at the crest of the dam, with the perimeter back of the dam crest to be graded to support drainage to the lowest elevation.

5.2.5.2 Environmental Summary of Option FS

A general summary of the environmental setting of Option FS is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-2 in Section 5.3.

Surface Water Hydrology

The Option FS TSF is located in the headwaters of Davidson Creek and covers the areas described above for both Options C and D. The footprint of the TSF is the largest of the options covering 11 km^2 of the Davidson Creek Watershed. The design includes 3 dams, one downstream of the outlet of Lake 01682LNRS, another upstream of the confluence of Creek 776798 with Davidson Creek and one upstream of the confluence of Creek 636713. Streams covered by the footprint include; Davidson Creek, Creek 636713, Creek 688328, Creek 776798, Creek 758727, Creek 704454, Creek 899664 and Creek 896157.

The potential changes to surface water hydrology are considered for Davidson Creek and are summarized in Table 5.2-37. The potential impact to timing and distribution of flows are measured on a qualitative scale from negligible to extreme.

Table 5.2-37. Potential Changes to Surface Water Hydrology for Option FS TSF

	Davidson Creek
Potential catchment loss to toe of TSF using watershed area	53.3%
Potential impacts to timing and distribution of flows	high

Surface Water Quality

The near-field or immediate receiving environment for discharge to the north from the proposed tailings impoundment is Davidson Creek. One monitoring station, WQ10, was used for water quality analysis in the immediate receiving environment (AMEC 2013g). Data used in this analysis were collected at WQ10 from March 2011 to December 2012. Mean annual water quality data from this study site on Davidson Creek have exceedances of BC 30-day mean guidelines for dissolved aluminum. The mean annual concentrations for the assessed parameters in the receiving environment for Option FS are: sulphate 1.94 mg/L, cadmium 0.00001 mg/L, and zinc 0.002 mg/L. Based on existing baseline conditions Option FS has a moderate risk due to good baseline water quality and one potentially affected watershed; however, baseline conditions are derived from one monitoring station.

The expected volume of NAG material required to construct the embankments for Option FS is 74 Mm^3. This is a moderate potential for water quality effects as it is within the range of the proposed options.

Groundwater Quantity and Quality

The groundwater quality baseline study at the site shows that typical groundwater quality with no anomalies regarding potential groundwater pollution.

Option FS is near or crosses the watershed divides to the north/northwest and southeast, and may potentially cause impacts to groundwater quantity and quality in several watersheds (Davidson Creek, Turtle Creek, Creek 661 and possibly further distant in the Tatelkuz Lake tributary catchment) as the mounding water in the tailing cell may alter the watershed divides. The potential impacts to groundwater flow would be predominantly within the Davidson Creek watershed and much less in other watersheds. A hydraulic barrier would be constructed adjacent to the West Saddle Dam and would prevent seepage loss to Creek 705.

This Option avoids the potential impacts of a separate on land PAG stockpile. However, the Option is located in the groundwater recharge zones at the headwaters and may pose seepage management constraints from migration of seepage through shallow and deep groundwater into the receiving environment. A benefit of this design option is the placement of an ECD interception system downstream from the TSF for seepage collection and recycle to the TSF.

Aquatic Habitat

The BC blue-listed freshwater mollusc *Acroloxus coloradensis* was observed in the headwater 01682LNRS Lake, which would be proximate to the Option FS infrastructure. *A. coloradensis* is listed as a taxon of "Special Concern", which is assigned to organisms potentially sensitive or vulnerable to human activities or natural events. No aquatic species of conservation concern, including the aforementioned mollusc, were identified in the Section 79(1) notification under the *Species at Risk Act* (2002d).

Fish and Fish Habitat

Davidson Creek and some of its tributaries are fish bearing within the Option FS TSF. The Option FS TSF is located in Upper Davidson Creek and the headwaters of Creek 661 where Rainbow Trout are

the only fish species present. Upper Davidson Creek provides good quality rearing habitat for juveniles from both the Davidson Creek and the Davidson Creek Headwaters Rainbow Trout populations. It also contains spawning habitat for fish from the Davidson Creek Headwaters population. The Rainbow Trout populations in Davidson Creek are separated by a partial impediment to fish passage in Reach 11 created by a steep series of cascades that are impassable during low summer flows and potentially during freshet. Headwater tributaries to Creek 661 within the Option FS TSF have good quality rearing and migration habitat for Rainbow Trout from the Creek 661 population that overwinters in Tatelkuz Lake.

No fish species of conservation concern have been captured in the Option FS TSF footprint. Brassy Minnow, a species classified by the BC CDC (2013) as "S2S3" (i.e., "Imperilled. Special concern. Vulnerable to extirpation or extinction") inhabit Tatelkuz Lake, which is located in the ALSA downstream of the downstream of the Option FS TSF, in the Creek 661 watershed.

Downstream Fisheries Values

Downstream Rainbow Trout Values

Rainbow Trout are present in the Davidson Creek, Creek 661 and Tatelkuz Lake watersheds downstream of the Option FS TSF, including Davidson Creek, Lower Chedakuz Creek, Creek 661 and its tributaries, Middle Chedakuz Creek, and Tatelkuz Lake. Rainbow Trout distribution and habitat quality are presented in Table 5.2-38.

Table 5.2-38. Rainbow Trout Values Downstream of Option FS TSF

Watercourse	Susceptibility to Potential Downstream Effects	Distribution	Habitat Quality
Lower and Middle Davidson Creek	Predominantly susceptible	Chedakuz Creek confluence to Davidson Creek Reach 10.	Good quality habitat for all life stages.
Lower Chedakuz Creek	Predominantly susceptible	RSA boundary to confluence with Davidson Creek.	Good quality habitat for all life stages.
Lower and Middle Creek 661	Potentially susceptible	Chedakuz Creek confluence to headwaters.	Good quality rearing and migration habitat, fair quality spawning and overwintering habitat.
Creek 661 tributaries	Potentially susceptible	All tributaries**	Good quality rearing and migration habitat, fair quality spawning and overwintering habitat.
Middle Chedakuz Creek	Potentially susceptible	Tatelkuz Lake to confluence with Creek 661.	N/A
Tatelkuz Lake	Potentially susceptible	Adult and overwintering fish from the Davidson Creek, Chedakuz Creek and Creek 661 populations.	Critical overwintering habitat.

(continued)

Table 5.2-38. Rainbow Trout Values Downstream of Option FS TSF (completed)

Watercourse	Susceptibility to Potential Downstream Effects	Distribution	Habitat Quality
Tatelkuz Lake tributaries	Potentially susceptible	Creek 579340 to headwaters including Snake Lake**, other unnamed tributaries.**	Fair quality rearing habitat, poor quality migration habitat and no spawning or overwintering habitat.
Turtle Creek	Potentially susceptible	Chedakuz Creek confluence to headwaters.	Good quality rearing, migration and overwintering habitat, poor quality spawning habitat.
Turtle Creek tributaries	Potentially susceptible	All tributaries.**	Fair quality rearing habitat, poor quality spawning, migration and overwintering habitat.

N/A: Not sampled
**Mean electrofishing density from 2011 and 2012 surveys*
***Rainbow Trout are presumed to be present but were not captured in all tributaries in 2011 and 2012 summer inventory surveys*

Downstream Kokanee Values

Kokanee are typically a lake-dwelling species; however, they spawn in streams. Davidson Creek, Creek 661, Lower and Middle Chedakuz Creek, and Creek 661 contain spawning habitat for Kokanee from Tatelkuz Lake and Kuyakuz Lake. The distance between the toe of tailings containment dams associated with the Option FS TSF and the first occurrence of downstream spawning Kokanee is 12.4 km in Davidson Creek.

The distribution and quality of Kokanee spawning habitat downstream of the Option FS TSF are presented in Table 5.2-39.

Table 5.2-39. Kokanee Values Downstream of Option FS TSF

Watercourse	Susceptibility to Potential Downstream Effects	Spawning Habitat Distribution and Quality	Critical Rearing and Overwintering Habitat Distribution
Lower Davidson Creek	Predominantly susceptible	Chedakuz Creek confluence to Davidson Creek Reach 4 (5.2 km), high quality spawning habitat in Reaches 1 to 5.	None*
Lower Chedakuz Creek	Predominantly susceptible	RSA boundary to confluence with Davidson Creek, high quality spawning habitat.	None*
Lower Creek 661	Potentially susceptible	Chedakuz Creek confluence to Creek 661 Reach 3 (7.1 km), high quality spawning habitat in Reaches 1 to 4.	Tatelkuz Lake
Middle Chedakuz Creek	Potentially susceptible	Tatelkuz Lake to confluence with Creek 661, high quality spawning habitat.	Tatelkuz Lake

**Rearing and overwintering habitat is in Tatelkuz Lake, located upstream of Chedakuz Creek confluence with Davidson Creek*

Downstream Mountain Whitefish Values

Fall spawning surveys downstream of the Option FS TSF captured a total of eight Mountain Whitefish. All eight were captured in Lower Davidson Creek. The low number of fish caught indicates that the number of Mountain Whitefish using streams that may be affected by construction of the Option FS TSF is very low, if any, compared to Rainbow Trout and Kokanee.

Potential Impacts on Fish and Fish Habitat

The construction of the Option FS TSF would result in the permanent alteration to, or destruction (PAD) of, fish habitat in an area of approximately 8.9 ha.

The construction of the Option FS TSF would results in a loss of connectivity between habitats occupied by the two Davidson Creek Rainbow Trout populations. The viability of the Headwaters population is not assumed to rely on contributions from the Davidson Creek population due to current partial isolation in the form of a partial impediment to fish passage in Reach 11 of Davidson Creek. Therefore, the viability of the Headwaters population may not be affected by further isolation. Some spawning and rearing habitat used by the Davidson Creek Headwaters population and juvenile rearing habitat used by the Davidson Creek population would be lost with the construction of the Option FS TSF, which could influence population densities.

Rainbow Trout in the Davidson Creek watershed and Kokanee spawning in Lower Davidson Creek and Lower Chedakuz Creek downstream of the Option FS TSF could be affected by reductions in stream flows, by seepage or discharge of contaminated tailings water into Davidson Creek. Rainbow Trout and spawning Kokanee in Creek 661 and its tributaries are subject to potential downstream effects from the Option FS TSF because a small portion of the TSF footprint is in the headwaters of the Creek 661 watershed. Since the upstream drainage area affected by the TSF is small, effects due to reductions in flow or tailings containment failure, though possible, would be likely be less severe in Creek 661, Middle Chedakuz Creek and Tatelkuz Lake than in the Davidson Creek watershed. Finally, Rainbow Trout in Turtle Creek and its tributaries are potentially susceptible to effects from contaminated groundwater seepage into the Turtle Creek watershed.

Terrestrial Wildlife

The mine site TELSA is characterized by mountainous topography with steep relief descending into Davidson Creek dominated by subalpine fir, Engelmann spruce, and lodgepole pine. The wildlife habitat is characterized by a mosaic of high elevation forest, wetlands, riparian, and mature forests with minor amounts of forestry impact.

Eight species of conservation concern were recorded in Option FS during baseline studies (see Table 1.8-3 for status designations; AMEC 2013p): western toad, caribou, little brown myotis, northern myotis, eastern red bat, Haget's bluet, barn swallow, and northern goshawk. Two species listed under the *Species at Risk Act* (2002d) were recorded; one as special concern: western toad and one as threatened species: caribou (sign only e.g., scat, and outside the mine footprint). Two observed species were listed as endangered by COSEWIC (COSEWIC 2012b), but not by the *Species at Risk Act* (2002d): little brown myotis and northern myotis. Additionally, one observed species were listed as threatened by COSEWIC (COSEWIC 2012a), but not by the *Species at Risk Act* (2002d): barn swallow.

Habitat suitability modeling exercises identified high-quality habitat that would be directly removed by the TSF or indirectly affected (i.e., within a 100 m buffer of the TSF) by the TSF for the following species: grizzly bear, caribou, moose, American marten, myotis spp. western toad, olive-sided flycatcher, and red-tailed hawk. The areas affected for each species are provided in detail in Tables 5.2-40 through 5.2-44).

Table 5.2-40. Wildlife Implications of Option FS TSF

Species	Total 1
Grizzly bear	389 ha (29.1% of the TSF footprint area)
Caribou	653.1 ha (48.8% of the TSF footprint area)
Moose	149.9 ha (11.2% of the TSF footprint area)
American Marten	213.5 ha (16% of the TSF footprint area)
Myotis spp.	870 ha (65% of the TSF footprint area)
Western toad	353 ha (26.4% of the TSF footprint area)
Terrestrial Birds (Olive-sided flycatcher)	868.5 ha (64.9% of the TSF footprint area)
Raptors (Red-tailed hawk)	711.6 ha (53.2% of the TSF footprint area)

[1]*Total loss of high-quality habitat represents the cumulative total amount of the various habitat requirements(for example: grizzly bear = feeding spring, feeding summer, feeding fall, security thermal and hibernating; Table 5.2-37).*

Table 5.2-41. Amounts of High Value Habitat from Habitat Suitability Mapping for Grizzly Bear Affected by the Option FS TSF, with and without 100 m Buffer

	Total Area (ha)	Grizzly Bear				
		Feeding Spring (ha)	Feeding Summer (ha)	Feeding Fall (ha)	Security/Thermal - Growing (ha)	Hibernating (ha)
TSF footprint only	1,116	0	0	123.4	102.6	317.2
TSF footprint plus 100 m buffer	1,338	0	0	149.7	124.3	389

Table 5.2-42. Amounts of High Value Habitat from Habitat Suitability Mapping for Caribou Affected by the Option FS TSF, with and without 100 m Buffer

	Total Area (ha)	Caribou				
		Feeding Winter (ha)	Feeding Spring (ha)	Feeding Summer(ha)	Security/Thermal - Winter (ha)	Security/Thermal - Growing (ha)
TSF footprint only	1,116	460.3	460.3	364.8	284	284
TSF footprint plus 100 m buffer	1,338	528.8	528.8	420.3	344.2	344.2

Vegetation, Ecosystems, and Wetlands

The Option FS TSF would cause the direct removal of 154 ha of mature forest, 142 ha of riparian areas, and 12 ha of ecosystems at risk (all blue-listed wetlands). Baseline studies identified no plant species of conservation concern, and no sparsely vegetated identified within the TSF footprint during field surveys or TEM mapping.

Table 5.2-43. Amounts of High Value Habitat from Habitat Suitability Mapping for Moose Affected by the Option FS TSF, with and without 100 m Buffer

	Total Area (ha)	Moose			
		Feeding Winter (ha)	Feeding Growing (ha)	Security/Thermal - Winter (ha)	Security/Thermal - Growing (ha)
TSF footprint only	1,116	104.9	74.1	102.6	131
TSF footprint plus 100 m buffer	1,338	109.4	81.1	105.6	142.2

Table 5.2-44. Amounts of High Value Habitat from Habitat Suitability Mapping for Western Toad, Marten, and Myotis Affected by the Option FS TSF, with and without 100 m Buffer

	Total Area (ha)	Marten		Myotis	Western Toad	Terrestrial Birds	Raptors
		Living Winter (ha)	Living Growing (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)	High-quality Habitat (ha)
TSF footprint only	1,116	196.5	196.5	726.9	330.4	728.5	584.2
TSF footprint plus 100 m buffer	1,338	213.5	213.5	870	353	868.5	711.6

The Option FS TSF will result in the loss of 194 ha of wetlands including 12 ha of wetlands identified as red and/or blue listed. Options that affect listed wetlands and are reviewed by Environment Canada will require a conservation plan to meet the federal policy on wetland conservation.

Air Quality

During construction and operation, the effect of Option FS on air quality would be related to fugitive dust and emissions from diesel-fuelled heavy equipment and blasting associated with building the dams and TSF supporting infrastructure (i.e., roads, plant site, and water diversions infrastructure), and to fugitive dust from tailings beaches and embankments. The volume of diesel emissions and fugitive dust for the dams would be related to the haul distances and the volume of local material required for the starter dams and the TSF dam core. The emissions for the supporting infrastructure would directly relate to the length of the supporting infrastructure and the site-specific terrain challenges of building the infrastructure. During operations and closure, exposed areas of tailings and waste rock may be subjected to wind erosion, causing wind-blown fugitive dust. Reclamation and capping of the tailings and waste rock would minimize the potential for fugitive dust.

Option FS TSF footprint is 11 km^2. The TSF is large enough to eliminate on land waste rock stockpile and therefore reducing fugitive dust associated with wind erosion. If tailings beach is dry, fugitive dust emissions may be emitted. Since Option FS TSF is located west of the camp, wind from the southwest may potentially affect the camp. The TSF is approximately 4 km away from the deposit. Fugitive road dust and vehicle exhaust will be emitted when haul trucks travel from the open pit to the TSF. However, air quality models predict that fugitive dust from the TSF will not result in residual effects for the Project for TSF Option FS.

5.2.5.3 Socio-Economic Summary of Option FS

A general summary of the socio-economic setting of Option FS is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-3 in Section 53.

Non-Traditional Land and Resource Use

The Option FS TSF overlaps with five commerical tenures. Firstly, Option FS is located within two trapline tenures, overlapping 785 ha of tenure 1205330 (2.08% of tenure) and 331 ha of tenure 1314664 (0.33% of tenure). These interactions have the potential to affect trapping due to potential displacement and a reduction in available wildlife. Secondly, Option FS overlaps with 167 ha of range tenure RAN07515 (0.87% of tenure). Option FS is overlaps two guide outfitting tenures, specifically 714 ha of tenure 484246 (0.22% of tenure) and 402 ha of tenure 1206416 (0.74% of tenure).

Option FS does not overlap with any known forestry or commerical recreation tenures; nor does it overlap with any mineral claims not held by New Gold.

Parks and Protected Areas

In terms of recreational land uses, Option FS does not overlap with any parks or protected areas however; there are areas of overlap with features of recreational sensitivity. Option FS transects with the following Recreation Feature Inventory attributes:

- RFI#10716, Medium Sensitivity-Medium Significance, 1,049 ha (5.93%);
- RFI# 10769, Unknown Sensitivity-Unknown Significance, 566 ha (1.35%); and
- RFI# 10784 Medium Sensitivity-High Significance, 0.16 ha (0.04%).

Heritage

Option FS TSF does not overlap with any known archaeological sites or paleontological sites. Option FS TSF does, however, overlap with 31 known heritage features, including 28 blazed trees and three culturally modified trees; these heritage features are not protected by the *HCA* (1996b).

Current Use of Lands and Resources for Traditional Purposes

Option FS is located entirely within the Lhoosk'uz Dene Nation, Skin Tyee Nations and Ulkatcho First Nation territories. For the three Aboriginal groups whose traditional territories overlap with the TSF (LDN, STN, UFN), Table 5.2-45 presents potential effects of Option FS to Aboriginal current use of lands and resources for traditional purposes.

5.2.5.4 Project Economics Summary of Option FS

A general summary of the Project economics setting of Option FS is provided below. Further detail, for those indicators which can be directly compared among options, is provided in Table 5.3-4 in section 5.3. The total undiscounted cost (including capital, operating, and closure costs) of Option FS is estimated to be $453,000,000, or $0.57/tonne. This total cost does not include fish habitat compensation costs.

Table 5.2-45. Potential Effects of Option FS on Aboriginal Current Use of Lands and Resources for Traditional Purposes

Concern or Issue	Potential effect to current use of lands and resources for traditional purposes		
	Llhoosk'uz Dene Nation	Skin Tyee Nation	Ulkatcho First Nation
Hunting	No specified use of area for hunting. Option may overlap with hunting areas.	Hunting locations identified in the Project footprint; other hunting occurs in areas around Davidson and Chedakuz creeks and Tatelkuz Lake.	UFN hunting occurs on Mount Davidson, near Tatelkuz Lake and along Chedakuz Creek.
Trapping	Option overlaps on trapline tenure held by a member of LDN (TR0512T027), this tenure is not currently being used; and 214 ha of high-quality American marten habitat.	No trapping locations identified in the Project footprint. Trapping locations identified areas around Davidson and Chedakuz creeks and Tatelkuz Lake. No STN registered traplines identified in the area.	No overlap with trapline tenures held by UFN members.
Fishing	LDN fish at Davidson and Chedakuz creeks and Tatelkuz and Kuyakuz lakes. LDN identified the lower reaches of Davidson Creek as having important fishing value.	No fishing use identified in the Project footprint.	No known fishing use in the Project footprint. UFN fish at Chedakuz Creek and Tatelkuz Lake, and have a fish camp at Kuyakuz Lake.
Gathering	No known gathering use in the Project footprint. Option may overlap areas for the harvest of traditional plants. LDN harvest plants around Tatelkuz and Kuyakuz Lake and along the Messue Wagon Trail.	The Project footprint was not identified as a harvesting areas. STN harvest near Chedakuz Creek and Tatelkuz Lake, and along the Messue Wagon Road Trail.	Harvesting areas have not been identified in the Project footprint. Option may overlap areas for the harvest of traditional plants while using the area for other purposes (camping, trail use).
Use of Cultural and Traditional Sites	No known use of area for cultural or traditional purposes.	One culturally significant named place is located in the Project footprint. There are important transportation routes and trails between Tatelkuz Lake and Kuyakuz Lake. Campsites and gathering areas are identified around Tatelkuz Lake, Tsacha Lake, Johnny Lake and Top Lake, Fawnie Dome and Mount Tatelkuz.	Overlaps with 31 known heritage features, including 28 blazed trees and three culturally modified trees. A trail, campsite, and a place name were identified within the area of the Project footprint.

Initial Capital Costs

The Option FS TSF has the lowest initial captial costs as starter dam volume required are relatively small (7.5 Mm^3). The option requires the construction of the downstream ECD. It is anticipated that sufficient NAG material will be available for both facilities at start-up. The initial capital costs are estimated to be $90,000,000.

Sustaining Capital and Operating Costs

The Option FS TSF has moderate sustaining capital and operating costs. Option FS TSF will require ongoing raises to one relatively large dam and one smaller dam, with a total volume of 66 Mm^3. However, sufficient NAG material should be available. This material must be hauled to two dam locations. The sustaining capital and operating costs are estimated to be $314,000,000.

Closure Costs

The Option FS TSF has relatively low closure costs. The TSF involves the closure of one, two cell relatively large dam, and seepage must only be contained in one watershed. Long-term water treatment costs will be minimal as it is anticipated that water treatment can occur through a fully passive system (i.e., wetlands). The closure costs are estimated to be $49,000,000.

PAD Compensation Costs

The Option D TSF will create approximately 8.9 ha of PAD. The approximate habitat compensation costs for this PAD is $4M.

5.3 CHARACTERIZATION SUMMARY TABLES

Tables 5.3-1 through 5.3-4 present the characterization summaries of the five TSF options.

Table 5.3-1. Technical Characterization Criteria Summary

Characterization Criteria	Rationale	Option C	Option D	Option D / PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Waste Streams							
physical characterization of waste	Options with less complex waste streams are preferred because of decreased risk to the environment	60,000 tpd of solid tailings discharged to TSF, ~35% solids; 367 Mt PAG waste rock +79 Mt NAG3 waste rock over total mine life	60,000 tpd of solid tailings discharged to TSF, ~35% solids; 367 Mt PAG waste rock +79 Mt NAG3 waste rock over total mine life	60,000 tpd of solid tailings discharged to TSF, ~35% solids; 367 Mt PAG waste rock +79 Mt NAG3 waste rock over total mine life	60,000 tpd of solid tailings discharged to TSF, ~35% solids; 367 Mt PAG waste rock +79 Mt NAG3 waste rock over total mine life	60,000 tpd of solid tailings discharged to TSF, ~35% solids; 367 Mt PAG waste rock +79 Mt NAG3 waste rock over total mine life	No (not sufficiently differentiating)
PAG Waste Rock Stored On-Land							
quality of PAG waste rock stored on-land	Storage options with lower quality PAG/ML waste rock (i.e., greater ML/ARD potential) stored on land are less preferred because of increased risk to the environment from ML/ARD of PAG/ML waste rock	no PAG waste rock stored on-land	no PAG waste rock stored on-land	PAG waste rock stored on-land	no PAG waste rock stored on-land	no PAG waste rock stored on-land	Yes
quantity of PAG waste rock stored on-land	Storage options with less PAG/ML waste rock stored on-land are preferred because of potential ML/ARD of the waste rock	no PAG waste rock stored on-land	no PAG waste rock stored on-land	202 Mm^3 waste rock stored on-land	no PAG waste rock stored on-land	no PAG waste rock stored on-land	Yes
complexity of containment	Storage options with lower complexity of containment are preferred because less complex containment facilities facilitate rapid underwater placement of PAG/ML waste rock and decrease risk to the environment	Option has small TSF footprint so deposition of PAG waste rock cannot be spread out and matching PAG waste rock deposition rates to the rise rate of the containment dams is difficult; does not facilitate rapid underwater placement of PAG waste rock (i.e., PAG waste rock may be exposed to air for a longer period of time)	Option has larger TSF footprint so deposition of PAG waste rock can be spread out and more easily matched to the rise rate of the containment dam; facilitates rapid underwater placement of PAG waste rock	complex because managing drainage & seepage from on-land PAG waste rock dump is complex, and significant engineering challenges exist related to the design and construction of the PAG dump base because of the high volumes of WR required and the resultant land footprint. (need a big area)	Option has large TSF footprint so deposition of PAG waste rock can be spread out and more easily matched to the rise rate of the containment dam; facilitates rapid underwater placement of PAG waste rock	Option has larger TSF footprint so deposition of PAG waste rock can be spread out and more easily matched to the rise rate of the containment dam; facilitates rapid underwater placement of PAG waste rock	Yes
Tailings Dam Characteristics							
distance from deposit (km)	Storage options located closer to the pit are preferred because they facilitate New Gold's 'clustering' Environmental Design Criteria	4 km	4.5 km	5 km	4 km	4 km	Yes
complexity of containment	Options with more complex containment (e.g., greater number of dams, more material required early in Project life cycle for construction purposes) may pose a scheduling risk to the Project as well as increase the need for construction activities during winter	Options has 3 relatively large containment dams, and the rate of rise would need to be fast to safely contain PAG waste rock - difficult to do because of scheduling and engineering constraints, may require greater construction over winter	best option because only relatively small dam required	best option because only relatively small dam required	three sided dam; difficult in terms of seepage control, scheduling, and material availability because dams are so large	3 dams (1 of which is large), but construction of these dams is staggered such that scheduling & engineering risks are minimized; staggered construction of dams also minimized need for construction during the winter	Yes
maximum TSF embankment heights	Higher dams pose greater engineering challenges and risk.	176 m	141 m	118 m	152 m	135 m, 88 m	Yes
maximum height of saddle dams	Higher dams pose greater engineering challenges and risk.	88 m, 61 m	31 m	N/A	N/A	15 m	No, primary risks are carried by the TSF embankment

(continued)

Table 5.3-1. Technical Characterization Criteria Summary (continued)

Characterization Criteria	Rationale	Option C	Option D	Option D / PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Tailings Dam Characteristics (cont'd)							
total TSF embankment volume	The magnitude of impacts such as dust, exhaust emissions, noise, sediment generation, and availability of adequate construction material area linked to the total volume of fill required to construct the dams required for a TSF. Options with lower total volume are thus preferred for both environmental impact reasons and economic considerations.	49 Mm^3	58 Mm^3	35 Mm^3	118 Mm^3	74 Mm^3	Yes
number of impoundment dams required	Fewer containment structures are preferable because they require fewer access roads to construct and maintain and they reduce the long-term maintenance requirements for the TSF.	3	2	1	1	3	Yes
TSF footprint	Options with lower footprints are preferred because of the lower potential for directly impacting ecological (e.g., wildlife habitat, aquatic resources) values	8.5 km^2	10 km^2	8 km^2	6.5 km^2	11 km^2	No, indicator is captured in greater detail in the technical and environmental indicators that would be affected by the TSF footprint (e.g., ease of construction, high-quality habitat affected)
storage efficiencies	Lower storage efficiencies pose greater engineering challenges with respect to the sourcing and timing of appropriate construction materials, as well as decreased economic efficiencies from increased labour requirements	10.6	8.9	10.1	4.4	8	Yes
tailings storage expansion capacity	Facilities with room for expansion are preferred; total life of mine tailings volume is estimated to be 265 Mm^3 and total life of mine PAG WR is 202 Mm^3; total required storage volume is 467 Mm^3.	515 Mm^3; facility has an additional 48 Mm^3 of capacity	520 Mm^3; facility has an additional 43 Mm^3 of capacity	315 Mm^3; facility has an additional 43 Mm^3 of capacity	515 Mm^3; facility has an additional 48 Mm^3 of capacity	525 Mm^3; facility has an additional 58 Mm^3 of capacity	No, all options have sufficient storage to store life-of-mine tailings and PAG waste rock and room for expansion
availability of local borrow materials for construction of embankments	Facilities with sufficient available local borrow materials for construction are preferred	Embankment would be constructed from NAG WR, overburden, and local borrow sources; sufficient material is available at the Project site	Embankment would be constructed from NAG WR, overburden, and local borrow sources; sufficient material is available at the Project site	Embankment would be constructed from NAG WR, overburden, and local borrow sources; sufficient material is available at the Project site	Embankment would be constructed from NAG WR, overburden, and local borrow sources; sufficient material may not be available at the Project site and may require identification of additional borrow sources or the use of PAG WR for construction	Embankment would be constructed from NAG WR, overburden, and local borrow sources; sufficient material is available at the Project site	Yes

(continued)

Table 5.3-1. Technical Characterization Criteria Summary (continued)

Characterization Criteria	Rationale	Option C	Option D	Option D / PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Tailings Dam Characteristics (cont'd)							
acceptability of dam foundation conditions	Appropriate underlying geology is required for safe containment of wastes	appropriate - option is located higher in Davidson Creek catchment where the surficial veneer is thinner (i.e., less sand and gravel excavation is required to construct the seepage cutoff trench); low permeability lodgemont underneath which is sufficient for dam foundations	appropriate - foundation conditions in lower Davidson Creek Valley require up to 15m of sand and gravel excavation for seepage cutoff trench; low permeability lodgemont underneath which is sufficient for dam foundations	appropriate - foundation conditions in lower Davidson Creek Valley require up to 15m of sand and gravel excavation for seepage cutoff trench; low permeability lodgemont underneath which is sufficient for dam foundations	Possible issue - assume that foundation conditions are generally acceptable for dam construction, although given the long length of the dams the probability of encountering unsuitable foundation conditions increases	appropriate - foundation conditions in lower Davidson Creek Valley require up to 15m of sand and gravel excavation for seepage cutoff trench; low permeability lodgemont underneath which is sufficient for dam foundations	Yes
CDA classification	Options with better CDA classifications are preferred because of the decreased associated risk	very high	very high	very high	very high	very high	No (not sufficiently differentiating)
Supporting Infrastructure							
number of starter dams	Fewer starter dams are preferable because they require fewer access roads to construct and they reduce the long-term maintenance requirements for the TSF.	2	1	1	1	1	Yes
height of starter dams	Smaller (lower) starter dams are preferable because they may require lower initial volumes of appropriate construction material.	95, 5 m	70 m	65 m	52 m	75 m	No (not sufficiently differentiating)
PAG/ML waste rock delivery and placement	Options with less complex PAG waste rock delivery and placement are preferred due to minimized environmental risk and lower haulage costs	delivery and placement may be challenging because a large volume of PAG placement in a small footprint	delivery and placement less challenging because a large volume of PAG placement can be spread out over a large footprint;	delivery of PAG relatively straight forward as PAG dumped on-land and haul distance from pit relatively short	delivery and placement less challenging because a large volume of PAG placement can be spread out over a large footprint; however dam construction may require use of NAG3 WR material due to large dam volumes	delivery and placement less challenging because a large volume of PAG placement can be spread out over a large footprint	Yes
tailings delivery and placement	Shorter tailings pipelines are preferred due to lower environmental and engineering risk, lower cost, and smaller linear disturbance	12 km tailings pipeline length	8.5 km tailings pipeline length	8 km pipeline length	8.5 km tailings pipeline length	17 km pipeline length	Yes
reclaim pipeline length	Shorter reclaim pipelines are preferred due to lower environmental and engineering risk, lower cost, and smaller linear disturbance	3 km	2 km	2 km	2.5 km	6.5 km	Yes
Containment Infrastructure Design							
containment infrastructure design	Options with simpler and well established containment infrastructure design are preferred due to lower technical, economic, and environmental risk	good containment structure design; conventional centreline design with cutoff trench for seepage control	good containment structure design; conventional centreline design with cutoff trench for seepage control	unacceptable containment structure design; conventional centreline design with cutoff trench for seepage control at Option D location; seepage control design for on-land PAG dump extremely challenging	acceptable containment structure design; conventional centreline design with cutoff trench for seepage control over three very long sides of dam	good containment structure design; conventional centreline design with cutoff trench for seepage control	Yes

(continued)

Table 5.3-1. Technical Characterization Criteria Summary (continued)

Characterization Criteria	Rationale	Option C	Option D	Option D / PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Containment Infrastructure Design (cont'd)							
ability to handle extreme events	Options with capacity to handle extreme events (which will primarily be water-related; e.g., high precipitation, storm floods) are preferred due to lower technical, economic, and environmental risk	Option will have sufficient freeboard to handle extreme events, such as the probable maximum flood (PMF)	Option will have sufficient freeboard to handle extreme events, such as the probable maximum flood (PMF)	TSF has sufficient freeboard to handle extreme events, such as the probable maximum flood (PMF); however, onland PAG dump does not have dams to contain water and may result in release of untreated contact water to the environment	Option will have sufficient freeboard to handle extreme events, such as the probable maximum flood (PMF)	Option will have sufficient freeboard to handle extreme events, such as the probable maximum flood (PMF)	Yes
Water Management System							
complexity of seepage collection	Options with less complex seepage collection management are preferred because of lower associated environmental risk	moderately complex seepage collection system as 2 high dams create high pressure head to drive seepage in 2 directions	relatively straight-forward seepage collection system as seepage is contained to a single front downstream of the main dam	highly complex seepage collection system required as seepage would need to be collected from 2 facilities, and a highly-efficient seepage collection related to the PAG would be required to reduce environmental risk	complex seepage collection system would be required as seepage would require collection on all four sides of the facility	relatively straight-forward seepage collection system would be required at 2 fronts; one from a large pressure head from the main dam and one from a smaller pressure head from the western dam	Yes
potential for long-term water treatment	Options with the potential for long-term water treatment are less preferred due to increased associated environmental risk and higher costs	not likely long-term water treatment; option may have more time exposure of PAG/ML waste rock prior to flooding, and higher dam creating a high pressure head for seepage; acceptable seepage quality predicted	low probability of long-term water treatment as, although the high main dam creates a high pressure head to drive seepage, the quality of the seepage is expected to be acceptable as the PAG waste rock will neutralized by being mixed with tailings	Expected long-term water treatment from PAG dump as PAG waste rock material is highly reactive and resultant water quality from seepage is expected to be poor over the long-term	Possible long-term water treatment required; option has very long and large dam with very large seepage face; difficult to capture this seepage but water treatment possibly still required on seepage that is captured	low probability of long-term water treatment as, although the high main dam creates a high pressure head to drive seepage, the quality of the seepage is expected to be acceptable as the PAG waste rock will be neutralized by being mixed with tailings	Yes
potential for active versus passive water treatment	Options with the potential for passive water treatment are preferred because of potentially lower environmental risk and lower costs	possible active water treatment expected over finite period of time expected	passive water treatment expected over a very long period of time expected	expected active water treatment in perpetuity for onland PAG dump runoff and seepage	possible active water treatment expected over finite period of time expected	passive water treatment for finite period of time expected	Yes
complexity of diversion structures	Options with less complex diversion structures are preferred because of potentially lower engineering and environmental risks	Make-up water supply pond required near Option D main dam location, or collection ditches	minimal collection or diversion infrastructure required because facility would operate roughly in balance	would require 1 major diversion ditch upstream of the PAG OL dump	would require collection ditches to provide process water to the TSF	minimal collection or diversion infrastructure required because facility would operate roughly in balance	Yes
Construction, Operation and Closure Approaches, and Precedent							
ease of construction	Options which have a greater ease of construction would be more desirable as they would potentially be subject to fewer geotechnical risks.	satisfactory construction requirements as facility would require a shorter construction schedule than others, but would require rapid dam raises to achieve required storage; an engineered cutoff trench would be required for start-up	satisfactory construction requirements as no rapid dam raises would be required, but an engineered cutoff trench would be required for start-up	acceptable construction requirements as dam raises would be low but initial construction of the PAG dump platform and drainage collection system may be challenging; engineered cutoff trenches may be required for startup	worst construction requirements as facility is 4-sided with very large dams, engineered cutoff trenches may be required for start-up, and facility liner may be required	best construction requirements as construction of facility is staged to allow for low dam raises; an engineered cutoff trench is required for startup	Yes

(continued)

Table 5.3-1. Technical Characterization Criteria Summary (completed)

Characterization Criteria	Rationale	Option C	Option D	Option D / PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Construction, Operation and Closure Approaches, and Precedent (cont'd)							
operational risks and uncertainties	Lower operational risks and during operations are preferable due to lower associated environmental risk	flexible and simple operations (i.e., low risk and uncertainty) requirement as only one reclaim system will be required	flexible and simple operations (i.e., low risk and uncertainty) requirement as only one reclaim system will be required	slightly more complex operations requirements as two reclaim systems will be required or possible discharge of treated water from the PAG dump to the TSF for reclaim. However, this approach would still involve low operational risks and uncertainties as all technologies involved are well-established.	flexible and simple operations (i.e., low risk and uncertainty) requirement as only one reclaim system will be required	flexible and simple operations (i.e., low risk and uncertainty) requirement as only one reclaim system will be required	No (not sufficiently differentiating)
closure requirements	Significant closure requirements would have a higher long-term risk of failure	moderately high risk as gravity feed of pit water discharge to TSF may not be possible; multiple closure spillways may be required into different drainages	low risk as pit water discharges to TSF via gravity feed; no test closure but TSF closure spillway only in one direction to Davidson Creek watershed	highest risk as safely closing PAG dump is extremely challenging	moderately high risk as sufficient water may not exist to maintain subaqueous waste rock and tailings cover; gravity feed of pit water discharge to TSF not possible;	lowest closure risk as option incorporates test-closure with early closure of the 'C' TSF	Yes
precedent	Facilities with established precedent for safe storage of tailings and waste rock are preferred	established precedent for subaqueous co-disposal of tailings and PAG waste rock	established precedent for subaqueous co-disposal of tailings and PAG waste rock	Precedent for on-land PAG waste dumps although generally demonstrate operation and closure can be challenging	established precedent for subaqueous co-disposal of tailings and PAG waste rock	established precedent for subaqueous co-disposal of tailings and PAG waste rock	No
Geotechnical and Seismic Conditions							
seismic conditions	Options with susceptibility to high seismic activity or active faults are less preferred due to risks associated with geotechnical hazards.	Seismic probability of strong shaking is low (less than 1% chance in 50 years; NRCan 2014). There are no known or active faults are located within or near the option	Seismic probability of strong shaking is low (less than 1% chance in 50 years; NRCan 2014). There are no known or active faults are located within or near the option	Seismic probability of strong shaking is low (less than 1% chance in 50 years; NRCan 2014). There are no known or active faults are located within or near the option	Seismic probability of strong shaking is low (less than 1% chance in 50 years; NRCan 2014). There are no known or active faults are located within or near the option	Seismic probability of strong shaking is low (less than 1% chance in 50 years; NRCan 2014) . There are no known or active faults are located within or near the option	No (not sufficiently differentiating)
geotechnical conditions	Options with susceptibility to terrain hazards and areas of instability are less preferred due to risks associated with geotechnical hazards.	Area predominantly flat-lying to gently sloping (<26%) with some potentially unstable areas up to 50% slope associated with river valleys. No mapped unstable terrain areas but historic rock fall areas at the western extent	Area predominantly flat-lying to gently sloping (<26%) with some potentially unstable areas up to 50% slope associated with river valleys. No mapped unstable terrain areas	Area predominantly flat-lying to gently sloping (<26%) with some potentially unstable areas up to 50% slope associated with river valleys. No mapped unstable terrain areas	Area predominantly flat-lying to gently sloping (<26%) with some potentially unstable areas up to 50% slope associated with river valleys. No mapped unstable terrain areas	Area predominantly flat-lying to gently sloping (<26%) with some potentially unstable areas up to 50% slope associated with river valleys. No mapped unstable terrain areas	No (not sufficiently differentiating; Knight Pièsold 2013c)

Table 5.3-2. Environmental Characterization Criteria Summary

Characterization Criteria Indicators	Rationale	Option C	Option D	Option D/PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Surface Water Quality Effects							
water quality of receiving environment	Options that have better water quality in the immediate receiving environment are less preferred as there is a higher likelihood that discharge would cause a measurable change in baseline conditions	High risk due to good baseline water quality and discharge into two watersheds WQ15, WQ16, WQ1 Sulphate: 1.20 mg/L Cadmium: 0.00001 mg/L Zinc: 0.003 mg/L	Moderate risk WQ10 Sulphate: 1.94 mg/L Cadmium: 0.00001 mg/L Zinc: 0.002 mg/L	Low risk due to poorer baseline water quality WQ10, WQ3, WQ4 Sulphate: 3.48 mg/L Cadmium: 0.00004 mg/L Zinc: 0.017 mg/L	Moderate risk WQ3 Sulphate: 1.47 mg/L Cadmium: 0.00001 mg/L Zinc: 0.003 mg/L	Moderate risk WQ10 Sulphate: 1.94 mg/L Cadmium: 0.00001 mg/L Zinc: 0.002 mg/L	Yes
potential for ARD / ML generation (dam construction material and unconfined PAG material)	Options with larger dams will require an increased amount of NAG (waste rock and overburden), insufficient amounts will increase the risk of incorporating material that is not NAG resulting in an increased likelihood that water quality in the receiving environment will be negatively impacted	49 Mm^3	58 Mm^3	35 Mm^3 and on-land PAG waste dump	118 Mm^3	74 Mm^3	Yes
Hydrology							
number of watersheds effected	Options that primarily affect greater than one watershed would be less preferable	2	2	2	2	2	No (not sufficiently differentiating)
size of watersheds effected	Options that are located in smaller watersheds and have water supply requirements are less preferable.	Davidson Creek: 58.5 km^2 Creek 705: 44.4 km^2	Davidson Creek: 58.5 km^2 Creek 661: 77.8 km^2	Davidson Creek: 58.5 km^2 Creek 661: 77.8 km^2	Davidson Creek: 58.5 km^2 Creek 661: 77.8 km^2	Davidson Creek: 58.5 km^2 Creek 661: 77.8 km^2	Yes
potential catchment loss to toe of TSF in the Davidson Creek and Creek 661 Watersheds	TSF alternatives that minimize potential catchment loss to the toe of the TSF are preferable. Data presented here are worst-case scenario; i.e., no mitigation measures are considered.	Davidson Creek: 21.2 km^2 Creek 705: 0.1 km^2	Davidson Creek: 41.5 km^2 Creek 661: 0.2 km^2	Davidson Creek: 40.9 km^2 Creek 661: 4.0 km^2	Davidson Creek: 21.1 km^2 Creek 705: 0.4 km^2	Davidson Creek: 41.5 km^2	Yes
potential impacts to timing and distribution of flows	TSF alternatives that minimize potential impacts to timing and distribution of flows are preferable. Data presented here are worst-case; i.e., no mitigation measures are considered.	High; Area of lakes and wetlands (includes intermittent) covered by footprint of TSF is 17.5 ha	High; Area of lakes and wetlands (includes intermittent) covered by footprint of TSF is 20.0 ha	High; Area of lakes and wetlands (includes intermittent) covered by footprint of TSF is 31.6 ha	High; Area of lakes and wetlands (includes intermittent) covered by footprint is 16.3 ha	High; Area of lakes and wetlands (includes intermittent) covered by footprint of TSF is 20 ha	No (not sufficiently differentiating)

(continued)

Table 5.3-2. Environmental Characterization Criteria Summary (continued)

Characterization Criteria Indicators	Rationale	Option C	Option D	Option D/PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Hydrogeology							
potential impacts to groundwater quantity and quality	Options with greater potential impacts to groundwater quantity (change of flow patterns and baseflows) and groundwater quality (due to seepage) are less preferable.	Option is on or close to the watershed divides to the west and southeast, and may potentially cause impacts to groundwater quantity and quality in several watersheds (Davidson Creek, Creek 705, and Creek 661) as the mounding water in the tailings cell may alter the watershed divides. Potential impacts to groundwater may be predominantly within the Davidson Creek watershed and less in other watersheds.	Option is near or crosses the watershed divides to the north/northwest and southeast, and may potentially cause impacts to groundwater quantity and quality in several watersheds (Davidson Creek, Turtle Creek, Creek 661 and possibly further distant in the Tatelkuz Lake tributary catchment) as the mounding water in the tailings cell may alter the watershed divides. Potential impacts to groundwater may be predominantly within the Davidson Creek watershed and less in other watersheds.	Option is near the watershed divides to the north and southeast, and includes a separate PAG stockpile location. Therefore it may potentially cause impacts to groundwater quantity and quality in several watersheds (Davidson Creek, Turtle Creek, Creek 661 and possibly further distant in the Tatelkuz Lake tributary catchment) as the mounding water in the tailings cell may alter the watershed divides. Potential impacts to groundwater may be predominantly within the Davidson Creek and the Creek 661 watersheds and less in other watersheds.	Relative to other Options, the potential impacts to groundwater quantity and quality may be high as potential for large seepage loss with long dam.	Option is near or crosses the watershed divides to the north/northwest and southeast, and may potentially cause impacts to groundwater quantity and quality in several watersheds (Davidson Creek, Turtle Creek, Creek 661 and possibly further distant in the Tatelkuz Lake tributary catchment) as the mounding water in the tailings cell may alter the watershed divides. Potential impacts to groundwater may be predominantly within the Davidson Creek watershed and less in other watersheds.	No, indicator not highly differentiating and is largely redundant to the indicator "seepage management"
seepage management	Options located in the groundwater recharge zones at the headwaters of the watershed are less preferred as it will have a higher potential for seepage due to potentially less hydraulic containment and cause challenges in seepage management (mitigation, interception and recovery).	Moderately High; Option avoids the potential impacts of a separate on land PAG stockpile. However, in this option the TSF is located in the groundwater recharge zones at the headwaters and may pose seepage management challenges from migration of seepage through shallow and deep groundwater into the receiving environment due to potentially less hydraulic containment. Seepage management challenges are potentially high	Moderately Low; This Option avoids the potential impacts of a separate on-land PAG stockpile. However, the Option is located in the groundwater recharge zones at the headwaters and may pose seepage management challenges from migration of seepage through shallow and deep groundwater into the receiving environment due to potentially less hydraulic containment. Seepage management challenges are potentially high. Option D is located further downstream in the Davidson Creek watershed than Option C, therefore potentially creating greater challenges with maintaining the flow regime and water quality in this creek.	Extremely High; Option has a separate location for the TSF and the onland PAG stockpile. Both the TSF and onland stockpile are located in the groundwater recharge zones at the headwaters and may pose seepage management challenges from migration of seepage through shallow and deep groundwater into the receiving environment due to potentially less hydraulic containment. Seepage management challenges will be greater than other options.	Moderately High; Option avoids the potential impacts of a separate onland PAG stockpile. Relative to other co-disposal options, seepage management challenges are potentially moderately high due to presence of large, 3-sided dam; seepage collection on all three fronts will present technical challenges and pose higher environmental risk.	Moderately Low; Option avoids the potential impacts of a separate onland PAG stockpile. Option is located in the groundwater recharge zones at the headwaters and may pose seepage management challenges from migration of seepage through shallow and deep groundwater into the receiving environment due to the lack of hydraulic containment. Seepage management challenges are potentially high, although mitigation measures will significantly reduce these challenges.	Yes

(continued)

Table 5.3-2. Environmental Characterization Criteria Summary (continued)

Characterization Criteria Indicators	Rationale	Option C	Option D	Option D/PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Climate and Atmosphere							
Climate effects on water management	Options that inadequately manage climate effects such as a large storm event or snow melt pose a greater risk to the project's water management system and the environment.	No anticipated effects to water management from climate; option will have sufficient freeboard to handle probable maximum flood (PMF)	No anticipated effects to water management from climate; option will have sufficient freeboard to handle probable maximum flood (PMF)	Anticipated effects to water management from climate; TSF has sufficient freeboard to handle probable maximum flood (PMF); onland PAG dump does not have dams to contain water and may result in release of untreated contact water to the environment	No anticipated effects to water management from climate; option will have sufficient freeboard to handle probable maximum flood (PMF)	No anticipated effects to water management from climate; option will have sufficient freeboard to handle probable maximum flood (PMF)	Yes
ability to adapt to wetter conditions	Options that are less adaptable to wetter conditions (i.e., larger storm events) pose a greater risk to the project's water management system and the environment.	No anticipated effects to ability to adapt to wetter conditions predicted to result from climate change; option will have sufficient freeboard to store increased snow melt, and more frequent storm events and can incorporate adaptive management practices to raise dam heights if deemed insufficient	No anticipated effects to ability to adapt to wetter conditions predicted to result from climate change; option will have sufficient freeboard to store increased snow melt and more frequent storm events, and can incorporate adaptive management practices to raise dam heights if deemed insufficient	Anticipated effects to ability to adapt to wetter conditions predicted to result from climate change; difficult to incorporate adaptive management into long-term operation of onland PAG dump to incorporate water management in a wetter climate	No anticipated effects to ability to adapt to wetter conditions predicted to result from climate change; option will have sufficient freeboard to store increased snow melt and more frequent storm events, and can incorporate adaptive management practices to raise dam heights if deemed insufficient	No anticipated effects to ability to adapt to wetter conditions predicted to result from climate change; option will have sufficient freeboard to store increased snow melt and more frequent storm events, and can incorporate adaptive management practices to raise dam heights if deemed insufficient	No, redundant to 'climate effects on water management' indicator
dust emissions	Options that have high potential for fugitive dust would be less desirable due to higher associated risks to human health, vegetation and wildlife habitat.	Minimal effects predicted for effects to air quality from dusting; option has long beach and is relatively unsheltered from the prevailing wind direction (southwest) as it is located high in the Davidson Creek catchment. TSF is located west of the camp and the dust dispersion is more likely to affect the camp. However, due to the distance between the sources and the camp, the effect is limited.	Minimal effects predicted for effects to air quality from dusting; option has longer beach than Option C but is more sheltered from the prevailing wind direction (southwest) as it is located lower in the Davidson Creek catchment. The TSF is located northeast of the camp and dust from beach is less likely to affect the camp.	Moderate effects predicted for effects to air quality from dusting; option has short beaches and is more sheltered from the prevailing wind direction (southwest) as it is located lower in the Davidson Creek catchment; on land PAG pile may result in increased fugitive dust events that may contain acidic compounds and trace metals.	Minimal effects predicted for effects to air quality from dusting; option has short beaches and is relatively sheltered from the prevailing wind direction (southwest)	Minimal effects predicted for effects to air quality from dusting; option has longer beach than Option C but is more sheltered from the prevailing wind direction (southwest) as it is located lower in the Davidson Creek catchment	Yes
Overall Land Footprint							
total footprint	Options that have high overall affected land footprint size would be less desirable due to higher overall potential effects to the terrestrial and aquatic environments.	933 ha	1,110 ha	1,176 ha	792 ha	1,116 ha	No, effects of indicator are better considered under more specific habitat loss indicators

(continued)

Table 5.3-2. Environmental Characterization Criteria Summary (continued)

Characterization Criteria Indicators	Rationale	Option C	Option D	Option D/PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Aquatic Habitat Loss							
presence of rare and endangered non-fish aquatic species	Options that impact rare or endangered species (as considered by the British Columbia Conservation Data Centre, the *Species at Risk Act*, and the Committee on the Status of Endangered Wildlife in Canada) are detrimental to biodiversity and may have broader ecosystem impacts.	Yes, B.C. blue-listed freshwater mollusc *Acroloxus coloradensis* observed in Davidson Creek Headwater Lake (01682LNRS).	No listed species observed.	No listed species observed.	No listed species observed.	Yes, BC blue-listed freshwater mollusc Acroloxus coloradensis observed in Davidson Creek Headwater Lake (01682LNRS).	No, species is not listed under Section 79(1) notification under *Species at Risk Act* (2002d)
Fish and Fish Habitat							
extent of permanent alteration to or destruction (PAD) of fish habitat	Options that minimize the amount of fish habitat that is lost are preferable.	12.2 ha	9.2 ha	7.9 ha	1.7 ha	8.9 ha	Yes
quality of fish habitat affected by PAD	Options that avoid impacting critical fish habitat (i.e. migration routes and spawning and overwintering grounds) are preferable	Critical; Davidson Creek: unique spawning, rearing, migration and overwintering habitat for Davidson Creek Headwaters Rainbow Trout population, good quality rearing habitat for Davidson Creek Rainbow Trout population; Creek 705: good quality rearing habitat for Creek 705 Headwaters South Rainbow Trout population.	Important; Davidson Creek: good quality rearing habitat for Davidson Creek Rainbow Trout population, fair to good quality spawning and rearing habitat for Davidson Creek Headwaters Rainbow Trout population; Creek 661 tributaries: good quality rearing and migration habitat and fair quality spawning and overwintering habitat for Rainbow Trout	Important; Davidson Creek: good quality rearing habitat for Davidson Creek population Rainbow Trout, fair quality spawning and rearing habitat for Davidson Creek Headwaters Rainbow Trout population; Creek 661 tributaries: good quality rearing habitat, fair quality migration habitat and poor quality spawning and overwintering habitat for Creek 661 Rainbow Trout population	Important; Creek 661 and tributaries: good quality rearing habitat and fair (tributaries) to good (mainstem) quality migration habitat for Creek 661 Rainbow Trout population	Important; Davidson Creek: good quality rearing habitat for Davidson Creek population Rainbow Trout, fair quality spawning and rearing habitat for Davidson Creek Headwaters Rainbow Trout population; Creek 661 tributaries: good quality rearing habitat, fair quality migration habitat and poor quality spawning and overwintering habitat for Creek 661 Rainbow Trout population	Yes
number of fish species directly affected within the TSF footprint	Options that impact greater number of fish species are detrimental to biodiversity and may have broader ecosystem impacts.	1	1	1	1	1	No (not sufficiently differentiating)
presence of rare and endangered fish species	Options that impact rare or endangered fish species (as considered by the British Columbia Conservation Data Centre, the *Species at Risk Act*, and the Committee on the Status of Endangered Wildlife in Canada) are detrimental to biodiversity and may have broader ecosystem impacts.	None	None	None	None	None	No (not sufficiently differentiating)

(continued)

Table 5.3-2. Environmental Characterization Criteria Summary (continued)

Characterization Criteria Indicators	Rationale	Option C	Option D	Option D/PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Fish and Fish Habitat (cont'd)							
downstream Kokanee values	Options with higher downstream kokanee values would be less preferred in case of chronic dam failure. Options with higher potential to impact downstream Kokanee fisheries would be less desirable in achieving New Gold's Environmental Design Criteria[1].	<u>Predominantly susceptible:</u> Lower Davidson Creek: high quality spawning habitat, moderate density of spawners; Lower Chedakuz Creek: high quality spawning habitat, high density of spawners; <u>Potentially susceptible:</u> Lower Creek 661: high quality spawning habitat, high density of spawners; Middle Chedakuz Creek: high density of spawners; Tatelkuz Lake: rearing and overwintering habitat	<u>Predominantly susceptible:</u> Lower Davidson Creek: high quality spawning habitat, moderate density of spawners; Lower Chedakuz Creek: high quality spawning habitat, high density of spawners; <u>Potentially susceptible:</u> Lower Creek 661: high quality spawning habitat, high density of spawners; Middle Chedakuz Creek: high density of spawners; Tatelkuz Lake: rearing and overwintering habitat	<u>Predominantly susceptible:</u> Lower Davidson Creek: high quality spawning habitat, moderate density of spawners; Lower Chedakuz Creek: high quality spawning habitat, high density of spawners; Lower Creek 661: high quality spawning habitat, high density of spawners; Middle Chedakuz Creek: high density of spawners; Tatelkuz Lake: rearing and overwintering habitat	<u>Predominantly susceptible:</u> Lower Creek 661: high quality spawning habitat, high density of spawners; Lower Chedakuz Creek: high quality spawning habitat, high density of spawners; Middle Chedakuz Creek: high density of spawners; Tatelkuz Lake: rearing and overwintering habitat	<u>Predominantly susceptible:</u> Lower Davidson Creek: high quality spawning habitat, moderate density of spawners; Lower Chedakuz Creek: high quality spawning habitat, high density of spawners; <u>Potentially susceptible:</u> Lower Creek 661: high quality spawning habitat, high density of spawners; Middle Chedakuz Creek: high density of spawners; Tatelkuz Lake: rearing and overwintering habitat	Yes
downstream Rainbow Trout values	Options with higher downstream Rainbow Trout values would be less preferred in case of chronic dam failure.	<u>Predominantly susceptible:</u> Davidson Creek: good quality habitat, moderate density of rearing fish; Lower Chedakuz Creek: good quality habitat, low density of rearing fish; Creek 705: fair to good quality habitat, high density of rearing fish; Creek 606013: fair to good quality habitat, moderate density of rearing fish ; Lake 0142UEUT and Lake 0158UEUT: good quality overwintering habitat; <u>Potentially susceptible:</u> Creek 661 and tributaries: fair to good quality habitat, low (tributaries) and moderate (mainstem) density of rearing fish; Middle Chedakuz Creek: habitat quality and density of rearing fish unknown; Tatelkuz Lake and tributaries: good quality overwintering habitat (lake), poor to fair quality habitat in tributaries, low (tributaries) density of rearing fish	<u>Predominantly susceptible:</u> Davidson Creek: good quality habitat, moderate density of rearing fish; Lower Chedakuz Creek: good quality habitat, low density of rearing fish; <u>Potentially susceptible:</u> Creek 661 and tributaries: fair to good quality habitat, low (tributaries) and moderate (mainstem) density of rearing fish; Middle Chedakuz Creek: habitat quality and density of rearing fish unknown; Tatelkuz Lake and tributaries: good quality overwintering habitat (lake), poor to fair quality habitat in tributaries, low (tributaries) density of rearing fish; Turtle Creek and tributaries: poor to good quality habitat, low density of rearing fish	<u>Predominantly susceptible:</u> Davidson Creek: good quality habitat, moderate density of rearing fish; Lower Chedakuz Creek: good quality habitat, low density of rearing fish; Creek 661 and tributaries: fair to good quality habitat, low (tributaries) and moderate (mainstem) density of rearing fish; Middle Chedakuz Creek: habitat quality and density of rearing fish unknown; Tatelkuz Lake: good quality overwintering habitat <u>Potentially susceptible:</u> Turtle Creek and tributaries: poor to good quality habitat, low density of rearing fish; Tatelkuz Lake tributaries: poor to fair quality habitat, low density of rearing fish	<u>Predominantly susceptible:</u> Creek 661 and tributaries: fair to good quality habitat, low (tributaries) and moderate (mainstem) density of rearing fish; Lower Chedakuz Creek: good quality habitat, low density of rearing fish; Middle Chedakuz Creek: habitat quality and density of rearing fish unknown; Tatelkuz Lake: good quality overwintering habitat <u>Potentially susceptible:</u> Tatelkuz Lake tributaries: poor to fair quality habitat, low density of rearing fish	<u>Predominantly susceptible:</u> Davidson Creek: good quality habitat, moderate density of rearing fish; Lower Chedakuz Creek: good quality habitat, density of rearing fish unknown; <u>Potentially susceptible:</u> Creek 661 and tributaries: fair to good quality habitat, low (tributaries) and moderate (mainstem) density of rearing fish; Middle Chedakuz Creek: habitat quality and density of rearing fish unknown; Tatelkuz Lake and tributaries: good quality overwintering habitat (lake), poor to fair quality habitat in tributaries, low (tributaries) density of rearing fish; Turtle Creek and tributaries: poor to good quality habitat, low density of rearing fish	Yes

(continued)

Table 5.3-2. Environmental Characterization Criteria Summary (continued)

Characterization Criteria Indicators	Rationale	Option C	Option D	Option D/PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Fish and Fish Habitat (cont'd)							
downstream Mountain Whitefish values	Options with higher downstream Mountain Whitefish values would be less preferred in case of chronic dam failure.	Lower Davidson Creek: low spawning; Chedakuz Creek: Unknown; Creek 705: low spawning; Top Lake: overwintering habitat	Lower Davidson Creek: low spawning; Chedakuz Creek: Unknown	Lower Davidson Creek: low spawning; Chedakuz Creek: Unknown	Chedakuz Creek: Unknown	Lower Davidson Creek: low spawning; Chedakuz Creek: Unknown	No (not sufficiently differentiating)
Wildlife							
presence of species of conservation concern other than western toad, caribou, grizzly bear, American marten, and myotis bats	Options that impact species of conservation concern are detrimental to biodiversity (# of species at risk). List species and rankings.	common nighthawk, olive-sided flycatcher, and northern goshawk	Hagen's bluet, and northern goshawk	Barn Swallow, Hagen's bluet and northern goshawk	Barn Swallow, Hagen's bluet and northern goshawk	Hagen's bluet, northern goshawk, barn swallow, eastern red bat	Yes
direct loss or disturbance (indirect loss = 100m buffer) to grizzly bear habitat	Options that more greatly disturbs high-quality grizzly bear habitat are less preferable.	Option C had grizzly bear and den observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 390 ha or 35.5% of the footprint (plus 100m buffer).	Option D had no grizzly bear and den observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 385.2 ha or 29% of the footprint (plus 100m buffer).	Option D/PAG OL had no grizzly bear and den observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 379.9 ha or 26% of the footprint (plus 100m buffer).	Option E had no grizzly bear and den observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 173.1 ha or 19% of the footprint (plus 100m buffer).	Option FS had no grizzly bear and den observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 389 ha or 29% of the footprint (plus 100m buffer).	Yes
direct loss or disturbance (indirect loss = 100m buffer) to caribou habitat	Options that more greatly disturbs high-quality caribou habitat are less preferable.	Option C does overlaps 43 ha of ungulate winter range that would provide high-quality winter habitat for caribou. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 504.3 ha or 46% of the footprint (plus 100m buffer).	Option D does not overlap ungulate winter range for caribou. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 658.3 ha or 49% of the footprint (plus 100m buffer).	Option D/PAG OL does not overlap ungulate winter range for caribou. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 656.6 ha or 45% of the footprint (plus 100m buffer).	Option E does not overlap ungulate winter range for caribou. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 358 ha or 38.5% of the footprint (plus 100m buffer).	Option FS does not overlap ungulate winter range for caribou. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 653.1 ha or 49% of the footprint (plus 100m buffer).	Yes
direct loss or disturbance (indirect loss = 100m buffer) to moose habitat	Options that more greatly disturbs high-quality moose habitat are less preferable.	Option C had no moose observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 87.2 ha or 8% of the footprint (plus 100m buffer).	Option D had no moose observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 135.4 ha or 10% of the footprint (plus 100m buffer).	Option D/PAG OL had no moose observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 159.7 ha or 11% of the footprint (plus 100m buffer).o	Option E had no moose observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 122.3 ha or 13% of the footprint (plus 100m buffer).	Option FS had no moose observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 149.9 ha or 11% of the footprint (plus 100m buffer).	Yes
direct loss or disturbance (indirect loss = 100m buffer) to American marten habitat	Options that more greatly disturbs high-quality American marten habitat are less preferable.	Option C had no marten observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 80.9 ha or 7% of the footprint (plus 100m buffer).	Option D had no marten observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 219.4 ha or 16% of the footprint (plus 100m buffer).	Option D/PAG OL had no marten observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 216.5 ha or 15% of the footprint (plus 100m buffer).	Option E had no marten observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 280.1 ha or 30% of the footprint (plus 100m buffer).	Option FS had no marten observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 213.5 ha or 16% of the footprint (plus 100m buffer).	Yes

(continued)

Table 5.3-2. Environmental Characterization Criteria Summary (continued)

Characterization Criteria Indicators	Rationale	Option C	Option D	Option D/PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Wildlife (cont'd)							
direct loss or disturbance (indirect loss = 100m buffer) to myotis spp habitat	Options that more greatly disturbs high-quality myotis bat habitat are less preferable.	Option C had no myotis spp observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 933.8 ha or 85% of the footprint (plus 100 m buffer).	Option D had myotis spp observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 865.8 ha or 65% of the footprint (plus 100 m buffer).	Option D/PAG OL had myotis spp observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 706.4 ha or 23% of the footprint (plus 100 m buffer).	Option E had no myotis spp observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 507.2 ha or 54.5% of the footprint (plus 100 m buffer).	Option FS had myotis spp observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 870 ha or 65% of the footprint (plus 100 m buffer).	Yes
direct loss or disturbance (indirect loss = 100m buffer) to western toad habitat	Options that more greatly disturbs high-quality western toad habitat are less preferable.	Option C had western toad observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 17.2 ha or 2% of the footprint (plus 100 m buffer).	Option D had western toad observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 353.9 ha or 26% of the footprint (plus 100 m buffer).	Option D/PAG OL had western toad observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 343.5 ha or 23% of the footprint (plus 100 m buffer).	Option E had no western toad observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 300.6 ha or 32% of the footprint (plus 100 m buffer).	Option FS had western toad observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 353 ha or 26% of the footprint (plus 100 m buffer).	Yes
direct loss or disturbance (indirect loss = 100m buffer) to terrestrial bird habitat	Options that more greatly disturbs high-quality terrestrial birds (olive-sided flycatcher) habitat are less preferable.	Option C recorded olive-sided flycatcher observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 910.3 ha or 83% of the footprint (plus 100 m buffer).	Option D recorded no olive-sided flycatcher observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 864.5 ha or 65% of the footprint (plus 100 m buffer).	Option D/PAG OL recorded no olive-sided flycatcher observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 711.5 ha or 48% of the footprint (plus 100 m buffer).	Option E recorded no olive-sided flycatcher observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 507.4 ha or 54.5% of the footprint (plus 100 m buffer).	Option FS recorded no olive-sided flycatcher observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 868.5 ha or 65% of the footprint (plus 100 m buffer).	Yes
direct loss or disturbance (indirect loss = 100m buffer) to raptor habitat	Options that more greatly disturbs high-quality raptors (red-tailed hawk) habitat are less preferable.	Option C recorded red-tailed hawk observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 799.3 ha or 73% of the footprint (plus 100 m buffer).	Option D recorded red-tailed hawk observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 701.8 ha or 52% of the footprint (plus 100 m buffer).	Option D/PAG OL recorded no red-tailed hawk observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 532.7 ha or 36% of the footprint (plus 100 m buffer).	Option E recorded no red-tailed hawk observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 360.4 ha or 39% of the footprint (plus 100 m buffer).	Option FS recorded red-tailed hawk observations. Habitat suitability modeling predicts direct and indirect high-quality habitat loss of 711.6 ha or 53% of the footprint (plus 100 m buffer).	Yes
Vegetation and Ecosystems							
loss of wetland extent	Options that directly impact greater wetland surface area have a higher probability of negatively affecting habitat for many wildlife species, as well as impacting their ability to filter water for downstream environments and provide other ecological functions.	Presence of 146 ha	Presence of 197 ha	Presence of 201 ha	Presence of 148 ha	Presence of 194 ha	Yes
loss of listed wetlands	Options that affect listed wetlands and are reviewed by Environment Canada will require a conservation plan to meet the federal policy on wetland conservation	Presence of 7 ha	Presence of 12 ha	Presence of 16 ha	Presence of < 1 ha	Presence of 12 ha	Yes
rare and endangered ecosystems	Options that affect rare or endangered ecosystems (as considered by the British Columbia Conservation Data Centre) are less preferable due to higher associated potential costs to biodiversity.	No non-wetland ecosystems at risk noted	No non-wetland ecosystems at risk noted	No non-wetland ecosystems at risk noted	No non-wetland ecosystems at risk noted	No non-wetland ecosystems at risk noted	No (not sufficiently differentiating)

(continued)

Table 5.3-2. Environmental Characterization Criteria Summary (completed)

Characterization Criteria Indicators	Rationale	Option C	Option D	Option D/PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Vegetation and Ecosystems (cont'd)							
rare and endangered plant species	Options that affect rare or endangered plant species (as considered by the British Columbia Conservation Data Centre, the *Species at Risk Act*, and the Committee on the Status of Endangered Wildlife in Canada), including whitebark pine, are less preferable due to higher associated potential costs to biodiversity.	No whitebark pine habitat noted; BC blue-listed moss species Tomentypnum falcifolium identified at one location	Whitebark pine identified at one location	Whitebark pine identified at one location	No whitebark pine habitat noted; BC blue-listed moss species Tomentypnum falcifolium identified at one location	Whitebark pine identified at one location	No, as all TSF options contain at least one rare or endangered plant species, this indicator is not differentiating
sparsely vegetated ecosystems	Options that affect sparsely vegetated ecosystems are less preferable due to their high contribution to terrestrial biodiversity.	No sparsely vegetated ecosystems noted	No sparsely vegetated ecosystems noted	No sparsely vegetated ecosystems noted	No sparsely vegetated ecosystems noted	No sparsely vegetated ecosystems noted	No (not sufficiently differentiating)
riparian ecosystems	Options that affect riparian ecosystems are less preferable due to their high contribution to terrestrial and aquatic biodiversity.	Presence of 80 ha	Presence of 147 ha	Presence of 168 ha	Presence of 121 ha	Presence of 142 ha	Yes
mature forest ecosystems	Options that affect mature forest are less preferable due to their high biodiversity values.	Presence of 37 ha	Presence of 161 ha	Presence of 93 ha	Presence of 91 ha	Presence of 154 ha	Yes
Terrain and Soils							
relief, complexity of topography	Options that can take advantage of natural topography to contain waste are preferred.	No topographical challenges predicted; option is a conventional valley dam that takes advantage of mountainous topography to contain tailings	No topographical challenges predicted; option is a conventional valley dam that takes advantage of mountainous topography to contain tailings	No topographical challenges predicted; option is a conventional valley dam that takes advantage of mountainous topography to contain tailings	topographical challenges predicted; option is a 3-sided facility that does not take advantage of mountainous topography to contain tailings	No topographical challenges predicted; option is a conventional valley dam that takes advantage of mountainous topography to contain tailings	Yes
soils	Options that include a large footprint are less preferred than those of a small footprint of similar productivity. Options that affect higher productivity soils (as determined by site productivity) are less preferable than low or non-productive soils or non-soils.	Extent: 933 ha; Average productivity of Low (Site Index 10.8); lowest productivity, 2nd smallest footprint	Extent: 1,110 ha; Average productivity of Moderate (Site Index 12.2); mid-range footprint, mid- range productivity	Extent: 1,176 ha; Average productivity of Moderate (Site Index 12.0); largest footprint, mid- range productivity	Extent: 792 ha; Average productivity of Moderate (Site Index 12.7); highest productivity, smallest footprint	Extent: 1,116 ha; Average productivity of Moderate (Site Index 12.2); mid-range footprint, mid- range productivity	Yes

Notes:
[1] *AMEC (2012c).*

Table 5.3-3. Socio-Economic Characterization Criteria Summary

Characterization Criteria	Rationale	Option C	Option D	Option D/PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Current Use of Lands and Resources for Traditional Purposes – Lhoosk'uz Dene Nation							
hunting	TSF options that overlap with LDN areas of current use of lands and resources for traditional purposes are less preferred	Option does not overlap with known LDN hunting areas	Option does not overlap with LDN known hunting areas	Option does not overlap with LDN known hunting	Option does not overlap with LDN known hunting areas	Option does not overlap with known LDN hunting area	No, not differentiating
trapping	TSF options that overlap with LDN areas of current use of lands and resources for traditional purposes are less preferred	Option overlaps trapline tenure held by LDN member, this tenure is not currently being used	Option overlaps trapline tenure held by LDN member, this tenure is not currently being used	Option overlaps trapline tenure held by LDN member, this tenure is not currently being used	Option overlaps trapline tenure held by a LDN member, this tenure is not currently being used	Option overlaps trapline tenure held by LDN member, this tenure is not currently being used	No, not differentiating
fishing	TSF options that overlap with LDN areas of current use of lands and resources for traditional purposes are less preferred	Option does not overlap with LDN fishing locations	Option does not overlap with LDN fishing locations	Option does not overlap with LDN fishing locations	Option does not overlap with LDN fishing locations	Option does not overlap with LDN fishing locations	No, not differentiating
harvest of traditional plants	TSF options that overlap with LDN areas of current use of lands and resources for traditional purposes are less preferred	Option does not overlap with LDN gathering areas	Option does not overlap with LDN gathering areas	Option does not overlap with LDN gathering areas	Option does not overlap with LDN gathering areas	Option does not overlap with LDN gathering areas	No, not differentiating
cultural or traditional use	TSF options that overlap with LDN areas of current use of lands and resources for traditional purposes are less preferred	No known use	No known use	No known use	No known use	No known use	No, not differentiating
Current Use of Lands and Resources for Traditional Purposes– Ulkatcho First Nation							
hunting	TSF options that overlap with areas of current use of lands and resources for traditional purposes for UFN are less preferred	Option overlaps with UFN hunting areas	Option overlaps with UFN hunting areas	Option overlaps with UFN hunting areas	Option overlaps with UFN hunting areas	Option overlaps with UFN hunting areas	No, not differentiating
trapping	TSF options that overlap with areas of current use of lands and resources for traditional purposes for UFN are less preferred	Option overlaps with UFN trapping areas	Option overlaps with UFN trapping areas	Option overlaps with UFN trapping areas	Option overlaps with UFN trapping areas	Option overlaps with UFN trapping areas	No, not differentiating
fishing	TSF options that overlap with areas of current use of lands and resources for traditional purposes for UFN are less preferred	Option does not overlap with UFN fishing locations	Option does not overlap with UFN fishing locations	Option does not overlap with UFN fishing locations	Option does not overlap with UFN fishing locations	Option does not overlap with UFN fishing locations	No, not differentiating
harvest of traditional plants	TSF options that overlap with areas of current use of lands and resources for traditional purposes for UFN are less preferred	Option may overlap areas for the harvest of traditional plants while using the area for other purposes (camping, trail use).	Option may overlap areas for the harvest of traditional plants while using the area for other purposes (camping, trail use).	Option may overlap areas for the harvest of traditional plants while using the area for other purposes (camping, trail use).	Option may overlap areas for the harvest of traditional plants while using the area for other purposes (camping, trail use).	Option may overlap areas for the harvest of traditional plants while using the area for other purposes (camping, trail use).	No, not differentiating
use of spritual/ traditional sites	TSF options that overlap with areas of current use of lands and resources for traditional purposes for UFN are less preferred	Option overlap with 13 known heritage features, all consisting of blazed trees. A trail, campsite, and a place name were identified within the area of the Project footprint.	Overlap with 34 known heritage features, including 31 blazed trees and three culturally modified trees. A trail, campsite, and a place name were identified within the area of the Project footprint.	Overlaps with 34 known heritage features, including the remains of a historic cabin, 29 blazed trees and four culturally modified trees. A trail, campsite, and a place name were identified within the area of the Project footprint.	Overlaps with 11 known heritage features, including eight blazed trees and three culturally modified trees. A trail, campsite, and a place name were identified within the area of the Project footprint.	Overlaps with 31 known heritage features, including 28 blazed trees and three culturally modified trees. A trail, campsite, and a place name were identified within the area of the Project footprint.	Yes

(continued)

Table 5.3-3. Socio-Economic Characterization Criteria Summary (continued)

Characterization Criteria	Rationale	Option C	Option D	Option D/PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Current Use of Lands and Resources for Traditional Purposes – Skin Tyee Nation							
hunting	TSF options that overlap with areas of current use of lands and resources for traditional purposes for STN are less preferred	Option overlaps with hunting areas	Option overlaps with hunting areas	Option overlaps with hunting areas	Option overlaps with hunting areas	Option overlaps with hunting areas	No, not differentiating
trapping	TSF options that overlap with areas of current use of lands and resources for traditional purposes for STN are less preferred	Option does not overlap with STN trapping areas	Option does not overlap with STN trapping areas	Option does not overlap with STN trapping areas	Option does not overlap with STN trapping areas	Option does not overlap with STN trapping areas	No, not differentiating
fishing	TSF options that overlap with areas of current use of lands and resources for traditional purposes for STN are less preferred	Option does not overlap with STN fishing locations	Option does not overlap with STN fishing locations	Option does not overlap with STN fishing locations	Option does not overlap with STN fishing locations	Option does not overlap with STN fishing locations	No, not differentiating
harvest of traditional plants	TSF options that overlap with areas of current use of lands and resources for traditional purposes for STN are less preferred	Option does not overlap with STN gathering areas	Option does not overlap with STN gathering areas	Option does not overlap with STN gathering areas	Option does not overlap with STN gathering areas	Option does not overlap with STN gathering areas	No, not differentiating
use of spritual/ traditional sites	TSF options that overlap with areas of current use of lands and resources for traditional purposes for STN are less preferred	Option overlaps with one culturally significant named place	Option overlaps with one culturally significant named place	Option overlaps with one culturally significant named place	Option overlaps with one culturally significant named place	Option overlaps with one culturally significant named place	No, not differentiating
Non-Traditional Land and Resource Use							
forestry tenures	TSF options that overlap with forestry tenures may affect the timber harvesting rights of tenure holders	no overlap	no overlap	no overlap	no overlap	no overlap	No (not sufficiently differentiating)
agriculture and range tenures	TSF options that overlap with agriculture or range tenures may affect the agriculture or range rights of tenure holders	no overlap	168 ha (0.88% overlap of Tenure RAN07515)	152 ha (0.8% overlap of Tenure RAN07515)	209 ha (Tenure RAN07515)	167 ha (0.87% overlap of Tenure RAN07515)	Yes
guide outfitting tenures	TSF options that overlap with guide outfitting tenures may affect the hunting and guiding rights of tenure holders	490.06 ha (0.15% overlap of Tenure 484246); 443.25 ha (0.82% overlap of Tenure 1206416)	714 ha (0.22% overlap of Tenure 484246); 396 ha (0.73% overlap of Tenure 1206416)	519 ha (0.16% overlap of Tenure 484246); 657 ha (1.21% overlap of Tenure 1206416)	792 ha (1.46% overlap of Tenure 1206416)	714 ha (0.22% overlap of Tenure 484246); 402 ha (0.74% overlap of Tenure 1206416)	Yes
trapline tenures	TSF options that overlap with trapline tenures may affect the trapping rights of tenure holders	916 Ha (2.43% overlap of Tenure TR0512T027)	774 ha (2.05% overlap of Tenure TR0512T027); 337 ha (0.33% overlap of Tenure TR0601T003)	900 ha (2.38% overlap of Tenure TR0512T027); 276 ha (0.27% overlap of Tenure TR0601T003)	792 ha (2.1% overlap of Tenure TR0512T027)	785 ha (2.08% overlap of Tenure TR0512T027); 331 ha (0.33 % overlap of Tenure TR0601T003)	Yes
commercial recreation tenures	TSF options that overlap with commercial recreation tenures may affect the commercial recreation rights of tenure holders	no overlap	no overlap	no overlap	no overlap	no overlap	No (not sufficiently differentiating)
mineral claims	TSF option overlap with Little Bear Corp's Mineral Claims	no overlap	no overlap	no overlap	no overlap	no overlap	No (not sufficiently differentiating)

(continued)

Table 5.3-3. Socio-Economic Characterization Criteria Summary Table (completed)

Characterization Criteria	Rationale	Option C	Option D	Option D/PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Recreational Land Uses							
parks and protected areas	TSF options that overlap with parks or protected areas may affect the ability of park visitors to enjoy the area of overlap	no overlap	no overlap	no overlap	no overlap	no overlap	No (not sufficiently differentiating)
recreational sensitivity	TSF options that are located in areas with highly sensitive recreation values may affect the ability of recreationists to enjoy the area of overlap	394 ha (2.23% overlap of RFI#10716 Med Sen/Med Sig); 398 ha (8.08% overlap of RFI# 10769 No Sen/Sig); 142 ha (35.78% overlap of RFI# 10784 Med Sen/High Sig)	1,056 ha (5.97% overlap of RFI#10716 Med Sen/Med Sig); 50 ha (1.02% overlap of RFI# 10769 No Sen/Sig); 4 ha (0.971% overlap of RFI# 10784 Med Sen/High Sig)	North Polygon: 774 ha (4.37% overlap of RFI#10716 Med Sen/Med Sig); 6 ha (0.12% overlap of RFI# 10769 No Sen/Sig). South Polygon: 197 ha (1.11% overlap of RFI#10716 Med Sen/Med Sig); 198 ha (4.02% overlap of RFI# 10769 No Sen/Sig).	768 ha (4.34% overlap of RFI#10716 Med Sen/Med Sig); 24 ha (0.49% overlap of RFI# 10769 No Sen/Sig)	1,049 ha (5.93% overlap of RFI#10716 Med Sen/Med Sig); 66 ha (1.35% overlap of RFI# 10769 No Sen/Sig); 0.16ha (0.04% overlap of RFI# 10784 Med Sen/High Sig)	Yes
Archaeology							
effects to known archaeological sites	TSF options that do not overlap with archaeological sites are preferred	option does not overlap any known archaeological sites	option is within 50 m of known archeological site	option is within 50 m of known archeological site	option does not overlap any known archaeological sites	option does not overlap any known archaeological sites	Yes
effects to known heritage sites	TSF options that do not overlap with heritage sites are preferred	option overlaps thirteen known heritage features	option overlaps 34 known heritage features	option overlaps 34 known heritage features	option overlaps eleven known heritage features	option overlaps 31 known heritage features	No (not sufficiently differentiating)
Engagement and Consultation							
local Aboriginal community response	The identification of asserted interests and rights allows for their consideration in project decision making	reflected through the inclusion of subaccounts/indicators of asserted interests/rights including traditional knowledge, where available	reflected through the inclusion of subaccounts/indicators of asserted interests/rights including traditional knowledge, where available	reflected through the inclusion of subaccounts/indicators of asserted interests/rights including traditional knowledge, where available	reflected through the inclusion of subaccounts/indicators of asserted interests/rights including traditional knowledge, where available	reflected through the inclusion of subaccounts/indicators of asserted interests/rights including traditional knowledge, where available	No – addressed indirectly – through other subaccounts/ indicators
regional community response	The identification of community values supports the alignment of project alternatives with those values	issues identified through consultation activities reflected by other subaccounts/indicators	issues identified through consultation activities reflected by other subaccounts/indicators	issues identified through consultation activities reflected by other subaccounts/indicators	issues identified through consultation activities reflected by other subaccounts/indicators	issues identified through consultation activities reflected by other subaccounts/indicators	No – addressed indirectly – through other subaccounts/ indicators

Table 5.3-4. Project Economic Characterization Criteria Summary

Characterization Criteria	Rationale	Option C	Option D	Option D / PAG OL	Option E	Option FS	Advanced to Evaluation Criteria?
Proponent Costs							
initial capital costs	Options with lower costs would be preferable.	$89,000,000	$118,000,000	$196,000,000	$170,000,000	$90,000,000	Yes
sustaining capital and operating costs	Options with lower costs would be preferable.	$281,000,000	$254,000,000	$217,000,000	$630,000,000	$314,000,000	Yes
closure costs	Options with lower costs would be preferable.	$47,000,000	$43,000,000	$166,000,000	$65,000,000	$49,000,000	Yes
total costs	Options with lower costs would be preferable (does not include habitat compensation costs)	$417,000,000	$415,000,000	$579,000,000	$832,000,000	$453,000,000	No, redundant to estimated costs per Project phase
cost per tonne of waste	Options with lower costs would be preferable (does not include habitat compensation costs)	$0.53	$0.53	$0.73	$1.05	$0.57	No, redundant to estimated costs per Project phase
fish habitat compensation costs	Options with lower costs would be preferable.	$5M	$4M	$4M	$1M	$4M	Yes

6. MULTIPLE ACCOUNTS LEDGER

As per section 2.5 of the *Guidelines* (Environment Canada 2011), a multiple accounts ledger identifies criteria from the alternative characterization that differentiate alternatives so that TSF options can be evaluated relative to one another (Figure 6-1). The multiple accounts ledger consists of two elements: sub-accounts (i.e., evaluation criteria) and indicators (i.e., measurement criteria).

