

APPENDIX 10B: FREEGOLD ROAD FISH AND AQUATIC BASELINE

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PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

Casino Project

Fish and Aquatic Resources Baseline Report:

Freegold Road Extension, Freegold Road Upgrade, and Casino Airstrip and Airstrip Access Road

Prepared for

Casino Mining Corporation

October 17, 2013



October 17, 2013

Jesse Duke
Project Director
Casino Mining Corporation
2050-1111 West Georgia Street
Vancouver, BC V6E 4M3

Dear Mr. Duke,

Re: Casino Project – Fish and Aquatic Resources Baseline Report:
Freegold Road Extension, Freegold Road Upgrade, and Casino
Airstrip and Airstrip Access Road

Palmer Environmental Consulting Group Inc. is pleased to submit the attached report describing results of the fish and aquatic resources baseline assessment conducted for the Freegold Road Extension, Freegold Road Upgrade, and Casino Airstrip and Airstrip Access Road as part of the Casino Mine Project's Proposal submission to the Yukon Environmental and Socio-Economic Assessment Board.

This report characterizes the pre-development conditions of the fish and aquatic resources in the study area of the proposed Freegold Road Extension, Freegold Road Upgrade, and Casino Airstrip and Airstrip Access Road and provides a basis for an effects assessment from development of these roadways for the Casino Project.

If there are any questions or comments on this report, please contact Rick Palmer at (604) 629-9075.

Thank you for the opportunity to work with you on this project.

Yours truly,

Palmer Environmental Consulting Group Inc.

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Executive Summary

This report provides a description of the baseline fish and aquatic resources along the proposed Freegold Road Upgrade, Freegold Road Extension and the proposed Airstrip and Airstrip Access Road planned to be constructed as part of the Casino Project. The Casino Project is a proposed porphyry copper-gold-molybdenum mine located at 611300E 695800N in west-central Yukon, approximately 300 km northwest of the territorial capital of Whitehorse. This project is 100% owned by Casino Mining Corporation, formerly Western Copper Corporation.

The objective of the fish and aquatic resource baseline investigation was to characterize each of the planned river and stream crossing locations to determine their fish bearing status (i.e., fish bearing or non-fish bearing) to provide the environmental information necessary for design and permitting of each crossing structure.

The fish and aquatic resource studies were conducted in 2010, 2011 and 2013 at 61 locations along the Freegold Road Upgrade section, at 95 locations along the Freegold Road Extension and at 12 crossings for the Airstrip Access Road (the "Casino Roads"). These assessments were conducted within the local study area and included the following watersheds: Big Creek, Selwyn River, Hayes Creek, Crossing Creek, Murray Creek, Isaac Creek, Mascot Creek, Dip Creek, the Nordenskiöld River and Yukon Tributaries.

The type of fish species present and their general distribution within the study area is already well known. Within the watersheds crossed by the Casino Roads, Chinook salmon, chum salmon, Arctic grayling, slimy sculpin, and round whitefish are known to be present. The study area contains very few lakes and therefore, overwintering habitat is primarily constrained to large groundwater fed rivers or small, deep pools. Many of these watercourses also provide critical spawning, rearing or overwintering habitat for known fish species. In addition, many of these watersheds have been previously disturbed by placer mining, quartz mining, and road crossings, and as a result may contain artificial barriers to fish movement. Therefore, the priority for design and permitting of the Casino Project is to confirm actual and current fish use of affected watercourses as well as the quality of the habitat at each crossing location.

The presence or absence of fish within each watercourse crossed by the Casino Roads was confirmed using: (1) a desktop GIS based assessment of stream gradients and barriers; (2) field investigations at all crossings to confirm channel gradient, location of barriers, flow regime, and site conditions; and (3) fish sampling at select watercourses where fish absence could not be confirmed based on habitat conditions alone.

Studies showed that the Freegold Road Upgrade had 22 fish bearing streams, the Freegold Road Extension had 56 fish bearing streams, and the Airstrip Access Road had six fish bearing streams. Fish sampling efforts were primarily targeted towards major watercourse crossings and smaller channels

where the fish-bearing status could not be confirmed based on the desktop assessment and field investigations.

Rearing habitat was the most common habitat type identified in the Project area, with most low gradient (<5%), higher order watercourses having rankings from moderate to good. Poor rearing habitat quality was documented in many small tributaries with some watercourses only containing seasonal or connecting habitat.

Due to the lack of deep pools and the frequent occurrence of intermittent or ephemeral streams in the study area, the potential for overwintering habitat was generally sparse. This limits productivity in many small watercourses and suggests that many creeks in the study area may not provide critical habitat required for sustaining fish populations. Areas of exception included Big Creek, Hayes Creek, Selwyn River, Dip Creek and Nordenskiöld River. Smaller tributaries such as Bow Creek, Seymour Creek (downstream of the confluence with Bow Creek), Murray Creek, Apex Creek, Brynolson Creek, were also identified as having the potential to provide good overwintering habitat.



Acronyms and Abbreviations

AE	Associated Engineering Ltd.
B	Boulder
C	Cobble
CMC	Casino Mining Corporation
CPUE	Catch-per-unit-effort
DFO	Fisheries and Oceans Canada
DO	Dissolved Oxygen
DP	Deep Pools
F	Fines
G	Gravel
GPS	Global Positioning System
HC	Habitat Card
LSA	Local Study Area
LWD	Large Woody Debris
µS	micro-Siemens
OV	Overhanging Vegetation
PECG	Palmer Environmental Consulting Group
QA/QC	Quality Assurance/Quality Control
RSA	Regional Study Area
S	Sand
% Sat	Saturation (DO) measured in percent
SWD	Small Woody Debris
Summit	Summit Environmental Consultants Inc.
U	Cutbank or Undercut banks
YESAB	Yukon Environmental and Socio-Economic Assessment Board
YT	Yukon Territory
YTG	Yukon Government

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1 Introduction

1.1 Background

The Casino Project is owned by the Casino Mining Corporation (CMC). It is a proposed porphyry copper-gold-molybdenum mine located in west-central Yukon, at 611300E 695800N, approximately 300 km northwest of the territorial capital of Whitehorse (Figure 1). This report presents the results of a multi-year fish and aquatic resources baseline program that has been undertaken for the Freegold Road Extension, Freegold Road Upgrade, and Airstrip and Airstrip Access Road (the “Casino Roads”) to characterize the pre-development aquatic environment of the Project area in support of the project proposal to the Yukon Environmental and Socio-economic Assessment Board (YESAB). The primary focus of the fish and aquatic resource baseline investigation is to characterize each of the planned river and stream crossing locations to provide the environmental information necessary for design and permitting of each crossing structure in accordance with the required Fisheries Act authorisations and/or direction received from the Department of Fisheries and Oceans (DFO).

This report presents the results from the following baseline fish and aquatic resource studies conducted for the Casino Roads:

- Freegold Extension: Environmental Baseline Studies 2010 – Summit Environmental Consultants Inc. (Summit, 2011);
- Freegold Extension – Baseline Environmental Studies 2011 – Summit Environmental Consultants Inc. (Summit, 2012a);
- Casino Mine Airstrip and Access Road Route Baseline Assessment: 2011 – Summit Environmental Consultants Inc. (Summit, 2012b); and
- 2013 Fish and Aquatic Resources Baseline Study – Palmer Environmental Consulting Group Inc. (results presented herein).

Additional information on fish and aquatic resources along the tributaries crossed by the Airstrip Access Road collected between 2008 and 2013 are contained in the Fish and Aquatic Resources Baseline Reports for the Casino Mine (PECG, 2011a, 2011b, 2012, 2013a, 2013b).

1.1.1 Freegold Road Extension and Upgrade

Access to the proposed Casino Mine is currently limited to fixed-wing aircraft, helicopter, and Yukon River barge, with some limited winter access for heavy equipment available along the old Casino Trail. To provide year-round access for heavy equipment, fuel and haulage trucks, CMC plans to construct a new all-weather resource road that connects the Casino mine site with the western edge of the existing Freegold Road, located approximately 85 km northwest of the village of Carmacks (Figure 1). This new road is referred to as the Freegold Road Extension, and is planned to be a 120 km long, two-lane (8.2 m wide), gravel resource road (AE, 2013). The existing Freegold Road will also be upgraded to a two-lane (8.2 m wide), gravel resource road that can accommodate the anticipated traffic from the Casino mine.

This road section is referred to as the Freegold Road Upgrade. These roads (both the extension and upgrade) will be designed to meet the BC Ministry of Forests and Range Forest Road Engineering Guidebook (2nd Edition, 2002) guidelines for a 70 km/h design speed with some 50 km/h sections where road geometry is limited by the terrain.

To facilitate initial construction of the mine and the Freegold Road Extension, CMC plans to construct a single lane “tote road” to provide a continuous route from the village of Carmacks to the Casino mine site (AE, 2013). The tote road will allow slow moving construction vehicles, fuel trucks and heavy equipment suitable for rough roads to access the site during the early stages of construction.

Construction of the Freegold Road Extension will require numerous permanent stream and river crossings. Eighteen (18) major bridge crossings and 71 culvert crossings have been identified along the Freegold Road Extension section (AE, 2013). Major streams and rivers will be crossed with single-span bridge structures, while smaller streams and tributaries will be crossed with either 1500 mm or 24000 mm diameter corrugated steel pipe (CSP) culverts. In some cases, it may be necessary to build temporary bridge or culvert structures until the permanent infrastructure can be constructed.

Existing bridge and culvert crossings along the Freegold Road Upgrade section will be expanded to accommodate larger construction vehicles (AE, 2013). Two (2) bridge crossing upgrades will be required, in addition to a new bridge over the Nordenskiöld River. The remaining streams will each have the existing culvert crossings upgraded.

1.1.2 Airstrip and Airstrip Access Road

The existing Casino Airstrip will be replaced with a larger facility located in the Dip Creek Valley, approximately 12 km southwest of the Casino mine site (Figure 1). The airstrip will be 1,600 m long, 30 m wide, with an 80 m grade width and a run out of 60 m at each end, and will be oriented northeast to southwest (AE, 2013). A new Airstrip Access Road will be constructed between the new Airstrip and the Casino mine site. This access road will be a 16 km single lane gravel road that meets the BC Ministry of Forests and Range Forest and Road Engineering Guide Book (2nd Edition, 2002) guidelines for a 30 km/h design road.

The Airstrip Access Road construction includes two bridges and nine major culvert crossings ranging in size from 1500 mm to 2500 mm.

1.2 Study Area

The study area extends from the Village of Carmacks to the Casino Project area and includes the Airstrip and Airstrip Access Road. The study area is separated by watershed (in some cases subwatershed) to reflect the different fish species and habitat quality present in each stream system. The study area for the fish and fish habitat assessments that were conducted at each planned crossing location consisted of a 100 m stream reach spanning both the upstream and downstream portions of the crossing (i.e., 50 m upstream and 50 m downstream of the crossing).



1.3 Study Objectives

The objective of the Fish and Aquatic Resources Baseline Program for the Freegold Road Extension, Freegold Road Upgrade, and Casino Airstrip and Airstrip Access Road was to characterize the pre-development fish and aquatic environment along the proposed alignment to understand how these features may be affected during construction and operation of the Casino Project. Aquatic assessments for linear developments, such as road crossings, are focused on fish and fish habitat characteristics at each crossing location. Thus, this report includes the fish and fish habitat assessment of all streams that will be crossed by the Freegold Road (extension and upgrade), Casino Airstrip and Airstrip Access Road.

The specific objectives of the fish and aquatic resources baseline program for the Casino Roads were as follows:

- To determine the fish bearing status and the quality of habitat at each crossing location;
- To assess the fish community composition, the relative abundance and the spatial distribution of fish at each crossing location;
- To understand the general distribution of fish and fish habitat within the watersheds crossed by the Casino Roads;
- To characterize each crossing location to provide recommendations and data to ensure proper sizing of crossing structures, and to ensure connectivity of fish habitat by crossing structures such as culverts;
- To identify potential erosion or channel alignment concerns at each crossing; and
- Determine potential impacts on fish habitat, using the Habitat Evaluation Procedures (HEP) at each fish bearing crossing in support of the Fish Habitat Compensation Plan (PECG, 2013).

This report will present the results of baseline fish and aquatic resource investigations separately for each of the Freegold Road Upgrade, Freegold Road Extension, and the Airstrip and Airstrip Access Road on a watershed or subwatershed basis.

1.4 Fisheries Resources of the Study Area

1.4.1 Study Area Watersheds

The study area is located within the Yukon River Drainage Basin in the area between the Nordenskiöld River and the White River (Figure 1). This area is characterized by steep valley side watercourses that drain into low gradient, meandering rivers found in valley bottoms. The area is made up of several large and small watersheds. These watersheds include:

- **Big Creek Watershed:** The Big Creek watershed is approximately 1,815 km² in size and drains into the Yukon River downstream of Minto. There are several major tributaries to Big Creek,



including: Seymour Creek, Bow Creek, Stoddart Creek, and Dark Creek. Minor tributaries include Magman and Noname Creeks.

- **Selwyn River Watershed:** The Selwyn River watershed is approximately 1,094 km² in size and drains into the Yukon River downstream of Big Creek. The major tributaries include: Hayes Creek and Battle Creek. Owing to the size and importance of the Hayes Creek subwatershed to this study, Hayes Creek will be discussed separately from the Selwyn River.
- **Hayes Creek Subwatershed:** The Hayes Creek subwatershed is approximately 564 km² in size and is part of the Selwyn River watershed. Major tributaries to Hayes Creek include: Apex Creek, Butterfield Creek, Fourmile Creek, and Selkirk Creek.
- **Crossing Creek Watershed:** The Crossing Creek watershed is approximately 274 km² in size and drains into the Yukon River downstream of Carmacks.
- **Murray Creek Watershed:** The Murray Creek watershed is a relatively small tributary to the Yukon River, measuring 94 km² in size. This watercourse drains into the Yukon River immediately downstream of Carmacks.
- **Isaac Creek Watershed:** The Isaac Creek watershed is approximately 112 km² in size and has two small named tributaries: Idaho Creek and Sunshine Creek.
- **Mascot Creek Watershed:** The Mascot Creek watershed is approximately 32 km² in size and drains into the Yukon River.
- **Dip Creek Watershed:** The Dip Creek watershed is approximately 545 km² in size and drains into the Klotassin River south of the Project Area. Major tributaries to Dip Creek include: Casino Creek, Victor Creek, and Rude Creek.
- **Nordenskiold River:** The Freegold Upgrade section crosses the Nordenskiold River south of Carmacks.
- **Yukon Tributary:** The Casino Roads cross a number of small tributaries, including Mascot Creek, which drain directly into the Yukon River.

The study area contains very few lakes and therefore, overwintering habitat for fish is primarily constrained to groundwater fed rivers and streams with suitably oxygenated, deep pools. Many of these watercourses also provide critical spawning or rearing habitat for Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*Oncorhynchus keta*), Arctic grayling (*Thymallus arcticus*), slimy sculpin (*Cottus cognatus*), and round whitefish (*Prosopium cylindraceum*), which are all found in the study area. In addition, many of these watersheds have been previously disturbed by placer mining, quartz mining, and road crossings, and as a result may contain pre-existing artificial barriers to fish movement.



1.4.2 Fisheries Resources

Fish species documented within the Yukon River Basin near the study area, include: Chinook and chum salmon, longnose sucker (*Catostomus catostomus*), Arctic grayling, slimy sculpin, inconnu (*Stenodus nelma*), round whitefish, least cisco (*Coregonus sardinella*), northern pike (*Esox lucius*), Arctic Lamprey (*Lethenteron camtschaticum*), and burbot (*Lota lota*) (Walker, 1976).

Chinook salmon are of particular importance to local communities and First Nations. Chinook spawning occurs between late July and September, within the Yukon River Basin near the study area (Yukon River Panel, 2008a). The young salmon hatch as fry in the spring and migrate to small non-natal streams where productivity is high and to escape predators. Fry spend their first winter in freshwater, before migrating down the Yukon River to the Bearing Sea to complete the marine stage of their lifecycle. As a result, overwintering habitat within smaller stream systems is critical for the success of Chinook salmon.

Within the watersheds crossed by the Casino Roads, Chinook salmon, chum salmon, Arctic grayling, slimy sculpin, and round whitefish are known to be present. Arctic grayling typically spend the spring and summer in smaller tributary streams and migrate to the lower reaches of large river systems to overwinter (McPhail, 2007). Spawning occurs shortly after spring ice-out within coarse gravel and cobble beds. Populations of Arctic grayling are particularly vulnerable to changes in habitat and water conditions, which may lead to habitat fragmentation (Stewart et al., 2007). Slimy sculpin spend their entire life cycle within a single stream system (von Finster, 1998). As a result, the presence of over wintering habitat (either in groundwater fed pools or river systems) and a lack of movement barriers is key to success of this species. Barriers to fish movement are common within the study area and are generally identified by steep gradients or boulder pavements found within creek channels. Burbot and round whitefish tend to be present within large river systems or major tributaries and are not commonly found within small or headwater tributaries (von Finster, 1998).

Both Chinook and chum salmon have been documented within the study area. Chinook salmon prefer to spawn in groundwater fed gravel beds within small tributaries or larger river systems (de Graff, 2009). Chum salmon tend to spawn in slow moving side channels where groundwater inputs are present (de Graff, 2009).

The areas of known adult Chinook salmon utilization and the areas of known Chinook salmon presence at other live stages (i.e., fry and juvenile) are presented on Figure 1. The areas shown are based on numerous historical studies conducted on Chinook habitat, presence, and spawning in the area (i.e., DFO, 1985; DFO, 1994; Yukon River Panel, 2008a, EDI, 2011). Big Creek and the Selwyn River are known to be utilized by adult Chinook salmon for spawning habitat (DFO 1985, Yukon River Panel, 2008a), and the tributaries of Seymour Creek, Bow Creek, Stoddart Creek, Hayes Creek, and Dip Creek have all been shown to contain fry and juvenile Chinook (DFO, 1994, von Finster, 1998). Juvenile Chinook salmon have also been documented in the lower reaches of Britannia Creek, Isaac Creek, Mascot Creek, Crossing Creek and Murray Creek, near the confluence with the Yukon River (DFO, 1994, EDI, 2011).

2 Methods

2.1 Baseline Study Programs

The fish and aquatic resources baseline study program for the Casino Roads was carried out between 2010 and 2013 at 68 locations along the Freegold Road Upgrade, 97 locations along the Freegold Road Extension, and 12 locations along the Airstrip and Airstrip Access Road (Figures 2 – 8). Three seasonal assessments were completed during August 2010 (Summit, 2011), July 2011 (Summit, 2012a; Summit, 2012b), and June and July 2013 (PECG). The number of sites sampled and locations surveyed varied in a given year. Specific sampling variances by year are detailed in the subsequent section below.

2010 Program

Twenty-three (23) stream crossing sites were assessed between August 20 and August 21, 2010 by Summit Environmental Consultants Inc. (Summit, 2011), focusing on the major watercourse crossings along the Freegold Road Extension to:

- Determine fish bearing status at each crossing location;
- Conduct fish sampling at select locations;
- Determine fish habitat quality and availability at each crossing;
- Assess site sensitivity in the vicinity of each crossing, including features that could impact design (i.e., erosion issues); and
- Collect general stream crossing information such as: channel dimensions, gradient, floodplain boundaries.

Additional details on the 2010 fish and aquatic habitat sampling program is provided in Summit (2011).

2011 Program

Aquatic habitat assessments were conducted between July 12 and July 20, 2011 by Summit Environmental Consultants Inc. (Summit, 2012a) at 50 small to medium sized crossings along the Freegold Road Extension to supplement the data collected in 2010. Between July 18th and July 23rd, 2011, aquatic assessments were conducted by Summit (Summit, 2012b) along the alignment of the Casino Airstrip and Airstrip Access Road. A total of seven crossings were assessed and sampling was conducted at four locations. For each of the stream crossing sites where a potential connection to known fish habitat was identified, the following assessments were completed to:

- Determine fish bearing status at each crossing location;
- Conduct fish sampling at select locations;



- Determine fish habitat quality and availability at each crossing;
- Assess site sensitivity in the vicinity of each crossing, including features that could impact design (i.e., erosion issues); and
- Collect general stream crossing information such as: channel dimensions, gradient, floodplain boundaries).

Detailed aquatic habitat assessments were conducted at 18 major bridge crossing locations along the proposed Freegold Road Extension. The assessments were conducted by Summit in accordance with the methodologies and standards described in *Fish Habitat Assessment Procedures* (Johnston and Slaney, 1996) and *Reconnaissance Fish and Fish Habitat Inventory: Standards and Procedures* (RISC, 2001). The focus of this assessment was to:

- Assess fish habitat suitability and availability (HAS) using habitat suitability criteria (HSC) and quantitative ranking system;
- Identify habitat types within crossing study area;
- Identify critical and sensitive habitats and species life stages; and
- Determine baseline habitat conditions and values at each crossing area.

Additional details on the 2011 fish and aquatic habitat assessment program are provided in Summit (2012a, 2012b).

2013 Program

Fish and aquatic habitat assessments were conducted by PECO at 61 locations along the Freegold Road Upgrade section between July 1 and 3, 2013 and between August 8 and 9, 2013. Assessments were also conducted at 95 locations along the Freegold Road Extension between June 19 and 27, 2013. Fish habitat assessments for the 12 crossings for the Airstrip Access Road were assessed on June 25, 2013. Detailed aquatic habitat data and photographs of each crossing are included in Appendices E, F and G.

For each of the stream crossing sites, the following assessments were completed to:

- Confirm the number of stream crossings along the Casino Roads;
- Determine and/or confirm the fish bearing status at each crossing location;
- Conduct fish sampling at crossings with a previously identified fish barrier to confirm fish bearing status;
- Collect *In situ* water quality data at each crossing location;
- Describe the quality of fish habitat at all crossing sites and conduct a HEP study for input into the Preliminary Fish Habitat Compensation Plan Report (PECO, 2013c);

- Support engineering design and crossing structure sizing by measuring and/or confirming channel dimensions (i.e., bankfull width, wetted width and average depth); and
- Assess existing culverts for flow barriers along the Freegold Road Upgrade section.

Additional details on the 2013 fish and aquatic habitat assessment program is provided in Section 3 of this report.

2.2 Baseline Study Design

The following sections provide a description of the 2013 fish and aquatic resources baseline program undertaken by PECO to supplement and expand upon the data collected in 2010 and 2011. The priority was to efficiently collect data at every crossing location to confirm design and permitting requirements and to satisfy the requirements of YESAB and DFO. All crossings along the proposed alignment of the Casino Roads were visited by PECO staff in 2013 to confirm if there was indeed a watercourse present at the specified crossing location and to confirm the fish bearing status of the watercourse. The results of these assessments are presented in Appendix B for the Freegold Road Upgrade, Appendix C for the Freegold Road Extension and Appendix D for the Airstrip and Airstrip Access Road.

2.2.1 Mapping Nomenclature

All crossings for the proposed Freegold Road Upgrade section were mapped along with a number of old crossing locations to show re-alignment areas and to confirm the total number of crossings. Figures 2 through 8 in Appendix B present the location of all crossings visited by PECO staff in 2013 (AE, 2013).

Crossings that were assessed as part of the new alignment for the Freegold Road Upgrade were given a capital "N" after the crossing number to distinguish the new crossing while leaving the existing crossing with the original number. For example, the existing crossing is 26 and the new crossing is 26N. Unmapped crossings for the Freegold Road Upgrade were recorded and assessed with the other crossings. Since the Freegold Road Upgrade crossings are referred to on a sequential numbering system, the new crossings were given a half value based on their general proximity to other crossings. For example, the unmapped crossing discovered between crossings 6 and 7 is now called 6.5. This half value, however, does not mean that the crossing is exactly halfway between the two sites just as the sequential numbering system has no bearing on distance down the Freegold Road.

Crossings on the Freegold Road Extension, Casino Airstrip and Airstrip Access Road, were numbered based on road station distance beginning with the kilometer mark + the number (AE, 2013). Any crossings that were previously unmapped and located during the 2013 PECO field study were mapped and given a similar road station number relative the sites location along the proposed extension. This was done during mapping using the ArcGIS Software to measure the distance from the closest existing crossing and calculating a road station number for the new crossing.

2.3 Determination of Fish Bearing Status

Confirming the presence or absence of fish within each watercourse crossed by the Casino Roads was a key outcome of the fish and aquatic habitat baseline program. The type of fish species present and their general distribution within the study area is already well known. Therefore, the priority for design and permitting of the Casino Project is confirming if fish actually use the watercourse being crossed and what the quality of the habitat is at the crossing location. This assessment was completed through the following investigations:

- Desktop Geographic Information System (GIS) based assessment of stream gradients and potential barriers;
- Field investigations of all crossing locations to confirm channel gradient, location of barriers, flow regime, and site conditions; and
- Selected fish sampling at watercourses where fish absence could not be confirmed based on habitat conditions.

The priorities of the 2010 and 2011 baseline programs conducted by Summit were to assess each of the major watercourse crossings in detail for fish habitat suitability and availability (HSA) and to guide the design of bridge crossings to limit the potential effects to fish and fish habitat. The 2013 program differs in that small to medium sized tributaries were the focus of the investigations. It was assumed that all low gradient, large watercourses were fish bearing, and therefore further sampling was not required at these locations to determine permitting requirements. The methods used to determine fish bearing status are further discussed in the following sections.

2.3.1 Desktop GIS Study

Prior to initiating field investigations in 2013, PECG conducted a review of previous work completed within the study area (i.e., Summit, 2011, 2012a, 2012b) and conducted a GIS based analysis to determine the gradient of each watercourse within the study area. The results of the GIS based analysis are presented in Appendix A.

In general, most watercourses crossed by the Casino Roads have a gradient of between 0.0 and 5.0 % or between 5.0 and 10.0 %. This is a result of the road alignment(s) following major river valleys to avoid steep alpine areas that would limit the speed and functionality of the roads. Only a small number of watercourse crossing locations had gradients that exceeded 15% and these were primarily found west of the Selwyn River watershed where the Freegold Road Extension climbs in elevation to join the Casino Mine site. The streams with steep gradients typically are small, shallow and have prominent boulder or drop type barriers.

2.3.2 Assessment Framework

Based on the results of the desktop study, PECG developed a detailed framework for classifying the fish-bearing status of the streams that will be crossed by the proposed Casino Roads. A flow chart of this framework is presented in Chart 1. This framework was presented to DFO in a meeting on March 1, 2012 for questions and comments.

All crossings were assessed during the summer of 2013 by qualified PECG fisheries biologists. The location of all crossings was taken from the road alignment and attribute tables provided by Associated Engineering (AE, 2013). Each crossing was first assessed for gradient both at and below the proposed crossing site using GIS (Appendix A). Crossings were then divided into three classes based on gradient, and each class was assigned requirements for assessment. The stream classifications made prior to the fieldwork were as follows:

- **Class 1:** 0-15% gradient, assumed to be fish bearing if connected to a fish bearing stream. A complete habitat assessment was conducted but the watercourse was not sampled for fish.
- **Class 2:** 15-20% gradient, confirm maximum gradient and conduct fish sampling. Fish bearing status was confirmed based on habitat assessment and fish sampling results.
- **Class 3:** >20% gradient, assumed to be non-fish bearing, confirm gradient at and below crossing.

Habitat assessments varied according to the gradient class. Overall, assessment methods followed the standards established by the BC Ministry of Forests (BC MOF, 1998). Habitat upstream of the barrier was assessed for deep pools or other habitat with potential to support overwintering fish. The ability for the watercourse to act as a connective corridor was also assessed, as Stewart et al. (2007) showed that this could lead to habitat fragmentation, particularly for Arctic grayling. As the Casino project is situated in an un-glaciated area of the Yukon, very few lakes are present to provide overwintering habitat. The location of barriers and the gradient was documented, and fish sampling was performed upstream to assess fish presence, based on the following methodology:

Class 1 streams, if determined to be connected to a fish-bearing stream without any barriers to fish passage, will assumed to be fish bearing. Therefore, assessments only included a survey of the habitat at the site of the crossing, which will be used in any calculations for fish habitat compensation.

Class 2 streams were assessed fully on a stream-by-stream basis, in order to determine the fish bearing status. Fish were sampled using a backpack electrofisher and one additional method (i.e., Gee trap) in order to confirm the status of the creek. If the creek was determined to be fish bearing, a survey of the habitat conditions was conducted similarly to Class 1 streams.

Class 3 streams were assumed to be non-fish bearing, as the gradient indicated is too great to allow fish passage. Class 3 streams were photographed and the gradient was confirmed. Habitats at class 3 stream crossings are excluded from the HEP analysis and therefore, only a cursory assessment was made in the field.



If after the field assessment there was still uncertainty about the fish bearing status, the watercourse was conservatively assumed to be fish bearing. It is recognized that some non-fish bearing crossings may be seasonally fish bearing (i.e., during spring freshet), but the lack of a continuous flow and subsequent lack of groundwater discharge prevent these watercourses from containing overwintering habitat required for sustained fish habitat. The results of the fish bearing status for all crossings of the Casino Roads are presented in Tables 1, 3, and 5, and on Figures 2 to 8 which are separated by watershed.

2.4 Fish Habitat and Sampling

2.4.1 Field Habitat Assessment

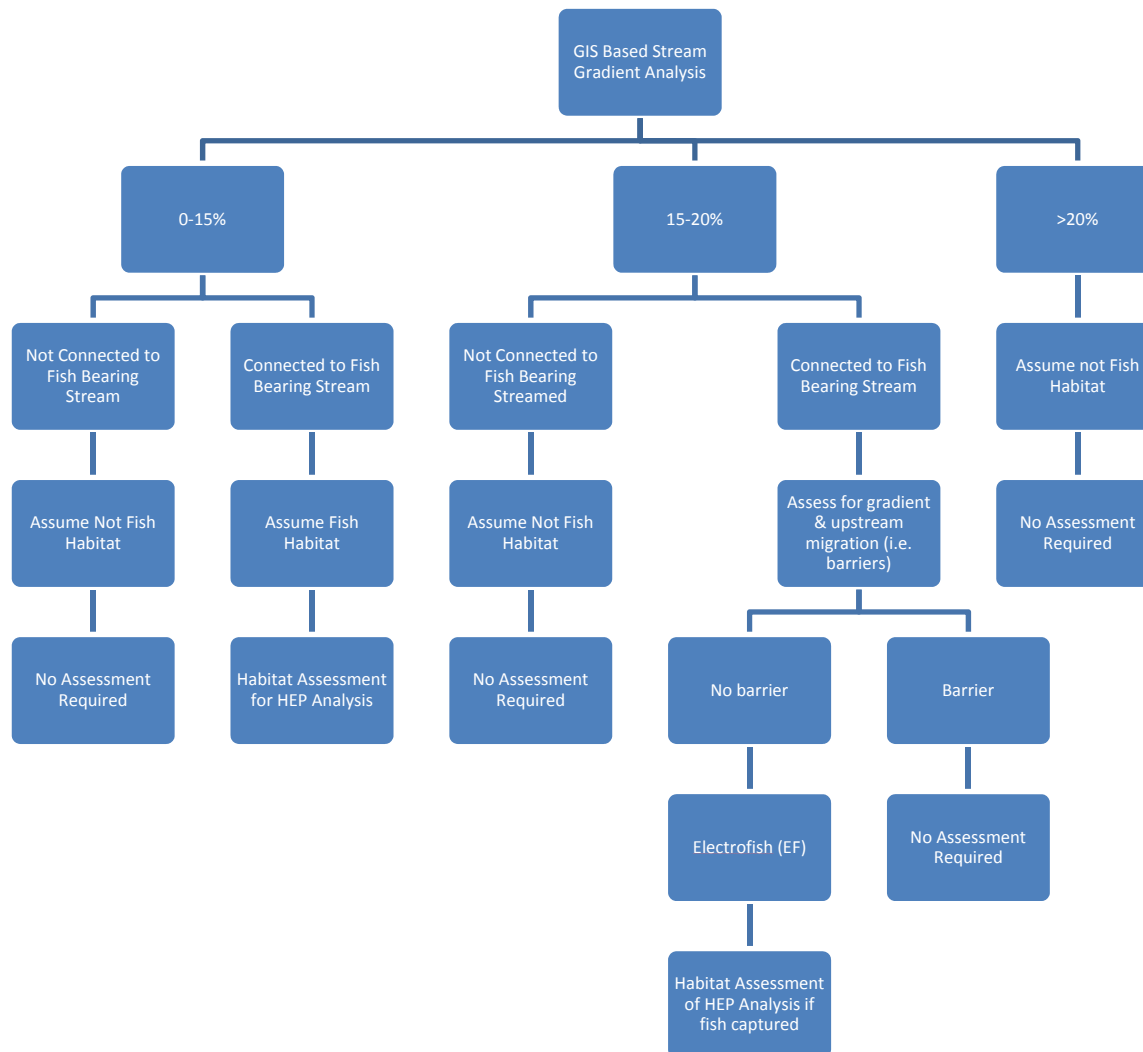
Fish habitat assessments were completed by qualified biologists for each crossing, at which several measurements and observations were made. The results of these assessments are presented in Appendix B, C, and D.

Bankfull, wetted widths and depths were taken using a meter stick and when greater than 2 meters, a measuring tape was used. When greater than 15 m, or at flows that made wading unsafe, a Bushnell laser rangefinder was used to measure widths. Gradient was determined using a Sunnto field clinometer. Signs of flooding or erosion were noted when possible and dominant riparian vegetation at each site was recorded. Observations on channel substrates and fish habitat attributes such as cover were made based on certain classifications described below. At each habitat site, stream length and stream width (i.e., wetted and bankfull width) were measured with surveyor's measuring tape. From the gathered data for all crossings values for gradient, bankfull width, bankfull depth, wetted width, wetted depth and cover percentage were averaged for the downstream, crossing and upstream locations of each site.

Habitat was visually assessed into the following five types (Johnson and Slaney, 1996):

- Pools have zero gradient, slow-moving water and a concave bottom;
- Runs (also called glides) are sections of non-turbulent, fast-flowing water;
- Riffles are areas of turbulent, fast-flowing water with gravel or cobble substrates and with obvious surface turbulence;
- Cascades are steep, stepped "riffles" of bedrock or emergent cobble or boulders in channels with gradients greater than about 4%; and
- Other includes wetland complexes that lack an identifiable primary channel, sloughs, lakes, areas of sub-surface flow or areas where the channel cannot be observed (e.g., under large log jams).

Chart 1 - Fish Presence/ Absence Assessment Framework: Stream Gradient and Stream Order Crossing Classification



Stream substrate was assessed visually into the following classes (Johnson and Slaney, 1996):

- Fines (or silt);
- Sand (<2mm particle diameter);
- Gravel (2-54 mm);
- Cobble (64-256 mm);
- Boulder (>256 mm) or
- Bedrock.

The percent of the stream surface that provided fish with cover was described using the following classes (Johnson and Slaney, 1996):

- Deep pool (>1m depth);
- Small woody debris (SWD);
- Large woody debris (LWD);
- Boulder;
- Cutbank;
- Instream vegetation; and
- Overhanging vegetation.

In situ water quality was taken using field instruments: YSI model 556 or HI 9828 Hanna Meter. Temperature, pH, conductivity, and dissolved oxygen in both percent saturated and in mg/L form were recorded.

2.4.1.1 Photographs

Photographs were taken at each site showing upstream of the crossing, across the crossing and downstream of the crossing. If a barrier or notable feature was identified, additional photos were taken and recorded. Photographs at each crossing location are presented in Appendix B, C, and D.

2.4.1.2 Fish Sampling Efforts

Crossing locations were selected for sampling based on the methodology described in Section 2.3.

Fish sampling was conducted using a LR-20B Smith-Root backpack electrofisher unit and a two person crew. Single pass and spot fishing methods were used moving in an upstream direction and sweeping the anode repeatedly from one bank to the other. Each site was fished for approximately 200 m, while effort ranged from 223 to 643 seconds (s) with an average of 499 s per site. Any fish captured was caught using a dip net and placed in a bucket with fresh water during processing.

Conical minnow traps made of galvanized steel of 42 cm length, 23 cm width and mesh size 0.6 cm were also used at selected crossing locations. Traps were baited with salmon roe in a perforated bag, tied to



the trap. They were placed in deep pools, among large woody debris or in slow moving eddies and anchored to debris or rocks and tied off nearby. Red or yellow fluorescent tape was used with the string to mark the trap positions in addition to GPS co-ordinates. The traps were left in position for approximately 24 hours.

All fish were identified to species and counted. Fork length was measured to the nearest 1 mm with a measuring board (total length was measured for slimy sculpin), and wet weight was measured to the nearest 0.1 g or 1.0 g with a balance (depending on size of fish).

2.4.2 QA/QC

All data collected in the field were collected by or under the supervision of qualified biologists.

All field data were recorded on water resistant paper using a spreadsheet template and later transcribed into excel spreadsheets of the same format as seen in Appendices E, F, and G. The spreadsheets were compared with the field notes to ensure accurate transcription. All spreadsheets and scanned field sheets are in order by site and sorted by Map number based on the Freegold Road Extension Map Series or the Stream Gradients for the Freegold Road Upgrade map series respectively. Any extra field notes were collected on waterproof notebook paper and recorded into the comments for the appropriate site spreadsheet.

All photos taken were recorded in the field based on photo number. The photos were then matched to the corresponding excel spreadsheets by number. Any discrepancy in photo number matching was remedied by using dates and photo ordering to match photos to crossing locations. Photo numbers were again compared between spreadsheets and field sheets for accuracy.

2.5 In Situ Water Quality

A suite of water quality variables were measured at each crossing location with field instruments (e.g., YSI model 556 or HI 9828 Hanna Meter) including pH, conductivity, total dissolved solids (TDS), and dissolved oxygen concentration. The collection of *in situ* water quality data at crossing locations were one-time events completed during the 2013 field investigations.

In situ water quality data were collected at all applicable crossing locations and is presented for each component of the Casino Roads on a watershed basis in Tables 2, 4, 5, 6, 7 and 10.

2.5.1 Data Analysis

In situ pH and dissolved oxygen data were compared to the guidelines for the protection of freshwater aquatic life (CCME 2007). There are presently no territorial, federal or provincial guidelines for the protection of aquatic life for conductivity or total dissolved solids.

3 Results and Discussion

The results of the fish and aquatic resource baseline assessment for the Casino Road are presented by road section and by watershed. Results on the physical habitat conditions, fish bearing status and water quality will be discussed for each site assessed during the baseline studies conducted in 2010, 2011 and 2013.

3.1 Freegold Road Upgrade

The majority of the data collected for the Freegold Road Upgrade section were collected by PECO in 2013. Data for the Upgrade section are presented on Tables 1 and 2. Figures 2, 3 and 4 present the fish bearing status at each watercourse crossing. Fish survey maps, data and photographs are presented in Appendix B.

3.1.1 Nordenskiöld River

Three sites were assessed in the Nordenskiöld River watershed (Table 1). Sites 1 and 1N represent the old and the new proposed crossing of the Nordenskiöld River for the Freegold Road Upgrade (Figure 2). Site 2 was visited and confirmed as not a watercourse crossing.

Overview of Physical Habitat

The proposed Nordenskiöld River crossing (Site 1N) had a wetted width of 53 m, an average depth of 1 m and a cobble dominated substrate (Table 2). In stream cover was low (<20%) and the channel gradient was low (2%) typical of large watercourses within the study area.

Fish Bearing Status

No fish sampling was conducted at any site in the Nordenskiöld River watershed as part of this study; however, both sites 1 and 1N are considered fish bearing (Figure 2). It is known that the Nordenskiöld River hosts eleven species of fish (Chinook salmon, chum salmon, lake trout (*Salvelinus namaycush*), Arctic grayling, round whitefish, lake whitefish (*Coregonus clupeaformis*), longnose sucker, burbot, northern pike, Arctic lamprey and slimy sculpin), all of which are common to the Yukon River Basin (Nordenskiöld Steering Committee, 2010). Both Chinook salmon and chum salmon utilize the river for spawning and rearing habitat and the river provides suitable conditions for overwintering habitat. No barriers to fish movement were identified as part of this study, however frequent log jams within the Nordenskiöld River may restrict salmon movement (Nordenskiöld Steering Committee, 2010).

Water Quality

In situ water quality data were collected at sites 1 and 1N (Table 2). The mean temperature as measured on August 9, 2013, for both sites was 15.9°C, which is warm for the Yukon River Basin but not uncommon in large watercourses. The pH, conductivity, and DO for the two crossings averaged, 7.2, 175 µS/cm, and 8.6 mg/L, respectively.

3.1.2 Yukon Tributary Watershed

Three sites were assessed in the Yukon Tributary Watershed along the Freegold Road Upgrade Section (Table 1). Sites 3 and 6 were assessed and determined not to be watercourse crossings (Table 1 and Figure 2). Site 5 is a small culvert crossing and was dry during the 2013 field investigation. This crossing is not considered to be fish bearing (Figure 2).

3.1.3 Murray Creek Watershed

One site (site 4) was assessed in the Murray Creek watershed (Table 1).

Overview of Physical Habitat

Site 4 had a wetted width of 4.95 m, a depth of 0.16 m and a gradient of 1% (Table 2). The site had a cobble gravel substrate and small amounts of overhanging vegetation. The culvert at this location is partly collapsed, but does not appear to present a barrier to fish movement (Photo 189 – Appendix B).

Fish Bearing Status

Fish sampling was not conducted at the Murray Creek crossing (site 4) as part of this investigation, however based on the study design criteria and the proximity of the crossing to the Yukon River, site 4 is considered to be fish bearing (Figure 2). Additionally, Beak Consulting Ltd (Beak, 1979) reported that Chinook fry, Arctic grayling, round whitefish, and slimy sculpin were captured near the Freegold Road crossing. The low gradient, lack of identified barriers and the cobble gravel substrate is thought to provide moderate to good rearing habitat.

Water Quality

In situ water quality data were collected at site 4 (Table 2). The mean temperature as measured on August 9, 2013, was 8.3°C. The pH, conductivity, and DO for the crossing was, 8.5, 189 µS/cm, and 10.3 mg/L, respectively.



3.1.4 Crossing Creek Watershed

A total of 34 sites were assessed in the Crossing Creek watershed (Table 1). Site 7 is the main crossing location of Crossing Creek and presently exists as a bridge structure (Figure 2). The existing Freegold Road runs primarily along the north side of Crossing Creek. Sites 8 – 22, 23-25, and 29 were visited and confirmed as non-watercourse crossings, however in some cases they were located immediately north of and adjacent to Crossing Creek. The remaining sites were assessed for fish and aquatic habitat as part of this study (Figures 2 and 3).

Overview of Physical Habitat

Site 7 (main branch of Crossing Creek), had a wetted width of 6.7 m, an average depth of 0.24 m and a gravel/ cobble substrate (Table 2). At this crossing location, Crossing Creek had a riffle-run morphology and a low gradient of 4%.

Each of the remaining sites in the Crossing Creek watershed (sites 6.5, 22.5, 25.5 – 28, 29N – 31.5) are small tributaries to Crossing Creek. Sites 6.5, 22.5, 25.5, and 26.5 were all dry at the time of the assessment and many had perched or collapsed culverts. Wetted widths for the Crossing Creek tributaries ranged from 0.39 m to 2.12, with a mean width of 0.8 m (Table 2). Wetted depth ranged from 0.07 m to 0.29 m, with a mean wetted depth of 0.14 m. Most sites consisted of a riffle-run morphology with a dominant gravel/fines substrate, although stream depths were often very shallow. Perched and partly collapsed culverts were common. Most sites had moderate to good cover (37 – 90%).

Fish Bearing Status

Beak (1979) reported that juvenile Chinook salmon were found in the lower reaches of Crossing Creek, but were not identified as far up as the Freegold Road (i.e., site 7). Sampling conducted as part of the Beak (1979) study only captured Arctic grayling within Crossing Creek.

No fish sampling was conducted at any sites in the Crossing Creek watershed as part of this study. Based on the fish bearing criteria employed as part of this study, it was concluded that sites 7, 26, 26N, 27, 28, and 30 – 31.5 were fish bearing (Figures 2 and 3). Each of these sites have a permanent flow regime, a low gradient, no identified barrier and are connected to the main branch of Crossing Creek which is known to be fish bearing. The remaining sites were determined to be non-fish bearing due to a lack of stream flow and/ or the presence of an identified barrier to movement. It is recognized that some of these crossings may be seasonally fish bearing, however the lack of continuous flow or continuous groundwater discharge suggest these watercourses may not provide critical habitat required for sustaining year-round fish populations.

Water Quality

In situ water quality data were collected at sites 7 and 26 – 31.5, excluding site 29 (Table 2). The water temperature at site 7 was 12.0°C, and the pH, conductivity, and DO, were 8.5, 211 µS/cm, and 8.5 mg/L, respectively. The mean water temperature for sites 26 – 31.5 was 6.5°C, with sites 31 and 31.5 having water temperatures below 5°C. The average pH, conductivity, and DO for the sites was 7.9, 177 µS/cm, and 7.3 mg/L, respectively.

3.1.5 Big Creek Watershed

A total of 27 sites were assessed in the Big Creek watershed for the area of the Freegold Road Upgrade (Table 1). Additional sites within this watershed were assessed as part of the Freegold Road Extension section (Section 3.2.1). Sites 32 – 40N and 42 – 45 are within the Seymour Creek subwatershed, site 41 crosses the Bow River, and sites 46 – 52 cross tributaries to the main branch of Big Creek (Figure 4).

Overview of Physical Habitat

Within the Seymour Creek subwatershed, sites 32, 34-36, 38, 43 and 45 were visited and confirmed as non-watercourse crossings. The remaining sites (33, 33N, 37, 39, 39.5, 42 and 44) are tributaries to the main branch of Seymour Creek. At the time of assessment, only sites 39 and 39.5 were flowing and assessed for stream channel characteristics. The average wetted width and depth for these sites were measured to be 1.14 m wide and 0.15 m deep, and both had a gravel/fine substrate. Groundwater seepage was noted near this site and was contributing to flow.

Sites 40 and 40N are the main crossings of Seymour Creek (Figure 4). A third crossing was identified (40NN) as a small side channel that will need to be crossed as part of road construction. Seymour Creek at this location is braided and demonstrates a primarily riffle-run morphology. Site 40 has a wetted width of 10.05 m and a depth of 0.21 m (Table 2). Site 40N has a wetted width of 10.33 m and a depth of 0.31 m. Both sites currently exist as single span bridges, with the bridge at Site 40N needing to clear a 44 m wide bank full width.

Site 41 is the crossing of Bow Creek near its confluence with Seymour Creek (Figure 4). This crossing had a wetted width of 6.8 m and a wetted depth of 0.34 m (Table 2). This site has a riffle-run morphology, low cover (10%) and cobble/ gravel substrate.

Sites 46 – 52 are small tributaries to Big Creek (Figure 4). Sites 47 and 52 were dry at the time of this investigation and had perched culverts. Wetted widths of the Big Creek tributaries ranged from 0.2 m to 1.17 m, with a mean of 0.64 m. Wetted depth ranged from 0.02 m to 0.47 m, with an average of 0.14 m. Tributary channel had either a gravel/fine or a fine/gravel substrate and generally had good cover (>37%).

Fish Bearing Status

Arctic grayling, slimy sculpin, and Chinook salmon have been documented within the Seymour Creek subwatershed (DFO, 1985 and Brown, 2003). Chinook fry have been known to use Seymour Creek as non-natal rearing habitat and have been documented 7.8 km upstream of Big Creek to the confluence with Bow Creek (DFO, 1985) (Figure 4). Upstream of Bow Creek, the gradient of Seymour Creek increases which lowers its suitability for high quality fish habitat (DFO, 1985).

Big Creek has been shown to contain Arctic grayling, slimy sculpin, round whitefish, chum salmon, and Chinook salmon (DFO, 1984 and Brown, 2003). Juvenile Chinook salmon have been captured 58.8 km upstream of the Yukon River confluence (Mathers *et al.*, 1981 and DFO, 1985). Adult Chinook salmon have been documented 47.7 km upstream of the Yukon River confluence and adult chum salmon have been captured 13.7 km upstream of the Yukon River confluence (DFO, 1985). Brown (2003) notes that the mid-reaches of Big Creek have sufficient groundwater discharge to provide year-round habitat, including overwintering habitat.

Arctic grayling utilize the mid to upper reaches of Big Creek as spawning habitat (Brown, 2003). Round whitefish are expected to use Big Creek for summer feeding habitat, but are not expected to use this watercourse for other life stages. Slimy sculpin use Big Creek and its major tributaries for all life stages.

No fish sampling was conducted at any site in the Big Creek watershed crossed by the Freegold Road Upgrade section. Based on the fish bearing criteria employed for this study, it was concluded that sites 33, 33N, 40 and 40N within the Seymour Creek subwatershed, site 41 within the Bow Creek subwatershed, and site 46, 47.5, 49 and 50 within the Big Creek watershed, were fish bearing (Figure 4). Each of these sites have a permanent flow regime, a low gradient, no identified barrier and are connected to the main branch of Seymour Creek or Big Creek, which are known to be fish bearing. The remaining sites were determined to be non-fish bearing due to a lack stream flow at the site or an identified barrier.

A habitat suitability and availability assessment (HSA) was conducted at site 41 (Bow Creek crossing) and identified high habitat suitability for adult grayling and moderate habitat suitability for fry and parr Arctic grayling and Chinook (Summit, 2012a). DFO (1985) captured juvenile Chinook salmon from the mouth of Bow Creek to approximately one kilometer upstream (Figure 4). This area contains high quality non-natal rearing habitat for Chinook. During the 2013 field investigations, four Arctic grayling were observed under the existing Bow Creek bridge.

Water Quality

In situ water quality data were collected at sites 33, 33N, 40, 40N, and 40NN within the Seymour Creek subwatershed (Table 2). The mean water temperature for sites within the Seymour Creek subwatershed was 5.3°C, with sites 33 and 33N having water temperatures below 5°C. These small headwater tributaries upstream of Bow Creek had water temperatures and conductivities characteristic of melting



permafrost. The average pH, conductivity, and DO for the sites was 8.1, 129 $\mu\text{S}/\text{cm}$, and 9.6 mg/L, respectively.

At the Bow Creek crossing (site 41), the water temperature was 7.2°C, and the pH, conductivity, and DO, were 8.0, 107 $\mu\text{S}/\text{cm}$, and 9.6 mg/L, respectively (Table 2).

In situ water quality data were collected at sites 47.5, 49, and 50 within the Big Creek watershed (Table 2). Sites 47.5 and 49 had high water temperatures averaging 18.8°C, which is an indication that these watercourses are not groundwater fed and may be stagnant. In addition, the pH, conductivity, and DO for sites 47.5 and 49, were higher than all other sites in the subwatershed and averaged, 8.4, 848 $\mu\text{S}/\text{cm}$ and 8.9 mg/L, respectively. The water quality at site 50 was consistent with the trends observed at other small tributaries within the Big Creek watershed.

3.2 Freegold Road Extension

Fish and aquatic resources along the Freegold Road Extension were studied between 2010 and 2013. Data for the Extension section are presented on Tables 3 – 7, with electrofishing results from 2013 efforts presented on Table 8. Figures 5, 6, and 7 present the fish bearing status at each watercourse crossing. Fish survey maps, data, and photographs are presented in Appendix C.

The naming convention for the Freegold Road Extension section differs from the numerical system used for the Upgrade section. Engineering Station or Chainage in kilometres+metres (i.e., 23+320) was used to identify watercourse crossings within the Extension section to be consistent with engineering design (AE, 2013). It is important to note that the engineering station number changed slightly between the 2010, 2011 and 2013 assessments due to changes in proposed road design. The 2010 and 2011 station numbers were modified where appropriate to match the 2013 station numbers for the purposes of this report.

3.2.1 Big Creek Watershed

A total of 29 sites between stations 13+150 and 41+340 were assessed in the Big Creek watershed for the Freegold Road Extension (Table 3, Figure 5). Sites within the Big Creek watershed covered by the Freegold Road Upgrade were previously discussed in Section 3.1.5. The Freegold Road Extension is situated within the middle to upper reaches of Big Creek and its tributaries.

Overview of Physical Habitat

The Freegold Road Extension crosses the main branch of Big Creek at three separate locations at stations 13+150, 18+370 and 26+820 (Figure 5). Each of these crossings exhibited a dominantly riffle-run morphology, with some deep pool/glide habitat (Appendix C). Each crossing was a cobble/ gravel or gravel/ cobble substrate and cobble and/or cobble/ sand bars were present at each location. The wetted widths of the Big Creek main branch crossings ranged from 18.67 m to 20.33 m with an average width of 19.33 m (Table 4). The average wetted depth ranged from 0.53 m upstream to 1.80 m downstream. Cover was low to moderate and consisted of overhanging vegetation and deep pools. Big Creek has been previously documented as salmon spawning habitat (Brown, 2003) and the results of this assessment continue to support this conclusion.

The remaining 26 crossing stations within the Big Creek watershed cross small tributaries on both the north and south sides of Big Creek (Figure 5). The majority of these tributaries were flowing at the time of investigation and many showed evidence of bank erosion, sedimentation, and slumping (Appendix C). Although stream cover was generally good at most crossings, pool habitat (and therefore overwintering habitat) was noticeably lacking at all crossings.

Wetted widths of the Big Creek tributaries ranged from 0.5 m to 9.0 m, with a mean of 1.92 m (Table 4). Average wetted depth ranged from 0.06 m to 0.97 m, with an average of 0.26 m. Tributary channels had wide range of substrate types, but generally consisted of fines and cobble/gravels.

Fish Bearing Status

Big Creek has been shown to contain Arctic grayling, slimy sculpin, round whitefish, chum salmon and Chinook salmon (DFO, 1984 and Brown, 2003). Juvenile Chinook salmon have been captured 58.8 km upstream of the Yukon River confluence (Figures 1 and 5) (Mathers *et al.*, 1981 and DFO, 1985). Adult Chinook salmon have been documented 47.7 km upstream of the Yukon River confluence and adult chum salmon have been captured 13.7 km upstream of the Yukon River confluence (DFO, 1985). Brown (2003) notes that the mid-reaches of Big Creek have sufficient groundwater discharge to provide year-round habitat, including overwintering habitat.

Arctic grayling use the mid to upper reaches of Big Creek as spawning habitat (Brown, 2003). Round whitefish are expected to use Big Creek for summer feeding habitat, but are not expected to occupy this watercourse for other life stages. Slimy sculpin are present in Big Creek and its major tributaries for all life stages.

Fish sampling was conducted in 2010 and 2011 at eight (8) locations within the Big Creek watershed (Table 3). At each location, single pass electrofishing and habitat assessment methods were employed based on the British Columbia Resource Inventory Standards Committee (RISC, 2001) 1:20,000 Fish and Fish Habitat Inventory, complete with site cards. No fish were captured at seven of the eight sites, and only Arctic grayling were captured at station 26+820. Of the eight sites samples, all except site 20+390 were determined to be fish bearing even though no fish were captured at the majority of locations (Figure 5).

Fish sampling was not conducted at any of the remaining crossing stations within the Big Creek watershed (Table 3). Based on the fish bearing criteria employed for this study, it was concluded that sites 13+150, 13+470, 18+370, 18+900, 21+580, 25+700, 28+210, 28+730, 29+240, 30+880, 40+630, and 41+340 were fish bearing (Figure 5). Each of these sites have a permanent flow regime, a low gradient, no identified barrier and are connected to the main branch of Big Creek, which is known to be fish bearing. The remaining stations listed in Table 3 were determined to be non-fish bearing due to a lack of stream flow, a steep (>20%) gradient or an identified barrier.

A detailed HSA was conducted at stations 13+150 (Big Creek), 13+470 (Big Creek tributary), 18+370 (Big Creek), 23+320 (Big Creek tributary), and 26+820 (Big Creek). This assessment identified high to moderate suitability for fry, parr, and adult grayling, and fry and parr Chinook, with only site 18+370 having high suitability for Chinook spawning and wintering habitat. The results of this assessment are discussed in detail in Summit (2012a).

Water Quality



In situ water quality data for the main branch of Big Creek was collected at stations 13+150, 18+370 and 26+820 (Table 4). The mean water temperature for these sites was 8.7°C, with site 26+820 having a much lower water temperature than the other two sites. The average pH, conductivity, and DO for the stations was 7.3, 145 µS/cm, and 12.4 mg/L, respectively.

In situ water quality data were collected at the majority of the remaining sites in the Big Creek watershed (Table 4). Differences in water temperature and chemistry were apparent between small 1st order tributaries and larger 2nd or 3rd order tributaries, particularly in terms of temperature. Water temperatures ranged from 2.8°C to 13.3°C, with a mean of 6.3°C. This wide variation between the min and max temperatures is related to small 1st order streams being fed by melting permafrost and the need to cross small, stagnate pools or valley bottom oxbow ponds. The average pH, conductivity, and DO for the stations was 6.8, 149 µS/cm, and 11.4 mg/L, respectively.

3.2.2 Hayes Creek Subwatershed

Although Hayes Creek is part of the Selwyn River watershed, owing to its size and the large number of crossings for the Freegold Road Extension section, the fish and aquatic resources results for this subwatershed will be discussed separately from the Selwyn River.

A total of 54 sites between stations 43+110 and 83+550 were assessed in the Hayes Creek subwatershed for the Freegold Road Extension (Table 3, Figures 6 and 7). The main branch of Hayes Creek is crossed seven times at stations 51+170, 64+700, 67+570, 68+450, 69+340, 78+980, and 79+380. Other major tributary crossings include: Apex Creek at 56+790, Fourmile Creek at 61+830, and Butterfield Creek at 63+870.

Overview of Physical Habitat

Each of the seven crossings of the main branch of Hayes Creek (stations 51+170, 64+700, 67+570, 68+450, 69+340, 78+980, and 79+380) exhibited a riffle-glide morphology, with dominant cobble/ gravel substrate and a limited amount of pool habitat (Appendix C). The wetted width of the Hayes Creek main branch ranged from 5.80 m to 20.67 m, and averaged 15.69 m (Table 5). The average wetted depth ranged from 0.31 m upstream to 0.77 m downstream. Cover was low to moderate and consisted of overhanging vegetation and large woody debris.

The Apex Creek crossing at station 56+790 was a long riffle section with a cobble/ gravel substrate (Appendix C). The wetted width of Apex Creek is 13.33 m and the average wetted depth is 0.40 m (Table 5). Cover was moderate and consisted of primarily large woody debris.

The Fourmile Creek crossing at station 61+830 consists of a complex riffle-run morphology with an identified pool along the outside of a small meander (Appendix C). The wetted width of Fourmile Creek was 2.6 m and the average wetted depth was 0.19 m (Table 5). Cover was moderate and consisted of overhanging vegetation.

The Butterfield Creek crossing at station 63+870 exhibits a riffle-run morphology with a cobble/ gravel substrate (Appendix C). The wetted width of Butterfield Creek was 4.23 m and the average wetted depth was 0.31 m (Table 5). Cover was moderate, and consisted of primarily large woody debris and overhanging vegetation.

The remaining 44 crossing stations within the Hayes Creek subwatershed cross small tributaries between stations 43+110 and 83+550 (Figures 6 and 7). Many of these crossings were dry at the time of investigation and had noticeable barriers to flow (i.e., water fall or discontinuous channel). Of the watercourses that were flowing, most had a cobble/ gravel or gravel/ fine substrate and a high amount of cover. The crossing at 75+410 was noted by PECG staff to be a particularly well-defined channel with good fish rearing habitat potential.

Wetted widths of the Hayes Creek tributaries ranged from 0.02 m to 5.75 m, with an average of 1.30 m (Table 4). Average wetted depth ranged from <0.01 m to 0.43 m, with an average of 0.20m.

Fish Bearing Status

Fish sampling was conducted in 2010, 2011 and/or 2013 at 20 locations within the Hayes Creek subwatershed (Table 3). At each location, single pass electrofishing, minnow trapping, and/or angling methods were used to determine fish species presence and distribution. Habitat assessment methods were employed based on the British Columbia Resource Inventory Standards Committee (RISC, 2001) 1:20,000 Fish and Fish Habitat Inventory.

Arctic grayling and/ or slimy sculpin in fry and juvenile age classes, were captured at 11 of the 20 crossing stations: 51+170, 56+790, 57+420, 62+480, 63+870, 66+170, 66+310, 67+570, 69+340, 75+410, and 79+380 (Table 3 and Figures 6 – 7). No Chinook salmon were captured despite this being a focus of the 2010 and 2011 field investigations. However, it can be assumed that given the habitat conditions within the main branch of Hayes Creek, and the known presence of Chinook spawning habitat in the Selwyn River located downstream, that the likelihood of Chinook fry and juveniles using Hayes Creek and its major tributaries is high.

Crossing 47+050 was sampled in 2013 by PECG fisheries biologists (Table 8). No fish were captured at this tributary to Hayes Creek despite conducting both electrofishing and minnow trapping. However, based on habitat conditions, this watercourse is still considered to be fish bearing. Crossing 83+550 was also sampled in 2013 by PECG, and no fish were captured (Tables 3 and 8). Based on the habitat conditions and an identified 0.94 m barrier, this watercourse is considered non-fish bearing.

Fish sampling at Apex Creek (56+790) captured both slimy sculpin and Arctic grayling (Table 3). Fish sampling at Fourmile Creek did not capture any fish. Fish sampling at Butterfield Creek captured Arctic grayling.

Fish sampling was not conducted at any of the remaining crossing stations within the Hayes Creek subwatershed (Table 3). Based on the fish bearing criteria employed for this study, it was concluded that, in addition to the sites listed above, the following sites were also fish bearing: 49+000, 58+980, 62+170, 64+700, 66+080, 67+500, 68+450, 71+100, 71+625, 71+980, 72+200, 74+770, 77+770, 78+980, 80+620, and 81+750 (Figures 6 and 7). Each of these sites have a permanent flow regime, a low gradient, no identified barrier and are connected to the main branch of Hayes Creek, which is known to be fish bearing. The remaining stations listed in Table 3 were determined to be non-fish bearing due to a lack stream flow, a steep (>20%) gradient or an identified barrier.

