newgold

Appendix 5.3.7A
Blackwater Gold Project
Conceptual Wetlands Compensation Plan

Blackwater Gold Project

Conceptual Wetlands Compensation Plan

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Version B

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ACRONYMS

Abbreviations and Units of Measure	Definition
AMEC	AMEC Environment & Infrastructure
BAFAun	Boreal Altai Fescue Alpine, Undifferentiated
BC	British Columbia
BC CDC	British Columbia Conservation Data Centre
BC *EAA*	British Columbia *Environmental Assessment Act*
BC MELP	British Columbia Ministry of Environment, Land and Parks
BC MFLNRO	British Columbia Ministry of Forests, Lands and Natural Resource Operations
BC MOE	British Columbia Ministry of Environment
BC MOF	British Columbia Ministry of Forests
BC MOFR	British Columbia Ministry of Forests and Range
BC SEE	British Columbia Species and Ecosystem Explorer
BEC	Biogeoclimatic Ecosystem Classification
BGC	biogeoclimatic
BWBS	Boreal White and Black Spruce
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWCS	Canadian Wetland Classification System
DO	dissolved oxygen
EC	Environment Canada
ESCP	Erosion and Sediment Control Plan
ESSF	Engelmann Spruce–Subalpine Fir
ESSFmc	Engelmann Spruce–Subalpine Fir Moist Cold
ESSFmv1	Engelmann Spruce–Subalpine Fir Nechako Moist Very Cold
ESSFmvp	Engelmann Spruce–Subalpine Fir Moist Very Cold Parkland
ESSFxv1	Engelmann Spruce–Subalpine Fir West Chilcotin Very Dry Very Cold
FPWC	Federal Policy on Wetland Conservation
ha	hectare
HGM	hydrogeomorphic
km	kilometre
LSA	Local Study Area
m	metre
m^2	square metres
µS/cm	microSiemens per centimetre
mg/L	milligrams per litre
MSxv	Montane Spruce Very Dry Very Cold

Abbreviations and Units of Measure	Definition
NWWG	National Wetlands Working Group
PEM	Predictive Ecosystem Mapping
Policy (the)	Federal Policy on Wetland Conservation
Proponent (the)	New Gold Inc.
Project (the)	proposed Blackwater Gold Project
QA/QC	quality assurance and quality control
RIC	Resource Inventory Committee
RSA	Regional Study Area
SARA	*Species at Risk Act*
SBPS	Sub-Boreal Pine Spruce
SBPSdc	Sub-Boreal Pine Spruce Dry Cold
SBPSmk	Sub-Boreal Pine Spruce Moist Cool
SBSdw2	Sub-Boreal Spruce Blackwater Dry Warm
SBSdw3	Sub-Boreal Spruce Stuart Dry Warm
SBSmc2	Sub-Boreal Spruce Babine Moist Cold
SBSmc3	Sub-Boreal Spruce Kluskus Moist Cold
SBSmw	Sub-Boreal Spruce Moist Warm
SWB	Spruce Willow Birch
TDS	total dissolved solids
TEM	Terrestrial Ecosystem Mapping
TRIM	Terrain Resource Information Management Program
TSS	total suspended solids
UBC	University of British Columbia
VFD	Vanderhoof Forest District
WCP	Wetlands Compensation Plan

EXECUTIVE SUMMARY

New Gold Inc. (the Proponent) is proposing to develop the Blackwater Gold Project (the Project), a gold mine located 110 kilometres (km) southwest of Vanderhoof in central British Columbia (BC). The Project is expected to result in the loss of freshwater wetlands, some of which are provincially Blue-listed ecosystems at risk. It is understood the 1991 *Federal Policy on Wetland Conservation* (the Policy) goal of no-net-loss of wetland functions applies to the Project because Blue-listed wetlands would be impacted by Project development. This Wetland Compensation Plan (WCP) is proposed to compensate for losses to these at risk wetland habitats in accordance with the Policy.

The WCP has been prepared to specifically address impacts on Blue-listed wetlands associated with the Project. The WCP summarizes on-site wetland mitigation during operations and closure phases, and provides details regarding off-site compensatory mitigation. The off-site compensatory mitigation will occur prior to construction to offset the temporal loss of wetland functions and the loss of Blue-listed wetlands that will result from Project implementation.

The Project will result in the loss of 24.2 ha of Blue-listed wetlands. The at-risk wetlands occur as pine and black spruce bogs, and shrub or emergent fens. Wetland loss will occur during the construction and operations phases of the Project. Residual effects identified in the effects assessment would primarily be related to the temporal loss of wetland functions in the upper Davidson Creek and Creek 661 watersheds, and the loss of Blue-listed wetlands.

Mitigation measures to address wetland impacts include avoidance, minimization, wetland creation on site, and wetland compensation off site. A total of 305 ha of wetlands will be created on site to mitigate for wetland loss in the Davidson Creek and Creek 661 watersheds to support the Not Significant (minor), determination in effects assessment for the Project (**Section 5.3.7**) (**Table ES 1**). Approximately 52.3 ha of wetlands compensation will be provided off site to offset impacts on 24.2 ha of Blue-listed wetlands and the temporal loss of these wetland functions.

The proposed 52.3 ha of wetland compensation results in a no-net-loss of wetland functions for the Project in accordance with the Policy. The 32 ha of wetland restoration and 6.7 ha of wetland enhancement in the Mathews Creek watershed, and the 13.6 ha of wetland habitat creation and enhancement off site associated with the FHMOP, compensates for the 24.2 ha of impacts on Blue-listed wetlands (**Table ES 2**).

Table ES 1: Wetland Impacts and Compensation Associated with the Project

Wetland Class	Lost Wetland Extent (ha)		Proposed Wetland Creation On-Site (ha)	Proposed Wetland Compensation Off-Site (ha)
	Mine Site	**Linear Features**		
Bog	-40.1	-1.6	-	
Fen	-22.4	-0.2	-	
Swamp	-239.9	-4.3	305[1]	38.7[2]
Marsh	-1.9	-		13.6[3]
Shallow water/pond	-5.0	-	-	
Total	**-309.3**	**-6.1**	**+305**	**+52.3**

Note: ha = hectare;
[1]Combination of marsh and swamp habitats.
[2]Includes 32.0 ha of wetland restoration, and 6.7 ha of wetland enhancement.
[3]Combination of wetland marsh, shallow water, and pond habitats associated with the Fish Habitat Mitigation and Offset Plan.

Table ES 2: Compensation Adequacy

	Wetland Area (ha)
Impacts: Blue-listed Wetlands	-24.2
Compensation[1]: Mathews Creek and FHMOP Ponds	+52.3
Net benefit to wetland ecosystems	+28.1

Note: [1] Includes both wetland restoration and enhancement.
FHMOP = Fish Habitat Mitigation and Offset Plan

A performance-based wetland monitoring and adaptive management program associated with the WCP will evaluate the long-term effectiveness of on-site wetlands creation and off-site wetlands compensation areas. Monitoring will consider total wetland area, vegetation cover, habitat structure, and wildlife use. Monitoring results will be compared to performance standards to evaluate individual site success following the installation of created wetlands on site and compensation wetland areas off site.

1.0 INTRODUCTION

NewGold Inc. (the Proponent) is proposing to develop the Blackwater Gold Project (the Project), a gold mine located 110 kilometres (km) southwest of Vanderhoof in central British Columbia (BC). The Project is expected to result in the loss of freshwater wetlands, some of which are provincially Blue-listed ecosystems at risk. The 1991 *Federal Policy on Wetland Conservation* (the Policy) goal of no-net-loss of wetland functions applies to the Project because Blue-listed wetlands would be impacted by Project development. This Wetland Compensation Plan (WCP) proposes compensation for losses to these at risk wetland habitats in accordance with the Policy.

The *Canadian Environmental Assessment Act, 2012* (Government of Canada, 2012) defines mitigation as the "practical means of preventing or reducing to an acceptable level any potential adverse effects of the Project." Mitigation measures for the Project comprise actions that eliminate, reduce, or control the adverse environmental effects of a project, and include actions taken to replace, restore, or compensate for any adverse effects. This process is typically summarized as the mitigation hierarchy, which entails four steps with the intention of identifying opportunities to avoid, minimize, restore on site, and compensate for or offset potential adverse environmental impacts (BC Ministry of Environment (MOE), 2012).

The WCP was prepared to specifically address impacts on Blue-listed wetlands associated with the Project. The WCP summarizes on-site wetland mitigation during operations and closure phases, and provides details regarding off-site compensatory mitigation. The off-site compensatory mitigation will occur prior to construction to offset the temporal loss of wetland functions and the loss of Blue-listed wetlands that will result from Project implementation.

1.1 Purpose and Objectives

The purpose of the WCP is to describe off-site wetland compensation to offset impacts on 24.2 ha of Blue-listed wetlands identified in the effects assessment for the Project Application for the Environmental Assessment Certificate. The objective of the WCP is to describe compensation for Project effects on regional and local wetland habitat functions (migratory birds, ecosystems at risk) documented in the Project area by:

- Identifying the spatial and temporal scope of potential mitigation options, including on-site and off-site actions;
- Providing no net loss of wetland functions, as per the 1991 *Federal Policy on Wetland Conservation*; and
- Compensating for impacts on Blue-listed wetlands.

1.2 Information Sources

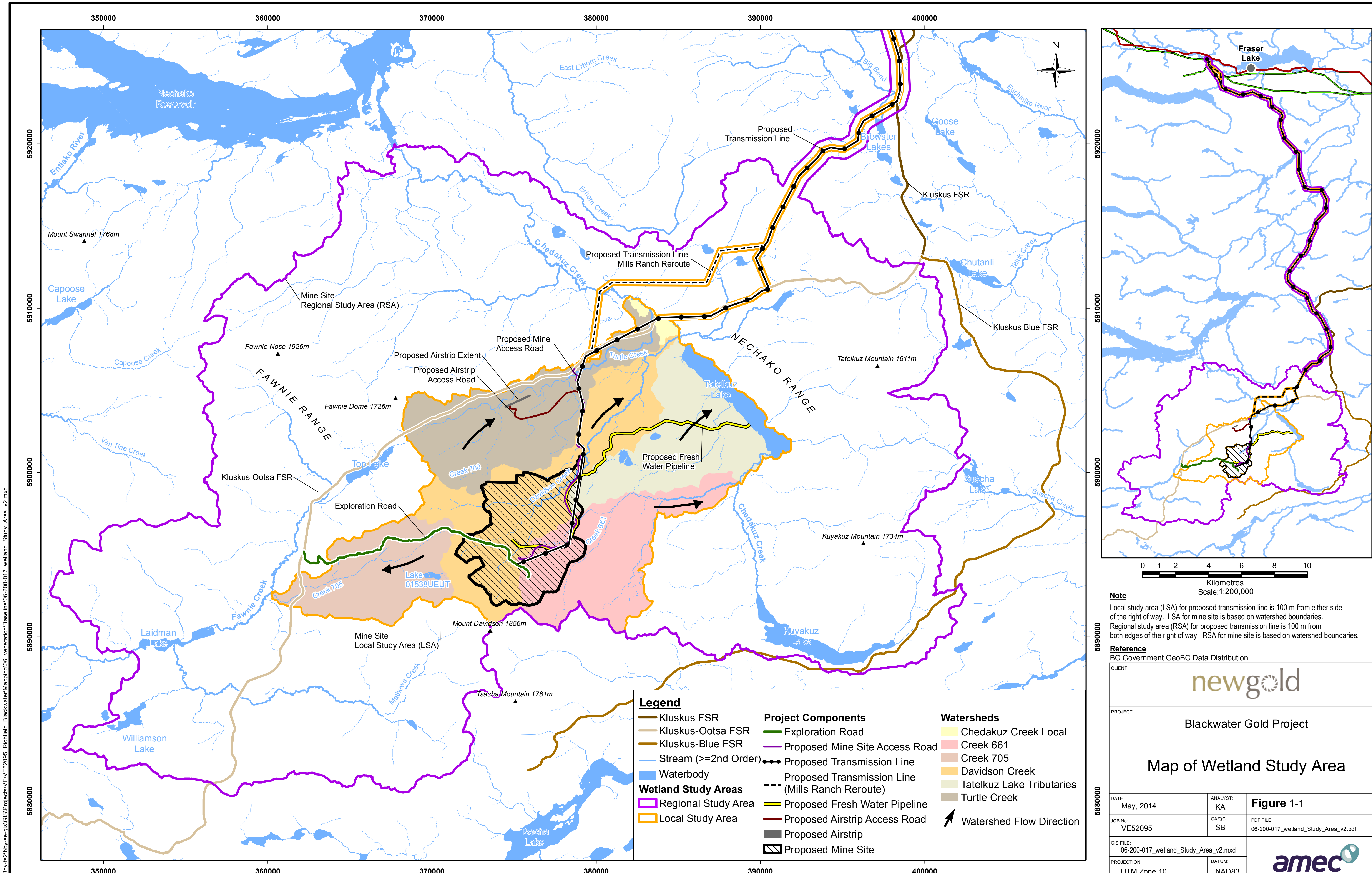
The WCP was developed following current guidance and information, including:

- Federal Policy on Wetland Conservation (EC, 1991);
- Federal Policy on Wetland Conservation: Implementation Guide for Federal Land Managers. (Lynch-Stewart et al.,1996);
- *Canadian Environmental Assessment Act (CEAA), 2012* (Government of Canada, 2012);
- *Environmental Assessment Act* (BC *EAA*) (Government of BC, 2002);
- Wetland Ecological Functions Assessment: An Overview of Approaches (Hanson et al., 2008);
- Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in BC (Wetland Stewardship Partnership, 2009);
- Wetland Mitigation in Canada: A Framework for Application (Cox and Grose, 2000);
- Wetland Mitigation and Compensation: Proceedings of a National Workshop (Cox and Grose, 1998); and
- Procedures for Mitigating Impacts on Environmental Values (Environmental Mitigation Procedures) (BC MOE, 2012).

1.3 Project Setting

The mine site comprises approximately 4,400 hectares (ha) across three biogeoclimatic (BGC) zones. The majority (99%) of the mine site lies within two BGC units: Engelmann Spruce-Subalpine Fir Nechako Moist Very Cold variant (ESSFmv1) (71%), and Sub-Boreal Spruce Kluskus Moist Cold variant (SBSmc3) (28%). The third unit, Engelmann Spruce-Subalpine Fir, Moist Very Cold Parkland subzone (ESSFmvp) comprises approximately 66 ha (1%) of the mine site at the highest elevations.

The mine site, Local Study Area (LSA), and Regional Study Area (RSA) used for the wetlands effects assessment are presented on **Figure 1-1**. The LSA is based on four sub-watersheds that include or about the mine site: Davidson Creek, Creek 661, Turtle Creek, Tatelkuz Lake tributaries, and Creek 705. These sub-watersheds were used to identify off-site wetland compensation sites to mitigate Project impacts on wetland functions.



350000
360000
370000
380000
390000
400000
5920000
5910000
5900000
5890000
5880000
Nechako Reservoir
Entiako River
East Erhorn Creek
Erhorn Creek
Big Bend
Euchiniko River
Goose Lake
Brewster Lakes
Proposed Transmission Line
Kluskus FSR
Mount Swannel 1768m
Chedakuz Creek
Proposed Transmission Line Mills Ranch Reroute
Chutanli Lake
Taiuk Creek
Capoose Lake
Mine Site Regional Study Area (RSA)
Kluskus Blue FSR
Fawnie Nose 1926m
Capoose Creek
Proposed Mine Access Road
Proposed Airstrip Extent
Turtle Creek
NECHAKO RANGE
Tatelkuz Mountain 1611m
Proposed Airstrip Access Road
FAWNIE RANGE
Fawnie Dome 1726m
Tatelkuz Lake
Van Tine Creek
Top Lake
Creek 700
Proposed Fresh Water Pipeline
Kluskus-Ootsa FSR
Davidson Creek
Suscha Lake
Suscha Creek
Exploration Road
Chedakuz Creek
Creek 661
Kuyakuz Mountain 1734m
Lake 01538UEUT
Creek 705
Fawnie Creek
Mount Davidson 1856m
Laidman Lake
Mine Site Local Study Area (LSA)
Kuyakuz Lake
Mathews Creek
Tsacha Mountain 1781m
Williamson Lake
Tsacha Lake
N
Fraser Lake
0 1 2 4 6 8 10
Kilometres
Scale:1:200,000
Legend
Kluskus FSR
Kluskus-Ootsa FSR
Kluskus-Blue FSR
Stream (>=2nd Order)
Waterbody
Wetland Study Areas
Regional Study Area
Local Study Area
Project Components
Exploration Road
Proposed Mine Site Access Road
Proposed Transmission Line
Proposed Transmission Line (Mills Ranch Reroute)
Proposed Fresh Water Pipeline
Proposed Airstrip Access Road
Proposed Airstrip
Proposed Mine Site
Watersheds
Chedakuz Creek Local
Creek 661
Creek 705
Davidson Creek
Tatelkuz Lake Tributaries
Turtle Creek
Watershed Flow Direction
Note
Local study area (LSA) for proposed transmission line is 100 m from either side of the right of way. LSA for mine site is based on watershed boundaries. Regional study area (RSA) for proposed transmission line is 100 m from both edges of the right of way. RSA for mine site is based on watershed boundaries.
Reference
BC Government GeoBC Data Distribution
CLIENT:
newgold
PROJECT:
Blackwater Gold Project
Map of Wetland Study Area
DATE: May, 2014
ANALYST: KA
Figure 1-1
JOB No: VE52095
QA/QC: SB
PDF FILE: 06-200-017_wetland_Study_Area_v2.pdf
GIS FILE: 06-200-017_wetland_Study_Area_v2.mxd
PROJECTION: UTM Zone 10
DATUM: NAD83
amec
\\Bby-fs2\bby-ee-gis\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\06_vegetation\Baseline\06-200-017_wetland_Study_Area_v2.mxd

2.0 EXISTING WETLAND EXTENT AND FUNCTIONS

2.1 Wetland Extent

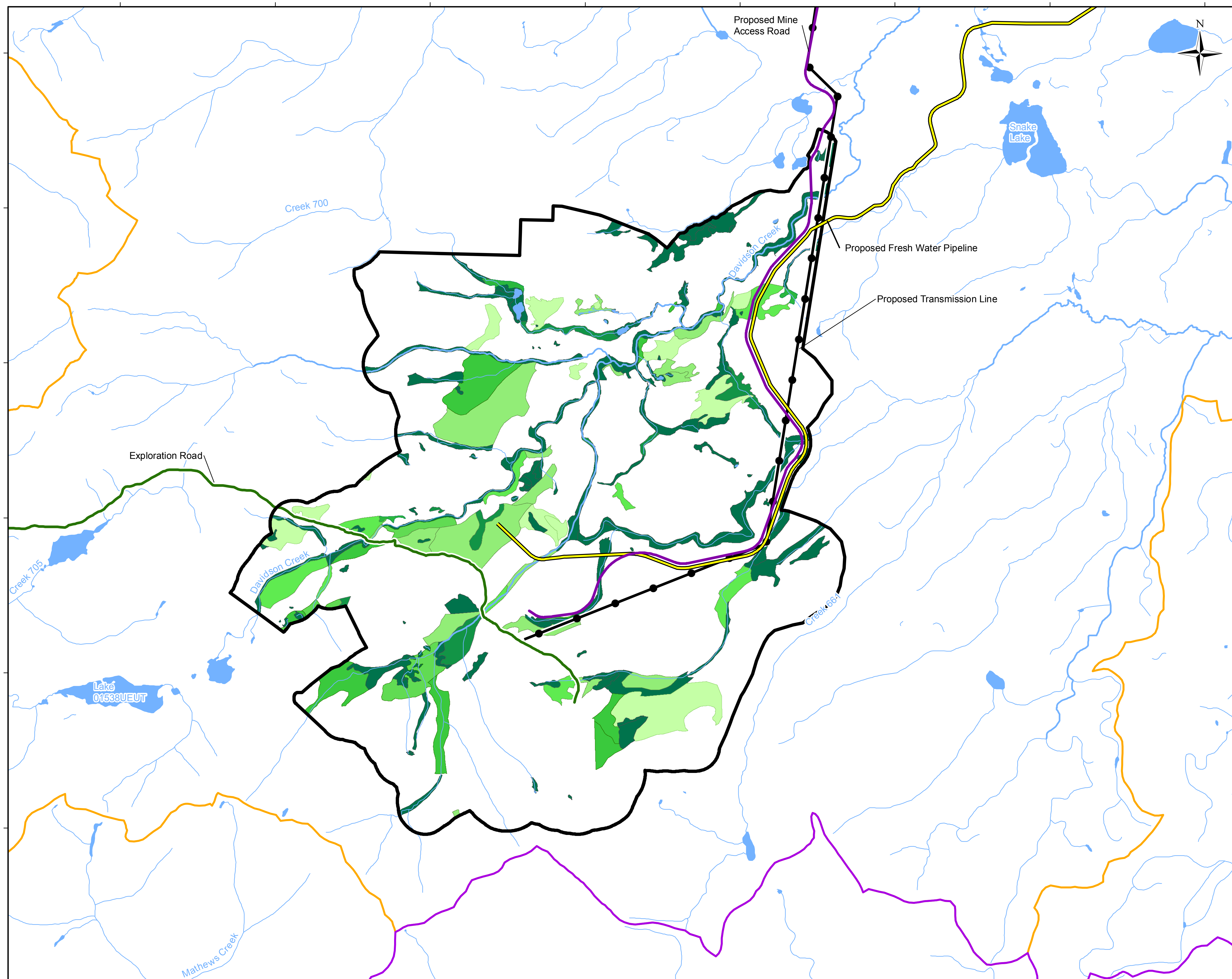
A comprehensive inventory of wetland resources within the Project area mapped using provincial Terrestrial Ecosystem Mapping (TEM) protocols (Resource Inventory Committee (RIC), 1998). The methods and detailed results of the wetland baseline study are provided in the Wetlands Baseline Report (AMEC, 2013) (**Appendix 5.1.2.5A**). Data on wetland extent, distribution, and habitat type were used to provide an overall understanding of wetland conditions in the Project area.

Within the mine site, approximately 575 ha were classified as wetlands, or 13% of the total mine site area, consisting of six wetland classes: bog, fen, marsh, swamp, shallow open water, and pond (**Figure 2-1**; **Table 2-1**). Swamp wetlands are the most common wetland class in the mine site (421 ha, 9.5%). Blue-listed wetland ecosystems comprise approximately 39 ha (0.9%). In the LSA and RSA, two Red-listed and several Blue-listed wetland ecosystems were identified. Mapped wetlands occur on approximately 3,122 ha (12%) of the LSA and 5,846 ha (5%) of the RSA.

Table 2-1: Wetland Classes and Distribution for the Mine Site, LSA, and RSA

Wetland Class	Mine Site		LSA		RSA	
	(ha)	**(%)**	**(ha)**	**(%)**	**(ha)**	**(%)**
Bog	101.40	2.29	947.79	3.64	-	-
Fen	39.34	0.89	612.66	2.35	-	-
Marsh	2.77	0.06	50.52	0.19	-	-
Swamp	421.25	9.54	1,452.54	5.58	-	-
Shallow water(1)	10.35.	0.23	58.17	0.22	-	-
TRIM/TEM	-	-			5,846.42	4.98
Total Wetland Area	**575.15**	**13.03**	**3,121**	**11.98**	**5,846.42**	**4.98**
Total Area	**4,412.66**		**26,047.57**		**117,349.82**	

Note: ha = hectare; LSA = Local Study Area; RSA = Regional Study Area; TRIM = Terrain Resource Information Management; percents are % of total area.
(1)Shallow water includes 2.16 ha of pond habitat in the mine site.