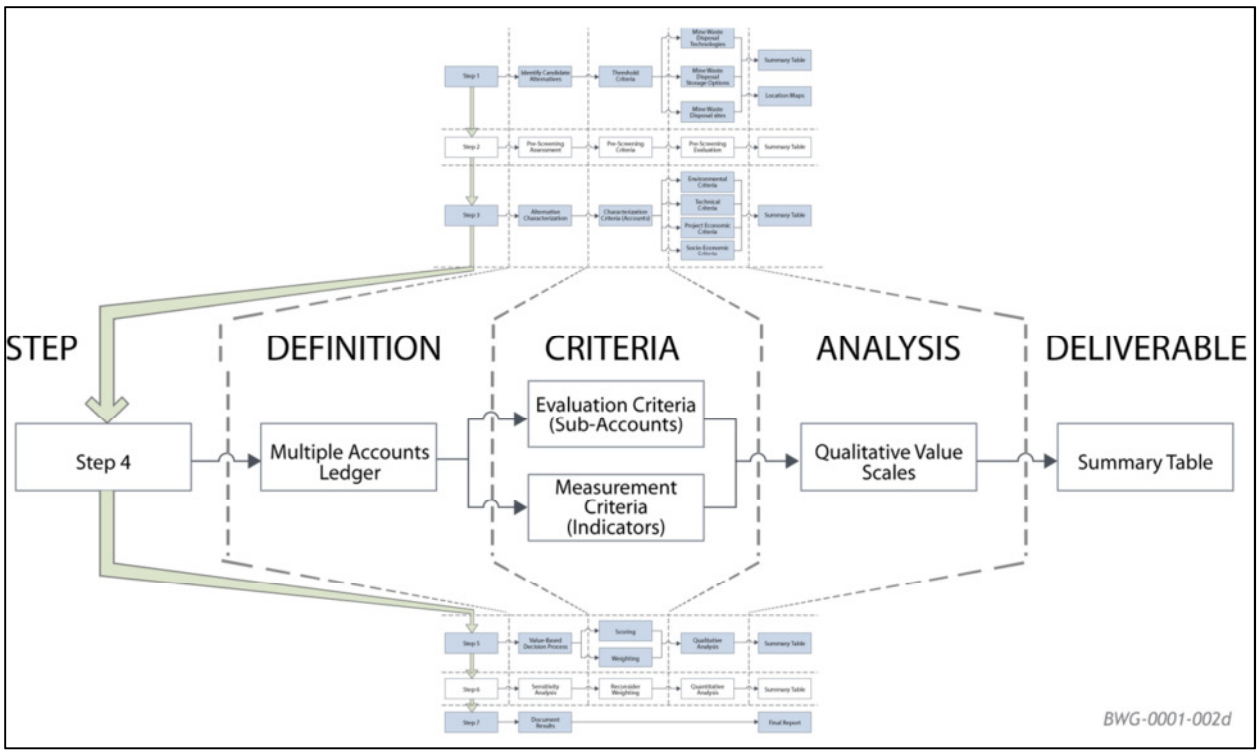


Figure 6-1. Multiple Accounts Ledger Step

6.1 SUB-ACCOUNTS (EVALUATION CRITERIA)

Sub-accounts only consider the benefit or loss associated with any of the alternatives being evaluated and they only include criteria that are:

- **Impact driven**: The sub-account must, as far as practicable, be linked to an impact.
- **Differentiating**: The sub-account must define an aspect which distinctly differentiates one alternative from another, and that difference is expected to have a material effect on the final selection of an alternative.
- **Value relevance**: A sub-account must be relevant in the context of the alternatives being evaluated.
- **Understandability**: A sub-account must be unambiguously defined, such that two external reviewers cannot interpret the outcome differently.

- **Non-redundancy**: There should not be more than one sub-account that measures the same evaluation criteria.
- **Judgmental independence**: Sub-accounts should be independent, meaning that one sub-account cannot depend on another.

As with accounts, the selected sub-accounts were identified on a project specific basis by a multi-disciplinary team who followed the recommendations outlined in the *Guidelines* (Table 6.1-1). The selected sub-accounts for each account are described below.

Table 6.1-1. Evaluation Criteria (Sub-Account) and Supporting Rationale for their Selection

Account	Evaluation Criteria (Sub-Account)	Rationale
Technical	PAG Waste Rock Stored On-Land	Options with less storage of PAG Waste Rock stored on-land are preferred due to less complex water management, and decreased environmental risk
	Tailings Dam Characteristics	Options with less complex or fewer tailings dams characteristic are preferred due to lower engineering and environmental risk
	Supporting Infrastructure	Options with less complex supporting infrastructure are preferred due to lower engineering and environmental risk
	Containment Structure Design	Options with less complex containment structure designs are preferred due to lower engineering and environmental risk
	Water Management System	Options with less complex water management requirements are more preferred because of lower engineering risk, lower costs, potentially greater success at closure, and lower environmental risk
	Construction, Operation and Closure Approaches	Options with higher construction, operation, and closure requirements are generally less desirable from a cost perspective, and may have a higher long-term risk of failure
Environmental	Surface Water Quality	Options that have high potential impacts to surface water quality are less desirable due to higher potential effects to the receiving environment and increased requirements for long-term water treatment.
	Hydrology	Options with higher potential impacts to surface water hydrology are less preferable due to the higher associated impacts to the aquatic environment, and the potential increased engineering challenges.
	Hydrogeology	Options with highly complicated hydrogeology (e.g., depth to groundwater) are less preferable due to the increased engineering challenges and risks associated with minimizing impacts to groundwater.
	Climate and Atmosphere	Options that have high potential for fugitive dust or greenhouse gas emissions are less desirable due to higher associated risks to human health, vegetation and wildlife habitat, and global climate change.
	Fish and Fish Habitat	Options with greater effects to fish and fish habitat are less desirable due to the high ecological, social, and economic importance of fish and fish habitat
	Wildlife	Options that affect rare ecosystems or high quality habitat for valued or at-risk wildlife species are less desirable due to higher associated costs to biodiversity and traditional use values.

(continued)

Table 6.1-1. Evaluation Criteria (Sub-Account) and Supporting Rationale for their Selection (completed)

Account	Evaluation Criteria (Sub-Account)	Rationale
Environmental *(cont'd)*	Vegetation and Ecosystems	Options that affect rare ecosystems or areas of high biodiversity are less desirable due to higher associated costs to biodiversity and traditional use values.
	Terrain and Soils	Options able to use terrain features for containment (e.g., U-shaped valleys) are preferred due to reduced engineering challenges and environmental risk, and lower costs to the Proponent.
Socio-Economics	Current Use of Lands and Resources for Traditional Purposes – UFN	Current use of lands and resources for traditional purposes may be affected by the location of TSF options
	Non-traditional Land and Resource Use	The economic interests of commercial tenure holders may be affected by the location of TSF option
	Recreational Land Uses	The enjoyment of recreational land users may be affected by the location of TSF options
	Archaeology	Archaeological sites are protected under the *Heritage Conservation Act* (1996b) and non-protected heritage sites may hold cultural and social value
Project Economics	Proponent Costs	Options with lower overall costs are more preferred

6.2 MEASUREMENT CRITERIA (INDICATORS)

To allow the accounts and sub-accounts to be measured and compared, the indicators must be measureable. A six-point scale was used because it provides sufficient range to differentiate without being overly detailed, and it is an even number scale which eliminates the tendency to select the "middle-of-the road" value. Qualitative (i.e., value-based) scales were developed (e.g., very high, high, low, etc.) when precise measurability was not possible, as per the *Guidelines*. (Environment Canada 2011). Value scales were developed to have the following characteristics:

- **Reliable**: External reviewers must be able to rate an alternative according to the value scale and assign the same score.
- **Value relevant**: The value scale must be directly relevant to the indicator being scored.
- **Justifiable**: Any external reviewer should reach the conclusion that the value scale is reasonable and representative.

The primary deliverable for this step is the multiple accounts ledger (Table 6.2-1) which details the sub-accounts and the indicators. The value scale for each of the indicators is documented in indicator-specific tables (Tables 6.2-2 through 6.2-5).

Note that, while only one of the alternatives considered here involves on-land PAG waste disposal, the inclusion of "quality of PAG waste rock stored on-land" and "complexity of containment" indicators were intended to highlight two of the greatest concerns/risks with on-land disposal of

PAG waste rock. These indicators are not measureable quantitatively. However the prevention of ARD and minimization of ML is a fundamental design criterion for Blackwater – creating an on-land PAG waste rock dump is inconsistent with that criterion and must be factored appropriately into the MAA.

6.2.1 Technical Indicator Quantitative Value Scales

Quantitative value scales are provided for each technical indicator with the ranked score for each TSF option indicated (Table 6.2-2). Specific values for each option are detailed in Table 5.3-1, the Technical Characterization Criteria Summary.

6.2.2 Environmental Indicator Quantitative Value Scales

Quantitative value scales are provided for each environmental indicator with the ranked score for each TSF option indicated. Specific values for each option are detailed in Table 5.3-2, the Environmental Characterization Criteria Summary.

6.2.3 Socio-Economic Indicator Quantitative Value Scales

Quantitative value scales are provided for each indicator with the ranked score for each TSF alternative indicated. Specific values for each option are detailed in Table 5.3-4, the Socio-Economic Characterization Criteria Summary.

6.2.4 Project Economic Indicator Quantitative Value Scales

Quantitative value scales are provided for each indicator with the ranked score for each TSF alternative indicated. Specific values for each option are detailed in Table 5.3-3, the Project Economics Characterization Criteria Summary.

Table 6.2-1. Multiple Accounts Ledger

Account	Sub-Account (Evaluation Criteria)	Indicator (Measurement Criteria)	Indicator Parameter	Unit
Technical	PAG Waste Rock Stored On-Land	Quality of PAG rock stored on-land	Acid-Metal generation potential of PAG Waste Rock	#
		Quantity of PAG rock stored on-land	Volume	Mm^3
		Complexity of containment	Qualitative Value	#
	Tailings Dam Characteristics	Distance from deposit	Distance	km
		Complexity of containment	Qualitative Value	#
		Maximum TSF embankment heights	Height	m
		Total TSF embankment volume	Volume	Mm^3
		Number of impoundment dams required	Number	#
		Storage efficiency	Ratio	unitless
		Availability of local borrow materials for construction of embankments	Qualitative Value	#
		Dam foundation conditions	Qualitative Value	#
	Supporting Infrastructure	Number of starter dams	Number	#
		PAG waste rock delivery and placement	Qualitative Value	#
		Tailings delivery and placement	Length	km
		Reclaim pipeline length	Length	km
	Containment Infrastructure Design	Containment infrastructure design	Qualitative Value	#
		Ability to handle extreme events	Qualitative Value	#
	Water Management System	Complexity of seepage collection	Qualitative Value	#
		Potential for long-term water treatment	Qualitative Value	#
		Potential for active versus passive water treatment	Qualitative Value	#
		Complexity of diversion structures	Qualitative Value	#
	Construction, Operation and Closure Approaches	Ease of construction	Qualitative Value	#
		Closure requirements	Qualitative Value	#
Environmental	Surface Water Quality	Water quality of receiving environment	Qualitative Value	#
		Potential for ARD / ML generation (construction material)	Volume	Mm^3

(continued)

Table 6.2-1. Multiple Accounts Ledger (continued)

Account	Sub-Account (Evaluation Criteria)	Indicator (Measurement Criteria)	Indicator Parameter	Unit
Environmental *(cont'd)*	Hydrology	Size of watersheds effected	Area	km^2
		Potential catchment loss to toe of TSF	Area	km^2
	Hydrogeology	Seepage management	Qualitative Value	#
	Climate and Atmosphere	Climate effects on water management	Value	#
		Dust emissions	Value	#
	Fish and Fish Habitat	Extent of permanent alteration to or destruction of fish habitat	Area	ha
		Loss of Fish Habitat	Value	#
		Downstream Kokanee values	Value	#
		Downstream Rainbow Trout values	Value	#
	Wildlife	Presence of species of conservation concern other than grizzly bear, caribou, moose, American marten, Myotis bats, western toad, olive-sided flycatcher and red-tailed hawk	Value	#
		Direct loss or disturbance to grizzly bear habitat	Area	ha
		Direct loss or disturbance to caribou habitat	Area	ha
		Direct loss or disturbance to moose habitat	Area	ha
		Direct loss or disturbance to American marten habitat	Area	ha
		Direct loss or disturbance to myotis spp. habitat	Area	ha
		Direct loss or disturbance to western toad habitat	Area	ha
		Direct loss or disturbance to terrestrial bird habitat	Area	ha
		Direct loss or disturbance to raptor habitat	Area	ha
	Vegetation and Ecosystems	Wetland ecosystems	Area	ha
		Rare and endangered wetland associations	Area	ha
		Riparian ecosystems	Area	ha
		Mature forest ecosystems	Area	ha
	Terrain and Soils	Relief, complexity of topography	Value	yes/no
		Soils	Qualitative Value	#

(continued)

Table 6.2-1. Multiple Accounts Ledger (completed)

Account	Sub-Account (Evaluation Criteria)	Indicator (Measurement Criteria)	Indicator Parameter	Unit
Socio-economic	Current Use of Lands and Resources for Traditional Purposes – Ulkatcho First Nation	Use of cultural/traditional sites	Qualitative Value	#
	Non-Traditional Land and Resource Use	Agriculture and range tenures	% overlap	%
		Guide outfitting tenures	% overlap	%
		Agricultural and range tenures	% overlap	%
		Trapline tenures	% overlap	%
	Recreational Land Uses	Recreational sensitivity	Qualitative Value	#
	Heritage	Effects to known archaeological sites	Number	#
Project Economics	Proponent Costs	Initial Capital cost	Cost	$
		Sustaining capital and operating cost	Cost	$
		Closure cost	Cost	$
		Fish habitat compensation costs	Cost	$

Table 6.2-2. Quantitative Value Scales for Technical Indicators

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
PAG Waste Rock Stored on Land	Quality of PAG waste rock stored on-land			4	4	1	4	4
		6	only overburden stored on land					
		5	NAG5 WR material stored on land					
		4	NAG4 WR material stored on land					
		3	NAG3 WR material stored on land					
		2	N/A					
		1	PAG WR material stored on land					
	Quantity of PAG waste rock stored on-land			6	6	1	6	6
		6	no PAG/ML WR stored on land					
		5	up to10 Mt PAG/ML WR stored on land					
		4	10 to 25 Mt PAG/ML WR stored on land					
		3	25.1 - 50 Mt PAG/ML WR stored on land					
		2	50.1 - 100 Mt PAG/ML WR stored on land					
		1	> 100 Mt PAG/ML WR stored on land					
	Complexity of containment			3	5	1	4	6
		6	simple					
		5	less simple					
		4	neutral					
		3	minor complexities					
		2	moderate complexities					
		1	complex					

(continued)

Table 6.2-2. Quantitative Value Scales for Technical Indicators (continued)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Tailings Dam Characteristics	Distance from deposit			6	6	5	6	6
		6	less than 5 km					
		5	5 km to 6 km					
		4	6.1 km to 7 km					
		3	7.1 km to 8 km					
		2	8.1 km to 9 km					
		1	greater than 9 km					
	Complexity of containment			4	6	6	3	5
		6	simple					
		5	less simple					
		4	neutral					
		3	minor complexities					
		2	moderate complexities					
		1	complex					
	Maximum TSF embankment height			3	5	6	4	5
		6	<135 m					
		5	135 to 150 m					
		4	151 to 165 m					
		3	166 to 180 m					
		2	181 to 195 m					
		1	>195 m					

(continued)

Table 6.2-2. Quantitative Value Scales for Technical Indicators (continued)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Tailings Dam Characteristics *(cont'd)*	Total TSF embankment volume			5	4	6	1	3
		6	< 40 Mm^3					
		5	40 to 55 Mm^3					
		4	55.1 to 70 Mm^3					
		3	70.1 to 85 Mm^3					
		2	85.1 to 100 Mm^3					
		1	> 100 Mm^3					
	Number of impoundment dams required	6	1	1	3	6	6	1
		5	-					
		4	-					
		3	2					
		2	-					
		1	3					
	Storage efficiency			6	5	6	1	4
		6	> 9					
		5	8.1 to 9					
		4	7.1 to 8					
		3	6.1 to 7					
		2	5 to 6					
		1	< 5					

(continued)

Table 6.2-2. Quantitative Value Scales for Technical Indicators (continued)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Tailings Dam Characteristics *(cont'd)*	Availability of local borrow materials for construction of embankments			6	6	6	3	6
		6	sufficient local material available					
		5	N/A					
		4	N/A					
		3	sufficient local material may not be available					
		2	N/A					
		1	sufficient local material is unavailable					
	Dam foundation conditions			5	5	5	3	5
		6	best					
		5	appropriate					
		4	neutral					
		3	limited information available					
		2	marginal					
		1	unacceptable					
Supporting Infrastructure	Number of starter dams			5	6	6	6	6
		6	1 starter dam					
		5	2 starter dams					
		4	3 starter dams					
		3	4 starter dams					
		2	5 starter dams					
		1	6 starter dams					

(continued)

Table 6.2-2. Quantitative Value Scales for Technical Indicators (continued)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Supporting Infrastructure *(cont'd)*	PAG waste rock delivery and placement			3	5	6	3	5
		6	best					
		5	good					
		4	satisfactory					
		3	acceptable					
		2	bad					
		1	worst					
	Tailings delivery and placement			3	6	6	6	1
		6	< 9 km pipeline length					
		5	9 - 10 km pipeline length					
		4	10.1 - 11 km pipeline length					
		3	11.1- 12 km pipeline length					
		2	12.1 - 13 km pipeline length					
		1	> 13 km pipeline length					
	Reclaim pipeline length			6	6	6	6	6
		6	< 3 km pipeline length					
		5	N/A					
		4	N/A					
		3	N/A					
		2	N/A					
		1	> 3 km pipeline length					

(continued)

Table 6.2-2. Quantitative Value Scales for Technical Indicators (continued)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Containment Infrastructure design	Containment infrastructure design			6	6	1	4	6
		6	good					
		5	satisfactory					
		4	acceptable					
		3	bad					
		2	worst					
		1	unacceptable					
	Ability to handle extreme events			6	6	1	6	6
		6	good					
		5	satisfactory					
		4	acceptable					
		3	bad					
		2	worst					
		1	unacceptable					
Water Management System	Complexity of seepage collection			4	6	1	2	5
		6	best					
		5	good					
		4	satisfactory					
		3	acceptable					
		2	bad					
		1	worst					

(continued)

Table 6.2-2. Quantitative Value Scales for Technical Indicators (continued)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Water Management System *(cont'd)*	Potential for long-term water treatment			4	5	1	3	5
		6	low / negligible potential for long-term water treatment					
		5	low probability potential for long-term water treatment					
		4	not likely potential for long-term water treatment					
		3	possible potential for long-term water treatment					
		2	likely potential for long-term water treatment					
		1	expected potential for long-term water treatment					
	Potential for active versus passive water treatment			3	5	1	3	6
		6	passive water treatment for finite period					
		5	passive water treatment for very long period					
		4	active water treatment for finite and passive water treatment for long period					
		3	possible active water treatment for long period					
		2	possibly active water management in perpetuity					
		1	expected active water treatment in perpetuity					
	Complexity of diversion infrastructure			5	6	3	4	6
		6	best					
		5	good					
		4	satisfactory					
		3	acceptable					
		2	bad					
		1	worst					

(continued)

Table 6.2-2. Quantitative Value Scales for Technical Indicators (completed)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Construction, Operation, and Closure Considerations	Ease of construction			4	4	3	1	6
		6	best, highly satisfactory					
		5	good					
		4	satisfactory					
		3	acceptable					
		2	bad					
		1	worst, possibly unsatisfactory					
	Closure requirements			3	5	1	2	6
		6	best, lowest risk					
		5	good					
		4	satisfactory					
		3	acceptable					
		2	bad					
		1	worst, highest risk					

Table 6.2-3. Quantitative Value Scales for Environmental Indicators

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Geochemistry	Water quality of receiving environment			3	4	5	4	4
		6	least risk due to very poor baseline water quality					
		5	lower risk due to poor baseline water quality					
		4	moderate risk due to average baseline water quality					
		3	highest risk due to good baseline water quality					
		2	very high risk due to higher baseline water quality					
		1	extremely high risk due to the highest baseline water quality					
	Potential for ARD/ML generation (construction material)			4	3	4	1	3
		6	nil					
		5	< 20 Mm3					
		4	20.1 Mm3 - 50 Mm3					
		3	50.1 Mm3 - 80 Mm3					
		2	80.1 Mm3 - 110 Mm3					
		1	> 110.1 Mm3					
Hydrology	Size of watersheds effected			4	3	3	3	3
		6	< 80 km^2 total catchment area					
		5	80 - 100 km^2 total catchment area					
		4	100.1 - 120 km^2 total catchment area					
		3	120.1 - 140 km^2 total catchment area					
		2	140.1 - 160 km^2 total catchment area					
		1	> 160 km^2 total catchment area					

(continued)

Table 6.2-3. Quantitative Value Scales for Environmental Indicators (continued)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Hydrology *(cont'd)*	Potential catchment loss to toe of TSF			4	2	2	4	3
		6	< 10 km² total runoff area lost					
		5	10 - 20 km² total runoff area lost					
		4	20.1 - 30 km² total runoff area lost					
		3	30.1 - 40 km² total runoff area lost					
		2	40.1 - 50 km² total runoff area lost					
		1	> 50 km² total runoff area lost					
Hydrogeology	Seepage management			3	5	1	3	5
		6	Low; least potential effect due to ability to manage seepage challenges					
		5	Moderately Low; minor potential effect due to ability to manage seepage challenges					
		4	Moderate potential effect due to ability to manage seepage challenges					
		3	Moderately High potential effect due to ability to manage seepage challenges					
		2	Very High; high potential effect due to ability to manage seepage challenges					
		1	Extremely High; extreme potential effect due to inability to manage seepage challenges					
Climate and Atmosphere	Climate effects on water management			6	6	3	6	6
		6	no anticipated effects					
		5	minor anticipated effects, unlikely challenges					
		4	moderate anticipated effects, unlikely challenges					
		3	probable challenges due to anticipated effects from the onland PAG dump which does not have dams to contain water and may result in release of untreated contact water to the environment					
		2	expected challenges					
		1	extreme challenges					

(continued)

Table 6.2-3. Quantitative Value Scales for Environmental Indicators (continued)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Climate and Atmosphere *(cont'd)*	Dust emissions			6	6	4	6	6
		6	least effects; short beach, sheltered from wind					
		5	minor effects; longer beach or less sheltered, or exposed waste rock					
		4	moderate effects; longer beach and less sheltered					
		3	high effects; long, exposed beach					
		2	major effects; very long exposed beach but may be slightly sheltered					
		1	extreme effects; very long exposed beach					
Fish and Fish Habitat	Extent of permanent alteration to or destruction of fish habitat			1	2	3	5	3
		6	No PAD to fish habitat					
		5	< 3 ha of PAD to fish habitat					
		4	3.1 to 6 ha of PAD to fish habitat					
		3	6.1 to 9 ha of PAD to fish habitat					
		2	9.1 to 12 ha of PAD to fish habitat					
		1	> 12 ha of PAD to fish habitat					
	Value of lost fish habitat			1	4	4	4	4
		6	No PAD to fish habitat					
		5	PAD to marginal fish habitat that has low productive capacity and low spawning and/or rearing potential					
		4	PAD to important fish habitat that is used by fish for feeding, growth and migration and has moderate spawning and rearing potential					
		3	N/A					
		2	N/A					
		1	PAD to critical fish habitat that is necessary for sustaining a fishery including high-value spawning, rearing and overwintering habitat					

(continued)

Table 6.2-3. Quantitative Value Scales for Environmental Indicators (continued)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Fish and Fish Habitat *(cont'd)*	Downstream Kokanee values			5	5	1	3	5
		6	One watershed containing Kokanee is predominantly susceptible to impacts from TSF. Predominantly susceptible watersheds have low density of spawning fish and no critical overwintering habitat downstream.					
		5	One watershed containing Kokanee is predominantly susceptible to impacts from TSF. Predominantly susceptible watersheds have moderate to high density of spawning fish and no critical overwintering habitat downstream.					
		4	One watershed containing Kokanee is predominantly susceptible to impacts from TSF. Predominantly susceptible watersheds have low to moderate density of spawning fish and critical overwintering habitat downstream.					
		3	One watershed containing Kokanee is predominantly susceptible to impacts from TSF. Predominantly susceptible watersheds have moderate to high density of spawning fish and critical overwintering habitat downstream.					
		2	More than one watershed containing Kokanee is predominantly susceptible to impacts from TSF. Predominantly susceptible watersheds have low to moderate density of spawning fish AND critical overwintering habitat downstream.					
		1	More than one watershed containing Kokanee is predominantly susceptible to impacts from TSF. Predominantly susceptible watersheds have moderate to high density of spawning fish AND critical overwintering habitat downstream.					

(continued)

Table 6.2-3. Quantitative Value Scales for Environmental Indicators (continued)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Fish and Fish Habitat *(cont'd)*	Downstream Rainbow trout values			1	5	2	4	5
		6	One watershed containing Rainbow Trout is predominantly susceptible to impacts from TSF. Predominantly susceptible watersheds have low density of spawning fish AND no critical overwintering habitat downstream.					
		5	One watershed containing Rainbow Trout is predominantly susceptible to impacts from TSF. Predominantly susceptible watersheds have moderate to high density of spawning fish AND no critical overwintering habitat downstream.					
		4	One watershed containing Rainbow Trout is predominantly susceptible to impacts from TSF. Predominantly susceptible watersheds have low to moderate density of spawning fish AND critical overwintering habitat downstream.					
		3	One watershed containing Rainbow Trout is predominantly susceptible to impacts from TSF. Predominantly susceptible watersheds have moderate to high density of spawning fish AND critical overwintering habitat downstream.					
		2	More than one watershed containing Rainbow Trout is predominantly susceptible to impacts from TSF. Predominantly susceptible watersheds have low to moderate density of spawning fish AND critical overwintering habitat downstream.					
		1	More than one watershed containing Rainbow Trout is predominantly susceptible to impacts from TSF. Predominantly susceptible watersheds have moderate to high density of spawning fish AND critical overwintering habitat downstream.					

(continued)

Table 6.2-3. Quantitative Value Scales for Environmental Indicators (continued)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Wildlife	Presence of species of conservation concern other than western toad, caribou, grizzly bear, American marten, myotis bats, olive-sided flycatcher and red-tailed hawk			2	4	2	6	4
		6	No rare and endangered wildlife species observed in TSF area					
		5	N/A					
		4	One BC blue-listed wildlife species observed in TSF area					
		3	N/A					
		2	Multiple BC blue-listed wildlife species observed in TSF area, and multiple COSEWIC or SARA Schedule 1 listed species observed in TSF area					
		1	One or more BC red-listed wildlife species observed in TSF area, and multiple COSEWIC or SARA Schedule 1 listed species observed in TSF area					
	Direct loss or disturbance to grizzly bear habitat			1	1	1	5	1
		6	No high-quality habitat					
		5	< 200 ha					
		4	N/A					
		3	N/A					
		2	N/A					
		1	> 200 ha of high-quality habitat					
	Direct loss or disturbance to caribou habitat			3	1	1	5	1
		6	No high-quality habitat					
		5	< 360 ha of high-quality habitat					
		4	360 to 450 ha of high-quality habitat					
		3	450.1 to 540 ha of high-quality habitat					
		2	540.1 to 630 ha of high quality habitat					
		1	> 630 ha of high-quality habitat					

(continued)

Table 6.2-3. Quantitative Value Scales for Environmental Indicators (continued)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Wildlife *(cont'd)*	Direct loss or disturbance to moose habitat			5	2	1	3	2
		6	No high-quality habitat					
		5	< 90 ha of high-quality habitat					
		4	90 to 110 of high-quality habitat					
		3	110.1 to 130 of high-quality habitat					
		2	130.1 to 150 of high quality habitat					
		1	> 150 ha of high-quality habitat					
	Direct loss or disturbance to American marten habitat			4	2	2	1	2
		6	No high-quality habitat					
		5	1 to 56 ha of high-quality habitat					
		4	57 to 112 of high-quality habitat					
		3	113 to 168 of high-quality habitat					
		2	169 to 224 of high quality habitat					
		1	> 224 of high-quality habitat					
	Direct loss or disturbance to myotis spp. habitat			1	1	3	5	1
		6	No high-quality habitat					
		5	< 510 ha of high-quality habitat					
		4	510 to 610 of high-quality habitat					
		3	610.1 to 710 of high-quality habitat					
		2	710.1 to 100 of high quality habitat					
		1	> 810 ha of high-quality habitat					

(continued)

Table 6.2-3. Quantitative Value Scales for Environmental Indicators (continued)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Wildlife *(cont'd)*	Direct loss or disturbance to western toad habitat			5	1	1	2	1
		6	No high-quality habitat					
		5	< 100 ha of high-quality habitat					
		4	100 to 180 ha of high-quality habitat					
		3	180.1 to 260 ha of high-quality habitat					
		2	260.1 to 340 ha of high quality habitat					
		1	> 340 ha of high-quality habitat					
	Direct loss or disturbance to terrestrial bird habitat			1	2	3	5	2
		6	No high-quality habitat					
		5	< 600 ha of high-quality habitat					
		4	600.1 to 700 ha of high-quality habitat					
		3	700.1 to 800of high-quality habitat					
		2	800.1 to 900 ha of high quality habitat					
		1	> 900 ha of high-quality habitat					
	Direct loss or disturbance to raptor habitat			1	2	3	5	2
		6	No high-quality habitat					
		5	< 370 ha of high-quality habitat					
		4	370 to 500 ha of high-quality habitat					
		3	500.1 to 630 ha of high-quality habitat					
		2	630.1 to 760 ha of high quality habitat					
		1	> 760 ha of high-quality habitat					

(continued)

Table 6.2-3. Quantitative Value Scales for Environmental Indicators (continued)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Vegetation and Ecosystems	Wetland ecosystems			5	2	1	5	2
		6	No loss of wetlands					
		5	< 150 ha loss of wetlands					
		4	150 to 166.5 ha loss of wetlands					
		3	166.6.1 to 183.1 ha loss of wetlands					
		2	183.1 to 200 ha loss of wetlands					
		1	> 200 ha loss of wetlands					
	Rare and endangered wetland associations			4	3	2	5	3
		6	No loss of wetlands					
		5	< 5 ha loss of listed wetland associations					
		4	5.1 to 10 ha loss of listed wetland associations					
		3	10.1 to 15 ha loss of listed wetland associations					
		2	15.1 to 20 ha loss of listed wetland associations					
		1	> 20 ha loss of listed wetland associations					
	Riparian ecosystems			5	2	1	3	2
		6	No loss of riparian ecosystems					
		5	< 90 ha of riparian ecosystems					
		4	90 to 110 ha of riparian ecosystems in					
		3	110.1 to 130 ha of riparian ecosystems					
		2	130.1 to 150 ha of riparian ecosystems					
		1	> 150 ha of riparian ecosystems in the TSF area					

(continued)

Table 6.2-3. Quantitative Value Scales for Environmental Indicators (completed)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Vegetation and Ecosystems *(cont'd)*	Mature forest ecosystems			5	2	4	4	2
		6	No mature forest ecosystems					
		5	< 50 ha of mature forest ecosystems					
		4	50.1 to 100 ha mature forest ecosystems					
		3	100.1 to 150 ha of mature forest ecosystems					
		2	150.1 to 200 ha of mature forest ecosystems					
		1	> 200 ha of mature forest ecosystems					
Terrain and Soils	Relief, complexity of topography			6	6	6	1	6
		6	Best option; no topographical challenges predicted; Option takes advantage of topography to contain tailings and PAG waste rock					
		1	Worst option; potential topographical challenges predicted; Option does not take advantage of topography to contain tailings and PAG waste rock					
	Soils	6	Best option; smaller area affected with low productivity soils	6	4	3	2	4
		5	Larger area affected with low productivity soils					
		4	Smaller area affected with moderate productivity soils					
		3	Larger area affected with moderate productivity soils					
		2	Smaller area affected with high productivity soils					
		1	Worst option; larger area affected with high productivity soils					

Table 6.2-4. Quantitative Value Scales for Socio-Economic Indicators

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Current Use of Lands and Resources for Traditional Purposes - Ulkatcho First Nation	Use of Cultural / Traditional Sites			5	1	1	6	2
		6	< 12 heritage features affected					
		5	12 - 16 heritage features affected					
		4	17 - 21 heritage features affected					
		3	22 - 26 heritage features affected					
		2	27 - 31 heritage features affected					
		1	> 31 heritage features affected					
Non-Traditional Land and Resource Use	Guide outfitting tenures			1	1	1	5	1
		6	No overlap with a guide outfitting tenure					
		5	0-24% overlap with one guide outfitting tenure					
		4	25-49% overlap with one guide outfitting tenure					
		3	50-74% overlap with one guide outfitting tenure					
		2	75-100% overlap with one guide outfitting tenure					
		1	Overlap with more than one guide outfitting tenure					
	Agricultural and Range Tenures			6	5	5	5	5
		6	No overlap with either an agricultural or range tenure					
		5	0-24% overlap with one agricultural or range tenure					
		4	25-49% overlap with one agricultural or range tenure					
		3	50-74% overlap with one agricultural or range tenure					
		2	75-100% overlap with one agricultural or range tenure					
		1	Overlap with more than one agricultural or range tenure					

(continued)

Table 6.2-4. Quantitative Value Scales for Socio-Economic Indicators (completed)

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Non-Traditional Land and Resource Use (*cont'd)*	Trapline tenures			5	1	1	5	1
		6	No overlap with a trapline tenure					
		5	0-24% overlap with one trapline tenure					
		4	25-49% overlap with one trapline tenure					
		3	50-74% overlap with one trapline tenure					
		2	75-100% overlap with one trapline tenure					
		1	Overlap with more than one trapline tenure					
Recreational land uses	Recreational sensitivity			3	3	4	4	3
		6	Overlap with unknown sensitivity or low sensitivity, low to moderate significance area					
		5	Overlap with low sensitivity, high significance area					
		4	Overlap with moderate sensitivity, low to moderate significance area					
		3	Overlap with moderate sensitivity, high significance area					
		2	Overlap with high sensitivity, low to moderate significance area					
		1	Overlap with high sensitivity, high significance area					
Archaeology	Effects to known archaeological sites			6	1	1	6	6
		6	No anticipated impacts; Project components are over 1,000 m from known archaeological sites.					
		5	Anticipated project impacts within 500 to 1,000 m of known archaeological sites.					
		4	N/A					
		3	N/A					
		2	Anticipated project impacts within 50 to 500 m of known archaeological sites.					
		1	Anticipated project impacts within 0 to 50 m of known archaeological sites.					

Table 6.2-5. Quantitative Value Scales for Project Economics Indicators

Sub-Account	Indicator	Scalar Value	Unit/ Metric	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS
Proponent costs	Initial capital costs			6	5	1	2	6
		6	<$100,00,000					
		5	$100,000,000 to $120,000,000					
		4	$120,000,001 to $140,000,000					
		3	$140,000,001 to $160,000,000					
		2	$160,000,001 to $180,000,000					
		1	>$180,000,000					
	Sustaining capital and operating costs			5	5	6	1	4
		6	<$220,000,000					
		5	$220,000,000 to $300,000,000					
		4	$300,000,001 to $380,000,000					
		3	$380,000,001 to $460,000,000					
		2	$460,000,001 to $520,000,000					
		1	>$520,000,000					
	Closure costs			6	6	1	4	6
		6	<$50,000,000					
		5	$50,000,000 to $60,000,000					
		4	$60,000,001 to $70,000,000					
		3	$70,000,001 to $80,000,000					
		2	$80,000,001 to $90,000,000					
		1	>90,000,000					
	Fish habitat compensation costs			2	3	4	6	4
		6	<= $2M					
		5	$2.1 - $3M					
		4	$3.1 - $4M					
		3	$4.1 - $5M					
		2	$5.1 - $6M					
		1	>$6M					

7. VALUE-BASED DECISION PROCESS

7.1 INDICATOR WEIGHTING

The indicators for each sub-account were assigned a weighting as presented in the following sections (7.1.1 to 7.1.4). The weightings presented in this section are based on the professional judgment of the appropriate professionals listed in the "List of Experts" given in the Executive Summary of this report.

All indictors were weighted on a 6-point scale, with 6 being the most significantly valued and 1 being the least, as recommended in the *Guidelines* (Figure 7-1).

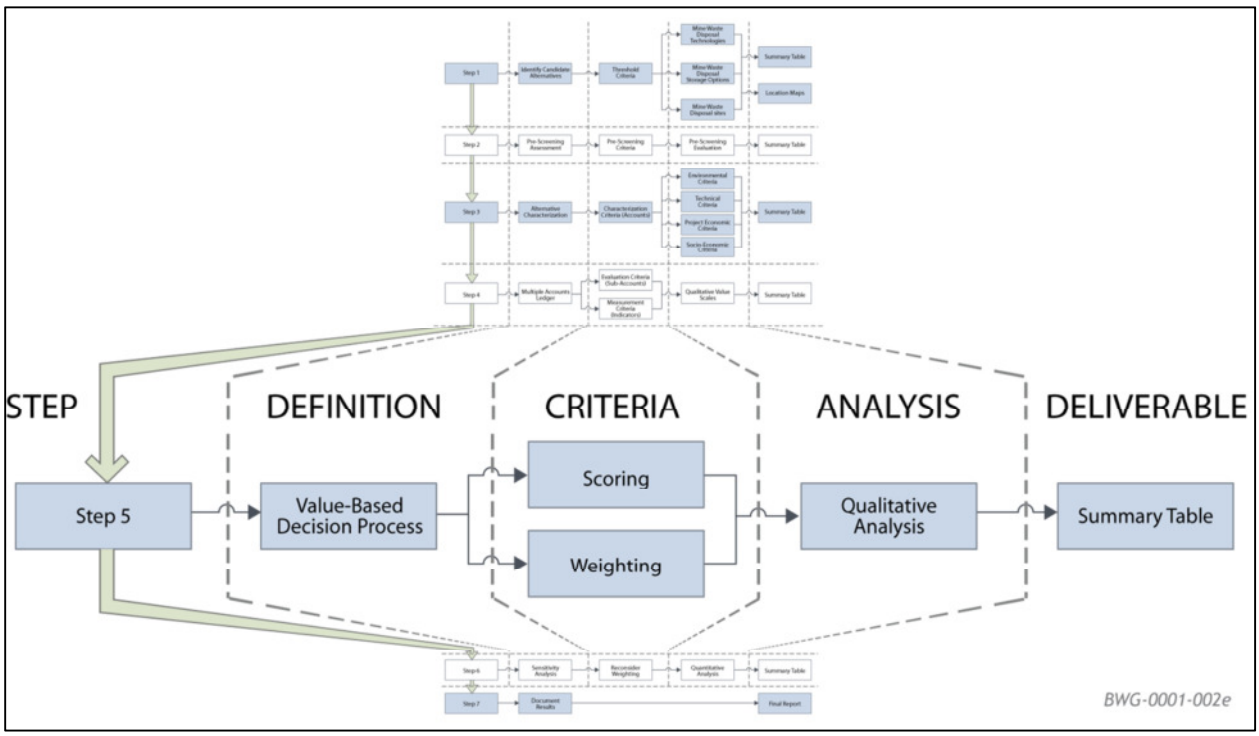


Figure 7-1. Value-based Decision Process Step

7.1.1 Technical Indicators

The indicators for each technical sub-account were each assigned a weighting according to professional judgment. For each sub-account with multiple indicators, these assigned weightings are presented in Tables 7.1-1 to 7.1-5.

The indicator values for the sub-account "PAG waste rock stored on-land" were assigned based on the relative environmental risk, and corresponding increased management challenges and complexity, associated with each indicator (Table 7.1-1). The "quality of the PAG waste rock scored on-land" indicator was given the highest weighting (i.e., had the highest associated risk) because of the reactive nature (relatively short lag time) of the PAG waste rock, the difficulty of managing ML/ARD once produced and the risk of ML/ARD affecting the receiving environment.

The "complexity of containment" indicator was given the lowest weighting (i.e., had the lowest associated risk) because the physical process of dumping waste rock on-land is straight forward and no additional TSF storage capacity would be required for the waste. However a well designed runoff and seepage collection system (possibly including a liner) would be required for an on-land PAG storage facility. In addition, an engineered soil cover would be needed at closure to reduce the quantity of contaminated runoff and seepage requiring long-term management.

Table 7.1-1. PAG Waste Rock Stored On-Land Indicator Weighting

Indicator	Weighting Value
Quality of PAG waste rock stored on-land	4
Quantity of PAG waste rock stored on-land	6
Complexity of containment	3

The indicator values for the sub-account "tailings dam characteristics" were assigned based on the relative complexity, and correpsonding management and environmental risks, of the associated infrastructure (Table 7.1-2). The indicator "maximum TSF embankment heights" and "maximum TSF embankment volumes" were assigned the highest weighting due to the relatively high dams required for the Project and the associated need to incrementally construct the large dams through the operating mine life. As well, the large volumes of construction material required for embankments increases the possibility that PAG material may be required to build them and thus poses a potential risk of ML/ARD being produced within the embankments. The indicators "distance from deposit" was assigned a low weighting because the primary considerations surrounding these indicators (e.g., haulage costs and greenhouse gas emissions) are captured elsewhere in this analysis. The indicator "number of impoundment dams required" was provided a moderate-high rating because of the increased construction and operational complexity associated with multiple impoundment dams. Dam foundations were assigned a moderate weighting because, while favourable dam foundation conditions are critical for the safe construction, operation, and closure of a TSF, the foundation conditions associated with all alternatives considered here are generally considered appropriate based on results from geotechnical drilling and test pits excavated on the site. The indicator "complexity of containment" was also assigned a high weighting because secure containment of large volumes of both tailings/PAG waste rock and water are required. Moroever, a key design objective for the Blackwater TSF is to have no surface water discharge to receiving waters during the operating period to facilitate effective management of process effluents and mine drainage.

Table 7.1-2. Tailings Dam Characteristics Indicator Weighting

Indicator	Weighting Value
Distance from deposit	1
Complexity of containment	5
Maximum TSF embankment heights	6
Total TSF embankment volume	4
Number of impoundment dams required	4

(continued)

Table 7.1-2. Tailings Dam Characteristics Indicator Weighting (continued)

Indicator	Weighting Value
Storage efficiency	3
Availability of local borrow materials for construction of embankments	2
Dam foundation conditions	4

The indicator values for the sub-account "supporting infrastructure" were based on the relative environment risks associated with each indicator (Table 7.1-3). The indicator "PAG waste rock delivery and placement" was assigned the highest weighting because of the risk of ML/ARD generation if there are excessive delays in the subaqeous disposal of the PAG WR (i.e., the PAG WR may be exposed to air for a long period of time). The "tailings delivery and placement" and "reclaim pipeline length" indicators were assigned moderate weightings because of the use of standard industry practice for tailings placement and TSF supernatant reclaim and the small risk of pipelines failure. The "number of starter dams" indicator was assigned a low weighting because it is anticipated that there will be sufficient NAG waste rock and overburden available for construction at mine start-up.

Table 7.1-3. Supporting Infrastructure Indicator Weighting

Indicator	Weighting Value
Number of starter dams	2
PAG waste rock delivery and placement	6
Tailings delivery and placement	4
Reclaim pipeline length	4

The indicator values for the sub-account "containment infrastructure design" were based on both the relative technical and environmental risks associated with each indicator (Table 7.1-4). Both indicators were assigned the same weighting.

Table 7.1-4. Containment Infrastructure Design Indicator Weighting

Indicator	Weighting Value
Containment infrastructure design	3
Ability to handle extreme events	3

The indicator values for the sub-account "water management system" were based on both the relative economic costs associated with each indicator and the relative environmental risks (Table 7.1-5). The indicator "complexity of seepage collection" was assigned a high rating because increased complexity of seepage collection may lead to the increased risk of TSF seepage being released to the receiving environment. The "potential for active versus passive water treatment" indicator was also assigned a high weighting because of the high economic costs and increased

environmental risks that would be associated with active water treatment over passive particularly if required during closure. Active water treatment is most often required for relatively large volumes of poor quality water whereas passive treatment is more appropriate for "polishing" low volumes of water with limited contaminant concentrations. The "complexity of diversion infrastructure" indicator is weighted the lowest because the ability to cluster mine components results in limited diversion infrastructure required for this Project. In addition, water is required to be captured from the upslope catchment to support the relatively large mill throughput (60,000 tpd) and to maintain the PAG waste rock in a saturated state in the TSF.

Table 7.1-5. Water Management System Indicator Weighting

Indicator	Weighting Value
Complexity of seepage collection	5
Potential for long-term water treatment	3
Potential for active versus passive water treatment	5
Complexity of diversion structures	1

Indicators for the sub-account "construction, operation, and closure approaches" were assigned weightings based on differences in the time frame involved (Table 7.1-6). Construction requirements, while different among TSF options, are only relevant for the life of mine (2 years construction and 17 years operation). Closure can involve very long-term considerations when managing potentially ML/ARD wastes, and are thus rated as a much more significant concern than the operating requirements of a particular TSF option. Closure design is a key aspect of successful management of potentially ML/ARD wastes.

Table 7.1-6. Construction, Operation, and Closure Approaches Indicator Weighting

Indicator	Weighting Value
Ease of construction	1
Closure requirements	6

7.1.2 Environmental Indicators

The indicators for each environmental sub-account were each assigned a weighting according to professional judgment. For each sub-account with multiple indicators these assigned weightings are presented in Tables 7.1-7 to 7.1-13 below. No indicator weightings are provided for the sub-account "hydrogeology" because that sub-account only has one indicator "seepage management".

The indicator values for the sub-account "surface water quality" were assigned based on the relative risk to the environment (Table 7.1-7). The "potential for ARD / ML generation (construction material)" was assigned the highest weighting because of the high potential risk of ARD / ML release into the receiving environment. The "water quality of the receiving environment" was assigned a moderate weighting because of the importance of the water quality in receiving environment to biological receptors.

Table 7.1-7. Surface Water Quality Indicator Weighting

Indicator	Weighting Value
Water quality of receiving environment	4
Potential for ARD / ML generation (construction material)	6

The indicator values for the sub-account "hydrology" were assigned based on the relative risk to the downstream environment (Table 7.1-8). The "potential catchment loss to toe of TSF" was assigned a relatively high weighting, again, because of the potential for downstream effects. The "size of the watersheds affected" was assigned a relatively low weighting because all the watersheds involved are large, and thus, are not highly differentiating (i.e., other indicators are more informative of the interaction between hydrology and the TSF alternatives).

Table 7.1-8. Hydrology Indicator Weighting

Indicator	Weighting Value
Size of watersheds effected	2
Potential catchment loss to toe of TSF	5

The indicator values for the sub-account "climate and atmosphere" were assigned based on the relative risk to human health and environment (Table 7.1-9). The indicator "dust emissions" was assigned the highest weighting, as the storage of on-land waste rock may cause negative effects to the on-site workers and to the surrounding environment. The indicator "climate effect on water management" was assigned a moderate weighting because, although the time frames under consideration in this indicator would primarily occur after the Project's closure phase, the presence of the on-land PAG dump would most-likely require long-term active water treatment measures which may become more challenging with climate change.

Table 7.1-9. Climate and Atmosphere Indicator Weighting

Indicator	Weighting Value
Climate effects on water management	4
Dust emissions	5

The indicator values for the sub-account "fish and fish habitat" were assigned based on legislative requirements and relative risk to the species under consideration (Table 7.1-10). The indicator "extent of permanent alteration to or destruction of fish habitat" and "loss of fish habitat" were assigned the highet weightings because creation of PAD and the loss of fish habitat are triggers for a Governor in Council Schedule 2 Amendment to the MMER (SOR/2002-222). The indicators "downstream Rainbow Trout values" and "downstream Kokanee values" were assigned moderate weightings because, while these fish species have high social and economic values, Project-related downstream effects to fish and fish habitat are predicted to be minimal.

Table 7.1-10. Fish and Fish Habitat Indicator Weighting

Indicator	Weighting Value
Extent of permanent alteration to or destruction of fish habitat	6
Loss of Fish Habitat	5
Downstream Kokanee values	3
Downstream Rainbow Trout values	3

Indicators for the sub-account "wildlife" were assigned considering the relative strength of the legal protection for each indicator, the stated concerns of Aboriginal groups for each species, the habitat specificity of the affected species, the sensitivity of species to disturbance, and the amount of suitable habitat in the general Project region (Table 7.1-11). The indicator "presence of species of conservation concern other than western toad, caribou, grizzly bear, American marten, myotis bats, olive-sided flycatcher and red-tailed hawk" was assigned the highest weighting because of the legal status, both provincially and federally, of these species, as well as the unknown regional habitat quality for these species. The indicator "direct loss or disturbance to caribou habitat" was also assigned high weightings because of the Aboriginal concern surrounding these species. The indicator "direct loss or disturbance to myotis ssp. habitat" was also assigned a high weighting to reflect the recent emergency COSEWIC listing of certain bat species as endangered (COSEWIC 2012b). All remaining indicators, including grizzly bear and western toad, are assigned low weightings because there is a great deal of high-quality habitat available for these species in the regional area, and overall habitat would not be materially affected.

Table 7.1-11. Wildlife Indicator Weighting

Indicator	Weighting Value
Presence of species of conservation concern other than western toad, caribou, grizzly bear, American marten, and myotis bats	6
Direct loss or disturbance to grizzly bear habitat	1
Direct loss or disturbance to caribou habitat	6
Direct loss or disturbance to moose habitat	1
Direct loss or disturbance to American marten	1
Direct loss or disturbance to myotis spp. habitat	5
Direct loss or disturbance to western toad habitat	1
Direct loss or disturbance to terrestrial bird habitat	1
Direct loss or disturbance to raptor habitat	1

Indicators for the sub-account "vegetation and ecosystems" were assigned considering the legal protection for each indicator, relative importance of habitat to other species considered in this assessment, and the relative abundance of indicators in the regional area (Table 7.1-12). The indicator "rare and endangered wetland associations" was assigned the highest weighting because of the provincial legal status of these wetlands and the requirement to compensate for the loss of these wetlands. The indicator "wetland ecosystems" was assigned a moderate weighting

because of the importance of wetland ecosystems to aquatic species, including migratory birds, fish and fish habitat, and aquatic species at risk. The indicators "riparian ecosystems" and "Mature forest ecosystems" were assigned the lowest weightings because these ecosystems are widespread and common in the regional area, and overall habitat would not be greatly affected.

Indicators for the sub-account "Terrain and Soils" were assigned considering the potential for reclamation (Table 7.1-13). The TSF options will be fully reclaimed at closure and thus, the long-term effects on soil will be negligible; thus the indicator "soils" was assigned a low weighting. The indicator "relief, complexity of topography" was assigned a high weighting because of the added complexities and risk introduced to the construction, operations, and closure of the Project by non-favourable topography.

Table 7.1-12. Vegetation and Ecosystems Indicator Weighting

Indicator	Weighting Value
Wetland ecosystems	3
Rare and endangered wetland associations	6
Riparian ecosystems	1
Mature forest ecosystems	1

Table 7.1-13. Terrain and Soils Indicator Weighting

Indicator	Weighting Value
Relief, complexity of topography	6
Soils	2

7.1.3 Socio-Economic Indicators

The indicators for each socio-economic sub-account were each assigned a weighting according to professional judgment. For each sub-account with multiple indicators these assigned weightings are presented in Tables 7.1-14 to 7.1-16 below. No indicator weightings are provided for the sub-accounts "recreational land uses" and "archaeology" because those sub-accounts have only one indicator each: "recreational sensitivity" and "effects to known archaeological sites" respectively. Additionally, while the sub-account "Current Use of Lands and Resources – STN" was characterized for hunting, trapping, fishing, harvest of traditional plants, and use of cultural/traditional sites, none of these indicators were found to be differentiating, and the sub-account was excluded from further consideration in this analysis (refer to Table 5.3-3).

The indicators for the socio-economic sub-account "Current Use of Lands and Resources – LDN" were each assigned a relative weighting based on the amount of interest expressed in a particular resource (e.g., Kokanee spawning in Davidson Creek and Tatlekuz Lake) and the amount of habitat affected relative to the total habitat availble in the larger regional area (Table 7.1-14). Note that, while trapping, harvest of traditional plants, and use of cultural/traditional sites were characterized for this sub-account, these indicators were not differentiating and were thus excluded from further consideration (refer to Table 5.3-3).

Table 7.1-14. Current Use of Lands and Resources for Traditional Purposes – Lhoosk'uz Dene Nation Indicator Weighting

Indicator	Weighting Value
Hunting	2
Fishing	6

The indicators for the socio-economic sub-account "Current Use of Lands and Resources – UFN" were each assigned a relative weighting based on the amount of interest expressed in a particular resource (e.g., Kokanee spawning in Davidson Creek and Tatlekuz Lake) and the amount of habitat affected relative to the total habitat availble in the larger regional area (Table 7.1-15). Note that, while trapping and harvest of traditional plants were characterized for this sub-account, these indicators were not differentiating and were thus excluded from further consideration (refer to Table 5.3-3).

Table 7.1-15. Current Use of Lands and Resources for Traditional Purposes – Ulkatcho First Nation Indicator Weighting

Indicator	Weighting Value
Hunting	2
Fishing	6
Use of Cultural/Traditional Sites	2

The indicators for the socio-economic sub-account "non-traditional land and resource use" were each assigned a weighting according based on concerns raised by Aboriginal registered trapline holders (Table 7.1-16). The indicator "trapline tenures" was assigned a higher weighting than "guide outfitting tenures" and "agricultural and range tenures" because the LDN and SFN have expressed concern about potential effects on registered trapline holders (New Gold 2015, Chapter 17).

Table 7.1-16. Non-Traditional Land and Resource Use Indicator Weighting

Indicator	Weighting Value
Guide outfitting tenures	3
Agricultural and range tenures	3
Trapline tenures	6

7.1.4 Project Economics Indicators

The Project Economics Account has a sole sub-account: "Proponent costs". Indicators for this sub-account were weighted according to the relative costs involved (Table 7.1-17).

Table 7.1-17. Estimated Costs Indicator Weighting

Indicator	Weighting Value
Initial capital costs	4
Sustaining capital and operating costs	6
Closure costs	3
Fish habitat compensation costs	1

7.2 SUB-ACCOUNT WEIGHTING

The base case sub-accounts were weighted as presented in the following tables (Tables 7.2-1 to 7.2-3). The weightings presented in this section are based on the professional judgment of experienced Subject Matter Experts.

All values were evaluated on a six-point scale, with 6 being the most significantly valued and 1 being the least. No relative weighting was assigned to the sub-accounts within the "Project Economic" account, as this account only has one sub-account: "Proponent costs".

The technical account sub-account weightings were assigned according to the risk associated with each sub-account (Table 7.2-1). The "construction, operating, and closure requirements" sub-account was given the highest weighting because of the long-term timeline associated with closure. The "water management infrastructure" and "PAG waste rock stored on-land" sub-accounts were also assigned high weightings due to the challenges in managing water and seepage, particularly for any PAG material able to oxidize. The "tailings dam characteristics" sub-account was considered to be a lower risk sub-account relative to the former sub-accounts because, while several of the containment dams would be large and may pose engineering challenges, all containment structures proposed in this document are based on well-established technologies. "Supporting infrastructure" was assigned the lowest weighting because this infrastructure poses the lowest risk, when compared with tailings and PAG disposal considerations.

Table 7.2-1. Technical Sub-Account Weighting

Sub-Account	Weighting Value
PAG waste rock stored on-land	6
Tailings dam characteristics	2
Supporting infrastructure	1
Containment infrastructure design	1
Water management infrastructure	5
Construction, operation and closure considerations	6

The environmental sub-accounts weightings were assigned based on both legal requirements and on professional judgment (Table 7.2-2). The "fish and fish habitat" sub-account was ranked as the most significant sub-account because of the potential for the Project to invoke a Schedule 2 amendment

under the *Fisheries Act* (1985) MMER (SOR/2002-222). The sub-account "hydrogeology" was assigned a high rating because of potential ongoing effects groundwater containment issues and declines in water quality would have on downstream environments if these containment issues cannot be effectively mitigated. The sub-account "surface water quality" was given a similarly high rating to reflect the negative effects potential surface water contamination would have on the downstream environment. The sub-accounts "wildlife", and "vegetation and ecosystems" were weighted with a low value because, although aquatic and terrestrial habitat are vital to the survival of many important wildlife species and at-risk ecosystems and plants, the overall affected aquatic and terrestrial habitat associated with each TSF footprint is small relative to the available habitat within the regional area.

Table 7.2-2. Environmental Sub-Account Weighting

Sub-Account	Weighting Value
Surface Water Quality	6
Hydrology	4
Hydrogeology	6
Climate and Atmosphere	2
Fish and Fish Habitat	6
Wildlife	1
Vegetation and Ecosystems	1
Terrain	1

The socio-economic sub-account weightings were assigned as presented in Table 7.2-3. The sub-account "Current Use of Lands and Resources – UFN" was assigned the highest weighting. Note that, while the sub-account "Current Use of Lands and Resources – STN" and "Current Use of Land and Resources – LDN" were characterized for hunting, trapping, fishing, harvest of traditional plants, and use of cultural/traditional sites, none of these indicators were found to be differentiating, and the sub-accounts were excluded from further consideration in this analysis (refer to Table 5.3-3). The sub-accounts "commerical land uses" and "heritage" were assigned the relative weighting LDN and SFN have expressed concern about potential effects on trapline holders (New Gold 2015, Chapter 17). LDN and UFN have expressed concern about potential effects to archaeological and/or heritage sites (New Gold 2015, Chapter 17). Archaeological sites are also subject to protection under the *Heritage Conservation Act* (1996b).

Table 7.2.3. Socio-Economic Sub-Account Weighting

Sub-Account	Weighting Value
Current Use of Lands and Resources for Traditional Purposes – UFN	6
Non-Traditional Land and Resource Use	4
Recreational land uses	2
Heritage	5

7.3 ACCOUNT WEIGHTING

Based on the recommendations from section 2.6.2 of the *Guidelines*, the base-case account weightings as presented in Table 7.3-1 have been applied.

Table 7.3-1. Account Weighting for Base-case Value Scenarios

Account	Weighting Base Case
Environment	6
Technical	3
Socio-Economic	3
Project Economic	1.5

7.4 QUANTITATIVE ANALYSIS

The results of the base-case account weighting (Table 7.3-1) are presented in Table 7.4.1. All calculations follow the methodology outlined in section 2.6.3 of the *Guidelines*. The resultant calculation tables are presented in Appendix A.

Table 7.4-1. Multiple Accounts Analysis Results

	Option C TSF	Option D TSF	Option D/PAG OL TSF	Option E TSF	Option FS TSF
Base Case	4.0	3.8	2.3	3.7	4.3

The Option FS TSF is the most appropriate TSF alternative, as it resulted in the highest number (4.3) in the Multiple Accounts Analysis (Table 7.4-1).

Although the Option FS TSF alternative has the similar environmental and socio-economic considerations to Options D and C, the Option FS is the most technically feasible to construct, operate, and close in a safe manner, and is the most economically viable of the options. In particular, Option FS is the most beneficial options in terms of storing PAG/ML material stored onland, has the simplest containment infrastructure design and the best water management system for operations and closure among the options.

For the Option FS TSF, the approximate distance from the ultimate toe of the Site D main dam to the centerline of the Environmental Control Dam is 1.4 km. This area contains habitat for Rainbow Trout and Kokanee fish species, and would be considered to be a part of the effluent collection system under section (5) of the MMER (SOR/2002-222). Thus, these areas are included in the Schedule 2 Amendment to the MMER Application. Note that the length of Davidson Creek and catchment area below the TSF to the ECD is not significant relative to the length and area within the TSF basin and is not a differentiator among the alternatives considered in this assessment. Baseline groundwater information and seepage collection designs are not available for all the alternatives so comparisons in the MAA report are based on TSF dams and basin footprints only to ensure consistency. The UTM

co-ordinates of the downstream toe of the Site D main dam and approximate centreline of the Environment Control dam are 377664.8E 5898638N and 376677.9E 5898199N respectively.

The placement and design of these seepage collection dams was based on the results of hydrogeological modeling (Appendix 5.3.5A – Blackwater Gold Project – Numerical Groundwater Modelling Report of the Project's Application/EIS). The ultimate placement of the dams was based on two primary factors:

- The locations of the seepage collection ditches and pond (ECD) are dictated by topography and results of the seepage/ groundwater analysis. The vast majority of seepage from the TSF is predicted by groundwater modelling to daylight up to 1 km downstream of the TSF dam. The ECD is sited in an optimal location to collect, monitor and recycle the about 53 L/s of seepage and as such minimizes the potential effect on the environment. ;
- TSF seepage must be collected downstream of where the groundwater would daylight. The seepage collection dams here were placed at sufficient distances downstream / downgradient to contain the vast majority of solute plumes in the seepage water. The quantity of "unrecovered seepage" is very small and downstream water quality is predicted to meet water quality objectives. Functionality of the seepage collection systems has been assessed by solute transport modeling (Seep/W and Modflow; Appendix 5.3.5A – Blackwater Gold Project – Numerical Groundwater Modelling Report of the Project's Application/EIS). The effects of unrecovered seepage on downstream water quality have been assessed by conservative mass balance modeling (GoldSim).

8. SENSITIVITY ANALYSIS

The final analytical step in the Alternatives Assessment presented in this report is a sensitivity analsysis, as per Step 6 of the *Guidelines* (Figure 8-1).

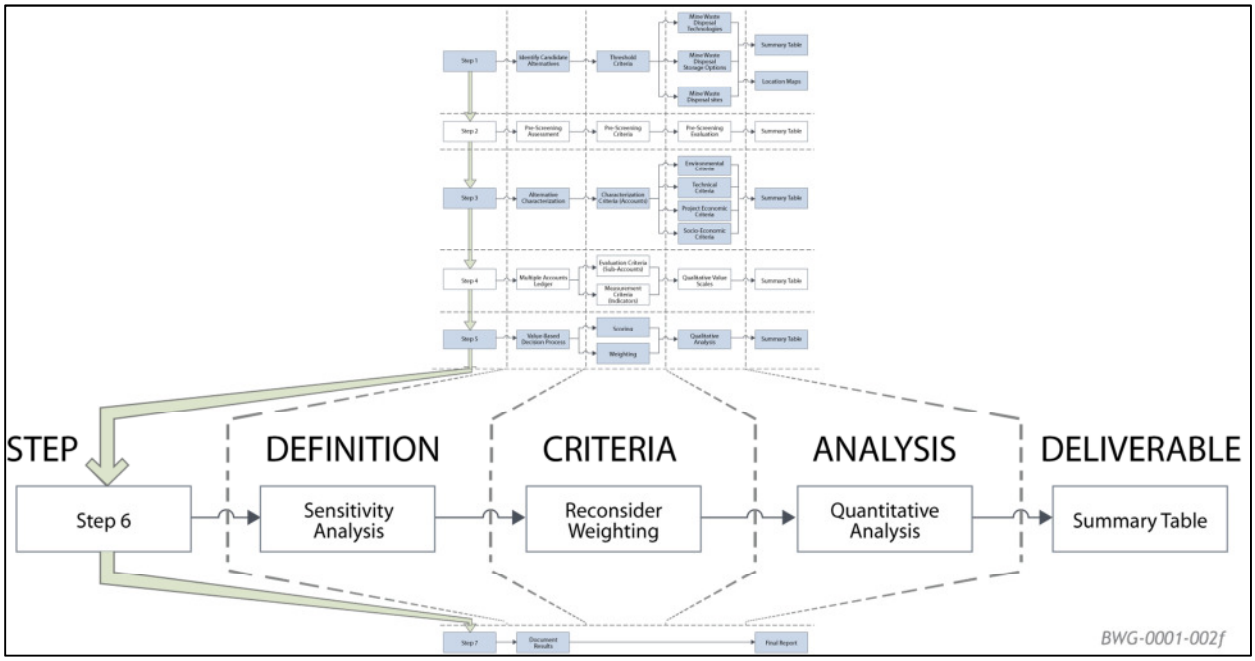


Figure 8-1. Value-based Decision Process Step

Nine sensitivity analyses were performed for this assessment (Table 8-1):

1. the first where all accounts were given an equal weighting (i.e., a value of 1; Appendix A.2),
2. all accounts and sub-accounts are assigned equal weightings (i.e., a value of 1; Appendix A.3),
3. all accounts, sub-accounts and indicators are assigned equal weighting (i.e., a value of 1; Appendix A.4),
4. the technical and project economics accounts are removed from the analysis (i.e., assigned a value of 0; Appendix A.5),
5. only the environmental account is considered (i.e., all other accounts assigned a value of 0; Appendix A.1),
6. only the technical account is considered (i.e., all other accounts assigned a value of 0; Appendix A.1), and
7. only the Project economics account is considered (i.e., all other accounts assigned a value of 0; Appendix A.1).

Table 8-1. Results of Sensitivity Analyses

Sensitivity Run	Option C TSF	Option D TSF	Option D/ PAG OL TSF	Option E TSF	Option FS TSF
1 - all accounts given equal weighting	4.4	3.9	2.4	3.6	4.4
2 – all accounts and sub-accounts given equal weighting	4.5	4.0	2.7	3.7	4.3
3 – all accounts, sub-accounts and indicators given equal weightings	4.4	4.1	2.8	4.0	4.6
4 – technical and Project economics accounts removed from the analysis	3.9	3.1	2.4	4.0	3.8
5 – only environmental account considered	3.4	4.0	2.8	3.2	4.0
6 – only socio-economic account considered	4.9	1.5	1.6	5.5	3.3
7 – only technical accountconsidered	4.0	5.1	1.7	3.3	5.4
8 – only Project economics account considered	5.3	5.1	3.4	2.3	5.0

Note: green boxes highlight the preferred alternative (i.e., the highest number outcome) for each sensitivity analysis

Option FS TSF remains the preferred (or tied for the preferred) alternative for the majority of the sensitivity analyses, with the exception of the following analysis:

- Sensitivity run 2 – all accounts and sub-accounts weighted equally; Option C TSF is the preferred option;
- Sensitivity run 4 – only technical and Project economics accounts considered
- Sensitivity run 6 - only socio-economic account considered: Option E TSF is the preferred option; and
- Sensitivity run 8 - only Project economics account considered: Option C TSF is the preferred option.

The sensitivity run with the highest emphasis on Aboriginal interests (i.e., sensitivity analysis 5 - only socio-economic account considered) resulted in Option E TSF being the preferred option. This option includes the sub-account "Current use of lands and resources – UFN"; the sub-account "Commercial land uses", which includes the indicator "trapline tenures", several of which are held by members of Aboriginal groups; and the sub-account "Archaeology. In order to minimize potential impact to First Nations, New Gold has committed to the following mitigation and monitoring measures to reduce TSF impacts:

- Project site design that minimized total footprint;
- locating the TSF outside of the Blackwater River drainage system;

- locating the TSF outside of designated Ungulate Winter Range;
- design for no discharge of surface water from the TSF during operations;
- flow augmentation in Davidson Creek to protect fish values;
- passive water treatment using wetlands during post-closure;
- surface and groundwater quality monitoring during all Project phases;
- sponsorship of a University of British Columbia graduate student and development of a Country Foods Monitoring Plan;
- historic and on-going engagement with trapline holders that includes informing trapline holders of Project activities, schedules, and locations;
- compensation for affected registered trapline holders in accordance with industry and provincial protocols with associated proof of lost revenue;
- facilitating trapper access to trails during logging and clearing;
- established a caribou sub-working group to better understand cumulative effects and establish best management practices and mitigation strategies;
- reclamation activities will attempt to restore pre-disturbance ecosystems and natural landforms;
- reclamation goals will include re-establishment of caribou winter habitat;
- implementation of Site Protection and Chance Find Procedures;
- implementation of the Project's Environmental Management System; and
- use of Traditional Knowledge/Land Use studies to refine Environmental Management Plans.

9. CONCLUSION

The Option FS TSF resulted in the highest value for all multiple accounts and the majority of sensitivity analyses. The Option FS TSF is similar to the Options C and 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).

Option FS TSF is the preferred TSF option for the Project.

REFERENCES

Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

1982. *Canada Constitution Act*, s. 35.

1985. *Fisheries Act*, RSC. C. F-14.

1992. *Canadian Environmental Assessment Act*, SC. C. 37.

1996a. *BC Forest Act*, RSBC. C. 157.

1996b. *Heritage Conservation Act* RSBC. C. 187.

1996c. *Mines Act*, RSBC. C. 293.

2002a. *BC Environmental Assessment Act*, SBC. C. 43.

2002b. *BC Forest and Range Practices Act*, SBC. C. 69.

2002c. *Environmental Assessment Act*, SBC 2002, c 43.

2002d. *Species at Risk Act*, SC. C. 29.

Government Actions Regulations, BC Reg 582/2004.

Metal Mining Effluent Regulations SOR/2002-222.

AMEC. 2011. *Blackwater Project, British Columbia - Preliminary Geochemical Characterization Report (draft)*. VE52095. Prepared for New Gold Inc, by AMEC Earth & Environmental: Mississauga, ON.

AMEC. 2012a. *Blackwater Gold Project, British Columbia - Project Description*. VE52095. Prepared for New Gold Inc. by AMEC Environment and Infrastructure: Vancouver, BC.

AMEC. 2012b. *Blackwater Project, British Columbia - NI 43-101 Technical Report on Preliminary Economic Assessment*. Prepared for New Gold Inc, by AMEC Earth & Environmental: Vancouver, BC.

AMEC. 2012c. *Blackwter Gold Project - Draft Environmental Design Criteria*. VE52095, Version V4.0. Prepared for NewGold Inc. by AMEC Environment and Infrastructure: Vancouver, BC.

AMEC. 2013a. *2011 - 2012 Vegetation Baseline Report*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure.: Vancouver, BC.

AMEC. 2013b. *2013 Vegetation Baseline Report*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure: Vancouver, BC.

AMEC. 2013c. *Air Quality 2011-2012 Baseline Report*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure: Vancouver, BC.

AMEC. 2013d. *Archaeology 2013 Baseline Report*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure: Vancouver, BC.

AMEC. 2013e. *Blackwater Gold Project - Aboriginal Baseline Information Draft*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure: Vancouver, BC.

AMEC. 2013f. *Blackwater Gold Project - Groundwater Quality 2012 - 2013 Baseline Report, Draft*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure: Vancouver, BC.

AMEC. 2013g. *Blackwater Gold Project - Social Baseline Report, Draft*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure: Vancouver, BC.

AMEC. 2013h. *Blackwater Gold Project - Water and Sediment Quality Baseline Report*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure: Vancouver, BC.

AMEC. 2013i. *Economic Health 2011-2012 Baseline Report*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure: Vancouver, BC.

AMEC. 2013j. *Fish and Aquatic Resources 2011-2012 Baseline Report*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure: Vancouver, BC.

AMEC. 2013k. *Fish and Aquatic Resources 2013 Baseline Report*. VE52277-2460. Prepared for New Gold Inc. by AMEC Environment & Infrastructure: Vancouver, BC.

AMEC. 2013l. Non-traditional Land Use (Draft). In *Blackwater Gold Project Application/EIS*. Vol. of Burnaby, BC: Prepared for New Gold Inc. by AMEC Environment and Infrastructure.

AMEC. 2013m. *Non-traditional Land Use Baseline Report, Draft*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure: Vancouver, BC.

AMEC. 2013n. *Soils, Terrain, and Surficial Geology 2011-2012 Baseline Report*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure: Vancouver, BC.

AMEC. 2013o. *Wetlands 2011 - 2012 Baseline Report*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure: Vancouver, BC.

AMEC. 2013p. *Wildlife and Wildlife Habitat 2011 - 2012 Baseline Report*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure: Vancouver, BC.

AMEC. 2014a. *Blackwater Gold Project, Project Description*. VE52277 V3.0. Prepared for New Gold Inc. by AMEC Environment & Infrastructure.: Vancouver, BC.

AMEC. 2014b. *Blackwater Project, British Columbia - Baseline Report Geochemistry version 2*. VE52095. Prepared for New Gold Inc, by AMEC Earth & Environmental: Vancouver, BC.

AMEC Earth & Environmental. 2013. *Blackwater Gold Project - Feasibility Study*. VAxx. New Gold Inc.: Vancouver, BC.

BC CDC. 2013. *BC Species and Ecosystems Explorer [web application] - Version 4.0.0*. British Columbia Ministry of Environment. http://a100.gov.bc.ca/pub/eswp/ (accessed July 12, 2013).

BC EAO. 2013. *Order Under Section 11, In the Matter of the Environmental Assessment Act S.B.C. 2002, c.43 (Act) and an Environmental Assessment of the Proposed Blackwater Project* BC Environmental Assessment Office. http://a100.gov.bc.ca/appsdata/epic/documents/p390/1373400520705_af68f87ea07405a54d0c304560d8205969a08a8eead989b8f075292fa1863a13.pdf (accessed December 2013).

BC Fisheries Information Services Branch. 2001. *Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures*. Resources Inventory Committee of the Province of British Columbia: Victoria, B.C.

BC MEM and BC MELP. 1998. *Policy for metal leaching and acid rock drainage at minesites in British Columbia*.

BC MEMPR. 2008. *Health, Safety and Reclamation Code for Mines in British Columbia*. Victoria, BC: British Cololumbia Ministry of Energy, Mines, and Petroleum Resources (BC MEMPR), Mining and Minerals Division.

BC MOE. 2001. *Ambient water quality guidelines for temperature: overview*. Victoria, BC.

BC MoFLNRO, BC MOE, and DFO. 2012. *Fish-stream Crossing Guidebook*. Published by British Columbia Ministry of Forests, Lands, and Natural Resources Operations, British Columbia Ministry of Environment, and Department of Fisheries and Oceans: Victoria, BC.

Besser, J. M. and C. F. Rabeni. 2009. Bioavailability and toxicity of metals leached from lead-mine tailings to aquatic invertebrates. *Environmental Toxicology and Chemistry*, 6: 879-90.

British Columbia Ministry of Environment. 2006a. *British Columbia Approved Water Quality Guidelines*. http://www.env.gov.bc.ca/wat/wq/ (accessed 2013).

British Columbia Ministry of Environment. 2006b. *A Compendium of Working Water Quality Guidelines for British Columbia*. http://www.env.gov.bc.ca/wat/wq/BCguidelines/working.html (accessed 2013).

British Columbia Ministry of Environment. 2010. *British Columbia Heritage Rivers Program*. http://www.env.gov.bc.ca/bcparks/heritage_rivers_program/history.html#objectives (accessed November 19, 2013).

Canadian Environmental Assessment Agency. 2013a. *Environmental Impact Statement Guidelines, Blackwater Gold Project - British Columbia, New Gold Incorporated*. Ottawa, ON.

Canadian Environmental Assessment Agency. 2013b. *Operational Policy Statement: Addressing "Need for", "Purpose of", "Alternatives to", and Alternative Means" under the Canadian Environmental Assessment Act. 2012*. Ottawa, ON.

Carrier Sekani Tribal Council. 2006. Aboriginal Interests and Use Study on the Enbridge Gateway Pipeline: An Assessment of the Impacts of the Proposed Enbridge Gateway Pipeline on the Carrier Sekani First Nations. http://www.cstc.bc.ca/AIUS%20COMPLETE%20FINAL%20inc.%20maps.pdf (accessed May 2015).

Coastal Gaslink. 2014. Application for Environmental Assessment Certificate. Coastal Gaslink Pipeline Ltd.: http://a100.gov.bc.ca/appsdata/epic/documents/p392/d37367/1394552883704_d56d24ee466441db246e16e23e42e730633649487df1686d6220780282b5a309.pdf (accessed May 2015).

COSEWIC. 2010. *COSEWIC Species Search: Pine, Whitebark | Pinus albicaulis*. April 2010. Committee on the Status of Endangered Wildlife in Canada: Ottawa.

COSEWIC. 2012a. *COSEWIC Species Search: Swallow, Barn | Hirundo rustica*. May 2011. Committee on the Status of Endangered Wildlife in Canada: Ottawa.

COSEWIC. 2012b. *Press Release: Emergency Assessment Concludes that Three Bat Species are Endangered in Canada*. COSEWIC press release. February 27, 2012. http://www.cosewic.gc.ca/eng/sct7/Bat_Emergency_Assessment_Press_Release_e.cfm (accessed January 22, 2013).

Cranny, M. 1986. Carrier Settlement and Subsistence and the Chinlac/Cluculz Lake Area of Central British Columbia. Unpublished MA Thesis diss., University of British Columbia.

CSTC. 2011. *Carrier Sekani Tribal Council*. Carrier Sekani Tribal Council. http://www.carriersekani.ca/culture-heritage/ (accessed December 2013).

Department of Fisheries and Oceans. 1991. *The Department of Fisheries and Oceans Policy for the Management of Fish Habitat* Fish Habitat Management Branch: Ottawa, ON.

Di Giulio, R. T. and D. E. Hinton, eds. 2008. *The Toxicology of Fishes*. Boca Raton, FL, USA: CRC Press.

Diakow, L. J. and V. M. Levson. 1997. *Bedrock and surficial geology of the Southern Nechako Plateau, Central British Columbia*. Geosciences Map 1997-2, 1:100,000 Scale. Ministry of Employment and Investment: Victoria, BC.

DM Cultural Services Ltd. 2015. *Skin Tyee First Nation Traditional Land Use Study for New Gold Inc.'s Proposed Blackwater Project*. Mill Bay, BC.

Ecofor. 2013. *Blackwater Regional Exploration Area, Northern Caribou Management Plan, Final Report, Version 3*. 28 March 2013. Prepared for New Gold Inc. by Ecofor Consulting Ltd.: Fort St. James, BC.

Environment Canada. 2011. *Guidelines for the Assessment of Alternatives for Mine Waste Disposal*. Government of Canada: Ottawa, ON.