A detailed HAS was conducted at stations 56+790 (Apex Creek), 62+480 (Hayes Creek), 64+700 (Hayes Creek), 66+170 (Hayes Creek side channel), 66+310 (Hayes Creek side channel), 67+570 (Hayes Creek), 68+450 (Hayes Creek), 69+340 (Hayes Creek), 78+980 (Hayes Creek), and 79+380 (Hayes Creek). This assessment identified high to moderate suitability for fry, parr, and adult grayling, and fry and parr Chinook. Sites 67+570, 68+450, 78+980, and 79+380 were identified as having high Chinook spawning habitat potential. The results of this assessment are discussed in detail in Summit (2012a).

Water Quality

In situ water quality data for the main branch of Hayes Creek was collected at stations 51+170, 64+700, 67+570, 68+450, 69+340, 78+980, and 79+380 (Table 5). The mean water temperature for these sites was 7.0°C, with site 64+700 having a much higher water temperature than the other sites. The average pH, conductivity, and DO for the stations was 8.0, 116 µS/cm, and 12.3 mg/L, respectively.

Apex Creek had a water temperature of 9.0°C, with pH, conductivity, and DO values of 8.8, 88 µS/cm, and 12.7 mg/L, respectively (Table 5). Fourmile Creek had a water temperature of 8.4°C, with pH, conductivity, and DO values of 9.4, 118 µS/cm, and 12.8 mg/L, respectively. Butterfiled Creek had a water temperature of 7.8°C, with pH, conductivity, and DO values of 4.0, 164 µS/cm, and 13.1 mg/L, respectively.

In situ water quality data were collected at the majority of the remaining sites in the Hayes Creek subwatershed (Table 5). Water temperatures ranged from 1.4°C to 11.0°C, with a mean of 4.1°C. This large range in temperatures is related to small 1st order streams being fed by melting permafrost. The average pH, conductivity, and DO for the stations was 7.7, 224 µS/cm, and 11.5 mg/L, respectively.

3.2.3 Selwyn River Watershed

A total of nine sites between stations 85+160 and 94+660 were assessed in the Selwyn River watershed for the Freegold Road Extension (Table 3, Figure 7).

Overview of Physical Habitat



The main branch of the Selwyn River is crossed at station 85+160 (Figure 7). The proposed crossing location was a long glide, with a boulder/cobble substrate and a high amount of boulder cover (Table 6). The wetted width of the Selwyn River at the proposed crossing was 19.67 m, with an average depth of 0.83m.

The remaining eight crossing stations cross small, steep tributaries to the west of the Selwyn River (Figure 7). The wetted width of these tributaries ranged from 0.43 m to 1.27 m, with an average width of 0.68 m (Table 6). Average wetted depths ranged from 0.05 m to 0.19 m, with an average depth of 0.12 m. The tributaries had a wide range of substrates including cobble/ gravel, cobble/ boulder and fines. It is also important to note that most of these tributaries have gradients that exceeded 20%, and large drops were common.

Fish Bearing Status

Juvenile Chinook salmon and slimy sculpin have previously been documented within the Selwyn River near the proposed crossing location at 85+160 (DFO, 1994). Summit (2011) describes that adult Chinook salmon have also been documented approximately 12 km upstream from the Yukon River as shown on Figure 7. Although Arctic grayling have not been previously documented in the Selwyn River, a HAS conducted by Summit in 2011 at 85+160, identified moderate potential for parr and adult Arctic grayling at the proposed crossing location. The same location was shown to have a low potential for Arctic grayling or Chinook salmon spawning habitat.

Fish sampling was conducted in 2013 by PEGC at four (4) locations in the Selwyn River watershed (Table 3). At each location, electrofishing and minnow trapping methods were used to sample the fish populations (Table 8). No fish were captured at any of the watercourses sampled, however based on habitat conditions and gradients, stations 94+550 and 94+660 were still considered fish bearing. Each of the remaining crossings in the watershed were not sampled and are not considered fish bearing due to identified barriers to fish passage and/or steep stream gradients (Table 3).

Water Quality

In situ water quality data for the main branch of the Selwyn River are presented in Table 6. The water temperature was 8.0°C at the time of sampling, and the pH, conductivity, and DO, was 4.5, 97 µS/cm, and 13.3 mg/L, respectively.

The mean water temperature within the tributaries sampled was 2.5°C, with all stations having water temperatures below 5°C. The average pH, conductivity, and DO for the sites was 6.5, 23 µS/cm, and 12.1 mg/L, respectively. These results are consistent with high elevation, 1st or 2nd order streams that are fed by melting permafrost.

3.2.4 Yukon Tributary, Mascot Creek, and Isaac Creek Watersheds

Four crossing stations are located in the Yukon Tributary, Mascot Creek and Isaac Creek watersheds (Table 3, Figure 7). Station 96+190 is a crossing of a small unnamed tributary to the Yukon River, station 105+620 crosses Mascot Creek, and stations 107+920 and 109+800 cross Idaho Creek, a tributary of Isaac Creek.

Overview of Physical Habitat

Stations 96+190 and 105+620 were found have intermittent flow and had poorly defined channels (Appendix C). Both locations had only a small amount of water present at the time of investigation (Table 7). Both the Idaho Creek crossings had sinuous channel patterns and boulder/ cobble substrates. Station 107+920 had a wetted width of 0.5 m and a wetted depth of 0.1 m (Table 7). Station 109+800 had a wetted width of 2.53 m and a wetted depth of 0.24 m.

Fish Bearing Status

Juvenile Chinook salmon were previously documented near the confluence of Mascot Creek and Isaac Creek and the Yukon River (Summit, 2011). Chinook have not been documented farther upstream in these watercourses.

Fish sampling was conducted in 2013 by PECO at station 109+800 at Idaho Creek in the Isaac Creek watershed (Table 8). No fish were captured during fish sampling efforts. Based on the habitat conditions it was assumed that this watercourse was fish bearing. Each of the remaining crossings were not sampled and are not considered fish bearing due to identified barriers to fish passage and/or steep stream gradients (Table 3).

Water Quality

In situ water quality sampling was only conducted at station 109+800 (Table 6). The water temperature was 1.7 C at the time of sampling, and the pH, conductivity, and DO, was 5.5, 73 µS/cm, and 13.7 mg/L, respectively.

3.3 Airstrip and Airstrip Access Road

Fish and aquatic resources along the proposed Casino Airstrip and Airstrip Access Road were studied in 2011 and 2013. A summary of the data for this section are presented on Tables 9 and 10. Figure 8 presents the fish bearing status at each crossing location. Fish survey maps, data, and photographs are presented in Appendix D.

The naming convention for the Airstrip and Airstrip Access Road uses Engineering Station or Chainage in kilometres+metres (i.e., 10+330) beginning at 10+000 to identify crossing locations.

3.3.1 Dip Creek Watershed

A total of 12 sites between stations 10+330 and 21+310 were assessed within the Dip Creek watershed for the Casino Airstrip and Airstrip Access Road (Table 9, Figure 8). Within the Dip Creek watershed, a number of named tributaries are crossed, including: a tributary to Casino Creek at 16+580, Austin Creek at 17+620, and Brynerson Creek and its tributaries at 20+300, 20+750 and 20+960.

Overview of Physical Habitat

The main branch of Dip Creek is crossed at station 14+650 (Figure 8). This location contained a long glide-pool section with a fine sandy substrate and good deep pool cover (Appendix D). The wetted width of Dip Creek at the proposed crossing was 8.1 m (Table 10). The watercourse was too deep to obtain a measurement of average depth.

Brynerson Creek is planned to be crossed at 20+750 (Figure 8). This location has a riffle-pool morphology and a cobble/sand substrate. The wetted width of Brynerson Creek at the proposed crossing was 2.58 m, with an average depth of 0.33m. This location had an abundance of deep pools and overhanging vegetation.

The remaining ten crossing stations consist predominantly of poorly defined, muddy channels with noticeable bank erosion (Appendix D). The wetted width of these tributaries ranged from 0.47 m to 3.97 m, with an average width of 1.13 m (Table 10). Average wetted depths ranged from 0.14 m to 0.34 m, with an average depth of 0.2 m.

Fish Bearing Status

DFO (1994) documented Juvenile Chinook salmon, burbot and slimy sculpin in Dip Creek. Arctic grayling and slimy sculpin have also been historically captured in Casino Creek, located upstream of the proposed Dip Creek crossing.

Fish sampling was conducted in 2011 at five (5) crossings in the Dip Creek watershed (Table 9). Arctic grayling, slimy sculpin and juvenile Chinook salmon were captured using electrofishing and angling efforts at station 14+650, which is the main crossing of Dip Creek. No fish were captured in any tributaries to Dip Creek.

For the remaining watercourses crossings, based on the methodologies employed for this study, stations 10+330, 11+840, 16+580, 20+300, and 20+750 are considered fish bearing (Figure 8). The remaining crossings are not considered fish bearing due to identified barriers to fish passage and/or steep stream gradients.



Water Quality

In situ water quality data for the main branch of Dip Creek (14+650) are presented in Table 10. The water temperature was 7.8°C at the time of sampling, and the pH, conductivity, and DO, was 7.4, 80 µS/cm, and 8.5 mg/L, respectively.

In situ water quality data for Brynolson Creek (20+750) showed a water temperature of 11.2°C, with the pH, conductivity, and DO, at 7.6, 92 µS/cm, and 8.7 mg/L, respectively.

The mean water temperature within the remaining tributaries sampled was 7.0°C. The average pH, conductivity, and DO for the remaining sites was 6.7, 243 µS/cm, and 10.9 mg/L, respectively.

4 Summary

The fish and aquatic resources baseline program for the Freegold Road Upgrade, Extension, and Airstrip and Airstrip Access Road was conducted during the summer months of 2010, 2011 and 2013. Summit conducted the 2010 and 2011 investigations, and PECG conducted the 2013 investigations. The objective of the fish and aquatic resource baseline investigation was to characterize each of the planned river and stream crossing locations to determine their fish bearing status (i.e., fish bearing or non-fish bearing) to provide the environmental information necessary for design and permitting of each crossing structure. Since the type and distribution of fish within the local study area was already well known, the priority was to confirm actual fish use of the watercourse being crossed by the project.

The presence or absence of fish within each watercourse crossed by the Casino Roads was confirmed using: (1) a desktop GIS based assessment of stream gradients and barriers; (2) field investigations at all crossings to confirm channel gradient, location of barriers, flow regime, and site conditions; and (3) selected fish sampling at watercourses where fish absence could not be confirmed based on habitat conditions alone.

Fish and aquatic habitat assessments were conducted at 61 locations along the Freegold Road Upgrade section, at 95 locations along the Freegold Road Extension and at 12 crossings for the Airstrip Access Road. These assessments were conducted within the local study area and included the following watersheds: Big Creek, Selwyn River, Hayes Creek, Crossing Creek, Murray Creek, Isaac Creek, Mascot Creek, Dip Creek, the Nordenskiöld River and Yukon Tributaries.

Key Findings:

The Freegold Road Upgrade had 22 fish bearing streams, the Freegold Road Extension had 56 fish bearing streams, and the Airstrip Access Road had six fish bearing streams. Fish sampling efforts were primarily targeted towards major watercourse crossings and smaller channels where the fish-bearing status could not be confirmed based on the desktop assessment and field investigations.

Rearing habitat was the most common habitat type identified in the Project area, with most low gradient (<5%), higher order watercourses having rankings from moderate to good. Poor rearing habitat quality was documented in many small tributaries with some watercourses only containing seasonal or connecting habitat.

Due to the lack of deep pools and the frequent occurrence of intermittent or ephemeral streams in the study area, the potential for overwintering habitat was generally sparse. This limits productivity in many small watercourses and suggests that many creeks in the study area may not provide critical habitat required for sustaining fish populations. Areas of exception included Big Creek, Hayes Creek, Selwyn River, Dip Creek and Nordenskiöld River. Smaller tributaries such as Bow Creek, Seymour Creek



(downstream of the confluence with Bow Creek), Murray Creek, Apex Creek, Brynolson Creek, were also identified as having the potential to provide good overwintering habitat.

Watershed-specific results are summarized below for the Freegold Road Upgrade, Extension, and Airstrip and Airstrip Access Road:

Freegold Road Upgrade:

Nordenskiöld River

- Three sites were assessed in the Nordenskiöld River watershed, with Site 1N representing a new bridge crossing.
- Both Chinook salmon and chum salmon use the river for spawning and rearing habitat and the river provides suitable conditions for overwintering habitat for fish.

Murray Creek Watershed

- One site was assessed in the Murray Creek watershed.
- This location was not sampled for fish but historical records show that Chinook fry, Arctic grayling, round whitefish, and slimy sculpin are present in this watercourse near the Freegold Road crossing location.
- Murray Creek is considered to be fish bearing.

Crossing Creek Watershed

- Thirty-four (34) sites in the Crossing Creek watershed were assessed.
- Ten (10) crossings were determined to be fish bearing.
- No fish sampling was conducted in this watershed, but previous studies have shown that Arctic grayling are present in this watercourse, and that juvenile Chinook have been captured near the confluence with the Yukon River.

Big Creek Watershed (Upgrade Section)

- Twenty-seven (27) sites in the Big Creek watershed were assessed, including two crossings of Seymour Creek (sites 40 and 40N) and one crossing of Bow Creek (site 41).
- Arctic grayling, slimy sculpin and juvenile Chinook salmon have been documented within the Seymour Creek subwatershed up to the confluence with Bow Creek.
- Big Creek has been shown to contain Arctic grayling, slimy sculpin, round whitefish, chum salmon and Chinook salmon (adult and juvenile), and provides important overwintering habitat.
- No fish sampling was conducted in the Big Creek watershed (Upgrade section) but it was assumed that all low gradient streams that are connected to Big Creek or Seymour Creek are fish bearing.
- Sites 33, 33N, 40 and 40N within the Seymour Creek subwatershed, site 41 within the Bow Creek subwatershed, and site 46, 47.5, 49 and 50 within the Big Creek watershed, were determined to be fish bearing.



- A HAS assessment was conducted at site 41 (Bow Creek) and identified to have high habitat suitability for adult grayling and moderate habitat suitability for fry and parr Arctic grayling and Chinook.

Freegold Road Extension:

Big Creek Watershed (Extension Section)

- Twenty-nine (29) sites in the Big Creek watershed were assessed, including three crossings of the main branch of Big Creek.
- Big Creek has been shown to contain Arctic grayling, slimy sculpin, round whitefish, chum salmon and Chinook salmon (adult and juvenile), and provides important overwintering habitat.
- Fish sampling was conducted at eight locations in the Big Creek watershed (Extension section). No fish were captured at seven of the eight sites, and only Arctic grayling were captured at station 26+820.
- Sites 13+150, 13+470, 18+370, 18+900, 21+580, 25+700, 28+210, 28+730, 29+240, 30+880, 40+630, and 41+340 were determined to be fish bearing.
- A HSA was conducted at stations 13+150 (Big Creek), 13+470 (Big Creek tributary), 18+370 (Big Creek), 23+320 (Big Creek tributary), and 26+820 (Big Creek), and identified high to moderate suitability for fry, parr, and adult grayling, and fry and parr Chinook at this locations.

Hayes Creek Subwatershed

- Fifty-four (54) sites in the Hayes Creek Subwatershed were assessed, including seven crossings of the main branch of Hayes Creek, and crossings of Apex Creek, Fourmile Creek, and Butterfield Creek.
- Fish sampling was conducted at 20 locations in the subwatershed. Arctic grayling and/ or slimy sculpin in fry and juvenile age classes, were captured at 11 of the 20 crossing stations: 51+170, 56+790, 57+420, 62+480, 63+870, 66+170, 66+310, 67+570, 69+340, 75+410, and 79+380.
- No Chinook salmon were captured despite a multi-year effort.
- In addition to the sites listed above, sites 49+000, 58+980, 62+170, 64+700, 66+080, 67+500, 68+450, 71+100, 71+625, 71+980, 72+200, 74+770, 77+770, 78+980, 80+620, and 81+750 were determined to be fish bearing.
- A HAS was conducted at stations 56+790 (Apex Creek), 62+480 (Hayes Creek), 64+700 (Hayes Creek), 66+170 (Hayes Creek side channel), 66+310 (Hayes Creek side channel), 67+570 (Hayes Creek), 68+450 (Hayes Creek), 69+340 (Hayes Creek), 78+980 (Hayes Creek), and 79+380 (Hayes Creek).
- The HAS identified high to moderate suitability for fry, parr, and adult grayling, and fry and parr Chinook at all sites. Sites 67+570, 68+450, 78+980, and 79+380 were also identified as having high Chinook spawning habitat potential.

Selwyn River Watershed

- Nine sites in the Selwyn River watershed were assessed, including a crossing on the main branch of the Selwyn River at 85+160.



- Juvenile Chinook salmon and slimy sculpin have previously been documented within the Selwyn River near the proposed crossing location.
- Fish sampling was conducted at four locations in the watershed to confirm the results of the desktop fish bearing assessment.
- Fish were not captured at any of the watercourses sampled, however based on habitat conditions and gradients, stations 94+550 and 94+660 were still considered fish bearing.

Yukon Tributary, Mascot Creek, and Isaac Creek Watersheds

- Four sites within these small watersheds were assessed.
- Juvenile Chinook salmon were previously documented near the confluence of Mascot Creek and Isaac Creek, and the Yukon River, but have not been documented further upstream.
- Fish sampling was conducted at crossing 109+800 (Idaho Creek in the Isaac Creek watershed).
- No fish were captured, but based on habitat conditions and lack of barriers, this location is considered fish bearing.

Airstrip and Airstrip Access Road:

Dip Creek Watershed

- Twelve (12) sites in the Dip Creek watershed were assessed, including a crossing on the main branch of Dip Creek at 14+650.
- Juvenile Chinook salmon, burbot and slimy sculpin have been previously documented in Dip Creek. Arctic grayling and slimy sculpin have also been historically captured in Casino Creek, located upstream of the proposed Dip Creek crossing.
- Fish sampling was conducted at five locations in the watershed. Arctic grayling, slimy sculpin and juvenile Chinook salmon were captured at site 14+650. No fish were captured at any other location sampled.
- Stations 10+330, 11+840, 16+580, 20+300, and 20+750 are considered to be fish bearing



5 References

- Associated Engineering (AE), 2013. Casino Mine Project Access Overview for Submission to YESAB. Prepared for Western Copper and Gold Corporation. Draft Report July 2013.
- British Columbia Ministry of Forests (BC MOF). 1998. Fish-Stream Identification Guidebook. Second Edition, Version 2.1. Forest Practices Branch, Ministry of Forests, Victoria, BC. Forest Practices Code of British Columbia Guidebook. 70 pp.
- Beak Consultants Ltd. 1979. Fishery Investigations Along the Proposed Dempster Lateral Pipeline Route, 1978, Volume 1 of 2. Prepared for Foothills Pipe Lines (Yukon) Ltd.
- Brown, B. 2003. Big Creek Investigation RE-33N-03. Submitted to Little Salmon Carmacks First Nation and Yukon River Panel.
- de Graff, Nicholas M. 2009. Identification of chinook and fall chum salmon spawning habitat in the Yukon River mainstem between Tatchun Creek and Minto, Yukon Territory. Prepared for the Little Salmon/Carmacks First Nation, Carmacks, Yukon Territory. 21 pp.
- Department of Fisheries and Oceans Canada (DFO), 1985. Distribution and abundance of Chinook Salmon in the Upper Yukon River Basin as determined by radio-tagging and spaghetti tagging program, 1982-1983. Canadian Technical Report of Fisheries and Aquatic Sciences 1352.
- Department of Fisheries and Oceans (DFO), 1994: Overview: waters which may be affected by the Casino Project or by infrastructure associated with it. Department of Fisheries and Oceans Canada, Whitehorse, Yukon Territory.
- Environmental Dynamics Inc. (EDI), 2011. Little Salmon Carmacks First Nation Knowledge Study. CRE-141N-10. EDI Project # 10-YC-0058.
- Johnson, N.T. and P.A. Slaney, 1996. Fish Habitat Assessment Procedures. Watershed Restoration Program Ministry of Environment, Lands and Parks and Ministry of Forests. Watershed Restoration Technical Circular No. 8 revised April 1996
- Mathers, J.S., N.O. West, and B. Burns. 1981. Aquatic and Wildlife Resources of Seven Yukon Streams Subject to Placer Mining. DFO, Vancouver; DIAND, Ottawa; DOE, Whitehorse.
- Nordenskiöld Steering Committee (NSC), 2010. Tsawnjik Chu Nordenskiöld Habitat Protection Area Management Plan. Finalized April, 2010.
- McPhail, J.D. 2007. The Freshwater Fishes of British Columbia. Published by the University of Alberta Press, Edmonton, Alberta
- Palmer Environmental Consulting Group (PECG), 2011a: Casino Project: 2009 Aquatic Studies Report. Prepared for Western Copper Corporation by PECG. March 2011.
- Palmer Environmental Consulting Group (PECG), 2011b: Casino Project: 2010 Aquatic Studies Report. Prepared for Western Copper Corporation by PECG. December 2011.



- Palmer Environmental Consulting Group (PECG), 2012: Casino Project: 2011 Aquatic Studies Report. Prepared for Western Copper Corporation by PECG. May 2012.
- Palmer Environmental Consulting Group (PECG), 2013a: Casino Project: 2012 Aquatic Studies Report. Prepared for Casino Mining Corporation by PECG. May 2013.
- Palmer Environmental Consulting Group (PECG), 2013b: Casino Project: 2013 Aquatic Studies Memo. Prepared for Casino Mining Corporation by PECG.
- Palmer Environmental Consulting Group (PECG), 2013c: Casino Project: Preliminary Fish Habitat Compensation Plan. Prepared for Casino Mining Corporation by PECG.
- Resources Information Standards Committee (RISC), 2008. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory. Prepared by the Ministry of Environment Ecosystems Branch for the Resources Information Standards Committee. April 2008. Version 2.0.
- Stewart, D.B., Mochnacz, N.J., Reist, J.D., Carmichael, T.J., and Sawatzky, C.D. 2007. Fish diets and food webs in the Northwest Territories: Arctic grayling (*Thymallus arcticus*). Can. Manuscr. Rep. Fish. Aquat. Sci. 2796: vi + 21 p.
- Summit Environmental Consultants Inc. 2011. Freegold Road Extension: Environmental Baseline Studies 2010. September 2011. Prepared for Western Copper Corporation. PN# 2010-8861.010.
- Summit Environmental Consultants Inc. 2012a. Freegold Road Extension – Baseline Environmental Studies 2011. February 2012. Prepared for Western Copper and Gold Corporation. PN# 2011-8094.000.002.
- Summit Environmental Consultants Inc. 2012b. Casino Mine Airstrip and Access Route Baseline Assessment: 2011 Final Report. Prepared for Associated Engineering Ltd. October, 2012.
- von Finster, A. 1994. Fisheries Resources of the mid-reaches of Big Creek, tributary to the Yukon River near Minto. Memorandum to file. Habitat and Enhancement Branch, DFO. 3 p.
- Walker, C.E., 1976. Studies on the Freshwater and Anadromous Fishes of the Yukon River Within Canada. Department of the Environment Fisheries and Marine Service. PAC T/76-7.
- Yukon River Panel, 2008a. Chinook salmon (*Oncorhynchus tshawytscha*). Accessed online September 30, 2013 at <http://yukonriverpanel.com/salmon/about/yukon-river-salmon/chinook/>
- Yukon River Panel, 2008b. Chum. Accessed online September 30, 2013 at <http://yukonriverpanel.com/salmon/about/yukon-river-salmon/chum/>



6 Tables

Table 1 - Freegold Road Upgrade Data Summary

Watershed	Crossing Number	Distance on Road (km)	Road Station	UTM Zone	Northing	Easting	Stream Crossing	Fish Assessment	Fish Bearing	Habitat Assessment (F/P/N)
Nordenskiöld River	1	0	-	8	6885976	431267	Nordenskiöld River	2013	Y	P
	1N	0	-	8	6882967	432195	Nordenskiöld River	2013	Y	P
	2	0.99	-	8	6886772	430710	N/A	2013	N/A	N
Yukon Tributary	3	4.58	-	8	6889244	428819	N/A	2013	No Crossing	N
Murray Creek	4	8.1	-	8	6892374	428307	Murray Creek	2013	Y	P
Yukon Tributary	5	14	-	8	6897278	426998	Yukon Tributary	2013	N	P
	6	18.04	-	8	6901080	426321	N/A	2013	N/A	N
Crossing Creek	6.5	~25	-	8	6903635	421706	Crossing Creek Tributary	2013	N	P
	7	25.62	-	8	6903613	421510	Crossing Creek	2013	Y	P
	8	26.16	-	8	6903719	421002	N/A	2013	N/A	N
	9	26.23	-	8	6903724	420934	N/A	2013	N/A	N
	10	26.45	-	8	6903841	420816	N/A	2013	N/A	N
	11	26.56	-	8	6903808	420721	N/A	2013	N/A	N
	12	26.76	-	8	6903776	420538	N/A	2013	N/A	N
	13	26.81	-	8	6903769	420483	N/A	2013	N/A	N
	14	28.29	-	8	6903861	419304	N/A	2013	N/A	N
	15	28.4	-	8	6903835	419196	N/A	2013	N/A	N
	16	28.46	-	8	6903833	419133	N/A	2013	N/A	N
	17	28.53	-	8	6903822	419070	N/A	2013	N/A	N
	18	29.02	-	8	6903853	418594	N/A	2013	No Crossing	N
	19	30.11	-	8	6903757	417540	N/A	2013	N/A	N
	20	30.25	-	8	6903759	417397	N/A	2013	N/A	N
	21	30.39	-	8	6903774	417250	N/A	2013	No Crossing	N
	22	31.23	-	8	6903880	416439	N/A	2013	No Crossing	N
	22.5	-	-	8	6903942	415607	Crossing Creek Tributary	2013	N	N
	23	32.26	-	8	6904009	415443	N/A	2013	No Crossing	N
	24	32.75	-	8	6904045	414979	N/A	2013	No Crossing	N

Watershed	Crossing Number	Distance on Road (km)	Road Station	UTM Zone	Northing	Easting	Stream Crossing	Fish Assessment	Fish Bearing	Habitat Assessment (F/P/N)
	25	33.79	-	8	6903767	414012	N/A	2013	No Crossing	N
	25.5	~35	-	8	6903328	413448	Crossing Creek Tributary	2013	N	N
	26	35.49	-	8	6903472	412617	Crossing Creek Tributary	2013	Y	P
	26N	35.33	-	8	6903230	412716	Crossing Creek Tributary	2013	Y	P
	26.5	~37	-	8	6903211	411995	Crossing Creek Tributary	2013	N	N
	27	36.4	-	8	6903150	411811	Crossing Creek Tributary	2013	Y	P
	28	39.17	-	8	6901780	409548	Crossing Creek Tributary	2013	Y	P
	29	41.38	-	8	6901716	407741	N/A	2013	N/A	N
	29N	41.32	-	8	6901667	407836	Crossing Creek Tributary	2013	N	P
	30	41.88	-	8	6901568	407285	Crossing Creek Tributary	2013	Y	P
	30N	41.97	-	8	6901519	407416	Crossing Creek Tributary	2013	Y	P
	31	46.93	-	8	6900480	402734	Crossing Creek Tributary	2013	Y	P
	31N	47.05	-	8	6900377	402782	Crossing Creek Tributary	2013	Y	P
	31.5	-	-	8	6900139	401843	Crossing Creek Tributary	2013	Y	P
Big Creek	32	48.08	-	8	6900161	401794	N/A	2013	N/A	N
	33	53.1	-	8	6901099	397330	Seymour Creek Tributary	2013	Y	P
	33N	53.3	-	8	6900693	397146	Seymour Creek Tributary	2013	Y	P
	34	60.39	-	8	6904328	391846	N/A	2013	No Crossing	N
	35	64.3	-	8	6905560	388575	N/A	2013	No Crossing	N
	36	64.89	-	8	6906012	388238	N/A	2013	N/A	N
	37	65.76	-	8	6906565	387569	Seymour Creek Tributary	2013	N	N
	38	66.06	-	8	6906784	387384	N/A	2013	N/A	N
	39	66.78	-	8	6907392	387074	Seymour Creek Tributary	2013	N	P
	39.5	-	-	8	6907382	387064	Seymour Creek Tributary	2013	N	N
	40	69.81	-	8	6909633	385203	Seymour Creek	2013	Y	P
	40N	-	-	8	6909572	385205	Seymour Creek	2013	Y	P
	41	70.42	0+280	8	6910209	385089	Bow Creek	2010/2011/ 2013	Y	P
	42	71.66	-	8	6911340	385468	Seymour Creek Tributary	2013	N	N
	43	72.18	1+930	8	6911722	385785	N/A	2013	No Crossing	N

Watershed	Crossing Number	Distance on Road (km)	Road Station	UTM Zone	Northing	Easting	Stream Crossing	Fish Assessment	Fish Bearing	Habitat Assessment (F/P/N)
	44	72.37	-	8	6911857	385925	Seymour Creek Tributary	2013	N	N
	45	74.04	-	8	6913286	386796	N/A	2013	No Crossing	N
	46	77.79	-	8	6915155	385937	Big Creek Tributary	2013	Y	P
	47	78.89	-	8	6914783	384948	Big Creek Tributary	2013	N	P
	47.5	-	9+320	8	6914767	384266	Big Creek Tributary	2013	Y	P
	48	79.76	-	8	6914718	384130	N/A	2013	N/A	N
	48.5	-	-	8	6914524	383284	Big Creek Tributary	2013	N	N
	49	80.87	10+610	8	6914666	383096	Big Creek Tributary	2013	Y	P
	50	81.75	10+830	8	6914869	382277	Big Creek Tributary	2013	Y	P
	50.5	-	-	8	6915023	382209	Big Creek Tributary	2013	N	N
	51	82.77	12+260	8	6915035	381481	N/A	2013	N/A	N
	52	82.98	12+430	8	6915218	381366	Big Creek Tributary	2013	N	N

Notes:

-	No Data
UM	Unmarked Crossing
N/A	Not Applicable
No Crossing	No Crossing Identified
Sampling Method	EF - Electrofishing; VO - Visual Observations; AG - Angling; MT - Minnow Trapping; SN - Seine Net
Species Captured	NFC - No Fish Captured; GR - Arctic Grayling; CCG - Slimy Sculpin; CH - Chinook Salmon
Fish Bearing	Y - Assumed Fish Bearing; N - Assumes Non-Fish Bearing; N/A - Not Applicable; No Crossing - No Crossing Identified
Habitat Assessment	F - Full Habitat Assessment Completed (Site Card Available); P - Partial Habitat Assessment Completed for Impact Assessment and Crossing Design; N - No Habitat Assessment Completed
*	2010 Freegold Road Extension data derived from Summit (2011) 2013 Freegold Road Upgrade, Freegold Road Extension, and Airstrip data collected by PECC

Table 2 - Freegold Road Upgrade Data (All Watersheds)

Crossing	In situ Water Quality					Estimated Length (m)	Gradient (%)	Bankfull Width (m)	Bankfull Depth (m)	Wetted Width (m)	Wetted Depth (m)	Area (m²)	Cover (%)	Cover	Substrate Bed	Fish (Yes/No)
	Temp (°C)	pH	Conductivity (µS/cm)	DO (mg/L)	DO (% Sat)											
1	17.00	7.20	197	8.30	91.1	10.00	1	31.70	-	27.00	-	317.00	5	OV	C/G	Yes
1N	14.76	7.11	153	8.85	92.7	10.00	2	53.00	1.00	53.00	1.00	530.00	20	SUB	C	Yes
4	8.31	8.45	189	10.30	93.2	10.00	1	7.53	0.55	4.95	0.16	75.33	13	OV	C/G	Yes
7	12.02	8.49	211	8.51	85.3	10.00	4	7.30	0.57	6.70	0.24	73.00	23	B	G/C	Yes
26	6.91	8.12	126	2.93	26.3	10.00	3	0.59	0.17	0.55	0.09	5.85	80	OV	G/F	Yes
26N	9.43	7.18	159	4.19	39.6	10.00	2	-	-	0.87	0.17	-	47	OV	F	Yes
27	7.62	8.50	496	8.52	78.1	10.00	2	2.18	0.25	0.99	0.14	21.77	20	OV	G/F	Yes
28	5.88	7.92	211	5.37	47.3	10.00	5	0.52	0.25	0.43	0.15	5.17	90	OV	F/G	Yes
29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No
29N	6.98	7.70	204	7.39	66.8	10.00	9	0.56	0.09	0.54	0.07	5.60	40	LWD	G/S	No
30	6.19	8.01	147	9.33	83.8	10.00	3	2.47	0.24	2.12	0.10	24.67	37	OV	G/C	Yes
30N	7.13	7.64	132	9.48	86.4	10.00	4	0.65	0.39	0.58	0.29	6.50	43	OV	S/G	Yes
31	4.49	8.78	99	9.33	80.9	10.00	3	1.11	0.17	0.67	0.07	11.13	80	OV	G/F	Yes
31N	5.44	7.29	97	9.13	80.6	10.00	5	0.41	0.20	0.39	0.16	4.10	73	OV	G	Yes
31.5	4.48	7.90	98	7.24	62.7	10.00	3	1.24	0.37	0.89	0.17	12.43	40	OV	F/G	Yes
33	2.49	8.41	82	9.70	80.5	10.00	4	1.96	0.31	1.16	0.09	19.63	82	OV	G/F	Yes
33N	2.73	7.87	73	10.05	83.2	10.00	3	1.16	0.24	1.12	0.20	11.60	65	OV	G	Yes
39	-	-	-	-	-	10.00	6	0.74	0.43	-	-	7.37	60	OV	C/G	No
39.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	No
40	9.86	7.99	195	9.61	92.0	10.00	1	15.65	0.58	10.05	0.21	156.50	7	OV	G/F / C/B	Yes
40N	5.90	8.12	151	10.06	87.3	10.00	2	44.00	0.95	10.33	0.31	440.00	10	SUB	C/G	Yes
40N*	5.40	7.96	143	8.54	73.4	10.00	4	5.00	1.00	2.00	0.14	50.00	10	SUB	C/G	Yes
41	7.18	7.98	107	9.57	86.3	10.00	1	7.53	0.59	6.80	0.34	75.33	10	OV	G/C	Yes
46	-	-	-	-	-	10.00	7	0.83	0.23	0.20	0.02	8.30	45	OV	F/G	Yes
47	-	-	-	-	-	10.00	4	1.13	0.33	-	-	11.33	80	OV	G/F	No
47.5	18.26	8.42	603	9.40	107.6	10.00	3	1.19	0.17	0.83	0.03	11.87	45	OV	G/C	Yes
49	19.39	8.45	1093	8.43	98.5	10.00	4	0.99	0.19	0.36	0.06	9.93	2	OV	F/G	Yes
50	7.27	7.34	105	4.99	45.0	10.00	1	1.17	0.64	1.17	0.47	11.70	37	OV	F/G	Yes

Note: The following sites were excluded from the table as measurements were not applicable and all were non fish bearing: 2, 3, 5-6.5, 8-25.5, 26.5, 32, 34-38, 42-45, 48, 48.5, 51.5-52.

* This site is a side channel to 40N and was assessed separately but considered the same crossing

DO Dissolved Oxygen

Hanna HI 9828 Hanna Meter

Sat Saturation

YSI YSI model 556

W, E West, East

"-" Not sampled, no data available / not applicable

N New proposed alignment crossing. Adjacent crossing with the same number is the existing crossing

B Boulder

C Cobble

F Fines

G Gravel

S Sand

DP Deep Pools

SWD Small Woody Debris

LWD Large Woody Debris

OV Overhanging Vegetation

U Undercut Banks

Table 3 - Freegold Road Data Summary

Watershed	PECG ID	Road Station	UTM Zone	Northing	Easting	Stream Crossing	Fish Assessment			Sampled (year)	Sampling Method	Species Captured	Fish Bearing	Habitat Assessment (F/P/N)
							2010*	2011**	2013					
BIG CREEK	8	13+150	8	6915200	380797	Big Creek	-	✓	✓	No	-	-	Y	F
	9	13+470	8	6915437	380643	Big Creek Tributary	-	✓	✓	No	-	-	Y	F
	10	15+500	8	6916772	379294	Big Creek Tributary	✓	-	✓	No	-	-	N	P
	11	16+560	8	6917122	378313	Big Creek Tributary	-	✓	✓	Yes (2011)	EF	NFC	Y	P
	12	18+050	8	6918147	377298	Big Creek Tributary	-	✓	✓	No	-	-	N	N
	13	18+080	8	6918167	377264	Big Creek Tributary	-	✓	✓	No	-	-	N	N
	14	18+370	8	6918095	377007	Big Creek	✓	✓	✓	NS	-	-	Y	F
	15	18+900	8	6918099	376573	Big Creek Tributary	-	✓	✓	No	-	-	Y	P
	16	19+570	8	6918534	376059	Big Creek Tributary	-	✓	✓	No	-	-	N	P
	17	20+390	8	6918907	375373	Big Creek Tributary	-	✓	✓	Yes (2011)	EF	NFC	N	P
	18	21+580	8	6919673	374514	Big Creek Tributary	-	-	✓	No	-	-	Y	P
	19	22+960 [†]	8	6920786	373732	Big Creek Tributary	-	-	✓	No	-	-	N	P
	UM	23+000	8	6920741	373693	Big Creek Tributary	-	-	✓	No	-	-	N	P
	20	23+320	8	6921078	373521	Big Creek Tributary	✓	✓	✓	Yes (2010)	EF	NFC	Y	F
	21	24+380	8	6921290	372497	Big Creek Tributary	-	-	✓	Yes (2011)	EF	NFC	Y	P
	UM	25+700	8	6921921	371452	Big Creek Tributary	-	-	✓	No	-	-	Y	P
	22	26+740	8	6922617	370963	Big Creek Tributary	✓	-	✓	No	-	-	N	N
	23	26+820	8	6922687	370986	Big Creek	✓	✓	✓	Yes (2010)	EF	GR	Y	F
	24	28+210	8	6923623	370172	Big Creek Tributary	-	✓	✓	No	-	-	Y	P
	25	28+730	8	6923860	369719	Big Creek Tributary	-	✓	✓	No	-	-	Y	P
	26	29+240	8	6924178	369328	Big Creek Tributary	-	✓	✓	No	-	-	Y	P
	UM	30+880	8	6925355	368206	Big Creek Tributary	-	-	✓	No	-	-	Y	P
	27	33+230	8	6925798	365959	Big Creek Tributary	-	✓	✓	Yes (2011)	EF	NFC	Y	P
	28	35+340	8	6926722	364712	Big Creek Tributary	-	✓	✓	No	-	-	N	N
	29	37+700	8	6928102	362891	Big Creek Tributary	✓	-	✓	Yes (2010)	EF	NFC	Y	P
	30	39+280	8	6929090	361702	Big Creek Tributary	-	✓	✓	Yes (2011)	EF	NFC	Y	P
	UM	40+630	8	6929810	360672	Big Creek Tributary	-	-	✓	No	-	-	Y	P
	31	41+340	8	6930102	359971	Big Creek Tributary	-	✓	✓	No	-	-	Y	P
	UM	W of 41+340	8	6929810	360672	Big Creek Tributary	-	-	✓	No	-	-	N	P
HAYES CREEK SUBWATERSHED	32	43+110	8	6931260	358985	Hayes Tributary	-	✓	✓	No	-	-	N	P
	33	45+150	8	6932851	357738	Hayes Tributary	-	✓	✓	No	-	-	N	P
	34	45+230	8	6932917	357680	Hayes Tributary	-	✓	✓	Yes (2011)	EF	NFC	Y	P
	35	46+740	8	6933680	356405	Hayes Tributary	-	-	✓	No	-	-	N	N
	36	47+050	8	6933948	356254	Hayes Tributary	-	✓	✓	Yes (2013)	EF, MT	NFC	Y	P
	37	49+000	8	6935425	355019	Hayes Tributary	✓	-	✓	No	-	-	Y	P
	38	51+170	8	6936828	353491	Hayes Creek	✓	-	✓	Yes (2010)	EF, VO	GR	Y	F
	39	52+330	8	6937376	352489	Hayes Tributary	-	✓	✓	Yes (2011)	EF	NFC	Y	P
	40	53+590	8	6938195	351534	Hayes Tributary	-	-	✓	No	-	-	N	P
	41	56+790	8	6940628	349556	Apex Creek	✓	✓	✓	Yes (2010)	EF, VO, AG	CCG, GR	Y	F
	42	57+420	8	6941194	349309	Hayes Tributary	-	✓	✓	Yes (2011)	EF, VO	GR	Y	P
	43	58+070	8	6941798	349138	Hayes Tributary	-	✓	✓	No	-	-	N	P
	44	58+980	8	6942396	348450	Hayes Tributary	-	✓	✓	No	-	-	Y	P

Watershed	PECG ID	Road Station	UTM Zone	Northing	Easting	Stream Crossing	Fish Assessment			Sampled (year)	Sampling Method	Species Captured	Fish Bearing	Habitat Assessment (F/P/N)
							2010*	2011**	2013					
	45	60+220	8	6943310	347629	Hayes Tributary	-	✓	✓	No	-	-	N	P
	UM	60+870	8	6943776	347277	Hayes Tributary	-	-	✓	No	-	-	N	P
	46	61+830	8	6944654	346888	Fourmile Creek	-	✓	✓	Yes (2011)	EF	NFC	Y	P
	47	62+170	8	6944960	346743	Hayes Tributary	-	✓	✓	No	-	-	Y	P
	UM	62+480	8	6945237	346720	N/A	✓	✓	✓	Yes (2010)	EF	CCG	No Crossing	F
	48	63+870	8	6946576	346593	Butterfield Creek	-	✓	✓	Yes (2011)	EF, VO	GR	Y	P
	49	64+700	8	6947271	346380	Hayes Creek	✓	✓	✓	No	-	-	Y	F
	50	65+640	8	6948131	346640	N/A	-	✓	✓	No	-	-	N/A	N
	UM	66+080	8	6948573	346547	Hayes Tributary	-	-	✓	No	-	-	Y	P
	51	66+170	8	6948653	346537	Hayes Creek Side Channel	✓	✓	✓	Yes (2010)	EF	GR, CCG	Y	F
	52	66+310	8	6948781	346529	Hayes Creek Side Channel Tribs	✓	✓	✓	Yes (2010)	VO	GR	Y	F
	53	67+500	8	6949915	346712	Hayes Creek Side Channel	-	-	✓	No	-	-	Y	P
	54	67+570	8	6949993	346696	Hayes Creek	✓	✓	✓	Yes (2010)	EF	GR, CCG	Y	F
	55	68+450	8	6950819	346819	Hayes Creek	✓	✓	✓	No	-	-	Y	F
	56	68+850	8	6951179	346896	Hayes Tributary	-	✓	✓	No	-	-	N	N
	57	69+110	8	6951323	346691	Hayes Tributary	-	✓	✓	No	-	-	N	N
	58	69+340	8	6951425	346481	Hayes Creek	✓	✓	✓	Yes (2010)	EF, VO	CCG	Y	F
	59	71+100	7	6951828	652181	Hayes Tributary	-	✓	✓	No	-	-	Y	P
	UM	71+290	7	6951933	651968	Hayes Tributary	-	-	✓	No	-	-	N	P
	60	71+600	7	6951973	651716	Hayes Tributary	-	✓	✓	Yes (2011)	EF	NFC	N	N
	UM	71+625	7	6951959	651678	Hayes Tributary	-	-	✓	No	-	-	Y	P
	61	71+760	7	6952033	651564	Hayes Tributary	-	✓	✓	No	-	-	N	N
	62	71+810	7	6952052	651512	Hayes Tributary	-	✓	✓	No	-	-	N	N
	63	71+980	7	6952110	651353	Hayes Tributary	-	✓	✓	No	-	-	Y	P
	64	72+200	7	6952170	651145	Senora Gulch	-	✓	✓	No	-	-	Y	P
	65	73+500	7	6952558	649980	Hayes Tributary	-	-	✓	No	-	-	N	P
	UM	74+770	7	6952594	648829	Hayes Tributary	-	-	✓	No	-	-	Y	P
	66	74+810	7	6952529	648749	Hayes Tributary	-	✓	✓	Yes (2011)	EF	NFC	Y	P
	67	75+410	7	6952532	648162	Hayes Tributary	-	✓	✓	Yes (2011)	EF	GR	Y	P
	68	77+220	7	6953097	646520	Hayes Tributary	-	✓	✓	Yes (2011)	EF, VO	NFC	Y	P
	UM	77+770	7	6953305	646068	Hayes Tributary	-	-	✓	No	-	-	Y	P
	69	78+420	7	6953565	645495	Hayes Tributary	-	✓	✓	Yes (2011)	EF	NFC	Y	P
	70	78+540	7	6953658	645437	Hayes Tributary	-	-	✓	No	-	-	N	N
	71	78+980	7	6953951	645113	Hayes Creek	✓	✓	✓	No	-	-	Y	F
	72	79+380	7	6954264	644886	Hayes Creek	✓	✓	✓	Yes (2010)	EF, SN	CCG	Y	F
	UM	80+620	7	6954779	643808	Hayes Tributary	-	-	✓	No	-	-	Y	P
	73	81+120	7	6954697	643317	Hayes Tributary	-	✓	✓	No	-	-	N	P
	74	81+570	7	6954859	642903	Hayes Tributary	-	✓	✓	No	-	-	N	P
	UM	81+680	7	6954913	642808	Hayes Tributary	-	-	✓	No	-	-	N	P
	UM	81+610	7	6954911	642897	Hayes Tributary	-	-	✓	No	-	-	N	P
	75	81+750	7	6954938	642743	Hayes Tributary	-	✓	✓	No	-	-	Y	P
	76	83+550	7	6955434	641077	Hayes Tributary	-	-	✓	Yes (2013)	EF, MT	NFC	N	P
Selwyn River	77	85+160	7	6956507	639993	Selwyn River	✓	✓	✓	No	-	-	Y	F
	78	87+920	7	6958246	638494	Selwyn Tributary	-	-	✓	Yes (2013)	EF, MT	NFC	N	P

Watershed	PECG ID	Road Station	UTM Zone	Northing	Easting	Stream Crossing	Fish Assessment			Sampled (year)	Sampling Method	Species Captured	Fish Bearing	Habitat Assessment (F/P/N)
							2010*	2011**	2013					
	79	89+330	7	6958668	637646	Selwyn Tributary	-	-	✓	No	-	-	N	P
	80	89+410	7	6958702	637585	Selwyn Tributary	✓	-	✓	No	-	-	N	P
	81	90+410	7	6959511	637143	Selwyn Tributary	-	-	✓	No	-	-	N	P
	82	91+570	7	6959588	636430	Selwyn Tributary	-	-	✓	No	-	-	N	P
	83	93+040	7	6959563	635624	Selwyn Tributary	-	-	✓	Yes (2013)	EF, MT	NFC	N	P
	84	94+550	7	6959720	634674	Selwyn Tributary	-	-	✓	Yes (2013)	EF, MT	NFC	Y	P
	85	94+660	7	6959780	634592	Selwyn Tributary	-	-	✓	Yes (2013)	EF, MT	NFC	Y	P
Yukon Tributary	86	96+190	7	6960539	634193	Yukon Tributary	-	-	✓	No	-	-	N	N
Mascot Creek	87	105+620	7	6956936	628781	Mascot Creek	-	-	✓	No	-	-	N	N
Isaac Creek	88	107+920	7	6956753	627290	Idaho Creek	-	-	✓	No	-	-	N	N
	89	109+800	7	6956577	625829	Idaho Creek	-	-	✓	Yes (2013)	EF, MT	NFC	Y	P

Notes:

-

No Data

UM

Unmarked Crossing

N/A

Not Applicable

No Crossing

No Crossing Identified

Sampling Method

EF - Electrofishing; VO - Visual Observations; AG - Angling; MT - Minnow Trapping; SN - Seine Net

Species Captured

NFC - No Fish Captured; GR - Arctic Grayling; CCG - Slimy Sculpin; CH - Chinook Salmon

Fish Bearing

Y - Assumed Fish Bearing; N - Assumes Non-Fish Bearing; N/A - Not Applicable; No Crossing - No Crossing Identified

Habitat Assessment

F - Full Habitat Assessment Completed (Site Card Available); P - Partial Habitat Assessment Completed for Impact Assessment and Crossing Design; N - No Habitat Assessment Completed

*

2010 Freegold Road Extension data derived from Summit (2011)

**

2011 Freegold Road Extension data derived from Summit (2012a)

2013 Freegold Road Upgrade, Freegold Road Extension, and Airstrip data collected by PECG

Table 4 - Big Creek Watershed Data

Station ID	In situ Water Quality					Estimated Length (m)	Gradient (%)	Bankfull Width (m)	Bankfull Depth (m)	Wetted Widths (m)	Wetted Depth (m)	Area (m²)	Cover (%)	Cover	Substrate Bed	Fish Bearing (Yes/No)
	Temperature (°C)	pH	Conductivity (µS/cm)	DO (mg/L)	DO (% Sat)											
13+150	9.32	7.22	170	11.90	100.0	18.8	2	40.67	-	18.67	1.80	764.53	10	OV	C/G	Yes
13+470	-	-	-	-	-	16.7	-	5.33	-	4.33	0.97	89.07	-	OV	F/C	Yes
15+500	-	-	-	-	-	14.8	-	-	-	-	-	-	-	-	-	No
16+560	6.00	7.80	377	13.15	105.0	17.4	6	3.63	0.24	2.10	0.14	63.22	15	B	C/B	Yes
18+050	-	-	-	-	-	17.1	-	-	-	-	-	-	-	-	-	No
18+080	-	-	-	-	-	14.5	-	-	-	-	-	-	-	-	-	No
18+370	9.79	7.53	132	12.19	107.4	13.5	1	24.00	-	19.00	1.03	324.00	33	DP	G/C	Yes
18+900	9.93	7.52	129	11.93	105.6	37.0	2	8.03	0.69	4.73	0.27	297.23	7	U	C/G	Yes
19+570	13.30	6.00	73	3.57	34.0	9.0	-	9.00	0.70	9.00	0.70	81.00	-	-	F	No
20+390	9.69	5.97	123	11.93	104.8	15.7	4	0.98	0.20	0.65	0.06	15.44	7	OV	F	No
21+580	5.07	3.97 (no)	126	13.50	106.0	37.5	4	1.30	0.27	0.50	0.07	48.63	60	OV	F	Yes
22+960	-	-	-	-	-	18.2	5	1.00	0.22	-	-	18.20	-	-	S/F	No
23+000*	3.62	7.45	69	8.50	70.7	18.9	4	1.82	0.31	1.30	0.24	34.34	20	LWD	S/F	No
23+320	5.72	5.58	190	13.38	106.8	30.0	3	4.13	-	3.50	0.57	124.00	7	SWD	C/G	Yes
24+380	6.00	4.44	38	13.22	106.2	18.7	5	2.16	0.52	1.14	0.11	40.45	15	LWD	C/G	Yes
25+700	6.50	6.80	5	12.30	110.0	15.1	5	1.45	0.25	0.83	0.14	21.90	8	SWD	G/S	Yes
26+740	-	-	-	-	-	14.5	-	-	-	-	-	-	-	-	-	No
26+820	6.98	7.00	132	13.17	108.5	34.3	1	39.67	-	20.33	0.53	1360.57	17	OV	C/G	Yes
28+210	2.82	7.40	144	9.90	80.8	15.7	14	0.30	0.24	0.18	0.12	4.66	25	U/OV	F	Yes
28+730	3.15	7.60	256	14.16	105.9	10.0	6	0.60	0.18	0.41	0.06	6.03	67	OV	G/F	Yes
29+240	3.41	6.81	99	9.04	74.5	19.5	6	1.06	0.27	0.72	0.10	20.61	50	OV	F/S	Yes
30+880	6.06	6.73	168	12.84	103.5		6	2.83	0.63	2.26	0.18	0.00	17	B	C/G	Yes
33+230	5.83	4.62	166	13.09	115.0	40.0	7	1.22	0.47	1.28	0.27	48.67	20	B	C/B	Yes
35+340	-	-	-	-	-	19.5	-	-	-	-	-	-	-	-	-	No
37+700	6.58	7.21	0.52	13.03	100.5	20.0	4	2.47	0.37	1.58	0.14	49.33	17	OV	G/C	Yes
39+280	3.96	7.88	254	11.40	98.0	27.2	9	0.74	0.31	0.56	0.08	20.22	43	SWD	S/G	Yes
40+630	7.27	7.92	340	11.65	96.9	-	5	0.91	0.62	0.77	0.49	-	90	OV	F	No
41+340	9.29	7.07	117	7.79	67.6	17.1	5	0.89	0.34	0.69	0.23	15.22	72	OV	F	Yes

Note: *

Area

DO

Hanna

Sat

YSI

W, E

"_"

B

Same creek as 22+960, assessed upstream

Estimated Length multiplied by the bankfull width

Dissolved Oxygen

HI 9828 Hanna Meter

Saturation

YSI model 556

West, East

No data available or not applicable

Boulder

C

F

G

S

DP

SWD

LWD

OV

U

Cobble

Fines

Gravel

Sand

Deep Pools

Small Woody Debris

Large Woody Debris

Overhanging Vegetation

Undercut Banks

Table 5 - Hayes Creek Subwatershed Data

Station ID	In situ Water Quality					Estimated Length (m)	Gradient (%)	Bankfull Width (m)	Bankfull Depth (m)	Wetted Widths (m)	Wetted Depth (m)	Area (m²)	Cover (%)	Cover	Substrate Bed	Fish Bearing (Yes/No)
	Temperature (°C)	pH	Conductivity (µS/cm)	DO (mg/L)	DO (% Sat)											
43+110	1.96	8.08	440	14.19	102.6	16.9	6	0.91	0.30	0.77	0.10	15.38	50	OV	F	No
45+150	-	-	-	-	-	16.2	-	0.85 / 0.55	0.43 / 0.45	0.00	0.00	-	-	-	F	No
45+230	2.82	8.17	72	10.52	88.4	18.4	8	1.23	0.54	1.31	0.35	22.57	33	U	B/C	Yes
46+740	-	-	-	-	-	20.8	-	-	-	-	-	-	-	-	-	No
47+050	2.85	7.42	207	8.69	71.9	16.3	11	0.90	0.25	0.83	0.10	14.67	100	OV	F/G	No
49+000	2.63	8.41	365	14.18	104.5	13.8	9	1.33	0.45	1.45	0.16	18.35	90	OV	B/C	Yes
51+170	5.61	8.07	64	12.10	107.0	19.8	2	9.52	0.60	5.80	0.31	188.43	13	OV	G/C	Yes
52+330	5.53	8.82	161	13.66	108.4	20.0	4	1.41	0.37	1.16	0.17	28.20	62	LWD	G/F	Yes
53+590	3.41	7.42	177	11.42	94.8	17.6	7	1.02	0.41	0.79	0.19	17.95	37	OV	G/F	No
56+790	8.97	8.84	88	12.65	109.0	21.2	1	26.67	-	13.33	0.4	565.33	28	LWD	C/G	Yes
57+420	6.99	8.10	7	12.76	115.2	15.6	5	1.56	0.44	1.36	0.29	24.39	33	LWD	G/C	Yes
58+070	6.33	9.20	682	11.66	94.8	16.0	9	1.31	0.11	0.65	0.05	20.96	38	OV	F	No
58+980	4.70	9.21	250	14.26	111.2	21.0	5	1.00	-	0.88	0.37	20.93	93	OV	G/F	Yes
60+220	1.95	8.24	250	13.25	103.5	27.8	10	0.69	0.33	0.63	0.23	19.09	30	LWD	F/G	No
60+870	-	-	-	-	-	-	18	0.41	0.15	0.30	0.05	-	75	OV	F	No
61+830	8.38	9.43	118	12.87	109.7	18.5	4	3.90	0.35	2.60	0.19	72.15	40	OV	C/G	Yes
62+170	6.12	7.73	58	10.71	93.7	15.6	7	0.99	-	0.54	0.24	15.44	13	U	G/F	Yes
63+870	7.77	4.00	164	13.10	110.1	16.4	3	4.83	0.40	4.23	0.31	79.27	30	LWD/OV	C/G	Yes
64+700	11.33	7.67	70	10.12	99.5	17.4	1	17.67	-	14.33	0.53	307.40	20	U/OV	C/G	Yes
65+640	-	-	-	-	-	22.0	-	-	-	-	-	-	-	-	-	No
66+080	5.05	7.81	297	8.02	68.0	-	2	2.14	0.64	1.16	0.54	47.15	27	U	F	No
66+170	1.42	8.26	99	7.15	54.9	16.1	1	8.17	-	5.75	0.27	131.48	35	SWD/OV	G/F	Yes
66+310	1.43	7.64	159	7.67	59.2	16.0	1	3.63	-	3.20	0.57	58.13	17	LWD	G	Yes
67+500	1.42	7.04	82	3.33	25.9	24.8	0	4.93	0.65	4.59	0.52	122.35	17	LWD	F	Yes
67+570	6.16	7.46	69	10.51	92.3	12.8	1	34.00	-	17.67	0.43	435.20	20	LWD/OV	C/G	Yes
68+450	6.53	9.86	139	13.20	107.5	15.6	1	17.67	-	16.33	0.73	275.60	28	U/OV	G/C	Yes
68+850	-	-	-	-	-	15.6	-	-	-	-	-	-	-	-	-	No
69+110	-	-	-	-	-	13.0	-	-	-	1.20	0.11	-	-	-	F	No
69+340	6.16	9.00	139	14.03	113.0	34.0	1	20.67	-	18.00	0.60	702.67	20	OV	C/B	Yes
71+100	10.96	7.45	337	11.40	110.0	27.8	9	1.25	0.23	0.75	0.12	34.84	3	OV	C/G	Yes
71+290	-	-	-	-	-	14.6	9	-	-	0.22	0.06	-	-	-	F	No
71+600	-	-	-	-	-	21.4	-	-	-	-	-	-	-	-	-	No
71+625	4.70	-	57	14.18	110.2		5	1.85	0.23	0.98	0.05	0.00	35	OV	G/C	Yes
71+760	-	-	-	-	-	33.5	-	-	-	-	-	-	-	-	-	No
71+810	-	-	-	-	-	20.9	-	-	-	-	-	-	-	-	-	No
71+980	3.73	-	152	7.75	73.9	16.8	2	5.70	0.54	4.53	0.25	95.76	17	LWD	G	Yes
72+200	3.05	-	159	15.27	113.7	13.4	8	3.02	0.61	2.15	0.19	40.42	33	LWD	C/B	Yes
73+500	-	-	-	-	-	15.4	13	0.48	0.37	0.50	0.18	7.34	67	OV	G	No
74+770	5.94	-	200	13.50	108.5	24.3	12	0.90	0.42	0.77	0.10	21.87	93	OV	G/C	Yes
74+810	3.05	-	161	14.71	109.8	28.7	5	1.05	0.38	0.45	0.19	30.14	63	OV	F	Yes
75+410	-	7.30	58	13.60	120.0	31.8	3	4.77	0.69	3.93	0.43	151.58	33	LWD	G/C	Yes
77+220	2.81	7.10	56	10.01	79.0	21.4	10	0.83	0.27	0.66	0.15	17.76	7	OV	G/F	Yes
77+770	3.58	-	153	14.80	111.8	-	8	3.23	1.04	1.23	0.16	-	22	OV	G/C	Yes

Station ID	In situ Water Quality					Estimated Length (m)	Gradient (%)	Bankfull Width (m)	Bankfull Depth (m)	Wetted Widths (m)	Wetted Depth (m)	Area (m²)	Cover (%)	Cover	Substrate Bed	Fish Bearing (Yes/No)
	Temperature (°C)	pH	Conductivity (µS/cm)	DO (mg/L)	DO (% Sat)											
78+420	3.90	5.50	114	14.44	110.0	19.5	15	1.98	0.49	1.53	0.14	38.55	18	LWD	C/B	Yes
78+540	-	-	-	-	-	23.0	-	-	-	-	-	-	-	-	-	No
78+980	6.64	7.00	164	12.98	105.9	38.5	1	22.33	-	17.00	0.77	859.83	33	LWD/OV	C/G	Yes
79+380	6.57	7.20	164	13.32	108.6	33.8	1	24.67	-	20.67	0.77	833.73	43	OV	C/G	Yes
80+620	5.05	6.84	52	8.79	72.8	27.8	9	0.32	0.12	0.27	0.09	8.80	60	OV	C/F	Yes
81+120	-	-	-	-	-	30.5	0	0.08	0.08	0.02	-	2.44	80	OV	F	No
81+570	4.77	7.51	791	12.40	103.0	20.1	14	0.30	0.07	0.20	0.05	6.03	33	OV	F/G	No
81+680	-	6.87	366	5.05	39.2	-	11	0.75	0.09	0.40	0.09	-	5	LWD	F	No
81+610	5.04	7.06	839	8.35	69.5	15.3	12	0.18	0.04	0.11	0.02	2.75	-	-	F	No
81+750	2.84	6.93	61	14.00	111.1	35.2	6	1.80	0.59	1.83	0.30	63.36	27	U	S/B	No
83+550	3.50	7.36	197	15.82	119.5	22.3	16	0.90	0.77	1.09	0.19	20.07	52	OV	C/B	No

Note:

Area

DO

Hanna

Sat

YSI

W, E

"_"

