APPENDIX 14-D

Fish and Aquatic Resources

Mine Access Road Baseline

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Coffee Gold Project

Fish and Aquatic Resources Baseline Report:

Mine Access Road

Prepared for

Kaminak Gold Corporation

March 11, 2016

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

470 Granville Street, Suite 630, Vancouver, BC V6C 1V5 t 604-629-9075

March 11, 2016

Allison Rippin Armstrong
Kaminak Gold Corporation
1020 – 800 West Pender Street
Vancouver, British Columbia
V6C 2V6 Canada

Dear Ms. Armstrong,

Re: Fish and Aquatic Resources Baseline Report, Mine Access Road, Coffee Gold Project, 2015

Palmer Environmental Consulting Group Inc. is pleased to submit the attached report describing results of the fish and aquatic resources baseline assessment conducted as part of the Coffee Gold Mine Access Road program carried out in 2015.

This report characterizes the pre-development conditions of the fish and aquatic resources in the study area of the proposed Coffee Gold Project northern road route, and Coffee-Casino route, and provides a basis for an effects assessment from mine road development.

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,

[signature redacted]

[signature redacted]

Palmer, M.Sc. R.P. Bio
President, Senior Fisheries Biologist

March 11, 2016
Kaminak Gold Corporation

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Revision Log

Revision #	Revised By	Date	Issue / Revision Description
1	Nicola Lower	January 15, 2016	Senior Review
2	Nicola Lower	March 7, 2016	Senior Review

Signatures

Report Prepared By:

[signature redacted]

Irene Mencke, M.Sc., AScT.
Environmental Biologist

[signature redacted]

Alyssa Murdoch, M.Sc., R.P. Bio.
Aquatic Biologist

[signature redacted]

Report Reviewed By:

Nicola Lower, M.Sc., Ph.D.
Senior Fisheries Biologist

Executive Summary

This report describes the fish and fish habitat studies conducted in 2015 by Palmer Environmental Consulting Group Inc. (PECG) on the aquatic environments along the proposed access routes of the Coffee Gold Project (the Project). The Coffee Gold Project is a proposed open-pit, heap leach gold mine located in the White Gold district of west-central Yukon, approximately 130 km south of Dawson City. Two route options were investigated for providing road access to the project. The selected option is a northern route from Dawson City, which is comprised of a 214 km single-lane, gravel road with pullouts. This route crosses the Yukon and Stewart Rivers, where barging will be required during the open water season. A previously considered alternative option is a route between the project site and the town of Carmacks ("the Coffee-Casino Route"). This route would run southeast from the project to the Casino Mine property, and there join the proposed Freegold Road connecting to Carmacks. The overall objective of the Fish and Aquatic Resources Baseline Program for the Coffee Gold Road Project was to characterize the pre-development fish and aquatic environment along the proposed road alignments in support of the project proposal to the Yukon Environmental and Socio-economic Assessment Board (YESAB).

The fish and aquatic resources baseline study program for the Coffee Road routes was carried out from June-September, 2015. Fish habitat assessments were conducted at 66 potential watercourse crossing sites along the northern route, and at six crossing sites along the Coffee-Casino route. These assessments were conducted within the following watersheds: Sulphur Creek, the Indian River, Eureka Creek, Black Hills Creek, Maisy May Creek, the Stewart River, Barker Creek, Ballarat Creek, Coffee Creek and Britannia Creek. The field assessment scope omitted certain sections of the road corridor: north of the Indian River, a mainstem crossing on lower Ballarat Creek, and upper Barker and Ballarat Creeks. Fish sampling (electrofishing and minnow trapping) was completed concurrently at seven crossing sites. A side channel of Stewart River was identified as potentially being impacted during road construction, and thus fish and fish habitat assessments were conducted along its length in August and September. Chinook salmon spawning assessments along the Yukon and Stewart River barging routes took place on July 30, 2015, to coincide with the known peak spawning period. Habitat assessments along the Yukon and Stewart River barging routes and at barge landing sites were conducted on September 9-10, 2015.

The northern route followed existing placer mine roads and trails along the majority of its path. Most watercourse crossings spanned low quality tributaries and avoided more sensitive areas by frequently remaining on higher elevation ridge roads. Due to historic and ongoing placer mining in the proposed road corridor, habitat conditions were often in a degraded state, as evidenced by high turbidity, disturbed and unstable banks, flow disruptions, and lack of riparian vegetation and cover. The Yukon Placer Mining Secretariat habitat suitability classification has downgraded effluent standards for the vast majority of watercourses along the route (Yukon Placer Secretariat, 2016). Of the 66 crossings along this route, 8 crossings were considered fish bearing, 19 were considered potentially fish bearing, and 39 were considered non-fish bearing. Along the Coffee-Casino route, one crossing was fish bearing, two were potentially fish bearing, and three were considered non-fish bearing. Potentially fish bearing sites were generally of very low quality and identified as highly unlikely to support fish. However, as there was the potential for seasonal connection to fish bearing habitats downstream, they were distinguished from non-

fish bearing sites. In a few select cases, crossings containing low to moderate habitat quality were also considered potentially fish bearing, as fish presence was considered likely but was not verified by sampling. Non-fish bearing sites contained permanent barriers to fish passage such as steep impassable stream gradients, underground flows, and areas with no visible stream channel.

The most common fish species in project area watercourses were Arctic grayling, slimy sculpin, and juvenile Chinook salmon. Maisy May, Barker, Ballarat, and Coffee Creeks contained juvenile Chinook salmon rearing habitat. Other fish species that were captured, or known to be potentially present included round whitefish, chum salmon, lake whitefish, northern pike, inconnu, burbot, least cisco, Arctic lamprey, and longnose sucker. Currently, there are no known fish species at risk in the regional area of the Project.

The Stewart River side channel was considered fish bearing due to its seasonal connection to the Stewart River. During flood conditions, the channel backwaters and thus may provide slow water refuge habitat for Stewart River fishes. However, during summer baseflow conditions, the habitat was stagnant and deemed highly unlikely to support fish throughout the majority of the side channel.

The sections of the Yukon and Stewart Rivers where barging will take place are important migratory corridors for Chinook salmon moving upstream to spawning areas, and downstream to non-natal freshwater rearing areas or to marine feeding areas in the Bering Sea. Juvenile Chinook salmon may utilize the habitat at the barge landing sites during their freshwater rearing period, which is typically over a one-year duration. While chum salmon have infrequently been observed in the Stewart River, there are no documented spawning areas and thus the basin is unlikely to be an important production area. In contrast, chum salmon are known to migrate past the Yukon River barging area to important production areas upstream, and spawning has been previously documented outside of but nearby the south barge landing. Overall, results from spawning surveys, fish habitat assessments, and a literature review indicated that the likelihood of salmon spawning in either barging area was low.

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1 Introduction

1.1 Project Overview

This report describes the studies conducted in 2015 by Palmer Environmental Consulting Group Inc. (PECG) on the aquatic environments along the proposed access routes of the Coffee Gold Project (the Project). The purpose of these studies was to characterize the pre-development environment in support of the project proposal to the Yukon Environmental and Socio-economic Assessment Board (YESAB).

The Project is a proposed open-pit, heap leach gold mine located in the White Gold district of west-central Yukon, approximately 130 km south of Dawson City. The Project is wholly owned by the Kaminak Gold Corporation (KGC). The Project encloses several gold occurrences within an exploration concession covering an area of more than 600 square kilometres. The location of the Project is shown in Figure 1, as well as the fish and aquatic resources study area. All watercourses in the Project area eventually discharge into the Yukon River.

Currently, the Project property is accessed by fixed wing plane, helicopter, and river barge, as there is no direct overland route connecting the Project to either of the nearest settlement areas (Dawson City and Carmacks, Yukon). One main route option from Dawson City is being investigated for providing road access to the project. The proposed route is comprised of a 214 km single-lane, gravel road with pullouts. This route crosses the Yukon and Stewart Rivers, where barging will be required during the open water season. A second, alternative option was investigated as part of this baseline program between the project site and the town of Carmacks ("the Coffee-Casino Route"). This route would run southeast from the project to the Casino Mine property, and there join the proposed Freegold Road connecting to Carmacks.

1.2 Fisheries Resources Overview

The study area for the proposed road routes is located within the Yukon River Drainage Basin. Eight sub-basins (i.e. watersheds) span the proposed routes (Figures 1-6). There are seven watersheds along the northern route, all of which have been previously disturbed by placer mining. The Coffee-Casino route alignment traverses the Coffee Creek watershed to the south, which covers approximately one third of the Coffee Gold property (Figure 1).

The protection of fish and fish habitat is built into the federal *Fisheries Act*, which aims to ensure that project activities do not cause serious harm to commercial, recreational, or Aboriginal (CRA) fisheries productivity or fish that support these fisheries. The dominant CRA fish species known to reside within the study area are Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*Oncorhynchus keta*), and Arctic grayling (*Thymallus arcticus*). Distributions for these three CRA species are presented on Figures 2-6, and are based on numerous historical studies conducted as well as likelihood of presence based on field assessments for Arctic grayling (DFO, 2016). Slimy sculpin (*Cottus cognatus*) are also widespread, and may support predatory CRA fish species. Other potential species include round whitefish (*Prosopium cylindraceum*), lake whitefish (*Coregonus clupeaformis)*, northern pike (*Esox lucius*), inconnu (*Stenodus*

nelma), burbot (*Lota lota*), least cisco (*Coregonus* sardinella), Arctic lamprey (*Lethenteron* camtschaticum), and longnose sucker (*Catostomus catostomus*).

Yukon River Chinook salmon have historically supported valuable commercial, recreational and Aboriginal fisheries; however, the population has experienced significant declines and fishery closures in recent years (JTC 2013; Yukon Salmon Sub-Committee 2014). Chinook spawning in the Yukon River Basin occurs between late July and mid-September (Yukon River Panel, 2016). Known spawning areas are located outside of the study area: near Whitehorse, Teslin, in the upper Stewart River watershed, in the Pelly and Klondike Rivers, and in the headwaters in northern British Columbia (Al von Finster, *pers. comms*. 2015; Milligan *et al*., 1985; Environment Canada, 2000). In spring, the eggs hatch and young salmon fry emerge from the gravel. Soon after emergence, fry typically migrate to small non-natal streams where productivity is high and risk of predation is lower (Moodie *et al.*, 2000). The young salmon will typically spend one winter in freshwater, before migrating down the Yukon River to the Bering Sea to complete the marine stage of their lifecycle. As a result, overwintering habitat within smaller stream systems is critical for the success of juvenile Chinook salmon (Bradford *et al.*¸ 2001).

Chum salmon supports both commercial and Aboriginal fisheries in the Yukon, with a small fishery located in the Minto area, and the Canadian Commercial fishery located in the Dawson area. The majority of the chum salmon harvest supports the commercial fishery (63%), whereas the remaining harvest is taken as part of the Aboriginal fishery (Yukon River Panel 2008). Chum salmon spawning in the Yukon River Basin occurs from October through to early November, in the upper watershed, from the Tanana River confluence to the headwaters of the Yukon River (Yukon River Panel 2016; USFWS, 2010). Chum salmon tend to spawn in slow moving side channels where groundwater inputs are present (de Graff, 2009). Chum salmon juveniles hatch as fry in the spring and immediately migrate downstream to estuaries (de Graff, 2009).

Arctic grayling is the most popular sport fish in the Yukon (Environment Yukon 2010), and may be targeted for fishing in accessible areas adjacent to the Stewart River, the Yukon River, or along existing road segments. 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 in clear, fast-flowing tributaries with temperatures between 4-16°C (Stewart *et al*., 2007). 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 may be an occasional prey species for larger predatory fish such as northern pike, Arctic grayling or burbot. However, piscivory in stream-dwelling Arctic grayling appears to be relatively rare in other Yukon and NWT systems (e.g., Bishop 1967; de Bruyn and McCart 1974; Mathers 1981; Jessop *et al.* 1993). The slimy sculpin is a bottom-dwelling species, residing under cobble or other in-stream habitat cover features. Slimy sculpins demonstrate very high site fidelity, generally remaining within a 50 m radius home range throughout their lives (Gray *et al*. 2004). Thus, all life history stages, including overwintering and spawning, must be carried out within this limited home range. 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.

With the exception of other large-bodied fish (e.g., northern pike) that may frequent larger rivers in the study area, no other fish species in the project area are known to support any notable CRA fisheries.

1.3 Study Objectives

The overall objective of the Fish and Aquatic Resources Baseline Program for the Coffee Gold Road Project was to characterize the pre-development fish and aquatic environment along the proposed road alignments. The baseline information will be important for understanding potential project effects, and for determining appropriate protection and mitigation measures, as well as monitoring requirements. The specific objectives of the fish and aquatic resources baseline program for the Coffee Road Project were as follows:

- To determine the fish bearing status and the quality of habitat at each crossing location;
- To investigate the fish community composition, the relative abundance and the spatial distribution of fish and fish habitat types at each crossing location;
- To identify potential erosion or channel alignment concerns at each crossing; and
- To identify any sensitive or regionally important fish species (e.g., Chinook salmon), or critical habitat types that may require enhanced protection from proposed development.