Environment Canada. 2012. *Streamlining the Approvals Process for Metal Mines with Tailings Impoundment Areas* https://www.ec.gc.ca/pollution/default.asp?lang=En&n=EFAD32D1-1 (accessed

ERM. 2015a. *Memorandum - Blackwater Proposed Project Current Use of Lands and Resources for Traditional Purposes*. Prepared by ERM for New Gold. Vancouver, BC.

ERM. 2015b. *Memorandum - Blackwater Proposed Project Socio-economic Baseline Information Update for Aboriginal Groups*. Prepared by ERM for New Gold: Vancouver, BC.

Farrand, L. 1899. *The Chilcotin. In Report of the 68th Meeting of the British Association for the Advancement of Science*. IH98 London:

Farrand, L. 1910. *Handbook of Indians North of Mexico.* Vol. 2 of *1910 Tsiolkotin*. Frederick W. Hodge.

Firelight Group. 2014. *Socio-Economic Study Specific to the Nak'azdli Band and Nadleh Whut'en First Nation, in relation to the proposed Coastal GasLink Pipeline Project. Part 1: Baseline*.

Firelight Group. 2015. *Stellat'en First Nation Socio-economic Baseline Study for the proposed New Gold Blackwater Gold Project*. Victoria, BC.

GeoBC. 2014. BC Freshwater Atlas. accessed 2013).

Government of Canada. 2007. *Cabinet Directive on Streamlining Regulation*. Prepared by the Treasury Board of Canada Secretariat for the Government of Canada: Ottawa, ON.

Hudson, D. 1983. Traplines and Timber: Social and Economic Change Among the Carrier Indians of Northern British Columbia. Ph.D. Dissertation diss., Department of Anthropology, University of Alberta.

International Cyanide Management Institute. 2012. *The International Cyanide Management Code*. July 2012. Washington, DC.

Johnston, N. T. and P. A. Slaney. 1996. *Fish Habitat Assessment Procedures*. Watershed Restoration Technical Circular No. 8. Watershed Restoration Program, Ministry of Environment, Lands and Parks and Ministry of Forests: Vancouver, BC.

Keeley E.R., Slaney P.A., and D. Zaldokas. 1996. *Estimates of Production Benefits for Salmonid Fishes from Stream Restoration Initiatives.* Watershed Restoration Management Report No. 4. Ministry of Environment, Lands and Parks and Ministry of Forests.: British Columbia.

Knight Pièsold. 2011a. *Blackwater Gold Project – Conceptual Waste and Water Management Planning*. VA11-00413. Prepared for New Gold Inc. by Knight Piesold Ltd.: Vancouver, BC.

Knight Pièsold. 2011b. *Blackwater Gold Project – Preliminary Mine Development Concept Alternatives Study*. VA1010-457/3-2. Prepared for New Gold Inc. by Knight Piesold Ltd.: Vancouver, BC.

Knight Pièsold. 2011c. *Blackwater Gold Project – Tailings Disposal Options Conceptual Planning and Cost Estimates*. VA11-01276. Prepared for New Gold Inc. by Knight Piesold Ltd.: Vancouver, BC.

Knight Pièsold. 2011d. *Blackwater Gold Project – Tailings Storage Facility Site Alternatives Assessment*. VA11-00235. Prepared for New Gold Inc. by Knight Piesold Ltd.: Vancouver, BC.

Knight Pièsold. 2012. *Blackwater Gold Project – Updated Mine Development Concept Evaluation Considering Potentially Acid Generating (PAG) Disposal On-land and Subaqueously in the Tailings Facility*. VA11-01960. Prepared for New Gold Inc. by Knight Piesold Ltd.: Vancouver, BC.

Knight Pièsold. 2013a. *Blackwater Gold Project – 2012 Groundwater Quality Data Collection Summary*. Prepared for New Gold Inc. by Knight Piesold Ltd. February 2013: Vancouver, BC.

Knight Pièsold. 2013b. *Blackwater Gold Project – Preliminary Engineering Hydrometeorology Report*. VA101-457/4-1, Revision 1. Prepared for New Gold Inc. by Knight Piesold Ltd. 22 February 2013: Vancouver, BC.

Knight Pièsold. 2013c. *Blackwater Gold Project – Reconnaissance Terrain and Terrain Stability Mapping, Rev. 0*. Prepared for New Gold Inc. by Knight Piesold Ltd.: Vancouver, BC.

Knight Pièsold. 2014. *Blackwater Gold Project – TSF Multiple Accounts Analysis – Design Alternatives Information* Prepared for New Gold Inc. by Knight Piesold Ltd.: Vancouver, BC.

Lane, R. B. 1953. Cultural Relations of teh Chilcotin Indians of west central British Columbia. PhD diss., University of Washington, Seattle.

Lane, R. B. 1981. Chilcotin. In *Handbook of North American Indians: Volume 6 Subarctic*. Ed. W. C. Sturtevant. 402-12. Washington, DC: Smithsonian Institute.

Lottermoser, B. 2010. *Mine Wastes: Characterization, Treatment and Environmental Impacts*. Berlin: Springer-Verlag.

MEND. 2009. *Prediction Manual for Drainage Chemistry from Sulphic Geologic Matierals*. 1.20.1. Natural Resources Canada: Ottawa, ON.

Métis Nation British Columbia. n.d. *A guide to the Métis Nation British Columbia*. University of British Columbia. http://www.ubc.ca/okanagan/cssej/__shared/assets/metisnationbritishcolumbia21948.pdf (accessed August 20, 2013).

Minister of Forests, M. o. E. a. I., Minister of Environment, Lands and Parks,. 1997. *Vanderhood Land and Resource Management Plan*. Minister of Forests, Lands and Natural Resouce Operations. http://www.ilmb.gov.bc.ca/slrp/lrmp/princegeorge/vanderhf/index.html (accessed December 2013).

New Gold. 2015. *Blackwater Gold Project Environmental Assessment Application/Environmental Impact Statement*. Prepared by AMEC Environment & Infrastructure for New Gold Inc.: Vancouver, BC.

New Gold. 2012. *Blackwater Gold Project, British Columbia - Project Description*. VE52095. Prepared for New Gold Inc. by AMEC Environment and Infrastructure for New Gold Inc.: Vancouver, BC.

New Gold. 2014. *Blackwater Gold Project, British Columbia - NI 43-101 Technical Report on Feasibility Study*. Prepared for New Gold Inc. by AMEC Earth & Environmental, GeoSim Services Inc., Norwest Corporation, and Knight Piesold Consulting: Vancouver, BC.

New Gold. 2015. *Blackwater Gold Project Environmental Assessment Application/Environmental Impact Statement*. Prepared by AMEC Environment & Infrastructure for New Gold Inc.: Vancouver, BC.

NFN. 2013. *Letter to BC EAO about the Proposed Blackwater Gold Project. Dated 19 September 2013*. Nazko First Nation: Quesnel, BC.

Plouffe, A., V. M. Levson, and D. J. Mate. 2004. *Surficial geology, Nechako River, British Columbia*. Map 2067A, scale 1:250,000. Geological Survey of Canada: Ottawa, ON.

Price, W. A. 2009. *Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials*. MEND Report 1.20.1. MEND, MAC, NRC, BCMEMP, BC Technical Research Committee on Reclamation, INAP, OMND, Yukon Mining and Petroleum Environmental Research Group: Ottawa, ON.

Price, W. A. and J. C. Errington. 1998. *Guidelines for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia*. BC Ministry of Energy and Mines. http://www.empr.gov.bc.ca/Mining/Permitting-Reclamation/ML-ARD/Pages/Guidelines.aspx (accessed April 2012).

PTP ASEP Training Society. 2010. *Nadleh Whut'en First Nation*. PTP ASEP Training Society in Northern British Columbia. http://www.ptpasep.ca/nadleh-whuten.html. (accessed December 2012).

PTP ASEP Training Society. 2012. *Stellat'en First Nation*. PTP ASEP Training Society in Northern British Columbia. http://www.ptpasep.ca/stellaten-first-nation.html (accessed December 2012).

Ray, V. F. 1942. Cultural Element Distributions: XXII Plateau. In *Anthropological Records, 8:2*.Berkely, CA: University of California Press.

Scott, G. R. and K. A. Sloman. 2004. The effects of environmental pollutants on complex fish behaviour: integrating behavioural and physiological indicators of toxicity. *Aquatic Toxicology*, 14: 369-92.

Snipview.com. 2009. Cheslatta Trail. http://www.snipview.com/q/Cheslatta_Trail (accessed May 2015).

tailings.info. 2013. *Surface Paste Tailings Disposal*. http://www.tailings.info/disposal/paste.htm (accessed February, 2014).

Teit, J. 1909. Notes on the Chilcotin Indians. In *Memoirs of American Museum of /batyrak /gustirt*. Vol. 4(7) of 759-89.

Thomas, J. 2015. *Saik'uz First Nation Traditional Land Use and Occupancy Study*. BC.

Triton. 2014. *Stellat'en First Nation Land and Resource Use Study Report*. Prepared for Stellat'en First Nation and New Gold Incorporated by Triton Environmental Consultants Ltd.: Prince George, BC.

Vander Zanden, M. J. and Y. Vadeboncoeur. 2002. Fishes as integrators of benthic and pelagic food webs in lakes. *Ecology*, 83: 2152-61.

Appendix A

Calculation Tables

Appendix A.1. Base Case Calculations

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Technical	3											
		PAG/ML Waste rock stored on land	6	Quality of PAG waste rock stored on-land	4	4	4	1	4	4	12	D
				Quantity of PAG waste rock stored on-land	6	6	6	1	6	6	30	D
				Complexity of containment	3	3	5	1	4	6	15	D
				Sub-account merit score		61	67	13	64	70		
				Sub-account merit rating		4.7	5.2	1.0	4.9	5.4		
		Tailings Dam Characteristics	2	Distance from deposit	1	6	6	5	6	6	1	ND
				Complexity of containment	5	4	6	6	3	5	15	D
				Maximum TSF embankment heights	6	3	5	6	4	5	18	D
				Total TSF embankment volume	4	5	4	6	1	3	20	D
				Number of impoundment dams required	4	1	3	6	6	1	20	D
				Storage efficiency	3	6	5	6	1	4	15	D
				Availability of local borrow materials for construction of embankments	2	6	6	6	3	6	6	ND
				Dam foundation conditions	4	5	5	5	3	5	8	ND
				Sub-account merit score		107	130	158	89	110		
				Sub-account merit rating		3.7	4.5	5.4	3.1	3.8		
		Supporting infrastructure	1	Number of starter dams	2	5	6	6	6	6	2	ND
				PAG waste rock delivery and placement	6	3	5	6	3	5	18	D
				Tailings delivery and placement	4	3	6	6	6	1	20	D
				Reclaim pipeline length	4	6	6	1	6	6	20	D
				Sub-account merit score		64	90	76	78	70		
				Sub-account merit rating		4.0	5.6	4.8	4.9	4.4		
		Containmnent infrastructure design	1	Containment infrastructure design	3	6	6	1	4	6	15	D
				Ability to handle extreme events	3	6	6	1	6	6	15	D
				Sub-account merit score		36	36	6	30	36		
				Sub-account merit rating		6.0	6.0	1.0	5.0	6.0		
		Water management system	5	Complexity of seepage collection	5	4	6	1	2	5	25	D
				Potential for long-term water treatment	3	4	5	1	3	5	12	D
				Potential for active versus passive water treatment	5	3	5	1	3	6	25	D
				Complexity of diversion infrastructure	1	5	6	3	4	6	3	ND
				Sub-account merit score		52	76	16	38	76		
				Sub-account merit rating		3.7	5.4	1.1	2.7	5.4		
		Construction, Operation, and Closure Considerations	6	Ease of construction	1	4	4	3	1	6	5	ND
				Closure requirements	6	3	5	1	2	6	30	D
				Sub-account merit score		22	34	9	13	42		
				Sub-account merit rating		3.1	4.9	1.3	1.9	6.0		
		Account merit score (S{SxW})				83	108	36	70	113		
		Account merit rating (S{SxW}/SW)				4.0	5.1	1.7	3.3	5.4		

Appendix A.1. Base Case Calculations

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Environmental	6											
		Geochemistry	6	Water quality of receiving environment	4	3	4	5	4	4	8	ND
				Potential for ARD/ML generation (construction material)	6	4	3	4	1	3	18	D
				Sub-account merit score		36	34	44	22	34		
				Sub-account merit rating		3.6	3.4	4.4	2.2	3.4		
		Hydrology	4	Size of watersheds effected	2	4	3	3	3	3	2	ND
				Potential catchment loss to toe of TMF	5	4	2	2	4	3	10	D
				Sub-account merit score		28	22	18	14	22		
				Sub-account merit rating		4.0	3.1	2.6	2.0	3.1		
		Hydrogeology	6	Seepage management	1	3	5	1	3	5	4	ND
				Sub-account merit score		3	5	1	3	5		
				Sub-account merit rating		3.0	5.0	1.0	3.0	5.0		
		Climate and Atmosphere	2	Climate effects on water management	4	6	6	3	6	6	12	D
				Dust emissions	5	6	6	4	6	6	10	D
				Sub-account merit score		54	54	32	54	54		
				Sub-account merit rating		6.0	6.0	3.6	6.0	6.0		
		Fish and Fish Habitat	6	Extent of permanent alteration to or destruction of fish habitat	6	1	2	3	5	3	24	D
				Loss of fish habitat	5	1	4	4	4	4	15	D
				Downstream Kokanee values	3	5	5	1	3	5	12	D
				Downstream Rainbow trout values	3	1	5	2	4	5	12	D
				Sub-account merit score		29	62	47	71	68		
				Sub-account merit rating		1.7	3.6	2.8	4.2	4.0		
		Wildlife	1	Presence of species of conservation concern other than western toad, caribou, grizzly bear, American marten, and myotis bats	6	2	4	2	6	4	24	D
				Direct loss or disturbance to grizzly bear habitat	1	1	1	1	5	1	4	ND
				Direct loss or disturbance to caribou habitat	6	3	1	1	5	1	24	D
				Direct loss or disturbance to moose habitat	1	5	2	1	3	2	4	ND
				Direct loss or disturbance to American marten habitat	1	4	2	2	1	2	3	ND
				Direct loss or disturbance to myotis spp. habitat	5	1	1	3	5	1	20	D
				Direct loss or disturbance to western toad habitat	1	5	1	1	2	1	4	ND
				Direct loss or disturbance to terrestrial bird habitat	1	1	2	3	5	2	4	ND
				Direct loss or disturbance to raptor habitat	1	1	2	3	5	2	4	ND
				Sub-account merit score		52	45	44	112	45		
				Sub-account merit rating		2.3	2.0	1.9	4.9	2.0		
		Vegetation and Ecosystems	1	Wetland ecosystems	3	5	2	1	5	2	12	D
				Rare and endangered wetland asscoiations	6	4	3	2	5	3	18	D
				Riparian ecosystems	1	5	2	1	3	2	4	ND
				Mature forest ecosystems	1	5	2	4	4	2	3	ND
				Sub-account merit score		49	28	20	52	28		
				Sub-account merit rating		4.5	2.5	1.8	4.7	2.5		
		Terrain and soils	1	Relief, complexity of topography	6	6	6	6	1	6	30	D
				Soils	2	6	4	3	2	4	8	ND
				Sub-account merit score		48	44	42	10	44		
				Sub-account merit rating		6.0	5.5	5.3	1.3	5.5		
		Account merit score (S{SxW})				91	107	75	87	109		
		Account merit rating (S{SxW}/SW)				3.4	4.0	2.8	3.2	4.0		

Appendix A.1. Base Case Calculations

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Socio-economics	3											
		Current Use of Lands and Resources – Ulkatcho First Nati	6	Use of Cultural/Traditional Sites	2	5	1	1	6	2	10	D
				Sub-account merit score		10	2	2	12	4		
				Sub-account merit rating		5.0	1.0	1.0	6.0	2.0		
		Commercial Land Uses	4	Agricultural and Range Tenures	3	6	5	5	5	5	3	ND
				Guide outfitting tenures	3	1	1	1	5	1	12	D
				Trapline tenures	6	5	1	1	5	1	24	D
				Sub-account merit score		51	24	24	60	24		
				Sub-account merit rating		4.3	2.0	2.0	5.0	2.0		
		Recreational land uses	2	Recreational sensitivity	1	3	3	4	4	3	1	ND
				Sub-account merit score		3	3	4	4	3		
				Sub-account merit rating		3.0	3.0	4.0	4.0	3.0		
		Archaeology	5	Effects to known archaeological sites	1	6	1	1	6	6	5	ND
				Sub-account merit score		6	1	1	6	6		
				Sub-account merit rating		6.0	1.0	1.0	6.0	6.0		
		Account merit score (S{SxW})				83	25	27	94	56		
		Account merit rating (S{SxW}/SW)				4.9	1.5	1.6	5.5	3.3		
Project Economics	1.5											
		Proponent costs	6	Initial capital costs	4	6	5	1	2	6	20	D
				Sustaining capital and operating costs	6	5	5	6	1	4	30	D
				Closure cost	3	6	6	1	4	6	15	D
				Fish habitat compensation	1	2	3	4	6	4	4	ND
				Sub-account merit score		74	71	47	32	70		
				Sub-account merit rating		5.3	5.1	3.4	2.3	5.0		
		Account merit score (S{SxW})				32	30	20	14	30		
		Account merit rating (S{SxW}/SW)				5.3	5.1	3.4	2.3	5.0		
MAA merit score						55	51	32	49	58		
MAA merit rating						4.0	3.8	2.3	3.7	4.3		

Appendix A.2. Sensitivity Analysis 1: All Accounts Weighted Equally

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Technical	1											
		PAG/ML Waste rock stored on land	6	Quality of PAG waste rock stored on-land	4	4	4	1	4	4	12	D
				Quantity of PAG waste rock stored on-land	6	6	6	1	6	6	30	D
				Complexity of containment	3	3	5	1	4	6	15	D
				Sub-account merit score		61	67	13	64	70		
				Sub-account merit rating		4.7	5.2	1.0	4.9	5.4		
		Tailings Dam Characteristics	2	Distance from deposit	1	6	6	5	6	6	1	ND
				Complexity of containment	5	4	6	6	3	5	15	D
				Maximum TSF embankment heights	6	3	5	6	4	5	18	D
				Total TSF embankment volume	4	5	4	6	1	3	20	D
				Number of impoundment dams required	4	1	3	6	6	1	20	D
				Storage efficiency	3	6	5	6	1	4	15	D
				Availability of local borrow materials for construction of embankments	2	6	6	6	3	6	6	ND
				Dam foundation conditions	4	5	5	5	3	5	8	ND
				Sub-account merit score		107	130	158	89	110		
				Sub-account merit rating		3.7	4.5	5.4	3.1	3.8		
		Supporting infrastructure	1	Number of starter dams	2	5	6	6	6	6	2	ND
				PAG waste rock delivery and placement	6	3	5	6	3	5	18	D
				Tailings delivery and placement	4	3	6	6	6	1	20	D
				Reclaim pipeline length	4	6	6	1	6	6	20	D
				Sub-account merit score		64	90	76	78	70		
				Sub-account merit rating		4.0	5.6	4.8	4.9	4.4		
		Containmnent infrastructure design	1	Containment infrastructure design	3	6	6	1	4	6	15	D
				Ability to handle extreme events	3	6	6	1	6	6	15	D
				Sub-account merit score		36	36	6	30	36		
				Sub-account merit rating		6.0	6.0	1.0	5.0	6.0		
		Water management system	5	Complexity of seepage collection	5	4	6	1	2	5	25	D
				Potential for long-term water treatment	3	4	5	1	3	5	12	D
				Potential for active versus passive water treatment	5	3	5	1	3	6	25	D
				Complexity of diversion infrastructure	1	5	6	3	4	6	3	ND
				Sub-account merit score		52	76	16	38	76		
				Sub-account merit rating		3.7	5.4	1.1	2.7	5.4		
		Construction, Operation, and Closure Considerations	6	Ease of construction	1	4	4	3	1	6	5	ND
				Closure requirements	6	3	5	1	2	6	30	D
				Sub-account merit score		22	34	9	13	42		
				Sub-account merit rating		3.1	4.9	1.3	1.9	6.0		
		Account merit score (S{SxW})				83	108	36	70	113		
		Account merit rating (S{SxW}/SW)				4.0	5.1	1.7	3.3	5.4		

Appendix A.2. Sensitivity Analysis 1: All Accounts Weighted Equally

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Environmental	1											
		Geochemistry	6	Water quality of receiving environment	4	3	4	5	4	4	8	ND
				Potential for ARD/ML generation (construction material)	6	4	3	4	1	3	18	D
				Sub-account merit score		36	34	44	22	34		
				Sub-account merit rating		3.6	3.4	4.4	2.2	3.4		
		Hydrology	4	Size of watersheds effected	2	4	3	3	3	3	2	ND
				Potential catchment loss to toe of TMF	5	4	2	2	4	3	10	D
				Sub-account merit score		28	22	18	14	22		
				Sub-account merit rating		4.0	3.1	2.6	2.0	3.1		
		Hydrogeology	6	Seepage management	1	3	5	1	3	5	4	ND
				Sub-account merit score		3	5	1	3	5		
				Sub-account merit rating		3.0	5.0	1.0	3.0	5.0		
		Climate and Atmosphere	2	Climate effects on water management	4	6	6	3	6	6	12	D
				Dust emissions	5	6	6	4	6	6	10	D
				Sub-account merit score		54	54	32	54	54		
				Sub-account merit rating		6.0	6.0	3.6	6.0	6.0		
		Fish and Fish Habitat	6	Extent of permanent alteration to or destruction of fish habitat	6	1	2	3	5	3	24	D
				Loss of fish habitat	5	1	4	4	4	4	15	D
				Downstream Kokanee values	3	5	5	1	3	5	12	D
				Downstream Rainbow trout values	3	1	5	2	4	5	12	D
				Sub-account merit score		29	62	47	71	68		
				Sub-account merit rating		1.7	3.6	2.8	4.2	4.0		
		Wildlife	1	Presence of species of conservation concern other than western toad, caribou, grizzly bear, American marten, and myotis bats	6	2	4	2	6	4	24	D
				Direct loss or disturbance to grizzly bear habitat	1	1	1	1	5	1	4	ND
				Direct loss or disturbance to caribou habitat	6	3	1	1	5	1	24	D
				Direct loss or disturbance to moose habitat	1	5	2	1	3	2	4	ND
				Direct loss or disturbance to American marten habitat	1	4	2	2	1	2	3	ND
				Direct loss or disturbance to myotis spp. habitat	5	1	1	3	5	1	20	D
				Direct loss or disturbance to western toad habitat	1	5	1	1	2	1	4	ND
				Direct loss or disturbance to terrestrial bird habitat	1	1	2	3	5	2	4	ND
				Direct loss or disturbance to raptor habitat	1	1	2	3	5	2	4	ND
				Sub-account merit score		52	45	44	112	45		
				Sub-account merit rating		2.3	2.0	1.9	4.9	2.0		
		Vegetation and Ecosystems	1	Wetland ecosystems	3	5	2	1	5	2	12	D
				Rare and endangered wetland asscoiations	6	4	3	2	5	3	18	D
				Riparian ecosystems	1	5	2	1	3	2	4	ND
				Mature forest ecosystems	1	5	2	4	4	2	3	ND
				Sub-account merit score		49	28	20	52	28		
				Sub-account merit rating		4.5	2.5	1.8	4.7	2.5		
		Terrain and soils	1	Relief, complexity of topography	6	6	6	6	1	6	30	D
				Soils	2	6	4	3	2	4	8	ND
				Sub-account merit score		48	44	42	10	44		
				Sub-account merit rating		6.0	5.5	5.3	1.3	5.5		
		Account merit score (S{SxW})				91	107	75	87	109		
		Account merit rating (S{SxW}/SW)				3.4	4.0	2.8	3.2	4.0		

Appendix A.2. Sensitivity Analysis 1: All Accounts Weighted Equally

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Socio-economics	1											
		Current Use of Lands and Resources – Ulkatcho First Nati	6	Use of Cultural/Traditional Sites	2	5	1	1	6	2	10	D
				Sub-account merit score		10	2	2	12	4		
				Sub-account merit rating		5.0	1.0	1.0	6.0	2.0		
		Commercial Land Uses	4	Agricultural and Range Tenures	3	6	5	5	5	5	3	ND
				Guide outfitting tenures	3	1	1	1	5	1	12	D
				Trapline tenures	6	5	1	1	5	1	24	D
				Sub-account merit score		51	24	24	60	24		
				Sub-account merit rating		4.3	2.0	2.0	5.0	2.0		
		Recreational land uses	2	Recreational sensitivity	1	3	3	4	4	3	1	ND
				Sub-account merit score		3	3	4	4	3		
				Sub-account merit rating		3.0	3.0	4.0	4.0	3.0		
		Archaeology	5	Effects to known archaeological sites	1	6	1	1	6	6	5	ND
				Sub-account merit score		6	1	1	6	6		
				Sub-account merit rating		6.0	1.0	1.0	6.0	6.0		
		Account merit score (S{SxW})				83	25	27	94	56		
		Account merit rating (S{SxW}/SW)				4.9	1.5	1.6	5.5	3.3		
Project Economics	1											
		Proponent costs	6	Initial capital costs	4	6	5	1	2	6	20	D
				Sustaining capital and operating costs	6	5	5	6	1	4	30	D
				Closure cost	3	6	6	1	4	6	15	D
				Fish habitat compensation	1	2	3	4	6	4	4	ND
				Sub-account merit score		74	71	47	32	70		
				Sub-account merit rating		5.3	5.1	3.4	2.3	5.0		
		Account merit score (S{SxW})				32	30	20	14	30		
		Account merit rating (S{SxW}/SW)				5.3	5.1	3.4	2.3	5.0		
MAA merit score						17	16	9	14	18		
MAA merit rating						4.4	3.9	2.4	3.6	4.4		

Appendix A.3. Sensitivity Analysis 2: All Accounts and Sub-Accounts Weighted Equally

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Technical	1											
		PAG/ML Waste rock stored on land	1	Quality of PAG waste rock stored on-land	4	4	4	1	4	4	12	D
				Quantity of PAG waste rock stored on-land	6	6	6	1	6	6	30	D
				Complexity of containment	3	3	5	1	4	6	15	D
				Sub-account merit score		61	67	13	64	70		
				Sub-account merit rating		4.7	5.2	1.0	4.9	5.4		
		Tailings Dam Characteristics	1	Distance from deposit	1	6	6	5	6	6	1	ND
				Complexity of containment	5	4	6	6	3	5	15	D
				Maximum TSF embankment heights	6	3	5	6	4	5	18	D
				Total TSF embankment volume	4	5	4	6	1	3	20	D
				Number of impoundment dams required	4	1	3	6	6	1	20	D
				Storage efficiency	3	6	5	6	1	4	15	D
				Availability of local borrow materials for construction of embankments	2	6	6	6	3	6	6	ND
				Dam foundation conditions	4	5	5	5	3	5	8	ND
				Sub-account merit score		107	130	158	89	110		
				Sub-account merit rating		3.7	4.5	5.4	3.1	3.8		
		Supporting infrastructure	1	Number of starter dams	2	5	6	6	6	6	2	ND
				PAG waste rock delivery and placement	6	3	5	6	3	5	18	D
				Tailings delivery and placement	4	3	6	6	6	1	20	D
				Reclaim pipeline length	4	6	6	1	6	6	20	D
				Sub-account merit score		64	90	76	78	70		
				Sub-account merit rating		4.0	5.6	4.8	4.9	4.4		
		Containmnent infrastructure design	1	Containment infrastructure design	3	6	6	1	4	6	15	D
				Ability to handle extreme events	3	6	6	1	6	6	15	D
				Sub-account merit score		36	36	6	30	36		
				Sub-account merit rating		6.0	6.0	1.0	5.0	6.0		
		Water management system	1	Complexity of seepage collection	5	4	6	1	2	5	25	D
				Potential for long-term water treatment	3	4	5	1	3	5	12	D
				Potential for active versus passive water treatment	5	3	5	1	3	6	25	D
				Complexity of diversion infrastructure	1	5	6	3	4	6	3	ND
				Sub-account merit score		52	76	16	38	76		
				Sub-account merit rating		3.7	5.4	1.1	2.7	5.4		
		Construction, Operation, and Closure Considerations	1	Ease of construction	1	4	4	3	1	6	5	ND
				Closure requirements	6	3	5	1	2	6	30	D
				Sub-account merit score		22	34	9	13	42		
				Sub-account merit rating		3.1	4.9	1.3	1.9	6.0		
		Account merit score (S{SxW})				25	32	15	22	31		
		Account merit rating (S{SxW}/SW)				4.2	5.3	2.4	3.7	5.2		

Appendix A.3. Sensitivity Analysis 2: All Accounts and Sub-Accounts Weighted Equally

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Environmental	1											
		Geochemistry	1	Water quality of receiving environment	4	3	4	5	4	4	8	ND
				Potential for ARD/ML generation (construction material)	6	4	3	4	1	3	18	D
				Sub-account merit score		36	34	44	22	34		
				Sub-account merit rating		3.6	3.4	4.4	2.2	3.4		
		Hydrology	1	Size of watersheds effected	2	4	3	3	3	3	2	ND
				Potential catchment loss to toe of TMF	5	4	2	2	4	3	10	D
				Sub-account merit score		28	22	18	14	22		
				Sub-account merit rating		4.0	3.1	2.6	2.0	3.1		
		Hydrogeology	1	Seepage management	1	3	5	1	3	5	4	ND
				Sub-account merit score		3	5	1	3	5		
				Sub-account merit rating		3.0	5.0	1.0	3.0	5.0		
		Climate and Atmosphere	1	Climate effects on water management	4	6	6	3	6	6	12	D
				Dust emissions	5	6	6	4	6	6	10	D
				Sub-account merit score		54	54	32	54	54		
				Sub-account merit rating		6.0	6.0	3.6	6.0	6.0		
		Fish and Fish Habitat	1	Extent of permanent alteration to or destruction of fish habitat	6	1	2	3	5	3	24	D
				Loss of fish habitat	5	1	4	4	4	4	15	D
				Downstream Kokanee values	3	5	5	1	3	5	12	D
				Downstream Rainbow trout values	3	1	5	2	4	5	12	D
				Sub-account merit score		29	62	47	71	68		
				Sub-account merit rating		1.7	3.6	2.8	4.2	4.0		
		Wildlife	1	Presence of species of conservation concern other than western toad, caribou, grizzly bear,	6	2	4	2	6	4	24	D
				Direct loss or disturbance to grizzly bear habitat	1	1	1	1	5	1	4	ND
				Direct loss or disturbance to caribou habitat	6	3	1	1	5	1	24	D
				Direct loss or disturbance to moose habitat	1	5	2	1	3	2	4	ND
				Direct loss or disturbance to American marten habitat	1	4	2	2	1	2	3	ND
				Direct loss or disturbance to myotis spp. habitat	5	1	1	3	5	1	20	D
				Direct loss or disturbance to western toad habitat	1	5	1	1	2	1	4	ND
				Direct loss or disturbance to terrestrial bird habitat	1	1	2	3	5	2	4	ND
				Direct loss or disturbance to raptor habitat	1	1	2	3	5	2	4	ND
				Sub-account merit score		52	45	44	112	45		
				Sub-account merit rating		2.3	2.0	1.9	4.9	2.0		
		Vegetation and Ecosystems	1	Wetland ecosystems	3	5	2	1	5	2	12	D
				Rare and endangered wetland asscoiations	6	4	3	2	5	3	18	D
				Riparian ecosystems	1	5	2	1	3	2	4	ND
				Mature forest ecosystems	1	5	2	4	4	2	3	ND
				Sub-account merit score		49	28	20	52	28		
				Sub-account merit rating		4.5	2.5	1.8	4.7	2.5		
		Terrain and soils	1	Relief, complexity of topography	6	6	6	6	1	6	30	D
				Soils	2	6	4	3	2	4	8	ND
				Sub-account merit score		48	44	42	10	44		
				Sub-account merit rating		6.0	5.5	5.3	1.3	5.5		
		Account merit score (S{SxW})				31	31	23	28	32		
		Account merit rating (S{SxW}/SW)				3.9	3.9	2.9	3.5	3.9		

Appendix A.3. Sensitivity Analysis 2: All Accounts and Sub-Accounts Weighted Equally

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Socio-economics	1											
		Current Use of Lands and Resources – Ulkatcho First Nati	1	Use of Cultural/Traditional Sites	2	5	1	1	6	2	10	D
				Sub-account merit score		10	2	2	12	4		
				Sub-account merit rating		5.0	1.0	1.0	6.0	2.0		
		Commercial Land Uses	1	Agricultural and Range Tenures	3	6	5	5	5	5	3	ND
				Guide outfitting tenures	3	1	1	1	5	1	12	D
				Trapline tenures	6	5	1	1	5	1	24	D
				Sub-account merit score		51	24	24	60	24		
				Sub-account merit rating		4.3	2.0	2.0	5.0	2.0		
		Recreational land uses	1	Recreational sensitivity	1	3	3	4	4	3	1	ND
				Sub-account merit score		3	3	4	4	3		
				Sub-account merit rating		3.0	3.0	4.0	4.0	3.0		
		Archaeology	1	Effects to known archaeological sites	1	6	1	1	6	6	5	ND
				Sub-account merit score		6	1	1	6	6		
				Sub-account merit rating		6.0	1.0	1.0	6.0	6.0		
		Account merit score (S{SxW})				18	7	8	21	13		
		Account merit rating (S{SxW}/SW)				4.6	1.8	2.0	5.3	3.3		
Project Economics	1											
		Proponent costs	1	Initial capital costs	4	6	5	1	2	6	20	D
				Sustaining capital and operating costs	6	5	5	6	1	4	30	D
				Closure cost	3	6	6	1	4	6	15	D
				Fish habitat compensation	1	2	3	4	6	4	4	ND
				Sub-account merit score		74	71	47	32	70		
				Sub-account merit rating		5.3	5.1	3.4	2.3	5.0		
		Account merit score (S{SxW})				5	5	3	2	5		
		Account merit rating (S{SxW}/SW)				5.3	5.1	3.4	2.3	5.0		
MAA merit score						18	16	11	15	17		
MAA merit rating						4.5	4.0	2.7	3.7	4.3		

Appendix A.4. Sensitivity Analysis 3: All Accounts , Sub-Accounts, and Indicators Weighted Equally

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Technical	1											
		PAG/ML Waste rock stored on land	1	Quality of PAG waste rock stored on-land	1	4	4	1	4	4	3	ND
				Quantity of PAG waste rock stored on-land	1	6	6	1	6	6	5	ND
				Complexity of containment	1	3	5	1	4	6	5	ND
				Sub-account merit score		13	15	3	14	16		
				Sub-account merit rating		4.3	5.0	1.0	4.7	5.3		
		Tailings Dam Characteristics	1	Distance from deposit	1	6	6	5	6	6	1	ND
				Complexity of containment	1	4	6	6	3	5	3	ND
				Maximum TSF embankment heights	1	3	5	6	4	5	3	ND
				Total TSF embankment volume	1	5	4	6	1	3	5	ND
				Number of impoundment dams required	1	1	3	6	6	1	5	ND
				Storage efficiency	1	6	5	6	1	4	5	ND
				Availability of local borrow materials for construction of embankments	1	6	6	6	3	6	3	ND
				Dam foundation conditions	1	5	5	5	3	5	2	ND
				Sub-account merit score		37	41	47	28	36		
				Sub-account merit rating		4.6	5.1	5.9	3.5	4.5		
		Supporting infrastructure	1	Number of starter dams	1	5	6	6	6	6	1	ND
				PAG waste rock delivery and placement	1	3	5	6	3	5	3	ND
				Tailings delivery and placement	1	3	6	6	6	1	5	ND
				Reclaim pipeline length	1	6	6	1	6	6	5	ND
				Sub-account merit score		17	23	19	21	18		
				Sub-account merit rating		4.3	5.8	4.8	5.3	4.5		
		Containmnent infrastructure design	1	Containment infrastructure design	1	6	6	1	4	6	5	ND
				Ability to handle extreme events	1	6	6	1	6	6	5	ND
				Sub-account merit score		12	12	2	10	12		
				Sub-account merit rating		6.0	6.0	1.0	5.0	6.0		
		Water management system	1	Complexity of seepage collection	1	4	6	1	2	5	5	ND
				Potential for long-term water treatment	1	4	5	1	3	5	4	ND
				Potential for active versus passive water treatment	1	3	5	1	3	6	5	ND
				Complexity of diversion infrastructure	1	5	6	3	4	6	3	ND
				Sub-account merit score		16	22	6	12	22		
				Sub-account merit rating		4.0	5.5	1.5	3.0	5.5		
		Construction, Operation, and Closure Considerations	1	Ease of construction	1	4	4	3	1	6	5	ND
				Closure requirements	1	3	5	1	2	6	5	ND
				Sub-account merit score		7	9	4	3	12		
				Sub-account merit rating		3.5	4.5	2.0	1.5	6.0		
		Account merit score (S{SxW})				27	32	16	23	32		
		Account merit rating (S{SxW}/SW)				4.5	5.3	2.7	3.8	5.3		

Appendix A.4. Sensitivity Analysis 3: All Accounts , Sub-Accounts, and Indicators Weighted Equally

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Environmental	1											
		Geochemistry	1	Water quality of receiving environment	1	3	4	5	4	4	2	ND
				Potential for ARD/ML generation (construction material)	1	4	3	4	1	3	3	ND
				Sub-account merit score		7	7	9	5	7		
				Sub-account merit rating		3.5	3.5	4.5	2.5	3.5		
		Hydrology	1	Size of watersheds effected	1	4	3	3	3	3	1	ND
				Potential catchment loss to toe of TMF	1	4	2	2	4	3	2	ND
				Sub-account merit score		8	19	15	11	19		
				Sub-account merit rating		4.0	9.5	7.5	5.5	9.5		
		Hydrogeology	1	Seepage management	1	3	5	1	3	5	4	ND
				Sub-account merit score		3	5	1	3	5		
				Sub-account merit rating		3.0	5.0	1.0	3.0	5.0		
		Climate and Atmosphere	1	Climate effects on water management	1	6	6	3	6	6	3	ND
				Dust emissions	1	6	6	4	6	6	2	ND
				Sub-account merit score		12	12	7	12	12		
				Sub-account merit rating		6.0	6.0	3.5	6.0	6.0		
		Fish and Fish Habitat	1	Extent of permanent alteration to or destruction of fish habitat	1	1	2	3	5	3	4	ND
				Loss of fish habitat	1	1	4	4	4	4	3	ND
				Downstream Kokanee values	1	5	5	1	3	5	4	ND
				Downstream Rainbow trout values	1	1	5	2	4	5	4	ND
				Sub-account merit score		8	16	10	16	17		
				Sub-account merit rating		2.0	4.0	2.5	4.0	4.3		
		Wildlife	1	Presence of species of conservation concern other than western toad, caribou, grizzly bear, American marten, and myotis bats	1	2	4	2	6	4	4	ND
				Direct loss or disturbance to grizzly bear habitat	1	1	1	1	5	1	4	ND
				Direct loss or disturbance to caribou habitat	1	3	1	1	5	1	4	ND
				Direct loss or disturbance to moose habitat	1	5	2	1	3	2	4	ND
				Direct loss or disturbance to American marten habitat	1	4	2	2	1	2	3	ND
				Direct loss or disturbance to myotis spp. habitat	1	1	1	3	5	1	4	ND
				Direct loss or disturbance to western toad habitat	1	5	1	1	2	1	4	ND
				Direct loss or disturbance to terrestrial bird habitat	1	1	2	3	5	2	4	ND
				Direct loss or disturbance to raptor habitat	1	1	2	3	5	2	4	ND
				Sub-account merit score		23	16	17	37	16		
				Sub-account merit rating		2.6	1.8	1.9	4.1	1.8		
		Vegetation and Ecosystems	1	Wetland ecosystems	1	5	2	1	5	2	4	ND
				Rare and endangered wetland asscoiations	1	4	3	2	5	3	3	ND
				Riparian ecosystems	1	5	2	1	3	2	4	ND
				Mature forest ecosystems	1	5	2	4	4	2	3	ND
				Sub-account merit score		19	9	8	17	9		
				Sub-account merit rating		4.8	2.3	2.0	4.3	2.3		
		Terrain and soils	1	Relief, complexity of topography	1	6	6	6	1	6	5	ND
				Soils	1	6	4	3	2	4	4	ND
				Sub-account merit score		12	10	9	3	10		
				Sub-account merit rating		6.0	5.0	4.5	1.5	5.0		
		Account merit score (S{SxW})				32	37	27	31	37		
		Account merit rating (S{SxW}/SW)				4.0	4.6	3.4	3.9	4.7		

Appendix A.4. Sensitivity Analysis 3: All Accounts , Sub-Accounts, and Indicators Weighted Equally

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Socio-economics	1											
		Current Use of Lands and Resources – Ulkatcho First Nati	1	Use of Cultural/Traditional Sites	1	5	1	1	6	2	5	ND
				Sub-account merit score		5	1	1	6	2		
				Sub-account merit rating		5.0	1.0	1.0	6.0	2.0		
		Commercial Land Uses	1	Agricultural and Range Tenures	1	6	5	5	5	5	1	ND
				Guide outfitting tenures	1	1	1	1	5	1	4	ND
				Trapline tenures	1	5	1	1	5	1	4	ND
				Sub-account merit score		12	7	7	15	7		
				Sub-account merit rating		4.0	2.3	2.3	5.0	2.3		
		Recreational land uses	1	Recreational sensitivity	1	3	3	4	4	3	1	ND
				Sub-account merit score		3	3	4	4	3		
				Sub-account merit rating		3.0	3.0	4.0	4.0	3.0		
		Archaeology	1	Effects to known archaeological sites	1	6	1	1	6	6	5	ND
				Sub-account merit score		6	1	1	6	6		
				Sub-account merit rating		6.0	1.0	1.0	6.0	6.0		
		Account merit score (S{SxW})				18	7	8	21	13		
		Account merit rating (S{SxW}/SW)				4.5	1.8	2.1	5.3	3.3		
Project Economics	1											
		Proponent costs	1	Initial capital costs	1	6	5	1	2	6	5	ND
				Sustaining capital and operating costs	1	5	5	6	1	4	5	ND
				Closure cost	1	6	6	1	4	6	5	ND
				Fish habitat compensation	1	2	3	4	6	4	4	ND
				Sub-account merit score		19	19	12	13	20		
				Sub-account merit rating		4.8	4.8	3.0	3.3	5.0		
		Account merit score (S{SxW})				5	5	3	3	5		
		Account merit rating (S{SxW}/SW)				4.8	4.8	3.0	3.3	5.0		
MAA merit score						18	17	11	16	18		
MAA merit rating						4.4	4.1	2.8	4.0	4.6		

Appendix A.5. Sensitivity Analysis 4: Only Socio-Economics and Environmental Accounts Considered

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Technical	0											
		PAG/ML Waste rock stored on land	6	Quality of PAG waste rock stored on-land	4	4	4	1	4	4	12	D
				Quantity of PAG waste rock stored on-land	6	6	6	1	6	6	30	D
				Complexity of containment	3	3	5	1	4	6	15	D
				Sub-account merit score		61	67	13	64	70		
				Sub-account merit rating		4.7	5.2	1.0	4.9	5.4		
		Tailings Dam Characteristics	2	Distance from deposit	1	6	6	5	6	6	1	ND
				Complexity of containment	5	4	6	6	3	5	15	D
				Maximum TSF embankment heights	6	3	5	6	4	5	18	D
				Total TSF embankment volume	4	5	4	6	1	3	20	D
				Number of impoundment dams required	4	1	3	6	6	1	20	D
				Storage efficiency	3	6	5	6	1	4	15	D
				Availability of local borrow materials for construction of embankments	2	6	6	6	3	6	6	ND
				Dam foundation conditions	4	5	5	5	3	5	8	ND
				Sub-account merit score		107	130	158	89	110		
				Sub-account merit rating		3.7	4.5	5.4	3.1	3.8		
		Supporting infrastructure	1	Number of starter dams	2	5	6	6	6	6	2	ND
				PAG waste rock delivery and placement	6	3	5	6	3	5	18	D
				Tailings delivery and placement	4	3	6	6	6	1	20	D
				Reclaim pipeline length	4	6	6	1	6	6	20	D
				Sub-account merit score		64	90	76	78	70		
				Sub-account merit rating		4.0	5.6	4.8	4.9	4.4		
		Containmnent infrastructure design	1	Containment infrastructure design	3	6	6	1	4	6	15	D
				Ability to handle extreme events	3	6	6	1	6	6	15	D
				Sub-account merit score		36	36	6	30	36		
				Sub-account merit rating		6.0	6.0	1.0	5.0	6.0		
		Water management system	5	Complexity of seepage collection	5	4	6	1	2	5	25	D
				Potential for long-term water treatment	3	4	5	1	3	5	12	D
				Potential for active versus passive water treatment	5	3	5	1	3	6	25	D
				Complexity of diversion infrastructure	1	5	6	3	4	6	3	ND
				Sub-account merit score		52	76	16	38	76		
				Sub-account merit rating		3.7	5.4	1.1	2.7	5.4		
		Construction, Operation, and Closure Considerations	6	Ease of construction	1	4	4	3	1	6	5	ND
				Closure requirements	6	3	5	1	2	6	30	D
				Sub-account merit score		22	34	9	13	42		
				Sub-account merit rating		3.1	4.9	1.3	1.9	6.0		
		Account merit score (S{SxW})				83	108	36	70	113		
		Account merit rating (S{SxW}/SW)				4.0	5.1	1.7	3.3	5.4		

Appendix A.5. Sensitivity Analysis 4: Only Socio-Economics and Environmental Accounts Considered

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Environmental	6											
		Geochemistry	6	Water quality of receiving environment	4	3	4	5	4	4	8	ND
				Potential for ARD/ML generation (construction material)	6	4	3	4	1	3	18	D
				Sub-account merit score		36	34	44	22	34		
				Sub-account merit rating		3.6	3.4	4.4	2.2	3.4		
		Hydrology	4	Size of watersheds effected	2	4	3	3	3	3	2	ND
				Potential catchment loss to toe of TMF	5	4	2	2	4	3	10	D
				Sub-account merit score		28	22	18	14	22		
				Sub-account merit rating		4.0	3.1	2.6	2.0	3.1		
		Hydrogeology	6	Seepage management	1	3	5	1	3	5	4	ND
				Sub-account merit score		3	5	1	3	5		
				Sub-account merit rating		3.0	5.0	1.0	3.0	5.0		
		Climate and Atmosphere	2	Climate effects on water management	4	6	6	3	6	6	12	D
				Dust emissions	5	6	6	4	6	6	10	D
				Sub-account merit score		54	54	32	54	54		
				Sub-account merit rating		6.0	6.0	3.6	6.0	6.0		
		Fish and Fish Habitat	6	Extent of permanent alteration to or destruction of fish habitat	6	1	2	3	5	3	24	D
				Loss of fish habitat	5	1	4	4	4	4	15	D
				Downstream Kokanee values	3	5	5	1	3	5	12	D
				Downstream Rainbow trout values	3	1	5	2	4	5	12	D
				Sub-account merit score		29	62	47	71	68		
				Sub-account merit rating		1.7	3.6	2.8	4.2	4.0		
		Wildlife	1	Presence of species of conservation concern other than western toad, caribou, grizzly bear,	6	2	4	2	6	4	24	D
				Direct loss or disturbance to grizzly bear habitat	1	1	1	1	5	1	4	ND
				Direct loss or disturbance to caribou habitat	6	3	1	1	5	1	24	D
				Direct loss or disturbance to moose habitat	1	5	2	1	3	2	4	ND
				Direct loss or disturbance to American marten habitat	1	4	2	2	1	2	3	ND
				Direct loss or disturbance to myotis spp. habitat	5	1	1	3	5	1	20	D
				Direct loss or disturbance to western toad habitat	1	5	1	1	2	1	4	ND
				Direct loss or disturbance to terrestrial bird habitat	1	1	2	3	5	2	4	ND
				Direct loss or disturbance to raptor habitat	1	1	2	3	5	2	4	ND
				Sub-account merit score		52	45	44	112	45		
				Sub-account merit rating		2.3	2.0	1.9	4.9	2.0		
		Vegetation and Ecosystems	1	Wetland ecosystems	3	5	2	1	5	2	12	D
				Rare and endangered wetland asscoiations	6	4	3	2	5	3	18	D
				Riparian ecosystems	1	5	2	1	3	2	4	ND
				Mature forest ecosystems	1	5	2	4	4	2	3	ND
				Sub-account merit score		49	28	20	52	28		
				Sub-account merit rating		4.5	2.5	1.8	4.7	2.5		
		Terrain and soils	1	Relief, complexity of topography	6	6	6	6	1	6	30	D
				Soils	2	6	4	3	2	4	8	ND
				Sub-account merit score		48	44	42	10	44		
				Sub-account merit rating		6.0	5.5	5.3	1.3	5.5		
		Account merit score (S{SxW})				91	107	75	87	109		
		Account merit rating (S{SxW}/SW)				3.4	4.0	2.8	3.2	4.0		

Appendix A.5. Sensitivity Analysis 4: Only Socio-Economics and Environmental Accounts Considered

Account	W	Sub-account	W	Indicator	W	Alt C	Alt D	Alt D/PAG OL	Alt E	Alt FS	Discrimination Value (based on 30% diff)	
Socio-economics	3											
		Current Use of Lands and Resources – Ulkatcho First Nati	6	Use of Cultural/Traditional Sites	2	5	1	1	6	2	10	D
				Sub-account merit score		10	2	2	12	4		
				Sub-account merit rating		5.0	1.0	1.0	6.0	2.0		
		Commercial Land Uses	4	Agricultural and Range Tenures	3	6	5	5	5	5	3	ND
				Guide outfitting tenures	3	1	1	1	5	1	12	D
				Trapline tenures	6	5	1	1	5	1	24	D
				Sub-account merit score		51	24	24	60	24		
				Sub-account merit rating		4.3	2.0	2.0	5.0	2.0		
		Recreational land uses	2	Recreational sensitivity	1	3	3	4	4	3	1	ND
				Sub-account merit score		3	3	4	4	3		
				Sub-account merit rating		3.0	3.0	4.0	4.0	3.0		
		Archaeology	5	Effects to known archaeological sites	1	6	1	1	6	6	5	ND
				Sub-account merit score		6	1	1	6	6		
				Sub-account merit rating		6.0	1.0	1.0	6.0	6.0		
		Account merit score (S{SxW})				83	25	27	94	56		
		Account merit rating (S{SxW}/SW)				4.9	1.5	1.6	5.5	3.3		
Project Economics	0											
		Proponent costs	6	Initial capital costs	4	6	5	1	2	6	20	D
				Sustaining capital and operating costs	6	5	5	6	1	4	30	D
				Closure cost	3	6	6	1	4	6	15	D
				Fish habitat compensation	1	2	3	4	6	4	4	ND
				Sub-account merit score		74	71	47	32	70		
				Sub-account merit rating		5.3	5.1	3.4	2.3	5.0		
		Account merit score (S{SxW})				32	30	20	14	30		
		Account merit rating (S{SxW}/SW)				5.3	5.1	3.4	2.3	5.0		
MAA merit score						35	28	22	36	34		
MAA merit rating						3.9	3.1	2.4	4.0	3.8		

Appendix B

Guidelines for the Assessment of Alternatives for Mine Waste Disposal

Guidelines for the Assessment of Alternatives for Mine Waste Disposal

© Her Majesty The Queen in Right of Canada, Environment Canada, 2011

Disclaimer

For all purposes of interpreting and applying the law, users should consult:

- the Acts as passed by Parliament, which are published in the "Assented to" Acts service, Part III of the Canada Gazette and the annual Statutes of Canada, and
- the regulations, as registered by the Clerk of the Privy Council and published in Part II of the Canada Gazette.

The above-mentioned publications are available in most public libraries. Official versions of the Statutes and regulations can also be found at the Department of Justice website at http://laws.justice.gc.ca/en/index.html. The law as stated in the above-mentioned publications will prevail should any inconsistencies be found in these guidelines.

These guidelines are subject to amendments from time to time. Each version is dated, therefore users should ensure that they are always consulting the most recent version of these guidelines. Users can contact Environment Canada for this information.

Table of Contents

1 Guidance for Proponents on the Federal Process for Designating Metal Mine Tailings Impoundment Areas 1
1.1 Context 1
1.2 Purpose 1
1.3 Environmental Assessment 2
1.3.1 Overview 2
1.3.2 Assessment of alternatives 3
1.3.3 Fish habitat compensation plan 4
1.3.4 Consultations 4
1.3.5 EA decision 5
1.4 Regulatory Process 5
1.4.1 Timing 6
1.4.2 Other Fisheries Act authorizations 6
1.5 Getting started 6

2 Requirements of Alternatives Assessment 7
2.1 Alternatives Assessment Process 8
2.2 Step 1: Identify Candidate Alternatives 11
2.3 Step 2: Pre-Screening Assessment 13
2.4 Step 3: Alternative Characterization 15
2.5 Step 4: Multiple Accounts Ledger 20
2.5.1 Sub-Accounts 20
2.5.2 Indicators 23
2.6 Step 5: Value-Based Decision Process 27
2.6.1 Scoring 28
2.6.2 Weighting 28
2.6.3 Quantitative Analysis 29
2.7 Step 6: Sensitivity Analysis 31
2.8 Step 7: Document Results 33

References 34

List of Tables

Table 1: Example of the Step 1 summary table to identify 13
Table 2: Example of the pre-screening criteria summary table 15
Table 3: Sampling of environmental characterization criteria 18
Table 4: Sampling of technical characterization criteria 18
Table 5: Sampling of project economic characterization criteria 19
Table 6: Sampling of socio-economic characterization criteria 19
Table 7: Example of the characterization criteria summary table 20
Table 8: Example of the sub-account (evaluation criteria) summary table for a TMF 23
Table 9: Beaufort scale (example of a qualitative value scale) 25
Table 10: Example of the completed multiple accounts ledger 27
Table 11: Example of qualitative value scale for the indicator 27
Table 12: Example of qualitative value scale for an indicator which at first glance would appear to be measurable, such as “capital cost” 28
Table 13: Example of the quantitative analysis for indicators 30
Table 14: Example of the quantitative analysis for sub-accounts 31
Table 15: Example of the quantitative analysis for accounts 31
Table 16: Example of the results of a sensitivity analysis 33

List of Figures

Figure 1: Flow diagram of the process of assessing alternatives 10
Figure 2: Fish habitat compensation requirements in typical TIA scenarios 38

List of Annexes

Annex 1: Steps in the EA and Regulatory Processes 35
Annex 2: Regulatory Impact Analysis Statement 36
Annex 3: Fish Habitat Compensation Plans under Section 27.1 of the MMER and Subsection 35(2) of the *Fisheries Act* 37

1 Guidance for Proponents on the Federal Process for Designating Metal Mine Tailings Impoundment Areas

1.1 Context

It is expected that natural water bodies frequented by fish shall be avoided to the extent practicable for the long-term disposal of mine waste; and that mine waste shall be managed to ensure the long-term protection of Canada's terrestrial and aquatic environment.

Using a natural water body frequented by fish for tailings disposal requires an amendment to the *Metal Mining Effluent Regulations* (MMER), which is a federal legislative action. The MMER, enacted in 2002, were developed under subsections 34(2), 36(5) and 38(9) of the *Fisheries Act* to regulate the deposit of mine effluent, waste rock and tailings into natural waters frequented by fish. These regulations, administered by Environment Canada, apply to both new and existing metal mines. They are available at http://laws-lois.justice.gc.ca/PDF/Regulation/S/SOR-2002-222.pdf. Schedule 2 of the MMER lists water bodies designated as tailings impoundment areas (TIAs). A water body is added to that Schedule through a regulatory amendment.

1.2 Purpose

These guidelines describe the process that must be undertaken when a proponent is considering using a natural water body frequented by fish for waste disposal such that a regulatory amendment to the MMER would be required. In the context of these guidelines, the term tailings impoundment area (TIA) is an area that includes tailings, waste rock, and any effluent that contains any concentration of the specified deleterious substances, and is of any pH, including effluent treatment sludges, that would be disposed in a natural water body frequented by fish.

Waste rock

Waste rock is generally deleterious; hence disposing it in a water body would require that the water body first be listed on Schedule 2 of the MMER as a TIA.

If the proponent can prove that the waste rock is *not* deleterious, then no Schedule 2 listing would be required.

These guidelines pertain to metal mines where a TIA has been proposed in a natural water body frequented by fish. However, the requirements for the conduct of alternatives

assessments that are presented in Part 2 provide useful guidance for the assessment of all mine waste disposal areas including those developed on land. The overall objective of the alternatives assessment process is to minimize the environmental footprint of the disposal area.

1.3 Environmental Assessment

A project which includes a proposal to use a natural, fish-frequented water body for the disposal of mine waste triggers a requirement for a federal environmental assessment (EA) under the *Canadian Environmental Assessment Act* (CEAA), where applicable. Proposals may also be subject to additional provincial and land claim based EA obligations such as those outlined under the Inuvialuit Final Agreement for the Inuvialiut Settlement Region of the Northwest Territories.

For projects in the Yukon (http://www.yesab.ca/act_regulations/), Nunavut (http://env.gov.nu.ca/programareas/environmentprotection/legislation) and the MacKenzie Valley portion of the Northwest Territories (http://www.gov.nt.ca/agendas/land/index. html) where CEAA does not apply, EA requirements are met through other federal and territorial regimes.

Proposals may also be subject to provincial EA obligations.

An Environment Canada policy, which was developed in conjunction with the repeal of the *Alice Arm Tailings Deposit Regulations* when the MMER were registered in 2002, recommends against unconfined tailings disposal in the sea.

1.3.1 Overview

A mining project that includes a proposal to use a natural water body frequented by fish as a TIA must undergo an EA and the project proponent must also:

- prepare an assessment of alternatives for mine waste disposal for consideration (see Part 2 of these Guidelines);
- prepare a fish habitat compensation plan for consideration as part of the EA; and
- participate in public and aboriginal consultations on the EA, including on possible amendments to the MMER.[1]

Details of the EA process vary depending on the legislation or land claim under which the EA is conducted and the type of EA conducted. The project proponent needs to verify which EA regime applies (e.g., screening, comprehensive study or

[1] If the proposed use of a natural water body as a TIA would impact navigable water, then an Order in Council approval is also required under the *Navigable Waters Protection Act*. In such cases, Transport Canada is involved in the EA, and would be involved in the regulatory process for the proposed TIA, in the event that the regulatory process is undertaken.

review panel for EAs conducted under the CEAA). The Canadian Environmental Assessment Agency has resources to help guide proponents through the federal EA process under the CEAA; they are available at http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=F1F30EEF-1.

In preparing the documentation for the EA, the proponent should take into consideration the requirements of the *Cabinet Directive on Streamlining Regulations* (CDSR), which are available at http://www.tbs-sct.gc.ca/ri-qr/directive/directive00-eng.asp. While the CDSR does not apply to proponents directly, it is a requirement of the regulatory process and it is strongly recommended that the proponent help lay the necessary groundwork to carry out a cost-benefit analysis in respect of the CDSR. More specifically, the necessary regulatory action should be demonstrated to maximize net benefits for society through an assessment of impacts as well as the distributional implications.

The proponent should also take into consideration the recommendations in Environment Canada's *Environmental Code of Practice for Metal Mines* during the EA (available at http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=CBE3CD59-1). The Code supports the MMER, but also covers a broad spectrum of environmental aspects that extend well beyond it.

1.3.2 Assessment of alternatives

A project proponent seeking to use a natural water body as a TIA must conduct an assessment of alternatives for mine waste disposal. It is strongly recommended that this assessment be undertaken during the EA to streamline the overall regulatory review process and minimize the time required to proceed with the MMER amendment process. Generally speaking, at least one of these alternatives should not impact a natural water body that is frequented by fish. It is important to note that a decision by the proponent to conduct the alternatives assessment after the EA has been completed could more than double the target timeline that has been established for the processing of Schedule 2 amendments.

This alternatives assessment must objectively and rigorously assess all feasible options for mine waste disposal. The project proponent must demonstrate through the EA and this assessment that the proposed use of the water body as a TIA is the most appropriate option for mine waste disposal from environmental, technical and socio-economic perspectives. It should also be demonstrated that the option offers the greatest overall benefit to current and future generations of Canadians, as per the CDSR. Part 2 describes the requirements of an assessment of alternatives.

1.3.3 Fish habitat compensation plan

Section 27.1 of the MMER requires the project proponent to develop and implement a fish habitat compensation plan to offset the loss of fish habitat that would occur as a result of the proposed addition of a water body to Schedule 2. The proposed plan must be submitted during the EA for consideration as part of the EA. The plan must describe, among other things:

1. fish habitat that would be lost as a result of the proposed TIA;
2. compensation measures that would be implemented, if approval is given to use the water body as a TIA, to offset the loss of fish habitat that would result;
3. plans to monitor the implementation of the compensation plan; and
4. a breakdown of estimated costs for implementation and monitoring of the plan.

A *Practioner's Guide to Habitat Compensation* is available at: http://www.dfo-mpo.gc.ca/habitat/role/141/1415/14155/compensation/index-eng.asp.

If the Governor in Council approves the regulation adding the water body as a TIA in Schedule 2, then, as per Section 27.1 of the MMER, the proponent must submit to DFO an irrevocable letter of credit to cover the plan's implementation costs.

The proponent must also develop and implement a fish habitat compensation plan under subsection 35(2) of the *Fisheries Act* to offset the harmful alteration, disruption or destruction of fish habitat as a result of the works needed for constructing the TIA. See Annex 3 for an explanation as to why two fish habitat compensation plans are needed.

1.3.4 Consultations

During the EA, Environment Canada and DFO consult local and national stakeholders and representatives of Aboriginal peoples to ensure that all interested parties have access to information about the project and have the opportunity to provide input and comments. The project proponent participates in the consultations to directly communicate the results of their alternatives assessment and its conclusions to all engaged parties.

Consultations on the proposed MMER amendment are conducted in accordance with the Treasury Board *Guidelines for Effective Regulatory Consultations*, available at: www.tbs-sct.gc.ca/ri-qr/documents/gl-ld/erc-cer/erc-certb-eng.asp.

DFO leads any additional Aboriginal consultations to ensure that all obligations that may exist in relation to rights protected by section 35 of the *Constitution Act, 1982* have been satisfied. Guidance on these consultations, which may be informed in

part by the consultations undertaken pursuant to the alternatives assessment, is available at http://www.mpmo-bggp.gc.ca/desc/aboriginal-autochtones-eng.php.

1.3.5 EA decision

The application for a TIA following the EA decision can only proceed to the regulatory stage if the decision taken pursuant to the environmental assessment is that the project can be carried out, in whole or in part, past the EA stage. If the government decision is that the project should not proceed, no further action is taken with respect to the possible MMER amendment.

1.4 Regulatory Process

The decision to add a water body to Schedule 2 of the MMER is made by Treasury Board. Key elements needed for the regulatory process (assessment of alternatives, fish habitat compensation plan) take place during the EA phase, described above. The next steps in the regulatory process are:

1. Environment Canada prepares the regulatory amendment package to move forward with the TIA listing on Schedule 2 of the MMER. The package includes the text of the proposed regulatory amendment, which provides the name and geographical description of the water body being proposed as a TIA. The package also includes a Regulatory Impact Analysis Statement (RIAS) which is a key document in justifying the proposed Schedule 2 amendment. It includes, among other things:

- a description of the project;
- the rationale for the proposed amendment;
- a summary of the proposed fish habitat compensation plan;
- a description of the options that are considered during the alternatives assessment evaluation;
- a summary of the consultations; and
- a cost-benefit analysis of the proposed amendment, which assesses potential impacts from a broad societal perspective (e.g., environment, businesses, consumers, and other sectors of society). A key element of the cost benefit analysis is the development of a baseline and regulatory scenario. Cost information related to the alternatives assessment as well as costs related to the fish habitat compensation plan are included in this analysis. For more information, see Annex 2 and also the Treasury Board of Canada Secretariat *Guide to the Regulatory Process* at http://www.tbs-sct.gc.ca/ri-qr/processguideprocessus-eng.asp.

2. If approved by the Ministers of Environment and Fisheries and Oceans, the regulatory amendment package is sent to the Treasury Board for consideration.

3. If approved by the Treasury Board, the proposed amendment is published in Part I of the *Canada Gazette* for a 30-day public comment period.

4. 30-day public comment period.

5. Review of comments received.
6. Environment Canada prepares the final regulatory package, with the final RIAS incorporating responses to the comments received.
7. Submission of the final regulatory package to the Ministers of Environment and Fisheries and Oceans for approval to submit the regulatory amendment to the Treasury Board.
8. If approved by the Treasury Board, the regulatory amendment becomes law and is registered.
9. The regulatory amendment and the RIAS are published in Part II of the *Canada Gazette*, approximately two weeks after being registered.

These steps conform to the requirements of the CDSR.

Annex 1 provides a flow chart of the key steps in the EA and regulatory processes.

1.4.1 Timing

The regulatory amendment process typically takes 8-12 months after the end of the EA. However, if additional information is required (e.g., data gaps, missing cost information about the TIA or fish habitat compensation plan, etc) or if there is litigation, the process could be longer.

For major resource projects, target timelines for the EA and regulatory processes are publicly tracked and monitored by the Major Projects Management Office (http://www.mpmo-bggp.gc.ca/index-eng.php).

1.4.2 Other Fisheries Act authorizations

Where subsection 35(2) *Fisheries Act* authorizations (regarding the harmful alteration, disruption or destruction of fish habitat) associated with the construction of the TIA is granted, this generally occurs *after* the Schedule 2 amendments are completed, typically no later than three weeks following listing.

However, subsection 35(2) authorizations that are *not* related to the construction of the TIAs could be issued prior to the Governor in Council decision on the Schedule 2 amendment.

1.5 Getting started

Proponents of metal mines south of 60^{o} are encouraged to contact the Major Projects Management Office (www.mpmo-bggp.gc.ca/index-eng.php) and, for mines north of 60^{o}, the Northern Projects Management Office (www.north.gc.ca/pr/emp-eng.asp). The offices provide overarching project coordination, management, project tracking and guidance to proponents.

2 Requirements of Alternatives Assessment

The MMER stipulates that for mine waste to be deposited in a natural, fish-bearing water body, the water body must be listed in Schedule 2 of the Regulations, designating it as a tailings impoundment area (TIA). In the context of these guidelines, a TIA includes tailings, waste rock, and any effluent that contains any concentration of the specified deleterious substances, and is of any pH, including effluent treatment sludges, that would be disposed in a natural water body frequented by fish.

The alternatives assessment should objectively and rigorously consider all available options for mine waste disposal. It should assess all aspects of each mine waste disposal alternative throughout the project life cycle (i.e., from construction through operation, closure and ultimately long-term monitoring and maintenance). The alternatives assessment should also include all aspects of the project, direct or indirect, that may contribute to the predicted impacts associated with the each potential alternative. These may include the design of the mine and ore processing system to the extent that they would impact waste rock and tailings production, storage options, water management and water treatment. The assessment will consider the predicted quality and quantity of effluent that would be discharged from each alternative assessed, taking into account the effluent quality limits set in the MMER, and the predicted impacts (inclusive of mitigation measures) associated with the proposed TIA, if any, on surface and groundwater water quality and flow.

The assessment should address environmental, technical and socio-economic aspects of all of the elements as described above for each alternative throughout the project life cycle. A comprehensive economic assessment of the alternatives is also required and should consider the full costs of each alternative throughout the project life cycle. This economic assessment should also consider all costs associated with any compensation agreements that are to be developed, including the habitat compensation plan associated with using the water body as a TIA.

2.1 Alternatives Assessment Process

Selecting the most suitable mine waste disposal alternative from an environmental, technical and socio-economic perspective, and obtaining input and striving to achieve consensus on the decision from a broad stakeholder group is a complex undertaking. From a purely technical perspective, the breadth of concerns and issues involve individuals from many disciplines within engineering, economics, and natural and social sciences. On the other hand, this complicated scientific language needs to be openly communicated such that the broader stakeholder group can meaningfully participate in the decision making process, or, at least when objectively looking in from the outside have confidence that the decision process is unbiased and representative.

This in itself introduces another level of complexity, in that decisions require judgement and cannot solely be based on technical merit. Two types of judgement are inherent in these decisions: technical judgements regarding the likely consequences inherent in the decision, and value judgements regarding the importance or seriousness of those consequences.

To overcome these challenges tools have been developed to facilitate the decision making process and to make them as transparent and reproducible as practicable. The underlying principal is that a successful decision making tool will allow technical specialists to communicate essential technical considerations while allowing stakeholders to establish value judgements for the decision.

The collective term for these decision making tools are multiple criteria decision analysis (MCDA). MCDA approaches can be classified in different ways, but one of the primary classifications distinguishes between multi-objective decision making (MODM) and multi-attribute decision making (MADM). The primary distinction between these methods is the number of alternatives under evaluation. MADM is designed for selecting discrete alternatives such as mine waste disposal alternatives, while MODM methods are designed for multi-objective planning problems when a theoretically infinite number of interdependent alternatives are defined.

Different categories of MCDA methods are found, but the most relevant in the context of assessment of alternatives for mine waste disposal are value measurement models. In these models numerical scores are constructed to represent the degree to which one decision option may be preferred over another. MCDA is a valuable tool to aid decision making, which is a process which seeks to integrate objective measurement with value judgement and make explicit and manage subjectivity which is inherent in all decision making.

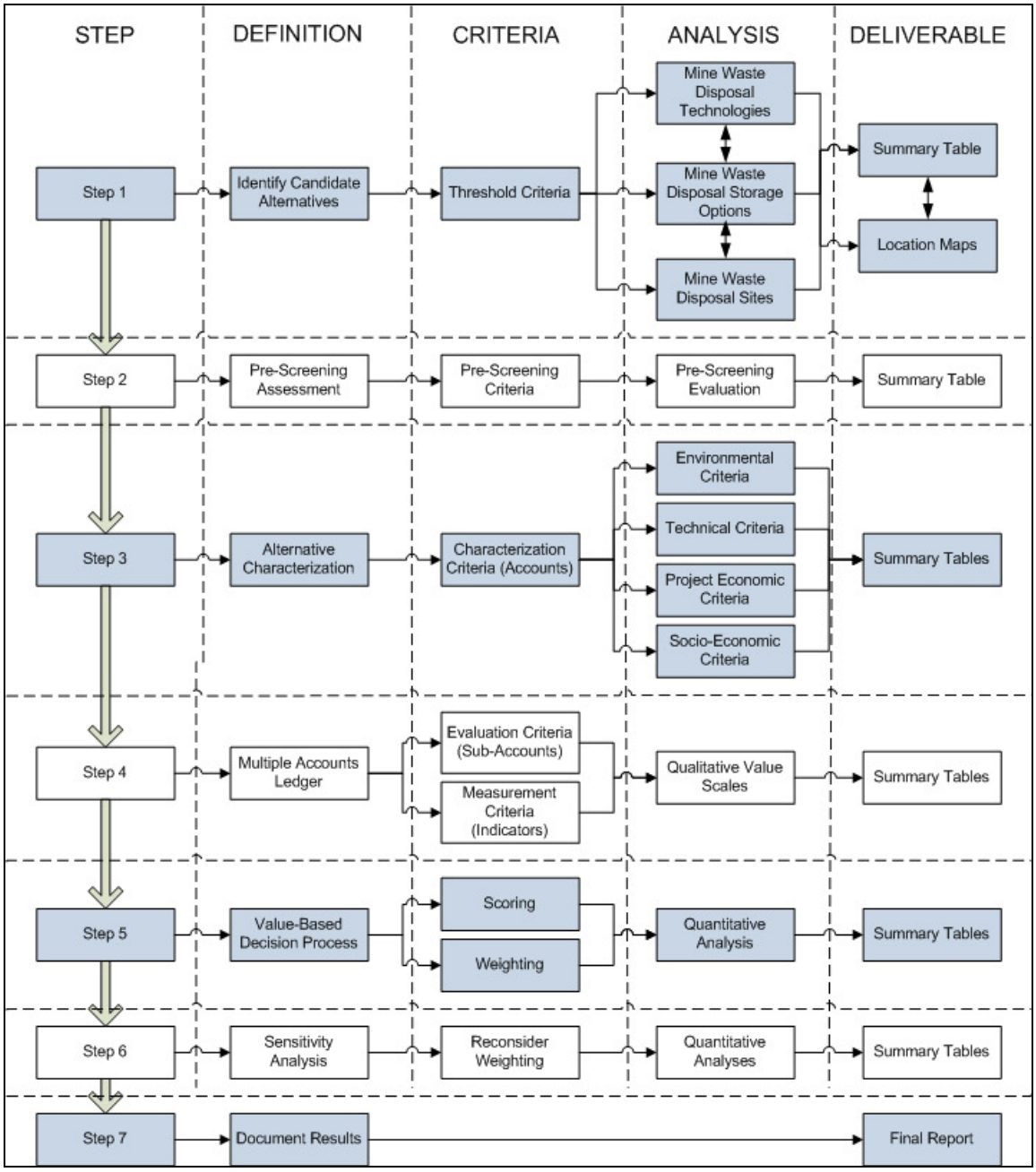
Within the general theory of MCDA there is a multitude of specific tools, each tailored for specific applications. Multiple Accounts Analysis (MAA) is one of the tools which have been

successfully used to conduct assessments of alternatives for mine waste disposal and other mining related decision processes. A notable example of the use of MAA in this context is that which was conducted as an element of the environmental assessment of the Meadowbank gold mine in Nunavut. The text of this document can be viewed at ftp://ftp.nirb.ca/02-REVIEWS/COMPLETED%20REVIEWS/03MN107-MEADOWBANK%20GOLD%20MINE/02-REVIEW/08-FINAL_EIS/174._051108-CRL-FEIS-MB-ITAE/SUPPORTING_DOCS/004project%20alternative/.

MAA consists of the development of a multiple accounts ledger, which is an explicit list of accounts (and sub-accounts) of the impacts from various alternatives and for each account indicator, which gives a clear understandable measurable description of those impacts. This is followed by a value-based decision process whereby indicator values are scored and weighted in a systematic transparent manner such that the value basis for the effects impacting them is readily apparent.

MAA is only part of a larger alternatives assessment process. This process, as it applies to proposed TIAs in the context of these guidelines, is illustrated graphically in Figure 1. Each of the seven steps of the process is described in greater detail in subsequent chapters of these guidelines. It should be noted that the MAA as presented in this guideline is slightly modified from the original method first described by Robertson and Shaw (1998, 1999). This modified approach makes the process more transparent and eliminates multiple levels of bias and subjectivity.

Figure 1: Flow diagram of the process of assessing alternatives for mine waste disposal



2.2 Step 1: Identify Candidate Alternatives

The first step in the alternatives assessment process entails developing a list of all possible (i.e., reasonable, conceivable and realistic) candidate mine waste disposal alternatives for the site. This should include different mine waste disposal technologies, different disposal storage options, and different disposal locations. At this time it is imperative that no a priori judgements be made about any of the alternatives.

It may be appropriate to establish a basic set of *threshold criteria* to establish the regional boundaries for selecting candidate alternatives. These threshold criteria should be as broad as possible and must be fully described and rationalized to ensure transparency. There is no master list of threshold criteria, but typical examples include:

- *Exclusion based on distance*: There is sufficient precedent to suggest that at some point the distance between the mill/mine complex and the TIA becomes too great to ensure a positive economic outcome to the project. For any given project this distance may be set.
- *Exclusion based on presence of protected areas*: There may be protected areas (e.g., nature reserves or sacred land) within the regional boundaries considered for candidate mine waste disposal alternatives. If it is known that a TIA in these areas would under no circumstances be allowed, these areas can justifiably be excluded from evaluation.
- *Exclusion based on legal boundaries*: Areas may be justifiably excluded from evaluation if legal boundaries would preclude mine waste disposal. These may include country borders or cadastral/land use/lease boundaries.
- *Exclusion based on corporate policy*: A project proponent may have specific corporate sustainability policies which would eliminate a candidate alternative from consideration. These may include a policy statement limiting consideration of alternatives that would require relocation of local inhabitants.

Mine waste deposition technologies and storage options should not be separately evaluated from deposition sites as the impacts linked to an individual site could vary substantially based on the deposition technology or storage option selected. Therefore, if a candidate site justifiably lends itself to more than one mine waste deposition method; these should be considered as candidate alternatives in their own right.

Due to the volume of waste rock associated with most mines, is not uncommon to have a number of different waste rock piles associated with any given project. This is typically not the case for tailings management facilities (TMFs). It is a generally understood fact that for any given project a single consolidated TMF is usually preferred over a series of smaller

TMFs. However, there are justifiable reasons why multiple TMFs may be considered for a project, such as:

- *Separation of the tailings stream*: In some cases separation of the float tailings (which typically represents the largest fraction of the tailings volume) from the leach residue tailings would result in the larger volume of float tailings being geochemically benign, which greatly reduces any potential impacts. This may justify more than one TMF for a site.
- *Using tailings as mine backfill*: Mine backfill is often required as part of the mine plan. It may be advantageous to consider tailings as a backfill material to achieve two goals. Firstly, it may offer a logical rationale to separate the leach and float tailings, and secondly, by reducing the volume of tailings that needs to go to the TMF, the potential impacts are reduced.

Should more than one TIA facility be considered for a project, the alternatives assessment process described in these guidelines applies equally to each disposal alternative under consideration.

It is recognized that the level of detail available about mine waste disposal alternatives during this stage of the process is highly conceptual. However, each candidate alternative should at least in principle be sufficiently thought through to allow an understanding of the concept. This is best done by developing a summary table which lists each alternative with a concise qualitative statement as to how the alternative would apply through each of the pertinent phases of the project (i.e., the project life cycle). Table 1 provides an example of the level of information that should be targeted during this step. The objective at this step in the process is to demonstrate to an external reviewer that all reasonable mine waste disposal alternatives have been brought forward.

Table 1: Example of the Step 1 summary table to identify candidate TMF alternatives

Project Phase	Alternative A	Alternative B	Alternative C
Construction approach	Construction of two large dams to impound Lake ABC, and an engineered diversion of stream DEF	Construction of a small dam to impound the stream XYZ valley	Construction of a ring dike on a land saddle at the catchment divide
Operational approach	Subaqueous deposition with discharge of effluent via treatment plant	Sub aerial deposition of thickened tailings with discharge of effluent via treatment plant	Sub aerial deposition of un-thickened slurry tailings with discharge of effluent via treatment plant
Closure approach	Draining of water cover and placing a dry cover	Buttressing of dam and placement of dry cover	Buttressing of ring dike and placement of dry cover

The deliverable after completing this step of the alternatives assessment process would be a summary table of candidate alternatives complemented by maps or figures showing the locations of each of the alternatives. Furthermore, any threshold criteria must be properly documented, such that an external reviewer would consider the criteria reasonable.

It should be noted that tailings separation goes against what is currently done at uranium mines where all tailings are placed in one single engineered pit. This is due to the fact that a review of historical practices for uranium mines indicated that tailings separation has caused more long term problems than benefits. Thus, the Canadian Nuclear Safety Commission expects that mine workings be used to the maximum extent possible for tailings disposal.

2.3 Step 2: Pre-Screening Assessment

Generally, it is not too difficult to develop a substantial list of alternatives during Step 1 of the process. However, this list of alternatives should be screened during Step 2 to allow the decision process to be carried out on an appropriate and manageable set of sufficiently detailed alternatives. It is important to note that the objective of this step is not to "*make less work*" for the proponent, but rather to "*optimize the decision making process*" by not evaluating alternatives that have obvious deficiencies.

The process of screening, called the *pre-screening assessment* in these guidelines, entails excluding those alternatives that are "non-compliant" in that they do not meet certain unique minimum specifications which have been developed for the project. This process is often referred to as a "fatal-flaw analysis" in the context of mine waste disposal alternatives assessments. A fatal flaw is defined as any site characteristic that is so unfavourable or severe that, if taken singly, it would eliminate that site as a candidate mine waste disposal alternative. In simple terms, these would be considered the "show-stoppers".

There is not a “master list” that qualifies as *pre-screening criteria*. These criteria need to be uniquely developed for each project, and a thorough qualification and justification of the rationale must be provided. The selection of pre-screening criteria and its rationale needs to be carefully considered since the objective at this time is to provide a transparent process for potentially eliminating the majority of alternatives from detailed analysis and assessment. Therefore, it should be clear to external reviewers that the pre-screening criteria, when evaluated singly, are sufficiently important to eliminate an alternative from further consideration. The level of detail required to support that conclusion has to be evaluated on a case-by-case basis, and it may have to be extensive to be sufficiently supportive.

Pre-screening criteria should be formulated such that there is a simple “YES” or “NO” response to whether the alternative complies with the set criteria. Most importantly, it must be clear to the external reviewer that there would be no reasonable mitigation strategy that would convert a “YES” into a “NO”.