B

C

Estimated Length multiplied by the bankfull width

Dissolved Oxygen

HI 9828 Hanna Meter

Saturation

YSI model 556

West, East

No data available or not applicable

Boulder

Cobble

F

G

S

DP

SWD

LWD

OV

U

Fines

Gravel

Sand

Deep Pools

Small Woody Debris

Large Woody Debris

Overhanging Vegetation

Undercut Banks

Table 6 - Selwyn River Watershed Data

Station ID	In situ Water Quality					Estimated Length (m)	Gradient (%)	Bankfull Width (m)	Bankfull Depth (m)	Wetted Widths (m)	Wetted Depth (m)	Area (m²)	Cover (%)	Cover	Substrate Bed	Fish Bearing (Yes/No)
	Temperature (°C)	pH	Conductivity (µS/cm)	DO (mg/L)	DO (% Sat)											
85+160	8.04	4.48	97	13.32	112.5	27.8	2	21.33		19.67	0.83	593.07	45	B	B/C	Yes
87+920	2.75	6.70	70	15.60	115.0	36.3	25	0.81	0.69	0.53	0.05	29.52	88	SWD	C/G	No
89+330	2.67	8.09	15	10.57	80.5	39.1	21	0.63	0.38	0.54	0.16	24.76	37	U	S/C	No
89+410	3.37	7.50	8	9.80	79.5	21.0	24	0.90	0.44	0.88	0.19	18.90	33	U	C/S	No
90+410	-	-	-	-	-	16.9	50	0.33	0.02	0.17	0.02	5.58	-	-	F	No
91+570	1.66	7.03	4	9.82	-	53.5	21	0.65	0.32	0.76	0.14	34.78	50	U	B/C	No
93+040	1.93	4.56	26	15.29	110.5	41.2	29	0.61	0.48	0.81	0.08	24.99	67	LWD	C/G	No
94+550	2.26	7.05	4	9.68	78.3	41.9	9	1.30	0.56	1.27	0.19	54.47	40	U	C/B	Yes
94+660	3.13	4.43	34	13.66	101.9	31.3	16	0.57	0.69	0.43	0.11	17.95	95	OV	B/C	Yes

Table 7 - Yukon Tributary, Mascot Creek and Isaac Creek Watershed Data

Station ID	In situ Water Quality					Estimated Length (m)	Gradient (%)	Bankfull Width (m)	Bankfull Depth (m)	Wetted Widths (m)	Wetted Depth (m)	Area (m²)	Cover (%)	Cover	Substrate Bed	Fish Bearing (Yes/No)
	Temperature (°C)	pH	Conductivity (µS/cm)	DO (mg/L)	DO (% Sat)											
96+190	-	-	-	-	-	20.7	20	0.30	0.17	0.08	0.04	6.21	-	-	F	No
105+620	-	-	-	-	-	24.3	-	0.37	0.45	0.00	0.00	8.99	-	-	B	No
107+920	-	-	-	-	-	24.4	5	0.70	0.18	0.50	0.10	17.08	75	OV	B/C	No
109+800	1.65	5.94	73	13.70	98.2	44.0	10	2.83	0.44	2.53	0.24	124.67	90	B/OV	B/C	Yes

Note:

Area

DO

Hanna

Sat

YSI

W, E

"-"

B

C

Estimated Length multiplied by the bankfull width

Dissolved Oxygen

HI 9828 Hanna Meter

Saturation

YSI model 556

West, East

No data available or not applicable

Boulder

Cobble

F

G

S

DP

SWD

LWD

OV

U

Fines

Gravel

Sand

Deep Pools

Small Woody Debris

Large Woody Debris

Overhanging Vegetation

Undercut Banks

Table 8 - 2013 Fish Sampling Summaries

Electrofishing Effort														
PECG ID	Road Station	UTM Zone	Northing	Easting	Type of Electrofishing	Length (m)	Date	Start Time	End Time	Time (s)	Frequency (Hz)	Voltage (V)	Duty Cycle	Fish Captured
36	47+050	8	6933948	356254	Backpack	200	27/06/2013	9:42	10:54	398	40	200	20	NFC
76	83+550	7	6955434	641077	Backpack	200	27/06/2013	14:15	15:15	643	40	300	20	NFC
78	87+920	7	6958246	638494	Backpack	200	28/06/2013	14:00	14:45	223	40	300	20	NFC
83	93+040	7	6959563	635624	Backpack	200	26/06/2013	13:45	15:10	547	40	350	20	NFC
84	94+550	7	6959720	634674	Backpack	200	26/06/2013	10:55	12:07	633	40	350	20	NFC
85	94+660	7	6959780	634592	Backpack	200	26/06/2013	8:55	10:12	548	40	300	20	NFC
89	109+800	7	6956577	625829	Backpack	220	19/06/2013	-	-	977	-	-	-	NFC
Minnow Trapping Effort														
PECG ID	Road Station	UTM Zone	Northing	Easting	Traps Set	Start Date/Time		End Date/Time		Fish				
36	47+050	8	6933948	356254	2	27/06/2013 11:10		28/06/2013 11:55		NFC				
76	83+550	7	6955434	641077	2	27/06/2013 15:25		28/06/2013 13:10		NFC				
78	87+920	7	6958246	638494	2	27/06/2013 17:15		28/06/2013 15:00		NFC				
83	93+040	7	6959563	635624	2	26/06/2013 15:20		27/06/2013 16:30		NFC				
84	94+550	7	6959720	634674	2	26/06/2013 12:15		28/06/2013 12:45		NFC				
85	94+660	7	6959780	634592	2	26/06/2013 10:30		28/06/2013 12:40		NFC				
89	109+800	7	6956577	625829	2	26/06/2013 16:30		28/06/2013 11:20		NFC				

Note: "NFC" No fish caught
 "-" Not sampled / No data available

Table 9 - Airstrip and Airstrip Access Road Summary

Watershed	PECG ID	Road Station	UTM Zone	Northing	Easting	Stream Crossing	Assessment Completed*			Sampled (year)	Sampling Method	Species Captured	Fish Bearing	Habitat Assessment (F/P/N)
							2010	2011	2013					
Dip Creek	UM	10+330	7	6944918	605896	Dip Creek Tributary	-	✓	✓	Yes (2011)	EF	NFC	Y	P
	90	11+600	7	6945600	606962	N/A	-	-	✓	No	-	-	N/A	N
	91	11+750	7	6945695	607072	Dip Creek Tributary	-	-	✓	No	-	-	N	P
	92	11+840	7	6945760	607146	Dip Creek Tributary	-	-	✓	No	-	-	Y	P
	93	13+070	7	6946172	608242	Dip Creek Tributary	-	✓	✓	No	-	-	N	P
	94	14+650	7	6947303	609094	Dip Creek	-	✓	✓	Yes (2011)	EF, AG	GR, CCR, CH	Y	P
	95	16+580	7	6948592	610055	Casino Creek Tributary	-	✓	✓	Yes (2011)	EF	NFC	Y	P
	96	17+620	7	6949543	610265	Austin Creek	-	✓	✓	Yes (2011)	EF	NFC	N	P
	97	20+300	7	6951968	610283	Brynelson Creek Tributary	-	-	✓	No	-	-	Y	P
	98	20+750	7	6952411	610133	Brynelson Creek	-	✓	✓	Yes (2011)	EF	NFC	Y	P
	99	20+960	7	6952522	610239	Brynelson Creek Tributary	-	-	✓	No	-	-	N	P
	100	21+310	7	6952327	610518	N/A	-	✓	✓	No	-	-	N/A	N

- No Data
Sampling Method EF - Electrofishing; VO - Visual Observations; AG - Angling; MT - Minnow Trapping; SN - Seine Net
Species Captured NFC - No Fish Captured; GR - Arctic Grayling; CCG - Slimy Sculpin; CH - Chinook Salmon
Fish Bearing Y - Assumed Fish Bearing; N - Assumes Non-Fish Bearing; N/A - Not Applicable; No Crossing - No Crossing Identified
Habitat Assessment F - Full Habitat Assessment Completed (Site Card Available); P - Partial Habitat Assessment Completed for Impact Assessment and Crossing Design;
N - No Habitat Assessment Completed
2011 Casino Airstrip Road data derived from Summit (2012b)
2013 Freegold Road Upgrade, Freegold Road Extension, and Airstrip data collected by PECG

Table 10 - Airstrip and Airstrip Access Road Data (Dip Creek Watershed)

Station ID	In situ Water Quality					Estimated Length (m)	Gradient (%)	Bankfull Width (m)	Bankfull Depth (m)	Wetted Widths (m)	Wetted Depth (m)	Area (m²)	Cover (%)	Cover	Substrate Bed	Fish Bearing (Yes/No)
	Temperature (°C)	pH	Conductivity (µS/cm)	DO (mg/L)	DO (% Sat)											
10+330	8.32	6.90	0.35	12.08	102.9		5	4.88	0.30	3.97	0.19	0.00	73	LWD/OV	F	Yes
11+600	-	-	-	-	-	9.6	-	-	-	-	-	-	-	-	-	No
11+750	-	-	-	-	-	13.3	4	1.08	0.30	0.47	0.14	14.30	93	OV	F	No
11+840	8.14	6.38	550	12.34	104.7	10.9	5	1.68	0.43	0.91	0.21	18.31	93	OV	F/G	Yes
13+070	10.39	6.50	170	9.73	87.0	11.6	8	1.05	0.34	0.75	0.15	12.18	83	OV	F	No
14+650	7.79	7.39	80	8.50	77.0	18.3	1	17.60	-	8.10	-	322.08	80	DP/U	S/F	Yes
16+580	8.61	7.67	91	6.40	59.5	24.8	9	0.94	0.44	0.91	0.34	23.31	37	OV	F	Yes
17+620	4.44	5.32	305	14.15	109.3	10.8	5	0.95	0.53	0.99	0.28	10.26	100	OV	F	No
20+300	4.92	7.29	185	7.55	64.2	10.0	10	0.49	0.30	0.49	0.23	4.90	20	U/OV	F/S	Yes
20+750	11.20	7.62	92	8.69	85.5	9.0	3	2.52	0.57	2.58	0.33	22.65	27	OV	C/S	Yes
20+960	4.05	6.58	398	14.31	109.3	12.2	11	1.43	0.35	0.56	0.06	17.49	65	OV	F	No
21+310	-	-	-	-	-	33.0	-	-	-	-	-	-	-	-	-	No

Note:

Area

DO

Hanna

Sat

YSI

W, E

"_"

Estimated Length multiplied by the bankfull width

Dissolved Oxygen

HI 9828 Hanna Meter

Saturation

YSI model 556

West, East

No data available or not applicable

F

G

S

DP

SWD

LWD

OV

Fines

Gravel

Sand

Deep Pools

Small Woody Debris

Large Woody Debris

Overhanging Vegetation

B

C

U

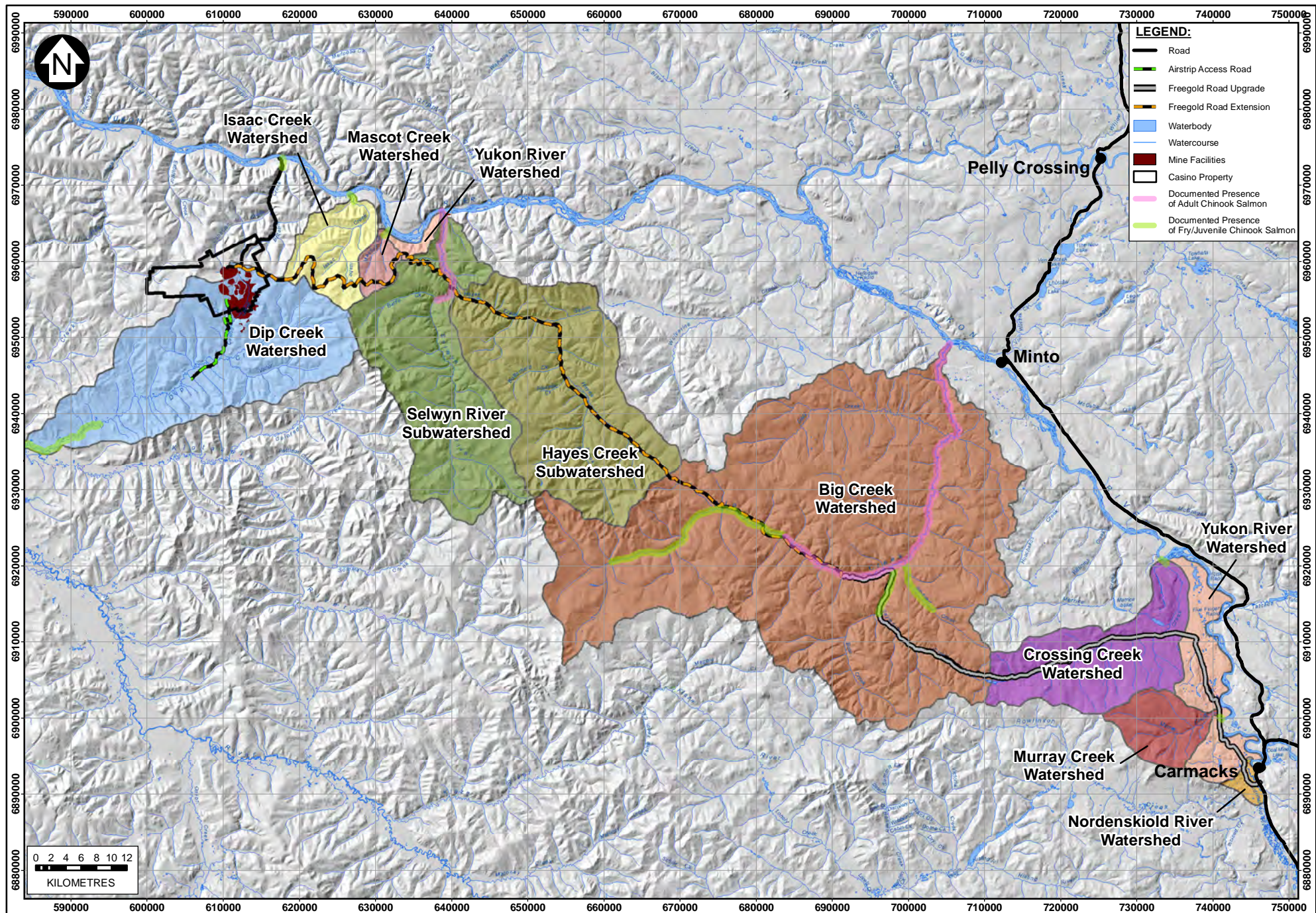
Boulder

Cobble

Undercut Banks



7 Figures



PREPARED BY:



PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHK'D	J. Cole
APP'D	J. Cole
REV	R. Palmer
DATE	12Sept'13

NOTES:

1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomaticsyukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 7N
3. COORDINATE GRID: METRES
4. SCALE: 1:650,000
5. Documentation on the presence of adult and fry/juvenile chinook salmon provided by DFO (1985), DFO (1994), Summit (2011) and EDI (2011)

CASINO
COPPER AND GOLD

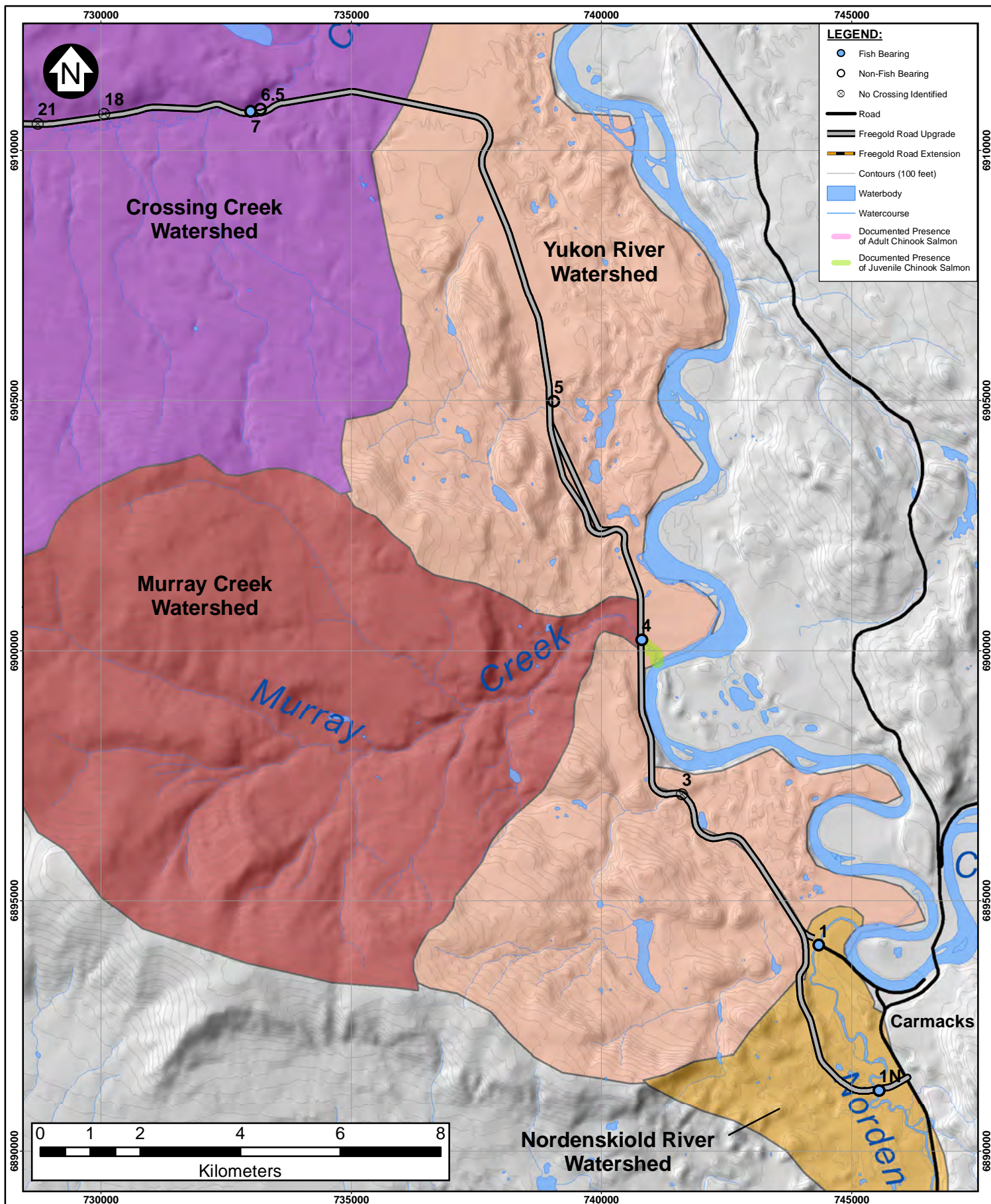
CASINO PROJECT

**Overview Map of the Casino
Mine Roads and Watersheds**

FIGURE 1

BASELINE REPORT

PN 10011



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DESIGNED	D. Turner
DRAWN	D. Turner
CHKD	J. Cole
APP'D	J. Cole
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2. PROJECTION: NAD 1983 UTM Zone 7N
3. COORDINATE GRID: METRES
4. SCALE: 1:100,000
5. Documentation of presence of adult and juvenile chinook salmon provided by DFO (1985), DFO (1994), Summit (2011) and EDI (2011)

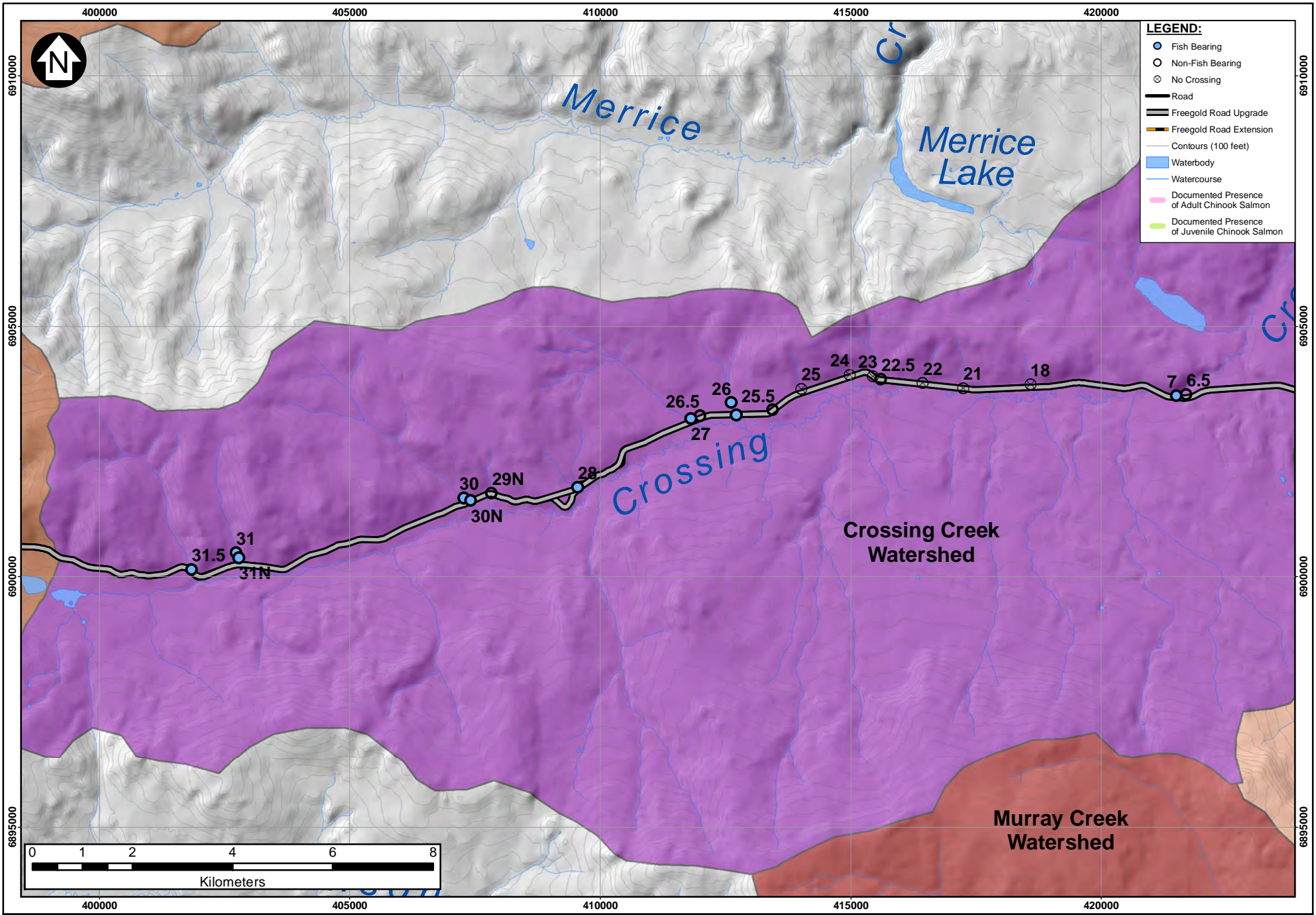
CASINO
COPPER AND GOLD

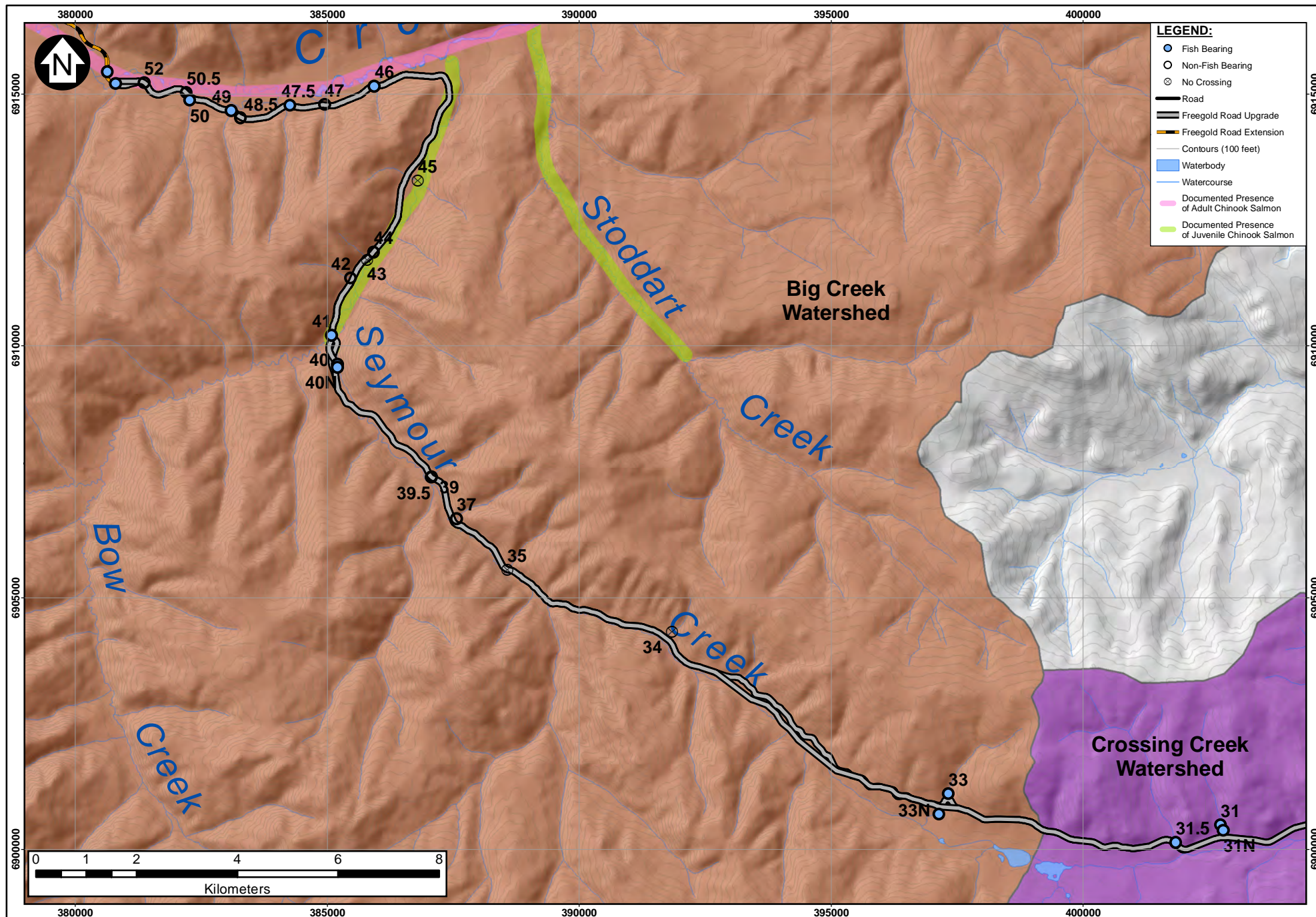
CASINO PROJECT

**Freegold Road Upgrade
Fish Presence / Absence
(Map 1)**

FIGURE 2

BASELINE REPORT
PN 10011





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GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHK'D	J. Cole
APP'D	J. Cole
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DATE	12Sept'13

NOTES:

1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomaticsyukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 8N
3. COORDINATE GRID: METRES
4. SCALE: 1:100,000
5. Documentation of presence of adult and juvenile chinook salmon provided by DFO (1985), DFO (1994), Summit (2011) and EDI (2011)

CASINO
COPPER AND GOLD

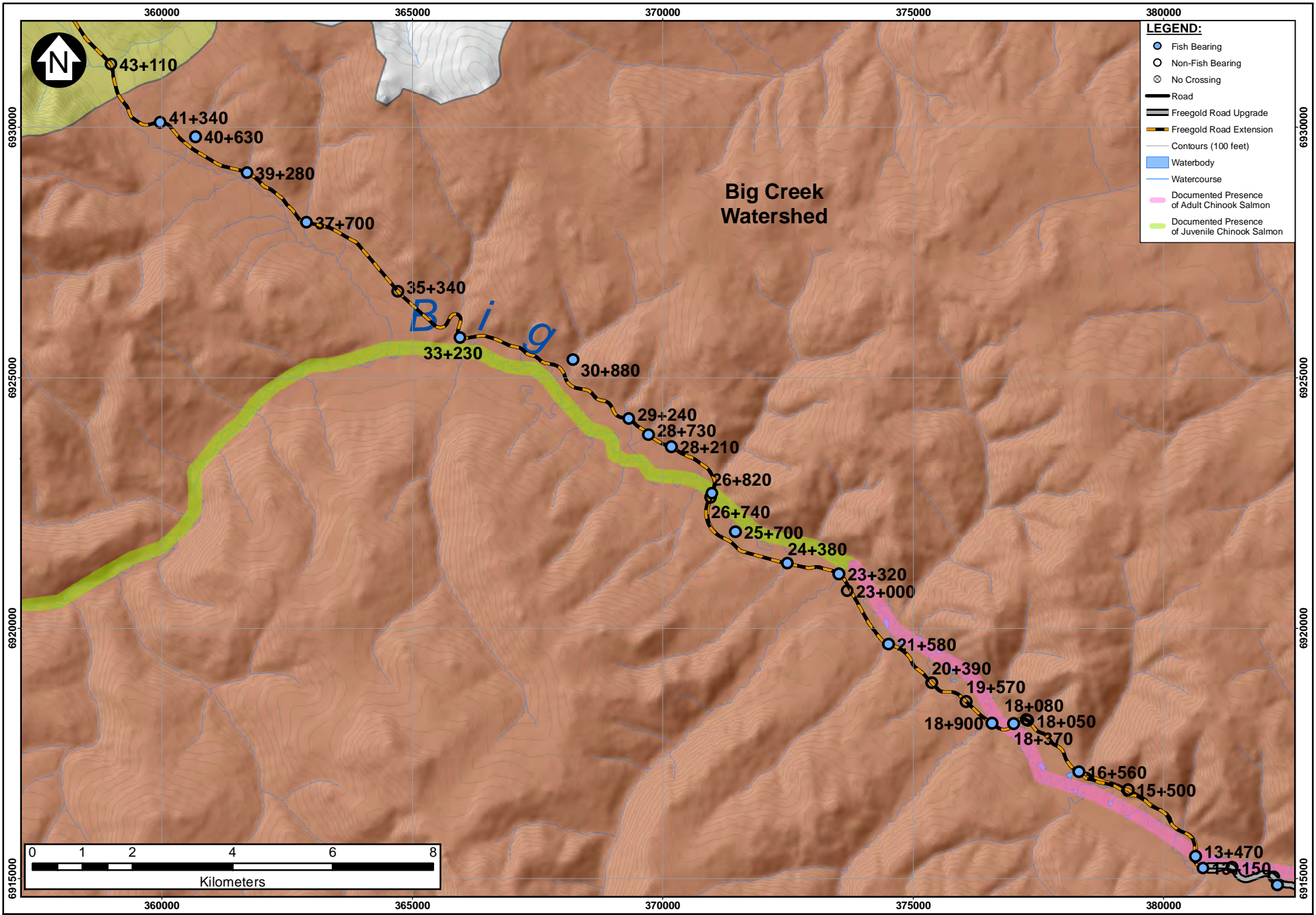
CASINO PROJECT

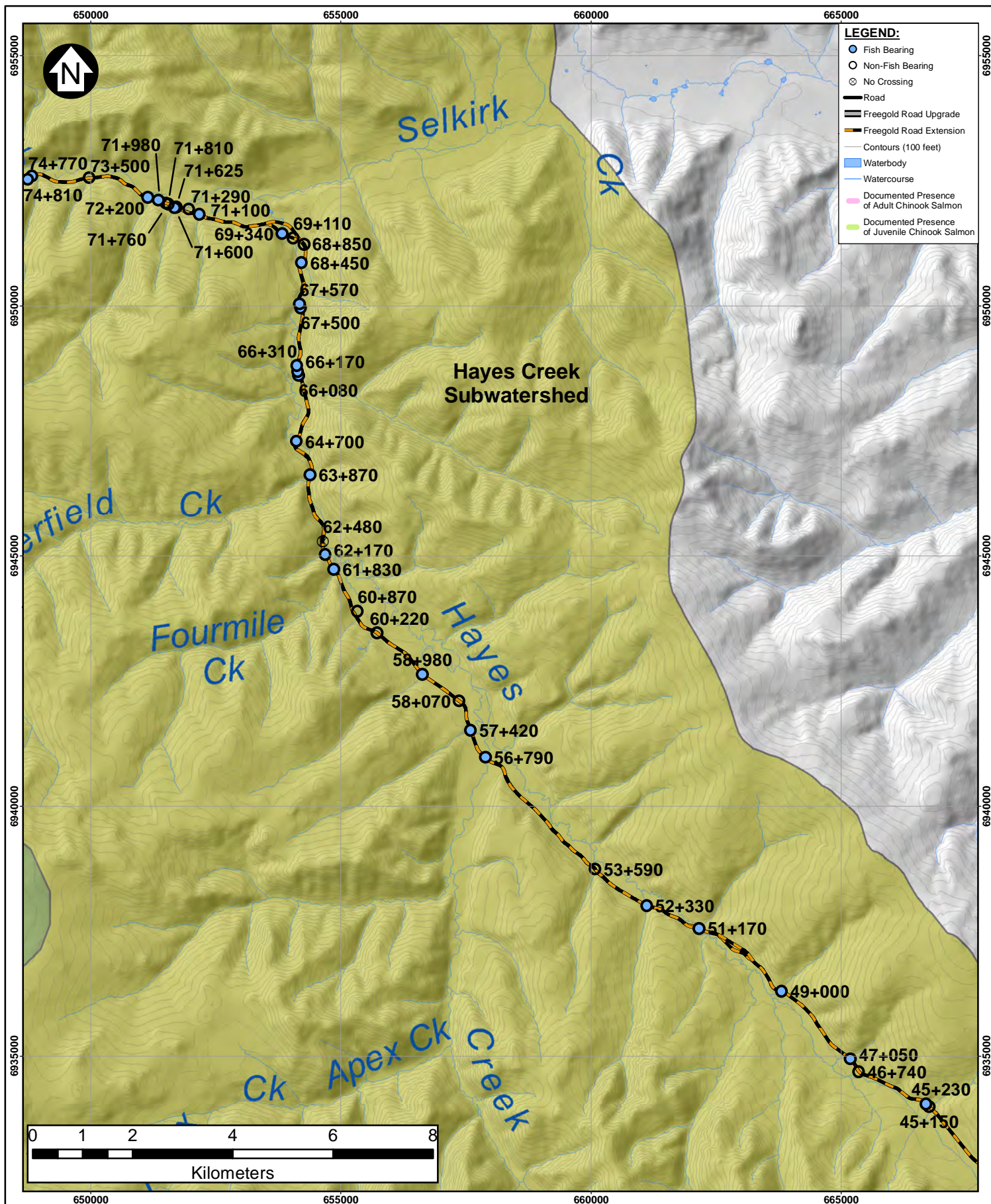
**Freegold Road Upgrade
Fish Presence / Absence
(Map 3)**

FIGURE 4

BASINELINE REPORT

PN 10011





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GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHKD	J. Cole
APP'D	J. Cole
REV	R. Palmer
DATE	12Sept'13

NOTES:

1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomatics.yukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 7N
3. COORDINATE GRID: METRES
4. SCALE: 1:100,000
5. Documentation on the presence of adult and fry/juvenile chinook salmon provided by DFO (1985), DFO (1994), Summit (2011) and EDI (2011)

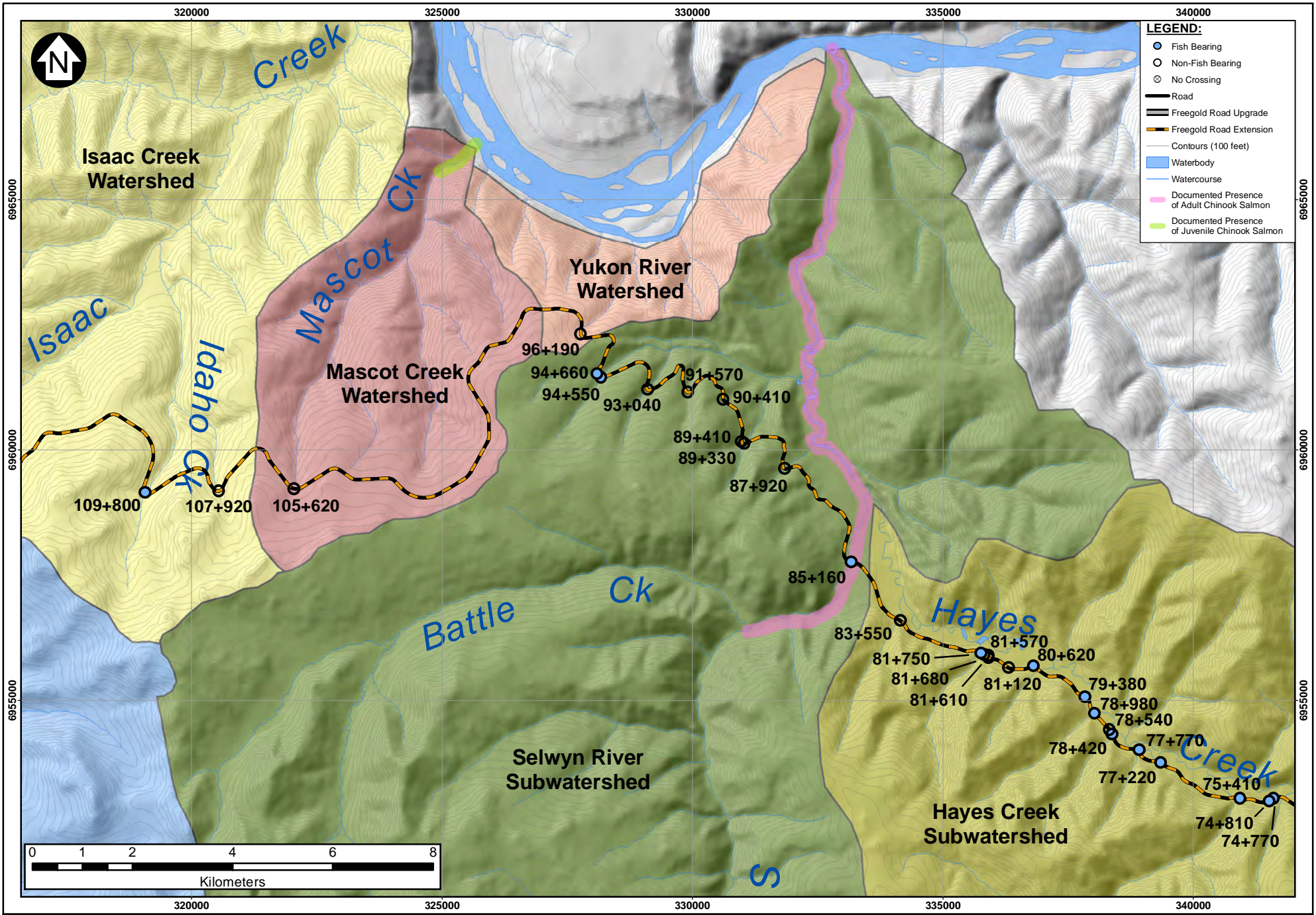
CASINO
COPPER AND GOLD

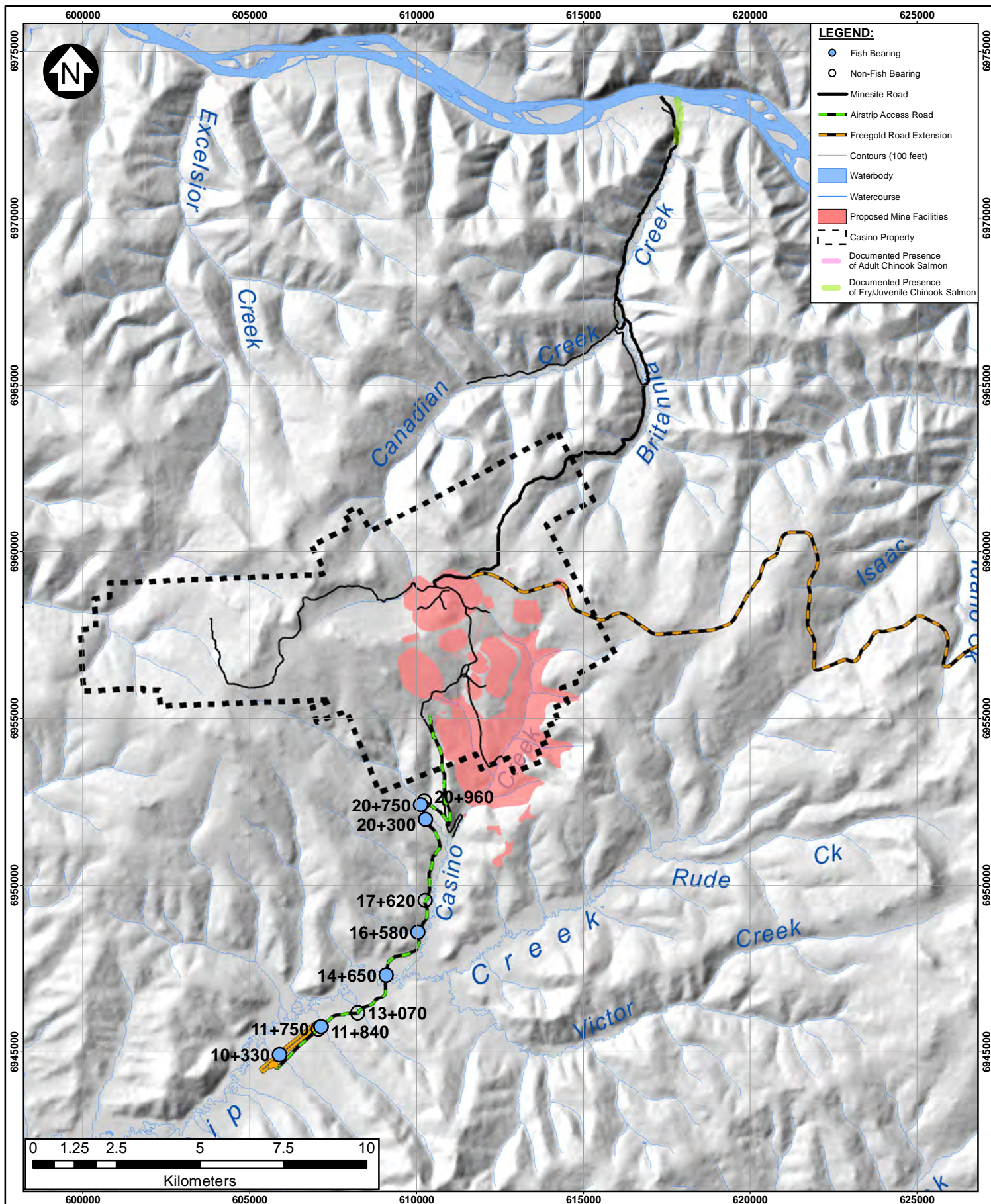
CASINO PROJECT

**Freegold Road Extension
Fish Presence / Absence
(Map 2)**

FIGURE 6

BASINELINE REPORT
PN 10011





PREPARED BY:



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ENVIRONMENTAL
CONSULTING
GROUP INC.

DESIGNED D. Turner

DRAWN D. Turner

CHKD J. Cole

APP'D J. Cole

REV R. Palmer

DATE 12Sept'13

NOTES:

1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomatics.yukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 7N
3. COORDINATE GRID: METRES
4. SCALE: 1:150,000
5. Documentation of the presence of adult and fry/juvenile chinook salmon provided by DFO (1985), DFO (1994), Summit (2011) and EDI (2011)

CASINO
COPPER AND GOLD

CASINO PROJECT

**Airstrip and Airstrip
Access Road
Fish Presence / Absence**

FIGURE 8

BASELINE REPORT

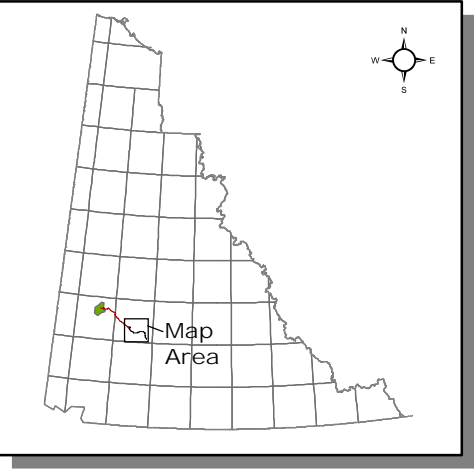
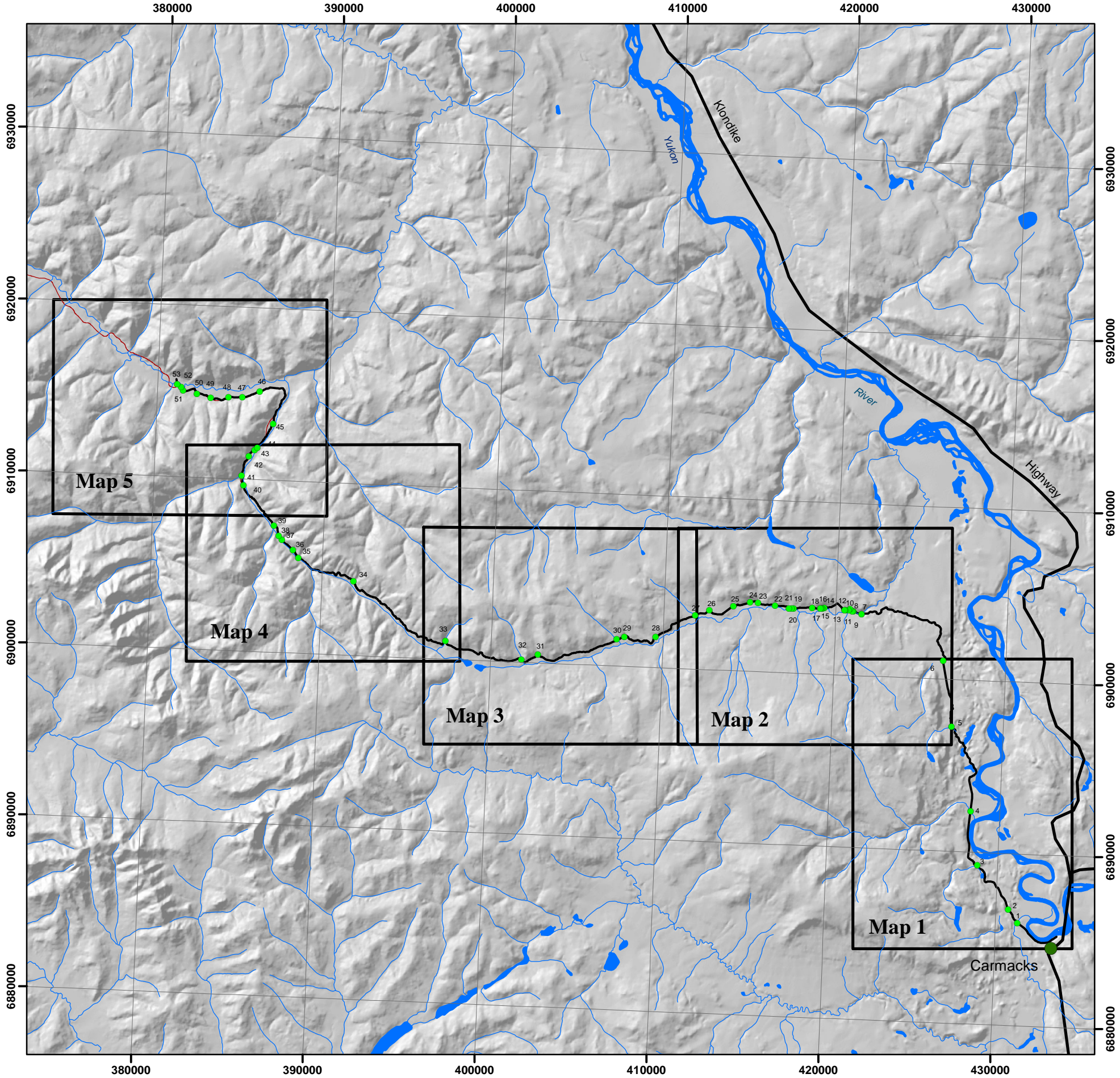
PN 10011

Appendix A

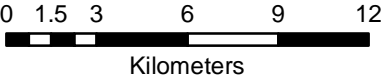
GIS Stream Gradient Assessment of the Freegold Road Upgrade and Extension

NUMBER	DISTANCE	X	Y
1	0	431267	6885976
2	0.99	430710	6886772
3	4.58	428819	6889244
4	8.1	428307	6892374
5	14	426998	6897278
6	18.04	426321	6901080
7	25.62	421510	6903613
8	26.16	421002	6903719
9	26.23	420934	6903724
10	26.45	420816	6903841
11	26.56	420721	6903808
12	26.76	420538	6903776
13	26.81	420483	6903769
14	28.29	419304	6903861
15	28.4	419196	6903835
16	28.46	419133	6903833
17	28.53	419070	6903822
18	29.02	418594	6903853
19	30.11	417540	6903757
20	30.25	417397	6903759
21	30.39	417250	6903774
22	31.23	416439	6903880
23	32.26	415443	6904009
24	32.75	414979	6904045
25	33.79	414012	6903767
26	35.49	412617	6903472
27	36.4	411811	6903150
28	39.17	409548	6901780
29	41.38	407741	6901716
30	41.88	407285	6901568
31	46.93	402734	6900480
32	48.08	401794	6900161
33	53.1	397330	6901099
34	60.39	391846	6904328
35	64.3	388575	6905560
36	64.89	388238	6906012
37	65.76	387569	6906565
38	66.06	387384	6906784
39	66.78	387074	6907392
40	69.81	385203	6909633
41	70.42	385089	6910209
42	71.66	385468	6911340
43	72.18	385785	6911722
44	72.37	385925	6911857
45	74.04	386796	6913286
46	77.79	385937	6915155
47	78.89	384948	6914783
48	79.76	384130	6914718
49	80.87	383096	6914666
50	81.75	382277	6914869
51	82.77	381481	6915035
52	82.98	381366	6915218

NOTES:
NUMBER = Stream Crossing
DISTANCE in kilometers
KM 0 is Nordenskiöld River Crossing



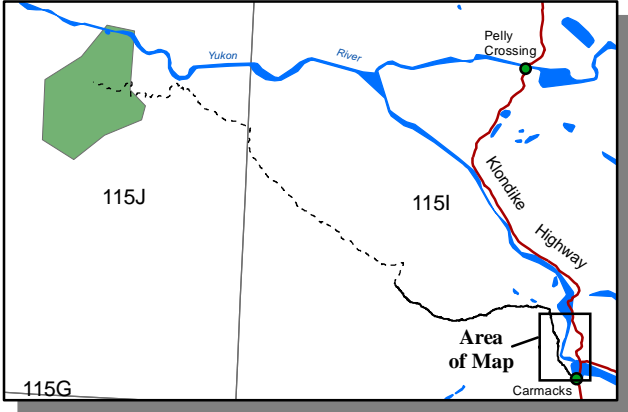
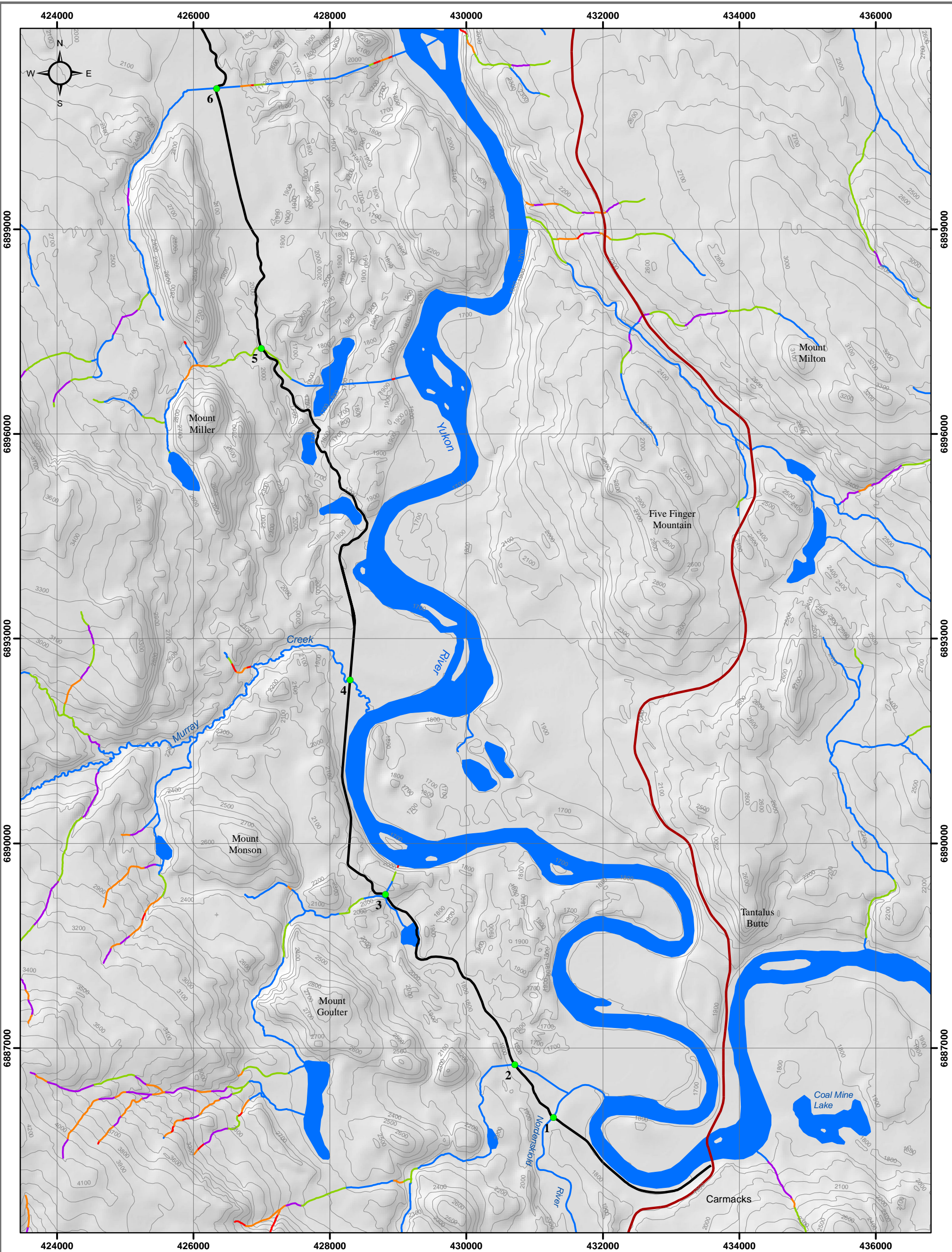
- Legend**
- Casino Mine Area
 - Freegold Road Map Series
 - Highway
 - Freegold Road
 - Proposed Casino Road
 - Stream Crossings



**Location Map for the
Map Series:
Stream Gradients Along
the Freegold Road**



Drawing prepared by K.Pelletier, Ibex Consulting
May 2012
Baseline data: <http://geogratis.cgdi.gc.ca/geogratis>
UTM Zone 8N, NAD 83
Scale: 1:250,000 on 11 x 17" format



LEGEND

- Casino Mine Area
- KlondikeHwy
- FreegoldRoad
- Freegold Road Extension
- Stream Crossings

NOTE: See Location Map for distance along road for each stream crossing.

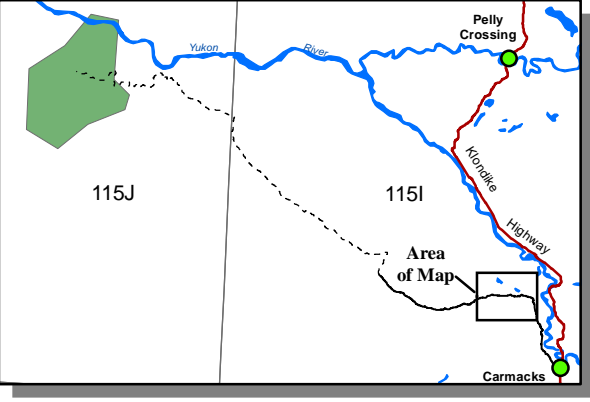
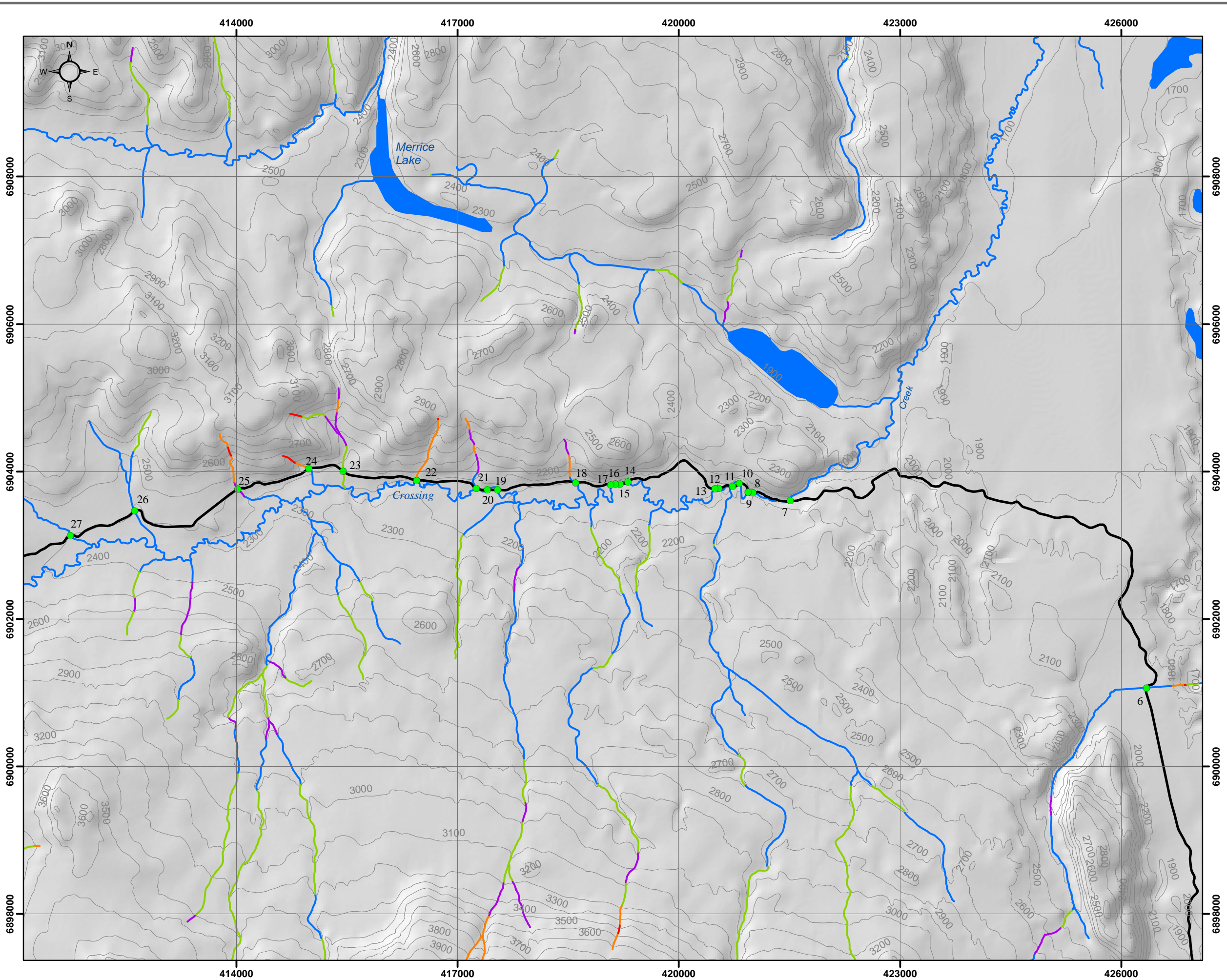
- Creeks
- Gradient in Percent
- 0.0 - 5.0
 - 5.0 - 10.0
 - 10.0 - 15.0
 - 15.0 - 25.0
 - 25.0 - 45.0

Freegold Road Map Series

MAP 1 of 4



Drawing prepared by K.Pelletier, Ibex Consulting
May 2012
Baseline data: <http://geogratis.cgdi.gc.ca/geogratis>
<http://www.geogratisyukon.ca/data>
NAD 83, UTM Zone 8N
Scale: 1:50,000 on 11 x 17" format



Legend

- Casino Mine Area
- Freegold Road
- Freegold Road Extension

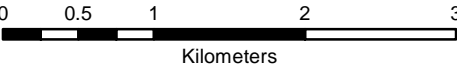
Stream

Gradient in Percent

- 0 - 5.0
- 5.0 - 10.0
- 10.0 - 15.0
- 15.0 - 25.0
- 25.0 - 45.0

- Stream Crossings

NOTE: See Location Map for distance along road for each stream crossing.