This report presents the results of the baseline fish and aquatic resource investigations for both road route options on a watershed or subwatershed basis.

2 Methods

2.1 Study Area

The watersheds along the northern route extend from the project property northwards to Dawson City. Placer mining has been widespread in this area and resulted in extensive changes to stream channel stability and aquatic communities (Birtwell *et al.*, 1984; Miles and Associates, 2003). The watersheds are characterized by steep v-shaped (*i.e*. unglaciated) valleys that drain into low gradient meandering rivers in the valley bottom. The seven watersheds that span the northern route are (from north to south):

- **Sulphur Creek:** The Sulphur Creek watershed is approximately 139 km^2 and drains into the Indian River (Figure 1). Sulphur Creek flows into Dominion Creek, which flows into the Indian River approximately 3.5 km downstream from the crossing location.

- **The Indian River:** The Indian River is a relatively large watershed that has been extensively mined for placer gold (Miles and Associates, 2003). The watershed area that is relevant to this study is in the upper watershed and is approximately 58 km^2 (Figure 1). Major tributaries of the upper Indian River include Gold Run Creek, Sulphur Creek, Australia Creek, Wounded Moose Creek, and Eureka Creek. Prior to placer mining development the river consisted of an irregularly tortuously meandering channel. The habitat has been highly altered from its natural state due to river diversions, the construction of pits, settling ponds, and exploration tracks.

- **Eureka Creek:** Eureka Creek drains an area of approximately 50 km^2 and is approximately 12 km long. The creek drains northward into the Indian River. The watershed has a low habitat suitability classification designated by the Yukon Placer Secretariat and almost its entire watershed has been developed for placer mining (Yukon Placer Secretariat, 2016).

- **Black Hills Creek:** The Black Hills Creek watershed is approximately 422 km^2 and drains southward into the Stewart River (Figure 1). The length of the creek is approximately 33 km, with the most downstream existing road intersection located approximately 25km upstream from the creek mouth, where there is extensive placer disturbance. Tributaries draining into upper Black Hills Creek include Dome Creek, Mills Creek, Minton Creek, McCrimmon Creek and Kernine Creek.

- **Maisy May Creek:** Maisy May Creek watershed is approximately 170 km^2 and drains south into the Stewart River (Figure 1). The length of the creek is approximately 20 km and the proposed road traverses the entire length of the valley before it veers west along the northern shore of the Stewart River.

- **The Stewart River:** The Stewart River is a major river basin that drains the most eastern part of the Yukon River watershed. Approximately 24 km^2 of the Stewart River watershed overlaps with the proposed road corridor (Figure 1), along the north side of the Stewart River where the northern route alignment runs close to the river (within 1 km from the shoreline). Tributaries of the

Stewart River along the proposed road corridor are small unnamed watercourses that have not been mined (Yukon Placer Secretariat, 2016).

- **Barker Creek:** The Barker Creek watershed is approximately 232 km^2 and drains northward into the Stewart River (Figure 1). The creek is approximately 21 km long. Major tributaries include Preacher Creek and Iron Creek, which have no placer mining activity.

- **Ballarat Creek:** Ballarat Creek watershed is approximately 117 km^2 and drains into the Yukon River (Figure 1). The creek is approximately 18 km long. Approximately 2.7 km of the lower creek (starting at the confluence with the Yukon River) is classified as a cultural area of special consideration (Yukon Placer Secretariat, 2016).

The Coffee-Casino route spans two watersheds:

- **Coffee Creek:** The Coffee Creek watershed is approximately 488 km^2 (Figure 1). The creek is unaffected by placer mining, and a cultural area of special consideration is located at the creek mouth (Yukon Placer Secretariat, 2016). A major tributary, Latte Creek, is located directly south of the Coffee Gold Project deposit.

- **Britannia Creek:** The Britannia Creek watershed is 147 km^2 (Figure 1). The Coffee-Casino route passes through the upper portion of this watershed, traversing Canadian Creek, which is a major tributary of Britannia Creek.

2.2 Desktop Analyses

2.2.1 Fish Crossing Identification

For the northern Route, watercourse crossings were identified using mapping provided by Kaminak in July 2015. The mapping included approximately 80% of the road route south of Indian River and excluded areas in upper Barker and Ballarat Creeks where the route alignment was still uncertain. Based on this mapping, 66 potential crossings between the Indian River and the Coffee project site were identified for field investigations. In addition, a crossing on the mainstem of lower Ballarat Creek was not assessed, as the original road alignment did not traverse the creek.

For the Coffee-Casino Route, six potential watercourse crossings were identified between the Coffee Gold Project site and the proposed Casino Mine road.

2.2.2 Stream Gradient Assessment

A desktop analysis of stream gradients in the road study area was completed in order to streamline field investigations. Average stream gradients were mapped at and below watercourse crossings to identify potential barriers to fish passage, and to provide an overall sense of habitat quality relating to steepness of the channel. Maps were created using Canadian Digital Elevation Data (geobase.ca) and stream data from Geomatics Yukon at a 1:25,000 scale. Stream gradients greater than 20% are considered

impassable by fish (BC MoF, 1998), and sections identified as meeting this criteria were verified in the field where possible.

2.3 Field Data Collection Overview

The fish and aquatic resources baseline study program for the Coffee Road routes was carried out in June, August, and September of 2015. Fish habitat assessments were conducted at 66 potential watercourse crossing sites along the northern route (Table 1A). Sixty-two crossing assessments, seven of which included fish sampling (electrofishing and minnow trapping), were conducted from August 18-24, 2015. Fish sampling was conducted at selected sites that were likely fish bearing to determine fish community composition, life stages present, and relative abundance. On September 9, 2015, two crossings (mainstem Sulphur Creek and the Indian River) were visited as part of a reconnaissance trip for the northern route. The last two crossing sites (of the total of 66) were assessed in the Coffee Creek watershed (along the winter alignment of the northern route) on September 14-15, 2015. In addition to the crossing site assessments, fish and fish habitat assessments were completed in August and September in a Stewart River side channel that may experience infilling for the road construction.

Six crossings were identified along the Coffee-Casino route (Table 1B) and fish habitat assessments were conducted at five of the crossing sites on June 19-20, 2015. The sixth crossing site was located on Canadian Creek, at a location previously assessed in 2008 and 2010 and determined to be non-fish bearing (PECG, 2013).

Chinook salmon spawning aerial surveys along the Yukon and Stewart River barging routes took place on July 30, 2015, to coincide with the known spawning period, which spans late July to mid-September (Yukon River Panel, 2016). Habitat assessments along the Yukon and Stewart River barging routes and at barge landing sites were conducted on September 9-10, 2015. Spawning surveys were not conducted during the September 2015 field visit, as water clarity in the Yukon and Stewart Rivers was too poor to complete aerial assessments with any confidence.

Table 1A. Northern Route Road Crossing Sites, Coffee Gold Road Project, 2015

Watershed	Watercourse	Crossing #	UTM Coordinates		Assessment Date	Type of Fish Habitat Assessment[1]	Fish Sampling (Y/N) [2]
			Easting	Northing			
Indian River	Sulphur Creek	48	614853	7059600	09/09/15	None	N
Indian River	Indian River	50	613529	7057121	09/09/15	None	N
Indian River	Indian River tributary	51	611313	7055107	18/08/15	Full	N
Indian River	Indian River tributary	52	610129	7055369	18/08/15	Full	N
Indian River	Indian River tributary	53	609658	7055218	18/08/15	Full	N
Indian River	Indian River tributary	54	609204	7055294	18/08/15	None	N
Indian River	Eureka Creek	54.5	607870	7055247	18/08/15	Full	N
Indian River	Eureka Creek	55	607647	7054980	18/08/15	Full	Y
Indian River	Eureka Creek	57	606801	7053676	18/08/15	Partial	N
Indian River	Eureka Creek	58	606489	7053226	19/08/15	None	N
Indian River	Eureka Creek	59	605410	7053301	19/08/15	None	N
Indian River	Eureka Creek	60	605323	7053389	19/08/15	None	N
Indian River	Eureka Creek	61	605095	7053749	19/08/15	None	N
Indian River	Eureka Creek	62	601660	7052521	19/08/15	None	N
Stewart River	Black Hills Creek	63	606312	7042629	19/08/15	None	N
Stewart River	Black Hills Creek	63.5	606433	7042377	19/08/15	Full	N
Stewart River	Black Hills Creek	64	607120	7041729	19/08/15	None	N
Stewart River	Black Hills Creek	65	607817	7040618	19/08/15	Full	N
Stewart River	Black Hills Creek	69	608009	7039938	19/08/15	Partial	N
Stewart River	Black Hills Creek	69.5	608013	7039540	19/08/15	Full	N
Stewart River	Black Hills Creek	70	608063	7039220	19/08/15	Full	N
Stewart River	Black Hills Creek	71	607960	7038666	19/08/15	Full	Y
Stewart River	Dome Creek	72	598186	7038992	19/08/15	Partial	N
Stewart River	Dome Creek	73	597985	7037893	19/08/15	Partial	N
Stewart River	Maisy May Creek	74	598743	7029092	19/08/15	Partial	N
Stewart River	Maisy May Creek	75	598946	7027771	19/08/15	Partial	Y
Stewart River	Maisy May Creek	76	599266	7027499	20/08/15	Partial	N
Stewart River	Maisy May Creek	77	599646	7027033	20/08/15	Partial	N
Stewart River	Maisy May Creek	80	600659	7025479	20/08/15	Partial	N
Stewart River	Maisy May Creek	80.5	601475	7024366	20/08/15	Partial	N
Stewart River	Maisy May Creek	81	603009	7021453	20/08/15	Full	Y
Stewart River	Maisy May Creek	82	604813	7019422	20/08/15	None	N
Stewart River	Maisy May Creek	83	605027	7018975	20/08/15	Partial	N
Stewart River	Maisy May Creek	84	606584	7017635	20/08/15	Partial	N
Stewart River	Maisy May Creek	85	607856	7015989	20/08/15	None	N
Stewart River	Maisy May Creek	86	608437	7015678	21/08/16	None	N
Stewart River	Maisy May Creek	91	609062	7014665	22/08/15	Full	Y
Stewart River	Unnamed Stewart River tributary	92	609258	7013777	22/08/15	None	n/a

Table 1A. Northern Route Road Crossing Sites, Coffee Gold Road Project, 2015, continued.

Watershed	Watercourse	Crossing #	UTM Coordinates		Date sampled	Type of Fish Habitat Assessment[1]	Fish Sampling (Y/N) [2]
			Easting	Northing			
Stewart River	Unnamed Stewart River tributary	93	608907	7012376	22/08/15	None	n/a
Stewart River	Unnamed Stewart River tributary	94	608837	7012184	22/08/15	None	n/a
Stewart River	Unnamed Stewart River tributary	95	608588	7011441	22/08/15	None	n/a
Stewart River	Unnamed Stewart River tributary	96	607267	7009765	22/08/15	None	n/a
Stewart River	Unnamed Stewart River tributary	97	606808	7009556	21/08/15	Full	N
Stewart River	Barker Creek	100	605754	7007136	25/08/15	Full	Y
Stewart River	Barker Creek	101	605703	7006526	25/08/15	Full	N
Stewart River	Barker Creek	102	605802	7005863	25/08/15	Full	N
Stewart River	Barker Creek	103	605666	7005507	24/08/15	Full	N
Stewart River	Barker Creek	104	605661	7004399	25/08/15	Full	N
Stewart River	Barker Creek	105	605378	7003446	25/08/15	Full	N
Stewart River	Barker Creek	106	605172	7002703	25/08/15	None	n/a
Stewart River	Barker Creek	107	604784	7002121	25/08/15	None	n/a
Stewart River	Barker Creek	108	604460	7001380	25/08/15	None	n/a
Stewart River	Barker Creek	109	604153	7001035	25/08/15	Partial	n/a
Stewart River	Barker Creek	110	603702	7000405	25/08/15	Full	N
Stewart River	Barker Creek	111	603058	6998497	25/08/15	Full	N
Stewart River	Barker Creek	112	603136	6997805	24/08/15	Full	N
Stewart River	Barker Creek	113	603212	6997209	24/08/15	Full	N
Stewart River	Barker Creek	114	603541	6996485	24/08/15	None	N
Stewart River	Barker Creek	115	603602	6996105	24/08/15	Partial	N
Stewart River	Barker Creek	116	603368	6995151	24/08/15	None	n/a
Yukon River South	Ballarat Creek	117	603541	6979534	25/08/15	None	n/a
Yukon River South	Ballarat Creek	118	603925	6978337	25/08/15	Full	Y
Yukon River South	Ballarat Creek	119	604280	6977495	24/08/15	None	N
Yukon River South	Ballarat Creek	120	604514	6976425	25/08/15	None	n/a
Yukon River South	Coffee Creek	125	598904	6976194	15/09/15	Full	N
Yukon River South	Coffee Creek	126	598836	6976567	14/09/15	Full	N

[1]Fish habitat assessments were not conducted, or partially conducted, where the channel was dry, not visible, or above an established barrier to fish passage (Section 2.4.1.1), with the exception of crossings #48 and #50 (visited during September road reconnaissance trip).