Legend

Stream
Waterbody

Project Components

Exploration Road
Proposed Transmission Line
Proposed Mine Access Road
Proposed Fresh Water Pipeline
Proposed Mine Site

Wetland Study Areas

Regional Study Area
Local Study Area

Percent Wetland in TEM Mapped Polygon

10%
20%
30%
40%
50%
60%
70%
80%
90%
100%

0 0.5 1 2
Kilometres
Scale:1:50,000

Note

Wetlands shown may contain multipl ecosystems.
Wetland areas were determined using Terrain Resource Information Management Program (TRIM) data for the RSA and Terrestrial Ecosystem Mapping (TEM) for the LSA / Proposed Mine Site.

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Distribution of Wetland Resources near the Mine Site

DATE: May, 2014	ANALYST: AA	**Figure 2-1**	
JOB No: VE52277	QA/QC: MY	PDF FILE: 06-200-016_wetland_ecosystem_footprint_v4.pdf	
GIS FILE: 06-200-016_wetland_ecosystem_footprint_v4.mxd			
PROJECTION: UTM Zone 10	DATUM: NAD83	amec	

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\06_vegetation\EIA\06-200-016_wetland_ecosystem_footprint_v4.mxd

2.2 Wetland Functions

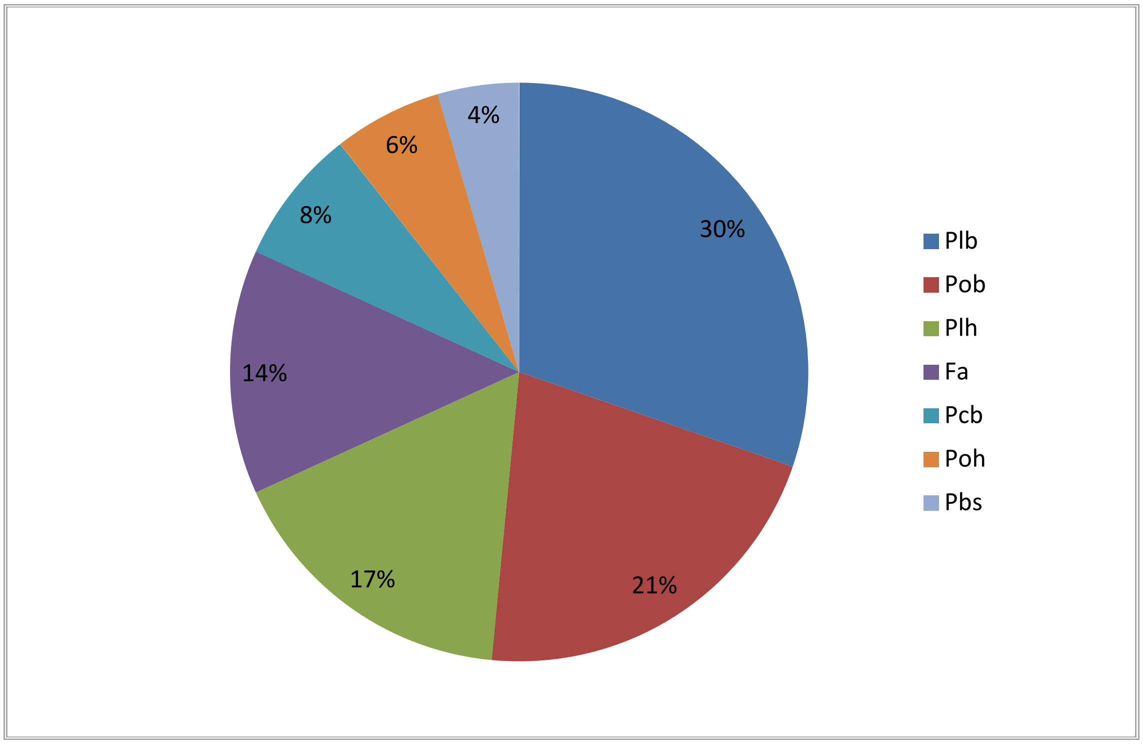
Wetlands within the mine site provide a variety of hydrological, biochemical, habitat, and ecological functions. Wetland functions are defined as natural processes (e.g., chemical, physical, and biological) that occur in wetlands and render services that are of value to society (Mitsch and Gosselink, 2007). Over 50% of the wetlands classified to hydrogeomorphic (HGM) unit were linked basins and hollows, which indicate that wetlands function to provide surface water storage, flow moderation in streams, and erosion protection. Wetlands in the mine site also perform biochemical functions at a high level, as swamp wetlands function to improve and maintain water quality, export nutrients and organics to streams, and store and sequester carbon. Ecological and habitat functions include supporting at-risk wetland ecosystems and plants, and providing moderately functioning wildlife habitat.

2.2.1 Hydrological Functions

Wetland hydrological functions include water flow moderation (flood protection), groundwater recharge, shoreline and erosion protection, and climate regulation (Hanson et al., 2008). Wetlands can be classified by HGM position to indicate the opportunity that wetlands provide for hydrological functions. For example, linked hollows receive overbank flooding from streams, which provides flood storage during storm events and freshet. Conversely, blanket slope wetlands are typically located above floodplains, receive hydrological inputs from groundwater seeps, and generally provide low hydrological functions.

Sixty-one percent (61%) of surveyed wetlands in the mine site were classified by HGM unit as linked basins, linked hollows, or fluvial wetlands (**Figure 2-2**). Linked hollows and fluvial swamps are both associated with riparian areas, and are common in the mine site. These wetlands include the largest sites; wetlands often occupy flat areas that are part of historical small lake or flood plain bottoms, and likely have little groundwater input. This indicates that mine site wetlands provide an important role in surface water storage, flow moderation, and erosion protection.

The performance of wetland hydrological functions by different wetland classes is variable (Hanson et al., 2008). Wetland hydrological functions provided by the different wetland classes in the mine site can be evaluated by assessing the extent of wetland classes that are known to provide a high level of hydrological functions. As such, 73% of mapped wetlands are classified as swamp wetlands, and the second most common wetland class are bogs (18%). Together, 91% of mapped wetlands occur as either swamps or bogs in the mine site, which perform hydrological functions at a high level.



Note: P = palustrine; F = fluvial; lb = linked basin; ob = overflow basin; lh = linked hollow; a = alluvial; cb = closed basin; oh = overflow hollow; bs = blanket slope.

Figure 2-2: Distribution of Hydrogeomorphic Classes for 66 Select Wetlands in the Mine Site

Riparian swamps generally function well for water flow control and erosion protection. Linked basins/hollows and fluvial HGM class swamps are common in the mine site, and function to slow runoff and store water for extended periods. These wetlands perform these functions because they receive overbank flooding during high flow events, and generally have inflowing or outflowing hydrological connections.

Bog hydrological function is typically low to variable, because bogs are isolated from surface water inputs, as indicated by the high proportion of closed basin bogs in the mine site. However, bogs are often in wetland complexes with fens, and therefore likely contribute to the control of flow during extreme flooding events.

Additionally, half of the sampled wetlands associated with the mine site are overflow or linked headwater wetlands. Headwater wetlands are associated with intermittent and perennial streams at the higher reaches of the watershed, and intercept and modify runoff and shallow groundwater entering streams and rivers. Headwater wetlands are important for water flow supply to lower reaches of the watershed (Mitsch and Gosselink, 2007).

2.2.2 Biochemical Functions

A high level of biochemical functions are performed by wetlands in the mine site due to the high proportion of swamp wetlands and bogs. Both swamps and bogs export nutrients and organic carbon to streams, which support the aquatic food chain. Swamps and bogs also function to sequester and store carbon. Bogs generally perform this function better than swamps, as bogs accumulate peat and woody biomass over time, whereas swamps' seasonally fluctuating water tables allow for biomass and soil decomposition. Consequently, disturbances and alterations to bog wetlands can potentially cause a release of carbon from the moderately decomposed sphagnum peat and buried wood (Hanson et al., 2008).

The potential for wetlands to provide biochemical functions is related to a wetland's position on the landscape. A wetland's opportunity to provide these functions is dependent on the resources in the aquatic system. The majority of wetlands within the mine site are hydrologically linked to surface waters and streams, as 61% of all wetlands are classified as linked basins/hollows or fluvial wetlands. The tributaries in the mine site support downstream populations of rainbow trout and kokanee in Davidson Creek and Creek 661. Wetlands within the mine site provide a high level of biochemical functions regarding nutrient export because of this hydrological connection to surface waters that support fish and other aquatic resources.

Wetlands within the mine site also function to provide water quality treatment, as 73% of all wetlands are swamps, and 61% are linked basins/hollows or fluvial wetlands. Seasonally fluctuating water tables in swamps enable frequent interactions between water and root bacteria assemblages that provide the opportunity for biogeochemical cycling. Linked basins/hollows and fluvial wetlands have surface water interactions that increase the exchange of minerals and nutrients with their surroundings through flooding (Mitsch and Gosselink, 2007). Conversely, bogs generally provide low water quality treatment functions, as they are typically isolated from surface water inputs such as streams (Hanson et al., 2008).

2.2.3 Habitat and Ecological Functions

Wetland ecological and habitat function involves the role of wetlands in relation to their surroundings and their ability to support a variety of plant and animal species and communities (Mitsch and Gosselink, 2007). Twenty-one distinct wetland ecosystems were classified within the wetlands LSA and RSA. Ten of these wetlands are Red-listed (Threatened) or Blue-listed (Special Concern) ecosystems. A minimum of 132 wildlife species potentially occurring in northern BC depend on wetlands for a portion of their life cycle, and 69 of them were detected in the LSA and RSA.

Approximately 69% (396 ha) of the wetlands mapped in the mine site are classified as Ws08 (Swamp Wetland–Subalpine fir–Horsetail–Glow moss) and Ws07 (Swamp Wetland–Spruce–Horsetail) site associations (274 ha and 122 ha, respectively). Swamp wetlands provide highly variable levels of habitat functions, which is consistent with the moderate wetland habitat functionality values of the sampled wetlands documented in the baseline report. Surveyed bogs, which potentially provide a high level of habitat functions (Hanson et al., 2008), also only had moderate functionality values, due to the lack of species detections during the surveys. Bogs, fens, and marshes potentially function to provide valuable wildlife habitat, and occurred as approximately 25% (101 ha, 39 ha, and 2.8 ha, respectively) of all mapped wetlands.