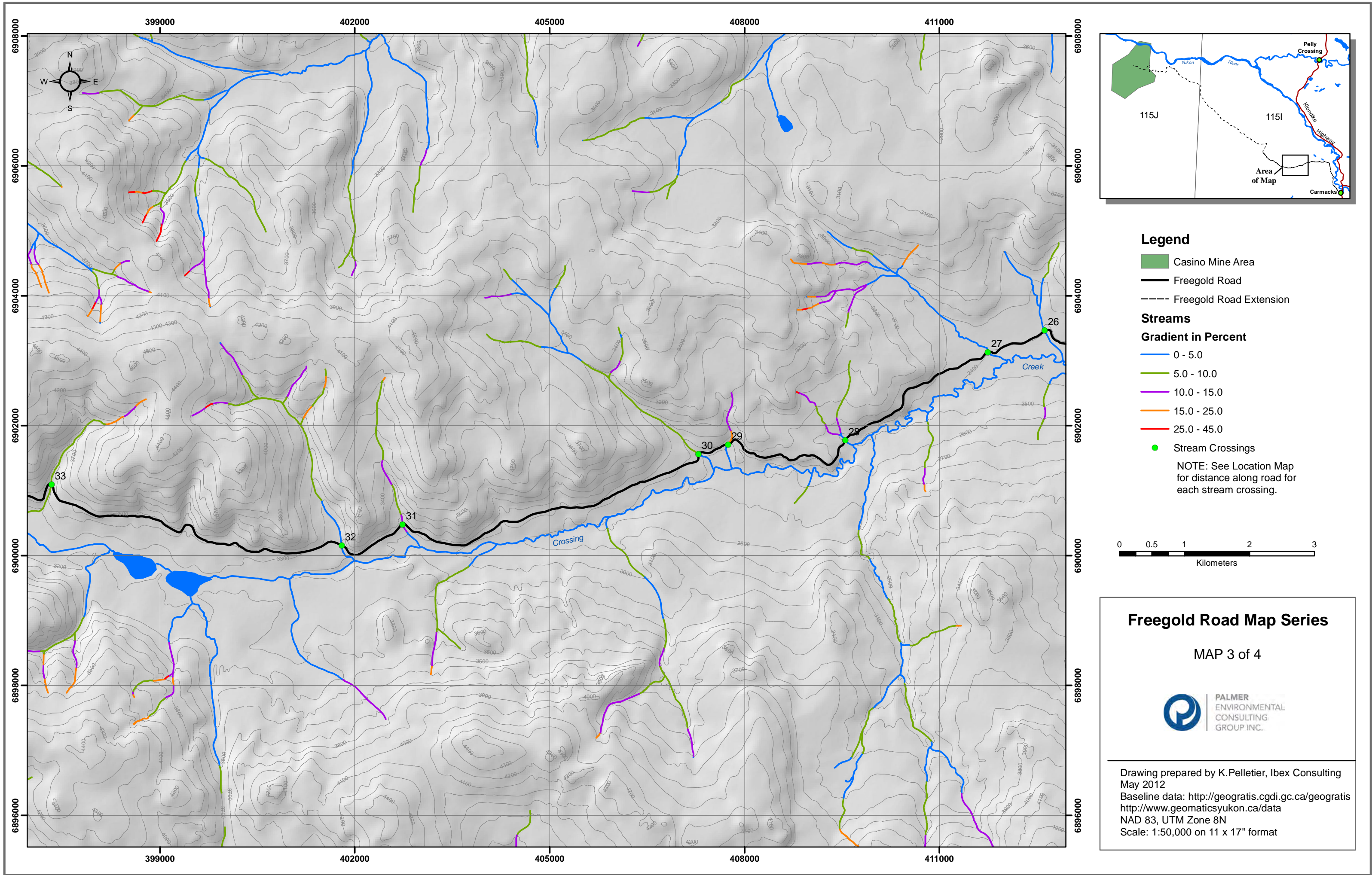
Freegold Road Map Series

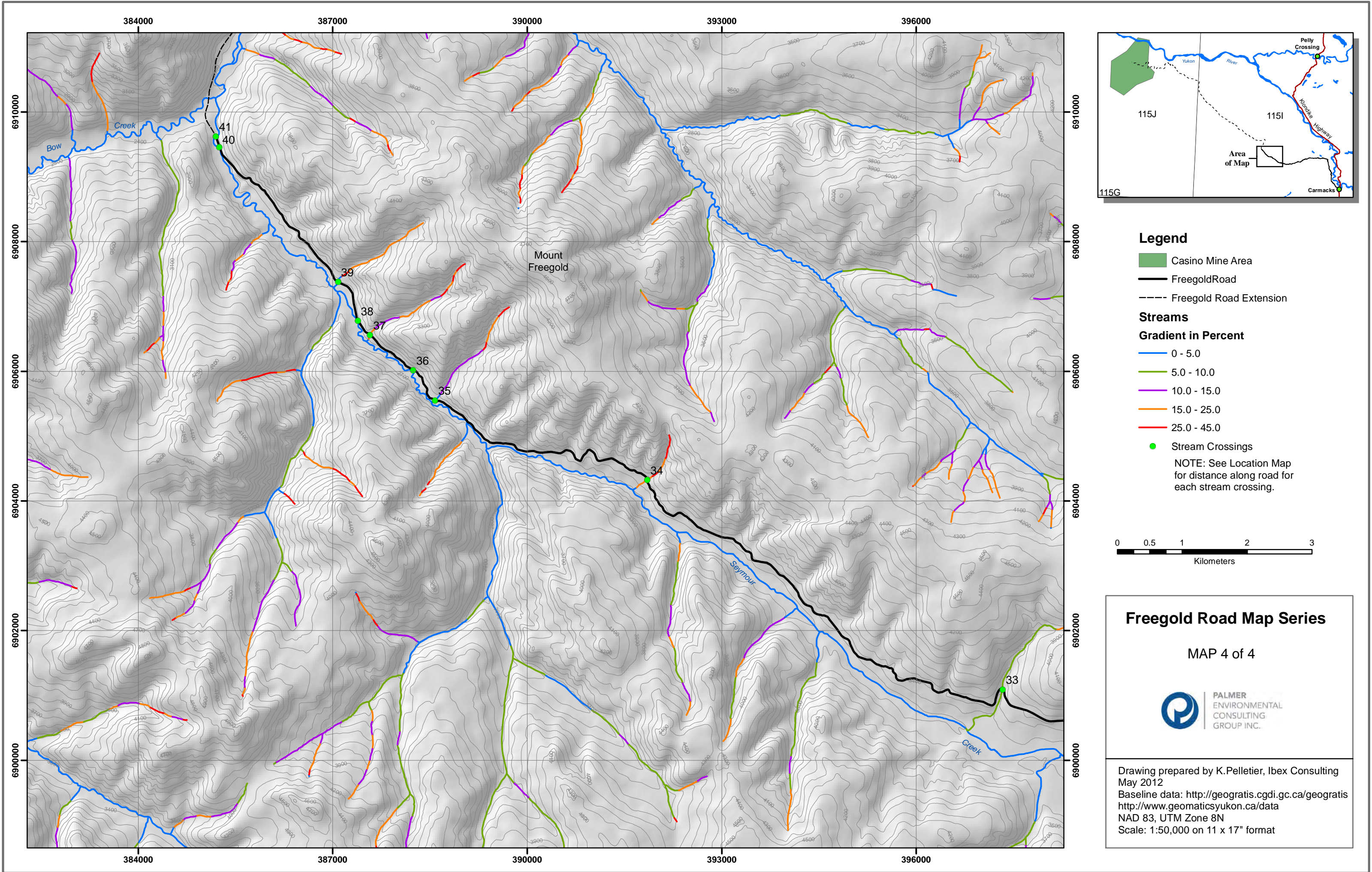
MAP 2 of 4

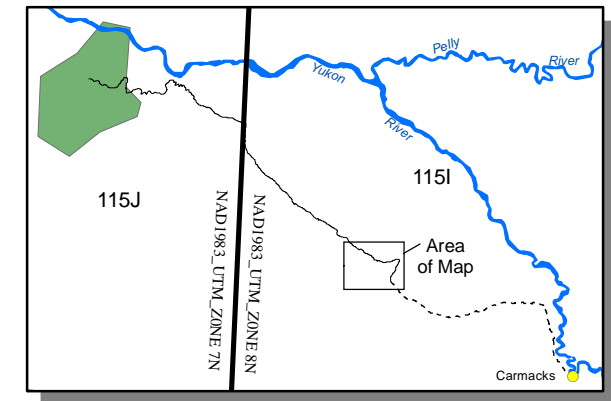
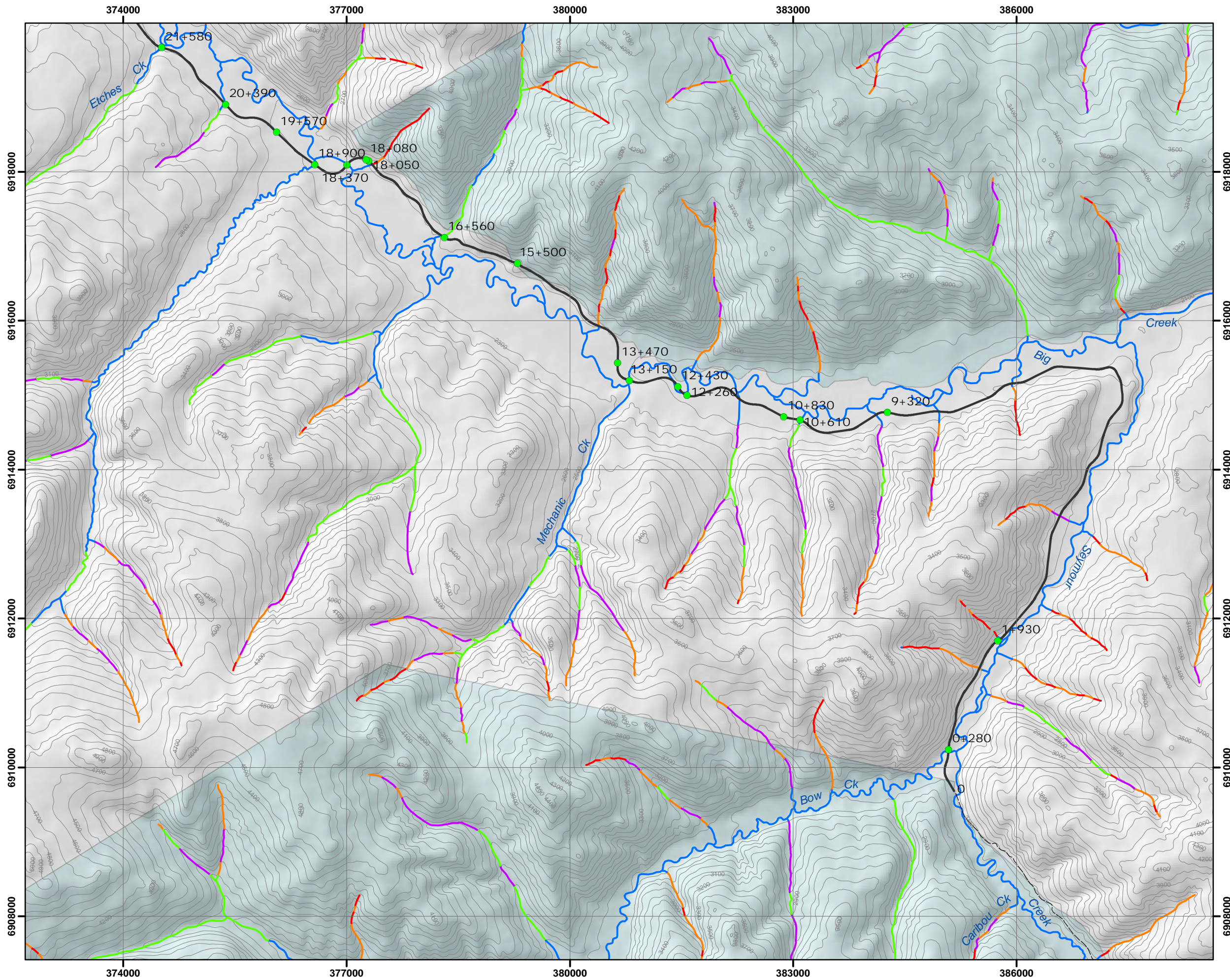


PALMER
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GROUP INC.

Drawing prepared by K. Pelletier, Ibex Consulting
May 2012
Baseline data: <http://geogratis.cgdi.gc.ca/geogratis>
<http://www.geomaticsyukon.ca/data>
NAD 83, UTM Zone 8N
Scale: 1:50,000 on 11 x 17" format

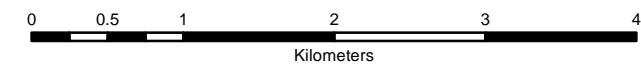






Legend

- Casino Mine Area
- First Nation Settlement Land
- Freegold Road
- Freegold Road Extension
- Streams
- Gradient in Percent
 - 0.0 - 5.0
 - 5.0 - 10.0
 - 10.0 - 15.0
 - 15.0 - 25.0
 - 25.0 - 45.0
- Stream Crossings (distance)

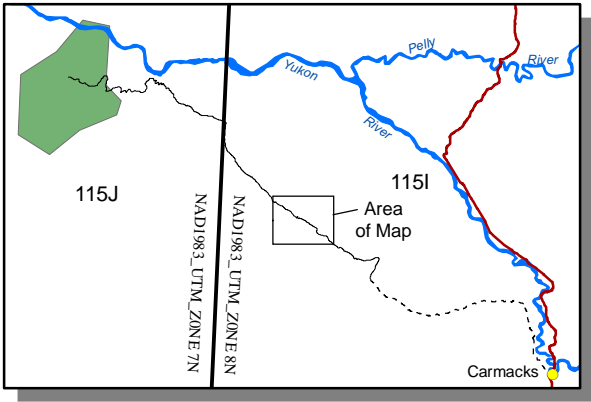
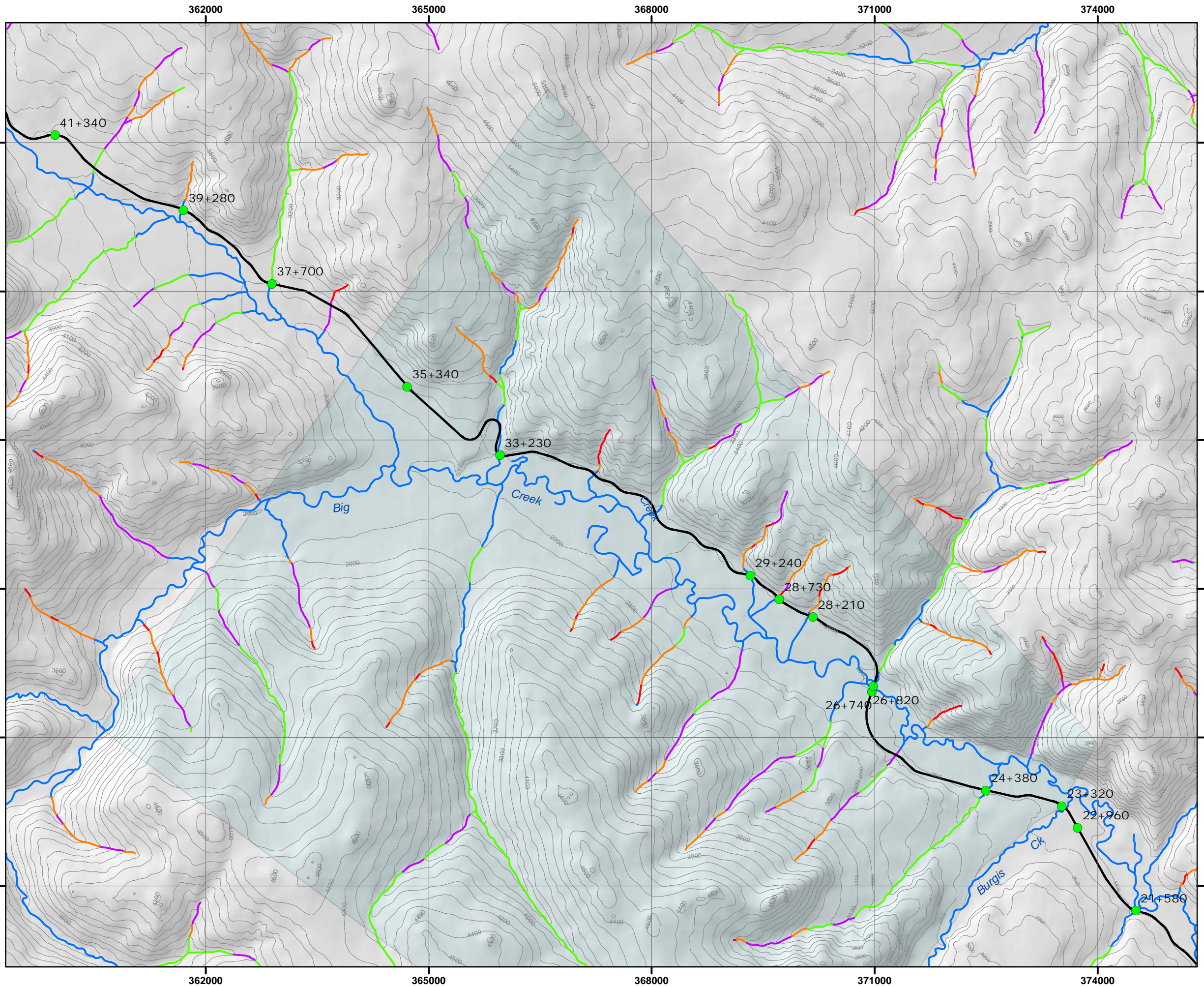


Freegold Road Extension Map Series

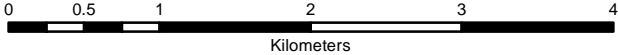
MAP 1 of 7



Drawing prepared by K. Pelletier, Ibex Consulting
May 2012
Baseline data: <http://geogratis.cgdi.gc.ca/geogratis>
<http://www.geomaticsyukon.ca/data>
NAD 83, UTM Zone 8N
Scale: 1:50,000 on 11 x 17" format



- Legend
- Casino Mine Area
 - First Nation Settlement Land
 - Klondike Highway
 - Freegold Road Extension
 - Freegold Road
- Streams
- Gradient in Percent
- 0.0 - 5.0
 - 5.0 - 10.0
 - 10.0 - 15.0
 - 15.0 - 25.0
 - 25.0 - 45.0
- Stream Crossings (distance)

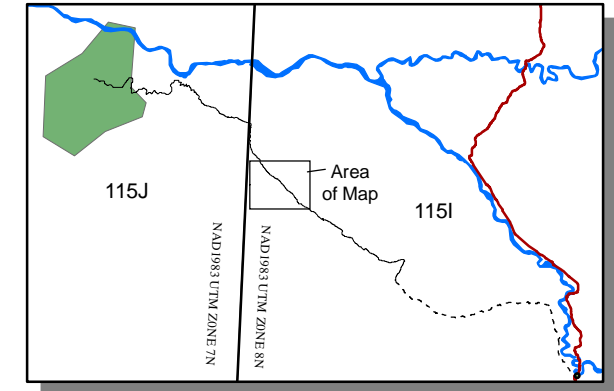
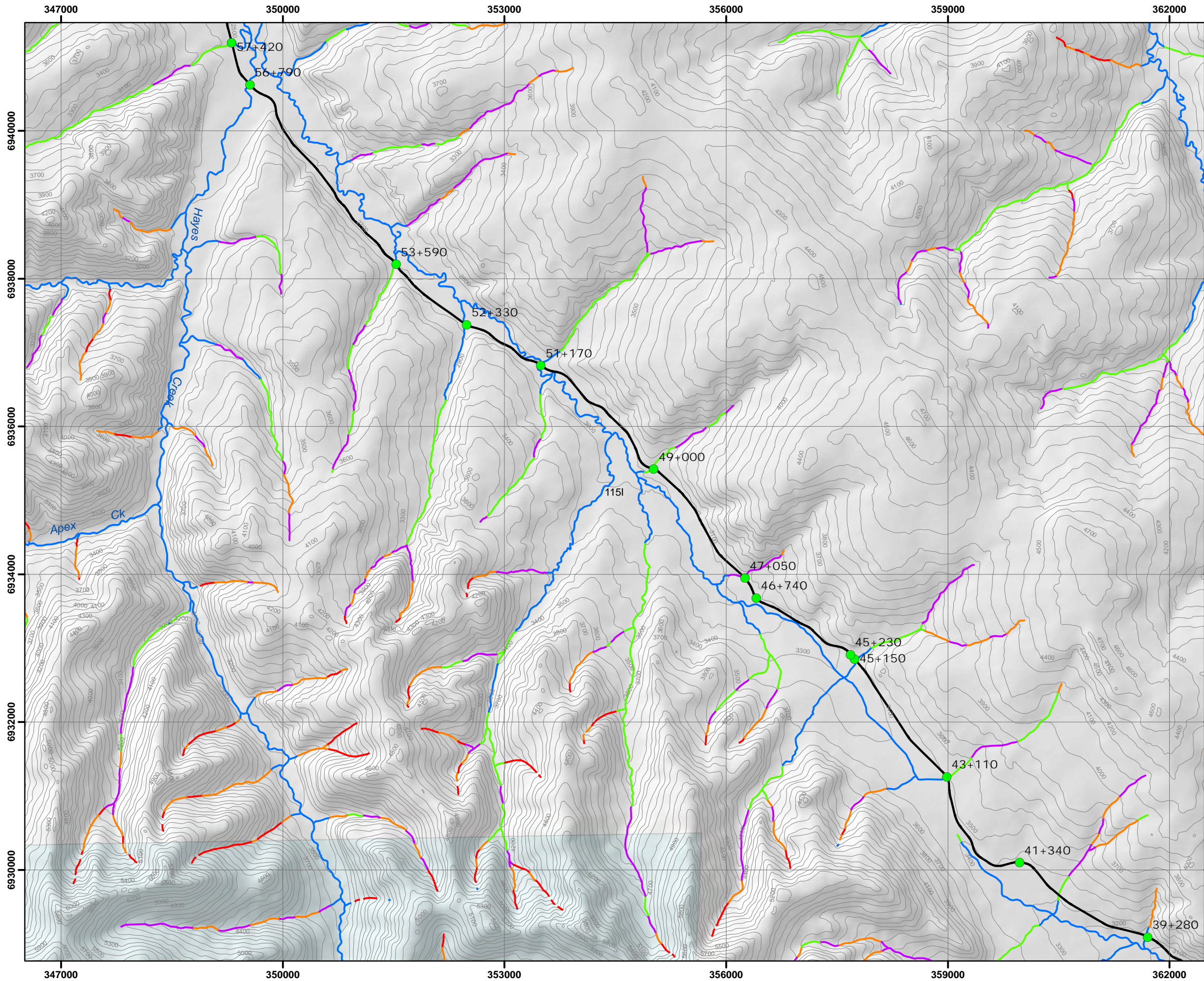


Freegold Road Extension Map Series

MAP 2 of 7

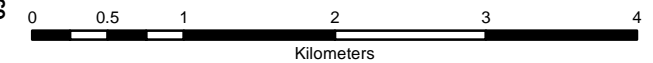


Drawing prepared by K.Pelletier, Ibex Consulting
May 2012
Baseline data: <http://geogratis.cgdi.gc.ca/geogratis>
<http://www.geomatics Yukon.ca/data>
NAD 83, UTM Zone 8N
Scale: 1:50,000 on 11 x 17" format



Legend

- Casino Mine Area
 - First Nation Settlement Land
 - Klondike Highway
 - Freegold Road Extension
 - Freegold Road
- Streams
- Gradient in Percent
- 0.0 - 5.0
 - 5.0 - 10.0
 - 10.0 - 15.0
 - 15.0 - 25.0
 - 25.0 - 45.0
- Stream Crossings (distance in km)

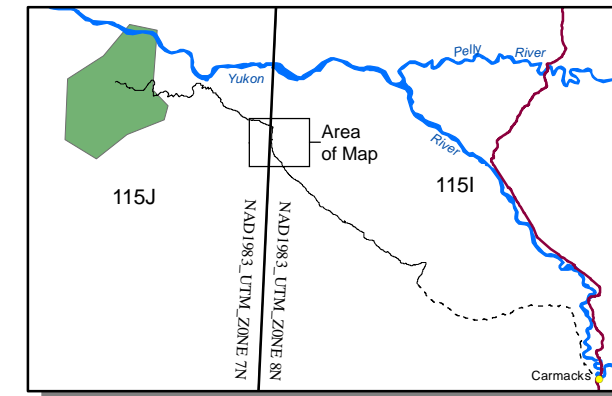
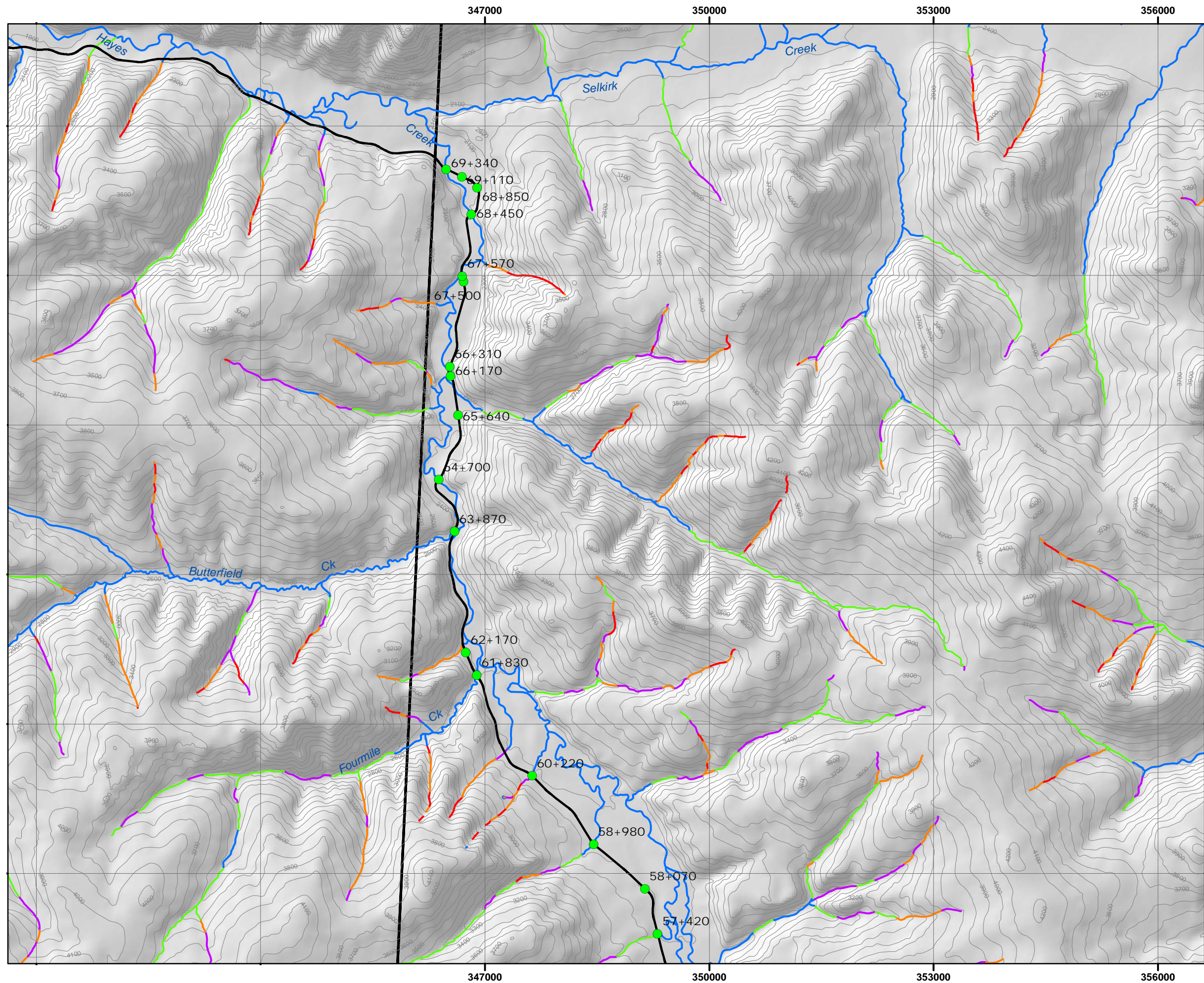


Freegold Road Extension Map Series

MAP 3 of 7



Drawing prepared by K.Pelletier, Ibex Consulting
May 2012
Baseline data: <http://geogratis.cgdi.gc.ca/geogratis>
<http://www.geomaticsyukon.ca/data>
NAD 83, UTM Zone 8N
Scale: 1:50,000 on 11 x 17" format



Legend

- Freegold Road
- Klondike Highway
- Freegold Road Extension

Streams

Gradient in Percent

- 0.0 - 5.0
- 5.0 - 10.0
- 10.0 - 15.0
- 15.0 - 25.0
- 25.0 - 45.0
- Stream Crossings (distance in Km)

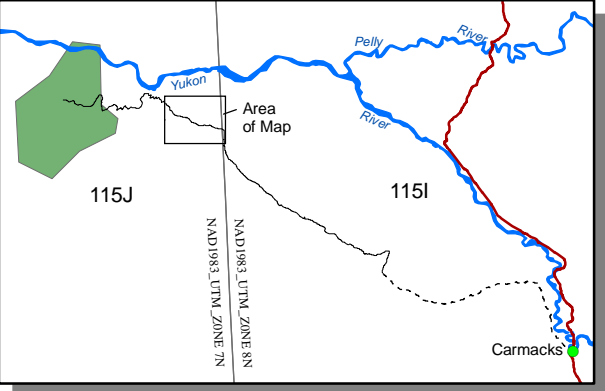
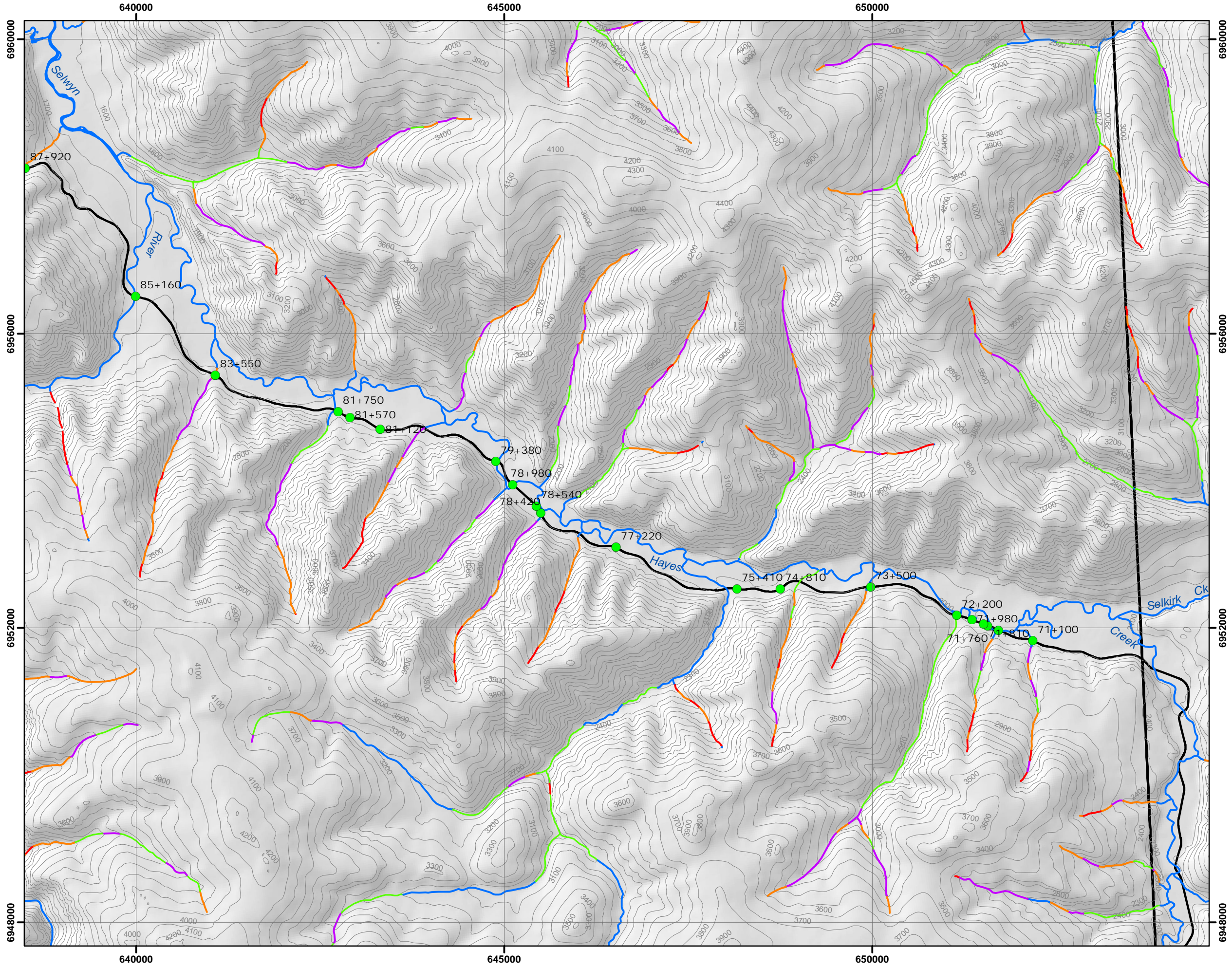


Freegold Road Extension Map Series

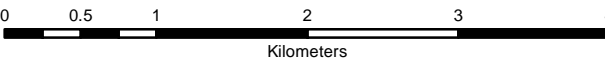
MAP 4 of 7



Drawing prepared by K. Pelletier, Ibex Consulting
May 2012
Baseline data: <http://geogratis.cgdi.gc.ca/geogratis>
<http://www.geomatics Yukon.ca/data>
NAD 83, UTM Zone 8N
Scale: 1:50,000 on 11 x 17" format



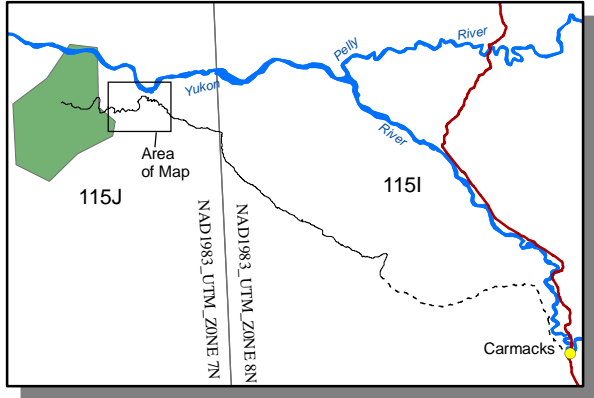
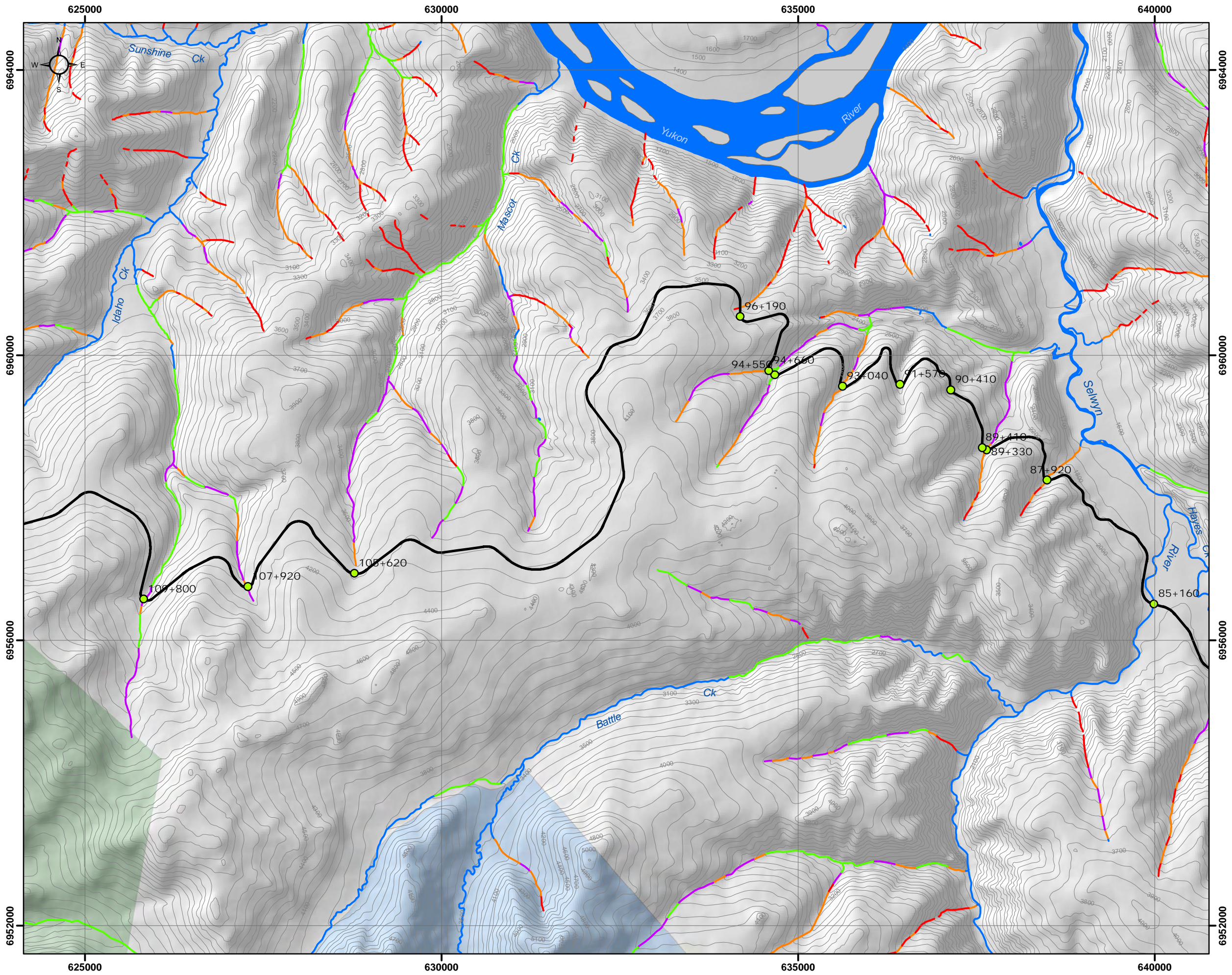
- Legend
- Casino Mine Area
 - KlondikeHwy
 - Freegold Road Extension
 - FreegoldRoad
 - Streams
 - Gradient in Percent
 - 0.0 - 5.0
 - 5.0 - 10.0
 - 10.0 - 15.0
 - 15.0 - 25.0
 - 25.0 - 45.0
 - Stream Crossings (distance in Km)



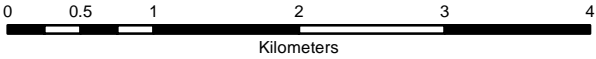
**Freegold Road Extension
Map Series**
MAP 5 of 7



Drawing prepared by K.Pelletier, Ibex Consulting
May 2012
Baseline data: <http://geogratis.cgdi.gc.ca/geogratis>
<http://www.geomatics Yukon.ca/data>
NAD 83, UTM Zone 7N
Scale: 1:50,000 on 11 x 17" format



- Legend
- Casino Mine Area
 - Klondike Highway
 - Freegold Road Extension
 - Freegold Road
 - Streams
 - Gradient in Percent
 - 0.0 - 5.0
 - 5.0 - 10.0
 - 10.0 - 15.0
 - 15.0 - 25.0
 - 25.0 - 45.0
 - StreamCrossings (distance in Km)

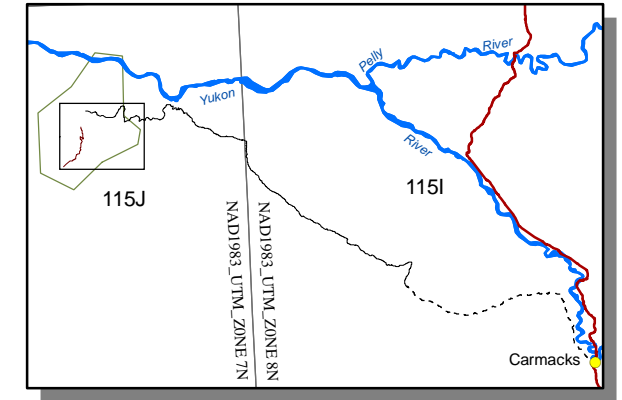
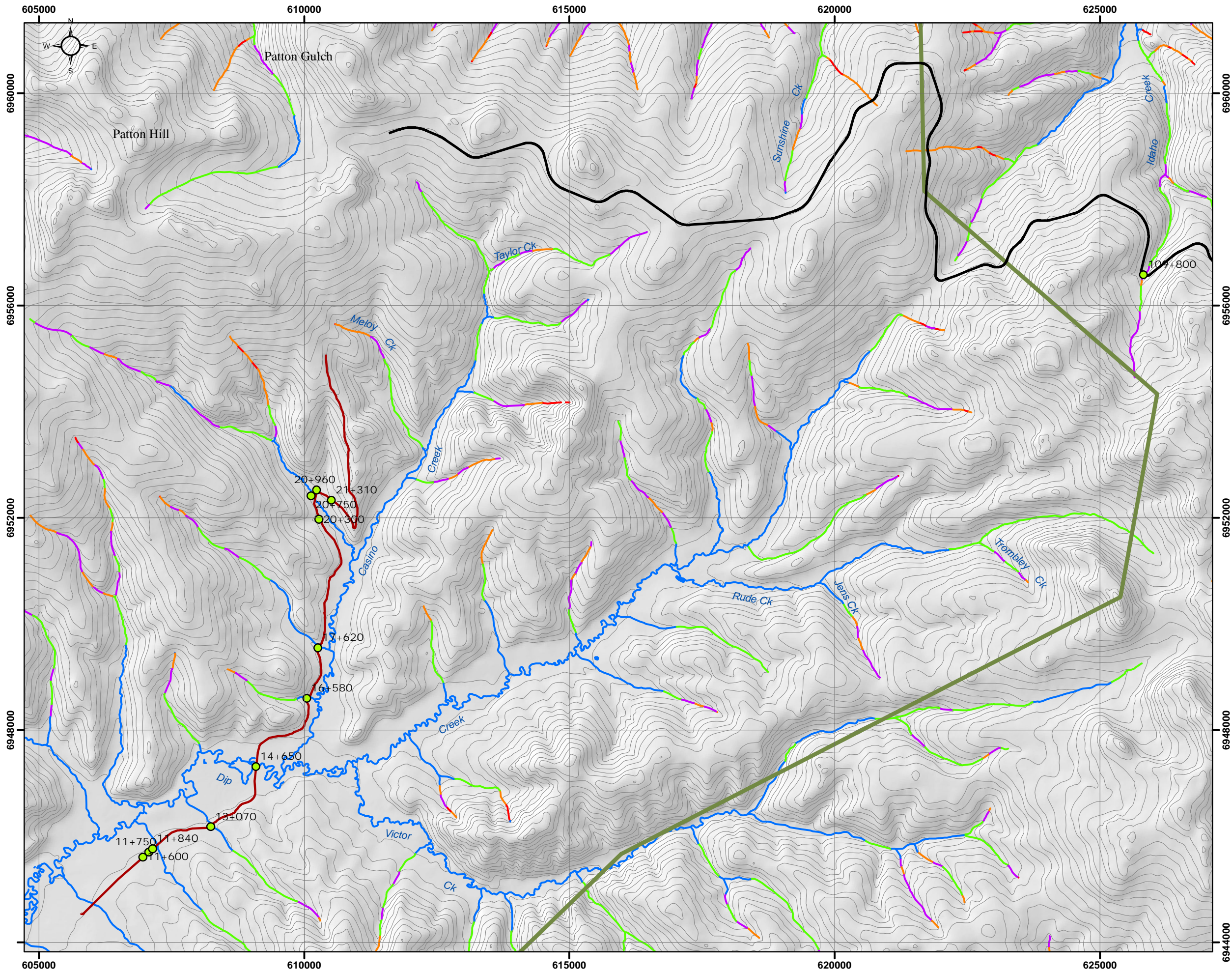


**Freegold Road Extension
Map Series**

MAP 6 of 7



Drawing prepared by K.Pelletier, Ibex Consulting
May 2012
Baseline data: <http://geogratis.cgdi.gc.ca/geogratis>
<http://www.geomaticsyukon.ca/data>
NAD 83, UTM Zone 7N
Scale: 1:50,000 on 11 x 17" format









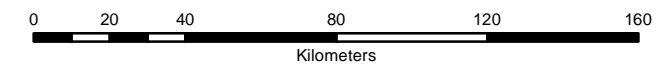
Legend

-  Casino Mine Area
-  Klondike Hwy
-  Freegold Road Extension
-  Freegold Road
-  Air Strip Road

Streams

Gradient in Percent

-  0.0 - 5.0
-  5.0 - 10.0
-  10.0 - 15.0
-  15.0 - 25.0
-  25.0 - 45.0
-  StreamCrossings (distance in Km)



Freegold Road Extension Map Series

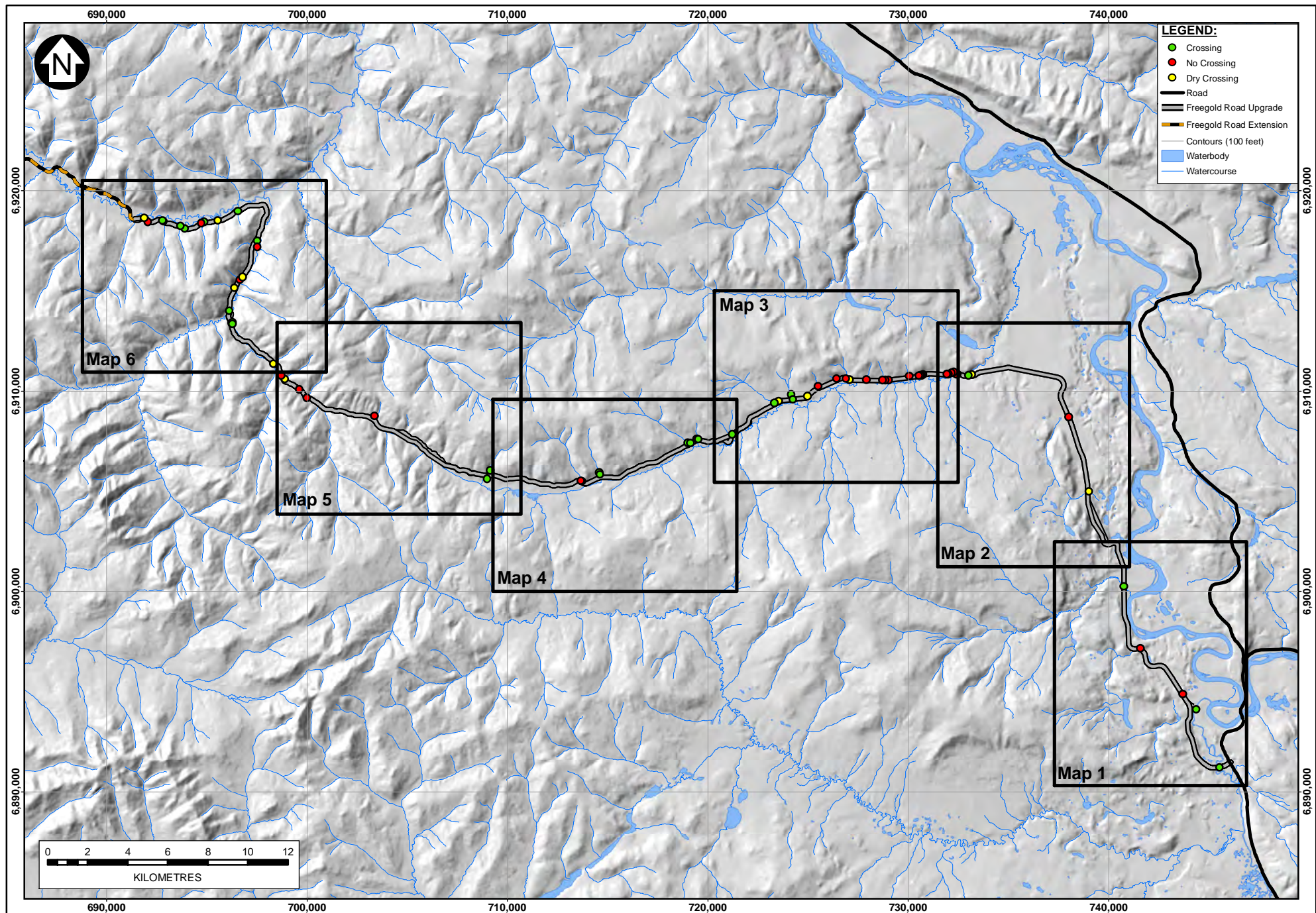
MAP 7 of 7



Drawing prepared by K.Pelletier, Ibex Consulting
May 2012
Baseline data: <http://geogratis.cgdi.gc.ca/geogratis>
<http://www.geomaticsyukon.ca/data>
NAD 83, UTM Zone 7N
Scale: 1:70,000 on 11 x 17" format

Appendix B

Freegold Road Upgrade Crossings, 2013 Fish Habitat Data and Crossing Photos



PREPARED BY:



PALMER
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CONSULTING
GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHK'D	L. Richards
APP'D	-
REV	-
DATE	28Aug'13

NOTES:

1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomaticsyukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 7N
3. COORDINATE GRID: METRES
4. SCALE: 1:250,000

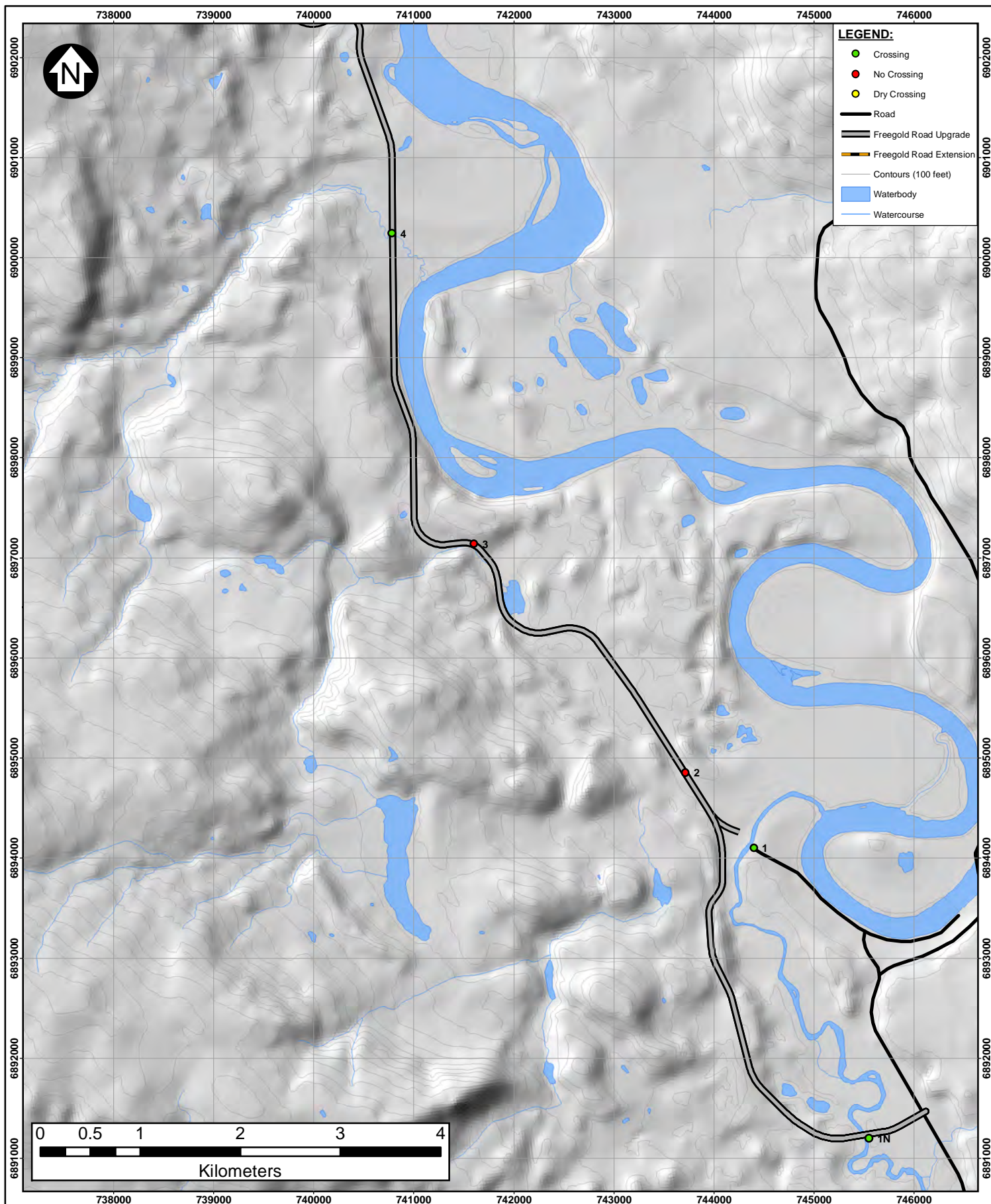
CASINO
COPPER AND GOLD

CASINO PROJECT

**Freegold Road Upgrade
Map Series - Index Map**

FIGURE 2

REF
P/A VA101-325/15



PREPARED BY:



PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHKD	L. Richards
APP'D	-
REV	-
DATE	28Aug'13

NOTES:

1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomatics.yukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 7N
3. COORDINATE GRID: METRES
4. SCALE: 1:50,000

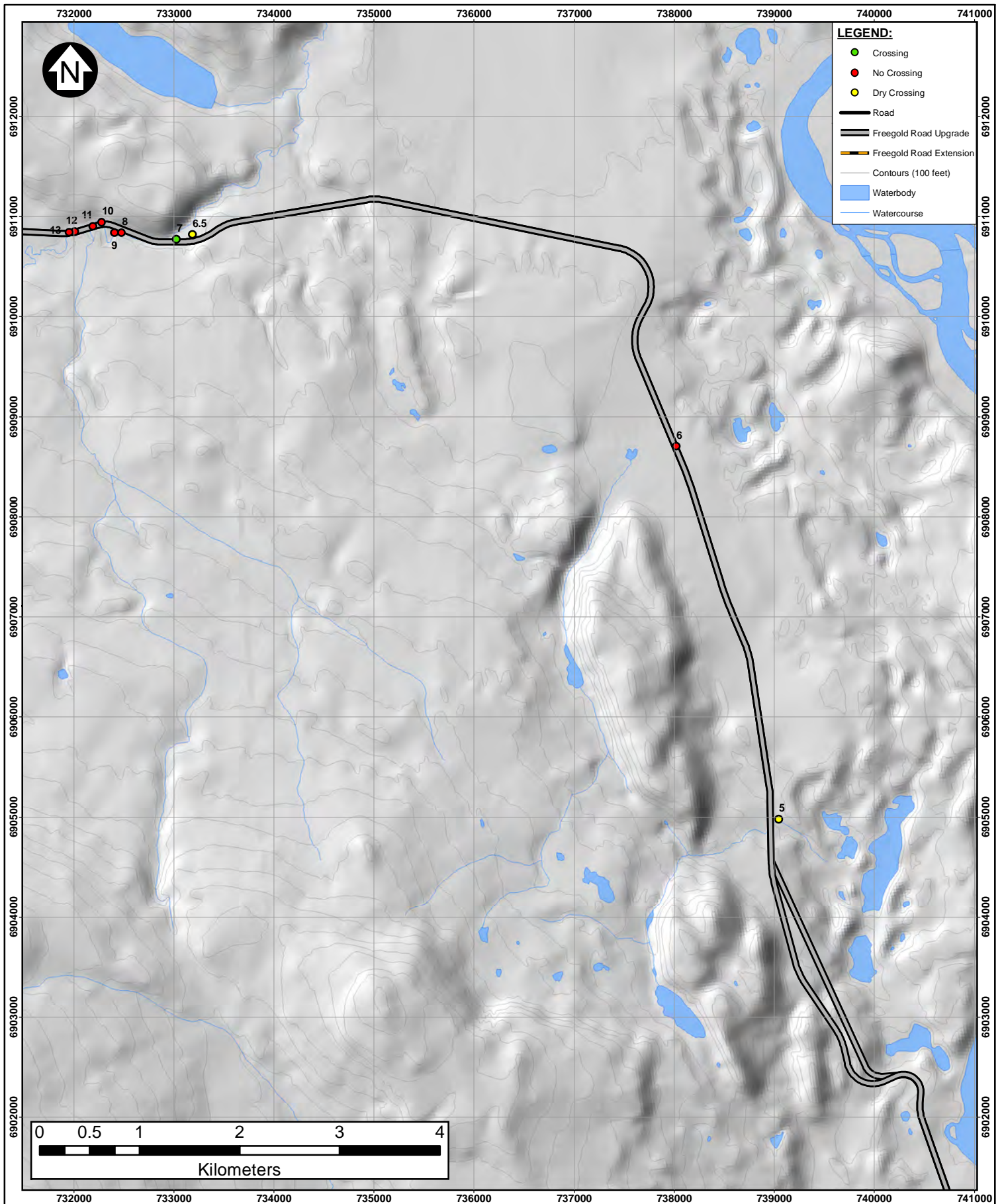
CASINO
COPPER AND GOLD

CASINO PROJECT

**Freegold Road Upgrade
Map Series - Map 1**

FIGURE 3

REF
P/A VA101-325/15



PREPARED BY:



PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHKD	L. Richards
APP'D	-
REV	-
DATE	28Aug'13

NOTES:

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2. PROJECTION: NAD 1983 UTM Zone 7N
3. COORDINATE GRID: METRES
4. SCALE: 1:50,000

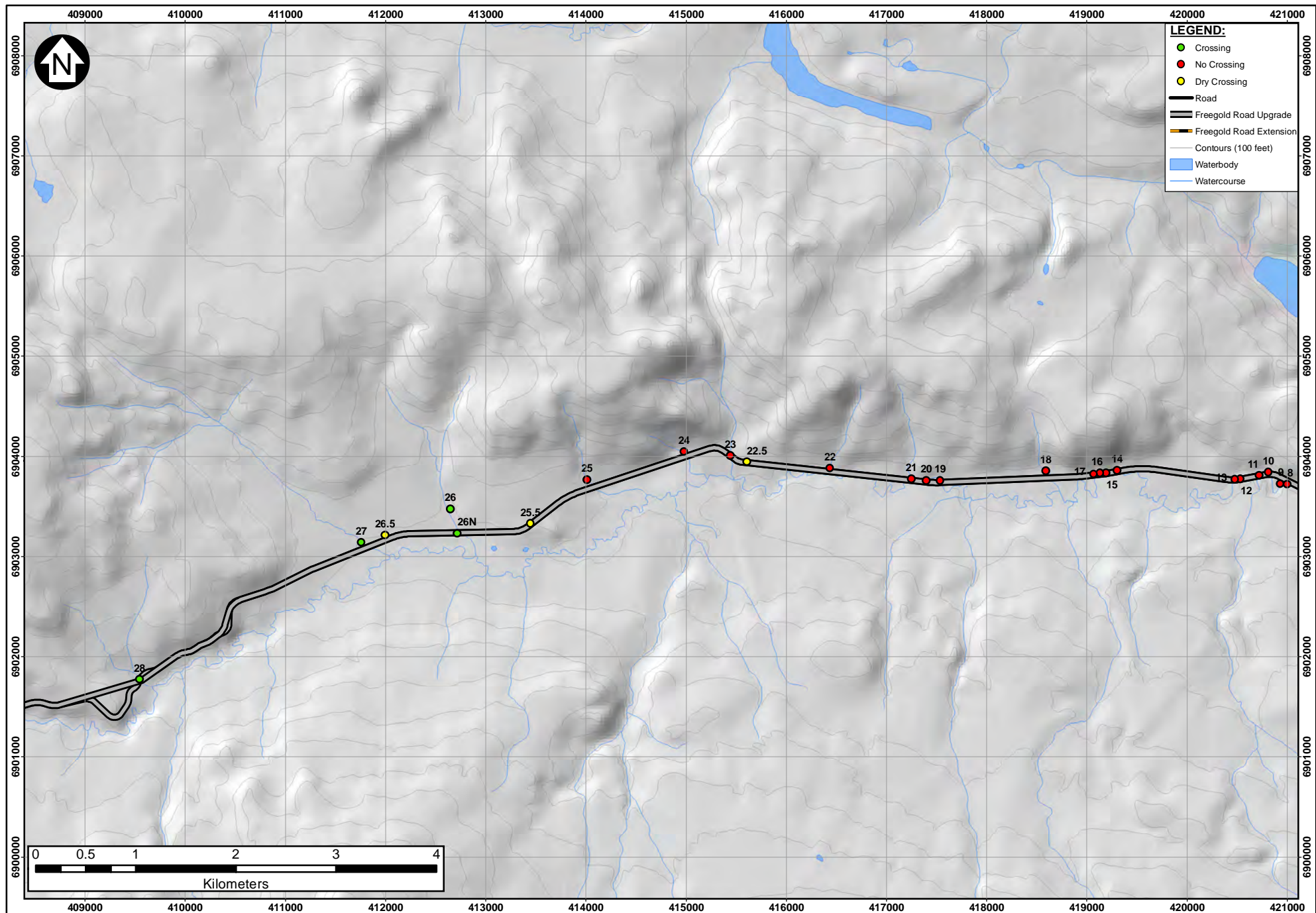
CASINO
COPPER AND GOLD

CASINO PROJECT

**Freegold Road Upgrade
Map Series - Map 2**

FIGURE 4

REF
P/A VA101-325/15



PREPARED BY:



PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHK'D	L. Richards
APP'D	-
REV	-
DATE	28Aug'13

NOTES:

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2. PROJECTION: NAD 1983 UTM Zone 8N
3. COORDINATE GRID: METRES
4. SCALE: 1:50,000

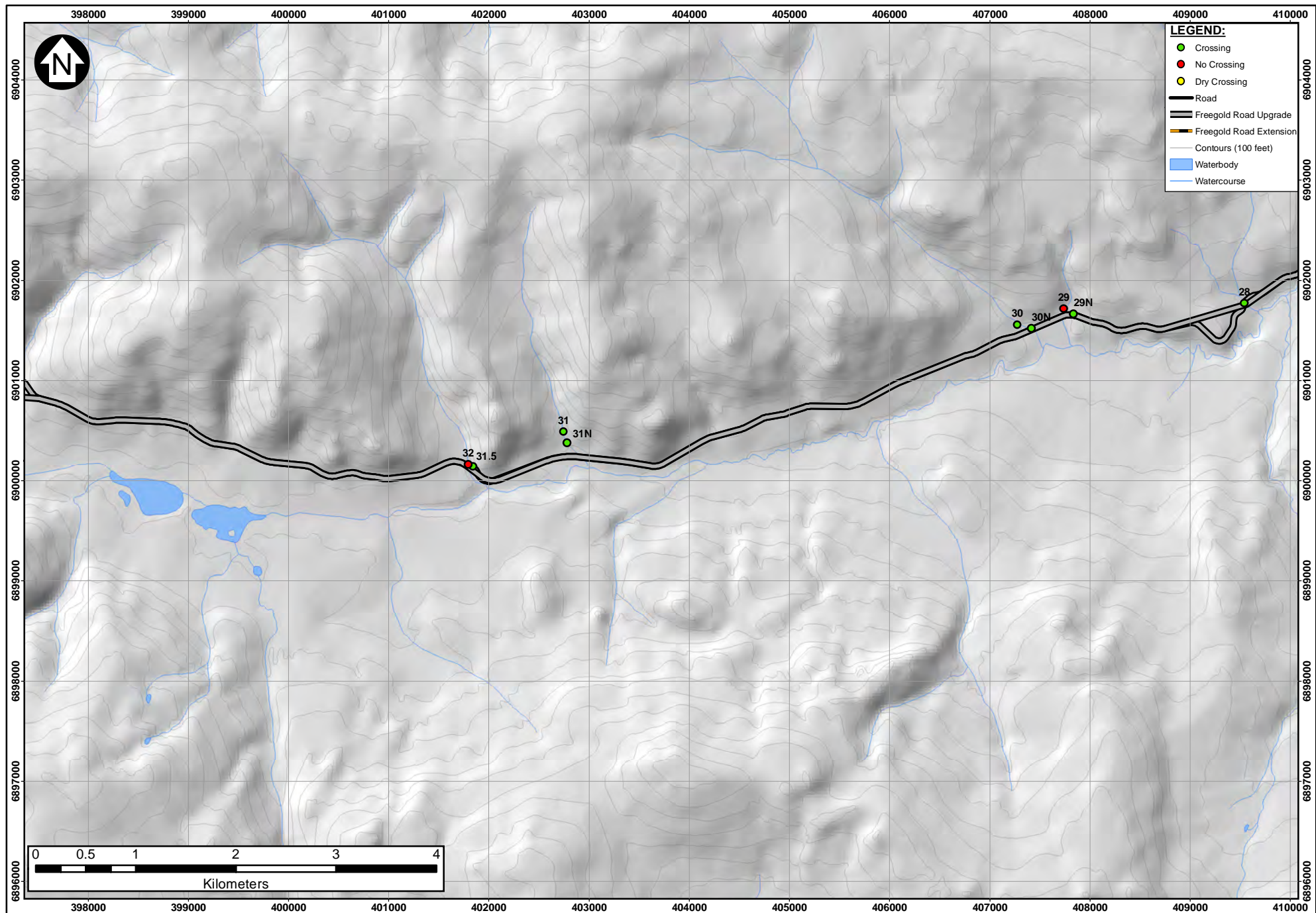
CASiNO
COPPER AND GOLD

CASINO PROJECT

**Freegold Road Upgrade
Map Series - Map 3**

FIGURE 5

REF
P/A VA101-325/15



PREPARED BY:



PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHK'D	L. Richards
APP'D	-
REV	-
DATE	28Aug'13

NOTES:

1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomaticsyukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 8N
3. COORDINATE GRID: METRES
4. SCALE: 1:50,000

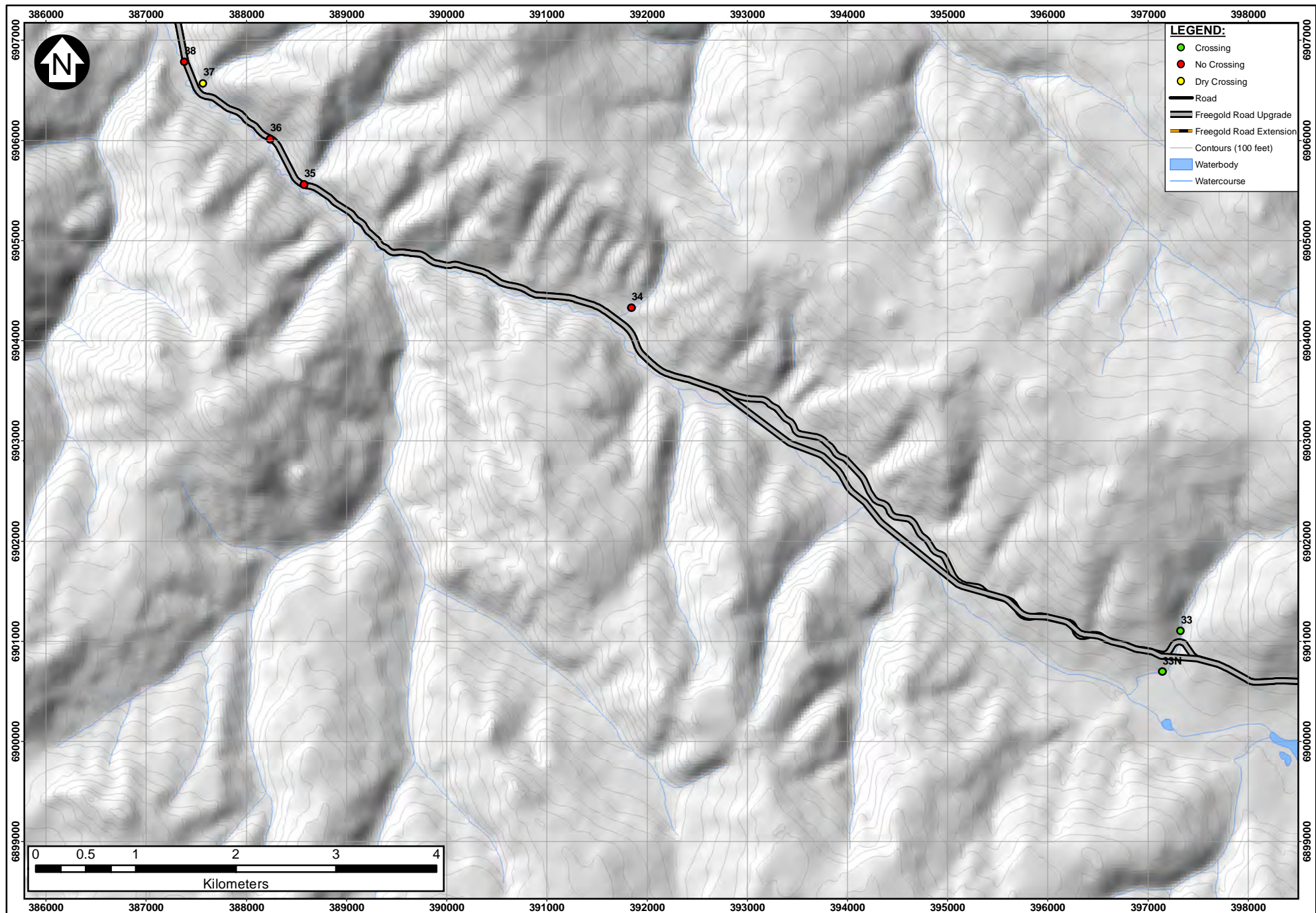
CASINO
COPPER AND GOLD

CASINO PROJECT

**Freegold Road Upgrade
Map Series - Map 4**

FIGURE 6

REF
P/A VA101-325/15



PREPARED BY:



PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHK'D	L. Richards
APP'D	-
REV	-
DATE	28Aug'13

NOTES:

1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomaticsyukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 8N
3. COORDINATE GRID: METRES
4. SCALE: 1:50,000

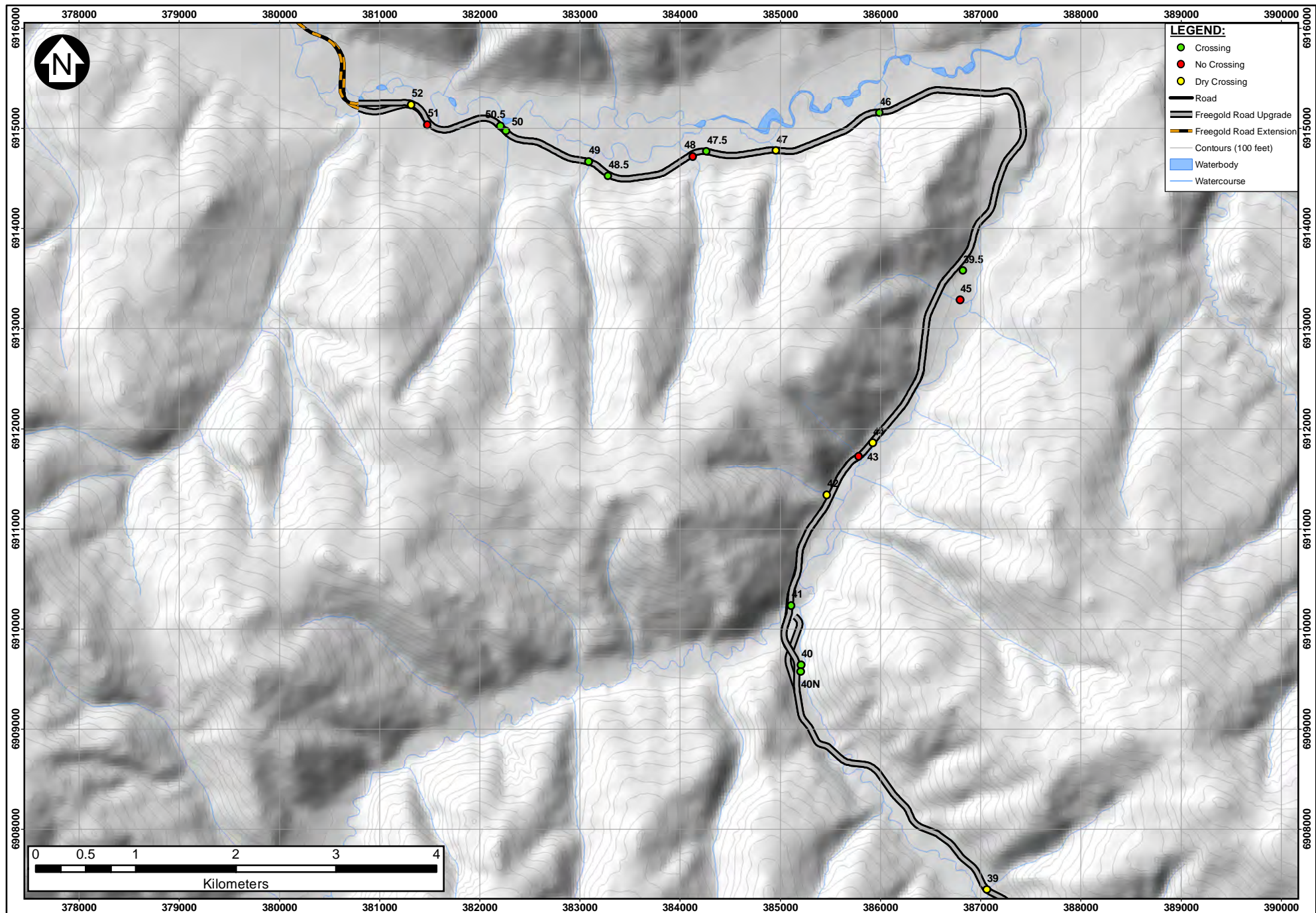
CASINO
COPPER AND GOLD

CASINO PROJECT

**Freegold Road Upgrade
Map Series - Map 5**

FIGURE 7

REF
P/A VA101-325/15



PREPARED BY:



PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHK'D	L. Richards
APP'D	-
REV	-
DATE	28Aug'13

NOTES:

1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomaticsyukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 8N
3. COORDINATE GRID: METRES
4. SCALE: 1:50,000

CASiNO
COPPER AND GOLD

CASINO PROJECT

**Freegold Road Upgrade
Map Series - Map 6**

FIGURE 8

REF
P/A VA101-325/15

KEY

Site Naming Codes

HC	Pre-existing AE Habitat Card
UM	Unmapped site, found during PEGC crossing assessment
AS	Site is on the proposed Airstrip
N, E, S, W	North, East, South, West

In Site key

- or N/A Not Sampled, No data available or Not applicable

Substrates:

B	Boulder
C	Cobble
F	Fines
G	Gravel
S	Sand

Riparian Vegetation:

AL	Alder
AS	Aspen
BI	Birch
GR	Grass
PO	Poplar
SH	Shrub
SP	Spruce
WI	Willow

Channel Pattern:

ST	Straight
SI	Sinuuous
RM	Regular Meanders
IM	Irregular Meanders
TM	Tortuous Meanders
WA	Wandering
BR	Braided

Cover:

B	Boulders
DP	Deep Pools
IV	Instream Vegetation
LWD	Large Woody Debris
OV	Overhanging Vegetation
SWD	Small Woody Debris
U	Undercut Banks

Freegold Road Upgrade Crossing # 1 - Nordenskiöld River

			D/S	X	U/S
Coordinates:	6885976 N	431267 E	Gradient (%):	0-1	0-1
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	31.70
Flow Conditions:	Med		Bankfull Depth (m):	-	-
Barrier/Confirmed:	None		Wetted Widths (m):	-	27.00
Electrofished/Effort?:	No		Wetted Depth (m):	-	-
Gee Trapping:	No		Substrate Bed:	C/G	C/G
Fish Bearing?	Yes		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	SP/PO	SP/PO
			Meander Pattern:	RM	RM
			Cover:	5% / OV	5% / OV
Photo #s	101-0046 u/s	101-0047 x	101-0048 d/s		
Areas of Erosion:	Yes		Temperature:	17	°C
Locations:	Erosion under bridge		pH:	7.2	pH units
	Rip rap on banks		Conductivity:	197	uS/cm
			DO:	8.3	mg/L
				91.1	% Sat

Comments:
One and a half lane bridge with foot crossing
Depth unknown, cannot see bottom, stream not wadable
Widths large but unknown at up and downstream sites - unwadable

Upstream



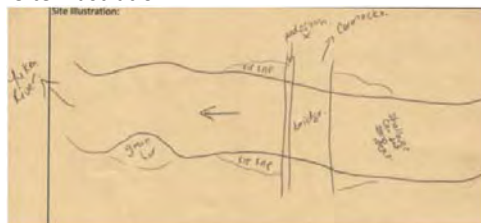
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 1N - Nordenskiöld River

			D/S	X	U/S	
Coordinates:	6882967 N	432195 E	Gradient (%):	-	2	-
Site Visit Date:	09-Aug-13		Bankfull Width (m):	-	53.00	-
Flow Conditions:	High		Bankfull Depth (m):	-	1.00	-
Barrier/Confirmed:	None		Wetted Widths (m):	-	53.00	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	1.00	-
Gee Trapping:	No		Substrate Bed:	-	C	-
Fish Bearing?	Yes		Substrate Bank:	-	F	-
Site Length:	100 m		Riparian Vegetation:	-	WI/SP	-
			Meander Pattern:	-	SI/RM	-
			Cover:	-	20% / SUB	-
Photo #s	93 u/s	95 x	94 d/s			
Areas of Erosion:	No		Temperature:	14.76	°C	
Locations:			pH:	7.11	pH units	
			Conductivity:	153	µS/cm	
			DO:	8.85	mg/L	
				92.7	% Sat	
Comments:						
River very high, warm, and turbid during assessment						
Substrate estimated from bar material						

Upstream



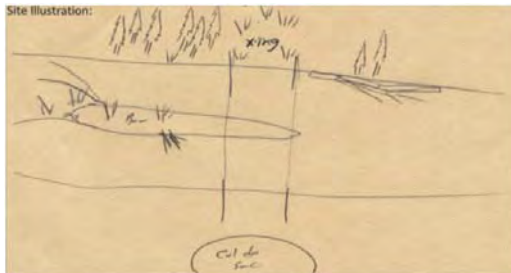
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 2 - No Crossing

			D/S	X	U/S
Coordinates:	6886772 N	430710 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	88 u/s	x	89 d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
Many appear to be stream crossings on map, however, co-ordinates are on the exisitng road					
which stays on one side of the creek					
No visible channel					

Upstream



Downstream



Freegold Road Upgrade Crossing # 3 - No Crossing

			D/S	X	U/S
Coordinates:	6889244 N	428819 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	90 u/s	x	91 d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
Many appear to be stream crossing on map, however, co-ordinates are on the existing road					
which stays on one side of the creek					
No visible channel					

Upstream



Downstream



Freegold Road Upgrade Crossing # 4 - Murray Creek

			D/S	X	U/S	
Coordinates:	6892374 N	428307 E	Gradient (%):	<1	2	1
Site Visit Date:	03-Jul-13		Bankfull Width (m):	7.60	8.10	6.90
Flow Conditions:	Low		Bankfull Depth (m):	0.30	0.85	0.50
Barrier/Confirmed:	None		Wetted Widths (m):	5.70	4.50	4.65
Electrofished/Effort?:	No		Wetted Depth (m):	0.15	0.10	0.23
Gee Trapping:	No		Substrate Bed:	G/C	C/G	C/G
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	PO/WI/SP	SP/PO/WI/AL	SP/PO/WI/AL
			Meander Pattern:	SI	RM	SI
		Cover:	15% / OV	10% / OV	15% / OV	
Photo #s	186 u/s	187 x	188 d/s			
Areas of Erosion:	Y		Temperature:	8.31	°C	
Locations:	Erosion around culvert. Photo 189		pH:	8.45	pH units	
			Conductivity:	189	uS/cm	
			DO:	93.1	mg/L	
				10.32	% Sat	
Comments:						
Culvert is partly collapsed - not creating a barrier						
Hish quality watercourse with a gravel/cobble substrate						

Upstream



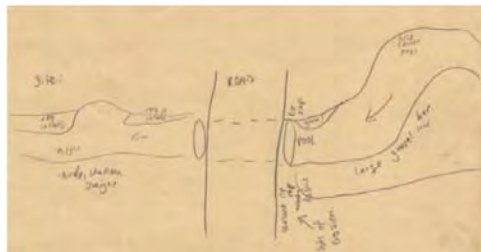
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 4 - Pg. 2

Photo 189



Freegold Road Upgrade Crossing # 5 - Yukon Tributary

			D/S	X	U/S
Coordinates:	6897278 N	426998 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	-
Gee Trapping:	No		Substrate Bed:	-	-
Fish Bearing?:	No		Substrate Bank:	-	-
Site Length:	100 m		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	95 u/s	96 x	97 d/s		
Areas of Erosion:	No		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel					
Many appear to be stream crossing on map, however, co-ordinates are on the existing road					
which stays on one side of the creek					
Culvert present with little evidence of flow					

Photo 95



Photo 96



Photo 97



Freegold Road Upgrade Crossing # 6 - No Crossing

			D/S	X	U/S
Coordinates:	6901080 N	426321 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	98 u/s	x	99 d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel					
Many appear to be stream crossing on map, however, co-ordinates are on the existing road					
which stays on one side of the creek					

Upstream



Downstream



Freegold Road Upgrade Crossing # 6.5 (Unmapped Site) - Crossing Creek Tributary

				D/S	X	U/S
Coordinates:	6903635 N	421706 E	Gradient (%):	-	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-	-
Flow Conditions:	None/ Dry		Bankfull Depth (m):	-	-	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	-	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	-	-
Gee Trapping:	No		Substrate Bed:	-	-	-
Fish Bearing?:	No		Substrate Bank:	-	-	-
Site Length:	100 m		Riparian Vegetation:	-	-	-
			Meander Pattern:	-	-	-
			Cover:	-	-	-
Photo #s	101-0049 u/s	101-0050 x	101-0051 d/s			
Areas of Erosion:	No		Temperature:	-	°C	
Locations:			pH:	-	pH units	
			Conductivity:	-	uS/cm	
			DO:	-	mg/L	
				-	% Sat	

Comments:	Dry channel
Two crossings close together	
Photos represent larger channel	
Smaller: no visible channel, photos: 101-0052 (downstream of culvert), 101-0053 (upstream of perched culvert)	
Lower end more defined, vegetation encroachment suggests not much water: photos 101-0054/101-0055	

Upstream



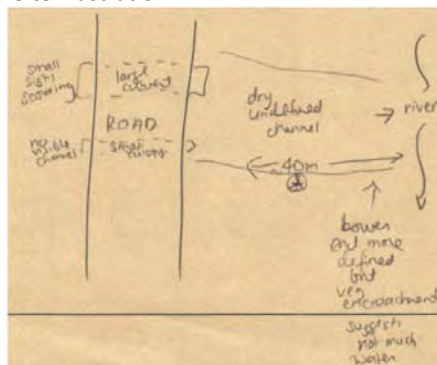
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # Unmapped site, near Crossing 7 - Pg. 2

Photo 101-0052



Photo 101-0053



101-0054



101-0055



Freegold Road Upgrade Crossing # 7 - Crossing Creek

			D/S	X	U/S	
Coordinates:	6903613 N	421510 E	Gradient (%):	4	3	5
Site Visit Date:	01-Jul-13		Bankfull Width (m):	5.80	7.80	8.30
Flow Conditions:	Med		Bankfull Depth (m):	0.70	0.32	0.70
Barrier/Confirmed:	None		Wetted Widths (m):	5.80	7.40	6.90
Electrofished/Effort?:	No		Wetted Depth (m):	0.26	0.12	0.34
Gee Trapping:	No		Substrate Bed:	B/C	G/C	B/C
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	SP/PO/WI	SP/PO/WI	SP/PO/WI
			Meander Pattern:	SI	RM	SI
			Cover:	45% / B/OV	5% / B	20% / B
Photo #s	101-0056 u/s	101-0057 x	101-0058 d/s			
Areas of Erosion:	N		Temperature:	12.02	°C	
Locations:			pH:	8.49	pH units	
			Conductivity:	211	uS/cm	
			DO:	8.51	mg/L	
				85.3	% Sat	
Comments:						
Saw grayling in upstream pool						
Culvert downstream of site at 08 V 0421577 6903600, no flow, no visible channel, lots of						
vegetation - photos 15 (downstream) and 16 (upstream)						

Upstream



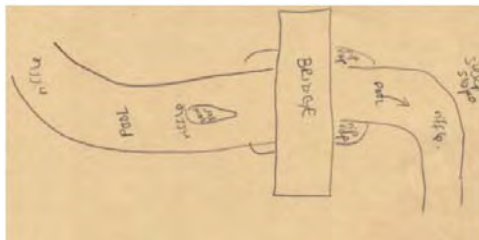
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 7 - Pg. 2

Photo 101-0059



Photo 15



Photo 16



Freegold Road Upgrade Crossing # 8 - No Crossing

			D/S	X	U/S
Coordinates:	6903719 N	421002 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	100 u/s	x	101 d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel					
Many appear to be stream crossing on map, however, co-ordinates are on the existing road					
which stays on one side of the creek					

Upstream



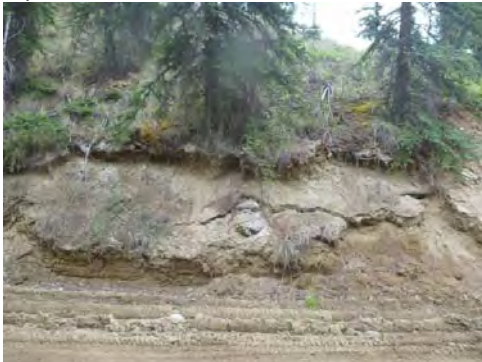
Downstream



Freegold Road Upgrade Crossing # 9 - No Crossing

			D/S	X	U/S
Coordinates:	6903724 N	420934 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	102 u/s	x	103 d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel					
Many appear to be stream crossing on map, however, co-ordinates are on the existng road					
which stays on one side of the creek					

Upstream



Downstream



Freegold Road Upgrade Crossing # 10 - No Crossing

			D/S	X	U/S
Coordinates:	6903841 N	420816 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	104 u/s	105x	106 d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel					
Many appear to be stream crossing on map, however, co-ordinates are on the existing road					
which stays on one side of the creek					

Upstream



Crossing



Downstream



Freegold Road Upgrade Crossing # 11 - No Crossing

			D/S	X	U/S
Coordinates:	6903808 N	420721 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	107 u/s	x	108 d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel					
Many appear to be stream crossing on map, however, co-ordinates are on the existing road					
which stays on one side of the creek					

Upstream



Downstream



Freegold Road Upgrade Crossing # 12 - No Crossing

			D/S	X	U/S
Coordinates:	6903776 N	420538 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	109 u/s	x	110 d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel					
Many appear to be stream crossing on map, however, co-ordinates are on the existing road					
which stays on one side of the creek					

Upstream



Downstream



Downstream - 2



Freegold Road Upgrade Crossing # 13 - No Crossing

			D/S	X	U/S
Coordinates:	6903769 N	420483 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	112 u/s	x	113 d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel					
Many appear to be stream crossing on map, however, co-ordinates are on the existing road					
which stays on one side of the creek					

Upstream



Downstream



Freegold Road Upgrade Crossing # 14 - No Crossing

			D/S	X	U/S
Coordinates:	6903861 N	419304 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
No visible channel					

Photo 86



Photo 87



Freegold Road Upgrade Crossing # 15 - No Crossing

			D/S	X	U/S
Coordinates:	6903835 N	419196 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	114 u/s	x	115 d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel					
Many appear to be stream crossing on map, however, co-ordinates are on the existing road					
which stays on one side of the creek					

Upstream



Downstream



Freegold Road Upgrade Crossing # 16 - No Crossing

			D/S	X	U/S
Coordinates:	6903833 N	419133 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	117 u/s	x	116 d/s		
Areas of Erosion:	Y/N		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel					
Many appear to be stream crossing on map, however, co-ordinates are on the existing road which stays on one side of the creek.					
Groundwater pond next to road, no connection to creek.					

Upstream



Downstream



Freegold Road Upgrade Crossing # 17 - No Crossing

			D/S	X	U/S
Coordinates:	6903822 N	419070 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:	No visible channel				

Photo 84



Freegold Road Upgrade Crossing # 18 - No Crossing

			D/S	X	U/S
Coordinates:	6903853 N	418594 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel					

Photo 82



Photo 83



Freegold Road Upgrade Crossing # 19 - No Crossing

			D/S	X	U/S
Coordinates:	6903757 N	417540 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	N/A		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
No visible channel					
Crosses mainstem creek on map, but co-ordinates on existing road					

Photo 80



Photo 81



Freegold Road Upgrade Crossing # 20 - No Crossing

			D/S	X	U/S
Coordinates:	6903759 N	417397 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
No visible channel					
Crosses mainstem creek on map, but co-ordinates on existing road					

Photo 77



Photo 78



Photo 79



Freegold Road Upgrade Crossing # 21 - No Crossing

			D/S	X	U/S
Coordinates:	6903774 N	417250 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:	No visible channel				

Photo 75



Photo 76



Freegold Road Upgrade Crossing # 22 - No Crossing

			D/S	X	U/S
Coordinates:	6903880 N	416439 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:	No visible channel				

Photo 73



Photo 74



Freegold Road Upgrade Crossing # 22.5 (Unmapped Site) - Crossing Creek Tributary

			D/S	X	U/S
Coordinates:	6903942 N	415607 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	-
Gee Trapping:	No		Substrate Bed:	-	-
Fish Bearing?:	No		Substrate Bank:	-	-
Site Length:	100 m		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	No		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
No visible channel					
No culvert but hole running under the road					

17



18



Freegold Road Upgrade Crossing # 23 - No Crossing

			D/S	X	U/S
Coordinates:	6904009 N	415443 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:	No visible channel				

Photo 71



Photo 72



Freegold Road Upgrade Crossing # 24 - No Crossing

			D/S	X	U/S
Coordinates:	6904045 N	414979 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:	No visible channel				

Photo 69



Photo 70



Freegold Road Upgrade Crossing # 25 - No Crossing

			D/S	X	U/S
Coordinates:	6903767 N	414012 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:	No visible channel				

Photo 67



Photo 68



Freegold Road Upgrade Crossing # 25.5 (Unmapped Site) - Crossing Creek Tributary

			D/S	X	U/S
Coordinates:	6903328 N	413448 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	-
Gee Trapping:	No		Substrate Bed:	-	-
Fish Bearing?:	No		Substrate Bank:	-	-
Site Length:	100 m		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	19 u/s	20 x	21 d/s		
Areas of Erosion:	No		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
Culvert on one side of the road, looked through and was blocked					
No culvert found on the other side					
No visible channel					

19



20



21



Freegold Road Upgrade Crossing # 26 - Crossing Creek Tributary

				D/S	X	U/S
Coordinates:	6903472 N	412617 E	Gradient (%):	-	2	3
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	0.62	0.55
Flow Conditions:	Low		Bankfull Depth (m):	-	0.15	0.19
Barrier/Confirmed:	None		Wetted Widths (m):	-	0.55	0.55
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.07	0.10
Gee Trapping:	No		Substrate Bed:	-	G/F	F
Fish Bearing?	Yes		Substrate Bank:	-	F	F
Site Length:	100 m		Riparian Vegetation:	-	SP/WI/GR	SP/WI/GR
			Meander Pattern:	-	IM	IM
			Cover:	-	75% / OV	85% / OV
Photo #s	22 u/s	23 x	24 d/s			
Areas of Erosion:	No		Temperature:	6.91	°C	
Locations:			pH:	8.12	pH units	
			Conductivity:	126	uS/cm	
			DO:	2.93	mg/L	
				26.3	% Sat	

Comments:
Very little flow
Winds through grasses, channel definition lost in areas
Fans out into ground at downstream site, no channel

Upstream



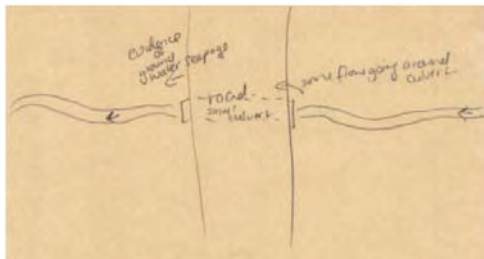
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 26 - 35.33 - Crossing Creek Tributary

			D/S	X	U/S
Coordinates:	6903230 N	412716 E	Gradient (%):	2	1
Site Visit Date:	08-Aug-13		Bankfull Width (m):	-	-
Flow Conditions:	Low		Bankfull Depth (m):	-	-
Barrier/Confirmed:	None		Wetted Widths (m):	0.49	0.70
Electrofished/Effort?:	No		Wetted Depth (m):	0.08	0.16
Gee Trapping:	No		Substrate Bed:	F	F
Fish Bearing?:	Yes		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	SP/WI	SP/WI
			Meander Pattern:	SI	SI
			Cover:	40% / OV	50% / OV
Photo #s	61 u/s	63 x	62 d/s		
Areas of Erosion:	No		Temperature:	9.43	°C
Locations:			pH:	7.18	pH units
			Conductivity:	159	µS/cm
			DO:	4.19	mg/L
				39.6	% Sat
Comments:					
No defined channel					
Flows through trees, discontinuous through moss					
No direct fish habitat					

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 26.5 (Unmapped Site) - Crossing Creek Tributary

			D/S	X	U/S
Coordinates:	6903211 N	411995 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	-
Gee Trapping:	No		Substrate Bed:	-	-
Fish Bearing?:	No		Substrate Bank:	-	-
Site Length:	100 m		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	25, 26 u/s	x	d/s		
Areas of Erosion:	No		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
No visible channel					
Culvert present					

25



26



Freegold Road Upgrade Crossing # 27 - Crossing Creek Tributary

			D/S	X	U/S	
Coordinates:	6903150 N	411811 E	Gradient (%):	3	1	1
Site Visit Date:	01-Jul-13		Bankfull Width (m):	0.60	4.70	1.23
Flow Conditions:	Low		Bankfull Depth (m):	0.16	0.24	0.36
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.60	1.50	0.86
Electrofished/Effort?:	No		Wetted Depth (m):	0.08	0.14	0.20
Gee Trapping:	No		Substrate Bed:	G/F	G/F	G/F
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	GR/WI/SP	GR/WI/SP	GR/WI/SP
			Meander Pattern:	IM	SI	IM
			Cover:	50% / OV	5% / OV	5% / OV
Photo #s	27 u/s	28 x	29 d/s			
Areas of Erosion:	Y		Temperature:	7.62	°C	
Locations:	Erosion on the downstream side		pH:	8.5	pH units	
	of the culvert		Conductivity:	496	uS/cm	
			DO:	8.52	mg/L	
				78.1	% Sat	
Comments:						
Perched culvert downstream of existing road creating a fish passage barrier						

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 27 - Pg. 2

Photo 30



Freegold Road Upgrade Crossing # 28 - Crossing Creek Tributary

			D/S	X	U/S	
Coordinates:	6901780 N	409548 E	Gradient (%):	4	5	6
Site Visit Date:	01-Jul-13		Bankfull Width (m):	0.34	0.78	0.43
Flow Conditions:	Low		Bankfull Depth (m):	0.23	0.37	0.16
Barrier/Confirmed:	None		Wetted Widths (m):	0.34	0.58	0.36
Electrofished/Effort?:	No		Wetted Depth (m):	0.10	0.27	0.07
Gee Trapping:	No		Substrate Bed:	F	F/G	F
Fish Bearing?	Yes		Substrate Bank:	F	F/G	F
Site Length:	100 m		Riparian Vegetation:	GR/WI/SP	GR/WI/SP/P O	SP/WI
		Meander Pattern:	IM	IM	IM	
		Cover:	95% / OV	85% / OV	90% / OV	
Photo #s	31 u/s	32 x	33 d/s			
Areas of Erosion:	No		Temperature:	5.88	°C	
Locations:			pH:	7.92	pH units	
			Conductivity:	211	uS/cm	
			DO:	5.37	mg/L	
				47.3	% Sat	

Comments:
Small drop pool at culvert outlet

Upstream



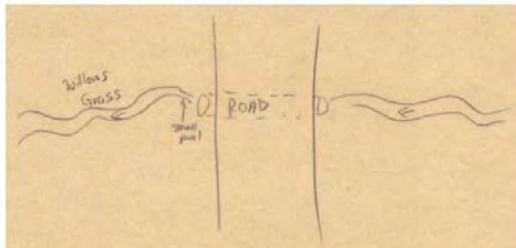
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 29 - No Crossing

			D/S	X	U/S
Coordinates:	6901716 N	407741 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:	No visible channel				

Photo 34



Photo 35



Freegold Road Upgrade Crossing # 29N (Unmapped Site) - Crossing Creek Tributary

			D/S	X	U/S	
Coordinates:	6901667 N	407836 E	Gradient (%):	-	9	8
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	0.19	0.93
Flow Conditions:	Low		Bankfull Depth (m):	-	0.08	0.09
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	0.14	0.93
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.04	0.09
Gee Trapping:	No		Substrate Bed:	-	G/S	G/S
Fish Bearing?:	No		Substrate Bank:	-	F	F
Site Length:	100 m		Riparian Vegetation:	-	WI/SP	WI/SP
			Meander Pattern:	-	SI	SI
			Cover:	-	60%/LWD	20% / LWD
Photo #s	87 u/s	89 x	88 d/s			
Areas of Erosion:	Yes		Temperature:	6.98	°C	
Locations:	Sand and gravel from existing		pH:	7.7	pH units	
	road have partly infilled channel		Conductivity:	204	µS/cm	
			DO:	7.39	mg/L	
				66.8	% Sat	

Comments:
Large amounts of woody debris (glaciation / flood damage)
High amounts of sand/ gravel have filled in channel downstream of the crossing
forcing the creek to go underground.

Upstream



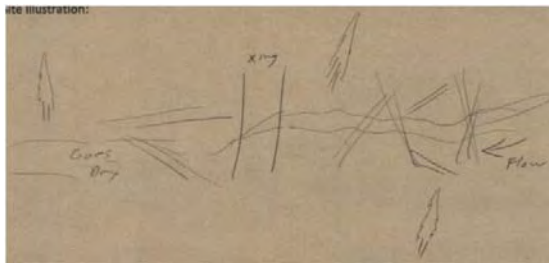
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 30 - Crossing Creek

			D/S	X	U/S
Coordinates:	6901568 N	407285 E	Gradient (%):	2	3
Site Visit Date:	01-Jul-13		Bankfull Width (m):	1.50	3.10
Flow Conditions:	Med		Bankfull Depth (m):	0.26	0.18
Barrier/Confirmed:	None		Wetted Widths (m):	1.12	3.10
Electrofished/Effort?:	No		Wetted Depth (m):	0.07	0.11
Gee Trapping:	No		Substrate Bed:	G/C	G/C
Fish Bearing?	Yes		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	WI/AL/SP	WI/SP
			Meander Pattern:	SI	SI
			Cover:	85% / OV	15% / OV
Photo #s	36 u/s	37 x	38 d/s		
Areas of Erosion:	Yes		Temperature:	6.19	°C
Locations:	US and DS of culverts		pH:	8.01	pH units
			Conductivity:	147	uS/cm
			DO:	9.33	mg/L
				83.8	% Sat
Comments:					
Straight riffle section both upstream and downstream					

Upstream



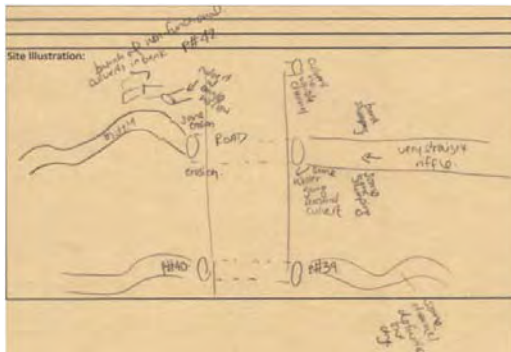
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 30 - Pg. 2

Photo 39



Photo 40



Photo 41



Photo 42



Freegold Road Upgrade Crossing # 30 (Unmapped Site) - Crossing Creek Tributary

			D/S	X	U/S	
Coordinates:	6901519 N	407416 E	Gradient (%):	2	4	6
Site Visit Date:	08-Aug-13		Bankfull Width (m):	0.64	0.40	0.90
Flow Conditions:	Low		Bankfull Depth (m):	0.25	0.58	0.33
Barrier/Confirmed:	None		Wetted Widths (m):	0.48	0.37	0.89
Electrofished/Effort?:	No		Wetted Depth (m):	0.15	0.45	0.26
Gee Trapping:	No		Substrate Bed:	G/S	S/G	G/S
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	AL/SP	AL/SP	AL/SP
			Meander Pattern:	SI	SI	SI
			Cover:	40% / OV	70% / OV	20% / LWD
Photo #s	84 u/s	86 x	85 d/s			
Areas of Erosion:	No		Temperature:	7.13	°C	
Locations:			pH:	7.64	pH units	
			Conductivity:	132	µS/cm	
			DO:	9.48	mg/L	
				86.4	% Sat	

Comments:
Small waterfall upstream of crossing

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 31 - Crossing Creek Tributary

			D/S	X	U/S
Coordinates:	6900480 N	402734 E	Gradient (%):	0	3
Site Visit Date:	01-Jul-13		Bankfull Width (m):	1.09	0.85
Flow Conditions:	Med		Bankfull Depth (m):	0.15	0.20
Barrier/Confirmed:	None		Wetted Widths (m):	0.51	0.50
Electrofished/Effort?:	No		Wetted Depth (m):	0.07	0.10
Gee Trapping:	No		Substrate Bed:	G/F	F/G
Fish Bearing?	Yes		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	WI/PO/SP	WI/PO/SP
			Meander Pattern:	IM	IM
			Cover:	80% / OV	80% / OV
Photo #s	43 u/s	44 x	45 d/s		
Areas of Erosion:	Yes		Temperature:	4.49	°C
Locations:	Both banks above and below culvert		pH:	8.78	pH units
	are eroded		Conductivity:	99	uS/cm
			DO:	9.33	mg/L
				80.9	% Sat
Comments:					
Riffle sections US and DS of culvert					

Upstream



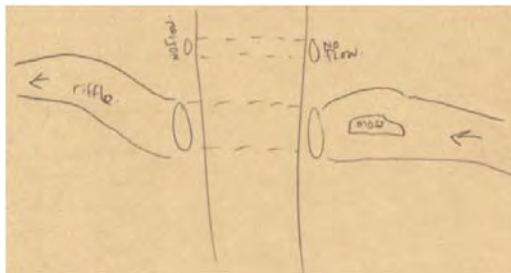
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 31N - Crossing Creek Tributary

			D/S	X	U/S
Coordinates:	6900377 N	402782 E	Gradient (%):	2	7
Site Visit Date:	08-Aug-13		Bankfull Width (m):	0.51	0.39
Flow Conditions:	Low		Bankfull Depth (m):	0.12	0.26
Barrier/Confirmed:	None		Wetted Widths (m):	0.49	0.37
Electrofished/Effort?:	No		Wetted Depth (m):	0.10	0.22
Gee Trapping:	No		Substrate Bed:	S	G
Fish Bearing?	Yes		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP
			Meander Pattern:	SI	SI
			Cover:	60% / OV	80% / OV
Photo #s	77 u/s	79 x	78 d/s		
Areas of Erosion:	No		Temperature:	5.44	°C
Locations:			pH:	7.29	pH units
			Conductivity:	97	µS/cm
			DO:	9.13	mg/L
				80.6	% Sat

Comments:

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 31.5 (Unmapped Site) - Crossing Creek Tributary

			D/S	X	U/S	
Coordinates:	6900139 N	401843 E	Gradient (%):	2	3	4
Site Visit Date:	01-Jul-13		Bankfull Width (m):	1.30	1.30	1.13
Flow Conditions:	Med		Bankfull Depth (m):	0.43	0.34	0.33
Barrier/Confirmed:	None		Wetted Widths (m):	1.08	1.10	0.48
Electrofished/Effort?:	No		Wetted Depth (m):	0.22	0.19	0.11
Gee Trapping:	No		Substrate Bed:	G/F	F	F/G
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
			Meander Pattern:	IM	SI	SI
		Cover:	90% / OV	15% / OV	15% / OV	
Photo #s	46 u/s	47 x	48 d/s			
Areas of Erosion:	Yes		Temperature:	4.48	°C	
Locations:	Erosion at culvert crossing		pH:	7.9	pH units	
			Conductivity:	98	uS/cm	
			DO:	7.24	mg/L	
				62.7	% Sat	

Comments:
Downstream site runs through willows, channel may have moved

Upstream



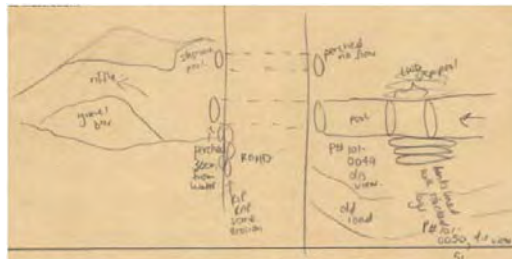
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # Unmapped site between sites 31 and 32 - 2

Photo 49



Photo 50



Photo 51



Freegold Road Upgrade Crossing # 32 - No Crossing

			D/S	X	U/S
Coordinates:	6900161 N	401794 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:	No visible channel				

Photo 52



Photo 53



Freegold Road Upgrade Crossing # 33 - Seymour Creek Tributary

			D/S	X	U/S	
Coordinates:	6901099 N	397330 E	Gradient (%):	4	3	4
Site Visit Date:	01-Jul-13		Bankfull Width (m):	1.80	3.15	0.94
Flow Conditions:	Low		Bankfull Depth (m):	0.26	0.23	0.43
Barrier/Confirmed:	Yes		Wetted Widths (m):	1.15	1.90	0.42
Electrofished/Effort?:	No		Wetted Depth (m):	0.10	0.08	0.10
Gee Trapping:	No		Substrate Bed:	G/F	G/F	C/G
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
			Meander Pattern:	IM	SI	SI
			Cover:	100% / OV	5% / OV	95% / OV
Photo #s	54 u/s	55 x	56 d/s			
Areas of Erosion:	Yes		Temperature:	2.49	°C	
Locations:	Downstream of culvert		pH:	8.41	pH units	
			Conductivity:	82	uS/cm	
			DO:	9.7	mg/L	
				80.5	% Sat	
Comments:						
perched culvert on downstream side of crossing						

Upstream



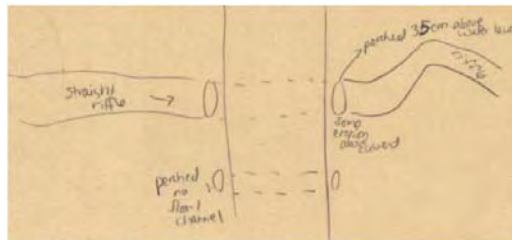
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 33N - Seymour Creek Tributary

			D/S	X	U/S	
Coordinates:	6900693 N	397146 E	Gradient (%):	3	1	6
Site Visit Date:	08-Aug-13		Bankfull Width (m):	0.87	1.35	1.27
Flow Conditions:	Medium		Bankfull Depth (m):	0.17	0.22	0.32
Barrier/Confirmed:	None		Wetted Widths (m):	0.87	1.35	1.13
Electrofished/Effort?:	No		Wetted Depth (m):	0.13	0.14	0.32
Gee Trapping:	No		Substrate Bed:	G/C	G	G
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/PO	WI/PO	WI/PO
			Meander Pattern:	SI	SI	SI
			Cover:	-	50% / OV	80% / OV
Photo #s	72 u/s	74 x	73 d/s			
Areas of Erosion:	No		Temperature:	2.73	°C	
Locations:			pH:	7.87	pH units	
			Conductivity:	73	µS/cm	
			DO:	10.05	mg/L	
				83.2	% Sat	
Comments:						
riffle-run section						

Upstream



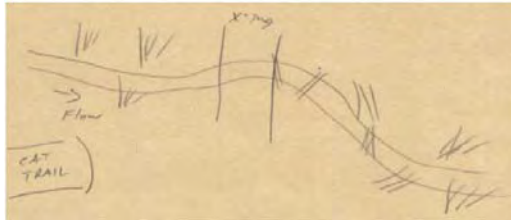
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 34 - No Crossing

			D/S	X	U/S
Coordinates:	6904328 N	391846 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:	No visible channel				

Photo 57



Photo 58



Freegold Road Upgrade Crossing # 35 - No Crossing

			D/S	X	U/S
Coordinates:	6905560 N	388575 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel, dry					

Photo 59



Photo 60



Freegold Road Upgrade Crossing # 36 - No Crossing

			D/S	X	U/S
Coordinates:	6906012 N	388238 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel					

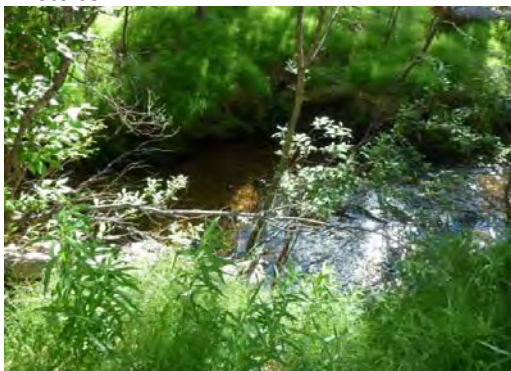
Photo 61



Photo 62



Photo 63



Freegold Road Upgrade Crossing # 37 - Seymour Creek Tributary

			D/S	X	U/S
Coordinates:	6906565 N	387569 E	Gradient (%):	-	-
Site Visit Date:	01-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	-
Gee Trapping:	No		Substrate Bed:	-	-
Fish Bearing?:	No		Substrate Bank:	-	-
Site Length:	100 m		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	64 u/s	65 x	66 d/s		
Areas of Erosion:	No		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
Channel dry					
Upstream - some scouring but not defined channel					
Downstream - more defined, cuts down and gravel substrate					
Water flows over road, no culvert					

Upstream



Crossing



Downstream



Freegold Road Upgrade Crossing # 38 - No Crossing

			D/S	X	U/S
Coordinates:	6906784 N	387384 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:	No visible channel				

Photo 118



Photo 119



Freegold Road Upgrade Crossing # 39 - Seymour Creek Tributary

			D/S	X	U/S
Coordinates:	6907392 N	387074 E	Gradient (%):	3	10
Site Visit Date:	02-Jul-13		Bankfull Width (m):	0.45	0.76
Flow Conditions:	None		Bankfull Depth (m):	0.48	0.49
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	-
Gee Trapping:	No		Substrate Bed:	C/G	C/G
Fish Bearing?:	No		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	SP/PO/WI	SP/PO/WI
			Meander Pattern:	IM	IM
			Cover:	60% / U	80% / OV
Photo #s	120 d/s	121 x	122 u/s		
Areas of Erosion:	Yes		Temperature:	-	°C
Locations:	Existing road is partly washed out		pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
Visible channel - dry					
Road washed out previously - no culvert					

Upstream



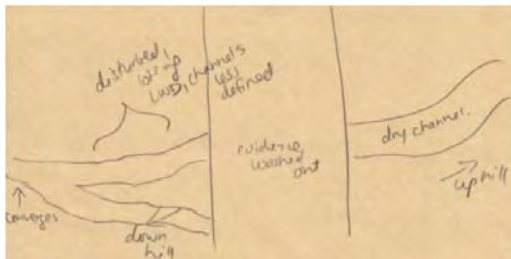
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 39.5 (Unmapped Site) - Seymour Creek Tributary

			D/S	X	U/S
Coordinates:	08 V 0386827 6913577	Gradient (%):	-	-	-
Site Visit Date:	02-Jul-13	Bankfull Width (m):	-	-	-
Flow Conditions:	Low	Bankfull Depth (m):	-	-	-
Barrier/Confirmed:	Yes	Wetted Widths (m):	-	-	-
Electrofished/Effort?:	No	Wetted Depth (m):	-	-	-
Gee Trapping:	No	Substrate Bed:	-	F	-
Fish Bearing?:	No	Substrate Bank:	-	-	-
Site Length:	100 m	Riparian Vegetation:	-	-	-
		Meander Pattern:	-	-	-
		Cover:	-	-	-
Photo #s	147 u/s	148 x	149 d/s		
Areas of Erosion:	Yes	Temperature:	-	°C	
Locations:	Both US and DS of crossing	pH:	-	pH units	
		Conductivity:	-	uS/cm	
		DO:	-	mg/L	
			-	% Sat	
Comments:					
Originates as a groundwater pond 20m above the road - photo 150					
Disturbed downstream of the road - photo 151					

Upstream



Crossing



Downstream



Photo 150



Freegold Road Upgrade Crossing # Unmapped Site - Pg. 2

Photo 151



Freegold Road Upgrade Crossing # 40 - Seymour Creek

			D/S	X	U/S	
Coordinates:	6909633 N	385203 E	Gradient (%):	1	1/1	1
Site Visit Date:	02-Jul-13		Bankfull Width (m):	9.80	8.50 / 7.30	21.50
Flow Conditions:	Low		Bankfull Depth (m):	0.49	0.32 / 0.84	0.67
Barrier/Confirmed:	None		Wetted Widths (m):	8.20	5.00 / 5.10	11.90
Electrofished/Effort?:	No		Wetted Depth (m):	0.19	0.07 / 0.43	0.22
Gee Trapping:	No		Substrate Bed:	C/G	G/F / C/B	C/G
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/PO/SP	SP/PO/WI	SP/PO/WI
			Meander Pattern:	SI	IM	IM
		Cover:	10% / OV	5% / OV	5% / B	
Photo #s	123/126 u/s	124/127 x	125/128 d/s			
Areas of Erosion:	Yes		Temperature:	9.86	°C	
Locations:	Area around road eroded, also banks		pH:	7.99	pH units	
	on small channel u/s of the road		Conductivity:	195	uS/cm	
	and at the ford		DO:	9.61	mg/L	
				92	% Sat	

Comments:
Two channels: approximately 9m bar, partly vegetated between two. Large sand piles upstream, also placer ponds further upstream, heavily disturbed: photos 129 (upstream) and 130 (downstream)
Potential for re-vegetation, bank stabilization, pools, instream habitat. U/s site assessed at main channel, 90% of flow. 2 arctic grayling spotted, 2 more upstream of the bridge and 2 downstream

Upstream



Upstream 2



Crossing



Crossing 2

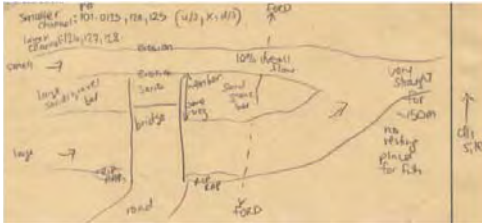


Downstream



A photograph of a river flowing through a forested area. The river is shallow and clear, revealing a rocky bed. The left bank is composed of light-colored, rounded stones and pebbles. The right bank is covered in dense green vegetation, including tall trees and shrubs. In the background, a mountain range is visible under a cloudy sky.

Photo 129



Freegold Road Upgrade Crossing # 40N - Seymour Creek

			D/S	X	U/S	
Coordinates:	6909572 N	385205 E	Gradient (%):	2	1	3
Site Visit Date:	08-Aug-13		Bankfull Width (m):	42.00	45.00	45.00
Flow Conditions:	Low		Bankfull Depth (m):	0.85	1.00	1.00
Barrier/Confirmed:	None		Wetted Widths (m):	6.00	16.00	9.00
Electrofished/Effort?:	/		Wetted Depth (m):	0.32	0.25	0.35
Gee Trapping:			Substrate Bed:	C/G	C/G	C/G
Fish Bearing?:	Y/N		Substrate Bank:	F/C	F/C	F/C
Site Length:			Riparian Vegetation:	WI	WI	WI
	(200m)		Meander Pattern:	SI	SI	SI
			Cover:	10% / SUB	10% / SUB	10% / SUB
Photo #s	63 u/s	65 x	64 d/s			
Areas of Erosion:	Y		Temperature:	5.9	°C	
Locations:	Old Placer mine just upstream		pH:	8.12	pH units	
	of crossing location		Conductivity:	151	µS/cm	
			DO:	10.06	mg/L	
				87.3	% Sat	
Comments:	Non-specific conductivity: 236 µS/cm					
	Braided channel at crossing, will need to be trained to bridge					

Upstream



Crossing



Downstream



Site Illustration

Freegold Road Upgrade Crossing # 40NN - Seymour Creek Side Channel

			D/S	X	U/S	
Coordinates:	-	-	Gradient (%):	-	4	-
Site Visit Date:	08-Aug-13		Bankfull Width (m):	-	5.00	-
Flow Conditions:	Low		Bankfull Depth (m):	-	1.00	-
Barrier/Confirmed:	None		Wetted Widths (m):	-	2.00	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.14	-
Gee Trapping:	No		Substrate Bed:	-	C/G	-
Fish Bearing?	Yes		Substrate Bank:	-	G/F	-
Site Length:	50 m		Riparian Vegetation:	-	WI	-
			Meander Pattern:	-	SI	-
			Cover:	-	10% / SUB	-
Photo #s	67 u/s	69 x	68 d/s			
Areas of Erosion:	Yes		Temperature:	5.4	°C	
Locations:	both LHB and RHB		pH:	7.96	pH units	
			Conductivity:	143	µS/cm	
			DO:	8.54	mg/L	
				73.4	% Sat	
Comments:						
Side channel most likely originating in settling ponds upstream						

Upstream



Crossing



Downstream



Site Illustration

Freegold Road Upgrade Crossing # 41 - Bow Creek

			D/S	X	U/S
Coordinates:	6910209 N	385089 E	Gradient (%):	1	1
Site Visit Date:	02-Jul-13		Bankfull Width (m):	7.00	9.00
Flow Conditions:	Low		Bankfull Depth (m):	0.62	0.48
Barrier/Confirmed:	None		Wetted Widths (m):	6.40	7.40
Electrofished/Effort?:	Yes (2010)		Wetted Depth (m):	0.32	0.36
Gee Trapping:	No		Substrate Bed:	C/G	G/C
Fish Bearing?	Yes		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	SP/PO/WI	PO/WI/SP
			Meander Pattern:	SI	SI
			Cover:	10% / OV	10% / OV
Photo #s	131 u/s	132 x	133 d/s		
Areas of Erosion:	Yes		Temperature:	7.18	°C
Locations:	Under bridge and at ford		pH:	7.98	pH units
			Conductivity:	107	uS/cm
			DO:	9.57	mg/L
				863	% Sat
Comments:					
4 grayling spotted under bridge					
Saw school of fish (approximately 15) just by the bridge					
High quality habitat lacking deep pools					

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 42 - No Crossing

			D/S	X	U/S
Coordinates:	6911340 N	385468 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
No visible channel					
Area down the road shows signs of intermittent water at 08 V 0385462 6911294					

Photo 134



Photo 135



Photo 136



Photo 137



Freegold Road Upgrade Crossing # 42 - Pg. 2

Photo 138



Freegold Road Upgrade Crossing # 43 - No Crossing

			D/S	X	U/S
Coordinates:	6911722 N	385785 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:	No visible channel				

Photo 139



Photo 140



Freegold Road Upgrade Crossing # 44 - No Crossing

			D/S	X	U/S
Coordinates:	6911857 N	385925 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel					
Photo 141 shows nearby highflow channel - not sure if it will be crossed					

Photo 141



Photo 142



Photo 143



Freegold Road Upgrade Crossing # 45 - No Crossing

			D/S	X	U/S
Coordinates:	6913286 N	386796 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:	No visible channel				

Photo 144



Photo 145



Photo 146



Freegold Road Upgrade Crossing # 46 - Big Creek Tributary

			D/S	X	U/S
Coordinates:	6915155 N	385937 E	Gradient (%):	-	7
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	0.83
Flow Conditions:	Very low		Bankfull Depth (m):	-	0.23
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	0.20
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.01
Gee Trapping:	No		Substrate Bed:	-	F/G
Fish Bearing?:	Yes		Substrate Bank:	-	F/G
Site Length:	100 m		Riparian Vegetation:	-	SP/WI
			Meander Pattern:	-	IM
			Cover:	-	0
					90% / OV
Photo #s	152 u/s	153 x	154 d/s		
Areas of Erosion:	Yes		Temperature:	-	°C
Locations:	Scouring along road crossing		pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
No culvert at road crossing - creating a barrier to fish passage					

Upstream



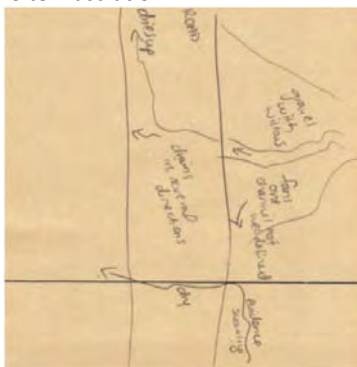
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 46 - Pg. 2

Photo 155



Freegold Road Upgrade Crossing # 47 - Big Creek Tributary

			D/S	X	U/S	
Coordinates:	6914783 N	384948 E	Gradient (%):	3	4	6
Site Visit Date:	02-Jul-13		Bankfull Width (m):	0.95	1.15	1.30
Flow Conditions:	None		Bankfull Depth (m):	0.50	0.25	0.25
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	-	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	-	-
Gee Trapping:	No		Substrate Bed:	C/G	G/F	G/F
Fish Bearing?:	No		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	SP/PO/WI	SP/PO/WI	SP/PO/WI
			Meander Pattern:	SI	SI	IM
			Cover:	80 % / OV	90% / OV	70% / OV
Photo #s	156 u/s	157 x	158 d/s			
Areas of Erosion:	No		Temperature:	-	°C	
Locations:			pH:	-	pH units	
			Conductivity:	-	uS/cm	
			DO:	-	mg/L	
				-	% Sat	
Comments:						
Dry channel with culvert						
Large channel with no water, was pool habitat in downstream section						
Perched culvert on downstream side creating a barrier to fish passage						

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 47 - Pg. 2

Photo 159



Photo 160



Freegold Road Upgrade Crossing # 47.5 (Unmapped Site) - Big Creek Tributary

				D/S	X	U/S
Coordinates:	6914767 N	384266 E	Gradient (%):	3	2	4
Site Visit Date:	02-Jul-13		Bankfull Width (m):	0.76	1.40	1.40
Flow Conditions:	Low		Bankfull Depth (m):	0.07	0.13	0.32
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.76	0.84	0.88
Electrofished/Effort?:	No		Wetted Depth (m):	0.02	0.03	0.04
Gee Trapping:	No		Substrate Bed:	F/G	G/C	G/C
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
			Meander Pattern:	SI	SI	SI
			Cover:	80% / OV	5% / OV	50% / OV
Photo #s	183 u/s	184 x	185 d/s			
Areas of Erosion:	Yes		Temperature:	18.26	°C	
Locations:	Disturbed area, road washed out.		pH:	8.42	pH units	
			Conductivity:	603	uS/cm	
			DO:	9.4	mg/L	
				107.6	% Sat	
Comments:						
Looks re-aligned, not much riparian vegetation or cover						
About 35m above road: dramatic step-pool through area with 100% riparian vegetation						
Downstream site is not natural; runs through willows and trees without defined channel						

Upstream



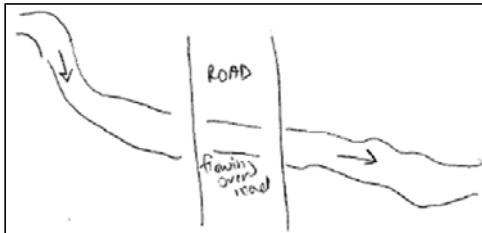
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 48 - No Crossing

			D/S	X	U/S
Coordinates:	6914718 N	384130 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel. Disturbed area. Photos 178, 179					

Photo 178



Photo 179



Photo 180



Photo 181



Freegold Road Upgrade Crossing # 48 - Pg. 2

Photo 182



Freegold Road Upgrade Crossing # 48.5 (Unmapped Site) - Big Creek Tributary

			D/S	X	U/S
Coordinates:	6914524 N	383284 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	-
Gee Trapping:	No		Substrate Bed:	-	-
Fish Bearing?:	No		Substrate Bank:	-	-
Site Length:	100 m		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	Yes		Temperature:	-	°C
Locations:	Erosion of road crossing		pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
Perched culvert downstream of crossing					
Dry channel					

Photo 175



Photo 176



Photo 177



Freegold Road Upgrade Crossing # 49

			D/S	X	U/S	
Coordinates:	6914666 N	383096 E	Gradient (%):	6	3	3
Site Visit Date:	02-Jul-13		Bankfull Width (m):	1.09	1.10	0.79
Flow Conditions:	Low		Bankfull Depth (m):	0.24	0.20	0.13
Barrier/Confirmed:	No		Wetted Widths (m):	0.37	0.47	0.25
Electrofished/Effort?:	No		Wetted Depth (m):	0.09	0.05	0.03
Gee Trapping:	No		Substrate Bed:	C/F	F/G	C/F
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	GR/WI/SP	SP/WI	SP/WI
			Meander Pattern:	IM	IM	IM
			Cover:	5% / OV	0	0
Photo #s	171 u/s	172 x	173 d/s			
Areas of Erosion:	Yes		Temperature:	19.39	°C	
Locations:	Stream crossing road with no culvert		pH:	8.45	pH units	
			Conductivity:	1093	uS/cm	
			DO:	8.43	mg/L	
				98.5	% Sat	
Comments:						
Heavy machinery and large sand piles present						
Creek possibly re-aligned? No immediate riparian vegetation or cover, those mentioned						
were only nearby						