Examples of pre-screening criteria and the possible associated rationale are presented below. It is important to note that these criteria are provided as examples and should not be considered as practices that would be acceptable in all circumstances. It is incumbent on the proponent to consider and examine criteria according to these guidelines in order to determine which would provide the best practicable manner to manage mine waste and provide for acceptable protection of the environment.

- *Would the TIA preclude future exploration or mining of a potential resource?* A TIA located over an area where there are proven indicators of mineralization, or a reasonable indication of possible mineralization based on regional trends, may be one possible reason to exclude it from further consideration. Under this scenario, it may not be reasonable to expect the proponent to conduct a lengthy exploration program to prove out whether an economically viable resource does exist in the area.
- *Is any part of the mine waste disposal system unproven technology?* If a specific disposal method relies on technology that has not been demonstrated to be effective in the context of the site under consideration, then it could justifiably be argued that the alternative should be excluded from further consideration. It would not be reasonable to expect the proponent to conduct lengthy fundamental or applied research to prove whether the technology may be successful.
- *Will the TMF capacity be too small to store the proposed upper limit of tailings?* Unless there is good rationale to have more than one TMF for any given project site (e.g., due to separation of tailings streams), it can justifiably be argued that if a site does not have sufficient capacity using reasonable technically viable containment strategies then it can be excluded from consideration.

- *Will the TIA result in negative life of project economics?* It is justifiable to exclude TIAs from further consideration if they would result in negative life of project total (overall) economics. When using project economics as pre-screening criteria, the proponent needs to be careful to not evaluate the mine waste disposal economics in isolation of the total project economics. It is conceivable that a more expensive mine waste disposal alternative could result in improved project economics.

Furthermore, it must be recognized that specific legal requirements may preclude the possibility of pursuing some potential alternatives. For example, the requirements of the *Species at Risk Act* could preclude the development of a TIA if the TIA was to be located in an area that would impact the habitat of specific endangered species.

Results of the pre-screening assessment are best presented in the form of a summary table that lists each alternative against the pre-screening criteria (and associated rationale) set for the project. Table 2 provides an example of what this summary table would look like. This table, complete with all applicable supporting information, will be the deliverable for this step.

Table 2: Example of the pre-screening criteria summary table

Pre-Screening Criteria	Rationale	Alternative A	Alternative B	Alternative C
Would the TIA sterilize a potential resource?	A TIA located over an area where there are proven indicators of mineralization, or a reasonable indication of possible mineralization based on regional trends may be excluded from further consideration.	NO	YES	NO
Is any part of the mine waste disposal system unproven technology?	If a specific deposition method relies on unproven technology at the project site, then it could justifiably be argued that the alternative should be excluded from further consideration.	YES	NO	NO
Should alternative be excluded from further assessment?		YES	YES	NO

2.4 Step 3: Alternative Characterization

At this stage in the alternatives assessment process, there should be a reduced number of alternatives remaining. However, there will have to have been sufficient justifiable pre-screening undertaken to ensure that any of the remaining alternatives could prove to be the preferred alternative. There is no “ideal number” of alternatives that should be carried through at this stage, but a general rule-of-thumb is that there would be at least three or more alternatives remaining and determined to be worthy of detailed assessment. At least one of these alternatives should not impact a natural water body that is frequented by fish, unless it can be demonstrated that this possibility does not reasonably exist based on site-specific circumstances.

These remaining alternatives need to be thoroughly characterized, and this serves two purposes:

- Firstly, complete characterization of each alternative ensures that every aspect and nuance of the alternative is properly considered, and;
- Secondly, the provision of a thorough characterization in a clear and concise format that directly compares alternatives, ensuring complete transparency of the alternatives assessment process.

Site specific *characterization criteria* should be developed for each project. To facilitate smooth transition towards the next more rigorous steps of the evaluation process these criteria should be categorized into four broad categories, or “accounts” in the context of these guidelines, that consider the entire project life cycle. This means that both short and long term environmental, technical and socio-economic aspects associated with construction through operation, mine closure and ultimately post-closure maintenance and monitoring need to be considered. The “accounts” can be summarized as follows:

- *Environmental characterization*: This account focuses on characterizing the local and regional environment surrounding the proposed TIA. These include elements such as climate, geology, hydrology, hydrogeology, water quality and potential impacts on aquatic, terrestrial and bird life.
- *Technical characterization*: This focuses on characterization of the engineered elements of each alternative such as storage capacity, dam size and volume, diversion channel size and capacity, dumping techniques, haul distances, sedimentation and pollution control dam requirements, tailings discharge methods, pipeline grades and routes, closure design, discharge and/or water treatment infrastructure and supporting infrastructure such as access roads.
- *Project economic characterization*: The focus of this account is to characterize life of project economics. All aspects of the mine waste management plan need to be considered including investigation, design, construction (inclusive of borrow development and royalties where applicable), operation, closure, post closure care and maintenance, water management, associated infrastructure (including transport and deposition systems), compensation payments and land use or lease fees.
- *Socio-economic characterization*: This account focuses on how a proposed TIA may influence local and regional land users. Elements that are considered here include characterization and valuation of land use, cultural significance, presence of archaeological sites and employment and/or training opportunities.

It is essential that the characterization remain factual, or where statements of judgement, risk or uncertainty are made, that they be explicitly defined and qualified. As previously stated, it should be clear to any external reviewer what the basis is for the characterization criteria stipulated for any alternative. In most cases there needs to be supporting

information for these criteria in the form of technical reports completed by appropriately qualified specialists. In populating the characterization criteria, care must be taken to not make a priori judgement about any criteria or alternative. It is also important to note that characterization of the alternatives in this step does not entail evaluating impacts. Impact evaluation is left to Step 4 of the assessment process when a thorough characterization of each alternative is readily available. The level of detail at which a project is characterized and subsequently documented should be evaluated based on project specific needs.

Selecting and documenting characterization criteria should be done by a multidisciplinary team with representatives from all four accounts. In some cases multiple representatives may be required from a single account, for example a person familiar with the aquatic habitat in an area may not be familiar with the bird or terrestrial life. There is no prescribed way as to how these teams should be solicited to set and populate the characterization criteria for a project. However, clearly documenting the process that was followed throughout this step can greatly help to instill confidence of the external reviewer that all alternatives have been thoroughly characterized.

Every project is unique, and as a result it is not appropriate to provide a standardized list of characterization criteria against which to document alternatives. The lists provided in Tables 3 through 6 offer a reasonable sampling of characterization criteria that are likely to be required for the majority of projects. Naturally, the selection of criteria would also depend to some extent on the type of mine waste under consideration, i.e., a TMF or waste rock pile.

When deciding upon characterization criteria, it may be useful to pose the following question: "*What would be reasonable questions that a stakeholder, regulator or technical reviewer may ask about any of the proposed mine waste disposal alternatives?*" By anticipating the response to this question, a reasonable basis for setting characterization criteria can be established. During this step of populating the characterization criteria table, it is conceivable that elements are "double-counted", i.e., the footprint size of the TIA may be listed under technical characterization criteria, with the goal of differentiating physical size, and again as an environmental characterization criteria, but with the goal of demonstrating loss of habitat. This apparent double-counting is not relevant at this time, as Step 4 is designed to address this issue. Notwithstanding, it does help the external reviewer if the logic behind the inclusion of all characterization criteria is immediately apparent though extensive documentation.

Table 3: Sampling of environmental characterization criteria

Geochemical characterization of wastes (e.g., acid rock drainage and/or metal leaching, weatherability)
Geochemical characterization of all construction materials and associated excavation waste (i.e., unsuitable soils stripped from foundations, quarries, or other borrow sources)
Geographical boundaries (e.g., country/provincial/territorial/municipal boundaries, land claim/land use/cadastral/other re-defined boundaries)
Topography (e.g., relief, complexity of topography)
Geotechnical and seismic conditions (e.g., geological setting, depth of overburden and/or permafrost, fault/fracture zones)
Hydrology (e.g., surface water features, size of streams/rivers/lakes/wetlands, catchment boundaries, flood lines)
Hydrogeology (e.g., depth to groundwater, perched water tables, presence of springs/artesian wells)
Climate (e.g., prevalent wind strength and direction, snow drifting, precipitation and/or temperature inversions)
Climate change projections (e.g., predicted changes in precipitation patterns and extreme precipitation events, warming impacts in permafrost areas)
Atmospheric issues (e.g., particulates, heavy metals)
Overall affected land footprint size of impoundment (including secondary/polishing ponds), related infrastructure (e.g., dams, saddle dykes), and access road
Water quality (e.g., surface water, groundwater, impacted waters)
Water quantity and storage issues
Special features (e.g., seismicity, avalanches, permafrost, radioactivity)
Vegetation (e.g., types, rarity/uniqueness, coverage)
Aquatic life and habitat (e.g., species variation/uniqueness, habitat suitability)
Terrestrial life and habitat (e.g., species variation/uniqueness, habitat suitability)
Bird life and habitat (e.g., species variation/uniqueness, habitat suitability)

Table 4: Sampling of technical characterization criteria

Physical characterization of wastes (e.g., grain size distribution, settlement rate, consolidation parameters)
TIA design (e.g., overall affected land footprint size of impoundment (including secondary/polishing ponds), related infrastructure (e.g., dams, saddle dykes), access and haul roads)
Containment structure design (e.g., size, hydraulic capacity, artificial materials, substrate, possible use of impermeable or geo-textile liner for impoundment)
Diversion structure designs (e.g., size, hydraulic capacity, construction materials, substrate)
Supporting infrastructure design (e.g., type, size, construction materials, substrate)
Borrow source and quarry design (e.g., size, volumes extracted, development methods, water management, rehabilitation)
Tailings delivery and deposition system design (e.g., type, capacity, location, containment)
Water management system design (e.g., water balance, discharge strategy, water treatment strategy, recycle strategy)
Closure design (e.g., approach, construction materials)
Flexibility (e.g., ability to handle upset conditions (chemical/volumetric/physical), expansion capacity, variable discharge strategies)
Precedent (e.g., new technologies, case studies – should include thickened, paste or dry stacking alternatives)
Design and construction of impermeable covers over wastes
Technical risks and benefits (e.g., variable foundation conditions, water balance)
Constructability (e.g., seasonality, access)

Table 5: Sampling of project economic characterization criteria

Capital cost (e.g., investigations, design, borrow development, construction, supervision, commissioning)
Operational cost (e.g., sustaining capital such as dam raises, deposition, monitoring, maintenance, water treatment)
Closure cost (e.g., bonding, investigations, design, borrow development, construction, supervision, commissioning)
Post-closure cost (e.g., monitoring, maintenance, inspections, water treatment)
Fish habitat compensation (e.g., bonding, construction, monitoring)
Land use cost (e.g., land use fees, lease rates, royalties on borrow materials)
Economic risks and benefits (e.g., permitting timelines, construction seasonality, design certainty, post-closure timeline)

Table 6: Sampling of socio-economic characterization criteria

Archaeology (e.g., location, size, type, importance, risk of unidentified sites such as burial sites)
Community/Aboriginal land/mineral use rights (e.g., formal/informal agreements, grandfathered agreements)
Maintenance of traditional lifestyle (e.g., loss of hunting, fishing or natural food harvesting, loss of access)
Ecological/cultural values (e.g., value of land, value of water, value of aquatic, bird or terrestrial species, value of lifestyle)
Perception (e.g., apparent acceptance or distrust, nature of communication)
Previous and existing land use (e.g., recreation/tourism, spiritual well being, mining, industry, hunting, fishing)
Aesthetics (e.g., line of sight, landform engineering, re-vegetation)
Employment (e.g., short and long-term opportunities, “boom-and-bust” cycles)
Capacity building (e.g., training opportunities, contracting opportunities, community infrastructure)
Economic benefits (e.g., partnerships, royalties, lease payments, compensation and benefit agreements)
Community safety (e.g., construction methods, operational management of TIA, closure state of TIA)
Overall perceived socio-economic consequences, benefits and relative preferences

The deliverable for this step should ideally be a series of summary tables that list the selected characterization criteria for each account for each of the alternatives under consideration. The table should include a concise summary of the rationale behind each criterion. This format allows an external reviewer to easily compare the factual characteristics across alternatives. Table 7 provides an example of what this summary table may look like.

Table 7: Example of the characterization criteria summary table

Account: Technical Characterization

Characterization Criteria	Rationale	Alternative A	Alternative B	Alternative C
Dam size	Larger dams are more complex, pose greater risk, require more construction materials, require a larger footprint	One dam, 300 m long, 20 m total height, final dam footprint of 2 ha	Two dams; first is 150 m long, 30 m high with a footprint of 1 ha; second is 200 m long, 15 m high with a footprint of 2 ha	Two dams; first is 400 m long, 30 m high with a footprint of 3 ha; second is 50 m long, 20 m high with a footprint of 0.5 ha
Dam foundation conditions	Dams constructed on poor foundation conditions are more complex, pose greater seepage and stability risk	Shallow (3 m thick) glacio-fluvial soil overlying competent intact bedrock	Shallow (0.5 m thick) organic layer overlying 5-8 m thick bouldery till, overlying fractured bedrock	Shallow (3 m thick) glacio-fluvial soil overlying competent intact bedrock
Supporting infrastructure	More supporting infrastructure results in greater demand on construction material, occupy larger footprint	5 km access road, and 4 km service road for discharge spigots	3 km access road and 8 km ring road to service discharge spigots	10 km access road and 7 km service road for discharge spigots

2.5 Step 4: Multiple Accounts Ledger

Up to this point in the process, the emphasis has been on identifying and characterizing alternatives. In order to evaluate alternatives using the MAA decision making tool, it is necessary to develop a *multiple accounts ledger*. This ledger seeks to identify those elements that differentiate alternatives, and provides the basis for scoring and weighting as described in Step 5, which is necessary to complete the evaluation. The multiple accounts ledger consists of the following two elements:

- Sub-accounts, known as evaluation criteria, and;
- Indicators, known as measurement criteria.

Complete definitions and procedures for developing sub-accounts and indicators are described in the following sections.

2.5.1 Sub-Accounts

Sub-accounts (evaluation criteria) are developed using the characterization criteria selected during Step 3. The fundamental difference between these sets of criteria is that characterization criteria are factual and have been developed with no a priori judgements being made regarding any of the alternatives being considered, while evaluation criteria consider only the material impact (i.e., benefit or loss) associated with any of the alternatives being evaluated.

The choice of sub-accounts must be carefully considered so that only those sub-accounts that truly differentiate mine waste disposal alternatives are presented for evaluation. To facilitate this, sub-accounts should comply with the following guidelines:

- *Impact driven*: The evaluation criteria must, as far as practicable, be linked to an impact as opposed to merely being a factual element. For example, the size of an impacted lake in itself is not a relevant sub-account, but if the size of the lake is linked to its value or potential habitat loss, then the sub-account is appropriate.
- *Differentiating*: The sub-account must define an aspect which distinctly differentiates one alternative from another, and that difference is expected to have a material effect on the final selection of an alternative. For example, land ownership may be an important evaluation criterion, if different alternatives fall on ground with different ownership. Conversely, if all the mine waste disposal alternatives under consideration were on land belonging to a single owner, then there really is no need to consider this sub-account in the analysis.
- *Value relevance*: A sub-account must be relevant in the context of the alternatives being evaluated. For example, the size of dams in itself is not a relevant sub-account unless it is linked to a relevant context such as increased long-term risk of failure or increased maintenance and inspection requirements.
- *Understandability*: Sub-accounts must be unambiguously defined, such that two external reviewers cannot interpret the outcome differently. For example, distance between the TIA and the mill complex may be a sub-account with the understanding that greater distances pose greater technical and environmental risk. However, someone may assume that because there is a significant dust hazard associated with a proposed alternative, a greater distance could be advantageous due to reduced worker health and safety risks.
- *Non-redundancy*: There should not be more than one sub-account that measures the same evaluation criteria. If individual sub-accounts measure similar criteria, consideration should be given to combining those criteria.
- *Judgemental independence*: Sub-accounts should be judgementally independent, which means that preferences with respect to a single criteria, or trade-offs between criteria, cannot depend on the value of another. For example, assume “traditional land use” is one sub-account and another is “landowner perception”. It may be concluded that for one alternative “hunting” will be impacted which would result in a negative impact on

"traditional land use". However, if "landowner perception" is influenced by a decrease in hunting then judgemental independence does not exist.

As with all the other criteria mentioned throughout this alternatives assessment process, there is no "master list" of evaluation criteria applicable to all projects and there is no ideal number of evaluation criteria. These should be defined on a project specific basis by a multi-disciplinary team with input from stakeholders. This helps instill confidence in the process in the eyes of an external reviewer, and ensures transparency which is an integral part of the success of the alternatives evaluation process.

The deliverable at this stage in the process will be a summary table which lists the sub-accounts complete with the rationale behind each. Appropriate supporting documentation will likely have to be clearly referenced. Table 8 provides an example of what this summary table may consist of.

Table 8: Example of the sub-account (evaluation criteria) summary table for a TMF

Account	Sub-account	Rationale
Environmental	Distance from mill site	A longer distance implies that the risk of an accidental spill of tailings along the pipeline is greater. Greater distance further implies more linear infrastructure which negatively affects Caribou migration.
	Value of aquatic life affected	A lake with larger species diversity has been deemed to carry greater value from a traditional use perspective.
	Post-closure land use	Alternatives that would most closely return land use to pre-mining conditions would be more palatable to the landowner.
Technical	Containment structure design	Larger or more complex containment structures are generally less desirable due to uncertainty associated with long term integrity particularly if the area is seismically active.
	Water management system	Long term water treatment is not desirable due to long term risks associated with treatment sludge handling and storage.
	Complete system flexibility	Waste characteristics are expected to change over the life of the project, affecting physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes are preferred.
Project economics	Capital cost	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
	Operational (and sustaining capital) cost	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
	Closure and post closure cost	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
Socio-economic	Archaeology	The prevalence of archaeological sites in the region implies complete avoidance will be impossible. Sites which would minimize the impact would be more amenable.
	Society and Culture	A regulatory proposal may have impacts or implications on people's way of life, culture, community and well being. Special consideration should be given to vulnerable social and economic groups such as Aboriginal peoples.
	Traditional land use value	It would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
	Perception	Tailings, irrespective of their geochemical composition, are generally perceived to be highly toxic by the local communities. Therefore, TMFs where animals and/or birds could have direct contact with tailings are less desirable.

2.5.2 Indicators

To allow qualitative or quantitative measurement of the impact (i.e., benefit or loss) associated with each alternative for any given sub-account, the sub-account needs to be measurable. Sub-accounts by nature are often not directly measurable, and need to be sufficiently decomposed to allow measurability. This decomposition

takes the form of sub-sub-accounts, which in the language of MAA are called *indicators*, or measurement criteria.

The concept of indicators is best described by examples:

- *Example 1*: The sub-account “traditional land use” may have a list of indicators including “effects on hunting”, “effects on fishing” and “effects on harvesting berries”.
- *Example 2*: The sub-account “water quality” may have a list of indicators including “pH”, “conductivity”, “TDS”, etc.

These indicators may be different for the different life-cycle stages of the project (i.e., construction, operation and closure) and, where appropriate, may be divided into separate time periods.

When selecting indicators thought should be given to the parameter that will be used to define measurability. This measurability is required in order to continue to Step 5, which is the value-based decision process. Assigning measurability is relatively simple for sub-accounts that readily lend themselves to parametric terms such as “water quality” or “capital costs”. The challenge comes when measurability needs to be assigned to sub-accounts that do not readily lend themselves to parametric terms such as “traditional land use” which must be supplemented by indicators such as “effects on hunting”.

This problem can be overcome by constructing qualitative value scales. Common examples of such qualitative value scales are the Apgar score used to quickly and summarily assess the health of newborn children immediately after birth (Apgar, 1953), and the Beaufort scale used by mariners to measure the strength of wind (Huler, 2004). For illustration, the Beaufort scale has been reproduced in Table 9. The Beaufort scale was developed because mariners could not actually measure the strength of wind, and they needed to communicate their sailing conditions in a fashion that could readily be understood by all. By taking factual information about how the sea state changes as the wind strength changes, a qualitative value scale was developed, and to this day it remains valid and is used in weather forecasts. Similar qualitative value scales can be developed for indicators where precise measurability is not immediately apparent.

Table 9: Beaufort scale (example of a qualitative value scale)

Force	Wind Speed (kts)	Descriptor	Sea Condition
0	0-1	Calm	Sea like a mirror
1	1-3	Light air	Ripples with the appearance of scales are formed, but without foam crests.
2	4-6	Light Breeze	Small wavelets, still short, but more pronounced. Crests have a glassy appearance and do not break.
3	7-10	Gentle Breeze	Large wavelets. Crests begin to break. Foam of glassy appearance. Perhaps scattered white horses.
4	11-16	Moderate Breeze	Small waves, becoming larger; fairly frequent white horses.
5	17-21	Fresh Breeze	Moderate waves, taking a more pronounced long form; many white horses are formed. Chance of some spray.
6	22-27	Strong Breeze	Large waves begin to form; the white foam crests are more extensive everywhere. Probably some spray.
7	28-33	Near Gale	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind.
8	34-40	Gale	Moderately high waves of greater length; edges of crests begin to break into spindrift. The foam is blown in well-marked streaks along the direction of the wind.
9	41-47	Severe Gale	High waves. Dense streaks of foam along the direction of the wind. Crests of waves begin to topple, tumble and roll over. Spray may affect visibility.
10	48-55	Storm	Very high waves with long over-hanging crests. The resulting foam, in great patches, is blown in dense white streaks along the direction of the wind. On the whole the surface of the sea takes on a white appearance. The 'tumbling' of the sea becomes heavy and shock-like. Visibility affected.
11	56-63	Violent Storm	Exceptionally high waves (small and medium-size ships might be for a time lost to view behind the waves). The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere the edges of the wave crests are blown into froth. Visibility affected.
12	64-71	Hurricane	The air is filled with foam and spray. Sea completely white with driving spray; visibility very seriously affected

In order to develop a qualitative value scale it is necessary to define at least two points on the scale (usually the end points). The points on the scale are defined descriptively and draw on multiple concepts in the definition of the indicator. The number of points on the scale will be determined by the indicator definition, and in the context of MAA for mine waste disposal alternatives, a good rule of thumb would be to target a six-point scale. This provides for sufficient capacity to differentiate, without being overly onerous, and also by providing an even number scale, the tendency to select the “middle-of-the road” value is eliminated. Qualitative value scales should be developed to have the following characteristics:

- *Operational*: The decision maker should be able to rate alternatives that were not specifically used to define the scale, i.e., should another TIA be added for evaluation at a later time, the scale developed previously should still be relevant.
- *Reliable*: Different external reviewers should be able to rate an alternative according to the value scale and assign the same score.
- *Value relevant*: The value scale must be directly relevant to the indicator being scored.
- *Justifiable*: Any external reviewer should reach the conclusion that the value scale is reasonable and representative.

The deliverable for this part of the process will be the expansion of the sub-accounts summary table to include indicators. As previously stated, this collective information is also known as the multiple accounts ledger, and Table 10 provides an example of what this may look like. Within Table 10, the indicator “fishing impact” and “ARD potential” are examples where indicator parameters are based on a qualitative value scale. This qualitative value scale must be documented, and Table 11 provides an example of what this may look like.

Table 10: Example of the completed multiple accounts ledger

Account	Sub-account	Indicator	Indicator Parameter	Unit	Indicator Quantity
Environmental	Effect on traditional land use during construction	Hunting impact	Time	Yr	2 years
		Fishing impact	Value	#	3
		Berry harvesting impact	Area	ha	400 ha
	Mine waste geochemistry	ARD potential	Value	#	2
		Metal leaching potential	Value	#	6
Technical	Containment design	Dam height	Height	m	25 m
		Foundation conditions	Value	#	4
	Diversion design	Channel length	Length	km	3.8 km
		Catchment size	Area	ha	134 ha
Project economics	Life of mine cost	Capital cost	Cost	$	10 million
		Operational cost	Cost	$	2 million/yr
		Closure cost	Cost	$	3 million
	Economic risk	Capital	Value	#	2
		Operational	Value	#	3
		Closure	Value	#	5
Socio-economic	Landowner perception	Land owner perception	Value	#	4
	Archaeological sites	Presence of immovable sites	Quantity	#	2
		Presence of mitagable sites	Quantity	#	33

Table 11: Example of qualitative value scale for the indicator "fishing impact" listed in Table 10

Score	Descriptor
6 (Best)	No impact
5	Short term temporary loss of fishing. During construction fishing in the area will be prohibited for health and safety reasons
4	Loss of fishing for foraging species for at least 10 years
3	Loss of fishing for foraging species and 1 large bodies specie for at least 10 years
2	Loss of fishing for foraging species and 2 large bodies species for at least 10 years
1 (Worst)	Complete and permanent loss of all fishing for the life of the project and into perpetuity

2.6 Step 5: Value-Based Decision Process

At the conclusion of Step 4, the *multiple accounts evaluation* is complete and the *value-based decision process* begins. This process entails taking the list of accounts, sub-accounts and indicators and assessing the combined impacts for each of the alternatives under review. This entails scoring and weighting of all indicators, sub-accounts and

accounts and quantitatively determining merit ratings for each alternative. These three processes are described in the following sections.

2.6.1 Scoring

Traditionally, MAA scoring is done through a process of ranking and scaling. This process is not inherently transparent, and for this reason these guidelines present a modification to the process that improves transparency.

Scoring is done by developing qualitative value scales for every indicator, including those which appear to be readily measurable. An example of such a qualitative value scale is presented in Table 12. The process of how these are developed has been described in Step 4. By following this procedure, it is abundantly obvious to the external reviewer why a particular indicator score has been assigned to an alternative, and since the qualitative value scale has been developed collaboratively, with input from stakeholders, there is built in confidence that the scoring is appropriate.

Table 12: Example of qualitative value scale for an indicator which at first glance would appear to be measurable, such as "capital cost"

Score	Descriptor
6 (Best)	Less than $10M
5	Between $10 and $20M
4	Between $20 and $30M
3	Between $30 and $40M
2	Between $40 and $50M
1 (Worst)	Greater than $50M

2.6.2 Weighting

At this time the analyst, with input from stakeholders, needs to have the ability to introduce their value bias between individual indicators. This is done by applying a weighting factor to each indicator. Weighting factors allow the analyst to assign relative importance of one indicator as compared to another, and this weighting factor is most likely to reflect the analyst's bias or value basis. Essentially what this means is that an indicator with a weighting factor of 2 is twice as important as an indicator with a weighting factor of 1.

It is important to bracket the weighting factor, and in the context of these guidelines, it is recommended that the weighting factors range from 1 through 6. This means that any one indicator can be considered to be up to 6 times more significant than another. If the multiple accounts evaluation has been rigorously carried out, then

this range of weighting factors should be sufficient to satisfy an external reviewer. Further consideration of weighting factors can be conducted during the sensitivity analysis (Step 6).

Weighting factors should be constant for any given indicator, sub-account or account across all alternatives. This is best illustrated through the quantitative analysis procedure.

Considering the inherent subjectivity of weighting, there is a natural tendency to want to standardize or prescribe weighting factors. This would result in a fixed value bias, which reflects the value bias of the imposing guidelines with no consideration of site specific conditions, rather than allowing the analyst with input from stakeholders, to set value bias relevant to their project. Notwithstanding this, within the framework of these guidelines, it is proposed that the Base Case of the alternatives assessment use the following weightings for accounts (refer to Table 15 of the quantitative analysis section):

- Environment – 6
- Technical – 3
- Project Economics – 1.5
- Socio-Economic – 3

The analyst is still encouraged to assign other weightings to accounts and demonstrate their effect on the assessment outcome, as described in Step 6.

Recognizing that for an external reviewer it may not be immediately apparent how the chosen weighting factors effects the outcome of the alternatives assessment, it is recommended that in all cases the analyst produce a sensitivity analysis run (see Step 6) where all weighting factors are assigned equal value (i.e., a weighting of 1).

2.6.3 Quantitative Analysis

The quantitative analysis is relatively simple, and given the potentially large amount of accounts, sub-accounts, and indicators this analysis is well suited to using a spreadsheet type approach. For each indicator, the **indicator value (S)** of each alternative is listed in one column. The **weighting factor (W)** is listed in another column and the combined **indicator merit score (S x W)** is calculated as the product of these values. An example of this analysis is presented in Table 13.

Indicator merit scores can be directly compared across alternatives, and likewise **sub-account merit scores (Σ{S x W})** can be directly compared across alternatives. However, to allow comparison of these values against values for other

sub-accounts, the scores must be normalized to the same six-point scale used to score each indicator value. This is achieved by dividing the sub-account merit score by the **sum of the weightings (ΣW)** to yield a **sub-account merit rating (R_s = (Σ{SxW}/ ΣW)**. This will again be a value between 1 and 6. This normalization is necessary to balance out different numbers of indicators and sub-accounts for each account. Without this normalization, the number of indicators associated with each sub-account, and the number of sub-accounts associated with each account, would have to be identical, otherwise the analysis will be skewed by accounts with more sub-accounts or indicators.

Table 13: Example of the quantitative analysis for indicators

Account: Socio-Economic					
Sub-Account: Effect on traditional land use during construction					
Indicator	**Indicator Weight (W)**	**Alternative A**		**Alternative B**	
		Indicator Value (S)	**Indicator Merit Score (S x W)**	**Indicator Value (S)**	**Indicator Merit Score (S x W)**
Hunting impact	2	6	12	1	2
Fishing impact	5	3	15	4	20
Berry harvesting impact	1	5	5	2	2
Sub-account merit score (Σ{S x W})			32		24
Subaccount merit rating (R_s = Σ{SxW}/ ΣW)			4		3

The same procedure of weighting and normalization is followed to determine **account merit scores (Σ{R_sxW})**, and **account merit ratings (R_a = Σ(R_sxW)/ ΣW)**. This is illustrated in Table 14. This process is repeated one final time, and an **alternative merit score (Σ{R_axW})**, and an **alternative merit rating (A = Σ(R_axW)/ ΣW)**, is determined for each of the alternatives, as illustrated in Table 15.

Table 14: Example of the quantitative analysis for sub-accounts

Account: Socio-Economic					
Sub-Account	**Indicator Weight (W)**	**Alternative A**		**Alternative B**	
		Sub-account Merit Rating (R_s)	**Sub-Account Merit Score (R_s x W)**	**Sub-account Merit Rating (R_s)**	**Sub-Account Merit Score (R_s x W)**
Effect on traditional land use during construction	6	4	24	3	18
Archaeology	1	6	6	6	6
Aesthetics	3	5	15	3	9
Account merit score ($\Sigma\{R_s \times W\}$)			45		33
Account merit rating ($R_a = \Sigma\{R_s x W\}/ \Sigma W$)			4.5		3.3

Table 15: Example of the quantitative analysis for accounts

Account	**Indicator Weight (W)**	**Alternative A**		**Alternative B**	
		Account Merit Rating (R_a)	**Account Merit score (R_a x W)**	**Account Merit Rating (R_a)**	**Account Merit score (R_a x W)**
Socio-economic	6	4.5	27.0	3.3	19.8
Technical	4	5.1	20.4	4.5	18.0
Project economics	3	3.4	10.2	5.6	16.8
Environment	5	4.4	22.0	3.8	19.0
Alternative merit score ($\Sigma\{R_a \times W\}$)			79.6		73.6
Alternative merit rating ($A = \Sigma\{R_a x W\}/ \Sigma W$)			4.4		4.1

At this time it is possible to compare alternative merit ratings for all mine waste disposal alternatives evaluated and the preferred option will be the one which has the highest merit rating.

The deliverable at this point in the process will be summary tables much like the examples presented in this section. It is, however, very important that justification is provided for all the weightings used along every step of the process. An external reviewer should be able to review the weightings, and conclude that they are reasonable, even though he may not agree with them.

2.7 Step 6: Sensitivity Analysis

The alternatives assessment and subsequent value based decision making process described in these guidelines is specifically tailored to be transparent, and to the extent practicable eliminate bias and subjectivity. However, the reality is that any decision making process is subject to bias and subjectivity, and the goal is to manage that bias and subjectivity to the point where an external reviewer would agree that the decision is justifiable and reasonable, irrespective of their own value system.

MAA as described in these guidelines uses weighting factors to encourage stakeholders to scale the importance of indicators according to their own value system. If the assignment of weighting has been done collaboratively with the appropriate stakeholders, then it is probably reasonable to assume that those weightings suggest general consensus. However, it is to be expected that some indicators would expose diametrically opposing value systems, and as a result general agreement on individual weightings may not be reached. At this point, the entire decision making process can come apart, as considerable effort may be exerted on discussing one or more problem indicators, whereas, potentially, irrespective on what value is adopted, those problem indicators may not be the ultimate deciding indicators.

The way to test the sensitivity of the value based decision making process is to assign different weightings to those indicators, sub-accounts and accounts according to a range of value systems representative of the perceived disparity.

The level and type of sensitivity analysis that should be carried out is not set, and should not be prescriptive. It is entirely project specific and to a large extent will be based on feedback received from stakeholders throughout the alternatives assessment process.

Table 16 presents an example of sensitivity analysis runs completed on the example dataset presented in Tables 13 through 15. The merit rating of each alternative is compared to the base case analysis to determine if the results of the sensitivity analysis are likely to lead to a different decision about which alternative may be the preferred option. In this example, all but the last case would have resulted in a different alternative having a higher merit rating.

It is conceivable that specific stakeholders may have completely biased opinions about how weightings should be evaluated, which may unfairly skew the assessment results. Sensitivity analysis is not intended to resolve this disparity. It does, however, provide a platform for presenting these opinions in a transparent manner where any stakeholder or external reviewer can make their own value judgements about all interpretations of the case.

Table 16: Example of the results of a sensitivity analysis

Analysis ID	Scenario Description	Merit Rating	
		Alternative A	Alternative B
Base	Base case as per Tables 13, 14 and 15	4.4	4.1
#1	Change weighting of indicator "berry harvesting impact" in Table 13 from 1 to 5	4.5	4.0
#2	Change weighting of sub-account "Aesthetics" in Table 14 from 3 to 1	4.4	4.1
#3	Change weighting from account "Project economics" in Table 15 from 1.5 to 0	4.6	3.9
#4	Apply all the changes from cases #1, #2 and #3 simultaneously	4.6	3.8
#5	Change weighting of all indicators in Table 13 as follows; "hunting impact" from 2 to 0; "fishing impact" from 5 to 6; and "berry harvesting impact" from 1 to 0	4.3	4.2
#6	Change all weighting factors to 1 in Tables 13, 14 and 15	4.5	4.4

The deliverable for this step would be a well documented summary of the sensitivity analysis that was carried out. This may be presented in summary tables similar to those presented in Step 5 and Table 16.

2.8 Step 7: Document Results

The final step in the alternatives assessment process entails thorough documentation of the results. This is best done through a comprehensive technical report, which systematically describes the outcome of each of the steps as recommended in these guidelines. The primary technical alternatives assessment report should be a concise summary of the findings of each step, using comparative summary tables and descriptive definitions which make the results immediately apparent to the external reviewer. Detailed supporting information related to elements such as cost estimate breakdowns, or geochemical assessment should be presented in appendices, or if stand-alone reports have been produced, these should be properly referenced and made available for review.

References

Apgar, V. 1953. *A proposal for a new method of evaluation of the newborn infant*. Curr. Res. Anesth. Analg. Vol. 32, No. 4, pp. 260–267.

Belton, V., Stewart, T.J. 2003. *Multiple Criteria Decision Analysis: An Integrated Approach*. Kluwer Academic Publishers, Massachusetts, USA, ISBN 0-7923-7505-X, Second Printing.

Caldwell, J.A., Robertson, A. MacG. 1983. *Selection of tailings impoundment sites*. Die Siviele Ingenieur in Suid Afrika, pp. 537-553. October.

Fisher, G., Makowski, M. 1996. *Multiple Criteria Land Use Analysis*. International Institute for Applied Systems Analysis Working Paper, WP-96-006, 15 p. January.

Gregory, R, Keeney, R.L. 1994. *Creating Policy Alternatives Using Stakeholder Values*. Management Science, Vol. 40, No. 8, pp. 1035-1048. August.

Gregory, R., Slovic, P. 1997. *A constructive approach to environmental evaluation*. Ecological Economics, Vol. 21, pp. 175-181.

Huler, S. 2004. *Defining the Wind: The Beaufort Scale, and How a 19th-Century Admiral Turned Science into Poetry*. Crown, ISBN 1-4000-4884-2.

Mendoza, G.A., Martins, H. 2006. *Multi-criteria decision analysis in natural resource management: A critical review of methods and new modeling paradigms*. Forest Ecology and Management, Vol. 230, pp. 1-22.

Merkhofer, M.W., Conway, R, Anderson, R.G. 1996. *Multi-attribute Utility Analysis as a Framework for Public Participation: Siting a Hazardous Waste Facility*. United States Department of Energy Report, Contract DE-AC04-94AL85000, 8 p.

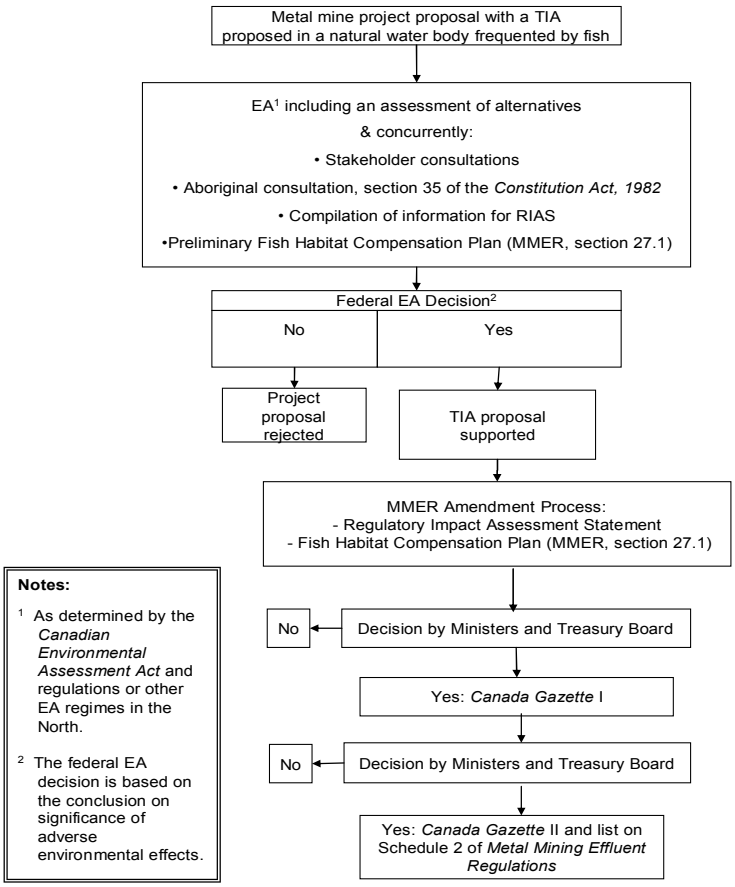
Robertson, A. MacG., Shepherd, T.A., Van Zyl, D.J.A. 1980. *Uranium tailings impoundment site selection*. In: Proceedings of Third Symposium on Uranium Mill Tailings Management, Fort Collins, USA.

Robertson A, MacG., Shaw, S.C. 1998. *Alternatives Analysis for Mine Development and Reclamation*. In: Proceedings of the 22nd Annual BC Mine Reclamation Symposium, Penticton, BC, Canada, pp. 52-61.

Robertson, A. MacG., Shaw, S.C. 1999. *A multiple accounts analysis for tailings site selection*. In: Sudbury ’99 Conference Proceedings, Mining and Environment II, Vol. 3, pp. 883-891.

Vick, S.G. 1983. *Planning, Design, and Analysis of Tailings Dams*. John Wiley & Sons, New York, 369 p., ISBN 0-471-89829-5.

Annex 1: Steps in the EA and Regulatory Processes



Annex 2: Regulatory Impact Analysis Statement

The Regulatory Impact Analysis Statement (RIAS) is a summary of the expected impact of a regulatory initiative that addresses each of the requirements of the federal government's regulatory policy as presented in the Cabinet Directive on Streamlining Regulation.[1] The use of regulatory impact analysis has long been recognized as an international best practice, and the RIAS has been used in Canada for over 20 years.

A properly prepared RIAS provides a cogent, non-technical synthesis of information that allows the various RIAS audiences to understand the issues being regulated. It allows audiences to understand the reason the issue is being regulated, the government's objectives, and the costs and benefits of the regulation. It also addresses who will be affected, who was consulted in developing the regulation, and how the government will evaluate and measure the performance of the regulation against its stated objectives. The RIAS is, in effect, a public accounting of the need for each regulation.[2]

The RIAS allows government decision-makers to do the following:

- synthesize information;
- improve their understanding of regulatory impacts; and
- better communicate the impacts of regulation to stakeholders

Outside the government, the RIAS gives the public and affected parties information that can be used to do the following:

- Evaluate proposed regulations;
- Better understand the regulation and obligations it imposes;
- Generate questions and comments about the regulation.

[1] On April 1, 2007, the CDSR (http://www.tbs-sct.gc.ca/ri-qr/directive/directive00-eng.asp) came into force, bringing new requirements for departments and agencies on preparing new regulatory proposals. These include elements such as performance measurement and evaluation, service standards, enhanced international regulatory cooperation, and more robust cost-benefit analysis.

[2] Privy Council Office (2001). *Guide to Making Federal Acts and Regulations*, 2nd edition. Page 181.

Annex 3: Fish Habitat Compensation Plans under Section 27.1 of the MMER and Subsection 35(2) of the *Fisheries Act*

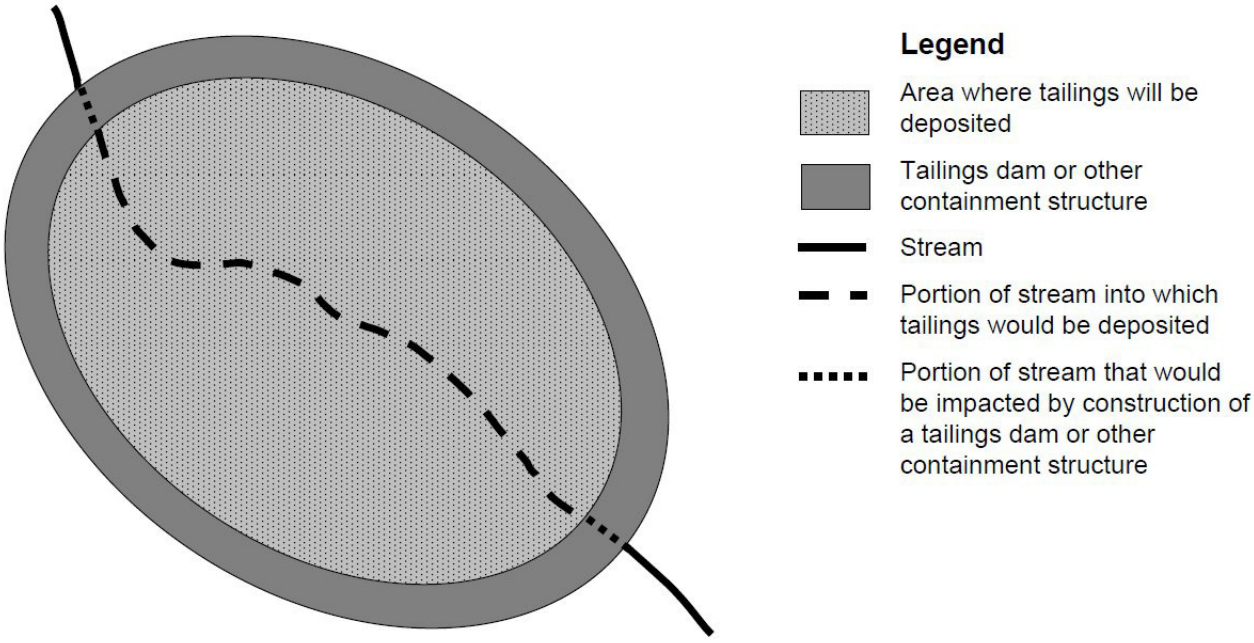
If a water body is added to Schedule 2 of the MMER the project proponent must develop and implement a fish habitat compensation plan in accordance with section 27.1 of the Regulations. In the majority of cases, a second fish habitat compensation plan is required under subsection 35(2) of the *Fisheries Act*. The key difference between these requirements is:

- Section 27.1 of the MMER requires fish habitat compensation to offset losses of fish habitat associated the deposit of a deleterious substance into the water body(ies) that are added to Schedule 2.
- Subsection 35(2) requires fish habitat compensation to compensate for the losses of fish habitat associated with the construction of the works themselves, such as a tailings dam.

Figure 2 illustrates the rationale for the need for the two separate fish habitat compensation plans in the case where a tailings impoundment area is established in an stream valley.

In this case, the losses of fish habitat in those portions of the stream into which mine waste would be deposited must be compensated under section 27.1. Losses of fish habitat in those portions of the stream that would be under the footprint of a tailings dam or other containment structure must be compensated under subsection 35(2).

Figure 2: **Fish habitat compensation requirements in typical TIA scenarios**



Appendix C

Blackwater Gold Project: TSF Multiple Accounts Analysis – Design Alternatives Information

February 6, 2014

File No.:VA101-457/6-A.01
Cont. No.:VA13-02401

Mr. Nigel Fisher
Manager Environment
New Gold Inc.
Suite 1800, Two Bentall Centre
555 Burrard Street
Vancouver, BC V7X 1M9

Dear Nigel,

Re: TSF Multiple Accounts Analysis – Design Alternatives Information

1. GENERAL

Knight Piésold Ltd. (KP) has completed engineering studies to develop mine waste and water management facility designs for the Blackwater Gold Project (the project). The assessment of tailings storage facility (TSF) site alternatives and potentially acid generating (PAG) waste rock disposal options began in January 2011 and continued through December 2013, culminating in the completion of the Feasibility Study (FS) for the project. The various alternatives assessments included a series of trade-off studies to determine the preferred alternative. A Preliminary Economic Assessment (PEA) was completed on the preferred alternative in 2012, and was followed by the FS in 2013.

The following reports were prepared between 2011 and 2013 by KP as part of the alternatives analysis:

- Blackwater Gold Project – Tailings Storage Facility Site Alternatives Assessment (Knight Piésold Ltd., 2011a).
- Blackwater Gold Project – Tailings Disposal Options – Conceptual Planning and Cost Estimates (Knight Piésold Ltd., 2011b).
- Blackwater Gold Project – Updated Mine Development Concept Evaluation Considering Potentially Acid Generating (PAG) Disposal On-land and Subaqueously in the Tailings Facility (Knight Piésold Ltd., 2012a).
- Blackwater Gold Project – Mine Waste and Water Management Design Report (Knight Piésold Ltd., 2013a).

A Multiple Accounts Analysis (MAA) of the TSF alternatives is being completed as part of the Environmental Assessment of the project. The MAA is a critical input to the application for a Schedule II fisheries amendment. The MAA compares the FS TSF arrangement with four previously considered TSF alternatives. The ultimate extents of the four alternative arrangements have been updated from earlier studies discussed to contain the waste volumes contemplated in the FS. References to previous studies will be provided for each alternative. This letter presents quantitative and qualitative design information related to each of the four alternatives for the purpose of completing the MAA.

The four alternative arrangements considered in the MAA assessment are as follows:

- Site C
- Site D
- Site E, and
- Site D PAG-OL.

The FS design was presented in detail previously (Knight Piésold Ltd., 2013a) and is not covered in this report.

Each of the four alternative arrangements considered in the MAA used the following design basis criteria shown in Table 1. The dam classification used for all TSF options was “VERY HIGH”.

Table 1 - MAA Design Basis

ITEM	DESIGN CRITERIA
1.0 GENERAL	
Mine Production	• Total ore milled = 344 million tonnes (Mt)
	• Throughput = 60,000 tonnes per day (tpd).
	• Mine Life = approximately 17 years
Climate Conditions	• Mean Annual Precipitation = 636 mm
	• Mean Annual Evaporation for the Project Site = 445 mm
2.0 MINE WASTE MANAGEMENT	
2.1 Waste Properties	
Tailings	• Total tailings production = 344 Mt
	• Dry density = 1.30 t/m3.
	• Specific Gravity of Solids = 2.79
Potentially Acid Generating (PAG) Waste Rock - PAG1 and PAG2	• PAG co-disposed with tailings = 366 Mt
	• Waste Rock Specific Gravity = 2.7
	• Dry density = 2.2 t/m3.
Potentially Metal Leaching Waste Rock - NAG3	• NAG3 (Total 79 Mt) - co-disposed with tailings or used to construct upstream zone of TSF embankments
	• Waste Rock Specific Gravity = 2.7
	• Dry density = 2.2 t/m3.
Non-Acid Generating (NAG) Waste Rock - NAG4 and NAG5	• NAG4 (Total 44 Mt) - Disposed in stockpiles or used to construct TSF embankments
	• NAG5 (Total 108 Mt) - Disposed in stockpiles or used to construct TSF embankments
	• Waste Rock Specific Gravity = 2.7
	• Dry density = 2.2 t/m3.
Non-Acid Generating (NAG) Overburden	• Overburden (Total 87 Mt) - Disposed in stockpiles or used to construct TSF embankments
	• Overburden Specific Gravity = 2.7
	• Dry density = 2.0 t/m3.
Low Grade Ore (LGO)	• 50 Mt stockpiled in an engineered facility for processing during Years 15-17
	• Specific Gravity = 2.7
	• Dry density = 2.2 t/m3.
2.2 Tailings Storage Facility (TSF)	
Storage Capacity	• Starter Embankment - 1 year of tailings and co-disposed waste rock, 10 Mm3 process water pond, plus IDF and freeboard.
	• Ultimate Embankment - Total tailings production and co-disposed waste rock plus storage and freeboard to attenuate IDF.
Inflow Design Flood (IDF)	• Based on catchment area and 681 mm IDF runoff depth (Dam Classification - Very High)
Design Freeboard	• Minimum 1 m above design storage capacity for wave runup; assumes tailings beaches developed at 0.5% slope from dam crest.
Flood Management	• Inflows are contained within the impoundment. The storage volume assumes any diversion systems are non-functional during the IDF.
Seepage	• Measures to control seepage include: - lower permeability core zone with filter/transition zones for raised embankments - lower permeability tailings deposit - downstream seepage collection ponds, interception trenches and wells, and pump-back systems
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.

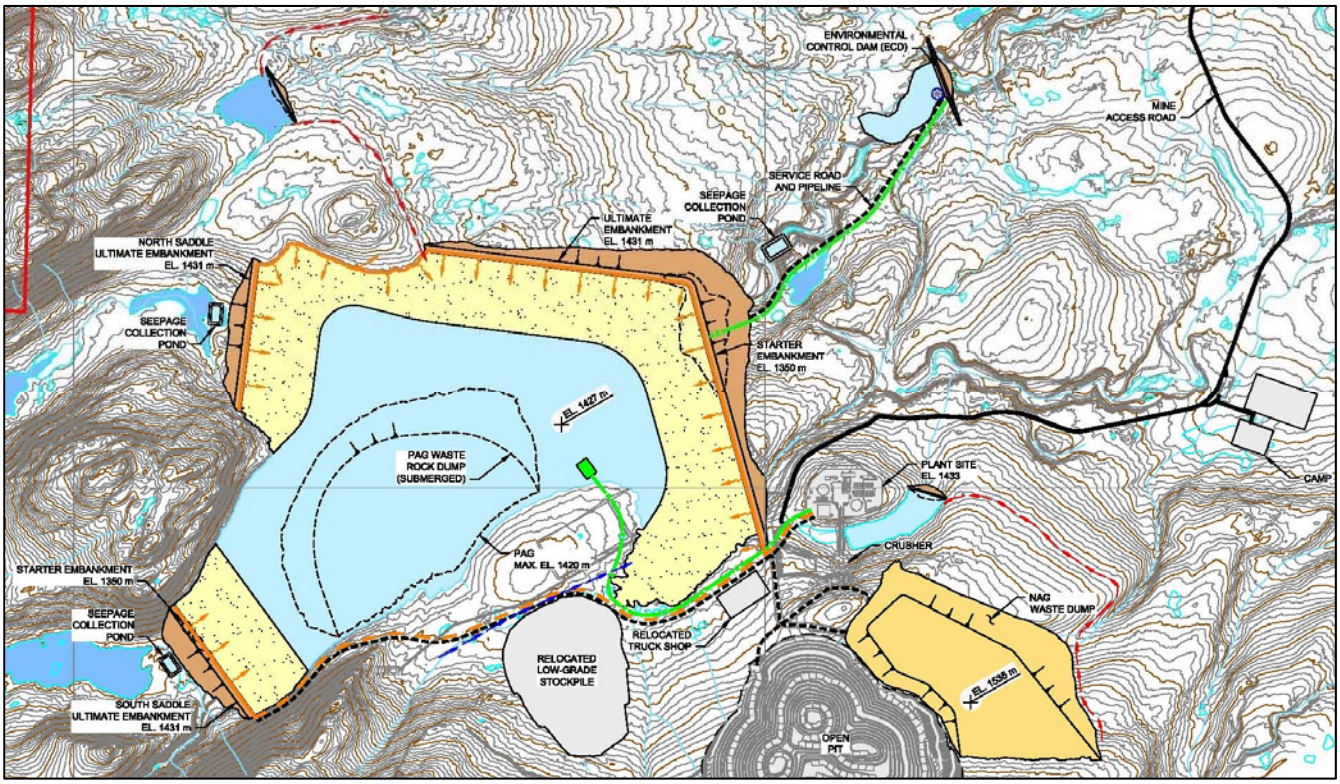
Each of the TSF arrangements allows for life of mine storage of 468 million cubic meters (Mm^3) of mine waste rock and tailings. This includes approximately 167 Mm^3 of PAG waste rock, 36 Mm^3 of NAG3 potentially metal leaching waste rock, and 265 Mm^3 of tailings (the majority of which are sulphide tailings also considered to be PAG). Each facility allows for a continuous supernatant pond of 10 Mm^3 and an Inflow Design Flood (IDF) allowance of 30 Mm^3 with 1 m of freeboard for wave run-up. The IDF allowance is equivalent to the required flood volume determined during the FS.

A summary of the technical information related to each alternative is provided in the following sections. A comparison of key TSF impoundment characteristics is required to develop the MAA ranking matrix. Comparative quantitative data for each site alternative required for the ranking matrix is shown in Table 2 (attached).

2. TSF SITE C ALTERNATIVE

The Site C TSF alternative is located on the north slope of Mount Davidson within the upper portion of the Davidson Creek watershed, approximately 4 km northwest of the Blackwater deposit. The site is situated at the top of the Davidson Creek catchment and extends to the catchment divide with Creek 705 to the west. The

impoundment would be created by constructing a main dam across Davidson Creek on the east side and two saddle dams to the west at the top of the Creek 705 catchment. The impoundment is constrained by topography to the north and south, and between the two drainages that flow west and contribute to Creek 705. The Site C arrangement considered in the MAA is shown on Figure 1. A scaled version of this figure is included in Appendix A.



NOTES:

1. ADAPTED FROM FIGURE 2 OF A PREVIOUS ALTERNATIVES STUDY (Knight Piésold Ltd., 2011b).

Figure 1 - TSF Site C Alternative

The Site C concept was originally developed in 2011 (Knight Piésold Ltd., 2011b). The final FS mine plan tailings and waste rock production quantities falls approximately halfway between the quantities considered for the base and expansion cases from this earlier study. The arrangement from the earlier study has been updated for the MAA with the FS mine plan quantities and is depicted in Figure 1, above.

TSF Site C involves storing tailings in a TSF located approximately four kilometres northwest of the deposit, as measured from the centre of the open pit to the centre of the TSF. The ultimate site C TSF footprint area is approximately 8.5 km^2. The Plant Site would be located approximately 2 km north of the open pit in the same location as the FS, but the truck shop would need to be relocated. The low-grade stockpile would need to be relocated slightly to the west and the excess NAG waste rock and overburden would be disposed of on the east side of the open pit. The construction and operations camp locations could remain the same.

The TSF starter embankments will be constructed with local borrow material initially and then from the pre-stripping of the open pit. Two starter dams required initially for the main and south saddle embankments will be 95 m and 5 m high, respectively.

The TSF embankments would be progressively expanded using NAG waste materials from the open pit and processed filter and transition zone material from local borrow areas. The TSF ultimately includes three

embankments – the main, south saddle and north saddle. The ultimate embankments will be 176 m, 86 m, and 61 m high, respectively, and require approximately 49 Mm^3 of material to construct. The embankments will all be zoned earthfill and rockfill dams, expanded over the life of the project using the centreline method of construction. The embankments have crest widths of 50 m and downstream slopes of 2H:1V. The ultimate volumetric storage efficiency of the TSF for Site C is considered to be good.

Foundation conditions at the embankment locations are characterized by a thick sequence of overburden underlain by competent bedrock. The surficial material has been classified as channelized and non-channelized glaciofluvial deposits. All of the embankments require cut-off trenches in excess of 10 m depth to limit potential seepage. The cut-off trench for the main embankment may need to intercept interglacial fluvial lenses in the foundation of the embankment. Additionally, an Environmental Control Dam (ECD) would be located downstream in Davidson Creek at a location approximately 1 km upstream of the FS location. The ECD would be located to intercept possible seepage paths from the TSF embankment foundation.

The cut-off trench for the south saddle embankment is relatively complicated due to a thickening sequence of overburden at the embankment site. Limited geotechnical information is available in the exact location of this embankment, but the low-permeability subgrade (LPS) material appears to be less prevalent in this area. The south saddle embankment may require additional seepage monitoring and collection measures to be implemented downstream, likely in the form of groundwater monitoring and interception pumping wells.

Seepage will be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the embankment would be collected in embankment drains and conveyed to seepage collection ponds downstream of each embankment. Seepage would be recycled back to the TSF. Unrecoverable seepage passing the collection and recycle systems could potentially affect two watersheds; Davidson Creek and Creek 705.

PAG waste will be co-disposed within the TSF in such a manner that it is progressively encapsulated by the tailings and saturated by the supernatant pond to prevent oxidation and subsequent acid generation. PAG haul distances will be in the order of 6 km downhill haulage. NAG waste rock and overburden in excess of the material required for dam construction is estimated to be 63 Mm^3 and stored in a waste dump approximately 1 km to the east of the open pit.

The catchment area for Site C without modification is 26 km^2. An additional 6 km^2 could be added to the catchment area by constructing approximately 3 km of collection ditches; however the total area reporting to the TSF would still fall well below of the 50 km^2 that is required to maintain a water balance under average conditions in the early years of mine waste disposal. Additional make-up water to supplement the process would be required from a dam lower down in the Davidson Creek catchment at the Environmental Control Dam depicted on Figure 1 or from external surface water sources. A collection system located at the Environmental Control Dam would allow for collection of runoff of up to an additional 9 km^2 for a total contributing area of 41 km^2, which still falls short of 50 km^2 and an another supplementary water source will be required.

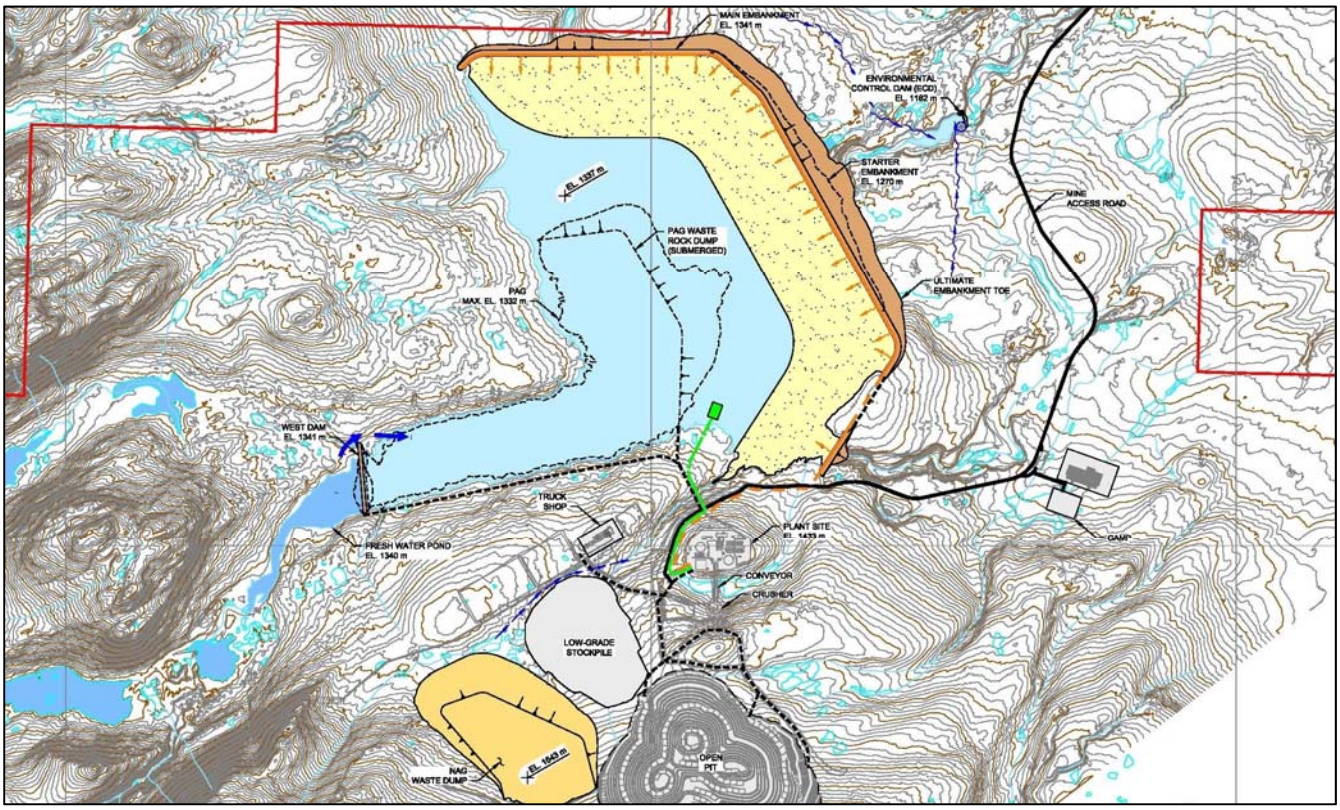
Tailings discharge during operations will initially be by gravity, but requires pumping later in mine life when the TSF elevation approaches the elevation of the plant site. A tailings spill collection system is required for the section of 500 m of tailings pipeline outside the TSF catchment. Selective discharge of tailings around the facility during the final years of operations will establish and flatten final tailings beaches to facilitate surface water management and reclamation.

Upon mine closure, surface facilities will be removed in stages and full reclamation of the TSF would be initiated. An overburden cover of at least 0.3 m would be established over the PAG waste rock dump and tailings. Wetlands would be established and upland beaches would be revegetated. The tailings supernatant pond would be maintained at its final level while pumping excess inflows to the open pit to accelerate filling of the pit lake. A riprap lined closure spillway sized for the Probable Maximum Flood (PMF) would be established towards

Davidson Creek with an additional emergency spillway for each of the saddle embankments. All roads, ponds, and ditches not required beyond mine closure would be removed and regraded.

3. TSF SITE D ALTERNATIVE

The Site D TSF alternative is located on the north slope of Mount Davidson within the upper portion of the Davidson Creek watershed, approximately 4.5 km north of the Blackwater deposit. The site is situated in the upper half of the Davidson Creek catchment. The impoundment will be created by constructing a main dam across Davidson Creek on the east side and a small dam on the west side to isolate the facility and limit the disturbance to a smaller area at the top end of the catchment. The impoundment is constrained by topography to the north and south. The Site D arrangement considered in the MAA is shown on Figure 2. A scaled version of this figure is included in Appendix A.



NOTES:
1. ADAPTED FROM FIGURE 4 OF A PREVIOUS ALTERNATIVES STUDY (Knight Piésold Ltd., 2011b).

Figure 2 - TSF Site D Alternative

The Site D concept was originally developed in 2011 (Knight Piésold Ltd., 2011b). The final FS mine plan tailings and waste rock production quantities falls approximately halfway between the quantities considered for the base and expansion cases from this earlier study. The arrangement from the earlier study has been updated for the MAA with the FS mine plan quantities and is depicted in Figure 2, above.

TSF Site D involves storing tailings in a TSF located approximately 4.5 kilometres north of the deposit, as measured from the centre of the open pit to the centre of the TSF. The ultimate TSF would have a footprint area of approximately 10 km^2. The Plant Site and truck shop are located approximately 2 km north of the open pit in the same location as the FS. The low-grade stockpile will be located to the northwest of the open pit rim adjacent to the pit similar to the FS. Excess NAG waste rock and overburden will be disposed of on the west

side of the open pit, or a combination of the east and west sides similar to the FS. The concept above shows the option of a west dump only for consistency with the previous study, however it is noted the FS arrangement is likely optimal from an operational perspective. The construction and operations camp locations could remain the same.

The TSF starter embankment will be constructed with local borrow material initially and from the pre-stripping of the open pit. One starter dam will be required initially for the main embankment and will be 70 m high.

The TSF embankment will be progressively expanded using NAG waste materials from the open pit and processed filter and transition zone material from local borrow areas. The TSF ultimately includes two embankments – the main and the west. The ultimate embankments will be 141 and 31 m high, respectively, and requires approximately 58 Mm^3 of material to construct. The embankments will be zoned earthfill and rockfill dams, expanded over the life of the project using the centreline method of construction. The embankments have crest widths of 50 m and downstream slopes of 2H:1V. The ultimate volumetric storage efficiency of the TSF for Site D is considered to be good.

Foundation conditions at the embankment locations are characterized by a thick sequence of overburden underlain by a completely weathered bedrock layer, and then competent bedrock. The surficial material has been classified as channelized and non-channelized glaciofluvial deposits, and lodgement glacial till. The main embankment requires a cut-off trench ranging from 5 to 20 m deep, essentially the same design as the FS cut-off trench arrangement.

The west dam for this option will be located in the upper part of Davidson Creek to limit the TSF disturbance area and isolate the supernatant pond from the upper portions of the TSF catchment. This dam creates a fresh water pond that would be available to supply a portion of the mill fresh water requirements from a closer source. The fresh water pond will be filled to a higher elevation than the supernatant pond and will act as a hydraulic barrier to prevent seepage towards the west of the TSF. Bedrock is expected to be less than 10 m below surface in the area of the west dam. A cut-off trench, if required, will likely only need to be a few meters deep to reach below the natural creek bed.

Seepage would be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the main embankment will be collected in embankment drains and conveyed to the Environmental Control Dam downstream of the main embankment. Seepage will be recycled back to the TSF. Unrecoverable seepage passing the collection and recycle systems potentially affects two watersheds; Davidson Creek and Creek 661.

PAG waste will be co-disposed within the TSF in such a manner that it is progressively encapsulated by the tailings and saturated by the supernatant pond to prevent oxidation and subsequent acid generation. PAG haul distances will be in the order of 7 km downhill haulage. NAG waste rock and overburden in excess of the material required for dam construction is estimated to be 54 Mm^3 and will be stored in a waste dump approximately 1.5 km to the west of the open pit.

The catchment area for Site D without modification is 49 km^2, sufficient to maintain a water balance under average conditions.

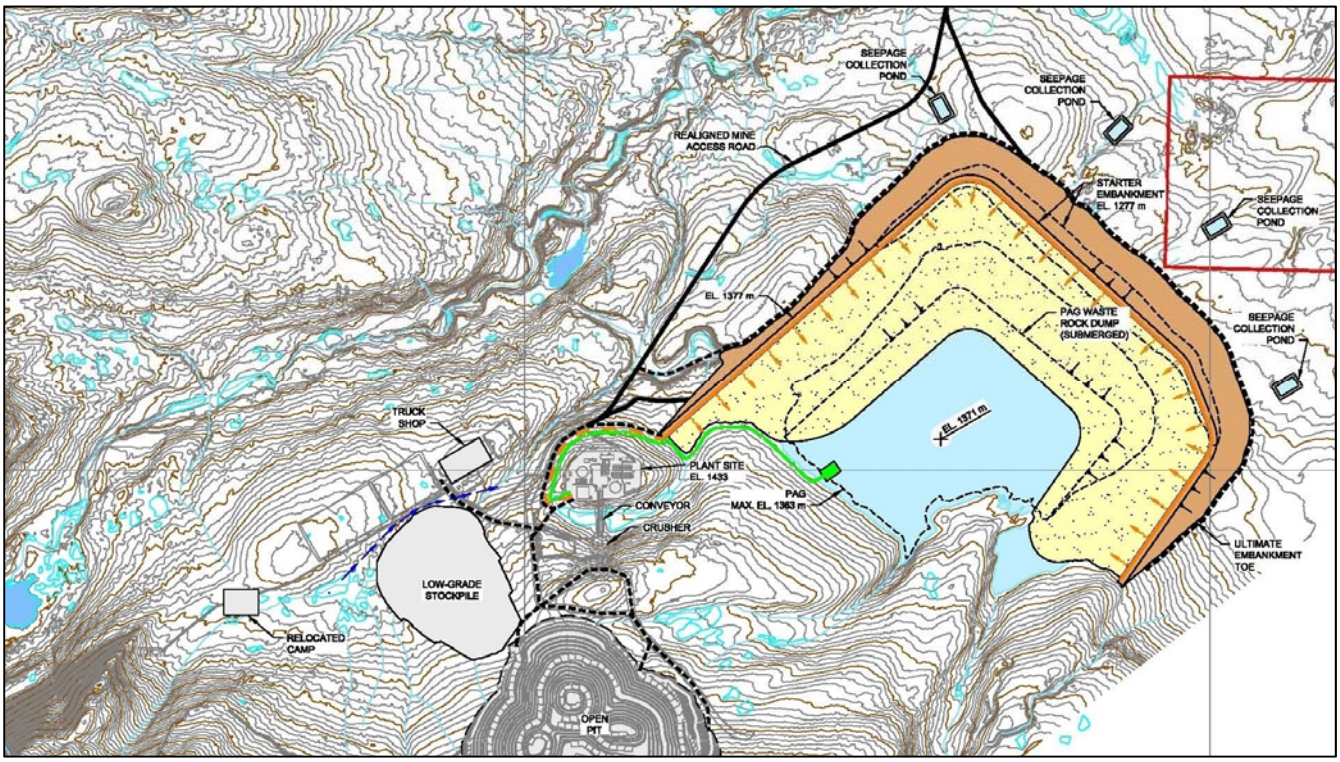
Tailings discharge during operations will be by gravity for the entire mine life. Some energy dissipation measures may be required for the tailings stream in the early years of tailings deposition. No tailings spill containment system will be required for the tailings pipeline as it is located entirely within the TSF catchment. Selective discharge of tailings around the facility during the final years of operations will establish and flatten final tailings beaches to facilitate surface water management and reclamation.

Upon mine closure, surface facilities will be removed in stages and full reclamation of the TSF would be initiated. An overburden cover of at least 0.3 m would be established over the PAG waste rock dump and tailings. Wetlands would be established and upland beaches would be revegetated. The tailings supernatant pond will

be maintained at its final level while pumping excess inflows to the open pit to accelerate filling of the pit lake. A riprap lined closure spillway sized for the Probable Maximum Flood (PMF) would be established towards Davidson Creek with an additional emergency spillway for the west dam. All roads, ponds, and ditches not required beyond mine closure will be removed and regraded.

4. TSF SITE E ALTERNATIVE

The Site E TSF alternative is located on the north slope of Mount Davidson within the upper portion of the Creek 661 watershed, approximately 4 km northeast of the Blackwater deposit. The impoundment will be created by constructing a three-sided main dam wrapping the facility. The impoundment is constrained by topography to the southwest. The Site E arrangement considered in the MAA is shown on Figure 3. A scaled version of this figure is included in Appendix A.



NOTES:
1. ADAPTED FROM FIGURE 7 OF A PREVIOUS ALTERNATIVES STUDY (Knight Piésold Ltd., 2011a).

Figure 3 - TSF Site E Alternative

The Site E concept was originally developed in early 2011 (Knight Piésold Ltd., 2011a). The earlier study was completed at a very high level to evaluate the options for storage of 300 Mm^3 of waste at five potential locations. The Site E concept did not progress beyond this level in the earlier alternatives assessments due to its relatively low storage efficiency and high total embankment volume. The final FS mine plan tailings and waste rock production quantities was approximately 50% more than the earlier study. The arrangement from the earlier study has been updated for the MAA with the FS mine plan quantities and is depicted in Figure 3, above.

TSF Site E involves storing tailings in a TSF located approximately 4 kilometres northeast of the deposit, as measured from the centre of the open pit to the centre of the TSF. The ultimate TSF will have a footprint area of approximately 8 km^2. The Plant Site and truck shop is approximately 2 km north of the open pit in the same location as the FS. The low-grade stockpile will be located to the northwest of the open pit rim adjacent to the pit similar to the FS. The construction and operations camp locations will need to be relocated. A temporary

stockpile of NAG waste rock and overburden could be constructed on either side of the open pit; however the total construction material volume for the Site E embankment exceeds the available NAG waste rock and overburden produced by the FS mine plan.

The TSF starter embankment will be constructed with local borrow material initially and then from the pre-stripping of the open pit. One starter dam will be required initially for the main embankment 52 m high.

The TSF embankment will be progressively expanded using NAG waste materials from the open pit and processed filter and transition zone material from local borrow areas. The TSF would ultimately include one three-sided embankment. The ultimate embankment will be 152 m high, and requires approximately 118 Mm^3 of embankment fill. The embankment will be a zoned earthfill and rockfill dam, expanded over the life of the project using the centreline method of construction. The embankment will have a crest width of 50 m and downstream slopes of 2H:1V. The ultimate volumetric storage efficiency of the TSF for Site D is considered to be poor.

Foundation conditions at the embankment locations are characterized by a very thick sequence of overburden underlain by a completely weathered bedrock layer, and then competent bedrock. The surficial material has been classified as channelized and non-channelized glaciofluvial deposits, and lodgement glacial till. The main embankment requires a cut-off trench expected to be in excess of 10 m deep.

Seepage will be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the embankment will be collected in embankment drains and conveyed to the seepage collection ponds at a minimum of four locations downstream of the embankment. Seepage will be recycled back to the TSF. Seepage control would be the most challenging of the options. The topography of the area is generally opening up with several meandering creeks emanating from the TSF basin area. Potential flow pathways would be less predictable than a TSF in Davidson Creek, which generally funnels flows towards the creek. Unrecoverable seepage passing the collection and recycle systems potentially affects two watersheds; Creek 661 and Davidson Creek.

PAG waste will be co-disposed within the TSF in such a manner that it is progressively encapsulated by the tailings and saturated by the supernatant pond to prevent oxidation and subsequent acid generation. PAG haul distances will be in the order of 5 km downhill haulage.

The catchment area for the Site E alternative without modification is 30 km^2. The total area reporting to the TSF falls well below the 50 km^2 required to maintain a water balance under average conditions in the early years of mine waste disposal. Additional make-up water to supplement the process will be required from a dam in the Davidson Creek catchment or from other external surface water sources, such as Tatelkuz Lake.

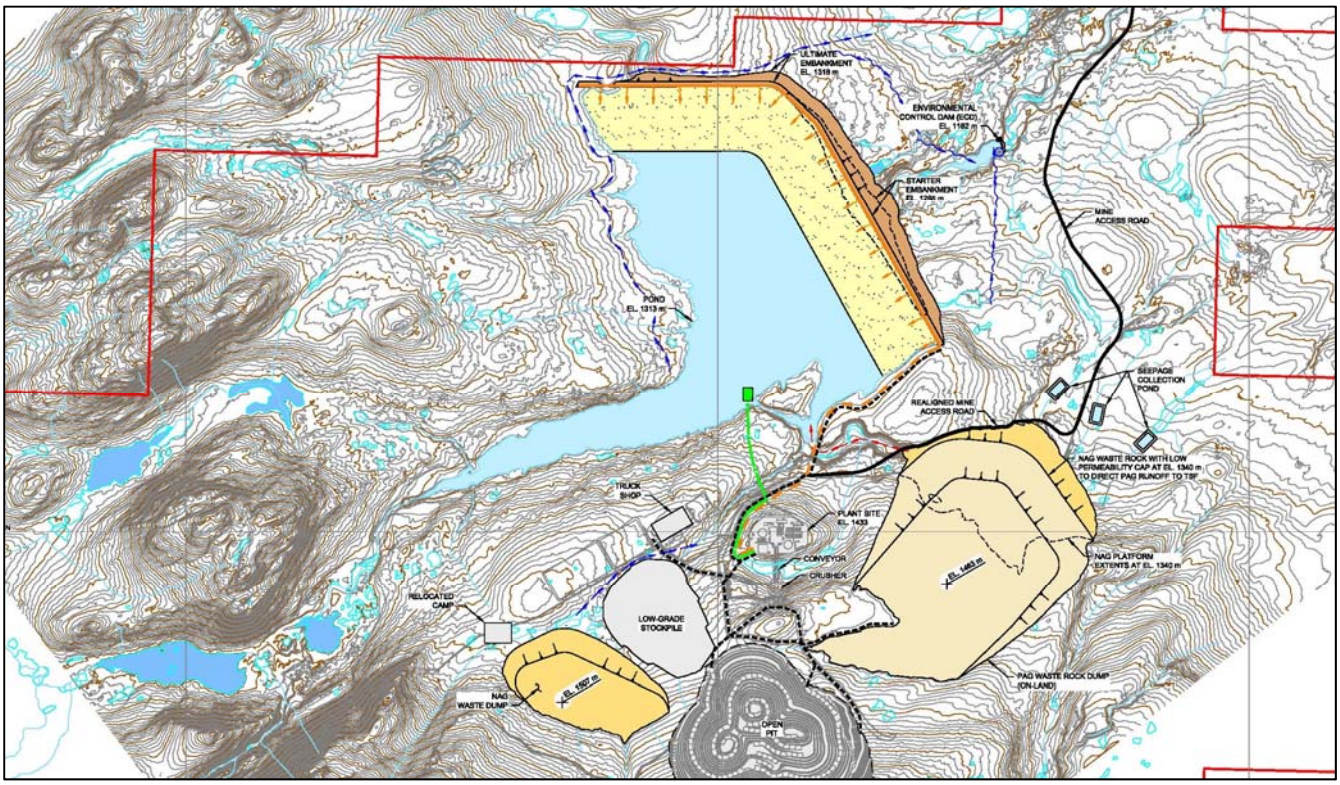
Tailings discharge during operations will be by gravity for the entire mine life. Some energy dissipation measures may be required for the tailings stream in the early years of tailings deposition. A tailings spill collection system will be required for the section of 1,300 m of tailings pipeline outside the TSF catchment. Selective discharge of tailings around the facility during the final years of operations will establish and flatten final tailings beaches to facilitate surface water management and reclamation.

Upon mine closure, surface facilities will be removed in stages and full reclamation of the TSF would be initiated. An overburden cover of at least 0.3 m would be established over the PAG waste rock dump and tailings. Wetlands would be established and upland beaches would be revegetated. The tailings supernatant pond would maintained at its final level while pumping excess inflows to the open pit to accelerate filling of the pit lake. A riprap lined closure spillway sized for the Probable Maximum Flood (PMF) would be established towards Creek 661. All roads, ponds, and ditches not required beyond mine closure would be removed and regraded.

5. TSF SITE D PAG ON-LAND (PAG-OL) ALTERNATIVE

An alternative with on-land PAG waste rock disposal was considered as part of the MAA. This alternative considered tailings stored at the Site D TSF location in the middle reaches of Davidson Creek with an on-land PAG dump in upper portion of the Creek 661 catchment. The TSF impoundment would be created by

constructing a main dam across Davidson Creek on the east side, where it is constrained by topography on all other sides. The on-land PAG dump would be situated on an engineered fill platform constructed with NAG waste rock and overburden with a soil liner foundation and cover system. Drainage from the PAG stockpile would be treated and conveyed towards the TSF for storage. The arrangement showing Site D with PAG disposal on-land that was considered in the MAA is shown on Figure 4. A scaled version of this figure is included in Appendix A.



NOTES:
1. ADAPTED FROM FIGURE 4 OF A PREVIOUS ALTERNATIVES STUDY (Knight Piésold Ltd., 2012a).

Figure 4 - TSF Site D with PAG On-Land Alternative

The Site D PAG-OL concept was originally developed in 2012 (Knight Piésold Ltd., 2012a). The final FS mine plan tailings and waste rock production quantities falls slightly below the quantities considered for the expansion case from this earlier study. The arrangement from the earlier study has been updated for the MAA with the FS mine plan quantities and is depicted in Figure 4, above.

TSF Site D involves storing tailings in a TSF located approximately 4.5 kilometres north of the deposit, as measured from the centre of the open pit to the centre of the TSF. The ultimate TSF D has a footprint area of approximately 8 km^2. The Plant Site and truck shop will be located approximately 2 km north of the open pit in the same location as the FS. The low-grade stockpile will be located to the northwest of the open pit rim adjacent to the pit similar to the FS. The excess NAG waste rock and overburden would be disposed of on the west side of the open pit. The construction and operations camp locations would need to be relocated.

The TSF starter embankment will be constructed with local borrow material initially and then from the pre-stripping of the open pit. One starter dam is required initially for the main embankment 65 m high.