[2]Fish sampling was not applicable (n/a) at crossings where there was no flow or visible channel (i.e. no fish habitat).

Table 1B. Coffee to Casino Route Road Crossing Sites, Coffee Gold Road Project, 2015.

Watershed	Watercourse	Crossing #	UTM Coordinates		Date sampled	Type of Fish Habitat Assessment	Fish Sampling (Y/N)
			Easting	Northing			
Yukon River South	Coffee Creek	1	598086	6975054	19/06/15	Full	N
Yukon River South	Unnamed Coffee Creek tributary	2	597985	6974486	19/06/15	Full	Y[1]
Yukon River South	Unnamed Coffee Creek tributary	3	596893	6972743	20/06/16	None	N
Yukon River South	Unnamed Coffee Creek tributary	4	596775	6969427	20/06/16	None	N
Yukon River South	Unnamed Coffee Creek tributary	5	603927	6959320	20/06/16	Full	N
Yukon River South	Canadian Creek	6	609679	6959953	not visited[2]	None	N

Notes:

[1]Sampling (electrofishing) was conducted at Crossing site #2 prior to the detection of a barrier to fish passage (underground flow) downstream.

[2]Crossing site #6 is located on Canadian Creek, just north of the proposed Casino Mine open pit, within a section of the creek previously determined as non-fish bearing (PECG, 2013).

Dawson City

Hunker Creek Watershed

Sulphur Creek Watershed

Indian River

Indian River Watershed

Eureka Creek Watershed

Black Hills Creek Watershed

Maisy May Creek Watershed

Stewart River

Stewart River Watershed

Barker Creek Watershed

Ballarat Creek Watershed

Yukon River

Britannia Creek Watershed

Coffee Creek Watershed

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

1:450,000

Nad83 Zone 7 N

0 6,250 12,500 25,000 m

Legend

- Existing Road
- Proposed Ice Road
- Existing Main Road
- Proposed Route (Dawson to Coffee)
- Barge Landing Locations
- Coffee Project Boundary
- Coffee Road
- Coffee to Casino Road

Figure 1. Overview Map of the Coffee Gold Mine Roads and Watersheds

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Base mapping from GeoYukon. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Drawn by: CB Checked by: AM Date: 26/01/2016

2.4 Field Methods

2.4.1 Road Crossings

2.4.1.1 Fish Habitat

Fish habitat assessments were carried out at each potential watercourse crossing site by two qualified biologists. Fish habitat was characterized following a modified version of the methods described in the Resources Inventory Standards Committee (RISC) Fish and Fish Habitat Inventory: Site Card Field Guide (Version 2.0, April 2008) and in the *Fish Habitat Assessment Procedures* guide for the British Columbia government (Johnston and Slaney, 1996), as there are no available watercourse sampling guides established for Yukon Territory.

The default 'full' assessment consisted of surveying the habitat within a 100 m section, extending approximately 50 m upstream and 50 m downstream of each proposed crossing location. At these sites, photographs and site illustrations were collected at each crossing location. Stream length and stream width (*i.e*., wetted and bankfull width) were measured with a surveyor's measuring tape. Stream gradient was measured with a Sunnto clinometer. Stream depth was measured with a meter stick, following methods outlined in Johnston and Slaney (1996). Habitat was visually assessed into the following five types:

- ***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).

The dominant and sub-dominant stream substrate was assessed visually into the following classes:

- fines (or silt);
- small gravel (2-16 mm particle diameter);
- large gravel (16-54 mm);
- small cobble (64-128 mm);
- large cobble (128-256 mm);
- boulder (>256 mm); or
- bedrock.

The overall percent of the stream surface that provided fish with cover was estimated, and the dominant cover type was described using the following classes:

- deep pool (>1m depth);

- large woody debris (LWD);
- boulder;
- cutbank;
- instream vegetation; and
- overhanging vegetation.

Additional notes recorded at each site included riparian vegetation types, stream morphology, *in situ* water quality, habitat disturbances, and the potential for supporting overwintering, spawning, rearing, feeding or migratory activities of known or potential fish species. General *in situ* water quality parameters included pH, conductivity (µs/cm), temperature (°C), and dissolved oxygen concentration (mg/L and %).

Partial fish habitat assessments were collected under circumstances where the channel was dry, not visible, or above an established barrier to fish passage. In these cases, photos were collected and notes recorded to document any barriers or lack of habitat. Where possible, channel measurements were estimated at the crossing location and *in situ* water quality was collected. Aerial habitat assessments (photos, general site conditions) were carried out for five sites on the northern route, and two sites on the Coffee-Casino route, where there was no feasible helicopter or road access.

2.4.2 Determination of Fish Bearing Status

Determining fish bearing status at each watercourse crossing site was a key objective of the road baseline study. By default, all watercourse crossing sites were considered to be fish bearing or potentially fish bearing unless a permanent fish passage barrier was identified, either at or downstream of the crossing. Types of fish passage barriers included:

- Stream gradients greater than 20%, which are considered to be unpassable to fish (BC MoF, 1998). Gradient barriers were verified on the ground with a clinometer and two-person crew in all cases, with the exception of one site where access was not permitted (Coffee-Casino Route Crossing #4).
- Underground flows with no evidence of surface connection.
- Lack of stream habitat present in areas downstream of a crossing. This included small, shallow, dispersed drainages lacking any channel definition (*i.e.*, no defined banks, visible scouring, or deposited mineral alluvium), and of insufficient sizes to support fish (even during high flow conditions) (BC MoF, 1998).

Further, crossing sites were confirmed as non-fish bearing when there was no visible evidence of a continuous defined channel bed. These sites did not contain surficial flow or visible scouring, defined banks, or deposited mineral alluvium (BC MoF, 1998).

Some sites contained very low fish habitat quality and were highly unlikely to support fish, but could not be considered non-fish bearing due to the potential for seasonal connection to fish bearing habitats downstream. Some additional crossing sites containing low to moderate fish habitat quality were also considered as potentially fish bearing, as fish presence was considered likely but was not verified by

sampling. Therefore, to ensure a conservative approach, these sites were identified as potentially fish bearing.

The fish bearing status of each crossing was based on data presented in this baseline report, however this may be adjusted in the future with additional site-specific information.

2.4.2.1 Fish Sampling

Fish sampling was conducted at selected crossing sites to determine fish community composition, life stages present, and relative abundance. Sites were selected for fish sampling based on high likelihood of fish presence, and were typically located on mainstem streams or higher order tributaries. Supplementary sampling to confirm background data was also completed in the Stewart River side channel and at a site above a hanging culvert (Crossing #75) to aid in the assessment of fish presence/absence above a potential barrier to fish movement. Ten sites were sampled, all of which were located along the northern route (Table 2). Sampling dates, methodologies, and fish captured are further detailed in Appendix A.

Single pass electrofishing was completed using a Smith-Root backpack electrofisher and a two-person crew. Site lengths ranged from 100-200 m and effort varied from 283-719 seconds. Minnow traps were made of 0.6 cm galvanized steel wire mesh with a conical entrance and were 42 cm long with a 23 cm diameter. Minnow traps were set in the deepest areas within each site and close to any cover. Each trap was baited with a perforated bag of Yukon River salmon roe and left to soak for approximately 24 hours.

All fish were identified to species and counted in the field. 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 (Ohaus Scout Pro SP2001).

Table 2. Fish Sampling Sites, Coffee Gold Road Project, 2015

Watershed	Watercourse	Crossing/Site #	Method	Site Length (m)	Effort	
					EF (s)	MT (# Traps x hrs)
Indian River	Eureka Creek	55	EF	170	283	n/a
Stewart River	Black Hills Creek	71	EF, MT	100	344	3 x 26.25
Stewart River	Maisy May Creek	75	MT	n/a	n/a	3 x 17.20
Stewart River	Maisy May Creek	81	EF, MT	100	511	3 x 17.30
Stewart River	Maisy May Creek	91	EF	~ 200	719	n/a
Stewart River	Barker Creek	100	MT	n/a	n/a	3 x 24.70
Stewart River	Side Channel	SR1	MT	n/a	n/a	1 x 23.50
Stewart River	Side Channel	SR2	MT	n/a	n/a	1 x 23.50
Stewart River	Side Channel	SR3	MT	n/a	n/a	2 x 23.50
Yukon River South	Ballarat Creek	118	EF, MT	100	434	2 x 20.75

Note: EF = Electrofishing, MT = Minnow Trapping

2.4.3 Barging Areas

The road alignment intersects the Stewart and Yukon Rivers, and barging is proposed as the method of transport across the rivers during the open water season. Hence, barge landings are proposed at each road/river intersection. The Yukon River south barge landing is northwest of the existing Coffee Gold camp, and approximately four km downstream from the north landing (Figure 1). Barging along this four km section of river is proposed to take place in the open water season. In winter, the road alignment will bypass the south barge landing, and will follow a land route on the south side of the Yukon River, which meets the Yukon River almost directly opposite the north landing. An ice bridge is proposed to cross the river at this location, traversing an island mid-stream.

The proposed location for the Stewart River area (barging route and landings) is approximately 35 km upstream of its confluence with the Yukon River. The barging route runs between the Barker Creek watershed to the south, to an area just west of the Maisy May drainage to the north, with the route being almost perpendicular to the river flow (length is approximately 220 m).

2.4.3.1 Barging Areas - Fish Habitat

Fish habitat assessments were conducted at the barge landing locations, and along the barging routes by two fisheries biologists in September 2015 (Table 3). The assessments aimed to determine habitat type and likelihood of salmon or other fish species utilization, including the potential for spawning activities. Data collection at the barge landing locations included habitat characteristics such as substrate type,

water depth and clarity, flow conditions, presence of fish cover, riparian habitat type, and photographs. A depth sounder was used during boat surveys along the barging route on the Yukon River to measure depths, estimate bed roughness, and detect fish presence. An infrared camera was also deployed but was not effective for detecting fish presence owing to poor water clarity. This equipment (boat, depth sounder, camera) was not employed on the Stewart River because water clarity was also poor, and it was determined that visual (aerial and ground) assessment would be more effective.

The crew assessed each barging area for evidence of potential salmon spawning habitat, such as:

- Shallow areas above the thalweg (e.g. gravel bars, shorelines) where adult salmon would be removed from higher turbidities (de Graff, 2009; de Graff 2010);
- Riffles, runs, or pool tails having shallow depth and suitable substrate (large gravels and/or cobbles) (Payne *et al*., 2011); and,
- Redds, which are spawning nests built by female salmon by digging a hollow in the gravel with their tail. Lighter coloured depressions in the substrate are indicative of redd development and spawning areas often contain clusters of redds (which would be more apparent when viewed aerially).

Table 3. Barging Fish Habitat Assessment Sites, Coffee Gold Road Project, 2015

Date	Location	Survey Type
9-Sep-15	Stewart River North Landing	Aerial, Ground
9-Sep-15	Stewart River Barging Route	Aerial
9-Sep-15	Stewart River South Landing	Aerial
9-Sep-15	Yukon River North Landing	Aerial, Ground
10-Sep-15	Yukon River North Landing	Boat
10-Sep-15	Yukon River South Landing	Boat
10-Sep-15	Yukon River Barging Route	Boat

2.4.3.2 Barging Areas - Salmon Spawning Survey

Stewart River Chinook salmon peak migration is in July, and by early August 90% of the stock have passed the mouth the river (Osborne *et al*, 2003; Osborne, 2004; Osborne 2005). Spawning occurs in August, and is earlier than most other upper tributary stocks in the Yukon River system (Mercer, 2005; Osborne *et al*, 2003). Yukon River Chinook salmon return to the mouth of the Yukon River from mid to late May through to early July. Peak migration into Canadian waters occurs in mid to late July, with spawning activities typically occurring from late July to mid-September (Yukon River Panel 2016).

Chinook salmon spawning habitat ranges from small streams to larger rivers and lake outlets. Substrate requirements, redd structure, and spawning behaviour have not been specifically studied in the Yukon River drainage (Yukon River Panel, 2015; Payne *et al*., 2011). Typically, Chinook salmon spawn over large gravels and cobbles in riffles, runs, and pool tails (Payne *et al*., 2011). However, there is high degree of variability between rivers (McPhail and Lindsey 1970, Geist and Dauble 1998). Accordingly, aerial surveys covered all habitat types along the study reach, with emphasis on areas such as river

margins, side channels, and submerged bars, that contained the most suitable substrate and flow conditions.