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 49 - Pg. 2

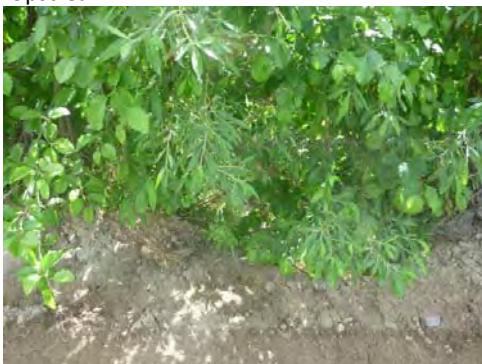
Photo 174



Freegold Road Upgrade Crossing # 50 - Big Creek Tributary

			D/S	X	U/S
Coordinates:	6914869 N	382277 E	Gradient (%):	<1	1
Site Visit Date:	02-Jul-13		Bankfull Width (m):	2.00	0.85
Flow Conditions:	Med		Bankfull Depth (m):	0.66	0.54
Barrier/Confirmed:	None		Wetted Widths (m):	2.00	0.85
Electrofished/Effort?:	No		Wetted Depth (m):	0.53	0.39
Gee Trapping:	No		Substrate Bed:	F	F/G
Fish Bearing?	Yes		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	AL/GR/SP	AL/GR
			Meander Pattern:	ST	IM
			Cover:	15% / OV	80% / OV
Photo #s	101-0168 u/s	101-0169 x	101-0170 d/s		
Areas of Erosion:	No		Temperature:	7.27	°C
Locations:			pH:	7.34	pH units
			Conductivity:	105	uS/cm
			DO:	4.99	mg/L
				45	% Sat
Comments:					
Backwatering from mainstem					
Drop pool downstream of culvert					

Upstream



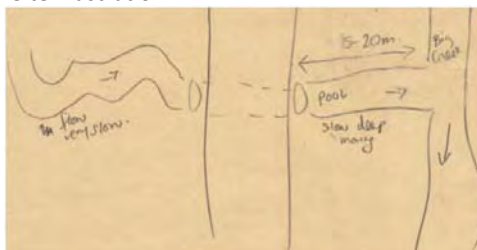
Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 50.5 (Unmapped Site) - Bog Near Big Creek

			D/S	X	U/S
Coordinates:	6915023 N	382209 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	No Flowing Water		Bankfull Depth (m):	-	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	-
Gee Trapping:	No		Substrate Bed:	-	-
Fish Bearing?:	No		Substrate Bank:	-	-
Site Length:	50 m		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	165 u/s	166 x	167 d/s		
Areas of Erosion:	No		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
Culvert present for water seeping from bog into a side channel.					
Grate present over culvert to block passage					

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Upgrade Crossing # 51 - No Crossing

			D/S	X	U/S
Coordinates:	6915035 N	381481 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:	No visible channel				

Photo 163



Photo 164



Freegold Road Upgrade Crossing # 52 - Big Creek Tributary

			D/S	X	U/S
Coordinates:	6915218 N	381366 E	Gradient (%):	-	-
Site Visit Date:	02-Jul-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments: No visible channel - stagnant pond near crossing location					

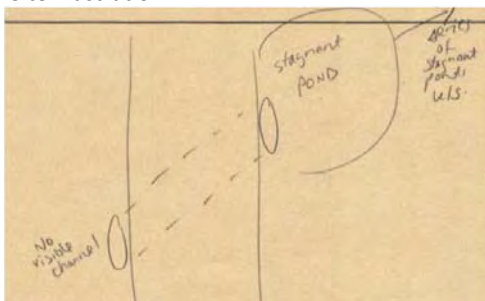
Photo 161



Photo 162

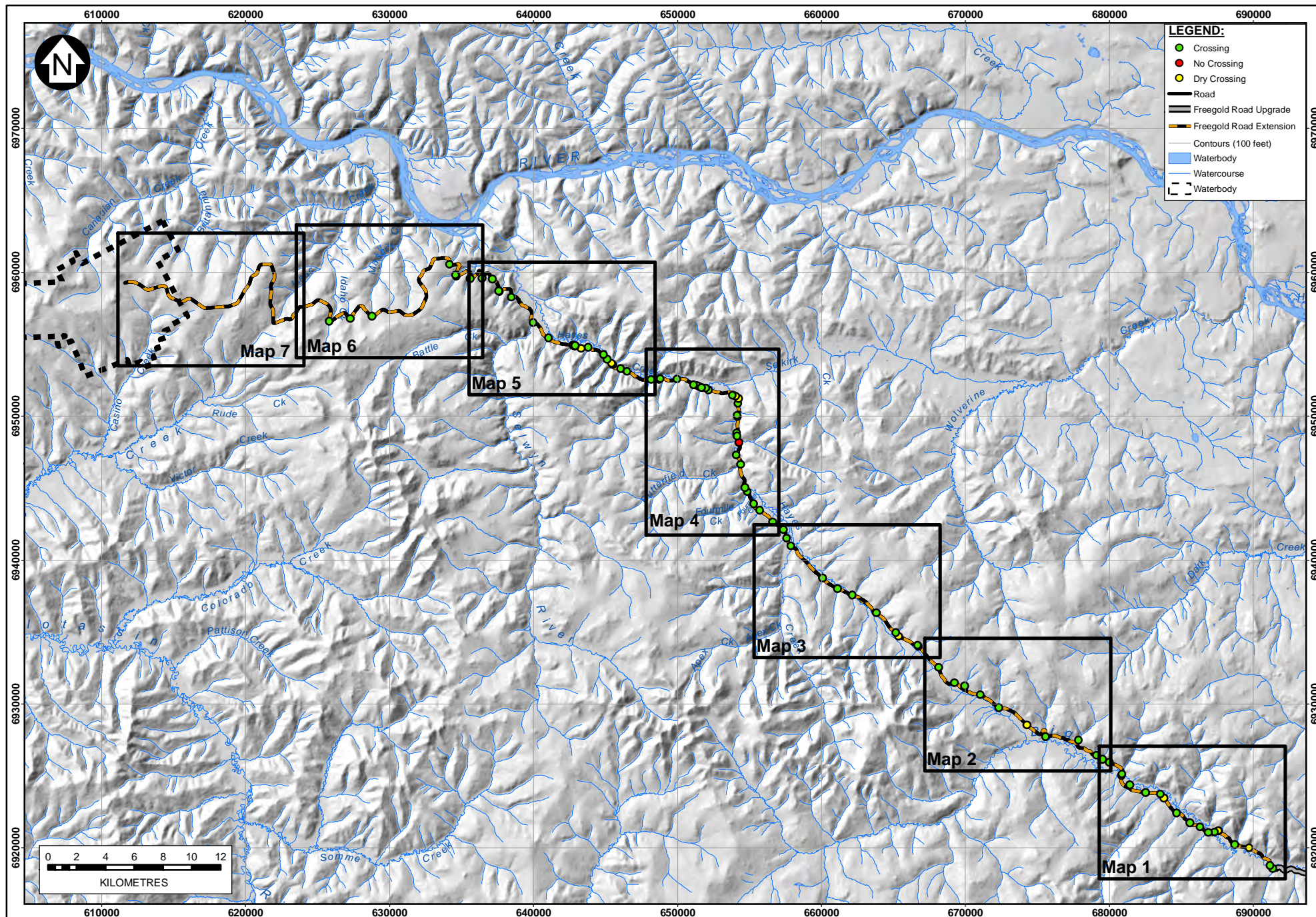


Site Illustration



Appendix C

Freegold Road Extension Crossings, 2013 Fish Habitat Data and Crossing Photos



PREPARED BY:



PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHK'D	L. Richards
APP'D	-
REV	-
DATE	28Aug'13

NOTES:

1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomaticsyukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 7N
3. COORDINATE GRID: METRES
4. SCALE: 1:350,000

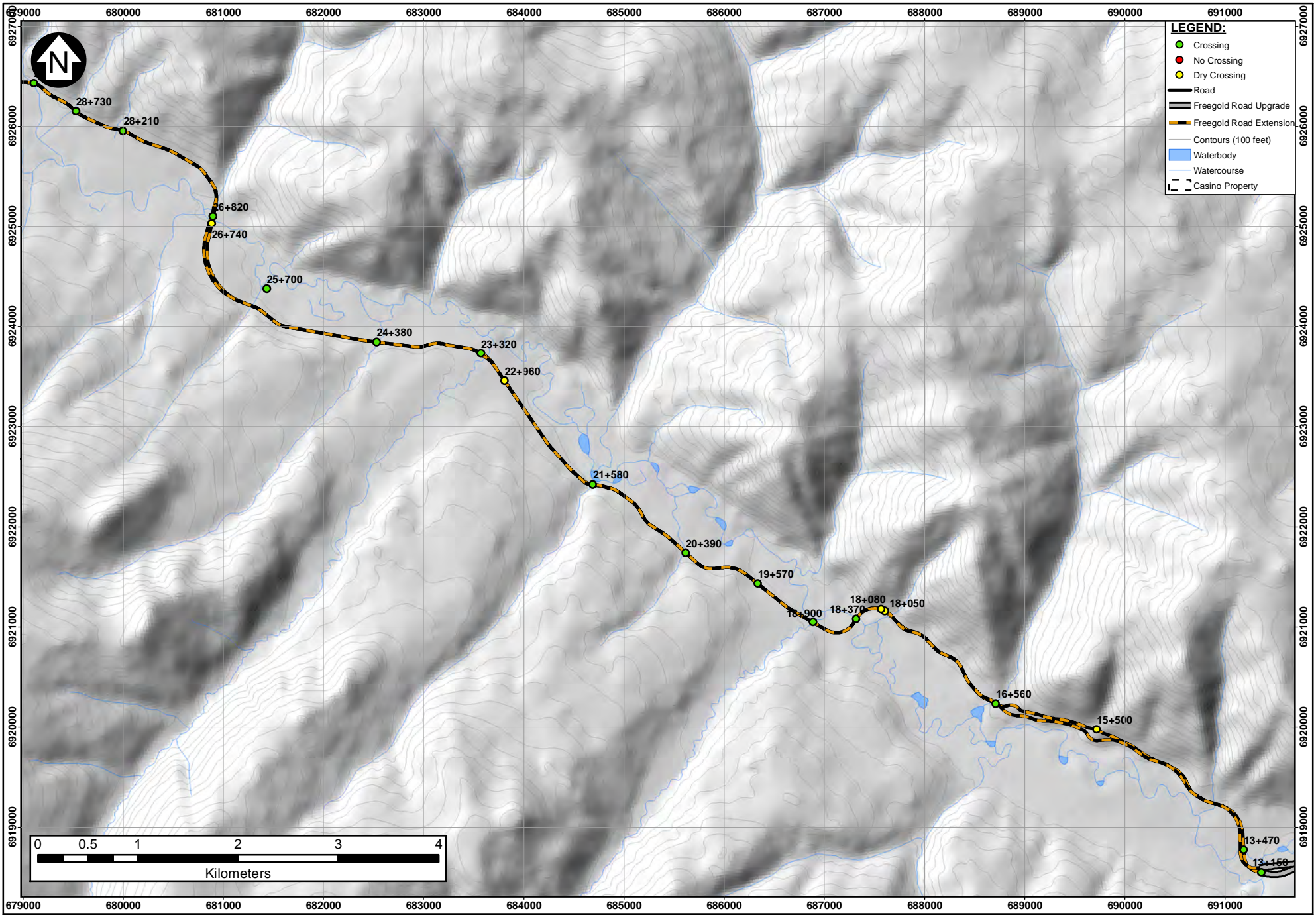
CASINO
COPPER AND GOLD

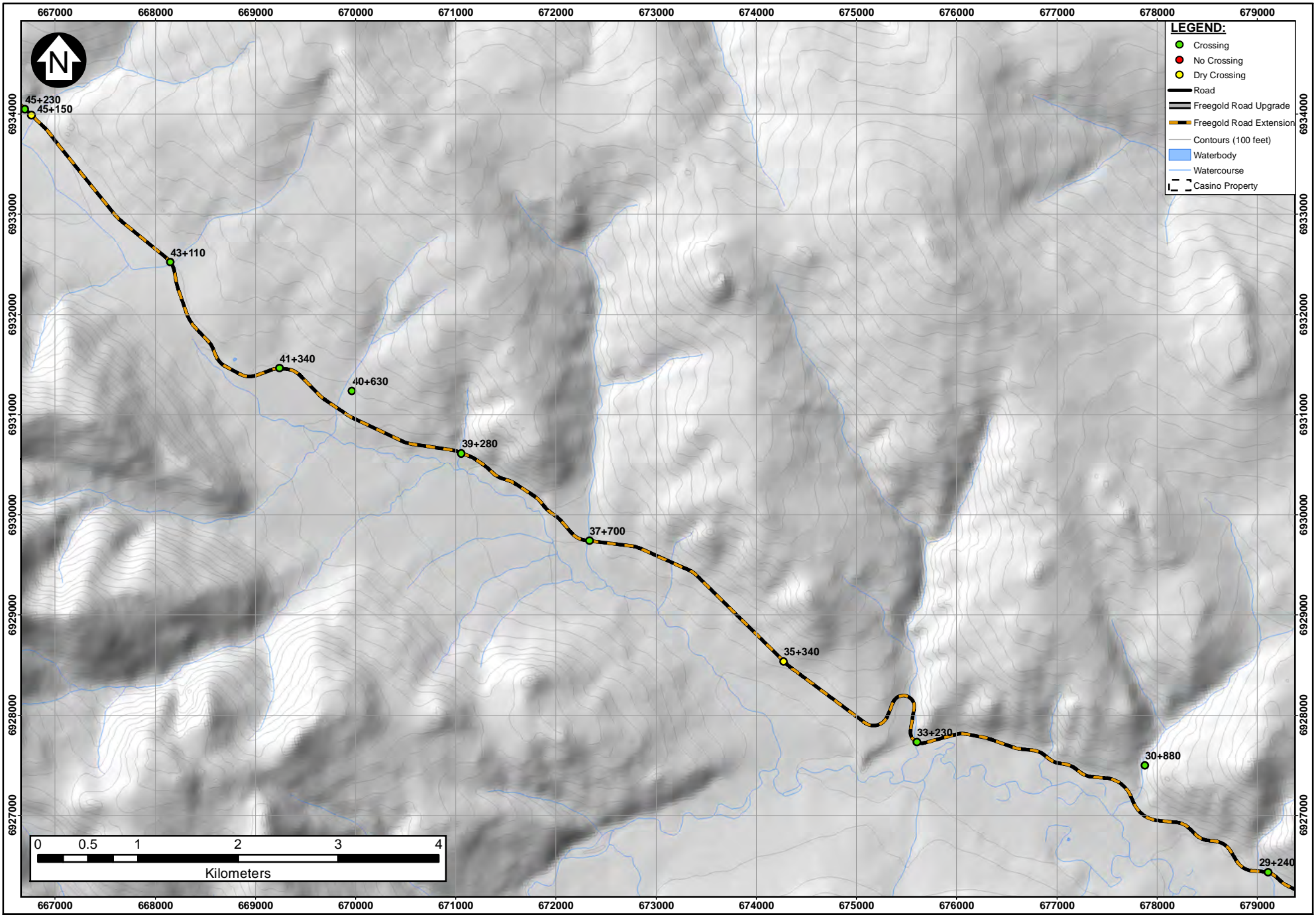
CASINO PROJECT

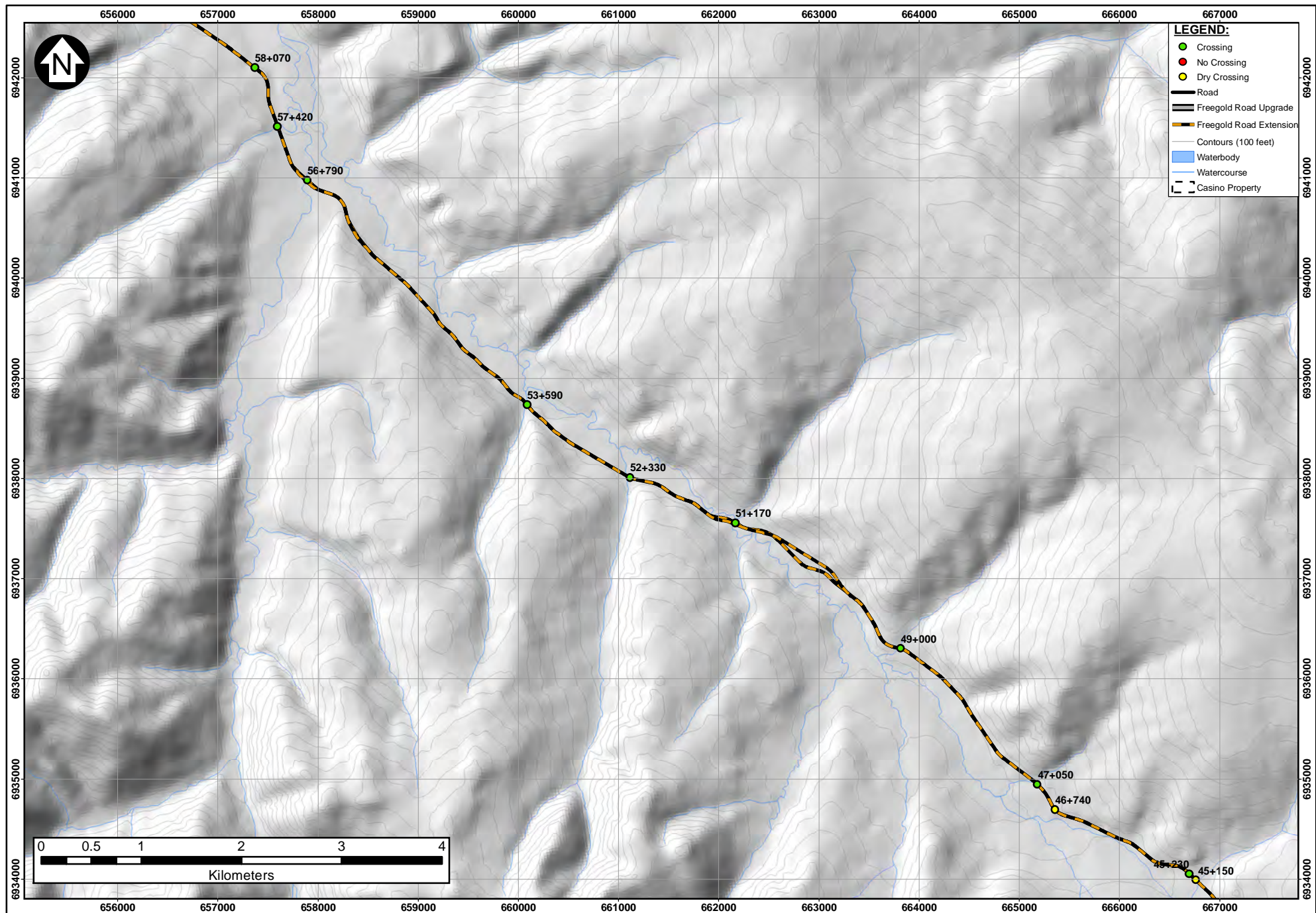
**Freegold Road Extension
Map Series - Index Map**

FIGURE 9

REF
P/A VA101-325/15







PREPARED BY:



PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHK'D	L. Richards
APP'D	-
REV	-
DATE	28Aug'13

NOTES:

1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomaticsyukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 7N
3. COORDINATE GRID: METRES
4. SCALE: 1:50,000

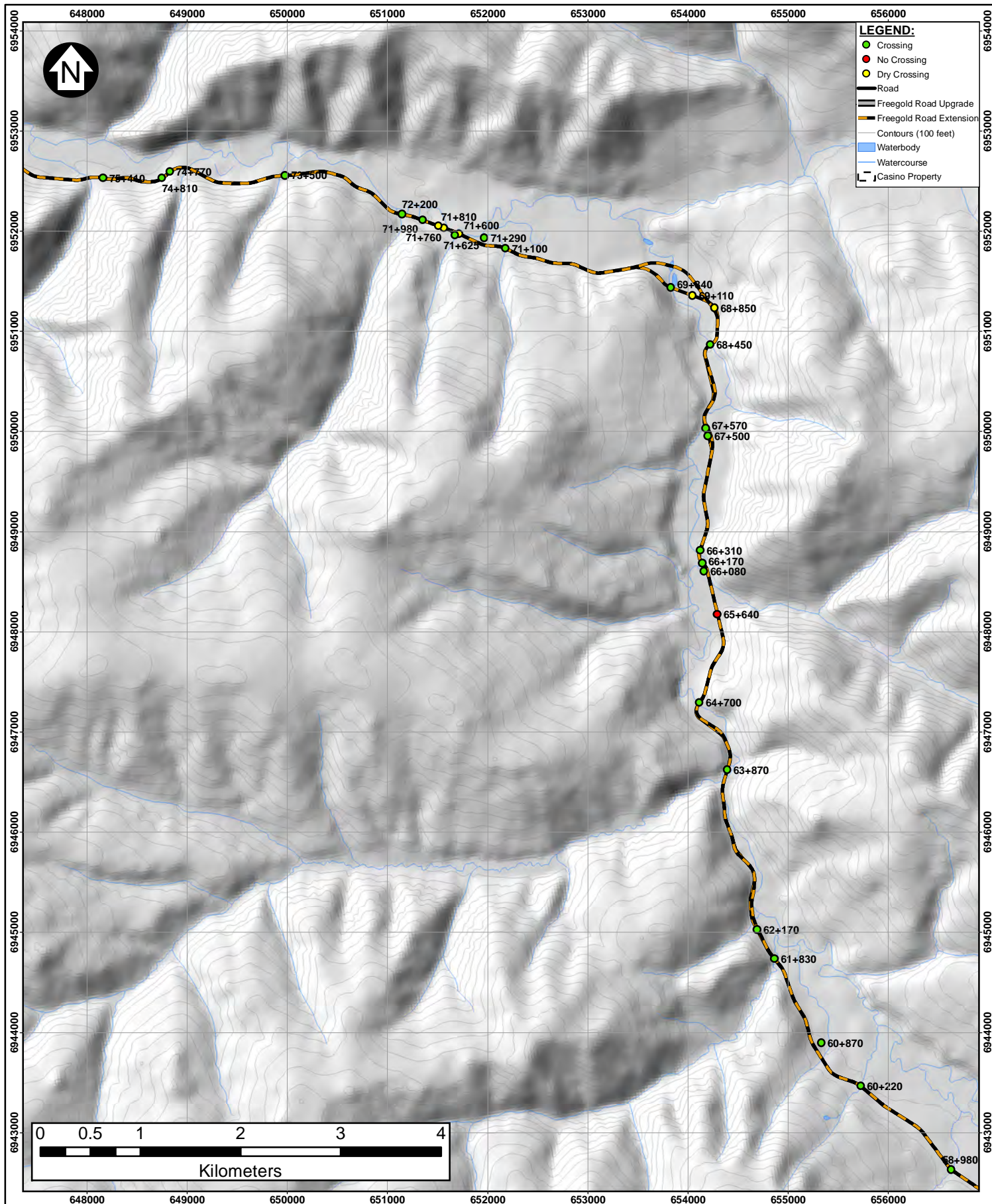
CASiNO
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CASINO PROJECT

**Freegold Road Extension
Map Series - Map 3**

FIGURE 12

REF
P/A VA101-325/15



PREPARED BY:



PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHKD	L. Richards
APP'D	-
REV	-
DATE	28Aug'13

NOTES:

1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomatics.yukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 7N
3. COORDINATE GRID: METRES
4. SCALE: 1:50,000

CASINO
COPPER AND GOLD

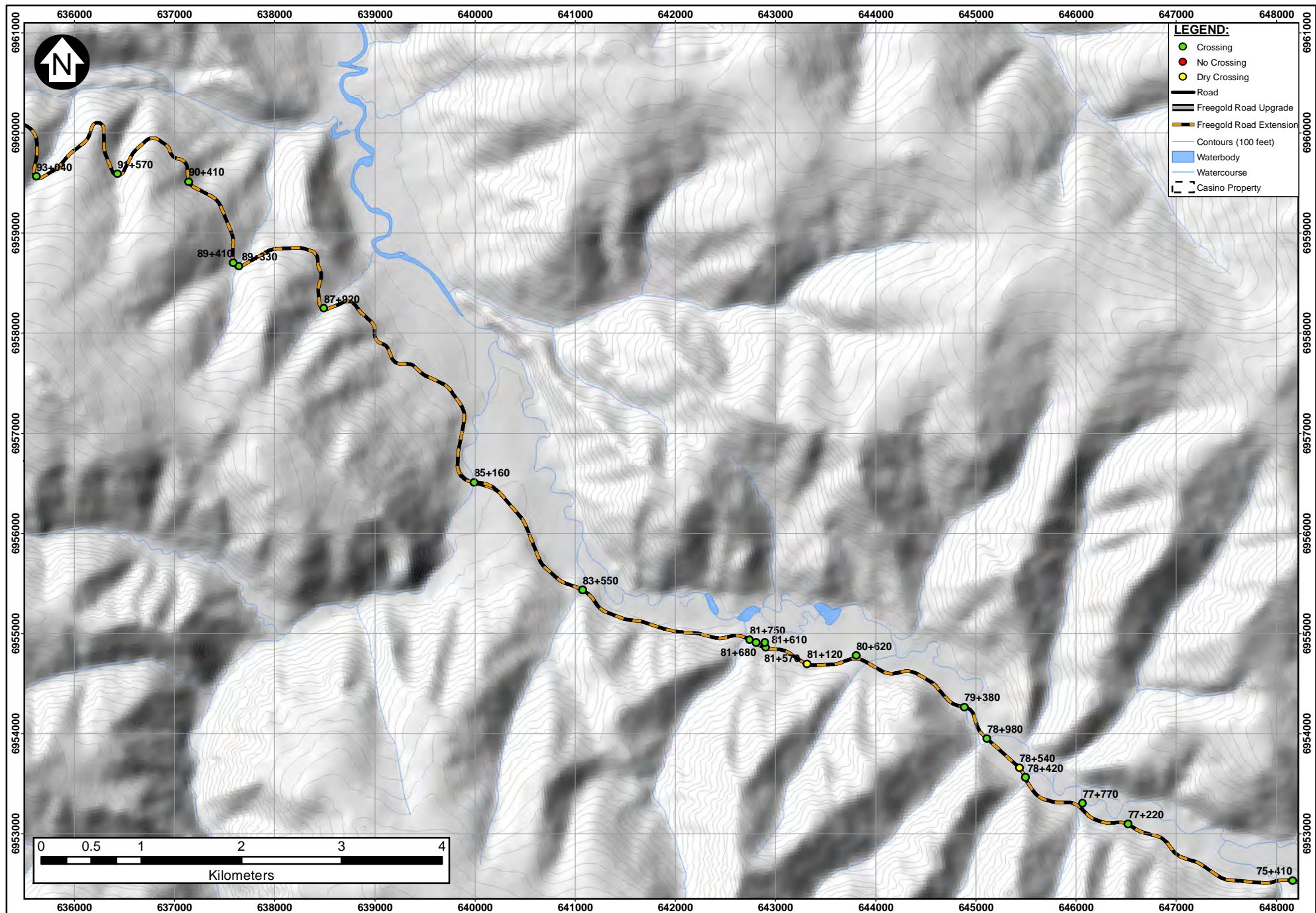
CASINO PROJECT

**Freegold Road Extension
Map Series - Map 4**

FIGURE 13

REF

P/A VA101-325/15



PREPARED BY:



PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHK'D	L. Richards
APP'D	-
REV	-
DATE	28Aug'13

NOTES:

1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomaticsyukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 7N
3. COORDINATE GRID: METRES
4. SCALE: 1:50,000

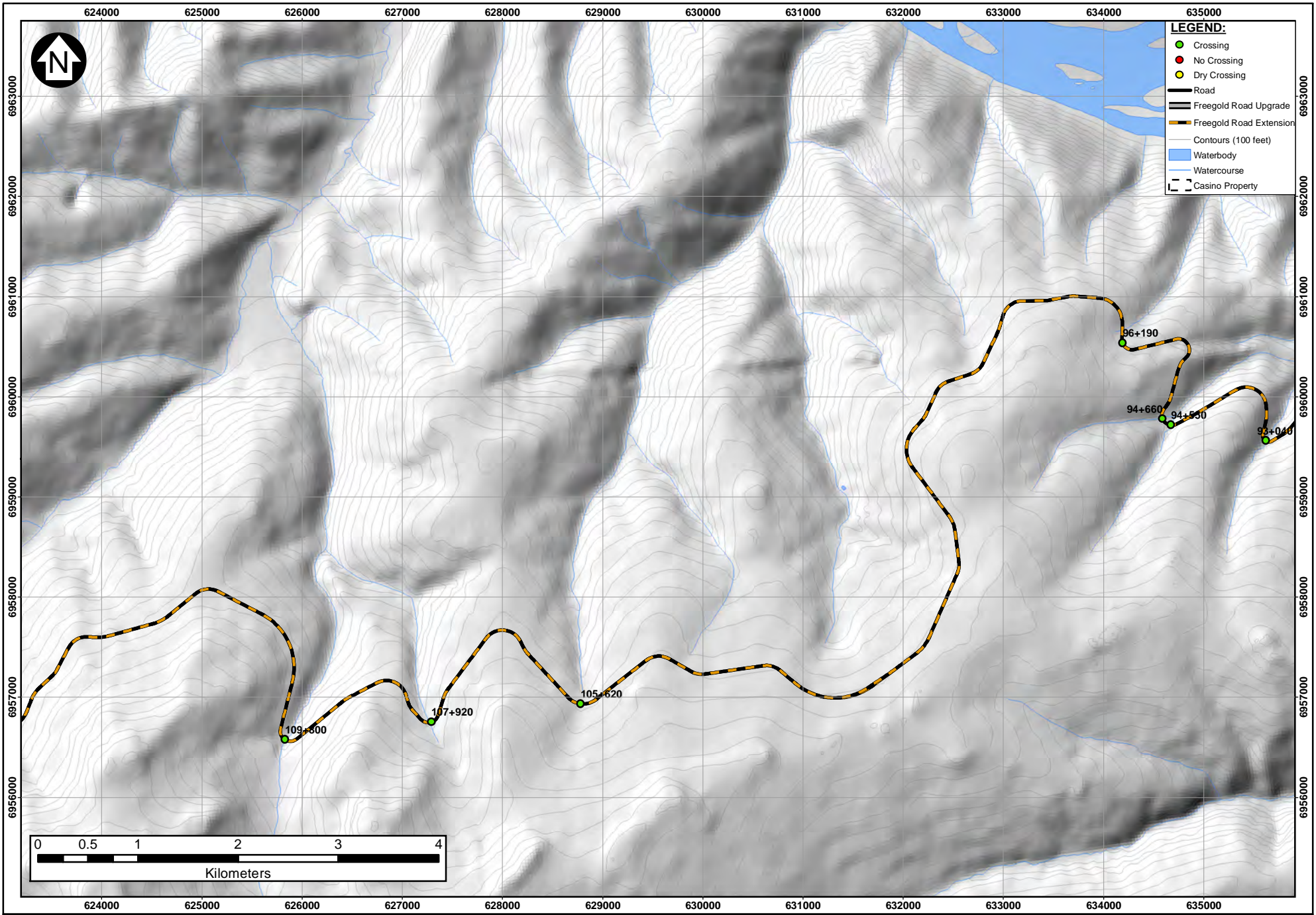
CASiNO
COPPER AND GOLD

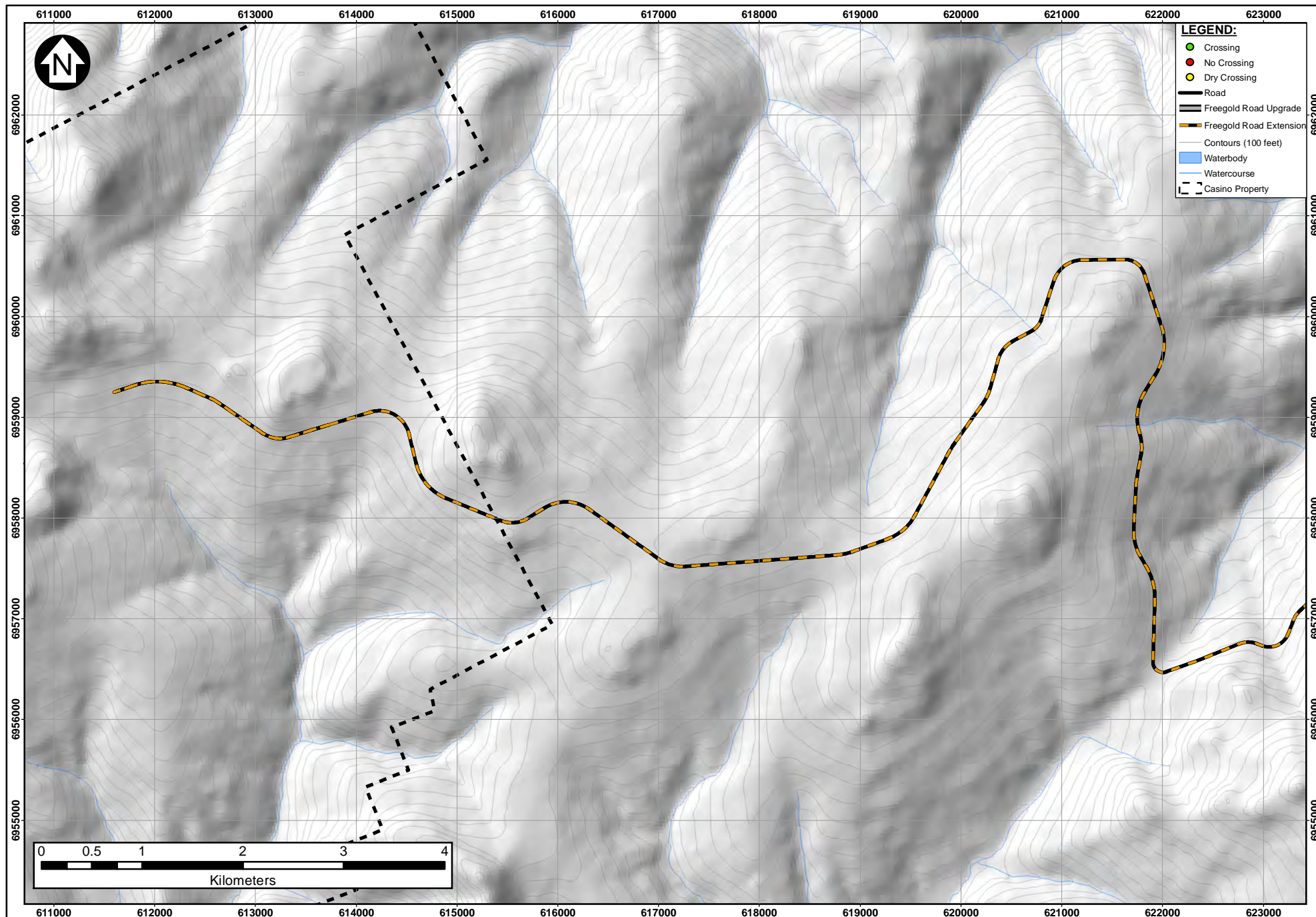
CASINO PROJECT

**Freegold Road Extension
Map Series - Map 5**

FIGURE 14

REF
P/A VA101-325/15





- LEGEND:**
- Crossing
 - No Crossing
 - Dry Crossing
 - Road
 - Freegold Road Upgrade
 - Freegold Road Extension
 - Contours (100 feet)
 - Waterbody
 - Watercourse
 - Casino Property

PREPARED BY:  PALMER ENVIRONMENTAL CONSULTING GROUP INC.	DESIGNED	D. Turner	NOTES: 1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomaticsyukon.ca) 2. PROJECTION: NAD 1983 UTM Zone 7N 3. COORDINATE GRID: METRES 4. SCALE: 1:50,000	 CASINO PROJECT	Freegold Road Extension Map Series - Map 7	
	DRAWN	D. Turner				
	CHKD	L. Richards				
	APP'D	-				
	REV	-				
	DATE	28Aug'13			FIGURE 16	REF P/A VA101-325/15

KEY

Site Naming Codes

HC	Pre-existing AE Habitat Card
UM	Unmapped site, found during PEGC crossing assessment
AS	Site is on the proposed Airstrip
N, E, S, W	North, East, South, West

In Site key

- or N/A Not Sampled, No data available or Not applicable

Substrates:

B	Boulder
C	Cobble
F	Fines
G	Gravel
S	Sand

Riparian Vegetation:

AL	Alder
AS	Aspen
BI	Birch
GR	Grass
PO	Poplar
SH	Shrub
SP	Spruce
WI	Willow

Channel Pattern:

ST	Straight
SI	Sinuuous
RM	Regular Meanders
IM	Irregular Meanders
TM	Tortuous Meanders
WA	Wandering
BR	Braided

Cover:

B	Boulders
DP	Deep Pools
IV	Instream Vegetation
LWD	Large Woody Debris
OV	Overhanging Vegetation
SWD	Small Woody Debris
U	Undercut Banks

Freegold Road Extension Crossing # 13+150 - Big Creek

			D/S	X	U/S	
Coordinates:	6915200 N	380797 E	Gradient (%):	3	0	2
Site Visit Date:	June 19, 2013		Bankfull Width (m):	58.00	24.00	40.00
Flow Conditions:	Low		Bankfull Depth (m):	1.00	1.40	3.00
Barrier/Confirmed:	None		Wetted Widths (m):	24.00	16.00	16.00
Electrofished/Effort?:	No		Wetted Depth (m):	0.38	1.10	2.00
Gee Trapping:	No		Substrate Bed:	C/G	C/G	C/G
Fish Bearing?	Yes		Substrate Bank:	C/S	C/S	C/S
Site Length:	100 m		Riparian Vegetation:	SP/WI/PO	SP/WI/PO	SP/WI/PO
			Meander Pattern:	IM	IM	IM
			Cover:	20% / LWD	5% / OV	5% / LWD
Photo #s	69 u/s	70 x	71 d/s			
Areas of Erosion:	Y		Temperature:	9.32	°C	
Locations:	Just upstream of Mechanic		pH:	7.22	pH units	
	Mechanic Creek		Conductivity:	170	uS/cm	
			DO:	11.9	mg/L	
				100	% Sat	
Comments: Pre-existing Habitat Card as 13+120						
Some deep pool/glide habitat, boulder/overhang vegetation cover, very limited						
Nice pool/ undercut bank on left bank. Log jam downstream, creek divides into several sections						

Photo 68



Site Illustration



Upstream - 70



Crossing 71



Freegold Road Extension Crossing # 13+470 - Big Creek Tributary

			D/S	X	U/S
Coordinates:	6915437 N	380643 E	Gradient (%):	1	1
Site Visit Date:	19-Jun-13		Bankfull Width (m):	5.00	6.00
Flow Conditions:	Low		Average Depth (m):	0.80	1.20
Barrier/Confirmed:	None		Wetted Widths (m):	4.00	5.00
Electrofished/Effort?:	No		Substrate Bed:	G/C	G/C
Gee Trapping:	No		Substrate Bank:	-	-
Fish Bearing?:	Yes		Riparian Vegetation:	-	-
Site Length:	100 m		Meander Pattern:	-	-
			Cover:	60% / OV	60% / OV

Photo #s	79 u/s	80 x	81 d/s
Areas of Erosion:	No	Temperature:	- °C
Locations:		pH:	- pH units
		Conductivity:	- uS/cm
		DO:	- mg/L
			- % Sat

Comments:
Pre-exisiting site card as 13+580 (Summit, 2011)
Good quality habitat

Upstream



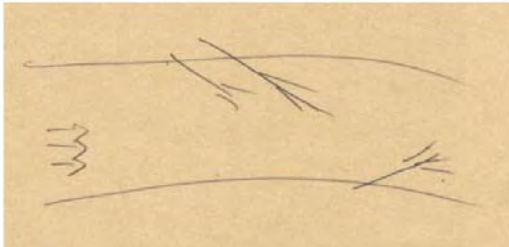
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 15+500 - Big Creek Tributary

			D/S	X	U/S
Coordinates:	6916772 N	379294 E	Gradient (%):	-	-
Site Visit Date:	19-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:	Dry		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N		Substrate Bank:	-	-
Site Length:	-		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	76 x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
Dry channel running straight off of hillside					
No permanent flow					

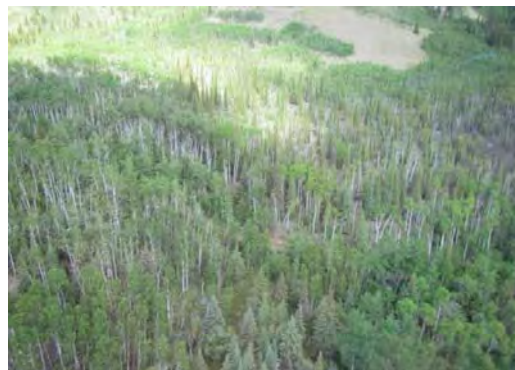
76



77



78



Freegold Road Extension Crossing # 16+560 - Big Creek Tributary

			D/S	X	U/S	
Coordinates:	6917122 N	378313 E	Gradient (%):	3	6	9
Site Visit Date:	19-Jun-13		Bankfull Width (m):	3.40	4.00	3.50
Flow Conditions:	Low		Bankfull Depth (m):	0.20	0.26	0.27
Barrier/Confirmed:	None		Wetted Widths (m):	1.80	1.90	2.60
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.10	0.16	0.17
Gee Trapping:	No		Substrate Bed:	C/B	C/B	C/B
Fish Bearing?	Yes		Substrate Bank:	C/S	B/S	C/S
Site Length:	100 m		Riparian Vegetation:	GR/SH	GR	GR
		Meander Pattern:	RM	RM	RM	
		Cover:	5% / B	10% / B	15% / U	
Photo #s	73 u/s	74 x	75 d/s			
Areas of Erosion:	Yes		Temperature:	6	°C	
Locations:	Slumped bank at crossing		pH:	7.8	pH units	
			Conductivity:	377	uS/cm	
			DO:	13.15	mg/L	
				105	% Sat	

Comments:
Slumping/erosion upstream and downstream of current ford

Upstream



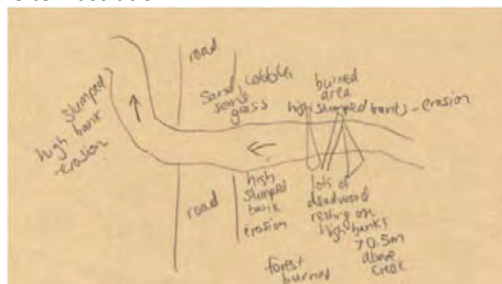
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 18+050 - Big Creek Tributary

			D/S	X	U/S
Coordinates:	6918147 N	377298 E	Gradient (%):	-	-
Site Visit Date:	19-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:	Dry		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	No		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
Dry - no visible channel					

Air photo from 18+080



Freegold Road Extension Crossing # 18+080 - Big Creek Tributary

			D/S	X	U/S
Coordinates:	6918167 N	377264 E	Gradient (%):	-	-
Site Visit Date:	19-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:	Dry		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	No		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	82 x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
Dry gully - no channel/water					

Photo from helicopter



Freegold Road Extension Crossing # 18+370 - Big Creek

			D/S	X	U/S
Coordinates:	6918095 N	377007 E	Gradient (%):	0.5	0.5
Site Visit Date:	19-Jun-13		Bankfull Width (m):	24.00	23.00
Flow Conditions:	Low		Average Depth (m):	1.00	0.90
Barrier/Confirmed:	None		Wetted Widths (m):	22.00	19.00
Electrofished/Effort?:	No		Substrate Bed:	G/C	G/C
Gee Trapping:	No		Substrate Bank:	-	-
Fish Bearing?	Yes		Riparian Vegetation:	-	-
Site Length:	100 m		Meander Pattern:	-	TS
			Cover:	30% / DP	30% / DP
				45% / DP/LWD	

Photo #s	83 u/s	84 x	85 d/s	
Areas of Erosion:	N		Temperature:	9.79 °C
Locations:			pH:	7.53 pH units
			Conductivity:	132 uS/cm
			DO:	12.19 mg/L
				107.4 % Sat

Comments:
Pre-existing site card (Summit, 2011)
High quality spawning and rearing habitat

Upstream



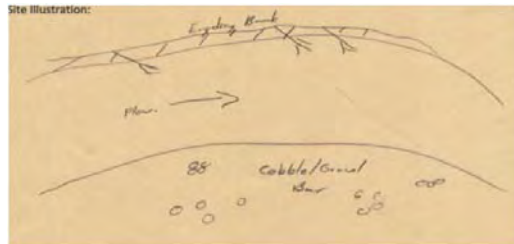
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 18+900 - Big Creek Tributary

			D/S	X	U/S	
Coordinates:	6918099 N	376573 E	Gradient (%):	3	1	2
Site Visit Date:	19-Jun-13		Bankfull Width (m):	10.60	6.00	7.50
Flow Conditions:	Low		Bankfull Depth (m):	0.83	0.60	0.65
Barrier/Confirmed:	None		Wetted Widths (m):	6.40	3.30	4.50
Electrofished/Effort?:	No		Wetted Depth (m):	0.27	0.30	0.24
Gee Trapping:	No		Substrate Bed:	C/G	C/G	C/G
Fish Bearing?	Yes		Substrate Bank:	C/S	C/S	C/S
Site Length:	100 m		Riparian Vegetation:	WI	WI/PO	WI/PO
		Meander Pattern:	RM	RM	RM	
		Cover:	5% / B	5% / U	10% / B	
Photo #s	86 u/s	87 x	88 d/s			
Areas of Erosion:	N		Temperature:	9.93	°C	
Locations:			pH:	7.52	pH units	
			Conductivity:	129	uS/cm	
			DO:	11.93	mg/L	
				105.6	% Sat	

Comments:
High quality rearing habitat
Distinct lack of pool habitat in this otherwise high quality channel

Upstream



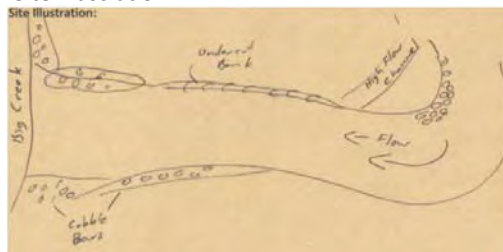
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 19+570 - Big Creek Tributary

			D/S	X	U/S
Coordinates:	6918534 N	376059 E	Gradient (%):	-	0
Site Visit Date:	19-Jun-13		Bankfull Width (m):	-	9.00
Flow Conditions:	No Flow		Bankfull Depth (m):	-	0.70
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	9.00
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.70
Gee Trapping:	No		Substrate Bed:	-	F
Fish Bearing?:	No		Substrate Bank:	-	F
Site Length:	50 m		Riparian Vegetation:	-	SP/WI
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	89 u/s	90 x	91 d/s		
Areas of Erosion:	N/A		Temperature:	13.3	°C
Locations:			pH:	6	pH units
			Conductivity:	73	uS/cm
			DO:	3.57	mg/L
				34	% Sat
Comments:					
Disconnected old oxbow, now shallow marsh					
Not connected to Big Creek and does not support fish					

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 20+390 - Big Creek Tributary

			D/S	X	U/S
Coordinates:	6918907 N	375373 E	Gradient (%):	5	3
Site Visit Date:	19-Jun-13		Bankfull Width (m):	1.35	0.70
Flow Conditions:	Low		Bankfull Depth (m):	0.25	0.14
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.90	0.45
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.05	0.09
Gee Trapping:	No		Substrate Bed:	F	F
Fish Bearing?	No		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP
			Meander Pattern:	SI	SI
			Cover:	0	50% / OV
Photo #s	92 u/s	93 x	94 d/s		
Areas of Erosion:	No		Temperature:	9.69	°C
Locations:			pH:	5.97	pH units
			Conductivity:	123	uS/cm
			DO:	11.93	mg/L
				104.8	% Sat

Comments:
Small incised creek cutting through organics - very turbid even at low flow
Non-fish bearing in all likelihood
Some small step pools identified

Upstream



Crossing



Downstream



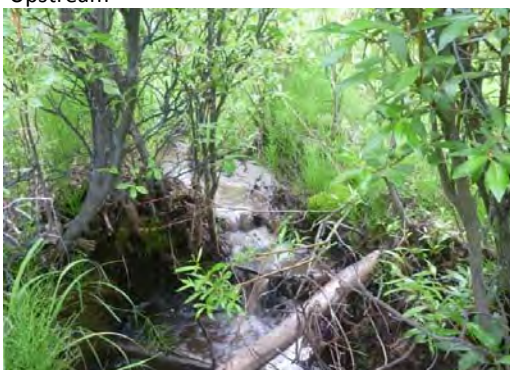
Site Illustration



Freegold Road Extension Crossing # 21+580 - Big Creek Tributary

			D/S	X	U/S
Coordinates:	6919673 N	374514 E	Gradient (%):	3.5	5
Site Visit Date:	23-Jun-13		Bankfull Width (m):	1.50	1.35
Flow Conditions:	Low		Bankfull Depth (m):	0.17	0.17
Barrier/Confirmed:	None		Wetted Widths (m):	0.70	0.23
Electrofished/Effort?:	No		Wetted Depth (m):	0.08	0.05
Gee Trapping:	No		Substrate Bed:	F	F
Fish Bearing?	Yes		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	WI/GR/SP	WI/SP/GR
			Meander Pattern:	IM	IM
			Cover:	70% / OV	60% / OV
Photo #s	896 u/s	897 x	898 d/s		
Areas of Erosion:	No		Temperature:	5.07	°C
Locations:	None but moderate potential		pH:	3.97 (no)	pH units
			Conductivity:	126	uS/cm
			DO:	13.5	mg/L
				106	% Sat
Comments:					
No noticeable disturbance or barrier					
Small muddy creek					

Upstream



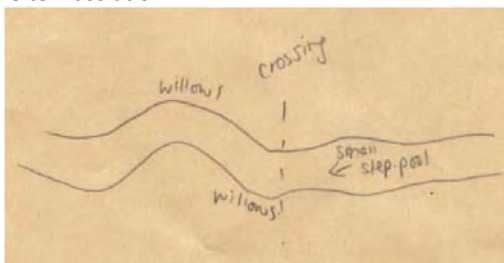
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 22+960 - Big Creek Tributary

			D/S	X	U/S	
Coordinates:	6920786 N	373732 E	Gradient (%):	-	5	-
Site Visit Date:	23-Jun-13		Bankfull Width (m):	-	1.00	-
Flow Conditions:	None		Bankfull Depth (m):	-	0.22	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-	-
Gee Trapping:	N/A		Substrate Bed:	-	S/F	-
Fish Bearing?:	No		Substrate Bank:	-	F	-
Site Length:	N/A		Riparian Vegetation:	-	SP	-
			Meander Pattern:	-	SI	-
			Cover:	-	-	-
Photo #s	34 u/s	35 x	36 d/s			
Areas of Erosion:	No		Temperature:	-	°C	
Locations:			pH:	-	pH units	
			Conductivity:	-	µS/cm	
			DO:	-	mg/L	
				-	% Sat	

Comments:
Dry intermittent creek - no connection to Big Creek downstream
No fish habitat
Large pockets of sand in channel from intermittent flows

Upstream



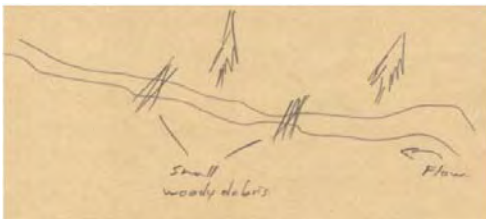
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # Unmapped site, 23+000 - Big Creek Tributary

			D/S	X	U/S	
Coordinates:	6920741 N	373693 E	Gradient (%):	6	3	3
Site Visit Date:	23-Jun-13		Bankfull Width (m):	2.00	2.05	1.40
Flow Conditions:	Low		Bankfull Depth (m):	0.18	0.60	0.16
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.54	2.05	1.30
Electrofished/Effort?:	No		Wetted Depth (m):	0.08	0.54	0.09
Gee Trapping:	No		Substrate Bed:	F	S/F	F
Fish Bearing?:	No		Substrate Bank:	F	F/S	F
Site Length:	N/A		Riparian Vegetation:	SP/WI	SP/WI	SP/WI
		Meander Pattern:	SI	SI	SI	
		Cover:	10% / LWD	30% / LWD	-	
Photo #s	37 u/s	38 x	39 d/s			
Areas of Erosion:	No		Temperature:	3.62	°C	
Locations:			pH:	7.45	pH units	
			Conductivity:	69	µS/cm	
			DO:	8.5	mg/L	
				70.7	% Sat	

Comments:
Dry intermittent creek - no connection to Big Creek downstream
No fish habitat
Unmapped in original crossing list

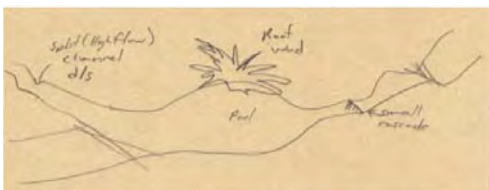
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 23+320 - Big Creek Tributary

			D/S	X	U/S	
Coordinates:	6921078 N	373521 E	Gradient (%):	3.5	2	3.5
Site Visit Date:	23-Jun-13		Bankfull Width (m):	4.60	3.60	4.20
Flow Conditions:	Low		Bankfull Depth (m):	0.74	0.54	0.43
Barrier/Confirmed:	None		Wetted Widths (m):	3.60	3.00	3.90
Electrofished/Effort?:	Yes (2010)		Wetted Depth (m):	0.25	0.19	0.16
Gee Trapping:	No		Substrate Bed:	C/G	C/G	C/G
Fish Bearing?	Yes		Substrate Bank:	F/C	F/C	F/C
Site Length:	100 m		Riparian Vegetation:	SP/WI/PO	SP/PO/WI	SP/WI
			Meander Pattern:	SI	RM	RM
			Cover:	5% / SWD	10% / SWD	5% / LWD

Photo #s	899 u/s	900 x	901 d/s	
Areas of Erosion:	Y		Temperature:	5.72 °C
Locations:	Downstream site - left bank		pH:	5.58 pH units
	eroding. Some undercut bank		Conductivity:	190 µS/cm
	erosion upstream of crossing.		DO:	13.38 mg/L
				106.8 % Sat

Comments:	Pre-existing habitat card (Summit, 2011)
Potential for enhancement:	increase cover (large woody debris) and create pool habitat
40m upstream of crossing, S/C/B bar:	photo 903-904. Lots of sand/gravel bars multiple channels
Flew upstream investigating placer mine disturbance to 08 V 0369555 6916422,	photo 908
No current activity, some evidence of previous digging further downstream.	

Upstream



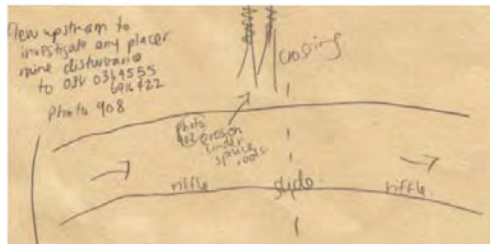
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 23+320 HC - Pg. 2

Photo 902



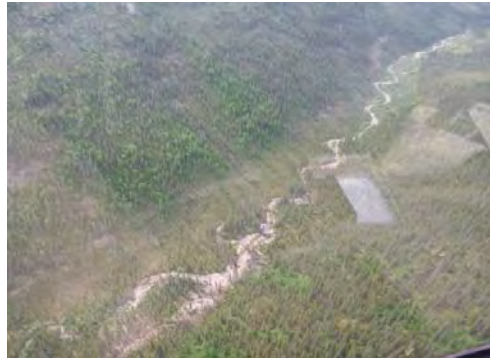
Photo 903



Photo 904



Photo 908



Freegold Road Extension Crossing # 24+380 - Big Creek Tributary

				D/S	X	U/S
Coordinates:	6921290 N	372497 E	Gradient (%):	3.5	5	7
Site Visit Date:	23-Jun-13		Bankfull Width (m):	2.50	2.50	1.49
Flow Conditions:	Low		Bankfull Depth (m):	0.48	0.55	0.54
Barrier/Confirmed:	None		Wetted Widths (m):	1.29	0.92	1.22
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.09	0.11	0.13
Gee Trapping:	No		Substrate Bed:	G/C	C/G	C/G
Fish Bearing?:	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	SP/WI	SP/WI	SP/WI
			Meander Pattern:	RM	IM	RM
			Cover:	15% / LWD	10% / LWD	20% / LWD
Photo #s	905 u/s	906 x	907 d/s			
Areas of Erosion:	Yes		Temperature:	6	°C	
Locations:	Minor erosion on west bank		pH:	4.44	pH units	
			Conductivity:	38	µS/cm	
			DO:	13.22	mg/L	
				106.2	% Sat	

Comments:
Low gradient step pool identified
Low conductivity relative to typical values in the area

Upstream



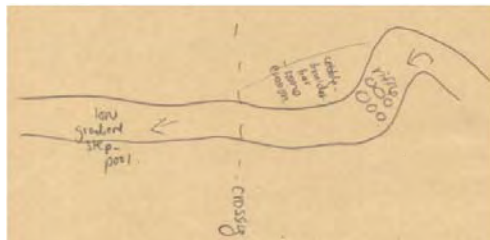
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 25+700 (Unmapped Site, 25+900) - Big Creek Tributary

			D/S	X	U/S	
Coordinates:	6921921 N	371452 E	Gradient (%):	3	2	9
Site Visit Date:	23-Jun-13		Bankfull Width (m):	1.00	1.90	1.05/1.14
Flow Conditions:	Low		Bankfull Depth (m):	0.25	0.24	0.35/0.15
Barrier/Confirmed:	None		Wetted Widths (m):	0.60	1.30	0.58
Electrofished/Effort?:	No		Wetted Depth (m):	0.10	0.10	0.22
Gee Trapping:	No		Substrate Bed:	G/S	G/S	S/G
Fish Bearing?:	Yes		Substrate Bank:	F/S	F/S	S/F
Site Length:	100 m		Riparian Vegetation:	GR/WI	WI/SP	WI/SP
			Meander Pattern:	SI	SI	SI
		Cover:	10% / OV	5% / SWD	10% / SWD	
Photo #s	40 u/s	41 x	42 d/s			
Areas of Erosion:	No		Temperature:	6.5	°C	
Locations:			pH:	6.8	pH units	
			Conductivity:	5	µS/cm	
			DO:	12.3	mg/L	
				110	% Sat	

Comments:
Large amount of gravel/sand bars, medial and lateral for a small stream
Previously Upmapped Site
Very shallow, braided stream
Provides marginal habitat

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 26+740 - Big Creek Tributary

			D/S	X	U/S
Coordinates:	6922617 N	370963 E	Gradient (%):	-	-
Site Visit Date:	23-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	-
Gee Trapping:	No		Substrate Bed:	-	-
Fish Bearing?:	No		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	909, 910, 911 x	d/s		
Areas of Erosion:	N		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	µS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
No visible channel					
Standing pool of water to the west at 08 V 0370966 6922632					
Photos of pool: 912 and 913, measurements: 0.5-2m wide, 15m long					

Photo 909



Photo 910



Photo 911



Photo 912



Freegold Road Extension Crossing # 26+820 - Big Creek

			D/S	X	U/S	
Coordinates:	6922687 N	370986 E	Gradient (%):	0.5	1	1
Site Visit Date:	23-Jun-13		Bankfull Width (m):	31.00	43.00	45.00
Flow Conditions:	Low		Average Depth (m):	0.70	0.40	0.50
Barrier/Confirmed:	None		Wetted Widths (m):	16.00	26.00	19.00
Electrofished/Effort?:	Yes (2010)		Substrate Bed:	G/C	C/G	C/G
Gee Trapping:	No		Substrate Bank:	-	-	-
Fish Bearing?:	Yes		Riparian Vegetation:	-	-	-
Site Length:	100 m		Meander Pattern:	-	-	-
			Cover:	20% / OV	15% / OV	15% / OV

Photo #s	914 u/s	915 x	916 d/s		
Areas of Erosion:	Y		Temperature:	6.98	°C
Locations:	Right hand bank		pH:	~7	pH units
			Conductivity:	132	µS/cm
			DO:	13.17	mg/L
				108.5	% Sat

Comments:	Pre-existing Habitat Card as 26+840 (Summit, 2011)
	Large side bar on the left bank, woody debris build up.
	Creek enters on left bank approximately 100m downstream of crossing
	Photo 920 is of large side channel upstream of the crossing, does not connect to the creek

Upstream



Crossing



Downstream



Photo 920



Freegold Road Extension Crossing # 28+210 - Big Creek Tributary

			D/S	X	U/S	
Coordinates:	6923623 N	370172 E	Gradient (%):	13	11	18
Site Visit Date:	23-Jun-13		Bankfull Width (m):	0.35	0.41	0.13
Flow Conditions:	Low		Bankfull Depth (m):	0.24	0.13	0.35
Barrier/Confirmed:	Low Flow		Wetted Widths (m):	0.29	-	0.07
Electrofished/Effort?:	No		Wetted Depth (m):	0.09	-	0.15
Gee Trapping:	No		Substrate Bed:	F/G	F	G/S
Fish Bearing?:	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
			Meander Pattern:	ST	ST	ST
		Cover:	20% / U	-	30% / OV	
Photo #s	43 u/s	44 x	45 d/s			
Areas of Erosion:	Y		Temperature:	2.82	°C	
Locations:	From existing winter road		pH:	7.4	pH units	
			Conductivity:	144	µS/cm	
			DO:	9.9	mg/L	
				80.8	% Sat	

Comments:
Existing road releasing sand and gravel into channel
Creek subterranean at crossing. Resurfaces about 20m downstream.
Too shallow to provide direct fish habitat
Culvert would provide a continuous channel

Upstream



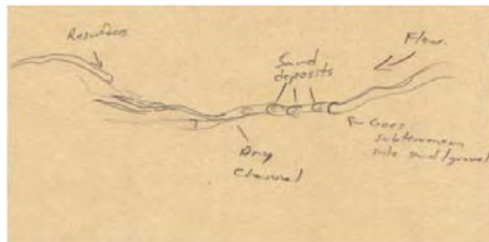
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 28+730 - Big Creek Tributary

			D/S	X	U/S	
Coordinates:	6923860 N	369719 E	Gradient (%):	3.5	5	10.5
Site Visit Date:	23-Jun-13		Bankfull Width (m):	0.63	0.80	0.38
Flow Conditions:	Low		Bankfull Depth (m):	0.12	0.14	0.28
Barrier/Confirmed:	None		Wetted Widths (m):	0.39	0.53	0.31
Electrofished/Effort?:	No		Wetted Depth (m):	0.06	0.05	0.06
Gee Trapping:	No		Substrate Bed:	G/F	G/F	G/F
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
		Meander Pattern:	IM	IM	IM	
		Cover:	90% / OV	20% / OV	90% / U	
Photo #s	917 u/s	918 x	919 d/s			
Areas of Erosion:	N		Temperature:	3.15	°C	
Locations:			pH:	7.6	pH units	
			Conductivity:	256	µS/cm	
			DO:	14.16	mg/L	
				105.9	% Sat	

Comments:
Shallow wetted depth but flows within a defined channel

Upstream



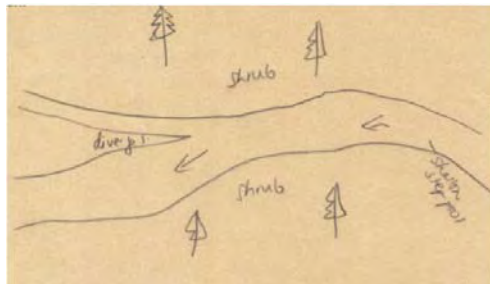
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 29+240 - Big Creek Tributary

			D/S	X	U/S	
Coordinates:	6924178 N	369328 E	Gradient (%):	5	8	5
Site Visit Date:	23-Jun-13		Bankfull Width (m):	1.80	0.60	0.77
Flow Conditions:	Low		Bankfull Depth (m):	0.32	0.26	0.22
Barrier/Confirmed:	None		Wetted Widths (m):	1.00	0.47	0.70
Electrofished/Effort?:	No		Wetted Depth (m):	0.12	0.07	0.10
Gee Trapping:	No		Substrate Bed:	F	F/S	S/F
Fish Bearing?	Yes		Substrate Bank:	F	F/S	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
			Meander Pattern:	SI	SI	SI
			Cover:	30% / OV	80% / OV	40% / OV
Photo #s	46 u/s	47 x	48 d/s			
Areas of Erosion:	Y		Temperature:	3.41	°C	
Locations:	Deposition downstream		pH:	6.81	pH units	
			Conductivity:	99	µS/cm	
			DO:	9.04	mg/L	
				74.5	% Sat	

Comments:
Heavy sedimentation of creeks flood plain
Material from existing winter road in creek bed
Shallow with some very small pools
Creek bed mostly soft organics

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 30+880 (Unmapped Site) - Big Creek Tributary

			D/S	X	U/S	
Coordinates:	6925355 N	368206 E	Gradient (%):	7	5	5
Site Visit Date:	23-Jun-13		Bankfull Width (m):	2.73	3.30	2.45
Flow Conditions:	Low		Bankfull Depth (m):	0.70	0.34	0.86
Barrier/Confirmed:	None		Wetted Widths (m):	2.73	2.40	1.65
Electrofished/Effort?:	No		Wetted Depth (m):	0.20	0.14	0.19
Gee Trapping:	No		Substrate Bed:	B/C	C/G	C/G
Fish Bearing?:	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/PO/SP	SP/WI	SP/PO/WI
			Meander Pattern:	IM	IM	IM
		Cover:	25% / LWD	5% / B	20% / SWD	
Photo #s	921 u/s	922 x	923 d/s			
Areas of Erosion:	Y		Temperature:	6.06	°C	
Locations:	see comments below		pH:	6.73	pH units	
			Conductivity:	168	µS/cm	
			DO:	12.84	mg/L	
				103.5	% Sat	
Comments: Crossing at a bridge. Still snow melting at this site.						
At 08 V 0368219 6925393, big mud/debris jam: photo 924 (upstream of it)						
Creek is flowing through trees, not in the channel (photo 925)						
Upstream site - surveyed main channel but water is pouring off the banks due to debris jam						
Right bank of downstream site was very eroded						

Upstream



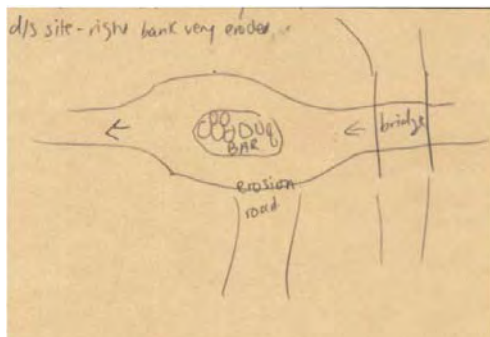
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # Unmapped Site, West of 29+240 - Pg. 2

Photo 924



Photo 925



Freegold Road Extension Crossing # 33+230 - Big Creek Tributary

			D/S	X	U/S	
Coordinates:	6925798 N	365959 E	Gradient (%):	7	7	7
Site Visit Date:	23-Jun-13		Bankfull Width (m):	1.40	1.20	1.05
Flow Conditions:	Low		Bankfull Depth (m):	0.35	0.57	0.48
Barrier/Confirmed:	None		Wetted Widths (m):	1.33	1.40	1.10
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.20	0.38	0.23
Gee Trapping:	None		Substrate Bed:	C/G	C/B	C/B
Fish Bearing?:	Yes		Substrate Bank:	F	F/C	F
Site Length:	100 m		Riparian Vegetation:	WI	WI	WI
			Meander Pattern:	SI	SI	SI
			Cover:	10% / U	40% / B	10% / LWD
Photo #s	57 u/s	58 x	59 d/s			
Areas of Erosion:	Y		Temperature:	5.83	°C	
Locations:	Existing road		pH:	4.62	pH units	
			Conductivity:	166	µS/cm	
			DO:	13.09	mg/L	
				115	% Sat	

Comments:

Photo 55: dry gully, no channel. To east, photo 56: disturbance at existing road crossing, bridge approaches washed out, now using ford.