2.2.3.1 Ecosystems at Risk

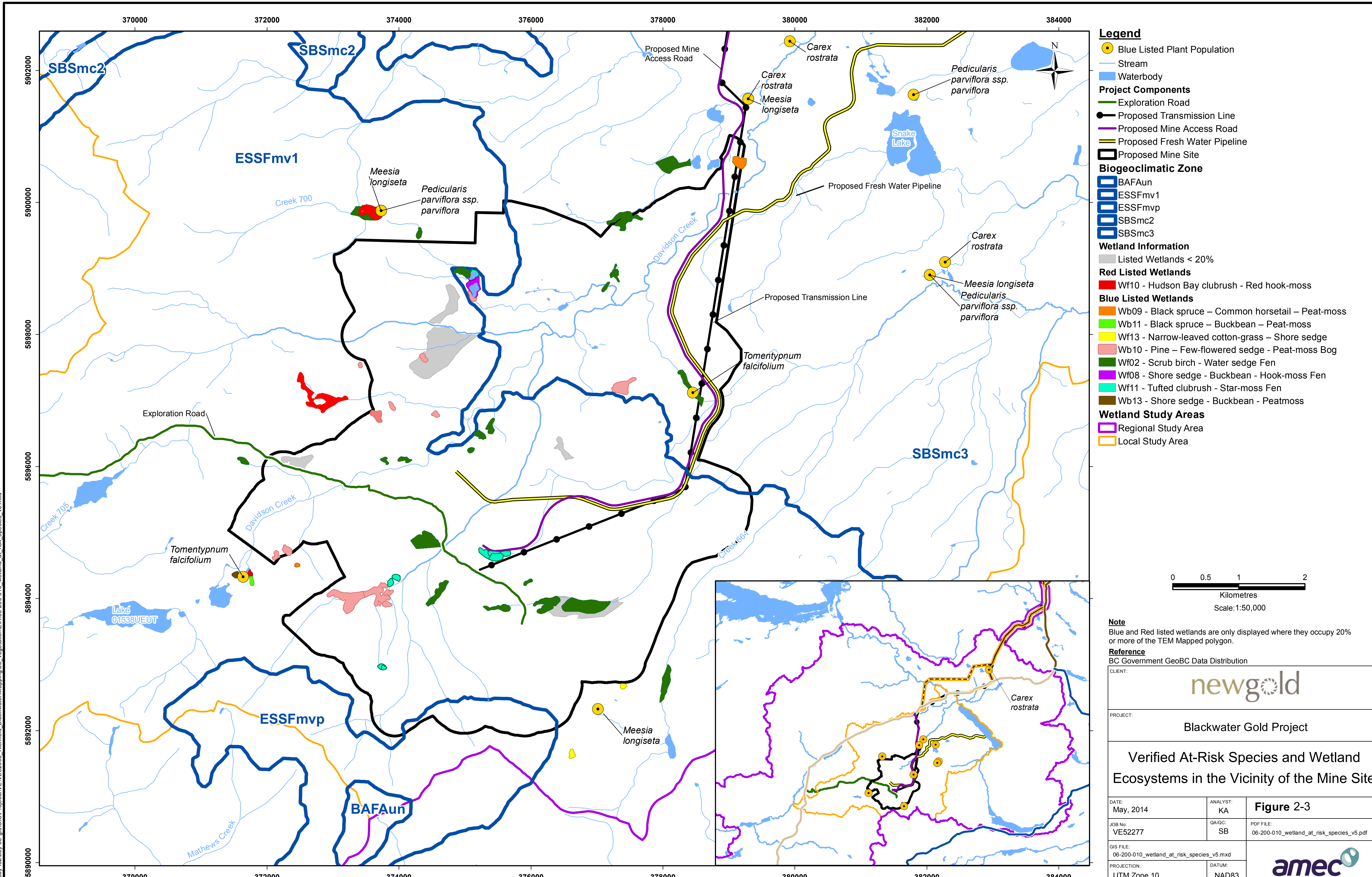
A total of 21 distinct wetland ecosystems were classified and confirmed in the field in the LSA and RSA during the 2011 to 2013 baseline studies. Ten of these wetland ecosystems are Red - or Blue-listed. Four Blue-listed wetland ecosystems occupy 39 ha (0.9%) of the mine site (**Figure 2-3).**

The hydrological, biogeochemical and habitat functions provided by these blue-listed wet/ands are typical for high-quality wetland ecosystems. Blue-listed wetlands harbor high levels of biodiversity and support unique plant assemblages, however the site conditions that support these plants associations are not well understood. In BC, Blue-listed wetlands are generally uncommon on the landscape or may be threatened by land use activities that affect the hydrological regime needed to maintain these wetland habitats.

The Wf02 (Scrub birch – Water sedge) and Wf11 (Tufted clubrush – Star moss) fens are the most common at-risk wetland in the mine footprint area. The Wf02 fen is a common wetland type in BC but provides valuable habitat and may be threatened by industrial activities. The Wf11 is a base rich wetland with a scattered distribution in BC. It is commonly groundwater fed and has a high pH, which limits nutrient availability.

Wf08 (Shore sedge – Buckbean – Hook-moss) and Wb10 (Lodgepole pine – Few-flowered sedge – Peat-moss) wetlands are less common at the minesite and in general on the landscape. The Wf08 is an uncommon, nutrient-rich wetland associated with pattered fens and is vulnerable to disturbance from nearby land use changes such as road building and harvesting. The Wb10 is a rare bog wetland with mineral poor groundwater inputs and is not well documented in BC.

No Red-listed ecosystems were identified in the mine site; however, the Red-listed Hudson Bay clubrush–Red hook-moss wetland site association (Wf10) was observed twice in the LSA. Red-listed wetlands comprise approximately 6.19 ha at three separate sites east of the mine site. Approximately 1.2 ha of Blue-listed wetlands are located in the transmission line corridor (0.9 ha) and the proposed Mills Ranch re-route (0.3 ha).



Legend
Blue Listed Plant Population
Stream
Waterbody
Project Components
Exploration Road
Proposed Transmission Line
Proposed Mine Access Road
Proposed Fresh Water Pipeline
Proposed Mine Site
Biogeoclimatic Zone
BAFAun
ESSFmv1
ESSFmvp
SBSmc2
SBSmc3
Wetland Information
Listed Wetlands < 20%
Red Listed Wetlands
Wf10 - Hudson Bay clubrush - Red hook-moss
Blue Listed Wetlands
Wb09 - Black spruce – Common horsetail – Peat-moss
Wb11 - Black spruce – Buckbean – Peat-moss
Wf13 - Narrow-leaved cotton-grass – Shore sedge
Wb10 - Pine – Few-flowered sedge - Peat-moss Bog
Wf02 - Scrub birch - Water sedge Fen
Wf08 - Shore sedge - Buckbean - Hook-moss Fen
Wf11 - Tufted clubrush - Star-moss Fen
Wb13 - Shore sedge - Buckbean - Peatmoss
Wetland Study Areas
Regional Study Area
Local Study Area
0 0.5 1 2
Kilometres
Scale:1:50,000
Note
Blue and Red listed wetlands are only displayed where they occupy 20% or more of the TEM Mapped polygon.
Reference
BC Government GeoBC Data Distribution
CLIENT: newgold
PROJECT: Blackwater Gold Project
Verified At-Risk Species and Wetland Ecosystems in the Vicinity of the Mine Site
DATE: May, 2014
ANALYST: KA
Figure 2-3
JOB No: VE52277
QA/QC: SB
PDF FILE: 06-200-010_wetland_at_risk_species_v5.pdf
GIS FILE: 06-200-010_wetland_at_risk_species_v5.mxd
PROJECTION: UTM Zone 10
DATUM: NAD83
amec
SBSmc2
ESSFmv1
ESSFmvp
BAFAun
SBSmc3
Snake Lake
Lake 01538UEUT
Creek 700
Creek 705
Davidson Creek
Mathews Creek
Creek 661
Proposed Mine Access Road
Proposed Fresh Water Pipeline
Proposed Transmission Line
Exploration Road
Carex rostrata
Meesia longiseta
Pedicularis parviflora ssp. parviflora
Tomentypnum falcifolium
370000 372000 374000 376000 378000 380000 382000 384000
5902000 5900000 5898000 5896000 5894000 5892000 5890000

2.2.3.2 Plant Species at Risk

Four Blue-listed wetland plant species were encountered in the LSA: swollen beaked sedge *(Carex rostrata*), small-flowered lousewort *(Pedicularis parviflora ssp. parviflora*), meesia moss *(Meesia longiseta*) and sickle leaf tomentypnum moss (*Tomentypnum falcifolium*). One population of sickle leaf tomentypnum moss was observed within the mine site boundaries, and a second population was observed approximately 450 m west of the mine site in the headwaters of Davidson Creek. The other three Blue-listed species were found in the LSA outside of the mine site. A population of meesia moss was identified approximately 750 m southeast of the mine site in the Creek 661 drainage (**Figure 2-3**).

2.2.3.3 Wildlife Habitat Functions

Of the 132 wildlife species identified as potentially occurring in the mine site LSA and RSA, 69 species were detected during field surveys. A comprehensive list of wildlife species potentially occurring versus detected in the LSA and RSA is provided in the Wetlands Baseline Report (**Appendix 5.1.2.5A**).

SARA-listed species detections within or adjacent to wetlands in the LSA include western toad, olive-sided flycatcher, rusty blackbird, and caribou. Additional provincially-listed mammal species detections include grizzly bear (*Ursus arctos*), eastern red bat (*Lasiurus borealis*), little brown myotis (*Myotis lucifugus*), and northern myotis (*Myotis septentrionalis*). Grizzly bear, little brown myotis, and northern myotis are also listed by COSEWIC. Additional provincially listed invertebrate species detections include Jutta Arctic (*Oeneis jutta chermocki*) and Hagen's bluet (*Enallagma hageni*). Individual species accounts are provided in the Wildlife and Wildlife Habitat Baseline Report (AMEC, 2013) (**Appendix 5.1.3.4A**).

Twenty-three (23) waterbird species were detected including one species of conservation concern in the RSA, the Blue-listed great blue heron (*Ardea herodias*). The four most frequently detected species include Wilson's snipe (*Gallinago gallinago*), greater yellowlegs (*Tringa melanoleuca*), bufflehead (*Bucephala albeola*), and common loon (*Gavia immer*). Many of the wetlands across the LSA and RSA were found to have greater yellowlegs or Wilson's snipe; bufflehead or common loon were present on most waterbodies. Wilson's snipe and greater yellowlegs were identified within the mine site.

3.0 SUMMARY OF ENVIRONMENTAL ASSESSMENT RESULTS

Project development will result in the loss of 309.3 ha (9.3%) of wetland ecosystems and associated hydrological, biochemical, and habitat functions in the mine site, including 24.2 ha of Blue-listed wetlands. Effects will occur during the construction and operations phases. Wetland functions will also be temporarily degraded in 132.6 ha of wetlands near or adjacent to mine infrastructure. In addition, 89.9 ha of wetlands adjacent to or downstream of the mine site footprint will potentially be hydrologically altered (**Section 5.3.7**).

Residual effects identified in the effects assessment are primarily related to the temporal loss of wetland functions in the upper Davidson Creek and Creek 661 watersheds, and the loss of Blue-listed wetlands. Compensation is proposed for unavoidable, permanent impacts on the 24.2 ha of Blue-listed wetlands.

3.1 Impacts to Blue-Listed Wetlands

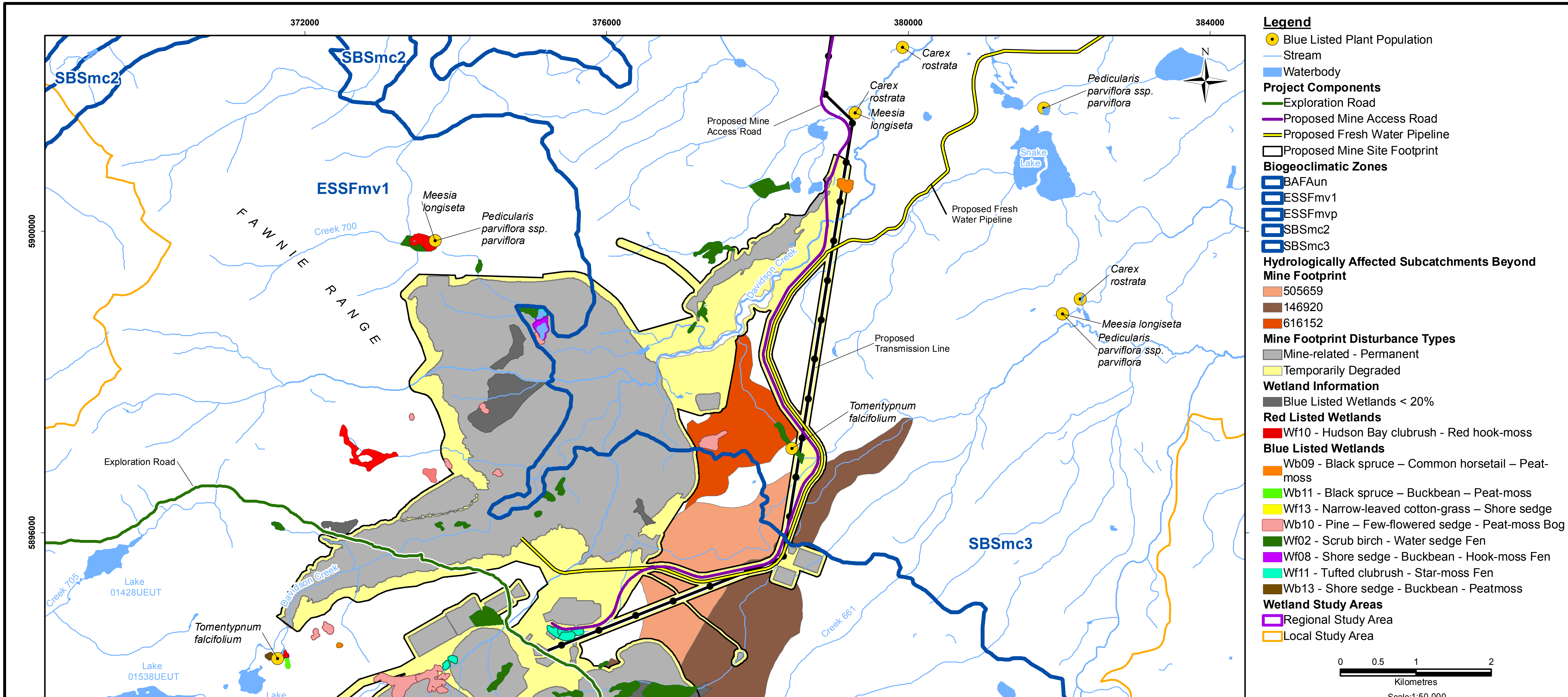
The 24.2 ha of affected Blue-listed wetlands occur as pine and black spruce bogs (Wb10), and shrub (Wf02) or emergent fens (Wf08 and Wf11) (**Table 3-1**). The bogs occur in closed basins, and the fens mainly occur in linked basins. Both the bogs and fens have a watertable near or at the surface. These fens and bogs are peatlands, and provide a low level of hydrological functions because of minimal storage capacity due to high water tables. The affected fens currently provide a high level of biochemical functions by maintaining water quality, whereas the affected bogs provide a low level of biochemical functions due to their isolation from surface water inputs that limits the opportunity to maintain water quality or export nutrients (Hanson et al., 2008). Both wetland classes function to store and sequester carbon. The main function provided by the blue-listed wetlands is habitat, as these ecological communities are of special concern due to the infrequency of these plant associations in the landscape (BC MOE, 2004 (**Figure 3-1**).