Chinook spawning surveys along the Yukon and Stewart Rivers took place in late July to coincide with expected peak spawning periods for both regions. During the time of assessment, the weather was clear and water clarity was good to moderate. Aerial spawning surveys were not conducted in September 2015, as water clarity in the Yukon and Stewart Rivers was too poor to complete aerial assessments with any confidence. Therefore, an assessment of potential chum salmon spawning in the barging areas was carried out using collected fish habitat data in combination with existing local fisheries information.

Spawning surveys entailed flying slowly along the relevant river section, at low elevation (just above treeline). Crew members (two fisheries biologists and an environmental monitor) seated on both sides of helicopter could observe potential spawning activity, such as the presence of salmon or areas where salmon had created redds. On the Yukon River, a longer distance was surveyed to include all areas adjacent to the Coffee Gold aquatic study area. The Yukon River survey started just upstream of the existing Ballarat barge landing (2.2 kilometers upstream of the proposed north barge landing). The survey continued west, past the south barge landing and downstream to Independence Creek (Table 4). On the north side of the Stewart River, the road alignment follows the river for seven kilometers, and the survey started approximately two kilometers upstream of where the alignment begins to curve away from the river. The survey ended two kilometers downstream of where the alignment crosses the river (Table 4).

Table 4. Aerial Spawning Surveys, Coffee Gold Road Project, 2015.

Date	Location	UTM Co-ordinates (Zone 7V, Easting, Northing)	
		Start	End
30-Jul-15	Yukon River from Ballarat Creek to Independence Creek	603429, 6975051	581014, 6984576
30-Jul-15	Stewart River from Barker Creek to Maisy May Creek	612110, 7013861	604220, 7007652

2.4.4 Stewart River Side Channel

The road alignment on the north side of the Stewart River may require partial infilling of a side channel, located approximately six kilometers upstream from the barge crossing (Figure 3). Fish habitat in the side channel was assessed on August 21, and again on September 11-12, 2015. On August 21, the crew visited the site with Kaminak's road engineer and recorded habitat conditions such as flow, channel depth, and connectivity to the Stewart River.

On September 11, the crew set four minnow traps, collected habitat information and channel characteristics, and measured water quality *in situ*. Two minnow traps were set at the downstream end of the side channel and near the confluence with the Stewart River (Site SR1, Figure 3). The water was shallow (< 0.5 m depth) and the substrate was comprised of fine materials. The other two traps were set further upstream in the side channel, approximately 250 m and 500 m distance upstream from the mouth

(Sites SR2 and SR3, respectively). Water at the most upstream minnow trap was approximately 1 m deep, and stagnant. Water quality was collected *in situ* (YSI pro plus meter) on September 12.

2.5 Quality Assurance /Quality Control

All field data were collected by qualified biologists. To ensure consistency in the data collection, the crew applied a standard methodology at each crossing site. This comprised filling out a road crossing datasheet with standard fields for site information (e.g. coordinates, date, photo numbers), and site habitat parameters (e.g. channel measurements, water quality data). In addition, at least one crew member was present throughout the entire road crossing program, which aided a consistent approach to habitat classification.

Field data collected during road crossing assessments were recorded on water resistant field sheets. Field data were transcribed into MS Excel spreadsheets using the same format (Appendix B). The data spreadsheets in excel were compared with the field sheets to ensure accurate transcription. Extra field notes were collected on waterproof notebook paper and recorded into the comments for the appropriate site spreadsheet. Habitat notes, photos, and GPS coordinates were collected on an Apple ipad (in a waterproof case) for the road overview and barging assessment in September. Data collected on the ipad were backed up and exported into excel spreadsheets.

All photos taken were recorded in the field based on photo number. The photos were then matched to the corresponding excel spreadsheets by number, with the exception of the ipad photos which were automatically linked to the data associated with the photo. 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.

3 Results and Discussion

The results of the fish and aquatic resource baseline assessment for the Northern Road (including the winter road), the Coffee-Casino road, and the barging routes are presented for each watershed below (Figures 2 – 6; Tables 5 - 6). Each section outlines specific assessment findings including physical habitat conditions, fish community, and a determination of fish bearing status for each site assessed during the 2015 baseline studies.

3.1 Northern Route

The northern route crossing sites (Table 1A) were assessed in August and September 2015. Most watercourse crossings spanned low quality tributaries, and several had no visible channel, were dry, or were upstream of a high gradient barrier (Table 5). Twenty-seven watercourse crossing sites were considered fish bearing or potentially fish-bearing, and seven of these had mid- to high- quality habitat suitable for rearing and feeding of one or more fish species Generally, the route tended to avoid more sensitive areas by frequently remaining on higher elevation ridge roads. Results for each watershed along the northern route are presented below.

3.1.1 Sulphur Creek

Sulphur Creek was not visited during the August 2015 field program as it was north of the field assessment scope (*i.e.* outside of the area in which the alignment of the road had been confirmed). However, taking into consideration that the existing (culvert) crossing on Sulphur Creek (#48) would likely form part of the northern road and may require an upgrade, this location was visited in September 2015 and notes on existing conditions and general habitat were recorded.

Fish Habitat

Sulphur Creek flows into Dominion Creek, which flows into the Indian River approximately 3.5 km downstream from the crossing location. Lower Sulphur Creek has been extensively dredged for placer mining, and this has resulted in channel confinement in some areas at the base of the creek valley (Miles and Associates, 2003). In addition, secondary stream channels have been lost due to on-going mining activities. Fish habitat at the crossing site was suitable for Arctic grayling based on the channel size (10 m wetted width) and proximity to Indian River. The crossing had a hanging culvert, and a narrower, lower, overflow culvert. The combined width of the culverts was significantly narrower than the channel width (Photo 1). The larger culvert was perched at the downstream outlet, and the smaller culvert had a relatively high gradient (>10%). At higher flows, the smaller culvert likely connects to the flow upstream, but the constricted flow would result in high velocities that may deter some fish passage.

Dominion Creek
Sulphur Creek
Indian River
Eureka Creek
Black Hills Creek
47
50
51
52
53
54
54.5
55
57
58
59
60
61
62
63
63.5
64
65
69
69.5
70
71
72

Figure 2

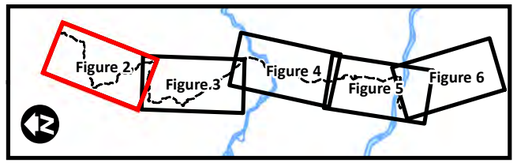
PECG Fish Habitat Survey Results

Legend

- Proposed Route
- Proposed Ice Road
- Existing Road
- Existing Main Road
- Coffee to Casino Road
- Coffee road
- Proposed Barge Crossing Locations
- Stewart River Minnow Trapping Site
- Barrier to Fish Passage
- Documented Presence of Juvenile Chinook Salmon
- Documented Presence of Adult Chinook and Chum Salmon
- Potential Arctic Grayling Habitat
- No visible stream

Fish Habitat Quality (with ID)

- Not fish-bearing
- Potentially fish-bearing
- Fish-bearing



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Black Hills Creek

Maisy May Creek

Stewart River

63 63.5 64 65 69 69.5 70 71 72 73 74 75 76 77 80 80.5 81 82 83 84 85 86 91 92 93 94

Figure 3

PECG Fish Habitat Survey Results

Legend

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- Proposed Ice Road
- Existing Road
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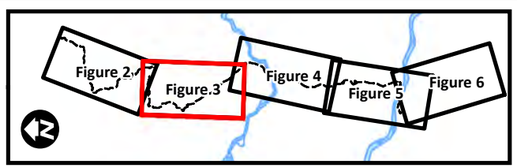

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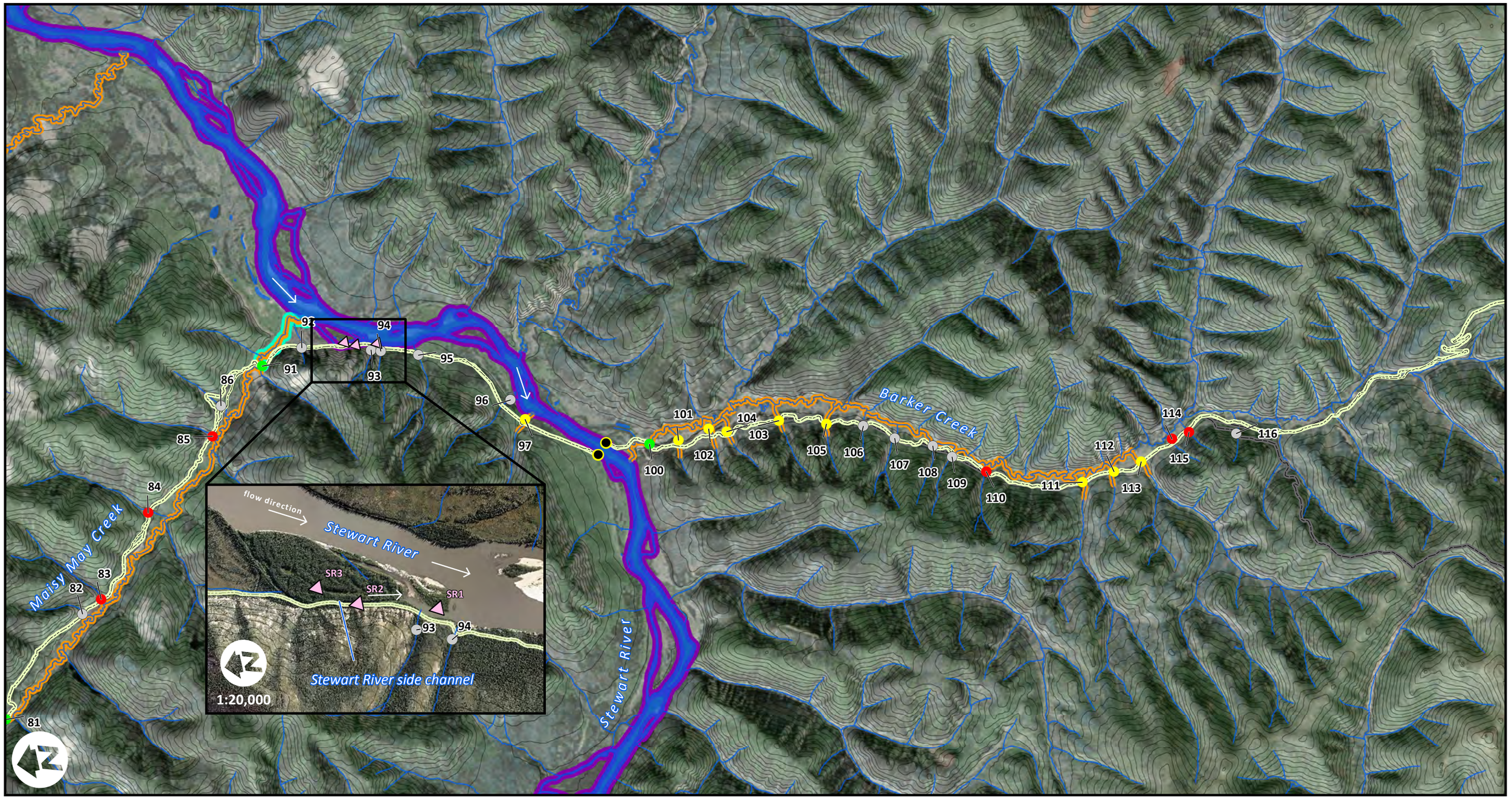

Figure 4

PECG Fish Habitat Survey Results

Legend

- Proposed Route
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- Existing Road
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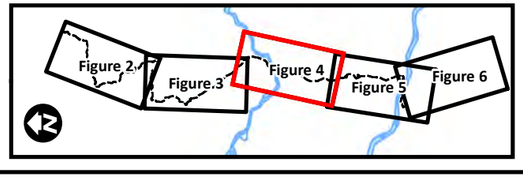