Obviously sedimentation downstream, restoration?

Step-pool creek, good cover.

Upstream



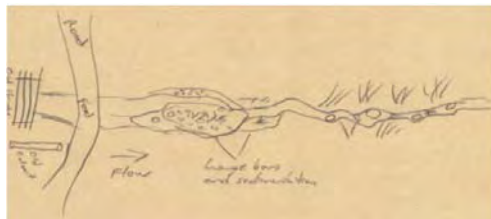
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 33+230 - Pg. 2

Photo 55

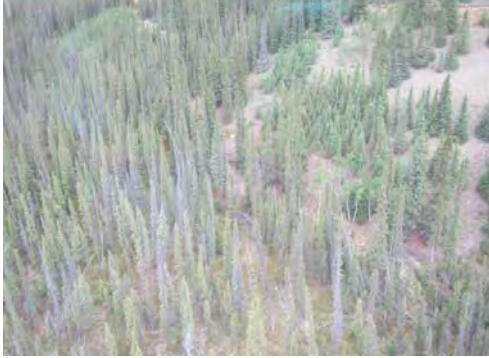


Photo 56



Freegold Road Extension Crossing # 35+340 - Big Creek Tributary

			D/S	X	U/S
Coordinates:	6926722 N	364712 E	Gradient (%):	-	-
Site Visit Date:	23-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	Dry Channel		Wetted Widths (m):	-	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	-
Gee Trapping:	No		Substrate Bed:	-	-
Fish Bearing?:	No		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	µS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
Dry channel					

Photo 55 from 33+230

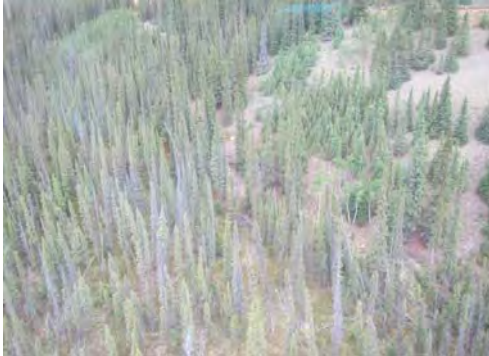


Photo 926 from 37+700



Freegold Road Extension Crossing # 37+700 - Big Creek Tributary

				D/S	X	U/S
Coordinates:	6928102 N	362891 E	Gradient (%):	5	3.5	3.5
Site Visit Date:	23-Jun-13		Bankfull Width (m):	1.90	3.30	2.20
Flow Conditions:	Low		Bankfull Depth (m):	0.50	0.21	0.40
Barrier/Confirmed:	None		Wetted Widths (m):	0.85	2.00	1.90
Electrofished/Effort?:	Yes (2010)		Wetted Depth (m):	0.10	0.08	0.23
Gee Trapping:	No		Substrate Bed:	G/C	G/C	G/F
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
			Meander Pattern:	IM	IM	IM
			Cover:	15% / OV	20% / OV	15% / OV
Photo #s	927 u/s	928 x	929 d/s			
Areas of Erosion:	Y		Temperature:	6.58	°C	
Locations:	Erosion around current road		pH:	7.21	pH units	
			Conductivity:	0.52	µS/cm	
			DO:	13.03	mg/L	
				100.5	% Sat	

Comments:
1500 mm CSP culvert located within channel
Lacks pool habitat

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 39+280 - Big Creek Tributary

			D/S	X	U/S	
Coordinates:	6929090 N	361702 E	Gradient (%):	-	12	5
Site Visit Date:	23-Jun-13		Bankfull Width (m):	0.85	0.40	0.98
Flow Conditions:	Low		Bankfull Depth (m):	0.30	0.25	0.38
Barrier/Confirmed:	None		Wetted Widths (m):	0.65	0.29	0.74
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.07	0.10	0.08
Gee Trapping:	No		Substrate Bed:	S/G	S/G	S/G
Fish Bearing?:	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI	WI/SP	WI/SP
			Meander Pattern:	SI	SI	SI
		Cover:	20% / SWD	40% / SWD	70% / U	
Photo #s	62 u/s	63 x	64 d/s			
Areas of Erosion:	Yes		Temperature:	3.96	°C	
Locations:	At 08 v 0361692 6929051,		pH:	7.88	pH units	
	Permafrost slump		Conductivity:	254	µS/cm	
	Photos 60 and 61		DO:	11.4	mg/L	
				98	% Sat	
Comments:						
Small, shallow creek with a drop pool						
Multiple areas of slumping - permafrost						

Upstream



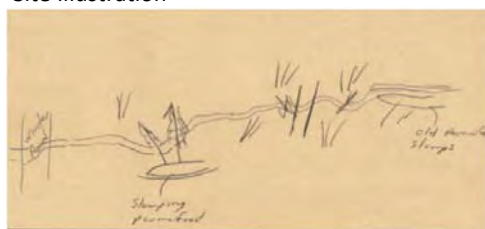
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 39+280 - Pg. 2

Photo 60



Photo 61



Freegold Road Extension Crossing # 40+630 (Unmapped Site) - Big Creek Tributary

				D/S	X	U/S
Coordinates:	6929810 N	360672 E	Gradient (%):	7	3.5	5
Site Visit Date:	23-Jun-13		Bankfull Width (m):	0.81	1.00	0.92
Flow Conditions:	Low		Bankfull Depth (m):	0.23	0.85	0.78
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.40	1.00	0.92
Electrofished/Effort?:	No		Wetted Depth (m):	0.08	0.73	0.65
Gee Trapping:	No		Substrate Bed:	F	F	F
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100		Riparian Vegetation:	WI/SP	WI/SP/GR	WI/SP/GR
			Meander Pattern:	IM	IM	IM
			Cover:	85% / OV	95% / OV	90% / OV
Photo #s	930 u/s	931 x	932 d/s			
Areas of Erosion:	N		Temperature:	7.27	°C	
Locations:			pH:	7.92	pH units	
			Conductivity:	340	µS/cm	
			DO:	11.65	mg/L	
				96.9	% Sat	

Comments:
At 08 V 0360669 6929758 (downstream): large drop and then flow goes underground
Photo: 934. Re-emerges further downstream, does this a few more times
At downstream site, 15% of flow is through another channel
Culvert crossing may improve connectivity of this channel

Upstream



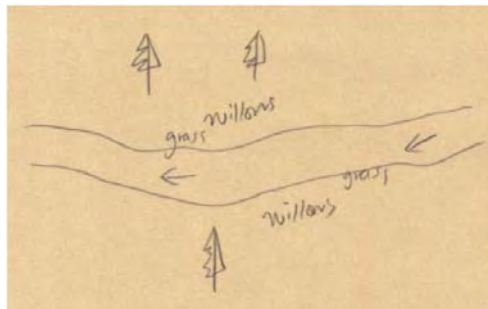
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # Unmapped Site, East of 41+340 - Pg. 2

Photo 933?



Photo 934



Freegold Road Extension Crossing # 41+340 - Big Creek Tributary

			D/S	X	U/S	
Coordinates:	6930102 N	359971 E	Gradient (%):	5	5	5
Site Visit Date:	23-Jun-13		Bankfull Width (m):	1.35	0.95	0.37
Flow Conditions:	Low		Bankfull Depth (m):	0.25	0.43	0.35
Barrier/Confirmed:	None		Wetted Widths (m):	0.93	0.80	0.33
Electrofished/Effort?:	No		Wetted Depth (m):	0.12	0.30	0.26
Gee Trapping:	No		Substrate Bed:	F	F	F
Fish Bearing?:	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	SP/WI	SP/WI
			Meander Pattern:	IM	IM	IM
		Cover:	75% / OV	90% / OV	50% / OV	
Photo #s	935 u/s	936 x	937 d/s			
Areas of Erosion:	Y		Temperature:	9.29	°C	
Locations:			pH:	7.07	pH units	
			Conductivity:	117	µS/cm	
			DO:	7.79	mg/L	
				67.6	% Sat	

Comments:
Channel not well developed
Downstream of site channel widens out and flow decreases

Upstream



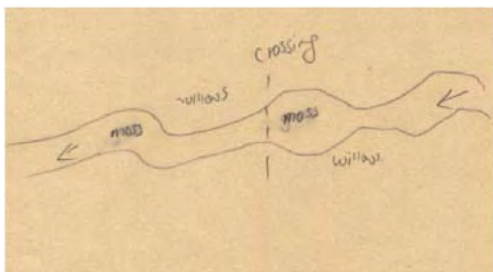
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 43+110 - Hayes Creek Tributary

				D/S	X	U/S
Coordinates:	6931260 N	358985 E	Gradient (%):	-	7	5
Site Visit Date:	24-Jun-13		Bankfull Width (m):	-	0.84	0.98
Flow Conditions:	Low		Bankfull Depth (m):	-	0.24	0.35
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	0.68	0.85
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.12	0.08
Gee Trapping:	No		Substrate Bed:	-	F	F
Fish Bearing?:	No		Substrate Bank:	-	F	F
Site Length:	50 m		Riparian Vegetation:	-	SP/WI/GR	SP/WI/GR
			Meander Pattern:	-	IM	IM
			Cover:	-	10% / OV	90% / OV
Photo #s	100 u/s	101 x	102 d/s			
Areas of Erosion:	N		Temperature:	1.96	°C	
Locations:			pH:	8.08	pH units	
			Conductivity:	440	µS/cm	
			DO:	14.19	mg/L	
				102.6	% Sat	

Comments:
Flow goes underground approximately 10m downstream of crossing on main branch: photo 103.
Tributary dries up 10m downstream of crossing, with a few disconnected stagnant pools below it.
Seasonal Barrier at low flow confirmed.

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 43+110 Pg. 2

Photo 103



Freegold Road Extension Crossing # 45+150 - Hayes Creek Tributary

			D/S	X	U/S
Coordinates:	6932851 N	357738 E	Gradient (%):	-	-
Site Visit Date:	24-Jun-13		Bankfull Width (m):	0.85 / 0.55	-
Flow Conditions:	None		Bankfull Depth (m):	0.43 / 0.45	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	0	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	0	-
Gee Trapping:	N/A		Substrate Bed:	F	-
Fish Bearing?:	No		Substrate Bank:	F	-
Site Length:	25 m		Riparian Vegetation:	WI/SP	-
			Meander Pattern:	SI	-
			Cover:	-	-
Photo #s	1 u/s	2 x	3 d/s		
Areas of Erosion:	No		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	µS/cm
			DO:	-	mg/L
				-	% Sat

Comments:
Dry, intermittent creek, poorly defined channel with vegetation throughout
No direct fish habitat
Second dry channel, 8m west
Another intermittent creek crossed at 08 V 0357702 6932863, photos: 4, 5 and 6

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 45+150 Pg. 2

Photo 4



Photo 5



Photo 6



Freegold Road Extension Crossing # 45+230 - Hayes Creek Tributary

			D/S	X	U/S
Coordinates:	6932917 N	357680 E	Gradient (%):	7	8
Site Visit Date:	24-Jun-13		Bankfull Width (m):	1.6	0.9
Flow Conditions:	Low		Bankfull Depth (m):	0.8	0.39
Barrier/Confirmed:	None		Wetted Widths (m):	1.55	1
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.6	0.24
Gee Trapping:	No		Substrate Bed:	F	B/C
Fish Bearing?	Yes		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP
			Meander Pattern:	SI	SI
			Cover:	30% / LWD	30% / SUB
Photo #s	7 u/s	8 x	9 d/s		
Areas of Erosion:	N		Temperature:	2.82	°C
Locations:			pH:	8.17	pH units
			Conductivity:	72	µS/cm
			DO:	10.52	mg/L
				88.4	% Sat
Comments:					
Split channel 10m upstream of crossing					
Pool habitat identified 20m downstream of crossing					

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 46+740 - Hayes Creek Tributary

			D/S	X	U/S
Coordinates:	6933680 N	356405 E	Gradient (%):	-	-
Site Visit Date:	24-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	No		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	µS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
No visible channel within >100m of site					

Photo 104



Photo 105



Freegold Road Extension Crossing # 47+050 - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6933948 N	356254 E	Gradient (%):	12	10.5	9
Site Visit Date:	27-Jun-13		Bankfull Width (m):	0.55 / 0.90	0.8	1
Flow Conditions:	Low		Bankfull Depth (m):	0.24 / 0.30	0.3	0.2
Barrier/Confirmed:	None		Wetted Widths (m):	0.34 / 0.60	0.75	0.9
Electrofished/Effort?:	Yes (2013)		Wetted Depth (m):	0.10 / 0.11	0.12	0.07
Gee Trapping:	Yes (2013)		Substrate Bed:	G/F	F/G	G/F
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	200m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
			Meander Pattern:	IM	IM	IM
		Cover:	100% / OV	100% / OV	100% / OV	
Photo #s	101-0036 u/s	101-0037 x	101-0038 d/s			
Areas of Erosion:	No		Temperature:	2.85	°C	
Locations:			pH:	7.42	pH units	
			Conductivity:	207	µS/cm	
			DO:	8.69	mg/L	
				71.9	% Sat	

Comments:
Moderate gradient stream that was sampled for fish to confirm presence/absence
Downstream site splits into 2 channels, separated by a vegetated island
Pool-riffle sequence

Upstream



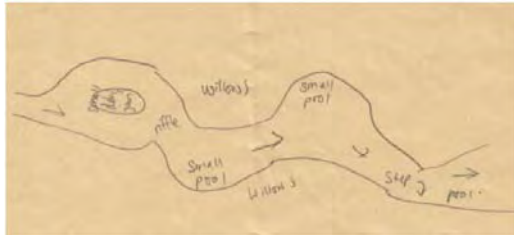
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 49+000 - Hayes Creek Tributary

				D/S	X	U/S
Coordinates:	6935425 N	355019 E	Gradient (%):	9	7	10.5
Site Visit Date:	24-Jun-13		Bankfull Width (m):	1.34	1.15	1.5
Flow Conditions:	Low		Bankfull Depth (m):	0.41	0.4	0.55
Barrier/Confirmed:	None		Wetted Widths (m):	1.34	1.5	1.5
Electrofished/Effort?:	No		Wetted Depth (m):	0.21	0.15	0.12
Gee Trapping:	No		Substrate Bed:	B/C	B/C	B/C
Fish Bearing?:	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
			Meander Pattern:	IM	IM	IM
		Cover:	90% / OV	90% / OV	95% / OV	
Photo #s	106 u/s	107 x	108 d/s			
Areas of Erosion:	No		Temperature:	2.63	°C	
Locations:			pH:	7.44	pH units	
			Conductivity:	365	µS/cm	
			DO:	14.18	mg/L	
				104.5	% Sat	

Comments:

Area directly above downstream site has low connectivity

Water picks up at downstream site - flow appears to re-connect via groundwater

At the downstream site, more water was draining to the west

Upstream



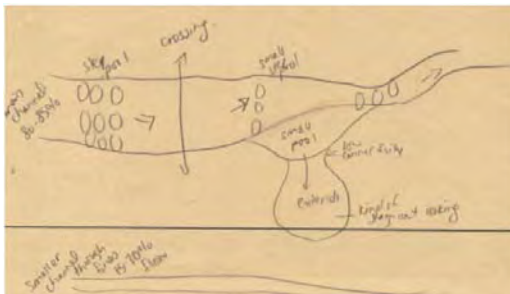
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 51+170 - Hayes Creek

				D/S	X	U/S
Coordinates:	6936828 N	353491 E	Gradient (%):	4	1	2
Site Visit Date:	24-Jun-13		Bankfull Width (m):	12.9	6.8	8.85
Flow Conditions:	Low		Bankfull Depth (m):	0.6	0.43	0.76
Barrier/Confirmed:	None		Wetted Widths (m):	7.2	6.6	3.6
Electrofished/Effort?:	Yes (2010)		Wetted Depth (m):	0.4	0.22	0.3
Gee Trapping:	No		Substrate Bed:	C/B	G/C	C/G
Fish Bearing?	Yes		Substrate Bank:	F/C	F/C	F/C
Site Length:	100 m		Riparian Vegetation:	WI/SP	SP/WI	WI/SP
			Meander Pattern:	RM	RM	RM
		Cover:	10% / SUB	10% / OV	20% / LWD	
Photo #s	10 u/s	11 x	12 d/s			
Areas of Erosion:	Y		Temperature:	5.61	°C	
Locations:	50m upstream of crossing,		pH:	8.07	pH units	
	actively eroding bank		Conductivity:	64	µS/cm	
			DO:	12.1	mg/L	
				107	% Sat	

Comments:
Crossing location on straight section, even flow, high quality habitat
Riparian previously disturbed by winter road access
1 Arctic grayling spotted
Picture 13: eroding bank

Upstream



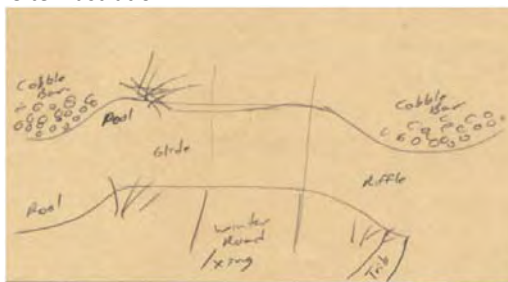
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 51+170 - Pg. 2

Photo 13



Freegold Road Extension Crossing # 52+330 - Hayes Creek Tributary

			D/S	X	U/S
Coordinates:	6937376 N	352489 E	Gradient (%):	3.5	3.5
Site Visit Date:	24-Jun-13		Bankfull Width (m):	1	1.54
Flow Conditions:	Low		Bankfull Depth (m):	0.37	0.4
Barrier/Confirmed:	None		Wetted Widths (m):	0.85	1.25
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.19	0.11
Gee Trapping:	No		Substrate Bed:	G/F	G/F
Fish Bearing?	Yes		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	WI/PO/SP	SP/WI/PO
			Meander Pattern:	IM	IM
			Cover:	85% / OV	15% / LWD
Photo #s	947 u/s	948 x	949 d/s		
Areas of Erosion:	Y		Temperature:	5.53	°C
Locations:	Med erosion potential		pH:	8.82	pH units
			Conductivity:	161	µS/cm
			DO:	13.66	mg/L
				108.4	% Sat

Comments:

Nice plunge pool upstream of crossing, approximately 15m, greater than 0.6m

Maybe potential to re-align creek here to previous downstream direction. At 08 V 0352291 6937549, flow enters winter road from the east, runs down it until 08 V 0349205 6941847 and then seeps into Hayes tributary.

Upstream



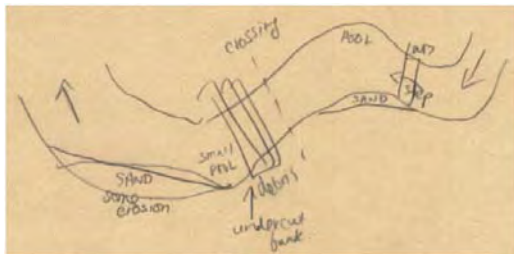
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 52+330 - Pg. 2

Photo 112



Photo 113



Freegold Road Extension Crossing # 53+590 - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6938195 N	351534 E	Gradient (%):	4	7	9
Site Visit Date:	24-Jun-13		Bankfull Width (m):	1.19	0.85	0.98 / 0.52
Flow Conditions:	Low		Bankfull Depth (m):	0.34	0.47	0.55 / 0.08
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.77	0.81	0.66 / 0.46
Electrofished/Effort?:	No		Wetted Depth (m):	0.12	0.25	0.15 / 0.04
Gee Trapping:	No		Substrate Bed:	G/S	G/F	G/S
Fish Bearing?	No		Substrate Bank:	F/G	F/G	F/G
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
			Meander Pattern:	SI	SI	SI
		Cover:	40% / OV	40% / OV	30% / U	
Photo #s	14 u/s	15 x	16 d/s			
Areas of Erosion:	N		Temperature:	3.41	°C	
Locations:			pH:	7.42	pH units	
			Conductivity:	177	µS/cm	
			DO:	11.42	mg/L	
				94.8	% Sat	
Comments:						
Creek intermittently flowing subterraneous at crossing						
Split channel upstream and downstream						
08 V 0351539 6938213 potential barrier: creek underground for 0.75m: photo 17						

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 53+590 - Pg. 2

Photo 17



Freegold Road Extension Crossing # 56+790 - Apex Creek

			D/S	X	U/S	
Coordinates:	6940628 N	349556E	Gradient (%):	1	0.5	1
Site Visit Date:	24-Jun-13		Bankfull Width (m):	27	16	37
Flow Conditions:	Low		Average Depth (m):	0.4	0.5	0.3
Barrier/Confirmed:	None		Wetted Widths (m):	15	9	16
Electrofished/Effort?:	Yes (2010)		Substrate Bed:	C/G	C/G	C/G
Gee Trapping:	No		Substrate Bank:	-	-	-
Fish Bearing?	Yes		Riparian Vegetation:	-	-	-
Site Length:	100 m		Meander Pattern:	-	-	-
			Cover:	30% / LWD	25% LWD	30% / LWD

Photo #s	114 u/s	115 x	116 d/s		
Areas of Erosion:	N		Temperature:	8.97	°C
Locations:			pH:	8.84	pH units
			Conductivity:	88	µS/cm
			DO:	12.65	mg/L
				109	% Sat

Comments:
Pre-existing Site Card as 56+820
A few large gravel bars on the right bank
Could add more in-stream cover/pool habitat
Area is mostly riffle

Upstream



Crossing



Downstream



Freegold Road Extension Crossing # 57+420 - Hayes Creek Tributary

				D/S	X	U/S
Coordinates:	6941194 N	349309 E	Gradient (%):	3	4	7
Site Visit Date:	24-Jun-13		Bankfull Width (m):	0.89	1.8	2
Flow Conditions:	Low		Bankfull Depth (m):	0.65	0.4	0.27
Barrier/Confirmed:	None		Wetted Widths (m):	0.89	1.58	1.6
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.52	0.24	0.1
Gee Trapping:	No		Substrate Bed:	F	G/C	C/B
Fish Bearing?	Yes		Substrate Bank:	F	F	F/C
Site Length:	100 m		Riparian Vegetation:	SP/WI	PO/WI	PO/WI
			Meander Pattern:	SI	SI	SI
		Cover:	30% / U	60% / LWD	10% / SUB	
Photo #s	18 u/s	19 x	20 d/s			
Areas of Erosion:	N		Temperature:	6.99	°C	
Locations:			pH:	8.1	pH units	
			Conductivity:	6.98	µS/cm	
			DO:	12.76	mg/L	
				115.2	% Sat	

Comments:
Crossing location has a large amount of debris from an old burn
Large build up of LWD in creek leading to backwater conditions in some cases (photo 21)

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 57+420 - Pg. 2

Photo 21



Freegold Road Extension Crossing # 58+070 - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6941798 N	349138 E	Gradient (%):	9	14	5
Site Visit Date:	24-Jun-13		Bankfull Width (m):	1.50	0.83	1.60
Flow Conditions:	Low		Bankfull Depth (m):	0.15	0.08	0.09
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.21	0.53	1.22
Electrofished/Effort?:	N/A		Wetted Depth (m):	0.07	0.03	0.04
Gee Trapping:	N/A		Substrate Bed:	F	F	F
Fish Bearing?	No		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
			Meander Pattern:	IM	IM	IM
		Cover:	50% / OV	15% / OV	50% / OV	
Photo #s	117 u/s	118 x	119 d/s			
Areas of Erosion:	N		Temperature:	6.33	°C	
Locations:			pH:	9.2	pH units	
			Conductivity:	682	µS/cm	
			DO:	11.66	mg/L	
				94.8	% Sat	

Comments:
Upstream site, above, dry 15m. Submerges underground immediately after crossing.

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 58+980 - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6942396 N	348450 E	Gradient (%):	5	3.5	5
Site Visit Date:	24-Jun-13		Bankfull Width (m):	1.03	1.20	0.76
Flow Conditions:	Low		Bankfull Depth (m):	0.38	0.34	0.38
Barrier/Confirmed:	None		Wetted Widths (m):	0.77	1.10	0.76
Electrofished/Effort?:	No		Wetted Depth (m):	0.27	0.14	0.22
Gee Trapping:	No		Substrate Bed:	G/F	G/F	G/F
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
			Meander Pattern:	IM	IM	IM
			Cover:	100% / OV	85% / OV	95% / OV
Photo #s	958 u/s	959 x	960 d/s			
Areas of Erosion:	N		Temperature:	4.7	°C	
Locations:			pH:	9.21	pH units	
			Conductivity:	250	µS/cm	
			DO:	14.26	mg/L	
				111.2	% Sat	
Comments:						

Upstream



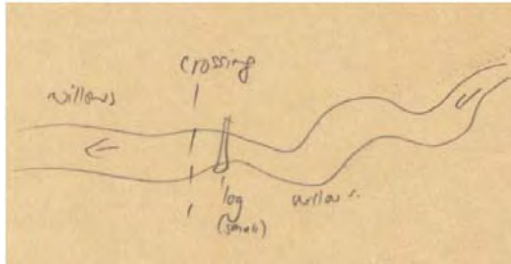
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 60+220 - Hayes Creek Tributary

			D/S	X	U/S
Coordinates:	6943310 N	347629 E	Gradient (%):	13	10
Site Visit Date:	June 24, 2013		Bankfull Width (m):	0.43	0.53
Flow Conditions:	Low		Bankfull Depth (m):	0.34	0.32
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.43	0.47
Electrofished/Effort?:	No		Wetted Depth (m):	0.30	0.20
Gee Trapping:	No		Substrate Bed:	F/G	F/G
Fish Bearing?	No		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP
			Meander Pattern:	SI	SI
			Cover:	40% / OV	30% / LWD
Photo #s	22 u/s	23 x	24 d/s		
Areas of Erosion:	N		Temperature:	1.95	°C
Locations:			pH:	8.24	pH units
			Conductivity:	250	µS/cm
			DO:	13.25	mg/L
				103.5	% Sat
Comments:					
Crossing location (original) at 08 V 0347625 6943309					
Low flow barriers upstream and downstream of crossing					

Upstream



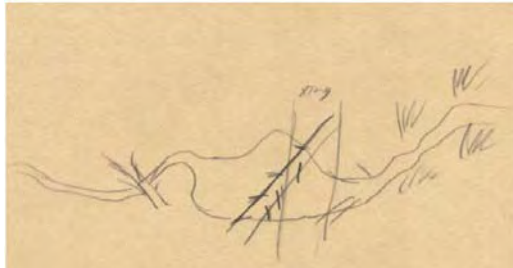
Crossing



Downstream



Site Illustration

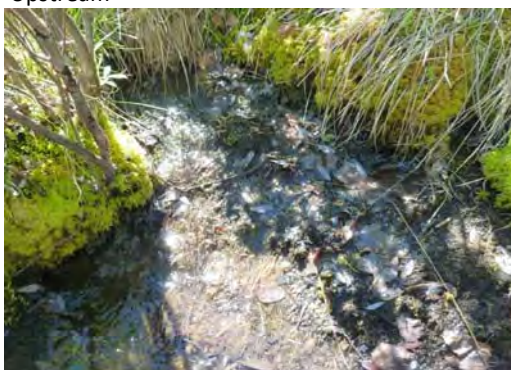


Freegold Road Extension Crossing # 60+870 (Unmapped) - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6943776 N	347277 E	Gradient (%):	-	17.5	-
Site Visit Date:	24-Jun-13		Bankfull Width (m):	-	0.41	-
Flow Conditions:	Low to None		Bankfull Depth (m):	-	0.15	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	0.30	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.05	-
Gee Trapping:	No		Substrate Bed:	-	F	-
Fish Bearing?	No		Substrate Bank:	-	F	-
Site Length:	100 m		Riparian Vegetation:	-	WI/BI	-
		Meander Pattern:	-	IM	-	
		Cover:	-	75% / OV	-	
Photo #s	123 u/s	124 x	125 d/s			
Areas of Erosion:	N		Temperature:	-	°C	
Locations:			pH:	-	pH units	
			Conductivity:	-	µS/cm	
			DO:	-	mg/L	
				-	% Sat	

Comments:
Water very low, barely any flow - stagnant puddle with very low flow
Channel dry upstream and downstream of crossing

Upstream



Crossing



Downstream



Freegold Road Extension Crossing # 61+830 - Fourmile Creek

			D/S	X	U/S
Coordinates:	6944654 N	346888 E	Gradient (%):	3.5	3.5
Site Visit Date:	24-Jun-13		Bankfull Width (m):	3.50	2.80
Flow Conditions:	Low		Bankfull Depth (m):	0.31	0.30
Barrier/Confirmed:	None		Wetted Widths (m):	2.80	2.20
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.19	0.20
Gee Trapping:	No		Substrate Bed:	C/G	C/G
Fish Bearing?	Yes		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP/BI	WI/SP/AS
			Meander Pattern:	IM	SI
			Cover:	50% / OV	20% / OV
				50% / OV	
Photo #s	126 u/s	127 x	128 d/s		
Areas of Erosion:	Y		Temperature:	8.38	°C
Locations:	Slumped left bank near crossing		pH:	9.43	pH units
			Conductivity:	118	µS/cm
			DO:	12.87	mg/L
				109.7	% Sat
Comments:					
Lots of woody debris from burn					
Riffle-pool habitat					

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 62+170 - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6944960 N	346743 E	Gradient (%):	6	7	9
Site Visit Date:	24-Jun-13		Bankfull Width (m):	1.02	1.00	0.95
Flow Conditions:	Low		Bankfull Depth (m):	0.17	0.17	0.37
Barrier/Confirmed:	None		Wetted Widths (m):	0.48	0.82	0.32
Electrofished/Effort?:	No		Wetted Depth (m):	0.09	0.05	0.17
Gee Trapping:	No		Substrate Bed:	G/F	G/F	G/F
Fish Bearing?	Yes		Substrate Bank:	F/S	F/G	S/F
Site Length:	100 m		Riparian Vegetation:	WI	SP/WI	WI/SP
			Meander Pattern:	SI	SI	SI
			Cover:	10% / U	0	30% / U
Photo #s	26 u/s	27 x	28 d/s			
Areas of Erosion:	Y		Temperature:	6.12		°C
Locations:	Permafrost slumping upstream and		pH:	7.73		pH units
	downstream of crossing		Conductivity:	58		µS/cm
			DO:	10.71		mg/L
				93.7		% Sat
Comments:						
Photo 25: overview of creek, slump						
exposed gravel hillside 400m upstream						

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 62+170 - Pg. 2

Photo 25



Freegold Road Extension Crossing # 63+870 - Butterfield Creek

			D/S	X	U/S	
Coordinates:	6946576 N	346593 E	Gradient (%):	2	3.5	2
Site Visit Date:	24-Jun-13		Bankfull Width (m):	4.00	4.60	5.90
Flow Conditions:	Low		Bankfull Depth (m):	0.46	0.48	0.25
Barrier/Confirmed:	None		Wetted Widths (m):	2.90	3.80	6.00
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.30	0.29	0.35
Gee Trapping:	No		Substrate Bed:	C/G	C/G	G/C
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/PO/SP	WI/SP/PO	WI/AL/SP
		Meander Pattern:	SI	SI	SI	
		Cover:	30% / OV	15% / LWD	45% / OV	
Photo #s	967 u/s	968 x	969 d/s			
Areas of Erosion:	N		Temperature:	7.77	°C	
Locations:			pH:	4	pH units	
			Conductivity:	164	µS/cm	
			DO:	13.1	mg/L	
				110.1	% Sat	

Comments:
Riffle-run sequence with a lack of pool habitat
Grayling spotted (TL = ~220mm) at upstream site

Upstream



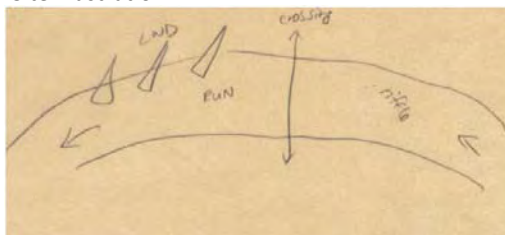
Crossing



Downstream



Site Illustration



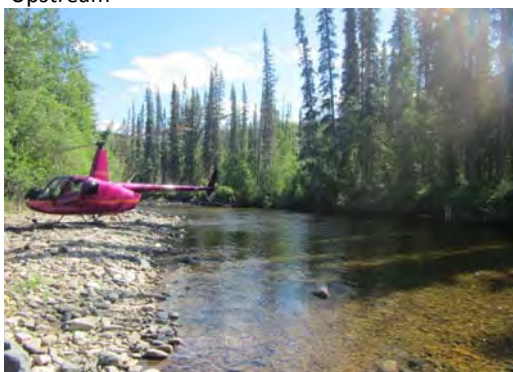
Freegold Road Extension Crossing # 64+700 - Hayes Creek

			D/S	X	U/S	
Coordinates:	6947271 N	346380 E	Gradient (%):	0.5	1	1.5
Site Visit Date:	24-Jun-13		Bankfull Width (m):	17.00	17.00	19.00
Flow Conditions:	Low		Average Depth (m):	0.45	0.65	0.50
Barrier/Confirmed:	None		Wetted Widths (m):	14.00	14.00	15.00
Electrofished/Effort?:	No		Substrate Bed:	C/B	C/G	B/C
Gee Trapping:	No		Substrate Bank:	-	C/F	-
Fish Bearing?	Yes		Riparian Vegetation:	-	SP/WI	-
Site Length:	100 m		Meander Pattern:	-	RM	-
			Cover:	25% / OV	10% / U	25% / OV

Photo #s	30 u/s	31 x	32 d/s		
Areas of Erosion:	N		Temperature:	11.33	°C
Locations:			pH:	7.67	pH units
			Conductivity:	70	µS/cm
			DO:	10.12	mg/L
				99.5	% Sat

Comments:
Pre-existing Site Card as 64+710
Riffle-run habitat with few pools
High quality gravel substrate

Upstream



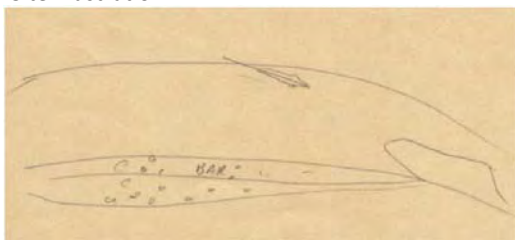
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 65+640 - No Crossing

			D/S	X	U/S
Coordinates:	6948131 N	346640 E	Gradient (%):	-	-
Site Visit Date:	24-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:	No Channel		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish present?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	µS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
GPS location in a spruce forest - no watercourse					

Photo 33



Photo 34

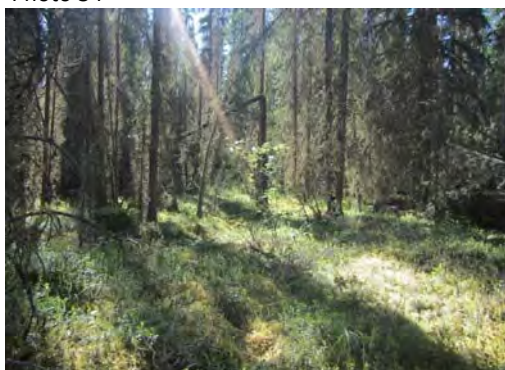


Photo 35



Freegold Road Extension Crossing # 66+080 - Hayes Creek Tributary

			D/S	X	U/S
Coordinates:	6948573 N	346547 E	Gradient (%):	2	1
Site Visit Date:	25-Jun-13		Bankfull Width (m):	3.00	2.10
Flow Conditions:	Typical		Bankfull Depth (m):	0.60	0.25
Barrier/Confirmed:	None		Wetted Widths (m):	-	1.15
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.14
Gee Trapping:	No		Substrate Bed:	C/S	F
Fish Bearing?:	Yes		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	WI	SP/WI
			Meander Pattern:	SI	SI
			Cover:	20% / U	20% / LWD
Photo #s	51 u/s	52 x	53 d/s		
Areas of Erosion:	No		Temperature:	5.05	°C
Locations:			pH:	7.81	pH units
			Conductivity:	297	µS/cm
			DO:	8.02	mg/L
				68	% Sat
Comments:					
Deeply incised creek through permafrost/ fines					
Potential for seasonal barriers downstream of crossing					

Upstream



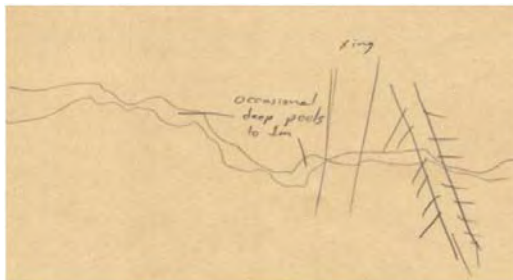
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 66+170 - Hayes Creek Side Channel

			D/S	X	U/S
Coordinates:	6948653 N	346537 E	Gradient (%):	0.5	1
Site Visit Date:	25-Jun-13		Bankfull Width (m):	8.00	3.50
Flow Conditions:	Typical		Average Depth (m):	0.20	0.20
Barrier/Confirmed:	None		Wetted Widths (m):	4.00	3.25
Electrofished/Effort?:	Yes (2010)		Substrate Bed:	G/F	G/F
Gee Trapping:	No		Substrate Bank:	-	-
Fish Bearing?	Yes		Riparian Vegetation:	-	-
Site Length:	100 m		Meander Pattern:	-	-
			Cover:	25% / OV	45% / SWD
				35% / OV	

Photo #s	48 u/s	49 x	50 d/s	
Areas of Erosion:	No		Temperature:	1.42 °C
Locations:			pH:	8.26 pH units
			Conductivity:	99 µS/cm
			DO:	7.15 mg/L
				54.9 % Sat

Comments:
Pre-existing site card as 66+200
Low temperature and conductivity for a major tributary

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 66+310 - Hayes Creek Side Channel Tributaries

			D/S	X	U/S	
Coordinates:	6948781 N	346529 E	Gradient (%):	1	2	1
Site Visit Date:	25-Jun-13		Bankfull Width (m):	4.70	3.70	2.50
Flow Conditions:	Low		Bankfull Depth (m):	1.00	0.46	0.25
Barrier/Confirmed:	None		Wetted Widths (m):	4.70	2.40	2.50
Electrofished/Effort?:	No		Wetted Depth (m):	0.50	0.35	0.20
Gee Trapping:	No		Substrate Bed:	G/S	G	C/G
Fish Bearing?	Yes		Substrate Bank:	S/C	F	S
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI	WI/GR
			Meander Pattern:	SI	SI	SI
			Cover:	20% / LWD	20% / LWD	10% / LWD
Photo #s	45 u/s	46 x	47 d/s			
Areas of Erosion:	No		Temperature:	1.43	°C	
Locations:			pH:	7.64	pH units	
			Conductivity:	159	µS/cm	
			DO:	7.67	mg/L	
				59.2	% Sat	
Comments:						
Low DO and temperature implies permafrost fed						

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 67+500 - Hayes Creek Side Channel

			D/S	X	U/S	
Coordinates:	6949915 N	346712 E	Gradient (%):	0	0	1
Site Visit Date:	25-Jun-13		Bankfull Width (m):	8.20	4.00	2.60
Flow Conditions:	Typical		Bankfull Depth (m):	0.94	0.80	0.22
Barrier/Confirmed:	None		Wetted Widths (m):	8.20	4.00	1.57
Electrofished/Effort?:	No		Wetted Depth (m):	0.84	0.60	0.12
Gee Trapping:	No		Substrate Bed:	F	F	C/G
Fish Bearing?	Yes		Substrate Bank:	F	F	F/C
Site Length:	100 m		Riparian Vegetation:	SP/AL	SP/AL	SP/AL
			Meander Pattern:	-	-	-
		Cover:	10% / LWD	20% / LWD	20% / LWD	
Photo #s	42 u/s	43 x	44 d/s			
Areas of Erosion:	No		Temperature:	1.42	°C	
Locations:			pH:	7.04	pH units	
			Conductivity:	82	µS/cm	
			DO:	3.33	mg/L	
				25.9	% Sat	
Comments:						
Old oxbow of Hayes Creek						
Connected via a small stream on the downstream side to Hayes Creek						
Temperature and DO make for a poor habitat						

Upstream



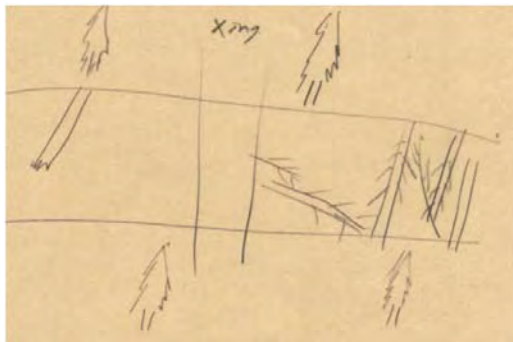
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 67+570 - Hayes Creek

			D/S	X	U/S
Coordinates:	6949993 N	346696 E	Gradient (%):	1.5	0.5
Site Visit Date:	25-Jun-13		Bankfull Width (m):	44.00	21.00
Flow Conditions:	Low		Average Depth (m):	0.50	0.40
Barrier/Confirmed:	None		Wetted Widths (m):	14.00	21.00
Electrofished/Effort?:	Yes (2010)		Substrate Bed:	C/B	G/C
Gee Trapping:	No		Substrate Bank:	-	-
Fish present?:	Yes		Riparian Vegetation:	-	-
Site Length:	100 m		Meander Pattern:	-	-
			Cover:	35% / OV	15% / OV

Photo #s	39 u/s	40 x	41 d/s
Areas of Erosion:	No	Temperature:	6.16 °C
Locations:		pH:	7.46 pH units
		Conductivity:	69 µS/cm
		DO:	10.51 mg/L
			92.3 % Sat

Comments:
Pre-existing site card as 67+600
High quality habitat

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 68+450 - Hayes Creek

			D/S	X	U/S
Coordinates:	6950819 N	346819 E	Gradient (%):	0.8	0.5
Site Visit Date:	25-Jun-13		Bankfull Width (m):	18.00	17.00
Flow Conditions:	Typical		Average Depth (m):	0.70	0.70
Barrier/Confirmed:	None		Wetted Widths (m):	17.00	16.00
Electrofished/Effort?:	No		Substrate Bed:	G/C	G/C
Gee Trapping:	No		Substrate Bank:	-	-
Fish present?:	Yes		Riparian Vegetation:	-	-
Site Length:	100 m		Meander Pattern:	-	-
			Cover:	25% / OV	30% / U/OV

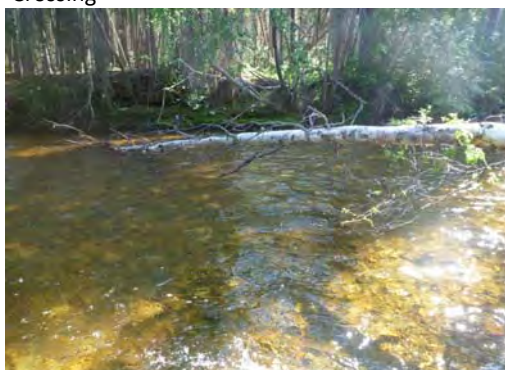
Photo #s	101-0003 u/s	101-0004 x	101-0005 d/s		
Areas of Erosion:	Y		Temperature:	6.53	°C
Locations:	Slumped bank on RB (100 m DS)		pH:	9.86	pH units
	Minor erosion at the crossing		Conductivity:	139	µS/cm
			DO:	13.2	mg/L
				107.5	% Sat

Comments:
Pre-existing Site Card as 68+470
Riffle-run sequence with little pool habitat

Upstream



Crossing



Downstream



Freegold Road Extension Crossing # 68+850 - No Channel

			D/S	X	U/S
Coordinates:	6951179 N	346896 E	Gradient (%):	-	-
Site Visit Date:	25-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:	No Channel		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish present?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	µS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
No channel or evidence of flow					

Photo 101-0001



Photo 101-0002



Freegold Road Extension Crossing # 69+110 - Hayes Creek Tributary

			D/S	X	U/S
Coordinates:	6951323 N	346691 E	Gradient (%):	-	-
Site Visit Date:	25-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:	Low		Bankfull Depth (m):	-	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	1.20
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.11
Gee Trapping:	No		Substrate Bed:	-	F
Fish Bearing?:	No		Substrate Bank:	-	F
Site Length:	25 m		Riparian Vegetation:	-	SP/BI
			Meander Pattern:	-	None
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	No		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	µS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
No flow					
Dry channel with stagnant pool					

Photo 998



Photo 999



Freegold Road Extension Crossing # 69+340 - Hayes Creek

			D/S	X	U/S
Coordinates:	6951425 N	346481 E	Gradient (%):	1	1
Site Visit Date:	25-Jun-13		Bankfull Width (m):	21.00	20.00
Flow Conditions:	Typical		Average Depth (m):	0.60	0.60
Barrier/Confirmed:	None		Wetted Widths (m):	16.00	19.00
Electrofished/Effort?:	Yes (2010)		Substrate Bed:	C/B	C/B
Gee Trapping:	No		Substrate Bank:	-	-
Fish Bearing?	Yes		Riparian Vegetation:	-	-
Site Length:	100 m		Meander Pattern:	-	-
			Cover:	20% / OV	20% / OV

Photo #s	100-0994 u/s	100-0995/0996 x	100-0997 d/s
Areas of Erosion:	Yes	Temperature:	6.16 °C
Locations:	Erosion in lower banks at crossing	pH:	9 pH units
		Conductivity:	139 µS/cm
		DO:	14.03 mg/L
			113 % Sat

Comments:
Pre-existing Site Card as 69+510
Could add some side pool habitat below bridge
Saw grayling in a pool, approximately 200m downstream
Crossing is one large riffle

Upstream



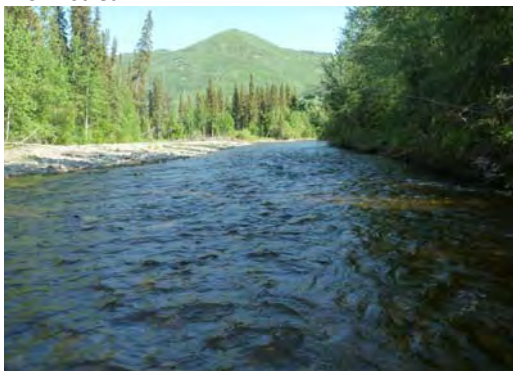
Crossing



Crossing 2



Downstream



Freegold Road Extension Crossing # 71+100 - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6951828 N	652181 E	Gradient (%):	11	7	10
Site Visit Date:	22-Jun-13		Bankfull Width (m):	1.53	1.18	1.05
Flow Conditions:	Low		Bankfull Depth (m):	0.20	0.25	0.23
Barrier/Confirmed:	None		Wetted Widths (m):	0.90	0.80	0.55
Electrofished/Effort?:	No		Wetted Depth (m):	0.12	0.14	0.10
Gee Trapping:	No		Substrate Bed:	C/G	C/G	C/G
Fish present?:	Yes		Substrate Bank:	C/S	C/S	C/S
Site Length:	100 m		Riparian Vegetation:	PO/GR	WI	None
			Meander Pattern:	ST/SI	ST/SI	ST/SI
		Cover:	0	5% / OV	-	
Photo #s	16 u/s	17 x	18 d/s			
Areas of Erosion:	Yes		Temperature:	10.96	°C	
Locations:	Entire upstream stretch		pH:	7.45	pH units	
	Placer and road		Conductivity:	337	uS/cm	
	Sonura Gulch		DO:	11.4	mg/L	
				110	% Sat	

Comments:
Sparse willow cover at crossing
Active placer upstream - very turbid
Cascade in ditch at crossing

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 71+290 (Unmapped Site) - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6951933 N	651968 E	Gradient (%):	-	9	-
Site Visit Date:	22-Jun-13		Bankfull Width (m):	-	-	-
Flow Conditions:	Low		Bankfull Depth (m):	-	-	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	0.22	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.06	-
Gee Trapping:	No		Substrate Bed:	-	F	-
Fish present?:	No		Substrate Bank:	-	F	-
Site Length:	100 m		Riparian Vegetation:	-	GR	-
			Meander Pattern:	-	SI	-
			Cover:	-	-	-
Photo #s	19 u/s	20 x	21 d/s			
Areas of Erosion:	No		Temperature:	-	°C	
Locations:			pH:	-	pH units	
			Conductivity:	-	uS/cm	
			DO:	-	mg/L	
				-	% Sat	

Comments:
Unmapped creek
No defined channel, flowing through grass
No direct fish habitat

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 71+600 - Hayes Creek Tributary

			D/S	X	U/S
Coordinates:	6951973 N	651716 E	Gradient (%):	-	-
Site Visit Date:	22-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:			Bankfull Depth (m):	-	-
Barrier/Confirmed:	/		Wetted Widths (m):	-	-
Electrofished/Effort?:	/		Wetted Depth (m):	-	-
Gee Trapping:			Substrate Bed:	-	-
Fish present?:	Y/N		Substrate Bank:	-	-
Site Length:			Riparian Vegetation:	-	-
	(200m)		Meander Pattern:	-	-
			Cover:	-	-
Photo #s	25/878 u/s	26/879 x	7/880-881 d/s		
Areas of Erosion:	N	Temperature:	-	°C	
Locations:		pH:	-	pH units	
		Conductivity:	-	uS/cm	
		DO:	-	mg/L	
			-	% Sat	
Comments:	This site was overlapped by both teams - 2 sets of confirming information				
	No flow at site, appears to be an old high water side channel of Hayes Creek				
	No habitat				
	No visible channel; nearby creek was assessed instead				
	Saw another dry drainage area nearby - no visible channel				

Upstream - 25



Upstream - 878



Crossing - 26



Crossing - 879



Downstream - 27



Downstream - 880



Downstream 2 - 881



Freegold Road Extension Crossing # 71+625 - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6951959 N	651678 E	Gradient (%):	3.5	5	5
Site Visit Date:	22-Jun-13		Bankfull Width (m):	1.50	2.50	1.55
Flow Conditions:	Low		Bankfull Depth (m):	0.13	0.13	0.43
Barrier/Confirmed:	Low Flow		Wetted Widths (m):	0.74	1.24	0.96
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.05	0.05	0.06
Gee Trapping:	No		Substrate Bed:	G/F	G/C	C/G
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/AL/GR	WI/PO	PO/WI/SP
			Meander Pattern:	IM	IM	IM
		Cover:	10% / OV	5% / OV	90% / LWD	
Photo #s	882 u/s	883 x	884 d/s			
Areas of Erosion:	No		Temperature:	4.7	°C	
Locations:			pH:	-	pH units	
			Conductivity:	57	uS/cm	
			DO:	14.18	mg/L	
				110.2	% Sat	

Comments:
Bankfull width is an underestimate, area fans out at high flow
Photo 885 looking upstream at high gradient cascade that may act as a low flow barrier

Upstream



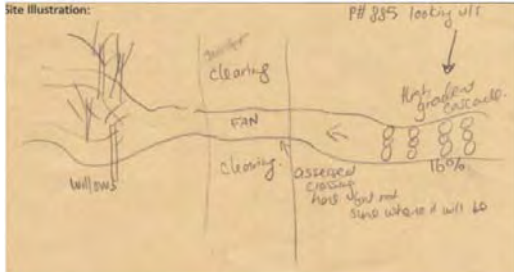
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # Unmapped site, near 71+600 - Pg. 2

Photo 885



Freegold Road Extension Crossing # 71+760 - Hayes Creek Tributary

			D/S	X	U/S
Coordinates:	6952033 N	651564 E	Gradient (%):	-	-
Site Visit Date:	22-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	874 u/s	875 x	876 d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
No visible channel					

Upstream



Crossing



Downstream



Photo 877



Freegold Road Extension Crossing # 71+810 - Hayes Creek Tributary

			D/S	X	U/S
Coordinates:	6952052 N	651512 E	Gradient (%):	-	-
Site Visit Date:	22-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish present?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	873 u/s	872 x	871 d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
Dry channel					
Likely ephemeral drainage feature					

Upstream



Crossing



Downstream



Freegold Road Extension Crossing # 71+980 - Hayes Creek Tributary

			D/S	X	U/S
Coordinates:	6952110 N	651353 E	Gradient (%):	2	2
Site Visit Date:	22-Jun-13		Bankfull Width (m):	7.50	6.50
Flow Conditions:	Low		Bankfull Depth (m):	0.97	0.34
Barrier/Confirmed:	None		Wetted Widths (m):	6.80	3.70
Electrofished/Effort?:	No		Wetted Depth (m):	0.58	0.07
Gee Trapping:	No		Substrate Bed:	G/F	G
Fish Bearing?	Yes		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	SP/PO/WI/AL	SP/PO/WI
			Meander Pattern:	SI	SI
			Cover:	10% / LWD	10% / LWD
Photo #s	868 u/s	869 x	870 d/s		
Areas of Erosion:	N		Temperature:	3.73	°C
Locations:			pH:	-	pH units
			Conductivity:	152	uS/cm
			DO:	7.75	mg/L
				73.9	% Sat

Comments:
Slow-moving wide channel, almost stagnant but some flow
Velocity barely above zero except at very shallow riffles

Upstream



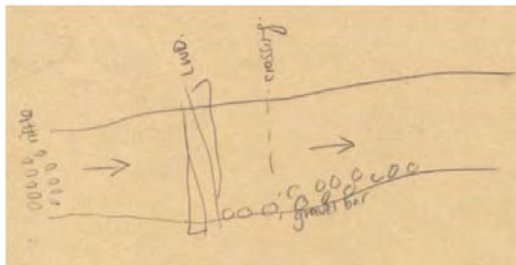
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 72+200 - Senora Gulch

			D/S	X	U/S	
Coordinates:	6952170 N	651145 E	Gradient (%):	7	10.5	7
Site Visit Date:	22-Jun-13		Bankfull Width (m):	1.75	3.30	4.00
Flow Conditions:	Low		Bankfull Depth (m):	0.64	0.50	0.70
Barrier/Confirmed:	None		Wetted Widths (m):	1.75	2.10	2.60
Electrofished/Effort?:	No		Wetted Depth (m):	0.15	0.23	0.18
Gee Trapping:	No		Substrate Bed:	C/B	C/B	G/C
Fish Bearing?	Yes		Substrate Bank:	F	F	F/C
Site Length:	100 m		Riparian Vegetation:	SP/WI	SP/WI/PO	SP/WI
			Meander Pattern:	IM	IM	IM
			Cover:	45% / LWD	25% / LWD	30% / LWD
Photo #s	865 u/s	866 x	867 d/s			
Areas of Erosion:	No		Temperature:	3.05	°C	
Locations:			pH:	-	pH units	
			Conductivity:	159	uS/cm	
			DO:	15.27	mg/L	
				113.7	% Sat	
Comments:						
Lots of LWD present						
Pool-riffle sequence at crossing						

Upstream



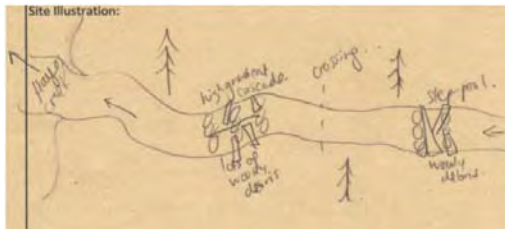
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 73+500 - Hayes Tributary

			D/S	X	U/S	
Coordinates:	6952558 N	649980 E	Gradient (%):	13	18	8
Site Visit Date:	22-Jun-13		Bankfull Width (m):	0.20	0.28	0.95
Flow Conditions:	Low		Bankfull Depth (m):	0.45	0.36	0.30
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.40	0.35	0.75
Electrofished/Effort?:	No		Wetted Depth (m):	0.16	0.23	0.15
Gee Trapping:	No		Substrate Bed:	G/C	G	C/G
Fish Bearing?	No		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	AL/WI	AL/WI	AL/WI
			Meander Pattern:	SI	SI	SI
		Cover:	60% / U	90% / OV	50% / OV	
Photo #s	28 u/s	29 x	30 d/s			
Areas of Erosion:	No		Temperature:	-	°C	
Locations:			pH:	-	pH units	
			Conductivity:	-	uS/cm	
			DO:	-	mg/L	
				-	% Sat	

Comments:
1 meter tall falls located just upstream of the crossing
Multiple barriers identified
Incised deeply, with a large amount of small woody debris

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 74+770 (Unmapped Site) - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6952594 N	648829 E	Gradient (%):	9	17.5	9
Site Visit Date:	22-Jun-13		Bankfull Width (m):	0.70	0.75	1.25
Flow Conditions:	Low		Bankfull Depth (m):	0.53	0.37	0.35
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.40	0.67	1.25
Electrofished/Effort?:	No		Wetted Depth (m):	0.22	0.05	0.03
Gee Trapping:	No		Substrate Bed:	G/C	G/C	G/C
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/AL/PO/SP	WI/AL/PO	WI/AL/PO
			Meander Pattern:	IM	IM	IM
		Cover:	100% / OV	80% / OV	100% / OV	
Photo #s	889 u/s	890 x	891 d/s			
Areas of Erosion:	No		Temperature:	5.94	°C	
Locations:			pH:	-	pH units	
			Conductivity:	200	uS/cm	
			DO:	13.5	mg/L	
				108.5	% Sat	
Comments:						
High waterfall at upstream site (at least 5'6") - photo 892						
Creates an unstream barrier to fish passage, however downstream appears to be clear						