The TSF embankment will be progressively expanded using NAG waste materials from the open pit and processed filter and transition zone material from local borrow areas. The ultimate embankment will be 118 m

high, and requires approximately 35 Mm^3 of embankment fill. The embankment will be a zoned earthfill and rockfill dam, expanded over the life of the project using the centreline method of construction. The embankment will have crest widths of 50 m and downstream slopes of 2H:1V. The ultimate volumetric storage efficiency of the TSF for Site D is considered to be good.

Foundation conditions at the embankment location are characterized by a thick sequence of overburden underlain by a completely weathered bedrock layer, and then competent bedrock. The surficial material has been classified as channelized and non-channelized glaciofluvial deposits, and lodgement glacial till. The main embankment would require a cut-off trench ranging from 5 to 20 m deep, and would be a slightly shorter in profile length than the FS cut-off trench arrangement.

Tailings discharge during operations will be by gravity for the entire mine life. Some energy dissipation measures may be required for the tailings stream in the early years of tailings deposition. No tailings spill containment system will be required for the tailings pipeline as it is located entirely within the TSF catchment. Selective discharge of tailings around the facility during the final years of operations will establish and flatten final tailings beaches to facilitate surface water management and reclamation.

TSF seepage will be primarily controlled by the low-permeability core zone constructed prior to the development of tailings beaches. Seepage passing through the main embankment will be collected in embankment drains and conveyed to the Environmental Control Dam downstream of the main embankment. Seepage would be recycled back to the TSF. Unrecoverable TSF seepage passing the collection and recycle systems potentially affects Davidson Creek.

PAG waste will be stored in an engineered containment up-gradient of the TSF and northeast of the open pit at the location of the TSF Site E alternative. A NAG fill platform of approximately 50 Mm^3 is required at the base of the PAG stockpile area to raise the topography to direct PAG stockpile drainage into the TSF impoundment by gravity. The fill platform will have an engineered soil liner constructed on top of compacted overburden from the open pit. This area is approximately 4 km to the northeast of the open pit, and will cover a footprint area of approximately 4 km^2. Seepage passing through the soil liner and fill platform will be collected in one of at least three selection collection ponds and pumped to the TSF via a pipeline and water treatment plant. Unrecovered seepage from the PAG stockpile has the potential to affect Creek 661.

NAG waste rock and overburden in excess of the material required for dam and fill platform construction is estimated to be 27 Mm^3 and will be stored in a waste dump approximately 1.5 km to the west of the open pit.

The catchment area for Site D PAG-OL without modification is in excess of 50 km^2, sufficient to maintain a water balance under average conditions. Since the PAG waste rock would not be disposed of subaqueously, it is expected that the TSF would operate in a surplus condition and the diversion of some of the area upslope of the TSF will be necessary to prevent a surface water discharge to receiving streams during the operations phase. A sufficient diversion channel could be constructed around the east and north perimeter of the TSF with approximately 5 km of diversion ditches.

Upon mine closure, surface facilities will be removed in stages and full reclamation of the TSF would be initiated. An overburden cover of at least 0.3 m would be established over the tailings. Wetlands would be established and upland beaches would be revegetated. The tailings supernatant pond would be maintained at its final level while pumping excess inflows to the open pit to accelerate filling of the pit lake. A riprap lined closure spillway sized for the Probable Maximum Flood (PMF) would be established towards Davidson Creek. All roads, ponds, and ditches not required beyond mine closure would be removed and regraded. The PAG waste rock dump would be capped with a 3 m-thick low permeability overburden cover capped with a 30 cm growth medium cover. Surface water runoff will be diverted around the PAG dump to the TSF or downstream environment depending on water quality. Infiltration through the soil cover would be collected as seepage and conveyed to the TSF for dilution or treated during post-closure with an on-site water treatment plant depending upon quantity and quality.

We trust this meets your needs at this time. Please contact the undersigned with any questions or comments.

Yours truly,

KNIGHT PIESOLD LTD.

Signed:
Daniel Fontaine, P.Eng.
Senior Engineer

Reviewed:
Bruno Borntraeger, P.Eng.
Specialist Engineer

Approved:
Ken Brouwer, P.Eng.
President

Attachments:

Table 2 Rev 0	TSF Multiple Accounts Analysis – Comparative Data
Appendix A	TSF Alternatives – Detailed Figures

References:

Knight Piésold Ltd., 2011a. Blackwater Gold Project – Tailings Storage Facility Site Alternatives Assessment (VA101-457/3-A.01, Continuity No. VA10-00235). January 31, 2011.

Knight Piésold Ltd., 2011b. Blackwater Gold Project – Tailings Disposal Options – Conceptual Planning and Cost Estimates (VA101-457/3-A.00, Continuity No. VA11-01276). September 9, 2011.

Knight Piésold Ltd., 2012a. Blackwater Gold Project – Updated Mine Development Concept Evaluation Considering Potentially Acid Generating (PAG) Disposal On-land and Subaqueously in the Tailings Facility (VA101-457/3-A.00, Continuity No. VA11-01960). April 17, 2012.

Knight Piésold Ltd., 2013a. Mine Waste and Water Management Design Report (VA101-457/6-11).

Copy To: Keith Ferguson, Lisa Desandoli

/ddf

Knight Piésold CONSULTING

TABLE 2

NEW GOLD INC.
BLACKWATER GOLD PROJECT

TSF MULTIPLE ACCOUNTS ANALYSIS
COMPARATIVE DATA

Print Feb/06/14 14:36:56

SITE	GENERAL TSF IMPOUNDMENT CHARACTERISTICS											WASTE ROCK DUMP CHARACTERISTICS				PIPING AND CATCHMENT SIZE ALTERING DITCHES			
	Number of Starter Dams	Height of Starter Dam(s)	Final Number of Dams	Final Height of Main Dams	Final Height of Saddle Dams	Total Dam Volume [4]	TSF Storage Capacity	Storage Efficiency	TSF Footprint Area [1]	Distance From Deposit [2]	Catchment Area Reporting	PAG Storage Volume (On-land)	PAG Dump Footprint Area [1]	NAG Storage Volume [3]	NAG Dump Footprint Area [1]	Tailings Pipeline Length	Reclaim Pipeline Length	Length of Diversion Ditches	Length of Collection Ditches
		(m)		(m)	(m)	(Mm^3)	(Mm^3)		(km^2)	km	(km^2)	(Mm^3)	(km^2)	(Mm^3)	(km^2)	(km)	(km)	(km)	(km)
C	2	95, 5	3	176	86, 61	49	515	10.6	8.5	4.0	32	N/A	N/A	63	1.5	12.0	3.0	1.5	6.0
D	1	70	2	141	31	58	520	8.9	10.0	4.5	49	N/A	N/A	54	1.4	8.5	2.0	1.5	3.5
E	1	52	1	152	N/A	118	515	4.4	6.5	4.0	30	N/A	N/A	0 [4]	0	8.5	2.5	1.5	0.0
D PAG-OL	1	65	1	118	N/A	35	315	10.1	8.0	5.0	55	203	4	77	1.0 [5]	8.0	2.0	5.0	3.5
FS	1	75	3	135, 88	15	74	525	8.0	11.0	4.0	50	N/A	N/A	67	2.7	17.0	6.5	1.5	5.5

\\van11\prj_file\1\01\00457\06\A\Correspondence\VA13-02401 - TSF Multiple Accounts Analyses - Design Information\tables\[Blackwater - Table 2 - Draft MAA Data Table - rB.xlsx]ReadMe_First

NOTES:

1. FOOTPRINT AREA WAS ROUNDED TO THE NEAREST 0.5 KM^2.
2. DISTANCE FROM DEPOSIT WAS MEASURED FROM CENTROID OF THE OPEN PIT TO CENTROID OF THE TSF IMPOUNDMENT.
3. NAG STORAGE VOLUME FOR THE MAA ALTERNATIVES WAS ASSUMED TO BE EQUAL TO TOTAL NAG WASTE ROCK AND OVERBURDEN PRODUCED BY THE MINE (112 Mm^3) LESS TOTAL DAM VOLUME FOR CONSTRUCTION.
4. DAM CONSTRUCTION VOLUME FOR THIS ALTERNATIVE EXCEEDS AVAILABLE NAG WASTE ROCK AND OVERBURDEN PRODUCED BY THE MINE, AND WOULD REQUIRE ADDITIONAL EXTERNAL BORROW AREAS OR UTILIZATION OF PAG WASTE MATERIALS IN CONSTRUCTION.
5. THE NAG FOOTPRINT AREA EXCLUDES 50 Mm^3 THAT IS USED TO CREATE THE FILL PLATFORM FOR THE PAG ON-LAND WASTE DUMP, AND IS ONLY THE AREA FOR THE REMAINING 27 Mm^3. THIS FOOTPRINT AREA IS CAPTURED IN THE PAG DUMP FOOTPRINT.

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	06FEB'14	ISSUED WITH LETTER VA13-02401	DDF	BB	KJB

Knight Piésold
CONSULTING

APPENDIX A

TSF ALTERNATIVES – DETAILED FIGURES

(Figures A.1 to A.4)

370 000 E
375 000 E
380 000 E
5 900 000 N
5 895 000 N

ENVIRONMENTAL CONTROL DAM (ECD)
MINE ACCESS ROAD
SERVICE ROAD AND PIPELINE
SEEPAGE COLLECTION POND
ULTIMATE EMBANKMENT EL. 1431 m
NORTH SADDLE ULTIMATE EMBANKMENT EL. 1431 m
SEEPAGE COLLECTION POND
STARTER EMBANKMENT EL. 1350 m
EL. 1427 m
PAG WASTE ROCK DUMP (SUBMERGED)
PLANT SITE EL. 1433
CAMP
CRUSHER
PAG MAX. EL. 1420 m
STARTER EMBANKMENT EL. 1350 m
SEEPAGE COLLECTION POND
RELOCATED TRUCK SHOP
NAG WASTE DUMP
RELOCATED LOW-GRADE STOCKPILE
EL. 1535 m
SOUTH SADDLE ULTIMATE EMBANKMENT EL. 1431 m
OPEN PIT

LEGEND:

- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT
- NAG DUMP
- RECLAIM SYSTEM
- PUMPSTATION
- MINE ACCESS ROAD
- MINE HAUL ROAD
- DIVERSION CHANNEL
- COLLECTION CHANNEL
- SEEPAGE INTERCEPTION TRENCHES
- WATER RECLAIM PIPELINE
- NEW GOLD PROPERTY BOUNDARY
- TAILINGS PIPELINE
- TAILINGS DEPOSIT

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 10.
2. CONTOUR INTERVAL IS 5 METRES.
3. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

SCALE A 400 200 0 400 800 1200 1600 2000 m

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
0	06FEB'14	ISSUED WITH LETTER	DDF	AN	BB	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY MULTIPLE ACCOUNT ANALYSIS SITE C

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-457/6	VA13-02401

FIGURE A.1 REV 0

SAVED: M:\1\101\00457\06\A\Acad\FIGS\B110_r0 , 2/6/2014 1:03:56 PM , ANASIRI PRINTED: 2/6/2014 1:08:20 PM, Layout1, ANASIRI
XREF FILES: IMAGE FILES:

370 000 E

375 000 E

380 000 E

5 900 000 N

5 895 000 N

MAIN EMBANKMENT
EL. 1341 m

ENVIRONMENTAL
CONTROL DAM (ECD)
EL. 1182 m

STARTER
EMBANKMENT
EL. 1270 m

MINE
ACCESS ROAD

EL. 1337 m

PAG WASTE
ROCK DUMP
(SUBMERGED)

PAG
MAX. EL. 1332 m

ULTIMATE
EMBANKMENT TOE

WEST DAM
EL. 1341 m

TRUCK
SHOP

FRESH WATER POND
EL. 1340 m

PLANT SITE
EL. 1433 m

CAMP

CONVEYOR

CRUSHER

LOW-GRADE
STOCKPILE

NAG
WASTE DUMP

EL. 1543 m

OPEN
PIT

LEGEND:

- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT
- NAG DUMP
- RECLAIM SYSTEM
- PUMPSTATION
- MINE ACCESS ROAD
- MINE HAUL ROAD
- DIVERSION CHANNEL
- SEEPAGE INTERCEPTION TRENCHES
- WATER RECLAIM PIPELINE
- NEW GOLD PROPERTY BOUNDARY
- TAILINGS PIPELINE
- TAILINGS DEPOSIT

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 10.
2. CONTOUR INTERVAL IS 5 METRES.
3. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

SCALE A 400 200 0 400 800 1200 1600 2000 m

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
0	06FEB'14	ISSUED WITH LETTER	DDF	AN	BB	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

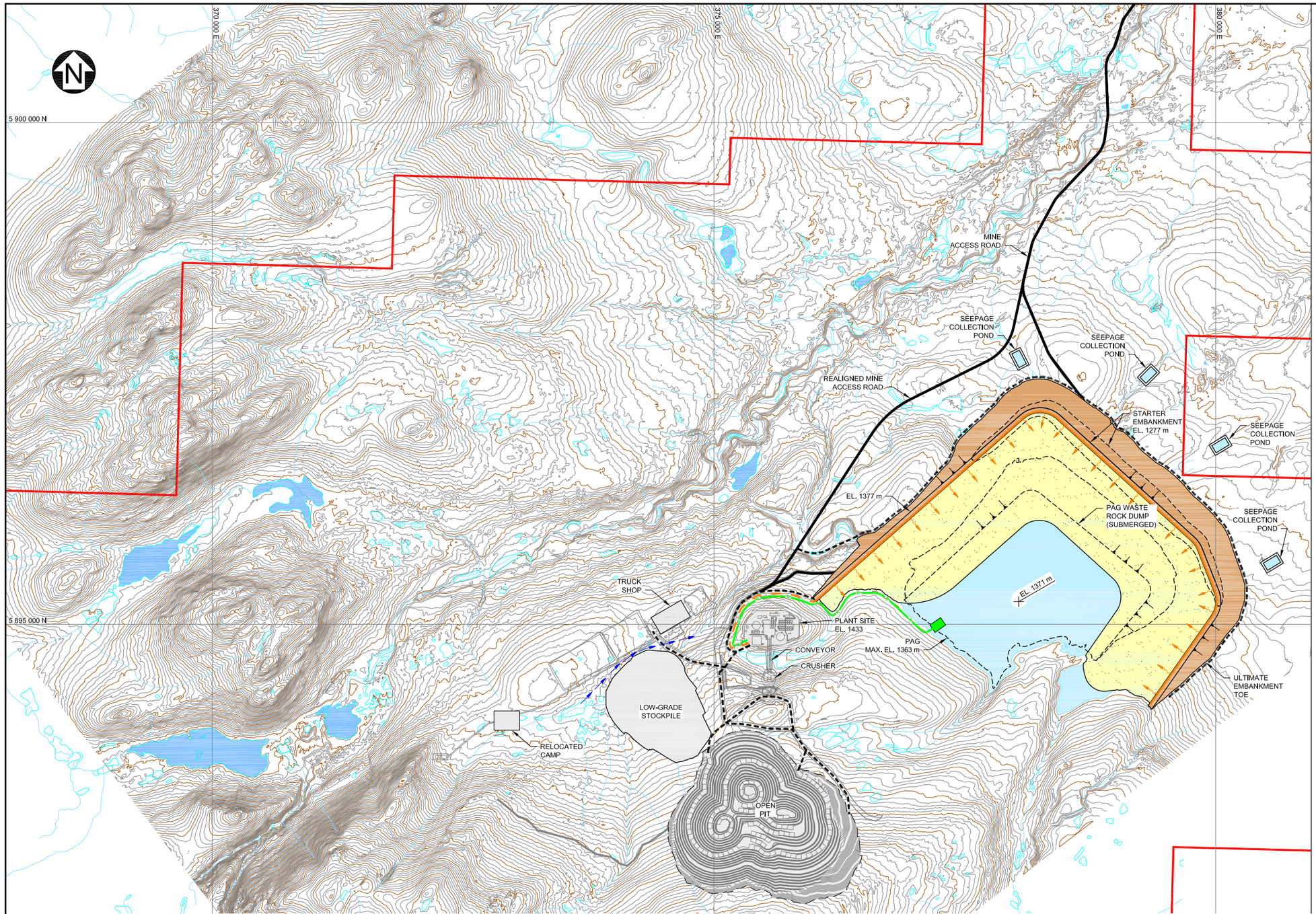
**TAILINGS STORAGE FACILITY
MULTIPLE ACCOUNTS ANALYSIS
SITE D**

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-457/6	VA13-02401

FIGURE A.2 REV 0

SAVED: M:\1\01\09457\06\A\acad\FIGS\B108_r0_ 2/6/2014 1:07:58 PM , ANASIRI PRINTED: 2/6/2014 1:08:30 PM, Layout1, ANASIRI
XREFILES: IMAGE FILES:



NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 10.
2. CONTOUR INTERVAL IS 5 METRES.
3. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

SCALE A 400 200 0 400 800 1200 1600 2000 m

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
0	06FEB'14	ISSUED WITH LETTER	DDF	AN	BB	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY MULTIPLE ACCOUNTS ANALYSIS SITE E

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-457/6	VA13-02401

FIGURE A.3 REV 0

SAVED: M:\1101\004570\06\A\cad\FIGS\B109_r0 , 2/6/2014 1:09:40 PM , ANASIRI PRINTED: 2/6/2014 1:10:22 PM, Layout1, ANASIRI
XREF FILES: IMAGE FILES:

370 000 E
375 000 E
380 000 E
5 900 000 N
5 895 000 N

ULTIMATE EMBANKMENT EL. 1318 m
ENVIRONMENTAL CONTROL DAM (ECD) EL. 1182 m
STARTER EMBANKMENT EL. 1265 m
MINE ACCESS ROAD
POND EL. 1313 m
SEEPAGE COLLECTION POND
REALIGNED MINE ACCESS ROAD
NAG WASTE ROCK WITH LOW PERMEABILITY CAP AT EL. 1340 m TO DIRECT PAG RUNOFF TO TSF
TRUCK SHOP
PLANT SITE EL. 1433
CONVEYOR
CRUSHER
EL. 1463 m
NAG PLATFORM EXTENTS AT EL. 1340 m
RELOCATED CAMP
LOW-GRADE STOCKPILE
EL. 1507 m
NAG WASTE DUMP
PAG WASTE ROCK DUMP (ON-LAND)
OPEN PIT

LEGEND:

- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT
- PAG STOCKPILE
- NAG STOCKPILE
- RECLAIM SYSTEM
- PUMPSTATION
- MINE ACCESS ROAD
- MINE HAUL ROAD
- DIVERSION CHANNEL
- COLLECTION CHANNEL
- SEEPAGE INTERCEPTION TRENCHES
- WATER RECLAIM PIPELINE
- NEW GOLD PROPERTY BOUNDARY
- TAILINGS PIPELINE
- TAILINGS DEPOSIT

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 10.
2. CONTOUR INTERVAL IS 5 METRES.
3. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

SCALE A 400 200 0 400 800 1200 1600 2000 m

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
0	06FEB'14	ISSUED WITH LETTER	DDF	AN	BB	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY MULTIPLE ACCOUNTS ANALYSIS SITE D PAG - OL

Knight Piésold CONSULTING

P/A NO. VA101-457/6

REF NO. VA13-02401

FIGURE A.4

REV 0

SAVED: M:\101\045\06\A\cad\FIGS\B111_0, 2/6/2014 1:11:23 PM, ANASIRI PRINTED: 2/6/2014 1:12:30 PM, Layout1, ANASIRI
XREF FILES: IMAGE FILES:

Appendix D

Blackwater Gold Project: Non-Acid Generating Waste Rock Disposal Alternatives Assessment

New Gold Inc.

BLACKWATER GOLD PROJECT

Non-Acid Generating Waste Rock Disposal Alternatives Assessment

September 2015

Project #0215644-0001

Citation:
ERM. 2015. *Blackwater Gold Project: Non-Acid Generating Waste Rock Disposal Alternatives Assessment.* Prepared for New Gold Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.

ERM
ERM Building, 15th Floor
1111 West Hastings Street
Vancouver, BC
Canada V6E 2J3
T: (604) 689-9460
F: (604) 687-4277

ERM prepared this report for the sole and exclusive benefit of, and use by, New Gold Inc.. Notwithstanding delivery of this report by ERM or New Gold Inc. to any third party, any copy of this report provided to a third party is provided for informational purposes only, without the right to rely upon the report.

EXECUTIVE SUMMARY

BLACKWATER GOLD PROJECT INTRODUCTION

The purpose of this document is to report on the non-acid generating waste rock storage (NAG WRS) alternatives assessment process undertaken for the Blackwater Gold Project (the Project) proposed by New Gold Inc (New Gold). The Project, lies in central BC, approximately 112 km southwest of Vanderhoof and 446 km northeast of Vancouver. The Project site is readily accessible by vehicle from the Kluskus-Ootsa Forest Service Road originating approximately 10 km west of Vanderhoof, off Highway 16. At km 146 along this road, an 18 km mine road built in 1986 and improved in 2009, provides direct access to the property and camp location for exploration. The area is very sparsely inhabited; two ranches, three lodges and Tatelkuz Lake Indian Reserve are found within a 20 km radius of the Project site. Although not connected by road directly to the site, Kluskus village is approximately 25 km to the south east. The nearest community to the Project is Vanderhoof, located 110 km away.

CONTEXT OF THE NON-ACID GENERATING WASTE ROCK STORAGE FACILITY ALTERNATIVES ASSESSMENT

Where possible fish-bearing waterbodies are avoided when considering tailing impoundment area (TIA; including waste rock disposal options) alternative candidates' locations, the challenges of identifying feasible sites near the Mine Area require that fish-bearing waterbodies be considered for TIA placement. In Canada, under the *Fisheries Act* (1985) the capacity to use a natural fish-bearing waterbody as a TIA is only possible through obtaining a regulatory amendment to have the proposed waterbody designated as a tailing impoundment area and listed under Schedule 2 of the Metal Mining Effluent Regulations (MMER; SOR/2002-222).

A project proponent must undergo a predetermined process when considering TIA options that would trigger a Schedule 2 amendment. This process includes: 1) preparing an environmental assessment (EA); 2) preparing a TIA alternatives assessment; 3) preparing a fish habitat offsetting plan for consideration as part of the EA; and 4) participating in public and Aboriginal consultations on the EA, including on the possible amendment to the MMER.

This report has been prepared as an appendix to the Tailing Management Facility (TSF) alternatives assessment for the Project, which identified the TSF Feasibility Study (FS) option as being preferred (ERM Rescan 2014). In that plan PAG waste rock would be co-disposed with tailing into a TSF located in the Davidson Creek valley.

This report advances the assessment of Project alternatives for mine waste disposal by assessing alternative NAG waste rock disposal locations for the TSF FS option. The NAG waste rock disposal alternatives are anticipated to affect assumed fish-bearing waters, and hence, the preferred NAG waste rock disposal alternative will be included in the Project's application for a Schedule 2 Amendment to the Metal Mining Effluent Regulations (MMER; SOR/2002-222).

For this report, New Gold followed the transparent and standardized process described in the *Guidelines for the Assessment of Alternatives for Mine Waste Disposal* (the *Guidelines*) published by Environment Canada (2011). These *Guidelines* delineate the alternatives assessment process required to identify, assess, evaluate, rank, and select the best overall NAG WRS from the options identified.

Under the recently released *Streamlining the Approvals Process for Metal Mines with Tailings Impoundment Areas* (Environment Canada 2012), a Project's application for a Schedule 2 Amendment to the MMER may be exempted from pre-publication in *Canada Gazette*, Part I, if: "1. The environmental assessment considered: public and stakeholder comments on the water body listed; an assessment of alternatives to the proposed TIA, including costs and public comments; consultations on the fish habitat compensation plan; Aboriginal consultation (to meet all obligations that may exist in relation to Aboriginal rights or Treaty rights protected by section 35 of the *Constitution Act* (1982); 2. The federal government has determined, based on the environmental assessment, that, taking into account the implementation of appropriate mitigation measures, the project is not likely to cause significant adverse environmental effects, and 3; Consultations on the MMER amendment … have met the Treasury Board *Guidelines for Effective Regulatory Consultations*".

If a proposed TIA authorization meets the above conditions for exemption, then the authorization may move directly to *Canada Gazette*, Part II.

THE NON-ACID GENERATING WASTE ROCK STORAGE ALTERNATIVES ASSESSMENT PROCESS

As described in the *Guidelines* (Environment Canada 2011), the alternatives assessment process involves seven steps to select a NAG WRS site by a process of systematic analysis and elimination.

Step 1: Identify Candidate Alternatives

This step is to identify preliminary NAG WRS candidates near the Mine Area deemed feasible based on basic physiographic and technical threshold criteria. Sites that do not meet these criteria are eliminated at this stage in the process. Step 1 involves the following activities:

i. Identify candidate alternatives for potential NAG WRS site locations;
ii. Establish basic threshold criteria based on topographic/geologic conditions, accessibility, and established technological precedent;
iii. Analyze candidates based on basic threshold criteria;
iv. Eliminate candidates that do not meet threshold criteria; and
v. Deliver summary table and maps of remaining alternatives.

Step 2: Pre-screening Assessment

In this step the number of candidate alternatives are further narrowed by applying a fatal flaw analysis to eliminate candidate alternatives that are not feasible. Analyzed deficiencies are based on legislative, physiographic, and technical site selection criteria; no values-based criteria are applied as a fatal flaw. Step 2 involves the following activities:

i. Develop a list of project-specific, pre-screening criteria (or fatal flaws, which are characteristics so unfavourable that, if taken singly, would eliminate a site as a candidate);

ii. Conduct a pre-screening evaluation (fatal flaw analysis) of the alternatives remaining from Step 1 using the project-specific site selection criteria;

iii. Eliminate candidates that do not meet the pre-screening selection criteria; and

iv. Deliver a summary table that outlines the selection process.

Step 3: Alternative Characterization

Step 3 identifies and employs a set of descriptive parameters as a basis for further evaluation of the remaining candidates. Step 3 involves the following activities:

i. Develop a list of descriptive parameters (characterization criteria) based on four broad categories (accounts): environmental, technical, socio-economic, and project economic criteria;

ii. Thoroughly characterize remaining alternatives based on characterization criteria; and

iii. Deliver summary tables listing the descriptive characterization criteria for each account.

Step 4: Multiple Accounts Ledger

Step 4 involves systematic evaluation of the characterization criteria developed in Step 3 based on a valuation system developed from professional judgment of relevant experts, as well as consultations with Aboriginal groups, local, provincial, and federal government agencies, stakeholders, and New Gold. Step 4 involves the following activities:

i. Develop evaluation criteria (sub-accounts) to help differentiate among the four main characterization criteria identified in Step 3;

ii. Develop indicators (also called measurement criteria or sub-sub-accounts) to allow qualitative/quantitative measurement of the benefit or loss associated (impact) within the sub-accounts for each remaining alternative;

iii. Conduct a multiple accounts evaluation by developing and applying qualitative value scales to analyze the sub-accounts and indicator criteria; and

iv. Deliver summary tables: table of sub-accounts with rationale behind each and an expansion of the sub-accounts table that includes indicators.

A Multiple Accounts Analysis (MAA) is the recommended decision-making tool under the *Guidelines*, and consists of developing a multiple accounts ledger to facilitate evaluation. A multiple accounts ledger is an explicit list of all the impacts associated with each NAG WRS alternative, which generates a clear and measurable description of those impacts.

Step 5: Value-based Decision Process

Step 5 involves a final value-based evaluation to identify the preferred NAG WRS candidate. This is done by scoring and weighting the indicators developed in Step 4, and applying a quantitative

analysis to develop weighted merit ratings for each NAG WRS candidate. Step 5 involves the following activities:

i. Develop a qualitative values-based weighting scale for every indicator;
ii. Apply a value-based weighting factor to every indicator and develop a base case from weightings;
iii. Conduct a quantitative analysis to generate weighted merit ratings (MAA); and
iv. Deliver a summary table listing the final candidate value-based weighting, which identifies the best potential NAG WRS candidate.

Step 6: Sensitivity Analysis

Step 6 considers different value systems when weighting accounts, sub-accounts, and indicators. Step 6 involves the following activities:

i. Develop alternate ranking systems based on professional judgment and stakeholder input;
ii. Re-analyze the data using a MAA as presented in Step 5; and
iii. Deliver a summary table of the results.

Step 7: Document Process (Entire Document)

Step 7 involves transparently reporting on the NAG WRS alternatives analysis process using the preceding steps, and consists of the following:

i. Write report documenting all steps undertaken, and their results; and
ii. Deliver report to present Aboriginal Groups, local, provincial, and federal government agencies, and stakeholders for consideration of final NAG WRS site selection.

RESULTS OF THE BLACKWATER GOLD PROJECT NON-ACID GENERATING WASTE ROCK STORAGE ALTERNATIVES ASSESSMENT

For the Blackwater Gold Project, New Gold followed the *Guidelines* (Environment Canada 2011) as outlined in Steps 1 through 7. The results of this process are as follows:

Step 1: Identify Candidate Alternatives

New Gold conducted an initial screening of potential NAG WRS sites within or near the Davidson Creek drainage. The result was the identification of five potential NAG WRS candidate alternative sites for the Project:

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

Step 2: Pre-screening Assessment

The following pre-screening criteria were applied against the five potential NAG WRS candidate alternative sites:

- 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 Ungulate Winter Range?

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;
3. Alt NAG E: Expanded East Facility;

Step 3: Alternative Characterization

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* (Environment Canada 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 in Table 1.

The summary tables developed in this step present the characterization criteria for each site, the rationale for the selection of each criterion, the descriptions corresponding to each criterion, and whether or not a characterization criterion will be carried forward to the next step—the multiple accounts ledger—as an evaluation criterion (sub-account).

Step 4: Multiple Accounts Ledger

The Blackwater NAG disposal MAA considered factors (accounts) in four primary categories: 1) environmental, 2) technical, 3) socio-economic, and 4) project economics. A multidisciplinary team of technical experts selected evaluation criteria (sub-accounts) and measurement criteria (indicators) under each of the four primary categories (Table 2).

Table 1. Accounts and their Evaluation Criteria

Account	Evaluation Criteria (Sub-account)	Rationale
Technical	Dump Characteristics	Options with less complex or dump characteristic are preferred due to lower engineering and environmental risk.
	Supporting Infrastructure	Options with less complex supporting infrastructure are preferred due to lower engineering and environmental risk.
	Foundation Conditions	Options with less complex containment structure designs and better foundation conditions are preferred due to lower engineering and environmental risk.
	Water Collection and Treatment	Options with less complex water management requirements are more preferred because of lower engineering risk, lower costs, potentially greater success at closure, and lower environmental risk.
	Construction, Operation, and Closure	Options with higher construction, operation, and closure requirements are generally less desirable from a cost perspective, and may have a higher long-term risk of failure.
Environmental	Surface Water	Options that have higher potential impacts to surface water are less desirable due to higher potential effects to the receiving environment and increased potential for water treatment.
	Groundwater	Options that have higher potential impacts to groundwater are less desirable due to higher potential effects to the receiving environment and increased need for seepage control.
	Air Quality	Options that have high potential for fugitive dust or greenhouse gas emissions are less desirable due to higher associated risks to human health, vegetation and wildlife habitat, and global climate change.
	Fish and Aquatic Habitat	Options with greater effects to fish and aquatic habitat are less desirable due to the high ecological, social, and economic importance of fish and aquatic habitat.
	Wildlife	Options that affect high quality habitat for valued or at-risk wildlife species are less desirable due to higher associated effects on biodiversity and traditional use values.
	Vegetation, Ecosystems, and Wetlands	Options that affect rare and endangered ecosystems or areas of high biodiversity are less desirable due to higher associated costs to biodiversity and traditional use values. Loss to at-risk wetlands may also require habitat compensation.
Socio-economics	Commercial Land Use	Options that affect the economic interests of commercial tenure holders are less desirable.
	Recreational Land Use	Options that affect the recreational land use are less desirable.
	Aboriginal Interests	Options that overlap a greater number of Aboriginal asserted territories may have higher potential impacts to Aboriginal rights and title and are less desirable.
	Archaeology	Options that affect known archaeological, heritage, or paleontological resources are less preferred. Archaeological sites are also protected under the *Heritage Conservation Act* (1996b).
Project Economics	Proponent Costs	Options with lower overall costs are preferred.

Table 2. Multiple Accounts Ledger

Account	Sub-account (Evaluation Criteria)	Indicator (Measurement Criteria)
Technical	Dump Characteristics	Complexity of containment
		Physical characterization of wastes
		Area footprint
		Expansion Potential
	Supporting Infrastructure	Waste haulage distance
	Water collection and treatment	Potential for water treatment
	Construction, Operation, and Closure	Complexity of construction
		Operational flexibility and complexity
		Closure risk
Environmental	Surface Water	Watersheds affected
		Reduction in catchment area
		Surface water quality
	Groundwater	Groundwater quality
	Air Quality	Vehicle emissions
		Fugitive dust
	Ecosystems	Rare and endangered ecosystems
		Wetland ecosystems
	Wildlife	Caribou high-quality habitat
		Moose high-quality habitat
		Myotis spp. high-quality habitat
		Invertebrate high-quality habitat
	Fish and Aquatic Habitat	Stream length affected
		Permanent alteration to, or destruction of fish habitat (PAD)
Socio-economics	Aboriginal Interests	Traditional territory overlapped
	Commercial Land Use	Guide outfitting tenures
		Trapline tenures
Project Economics	Proponent Costs	Capital cost
		Operational cost
		Closure cost
		Fish habitat compensation cost

Step 5: Value-based Decision Process

The value-based decision process involves the creation of scoring and weighting scales for all relevant criteria (account, sub-account, and indicators). This value-based ranking methodology was done in concordance with the *Guidelines* (Environment Canada 2011) in order to differentiate the benefit or loss associated with each site. The results of the MAA for the Blackwater NAG WRS alternatives assessment is shown in Table 3.

Table 3. Multiple Accounts Analysis Results

	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)
Base case	3.8	3.5	3.5

The Combined East and West Facility (Alt NAG E/W) is the most appropriate NAG WRS alternative, as it resulted in the highest number (3.8) in the Multiple Accounts Analysis.

Step 6: Sensitivity Analysis

A sensitivity analysis was performed for the Blackwater NAG WRS alternatives assessment according to the *Guidelines* (Environment Canada 2011). For the Blackwater NAG WRS alternatives assessment, the following sensitivity analyses were performed:

1. all accounts were weighted equally; and
2. only indicators with discriminating values of 30% or higher were considered.

The result of all the sensitivity analyses runs was that the Combined East and West (Alt NAG E/W) alternative remained the most appropriate option (Table 4).

Table 4. Results of Sensitivity Analyses

	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)
1 (all accounts given equal weighting)	3.9	3.3	3.4
2 (discriminating indicators only)	4.0	3.9	3.4

Step 7: Document Results

This report documents the NAG WRS alternative assessment process that was undertaken by New Gold for the Blackwater Gold Project, in conjunction with consultation with Aboriginal groups, and local, provincial, and federal government agencies.

ACKNOWLEDGEMENTS

ERM would like to acknowledge Knight Piésold Ltd., AMEC Earth and Environmental (AMEC), pHase Geochemistry, and Ferguson Sustainability Engineering for the provision of baseline data summaries, mapping and habitat data, general guidance and feedback, and technical summaries to support this Non-Acid Generating Waste Rock Storage Alternatives Assessment Report.

BLACKWATER GOLD PROJECT

Non-Acid Generating Waste Rock Disposal Alternatives Assessment

TABLE OF CONTENTS

Executive Summary i

Acknowledgements ix

Table of Contents xi

List of Figures xiii

List of Tables xiii

List of Appendices xiv

1. Introduction 1–1

1.1 Report Purpose 1–1

1.2 NAG Material Disposal Design Criteria 1–1

2. Pre-feasibility Alternatives 2–1

2.1 Candidate Alternatives – NAG Waste Rock Facility 2–2

2.2 Pre-screening Assessment 2–17

2.2.1 Results of the Pre-screening Assessment 2–18

2.2.1.1 Would the NAG WRS Facility Preclude Future Mining Exploration or Extraction of a Potential Deposit? 2–18

2.2.1.2 Is Any Part of the NAG WRS Facility System Unproven Technology? 2–18

2.2.1.3 Does the NAG Waste Rock Storage Facility Have Insufficient Capacity to Store the Proposed Upper Limit of NAG Waste Rock? 2–18

2.2.1.4 Will the NAG Waste Rock Storage Facility Result in Negative Life of Project Economics? 2–18

2.2.1.5 Will the NAG Waste Rock Facility be Located Partially within the Blackwater Watershed? 2–20

2.2.1.6 Will the NAG Waste Rock Storage Facility be Located in an Ungulate Winter Range? 2–20

2.2.2 Results of the Pre-screening Assessment 2–21

3. Alternative Characterization 3–1

3.1 Data Sources for Alternatives Characterization 3–5

3.2 Detailed Description of Non-Acid Generating Waste Rock Storage Facility Alternatives 3–6

3.2.1 Combined East and West Facility (Alt NAG E/W) 3–6
3.2.1.1 Technical 3–6
3.2.1.2 Environmental 3–9
3.2.1.3 Socio-economics 3–12
3.2.1.4 Project Economics 3–13
3.2.2 Expanded West Facility (Alt NAG W) 3–14
3.2.2.1 Technical 3–14
3.2.2.2 Environmental 3–16
3.2.2.3 Socio-economics 3–19
3.2.2.4 Project Economics 3–19
3.2.3 Expanded East Facility (Alt NAG E) 3–20
3.2.3.1 Technical 3–20
3.2.3.2 Environmental 3–23
3.2.3.3 Socio-economics 3–25
3.2.3.4 Project Economics 3–26
3.3 Characterization Criteria Summary Table 3–27
3.3.1 Accounts and Characterization Criteria 3–27
4. Multiple Accounts Ledger 4-1
4.1 Evaluation Criteria (Sub-accounts) 4-1
4.2 Measurement Criteria (Indicators) 4-3
4.2.1 Technical Indicator Quantitative Value Scales 4-3
4.2.2 Environmental Indicator Quantitative Value Scales 4-3
4.2.3 Socio-economic Indicator Quantitative Value Scales 4-3
4.2.4 Project Economic Indicator Quantitative Value Scales 4-3
5. Value-based Decision Process 5-1
5.1 Indicator Weighting 5-1
5.1.1 Technical Indicators 5-1
5.1.2 Environmental Indicators 5-2
5.1.3 Socio-economic Indicators 5-4
5.1.4 Project Economics Indicators 5-4
5.2 Sub-account Weighting 5-5
5.3 Account Weighting 5-6
5.4 Quantitative Analysis 5-7
6. Sensitivity Analysis 6-1
7. Conclusion 7-1
References R-1

LIST OF FIGURES

Figure 1.1-1. Preferred Tailings Storage Facility Location 1–3
Figure 2-1. Pre-feasibility Alternatives Step 2–1
Figure 2.1-1. Blackwater Gold Project: Non-Acid Generating Waste Stockpile Alternatives 2–5
Figure 2.1-2. Detailed View of Combined East and West Non-Acid Generating Waste Rock Storage Option 2–7
Figure 2.1-3. Detailed View of Expanded West Non-Acid Generating Waste Rock Storage Option 2–9
Figure 2.1-4. Detailed View of Expanded East Non-Acid Generating Waste Rock Storage Option 2–11
Figure 2.1-5. Detailed View of North Non-Acid Generating Waste Rock Storage Option 2–13
Figure 2.1-6. Detailed View of South Non-Acid Generating Waste Rock Storage Option 2–15
Figure 2.2-1. Pre-Screening Assessment Step 2–17
Figure 3-1. Alternative Characterization Step 3–1
Figure 3.2-1. Combined East and West Non-Acid Generating Waste Rock Storage Option 3–7
Figure 3.2-2. Expanded West Non-Acid Generating Waste Rock Storage Option 3–15
Figure 3.2-3. Expanded East Non-Acid Generating Waste Rock Storage Option 3–21
Figure 4-1. Multiple Accounts Ledger Step 4-1
Figure 5-1. Value-based Decision Process Step 5-1
Figure 6-1. Value-based Decision Process Step 6-1

LIST OF TABLES

Table 1. Accounts and their Evaluation Criteria vi
Table 2. Multiple Accounts Ledger vii
Table 3. Multiple Accounts Analysis Results viii
Table 4. Results of Sensitivity Analyses viii
Table 1.2-1. Median Neutralization Potential Ratios and Metals for Waste Rock (Acid-Base Accounting Database) 1–2
Table 2.1-1. Construction, Operation, and Closure Considerations for Non-acid Generating Waste Rock Storage Alternatives 2–3
Table 2.2-1. Pre-screening Assessment for Blackwater NAG Waste Rock Storage Facility Candidate Alternatives 2–19
Table 3-1. Valued Components for the Blackwater Gold Project 3–2

Table 3.2-1. Wildlife Habitat Requirements Affected by Alt NAG E/W 3–10
Table 3.2-2. Wildlife Habitat Requirements Affected by Alt NAG W 3–17
Table 3.2-3. Wildlife Habitat Requirements Affected by Alt NAG E 3–24
Table 3.3-1. Technical Characterization Criteria Summary Table 3–28
Table 3.3-2. Environmental Characterization Criteria Summary Table 3–30
Table 3.3-3. Socio-economic Characterization Criteria Summary Table 3–35
Table 3.3-4. Economic Characterization Criteria Summary Table 3–37
Table 4.1-1. Evaluation Criteria (Sub-accounts) and Supporting Rationale for their Selection 4-2
Table 4.2-1. Multiple Accounts Ledger 4-4
Table 5.1-1. Dump Characteristic Indicator Weighting 5-2
Table 5.1-2. Construction, Operation, and Closure Indicator Weighting 5-2
Table 5.1-3. Surface Water Indicator Weighting 5-3
Table 5.1-4. Air Quality Indicator Weighting 5-3
Table 5.1-5. Ecosystems Indicator Weighting 5-3
Table 5.1-6. Wildlife Indicator Weighting 5-4
Table 5.1-7. Fish and Aquatic Habitat Indicator Weighting 5-4
Table 5.1-8. Commercial Land Uses Indicator Weighting 5-4
Table 5.1-9. Estimated Costs Indicator Weighting 5-5
Table 5.2-1. Technical Sub-account Weighting 5-5
Table 5.2-2. Environmental Sub-account Weighting 5-6
Table 5.2.3. Socio-economic Sub-account Weighting 5-6
Table 5.3-1. Account Weighting for Base-case Value Scenarios 5-6
Table 5.4-1. Multiple Accounts Analysis Results 5-7
Table 6-1. Results of Sensitivity Analyses 6-1

LIST OF APPENDICES

Appendix A. Calculation Tables

1. INTRODUCTION

1.1 REPORT PURPOSE

This report is an appendix to the Tailing Management Facility (TSF) alternatives assessment for New Gold Inc.'s (New Gold's) Blackwater Gold Project (the Project), which identified the TSF Feasibility Study (FS) option (ERM Rescan 2014) as being preferred (Figure 1.1-1). This report advances the assessment of Project alternatives for mine waste disposal by assessing alternative Non-Acid Generating (NAG) waste rock disposal locations for the TSF FS option. The NAG waste rock disposal alternatives are anticipated to affect fish-bearing waters, and hence, the preferred NAG waste rock disposal alternative will be included in the Project's application for a Schedule 2 Amendment to the Metal Mining Effluent Regulations (MMER; SOR/2002-222).

The background and objectives of this assessment are provided in Section 1.1 of the *Assessment of Alternatives for Blackwater Project Tailing Storage Facility* (ERM Rescan 2014).

A description of the Project proponent, New Gold, is provided in Section 1.2 of the *Assessment of Alternatives for Blackwater Project Tailing Storage Facility* (ERM Rescan 2014).

A description of the Project and its location is provided in Section 1.3 of the *Assessment of Alternatives for Blackwater Project Tailing Storage Facility* (ERM Rescan 2014).

The environmental, human environment, and Aboriginal groups settings used to support this assessment are provided in Sections 1.8 through 1.10 of the *Assessment of Alternatives for Blackwater Project Tailing Storage Facility* (ERM Rescan 2014) respectively.

1.2 NAG MATERIAL DISPOSAL DESIGN CRITERIA

Classification of mine wastes to be produced by the Project was based on the results from a Metal Leaching/Acid Rock Drainage (ML/ARD) test program, BC government and international guidance, and best mining industry practice (BC MEM and BC MELP 1998; Price and Errington 1998; MEND 2009; Price 2009).

Mine waste was classified based on whether it is predicted to be PAG or Non-Acid Generating (NAG), as shown by the calculated neutralization potential ratio (NPR). NAG waste rock was further classified as to its metal leaching potential based on zinc content. Classification criteria are as follows (AMEC 2014):

- 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 (PAG),

  - NAG4 – NPR > 2.0 and 600 ≤ Zn <1,000 ppm (NAG),
  - NAG5 – NPR > 2.0 and Zn < 600 ppm (NAG);
- ore and tailings (PAG); and
- low grade ore (PAG).

Median NPR values for PAG waste rock (particularly PAG1) are low, indicating a relatively short lag time to acid production (Table 1.2-1), which was verified in laboratory kinetic (humidity cells) and field tests (field bins). PAG waste rock requires subaqueous disposal to prevent ARD formation.

Table 1.2-1. Median Neutralization Potential Ratios and Metals for Waste Rock (Acid-Base Accounting Database)

Waste Rock Type	NPR	Total S (%)	Zn (ppm)	Cd (ppm)
PAG1	0.3	0.6	1,720	10.4
PAG2	1.5	0.3	878	5.6
NAG3	3.6	0.14	1,600	9.9
NAG4	6.1	0.12	767	5.0
NAG5	6.8	0.04	128	0.25

In contrast, median NPR values for NAG waste rock are relatively high indicating very little potential for acid production. Segregation of waste rock with zinc greater than 1,000 ppm (NAG3) results in high NPR and relatively low zinc and cadmium 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 is preferably stored subaqueously in the TSF to minimize metal leaching.

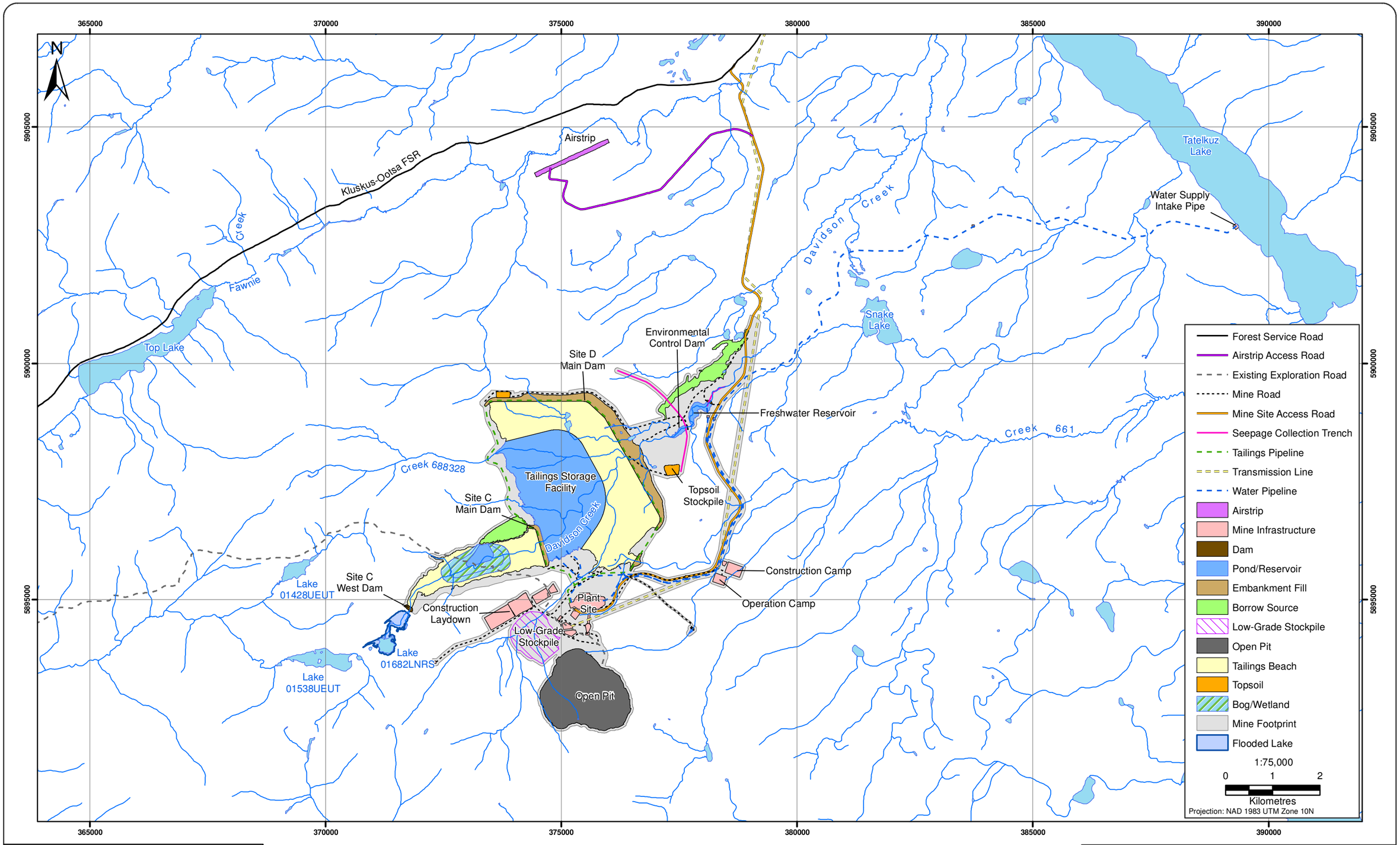
PAG1 and PAG2 waste rock will be stored and submerged in the TSF within one year of mining to prevent the formation of acid rock drainage (ARD). NAG3 waste rock will be stored and submerged in the TSF within three to five years of mining to reduce metal leaching. NAG4 waste rock will be used for construction on site and in the downstream shell of TSF Dam D if required. NAG5 will be used for construction and in the downstream shell of TSF Dam D.

Overburden is classed as non-acid generating and will be used for construction on and off site. Sulphide and transition ore tailings are classified as potentially acid generating and will be kept saturated or submerged within the TSF during operations to prevent ARD. Oxide tailings exhibit low ARD and ML potential and will be placed as the upper layer in TSF Site C.

The principal design objectives for the NAG waste rock facility are to ensure protection of regional groundwater and surface water flows and quality during both operations and in the long-term (after closure), to achieve effective reclamation at mine closure, and to minimize impacts to Aboriginal, commercial, recreational fisheries and their habitat, and the fish species these fisheries are dependent on. The design of the NAG WRS has taken into account the following requirements (AMEC 2013b):

- Permanent, secure, and total confinement of all NAG waste materials (total of 63 Mm^3) within engineered disposal facilities;

PROJECT #0215644-0001 GIS # BLW-15-038 March 11, 2014



newgold

Rescan an ERM company

Figure 1.1-1

Preferred Tailings Storage Facility Location

- Control, collection, and removal of contact water from the waste and tailings facilities during operations, for recycling as process water to the maximum practical extent;
- Collection and diversion of non-contact water from upstream of the waste rock facilities, low-grade stockpile, open pit, and plant site areas and direction to the TSF during operations;
- The inclusion of monitoring programs for all aspects of the facility to ensure performance goals are achieved and design criteria and assumptions are met; and
- Staged development of the facility over the life of the proposed Project.

In addition to the above, the disposal location of NAG waste rock for the Project is based on the prior selection of a TSF location, such that the selected location for a TSF is not available for the storage of NAG mine rock (ERM Rescan 2014).

2. PRE-FEASIBILITY ALTERNATIVES

The first step of the NAG waste rock disposal selection process involves using threshold criteria, such as geographic, economic, or technical boundaries, to select an initial set of potential NAG waste rock disposal options. These options are then progressively narrowed in future steps of the assessment. The initial candidate alternatives are briefly described at a conceptual level to facilitate the next step, the pre-screening assessment, as per Section 2.2 of the *Guidelines* (Environment Canada 2011; Figure 2-1).

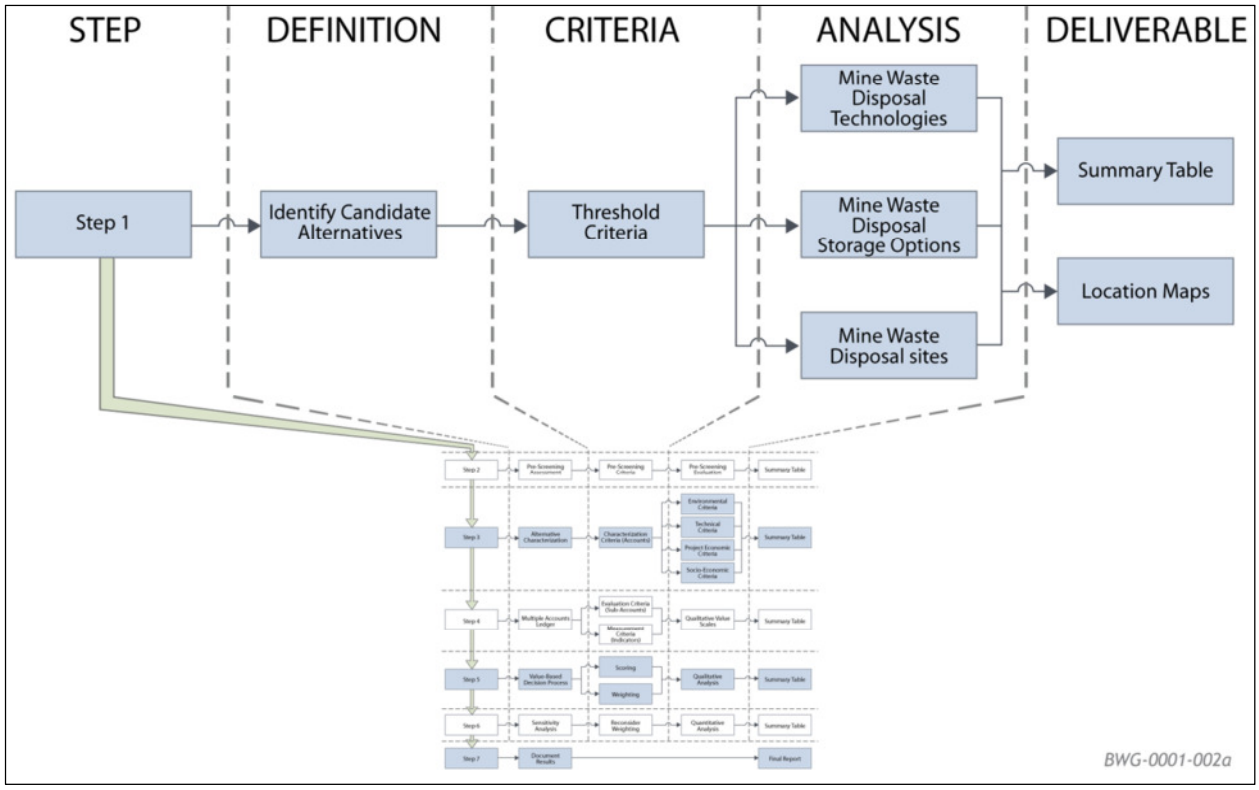


Figure 2-1. Pre-feasibility Alternatives Step

The following threshold criteria were applied to determine reasonable potential NAG waste rock disposal options for the Project:

- *Exclusion based on distance* – An original screening distance of 10 kms from the open pit was applied to the selection of initial disposal sites due to the cost of hauling waste rock to the facility. Any potential facility that did not at least partially occur within this watershed was not considered in this analysis.
- *Exclusion based on technological limitations* – NAG waste rock disposal technologies considered as options included: NAG material used for TSF construction; stockpiling NAG material in a waste rock facility; NAG overburden used for reclamation; and, relocating material to open pit at closure.

An overview of the technologies considered for NAG waste rock disposal and their feasibility for the Project is provided below.

Backfilling NAG Material to Open Pit at Closure

Backfilling NAG overburden and waste rock back into the open pit at closure would involve the use of temporary stockpiles during operation, followed by re-handling the material at closure. This approach would have the same operational environmental effects as an engineered waste rock facility alternative, but would involve considerable increased costs due to material haulage, likely in excess of $200 million. This alternative was therefore determined to unfeasible, due to it being neither practical nor economically viable.

NAG Material Used for TSF Construction

An estimated 74 Mm^3 of earth and rock fill will be required for construction of the TSF dams. At an average density of 2.0 t/m^3 for compacted till and waste rock, this 74 Mm^3 value translates to an approximate requirement for about 65% of the projected overburden and low-metal leaching NAG waste rock. It would therefore be possible to utilize a large portion of the overburden and NAG waste rock from open pit stripping and mine production for TSF dam construction; however, timing of material availability can limit this use. The use of this NAG material for construction purposes was selected as a feasible disposal alternative for NAG material, and is discussed further in the *Assessment of Alternatives for Blackwater Project Tailing Storage Facility* (ERM Rescan 2014).

Stockpile NAG Material in a Waste Rock Facility

Stockpiling NAG waste rock is an industry wide practice for managing large quantities of NAG waste rock during the mine life. Wherever possible, it is desirable to stockpile excess overburden and NAG waste rock as close to the open pit as possible to minimize haulage costs and to reduce the overall environmental footprint of the Project. Properly positioned, stockpiles can have the important advantage of draining by gravity to the TSF, which is helpful for consistency with *Metal Mining Effluent Regulations* (SOR/2002-222) runoff and seepage collection and monitoring requirements.

The stockpiling of 63 Mm^3 NAG material, not utilized for construction of the TSF, in a waste rock storage (WRS) facility is the focus of this assessment; potential locations for these dumps are discussed further in Section 2.1.

2.1 CANDIDATE ALTERNATIVES – NAG WASTE ROCK FACILITY

Based on the threshold criteria above, New Gold reviewed all potential NAG waste rock facility locations over a screening area within or near the Davidson Creek watershed (see Section 2.1-1), centering on the mine site. An initial set of five candidate alternative for the NAG waste rock facility were identified for the Option FS TSF (Figure 2.1-1; ERM Rescan 2014). Details regarding the general construction, operations, and closure considerations of each NAG WRS location are presented in Table 2.1-1.

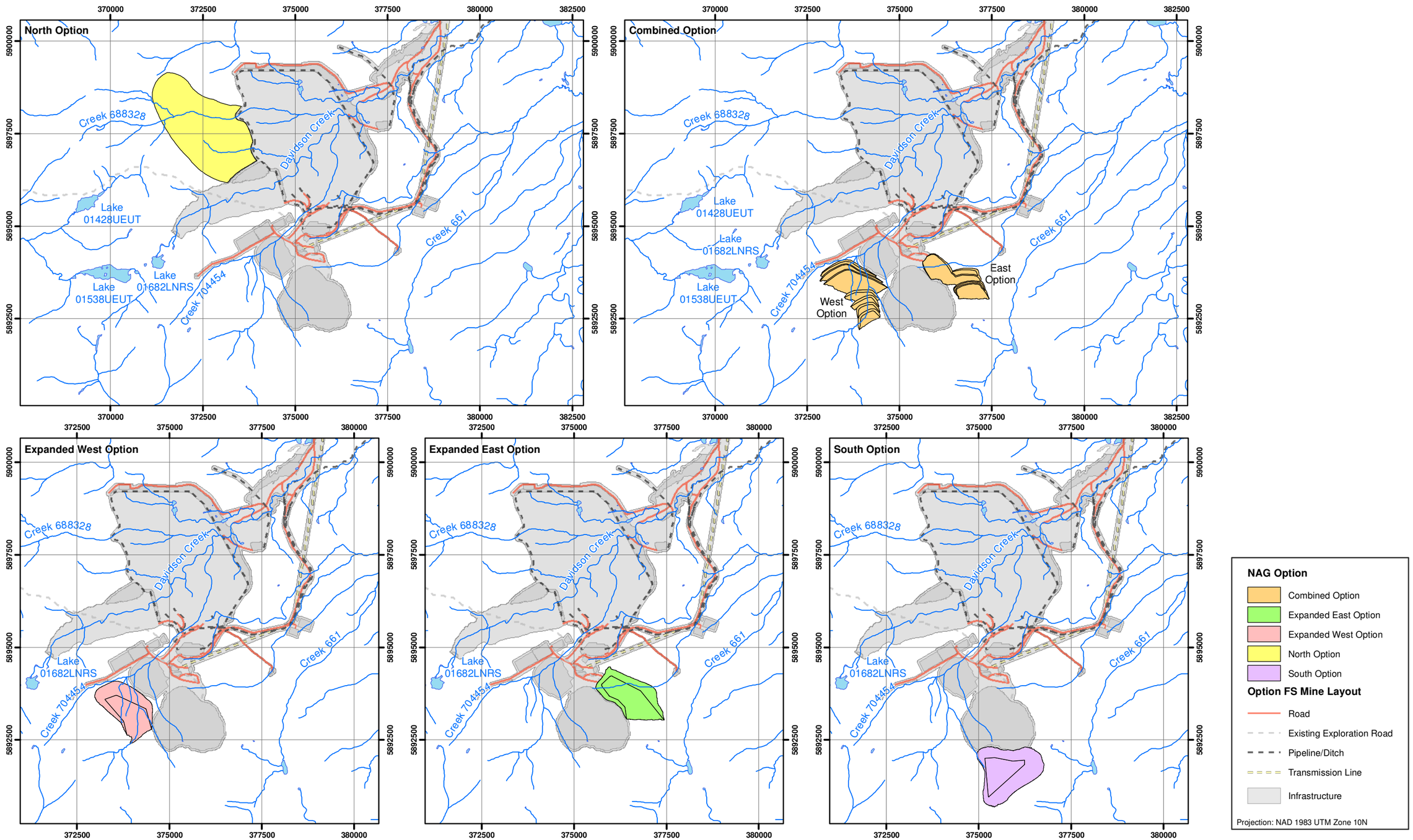
Table 2.1-1. Construction, Operation, and Closure Considerations for Non-acid Generating Waste Rock Storage Alternatives

NAG Waste Rock Storage Option	Construction Approach	Operational Approach	Closure Approach
Combined East and West (Alt NAG E/W)	Two facilities would be constructed to the immediate east and west of the open pit (Figure 2.1-2). The facility would occur in the Davidson Creek and Creek 661 drainages. Waste rock hauled by truck and would primarily be placed on contour with the open pit and the facility would be raised in a series of lifts, with terraced areas occurring between the lifts.	Waste would be segregated into two streams. The ML NAG4 and overburden material would be disposed in the West dump to facilitate the capture of runoff. The non-ML NAG5 and overburden material, not used for TSF construction would be stored in the East dump. Mined overburden will be distributed between the two waste facilities based on ratio of rock to overburden; a minimum of 10% of waste rock will be placed with the overburden to provide plating and maintain integrity of facilities. Facility seepage and drainage would report to the TSF.	Facility is designed to promote progressive reclamation and closure. The re-sloping requirements are minimized due to construction in a series of lifts. Some of West dump lifts will be progressively reclaimed during operations. Some areas of east dump will be primarily overburden that can be reused to reclaim the TSF and other facilities at closure.
Expanded West (Alt NAG W)	The facility would be located to the immediate west of and adjacent to the open pit (Figure 2.1-3). The facility occurs entirely within the Davidson Creek drainage. Waste rock would be hauled by truck placed off-contour from the open pit; the facility would be raised in a series of lifts, although little to no terracing would occur between these lifts, and the resultant facility would have relatively steep sides with an elevated top surface.	Waste would be placed in a single stream, with little to no separation of ML (NAG4) and non-ML (NAG5 and overburden) waste. Waste would need to be hauled upslope during later mine years at higher cost and greater GHG emissions. Mined overburden would be placed in a single facility based on ratio of rock to overburden; a minimum of 10% of waste rock will be placed with the overburden to provide plating and maintain integrity of facility. Facility seepage and drainage would report to the TSF during operations.	The Alt NAG W option design is not conducive to progressive reclamation, and dump closure activities will occur during the Project's closure phase.

(continued)

Table 2.1-1. Construction, Operation, and Closure Considerations for Non-acid Generating Waste Rock Storage Alternatives (completed)

NAG Waste Rock Storage Option	Construction Approach	Operational Approach	Closure Approach
Expanded East (Alt NAG E)	The facility would be located to the immediate east of and adjacent to the open pit (Figure 2.1-4). The facility occurs entirely within the Creek 661 drainage. Waste rock would be hauled by truck and placed off-contour from the open pit; the facility would be raised in a series of lifts, although little to no terracing would occur between these lifts, and the resultant facility would have relatively steep sides with an elevated top surface.	Waste would be placed in a single stream, with little to no separation of ML (NAG4) and non-ML (NAG5 and overburden) waste. Mined overburden will be placed in a single facilities based on ratio of rock to overburden; a minimum of 10% of waste rock will be placed with the overburden to provide plating and maintain integrity of facility. Facility seepage and drainage would report to the TSF although collection could be challenging as the footprint would extend further into Creek 661 drainage system.	The Alt NAG E option design is not conducive to progressive reclamation, and dump closure activities will occur during the Project's closure phase.
Northern (Alt NAG N)	The facility would be located to the immediate north of and adjacent to the TSF (Figure 2.1-5). The facility occurs entirely within the Davidson Creek drainage. Waste rock would be hauled by truck an average of 5.5 km from the open pit; the facility would be raised in a series of lifts, although little to no terracing would occur between these lifts, and the resultant facility would have relatively steep sides with an elevated top surface.	Waste would be placed in a single stream, with little to no separation of ML (NAG4) and non-ML (NAG5 and overburden) waste. Mined overburden will be placed in a single facilities based on ratio of rock to overburden; a minimum of 10% of waste rock will be placed with the overburden to provide plating and maintain integrity of facility. Facility seepage and drainage would report to the TSF.	The Alt NAG N option design is not conducive to progressive reclamation, and dump closure activities will occur during the Project's closure phase.
Southern (Alt NAG S)	The Alt NAG S facility would be located to the immediate south of and adjacent to the open pit (Figure 2.1-6). The facility occurs within the Davidson Creek, Creek 661, and Blackwater River drainages. Waste rock would be hauled by truck and placed off-contour from the open pit; the facility would be raised in a series of lifts, although little to no terracing would occur between these lifts, and the resultant facility would have relatively steep sides with an elevated top surface.	Waste would be placed in a single stream, with little to no separation of ML (NAG4) and non-ML (NAG5 and overburden) waste. Mined overburden will be placed in a single facilities based on ratio of rock to overburden; a minimum of 10% of waste rock will be placed with the overburden to provide plating and maintain integrity of facility. Facility seepage and drainage would ultimately report to the TSF; although challenges may exist due to the facility spanning three distinct watersheds and likely need for drainage pumping.	The Alt NAG S option design is not conducive to progressive reclamation, and dump closure activities will occur during the Project's closure phase.



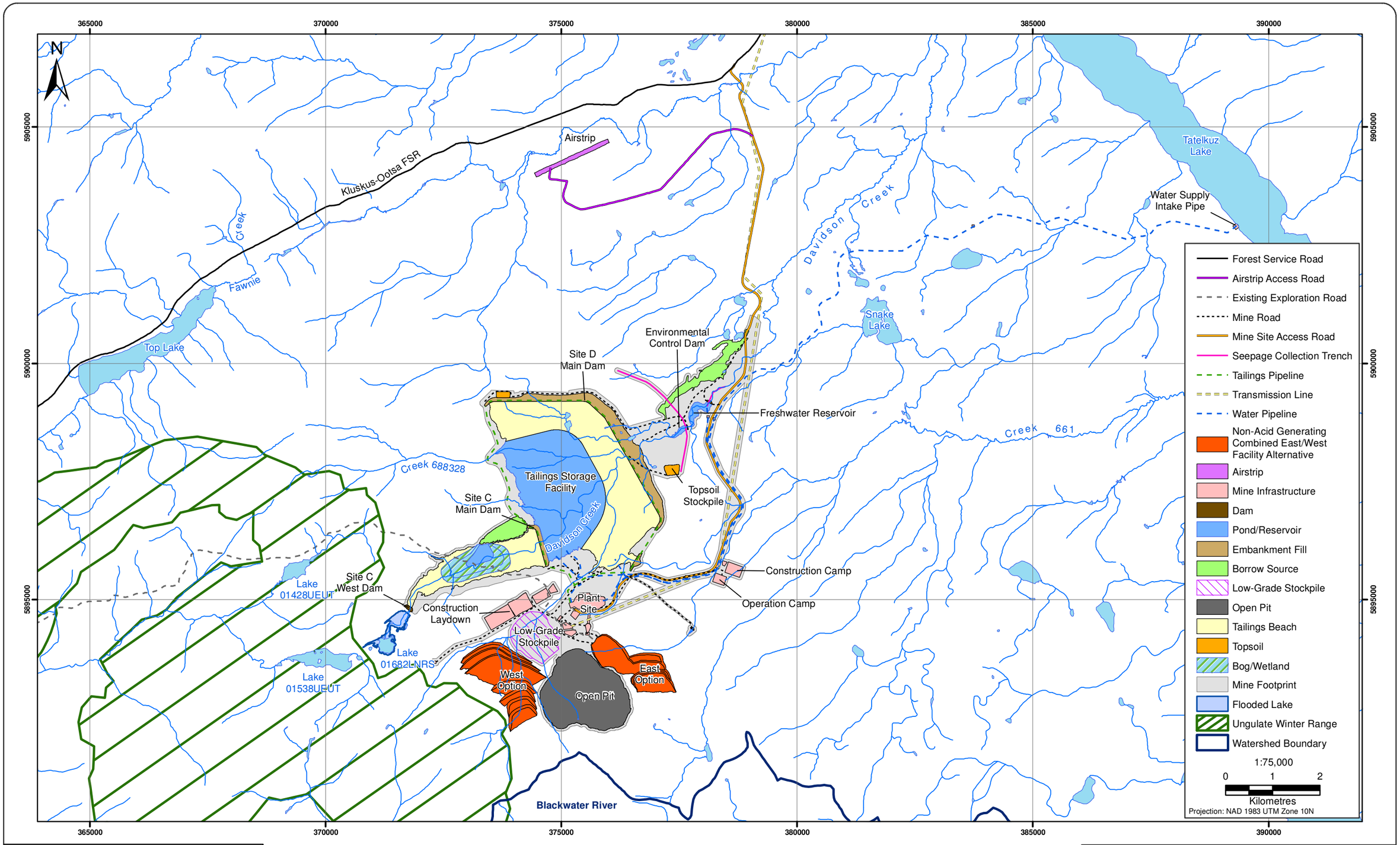
newgold

Rescan an ERM company

Figure 2.1-1

Blackwater Gold Project: Non-Acid Generating Waste Stockpile Alternatives

PROJECT #0215644-0001 GIS # BLW-15-030 March 10, 2014

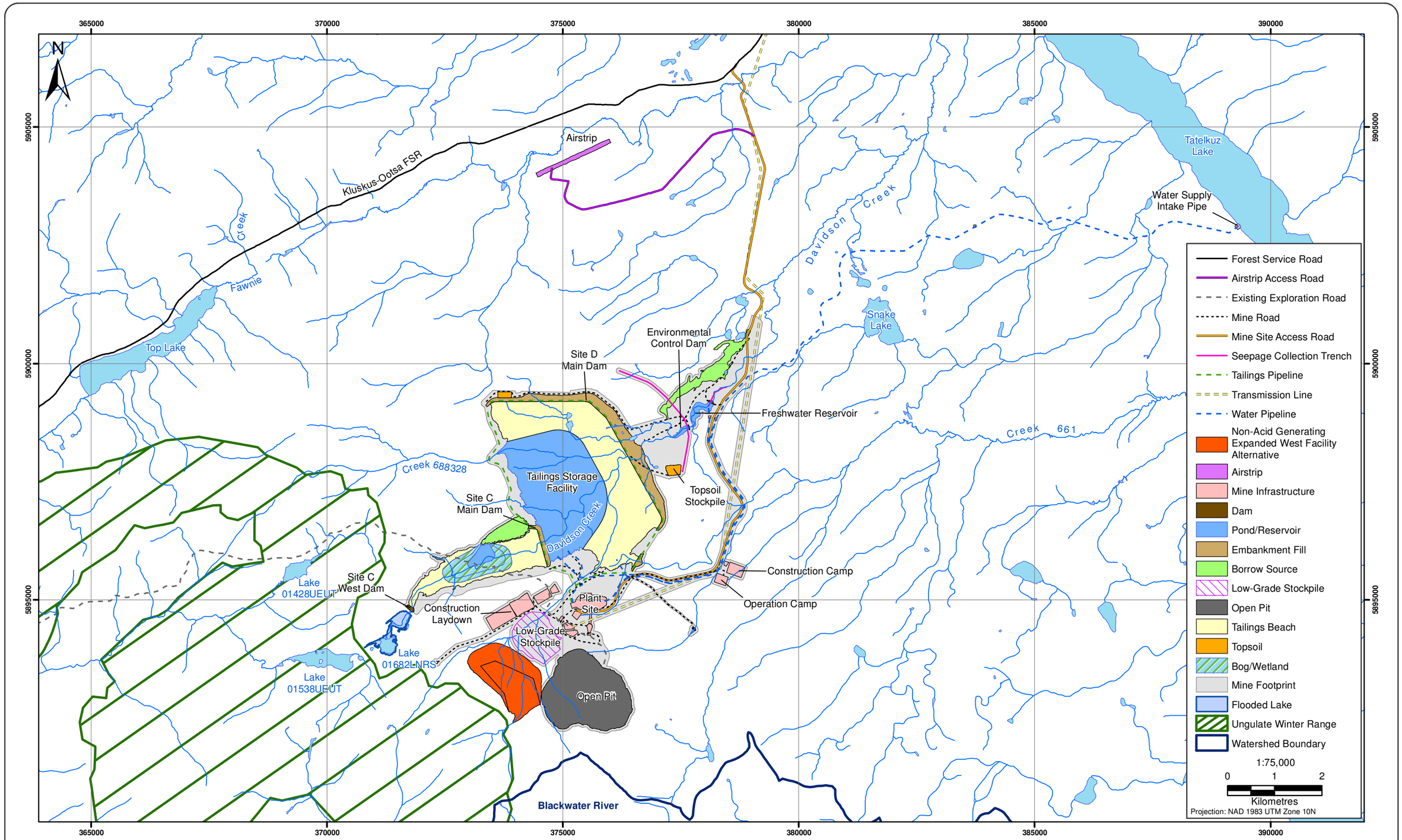


newgold

Rescan an ERM company

Figure 2.1-2

Detailed View of Combined East and West Non-Acid Generating Waste Rock Storage Option

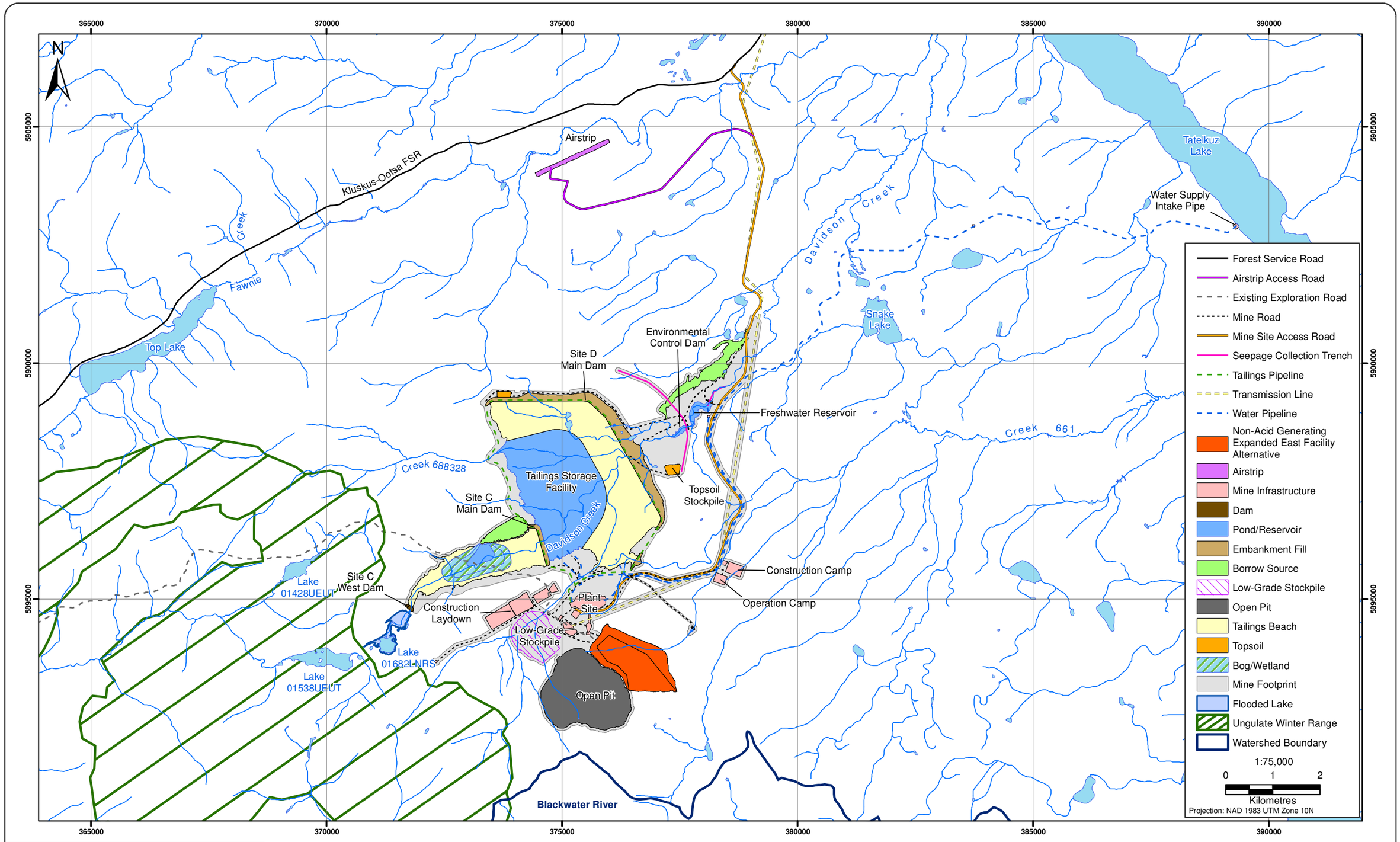


newgold

Rescan an ERM company

Figure 2.1-3

Detailed View of Expanded West Non-Acid Generating Waste Rock Storage Option

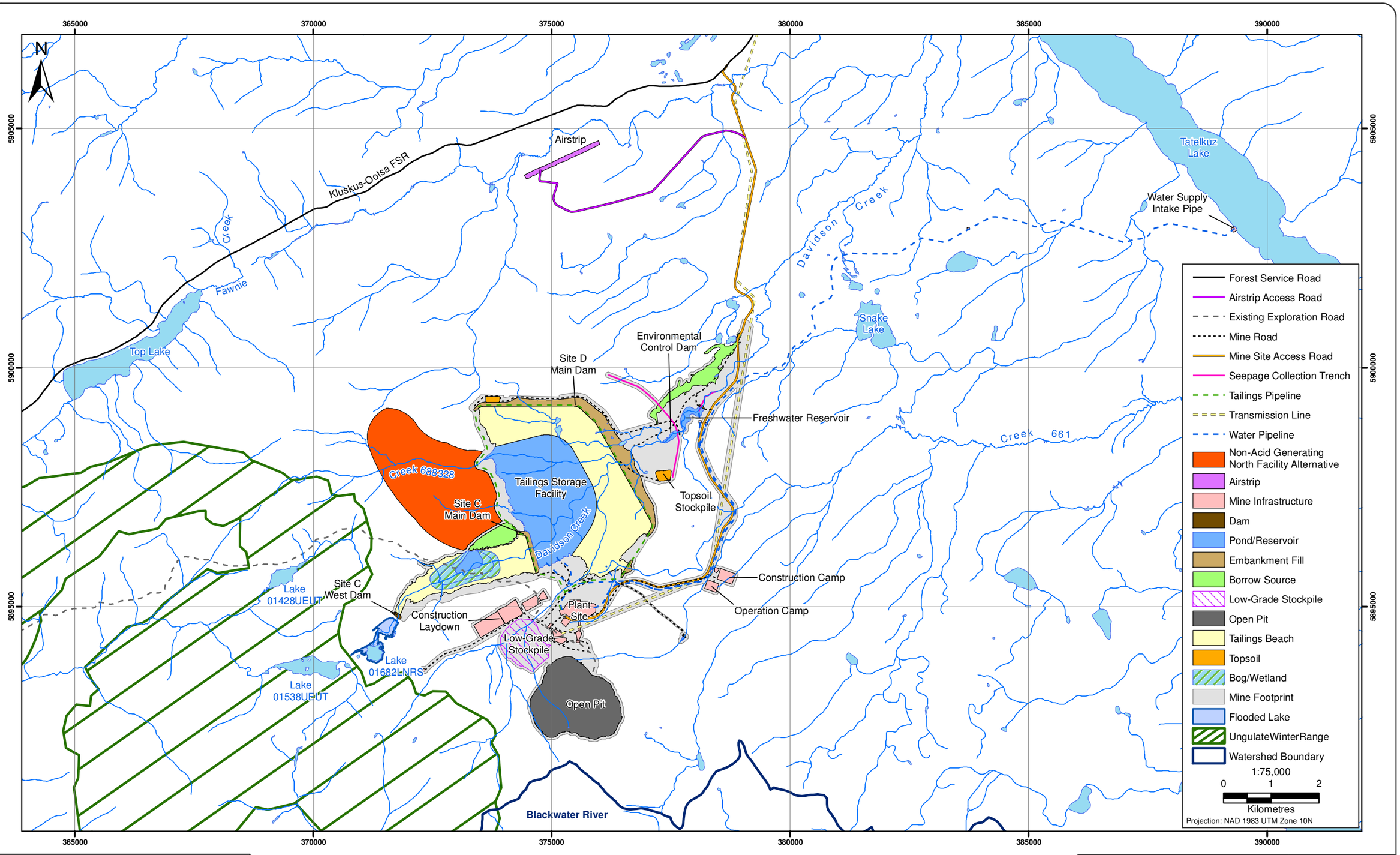


newgold

Rescan an ERM company

Figure 2.1-4

Detailed View of Expanded East Non-Acid Generating Waste Rock Storage Option



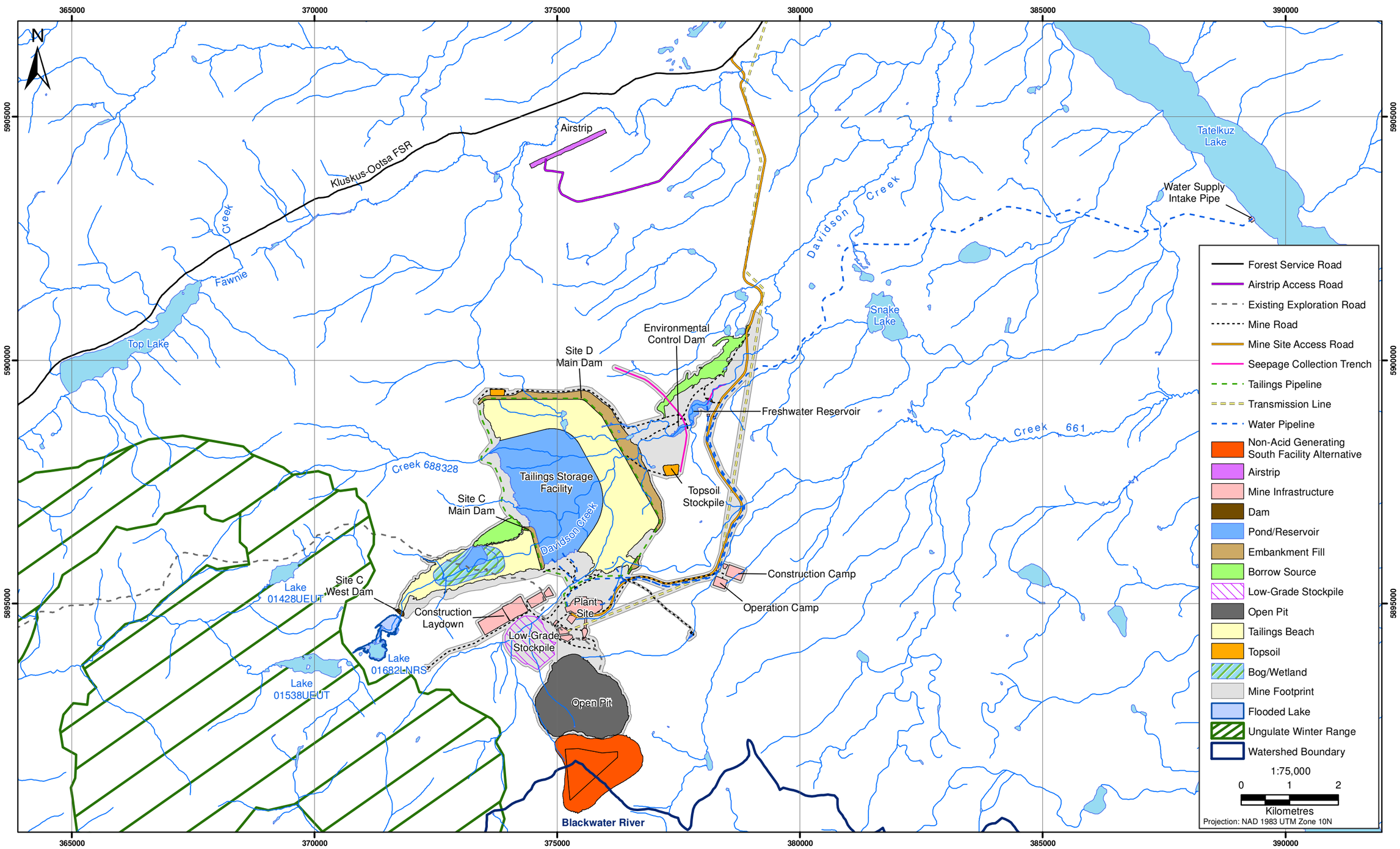
newgold

Rescan an ERM company

Figure 2.1-5

Detailed View of North Non-Acid Generating Waste Rock Storage Option

PROJECT #0215644-0001 GIS # BLW-15-034 March 10, 2014



newgold

Rescan an ERM company

Figure 2.1-6

Detailed View of South Non-Acid Generating Waste Rock Storage Option

2.2 PRE-SCREENING ASSESSMENT

The preceding section describes the five NAG waste rock facility candidate alternatives in sufficient detail as to allow for a pre-screening assessment, or "fatal flaw[1] analysis". This "fatal flaw analysis" removes the NAG waste rock facility candidate alternatives from further consideration that are non-compliant with minimum specifications developed for the Project, as per Section 2.3 of the *Guidelines* (Figure 2.2-1; Environment Canada 2011).