Table 3-1: Mine-Related Impacts on Blue-Listed Wetlands and Degraded Functions

Wetland Class	Site Association	Mine-Related Impacts (ha)	Degraded Wetland Functions (ha)
Bog	Wb10	9.5	1.7
Fen	Wf02	10.3	2.0
	Wf08	2.2	0.0
	Wf11	2.2	2.2
Total		24.2	5.9

Note: ha = hectare, Wb10 = Pine–Few-flowered sedge - Peat-moss, Wf02 = Scrub birch–Water sedge, Wf08 = Shore sedge–Buckbean - Hook-moss, Wf11 = Tufted clubrush–Star-moss, Wb = Bog Wetland, Wf = Fen Wetland

Wetland functions in an additional 5.9 ha of Blue-listed wetlands will be degraded through habitat fragmentation, noise and light pollution, and dust deposition during the construction, operations, and closure phases. Habitat fragmentation will potentially reduce wildlife use and the amount of available habitat. Noise and light pollution will potentially adversely affect nocturnal and diurnal wildlife species. Dust deposition in wetland can degrade water quality and reduce wetland biochemical functions. Impacts to these wetland functions are not anticipated to result in a loss of wetland extent.



Note

Blue and Red listed wetlands are only displayed where they occupy 20% or more of the TEM Mapped polygon.

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Potential Impacts to Verified Ecosystems at Risk

DATE: June, 2014	ANALYST: KA	**Figure 3-1**
JOB No: VE52420	QA/QC: MY	PDF FILE: 06-200-013_PotImpVerifEAR_v4.pdf
GIS FILE: 06-200-013_PotImpVerifEAR_v4.mxd		amec
PROJECTION: UTM Zone 10	DATUM: NAD83	

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An additional 1.2 ha of Blue-listed wetlands intersect with the transmission line. Direct Project effects on these wetlands can potentially be avoided or minimized through mitigation measures (pre-construction planning), such as avoiding wetlands altogether and locating support poles in uplands. No loss of wetland extent is expected. However, canopy removal will potentially occur for 0.9 ha of black spruce bog wetlands (Wb01), which would likely convert these wetlands to shrub or emergent wetland habitat. These effects will be temporary because the original vegetation structure will likely restore itself following decommissioning of the transmission line. The remaining 0.3 ha of Blue-listed wetland habitat, which is existing shrub (Wf02) and emergent habitat (Wf08), is not expected to be affected.

4.0 WETLAND MITIGATION SEQUENCING

The *CEA Act* (Government of Canada, 2012) defines mitigation as the "practical means of preventing or reducing to an acceptable level any potential adverse effects of the Project." Mitigation measures for the Project comprise actions that eliminate, reduce, or control the adverse environmental effects of a project, and include actions taken to replace, restore, or compensate for any adverse effects. This process is typically summarized as the mitigation hierarchy, which entails four steps with the intention of identifying opportunities to avoid, minimize, restore on site, and compensate for or offset potential adverse environmental impacts (BC MOE, 2012).

Considerations for wetland mitigation in Canada and BC include accounting for environmental values and functions impacted by the Project as indicated in the Project Application for Environmental Assessment Certificate (BC MOE, 2012). Criteria used to determine relative priorities among environmental values and associated components include:

- Scale of impact;
- Current condition of wetlands in the area of influence;
- Ability to effectively mitigate for various wetland functions;
- Sound best management practices (BMPs) and guidelines used during planning, construction, and operations; and
- Adequate guidance from regulators and collaboration with stakeholders regarding regulatory review and jurisdiction.

Higher value wetlands may require more rigorous mitigation measures in BC. Based on agency communications during the planning process for the Project, any federally or provincially listed ecosystems or species will receive priority regarding proposed compensation.

Other important considerations when identifying wetland mitigation measures include temporal loss of wetland functions and probability of success of the mitigation methods. Temporal loss is the lag time between the loss of wetland functions caused by a permitted activity and the replacement of the wetland functions. Temporal loss can be reduced by installing off-site compensatory mitigation sites in advance of, or concurrently with, the Project impacts. To reduce risk of failure, steps must be taken during site selection and planning to ensure a high probability of success in undertaking the intended wetland compensation measures.

Proposed wetlands compensation will provide wetlands with similar functions and habitat structure as the Blue-listed wetlands being lost. It is important, therefore, to set targets and metrics that are attainable and measurable so that proposed compensation actions can be evaluated for their success in mitigating Project effects on exiting wetland functions. This can be achieved by establishing performance standards, and implementing a monitoring program to track wetland succession and development over time. Monitoring the success of on-site mitigation and off-site compensation efforts, and implementing adaptive management strategies and contingency measures, if necessary, will help gauge the success of the mitigation plan and reduce risk.

Ensuring the success of off-site compensation sites includes proper site selection and baseline studies to document the increase in wetland functions provided by the compensation. The identification of off-site wetland compensation sites is an iterative process between Project proponents and agencies, with input from stakeholders. Proposed wetland mitigation for the Project will use a multilateral approach to conserve and create wetlands on site, and restore and enhance wetlands off site. Both on-site wetland creation and off-site wetland compensation are intended to offset the loss of wetland functions due to the Project.

Off-site wetland compensation involves habitat enhancement through the Fish Habitat Mitigation and Offset Plan (FHMOP), and restoration and enhancement of nearby historically drained and degraded wetlands in the Mathews Creek watershed.

4.1 Avoidance and Minimization on Site

Adverse wetland effects were avoided during Project planning to the extent practicable with the current Project design. Wetland effects were avoided in the adjacent Blackwater River watershed by sitting the TSF within the Davidson Creek and Creek 661 watersheds. The Blackwater River watershed was identified during the Project scoping process as an area with significant natural resources, and impacts on this watershed were avoided through consideration of multiple site layouts, as described in **Section 2.5** (Alternative Means of Undertaking the Project). The location of many of the mine infrastructure features, including the open pit and TSF, is limited by topography and ore deposits, which limits avoidance measures.

Unavoidable Project effects on wetlands and wetland functions will be minimized through implementation of the Wetlands Management Plan (**Section 12.2**), Project design features, and on-site wetland creation.

4.1.1 Wetland Management Plan for Construction, Operations, and Closure

On-site mitigation will use BMPs to minimize potential adverse effects from construction and operations of the proposed mine, mine access road, airstrip, transmission line, and water supply pipeline. These BMPs are designed to reduce the effects of fragmentation and sedimentation, as well as reduce changes in hydrology and water quality. Several management plans have been developed to minimize these issues, including the Wetlands Management Plan (**Section 12.2**), Water Quality and Liquid Discharges Management Plan (**Section 12.2**), and the site-specific Environmental Management Plan **(Section 12.2.**).

BMPs for work around and in wetlands will be implemented during several phases of the Project (planning, access/construction, mine operations, and closure). Wetland BMPs focus on minimizing and avoiding impacts on on-site wetlands by implementing the following protective measures:

4.1.1.1 Planning Measures

- Design roads and other linear components to avoid and minimize wetland impacts;
- Minimize the number of wetland and stream crossings for all linear components;
- Reduce noise and other disturbances during sensitive times for wildlife, particularly for birds during the breeding season, and refer to the Aquatic Resource Management Program and Wildlife Management Program for information on respective fish and wildlife timing windows for construction;

4.1.1.2 Access/Construction Measures

- Protect remaining wetlands through the retention of buffers by establishing limits of disturbance during construction;
- Confine any development within wetlands to wetland margins, and avoid hydrologically active areas such as seeps, rivulets, or ponded areas where possible;
- When working in saturated soils, use timber mats, driving mats, or log corduroys as ground protection to minimize soil erosion and prevent rutting, and use low ground pressure equipment or tracked equipment when possible;
- Maintain existing drainage connections and water flows when designing and installing culverts for cross drainage where possible, and do not create outlets that either drain wetlands or constrict the natural outlet;
- Minimize soil erosion and sedimentation by maintaining sediment control devices in accordance with the Erosion and Sediment Control Plan (ESCP);

4.1.1.3 Mine Operations Measures

- Protect existing wetlands through the retention of buffers by establishing limits of disturbance during operations;
- Control metal leaching by separating contact and non-contact surface water through diversion dams and collection trenches;
- Ensure dewatering operations are not directly discharged to wetlands or streams;
- Prevent sedimentation by stabilizing disturbed soils with seed mixes and using sediment control devices (e.g., sediment control fencing and hay bales);
- Prevent invasive species from establishing in wetlands and wetland buffers by following the Invasive Species Management Plan (ISMP), which includes quality controls for hay bales and inspecting vehicles and equipment, as these can be pathways to establishment;
- Maintain sediment control devices in accordance with the ESCP.

4.1.1.4 Closure Measures

- Re-establish wetland ecosystems and lost wetland functions by creating indigenous, pre-development wetland vegetation communities (e.g., along pond margins of TSF);
- Monitor created wetland areas to ensure success.

4.1.2 Project Design Features

Potential impacts on wetlands will be minimized through several Project design features embedded within the Project design. During operations, these mitigating design features include the freshwater supply system, seepage collection trenches, the TSF, and wetland creation around the TSF (Pond 1). During closure and reclamation, wetlands will be created around the TSF (Pond 2) and in the converted freshwater reservoir (**Appendix 2.2.6B**, Reclamation and Closure).

The freshwater supply system (**Section 2.2**, Project Description) will minimize impacts on riparian wetlands within Davidson Creek by maintaining stream surface flows. Water will be pumped from Tatelkuz Lake to a freshwater reservoir, which will discharge to Davidson Creek and compensate for the loss of water flows. This mitigation measure will help sustain riparian marshes and swamps along Davidson Creek downstream from the mine site during the life of the Project.

Mine site facilities and the TSF are mainly located within the upper Davidson Creek watershed. Approximately 60% of the headwater catchment area for Davidson Creek would be diverted into the TSF during Project operations. The flow of Davidson Creek would potentially be reduced during mine operations, which would result in adverse effects on fluvial wetlands along Davidson Creek. However, these potential effects will be avoided by maintaining flows in Davidson Creek through pumping and the freshwater supply system.

The water supply pipeline would operate until the open pit and TSF are full, and water quality is suitable for release to Davidson Creek (**Section 5.3.3** - Surface Water Quality). At this point, the water supply pipeline would be decommissioned, and runoff from the upper Davidson Creek headwaters would resume normal flows to lower Davidson Creek.