Upstream



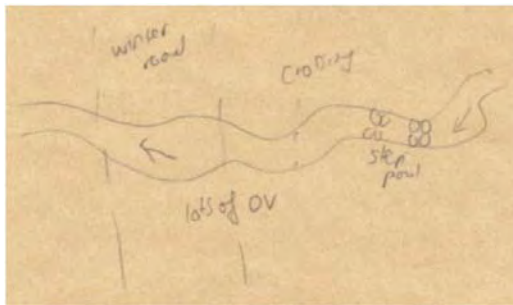
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # Unmapped site, East of 74+810 - Pg. 2

Photo 892



Photo 893



Photo 894



Freegold Road Extension Crossing # 74+810 - Hayes Creek Tributary

				D/S	X	U/S
Coordinates:	6952529 N	648749 E	Gradient (%):	3.5	9	3.5
Site Visit Date:	22-Jun-13		Bankfull Width (m):	0.94	0.95	1.26
Flow Conditions:	Low		Bankfull Depth (m):	0.31	0.29	0.55
Barrier/Confirmed:	None		Wetted Widths (m):	0.58	0.42	0.36
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.14	0.12	0.31
Gee Trapping:	No		Substrate Bed:	F	F	F
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	SP/PO/WI	WI/PO/SP	SP/WI/PO
			Meander Pattern:	IM	IM	IM
			Cover:	50% / OV	80% / SWD	60% / OV
Photo #s	886 u/s	887 x	888 d/s			
Areas of Erosion:	No		Temperature:	3.05	°C	
Locations:			pH:	-	pH units	
			Conductivity:	161	uS/cm	
			DO:	14.71	mg/L	
				109.8	% Sat	

Comments:
At the downstream site, water flows into winter road.
Channel fans out with minimal definition and runs straight down the road

Upstream



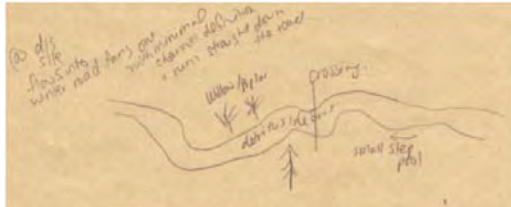
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 75+410 - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6952532 N	648162 E	Gradient (%):	3	2	5
Site Visit Date:	22-Jun-13		Bankfull Width (m):	3.80	3.70	6.80
Flow Conditions:	Low		Bankfull Depth (m):	0.54	0.57	0.96
Barrier/Confirmed:	None		Wetted Widths (m):	3.80	3.50	4.50
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.36	0.27	0.66
Gee Trapping:	No		Substrate Bed:	C/G	G/C	C/G
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	SP/AL	WI/AL/SP	SP/AL
			Meander Pattern:	IM	IM	IM
		Cover:	40% / LWD	30% / LWD	30% / LWD	
Photo #s	31 u/s	32 x	33 d/s			
Areas of Erosion:	No		Temperature:	-	°C	
Locations:			pH:	7.3	pH units	
			Conductivity:	58	uS/cm	
			DO:	13.6	mg/L	
				120	% Sat	
Comments:						
Ample large woody debris						
Crossing at grove of large spruce						
High quality rearing habitat						

Upstream



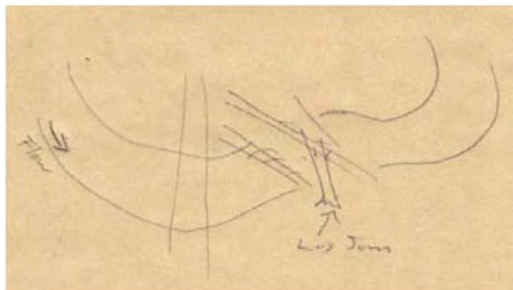
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 77+220 - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6953097 N	646520 E	Gradient (%):	1	11	17
Site Visit Date:	25-Jun-13		Bankfull Width (m):	-	0.59/0.47	0.83
Flow Conditions:	Low		Bankfull Depth (m):	-	0.10/0.14	0.27
Barrier/Confirmed:	None		Wetted Widths (m):	-	0.39/0.41	0.66
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	-	0.06/0.09	0.15
Gee Trapping:	No		Substrate Bed:	F	G/S	G/S
Fiah Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	GR	WI/GR	SP/AL
			Meander Pattern:	SI	SI	SI
		Cover:	0	0	20% / OV	
Photo #s	36 u/s	37 x	38 d/s			
Areas of Erosion:	Yes		Temperature:	2.81	°C	
Locations:	25m downstream of station,		pH:	7.1	pH units	
	new placer operation		Conductivity:	56	uS/cm	
			DO:	10.01	mg/L	
				79	% Sat	
Comments:						
Small creek draining directly into new placer operation on Hayes Creek floodplain						
Creek is ditched and managed downstream of the crossing						
Split channel at the crossing						

Upstream



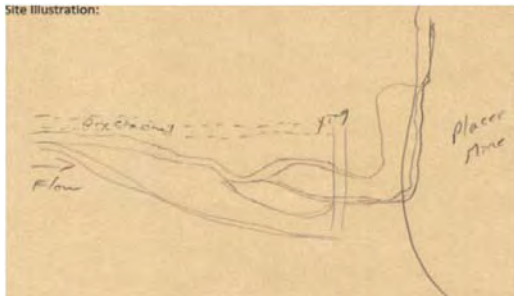
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 77+770 (Unmapped site) - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6953305 N	646068 E	Gradient (%):	2	3.5	19
Site Visit Date:	21-Jun-13		Bankfull Width (m):	4.00	2.70	3.00
Flow Conditions:	Low		Bankfull Depth (m):	1.10	1.41	0.60
Barrier/Confirmed:	Yes		Wetted Widths (m):	2.50	0.30	0.90
Electrofished/Effort?:	No		Wetted Depth (m):	0.34	0.05	0.10
Gee Trapping:	No		Substrate Bed:	G/C	G	C/B
Fish Bearing?	Yes		Substrate Bank:	F/G	F/G	F
Site Length:	100 m		Riparian Vegetation:	WI/PO	WI	SP/PO
			Meander Pattern:	SI	SI	IM
		Cover:	5% /	0	60% / OV	
Photo #s	854 u/s	855 x	856 d/s			
Areas of Erosion:	Yes		Temperature:	3.58	°C	
Locations:	Placer mining activities at crossing		pH:	-	pH units	
			Conductivity:	153	uS/cm	
			DO:	14.8	mg/L	
				111.8	% Sat	

Comments:
Channel runs through a previous placer mining operation
This has artificially created some drop barriers
Watercourse would benefit from restoration and addition of pool habitat

Upstream



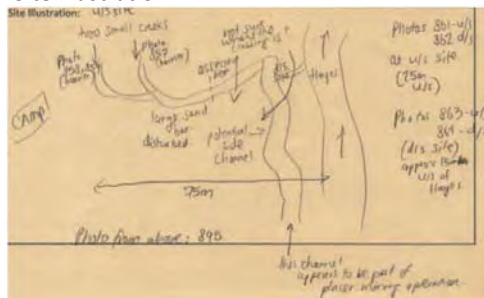
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # Unmapped site between 77+220 and 78+420 - Pg. 2

Photo 857 - Barrier



Photo 858 - Barrier



Photo 859 - Barrier



Photo 860 Assumed



Photo 861 US Site - US



Photo 862 US Site - DS



Freegold Road Extension Crossing # Unmapped site between 77+220 and 78+420 - Pg. 3

Photo 863 DS Site - US



Photo 864 DS Site - DS



Photo 895 - Air



Freegold Road Extension Crossing # 78+420 - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6953565 N	645495 E	Gradient (%):	14	16	14
Site Visit Date:	21-Jun-13		Bankfull Width (m):	2.50	1.60	1.83
Flow Conditions:	Low		Bankfull Depth (m):	0.50	0.49	0.49
Barrier/Confirmed:	None		Wetted Widths (m):	1.70	1.10	1.80
Electrofished/Effort?:	yes (2011)		Wetted Depth (m):	0.12	0.17	0.13
Gee Trapping:	No		Substrate Bed:	C/G	C/B	C/B
Fish Bearing?	Yes		Substrate Bank:	F/C	F/C	F/C
Site Length:	100 m		Riparian Vegetation:	SP/PO	SP/PO	SP/PO
			Meander Pattern:	IM	IM	IM
		Cover:	15% / LWD	25% / LWD	15% / LWD	
Photo #s	851 u/s	852 x	853 d/s			
Areas of Erosion:	N		Temperature:	3.9	°C	
Locations:			pH:	5.5	pH units	
			Conductivity:	114	uS/cm	
			DO:	14.44	mg/L	
				110	% Sat	
Comments:						
Good step-pool cover with LWD						

Upstream



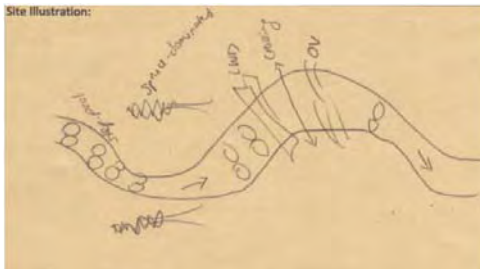
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 78+540 - Hayes Creek Tributary

			D/S	X	U/S
Coordinates:	6953658 N	645437 E	Gradient (%):	-	-
Site Visit Date:	21-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?:	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	848 u/s	849 x	850 d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
Potential ephemeral drainage feature					

Upstream



Crossing



Downstream



Freegold Road Extension Crossing # 78+980 - Hayes Creek

			D/S	X	U/S	
Coordinates:	6953951 N	645113 E	Gradient (%):	0.5	0.5	1
Site Visit Date:	21-Jun-13		Bankfull Width (m):	22.00	22.00	23.00
Flow Conditions:	Low		Average Depth (m):	0.80	0.80	0.70
Barrier/Confirmed:	None		Wetted Widths (m):	19.00	16.00	16.00
Electrofished/Effort?:	No		Substrate Bed:	C/G	C/G	C/G
Gee Trapping:	No		Substrate Bank:	-	-	-
Fish Bearing?	Yes		Riparian Vegetation:	-	-	-
Site Length:	100 m		Meander Pattern:	-	-	-
			Cover:	30% / OV	40% / LWD	30% / OV

Photo #s	845 u/s	846 x	847 d/s	
Areas of Erosion:	Yes		Temperature:	6.64 °C
Locations:	Slumping noted on both banks		pH:	~ 7 pH units
			Conductivity:	164 uS/cm
			DO:	12.98 mg/L
				105.9 % Sat

Comments:
Pre-existing site card as 79+090
High erosion potential
High quality rearing habitat

Upstream



Crossing



Downstream



Freegold Road Extension Crossing # 79+380 - Hayes Creek

			D/S	X	U/S
Coordinates:	6954264 N	644886 E	Gradient (%):	1.5	1
Site Visit Date:	21-Jun-13		Bankfull Width (m):	26	22
Flow Conditions:	Low		Average Depth (m):	0.9	0.7
Barrier/Confirmed:	None		Wetted Widths (m):	22	20
Electrofished/Effort?:	Yes (2010)		Substrate Bed:	C/G	C/G
Gee Trapping:	No		Substrate Bank:	-	-
Fish Bearing?	Yes		Riparian Vegetation:	-	-
Site Length:	100 m		Meander Pattern:	-	-
			Cover:	50% / OV/LWD	40% / OV

Photo #s	842 u/s	843 x	844 d/s	
Areas of Erosion:	Yes		Temperature:	6.57 °C
Locations:	Left bank		pH:	7.2 pH units
			Conductivity:	164 uS/cm
			DO:	13.32 mg/L
				108.6 % Sat

Comments:
Pre-existing Site Card as 79+380
Small amount of erosion on left bank
Riffle sequence with only a small amount of slow refuge areas

Upstream



Crossing



Downstream



Freegold Road Extension Crossing # 80+620 (Unmapped Site) - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6954779 N	643808 E	Gradient (%):	9	8	9
Site Visit Date:	21-Jun-13		Bankfull Width (m):	0.28	0.42	0.25
Flow Conditions:	Low		Bankfull Depth (m):	0.10	0.13	0.12
Barrier/Confirmed:	None		Wetted Widths (m):	0.25	0.30	0.25
Electrofished/Effort?:	No		Wetted Depth (m):	0.07	0.09	0.10
Gee Trapping:	No		Substrate Bed:	F	C/S	G
Fish Bearing?	Yes		Substrate Bank:	F	F/C	F
Site Length:	100 m		Riparian Vegetation:	GR	WI/BI	WI
		Meander Pattern:	SI	SI	SI	
		Cover:	0	80% / OV	100% OV	
Photo #s	22 u/s	23 x	24 d/s			
Areas of Erosion:	No		Temperature:	5.05	°C	
Locations:			pH:	6.84	pH units	
			Conductivity:	52	uS/cm	
			DO:	8.79	mg/L	
				72.8	% Sat	

Comments:
Small creek running from drainage to site
Previously unmapped watercourse
Crosses winter road

Upstream



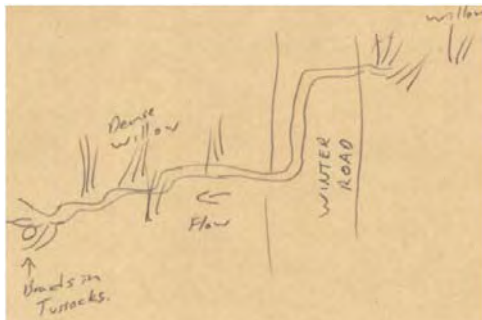
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 81+120 - Hayes Creek Tributary

			D/S	X	U/S
Coordinates:	6954697 N	643317 E	Gradient (%):	-	-
Site Visit Date:	22-Jun-13		Bankfull Width (m):	0.23	-
Flow Conditions:	Low/None		Bankfull Depth (m):	0.08	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.08	-
Electrofished/Effort?:	No		Wetted Depth (m):	0.02	-
Gee Trapping:	No		Substrate Bed:	F	-
Fish Bearing?	No		Substrate Bank:	F	-
Site Length:	100 m		Riparian Vegetation:	SP/GR	-
	(200m)		Meander Pattern:	SI	-
			Cover:	80% / OV	-
Photo #s	13 u/s	14 x	15 d/s		
Areas of Erosion:	No		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat

Comments:
Intermittent creek
No flow at this time
No direct fish habitat

Upstream



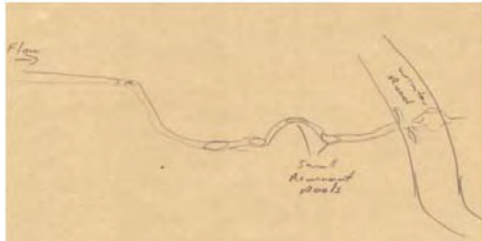
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 81+570 - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6954859 N	642903 E	Gradient (%):	-	15	13
Site Visit Date:	22-Jun-13		Bankfull Width (m):	0.18	0.35	0.37
Flow Conditions:	Low		Bankfull Depth (m):	0.06	0.08	0.07
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.13	0.28	0.18
Electrofished/Effort?:	No		Wetted Depth (m):	0.03	0.06	0.05
Gee Trapping:	No		Substrate Bed:	S/G	S/F	S/G
Fish Bearing?	No		Substrate Bank:	F/S	F/S	F/S
Site Length:	100 m		Riparian Vegetation:	SP/WI	SP/WI	SP/WI
			Meander Pattern:	SI	SI	SI
		Cover:	20% / OV	30% / OV	50% / OV	
Photo #s	7 u/s	8 x	9 d/s			
Areas of Erosion:	No		Temperature:	4.77	°C	
Locations:			pH:	7.51	pH units	
			Conductivity:	791	uS/cm	
			DO:	12.4	mg/L	
				103	% Sat	

Comments:
Very shallow, small creek
No direct fish habitat

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 81+680 (Unmapped Site) - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6954913 N	642808 E	Gradient (%):	12	10	11
Site Visit Date:	22-Jun-13		Bankfull Width (m):	1.00	0.50	-
Flow Conditions:	Low		Bankfull Depth (m):	0.05	0.13	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	0.40	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.09	-
Gee Trapping:	No		Substrate Bed:	F	F	-
Fish Bearing?	No		Substrate Bank:	F	F	-
Site Length:	100 m		Riparian Vegetation:	SP/GR	SP/GR	-
			Meander Pattern:	Si	Si	-
		Cover:	-	5% / LWD	-	
Photo #s	4 u/s	5 x	6 d/s			
Areas of Erosion:	No		Temperature:	-	°C	
Locations:			pH:	6.87	pH units	
			Conductivity:	366	uS/cm	
			DO:	5.05	mg/L	
				39.2	% Sat	

Comments:
Unmapped creek, over shallow permafrost
Intermittent, flowing through tussocks
No direct fish habitat
No channel upstream, no flow - subterranean

Upstream



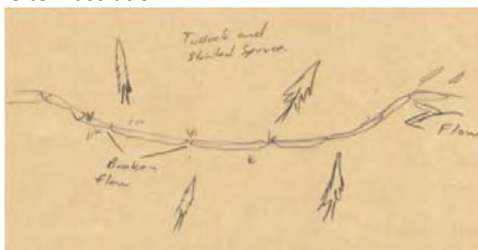
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 81+610 (Unmapped Site) - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6954911 N	642897 E	Gradient (%):	-	12	-
Site Visit Date:	22-Jun-13		Bankfull Width (m):	-	0.18	-
Flow Conditions:	Low		Bankfull Depth (m):	-	0.04	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	0.11	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.02	-
Gee Trapping:	No		Substrate Bed:	-	F	-
Fish Bearing?	No		Substrate Bank:	-	F	-
Site Length:	100 m		Riparian Vegetation:	-	SP/WI	-
			Meander Pattern:	-	SI	-
		Cover:	-	-	-	
Photo #s	10 u/s	11 x	12 d/s			
Areas of Erosion:	No		Temperature:	5.04	°C	
Locations:			pH:	7.06	pH units	
			Conductivity:	839	uS/cm	
			DO:	8.35	mg/L	
				69.5	% Sat	

Comments:
Small permafrost melt creek - unmapped
No direct fish habitat

Upstream



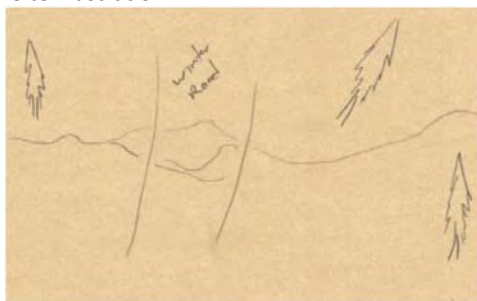
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 81+750 - Hayes Creek Tributary

				D/S	X	U/S
Coordinates:	6954938 N	642743 E	Gradient (%):	4	8	5
Site Visit Date:	22-Jun-13		Bankfull Width (m):	2.00	2.00	1.40
Flow Conditions:	Low		Bankfull Depth (m):	0.53	0.60	0.63
Barrier/Confirmed:	None		Wetted Widths (m):	2.00	1.80	1.70
Electrofished/Effort?:	No		Wetted Depth (m):	0.23	0.40	0.28
Gee Trapping:	No		Substrate Bed:	B/C	S/B	S/B
Fish Bearing?:	Yes		Substrate Bank:	F/G	F/G	F
Site Length:	100 m		Riparian Vegetation:	SP/WI	SP/WI	SP/WI
			Meander Pattern:	IM	IM	IM
			Cover:	20% / B	40% / U	20% / U
Photo #s	01 u/s	02 x	03 d/s			
Areas of Erosion:	No		Temperature:	2.84	°C	
Locations:			pH:	6.93	pH units	
			Conductivity:	61	uS/cm	
			DO:	14	mg/L	
				111.1	% Sat	

Comments:
Abundant woody debris
Boulder/G with some step pools
Ample cover, good nursery habitat

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 83+550 - Hayes Creek Tributary

			D/S	X	U/S	
Coordinates:	6955434 N	641077 E	Gradient (%):	14	21	14
Site Visit Date:	21-Jun-13		Bankfull Width (m):	0.71	1.07	0.92
Flow Conditions:	Low		Bankfull Depth (m):	0.72	0.64	0.96
Barrier/Confirmed:	No		Wetted Widths (m):	1.01	1.02	1.25
Electrofished/Effort?:	Yes (2013)		Wetted Depth (m):	0.17	0.15	0.25
Gee Trapping:	Yes (2013)		Substrate Bed:	C/B	C/B	C/G
Fish Bearing?	No		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/PO/SP	WI/PO/SP	WI/PO/SP
			Meander Pattern:	IM	IM	IM
		Cover:	25% / LWD	70% / OV	60% / OV	
Photo #s	835 u/s	836 x	837 d/s			
Areas of Erosion:	No		Temperature:	3.5	°C	
Locations:			pH:	7.36	pH units	
			Conductivity:	197	uS/cm	
			DO:	15.82	mg/L	
				119.5	% Sat	

Comments:
High gradient channel with no fish present
Vertical Falls (0.94m length) identified downstream of crossing
Falls at 07 V 0641116 6955570

Upstream



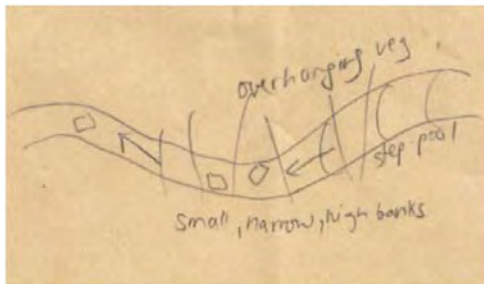
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 85+160 - Selwyn River

			D/S	X	U/S	
Coordinates:	6956507 N	639993 E	Gradient (%):	2	2	2.5
Site Visit Date:	21-Jun-13		Bankfull Width (m):	25	19	20
Flow Conditions:	Typical		Average Depth (m):	0.8	0.8	0.9
Barrier/Confirmed:	None		Wetted Widths (m):	23	18	18
Electrofished/Effort?:	No		Substrate Bed:	B/C	B/C	B/C
Gee Trapping:	No		Substrate Bank:	-	-	-
Fish Bearing?	Yes		Riparian Vegetation:	-	-	-
Site Length:	100 m		Meander Pattern:	-	-	-
			Cover:	45% / B	45% / B	45% / B

Photo #s	839 u/s	840 x	841 d/s		
Areas of Erosion:	Yes		Temperature:	8.04	°C
Locations:	Right bank - lots of trees fallen over.		pH:	4.48	pH units
	Med erosion potential		Conductivity:	97	uS/cm
			DO:	13.32	mg/L
				112.5	% Sat

Comments:
Pre-existing Site Card as 85+280
High quality habitat for many life stages

Upstream



Crossing



Downstream



Freegold Road Extension Crossing # 87+920 - Selwyn River Tributary

			D/S	X	U/S	
Coordinates:	6958246 N	638494 E	Gradient (%):	23	30.5	21
Site Visit Date:	21-Jun-13		Bankfull Width (m):	0.82	1.15	0.47
Flow Conditions:	Low		Bankfull Depth (m):	0.45	0.81	0.80
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.58	0.62	0.39
Electrofished/Effort?:	Yes (2013)		Wetted Depth (m):	0.04	0.03	0.07
Gee Trapping:	Yes (2013)		Substrate Bed:	C/G	C/G	C/G
Fish Bearing?:	No		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	SP/PO	PO/ SP	SP/PO
			Meander Pattern:	IM	IM	IM
		Cover:	80% / SWD	85% / SWD	100% / U	
Photo #s	830 u/s	831 x	832-833 d/s			
Areas of Erosion:	No		Temperature:	2.75	°C	
Locations:			pH:	6.7	pH units	
			Conductivity:	70	uS/cm	
			DO:	15.6	mg/L	
				115	% Sat	

Comments:
Barrier: vertical drop at 07 V 0638515 6958273
Sparse vegetation at crossing

Upstream



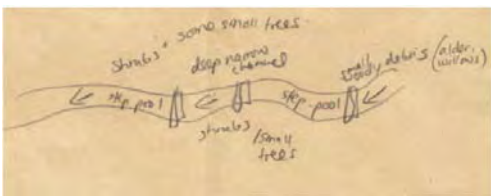
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 87+920 - Pg. 2

Vertical Drop



Photo 834



Freegold Road Extension Crossing # 89+330 - Selwyn River Tributary

			D/S	X	U/S	
Coordinates:	6958668 N	637646 E	Gradient (%):	22	21	20
Site Visit Date:	21-Jun-13		Bankfull Width (m):	1.00	0.40	0.50
Flow Conditions:	Low		Bankfull Depth (m):	0.50	0.24	0.40
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.80	0.40	0.43
Electrofished/Effort?:	No		Wetted Depth (m):	0.19	0.17	0.11
Gee Trapping:	No		Substrate Bed:	S/C	S/C	C/B
Fish Bearing?:	No		Substrate Bank:	F/C	F/C	F/S
Site Length:	100 m		Riparian Vegetation:	WI/SP	BI/WI	WI/BI
			Meander Pattern:	Si	Si	Si
		Cover:	20% / U	20% / U	70% / U	
Photo #s	16 u/s	17 x	18 d/s			
Areas of Erosion:	No		Temperature:	2.67	°C	
Locations:			pH:	8.09	pH units	
			Conductivity:	15	uS/cm	
			DO:	10.57	mg/L	
				80.5	% Sat	

Comments:
Continuous drop/pool sequence
> 20% gradient throughout and continuing downstream
No direct fish habitat

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 89+410 - Selwyn River Tributary

			D/S	X	U/S	
Coordinates:	6958702 N	637585 E	Gradient (%):	21	23	29
Site Visit Date:	21-Jun-13		Bankfull Width (m):	0.85	1.00	0.85
Flow Conditions:	Low		Bankfull Depth (m):	0.46	0.47	0.40
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.85	1.00	0.80
Electrofished/Effort?:	No		Wetted Depth (m):	0.20	0.16	0.22
Gee Trapping:	No		Substrate Bed:	B/S	C/S	B/S
Fish Bearing?:	No		Substrate Bank:	F	F/C	F/C
Site Length:	100 m		Riparian Vegetation:	BI/SP	BI/SP	BI/SP
		Meander Pattern:	ST	ST	ST	
		Cover:	30% / U	50% / U	20% / U	
Photo #s	20 u/s	19 x	21 d/s			
Areas of Erosion:	No		Temperature:	3.37	°C	
Locations:			pH:	7.5	pH units	
			Conductivity:	8	uS/cm	
			DO:	9.8	mg/L	
				79.5	% Sat	

Comments:
Step pool sequence
>20 % throughout

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 90+410 - Selwyn River Tributary

			D/S	X	U/S	
Coordinates:	6959511 N	637143 E	Gradient (%):	-	50	-
Site Visit Date:	21-Jun-13		Bankfull Width (m):	-	0.33	-
Flow Conditions:	Low		Bankfull Depth (m):	-	0.02	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	0.17	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.02	-
Gee Trapping:	No		Substrate Bed:	-	F/Organics	-
Fish Bearing?:	No		Substrate Bank:	-	F/Organics	-
Site Length:	100 m		Riparian Vegetation:	-	AL	-
			Meander Pattern:	-	ST	-
			Cover:	-	-	-
Photo #s	10 u/s	11 x	12 d/s			
Areas of Erosion:	No		Temperature:	-	°C	
Locations:			pH:	-	pH units	
			Conductivity:	-	uS/cm	
			DO:	-	mg/L	
				-	% Sat	

Comments:
Tiny creek at upper edge of watershed
No fish habitat
50% gradient

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 90+410 - Pg. 2

Photo 13



Photo 14



Photo 15



Freegold Road Extension Crossing # 91+570 - Selwyn River Tributary

			D/S	X	U/S	
Coordinates:	6959588 N	636430 E	Gradient (%):	15	25	22
Site Visit Date:	21-Jun-13		Bankfull Width (m):	0.85	0.50	0.60
Flow Conditions:	Low		Bankfull Depth (m):	0.22	0.34	0.40
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.79	0.80	0.70
Electrofished/Effort?:	No		Wetted Depth (m):	0.14	0.20	0.08
Gee Trapping:	No		Substrate Bed:	S/B	B/C	B/G
Fish Bearing?:	No		Substrate Bank:	F/C	F/C	B/F
Site Length:	100 m	Riparian Vegetation:	BI/AL	BI/AL	BI/AL	
		Meander Pattern:	SI	SI	SI	
		Cover:	20% /U	60% /U	70% /U	
Photo #s	07 u/s	08 x	09 d/s			
Areas of Erosion:	No		Temperature:	1.66	°C	
Locations:			pH:	7.03	pH units	
			Conductivity:	4	uS/cm	
			DO:	9.82	mg/L	
				-	% Sat	

Comments:
Step pool, boulders with very little flow
Creek subterranean in places for short periods
Very steep overall and no direct fish habitat

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 93+040 - Selwyn River Tributary

			D/S	X	U/S	
Coordinates:	6959563 N	635624 E	Gradient (%):	21	35	30.5
Site Visit Date:	21-Jun-13		Bankfull Width (m):	0.46	0.72	0.64
Flow Conditions:	Low		Bankfull Depth (m):	0.26	0.49	0.69
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.74	0.96	0.73
Electrofished/Effort?:	Yes (2013)		Wetted Depth (m):	0.07	0.08	0.10
Gee Trapping:	Yes (2013)		Substrate Bed:	G/C	C/G	B/C
Fish Bearing?:	No		Substrate Bank:	F	F	B/F
Site Length:	100 m		Riparian Vegetation:	PO/AL	WI/BI	PO
			Meander Pattern:	IM	IM	IM
			Cover:	80% / LWD	50% / LWD	70% / OV
Photo #s	823 u/s	824 x	825 d/s			
Areas of Erosion:	No		Temperature:	1.93	°C	
Locations:			pH:	4.56	pH units	
			Conductivity:	26	uS/cm	
			DO:	15.29	mg/L	
				110.5	% Sat	
Comments:						
High gradient watercourse with a high potential to act as a fish barrier						
At 07 V 0635845 6959968 vertical drop of 1.12m from top to substrate (photos: 826 and 827)						

Upstream



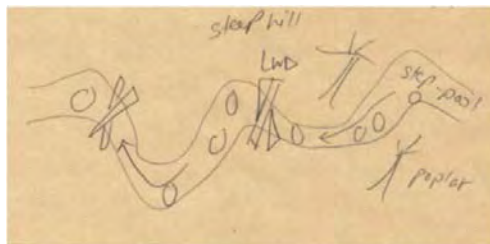
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 93+040 - Pg. 2

826 - Vertical Drop



827 - Vertical Drop



828 - Vertical Drop



829 - Gradient



Freegold Road Extension Crossing # 94+550 - Selwyn River Tributary

			D/S	X	U/S	
Coordinates:	6959720 N	634674 E	Gradient (%):	10	10	8
Site Visit Date:	21-Jun-13		Bankfull Width (m):	1.20	1.70	1.00
Flow Conditions:	Low		Bankfull Depth (m):	0.50	0.60	0.57
Barrier/Confirmed:	None		Wetted Widths (m):	1.20	1.80	0.80
Electrofished/Effort?:	Yes (2013)		Wetted Depth (m):	0.19	0.20	0.17
Gee Trapping:	Yes (2013)		Substrate Bed:	B/C	C/B	C/B
Fish Bearing?:	Yes		Substrate Bank:	F/C	F/C	F/C
Site Length:	100 m	Riparian Vegetation:	WI/BI	WI/BI	WI/BI	
		Meander Pattern:	Si	Si	Si	
		Cover:	40% / U	40% /U	40% /U	
Photo #s	4 u/s	5 x	6 d/s			
Areas of Erosion:	No		Temperature:	2.26	°C	
Locations:			pH:	7.05	pH units	
			Conductivity:	4	uS/cm	
			DO:	9.68	mg/L	
				78.3	% Sat	

Comments:
Step pool, cobble boulder, well undercut banks

Upstream



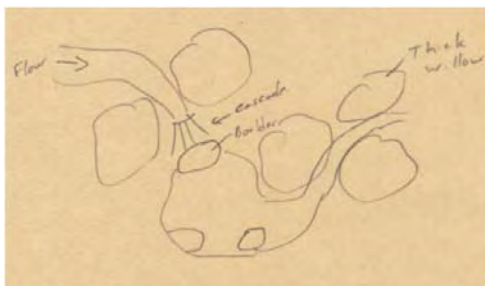
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 94+660 - Selwyn River Tributary

			D/S	X	U/S	
Coordinates:	6959780 N	634592 E	Gradient (%):	17.5	9	21
Site Visit Date:	21-Jun-13		Bankfull Width (m):	0.42	0.75	0.55
Flow Conditions:	Low		Bankfull Depth (m):	0.65	0.72	0.70
Barrier/Confirmed:	None		Wetted Widths (m):	0.32	0.65	0.33
Electrofished/Effort?:	Yes (2013)		Wetted Depth (m):	0.08	0.09	0.15
Gee Trapping:	Yes (2013)		Substrate Bed:	B/G	B/C	F/B
Fish Bearing?:	Yes		Substrate Bank:	F	B/F	F
Site Length:	100 m		Riparian Vegetation:	SH/BI/SP	SH/BI/SP	SH/BI/AL/SP
			Meander Pattern:	IM	IM	IM
			Cover:	95% / OV	95% / OV	95% / OV
Photo #s	820 u/s	821 x	822 d/s			
Areas of Erosion:	No		Temperature:	3.13	°C	
Locations:			pH:	4.43	pH units	
			Conductivity:	34	uS/cm	
			DO:	13.66	mg/L	
				101.9	% Sat	

Comments:
Deep narrow channel, small side flow
Very large amount of overhanging cover

Upstream



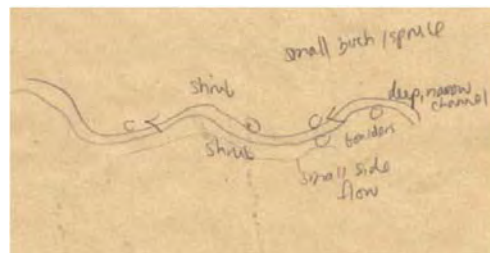
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 96+190 - Yukon River Tributary

			D/S	X	U/S	
Coordinates:	6960539 N	634193 E	Gradient (%):	-	20	-
Site Visit Date:	21-Jun-13		Bankfull Width (m):	-	0.30	-
Flow Conditions:	Low		Bankfull Depth (m):	-	0.17	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	0.08	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.04	-
Gee Trapping:	No		Substrate Bed:	-	F	-
Fish present?:	No		Substrate Bank:	-	F	-
Site Length:	100 m		Riparian Vegetation:	-	WI/GR	-
			Meander Pattern:	-	SI	-
			Cover:	-	-	-
Photo #s	01 u/s	02 x	03 d/s			
Areas of Erosion:	No		Temperature:	-	°C	
Locations:			pH:	-	pH units	
			Conductivity:	-	uS/cm	
			DO:	-	mg/L	
				-	% Sat	

Comments:
Intermittent at crossing, 20% or greater slope for entire length of the creek
Poorly defined channel
No direct fish habitat

Upstream



Crossing



Downstream



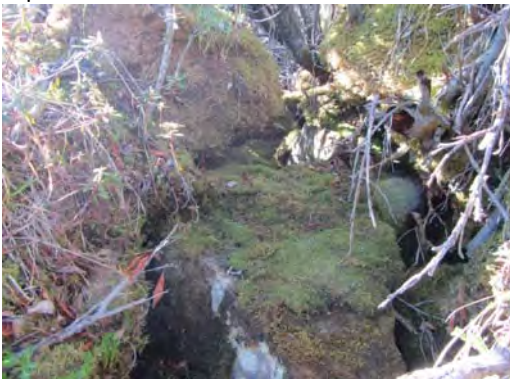
Site Illustration



Freegold Road Extension Crossing # 105+620 - Mascot Creek

			D/S	X	U/S
Coordinates:	6956936 N	628781 E	Gradient (%):	-	-
Site Visit Date:	19-Jun-13		Bankfull Width (m):	-	0.37
Flow Conditions:	None		Bankfull Depth (m):	-	0.45
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	0
Electrofished/Effort?:	No		Wetted Depth (m):	-	0
Gee Trapping:	No		Substrate Bed:	-	B
Fish Bearing?:	Yes		Substrate Bank:	-	F/B
Site Length:	100 m		Riparian Vegetation:	-	WI
			Meander Pattern:	-	SI
			Cover:	-	-
Photo #s	65 u/s	66 x	67 d/s		
Areas of Erosion:	No		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	uS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
Intermittent stream, some small pools of water but channel generally dry					

Upstream



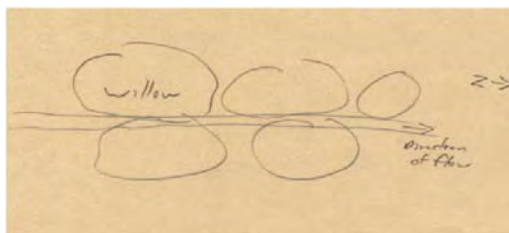
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 107+920 - Idaho Creek (Isaac Creek Tributary)

			D/S	X	U/S	
Coordinates:	6956753 N	627290 E	Gradient (%):	-	5	-
Site Visit Date:	June 19, 2013		Bankfull Width (m):	-	0.7	-
Flow Conditions:	Low		Bankfull Depth (m):	-	0.18	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	-	0.5	-
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.1	-
Gee Trapping:	No		Substrate Bed:	-	B/C	-
Fish Bearing?:	No		Substrate Bank:	-	C/F	-
Site Length:	100 m		Riparian Vegetation:	-	WI	-
		Meander Pattern:	-	SI	-	
		Cover:	-	A / Will	-	
Photo #s	62 u/s	63 x	64 d/s			
Areas of Erosion:	No		Temperature:	-	°C	
Locations:			pH:	-	pH units	
			Conductivity:	-	uS/cm	
			DO:	-	mg/L	
				-	% Sat	

Comments:
Barrier confirmed at 07 V 0626312 6958420, 28% gradient, photos: 60 and 61
Heavy, willow cover at crossing

Upstream



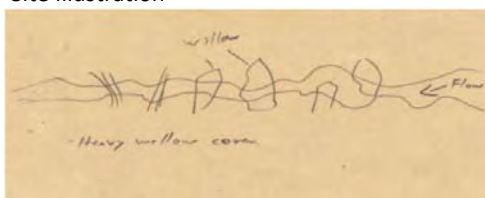
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 107+920 - Pg. 2

Photo 60 - Barrier



Photo 61 - Barrier



Freegold Road Extension Crossing # 109+800 - Idaho Creek (Isaac Creek Tributary)

			D/S	X	U/S	
Coordinates:	6956577 N	625829 E	Gradient (%):	12	7	10
Site Visit Date:	19-Jun-13		Bankfull Width (m):	3	3	2.5
Flow Conditions:	Low		Bankfull Depth (m):	0.48	0.38	0.45
Barrier/Confirmed:	None		Wetted Widths (m):	3	2.6	2
Electrofished/Effort?:	Yes (2013)		Wetted Depth (m):	0.28	0.18	0.25
Gee Trapping:	Yes (2013)		Substrate Bed:	B/C	B/C	B/C
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	220 m		Riparian Vegetation:	WI	WI	WI
			Meander Pattern:	SI	SI	SI
		Cover:	-	80% / B/OV	100% / OV/B	
Photo #s	57 u/s	58 x	59 d/s			
Areas of Erosion:	No		Temperature:	1.65	°C	
Locations:			pH:	5.94	pH units	
			Conductivity:	73	uS/cm	
			DO:	13.7	mg/L	
				98.2	% Sat	

Comments:
Very high cover, boulders and willows

Upstream



Crossing



Downstream

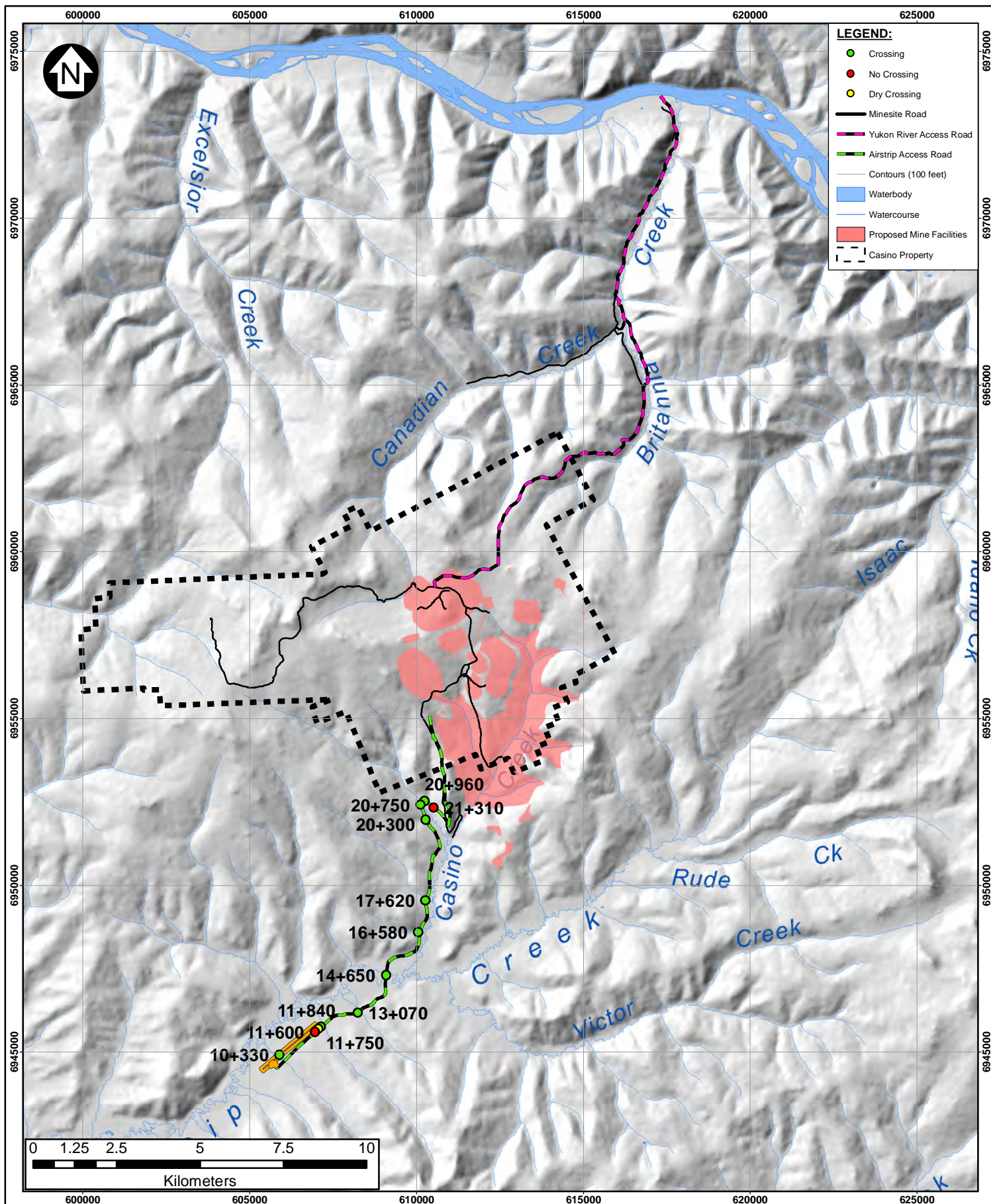


Site Illustration



Appendix D

Airstrip and Airstrip Access Road Crossings, 2013 Fish Habitat Data and Crossing Photos



PREPARED BY:



PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

DESIGNED	D. Turner
DRAWN	D. Turner
CHKD	L. Richards
APP'D	-
REV	-
DATE	28Aug'13

NOTES:

1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomatics.yukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 7N
3. COORDINATE GRID: METRES
4. SCALE: 1:150,000

CASINO
COPPER AND GOLD

CASINO PROJECT

**Casino Project Area
Internal Access Roads**

FIGURE 17

REF	REPORT 1
P/A	VA101-325/15

KEY

Site Naming Codes

HC	Pre-existing AE Habitat Card
UM	Unmapped site, found during PEGC crossing assessment
AS	Site is on the proposed Airstrip
N, E, S, W	North, East, South, West

In Site key

- or N/A Not Sampled, No data available or Not applicable

Substrates:

B	Boulder
C	Cobble
F	Fines
G	Gravel
S	Sand

Riparian Vegetation:

AL	Alder
AS	Aspen
BI	Birch
GR	Grass
PO	Poplar
SH	Shrub
SP	Spruce
WI	Willow

Channel Pattern:

ST	Straight
SI	Sinuuous
RM	Regular Meanders
IM	Irregular Meanders
TM	Tortuous Meanders
WA	Wandering
BR	Braided

Cover:

B	Boulders
DP	Deep Pools
IV	Instream Vegetation
LWD	Large Woody Debris
OV	Overhanging Vegetation
SWD	Small Woody Debris
U	Undercut Banks

Freegold Road Extension Crossing # 10+330 (Unmapped Site: end of airstrip) - Dip Creek Tributary

			D/S	X	U/S	
Coordinates:	6944918 N	605896 E	Gradient (%):	5	3.5	5
Site Visit Date:	25-Jun-13		Bankfull Width (m):	4.25	8.70	1.70
Flow Conditions:	Medium to High		Bankfull Depth (m):	0.21	0.35	0.35
Barrier/Confirmed:	None		Wetted Widths (m):	1.50	8.70	1.70
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.10	0.20	0.28
Gee Trapping:	No		Substrate Bed:	F	F	F
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
			Meander Pattern:	IM	IM	IM
		Cover:	90% / OV	80% / LWD	50% / OV	
Photo #s	101-0025 u/s	101-0026 x	101-0027 d/s			
Areas of Erosion:	Y		Temperature:	8.32	°C	
Locations:	Heavy disterbance at crossing		pH:	6.9	pH units	
	Slumps on both banks		Conductivity:	0.347	µS/cm	
			DO:	12.08	mg/L	
				102.9	% Sat	

Comments:
Upstream site, above major disturbance; channelized and flows seem high, some trees still in water
Downstream site, still disturbed, however, more confined.
Heavily disturbed site

Upstream



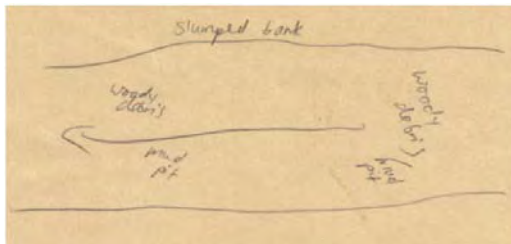
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 11+600 - No Crossing

			D/S	X	U/S
Coordinates:	6945600 N	606962 E	Gradient (%):	-	-
Site Visit Date:	25-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	No		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	µS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
No visible channel					

Photo 101-0006



Photo 101-0007



Freegold Road Extension Crossing # 11+750 - Dip Creek Tributary

			D/S	X	U/S
Coordinates:	6945695 N	607072 E	Gradient (%):	3.5	3.5
Site Visit Date:	25-Jun-13		Bankfull Width (m):	0.65	-
Flow Conditions:	None		Bankfull Depth (m):	0.40	-
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.51	0.30
Electrofished/Effort?:	No		Wetted Depth (m):	0.25	0.03
Gee Trapping:	No		Substrate Bed:	F	F
Fish Bearing?	No		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	WI/GR/SP	WI/SP
			Meander Pattern:	IM	N/A
			Cover:	80%/OV	100%/OV
Photo #s	101-0008 u/s	101-0009 x	101-0010 d/s		
Areas of Erosion:	No		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	µS/cm
			DO:	-	mg/L
				-	% Sat

Comments:
Stagnant disconnected puddles u/s of crossing, some low flow in places
Flow upstream of site, water downstream of site - again intermittent flow along creek here

Upstream



Crossing



Downstream



Photo 101-0011



Freegold Road Extension Crossing # 11+750 - Pg. 2

Photo 101-0012



Freegold Road Extension Crossing # 11+840 - Dip Creek Tributary

			D/S	X	U/S
Coordinates:	6945760 N	607146 E	Gradient (%):	3.5	5
Site Visit Date:	25-Jun-13		Bankfull Width (m):	2.70	1.37
Flow Conditions:	Low		Bankfull Depth (m):	0.62	0.35
Barrier/Confirmed:	None		Wetted Widths (m):	1.05	0.90
Electrofished/Effort?:	No		Wetted Depth (m):	0.29	0.15
Gee Trapping:	No		Substrate Bed:	F/G	F
Fish Bearing?	Yes		Substrate Bank:	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP
			Meander Pattern:	IM	IM
			Cover:	100% / OV	80% / OV
Photo #s	101- 0013 u/s	101-0014 x	101-0015 d/s		
Areas of Erosion:	No		Temperature:	8.14	°C
Locations:			pH:	9.47	pH units
			Conductivity:	550	µS/cm
			DO:	12.34	mg/L
				104.7	% Sat

Comments:
Watercourse fans out upstream of crossing
Fine (muddy) substrate
0.64 m deep pool identified downstream of crossing

Upstream



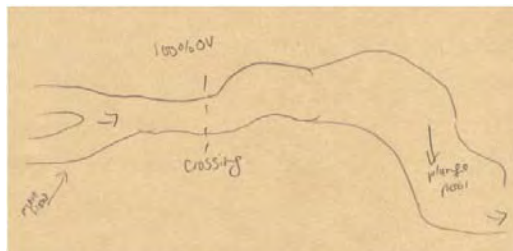
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 11+840 - Pg. 2

Photo 101-0016 US Site



Photo 101-0017 US Site



Freegold Road Extension Crossing # 13+070 - Dip Creek Tributary

			D/S	X	U/S	
Coordinates:	6946172 N	608242 E	Gradient (%):	7	7	9
Site Visit Date:	25-Jun-13		Bankfull Width (m):	0.60	2.40 / 1.03	1.50
Flow Conditions:	Low		Bankfull Depth (m):	0.37	0.38 / 0.50	0.30
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.50	1.00 / 0.66	1.00
Electrofished/Effort?:	No		Wetted Depth (m):	0.10	0.11 / 0.24	0.20
Gee Trapping:	No		Substrate Bed:	F	F	F
Fish Bearing?	No		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	SP/WI	SP/WI	WI/SP
			Meander Pattern:	IM	IM	IM
		Cover:	75% / OV	100% / OV	75% / OV	
Photo #s	101-0020 u/s	101-0021 x	101-0022 d/s			
Areas of Erosion:	Yes		Temperature:	10.39	°C	
Locations:	Erosion of fine bed and bank material		pH:	9.8	pH units	
			Conductivity:	170	µS/cm	
			DO:	9.73	mg/L	
				87	% Sat	

Comments:
Two channels at crossing with approximately 2.2m vegetated bar in between
Photos showing the larger main channel
Steep drop downstream is 29% gradient. Photos: 101-0018 upstream of drop, 101-0019 downstream

Upstream



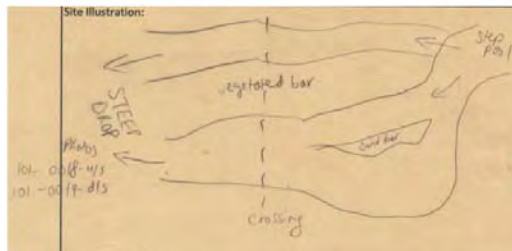
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 13+070 - Pg. 2

Photo 101-0018



Photo 101-0019



Photo 101-0023



Photo 101-0024



Freegold Road Extension Crossing # 14+650 - Dip Creek

			D/S	X	U/S	
Coordinates:	6947303 N	609094 E	Gradient (%):	-	1	-
Site Visit Date:	25-Jun-13		Bankfull Width (m):	-	17.6	-
Flow Conditions:	Low		Bankfull Depth (m):	-	-	-
Barrier/Confirmed:	None		Wetted Widths (m):	-	8.1	-
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	-	-	-
Gee Trapping:	No		Substrate Bed:	-	S/F	-
Fish Bearing?	Yes		Substrate Bank:	-	F	-
Site Length:	100 m		Riparian Vegetation:	-	WI/SP	-
			Meander Pattern:	-	TM	-
			Cover:	-	80% / Pool	-
Photo #s	54 u/s	55 x	56 d/s			
Areas of Erosion:	Yes		Temperature:	7.79	°C	
Locations:	Minor erosion on outside		pH:	7.39	pH units	
	bend of thalweg US of crossing		Conductivity:	80	µS/cm	
			DO:	8.5	mg/L	
				77	% Sat	
Comments:						
Site card previously prepared for crossing						
Watercourse too deep to obtain wetted depth measurements (>1.5 m)						
High quality habitat						

Upstream



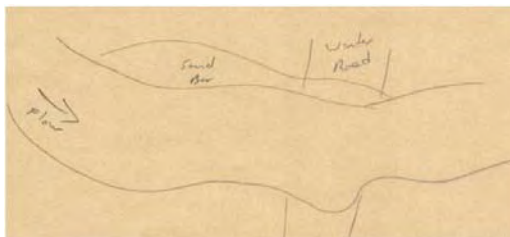
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 16+580 - Casino Creek Tributary

			D/S	X	U/S	
Coordinates:	6948592 N	610055 E	Gradient (%):	8	11	7
Site Visit Date:	25-Jun-13		Bankfull Width (m):	1.88	0.33	0.61
Flow Conditions:	Low		Bankfull Depth (m):	0.27	0.40	0.64
Barrier/Confirmed:	None		Wetted Widths (m):	1.88	0.23	0.61
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.19	0.28	0.55
Gee Trapping:	No		Substrate Bed:	F	F	F
Fish Bearing?	Yes		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
			Meander Pattern:	SI	SI	SI
			Cover:	40% / OV	40% / OV	30% / OV
Photo #s	57 u/s	58 x	59 d/s			
Areas of Erosion:	No		Temperature:	8.61		°C
Locations:			pH:	7.67		pH units
			Conductivity:	91		µS/cm
			DO:	6.4		mg/L
				59.5		% Sat
Comments:						
Very small creek fed by runoff and melting permafrost						
No direct fish habitat						
Creek braided around tussocks and willow						

Upstream



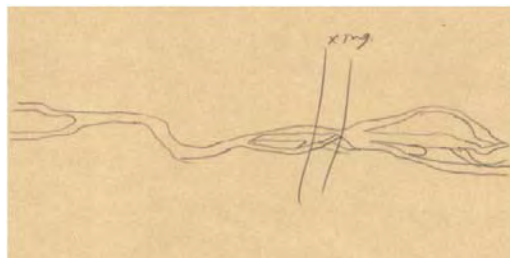
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 17+620 - Austin Creek

			D/S	X	U/S	
Coordinates:	6949543 N	610265 E	Gradient (%):	5	5	5
Site Visit Date:	25-Jun-13		Bankfull Width (m):	0.30	0.55	2.00
Flow Conditions:	Medium		Bankfull Depth (m):	0.50	0.37	0.73
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.67	0.44	1.87
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.28	0.22	0.34
Gee Trapping:	No		Substrate Bed:	F	F	F
Fish Bearing?	No		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
			Meander Pattern:	IM	IM	IM
		Cover:	100% / OV	100% / OV	100% / OV	
Photo #s	101-0028 u/s	101-0029 x	101-0030 d/s			
Areas of Erosion:	No		Temperature:	4.44	°C	
Locations:			pH:	10.74	pH units	
			Conductivity:	305	µS/cm	
			DO:	14.15	mg/L	
				109.3	% Sat	

Comments:
Upstream site at plunge pool
Downstream site (~10m) water goes underground and re-emerges briefly and goes down again
Small muddy creek with no in-stream features

Upstream



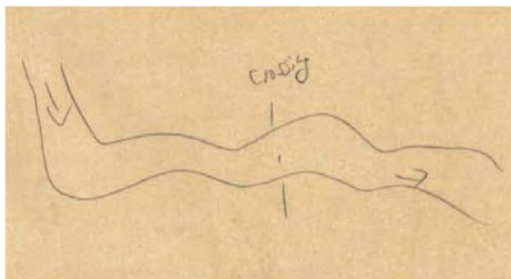
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 20+300 - Brynelson Creek Tributary

			D/S	X	U/S	
Coordinates:	6951968 N	610283 E	Gradient (%):	-	11	9
Site Visit Date:	25-Jun-13		Bankfull Width (m):	-	0.49	0.49
Flow Conditions:	Low		Bankfull Depth (m):	-	0.27	0.33
Barrier/Confirmed:	None		Wetted Widths (m):	-	0.49	0.49
Electrofished/Effort?:	No		Wetted Depth (m):	-	0.22	0.23
Gee Trapping:	No		Substrate Bed:	-	F/S	F
Fish Bearing?	Yes		Substrate Bank:	-	F	F
Site Length:	100 m		Riparian Vegetation:	-	WI/SP	WI/SP
			Meander Pattern:	-	SI	SI
			Cover:	-	30% / U	10% / OV
Photo #s	62 u/s	63 x	64 d/s			
Areas of Erosion:	Yes		Temperature:	4.92	°C	
Locations:	Some permafrost slumping		pH:	7.29	pH units	
	along creek length		Conductivity:	185	µS/cm	
			DO:	7.55	mg/L	
				64.2	% Sat	
Comments:						
Small tributary to Brynelson - 100% fines/sand substrate fed by melting permafrost						
No direct fish habitat						

Upstream



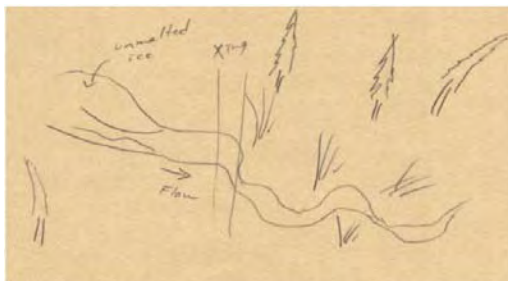
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 20+750 - Brynolson Creek

			D/S	X	U/S	
Coordinates:	6952411 N	610133 E	Gradient (%):	2	3	4
Site Visit Date:	25-Jun-13		Bankfull Width (m):	2.55	2.83	2.17
Flow Conditions:	Low		Bankfull Depth (m):	0.52	0.54	0.66
Barrier/Confirmed:	None		Wetted Widths (m):	2.55	2.80	2.40
Electrofished/Effort?:	Yes (2011)		Wetted Depth (m):	0.31	0.29	0.40
Gee Trapping:	No		Substrate Bed:	C/B	C/S	B/G
Fish Bearing?	Yes		Substrate Bank:	F	F	F/B
Site Length:	100 m		Riparian Vegetation:	WI	WI	WI
			Meander Pattern:	SI	SI	SI
		Cover:	30% / OV	20% / OV	30% / SWD	
Photo #s	65 u/s	66 x	67 d/s			
Areas of Erosion:	No		Temperature:	11.2	°C	
Locations:			pH:	7.62	pH units	
			Conductivity:	92	µS/cm	
			DO:	8.69	mg/L	
				85.5	% Sat	
Comments:						
Riffle-run morphology						
Good habitat, 1 adult and 1 juvenile arctic grayling spotted 25m upstream of crossing						

Upstream



Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 20+960 - Brynolson Creek Tributary

			D/S	X	U/S	
Coordinates:	6952522 N	610239 E	Gradient (%):	9	-	12
Site Visit Date:	25-Jun-13		Bankfull Width (m):	1.20	2.00	1.10
Flow Conditions:	Low		Bankfull Depth (m):	0.25	0.53	0.28
Barrier/Confirmed:	Yes		Wetted Widths (m):	0.58	0.35	0.75
Electrofished/Effort?:	No		Wetted Depth (m):	0.05	0.07	0.05
Gee Trapping:	No		Substrate Bed:	F	F	F / G
Fish Bearing?	No		Substrate Bank:	F	F	F
Site Length:	100 m		Riparian Vegetation:	SP/WI	SP/WI	SP/WI
			Meander Pattern:	IM	IM	IM
		Cover:	60% / OV	75% / OV	60% / OV	
Photo #s	101-0031 u/s	101-0032 x	101-0033 d/s			
Areas of Erosion:	Yes		Temperature:	4.05	°C	
Locations:	Erosion of muddy substrate and bank		pH:	10.91	pH units	
			Conductivity:	398	µS/cm	
			DO:	14.31	mg/L	
				109.3	% Sat	

Comments:
No surface flow for 50m upstream of the crossing - upstream site measured
Flows underground at 07 V 0610292 6952559
No Surface flow for 60m downstream of the crossing (downstream measurements),
re-emerges at 07 V 0610200 6952462

Upstream



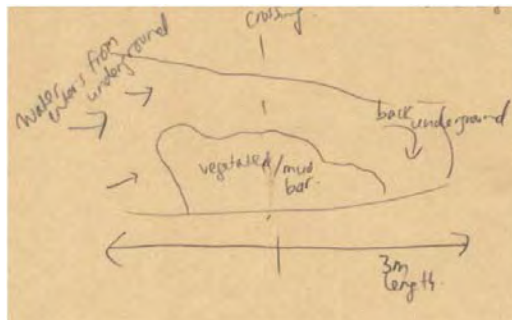
Crossing



Downstream



Site Illustration



Freegold Road Extension Crossing # 20+960 - Pg. 2

Photo 101 -0034



Freegold Road Extension Crossing # 21+310 - No Crossing

			D/S	X	U/S
Coordinates:	6952327 N	610518 E	Gradient (%):	-	-
Site Visit Date:	25-Jun-13		Bankfull Width (m):	-	-
Flow Conditions:	None		Bankfull Depth (m):	-	-
Barrier/Confirmed:	N/A		Wetted Widths (m):	-	-
Electrofished/Effort?:	N/A		Wetted Depth (m):	-	-
Gee Trapping:	N/A		Substrate Bed:	-	-
Fish Bearing?	N/A		Substrate Bank:	-	-
Site Length:	N/A		Riparian Vegetation:	-	-
			Meander Pattern:	-	-
			Cover:	-	-
Photo #s	u/s	x	d/s		
Areas of Erosion:	N/A		Temperature:	-	°C
Locations:			pH:	-	pH units
			Conductivity:	-	µS/cm
			DO:	-	mg/L
				-	% Sat
Comments:					
No watercourse identified at or near crossing location					

Photo 101-0035 - Air