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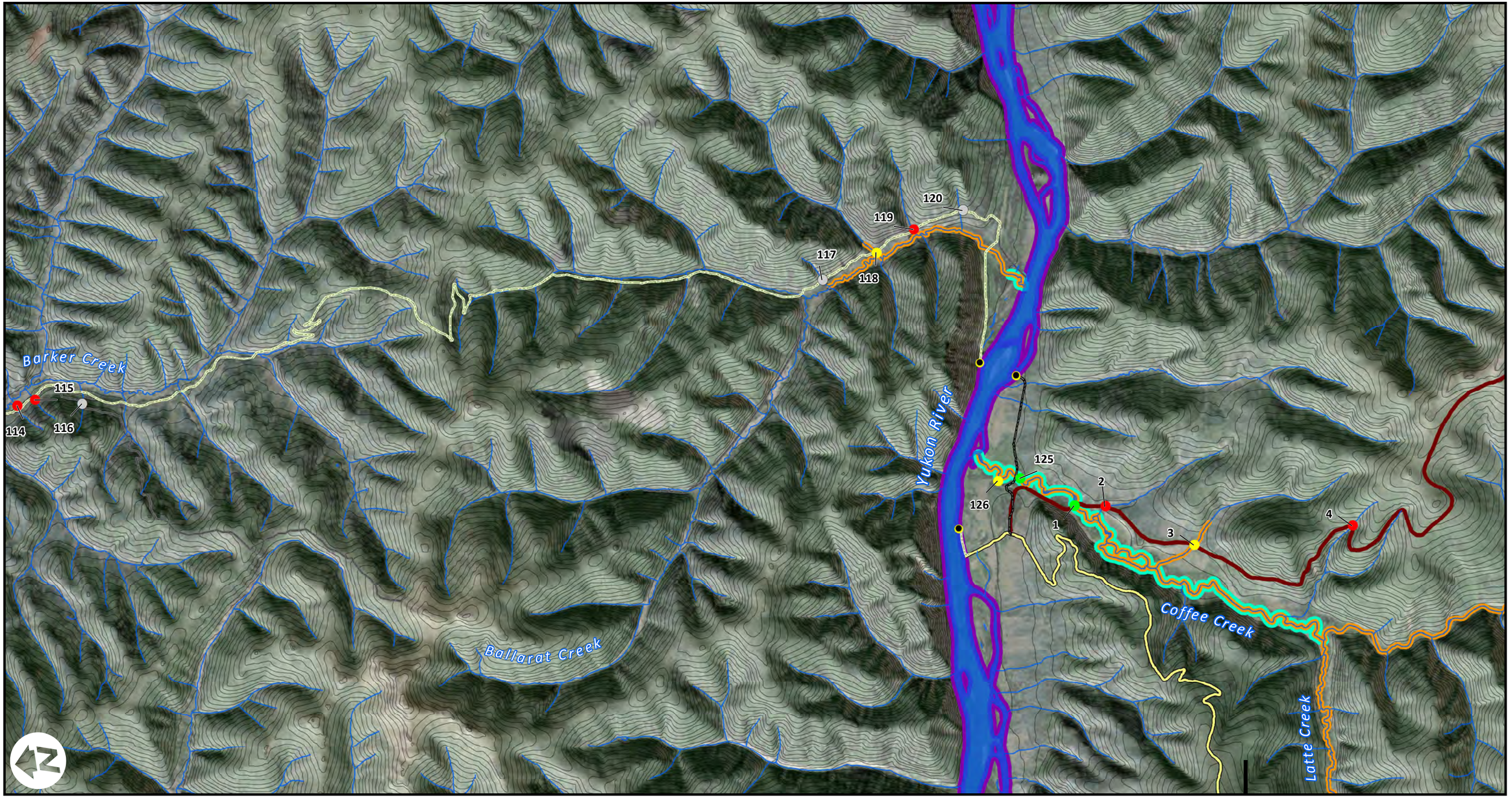

Figure 5

PECG Fish Habitat Survey Results

Legend

- Proposed Route
- Proposed Ice Road
- Existing Road
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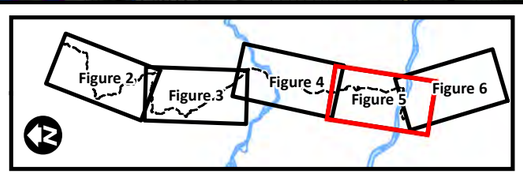

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Canadian Creek

Yukon River

Coffee Creek

117 118 119 120 125 126 1 2 3 4 5 6

Figure 6

PECG Fish Habitat Survey Results

Legend

- Proposed Route
- Proposed Ice Road
- Existing Road
- Existing Main Road
- Coffee to Casino Road
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- Stewart River Minnow Trapping Site
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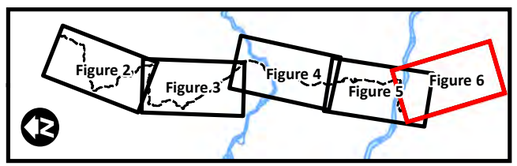

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Fish Community

Based on background review, fish species known to be present in the Indian River watershed such as Arctic grayling, round whitefish, slimy sculpin, lake chub and longnose sucker may use habitat in lower Sulphur Creek (Al von Finster, *pers. comms.* 2015). Historically, Arctic grayling of all age classes, as well as whitefish species (likely round whitefish), were documented in Sulphur Creek (Birtwell *et al*. 1984). The Yukon DFO Fisheries Information Summary System (FISS) database has no record of Chinook salmon in Sulphur Creek (DFO, 2016). In addition, the nearest documented Chinook salmon spawning areas are approximately 50 km downstream, on the lower Indian River, below areas that are heavily disturbed by placer mining (Miles and Associates, 2003; DFO, 2016). Consequently, Sulphur Creek is unlikely to support rearing juvenile Chinook salmon.

Fish Bearing Status

Sulphur Creek is considered fish bearing although the culvert crossing likely obstructs fish movement to upstream areas at certain times of the year.

Photo 1 – Road crossing (#48) at Sulphur Creek on September 9, 2015. Showing hanging culvert and smaller overflow culvert.

Table 5. Fish and Fish Habitat Summary, Coffee Gold Northern Route, 2015

Crossing #	Watercourse	*In situ* Water Quality					Gradient (%)	BFw (m)	BFd (m)	Ww (m)	Wd (m)	Cover		Substrate Bed	Fish bearing Status	Rationale for Not fish bearing	Fish Captured
		T_w (°C)	pH	COND (µS/cm)	DO (mg/L)	DO (%Sat)						%	Dominant Type(s)				
51	Indian River tributary	5.1	7.1	63	10.80	92.0	4	1.1	0.1	1	0.1	5	OV	F	Potentially fish bearing	-	-
52	Indian River tributary	5.2	7.9	183	11.02	94.0	5	2+	0.09	2+	0.09	100	OV	F	Potentially fish bearing	-	-
53	Indian River tributary	6.4	7.8	879	10.61	93.3	2	2.5	0.06	2.5	0.06	5	OV	G/F	Potentially fish bearing	-	-
54	Indian River tributary	-	-	-	-	-	-	-	-	-	-	-	-	-	Potentially fish bearing	-	-
54.5	Eureka Creek	7.9	7.6	54.7	10.03	91.1	1	0.55	0.07	0.55	0.07	30	OV	F	Not fish bearing	High gradient barrier (28%) directly downstream of crossing	-
55	Eureka Creek	10.4	7.6	369	9.92	95.7	2	~ 30 m	0.63	2.4	0.18	<5	OV	G/C	Fish bearing	-	NFC
57	Eureka Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Potentially fish bearing	-	-
58	Eureka Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
59	Eureka Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
60	Eureka Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	High gradient barrier (30%) directly downstream of crossing	-
61	Eureka Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Potentially fish bearing	-	-
62	Eureka Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
63	Black Hills Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
63.5	Black Hills Creek	5.7	7.9	145	11.85	102	4	10.5	0.17	7.7	0.07	<5	B	G/C	Potentially fish bearing	-	-
64	Black Hills Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
65	Black Hills Creek	2.9	7.6	69.7	12.61	100.3	2	4.5	0.14	6.7	0.11	0	OV	G/F	Not fish bearing	High gradient barrier (22%) directly downstream of crossing	-
69	Black Hills Creek	8.5	6.6	56.7	2.85	24.2	1	-	-	0.4	0.2	1	OV	F	Not fish bearing	Ephemeral drainage feature with no surficial connectivity to downstream stream habitat	-
69.5	Black Hills Creek	7.1	7.1	846	9.18	82.2	2	0.65	0.15	0.65	0.15	80	OV	G/F	Potentially fish bearing	-	-
70	Black Hills Creek	4.9	7.2	76.3	11.75	98.6	3	0.98	0.05	0.98	0.05	80	OV	F/G	Not fish bearing	High gradient barrier (34%) directly downstream of crossing	-
71	Black Hills Creek	7.8	7.9	143.2	10.84	97.4	2	13	0.25	11	0.2	<5	OV	F/G	Fish bearing	-	GR
72	Dome Creek	1.2	7.6	69.3	12.48	99	68	6	0.01	6	0.01	-	-	-	Not fish bearing	High gradient barrier (68%) directly downstream of crossing	-
73	Dome Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	High gradient barrier (38%) directly downstream of crossing	-
74	Maisy May Creek	3.3	7.2	43.6	12.1	98.8	-	-	-	0.37	0.08	-	-	-	Not fish bearing	High gradient barrier (>35%) directly downstream of crossing	-

Table 5. Fish and Fish Habitat Summary, Coffee Gold Northern Route, 2015, continued.

Crossing #	Watercourse	*In situ* Water Quality					Gradient (%)	BFw (m)	BFd (m)	Ww (m)	Wd (m)	Cover		Substrate Bed	Fish bearing Status	Rationale for Not fish bearing	Fish Captured
		T_w (°C)	pH	COND (µS/cm)	DO (mg/L)	DO (%Sat)						%	Dominant Type(s)				
75	Maisy May Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	High gradient barrier (>20%) directly downstream of crossing	NFC
76	Maisy May Creek	2.9	7.9	105	12.88	102	-	-	-	-	-	-	-	-	Not fish bearing	High gradient barrier (37%) directly downstream of crossing	-
77	Maisy May Creek	2.3	7.6	97.3	12.75	99.8	-	1.9	0.36	1.7	0.26	-	-	-	Not fish bearing	High gradient barrier (46%) directly downstream of crossing	-
80	Maisy May Creek	3.1	7.9	166.2	12.54	100.8	-	1	0.19	0.76	0.07	-	-	-	Not fish bearing	High gradient barrier (26%) directly downstream of crossing	-
80.5	Maisy May Creek	1.7	7.3	78.1	12.59	96.9	-	0.6	0.15	0.5	0.05	-	-	-	Not fish bearing	High gradient barrier (71%) directly downstream of crossing	-
81	Maisy May Creek	3.0	8.0	152.4	12.58	98.7	1	3.6	0.45	3.6	0.45	0	OV, U	F	Fish bearing	-	GR
82	Maisy May Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
83	Maisy May Creek	3.7	8.3	613	12.55	99.9	-	-	-	0.57	0.02	-	-	-	Not fish bearing	No connectivity to downstream stream habitat	-
84	Maisy May Creek	-	-	-	-	-	-	-	-	0.45	0.17	-	-	-	Not fish bearing	Ephemeral drainage feature with no surficial connectivity to downstream stream habitat	-
85	Maisy May Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	Ephemeral drainage feature with no surficial connectivity to downstream stream habitat	-
86	Maisy May Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
91	Maisy May Creek	4.3	8.0	210	12.43	105	2	4.9	0.78	4.7	0.43	20	LWD	F/G	Fish bearing	-	BB, GR, CCG, CH
92	Unnamed Stewart River tributary	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
93	Unnamed Stewart River tributary	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
94	Unnamed Stewart River tributary	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
95	Unnamed Stewart River tributary	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
96	Unnamed Stewart River tributary	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
97	Unnamed Stewart River tributary	-	-	-	-	-	2	0.7	0.38	0.7	0.38	20	SWD	F	Potentially fish bearing	-	-
100	Barker Creek	6.2	7.8	132.9	11.61	97.4	2	~10	0.9	~9	0.6	15	DP	G/C	Fish bearing	-	NFC
101	Barker Creek	8.7	7.4	61.5	10.65	95.5	5	0	0	0.59	0.17	30	OV	F	Potentially fish bearing	-	-

Table 5. Fish and Fish Habitat Summary, Coffee Gold Northern Route, 2015, continued.

Crossing #	Watercourse	*In situ* Water Quality					Gradient (%)	BFw (m)	BFd (m)	Ww (m)	Wd (m)	Cover		Substrate Bed	Fish bearing Status	Rationale for Not fish bearing	Fish Captured
		T_w (°C)	pH	COND (µS/cm)	DO (mg/L)	DO (%Sat)						%	Dominant Type(s)				
102	Barker Creek	5.5	7.6	81.4	10.53	87	3	0.67	0.07	0.67	0.07	80	OV	F	Potentially fish bearing	-	-
103	Barker Creek	5.2	7.8	70	12.8	105	1	1.25	0.15	0.42	0.02	70	OV	F	Potentially fish bearing	-	-
104	Barker Creek	1.8	7.4	65.7	12.54	94	8	0.62	0.22	0.62	0.13	20	OV	F	Potentially fish bearing	-	-
105	Barker Creek	3.5	8.0	153.5	12.45	99.1	8	0.42	0.12	0.22	0.06	20	OV	C/F	Potentially fish bearing	-	-
106	Barker Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
107	Barker Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
108	Barker Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
109	Barker Creek	-	-	-	-	-	-	-	-	0.23	0.02	-	-	-	Not fish bearing	No visible stream channel	-
110	Barker Creek	3.0	7.3	82.6	12.18	94.8	3	0.81	0.1	0.36	0.02	50	OV	G/F	Not fish bearing	High gradient barrier (30%) directly downstream of crossing	-
111	Barker Creek	2.6	8.0	120.8	12.77	98.2	14	2.25	0.4	1.7	0.15	<5	B	C/G	Potentially fish bearing	-	-
112	Barker Creek	7.7	8.2	264	11.64	102	2	-	-	1.03	0.06	None	-	G/F	Potentially fish bearing	-	-
113	Barker Creek	3.7	8.0	153.9	12.95	100	2	7.4	0.81	3.6	0.16	None	-	F/G	Potentially fish bearing	-	-
114	Barker Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No surficial connectivity to downstream stream habitat; high gradient barrier (30%) at crossing site	-
115	Barker Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	High gradient barrier (56%) directly downstream of crossing	-
116	Barker Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
117	Ballarat Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-
118	Ballarat Creek	2.7	8.0	148	12.95	99.8	5	11	0.1	6	0.07	<5	OV	G/C	Potentially fish bearing	-	NFC
119	Ballarat Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	High gradient barrier (35%) directly downstream of crossing	-
120	Ballarat Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	No visible stream channel	-

Table 5. Fish and Fish Habitat Summary, Coffee Gold Northern Route, 2015, continued.