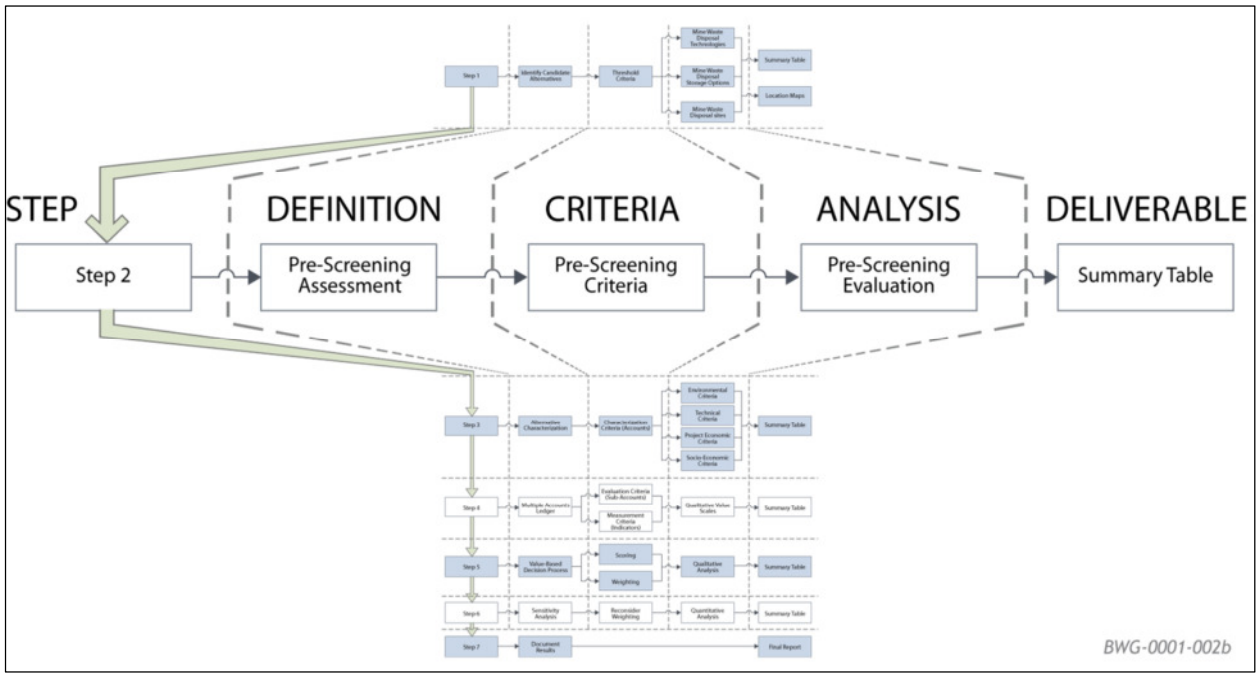


Figure 2.2-1. Pre-Screening Assessment Step

The following pre-screening criteria were applied to each of the initial five NAG waste rock storage facility candidate alternatives:

- 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 Ungulate Winter Range?

[1] A fatal flaw is defined as any site characteristic that is so unfavourable or severe that, if taken singly, it would eliminate an option as a candidate mine waste disposal alternative.

After conducting an assessment of each NAG WRS facility candidate alternative against the above pre-screening criteria, those candidate alternatives determined to have a “fatal flaw" are deemed “non-compliant” and are discarded from further assessment.

2.2.1 Results of the Pre-screening Assessment

Table 2.2-1 provides the rationale for each pre-screening criteria and applies these criteria to each candidate alternative. Explanations of why candidate alternatives meet certain criteria are provided in the text following the table.

2.2.1.1 Would the NAG WRS Facility Preclude Future Mining Exploration or Extraction of a Potential Deposit?

If a NAG WRS facility were to preclude future exploration or mining of a potential resource, that option should be excluded from further assessment. Based upon exploration and condemnation drilling conducted to date, none of the NAG WRS facility options lie above known economic mineral resources, and no options are excluded from further consideration.

2.2.1.2 Is Any Part of the NAG WRS Facility System Unproven Technology?

If any part of the mine waste disposal system is based on unproven technology, this option may provide unmanageable engineering, economic, or environmental risks. Various methods of NAG waste rock disposal are used worldwide. Efforts to decrease environmental effects and economic costs have encouraged development of new disposal methods. However, these new methods may be unproven, or provide low confidence/high uncertainty for long-term durability if technologies have only been in operations recently, or have not been employed at full-scale. However, all NAG WRS facilities discussed here utilize well-established technologies, and no options are excluded from further consideration based on this criterion.

2.2.1.3 Does the NAG Waste Rock Storage Facility Have Insufficient Capacity to Store the Proposed Upper Limit of NAG Waste Rock?

If any NAG WRS facility has insufficient capacity to store life-of-mine NAG material (total 100 Mm^3), then this option may provide unmanageable engineering, economic, or environmental risks. All NAG waste rock facilities considered here have sufficient capacities to store life-of-mine NAG material, and no options are excluded from further consideration based on this criterion.

2.2.1.4 Will the NAG Waste Rock Storage Facility Result in Negative Life of Project Economics?

Due to high haulage costs, (estimated at $0.16/tonne per km), NAG WRS facility locations must be located as close as possible to the open pit to be economically viable. The Alt NAG N is located 5.5 km from the open pit, and haulage costs are estimated to be in the order of $120M. The Alt NAG N option is considered to be uneconomical, and is excluded from further consideration.

Table 2.2-1. Pre-screening Assessment for Blackwater NAG Waste Rock Storage Facility Candidate Alternatives

Pre-Screening Criteria	Rationale	Alt NAG E/W	Alt NAG W	Alt NAG E	Alt NAG N	Alt NAG S
Would the NAG WRS facility preclude future mining exploration or extraction of a potential deposit?	If a specific storage facility interferes with future exploration or mining of resources the alternative should be excluded from further consideration.	NO	NO	NO	NO	NO
Is any part of the NAG WRS facility disposal system unproven technology?	If a specific deposition method has no precedent of being successfully implemented, then it could justifiably be argued that the alternative should be excluded from further consideration.	NO	NO	NO	NO	NO
Will the NAG WRS facility capacity be too small to store the proposed upper limit of NAG WR?	If a specific storage facility does not have sufficient capacity to store the entire mine-life waste rock, then it could justifiably be argued on economic grounds that the alternative should be excluded from further consideration.	NO	NO	NO	NO	NO
Will the NAG WRS facility result in negative life of project economics?	If a specific deposition method requires long haul distances, then it could justifiably be argued on economic grounds that the alternative should be excluded from further consideration.	NO	NO	NO	YES	NO
Will the NAG WRS facility be located partially within the Blackwater watershed?	If a specific storage facility will impact the watershed of the Blackwater River, a heritage river, the alternative should be excluded from further consideration.	NO	NO	NO	NO	YES
Will the NAG WRS facility be located in an Ungulate Winter Range?	If a specific storage facility overlaps with the designated Ungulate Winter Range for Northern Caribou, the alternative should be excluded from further consideration.	NO	NO	NO	NO	NO
Should the alternative be excluded from further assessment?	If any alternative fails the pre-screening criteria, the alternative is excluded from further assessment.	NO	NO	NO	YES	YES

2.2.1.5 Will the NAG Waste Rock Facility be Located Partially within the Blackwater Watershed?

The Blackwater River is listed as a Heritage River under the BC Heritage Rivers System by the BC Ministry of Environment (BC MOE 2010). The BC Heritage Rivers System showcases outstanding examples of a representative range of BC's most important waterways. Heritage status gives these rivers a greater public profile and focus. Heritage Rivers represent the diversity of river landscapes in terms of their natural characteristics, their historical and cultural importance to the human story of the province, and the spectrum of recreational opportunities they support (BC MOE 2010).

A Heritage River proclamation does not carry legal or regulatory power. Rather, the designation serves each river by (BC MOE 2010):

- providing a greater emphasis on river-related values during land-use planning processes;
- raising awareness of the importance of healthy river systems;
- helping to protect the special values of the river; and
- helping to build stronger public support for, and involvement in, stewardship of the river.

New Gold respects the intended purpose of a Heritage River designation and has chosen not to develop any mine infrastructure within the Blackwater River drainage (AMEC 2012). Thus, if any portion of a TSF option lies within the Blackwater River drainage, then this option should be excluded from further consideration. Option A lies partially within this watershed (see Figure 4.1-2) and is therefore not considered further in this assessment. All other options are not located within this catchment area.

The South NAG WRS facility candidate alternative lies within the Blackwater watershed, and is excluded from further consideration. All other candidate alternatives will not impact this watershed.

2.2.1.6 Will the NAG Waste Rock Storage Facility be Located in an Ungulate Winter Range?

Ungulate Winter Range (UWR) is defined as an area that contains habitat that is necessary to meet the winter habitat requirements of an ungulate species. Sections 9 and 12 of the *Government Actions Regulation* (2013d) of the *Forest and Range Practices Act* (1996a) outline the regulatory authority for establishing UWR. Caribou UWRs have legally established objectives with which most commercial and industrial operations must be consistent.

The Project area is adjacent to the Tweedsmuir-Entiako Northern Caribou UWR, which is key winter habitat used by the Tweedsmuir-Entiako Northern Caribou herd (Ecofor 2013). These Northern Caribou are listed on Schedule 1 of the Canadian *Species at Risk Act* (2002) as Threatened.

The legal direction for the Tweedsmuir-Entiako Northern Caribou herd comes from the document *Order – Ungulate Winter Range #U-7-012* dated December 30, 2005 (the Order). Mineral exploration and development activities are exempt from requirements to manage Northern Caribou through Section 6 of the Order:

> *[T]he general wildlife measures outlined in Schedule 1 do not apply for the purposes of exploration, development and production activities when these activities have been authorized*

> *for the purpose of subsurface resource exploration, development or production by the Mineral Tenure Act, the Coal Act, the Mines Act, the Petroleum and Natural Gas Act, the Pipeline Act or the Geothermal Resources Act.*

In concordance with the Northern Caribou Management Plan (Ecofor 2013) developed by New Gold, New Gold has chosen to eliminate any NAG WRS option that overlaps with UWR from further consideration. No NAG WRS facilities overlap this UWR, and no options are excluded from further consideration based on this criterion.

2.2.2 Results of the Pre-screening Assessment

The pre-screening analysis rejected one candidate alternative (South Facility) due to it being "non-compliant" with the Blackwater watershed pre-screening criteria. The three remaining candidate alternatives deemed acceptable for further characterization and assessment are:

- Option 1: Combined East and West Facilities (Alt NAG E/W);
- Option 2: Expanded West Facility (Alt NAG W); and
- Option 3: Expanded East Facility (Alt NAG E).

3. ALTERNATIVE CHARACTERIZATION

The alternative characterization describes the three NAG WRS facilities alternatives short-listed by the prefeasibility assessment using project specific characterization criteria.

These three alternatives - Alt NAG E/W, Alt NAG W, and Alt NAG E - are generally described at the beginning of this chapter and described in detail in the Characterization Criteria Summary tables (see Tables 3.3-1 through 3.3-4; Figure 3-1). The general description includes information that may not be comparable among options. This information provides a characterization of the three options with no a priori judgement assumed. Only the characterization criteria that can be directly compared among the three alternative options are presented in Tables 3.3-1 through 3.3-4.

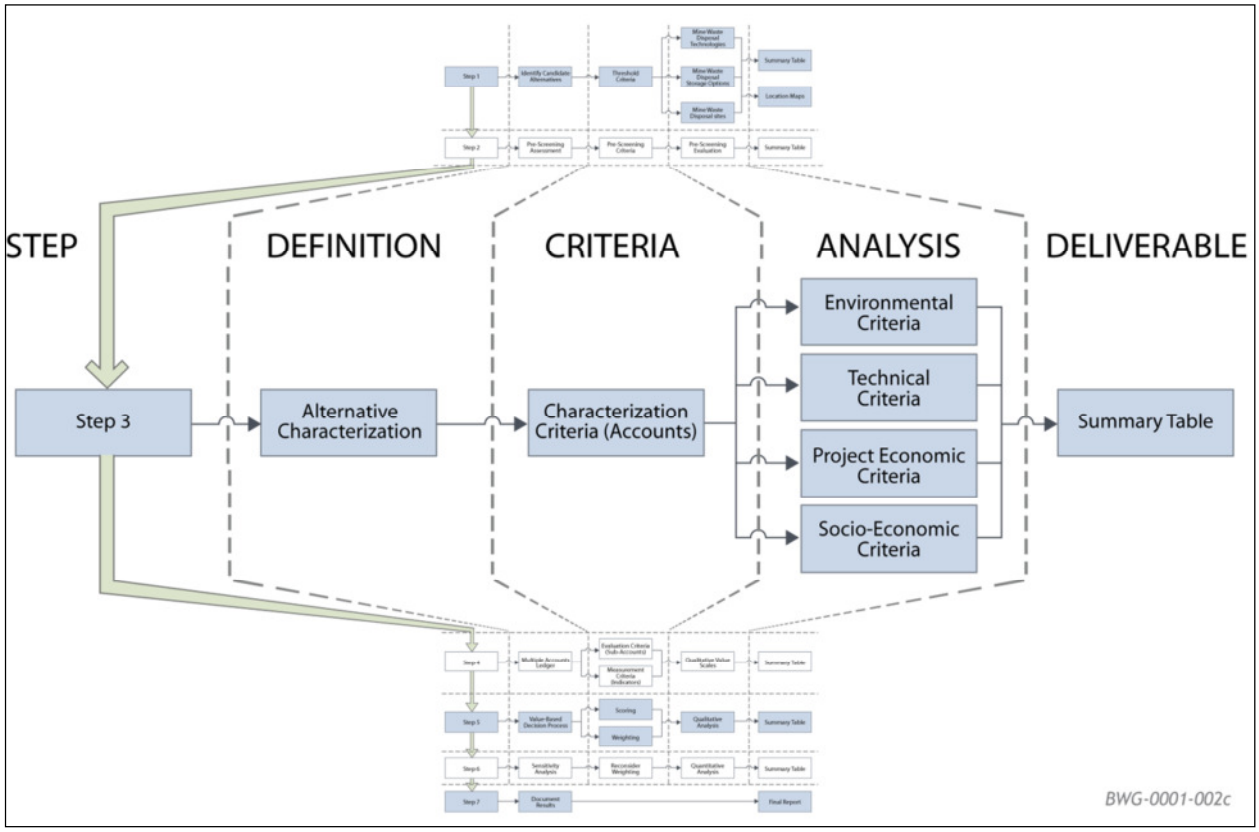


Figure 3-1. Alternative Characterization Step

The Characterization Criteria Summary tables are the primary deliverables of the Alternatives Characterization step as per section 2.4 of the *Guidelines* (Environment Canada 2011). They provide the characterization criteria, the rationale for the selection of each criterion, the descriptions corresponding to each criterion for each alternative, and information on whether or not a characterization criterion will be carried forward to the next step, the multiple accounts ledger, as an evaluation criterion.

This assessment is administered by Environment Canada and follows the multiple accounts analysis as defined in the *Guidelines*. However, the *Guidelines* do not prescribe a method for the selection of characterization criteria. The Proponent has decided to follow the direction provided in the Canadian Environment Assessment Agency's (2013) *Operational Policy Statement Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012.* This guidance suggests that the effects of a Project's alternative means be assessed for each of the Project's Valued Components (VCs) by "*Identify[ing] the VCs potentially affected by each alternative means*", and "*Examin[ing] briefly the potential effects on the VCs for each alternative means*". Table 3-1 provides a list of the Project's selected VCs (New Gold 2014). As these VCs were selected to evaluate the potential impacts of the entire Project on environmental, social, heritage, health and economic aspects, not all of these VCs are relevant to the evaluation of NAG WRS facility alternatives. The rationale for exclusion of Project VCs from these analyses are provided in Table 3-1. If the VCs are included in for analysis, then Table 3-1 provides a list of indicators to highlight how these VCs were considered.

For this assessment's technical account, the *Guidelines* (Environment Canada 2011) were used as guidance for characterization criteria selection.

Table 3-1. Valued Components for the Blackwater Gold Project

Blackwater Gold Project Valued Components	Included in Assessment of NAG WRS Facility Alternatives	Rationale for Exclusion or Description of How Valued Component is Considered in the Analysis
Environment Valued Components		
Noise and vibration	No	Noise and vibration effects associated with each NAG WRS location are not available, and are unlikely to be differentiating among alternatives.
Climate change	No	Vehicle emissions
Air quality	Yes	Fugitive dust
Surface water flow	Yes	Watersheds affected; Reduction in catchment area
Surface water quality	No	Surface water quality
Groundwater flow	Yes	Groundwater quantity
Groundwater quality	Yes	Groundwater quality
Wetlands	Yes	Wetland ecosystems; Rare and endangered ecosystems
Fish Habitat	Yes	Stream length affected; Extent of permanent alteration to or destruction (PAD) of fish habitat; Stream length affected
Fish	Yes	Number of fish species directly affected; Fish and aquatic species at risk
Physiography and topography	No	All three NAG WRS options are constructed, operated and closed using the same general technologies and occupy similar footprint; thus, these options will not have differential susceptibilities to or impacts on physiography and topography.
Surficial geology and soil cover	No	The effects of the NAG WRS alternatives on soil quality are not anticipated to be differentiating among alternatives as all options will be reclaimed during the Project's closure phase.

(continued)

Table 3-1. Valued Components for the Blackwater Gold Project (continued)

Blackwater Gold Project Valued Components	Included in Assessment of NAG WRS Facility Alternatives	Rationale for Exclusion or Description of How Valued Component is Considered in the Analysis
Environment Valued Components *(cont'd)*		
Soil quality	No	The effects of the NAG WRS alternatives on soil quality are not anticipated to be differentiating among alternatives as all options will be reclaimed during the Project's closure phase.
Ecosystem composition	Yes	Rare and endangered ecosystems
Plant species and ecosystems at risk	Yes	Rare plant species; rare and endangered ecosystems
Amphibians	Yes	High-quality amphibian habitat
Water birds	Yes	high-quality bird habitat; birds – species of conservation concern
Forest and grassland birds	Yes	High-quality bird habitat; birds – species of conservation concern
Moose	Yes	Moose high-quality habitat
Caribou	Yes	Caribou high-quality habitat
Grizzly bear	Yes	Grizzly bear high-quality habitat
Furbearers	Yes	American marten high-quality habitat
Bats	Yes	Myotis spp. high-quality habitat
Invertebrates	Yes	Invertebrate high-quality habitat
Social Valued Components		
Demographics	No	Any potential changes in demographics due to the construction, operation, and closure of the NAG WRS alternatives is beyond the scope of the Project's environmental assessment and data were not available for comparison in this analysis. As well, any potential changes to demographics resulting from the various NAG WRS alternatives are unlikely to be differentiating as the alternatives considered here utilize similar technologies and occupy similar footprints.
Regional and community infrastructure	No	Any potential changes in regional and community infrastructure due to the construction, operation, and closure of the NAG WRS alternatives is beyond the scope of the Project's environmental assessment and data was not available for comparison in this analysis. As well, any potential changes to regional and community infrastructure resulting from the various NAG WRS alternatives are unlikely to be differentiating among alternatives as the alternatives considered here utilize similar technologies and occupy similar footprints.

(continued)

Table 3-1. Valued Components for the Blackwater Gold Project (continued)

Blackwater Gold Project Valued Components	Included in Assessment of NAG WRS Facility Alternatives	Rationale for Exclusion or Description of How Valued Component is Considered in the Analysis
Social Valued Components *(cont'd)*		
Regional and local services	No	Any potential changes in regional and local services due to the construction, operation, and closure of the NAG WRS alternatives options is beyond the scope of the Project's environmental assessment and data were not available for comparison in this analysis. As well, any potential changes to regional and local services resulting from the various the NAG WRS alternatives are unlikely to be differentiating as the alternatives considered here utilize similar technologies and occupy similar footprints.
Family and community well-being	No	Any potential changes in family and community well-being due to the construction, operation, and closure of the NAG WRS alternatives options is beyond the scope of the Project's environmental assessment and data were not available for comparison in this analysis. As well, any potential changes to family and community well-being resulting from the various NAG WRS alternatives are unlikely to be differentiating as the alternatives considered here utilize similar technologies and occupy similar footprints.
Non-traditional land and resource use	Yes	Forestry tenures; agriculture and range tenures; guide-outfitting tenures; trapline tenures; commercial recreation tenures; mineral claims; recreational sensitivity; parks and protected areas
Current land use for traditional purposes	Yes	Traditional territory overlapped (area)
Visual resources	No	As the Project is relataively isolated from local communities, including Indian Reserves, provincial parks and protected areas, and recreational areas, visual resources are not anticipated to be differentiating among alternatives.
Heritage Valued Components		
Archaeological sites	Yes	Known archaeological sites
Historic heritage sites	Yes	Known heritage resource sites
Paleontological resources	No	No known paleontological resources occur within any of the proposed NAG WRS alternatives.
Human Health Valued Components		
Environmental exposures	No	Land use of the Project area for traditional and non-traditional purposes is limited; Project activities will adhere to all applicable laws and standards; as such public and worker health and safety concerns are not expected to be differentiating among NAG WRS alternatives.
Workers health and safety	No	Project activities will adhere to all applicable laws and standards; as such worker health and safety concerns are not expected to be differentiating among NAG WRS alternatives.

(continued)

Table 3-1. Valued Components for the Blackwater Gold Project (completed)

Blackwater Gold Project Valued Components	Included in Assessment of NAG WRS Facility Alternatives	Rationale for Exclusion or Description of How Valued Component is Considered in the Analysis
Economic Valued Components		
Provincial economy	Yes	Initial capital costs; operating costs; closure costs; fish habitat compensation costs
Regional and local employment and businesses	No	Any potential changes in regional and local employment due to the construction, operation, and closure of the NAG WRS alternatives is beyond the scope of the Project's environmental assessment and data were not available for comparison in this analysis.
Regional and local government finance	No	Any potential changes in regional and local government finance due to the construction, operation, and closure of the NAG WRS alternatives is beyond the scope of the Project's environmental assessment and data were not available for comparison in this analysis. As well, any potential changes to regional and local government finance resulting from the various NAG WRS alternatives are unlikely to be differentiating as the alternatives considered here utilize similar technologies and occupy similar footprints.

3.1 DATA SOURCES FOR ALTERNATIVES CHARACTERIZATION

Section 5.1 of the report: *Blackwater Gold Project: Assessment of Alternatives for the Blackwater Gold Project Tailings Storage Facility* (ERM Rescan 2014) describes the data sources and anlyses used for the generation of characterization criteria. Sections 3.2 and 3.3 of this report present the characterization summaries for the three short-listed NAG stockpile location options.

The *Guidelines* state that when choosing indicators, thought should be given to parameters that will be used to define measurability (i.e., describing alternatives using quantitative data rather than qualitative data). However, in certain cases, non-parametric data can be used to sufficiently characterize and compare alternatives.

With respect to quantifying surface water quality and groundwater quality, all contact surface water and groundwater will report to either the pit or the TSF where runoff will be treated as part of the TSF management process (see relevant descriptions in Section 3.2). The assessment for these indicators was risk-based (i.e., minimal risk from combined and west dump as contact water and groundwater reports to pit or TSF), and some risk for the east dump as seepage may reach Creek 661. The level of characterization is sufficient to differentiate the alternatives with respect to effects on surface water quality and hydrogeology.

With respect to waste haulage distance, exact waste haulage distances will be determined throughout the life of the Project, as opportunities for optimization are identified. Currently, waste haulage distances can only be assessed qualitatively. However, due to the large differences in the contributing factors (primarily the change in elevation between the pit and the dumps), the differentiation in waste haulage distance among alternatives is sufficient using a qualitative scale.

With respect to capital, operational and closure costs, the differences in costs among the NAG options will primarily be directly proportional to the differences in haulage distances. Thus, costs differentials for the alternatives can be evaluated qualitatively.

3.2 DETAILED DESCRIPTION OF NON-ACID GENERATING WASTE ROCK STORAGE FACILITY ALTERNATIVES

3.2.1 Combined East and West Facility (Alt NAG E/W)

3.2.1.1 Technical

General Description

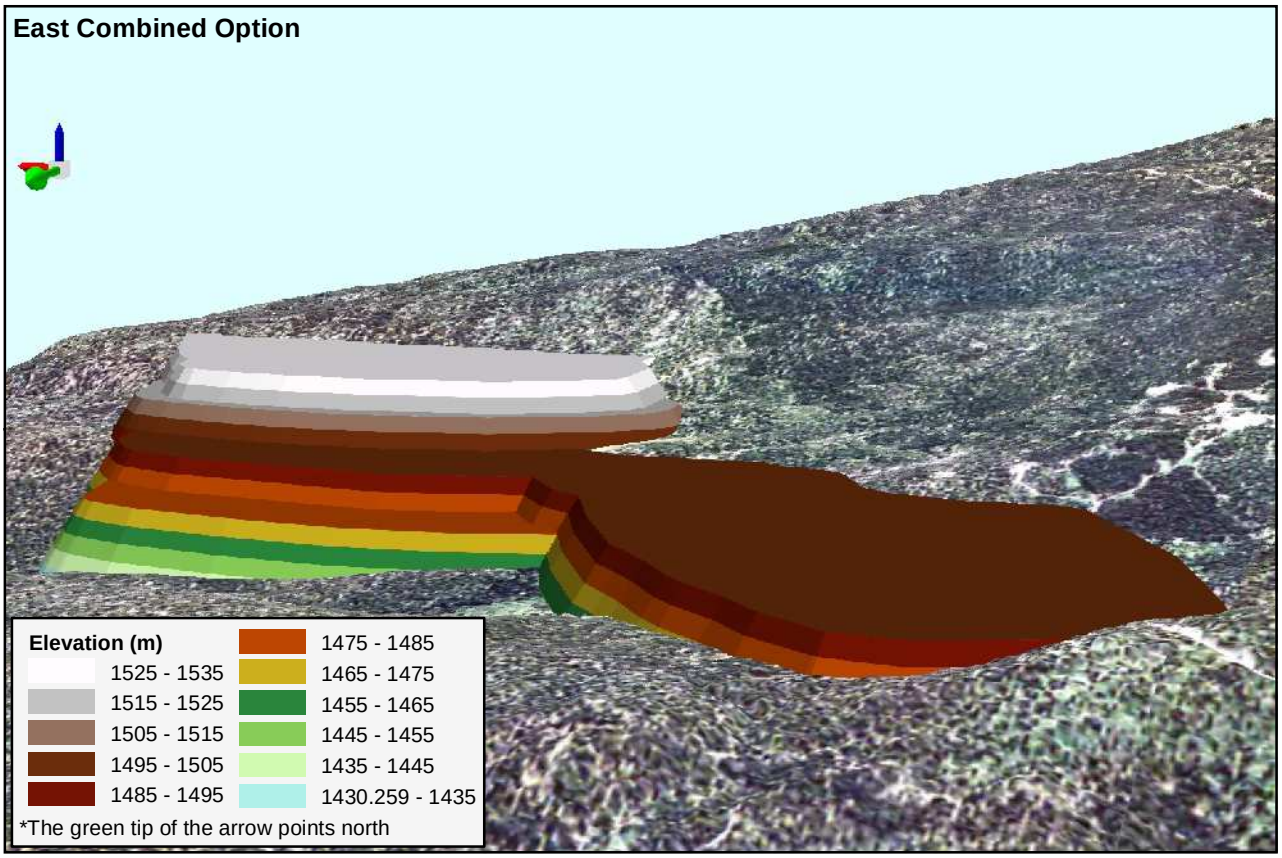
The combined East and West Facility (Alt NAG E/W) will involve the construction, operation, and closure of two waste rock dumps - the West dump to the immediate west of the open pit and the East dump to the immediate east (Figure 3.2-1). The West dump will be located in a low-gradient area sloping to the northwest. The East dump will be located in a low-gradient area that slopes to the northeast. NAG waste and overburden material not used for construction of the TSF will be placed in either the East or West dump locations. All NAG4 material will be placed in the West dump in order 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 (New Gold Inc. 2014).

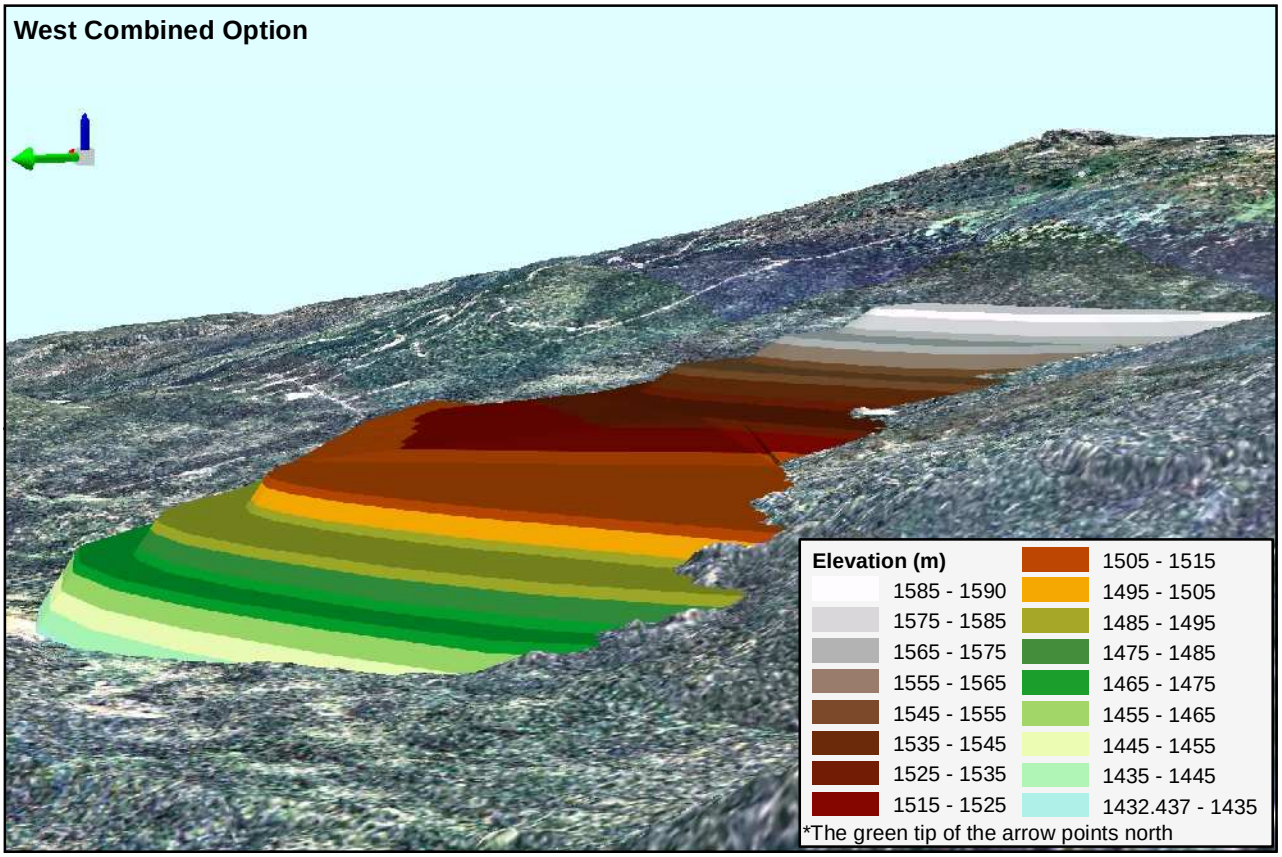
Under the West dump, the geotechnical conditions are characterized by surficial materials ranging from 18 m to 75 m thick which are thickest at lower elevations. Several eskers and localized kames and ablation till were identified in the footprint area of the West dump. Static groundwater levels range from 3 m to 4 m below surface and mirror the subsurface surficial topography (New Gold Inc. 2014). These geotechnical conditions provide appropriate foundations for dump construction, operation, and closure. These geotechnical conditions provide appropriate foundations for dump construction, operation, and closure, although they may require somewhat greater initial engineering effort than for the East dump due to the presence of eskers and kames.

Under the East dump, the geotechnical conditions are characterized by a surficial material sequence ranging from 24 m to 108 m thick, with the thickest deposits at the lower elevations. A sub-glacial 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. The bedrock geology consists of andesitic volcanic rocks that are highly weathered at less than 5 m depth (New Gold Inc. 2014).

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 (New Gold Inc. 2014).

During construction, 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 upper layer will be spoiled in a windrow and buried beneath the dump. A total of 63 Mm^3 of material will be stored in these waste rock dumps outside of the TSF.





newgold

Combined East and West Non-Acid Generating Waste Rock Storage Option

Figure 3.2-1

Rescan an ERM company

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. Surface water runoff during operations and at closure will be diverted around the dump to the TSF. These surface water diversions will be field-fit with the advancing fill platforms. The dumps will be developed with overall slopes to facilitate reclamation with growth media at closure (New Gold Inc. 2014).

The West Dump of the Alt NAG E/W option will progressively reclaimed over the life-of-mine. Over the life-of-mine, maximum slope angles will be 1.3H:1V, although a maximum slope angle of 3H:1V is designed during reclamation. Maximum facility lift height will be 40 m. The dumps will be covered with 0.3 m of overburden at the end of mine life, and will be re-vegetated (AMEC 2013b).

Complexity of Containment/Physical Characterization of Waste

The Alt NAG E/W is the best option among the three considered in this assessment in terms of the complexity of containment and the physical characterization of waste. The Alt NAG E/W option has the simplest containment considerations of the options considered in this analysis, primarily due to the division of material into two waste streams, which has the following advantages:

- Waste can be separated into two streams depending on the potential for metal leaching. NAG4 waste, which has a higher metal leaching potential, could be isolated in one dump, while, NAG5 waste with lower metal leaching potential could be isolated in the other, improving accessibility of NAG5 material for construction purposes.
- Overburden material can be more dispersed among the NAG WR, which may increase the geotechnical stability of the dump (i.e., less overburden material contained within a single dump).
- Waste deposition can be optimized based on the elevation differences in the dumps. The east dump is lower in elevation than the west dump and as the pit is developed through Project operations, the pit rim, which will start close to the elevation of the West dump, will eventually reach the elevation of the East dump. Thus, early in the Project, waste can be hauled to the West dump, and then waste deposition can be prioritized in the East dump when the pit rim is closer in elevation. This optimization reduces the distance that waste will be hauled over the life-of-mine and reduces GHG emissions as less uphill hauling is required.
- Lower overall slopes of the facilities minimizes the risk of material run out.
- Placement of material can be staged such that wet or unstable material placed in one dump can be allowed to dry or stabilize, while operations move to the other dump.
- Lower vertical uphill haulage distances decrease construction time of lifts, and decrease engineering challenges associated with creating a steeper facility.
- High potential expansion capacity allowed for by large degree of terracing.

Footprint Area

The Alt NAG E/W has the highest footprint of the three options considered in this assessment. The expected footprint area of this option is approximately 271 hectares.

Water Treatment

As all contact surface water and groundwater will report to the TSF during operations, no water treatment would be required for the Alt NAG E/W option. Minimal unrecoverable seepage might eventually reach Creek 661 from the East Dump but no significant effect is predicted (Application/ EIS, Section 5.3.6).

3.2.1.2 Environmental

Surface Water

Placement of site infrastructure including the NAG facilities will require diversion or elimination of some stream reaches. The east dump is located in the Creek 661 drainage and the west dump is located in the Davidson Creek drainage; the TSF and all associated water management infrastructure occur in the Davidson Creek drainage. Both the east and west dumps overlap small intermittent drainages, with the creek located within the west dump already being diverted due to TSF construction.

A total of 4.2 km of streams would be eliminated due to Alt NAG E/W, resulting in a decrease of 736 ha in Davidson Creek catchment (10% of total Davidson Creek catchment of 7,783 ha) and 347 ha in Creek 661 catchment (6% of total Creek 661 catchment of 5,858 ha) to the downstream catchment areas. Some flow may be mitigated by diverting water around infrastructure or pumping freshwater from a local lake to maintain surface water quantity.

Water quality in the Davidson Creek receiving environment is not expected to be impacted by the Alt NAG E/W option as surface water is designed to report to the TSF via gravity flow where runoff would be treated as a part of the TSF management process. Some water quality effects may occur to the receiving environment of Creek 661, as it may not be possible to capture all seepage and runoff through the east dump. However, as only non-ML material will be stored in the east dump, these effects would not be significant (Application/EIS, Section 5.3.6).

Groundwater

Construction of the NAG WRS facilities will alter the pattern of groundwater flow in the Project area. In particular the placement of rock in the Alt NAG E/W will result in mounding of groundwater and increased pressure head and thus an increased groundwater flow. The groundwater flow from the West Dump will flow to the TSF and from the East Dump will be captured in the collection ditch east of the dump while a small amount of unrecoverable seepage may eventually reach Creek 661 as described above.

As NAG4 waste will only be placed in the West Dump, any groundwater affected by ML from this dump will ultimately report to the TSF; thus, downstream effects on groundwater quality due to the west dump are expected to be negligible. As only non-ML NAG5 and overburden material will be placed in the east dump, potential effects to groundwater quality on Creek 661 are low and were considered in the Application/EIS.

Air Quality

The main source of potential air quality impacts due to the NAG dumps comes from emissions during trucking of rock to the dump sites, and from fugitive dust along the haul roads and during

placement of material in the dump sites. The two-dump design of Alt NAG E/W option reduces overall haulage distances through optimization of waste placement (see Section 3.2.1.1); thus, Alt NAG E/W will have the lowest air quality effects due to emissions and fugitive dust from waste haulage and placement.

Prevailing and local wind may transport fugitive dust from the dump sites; this transport is influenced by the height and slope of each dump. To minimize fugitive dust, a terraced-design would be incorporated into both the east and the west dump design (see Figure 3.2-1), and air quality effects from this dump configuration are expected to be not significant.

Vegetation, Ecosystems, and Wetlands

No plant species of concern, including whitebark pine (*Pinus albicaulis*), were identified as occurring within the footprint of the Alt NAG E/W option during baseline studies (AMEC 2013a).

Based on Terrestrial Ecosystem Mapping (TEM), a total of 117 ha of wetlands occur within the footprint of the Alt NAG E/W, as well as a total of 15.7 ha of blue-listed wetlands (AMEC 2013e; BC CDC 2013).

No other ecosystems of conservation concern were mapped within the footprint.

Wildlife

During baseline studies, all wildlife observations of species of conservation concern within the Alt NAG E/W were of barn swallows (*Hirundo rustica*). Although no nesting was observed for this species, eight observations of were recorded over a period of three years in the East dump location (AMEC 2013f). This species is protected under the *Migratory Birds Convention Act* (1994), is listed as Threatened under the Committee for the Status of Endangered Wildlife in Canada (COSEWIC), is blue-listed in BC (BC CDC 2013), and is listed in the Project's Section 79(1) notification under the *Species at Risk Act* (2002; see Appendix D of the TSF Alternatives Assessment Report).

The Alt NAG E/W footprint also overlaps with high quality habitat for several wildlife species (Table 3.2-1).

Table 3.2-1. Wildlife Habitat Requirements Affected by Alt NAG E/W

Species	Life Requirement	Habitat (ha)	Total Habitat (ha)[1]
Amphibian	High-quality habitat	0	0
Invertebrate	High-quality habitat	16	16
Caribou	Feeding winter	8	
	Feeding spring	8	
	Feeding summer	9	
	Security/thermal - winter	66	
	Security/thermal - growing	39	66

(continued)

Table 3.2-1. Wildlife Habitat Requirements Affected by Alt NAG E/W (completed)

Species	Life Requirement	Habitat (ha)	Total Habitat (ha)[1]
Moose	Security/thermal - winter	23	
	Security/thermal - growing	9	
	Feeding winter	181	
	Feeding growing	25	182
American Marten	Living winter	25	
	Living growing	9	25
Grizzly Bear	Feeding spring	32	
	Feeding summer	81	
	Feeding fall	81	
	Security/thermal - growing	45	
	Hibernating	65	81
Myotis spp.	High-quality habitat	156	156
Birds (Olive-sided Flycatcher)	High-quality habitat	1	1
Birds (Olive-sided Flycatcher and Red-tailed Hawk)	High-quality habitat	1	1

[1] *Total habitat calculated using overlap of lifestage requirements.*

Fish and Fish Habitat

The Project ALSA and ARSA supports twelve species of fish including Kokanee (*Oncorhynchus nerka*), Rainbow Trout (*Oncorhynchus mykiss*), Lake Chub (*Couesius plumbeus*), Longnose Sucker (*Catostomus catostomus*), Brassy Minnow (*Hybognathus hankinsoni*), Mountain Whitefish (*Prosopium williamsoni*), Burbot (*Lota lota*), Longnose Dace (*Rhinichthyes cataractae*), Slimy Sculpin (*Cottus cognatus*), Northern Pikeminnow (*Ptycheilus oregonensis*), Largescale Sucker (*Catostomus macrocheilus*), and White Sucker (*Catostomus commersonii*). Only Rainbow Trout is potentially found in the footprint of the proposed Alt NAG E/W (AMEC 2013b).

The Alt NAG E/W option consists of two dumps located in two watersheds; the West dump is located in the Davidson Creek watershed and the East dump is in the Creek 661 watershed. Baseline studies did not extensively sample within the footprint of the Alt NAG E/W option, but Rainbow Trout (*Oncorhynchus mykiss*) were the only species collected within the headwaters of Davidson Creek and Creek 661. No barriers to fish movement were identified in the potentially affected reaches, so fish may seasonally use these sections of each stream (AMEC 2013b). For the purposes of this assessment, these streams are considered to be fish-bearing.

Rainbow Trout habitat within the footprint of the west portion of the Alt NAG E/W option generally declined with upstream distance in the Davidson Creek watershed. Rearing habitat was fair or good in most streams but migration habitat declined from good in second order tributaries to poor or none in first order tributaries. Winter habitat in the upper reaches of Davidson and 661 creeks were rated as poor, suggesting that these sections provide temporary habitat during spring and summer (AMEC 2013b).

Rainbow Trout habitat quality was not extensively assessed in reaches of Creek 146920 within the footprint of east portion of the Alt NAG E/W option. However, Rainbow Trout are presumed to be present in potentially affected stream reaches due to fair or good quality rearing and migration habitat in reaches directly downstream.

Kokanee (*Oncorhynchus nerka*) spawn in the lower reaches of both the Davidson and 661 creek watersheds. Mountain Whitefish (*Prosopium williamsoni*) use of Davidson or 661 creeks is limited and are predominately found over 20 km away in Chedakuz Creek and Tatelkuz Lake Habitat within the footprint of either dump site is not utilised by either species throughout their life history.

The construction of the Alt NAG E/W option would result in the permanent alteration to, or destruction (PAD) of, fish habitat in an area of approximately 0.7 ha. Potentially impacted fish habitat in the footprint of the west dump is in the upper reaches of several tributaries to Davidson Creek. Potentially impacted fish habitat in the footprint of the East dump is in Creek 146920, a tributary of Creek 661. A total of 4.7 km of streams would be isolated upstream of the NAG area as it would create a permanent barrier to fish passage.

The Brassy Minnow is a blue-listed species in BC and is classified as sensitive or vulnerable (BC CDC 2013). This species is known to inhabit Tatelkuz Lake, downstream of the Combined East and West storage, via Creek 661. Blue-listed taxa are at risk, but are not extirpated, endangered or threatened. Brassy Minnow is not ranked by the COSEWIC or listed under the *Species at Risk Act* (2002d). This species has not been identified in the Project's Section 79(1) notice under the *Species at Risk Act* (2002d).

3.2.1.3 Socio-economics

Aboriginal Interests

The Alt NAG E/W option is located within the traditional territories of the Lhoosk'uz Dene Nation, Ulkatcho First Nation, and Skin Tyee Nation.

Commercial Land Uses

The Alt NAG E/W option may temporarily (construction and operations) affect trapping due to potential displacement and a reduction in available wildlife. The Alt NAG E/W option is located within trapline tenure TR0512T027. A total of 271 ha of the tenure is located within the combined Alt NAG E/W option, representing 0.7% of the total tenure area.

Guide outfitting tenures may be temporarily (construction and operations) affected by the combined Alt NAG E/W option due to potential displacement and reduction of available wildlife. The Alt NAG E/W option is located within guide outfitter tenure 601039. A total of 271 ha of tenure 601039 are located in the combined Alt NAG E/W option, representing 0.5% of the total tenure area.

There are no mineral tenures not held by New Gold, forest tenures, agriculture or range tenures or commercial recreation tenures that overlap with the Alt NAG E/W option.

Recreational Land Uses

The Alt NAG E/W option is located within 0.015 ha of area of recreational sensitivity, rated as moderately vulnerable to alterations caused by resource development and as having high significance.

No parks, protected areas or ecological reserves are located within the combined East and West Facility option area.

Heritage

The East dump of the Alt NAG E/W option overlaps three historical heritage resource sites: remnants of a cabin thought to be occupied from 1940 to 1980, and two culturally modified tree sites (dated to the post-contact era). The West dump of the Alt NAG E/W option overlaps one tree blaze site, likely associated with mineral exploration activities.

The Alt NAG E/W option does not overlap any known archaeological sites.

3.2.1.4 Project Economics

The relative Proponent costs for Alt NAG E/W alternative are estimated from their construction, operation and closure considerations (see Section 3.2.1.1); e.g., footprint area, complexity of containment, and ease of closure.

Capital Costs

The Alt NAG E/W option will result in the lowest capital costs among the options considered in this assessment. Fewer haul trucks would be required given the shorter haul distance offset somewhat by the need to prepare two dump foundations.

Operational Costs

The Alt NAG E/W option will result in the lowest operational costs among the options considered in this assessment. The ability to split waste into two streams reduces operation costs by decreasing haulage distances, minimizing the risk of any schedule delays, minimizes engineering costs associated with dump stabilization, and provides easier access to construction materials.

Closure Costs

The Alt NAG E/W option will result in higher closure costs to the other options considered in this assessment because this option will require the closure of two dumps. However, the West dump will be progressively reclaimed and closed, which will reduce engineering risks and their associated costs.

Fish Habitat Compensation Costs

The Alt NAG E/W option will result in PAD of approximately 0.7 ha. The approximate habitat compensation cost for this PAD is $1.45M.

3.2.2 Expanded West Facility (Alt NAG W)

3.2.2.1 Technical

General Description

The Expanded West Facility (Alt NAG W) will involve the construction, operation and closure of one waste rock dump, the West dump to the immediate west of the open pit (Figure 3.2-2). The Alt NAG W option will be located in a low-gradient area sloping to the northwest, and will occupy a very similar footprint to the west dump of the Alt NAG E/W option. A total of 63 Mm^3 of NAG waste and overburden material, not used for construction of the TSF, will be placed in the dump of the life-of-mine. Dump runoff will report to the TSF (New Gold Inc. 2014).

Under the Alt NAG W dump, the geotechnical conditions are characterized by surficial materials ranging from 18 m to 75 m thick which are thickest at lower elevations. Several eskers and localized kames and ablation till were identified in the footprint area of this option. Static groundwater levels range from 3 m to 4 m below surface and mirror the subsurface surficial topography (New Gold Inc. 2014). These geotechnical conditions provide appropriate foundations for dump construction, operation, and closure, although they may require greater initial engineering effort than for the east dumps due to the presence of eskers and kames.

NAG waste (NAG4 and 5) and overburden, not used for construction of the TSF, will be placed in the dump in a single waste stream. Mined overburden will be distributed within the dump with a minimum of 10% waste rock to provide plating and maintain the overall integrity of the waste dump. Dump runoff will report to the TSF.

During the Project's construction phase, 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 upper layer will be spoiled in a windrow and buried beneath the dump. Water that infiltrates through the Alt NAG W will be collected at the base of the dump in a collection pond and directed by gravity to the TSF. Surface water runoff during operations and at closure will be diverted around the dump to the TSF. These surface water diversions will be field-fit with the advancing fill platforms. The dump will be developed with overall slopes to facilitate reclamation with growth media at closure (New Gold Inc. 2014).

The design of the plan for closure is a considered with regard to degree of acceptability for closure at the end of the mine life. The Alt NAG W option design is not conducive to progressive reclamation, and dump closure activities will occur during the Project's closure phase.

Complexity of Containment/Physical Characterization of Waste

The Alt NAG W is the less suitable than the Alt NAG E/W option in terms of the physical characterization of waste and the complexity of containment. The deposition of all waste rock and overburden into a single facility has the following disadvantages:

- Waste cannot be separated into two streams depending on the potential for metal leaching, which decreases the availability of NAG5 material for construction purposes (e.g., re-handling potential).

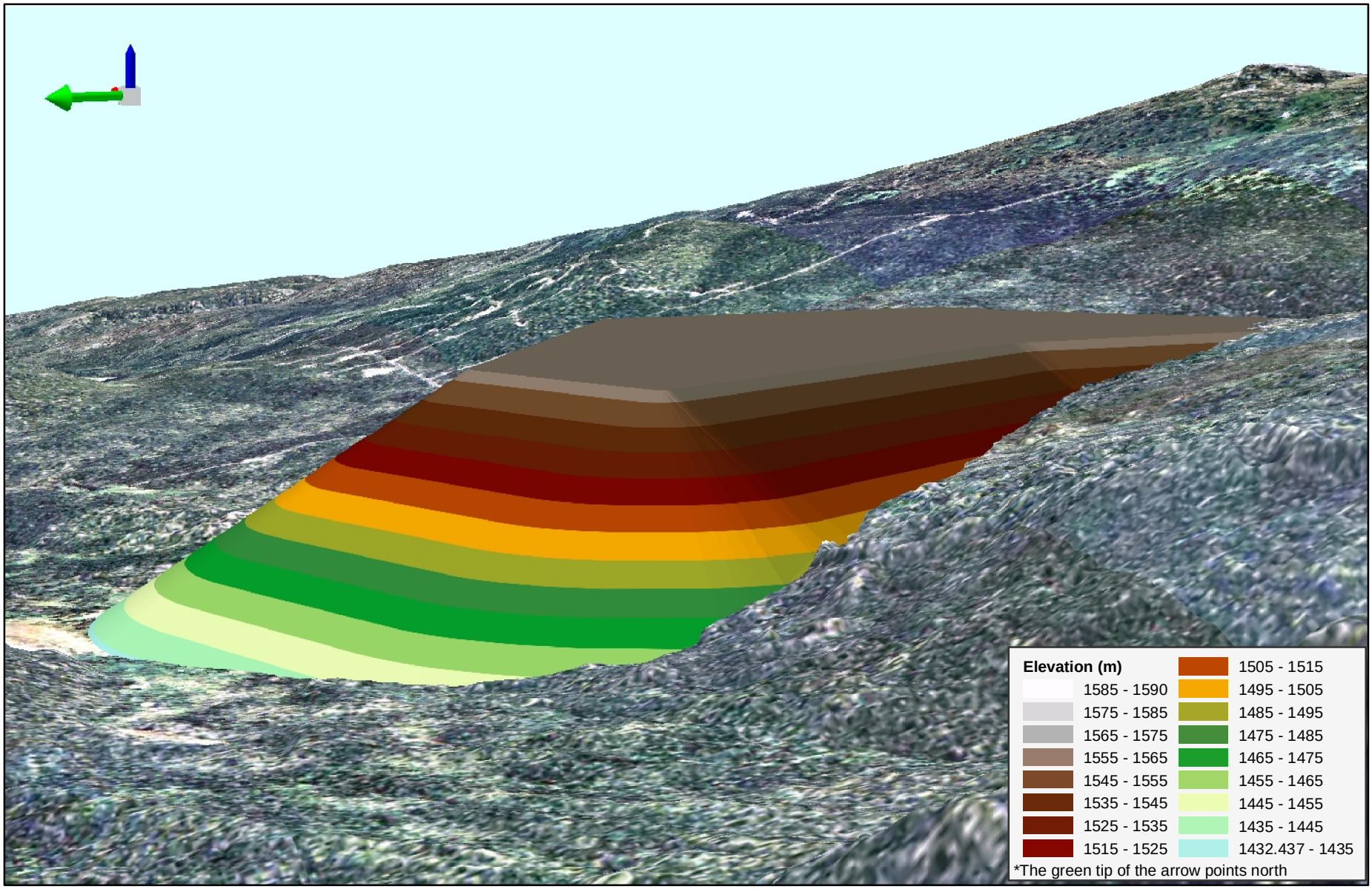


Figure 3.2-2

newgold

Expanded West Non-Acid Generating Waste Rock Storage Option

Figure 3.2-2

Rescan an ERM company

- Waste deposition cannot be optimized based on the elevation. As the pit is developed through the Project's operations phase, the depth of the pit and the elevation of the Alt NAG W increases, and ultimately increases the distance that waste will be hauled over the life-of-mine.
- Increased difficulty in the staging of material placement as long lag-times may occur if wet material is placed and requires drying before the placement of additional material.
- Higher overall slopes of the facilities increases the risk of material run out (see Figure 3.2-2).
- Higher overall vertical haulage distances increase construction time of lifts, and increased engineering challenges associated with creating a steeper facility.
- Possible increased difficulties with respect to overburden placement in the dump, which may decrease the geotechnical stability of the dump (i.e., more overburden material contained within a single dump).
- Lower potential expansion capacity allowed for by low degree of terracing and constrained footprint.

Footprint Area

The expected footprint area of the Alt NAG W disposal alternative is approximately 150 hectares.

Water Treatment

As all contact surface water and groundwater will report to the TSF, no water treatment would be required for the Alt NAG E/W option.

3.2.2.2 Environmental

Surface Water

Placement of site infrastructure including the NAG WRS facilities will require diversion or elimination of some stream reaches. The Alt NAG W overlaps small intermittent drainages, with these drainages already being diverted due to TSF construction. A total of 4.3 km of streams would be eliminated due to this configuration, resulting in a decrease of 734 ha to the downstream catchment area (10% of the total Davidson Creek catchment area of 7783 ha). Some flow may be mitigated by diverting water around infrastructure or pumping freshwater from a local lake to maintain surface water quantity.

Water quality in the Davidson Creek receiving environment is not expected to be impacted by the Alt NAG W option as surface water is designed to report to the TSF via gravity flow where runoff would be treated as a part of the TSF management process.

Groundwater

Construction of the NAG WRS facilities will alter the pattern of groundwater flow in the Project area. In particular the placement of rock in the Alt NAG W facility will result in a groundwater mound and increased pressure head and result in increased groundwater flow to the TSF.

Air Quality

The main source of air quality impacts due to the NAG dumps comes from emissions during trucking of rock to the dump sites, and from fugitive dust along the haul roads and during placement of material in the dump sites. The single dump design of Alt NAG W option increases overall haulage distances because it does not permit the optimization of waste placement (see Section 3.2.2.1); thus, Alt NAG W will have the highest air quality effects due to emissions and fugitive dust from waste haulage and placement.

Prevailing and local wind may transport fugitive dust from the dump sites; this transport is influenced by the height and slope of each dump. The Alt NAG W facility has a higher overall slope than the Alt NAG E/W facility, as it is not designed to be terraced (see Figure 3.2-2). Fugitive dust emissions will therefore be higher.

Vegetation, Ecosystems, and Wetlands

No plant species of concern, including white bark pine (*Pinus albicaulis*), were identified as occurring within the footprint of the Alt NAG W option during baseline studies (AMEC 2013a).

Based on TEM, a total of 47 ha of wetlands occur within the footprint of the Alt NAG W, as well as a total of 6 ha of blue-listed wetlands (AMEC 2013e; BC CDC 2013).

No other ecosystems of conservation concern were mapped within the footprint.

Wildlife

No species of conservation concern, including avian species protected under the *Migratory Birds Convention Act* (1994), or species listed in the Project's Section 79(1) notification under the *Species at Risk Act* (2002; see Appendix D of the TSF Alternatives Assessment Report) were observed in the Alt NAG W during the Project's baseline studies (AMEC 2013f).

The Alt NAG W footprint also overlaps with high quality habitat for several wildlife species (Table 3.2-2).

Table 3.2-2. Wildlife Habitat Requirements Affected by Alt NAG W

Species	Life Requirement	Habitat (ha)	Total Habitat (ha)[1]
Amphibian	High-quality habitat	0	0
Invertebrate	High-quality habitat	6	6
Caribou	Feeding winter	0	
	Feeding spring	0	
	Feeding summer	0	
	Security/thermal - winter	36	
	Security/thermal - growing	26	36

(continued)

Table 3.2-2. Wildlife Habitat Requirements Affected by Alt NAG W (completed)

Species	Life Requirement	Habitat (ha)	Total Habitat (ha)[1]
Moose	Security/thermal - winter	7	
	Security/thermal - growing	0	
	Feeding winter	76	
	Feeding growing	0	76
American Marten	Living winter	6	
	Living growing	0	6
Grizzly Bear	Feeding spring	7	
	Feeding summer	36	
	Feeding fall	36	
	Security/thermal - growing	16	
	Hibernating	36	36
Myotis spp.	High-quality habitat	139	139
Birds (Olive-sided Flycatcher)	High-quality habitat	0	0
Birds (olive-sided Flycatcher and Red-tailed Hawk)	High-quality habitat	0	0

[1] *Total habitat calculated using overlap of lifestage requirements.*

Fish and Fish Habitat

The Alt NAG W option consists of a NAG dump located in the Davidson Creek watershed. Baseline studies did not extensively sample within the footprint of the Expanded West Facility option, but Rainbow Trout were the only species collected within the headwaters of Davidson Creek. No barriers to fish movement were identified in the potentially affected reaches, so fish may seasonally use the impacted sections of stream (AMEC 2013c). For the purposes of this assessment, these streams are considered to be fish-bearing.

Rainbow Trout habitat quality in potentially affected stream reaches of the Alt NAG W ranges from fair to good for rearing fish. While no barriers to migration were identified downstream, migration habitat quality within the footprint ranges from poor to good with smaller first order tributaries having the lowest migration potential. No overwintering and spawning habitat for Rainbow Trout was identified in several of the potentially affected stream reaches and available overwintering and spawning habitat was poor due to minimal residual pool depths and poor spawning gravels.

Kokanee and Mountain Whitefish spawn in the lower reaches of the Davidson Creek watershed. The spawning sites of these species are not within the footprint of the proposed Alt NAG W site but are located in the lower reaches of the Davidson Creek, close to Tatelkuz Lake.

The construction of the Alt NAG W option would result in the permanent alteration to, or destruction (PAD) of, fish habitat in an area of approximately 0.7 ha. A total of 4.7 km of streams would be isolated upstream of the NAG area as it would create a permanent barrier to fish passage.

No provincially or federally listed fish species are located within or downstream of the Expanded West NAG option. The Brassy Minnow is a blue-listed species in BC and is known to inhabit Tatelkuz Lake; the West NAG option is in the Davidson Creek watershed, which merges with Chedakuz Creek downstream of this lake. This species is not listed on the Project's Section 79 (1) notification under the *Species at Risk Act* (2002; see Appendix D of the TSF Alternatives Assessment Report).

3.2.2.3 Socio-economics

Aboriginal Interests

The Alt NAG W option is located within the traditional territories of the Lhoosk'uz Dene Nation, Ulkatcho First Nation, and Skin Tyee Nation.

Commercial Land Uses

The Alt NAG W option may temporarily (construction and operations) affect trapping tenures due to potential displacement and a reduction in available wildlife. The Alt NAG W option is located within trapline TR0512T027. A total of 150 ha of the tenure is located in Alt NAG W option, representing 0.4% of the total tenure area.

Guide outfitting tenures may be temporarily (construction and operations) affected by the Alt NAG W option due to potential displacement and reduction of available wildlife. The Alt NAG W option is located mainly within guide outfitter tenure 601039. A total of 150 ha of tenure 601039 is located in the Alt NAG W option representing 0.3% of the total tenure area.

There are no mineral tenures not held by New Gold, forest tenures, agriculture or range tenures or commercial recreation tenures that overlap with the Alt NAG W option.

Recreational Land Uses

The Alt NAG W option is not located in recreational areas that are rated as vulnerable to alterations caused by resource development and as having specific significance.

No parks, protected areas or ecological reserves are located within the Alt NAG W option.

Heritage

The Alt NAG W option overlaps one historical heritage resource site: one blaze site, most likely associated with mineral exploration activities. No known archaeological sites occur within the footprint of the Alt NAG W option.

3.2.2.4 Project Economics

The relative Proponent costs for Alt NAG W alternative are estimated from their construction, operation and closure considerations (see Section 3.2.2.1); e.g., footprint area, complexity of containment, and ease of closure.

Capital Costs

The Alt NAG W option will result in the highest capital costs among the options considered in this assessment. More haul trucks would be required given the increased distance and more uphill hauling as well as the additional preparation required for the foundation due to the presence of eskers and kames.

Operational Costs

The Alt NAG W option will result in the highest operational costs among the options considered in this assessment, although these costs will be similar to those of the Alt NAG E option. The inability to split waste into two streams increases operation costs by increasing haulage distances and uphill haulage, increases the risk of any schedule delays, increases engineering costs associated with dump stabilization, and does not provide easy access to construction materials.

Closure Costs

The Alt NAG W option will result in lower closure costs to the other options considered in this assessment. This option will require the closure of only one facility, although progressive reclamation and closure is not possible.

Fish Habitat Compensation Costs

The Alt NAG W option will result in PAD of approximately 0.7 ha. The approximate habitat compensation cost for this PAD is $1.3M.

3.2.3 Expanded East Facility (Alt NAG E)

3.2.3.1 Technical

General Description

The Expanded East Facility (Alt NAG E) will involve the construction, operation and closure of one waste rock dump, the East dump to the immediate east of the open pit (Figure 3.2-3). The East dump will be located in a low-gradient area sloping to the northeast, and will occupy a similar footprint to the East dump of the Alt NAG E/W option. A total of 63 Mm^3 of NAG waste and overburden material, not used for construction of the TSF, will be placed in the dump of the life-of-mine. Drainage from the Alt NAG E option will also be captured and directed to the TSF but may be returned to Creek 661 if of acceptable quality (New Gold Inc. 2014).

Under the Alt NAG E footprint, the geotechnical conditions are characterized by a surficial material sequence ranging from 24 m to 108 m thick, with the thickest deposits at the lower elevations. A sub-glacial meltwater corridor was identified in the footprint area of the Alt NAG E option. Static groundwater levels range between artesian conditions to a depth of 12 m. The bedrock geology consists of andesitic volcanic rocks that are highly weathered at less than 5 m depth (New Gold Inc. 2014). These geotechnical conditions provide appropriate foundations for dump construction, operation, and closure.

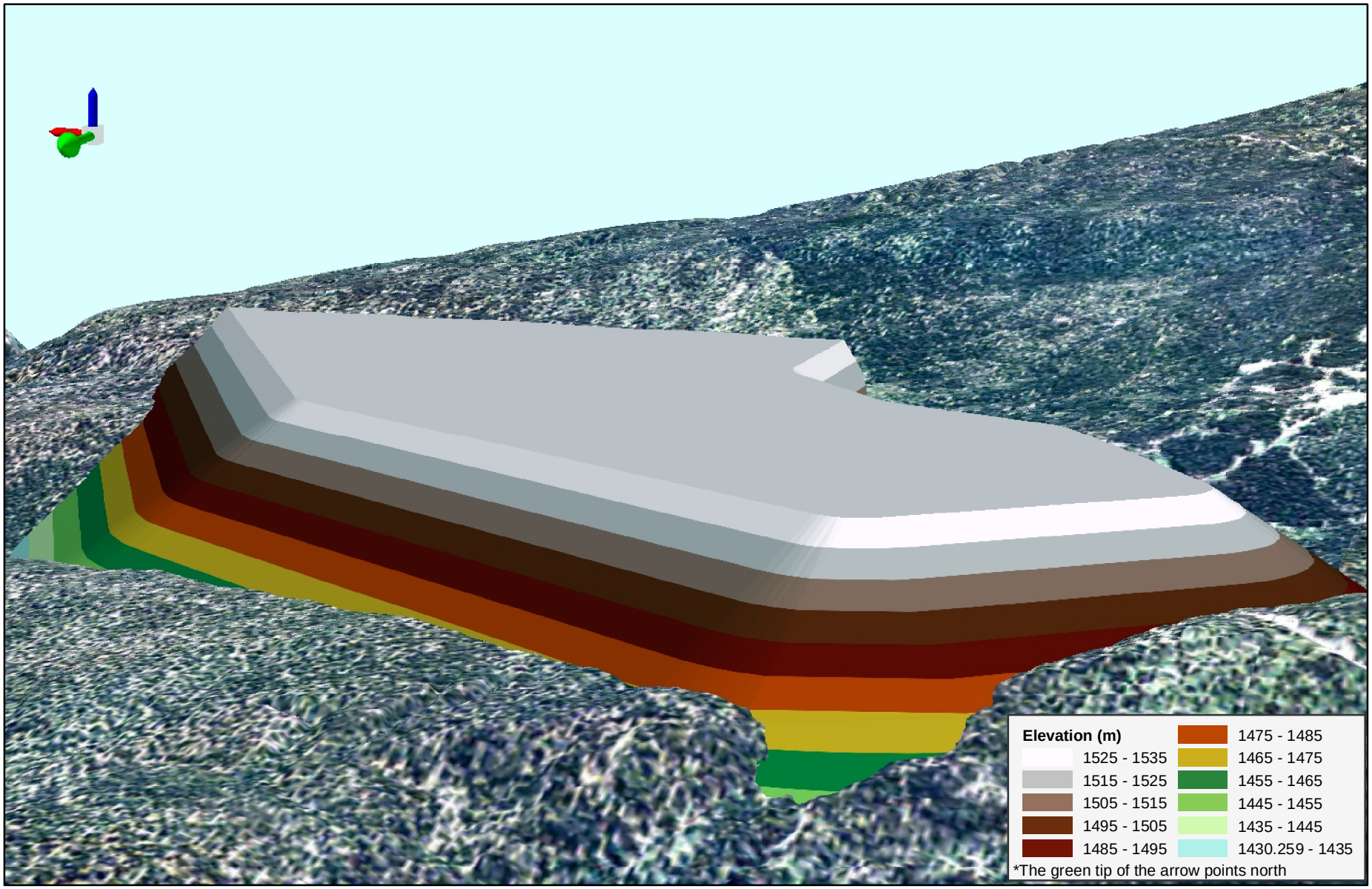


Figure 3.2-3

newgold

Expanded East Non-Acid Generating Waste Rock Storage Option

Figure 3.2-3

Rescan an ERM company

NAG waste (NAG4 and 5) and overburden, not used for construction of the TSF, will be placed in the dump in a single waste stream. Mined overburden will be distributed within the dump with a minimum of 10% waste rock to provide plating and maintain the overall integrity of the waste dump.

During the Project's construction phase, 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 upper layer will be spoiled in a windrow and buried beneath the dump. Water that infiltrates through the Alt NAG E dump will be collected at the base of the dump in a collection pond and directed by gravity to the TSF. Surface water runoff during operations and at closure will be diverted around the dump to the TSF. These surface water diversions will be field-fit with the advancing fill platforms. The dump will be developed with overall slopes to facilitate reclamation with growth media at closure (New Gold Inc. 2014).

The Alt NAG E option design is not conducive to progressive reclamation, and all dump closure activities will occur during the Project's closure phase.

Complexity of Containment/Physical Characterization of Waste

The Alt NAG E is less suitable than the Alt NAG E/W option in terms of the physical characterization of waste and the complexity of containment. The deposition of all waste rock and overburden into a single facility has the following disadvantages:

- Waste cannot be separated into two streams depending on the potential for metal leaching, which decreases the availability of NAG5 material for construction purposes.
- Waste deposition cannot be optimized based on the elevation. At commencement of pit development, the use of Alt NAG E is less optimal for waste haulage as it is located farther from the initial pit location, and ultimately increases the distance that waste will be hauled over the life-of-mine.
- Increased difficulty in the staging of material placement as long lag-times may occur if wet material is placed and requires drying before the placement of additional material.
- Higher overall slopes of the facilities increases the risk of material run out (see Figure 3.2-3).
- Higher overall vertical haulage distances increase construction time of lifts, and increased engineering challenges associated with creating a steeper facility.
- Possible increased difficulties with respect to overburden placement in the dump, which may decrease the geotechnical stability of the dump (i.e., more overburden material contained within a single dump)
- Results in NAG4 waste (higher ML potential) present in the Creek 661 drainage where runoff and seepage somewhat harder to collect.
- Lower potential expansion capacity allowed for by low degree of terracing and constrained footprint.

Footprint Area

The expected footprint area of the Alt NAG E disposal alternative is approximately 153 hectares.

Water Treatment

Surface water and most of the groundwater will report to the TSF, or to Creek 661 if water is of acceptable quality. More unrecoverable seepage of a poorer quality than for the other options might eventually reach Creek 661 from the East Dump; polishing wetland treatment may be required. Active chemical treatment is unlikely to be needed as all waste rock is NAG.

3.2.3.2 Environmental

Surface Water

The Alt NAG E footprint overlaps small intermittent drainages. A total of 1.6 km of streams would be eliminated due to this configuration, resulting in a decrease of 381 ha to the downstream catchment area (6.5% of the total Creek 661 catchment area of 5,858 ha).

Some water quality effects may occur to the receiving environment of Creek 661, as it may not be possible to capture all seepage through the east dump. This potential effect is greater than the potential effects to Creek 661 from the Alt NAG E/W because NAG4 waste rock would be stored within the Creek 661 watershed.

Groundwater

Construction of the NAG WRS facilities will alter the pattern of groundwater flow in the Project area. In particular the placement of rock in the Alt NAG E facility will result in a groundwater mound and increased pressure head resulting in increased groundwater flow towards Creek 661.

As no segregation of waste is possible using a single dump, groundwater quality in Creek 661 may be affected through metal leaching. As discussed above, more unrecoverable seepage of a poorer quality may be produced from the East Dump.

Air Quality

The main source of air quality impacts due to the NAG dumps comes from emissions during trucking of rock to the dump sites, and from fugitive dust along the haul roads and during placement of material in the dump sites. The single dump design of Alt NAG E option increases overall haulage distances because it does not permit the optimization of waste placement (see Section 3.2.3.1); thus, Alt NAG E will have the highest air quality effects due to emissions and fugitive dust from waste haulage and placement.

Prevailing and local wind may transport fugitive dust from the dump sites; this transport is influenced by the height and slope of each dump. The Alt NAG E facility has a higher overall slope than the Alt NAG E/W facility, as it is not designed to be terraced (see Figure 3.2-3). Fugitive dust emissions will therefore be higher.

Vegetation, Ecosystems, and Wetlands

No plant species of concern, including white bark pine, were identified as occurring within the footprint of the Alt NAG E option during baseline studies (AMEC 2013a).

Based on TEM, a total of 90 ha of wetlands occur within the footprint of the Alt NAG E, as well as a total of 11 ha of blue-listed wetlands (AMEC 2013e; BC CDC 2013).

No other ecosystems of conservation concern were mapped within the footprint.

Wildlife

During baseline studies, all wildlife observations of species of conservation concern within the Alt NAG E were of barn swallows. Eight observations of this species were recorded over a period of three years in the east dump location (AMEC 2013f). This species is protected under the *Migratory Birds Convention Act* (1994), is listed as Threatened under COSEWIC, is blue-listed in BC (BC CDC 2013) and is listed in the Project's Section 79(1) notification under the *Species at Risk Act* (2002; see Appendix D of the TSF Alternatives Assessment Report).

The Alt NAG E footprint also overlaps with high quality habitat for several wildlife species (Table 3.2-3).

Table 3.2-3. Wildlife Habitat Requirements Affected by Alt NAG E

Species	Life Requirement	Habitat (ha)	Total Habitat (ha)[1]
Amphibian	High-quality habitat	0	0
Invertebrate	High-quality habitat	55	55
Caribou	Feeding winter	12	
	Feeding spring	12	
	Feeding summer	13	
	Security/thermal - winter	43	
	Security/thermal - growing	19	43
Moose	Security/thermal - winter	21	
	Security/thermal - growing	14	
	Feeding winter	141	
	Feeding growing	32	141
American Marten	Living winter	26	
	Living growing	14	26
Grizzly Bear	Feeding spring	37	
	Feeding summer	62	
	Feeding fall	62	
	Security/thermal - growing	38	
	Hibernating	41	62
Myotis spp.	High-quality habitat	8	8
Birds (Olive-sided Flycatcher)	High-quality habitat	6	6
Birds (olive-sided Flycatcher and Red-tailed Hawk)	High-quality habitat	6	6

Fish and Fish Habitat

The Project ALSA and ARSA supports twelve species of fish but only Rainbow Trout (*Oncorhynchus mykiss)* is potentially found in the footprint of the Alt NAG E dump option (AMEC 2013c). Fish sampling efforts during baseline studies did not collect fish from the exact locations of the dump sites, however Rainbow Trout were the only species collected within the headwaters of Creek 661, with the lack of barriers indicating they are at least seasonally potentially present in the headwater tributaries (AMEC 2013c). Winter habitat in the upper reaches of Creek 661 was rated as poor, suggesting that these sections may provide temporary habitat during spring and summer (AMEC 2013c).

Habitat and fish presence were only assessed at one location in the Alt NAG E footprint (Reach 3 of Creek 149620). Lower reaches of Creek 149620 provide fair to good quality rearing and migration habitat and poor to fair quality spawning and overwintering habitat for Rainbow Trout. Although no fish were captured in Reach 3, migration and rearing habitat quality were considered to be good and fair respectively and Rainbow Trout are therefore presumed to be present throughout the upper reaches of the stream.

Kokanee spawn in the lower reaches of the Creek 661 watershed. The spawning sites of this species is not within the footprint of Alt NAG E but are located in the lower reaches of Creek 661, close to Tatelkuz Lake.

A total of 1.6 km of fish-bearing streams would be eliminated due to the Alt NAG E dump. The creeks within this footprint provide seasonal habitat for fish and as a result the loss of this habitat is considered a permanent harm to fish which requires compensation.

The construction of the Alt NAG E option would result in the permanent alteration to, or destruction (PAD) of, fish habitat in an area of approximately 0.1 ha. A total of 94 m of streams would be isolated upstream of the NAG area as it would create a permanent barrier to fish passage.

The Brassy Minnow is a blue-listed species in BC and is classified as sensitive or vulnerable (BC CDC 2013). This species is known to inhabit Tatelkuz Lake, downstream of the Expanded East storage option, via Creek 661. Blue-listed taxa are at risk, but are not extirpated, endangered or threatened. Brassy Minnow is not ranked by the COSEWIC or listed under the *Species at Risk Ac*t (2002d). This species is not listed on the Project's Section 79(1) notification under the *Species at Risk Act* (2002; see Appendix D of the TSF Alternatives Assessment Report).

3.2.3.3 Socio-economics

Aboriginal Interests

The Alt NAG E option is located within the traditional territories of the Lhoosk'uz Dene Nation and Skin Tyee Nation. The Alt NAG E option does not occur within the traditional territory of the Ulkatcho First Nation.

Commercial Land Uses

The Alt NAG E option may temporarily (construction and operations) affect trapping tenures due to potential displacement and a reduction in available wildlife The Alt NAG E option is located within

trapline tenure TR0512T027. A total of 153 ha of the tenure are located in the Alt NAG E option, representing 0.4% of the total tenure area.

Guide outfitting tenures may be temporarily (construction and operations) affected by the Alt NAG E option due to potential displacement and reduction of available wildlife. The Alt NAG E option is located within guide outfitter tenure 601039. A total of 153 ha of tenure 601039 are located in the expanded East stockpile option representing 0.3 % of the total tenure area.

There are no active mineral tenures not held by New Gold, forest tenures, agriculture or range tenures or commercial recreation tenures that overlap with the Alt NAG E option.