Wetland effects will be further minimized through surface water management and seepage collection that will minimize potential effects on groundwater and surface water quality entering wetlands. The seepage collection trenches and the Environmental Control Dam (ECD) will collect seepage water from the TSF dam, which will prevent seepage from potentially effecting downstream wetland resources in Davidson Creek. In addition, a 2 ha treatment wetland is proposed as contingency downstream of the ECD to treat any seepage that may potentially bypass the ECD.

4.2 Wetland Creation on Site

Progressive wetland creation on site is proposed during the Project operations and closure to reduce the temporal effects of wetland loss. Approximately 305 ha of swamp, marsh, and shallow-water wetlands can be created on site by Year 32. This includes wetlands around two basin ponds, and converting the freshwater reservoir into riparian wetlands.

The Reclamation and Closure Plan (**Appendix 2.2.6B**) describes the general restoration strategy for the mine site landscape, and wetland creation details regarding target plant communities and intended habitats are provided in the Wetlands Effects Assessment (**Section 5.3.7**). In summary, the following wetland habitat creation actions are proposed for the progressive reclamation plan:

- 63 ha of swamp and marsh wetland habitat will be created around Pond 1 of the TSF at Year 4 of the operations phase;
- 231 ha of swamp and marsh wetland habitat will be created around Pond 2 of the TSF at post-closure (Year 32); and
- 11 ha of riparian swamp wetland habitat will be restored by converting the freshwater reservoir to wetlands at post-closure (Year 32).

Successful wetland creation involves using suitable soil material, promoting optimum water levels and saturated soil conditions, and establishing vegetation communities through native plantings and controlling invasive species. Hydrology is the main factor in creating and maintaining wetlands, which will be ensured by low gradients around the edges of the TSF. The created wetlands will be designed and constructed such that the least amount of maintenance is required.

The created wetlands will support wetland ecosystem components such as standing water, hydric soils, and distinct wetland (facultative wet and obligate wetland species) plants. Presence of these components does not guarantee a functioning ecosystem, especially in the early years following creation. However, as created wetlands mature, these components will become ecologically interrelated, gradually evolving into a functioning wetland (McKinstry et. al., 2004).

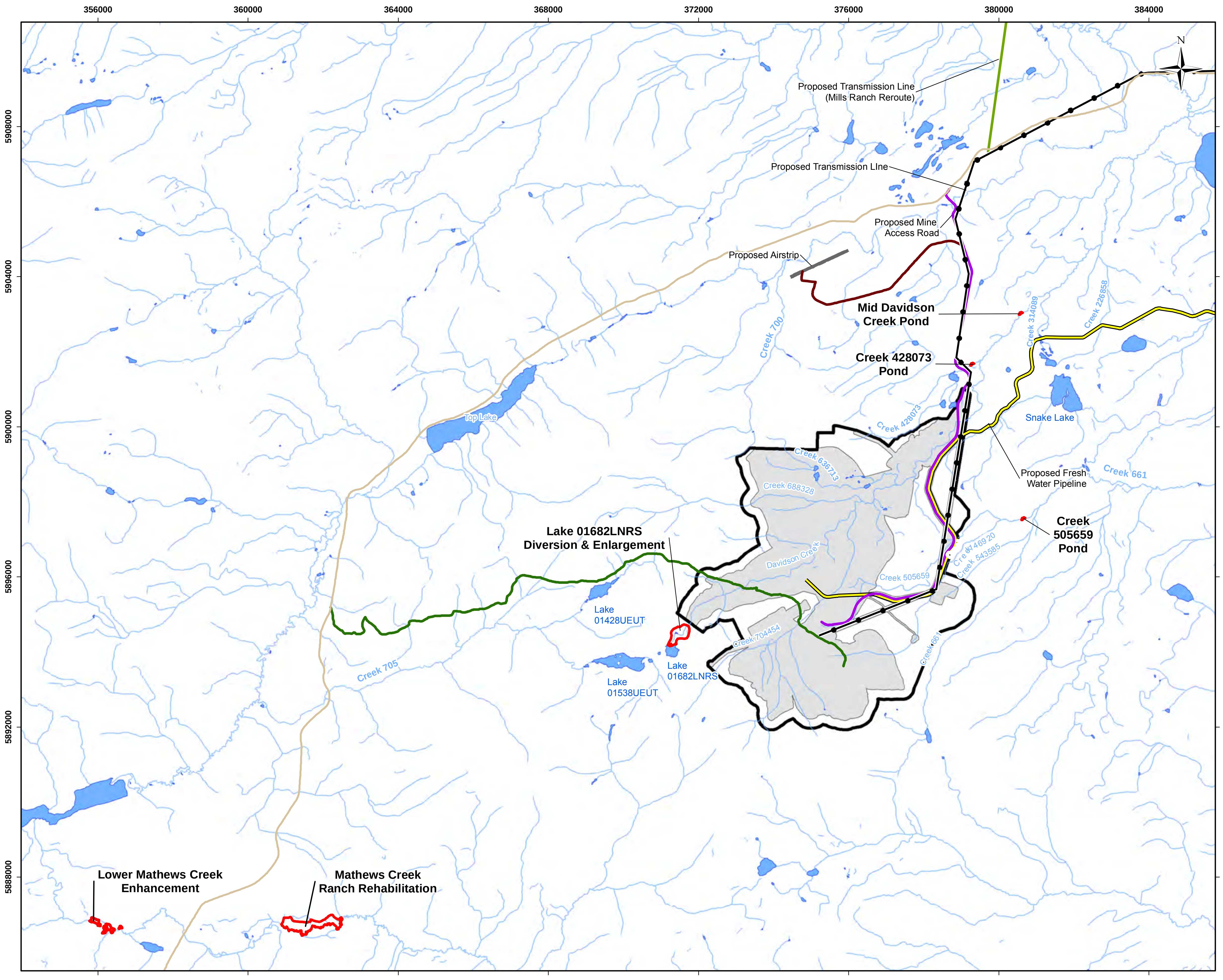
5.0 OFF-SITE COMPENSATORY MITIGATION

The mitigation site selection process for this Project began early in the mine planning stages. Potential wetland and stream mitigation sites in Davidson Creek and surrounding watersheds were identified using aerial photos and by consulting local agencies and ecologists. Several potential sites were selected following further evaluation and site visits. Site selection focused on biological equivalency to wetlands affected by the Project, along with technical feasibility, sustainability, probability of success, and cultural value. Landscape position, soil conditions, and anticipated construction expenses (i.e., degree of grading required, access issues, etc.) were also contributing factors.

A total of 52.3 ha of off-site wetland compensation is proposed to offset the impacts on 24.2 ha of Blue-listed wetlands. Off-site wetland compensation consists of enhancing 2.2 ha of wetland functions by increasing habitat diversity in existing wetlands through the creation of fishponds in the Davidson Creek and Creek 661 watersheds (**FHMOP, Section 5.3.9**). An additional 11.4 ha of wetland habitat will be created in the Creek 705 watershed by enlarging Lake 01682LNRS (Lake 16), which will provide wetland habitat in side channels and the margins of open water areas. The open water and marsh habitat complexes will provide habitat for migratory waterfowl and amphibian species, such as the western toad.

Compensatory mitigation will be provided through the restoration and enhancement of approximately 38.7 ha of drained and degraded agricultural wetlands that exist southwest of the Project in the Mathews Creek watershed. These wetlands are currently harvested for hay and utilized for pasture, some of which have been drained to support these agricultural uses. These wetlands will be restored to a mosaic of black spruce (*Picea mariana*), shrub, and emergent wetland habitats to support wildlife use by mammals, including caribou, moose, grizzly bears, furbearers, and bats.

Construction and installation of compensation projects will occur as early as possible following approval of the Project. This includes construction of the compensation sites prior to Project construction. This initiative is intended to reduce the temporal loss of wetland functions due to the Project. All proposed off-site mitigation areas are shown on **Figure 5-1**.



Legend

- Exploration Road
- Kluskus-Ootsa FSR
- Stream
- Lake

Project Components

- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Transmission Line (Mills Ranch Reroute)
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Proposed Airstrip
- Proposed Mine Site
- Proposed Mine Footprint
- Wetland Compensation Site

Scale:1:100,000

0 1 2 4

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Offsite Wetlands Compensation Areas

DATE: February, 2014	ANALYST: MY	**Figure** 5-1
JOB No: VE52277	QA/QC: SB	PDF FILE: 06-200-024_OnSiteMitigation.pdf
GIS FILE: 06-200-024_OnSiteMitigation.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

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5.1 Site Selection

Site selection for off-site compensatory mitigation sites focused on the Davidson Creek, Creek 661, Turtle Creek, Mathews Creek, and Creek 705 watersheds. Compensation areas are concentrated as close as possible to the wetland impacts to provide stability to watershed processes, as well as providing wetland hydrologic, biochemical, and habitat functions. Compensation sites were also evaluated based on their potential for self-sustainability on the landscape once established. Feedback from Aboriginal groups on the compensation sites will be incorporated as appropriate.

The identified off-site wetland compensation areas met one or more of the following criteria:

- Suitable and sustainable hydrologic source for wetland compensation activities that would not require engineered or maintained berms, dikes, or other water control mechanisms;
- Areas of wetland where one or more wetland functions have been eliminated by prior human activity that could be restored to their previous type, size, and vigour;
- Areas where wetland functions have been severely degraded by prior human activity that could be enhanced to the previous type, size, and vigour;
- Areas where wetland values, and hydrologic functions and linkages between streams and wetlands, could be created or enhanced; and
- Areas where wetland enhancement would increase habitat diversity and provide habitat functions for wildlife.

5.2 Wetlands Functions Provided by Fish Habitat Mitigation

5.2.1 Diversion and Enlargement of Lake 01682LNRS

A network of abundant and healthy wetlands is vital to the survival of most fish species. Under the *Fisheries Act* (Government of Canada, 2013), mitigation of effects on fish habitat often includes wetland restoration projects. Lake 16 and the highest reaches of Davidson Creek would be cut off from the rest of Davidson Creek by construction of the upper TSF (Site C). This would result in an isolated and unsustainable rainbow trout population in this area. To mitigate for this stranding effect, it is proposed to reverse flow from Lake 16 to the neighbouring watershed via a newly constructed diversion channel to Lake 01538UEUT (Lake 15), a headwater lake in the Creek 705 watershed (**Figure 5-1**).

The diversion project will promote a self-sustaining population of rainbow trout in Lake 16 by providing connectivity and access to existing rainbow trout habitat in Lake 15 and Creek 705. Wetland features can be incorporated into low-gradient sections of the diversion channel to create swamp habitat and other wetland habitat types. Side-channel fluvial wetlands can also be established. The marsh and open water habitats will provide usable habitat for migratory waterbirds.

The upper Davidson Creek reroute will result in the enlargement of Lake 16 by 11.4 ha (**FHMOP**, **Section 5.3.9**). Shallow-water areas around the perimeter of the lake will have low gradients to promote marsh habitat, and riparian edges can support swamp habitat. For the purposes of the WCP, the entire wildlife habitat created by the expanded lake area and wetland fringe is considered under compensation.

5.2.2 Off-Channel Overwintering Ponds in Selected Watersheds

In an effort to offset loss of salmonid habitat, sites in the middle to upper watersheds of Davidson Creek, Creek 661, and Creek 705 were identified for construction of 2.2 ha of off-channel overwintering ponds (**Figure 5-1**). The goals for pond construction are to increase the availability of rainbow trout overwintering sites in the local watershed, and to provide increased diversity of wetland wildlife habitat for migratory water birds and amphibians. Additional wetland features potentially incorporated into these off-channel fishponds include:

- Shallow water benches around the perimeter of fish ponds to allow opportunities for colonization by marsh vegetation and to promote habitat complexity;
- Shallow banks, where possible, to minimize erosion and sedimentation and provide marsh and swamp habitat; and
- Riparian plantings to establish native vegetation along the banks and perimeters of the off-channel ponds.