Crossing #	Watercourse	*In situ* Water Quality					Gradient (%)	BFw (m)	BFd (m)	Ww (m)	Wd (m)	Cover		Substrate Bed	Fish bearing Status	Rationale for Not fish bearing	Fish Captured
		T_w (°C)	pH	COND (µS/cm)	DO (mg/L)	DO (%Sat)						%	Dominant Type(s)				
125	Coffee Creek	4.2	7.8	86.2	12.57	102.4	1	19	0.7	18.2	0.4	5	LWD	C/G	Fish bearing	-	-
126	Coffee Creek	-	-	-	-	-	0	-	-	4	0.15	80	OV	F	Potentially fish bearing	-	-

Note on crossing #s:
The following crossing numbers were excluded from the table: 1-50 (existing road, north of assessment scope); 56, 66-68, 78-79, 87-90, 98-99 (numbers were assigned to false crossings during desktop mapping and were not carried forward in the assessment); 121-124 (sites along previous iteration of the road that were omitted in September 2015).

Criteria for fish bearing statuses:
Refer to Section 2.4.2.

Legend:

#	Crossing ID	LWD	Large Woody Debris	DO	Dissolved Oxygen	S	Sand	"-"	Not sampled, no data available / not applicable
Tw	Water Temperature	OV	Overhanging Vegetation	Sat	Saturation	DP	Deep Pools		
COND	Conductivity	U	Undercut Banks	NFC	No Fish Caught	BB	Burbot		
BFw	Bankfull Width	B	Boulder	C	Cobble	GR	Arctic grayling		
BFd	Bankfull Depth	Ww	Wetted Width	F	Fines	CCG	Slimy sculpin		
SWD	Small Woody Debris	Wd	Wetted Depth	G	Gravel	CH	Chinook salmon		

3.1.2 Indian River

The proposed northern route crosses the mainstem of the Indian River at an existing bridge location (#50). The bridge was not visited during the August 2015 field program as it was north of the field assessment scope (*i.e.* outside of the area in which the alignment of the road had been confirmed). However, taking in consideration that the existing bridge would likely form part of the northern road and may require an upgrade, this location was visited in September 2015 and notes on existing conditions and general habitat were recorded. In August 2015, fish habitat assessments were completed at four crossing sites (#51-54) on unnamed drainages that flow northward into the Indian River and are south of the mainstem crossing.

Fish Habitat

The Indian River is a large watershed that has been placer mined almost continuously since 1898, and consequently the river and its tributaries are heavily altered in all but a few areas (Duncan, 1997; Miles and Associates, 2003). The degraded habitat is considered 'low suitability' by the Yukon Placer Mining Secretariat, but remains usable for Arctic grayling and other tolerant resident fish species (Yukon Placer Secretariat, 2016).

Habitat in the four tributaries (#51-54) was considered low quality. Generally, the tributaries were shallow, turbid, had poor channel definition, and flow disruption (e.g. pooling, dispersion) where they intersected with the existing road. Site #54 had no flow at the time of assessment, however, limited channel definition was noted indicating that the site may conduct flows during periods of high snow melt.

Fish Community

There is little information on fish communities in the Indian River. The river is known to support Arctic grayling populations and it is highly likely that other non-anadromous resident fish species such as slimy sculpin, round whitefish, lake chub, burbot and longnose sucker are also present in the mainstem and suitable tributaries (Al von Finster, *pers. comms*. 2015). Northern pike may also be present in larger mainstem habitats, or in pond habitats created by placer disturbance. Adult Chinook salmon reside in the downstream area of the Indian River; the upper limit of their range is approximately 47 km downstream from the crossing (DFO 2016). Based on the large distance to downstream salmon spawning areas, and the known low suitability fish habitat designation, juvenile Chinook salmon are unlikely to be present in the upper Indian River watershed (Yukon Placer Secretariat 2016).

Fish Bearing Status

The Indian River mainstem crossing site is fish bearing. The tributary sites are very unlikely to support fish; however, they may have temporary seasonal connections to the Indian River and are therefore considered potentially fish bearing.

3.1.3 Eureka Creek

Eight crossing sites (#54.5, #55, #57, #58, #59, #60, #61, and #62) were assessed in the Eureka Creek watershed, including one mainstem site (#55).

Fish Habitat

Eureka Creek flows north into the Indian River. Overall Eureka Creek is heavily altered from placer mining activities, and the remaining habitat is low quality. Creek flow is altered along some sections, and riparian habitat is degraded (Photo 2). At the mainstem crossing site (#55), the creek was braided, shallow, and turbid. Flow was at mid- to low level. Channel width at the site ranged from 10 m (upstream), to approximately 30 m (at the crossing location). Average wetted width was 3 m. There was little to no in-stream cover, the banks and riparian vegetation were highly disturbed, and the substrate was embedded with fines making it unsuitable for Arctic grayling spawning. Depending on flow levels, site #55 has the potential to support marginal rearing, feeding, or migratory habitat for Arctic grayling. Pool habitat, which is preferred for rearing and feeding life stages of Arctic grayling (Stewart *et al*., 2007) was absent at the time of assessment. The lack of pool habitat also precludes the potential for overwintering habitat at the crossing site.

Eureka Creek tributary crossing sites were smaller and provided lower habitat quality relative to the mainstem site. High gradient (> 25%) barriers were noted downstream of crossings 54.5 and 60, and there was no visible channel at crossings #58 and #59. Crossing #62 was located in the creek headwaters; there was no visible channel upstream and only limited evidence of scour downstream, as well as terrestrial vegetation growing in the channel. Crossing #57 was on a small drainage (narrow and shallow), and a channel was only visible on the downstream side of the existing road. Crossing #61 was dry at the time of the assessment, despite recent precipitation events. Some evidence of scour was present, indicating that this drainage is likely ephemeral.

Photo 2 – Aerial view of Eureka Creek on September 9, 2015, near crossing #58. Showing degraded riparian habitat from placer mining activities.

Fish Community

Fish sampling (electrofishing) was conducted at site #55 on mainstem Eureka Creek, and no fish were caught (Table 2). At the time of the assessment the site was too shallow to submerge minnow traps. DFO's Yukon FISS database currently has no fisheries information for Eureka Creek (DFO, 2016). However, fish species present in the Indian River system (see section 3.1.2) may also reside in Eureka Creek, or utilize it periodically. The likelihood for juvenile Chinook salmon presence is very low, considering that the nearest documented Chinook salmon spawning areas are approximately 40 km downstream, and the habitat in this creek is not suitable for this species, based on high turbidities and lack of pool habitat and cover.

Fish Bearing Status

Due to the proximity of the Indian River, Eureka Creek mainstem crossing site (#55) is considered fish bearing. However, juvenile Chinook salmon are likely absent in Eureka Creek and its tributaries, as the nearest areas where adult Chinook salmon are known to reside are approximately 40 km downstream, in the lower reaches of the Indian River.

Crossing sites #57 and #61 are considered potentially fish bearing as they may have periodic connectivity to the Indian River. However, these sites were considered highly unlikely to support fish owing to poor channel definition, and limited habitat potential. Crossing sites #58, #59 and #62 are considered non-fish

bearing, due to lack of physical habitat. Additionally, crossing sites #54.5 and #60 were considered non-fish bearing due to high gradient barriers noted downstream.

3.1.4 Black Hills Creek

Ten crossing locations (#63, #63.5, #64, #65, #69, #69.5, #70, #71, #72, and #73) were assessed in the Black Hills Creek watershed, including one mainstem crossing site (#71). All crossings were in the upper watershed, over 25 km upstream from the Stewart River.

Fish Habitat

Black Hills Creek is heavily disturbed by placer mining and is classified as low suitability fish habitat by the Yukon Placer Mining Secretariat. Further, monitoring of mining activities have identified a stressed benthic invertebrate community (Yukon Placer Aquatic Health Working Group, 2012). Currently vehicle traffic fords the creek at the mainstem crossing (#71). Flow levels were high at the time of the assessment and the creek was very turbid. The habitat at the ford consisted of fast flowing, shallow riffles with little to no pool habitat. Average channel and wetted widths were 10 m and 8 m respectively. In some areas, the banks were disturbed and composed of sand and gravel debris piles.

The remaining crossing locations in the Black Hills Creek watershed were along tributaries. Crossing #63.5 was on the largest of these tributaries and had a ford crossing with no culvert. The habitat at this site consisted of a shallow fast-flowing riffle. Channel width ranged from 4.8 m (upstream) to 10.5 m (at the crossing). Wetted width ranged from 2.5 m (downstream) to 7.7 m (at the crossing). Upstream of the site, berms of large substrate with established vegetation (shrubs) remained from past placer mining disturbance. The site had low to moderate potential for Arctic grayling spawning, based on substrate (gravel and cobble) and channel size.

At crossing #69.5 water appeared to be flowing through the road (no culvert). Upstream of this crossing there was standing water under a thick mat of wetland vegetation, while downstream the flow converged into a poorly defined narrow channel (approximately 0.4 m wide).

Crossings #63 and #64 had no visible channel, and crossings #65, #70, #72, and #73 had non-passable high gradient barriers (22-68%) downstream. At crossing #69 there was standing water near the road, however flow downstream of the crossing dispersed through a grassy area that was not passable for fish.

Fish Community

DFO's Yukon FISS database had no current fisheries information for Black Hills Creek (DFO, 2016). Electrofishing and minnow trapping were conducted at site #71 on the mainstem of the creek (Table 2). Five Arctic grayling (juveniles and adults) were captured during electrofishing, four of which were probable young-of-the year (lengths=47-52 mm). The Coffee Gold Fish and Aquatic Resources Baseline Report (PECG, 2015) includes an Age-Length curve for Arctic grayling in the local study area, which is consistent with this observation. No fish were caught in the minnow traps.

Fish Bearing Status

Crossing site #71 is fish bearing, as Arctic grayling ranging from young-of-the-year to adults were captured at the site. However, this area is very unlikely to support other species of fish, including juvenile Chinook salmon, based on the low quality habitat and long distance (25 km) from the Stewart River (Yukon River Panel, 2016). Crossing site #63.5 is considered to be likely fish bearing, due to its relatively larger channel and close connection to the mainstem of Black Hills Creek. However, this crossing has been classified as potentially fish bearing, as fish presence has not been confirmed to-date. Crossing site #69.5 may support fish during high flows, which would improve connectivity to the mainstem and perhaps provide temporary access for fish to travel upstream. At low to mid flow levels the crossing is not passable for fish. Crossings #63 and #64 are considered non-fish bearing as no visible stream channels were observed. Crossings #65, #70, #72, and #73 are considered non-fish bearing based on existence of downstream high gradient barriers. Crossing #69 is considered non-fish bearing due to lack of surficial connectivity between the crossing location and downstream stream habitat.

3.1.5 Maisy May Creek

Thirteen crossing sites (#74-77, #80, #80.5, #81-86 and #91) were assessed in the Maisy May Creek watershed, including two mainstem sites (#75 and #91). The most upstream crossing in the watershed (#74) is approximately 20 km upstream from the confluence with the Stewart River, and the most downstream (#91) is within a kilometer from the confluence.

Fish Habitat

Maisy May Creek flows south into the Stewart River. Placer mining on the creek has resulted in severe alteration of the habitat and a stressed aquatic community (Yukon Placer Aquatic Health Working Group, 2012). The most downstream section of the creek (approximately 3 km), along which site #91 is located, is classified as moderate to low suitability fish habitat by the Yukon Placer Mining Secretariat. Habitat at site #91 consisted of deep pools connected by slow moving runs. Flow was at mid-level during the time of the assessment, and turbidity was high. Channel and wetted widths ranged from 4 m to 5 m. Large woody debris formed the dominant cover, and the substrate was predominantly fines and gravel.