Recreational Land Uses

The Alt NAG E option is not located in recreational areas that are rated as vulnerable to alterations caused by resource development and as having specific significance.

No parks, protected areas or ecological reserves are located within the Alt NAG E option.

Heritage

The Alt NAG E option overlaps one historical heritage resource site, remnants of a cabin thought to be occupied from 1940 to 1980. Two culturally modified tree sites are located within the boundary of the Alt NAG E option (dated to the post-contact era).

No known archaeological sites occur within the Alt NAG E option footprint.

3.2.3.4 Project Economics

The relative Proponent costs for Alt NAG E alternative are estimated from their construction, operation and closure considerations (see Section 3.2.3.1); e.g., footprint area, complexity of containment, and ease of closure.

Capital Costs

The Alt NAG E option will result in the moderate capital costs among the options considered in this assessment. More haul trucks would be required than the separate dump option but less than the West Dump only option. This is offset somewhat but the smaller footprint (153 ha), lower capital costs will be incurred from foundation preparations and fill platform construction. The foundation of this facility will require less preparation than that of the Alt NAG W option, and thus reducing capital costs somewhat.

Operational Costs

The Alt NAG E option will result in the second-highest operational costs among the options considered in this assessment, although these costs will be similar to those of the Alt NAG W option. The inability to split waste into two streams increases operation costs by increasing haulage distances, increases the risk of any schedule delays, increases engineering costs associated with dump stabilization, and does not provide easy access to construction materials. Costs will be slightly lower than for the Alt NAG W option as less uphill haulage will be required.

Closure Costs

The Alt NAG W option will result in lower closure costs to the other options considered in this assessment. This option will require the closure of only one facility, although progressive reclamation and closure is not possible.

Fish Habitat Compensation Costs

The Alt NAG W option will result in PAD of approximately 0.1 ha. The approximate habitat compensation cost for this PAD is $300,000.

3.3 CHARACTERIZATION CRITERIA SUMMARY TABLE

Characterization of the alternatives provides a thorough, factual, and comparative characterization for each alternative (Table 3.3-1 to Table 3.3-4). This step does not entail judging the relative importance of the criteria or evaluating the significance of different effects of the alternatives. It simply provides the information necessary to enable the next steps of the assessment process, which involve differentially weighting the importance of criteria and evaluating the importance of relative effects of alternatives. The final column in the Characterization Criteria Summary Table provides information and rationale regarding whether the criteria will advance to the next step, the multiple accounts ledger, as an evaluation criteria.

3.3.1 Accounts and Characterization Criteria

The characterization criteria are Project-specific but fall under the following four broad categories, referred to as "accounts":

- *Technical characterization:* This account describes the engineered elements of each alternative such as the operational simplicity and construction considerations (Table 3.3-1).
- *Environmental characterization:* This account describes the local and regional environment surrounding each proposed alternative. Elements such as climate, geology, hydrology, hydrogeology, water quality and potential effects on fish and wildlife are considered (Table 3.3-2).
- *Socio-economic characterization:* This account describes how each proposed alternative may influence local and regional land users. Elements considered include Aboriginal territories overlapped, cultural significance, presence of archaeological or heritage sites and tenure areas overlapped (Table 3.3-3).
- *Project economic characterization:* The account describes the life of project economics. Aspects of the construction, operation, and closure are considered (Table 3.3-4).

Each account considers short- and long-term issues associated with construction through operation, mine closure and, ultimately, post-closure maintenance and monitoring. Some characterization criteria are relevant to more than one account. Although characterization criteria may be listed under multiple accounts, the multiple accounts ledger, only considers non-redundant and judgementally independent characterization criteria when ranking alternatives; therefore, no characterization criterion is considered more than once.

Table 3.3-1. Technical Characterization Criteria Summary Table

Characterization Criteria	Rationale	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)	Advanced to Evaluation Criteria? (Yes/No)
Dump Characteristics					
Distance from Deposit	NAG WRS options located closer to the open pit are preferred	Dumps are located immediately adjacent to open pit	Dumps are located immediately adjacent to open pit	Dumps are located immediately adjacent to open pit	No (not sufficiently differentiating)
Complexity of Containment	NAG WRS options with less complex containment are preferred	Least complex containment - dual facility allows for optimization of waste placement	More complex containment - single facility presents challenges for optimization of waste placement	More complex containment - single facility presents challenges for optimization of waste placement	Yes
Physical Characterization of Wastes	NAG WRS options that allow segregation of waste streams are preferred due to decreased operational complexity and risk	Dual facility design has allow for segregation of waste streams	Single dump design does not allow for segregation of waste streams	Single dump design does not allow for segregation of waste streams	Yes
Area footprint (ha)	NAG WRS options with a greater footprint are less preferred due to potentially higher environmental impacts	271 ha	150 ha	153 ha	Yes
Expansion potential	NAG WRS options with greater expansion potential are preferred.	Highest expansion potential	Lower expansion potential	Lower expansion potential	Yes
Foundation Conditions					
Degree of Acceptability	NAG WRS options with more acceptable foundation conditions are preferred	Although the West dump may have more challenging foundation conditions, the foundation conditions of both dumps are deemed to be acceptable	Dump may present more challenging foundation conditions, although the foundation conditions is still deemed to be acceptable	Dump has acceptable foundation conditions	No (not sufficiently differentiating)

(continued)

Table 3.3-1. Technical Characterization Criteria Summary Table (continued)

Characterization Criteria	Rationale	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)	Advanced to Evaluation Criteria? (Yes/No)
Supporting Infrastructure					
Waste haulage distance	NAG WRS options with greater lengths or required haul roads result in greater costs and decreased efficiencies	Least amount of supporting infrastructure expected due to optimization capacity inherent in dual-facility (i.e., probable shorter haul roads required)	Higher amount of supporting infrastructure expected due to no optimization capacity of single facility (i.e., probable longer haul roads and distances required)	Higher amount of supporting infrastructure expected due to no optimization capacity of single facility (i.e., probable longer haul roads and distances required)	Yes
Water Collection and Treatment					
Drainage collection	NAG WRS options with fewer drainage collection risks are preferred	No perceived risks to drainage collection	No perceived risks to drainage collection	No perceived risks to drainage collection	No (not sufficiently differentiating)
Potential for water treatment	NAG WRS options that do not require water treatment are preferred	Water treatment not required	Water treatment not required	Water treatment not required but potential for wetland polishing	Yes
Construction, Operation, and Closure					
Complexity of construction	NAG WRS options with increased operational flexibility and simplicity are preferred due to decreased risk	Higher construction requirements due to two facilities being required; East dump may have more challenging foundation conditions increasing construction complexity	Lowest construction requirements due to single facility being required, and relatively simple foundation conditions	Moderate construction requirements due to single facility being required; although the dump may have more challenging foundation conditions increasing construction complexity	Yes
Operational flexibility and simplicity	NAG WRS options with increased operational flexibility and simplicity are preferred due to decreased risk	Spilt design is optimal for simplification and flexibility of operations	Single NAG facility design is less flexible and simple for operations	Single NAG facility design is less flexible and simple for operations	Yes

(continued)

Table 3.3-1. Technical Characterization Criteria Summary Table (completed)

Characterization Criteria	Rationale	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)	Advanced to Evaluation Criteria? (Yes/No)
Construction, Operation, and Closure *(cont'd)*					
Closure Risk	NAG WRS options that allow for progressive reclamation and closure are preferred due to decreased risk	Design allows for progressive reclamation and closure	Design does not allow for progressive reclamation and closure	Design does not allow for progressive reclamation and closure	Yes

Table 3.3-2. Environmental Characterization Criteria Summary Table

Characterization Criteria	Rationale	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)	Advanced to Evaluation Criteria? (Yes/No)
Surface Water					
Surface Water Quantity	NAG WRS options with lower impacts to surface water hydrology are preferred	1,083 ha overall reduction in catchment areas downstream (736 ha change in Davidson Creek catchment [10% of catchment area] and 347 ha change in Creek 661 catchment [6% of catchment area]); 2 watersheds affected	734 ha reduction in Davidson Creek catchment (10% of catchment area); 1 watershed affected	381 ha reduction in Creek 661 catchment (6.5% of catchment area); 1 watershed affected	Yes
Surface Water Quality	NAG WRS options with lower impacts to surface water quality are preferred	Minimal effects to surface water quality in the receiving environment; surface water from West dump reports to TSF via gravity flow; some effects to Creek 661 may occur although these effects will be negligible as only the lowest ML potential material will be stored in East dump	Minimal effects to surface water quality in the receiving environment; surface water from dump reports to TSF	Potential effects to surface water quality in the receiving environment; higher ML potential material stored in Creek 661 drainage	Yes

(continued)

Table 3.3-2. Environmental Characterization Criteria Summary Table (continued)

Characterization Criteria	Rationale	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)	Advanced to Evaluation Criteria? (Yes/No)
Groundwater					
Groundwater Quantity	NAG WRS options with lower impacts to groundwater flow are preferred	Minimal effects to groundwater quantity	Minimal effects to groundwater quantity	Minimal effects to groundwater quantity	No
Groundwater Quality	NAG WRS options with lower impacts to groundwater quality are preferred	Minimal effects to groundwater quality; groundwater from West dump reports to TSF; some effects to Creek 661 may occur although these effects will be negligible as only the lowest ML potential material will be stored in East dump	Minimal effects to groundwater quality; surface water from dump reports to TSF	Potential effects to ground water quality in the receiving environment; higher ML potential material stored in Creek 661 drainage	Yes
Air Quality					
Vehicle Emissions	NAG WRS options with shorter waste haulage distances are preferred due to lower vehicle emissions	Optimization of waste haulage possible; lowest predicted haul distances	Optimization of waste haulage not possible; highest predicted haul distances	Optimization of waste haulage not possible; higher predicted haul distances	Yes
Fugitive Dust	NAG WRS options with lower potential for fugitive dust emissions are preferred	Facilities are highly terraced and progressive reclamation is possible; Terrace shape; 105 m east facility height and 158 m west facility height, ~80% facility slope between terraces	Facility is not terraced and progressive reclamation is not possible; 127 m facility height, 33% overall facility slope	Facility is not terraced and progressive reclamation is not possible; 110 m facility height, overall 33% facility slope	Yes
Fish and Aquatic Habitat					
Stream length affected	NAG WRS options that overlap fewer streams are preferred due to lower potential impacts to aquatic habitat.	4.9 km of streams (0.69 km East and 4.16 km West Dumps)	4.3 km of streams	1.6 km of streams	Yes

(continued)

Table 3.3-2. Environmental Characterization Criteria Summary Table (continued)

Characterization Criteria	Rationale	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)	Advanced to Evaluation Criteria? (Yes/No)
Fish and Aquatic Habitat *(cont'd)*					
PAD	NAG WRS options that create less PAD are preferred due to lower impacts to fish habitat and lower requirements for habitat compensation	0.7 ha	0.7 ha	0.1 ha	Yes
Fish species	NAG WRS options that affect greater number of species are less preferred	Rainbow Trout	Rainbow Trout	Rainbow Trout	No
Fish and aquatic species at risk	NAG WRS options with lower impacts to known fish and aquatic species at risk are preferred due to their high contribution to biodiversity and their protection under the *Species at Risk Act* (2002)	No known fish or other aquatic species at risk overlap with option	No known fish or other aquatic species at risk overlap with option	No known fish or other aquatic species at risk overlap with option	No
Vegetation, Ecosystems, and Wetlands					
Rare and Endangered Ecosystems	NAG WRS options with lower impacts to terrestrial rare and endangered ecosystems are preferred due to their high contribution to biodiversity	16 ha overlap with rare and endangered ecosystems	6 ha overlap with rare and endangered ecosystems	11 ha overlap with rare and endangered ecosystems	Yes
Rare Plant Species	NAG WRS options with lower impacts to known rare plant species are preferred due to their high contribution to biodiversity	0 rare plant species identified	0 rare plant species identified	0 rare plant species identified	No

(continued)

Table 3.3-2. Environmental Characterization Criteria Summary Table (continued)

Characterization Criteria	Rationale	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)	Advanced to Evaluation Criteria? (Yes/No)
Vegetation, Ecosystems, and Wetlands *(cont'd)*					
Wetland Ecosystems	NAG WRS options with lower impacts to wetland ecosystems are preferred due to their high contribution to both aquatic biodiversity and terrestrial biodiversity	117 ha overlap with mapped wetlands	47 ha overlap with mapped wetlands	90 ha overlap with mapped wetlands	Yes
Wildlife					
Amphibians – High-quality Habitat	NAG WRS options that overlap less high-quality habitat for amphibians are preferred due to lower biodiversity impact.	No overlap	No overlap	No overlap	No
Birds – High-quality habitat	NAG WRS options that overlap less high-quality habitat for birds are preferred due to lower biodiversity impact	1 ha	No overlap	6 ha	No (habitat affected is small compared to regionally-available high-quality habitat)
Caribou – High-quality habitat	NAG WRS options that overlap less high-quality habitat for caribou are preferred due to lower biodiversity impact	66 ha	36 ha	43 ha	Yes
Moose – High-quality habitat	NAG WR disposal options that overlap less high-quality habitat for moose are preferred due to lower biodiversity impact	182 ha	76 ha	141 ha	Yes
American marten – High-quality habitat	NAG WRS options that overlap less high-quality habitat for American marten are preferred due to lower biodiversity impact	45 ha	6 ha	26 ha	No (habitat affected is small compared to regionally-available high-quality habitat)

(continued)

Table 3.3-2. Environmental Characterization Criteria Summary Table (completed)

Characterization Criteria	Rationale	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)	Advanced to Evaluation Criteria? (Yes/No)
Wildlife *(cont'd)*					
Grizzly bear – High-quality habitat	NAG WRS options that overlap less high-quality habitat for grizzly bear are preferred due to lower biodiversity impact	81 ha	62 ha	36 ha	No (habitat affected is small compared to regionally-available high-quality habitat)
Myotis spp. – High-quality Habitat	NAG WRS options that overlap less high-quality habitat for myotis spp. are preferred due to lower biodiversity impact	156 ha	139 ha	8 ha	Yes
Invertebrates – High-quality Habitat	NAG WRS options that overlap less high-quality habitat for invertebrates are preferred due to lower biodiversity impact	102 ha	64 ha	55 ha	Yes
Bird species of conservation concern	NAG WRS options with less overlap of identified bird species of conservation concern, including with those protected under the *Migratory Birds Convention Act* (1994) are preferred	1 species of conservation concern (Barn Swallow) with 8 observations over a period of 3 years surveys; no observed nesting	0 species of conservation concern; no observed nesting	1 species of conservation concern (Barn Swallow) with 8 observations over a period of 3 years surveys; no observed nesting	No, indicator is better considered under 'bird high-quality habitat'
Mammal Species of Conservation Concern	NAG WRS options which overlap with endangered mammal sightings may affect regional biodiversity	0	0	0	No

Table 3.3-3. Socio-economic Characterization Criteria Summary Table

Characterization Criteria	Rationale	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)	Advanced to Evaluation Criteria? (Yes/No)
Aboriginal Interests					
Traditional Territory Overlapped	NAG WRS options that overlap with Aboriginal traditional territory are less preferred as they may affect the exercise of Aboriginal rights and title in the area of overlap	271 ha (Lhoosk'uz Dene Nation); 155 ha (Ulkatcho First Nation); 271 ha (Skin Tyee Nation)	150 ha (Lhoosk'uz Dene Nation); 149 ha (Ulkatcho First Nation); 150 ha (Skin Tyee Nation)	153 ha (Lhoosk'uz Dene Nation); 0 ha (Ulkatcho First Nation); 153 ha (Skin Tyee Nation)	Yes
Commercial Land Use					
Forestry Tenures	NAG WRS options that overlap with forestry tenures are less preferred as they may affect the rights of tenure holders	No overlap	No overlap	No overlap	No
Agriculture and Range Tenures	NAG WRS options that overlap with agriculture and range tenures are less preferred as they may affect the rights of tenure holders	No overlap	No overlap	No overlap	No
Guide Outfitting Tenures	NAG WRS options that overlap with guide outfitting tenures are less preferred as they may affect the rights of tenure holders	271 ha (601039) 0.5% of the total tenure area	150 ha (601039) 0.3% of the total tenure area	153 ha (601039) 0.3% of the total tenure area	Yes
Trapline Tenures	NAG WRS options that overlap with trapline tenures are less preferred as they may affect the rights of tenure holders	271 ha (TR0512T027) 0.7% of the total tenure area	150 ha (TR0512T027) 0.4% of the total tenure area	153 ha (TR0512T027) 0.4% of the total tenure area	Yes

(continued)

Table 3.3-3. Socio-economic Characterization Criteria Summary Table (completed)

Characterization Criteria	Rationale	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)	Advanced to Evaluation Criteria? (Yes/No)
Recreational Land Use					
Parks and Protected Areas	NAG WRS options that overlap with parks or protected areas may affect the ability of park visitors to enjoy the area of overlap	No overlap	No overlap	No overlap	No
Recreational Sensitivity	NAG WRS options that are located in areas with highly sensitive recreation values may affect the ability of recreationists to enjoy the area of overlap	0.015 ha within areas with moderate sensitivity, High significance	Not in area with sensitivity or significance value	Not in area with sensitivity or significance value	No (not significantly different)
Archaeology					
Known Archaeological Sites	NAG WRS options that overlap with archaeological sites are less preferred as these sites are protected under the *Heritage Conservation Act*.	No overlap with known archaeological sites	No overlap with known archaeological sites	No overlap with known archaeological sites	No
Known Heritage Resource Sites (including cabin remains, CMTs and tree blazes)	NAG WRS options that overlap with historical heritage resource sites may require additional mitigation	4 heritage sites (1 cabin and 1 blaze, 2 modified tree sites)	1 heritage site (1 blazes)	3 heritage sites (1 cabin, 2 modified tree sites)	No (not significantly different)

Table 3.3-4. Economic Characterization Criteria Summary Table

Characterization Criteria	Rationale	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)	Advanced to Evaluation Criteria? (Yes/No)
Proponent Costs					
Capital cost	Lower capital costs are preferred	Lowest capital cost due to fewer haul trucks would be required given the shorter haul distance, although this cost savings is offset somewhat by the need to prepare two dumps	Highest capital costs as more haul trucks would be required given the increased distance and more uphill hauling, and greater foundation preparation efforts.	Moderate capital costs as more haul trucks would be required given the increased distance and more uphill hauling (although fewer haul trucks would be required than for the Alt NAG W option). Minimal foundation preparation would be required.	Yes
Operational cost	Lower operational costs are preferred	Lowest operational costs due to capacity for optimization of waste placement	Highest operational costs due to limited/ no capacity for optimization of waste placement	High operational costs due to limited/no capacity for optimization of waste placement. Costs will be slightly lower than for the Alt NAG W option as less uphill haulage will be required.	Yes
Closure cost	Lower closure costs are preferred	Highest closure costs due to need to close two facilities required	Low closure costs due to limited/no capacity for progressive reclamation and closure; closure of one facility required	Low closure costs due to limited/no capacity for progressive reclamation and closure; closure of one facility required	Yes (not sufficiently differentiating)
Fish habitat compensation	Lower fish habitat compensation costs are preferred	$1,450,000	$1,300,000	$300,000	Yes

4. MULTIPLE ACCOUNTS LEDGER

As per section 2.5 of the *Guidelines* (Environment Canada 2011), a multiple accounts ledger identifies criteria from the alternative characterization that differentiate alternatives so that NAG WRS options can be evaluated relative to one another (Figure 4-1). The multiple accounts ledger consists of two elements: sub-accounts (i.e., evaluation criteria) and indicators (i.e., measurement criteria).

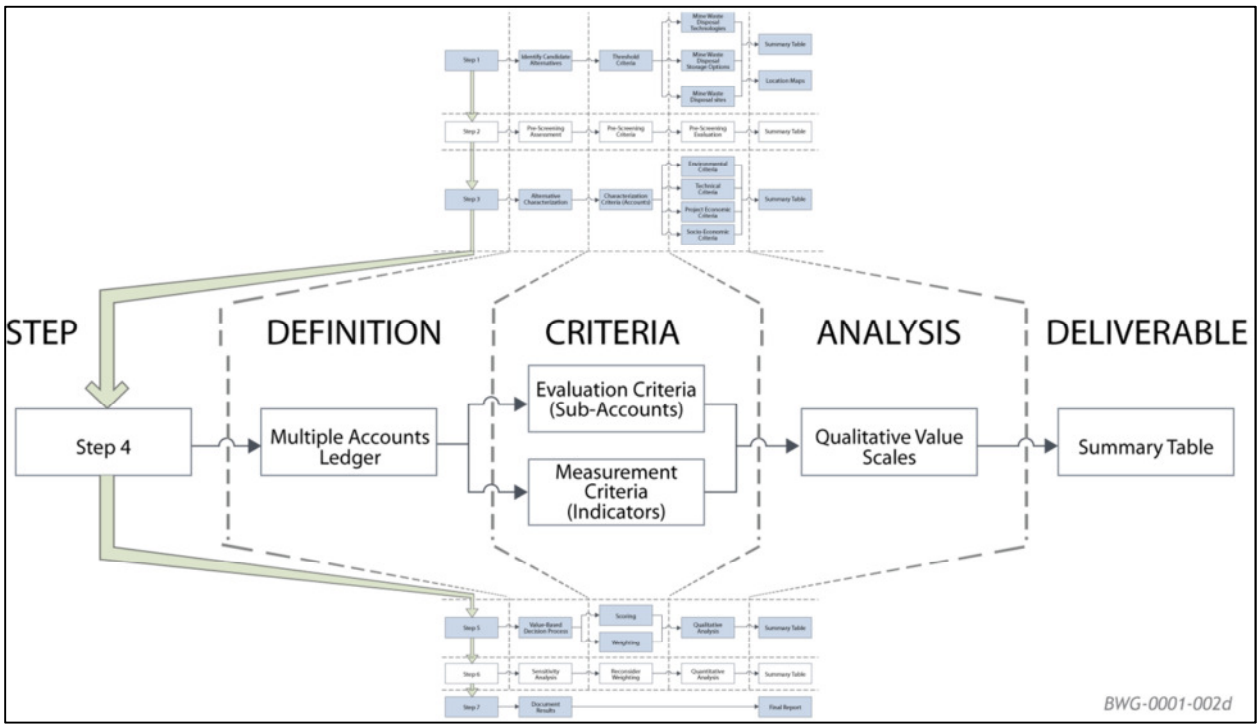


Figure 4-1. Multiple Accounts Ledger Step

4.1 EVALUATION CRITERIA (SUB-ACCOUNTS)

Sub-accounts only consider the benefit or loss associated with any of the alternatives being evaluated and they only include criteria that are:

- **Impact driven**: The evaluation criteria must, as far as practicable, be linked to an impact as opposed to merely being a factual element.
- **Differentiating**: The evaluation criteria must define an aspect which distinctly differentiates one alternative from another, and that difference is expected to have a material effect on the final selection of an alternative.
- **Value relevance**: An evaluation criterion must be relevant in the context of the alternatives being evaluated.
- **Understandability**: An evaluation criterion must be unambiguously defined, such that two external reviewers cannot interpret the outcome differently.
- **Non-redundancy**: There should not be more than one sub-account that measures the same evaluation criteria.

- **Judgmental independence**: Sub-accounts should be judgmentally independent, meaning that preferences with respect to a single criterion, or trade-offs between criteria, cannot depend on the value of another.

As with characterization criteria, the selected sub-accounts were identified on a project specific basis by a multi-disciplinary team who followed the recommendations outlined in the *Guidelines* (Table 4.1-1). The selected sub-accounts for each account are described below.

Table 4.1-1. Evaluation Criteria (Sub-accounts) and Supporting Rationale for their Selection

Account	Evaluation Criteria (Sub-account)	Rationale
Technical	Dump Characteristics	Options with less complex dump characteristics are preferred due to lower engineering requirements and environmental risk.
	Supporting Infrastructure	Options with less complex supporting infrastructure are preferred due to lower engineering requirements and environmental risk.
	Water Collection and Treatment	Options with less complex water management requirements are more preferred because of lower engineering risk, lower costs, potentially greater success at closure, and lower environmental risk.
	Construction, Operation, and Closure	Options with higher construction, operation, and closure requirements are generally less desirable from a cost perspective, and may have a higher long-term risk of failure.
Environmental	Surface Water	Options that have higher potential impacts to surface water are less desirable due to higher potential effects to the receiving environment and increased potential for water treatment.
	Groundwater	Options that have higher potential impacts to groundwater are less desirable due to higher potential effects to the receiving environment and increased need for seepage control.
	Air Quality	Options that have high potential for fugitive dust or greenhouse gas emissions would be less desirable due to higher associated risks to human health, vegetation and wildlife habitat, and global climate change.
	Ecosystems	Options that affect rare and endangered ecosystems or areas of high biodiversity would be less desirable due to higher associated effects on biodiversity and traditional use values.
	Wildlife	Options that affect high-quality habitat for valued or at-risk wildlife species would be less desirable due to higher associated effects on biodiversity and traditional use values.
	Fish and Aquatic Habitat	Options with greater effects to fish and aquatic habitat would be less desirable due to the high ecological importance of fish and aquatic habitat and the corresponding riparian ecosystems, as well as the potential need for habitat compensation.
Socio-economics	Aboriginal Interests	Options that overlap a greater number of Aboriginal asserted territories may have higher potential impacts to Aboriginal rights and title and are less desirable.
	Commercial Land Uses	Options that overlap a greater area of commercial tenure are less desirable.
Project Economics	Proponent Costs	Options with lower overall costs are preferred.

4.2 MEASUREMENT CRITERIA (INDICATORS)

To allow qualitative or quantitative measurement of the effect associated with each alternative for any given evaluation criterion, the criterion had to be measurable.

Qualitative value scales were developed when precise measurability was not possible. The points on the scale were defined descriptively and draw on multiple concepts in the definition of the indicator. A six-point scale was used because it provides for sufficient capacity to differentiate without being overly detailed, and it is an even number scale that eliminates the tendency to select the "middle-of-the road" value. Qualitative value scales were developed to have the following characteristics:

- **Operational**: The scale must be applicable to alternatives that were not specifically used to define the scale.
- **Reliable**: External reviewers must be able to rate an alternative according to the value scale and assign the same score.
- **Value relevant**: The value scale must be directly relevant to the indicator being scored.
- **Justifiable**: Any external reviewer should reach the conclusion that the value scale is reasonable and representative.

The primary deliverable for this step is the multiple accounts ledger (Table 4.2-1) that provides the evaluation criteria (sub accounts) and the measurement criteria (indicators). The qualitative value scale for each of the indicators is documented in indicator-specific tables (see Tables 4.2-2 through 4.2-5).

4.2.1 Technical Indicator Quantitative Value Scales

Quantitative value scales are provided for each technical indicator with the ranked score for each NAG WRS option indicated (Table 4.2-2). Specific values for each option are detailed in Table 3.3-1, the Technical Characterization Criteria Summary Table.

4.2.2 Environmental Indicator Quantitative Value Scales

Quantitative value scales are provided for each environmental indicator with the ranked score for each NAG WRS option indicated (Table 4.2-3). Specific values for each option are detailed in Table 3.3-2, the Environmental Characterization Criteria Summary Table.

4.2.3 Socio-economic Indicator Quantitative Value Scales

Quantitative value scales are provided for each socio-economic indicator with the ranked score for each NAG WRS option indicated (Table 4.2-4). Specific values for each option are detailed in Table 3.3-3, the Socio-economic Characterization Criteria Summary Table.

4.2.4 Project Economic Indicator Quantitative Value Scales

Quantitative value scales are provided for each economic indicator with the ranked score for each NAG WRS option indicated (Table 4.2-5). Specific values for each option are detailed in Table 3.3-4 the Project Economics Characterization Criteria Summary Table.

Table 4.2-1. Multiple Accounts Ledger

Account	Sub-account (Evaluation Criteria)	Indicator (Measurement Criteria)	Indicator Parameter	Unit
Technical	Dump Characteristics	Complexity of containment	Qualitative Value	#
		Physical characterization of wastes	Qualitative Value	#
		Area footprint	Area	ha
		Expansion potential	Qualitative Value	#
	Supporting Infrastructure	Waste haulage distance	Qualitative Value	#
	Water collection and treatment	Potential for water treatment	Qualitative Value	#
	Construction, Operation, and Closure	Complexity of construction	Qualitative Value	#
		Operational flexibility and complexity	Qualitative Value	#
		Closure risk	Qualitative Value	#
Environmental	Surface Water	Watersheds affected	Count	#
		Reduction in catchment area	Area	ha
		Surface water quality	Qualitative Value	#
	Groundwater	Groundwater quality	Qualitative Value	#
	Air Quality	Vehicle emissions	Qualitative Value	#
		Fugitive dust	Qualitative Value	#
	Ecosystems	Rare and endangered ecosystems	Area	ha
		Wetland ecosystems	Area	ha
	Wildlife	Caribou high-quality habitat	Area	ha
		Moose high-quality habitat	Area	ha
		Myotis spp. high-quality habitat	Area	ha
		Invertebrate high-quality habitat	Area	ha
	Fish and Aquatic Habitat	Stream length affected	Length	km
		Permanent alteration to, or destruction (PAD) of, fish habitat	Area	ha
Socio-economics	Aboriginal Interests	Traditional territory overlapped	Count	#
	Commercial Land Use	Guide outfitting tenures	Area	ha
		Trapline tenures	Area	ha
Project Economics	Proponent Costs	Capital cost	Cost	$
		Operational cost	Cost	$
		Closure cost	Cost	$
		Fish habitat compensation cost	Cost	$

Table 4.2-2. Quantitative Value Scale for Technical Indicators

Sub-account	Indicator	Scalar	Unit/ Metric	Alt NAG E/W	Alt NAG W	Alt NAG E
Dump Characteristics	Complexity of containment			6	3	3
		6	Simple			
		5	Less simple			
		4	Neutral			
		3	Minor complexities			
		2	Moderate complexities			
		1	Complex			
	Physical characterization of wastes			6	1	1
		6	Simple (dual waste stream)			
		5	Less simple			
		4	Neutral			
		3	Minor complexities			
		2	Moderate complexities			
		1	Complex (single waste streams)			
	Area footprint			2	5	4
		6	<100 ha			
		5	100 to 150 ha			
		4	150.1 to 200 ha			
		3	200.1 to 250 ha			
		2	250.1 to 300 ha			
		1	> 300 ha			
	Expansion potential			6	1	1
		6	Highest expansion potential			
		1	Lowest expansion potential			
Water Collection and Treatment	Potential for water treatment			6	6	3
		6	Negligible/low potential for water treatment			
		5	Low probability potential for water treatment			
		4	Not likely potential for water treatment			
		3	Possible potential for water treatment			
		2	Likely potential for water treatment			
		1	Expected potential for water treatment			
Supporting Infrastructure	Waste haulage distance			6	3	3
		6	Good			
		5	Satisfactory			
		4	Acceptable			
		3	Bad			
		2	Worst			
		1	Unacceptable			
Construction, Operation, and Closure	Complexity of construction			1	6	3
		6	Simple / Least risk			
		5	Less simple			
		4	Neutral			
		3	Minor complexities			
		2	Moderate complexities			
		1	Complex / Highest risk			
	Operational flexibility and complexity			6	3	3
		6	Simple / Least risk			
		5	Less simple			
		4	Neutral			
		3	Minor complexities			
		2	Moderate complexities			
		1	Complex / Highest risk			
	Closure risk			6	3	3
		6	Good			
		5	Satisfactory			
		4	Acceptable			
		3	Bad			
		2	Worst			
		1	Unacceptable			

Table 4.2-3. Quantitative Value Scale for Environmental Indicators

Sub-account	Indicator	Scalar	Unit/ Metric	Alt NAG E/W	Alt NAG W	Alt NAG E
Surface Water	Watersheds affected			5	6	6
		6	One watershed affected			
		5	Two watersheds affected			
		4	Three watersheds affected			
		3	Four watersheds affected			
		2	Five watersheds affected			
		1	More than five watersheds affected			
	Reduction in catchment area			1	2	4
		6	< 100 ha reduction in catchment area			
		5	100 to 300 ha reduction in catchment area			
		4	300 to 500 ha reduction in catchment area			
		3	500 to 700 ha reduction in catchment area			
		2	700 to 900 ha reduction in catchment area			
		1	> 900 ha reduction in catchment area			
	Surface water quality			6	6	4
		6	Lowest potential impacts to surface water quality in receiving environment			
		5	Low-moderate potential impacts to surface water quality in receiving environment			
		4	Moderate potential impacts to surface water quality in receiving environment			
		3	Moderate - high potential impacts to surface water quality in receiving environment			
		2	High potential impacts to surface water quality in receiving environment			
		1	Extreme potential impacts to surface water quality in receiving environment			
Groundwater	Groundwater quality			6	5	4
		6	Lowest potential impacts to groundwater quality			
		5	Low-moderate potential impacts to groundwater quality			
		4	Moderate potential impacts to groundwater quality			
		3	Moderate - high potential impacts to groundwater quality			
		2	High potential impacts to groundwater quality			
		1	Extreme potential impacts to groundwater quality			
Air Quality	Vehicle emissions			6	1	1
		6	Lowest vehicle emissions; optimazation of waste haulage possible			
		1	Highest vehicle emissions; optimization of waste haulage not possible			
	Fugitive dust			6	3	4
		6	Terraced design and progressive reclamation possible			
		5	Dump height < 100 m and slopes < 50%; progressive reclamation not possible			
		4	Dump height from 100 to 120 m and dump slopes < 50%; progressive reclamation not possible			
		3	Dump height from 120 to 140 m and dump slopes < 50%; progressive reclamation not possible			
		2	Dump height from 140 to 160 m and dump slopes > 50%; progressive reclamation not possible			
		1	Dump height > 160 m and dump slopes > 50%; progressive reclamation not possible			

(continued)

Table 4.2-3. Quantitative Value Scale for Environmental Indicators (continued)

Sub-account	Indicator	Scalar	Unit/ Metric	Alt NAG E/W	Alt NAG W	Alt NAG E
Fish and Aquatic Habitat	Stream length affected			3	3	5
		6	No overlap with streams			
		5	< 2 km overlap with streams			
		4	2 to 4 km overlap with streams			
		3	4 to 6 km overlap with streams			
		2	6 to 8 km overlap with streams			
		1	> 8 km overlap with streams			
	Permanent alteration to, or destruction (PAD) of, fish habitat			4	4	5
		6	No PAD			
		5	< 0.5 ha of PAD			
		4	0.5 to 1 ha of PAD			
		3	1.1 to 1.5 ha of PAD			
		2	1.5 to 2 ha of PAD			
		1	> 2 ha of PAD			
Ecosystems	Rare and endangered ecosystems			4	5	4
		6	No overlap with rare ecosystems			
		5	< 10 ha overlap with rare ecosystems			
		4	10.1 ha to 20 ha overlap with rare ecosystems			
		3	20.1 ha to 30 ha overlap with rare ecosystems			
		2	30.1 ha to 40 ha overlap with rare ecosystems			
		1	> 40 ha overlap with rare ecosystems			
	Wetland ecosystems			1	2	3
		6	No overlap with wetland ecosystems			
		5	< 10 ha overlap with rare ecosystems			
		4	10.1 ha to 40 ha overlap with rare ecosystems			
		3	40.1 ha to 70 ha overlap with rare ecosystems			
		2	70.1 ha to 100 ha overlap with rare ecosystems			
		1	> 100 ha overlap with rare ecosystems			

(continued)

Table 4.2-3. Quantitative Value Scale for Environmental Indicators (completed)

Sub-account	Indicator	Scalar	Unit/ Metric	Alt NAG E/W	Alt NAG W	Alt NAG E
Wildlife	Caribou high-quality habitat			1	3	3
		6	No overlap with high-quality caribou habitat			
		5	< 15 ha overlap with high-quality caribou habitat			
		4	15.1 to 30 ha overlap with high-quality caribou habitat			
		3	30.1 to 45 ha overlap with high-quality caribou habitat			
		2	45.1 to 60 ha overlap with high-quality caribou habitat			
		1	> 60 ha overlap with high-quality caribou habitat			
	Moose high-quality habitat			2	4	3
		6	No overlap with high-quality moose habitat			
		5	< 50 ha overlap with high-quality moose habitat			
		4	50 to 100 ha overlap with high-quality moose habitat			
		3	100 to 150 ha overlap with high-quality moose habitat			
		2	150 to 200 ha overlap with high-quality moose habitat			
		1	> 200 ha overlap with high-quality moose habitat			
	Myotis spp. high-quality habitat			1	1	6
		6	No overlap with high-quality myotis spp. habitat			
		5	< 30 ha overlap with high-quality myotis spp. habitat			
		4	30 to 60 ha overlap with high-quality myotis spp. habitat			
		3	60.1 to 90 ha overlap with high-quality myotis spp. habitat			
		2	90.1 to 120 ha overlap with high-quality myotis spp. habitat			
		1	> 120 ha overlap with high-quality myotis spp. habitat			
	Invertebrate high-quality habitat			1	3	3
		6	No overlap with high-quality invertebrate habitat			
		5	< 25 ha overlap with high-quality invertebrate habitat			
		4	25 to 50 ha overlap with high-quality invertebrate habitat			
		3	50.1 to 75 ha overlap with high-quality invertebrate habitat			
		2	75.1 to 100 ha overlap with high-quality invertebrate habitat			
		1	> 100 ha overlap with high-quality invertebrate habitat			

Table 4.2-4. Quantitative Value Scale for Socio-economic Indicators

Sub-account	Indicator	Scalar - Quality	Unit/ Metric	Alt NAG E/W	Alt NAG W	Alt NAG E
Aboriginal Interests	Traditional territory overlapped			3	3	4
		6	Does not overlap with any asserted traditional territory			
		5	Overlaps with the asserted territory of one Aboriginal group			
		4	Overlaps with the asserted territory of two Aboriginal groups			
		3	Overlaps with the asserted territory of three Aboriginal groups			
		2	Overlaps with the asserted territory of four Aboriginal groups			
		1	Overlaps with the asserted territory of five Aboriginal groups			
Commerical Land Use	Guide outfitting tenures			2	5	4
		6	< 100 ha overlap with guide outiftting tenures			
		5	100 to 150 ha with guide outiftting tenures			
		4	150.1 to 200 ha with guide outiftting tenures			
		3	200.1 to 250 ha with guide outiftting tenures			
		2	250.1 to 300 ha with guide outiftting tenures			
		1	> 300 ha with guide outiftting tenures			
	Trapline tenures			2	5	4
		6	< 100 ha overlap with trapline tenures			
		5	100 to 150 ha with trapline tenures			
		4	150.1 to 200 ha with trapline tenures			
		3	200.1 to 250 ha with trapline tenures			
		2	250.1 to 300 ha with trapline tenures			
		1	> 300 ha with trapline tenures			

Table 4.2-5. Quantitative Value Scale for Project Economics Indicators

Sub-account	Indicator	Scalar - Quality	Unit/ Metric	Alt NAG E/W	Alt NAG W	Alt NAG E
Proponent costs	Capital cost			6	1	2
		6	Lowest capital costs			
		5	Moderate-low capital costs			
		4	Moderate capital costs			
		3	N/A			
		2	Moderate-high capital costs			
		1	Highest capital costs			
	Operational cost			6	1	2
		6	Lowest operational costs			
		5	Moderate-low operational costs			
		4	Moderate operational costs			
		3	N/A			
		2	Moderate-high operational costs			
		1	Highest operational costs			
	Closure cost			1	6	6
		6	Lowest closure costs			
		5	Moderate-low closure costs			
		4	Moderate closure costs			
		3	N/A			
		2	Moderate-high closure costs			
		1	Highest closure costs			
	Fish habitat compensation			1	2	5
		6	No habitat compensation required			
		5	< $350k			
		4	$350 to $700k			
		3	$700k to $1.05M			
		2	$1.05M to $1.4M			
		1	> $1.4M			

5. VALUE-BASED DECISION PROCESS

5.1 INDICATOR WEIGHTING

The indicators for each sub-account were assigned a weighting as presented in the following sections (Sections 5.1.1 to 5.1.4). All indictors were weighted on a 6-point scale, with 6 being the most significantly valued and 1 being the least, as recommended in the *Guidelines* (Figure 5-1).

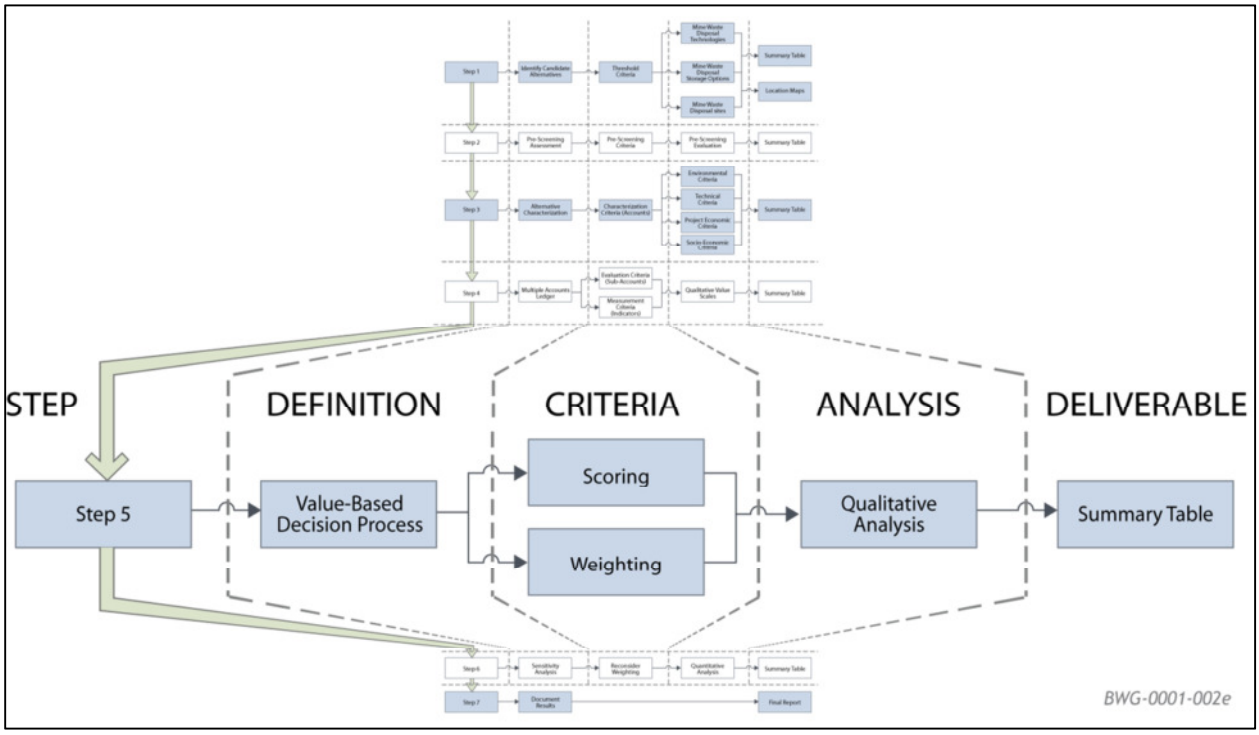


Figure 5-1. Value-based Decision Process Step

5.1.1 Technical Indicators

For technical sub-accounts with more than one indicator, each indicator was assigned a weighting based on professional judgment (Tables 5.1-1 and 5.1-2). Indicator weightings for "potential for water treatment" and "waste haulage distance" are not provided as those indicators are the only indicators under their relative sub-accounts: "Supporting Infrastructure" and "Water Collection and Treatment" respectively.

Indicators for the sub-account "Dump Characteristics" were assigned weightings based on the engineering considerations involved and the relative risks to the environment (Table 5.1-1). The "complexity of containment" and "physical characterization of wastes" indicators were assigned the highest weightings because the ability to segregate ML WR into two waste streams is a major factor in the construction, operation and closure of the NAG WRS facility. The indicator "expansion potential" was assigned a moderate weighting because this indicator is primarily related to the

Project's ability to incorporate changes in production rates rather than environmental risks. The indicator "area footprint" was assigned the lowest weighting because the areas involved are relatively small (<300 ha) compared to the size of the project, and specific impacts of these footprints (e.g., habitat loss) are considered in more detail in the Environment account.

Table 5.1-1. Dump Characteristic Indicator Weighting

Indicator	Weighting Value
Complexity of containment	6
Physical characterization of waste	6
Area footprint	1
Expansion potential	3

Indicators for the sub-account "Construction, Operation, and Closure" were assigned weightings based on the relative engineering and cost considerations involved (Table 5.1-2). The "complexity of construction" indicator was assigned the highest weighting because the most engineering associated with WR dumps are foundation preparations and lift construction. The "operational flexibility and complexity" indicator was assigned a moderate rating because of the increased costs to the Proponent associated with significant delays in waste placement. The "closure risk" indicator was assigned the lowest rating because all three options are based on well-established technologies, and closure risks can be mitigated.

Table 5.1-2. Construction, Operation, and Closure Indicator Weighting

Indicator	Weighting Value
Complexity of construction	6
Operational flexibility and complexity	3
Closure risk	1

5.1.2 Environmental Indicators

For environmental sub-accounts with more than one indicator, each indicator was assigned a weighting according to professional judgment (Tables 5.1-3 through 5.1-7). Indicator weightings for "groundwater quality" is not provided as this indicator is the only indicator for the sub-account "Groundwater".

Indicators for the sub-account "Surface water" were weighted considering the relative risk to the downstream environment related to each indicator (Table 5.1-3). The indicator "surface water quality" was assigned the highest weighting due to the potential risk of impacts to surface water quality in Creek 661 and resultant impacts to fish and aquatic resources within that waterbody. The indicator "reduction in catchment area" was assigned a moderate weighting because, again impacts may be observed in Creek 661, although this change will be incremental as the catchment will already have been reduced with the development of the open pit. The indicator "watershed affected" was assigned the lowest weighting as the watersheds affected by the NAG WRS options would be affected by other aspects of the Project.

Table 5.1-3. Surface Water Indicator Weighting

Indicator	Weighting Value
Watersheds affected	1
Reduction in catchment area	3
Surface water quality	6

Indicator weightings for the sub-account "Air quality" were assigned based on the relative risk to human health and environment (Table 5.1-4). The indicator "fugitive dust" was assigned the highest weighting, as the storage of on-land waste rock may cause negative effects to the on-site workers and to the surrounding environment. The indicator "vehicle emissions" was assigned a lower weighting because the NAG WRS options considered here are all located adjacent to the pit, which minimizes vehicle emissions and the associated greenhouse gas emissions. The Project has been designed to minimize haul distances, which would be the primary source of greenhouse gas emissions for the Project.

Table 5.1-4. Air Quality Indicator Weighting

Indicator	Weighting Value
Fugitive dust	6
Vehicle emissions	3

Indicators for the sub-account "Ecosystems" were weighted considering the relative protections for each indicator (Table 5.1-5). The indicator "rare and endangered ecosystems" was assigned the highest weighting because of the provincial legal status of these ecosystems (all blue-listed wetlands) and the potential requirement to compensate for the loss of these wetlands. The indicator "wetland ecosystems" was assigned a moderate weighting because of the importance of wetland ecosystems to aquatic species, including migratory birds, fish and fish habitat, and aquatic species at risk.

Table 5.1-5. Ecosystems Indicator Weighting

Indicator	Weighting Value
Rare and endangered ecosystems	6
Wetland ecosystems	3

Indicators for the sub-account "wildlife" were assigned considering the relative strength of the legal protection for each indicator, the stated concerns of Aboriginal groups for each species, the habitat specificity of the affected species, the sensitivity of species to disturbance, and the amount of suitable habitat in the general Project region (Table 5.1-6). The indicators "caribou high-quality habitat" and "moose high-quality habitat" were assigned high weightings because of the Aboriginal concern surrounding these species (see Section 2 of the *Assessment of Alternatives for Blackwater Project Tailing Storage Facility* (ERM Rescan 2014)). The indicator "direct loss or disturbance to myotis ssp. habitat" was also assigned a high weighting to reflect the recent emergency COSEWIC listing of certain bat species as endangered (COSEWIC 2012). The indicator "invertebrate high-quality habitat" was assigned a low weighting because there is a great deal of high-quality habitat available for these species in the regional area, and overall habitat would not be greatly affected.

Table 5.1-6. Wildlife Indicator Weighting

Indicator	Weighting Value
Caribou high-quality habitat	6
Moose high-quality habitat	6
Myotis spp. high-quality habitat	5
Invertebrate high-quality habitat	1

The indicator values for the sub-account "fish and aquatic habitat" were assigned based on legislative requirements and relative risk to the species under consideration (Table 5.1-7). The indicator "PAD" was assigned the highest weightings because creation of PAD indicates the amount of fish habitat potentially affected and is the trigger for a Governor in Council Schedule 2 Amendment to the MMER (SOR/2002-222). The indicator "stream length affected" was assigned a low weighting because this indicator provides little information on the habitat function of these affected streams.

Table 5.1-7. Fish and Aquatic Habitat Indicator Weighting

Indicator	Weighting Value
Stream length affected	2
Permanent alteration to, or destruction (PAD) of, fish habitat	6

5.1.3 Socio-economic Indicators

The indicators for the socio-economic sub-account "Commercial land uses" were each assigned a weighting according to stated Aboriginal concern (Table 5.1-8; see Section 2 of the *Assessment of Alternatives for Blackwater Project Tailing Storage Facility* (ERM Rescan 2014). The indicator "trapline tenures" was assigned a higher weighting than "guide outfitting tenures" because the Lhoosk'us Dene Nation and Saik'uz First Nation have expressed concern about potential effects on trapline holders (New Gold Inc. 2014, Chapter 17).

Table 5.1-8. Commercial Land Uses Indicator Weighting

Indicator	Weighting Value
Guide outfitting tenures	3
Trapline tenures	6

Indicator weightings for "traditional territory overlapped" is not provided as this indicator is the only indicator for the sub-account "Aboriginal interests".

5.1.4 Project Economics Indicators

The Project Economics Account has a sole sub-account: "Proponent costs". Indicators for this sub-account were weighted according to the relative costs involved with initial capital costs generally having the greatest effect on the net present value (NPV) of the Project (Table 5.1-9).

Table 5.1-9. Estimated Costs Indicator Weighting

Indicator	Weighting Value
Initial capital costs	6
Sustaining capital and operating costs	5
Closure costs	3
Fish habitat compensation costs	1

5.2 SUB-ACCOUNT WEIGHTING

The base case sub-accounts were weighted as presented in the following tables (Tables 5.2-1 to 5.2-3). The weightings presented in this section are based on the professional judgment.

All values were evaluated on a six-point scale, with 6 being the most significantly valued and 1 being the least.

The technical account sub-account weightings were assigned according to the environmental and engineering risk associated with each sub-account (Table 5.2-1). The "construction, operation, and closure" sub-account was given the highest weighting because of the long-term timeline associated with closure. The "dump characteristics" and "water collection and treatment" sub-accounts were assigned moderate weightings because all dumps proposed here are based on well-established technologies, and while some challenges may occur due to waste with a higher ML potential in the Creek 661 drainage for one of the options, these challenges can be easily mitigated. "Supporting infrastructure" was assigned the lowest weighting because this infrastructure poses the lowest risk.

Table 5.2-1. Technical Sub-account Weighting

Sub-account	Weighting Value
Dump characteristics	3
Supporting infrastructure	1
Water collection and treatment	3
Construction, operation, and closure	6

The environmental sub-accounts weightings were assigned based on both legal requirements and on professional judgment (Table 5.2-2). The "fish and aquatic habitat" sub-account was ranked as the most significant sub-account because of the potential effect on valued fish habitat and for the Project to invoke a Schedule 2 amendment under the *Fisheries Act* (1985) Metal Minining Effluent Regulations (SOR/2002-222). The sub-accounts "surface water" and "groundwater" were assigned moderate-high weightings because of potential effects of surface water and groundwater containment issues and associated declines in water quality would have on downstream environments. The sub-account "air quality" was assigned a moderate weighting because of the potential risks to human health, although these are expected to be not significant. The sub-accounts "wildlife" and "ecosystems" were weighted with a low value because, although terrestrial habitat are vital to the survival of many important wildlife species and at-risk ecosystems and plants, the overall affected aquatic and

terrestrial habitat associated with each NAG WRS footprint is small relative to the available habitat within the regional area.

Table 5.2-2. Environmental Sub-account Weighting

Sub-account	Weighting Value
Surface water	4
Groundwater	4
Air quality	3
Ecosystems	1
Wildlife	1
Fish and aquatic habitat	6

The socio-economic sub-account weightings were assigned as presented in Table 5.2-3. The sub-accounts "Aboriginal interests" was assigned the highest weighting because of the potential for the NAG WRS options to interfere with the exercise of Aboriginal rights and title in the area of overlap. The sub-account "commercial land use" was assigned a low weighting. Lhoosk'us Dene Nation and Saik'uz First Nation have expressed concern about potential effects on trapline holders (see Section 2 of the *Assessment of Alternatives for Blackwater Project Tailing Storage Facility* (ERM Rescan 2014)), although the total area affected by any NAG WRS option is very small (< 1% of tenure).

Table 5.2.3. Socio-economic Sub-account Weighting

Sub-account	Weighting Value
Aboriginal interests	6
Commercial land use	2

Sub-account weightings for "Proponent costs" is not provided as this sub-account is the only sub-account for the account "Project Economics".

5.3 ACCOUNT WEIGHTING

Based on the recommendations from section 2.6.2 of the *Guidelines* (Environment Canada 2011), the base-case account weightings as presented in Table 5.3-1 have been applied.

Table 5.3-1. Account Weighting for Base-case Value Scenarios

Account	Weighting Base-case
Environment	6
Technical	3
Socio-economic	3
Project Economic	1.5

5.4 QUANTITATIVE ANALYSIS

The results of the base-case account weighting (Table 5.3-1) are presented in Table 5.4.1. All calculations follow the methodology outlined in section 2.6.3 of the *Guidelines* (Environment Canada 2011). The resultant calculation tables are presented in Appendix A.

Table 5.4-1. Multiple Accounts Analysis Results

	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)
Base case	3.8	3.5	3.5

The Alt NAG E/W is the most appropriate NAG WRS alternative, as it resulted in the highest number (3.8) in the Multiple Accounts Analysis (Table 5.4-1). Although Alt NAG E/W has the largest footprint of the options considered, the ability to split the waste into two streams is advantageous in that it reduces overall waste haulage distances and the resultant impacts to air quality, and greatly reduces the complexity of the containment infrastructure.

6. SENSITIVITY ANALYSIS

The final analytical step in the Alternatives Assessment presented in this report is a sensitivity analsysis, as per Step 6 of the *Guidelines* (Figure 6-1).

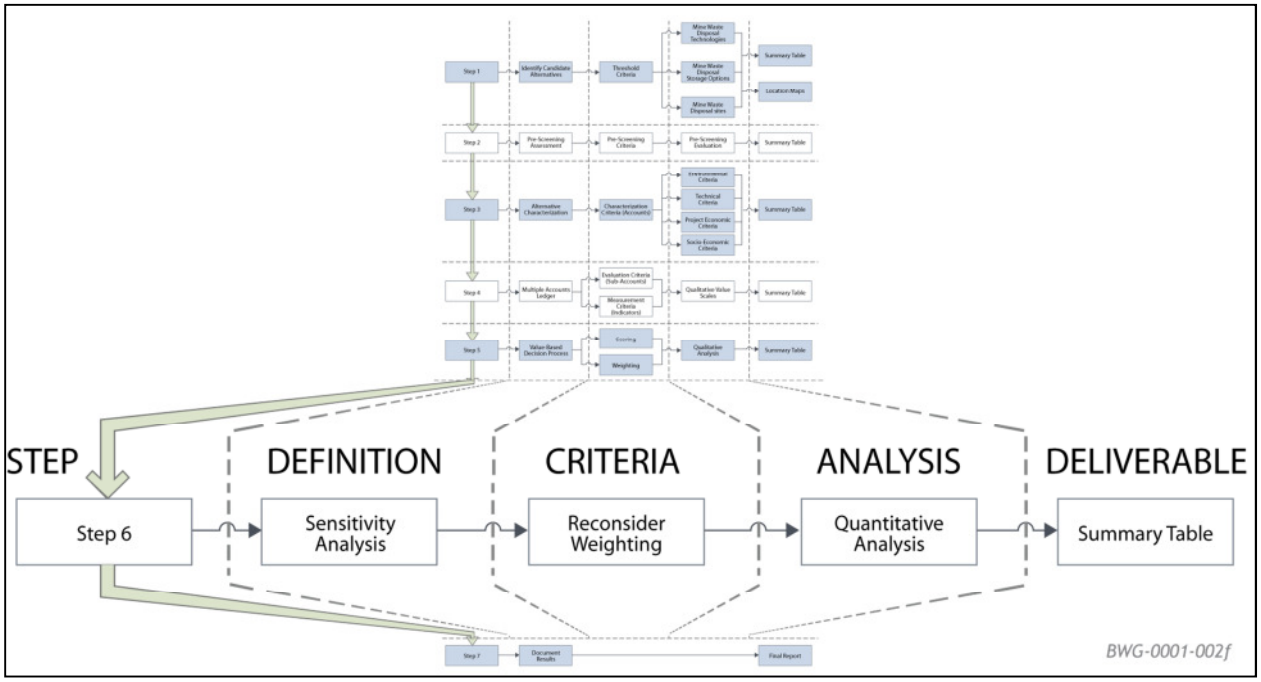


Figure 6-1. Value-based Decision Process Step

Two sensitivity analyses were performed for this assessment: the first where all accounts were given an equal weighting, and the second where only indicators with discriminating values of 30% or higher were considered. To determine if an indicator was highly differentiating, the difference between the highest indicator value and the lowest indicator value was multiplied by the indicator weighting and the lower value was subtracted from the higher value. If this value was greater than 30% of the possible range of values (maximum high value [6] *x* indicator weighting – minimum low value [1] *x* indicator weighting), then this indicator was considered to be discriminating. The underlying analyses are provided in Appendix A.

For both sensitivity analyses, the Alt NAG E/W remained the preferred alternative (Table 6-1).

Table 6-1. Results of Sensitivity Analyses

	Combined East and West (Alt NAG E/W)	Expanded West (Alt NAG W)	Expanded East (Alt NAG E)
1 (all accounts given equal weighting)	3.9	3.3	3.4
2 (discriminating indicators only)	4.0	3.9	3.4

7. CONCLUSION

The Alt NAG E/W resulted in the highest overall value for the multiple accounts and sensitivity analyses, and is the preferred NAG WRS facility for the Project. Although Alt NAG E/W has the largest footprint, it provides superior containment of ML wastes, provides access to NAG WR and overburden for construction, and has the lowest potential impacts to surface water, groundwater and air quality.

REFERENCES

Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

1982. *Canada Constitution Act*, s. 35.

1985. *Fisheries Act*, RSC. C. F-14.

1994. *Migratory Birds Convention Act*, SC. C. 22.

1996a. *BC Forest Act*, RSBC. C. 157.

1996b. *Heritage Conservation Act* RSBC. C. 187.

2002. *Species at Risk Act*, SC. C. 29.

Metal Mining Effluent Regulations SOR/2002-222.

AMEC. 2012. *Blackwater Gold Project - Draft Environmental Design Criteria*. VE52095, Version V4.0. NewGold Inc.: Vancouver, BC.

AMEC. 2013a. *2013 Vegetation Baseline Report*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure, a division of AMEC Americas Ltd.: Vancouver, BC.

AMEC. 2013b. *Blackwater Gold Project - Feasibility Study*. VAxx. New Gold Inc.: Vancouver, BC.

AMEC. 2013c. *Fish and Aquatic Resources 2011-2012 Baseline Report*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure, a division of AMEC Americas Ltd.: Vancouver, BC.

AMEC. 2013d. *Fish and Aquatic Resources 2013 Baseline Report*. VE52277.2460. Prepared for New Gold Inc. by AMEC Environment & Infrastructure, a division of AMEC Americas Ltd.: Vancouver, BC.

AMEC. 2013e. *Wetlands 2011 - 2012 Baseline Report*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure, a division of AMEC Americas Ltd.: Vancouver, BC.

AMEC. 2013f. *Wildlife and Wildlife Habitat 2011 - 2012 Baseline Report*. VE52277. Prepared for New Gold Inc. by AMEC Environment & Infrastructure, a division of AMEC Americas Ltd.: Vancouver, BC.

AMEC. 2014. *New Gold Inc. Blackwater Gold Project, BC. NI 43-101 Technical Report of Feasibility Study*. Prepared for New Gold Inc. by AMEC Americas Ltd.: Vancouver, BC. January 2014.

BC CDC. 2013. *BC Species and Ecosystems Explorer [web application] - Version 4.0.0*. British Columbia Ministry of Environment, Conservation Data Centre. http://a100.gov.bc.ca/pub/eswp/ (accessed July 2013).

BC MEM and BC MELP. 1998. *Policy for metal leaching and acid rock drainage at minesites in British Columbia*. British Columbia Ministry of Energy and Mines, and British Columbia Ministry of Environment, Lands and Parks.

BC MOE. 2010. *British Columbia Heritage Rivers Program*. British Columbia Ministry of Environment. http://www.env.gov.bc.ca/bcparks/heritage_rivers_program/history.html#objectives (accessed November 2013).

Canadian Environmental Assessment Agency. 2013. *Operational Policy Statement: Addressing "Need for", "Purpose of", "Alternatives to", and Alternative Means" under the Canadian Environmental Assessment Act. 2012*. Ottawa, ON.

COSEWIC. 2012. *Press Release: Emergency Assessment Concludes that Three Bat Species are Endangered in Canada*. COSEWIC press release. February 27, 2012. http://www.cosewic.gc.ca/eng/sct7/Bat_Emergency_Assessment_Press_Release_e.cfm (accessed January 2013).

Ecofor. 2013. *Blackwater Regional Exploration Area, Northern Caribou Management Plan, Final Report, Version 3*. 28 March 2013. Prepared for New Gold Inc. by Ecofor Consulting Ltd.: Fort St. James, BC.

Environment Canada. 2011. *Guidelines for the Assessment of Alternatives for Mine Waste Disposal*. Government of Canada: Ottawa, ON.

Environment Canada. 2012. *Streamlining the Approvals Process for Metal Mines with Tailings Impoundment Areas*. https://www.ec.gc.ca/pollution/default.asp?lang=En&n=EFAD32D1-1 (accessed November 2013).

ERM Rescan. 2014. *Assessment of Alternatives for Blackwater Gold Project Tailing Storage Facility*. Prepared for New Gold Inc. by ERM Consultants Canada Ltd.: Vancouver, BC.

MEND. 2009. *Prediction Manual for Drainage Chemistry from Sulphic Geologic Matierals*. 1.20.1. Natural Resources Canada: Ottawa, ON.

New Gold. 2014. *Blackwater Gold Project Environmental Assessment Application/Environmental Impact Statement*. Prepared by AMEC Environment & Infrastructure for New Gold Inc.: Vancouver, BC.

New Gold Inc. 2014. *Blackwater Gold Project Environmental Assessment Application/Environmental Impact Statement*. Prepared by AMEC Environment & Infrastructure for New Gold Inc.: Vancouver, BC.

Price, W. A. 2009. *Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials*. MEND Report 1.20.1. MEND, MAC, NRC, BCMEMP, BC Technical Research Committee on Reclamation, INAP, OMND, Yukon Mining and Petroleum Environmental Research Group: Ottawa, ON.

Price, W. A. and J. C. Errington. 1998. *Guidelines for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia*. BC Ministry of Energy and Mines. http://www.empr.gov.bc.ca/Mining/Permitting-Reclamation/ML-ARD/Pages/Guidelines.aspx (accessed April 2012).

Appendix A

Calculation Tables

Appendix A-1. Base Case Calculations

Account	W	Sub-account	W	Indicator	W	Alt NAG E/W	Alt NAG W	Alt NAG E	Discrimination Value (based on 30% diff)	
Environmental	6									
		Surface Water	4	Watersheds affected	1	5	6	6	1	ND
				Reduction in catchment area	3	1	2	4	9	D
				Surface water quality	6	6	6	4	12	D
				Sub-account merit score		44	48	42		
				Sub-account merit rating		4.4	4.8	4.2		
		Groundwater	4	Groundwater Quality	3	6	5	4	6	ND
				Sub-account merit score		18	15	12		
				Sub-account merit rating		6.0	5.0	4.0		
		Air Quality	3	Vehicle emissions	3	6	1	1	15	D
				Fugitive Dust	6	6	3	4	18	D
				Sub-account merit score		54	21	27		
				Sub-account merit rating		6.0	2.3	3.0		
		Ecosystems	1	Rare and Endangered Ecosystems	6	4	5	4	6	ND
				Wetland Ecosystems	3	1	2	3	6	ND
				Sub-account merit score		27	36	33		
				Sub-account merit rating		3.0	4.0	3.7		
		Wildlife	1	Caribou high-quality habitat	6	1	3	3	12	D
				Moose high-quality habitat	6	2	4	3	12	D
				Myotis spp. high-quality habitat	5	1	1	6	25	D
				Invertebrate high-quality habitat	1	1	3	3	2	ND
				Sub-account merit score		24	50	69		
				Sub-account merit rating		1.3	2.8	3.8		
		Fish and Aquatic Habitat	6	Stream length affected	2	3	3	5	4	ND
				Permanent alteration to, or destruction (PAD) of, fish habitat	6	4	4	5	6	ND
				Sub-account merit score		30	30	40		
				Sub-account merit rating		3.8	3.8	5.0		
		Account merit score (S{SxW})				72	64	71		
		Account merit rating (S{SxW}/SW)				3.8	3.4	3.8		
Technical	3									
		Dump Characteristics	3	Complexity of containment	6	6	3	3	18	D
				Physical characterization of wastes	6	6	1	1	30	D
				Area footprint	1	2	5	4	3	ND
				Expansion potential	3	6	1	1	15	D
				Sub-account merit score		92	32	31		
				Sub-account merit rating		5.8	2.0	1.9		
		Supporting Infrastructure	1	Waste haulage distance	3	6	3	3	9	D
				Sub-account merit score		18	9	9		
				Sub-account merit rating		6.0	3.0	3.0		
		Water Collection and Treatment	3	Potential for Water Treatment	3	6.0	6.0	3.0	9	D
				Sub-account merit score		18	18	9		
				Sub-account merit rating		6.0	6.0	3.0		
		Construction, Operation, and Closure	6	Complexity of construction	6	1	6	3	30	D
				Operational flexibility and complexity	3	6	3	3	9	D
				Closure risk	1	6	3	3	3	ND
				Sub-account merit score		30.0	48.0	30.0		
				Sub-account merit rating		3.0	4.8	3.0		
		Account merit score (S{SxW})				59	56	36		
		Account merit rating (S{SxW}/SW)				4.6	4.3	2.8		

Appendix A-1. Base Case Calculations

Account	W	Sub-account	W	Indicator	W	Alt NAG E/W	Alt NAG W	Alt NAG E	Discrimination Value (based on 30% diff)	
Socio-economics	3									
		Aboriginal Interests	6	Traditional territory overlapped	3	3	3	4	3	ND
				Sub-account merit score		9.0	9.0	12.0		
				Sub-account merit rating		3.0	3.0	4.0		
		Commerical Land Use	2	Guide outfitting tenures	3	2	5	4	9	D
				Trapline tenures	6	2	5	4	18	D
				Sub-account merit score		18.0	45.0	36.0		
				Sub-account merit rating		2.0	5.0	4.0		
		Account merit score (S{SxW})				22	28	32		
		Account merit rating (S{SxW}/SW)				2.8	3.5	4.0		
Project Economics	1.5									
		Proponent costs	6	Capital cost	6	6	1	2	30	D
				Operational cost	5	6	1	2	25	D
				Closure cost	3	1	6	6	15	D
				Fish habitat compensation	1	1	2	5	4	ND
				Sub-account merit score		70	31	45		
				Sub-account merit rating		4.7	2.1	3.0		
		Account merit score (S{SxW})				28	12	18		
		Account merit rating (S{SxW}/SW)				4.7	2.1	3.0		
MAA merit score						52	47	47		
MAA merit rating						3.8	3.5	3.5		

Appendix A-2. Sensitivity Analysis 1: All Accounts Weighted Equally

Account	W	Sub-account	W	Indicator	W	Alt NAG E/W	Alt NAG W	Alt NAG E	Discrimination Value (based on 30% diff)	
Environmental	1									
		Surface Water	4	Watersheds affected	1	5	6	6	1	ND
				Reduction in catchment area	3	1	2	4	9	D
				Surface water quality	6	6	6	4	12	D
				Sub-account merit score		44	48	42		
				Sub-account merit rating		4.4	4.8	4.2		
		Groundwater	4	Groundwater Quality	3	6	5	4	6	ND
				Sub-account merit score		18	15	12		
				Sub-account merit rating		6.0	5.0	4.0		
		Air Quality	3	Vehicle emissions	3	6	1	1	15	D
				Fugitive Dust	6	6	3	4	18	D
				Sub-account merit score		54	21	27		
				Sub-account merit rating		6.0	2.3	3.0		
		Ecosystems	1	Rare and Endangered Ecosystems	6	4	5	4	6	ND
				Wetland Ecosystems	3	1	2	3	6	ND
				Sub-account merit score		27	36	33		
				Sub-account merit rating		3.0	4.0	3.7		
		Wildlife	1	Caribou high-quality habitat	6	1	3	3	12	D
				Moose high-quality habitat	6	2	4	3	12	D
				Myotis spp. high-quality habitat	5	1	1	6	25	D
				Invertebrate high-quality habitat	1	1	3	3	2	ND
				Sub-account merit score		24	50	69		
				Sub-account merit rating		1.3	2.8	3.8		
		Fish and Aquatic Habitat	6	Stream length affected	2	3	3	5	4	ND
				Permanent alteration to, or destruction (PAD) of, fish habitat	6	4	4	5	6	ND
				Sub-account merit score		30	30	40		
				Sub-account merit rating		3.8	3.8	5.0		
		Account merit score (S{SxW})				72	64	71		
		Account merit rating (S{SxW}/SW)				3.8	3.4	3.8		
Technical	1									
		Dump Characteristics	3	Complexity of containment	6	6	3	3	18	D
				Physical characterization of wastes	6	6	1	1	30	D
				Area footprint	1	2	5	4	3	ND
				Expansion potential	3	6	1	1	15	D
				Sub-account merit score		92	32	31		
				Sub-account merit rating		5.8	2.0	1.9		
		Supporting Infrastructure	1	Waste haulage distance	3	6	3	3	9	D
				Sub-account merit score		18	9	9		
				Sub-account merit rating		6.0	3.0	3.0		
		Water Collection and Treatment	3	Potential for Water Treatment	3	6.0	6.0	3.0	9	D
				Sub-account merit score		18	18	9		
				Sub-account merit rating		6.0	6.0	3.0		
		Construction, Operation, and Closure	6	Complexity of construction	6	1	6	3	30	D
				Operational flexibility and complexity	3	6	3	3	9	D
				Closure risk	1	6	3	3	3	ND
				Sub-account merit score		30.0	48.0	30.0		
				Sub-account merit rating		3.0	4.8	3.0		
		Account merit score (S{SxW})				59	56	36		
		Account merit rating (S{SxW}/SW)				4.6	4.3	2.8		

Appendix A-2. Sensitivity Analysis 1: All Accounts Weighted Equally

Account	W	Sub-account	W	Indicator	W	Alt NAG E/W	Alt NAG W	Alt NAG E	Discrimination Value (based on 30% diff)	
Socio-economics	1									
		Aboriginal Interests	6	Traditional territory overlapped	3	3	3	4	3	ND
				Sub-account merit score		9.0	9.0	12.0		
				Sub-account merit rating		3.0	3.0	4.0		
		Commerical Land Use	2	Guide outfitting tenures	3	2	5	4	9	D
				Trapline tenures	6	2	5	4	18	D
				Sub-account merit score		18.0	45.0	36.0		
				Sub-account merit rating		2.0	5.0	4.0		
		Account merit score (S{SxW})				22	28	32		
		Account merit rating (S{SxW}/SW)				2.8	3.5	4.0		
Project Economics	1									
		Proponent costs	6	Capital cost	6	6	1	2	30	D
				Operational cost	5	6	1	2	25	D
				Closure cost	3	1	6	6	15	D
				Fish habitat compensation	1	1	2	5	4	ND
				Sub-account merit score		70	31	45		
				Sub-account merit rating		4.7	2.1	3.0		
		Account merit score (S{SxW})				28	12	18		
		Account merit rating (S{SxW}/SW)				4.7	2.1	3.0		
MAA merit score						16	13	14		
MAA merit rating						3.9	3.3	3.4		

Appendix A-3. Sensitivity Analysis 2: Only Differentiating Indicators Included

Account	W	Sub-account	W	Indicator	W	Alt NAG E/W	Alt NAG W	Alt NAG E	Discrimination Value (based on 30% diff)	
Environmental	6									
		Surface Water	4	Watersheds affected	0	5	6	6	0	ND
				Reduction in catchment area	3	1	2	4	9	D
				Surface water quality	6	6	6	4	12	D
				Sub-account merit score		39	42	36		
				Sub-account merit rating		4.3	4.7	4.0		
		Groundwater	0	Groundwater Quality	0	6	5	4	0	ND
				Sub-account merit score		0	0	0		
				Sub-account merit rating		0.0	0.0	0.0		
		Air Quality	3	Vehicle emissions	3	6	1	1	15	D
				Fugitive Dust	6	6	3	4	18	D
				Sub-account merit score		54	21	27		
				Sub-account merit rating		6.0	2.3	3.0		
		Ecosystems	0	Rare and Endangered Ecosystems	0	4	5	4	0	ND
				Wetland Ecosystems	0	1	2	3	0	ND
				Sub-account merit score		0	0	0		
				Sub-account merit rating		0.0	0.0	0.0		
		Wildlife	1	Caribou high-quality habitat	6	1	3	3	12	D
				Moose high-quality habitat	6	2	4	3	12	D
				Myotis spp. high-quality habitat	5	1	1	6	25	D
				Invertebrate high-quality habitat	1	1	3	3	2	ND
				Sub-account merit score		24	50	69		
				Sub-account merit rating		1.3	2.8	3.8		
		Fish and Aquatic Habitat	0	Stream length affected	0	3	3	5	0	ND
				Permanent alteration to, or destruction (PAD) of, fish habitat	0	4	4	5	0	ND
				Sub-account merit score		0	0	0		
				Sub-account merit rating		0.0	0.0	0.0		
		Account merit score (S{SxW})				37	28	29		
		Account merit rating (S{SxW}/SW)				4.6	3.6	3.6		
Technical	3									
		Dump Characteristics	3	Complexity of containment	6	6	3	3	18	D
				Physical characterization of wastes	6	6	1	1	30	D
				Area footprint	0	2	5	4	0	ND
				Expansion potential	3	6	1	1	15	D
				Sub-account merit score		90	27	27		
				Sub-account merit rating		6.0	1.8	1.8		
		Supporting Infrastructure	1	Waste haulage distance	3	6	3	3	9	D
				Sub-account merit score		18	9	9		
				Sub-account merit rating		6.0	3.0	3.0		
		Water Collection and Treatment	3	Potential for Water Treatment	3	6.0	6.0	3.0	9	D
				Sub-account merit score		18	18	9		
				Sub-account merit rating		6.0	6.0	3.0		
		Construction, Operation, and Closure	6	Complexity of construction	6	1	6	3	30	D
				Operational flexibility and complexity	3	6	3	3	9	D
				Closure risk	0	6	3	3	0	ND
				Sub-account merit score		24.0	45.0	27.0		
				Sub-account merit rating		2.7	5.0	3.0		
		Account merit score (S{SxW})				58	56	35		
		Account merit rating (S{SxW}/SW)				4.5	4.3	2.7		

Appendix A-3. Sensitivity Analysis 2: Only Differentiating Indicators Included

Account	W	Sub-account	W	Indicator	W	Alt NAG E/W	Alt NAG W	Alt NAG E	Discrimination Value (based on 30% diff)	
Socio-economics	3									
		Aboriginal Interests	0	Traditional territory overlapped	0	3	3	4	0	ND
				Sub-account merit score		0.0	0.0	0.0		
				Sub-account merit rating		0.0	0.0	0.0		
		Commerical Land Use	2	Guide outfitting tenures	3	2	5	4	9	D
				Trapline tenures	6	2	5	4	18	D
				Sub-account merit score		18.0	45.0	36.0		
				Sub-account merit rating		2.0	5.0	4.0		
		Account merit score (S{SxW})				4	10	8		
		Account merit rating (S{SxW}/SW)				2.0	5.0	4.0		
Project Economics	1.5									
		Proponent costs	6	Capital cost	6	6	1	2	30	D
				Operational cost	5	6	1	2	25	D
				Closure cost	3	1	6	6	15	D
				Fish habitat compensation	0	1	2	5	0	ND
				Sub-account merit score		69	29	40		
				Sub-account merit rating		4.9	2.1	2.9		
		Account merit score (S{SxW})				30	12	17		
		Account merit rating (S{SxW}/SW)				4.9	2.1	2.9		
MAA merit score						54	52	46		
MAA merit rating						4.0	3.9	3.4		

Appendix E

Blackwater Gold Project: Low Grade Ore Stockpile Alternatives Assessment

New Gold Inc.

BLACKWATER GOLD PROJECT

Low Grade Ore Stockpile Alternatives Assessment

June 2014

Project #0215644-0001

Citation:
ERM Rescan. 2014. Blackwater Gold Project: Low Grade Ore Stockpile Alternatives Assessment. Prepared for New Gold Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.

ERM Rescan
Rescan Building, 15th Floor
1111 West Hastings Street
Vancouver, BC
Canada V6E 2J3
T: (604) 689-9460
F: (604) 687-4277

ERM Rescan prepared this report for the sole and exclusive benefit of, and use by, New Gold Inc.. Notwithstanding delivery of this report by ERM Rescan or New Gold Inc. to any third party, any copy of this report provided to a third party is provided for informational purposes only, without the right to rely.

BLACKWATER GOLD PROJECT

Low Grade Ore Stockpile Alternatives Assessment

TABLE OF CONTENTS

Table of Contents i

List of Figures ii

List of Tables ii

Glossary and Abbreviations iii

1. Introduction 1–1

1.1 Report Purpose 1–1

1.2 Low Grade Ore Material Disposal Design Criteria 1–1

2. Pre-feasibility Alternatives 2–1

2.1 Candidate Alternatives – LGO Stockpile 2–3

2.2 Pre-screening Assessment 2–3

2.2.1 Results of the Pre-screening Assessment 2–6

2.2.1.1 Would the LGO stockpile location preclude future exploration or mining of a potential resource? 2–6

2.2.1.2 Is Any Part of the LGO Stockpile Management System Unproven Technology? 2–6

2.2.1.3 Does the LGO stockpile location have sufficient capacity for storage of the LGO produced during the entire proposed mine life? 2–6

2.2.1.4 Will the LGO stockpile management system result in negative life of project economics? 2–6

2.2.1.5 Will the LGO stockpile be located partially within the Blackwater watershed? 2–6

2.2.1.6 Will the LGO stockpile be located in the Ungulate Winter Range? 2-11

2.2.1.7 Will the LGO stockpile be contained within the Davidson Creek watershed? 2-12

2.2.2 Results of the Pre-screening Assessment 2-12

3. Alternative Characterization 3-1

3.1 Alt LGO FS 3-1

3.1.1 Technical Characterization 3-1

3.1.2 Environmental Characterization 3-2

3.1.3 Project Economics Characterization 3-2
3.2 Alt LGO A 3-2
3.2.1 Technical Characterization 3-2
3.2.2 Environmental Characterization 3-3
3.2.3 Project Economics Characterization 3-3
4. Comparison of Alternatves 4-1
5. Conclusions 5-1
References R-1

LIST OF FIGURES

Figure 1.1-1. Preferred Tailings and Non-Acid Generating Waste Rock Storage Facility Location 1–3
Figure 2-1. Pre-feasibility Alternatives Step 2–1
Figure 2.1-1. Blackwater Project: Low Grade Ore Stockpile Candidate Alternatives 2–7

LIST OF TABLES

Table 2.1-1. Construction, Operation, and Closure Considerations for Non-acid Generating Waste Rock Storage Alternatives 2–4
Table 2.2-1. Pre-screening Assessment for Blackwater Low Grade Ore Stockpile Candidate Alternatives 2–9

GLOSSARY AND ABBREVIATIONS

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

EDC	Environmental Design Criteria
FS	Feasibility Study
LGO	Low grade ore
ML/ARD	Metal Leaching / Acid Rock Drainage
MMER	Metal Mining Effluent Regulations
NAG	Non-acid generating
TSF	Tailings storage facility
WR	Waste rock

1. INTRODUCTION

1.1 REPORT PURPOSE

This report is an appendix to the Tailing Management Facility (TSF) alternatives assessment for New Gold Inc.'s (New Gold's) Blackwater Gold Project (the Project), which identified the TSF Feasibility Study (FS) option (ERM Rescan 2014) as being preferred (Figure 1.1-1). This report advances the assessment of Project alternatives for mine waste disposal by assessing alternative Low Grade Ore (LGO) Stockpile disposal locations for the TSF FS option, given the Alt NAG E/W was the selected NAG dump alternative (see Appendix D of the main report). The proposed LGO stockpile is anticipated to affect fish-bearing waters, and hence, the preferred LGO stockpile alternative will be included in the Project's application for a Schedule 2 Amendment to the Metal Mining Effluent Regulations (MMER; SOR/2002-222).