Off-channel overwintering ponds would range in size and follow local topographic features to maximize habitat complexity. Designs would be adapted to the local site conditions at each of the proposed sites to support a fish and wetland habitat complex.

To minimize the release of suspended sediments during construction, the inlet/outlet channels will be used as natural plugs to effectively isolate the main pond area. The ponds can be connected to the main stream when conditions stabilize. At an appropriate planting time immediately following Project construction, all disturbed areas and banks will be stabilized and planted using appropriate native vegetation.

5.3 Mathews Creek Ranch Property Restoration

The Proponent has acquired ranch land in the Mathews Creek watershed intended for wetland restoration and conservation, and fish habitat creation and enhancement. This property is identified as the Mathews Creek Ranch Property, and is located approximately 15 km southwest of the mine site. Historical air photos indicate that intensive agriculture and livestock grazing has occurred in the watershed since at least the late 1960s. Extensive wetland disturbance occurred along the middle reaches of Mathews Creek, where cattle ranching and drainage ditch excavation resulted in lowered water tables, altered wetland vegetation, soil rutting, and erosion of riparian areas.

A multidisciplinary program was initiated to integrate the fish habitat compensation strategies with wetland mitigation at the Mathews Creek Ranch site. Wetland restoration and fish habitat creation are mutually beneficial when considering the ecological restoration of the historically degraded system. The objectives and actions for wetlands compensation at the Mathews Creek Ranch site are intended to offset the impacts on wetland habitat that will be impacted by the Project. Site objectives and proposed actions to achieve this goal include:

Objective #1: Restore water quality functions in wetlands altered by human activities

- ***Actions:*** Remove livestock from floodplain wetlands to eliminate nutrient loading from animal waste, reduce erosion and sedimentation in Mathews Creek and associated wetlands, and improve the thermal regulation function of wetlands.

Objective #2: Restore hydrologic processes in wetlands altered by human activities

- ***Actions:*** Fill or block created drainage ditches that artificially lower the water table for hay harvest in associated wetlands. Linear ditches will be backfilled with on-site soil that was historically removed to create the ditches. Restoring wetland hydrology will improve flow moderation in Mathews Creek, reduce erosion, and enable the re-establishment of native wetland vegetation.

Objective #3: Restore forested wetland habitat to support wildlife use

- ***Actions:*** Eliminate annual haying, and plant appropriate native trees, shrubs, herbs and graminoids along the riparian corridor and in patches to create a mosaic of habitat types in the restored wetlands. Restoring a diversity of native plant communities in the wetlands will foster wildlife use by mammals, amphibians, and invertebrates that utilize this resource.

Objective #4: Improve fish habitat, water quality, and thermal regulation in Mathews Creek

- ***Actions:*** Implement fish habitat creation, and wetland restoration and enhancement activities described in the FHMOP for Mathews Creek, including riparian plantings, bank stabilization, increased sinuosity of tributaries, and large woody debris structures.

Objective #5: Increase shallow-water and marsh habitat along Mathews Creek for migratory waterfowl

- ***Actions:*** Create open water and marsh habitats in restored wetlands to provide habitat for migratory waterfowl. Install off-channel fish habitat in the Mathews Creek floodplain.

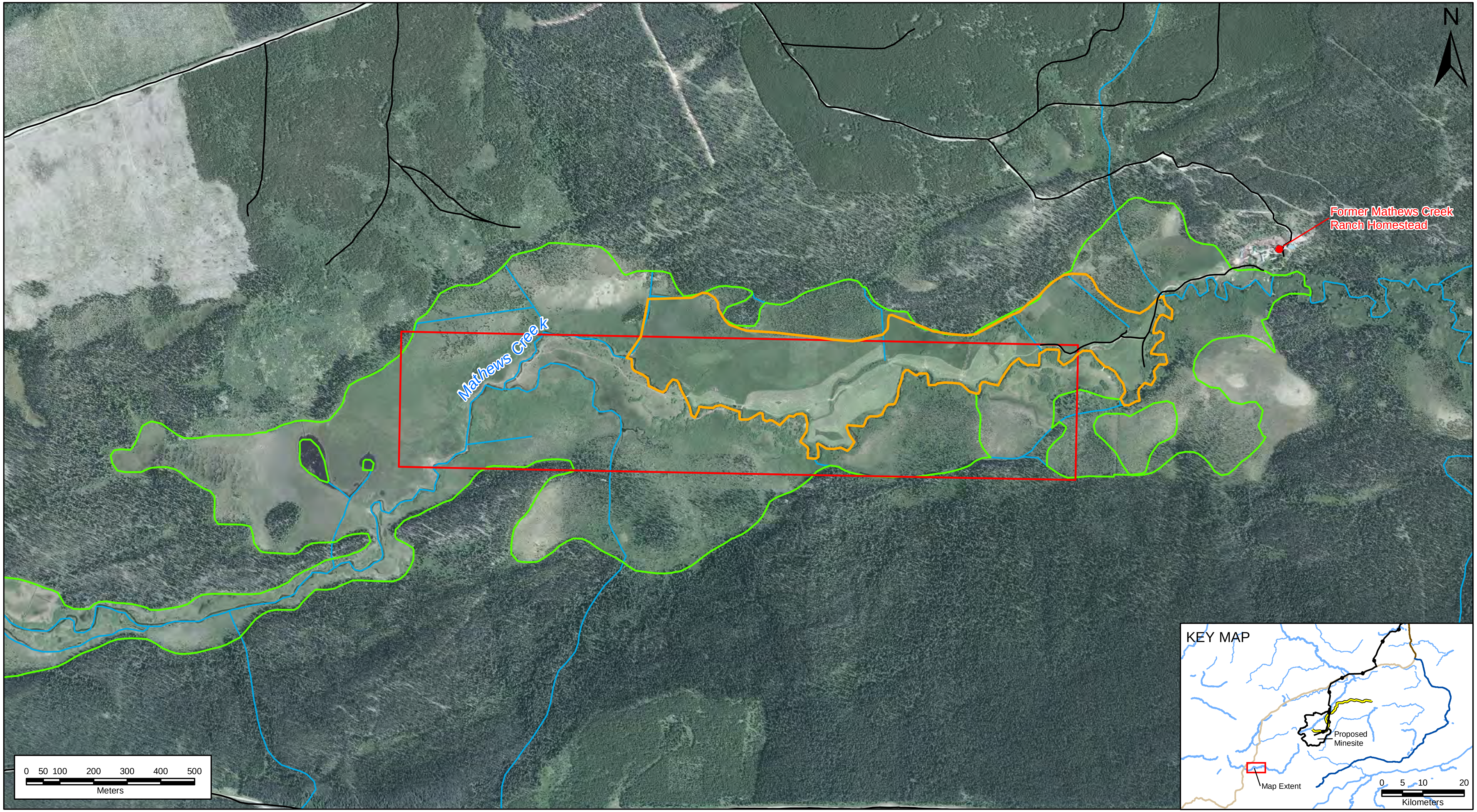
To meet these objectives, several drainage ditches on the north side of Mathews Creek within the wetland restoration area are proposed to be filled (**Figure 5-2**). Each of the affected ditches is either disconnected from Mathews Creek, or is only seasonally connected via a cattle-trampled, vegetated swale. Filling the ditches will return the groundwater table to its slightly higher, natural level within the valley bottom alluvium, which will in turn restore the wetter soil moisture regime necessary to promote and sustain the growth of natural wetland vegetation communities.

The restored swamp wetlands will provide a high level of habitat functions due to the wetlands' proximity to Mathews Creek. A mosaic of habitat types will be created within a 32 ha area on the north side of Mathews Creek by planting native trees and shrubs on slightly elevated mounds, and herbs and graminoids on inundated areas. The re-establishment of natural, historical vegetation patterns is anticipated to attract birds, mammals, and amphibians that were displaced from the area by previous land clearing and cattle ranching activity. The forested, shrub, and emergent wetland habitats are intended to compensate for impacts to Blue-listed forested bogs, and shrub and emergent fen habitats.

The restored wetlands will also provide a high level of biochemical functions. Surface water quality will improve because of the exclusion of cattle from the wetland restoration area will eliminate unnaturally high nutrient loading from animal waste. Increased water quality treatment will be provided by the restored wetlands because interactions between water and root-bacteria assemblages will increase nutrient cycling (Mitsch and Gosselink, 2008). These restored riparian swamps will also export nutrients and organic matter to streams, improve thermal regulation, and provide carbon sequestration and storage by increasing biomass production through the conversion of grass pastures to swamps with woody vegetation (Hanson et al., 2008). Basic restoration efforts should result in significant improvements in the quality of local and downstream wetlands, riparian areas, and fish habitat in the Mathews Creek watershed.

A moderate level of hydrologic functions will be provided by the restored wetlands. These wetlands will be located in the floodplain of Mathews Creek, and will have the opportunity to moderate flows during floods and storm events. These wetlands will also stabilize soils to reduce erosion and sedimentation in Mathews Creek. Minimal opportunities for groundwater recharge will be available because of the shallow groundwater table that will be restored (Hanson et al., 2008).

Further work is required to establish the wetland community composition that was present before disturbance. It is likely that the restored forested wetlands will be similar in vegetation community composition to Ws07 (Swamp Wetland–Spruce–Horsetail)) (MacKenzie and Moran, 2004), or other spruce-dominated floodplain wetlands. This information will likely be collected during site visits in 2014 to nearby undisturbed wetlands with similar site conditions to establish biological benchmarks during restoration planning. Coordination of wetland restoration efforts and fish habitat offsetting measures will ensure mutual benefits are targeted and maximized.



REFERENCE:
BC Government
GeoBC Data Distribution

Legend
- Exisiting Road
- Stream
- Waterbody
- Mathews Creek Ranch Property boundary
- Confirmed Wetland Restoration Area
- Freshwater Atlas Wetlands

CLIENT
newgold

AMEC Environment and Infrastructure
4445 Lougheed Highway, Suite 600, Burnaby, B.C. V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