Site #81 was located on a tributary of Maisy May Creek and consisted predominantly of fast flowing riffle and run habitat, with few pools that could support fish rearing or feeding. Wetted width was the same as bankfull (channel) width, and ranged from 0.5 m to 3.6 m. Some pool habitat was noted upstream, but considered too shallow (<1 m deep) to provide overwintering habitat.

Crossing #75 was located on a side channel that drained into two other branches of upper Maisy May downstream. The crossing had a perched culvert, with a vertical drop (greater than 75 cm) that was considered a fish passage barrier (Photo 3). Channel and wetted widths upstream of the culvert were 2.4 m and 1.4 m respectively. Active placer mining was occurring upstream of the crossing site in August 2015. The crew conducted an aerial assessment upstream of the crossing site and no deep water habitat (which could provide fish overwintering) was observed. The creek valley was highly disturbed and unstable, in particular where the side channel joined upper Maisy May downstream of the crossing location. Nearby, another side channel ran adjacent to the road, and the road was eroding into the creek.

Photo 3 – Perched culvert crossing (#75) on side channel of Maisy May Creek.

Crossings #74, #76, #77, #80 and #80.5 were upstream of high gradient barriers (26-71%), while crossings #82, #84 and #85 had no visible channels. Crossing site #83 had no direct connectivity to Maisy May Creek, owing to a large overburden pile.

Fish Community

Fish sampling at site #91 confirmed the presence of Arctic grayling, slimy sculpin, burbot, and juvenile Chinook salmon. Adult and sub-adult Arctic grayling (lengths 254-294 mm) were also captured further upstream at site #81. Confirmatory sampling (three minnow traps deployed for 24 hours) was conducted upstream of site #75; no fish were caught. Site #91 is located near the mouth of the creek, and juvenile Chinook salmon are unlikely to migrate far upstream of this site due to increasing elevation and noted placer mining disturbances (Yukon River Panel, 2016; Yukon Placer Secretariat, 2016).

Fish Bearing Status

Sites #81 and #91 are fish bearing, as confirmed by on site sampling. Arctic grayling were present at both of these sites, and site #91 (on the lower mainstem) had a relatively diverse fish community. Based on the habitat and sampling results, the site 81 tributary likely provides seasonal feeding habitat for low densities of adult Arctic grayling. The site is unlikely to support Arctic grayling spawning, as water temperature was low and the substrate was often embedded. Sites #74, #75, #76, #77, #80, and #80.5 are considered non-fish bearing, based on existence of downstream high gradient barriers. Sites #82,

#83, #84, #85, #86 are considered non-fish bearing, based on lack of physical habitat or connectivity to downstream areas.

3.1.6 Stewart River Unnamed Tributaries

Six crossings (#92-97) were assessed in the Stewart River watershed, along unnamed tributaries that drain south into the Stewart River.

Fish Habitat

Of the six potential crossing sites, only crossing #97 had a visible channel. The crossing was located approximately 200 m upstream of the Stewart River. The tributary was small, slow, irregularly meandering, and flowed underground briefly at crossing site. Wetted width was the same as bankfull (channel) width, and ranged from 0.6 m to 1.0 m. Large amounts of large woody debris at the site formed potential obstructions to fish passage. Furthermore, there were no deep pools for overwintering, and the dominant substrate was fines, providing low suitability for Arctic grayling spawning.

Fish Community

DFO's Yukon FISS database has no current fisheries information for the tributary on which site #97 is located (DFO, 2016), and no fish sampling was conducted. Fish species known to reside in the Stewart River, (which may occasionally enter the tributary) include juvenile Chinook salmon, Arctic grayling, lake whitefish, round whitefish, slimy sculpin, northern pike, inconnu, burbot, least cisco, and longnose sucker (Elson, 1974). However, it is noted that most of these species do not frequent small stream habitats during their adult life stages.

Fish Bearing Status

The Site #97 tributary is considered to be likely fish bearing due to its close and permanent connection to the Stewart River. However, this crossing has been classified as potentially fish bearing, as fish presence has not been confirmed to-date. The habitat was marginal and likely only seasonally utilized depending on flow levels. Juvenile Chinook salmon may periodically enter the tributary, however, the lack of pool habitat and natural obstructions likely limits usage on a seasonal basis. Crossings #92-96 were non-fish bearing due to lack of physical stream habitat (no visible channel).

3.1.7 Barker Creek

Seventeen crossings (#100-116) were assessed in the Barker Creek watershed, south of the Stewart River. The most upstream (and southerly) crossing (#116) was approximately 14 km upstream from the Stewart River confluence. The most downstream crossing (#100) was within a kilometer of the confluence.

Fish Habitat

Barker Creek flows north into the Stewart River, downstream of Maisy May Creek (Figure 3). The creek has been heavily degraded by placer mining, and the aquatic community (benthic invertebrates) was considered to be stressed during routine monitoring (Yukon Placer Aquatic Health Working Group, 2012).

Recent burn areas were noted throughout the Barker Creek valley, and were often associated with riparian vegetation and bank slumping, increased erosion into watercourses, and disrupted drainage patterns.

Crossing site #100 was on the mainstem of Barker Creek, approximately one kilometer upstream from the Stewart River. The creek was large (wetted width=10 m), and contained deep pools with the potential to provide good quality rearing, feeding, and overwintering habitat for a variety of fish species. Cover for fish was abundant and mainly consisted of deep pools and large woody debris. The substrate was composed predominately of gravel and cobble. The presence of gravel substrates indicated that Arctic grayling spawning may occur, although the depth and turbidity of the creek precluded a thorough assessment.

Crossing sites #111 and #113 were located on tributaries further upstream in the watershed. Both sites were highly disturbed by placer mining activities. Site #111 contained some pool habitat, though noted depths were insufficient for overwintering. Channel width was approximately 2.2. m, except downstream where the channel spread out into an alluvial fan (> 40 m wide). Wetted width ranged from 1.6 m to 3.4 m. Shallow extended riffles and vertical drops presented natural obstructions to fish passage. At site #113, the creek was shallow, moderately turbid, and the valley had been completely stripped of riparian vegetation downstream. Average channel and wetted widths were 11.3 m and 3.7 m, respectively. No pools that could provide habitat for resting, rearing, or overwintering were present. Overall, habitat at these two crossing locations was low quality due to the high degree of placer disturbance, lack of pool habitat and cover, high turbidities, and predominantly fine substrates.

Crossing sites #101-105, and #112 were located on small, shallow drainages with poor channel definition, dispersed flows, and no pool habitat. At the time of assessment, turbidity was high at all locations, and fish passage was prohibited at the observed flow levels at sites #101, #103, and #105.

Crossings #106-109, and #116 were located on small drainages on the west side of Barker Creek; none of these crossings had a visible stream channel. Crossings #110, #114, and #115 were upstream of high gradient barriers (≥ 30%) and therefore inaccessible to fish.

Fish Community

Barker Creek mainstem may support Arctic grayling spawning and rearing, as well as juvenile Chinook salmon rearing. No fish were caught in three minnow traps set overnight at site #100. Given its proximity to the Stewart River, the creek may also support other resident fish species such as lake whitefish, round whitefish, slimy sculpin, pike, inconnu, burbot, least cisco, and longnose sucker (Elson, 1974). While adult salmon are known to migrate through the Stewart River past Barker Creek, there has been no documentation of salmon spawning in Barker Creek, or in the Stewart River adjacent to the creek outlet (Milligan *et al*., 1985; Mercer, 2005).

Fish Bearing Status

Although fish were not captured during sampling conducted at Site #100, the site is considered fish bearing due to its large size, close proximity to the Stewart River, and wide variety of available habitats, including deep pools for rearing, feeding, and potentially overwintering. Sites #111 and #113 are considered likely fish bearing due to their close proximity to the Barker Creek mainstem, and their relatively large channel sizes compared to other tributary habitats in this system. However, these

crossings have been classified as potentially fish bearing, as fish presence has not been confirmed to-date. Sites #101-105, and #112 are potentially fish bearing, as these watercourses are intermittently connected to Barker Creek. However the likelihood of fish presence is low, given the poor channel definition, frequent natural obstructions, and lack of pool habitat noted at these sites. Crossings #106-109, and #116 are considered non-fish bearing, based on lack of physical stream habitat, and crossings #110, #114, and #115 are considered non-fish bearing based on existence of downstream gradient barriers.

3.1.8 Ballarat Creek

Four crossing locations (#117- 120) were assessed in the Ballarat Creek watershed. All four crossings are along tributaries on the east side of Ballarat Creek. Ballarat Creek flows south, and enters the Yukon River on the north side.

Fish Habitat

Crossing #118 (a ford) was located on a tributary to Ballarat Creek approximately 4 km upstream from the Yukon River, and close to the mainstem. The habitat at the crossing site was comprised of shallow, moderately steep (16%), fast flowing riffles and runs. Channel and wetted widths were 11 m and 6 m respectively at the crossing. The channel narrowed (approximately 1 to 2 metres wide) at upstream and downstream locations. The substrate at and below the ford was dominated by gravels, and limited areas near the ford were potentially suitable for supporting Arctic grayling spawning. Few pools were noted throughout the site to support resting, rearing, or overwintering activities. Upstream of the crossing the channel was heavily incised with some deeper run-pool sections noted, and the dominant substrate was fines.

Fish Community

Crossing site #118 has the potential to support low densities of fish closer to Ballarat mainstem during lower flows. No fish were caught during electrofishing, or in three minnow traps set overnight at the site. Fish species known to reside in Ballarat Creek include Arctic grayling, juvenile Chinook salmon, and slimy sculpin (Sparling, 2001; PECG, 2015).

Fish Bearing Status

Crossing site #118 is considered likely fish bearing due to its close proximity to Ballarat Creek. However, this crossing has been classified as potentially fish bearing, as fish presence has not been confirmed to-date. The crossing site provided marginal habitat for fish species and no fish were caught during August 2015 sampling. Juvenile Chinook salmon have been documented in the lower 500 m of Ballarat Creek and may on occasion migrate upstream and into the tributary (Sparling, 2001).

Crossings #117 and #120 did not contain visible drainage channels and are considered non-fish bearing. Crossing #119 is considered non-fish bearing due to a high gradient barrier (35%) located directly downstream of the road.

3.1.9 Coffee Creek (Winter Road)

Two crossing locations (#125 and #126) were assessed in the Coffee Creek watershed, along the winter road route. One was along the mainstem, and the other was located west of Coffee Creek on a disconnected oxbow.

Fish Habitat

The mainstem crossing site (#125) was located approximately 1.6 km upstream of the creek outlet into the Yukon River. The habitat at this crossing site consisted of a long straight riffle section. Channel width and wetted width were 19 m and 18.3 m, respectively. The substrate was dominated by cobble and gravel, and the riparian vegetation consisted of mixed mature forest. The second crossing (#126) was located in a low swale area, formed from an old (overgrown) oxbow lake. The area was not connected to Coffee Creek, or the Yukon River. The channel may collect some surface run-off, and drains to a small isolated pond nearby.

Fish Community

Fish known to reside in Coffee Creek include juvenile Chinook salmon, Arctic grayling, and slimy sculpin. The fish community in Coffee Creek is described at length in the Coffee Gold Fish and Aquatic Resources Baseline Report (PECG, 2015).

Fish Bearing Status

Crossing site #125 on mainstem Coffee Creek is known to be fish bearing. Crossing site #126 is considered potentially fish bearing, as there is a possibly that fish may enter it during high flow (flooding) or ice jam events. However, this is unlikely to occur, and without a connection to Coffee Creek there is no potential for fish utilization.

3.2 Stewart River Side Channel

Fish habitat was assessed at the Stewart River side channel where infill may be required for the northern road route. The habitat in the side channel was considered poor quality, based on the substrate, flow conditions, and *in situ* water quality measurements. The channel had little to no flow through, and grasses and fines formed the dominant vegetation and substrate, respectively (Photo 4). No fish were caught in four minnow traps set for approximately 24 hours. Water quality *in situ* measurements (measured on September 11) showed that the water was acidic (pH=3.5) in the upstream area near SR3, and neutral (pH=7.4) at SR1 in the downstream section near the side channel confluence. On September 12 *in situ* measurements were taken near SR2; dissolved oxygen was markedly low (40.7% and 5.19 mg/L), pH was 7.3, and specific conductivity was 431.4 µS cm.

Fish Bearing Status

The side channel was considered fish bearing due to its seasonal connection to the Stewart River. The channel is likely to backflood and provide temporary fish habitat during spring flood conditions. However, during summer baseflow conditions, the habitat was stagnant and deemed highly unlikely to support fish throughout the majority of the channel.

Photo 4 - Stewart River Side Channel (near confluence), on September 11, 2015.

3.3 Coffee-Casino Route

Sites along the Coffee-Casino road alignment were assessed in June 2015 (Table 6).