The background and objectives of this assessment are provided in Section 1.1 of the *Assessment of Alternatives for Blackwater Project Tailing Storage Facility* (ERM Rescan 2014).

A description of the Project proponent, New Gold, is provided in Section 1.2 of the *Assessment of Alternatives for Blackwater Project Tailing Storage Facility* (ERM Rescan 2014).

A description of the Project and its location is provided in Section 1.3 of the *Assessment of Alternatives for Blackwater Project Tailing Storage Facility* (ERM Rescan 2014).

The environmental, human environment, and Aboriginal groups settings used to support this assessment are provided in Sections 1.8 through 1.10 of the *Assessment of Alternatives for Blackwater Project Tailing Storage Facility* (ERM Rescan 2014) respectively.

1.2 LOW GRADE ORE MATERIAL DISPOSAL DESIGN CRITERIA

The proposed Low Grade Ore (LGO) stockpile will be an elevated grade stockpile, where low grade ore will be stockpiled for use in later years of the Mine life. The mine production schedule calls for 50 Mt of LGO to be stockpiled for treatment in the last three years of the seventeen year mine life. Cut-off grades for the LGO will be approximately 0.3 g/t Au. This LGO will be stockpiled from Years 0 through the end of Year 10 and then processed from Years 15 through 17.

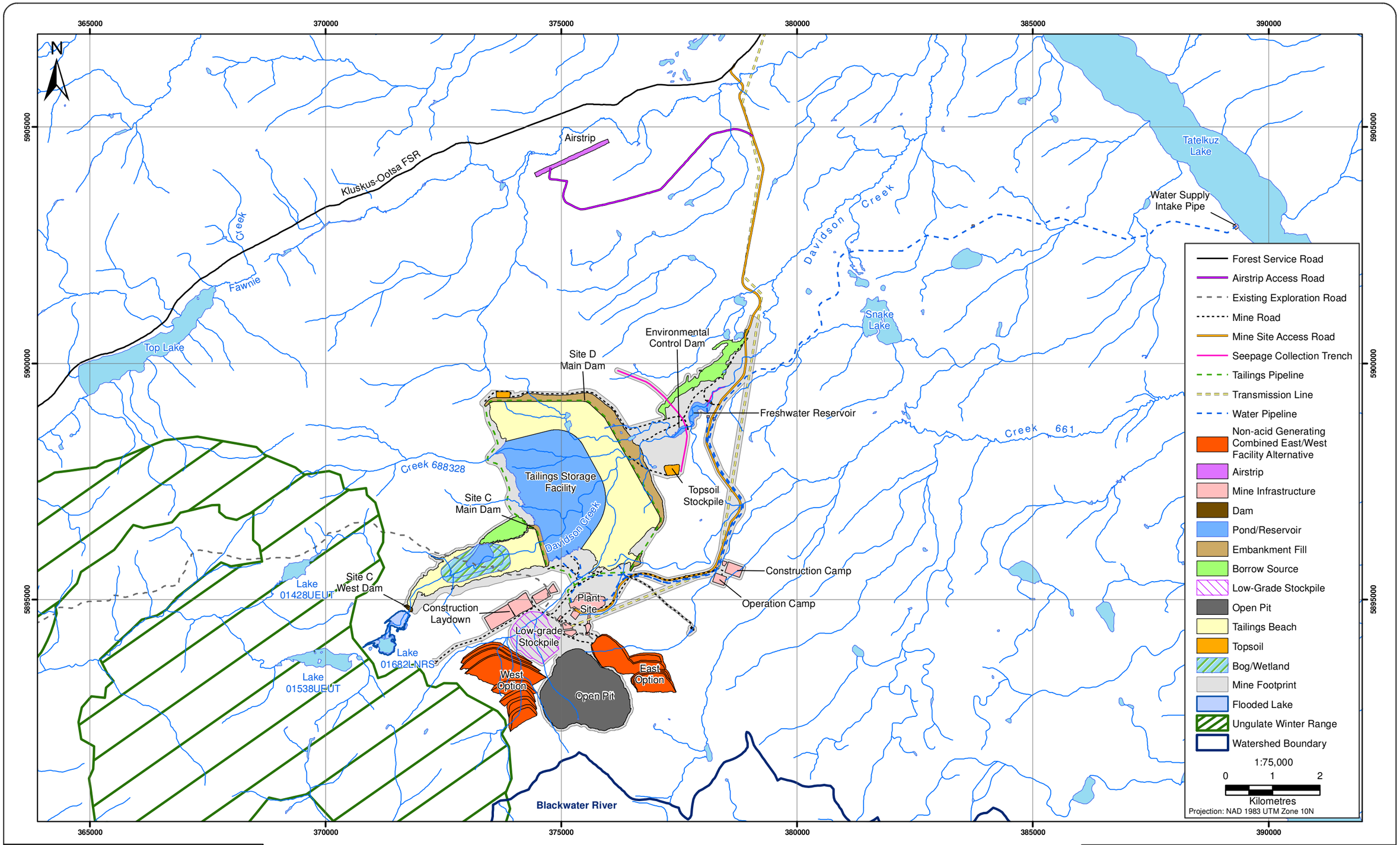
The principal design objectives for the LGO stockpile are to ensure protection of regional groundwater and surface water flows and quality, to achieve effective reclamation of the LGO footprint at mine closure, and to minimize impacts to Aboriginal, commercial, recreational fisheries and their habitat, and the fish species these fisheries are dependent on. The design of the LGO stockpile has taken into account the following requirements (AMEC 2013):

- Control, collection, and management of contact water from the waste, LGO stockpile, and tailings facilities during operations, for recycling as process water to the mill to the maximum practical extent;

- Collection and diversion of non-contact water from upstream of the waste rock facilities, low-grade stockpile, open pit, and plant site areas and direction to the TSF during operations for use in mill operations;
- The inclusion of monitoring programs for all aspects of the facility to ensure performance goals are achieved and design criteria and assumptions are met; and
- Staged development of the facility over the life of the proposed Project.

In addition to the above, the disposal location of LGO stockpile location for the Project is based on the prior selection of the locations of the TSF and NAG WR dumps, such that the selected location for a TSF and WR dumps are not available for the storage of NAG mine rock (ERM Rescan 2014).

PROJECT #0215644-0001 GIS # BLW-15-039 May 29, 2014



newgold

Rescan an ERM company

Figure 1.1-1

Preferred Tailings and Non-acid Generating Waste Rock Storage Facility Location

2. PRE-FEASIBILITY ALTERNATIVES

The first step of the LGO stockpile waste rock disposal selection process involves using threshold criteria, such as geographic, economic, or technical boundaries, to select an initial set of potential LGO stockpile disposal options. These options are then progressively narrowed in future steps of the assessment. The initial candidate alternatives are briefly described at a conceptual level to facilitate the next step, the pre-screening assessment, as per Section 2.2 of the *Guidelines* (Environment Canada 2011; Figure 2-1).

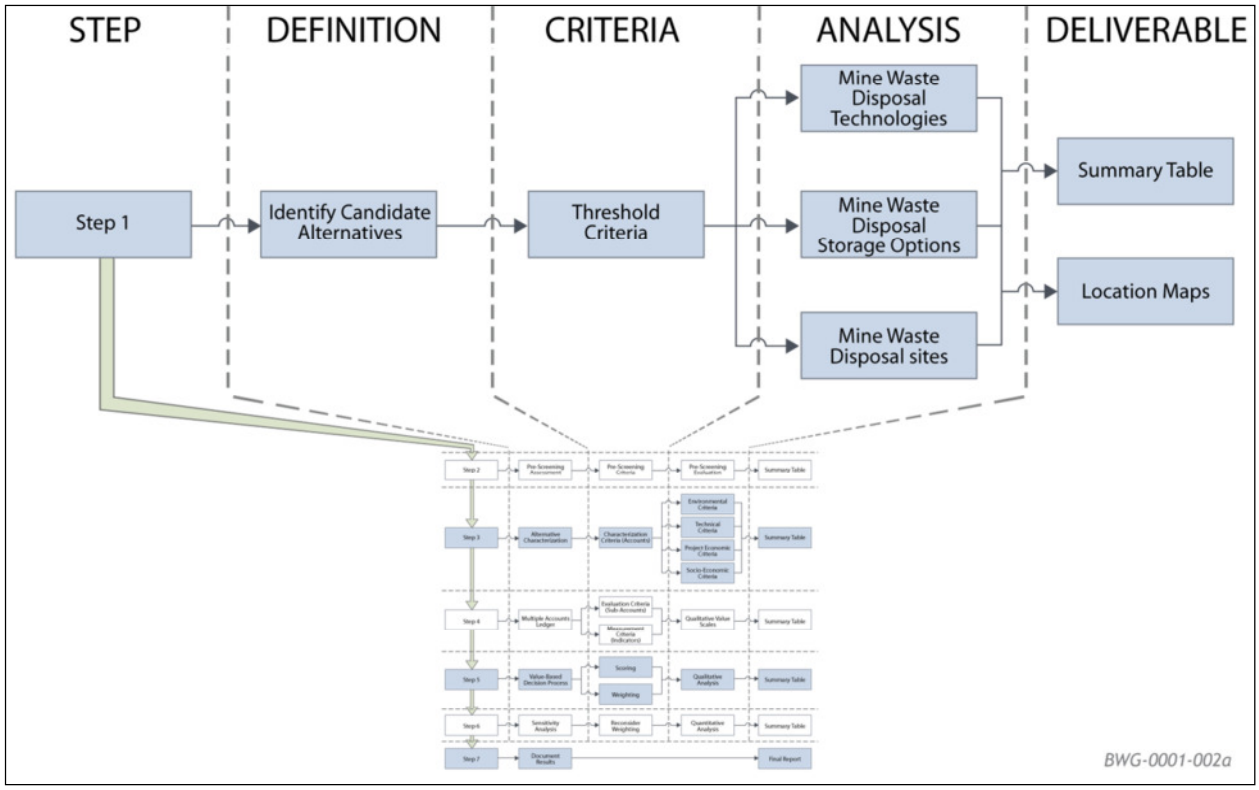


Figure 2-1. Pre-feasibility Alternatives Step

The following threshold criteria were applied to determine reasonable potential LGO stockpile locations for the Project:

- *Exclusion based on distance* – An original screening distance of 5 kms from the open pit was applied to the selection of initial disposal sites due to the cost of hauling ore to the stockpiile. Any potential facility that was not within this boundary was not considered in this analysis.

An overview of the technologies considered for LGO stockpile and their feasibility for the Project is provided below.

No Low Grade Ore Stockpile

The absence of a LGO stockpile was evaluated as a potential disposal option. In this Project configuration, all LGO would either be stored in the TSF as waste or processed in the mill. In the most conservative scenario, all LGO would be disposed of subaqueously in the TSF. This option would remove the last three years of low-grade stockpile production from the Project, and would have the following impacts to the Project:

- Technical
  - ability to place oxide tailings on the beach of TSF Site D during last years of mill operation is lost
  - necessitates increased TSF storage of PAG waste rock by approximately 50 Mt (off-set to some extent by less tailings)
- Economic
  - reduces the Net Present Value (NPV) of the Project from $1,044 M to about $881 M (a 16% reduction in NPV)
  - reduces the Mine Life from 17 years to 14 years (a reduction of about 3 years)
  - reduces the gold recovered from the Project from 7,016 to about 6,486 koz (an 8% reduction in recovered gold)
  - reduces employment benefits to Aboriginal Groups, local communities and BC residents and decreases taxation revenue to all levels of governments
- Regulatory
  - One of the objectives of the Health, Safety and Reclamation Code (BC MEMPR 2008) for under the BC *Mines Act* (1996b) is to "… ensure maximum extraction with a minimum of environmental disturbance …". Thus, by not processing the LGO, New Gold may be in contravention of the Code.

The option of not having an LGO stockpile increases the technical challenges of the Project, is uneconomical, is disadvantageous from a regulatory perspective, and reduces employment and tax revenues and is not considered further in this assessment.

Stockpile Low Grade Ore Material in a Single Temporary Facility

Stockpiling LGO into a temporary facility is an industry wide practice for maximizing the ore extracted from a deposit, and hence maximizing the value of projects. It is particularly important for large tonnage, relatively low grade deposits like Blackwater in order to enhance project economics to acceptable levels. Segregating LGO allows higher direct ore feed grades and faster project payback while preserving the value of the deposit.

Wherever possible, it is desirable to stockpile LGO as close to the open pit and process plant as possible to minimize haulage costs and to reduce the overall environmental footprint of the Project. This placement maximizes the probability of processing the ore during the mine life rather than re-

handling and disposing in the TSF or pit at the end of mining. Properly positioned, stockpiles can have the important advantage of draining by gravity to the TSF or the plant site, which is helpful for consistency with *Metal Mining Effluent Regulations* (SOR/2002-222) runoff and seepage collection and monitoring requirements.

The stockpiling of approximately 50 Mt LGO material in a temporary facility is the focus of this assessment; potential locations for these facilities are discussed further in Section 2.1.

2.1 CANDIDATE ALTERNATIVES – LGO STOCKPILE

Based on the threshold criteria above, New Gold reviewed potential LGO stockpile locations over a screening area within or near the Davidson Creek watershed (see section 2.1-1), centering on the pit. An initial set of five candidate alternative for the LGO stockpile were identified for the Option FS TSF and Alt NAG E/W mine configuration (Figure 2.1-1; ERM Rescan 2014). Details regarding the general construction, operations, and closure considerations of each LGO stockpile are presented in Table 2.1-1.

2.2 PRE-SCREENING ASSESSMENT

The preceding section describes the five NAG waste rock facility candidate alternatives in sufficient detail to allow a pre-screening assessment, or "fatal flaw[1] analysis". This "fatal flaw analysis" removes the LGO stockpile candidate alternatives from further consideration that are non-compliant with minimum specifications developed for the Project, as per Section 2.3 of the *Guidelines* (Environment Canada 2011).

The following pre-screening criteria were applied to each of the initial five NAG waste rock storage facility candidate alternatives:

- Would the LGO stockpile location preclude future exploration or mining of a potential resource?
- Is any part of the LGO stockpile management facility system using unproven technology?
- Does the LGO stockpile location have sufficient capacity for storage of the LGO produced during the entire proposed mine life?
- Will the LGO stockpile management system result in negative life of project economics?
- Will the LGO stockpile be located partially within the Blackwater watershed?
- Will the LGO stockpile be located in the Ungulate Winter Range?
- Will the LGO stockpile be contained within the Davidson Creek watershed?

After conducting an assessment of each LGO stockpile candidate alternative against the above pre-screening criteria, those candidate alternatives determined to have a "fatal flaw" are deemed "non-compliant" and are discarded from further assessment.

[1] A fatal flaw is defined as any site characteristic that is so unfavourable or severe that, if taken singly, it would eliminate an option as a candidate mine waste disposal alternative.

Table 2.1-1. Construction, Operation, and Closure Considerations for Non-acid Generating Waste Rock Storage Alternatives

Low Grade Ore Stockpile Option	Construction Approach	Operational Approach	Closure Approach
LGO Alt FS	The facility would be constructed to the immediate north of the open pit (Figure 2.1-1). The facility is located entirely within the Davidson Creek drainage. The LGO stockpile foundation will be constructed in three stages. The first stage will occur during Years -2 and -1 and will consist of approximately 50% of the area, with the remaining 50% distributed into Years 2 and 4. The LGO stockpile will be developed over an engineered low-permeability 0.5 m compacted till liner with surface water and seepage collection and monitoring systems. Foundation drains will be installed in the footprint area of the stockpile within existing drainage courses or in any areas of seepage encountered during topsoil stripping. The collection drain and foundation drains will report to their respective seepage sumps near the edge of the stockpile.	The LGO stockpile will be constructed from the bottom up in 20 m lifts. Lower lifts will be resloped to an overall slope of 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. Drainage from the LGO stockpile is expected to be acidic and contain elevated metals. Therefore the drainage will be collected, neutralized with lime from the mill, and discharged to the TSF. The facility would be continuously constructed until Operations Year 10. The LGO would be processed in later years in the plant, or, if not processed for economic reasons, placed underwater in the TSF and/or open pit, where the material will be submerged.	At closure, all of the LGO will have been processed or disposed of in the open pit or TSF, and the LGO stockpile will no longer exist. The LGO is expected to be acidic near the sometime during the mine life. If dumped in the TSF or pit rather than processed, 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.
LGO Alt A	The facility would be constructed to the immediate northwest of the West NAG dump, and to the immediate south of the Site C TSF (Figure 2.1-1). The facility is located entirely within the Davidson Creek drainage. Other Construction approaches are similar to LGO Alt FS.	Operational approaches for LGO Alt A are similar to LGO Alt FS.	Closure approaches for LGO Alt A are similar to LGO Alt FS.

(continued)

Table 2.1-1. Construction, Operation, and Closure Considerations for Non-acid Generating Waste Rock Storage Alternatives (completed)

Low Grade Ore Stockpile Option	Construction Approach	Operational Approach	Closure Approach
LGO Alt B	The facility would be constructed to the immediate northeast of the East NAG dump (Figure 2.1-1). The facility is located entirely within the Creek 661 drainage. Other Construction approaches are similar to LGO Alt FS.	Operational approaches for LGO Alt B are similar to LGO Alt FS.	Closure approaches for LGO Alt B are similar to LGO Alt FS.
LGO Alt C	The facility would be constructed to the immediate southeast of the open pit (Figure 2.1-1). The facility is located entirely within the Creek 661 drainage. Other Construction approaches are similar to LGO Alt FS.	Operational approaches for LGO Alt C are similar to LGO Alt FS.	Closure approaches for LGO Alt C are similar to LGO Alt FS.
LGO Alt D	The facility would be constructed to the immediate southwest of the open pit (Figure 2.1-1). The facility is located primarily within the Davidson Creek drainage, although overlap with the Blackwater watershed is possible. Other Construction approaches are similar to LGO Alt FS.	Operational approaches for LGO Alt D are similar to LGO Alt FS.	Closure approaches for LGO Alt C are similar to LGO Alt FS.
LGO Alt E	The facility would be constructed to the immediate north of the TSF Site C (Figure 2.1-1). The facility is located entirely within the Davidson Creek drainage. Other Construction approaches are similar to LGO Alt FS.	Operational approaches for LGO Alt E are similar to LGO Alt FS.	Closure approaches for LGO Alt C are similar to LGO Alt FS.

2.2.1 Results of the Pre-screening Assessment

Table 2.2-1 provides the rationale for each pre-screening criteria and applies these criteria to each candidate alternative. Explanations of why candidate alternatives meet certain criteria are provided in the text following the table.

2.2.1.1 Would the LGO stockpile location preclude future exploration or mining of a potential resource?

If a LGO stockpile were to preclude future exploration or mining of a potential resource, that option should be excluded from further assessment. Based upon exploration and condemnation drilling conducted to date, none of the LGO stockpiles candidate alternatives lie above known economic mineral resources, and no options are excluded from further consideration.

2.2.1.2 Is Any Part of the LGO Stockpile Management System Unproven Technology?

If any part of the LGO stockpile management system is based on unproven technology, this option may provide unmanageable engineering, economic, or environmental risks. All LGO stockpile management systems discussed here utilize well-established technologies, and no options are excluded from further consideration based on this criterion.

2.2.1.3 Does the LGO stockpile location have sufficient capacity for storage of the LGO produced during the entire proposed mine life?

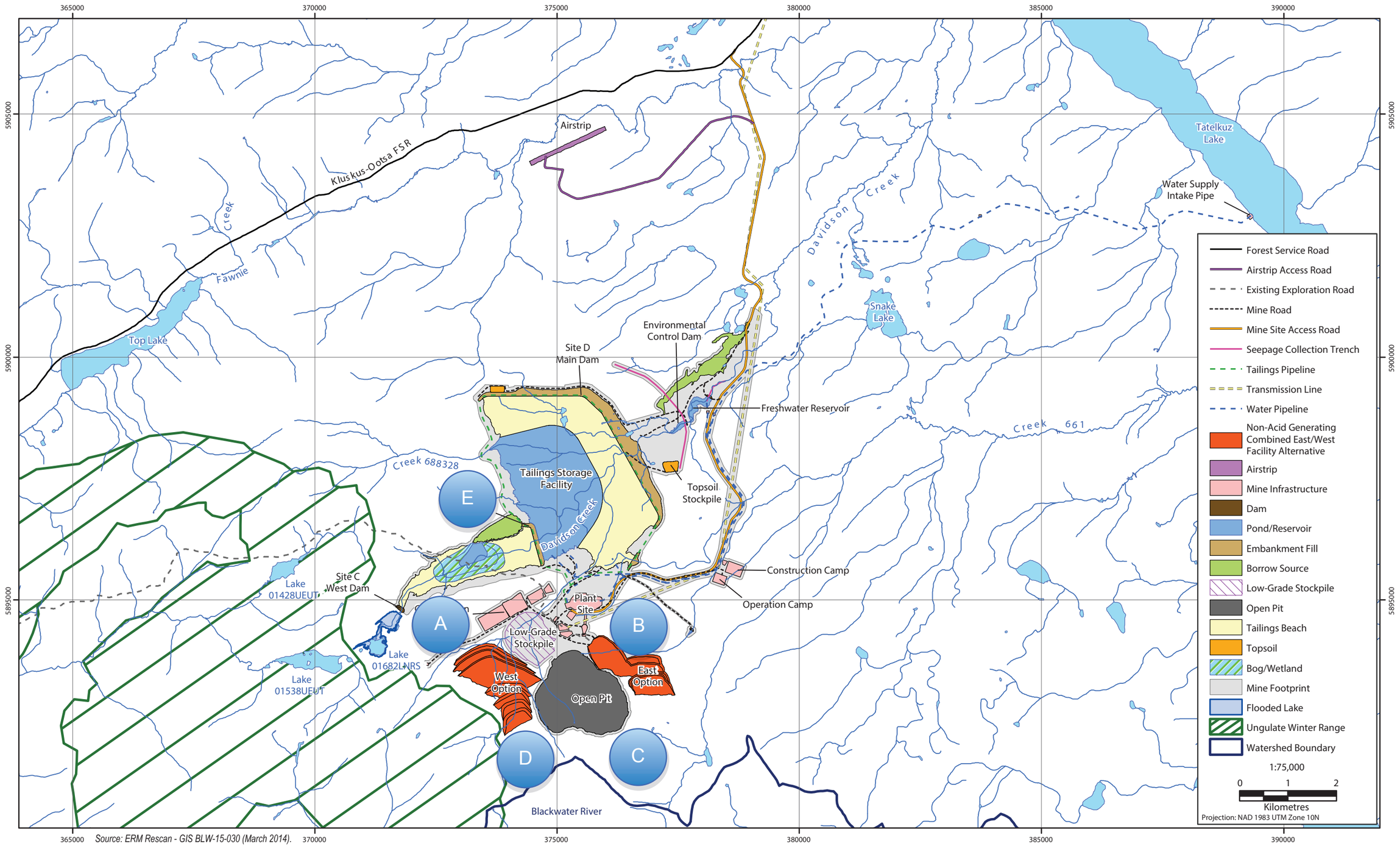
If any LGO stockpile location has insufficient capacity for storage of the LGO produced during the entire proposed mine life (estimated total 50 Mt), then this option may provide unmanageable engineering, economic, or environmental risks. All LGO stockpile locations considered here have sufficient capacities to store the LGO produced during the entire proposed mine life, and no options are excluded from further consideration based on this criterion.

2.2.1.4 Will the LGO stockpile management system result in negative life of project economics?

Due to high haulage costs, (estimated at $0.16/tonne per km), LGO stockpile locations must be located as close as possible to the open pit and the process plant to be economically viable. The Alt E LGO is located approximately 6 km from the open pit along proposed mine roads, and haulage and rehandling costs are estimated to be in the order of $100M. The Alt E LGO option is considered to be uneconomical, and is excluded from further consideration.

2.2.1.5 Will the LGO stockpile be located partially within the Blackwater watershed?

The Blackwater River is listed as a Heritage River under the BC Heritage Rivers System by the BC Ministry of Environment (BC MOE 2010). The BC Heritage Rivers System showcases outstanding examples of a representative range of BC's most important waterways. Heritage status gives these rivers a greater public profile and focus. Heritage Rivers represent the diversity of river landscapes in terms of their natural characteristics, their historical and cultural importance to the human story of the province, and the spectrum of recreational opportunities they support (BC MOE 2010).



Source: ERM Rescan - GIS BLW-15-030 (March 2014).

newgold Rescan an ERM company

Figure 2.1-1

Blackwater Project: Low Grade Ore Stockpile Candidate Alternatives

Table 2.2-1. Pre-screening Assessment for Blackwater Low Grade Ore Stockpile Candidate Alternatives

Pre-Screening Criteria	Rationale	Alt LGO FS	Alt LGO A	Alt LGO B	Alt LGO C	Alt LGO D	Alt LGO E
Would the NAG WRS facility preclude future mining exploration or extraction of a potential deposit?	If a specific storage facility interferes with future exploration or mining of resources the alternative should be excluded from further consideration.	NO	NO	NO	NO	NO	NO
Is any part of the NAG WRS facility disposal system unproven technology?	If a specific deposition method has no precedent of being successfully implemented, then it could justifiably be argued that the alternative should be excluded from further consideration.	NO	NO	NO	NO	NO	NO
Will the NAG WRS facility capacity be too small to store the proposed upper limit of NAG WR?	If a specific storage facility does not have sufficient capacity to store the entire mine-life waste rock, then it could justifiably be argued on economic grounds that the alternative should be excluded from further consideration.	NO	NO	NO	NO	NO	NO
Will the NAG WRS facility result in negative life of project economics?	If a specific deposition method requires long haul distances, then it could justifiably be argued on economic grounds that the alternative should be excluded from further consideration.	NO	NO	NO	NO	NO	YES
Will the NAG WRS facility be located partially within the Blackwater watershed?	If a specific storage facility will impact the watershed of the Blackwater River, a heritage river, the alternative should be excluded from further consideration.	NO	NO	NO	NO	YES	NO
Will the NAG WRS facility be located in an Ungulate Winter Range?	If a specific storage facility overlaps with the designated Ungulate Winter Range for Northern Caribou, the alternative should be excluded from further consideration.	NO	NO	NO	NO	YES	NO
Will the LGO stockpile be contained within the Davidson Creek watershed?	If a specific stockpile location is located outside of the Davidson Creek watershed, then the alternative should be excluded from further consideration	NO	NO	YES	YES	NO	NO
Should the alternative be excluded from further assessment?	If any alternative fails the pre-screening criteria, the alternative is excluded from further assessment.	NO	NO	YES	YES	YES	YES

A Heritage River proclamation does not carry legal or regulatory power. Rather, the designation serves each river by (BC MOE 2010):

- providing a greater emphasis on river-related values during land-use planning processes;
- raising awareness of the importance of healthy river systems;
- helping to protect the special values of the river; and
- helping to build stronger public support for, and involvement in, stewardship of the river.

New Gold respects the intended purpose of a Heritage River designation and has chosen not to develop any mine infrastructure within the Blackwater River drainage (AMEC 2012). Thus, if any portion of a LGO stockpile option lies within the Blackwater River drainage, then this option should be excluded from further consideration.

The Alt LGO D facility candidate alternative may overlap physically or cause seepage to reach the Blackwater watershed (Figure 2.1-1), and is excluded from further consideration. All other candidate alternatives will not impact this watershed.

2.2.1.6 Will the LGO stockpile be located in the Ungulate Winter Range?

Ungulate Winter Range (UWR) is defined as an area that contains habitat that is necessary to meet the winter habitat requirements of an ungulate species. Sections 9 and 12 of the *Government Actions Regulation* (BC Reg 582/2004) of the *Forest and Range Practices Act* (1996a) outline the regulatory authority for establishing UWR. Caribou UWRs have legally established objectives with which most commercial and industrial operations must be consistent.

The Project area is adjacent to the Tweedsmuir-Entiako Northern Caribou UWR, which is key winter habitat used by the Tweedsmuir-Entiako Northern Caribou herd (Ecofor 2013). These Northern Caribou are listed on Schedule 1 of the Canadian *Species at Risk Act* (2002) as Threatened.

The legal direction for the Tweedsmuir-Entiako Northern Caribou herd comes from the document *Order – Ungulate Winter Range #U-7-012* dated December 30, 2005 (the Order). Mineral exploration and development activities are exempt from requirements to manage Northern Caribou through Section 6 of the Order:

> *[T]he general wildlife measures outlined in Schedule 1 do not apply for the purposes of exploration, development and production activities when these activities have been authorized for the purpose of subsurface resource exploration, development or production by the Mineral Tenure Act, the Coal Act, the Mines Act, the Petroleum and Natural Gas Act, the Pipeline Act or the Geothermal Resources Act.*

In concordance with the Northern Caribou Management Plan (Ecofor 2013) developed by New Gold, New Gold has chosen to eliminate any LGO stockpile option that overlaps with UWR from further consideration. Alt LGO D may overlap this UWR (Figure 2.1-1), and is therefore excluded from further consideration based on this criterion.

2.2.1.7 Will the LGO stockpile be contained within the Davidson Creek watershed?

The material to be stored within the LGO stockpile will be ML/ARD and poses a risk to the receiving environment if not properly contained. The most efficient and effective way to treat and contain contact water would be through gravity feed to the plant site for lime addition, with eventual discharge to the TSF with the tailings. Moreover, in order to minimize the risk to the environment, while not expected, any runoff or seepage inadvertently not collected from the LGO should flow by gravity to the TSF. This is not possible if the stockpile is not located within the same watershed and upslope of the TSF; i.e., the upper Davidson Creek watershed. Thus, options located outside of the Davidson Creek watershed would be considered fatally flawed. Low Grade Ore stockpile options B and C are located within the Creek 661 drainage and are excluded from further consideration based on this criterion.

2.2.2 Results of the Pre-screening Assessment

The pre-screening analysis rejected four candidate alternatives due to their being "non-compliant" with the Blackwater watershed pre-screening criteria. The two remaining candidate alternatives deemed acceptable for further characterization and assessment are:

- Option 1: Alt LGO FS
- Option 2: Alt LGO A

3. ALTERNATIVE CHARACTERIZATION

Two alternatives remain for characterization. As these alternatives are located in the same general area (which will already be highly disturbed by the mine site) and utilize the same technology for their construction, operation, and closure a full alternative characterization of the alternatives' environmental, technical, and socio-economic considerations is not deemed to be necessary. As such, the following are considered to be the most differentiating among the alternatives:

- Technical
  - general site conditions
  - ease of water treatment
- Environmental
  - overall mine site footprint
- Socio-economic
  - none; although socio-economic considerations exist within the footprints of the proposed LGO stockpile options, these areas would be isolated and impacted Project components and activities at the mine site, and negligible incremental changes to the socio-economic environment are expected to occur from these stockpiles.
- Project Economics
  - haulage costs

3.1 ALT LGO FS

The Alt LGO FS proposed to place a LGO stockpile to the immediate northwest of the open pit (Figure 2.1-1). A more detailed description of the construction, operation, and closure considerations surrounding this candidate alternative are provided in Table 2.2-1.

3.1.1 Technical Characterization

The general site conditions for the Alt FGO FS are appropriate for the appropriate for the construction, operation and closure of the stockpile. This site would be optimal for location of an LGO stockpile because it would be isolated from the surrounding environment by existing mine infrastructure (open pit, waste rock dump, construction laydown and plant site). The average slope of the site is relatively flat, and the foundation conditions are considered to be appropriate for the construction, operation and closure of the stockpile.

As the stockpile would generate ML/ARD runoff over the life of the mine, safe and effective treatment of that runoff is essential to meeting MMER and other regulatory requirements. The ALT LGO FS stockpile is situated uphill and in close proximity to the plant, so any runoff would report to the mill by gravity feed and the chances of accidental release into the environment would be minimal.

3.1.2 Environmental Characterization

New Gold (2012) has published EDC, one of which is the clustering of the facilities in the mine site. `Clustering' of Project facilities minimizes the overall footprint of the Project and ensures that the mine waste management facilities such as the TSF , waste rock dumps, and LGO stockpile are located in close proximity to the open pits and within the same or adjacent sub-drainages. The location of the FS stockpile meets these EDC as it disturbs land that would already provide fragmented habitat. Approximately 2.1 linear km of fish habitat are overprinted by the footprint of the LGO stockpile, although this habitat would become isolated from downstream reaches upon construction of the TSF Site D Main Dam. Thus, these stream reaches would become non-fish bearing with or without the LGO stockpile.

3.1.3 Project Economics Characterization

The primary economic differentiator among LGO stockpile alternatives would be the haulage and rehandling associated with transporting the LGO to the stockpile and returning it to the plant for processing. As such, the proximity of the LGO stockpile to the open pit and the plant site will drive the overall economic considerations of the alternatives.

The approximate distance from the centre of the pit to the centre of Alt LGO FS stockpile is 1 km, and the approximate distance from the centre of the LGO FS stockpile to the mill site is 900 m. These haulage distances would primarily be downhill, minimizing the fuel costs associated with hauling ore. Predicted haulage costs for the Project are estimated to be $0.16/t/km; haulage costs specific to Alt LGO FS are estimated to be about $15 M.

3.2 ALT LGO A

3.2.1 Technical Characterization

The general site conditions for the Alt LGO A would be considered to be appropriate for construction, operation and closure of the stockpile. This site would be less optimal than the location of the Alt LGO FS stockpile because the overprinted area would be less isolated from the surrounding environment by existing mine infrastructure (TSF, open pit, waste rock dump, construction laydown). The average slope of the site is steeper, although the foundation conditions are considered to be appropriate for the construction, operation, and closure of an LGO stockpile. The steepness of the slope would make liner construction challenging.

Given the steepness of the terrain and proximity to the West Dump and TSF, the LGS might encroach on the footprint of those latter two facilities.

As the stockpile would generate ML/ARD runoff over the life of the mine, safe and effective treatment of that runoff is essential to meeting MMER and other regulatory requirements. The ALT LGO A stockpile is situated uphill and but at a greater distance to the plant than the Alt LGO FS, so any runoff would report to the mill by gravity feed and although there are greater chances for the runoff to be released to the TSF in an untreated form.

3.2.2 Environmental Characterization

New Gold (2012) has published EDC, one of which is the clustering of the facilities in the mine site. `Clustering' of Project facilities minimizes the overall footprint of the Project and ensures that the mine waste management facilities such as the TSF , waste rock dumps, and LGO stockpile are located in close proximity to the open pits and within the same or adjacent sub-drainages. The location of the LGO A stockpile is less compatible with these EDS as it overprints land that would be relatively undisturbed by existing Project infrastructure, as compared to the LGO FS stockpile. Approximately 1.1linear km of fish habitat are overprinted by the footprint of the LGS, although this habitat would become isolated from downstream reaches once the construction of the TSF Site C facility starts. Thus, these stream reaches would become non-fish bearing with or without the LGO stockpile.

3.2.3 Project Economics Characterization

The primary economic differentiator among LGO stockpile alternatives would be the haulage and rehandling associated with transporting the LGO to the stockpile and returning it to the plant for processing. As such, the proximity of the LGO stockpile and to the open pit and the plant site will drive the overall economic considerations of the alternatives.

The approximate distance from the centre of the pit to the centre of Alt LGO FS stockpile is 2 km, and the approximate distance from the centre of the LGO FS stockpile to the mill site is 1.8 km. As a portion of the haulage would be two-way along the same route, more uphill haulage would be expected for this option as compared to the Alt LGO FS, increasing the fuel costs associated with hauling LGO. Haulage costs for the Project are estimated to be $0.16/t/km; conservative (straight-line) haulage costs specific to Alt LGO FS are estimated to be approximately $38 M.

4. COMPARISON OF ALTERNATVES

The two LGO candidate alternatives are compared below for the characterization criteria described in Section 3:

- **Tec**hnical
  - *general site conditions* – the general site conditions are preferable for Alt LGO FS as the underlying topography is gentler (i.e., less steep) and agreeable to construction of a liner and seepage collection system
  - *ease of water treatment* – the ease of discharge water treatment is preferable for Alt LGO FS, as the facility is located closer to the plant and there is much lower environmental risk of accidental untreated ML/ARD water released to the TSF
- **Environmental**
  - *overall mine site footprint* – Alt LGO FS better meets New Gold's EDC of clustering of mine facilities and impacting previously disturbed land
  - *fish habitat* – Alt LGO A impacts less fish habitat, although for both options, the stream reaches involved would be non-fish bearing at the initiation of the construction of the LGO stockpiles due to other mine activity.
- **Socio-economic**
  - none
- **Project Economics**
  - *haulage costs* – Option LGO FS has significantly lower estimated haulage costs than Alt LGO A ($15 M vs $38 M)

As the Alt LGO FS is superior to the Alt LGO A for all characteristics considered, a full multiple accounts analysis, including sensitivity analyses, as outlined in the *Guidelines* (Environment Canada 2011) is deemed to be unnecessary.

Alt LGO FS is the preferred LGO stockpile for the Project.

5. CONCLUSIONS

The Alt LGO FS is the preferred LGO stockpile option for the Project because it has better technical considerations (gentler slopes, and increased ease of water treatment), better meets New Gold's Environmental Design Criteria, and is less costly than the Alt LGO A option. Although Alt LGO FS affects greater (current) fish habitat, all habitat affected by both options would become non-fish bearing through other Project activities (e.g. construction of TSF Dam D for the selected TIA alternative and the Environmental Control Dam) and this indicator was therefore not differentiating in this analysis.

REFERENCES

Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

1996a. *BC Forest Act*, RSBC. C. 157.

1996b. *Mines Act*, RSBC. C. 293.

2002. *Species at Risk Act*, SC. C. 29.

Government Actions Regulations, BC Reg 582/2004.

Metal Mining Effluent Regulations SOR/2002-222.

AMEC. 2012. *Blackwter Gold Project - Draft Environmental Design Criteria*. VE52095, Version V4.0. Prepared for NewGold Inc. by AMEC Environment and Infrastructure: Vancouver, BC.

AMEC. 2013. *Blackwater Gold Project - Feasibility Study.* VAxx. New Gold Inc.: Vancouver, BC.

BC MEMPR. 2008. H*ealth, Safety and Reclamation Code for Mines in British Columbia*. Victoria, BC: British Cololumbia Ministry of Energy, Mines, and Petroleum Resources (BC MEMPR), Mining and Minerals Division.

British Columbia Ministry of Environment. 2010. British Columbia Heritage Rivers Program. http://www.env.gov.bc.ca/bcparks/heritage_rivers_program/history.html#objectives (accessed November 19, 2013).

Ecofor. 2013. B*lackwater Regional Exploration Area, Northern Caribou Management Plan, Final Report, Version 3. 28 March 2013*. Prepared for New Gold Inc. by Ecofor Consulting Ltd.: Fort St. James, BC.

Environment Canada. 2011. *Guidelines for the Assessment of Alternatives for Mine Waste Disposal*. Government of Canada: Ottawa, ON.

ERM Rescan. 2014. *Assessment of Alternatives for Blackwater Gold Project Tailing Storage Facility*. Prepared for New Gold Inc. by ERM Rescan Vancouver, BC.

Appendix F

Blackwater Gold Project: Notice under Section 79(1) of the Species at Risk Act

Canadian Environmental Assessment Agency
Agence canadienne d'évaluation environnementale

PO Box 10114
701 West Georgia Street
Suite 410
Vancouver, British Columbia
V7Y 1C6

Boite postale 10114
701 rue Georgia ouest
Bureau 410
Vancouver (Colombie-Britannique)
V7Y 1C6

January 8, 2014

Agency File No.: 80017

Barry Smith
Regional Director
Canadian Wildlife Service
Pacific Wildlife Research Centre
5241 Robertson Road
Delta BC V4K 3N2

Dear Mr. Smith:

Subject: Notification Pursuant to the Requirements of Subsection 79(1) of the *Species at Risk Act* for the Blackwater Gold Project

Please be advised that the Canadian Environmental Assessment Agency (the Agency), in performing the duties and functions of the responsible authority for the environmental assessment (EA) of the proposed Blackwater Gold Project (the Project), has determined that the Project may affect listed wildlife species.

Listed species or their critical habitat as defined in the *Species at Risk Act* (SARA), in addition to other federally (i.e., COSEWIC) listed species that may be impacted by the Project, are provided in Annex A. In addition, provincially (i.e., Blue and Red) listed species are provided in Annex B.

These determinations are based on information provided in the Blackwater Gold Project Description (submitted to the Agency on October 24, 2012) and subsequent presentations made by New Gold Inc. An Executive Summary of the Project Description is attached to this letter. Additional species at risk may be identified as the EA progresses. In the event that this should occur, the Agency will notify the appropriate federal departments of any changes.

The Project is located approximately 100 kilometres south of Vanderhoof, British Columbia (B.C.) and is a proposed open pit gold and silver mine. Additional project components include access roads and a transmission line corridor. As proposed, the Project is expected produce 60,000 tonnes of gold and silver over a mine life of 17 years.

.../2

The potential adverse environmental effects of the Project on SARA-listed species, as described by the proponent in the Project Description and expanded upon in the final Environmental Impact Statement (EIS) Guidelines and draft Application Information Requirements include:

For avian species at risk:

- alteration, fragmentation or loss of critical habitat, including but not limited to wetlands, aquatic or riparian habitat, grasslands and forests that provide over-wintering, foraging, breeding, and roosting areas, consequently impacting avian survival and productivity;
- changes to surface water quantity and quality may affect water birds;
- insectivorous species may be impacted in response to changes in the abundance and species composition of invertebrates;
- disruption of daily and seasonal movements of migratory species, having subsequent consequences on over-winter survival and reproduction;
- direct or indirect mortality as a result of mine operations and traffic, contact with the transmission line, contamination from tailings and reagents, and increased recreational hunting opportunities or improved access for predator species with impacts to predator-prey dynamics;
- facilitation of invasion or domination of foreign or noxious species; and
- sensory disturbance (e.g., noise, vibration, and lighting) may potentially influence avian behaviour.

For wildlife (mammals, amphibians and invertebrates) species at risk:

- alteration, fragmentation or loss of critical habitat, including but not limited to wetlands, aquatic or riparian habitat, grasslands and forests that provide over-wintering, foraging, breeding, and denning areas, consequently impacting survival and productivity;
- changes to surface water quantity and quality may affect invertebrates as well as insectivorous species;
- insectivorous species may be impacted in response to changes in the abundance and species composition of invertebrates;
- disruption of daily and seasonal movements of migratory species, having subsequent consequences on over-winter survival and reproduction;
- direct or indirect mortality as a result of mine operations and traffic, and increased recreational hunting opportunities or improved access for predator species with impacts to predator-prey dynamics;
- facilitation of invasion or domination of foreign or noxious species; and
- sensory disturbance (e.g., noise, vibration, and lighting) may potentially influence wildlife behaviour.

.../3

For plant species at risk:

- potential alteration, fragmentation or loss of unique ecosystems influencing plant species diversity, abundance, and distribution;
- facilitation of invasion or domination by foreign or noxious species; and
- direct or indirect plant mortality through clearing and habitat deterioration (e.g., soil quality, exposure, etc.).

If Environment Canada is aware of additional potential adverse environmental effects to federally-listed species and their critical habitat, please contact the Agency prior to **February 7, 2014**. The Agency acknowledges that the species listed in Annex B are managed by the Province of B.C. and therefore requests Environment Canada to liaise with the appropriate provincial ministries as required.

The Project is subject to an EA under the *Canadian Environmental Assessment Act, 2012*. The Project is also subject to provincial review under the *British Columbia Environmental Assessment Act* (*BCEAA*), administered by the B.C. Environmental Assessment Office (B.C. EAO). Additional information about the EA is available on the Agency's website at *www.ceaa-acee.gc.ca* (registry reference number 80017) and on the EAO's Project Information Centre (e-PIC) at *www.eao.gov.bc.ca*.

I will be managing, on behalf of the Agency, the EA process for the Project. Please do not hesitate to contact me at 604-666-2005 or Christal.Nieman@ceaa-acee.gc.ca if you have any questions or wish to provide the Agency with information relating to the Project and any potential impacts it could have on Species at Risk and their critical habitat.

Sincerely,

Christal Nieman
Acting Project Manager, Pacific and Yukon Region

Attachments: Annex A: Table of federally (SARA and COSEWIC) listed species
Annex B: Table of provincially (Red and Blue) listed species
Blackwater Gold Project Description Executive Summary

.../4

c.c.: Shelley Murphy, BC Environmental Assessment Office
Steve McNaughton, BC Environmental Assessment Office
Barry Jeffrey, Environment Canada
Bob More, Environment Canada
Coral DeShield, Canadian Wildlife Services
René McKibbin, Canadian Wildlife Services
Alvaro Paredes, AMEC Environment and Infrastructure
Tim Bekhuys, New Gold Inc.
Nigel Fisher, New Gold Inc.

Annex A:

Table of federally (SARA and COSEWIC) listed species, as identified by the proponent as being present, or potentially occurring within the Project Region.

Common Name	Scientific Name	List	Status	Designation Date
	BIRDS			
Olive-sided Flycatcher	*Contopus cooperi*	SARA	Threatened	2010
Common Nighthawk	*Chordeiles minor*	SARA	Threatened	2010
Short-eared Owl	*Asio flammeus*	SARA	Special Concern	2012
Rusty Blackbird	*Euphagus carolinus*	SARA	Special Concern	2009
Long-billed Curlew	*Numenius americanus*	SARA	Special Concern	2005
Yellow Rail	*Coturnicops noveboracensis*	SARA	Special Concern	2003
Barn Swallow	*Hirundo rustica*	COSEWIC	Threatened	2011
Horned Grebe	*Podiceps auritus*	COSEWIC	Special Concern	2009
Peregrine Falcon	*Falco peregrinus*	COSEWIC	Special Concern	2007
Western Screech-owl	*Megascops kennicottii kennicottii*	COSEWIC	Threatened	2012
Lewis's Woodpecker	*Melanerpes lewis*	COSEWIC	Threatened	2010
	MAMMALS			
Woodland Caribou (Northern Mountain population)	*Rangifer tarandus caribou*	SARA	Special Concern	2005
Woodland Caribou (Southern Mountain population)	*Rangifer tarandus caribou*	SARA	Threatened	2003
Grizzly Bear	*Ursus arctos*	COSEWIC	Special Concern	2012
Wolverine	*Gulo gulo luscus*	COSEWIC	Special Concern	2003
Little Brown Myotis	*Myotis lucifugus*	COSEWIC	Endangered	2012
Northern Myotis	*Myotis septentrionalis*	COSEWIC	Endangered	2013
	AMPHIBIANS			
Western Toad	*Anaxyrus boreas*	SARA	Special Concern	2005
	PLANTS			
Whitebark Pine	*Pinus albicaulis*	SARA	Endangered	2012

Annex B:

Table of provincially (Red and Blue) listed species, as identified by the proponent as being present, or potentially occurring within the Project Region.

Common Name	Scientific Name	List	Status	Designation Date
	BIRDS			
American Bittern	*Botaurus lentiginosus*	Blue	Special Concern	2010
Great Blue Heron (*herodias* subspecies)	*Ardea herodias herodias*	Blue	Special Concern	2009
American Golden-plover	*Pluvialis dominica*	Blue	Special Concern / Apparently Secure	2005
Sharp-tailed Grouse (*columbianus* subspecies)	*Tympanuchus phasianellus columbianus*	Blue	Imperiled / Special Concern	2005
California Gull	*Larus californicus*	Blue	Special Concern	2013
Caspian Tern	*Hydroprogne caspia*	Blue	Special Concern	2011
	MAMMALS			
Fisher	*Pekania pennanti*	Blue	Imperiled / Special Concern	2006
	INVERTEBRATES			
Hagen's Bluet	*Enallagma hageni*	Blue	Special Concern / Apparently Secure	2004
Beaverpond Baskettail	*Epitheca canis*	Blue	Special Concern	2004
Quebec Emerald	*Somatochlora brevicincta*	Blue	Special Concern	2004
Forcipate Emerald	*Somatochlora forcipata*	Blue	Imperiled / Special Concern	2004
Kennedy's Emerald	*Somatochlora kennedyi*	Blue	Special Concern / Apparently Secure	2004
Assiniboine Skipper	*Hesperia assiniboia*	Red	Imperiled	2013
Checkered Skipper	*Pyrgus communis*	Blue	Special Concern	2013
Jutta Arctic (*chermocki* subspecies)	*Oeneis jutta chermocki*	Blue	Special Concern	2013
Northern Tightcoil	*Pristiloma arcticum*	Blue	Special Concern / Apparently Secure	2008
Black-footed Tightcoil	*Pristiloma chersinella*	Blue	Special Concern / Apparently Secure	2008
	PLANTS			
190 Blue- and Red-listed species were identified in the proponent's baseline report. Full list available upon request.				

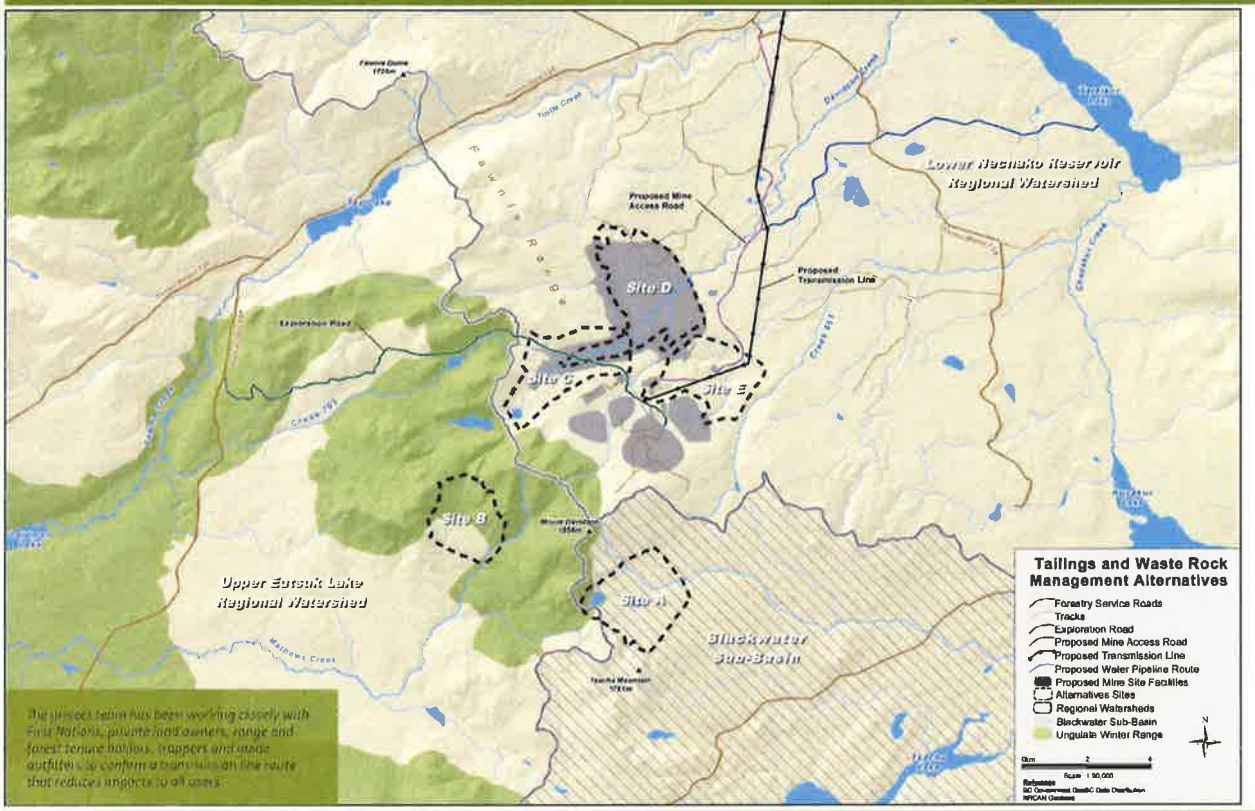
Appendix G

Poster: Alternatives Considered for Mine Waste Management

newgold™

Blackwater Project

Alternatives considered for mine waste management



Five potential locations for storage of 3 billion cubic metres of mine waste (tailings and waste rock) were identified within ten kilometres of the open pit location.

The alternatives assessment considered considered environmental, technical, socio-economic, and project economic factors concluded that Sites C and D were the best sites due to:

- Location outside of the Blackwater River drainage and the Ungulate Winter Range (critical winter habitat for hooved animals, including Caribou)
- Relatively high storage to footprint area ratio and low embankment volumes
- Close proximity to the mineral deposit area
- Location within the upper portion of the Davidson Creek catchment, simplifying operational water management.

PROPOSED ACCESS ROAD

The map also illustrates the proposed access road. This route was selected because it avoids crossing the Ungulate Winter Range (critical winter habitat for hooved animals).

Appendix H

Project Consultation History Relating to Mine Waste

Appendix H – Project Consultation History Relating to Mine Waste

Key Contact Summary for Burns Lake Band

ROC #	Event Type	Date	Participating Organizations	Summary*
223	Meeting	03/15/2012	Burns Lake Band, The Proponent	1) The Proponent introduced the Project.
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
2329	Mass Mailout	07/17/2013	Mailing List, The Proponent	1) Project update letter to those on the stakeholder e-mail list.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the "Date" column (Mo/Day/Yr).

Key Contact Summary for Cheslatta Carrier Nation

ROC #	Event Type	Date	Participating Organizations	Summary*
726	Phone Call	10/01/2012	Cheslatta Carrier Nation, The Proponent	1) Informal project introduction.
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
2002	Drop-in Visit/ Casual Meeting	01/09/2013	Cheslatta Carrier Nation, The Proponent	1) The Proponent provided an overview of the Project to the Chief during a discussion at the Natural Resources Forum. CCN does not have any issues with the Project. Asked to be contacted for construction hiring.
2329	Mass Mailout	07/17/2013	Mailing List, The Proponent	1) Project update letter to those on the stakeholder e-mail list.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the "Date" column (Mo/Day/Yr).

Key Contact Summary for Carrier Chilcotin Tribal Council

ROC #	Event Type	Date	Participating Organizations	Summary*
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
2329	Mass Mailout	07/17/2013	Mailing List, The Proponent	1) Project update letter to those on the stakeholder e-mail list.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the "Date" column (Mo/Day/Yr).

Key Contact Summary for Carrier Sekani Tribal Council (CSTC)

ROC #	Event Type	Date	Participating Organizations	Summary*
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
2460	Meeting	04/18/2013	CSTC, Nadleh Whut'en First Nation (NWFN), The Proponent	1) The Proponent provided a project overview and update to the NWFN Chief and Councillor and CSTC Tribal Chief. Discussion included participation in the EA process, a site visit and potential effects of mine water.
2185	Phone Call	06/20/2013	CSTC, The Proponent	1) The Proponent requested a meeting to discuss the Project; CSTC will contact The Proponent when they are available to discuss.
2325	Letter	07/16/2013	CSTC, The Proponent	1) The Proponent provided the Tribal Chief with copies of the section 11 Order, CEAA Project Agreement, The Proponent newsletter and sustainability report.
2329	Mass Mailout	07/17/2013	Mailing List, The Proponent	1) Project update letter to those on the stakeholder e-mail list.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the "Date" column (Mo/Day/Yr).

Key Contact Summary for ?Esdilagh First Nation

ROC #	Event Type	Date	Participating Organizations	Summary*
1427	Meeting	02/22/2013	?Esdilagh First Nation, Tsilhqot'in National Government (TNG), The Proponent	1) The Proponent provided an overview of the Project to the Chiefs and others, which led to discussions on employment, contracting, training, and potential effects on caribou.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the "Date" column (Mo/Day/Yr).

Key Contact Summary for Lhoosk'uz Dene Nation (LDN)

ROC #	Event Type	Date	Participating Organizations	Summary*
60	Meeting	08/22/2011	Environmental and Resources Law (LDN), Ganhada Management (LDN), LDN, Catana Consulting, The Proponent	1) The Proponent introduced the Project. Discussion topics included concern about the past Richfield program, identification of important traditional/archaeology sites, wildlife, concern about effects on water, future work, the EA process, and employment and training.
56	Presentation	09/08/2011	Ganhada Management (LDN), LDN, Catana Consulting, The Proponent	1) The Proponent provided a short presentation on the Project at the community audit meeting.
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
116	Site Visit	11/03/2011	LDN, Tobias & Associates (LDN), AMEC	1) Two-day helicopter overflight of the project area with LDN members, as well as a ground inspection of the MYAB Area A. No archaeological sites were identified.
159	Drop-in Visit/ Casual Meeting	01/25/2012	LDN, Catana Consulting	1) Lunch meeting. Discussed BCAMTA, concerns about cyanide and an agreement signing ceremony.
670	Meeting	07/19/2012	Ganhada Management (LDN), The Proponent	1) JIC meeting. Discussed employment, training and contracting opportunities; Blackwater camp; cell tower; NOW amendments and permits; environmental assessment; TLU study and agreements; and concerns about tailings and monitoring.
692	Phone Call	07/30/2012	LDN, The Proponent	1) Tour of drill sites and tailings area set for 12/08/23 per request by LDN member.
705	Site Visit	09/13/2012	LDN, Trapline TR0711T007 (SFN), The Proponent	1) Site tour for LDN Elder and trapline tenure holder.
764	Drop-in Visit/ Casual Meeting	09/17/2012	Ganhada Management (LDN), LDN, The Proponent	1) General project discussion with Chief and Band Manager over lunch.

ROC #	Event Type	Date	Participating Organizations	Summary*
1047	Meeting	11/01/2012	LDN, Skeetchestn Indian Band, Tk'emlúps te Secwépemc, Ulkatcho First Nation, The Proponent	1) Project introduction and discussion on potential agreements.
N/A	Meeting	11/29/2012	LDN, The Proponent	1) Second presentation about the project to the LDN community at their Annual General Assembly.
	Meeting	04/30/2013	LDN, The Proponent	1) Drinking water sources. 2) Closure of mine and tailings effects
	EA Working Group Meeting	04/30/2013	EA Working Group, including LDN and the Proponent	1) Overview of Tailings Storage Facility Alternatives Assessment
	Meeting	05/01/2013	LDN, trapline holder, The Proponent	1) Concerns of effects of water and tailings on trapline keyoh territory
	Meeting	05/28/2013	LDN, The Proponent	1) Project update
2218	Site Visit	06/18/2013	LDN, Trapline TR0512T014, The Proponent	1) LDN members and a trapline tenure holder participated in a heli tour of the project site. Discussion topics included wildlife (moose, grizzly and marten), some traditional knowledge of the area, and the tailings facility and area. Concerns related to tailings effects on waterways and effects on wildlife habitat.
	Meeting	07/11/2013	LDN, The Proponent	1) Elders – discussion of traditional lifestyle and concerns of tailings and water
	Meeting	08/13/2013	LDN, The Proponent	1) Update community and interview with Elder Cassam - keyoh
	Phone Call	09/19/2013	LDN, The Proponent	1) Advise of baseline studies on New Gold website
	Meeting	10/31/2013	LDN, The Proponent	1) Water quality presentation
	EA Working Group Meeting	03/04/2014	EA Working Group, including LDN and the Proponent	1) Groundwater modelling and EA.
	Community Meeting	08/06/2014	LDN, The Proponent	1) Poster presentation showing TSF alternatives

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the "Date" column (Mo/Day/Yr).

Key Contact Summary for Métis Nation of British Columbia (MNBC)

ROC #	Event Type	Date	Participating Organizations	Summary*
823	Meeting	10/31/2012	MNBC, The Proponent	1) The Proponent introduced the Project. Discussion included Aboriginal consultation, Métis land users and capacity funding.
1039	E-mail	01/07/2013	MNBC, The Proponent	1) Call to discuss the Project set for 13/01/07.
1416	Meeting	01/30/2013	MNBC, The Proponent	1) The Proponent provided a project update.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the "Date" column (Mo/Day/Yr).

Key Contact Summary for Nazko First Nation (NFN)

ROC #	Event Type	Date	Participating Organizations	Summary*
416	Phone Call	01/27/2012	NFN, The Proponent	1) Discussed the Project, and set a meeting for 12/02/08.
192	Meeting	02/08/2012	NFN, The Proponent	1) The Proponent introduced the Project to NFN.
381	Meeting	03/19/2012	NFN, The Proponent	1) The Proponent introduced the Project to NFN
686	Meeting	07/26/2012	NFN, The Proponent	1) General project discussion on jobs, contracting, agreements and concerns about arsenic.
691	Phone Call	07/30/2012	NFN, The Proponent	1) Introduced Project and discussed potential project employment opportunities for members.
1663	E-mail	08/29/2012	NFN, The Proponent	1) Per NFN's request at the 12/07/26 meeting, The Proponent provided information on arsenic concentrations downstream of the project site.
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
1280	Meeting	11/13/2012	NFN, Bram Rogachevsky Law Corp. (NFN), Nazko Economic Development Corporation, The Proponent	1) Presentation and discussion on the Project Description.
2464	Mail (Letter)	11/19/2012	NFN, The Proponent	1) Per NFN's request, The Proponent provided two hard copies of the Project Description.
2263	Meeting	07/09/2013	Nazko Economic Development Corporation, NFN, The Proponent	1) Project introduction to Chief, Councillor and staff. Discussed the Project and potential effects. Also discussed the draft EA Participation Agreement and a TLU study.
2329	Mass Mailout	07/17/2013	Mailing List, The Proponent	1) Project update letter to those on the stakeholder e-mail list.
2594	E-mail	09/26/2013	NFN, The Proponent	1) The Proponent requested a meeting of Chief & Council.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the "Date" column (Mo/Day/Yr).

Key Contact Summary for Nadleh Whut'en First Nation (NWFN)

ROC #	Event Type	Date	Participating Organizations	Summary*
706	Meeting	09/14/2012	NWFN, The Proponent	1) Project introduction for Band Manager and Councillor.
716	Letter	09/27/2012	NWFN, The Proponent	1) Request for introductory meeting with Chief & Council.
1654	Phone Call	10/11/2012	NWFN, The Proponent	1) Meeting between the Chief and The Proponent's First Nations Coordinator scheduled for 12/10/18. Chief did not show for meeting on 12/10/18.
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
948	Meeting	12/07/2012	NWFN, The Proponent	1) Meeting planned with Chief did not occur. Met with Band Manager instead.
1388	Meeting	02/13/2013	NWFN, XL Mining, Inc., The Proponent	1) Meeting with Chief & Councillor. Discussed the Project and activities over the next few years.
2460	Meeting	04/18/2013	NWFN, Carrier Sekani Tribal Council, The Proponent	1) The Proponent provided a project overview and update to the NWFN Chief & Councillor and CSTC Tribal Chief. Discussion included participation in the EA process, a site visit and potential effects of mine water.
	EA Working Group Meeting	04/30/2013	EA Working Group, including NWFN and the Proponent	1) Overview of Tailings Storage Facility Alternatives Assessment

ROC #	Event Type	Date	Participating Organizations	Summary*
2316	Meeting	07/11/2013	NWFN, The Proponent	1) Project introduction for NWFN Chief & Council.
2329	Mass Mailout	07/17/2013	Mailing List, The Proponent	1) Project update letter to those on the stakeholder e-mail list.
2342	E-mail	07/18/2013	NWFN, The Proponent	1) The Proponent proposed a meeting with NWFN on 13/08/14 and a helicopter site tour on 13/08/15.
2382	E-mail	07/30/2013	NWFN, The Proponent	1) The Proponent confirmed meeting with NWFN Chief & Council on 13/08/14 and helicopter tour on 13/07/15.
2445	E-mail	08/13/2013	NWFN, The Proponent	1) NWFN requested that the 13/08/14 meeting be postponed.
2632	Phone Call	08/16/2013	NWFN, The Proponent	1) Discussed the Project.
2596	E-mail	09/26/2013	NWFN, The Proponent	1) The Proponent requested a call to discuss a meeting with Chief & Council.
	Meeting	07/04/2014	NWFN, The Proponent, The Firelight Group, Source Environmental, AMEC	1) The Proponent provided NWFN with an overview of the environmental, water quality, and waste management studies. Discussion ensued.
	Meeting	07/11/2013	NWFN, The Proponent	1) The Proponent provided a Project update to the NWFN Chief and Council.
	Meeting	09/26/2014	NWFN, The Proponent, Environmental Sciences Ltd, Source Environmental, AMEC	1) The Proponent presented the water quality model, predictions, and fish assessment.
	E-mail	10/03/2014	NWFN, The Proponent	1) The Proponent responded to NWFN with the information they had requested during the September 19, 2014 site tour including questions about fish habitat in Davidson Creek and volume of water in Tatlekuz Lake.
	Meeting	03/27/2015	NWFN, The Proponent	1) Discussion of NWFN concerns including tailings.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the “Date” column (Mo/Day/Yr).

Key Contact Summary for Saik’uz First Nation (SFN)

ROC #	Event Type	Date	Participating Organizations	Summary*
186	Meeting	03/20/2012	SFN, The Proponent	1) The Proponent introduced the Project to SFN.
1637	Meeting	08/13/2012	SFN, The Proponent	1) Project introduction to Chief & Council.
699	Open House	08/14/2012	SFN, The Proponent	1) Community meeting to discuss the Project. Attended by 68 people.
482	Site Visit	08/15/2012	SFN, District of Vanderhoof, The Proponent	1) Heli tour of project site for Mayor and Chief.
567	Meeting	10/02/2012	Vanderhoof & District Chamber of Commerce, SFN, Other Stakeholders, The Proponent	1) Project presentation to the Vanderhoof & District Chamber of Commerce.
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
1426	E-mail	03/07/2013	SFN, The Proponent	1) The Proponent invited SFN to attend the project site tour on 13/03/08.
1434	Phone Call	03/07/2013	SFN, The Proponent	1) SFN is unable to attend the 13/03/08 site tour.
	EA Working Group Meeting	04/30/2013	EA Working Group, including SFN and the Proponent	1) Overview of Tailings Storage Facility Alternatives Assessment
1817	Meeting	05/07/2013	SFN, The Proponent	1) The Proponent provided an update on the Project and transmission line. Discussed amount of consultation to date, baseline and TK studies (and SFN involvement in them), project water use, the transmission line and power needs, site reclamation, concerns about arsenic, process for extracting gold, employment at The Proponent projects, and a potential site tour of the New Afton mine site.
2037	Conference Call	06/13/2013	SFN, AMEC, The Proponent	1) Discussed concerns raised by SFN in their letter to the BC EAO. Concerns related to effects on traditional harvesting and land use, socio-economic issues, and waste management at the site.
2329	Mass Mailout	07/17/2013	Mailing List, The Proponent	1) Project update letter to those on the stakeholder e-mail list.
	Meeting	12/11/2014	SFN, The Proponent	1) Discussion of outstanding SFN issues including alternatives assessment, PAG management at closure, and cyanide management.
	Memo	12/15/2014	SFN, the Proponent	1) Memo from SFN describing the outstanding issues that SFN had previously raised that were not adequately addressed in their opinion.
	Meeting	12/15/2014	SFN, The Proponent	1) Discussion of outstanding SFN issues (“yellow issues”) including tailings reclamation.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the “Date” column (Mo/Day/Yr).

Key Contact Summary for Skeetchestn Indian Band

ROC #	Event Type	Date	Participating Organizations	Summary*
1047	Meeting	11/01/2012	Skeetchestn Indian Band, Lhoosk'uz Dene Nation, Tk’emlúps te Secwépemc, Ulkatcho First Nation, The Proponent	1) Project introduction and discussion on potential agreements.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the “Date” column (Mo/Day/Yr).

Key Contact Summary for Stellat’en First Nation (StFN)

ROC #	Event Type	Date	Participating Organizations	Summary*
707	Meeting	09/14/2012	StFN, The Proponent	1) Project introduction to Band staff.
718	Letter	09/27/2012	StFN, The Proponent	1) The Proponent requested an introductory meeting with Chief & Council.
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
1373	Meeting	02/20/2013	StFN, The Proponent	1) Introduction to Chief & Council, and discussion on the Project and the proposed transmission line route.
	EA Working Group Meeting	04/30/2013	EA Working Group, including StFN and the Proponent	1) Overview of Tailings Storage Facility Alternatives Assessment
2329	Mass Mailout	07/17/2013	Mailing List, The Proponent	1) Project update letter to those on the stakeholder e-mail list.
	Meeting	06/26/2014	StFN, The Proponent, Triton Consulting	1) Project update including discussion of the possibility of effluent entering Tatelkuz Lake.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the “Date” column (Mo/Day/Yr).

Key Contact Summary for Skin Tyee Nation

ROC #	Event Type	Date	Participating Organizations	Summary*
6	Letter	06/24/2011	STN, The Proponent	1) Formal introduction of The Proponent; will set up a meeting to introduce the Project.
637	Meeting	07/03/2012	STN, The Proponent	1) Initial project meeting.
647	E-mail	07/09/2012	STN, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
651	E-mail	07/10/2012	STN, The Proponent	1) The Proponent introduced the Project to STN Chief & Council, and BC FLNRO.
653	E-mail	07/11/2012	STN, The Proponent	1) Meeting with Band Manager to discuss the Project and strength of claim.
664	Phone Call	07/16/2012	STN, The Proponent	1) The Proponent provided information on the project, including 2013 exploration plans, work completed to date and a TLU study.
	Meeting	11/16/2012	STN, The Proponent	1) Community meeting – Project design
	E-mail	11/19/2012	STN, The Proponent	1) Project description
1206	E-mail	01/23/2013	STN, The Proponent	1) Project update letter to those on the stakeholder e-mail list.
	Meeting	12/14/2013	STN, The Proponent	1) Presentation of Project
	Meeting	01/21/2013	STN, The Proponent	1) Project review
	Meeting	03/12/2014	STN, The Proponent	1) Exploration review

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the “Date” column (Mo/Day/Yr).

Key Contact Summary for Toosey First Nation

ROC #	Event Type	Date	Participating Organizations	Summary*
9	Letter	06/24/2011	Toosey First Nation, The Proponent	1) Formal introduction of The Proponent; will set up a meeting to introduce the Project.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the “Date” column (Mo/Day/Yr).

Key Contact Summary for Takla Lake First Nation

ROC #	Event Type	Date	Participating Organizations	Summary*
1798	E-mail	04/30/2013	Takla Lake First Nation, The Proponent	1) Forestry Coordinator requested a call from The Proponent to discuss the Project.
1840	Phone Call	05/06/2013	Takla Lake First Nation, The Proponent	1) The Proponent called the Forestry Coordinator on 13/04/30, 13/05/01 and 13/05/06 in follow-up to her 13/05/08. Left a message on 13/05/06, requesting a call back to discuss the Project.
1847	E-mail	05/08/2013	Takla Lake First Nation, The Proponent	1) The Proponent sent an e-mail regarding the First Nation's request for a call (see previous ROCs).

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the “Date” column (Mo/Day/Yr).

Key Contact Summary for Tk’emlúps te Secwépemc

ROC #	Event Type	Date	Participating Organizations	Summary*
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
1047	Meeting	11/01/2012	Tk’emlúps te Secwépemc, Lhoosk'uz Dene Nation, Skeetchestn Indian Band, Ulkatcho First Nation, The Proponent	1) Project introduction and discussion on potential agreements.
2329	Mass Mailout	07/17/2013	Mailing List, The Proponent	1) Project update letter to those on the stakeholder e-mail list.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the “Date” column (Mo/Day/Yr).

Key Contact Summary for Tsilhqot’in National Government (TNG)

ROC #	Event Type	Date	Participating Organizations	Summary*
8	Letter	06/24/2011	TNG, The Proponent	1) Formal introduction of The Proponent; will set up a meeting to introduce the Project.
1046	Phone Call	06/09/2012	TNG, The Proponent	1) Project introduction. The Proponent to stop by the office on 12/06/29.
495	Meeting	06/14/2012	TNG, The Proponent	1) The Proponent introduced the Project.
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
1427	Meeting	02/22/2013	TNG, ?Esdilagh First Nation, The Proponent	1) The Proponent provided an overview of the Project to the Chiefs and others, which led to discussions on employment, contracting, training, and potential effects on caribou.
2329	Mass Mailout	07/17/2013	Mailing List, The Proponent	1) Project update letter to those on the stakeholder e-mail list.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the “Date” column (Mo/Day/Yr).

Key Contact Summary for Ulkatcho First Nation (UFN)

ROC #	Event Type	Date	Participating Organizations	Summary*
1	Letter	05/01/2011	UFN, The Proponent	1) The Proponent introduced the Project and noted they recently acquired the Richfield property.
5	Letter	06/24/2011	UFN, The Proponent	1) Formal introduction of The Proponent; will set up a meeting to introduce the Project.
85	Site Visit	09/30/2011	UFN, Devlin Gailus (UFN), Catana Consulting, The Proponent	1) Heli tour of the Blackwater site. Discussion included caribou herds, employment and training, road to the site, water resources and tailings pond location.
122	Meeting	11/10/2011	UFN, Devlin Gailus (UFN), Catana Consulting, The Proponent	1) Discussed the Project and Exploration Agreement, including communication, TLU study, archaeological assessment, homesteads and social impacts of development.
608	Meeting	04/24/2012	UFN, The Proponent	1) JIC meeting.
254	Meeting	06/07/2012	UFN, The Proponent	1) Meeting between UFN and The Proponent.

ROC #	Event Type	Date	Participating Organizations	Summary*
676	Site Visit	07/24/2012	UFN, The Proponent	1) Flyover and camp tour for UFN Elders and councillor.
1051	Phone Call	07/26/2012	UFN, The Proponent	1) Project introduction to Lands Manager.
797	Site Visit	09/07/2012	UFN, The Proponent	1) Site tour and general discussion of the Capoose Project and traditional land use in the area.
798	Site Visit	09/28/2012	UFN, The Proponent	1) Site tour and discussion about employment and hiring.
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
1047	Meeting	11/01/2012	UFN, Lhoosk'uz Dene Nation, Skeetchestn Indian Band, Tk'emlúps te Secwépemc, The Proponent	1) Project introduction and discussion on potential agreements.
1499	Site Visit	02/13/2013	UFN, Ecofor, BC FLNRO	1) Helicopter overflight of areas proposed for 2013 exploration program in relation to the caribou management plan.
	Community Meeting	03/15/2013	UFN, The Proponent	1) Question: how high dam? 2) Question: What becomes of tailings? 3) UFN land use vision shared - reclamation
	Meeting	04/30/2013	UFN, The Proponent	1) Questions about waste rock 2) At closing what topography permanent changes from tailings? 3) Discuss methodologies for design 4) Impact on drinking water sources?
	EA Working Group Meeting	04/30/2013	EA Working Group, including UFN and the Proponent	1) Overview of Tailings Storage Facility Alternatives Assessment
	Call	06/13/2013	UFN, The Proponent	1) Request to discuss comments in dAIR version C
2329	Mass Mailout	07/17/2013	Mailing List, The Proponent	1) Project update letter to those on the stakeholder e-mail list.
2488	Meeting	08/15/2013	UFN, The Proponent	1) The Proponent provided a project update. Discussed UFN's AIR Version D comments.
2628	Meeting	08/28/2013	UFN, The Proponent	1) Discussed the Project, EA process and Participation Agreement.
2528	Meeting	09/04/2013	UFN, The Proponent	1) Discussed the Project and the Participation Agreement.
	E-mail	09/18/2013	UFN, The Proponent	1) Advised – baseline studies report available on New Gold website
	Phone	10/24/2013	UFN, The Proponent	1) Invited to New Gold water quality results presentation
	Phone	10/29/2013	UFN, The Proponent	1) UFN notification water quality results received calling in on Oct 31 for presentation
	Community Meeting	05/27/2014	UFN, The Proponent	1) Poster presentation showing TSF alternatives
	Meeting	11/03/2014	UFN, The Proponent	1) Project update including discussion of tailings management, water quality, and accidents and malfunctions related to the dam.
	Meeting	11/20/2014	UFN, The Proponent	1) Project overview and update. 2) EA process. 3) UFN issues and how/where addressed. 4) Next steps.
	Community Meeting	13/03/2015	UFN, The Proponent	1) Community meeting to discuss the incinerator and exploration permits. UFN raised concerns about water quality and the reclamation of the tailings dam.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the "Date" column (Mo/Day/Yr).

Key Contact Summary for Trappers

ROC #	Event Type	Date	Participating Organizations	Summary*
705	Site Visit	09/13/2012	Trapline TR0512T014, LDN, The Proponent	1) Site tour for LDN Elder and trapline tenure holder.
2218	Site Visit	06/18/2013	Trapline TR0512T014, LDN, The Proponent	1) LDN members and a trapline tenure holder participated in a heli tour of the project site. Discussion topics included wildlife (moose, grizzly and marten), some traditional knowledge of the area, and the tailings facility and area. Concerns related to tailings effects on waterways and effects on wildlife habitat.
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
1002	Meeting	11/13/2012	Trapline TR0512T027, The Proponent	1) Trappers did not show up for scheduled meeting.
883	Letter	11/21/2012	Trapline TR0512T027, The Proponent	1) Project introduction and request for meeting by The Proponent. 2) No response received to letter.
884	Letter	11/21/2012	Trapline TR0512T027, The Proponent	1) Project introduction and request for meeting by The Proponent.
2329	Mass Mailout	07/17/2013	Mailing List, The Proponent	1) Project update letter to those on the stakeholder e-mail list.
2402	Meeting	07/31/2013	Trapline TR0512T027, The Proponent	1) Discussed the Blackwater project and the potential effect on the trapline tenure. Also discussed the potential for employment.
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
930	Meeting	11/30/2012	Trapline TR0601T003, The Proponent	1) Project introduction and discussion about trapline.
2329	Mass Mailout	07/17/2013	Mailing List, The Proponent	1) Project update letter to those on the stakeholder e-mail list.
1008	Meeting	11/20/2012	Trapline TR0601T006, The Proponent	1) Project introduction and discussion regarding the proposed transmission line.
778	Drop-in Visit/Casual Meeting	10/31/2012	Trapline TR0604T053, The Proponent	1) Discussion about Project, transmission line and individual's trapping and agricultural areas.
875	Letter	11/20/2012	Trapline TR0711T006, The Proponent	1) Project introduction and request for meeting by The Proponent.
1624	Letter	04/11/2013	Trapline TR0711T006, The Proponent	1) The Proponent provided information about the Project, and a revised proposed transmission line route map via registered letter. The letter was not picked up by the trapline tenure holder.
1876	Letter	05/08/2013	Trapline TR0711T006, The Proponent	1) The Proponent introduced the Project to the trapline tenure holder and requested a meeting to discuss any potential conflicts relating to the tenure. Letter returned as "no such address"; all correspondence to date has been returned.
844	Meeting	11/14/2012	Trapline TR0711T007, The Proponent	1) Project introduction to the trapline tenure holder and family.
1522	Drop-in Visit/Casual	03/18/2013	Trapline TR0711T007, The Proponent	1) Trapline tenure holder stopped by the office to discuss the Project, the transmission line and consultation regarding his trapping tenure.

ROC #	Event Type	Date	Participating Organizations	Summary*
	Meeting			
1920	Drop-in Visit/Casual Meeting	05/16/2013	Trapline TR0711T007, The Proponent	1) Discussed the project in the trapper's tenure as well as baseline studies.
938	Letter	11/20/2012	Trapline TR0712T029, The Proponent	1) Project introduction and request for meeting with trapline tenure holder.
874	Letter	11/20/2012	Trapline TR0712T035, The Proponent	1) Project introduction and request for meeting by The Proponent.
877	Letter	11/20/2012	Trapline TR0712T036, The Proponent	1) Project introduction and request for meeting by The Proponent.
956	Letter	12/13/2012	Trapline TR0712T036, The Proponent	1) Project introduction and request for meeting.
805	Mass Mailout	10/17/2012	Mailing List, The Proponent	1) Fall 2012 Blackwater Project update newsletter.
2329	Mass Mailout	07/17/2013	Mailing List, The Proponent	1) Project update letter to those on the stakeholder e-mail list.
	Meeting	11/12/2014	Trapline TR0711T007, The Proponent	1) Project introduction and discussion of transmission line through the trapline area.

*Date format in the Summary column are: Yr/Mo/Day and are different than the format used in the “Date” column (Mo/Day/Yr).

Key Contact Summary for Government

ROC #	Event Type	Date	Participating Organizations	Summary*
	EA Working Group Meeting	04/30/2013	EA Working Group, including Environment Canada, the BC EAO, CEA Agency, and the Proponent	1) Overview of Tailings Storage Facility Alternatives Assessment
	Presentation	06/14/2013	Environment Canada, CEA Agency, the Proponent	1) Overview of Tailings Storage Facility Alternatives Assessment.
	Site Visit	09/26/2013	Environment Canada	1) Discussion of Tailings Storage Facility Alternatives Assessment
	Presentation	10/25/2013	Environment Canada	1) Discussion of Tailings Storage Facility Alternatives Assessment
	Presentation	04/25/2014	Environment Canada, CEA Agency, the Proponent	1) Overview of Tailings Storage Facility Alternatives Assessment.