amec

ANALYST:	AA
QA:	SB
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:11,000

PROJECT
Blackwater Gold Project

TITLE
Wetlands Restoration on
Mathews Creek Ranch Property

REV. NO:	A
DATE:	February, 2014
PROJECT NO:	VE52277
FIGURE NO:	5-2

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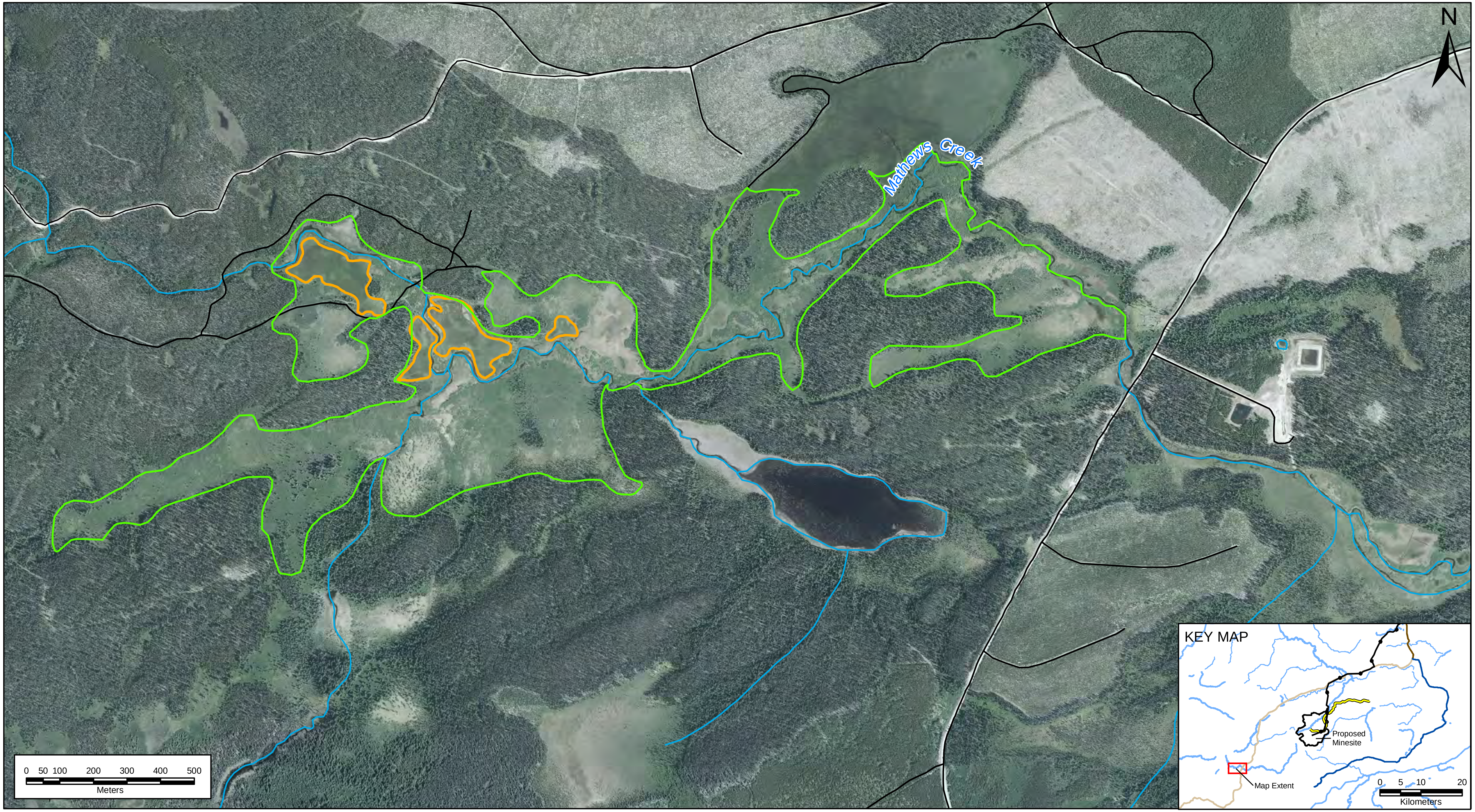
5.4 Lower Mathews Creek Wetland Enhancement

Staff with the Ecosystems Branch, BC Ministry of Environment, identified an additional 6.7 ha of degraded wetlands in the Mathews Creek watershed downstream of the Mathews Creek Ranch for wetland compensation (**Figure 5-3**). Wetlands and other aquatic features are often high priority for restoration treatments for the Ecosystems Branch, which formerly hosted the Terrestrial Ecosystem Restoration Program (BC MOE, 2001). The entire Lower Mathews Creek is on Crown Land. The Proponent is committed to working with the Government of BC to create a partnership to follow through with the restoration of these wetland areas.

Wetland functions on these 6.7 ha have been degraded by agricultural activities that have caused significant soil and vegetation disturbance. Hayfield agriculture has resulted in rutting from large machinery. Annual harvesting has also degraded wetland habitat functions by limiting the development of shrub and forested wetland habitats in riparian areas.

The Lower Mathews Creek site offers additional opportunities to restore and conserve wetland and riparian ecosystems within the Mathews Creek watershed. Returning these wetlands to their original condition and eliminating annual harvest will help offset the loss of Blue-listed wetlands at the mine site. Restoration design will be coordinated with the Government of BC so that this wetland compensation area will be installed prior to or concurrently with Project implementation.



Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\06_vegetation\EIA\06-200-029_lower_matthews.mxd

REFERENCE: BC Government GeoBC Data Distribution	**Legend** Exisiting Road; Stream; Waterbody; Confirmed Enhancement Wetlands; Freshwater Atlas Wetlands

CLIENT: newgold

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amec

ANALYST:	MY
QA:	MY
DATUM:	NAD83
PROJECTION:	UTM Zone 10
SCALE:	1:11,000

PROJECT: Blackwater Gold Project

TITLE: Wetland Enhancement on Lower Mathews Creek

REV. NO:	A
DATE:	February, 2014
PROJECT NO:	VE52277
FIGURE NO:	5-3

5.5 Compensatory Mitigation Adequacy Analysis

Mitigation measures to address wetland impacts include avoidance, minimization, wetland creation on site, and wetland compensation off site. A total of 305 ha of wetlands will be created on site to mitigate for wetland loss in the Davidson Creek and Creek 661 watersheds to support the Not Significant (minor) determination in effects assessment for the Project (**Section 5.3.7**). Approximately 52.3 ha of wetlands compensation will be provided off site to offset impacts on 24.2 ha of Blue-listed wetlands.

The proposed 52.3 ha of wetland compensation results in a no-net-loss of wetland functions for the Project in accordance with the *Federal Policy on Wetland Conservation*. The 32 ha of wetland restoration and 6.7 ha of wetland enhancement in the Mathews Creek watershed, and the 13.6 ha of wetland habitat enhancement off site associated with the FHMOP, compensates for the 24.2 ha of impacts on Blue-listed wetlands (**Table 5-1**).

Table 5-1: Compensation Adequacy

	Wetland Area (ha)
Impacts: Blue-listed Wetlands	-24.2
Compensation[(1)]: Mathews Creek and FHMOP Ponds	+52.3
Net benefit to wetland ecosystems	+28.1

Note: FHMOP = Fish Habitat Mitigation and Offset Plan; ha = hectare
[(1)] Includes both wetland restoration and enhancement.

The compensation wetlands will provide wetland hydrologic, biochemical, and habitat functions similar to the Blue-listed bog and fen wetland habitat types that will be impacted by the Project. Regarding wetland habitat functions, the 32 ha wetland restoration at the Mathews Creek Ranch site will include a mosaic of black spruce and pine forest, shrub, and emergent habitats. These wetland habitats are intended to provide suitable habitat for mammals, and invertebrates affected by the project, such as caribou, grizzly bear, and the Jutta arctic. These restored wetlands will provide foraging opportunities and improve wildlife access in the Mathews Creek corridor by ending the ranching activities and restoring the riparian habitat. The additional 6.7 ha of wetland compensation at the Lower Mathews Creek site will likely have similar habitat structures, and will be implemented in partnership with the Government of BC.

The restored wetlands at the Mathews Creek Ranch site will also provide high level of biochemical functions similar to the impacted bogs and fens. By restoring groundwater levels, water quality treatment will be provided from increased nutrient cycling. The restored wetlands will also export nutrients and organic matter to streams to support the aquatic food chain. An increasing woody vegetation will increase atmospheric carbon storage (Hanson et al., 2008). Wetland compensation also includes enhancing 2.2 ha of wetland functions by increasing habitat diversity in existing wetlands through the creation of fishponds in the Davidson Creek and Creek 661 watersheds. An additional 11.4 ha of wetland habitat will be created in the

Creek 705 watershed by enlarging Lake 16, which will provide wetland habitat in side channels and the margins of open water areas. These pond, shallow-water, and marsh habitat complexes will provide habitat for migratory waterfowl and amphibian species, such as bufflehead and western toad.

5.6 Long-Term Site Protection

The off-site compensatory mitigation sites will be protected in perpetuity through different legal mechanisms developed for each of the sites. Legal mechanisms may include a land use or deed restriction on the individual property, or similar conservation covenant that will restrict any development or other land use that would interfere with the purpose and objectives of the compensation sites. The conservation covenant would define only those actions that are compatible with the site's purpose, and then run with the land and property. Incompatible uses would include land development, logging, or grazing, for example. The Mathews Creek Ranch property is owned fee simple by the Proponent, and a conservation covenant would be an effective means to assure long-term protection of this compensation site's objectives regarding wetland functions.

The Lower Mathews Creek wetland enhancement site is on provincially-owned land, and a land use designation or other conservation measure would be enacted to provide long-term protection. Restoration design will be coordinated with the Government of BC, as well as a strategy to protect this compensation site from alternate uses that would otherwise jeopardize the site's purpose to provide wetland functions.

The fish habitat mitigation ponds would likely be protected through Fisheries Authorizations as per the *Fisheries Act* (Government of Canada, 2013). Provisions could be included in these instruments that also provide for the conservation of the property for both wetland and fisheries functions. Legal mechanisms for the long-term protection of these sites will be developed that serve both objectives regarding fisheries and wetland functions.

6.0 IMPLEMENTATION SCHEDULE

An implementation schedule will be developed to ensure that off-site wetland compensation is successfully undertaken prior to, or concurrently with, the loss of wetlands on site. The implementation schedule will address the on-site wetland creation and off-site compensation sites' relationships with the surrounding landscape and mine operations, and lay out the process for achieving the Project's goal of no-net-loss of wetland functions. Factors that must be addressed for each wetland mitigation site include the interaction between flora and fauna, material moving between a site and the surrounding ecosystems (e.g., water, nutrients, sediments, pollutants), and how a site's natural and man-made boundaries will affect ecological processes (Ehrenfeld and Toth, 1997).

The implementation schedule will be developed in conjunction with the FHMOP to minimize temporary disturbances at each compensation site. Earthwork is anticipated to occur during the drier months to reduce the potential for erosion and sedimentation of aquatic resources. It is estimated to require one year to construct the compensation sites, stabilize soils, plant native vegetation, and then hydrologically connect them to adjacent aquatic resources. Maintenance will begin immediately following site installation, and performance monitoring will commence one year after completion of the as-built survey for each site.

7.0 MONITORING AND PERFORMANCE STANDARDS

Wetland compensation sites will be monitored to assess compensation success. Performance standards will be developed to measure each site's gain in wetland functions. Compensation site monitoring will also provide a framework to identify preventative measures and address changes in site conditions that may trigger the need for actions to avoid adverse effects (e.g., soil stabilization). This approach is consistent with the overall adaptive management strategy for the Project during construction, operations, and closure. Wetland monitoring events will be conducted along with fish habitat monitoring at the compensation sites.

The progress of on-site wetland mitigation areas and off-site compensation areas will be evaluated through performance standards. Performance standards are measurable or observable physical, chemical, or biological attributes used to determine if the created, restored, or enhanced wetlands are meeting wetland objectives. Performance standards will be developed in consultation with agencies. Performance standards could include total wetland area, habitat structure, vegetation cover, and site hydrology to anticipate the wetland site's successional trajectory about the wetland functions they were initially intended to provide. If performance standards are not being consistently achieved annually, then agency consultation will be initiated to determine corrective measures (e.g., supplemental plantings).

Monitoring methods will likely utilize established sampling plots. Monitoring could include photographic documentation, vegetation surveys, wildlife surveys, soil profile documentation, and hydrological assessments. Photo-points will be established at each sample plot to visually document site progress over time. Vegetation monitoring will document plant cover, species, and survival to ensure the compensation sites are on a successional trajectory towards the intended habitat types. Invasive species will also be recorded in order to prescribe remedial actions to remove them, if necessary. Wildlife observations will be documented during the sampling events, including bird use. Soil development and hydrological conditions will be recorded at each sampling plot to a depth of at least 18 inches.

Monitoring will commence following installation, stabilization, and planting. Monitoring events will be conducted until the performance standards are met. Annual monitoring reports will be submitted to agencies for review following each annual monitoring event.

8.0 SUMMARY OF COMPENSATION MEASURES

The WCP addresses impacts on wetlands associated with the Project. On-site mitigation measures to address wetland impacts include avoidance, minimization, and wetland creation on site. Off-site compensation sites will offset impacts on Blue-listed wetland habitat, biochemical, and hydrologic functions. A total of 305 ha of wetlands will be created on site to mitigate for wetland loss in the Davidson Creek and Creek 661 watersheds, and 52.3 ha of wetland compensation will be provided off site for impacts on Blue-listed wetlands (**Table 8-1**).

Table 8-1: Proposed Wetland Habitats at Compensation Sites

Compensation Site	Total Compensation Area (ha)	Proposed Wetland Habitats	Potential Use by Wildlife Family Groups
Off-channel Fish Ponds	2.2	Marsh, shallow open water, pond	Migratory waterbirds and amphibians
Lake 16 Diversion and Enlargement	11.4	Marsh, shallow open water, pond	Migratory waterbirds and amphibians
Mathews Creek	38.7	Riparian swamp	Mammals and invertebrates
Total	**52.3**		

Note: ha = hectare

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