3.3.1 Coffee Creek

Five crossings (#1-5) were assessed in the Coffee Creek watershed, along the Coffee-Casino route (Table 6). One crossing site was assessed along mainstem Coffee Creek and four others were assessed on individual tributaries that enter Coffee Creek from the east. Two of the tributary crossings (#3 and #4) were assessed aerially.

Fish Habitat

Crossing site #1 on mainstem Coffee Creek was approximately 3.6 km upstream from the confluence with the Yukon River. The proposed crossing is within a straight, low gradient riffle section of the creek with cobble and gravel substrate. At the crossing location, channel and wetted widths were 14.8 m and 8.9 m, respectively. For further details, surrounding general fish habitat quality of mainstem Coffee Creek, refer to the Coffee Gold Fish and Aquatic Resources Baseline Report (PECG, 2015).

Crossing site #2 was located on a narrow and heavily incised tributary of Coffee Creek, upstream of a barrier to fish passage (underground flow). The tributary site (#3) was assessed aerially, and appeared to

dissipate before reaching Coffee Creek. Site #4 was located on a small, steep tributary that retained some snow and ice at the time of the assessment (late June), although water was visible at the crossing location. The habitat was considered low quality based on the small size of the channel, lack of pool habitat, and steep gradient. In addition, the desktop gradient assessment showed downstream gradients greater than 20%, which would prohibit fish passage. Site #5 was located along a steep tributary to upper Coffee Creek. The channel was 3.9 m to 5.8 m wide, with average wetted width of 4.2 m. The tributary had step-pool morphology and large substrate (large cobble, boulders). Upstream of the crossing was a medium to high gradient cascade. No deep pools were observed.

Fish Community

The fish community in Coffee Creek was described at length in the Coffee Gold Fish and Aquatic Resources Baseline Report (PECG, 2015). Fish species known to reside in Coffee Creek include Arctic grayling, juvenile Chinook salmon and slimy sculpin. Site #5 is potentially accessible to Arctic grayling, however their presence is unlikely given the habitat quality noted and long distance to suitable habitats downstream.

Fish Bearing Status

Crossing site #1 on mainstem Coffee Creek is known to be fish bearing. Site #5 is potentially fish bearing as there is connection to Coffee Creek, however, given the steep gradient, distance from Coffee Creek mainstem, lack of overwintering habitat and overall low habitat quality, the likelihood of fish presence is very low. Site #3 could not be assessed on the ground due to poor site access, however an aerial survey revealed the crossing site to be likely non fish-bearing. Until ground verification occurs, the site is conservatively considered as potentially fish bearing. Site #2 is considered non-fish bearing due to lack of surficial connection to downstream stream habitat (underground flows). Site #4 is considered non-fish bearing based on desktop gradient mapping, which revealed a higher gradient (>20%) barrier downstream of the crossing site. An aerial assessment confirmed the small, steep nature of this drainage.

Table 6. Fish and Fish Habitat Summary, Coffee-Casino Route, 2015

Crossing #	Watercourse	*In situ* Water Quality					Gradient (%)	BFw (m)	BFd (m)	Ww (m)	Wd (m)	Cover		Substrate Bed	Fish bearing Status	Rationale for Not fish bearing	Fish Captured
		T_w (°C)	pH	COND (µS/cm)	DO (mg/L)	DO (%Sat)						%	Dominant Type(s)				
1	Coffee Creek	10.2	7.3	167	10.1	94.9	0.5	14.80	1.10	8.90	0.38	10	LWD	C/G	Fish bearing	-	-
2	Unnamed tributary of Coffee Creek	6.6	7.1	-	11.4	96.5	5	2.70	0.85	0.80	0.51	50	SWD	F/C	Not fish bearing	No surficial connectivity to downstream stream habitat	-
3	Unnamed tributary of Coffee Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Potentially fish bearing	-	-
4	Unnamed tributary of Coffee Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	Not fish bearing	High gradient barrier (>20%) downstream of crossing area*	-
5	Unnamed tributary of Coffee Creek	4.2	7.6	-	12.47	109.3	18	3.90	0.85	3.50	0.20	20	B	B/C	Potentially fish bearing	-	-
6	Canadian Creek	6.5	6.1	123.1	-	-	-	-	-	-	-	-	-	-	Not fish bearing	High gradient barrier (>20%) downstream of crossing area	-

Notes: Please refer to Section 2.4.2 for fish bearing status criteria

*High gradient barrier noted by desktop mapping; could not be verified on the ground due to poor site access

#	Crossing ID	SWD	Small Woody Debris
Tw	Water Temperature	LWD	Large Woody Debris
COND	Conductivity	OV	Overhanging Vegetation
BFw	Bankful Width	U	Undercut Banks
BFd	Bankful Depth	B	Boulder
Ww	Wetted Width	C	Cobble
Wd	Wetted Depth	F	Fines
DO	Dissolved Oxygen	G	Gravel
Sat	Saturation	S	Sand
"-"	Not sampled, no data available / not applicable	DP	Deep Pools

3.3.2 Canadian Creek

The crossing site on Canadian Creek (#6) coincides with a previously assessed site, which was determined to be non-fish bearing (PECG, 2013). The site is located on upper Canadian Creek, upstream of a documented high gradient (>20%) cascade barrier. No fish were caught above this barrier during sampling in 2008 and 2010 (electrofishing and minnow trapping). The habitat consisted of riffles (80%), with some runs and pools also noted. The substrate was dominated by large cobble (60%), followed by boulders, and small amounts of small cobble and fines (PECG, 2013).

3.4 Barge Crossings

Fish habitat and potential fish utilization at each barge crossing location was evaluated based on field fish habitat assessments conducted in 2015, in conjunction with existing regional fisheries information. These results and interpretations are presented and discussed below for each river.

3.4.1 Stewart River

Watershed Overview

The Stewart River rises in the Hess Mountains along the Yukon-Northwest Territories border and flows west for approximately 640 km to its confluence with the Yukon River (Milligan *et al*., 1985). It is the largest sub-basin of the Yukon River in Canada, with a drainage area of 52,000 square kilometers (Ennis *et al*. 1984; Milligan *et al*., 1985).

General Habitat Assessment

The proposed north barge landing is located west of a small rock bluff, on a gentle sloping beach with fine and cobble substrates, and grasses (Photo 5). At time of assessment (September 9), the river level was high, with poor water clarity. The riparian habitat was comprised of a mature, predominately deciduous forest. Based on substrate, water clarity and flow conditions, as well as the geographical location of barging area within the watershed, the fish habitat was identified as rearing in the immediate vicinity of the proposed landing location, and as rearing and migratory in the larger reach.

The proposed south barge landing location had a steep bank comprised of cobble, gravel, and fine substrates. Evidence of erosion was noted in the form of slumping riparian vegetation, exposed roots and undercutting along the top of the bank (Photo 6). Overhanging riparian vegetation and large woody debris along the shore was identified as providing potential fish habitat; however, it is likely that this material is mobile each year during high flows and ice flow. Habitat and channel physical characteristics were similar to those observed on the north side barge landing proposed location.

Photo 5 – Proposed Barge Landing Location on the Stewart River (north side), on September 9, 2015. Blue arrow shows proposed landing location.

Photo 6 – Proposed Barge Landing Location on the Stewart River (south side), on September 9. 2015.

Salmon Spawning

Adult Chinook salmon, or other indications of spawning (e.g. redds) were not observed during aerial spawning surveys along the Stewart River barging route in late July 2015. The Stewart River Chinook salmon sub-population accounts for approximately 10% of the Chinook salmon stocks in the Yukon River system (Osborne *et al*, 2003; Osborne, 2004; Osborne, 2005). Documented Chinook spawning areas within the Stewart River watershed are located 200 to 600 km above the Stewart-Yukon confluence (Milligan *et al*., 1985), whereas the proposed barging area is 35 km above the confluence. Spawning occurs in the major tributaries, including the McQuesten, Beaver, Mayo, Lansing, Hess, and Pleasant Rivers, Janet Creek, and Crooked Creek (Ennis *et al*. 1982), as well as above Fraser Falls, which is upstream of the Mayo River (Milligan *et al*., 1985; Mercer, 2005). The majority of other tributaries of the Stewart River have unknown salmon values (Applied Ecosystem Management Ltd. 2003; Al Von Finster, pers. comms). To date, there is no documented record of Chinook salmon spawning in the mainstem of the Stewart River (Al Von Finster, *pers. comms*. 2015).

Chum salmon spawning surveys were not conducted for this study as water clarity in the Stewart River during the September field investigation was too poor to complete aerial assessments with any confidence. There have been reports of chum salmon in the McQuesten River, in the Stewart River near Mayo, and in the Mayo River (Mahoney, R. 2007; Buchan, L. 1993; MacDonald, 2012). Elders of the Na Cho Nyak Dun First Nation report of a historical dog food fishery in the McQuesten River area (Mahoney, 2007). The McQuesten River is approximately 100 km upstream from the proposed barge crossing, while the town of Mayo and the Mayo River are even further upstream.

Salmon Spawning Conclusions

Based on the 2015 fish habitat and spawning surveys, a literature review of available regional fisheries information, and professional judgment, it was determined that salmon spawning in the vicinity of the Stewart River barge landings is highly unlikely. Chinook salmon typically spawn in tributaries of the Stewart River, further upstream in the watershed. The nearest tributary where Chinook spawning is known to occur (the McQuesten River) is approximately 100 km upstream of the barging area. No mainstem Chinook spawning in the Stewart River downstream of the McQuesten River has been documented to date. Furthermore, aerial spawning surveys in late July, which would coincide with the known Chinook salmon spawning period as well as the tail end of migration up the Stewart River, did not detect any evidence of salmon presence. Chum salmon have infrequently been observed in the Stewart River but there are no documented spawning areas. Upstream of the proposed barge landings, there are areas with extensive erosion extending as far up as the Beaver River, and the lower Stewart River is believed to act as a conduit for sand and larger sized particles, which would infill potential spawning substrate and deter spawning salmon (Al von Finster, *pers. comm*. 2015). Evidence for this was observed during field assessments, as the visible bar and shore material at both barge landing sites was comprised of gravel cobble embedded in a sand/silt matrix.

Although salmon spawning was determined to be unlikely, the barging area is within an important migratory corridor to upstream spawning areas. Returning adult salmon migrate upstream in late spring and early summer to spawning areas higher in the watershed. Almost concurrently, juvenile Chinook salmon (and 0+ chum, if present), migrate downstream on route on the Bering Sea. While chum salmon juveniles will migrate immediately to sea, juvenile Chinook will reside in freshwater habitat for typically one and sometimes two winters prior to entering the marine environment (Bradford *et al*., 2001). Juvenile

Chinook salmon seek slow water habitats for rearing, such as clear non-natal tributaries, or along river margins providing near shore micro-habitats (Bradford *et al*., 2001; Yukon River Panel, 2016). Given this, habitat in the immediate vicinity of the barge landing (i.e. near shore, lower velocity area) could potentially be utilized for rearing or overwintering.

3.4.2 Yukon River

Watershed Overview

The Yukon River originates in northern British Columbia and flows more than 3,000 km to its mouth at the Bering Sea. There are four major tributaries to the Yukon River in Canada; the Teslin River, the Pelly River, the White River, and the Stewart River. Both Chinook and chum salmon are known to migrate through or reside in the Yukon River. Spawning salmon enter the Yukon River in Alaska from the Bering Sea and travel hundreds of kilometers upstream before entering Canadian waters (Yukon River Panel, 2016; Environment Canada, 2000).

General Habitat Assessment

The proposed north barge landing location is at the downstream end of an alluvial terrace and immediately upstream of a rock bluff that extends to the shoreline. The location is approximately 1.6 km downstream of the existing Ballarat landing. The bank height was lower than at the other three proposed landing locations. The landing site was within a grassy open area, with relatively stable banks (mud, roots, and grasses) (Photo 7). The water depth at 1 to 1.5 m horizontal distance from the shoreline was approximately 2 m. Water level was high, with poor clarity. Thus, the substrate was inferred as being predominately fines, based on the bank material.

The proposed south barge landing location is approximately 1.6 km downstream of the mouth of Coffee Creek, and 500 m upstream from the existing barge landing near the Coffee camp. The proposed landing will descend from a low alluvial terrace. The specific location was at a steep bank (approximately 2 m high and composed of organic soil). The bank was unstable with signs of sloughing into the river (Photo 8). The site had gravel substrate. A fish finder (depth sounder) was used in the vicinity of the proposed landing location, and sonar returns consistent with chum salmon were detected. The specific area where the signals were detected was in slow moving water along the south bank. The depth sounder showed that the Yukon River thalweg was smooth from upstream of the north barge landing to downstream of the south landing, implying a lack of spawning dune or redd structures. Based on these observations, the geographical location of the landing sites relative to known spawning areas, and no observable spawning habitat, fish habitat at the landing sites and along the barging route was identified as likely limited to rearing and migratory functions for salmon.

Photo 7 – Proposed Barge Landing Location on the Yukon River (north side), on September 10, 2015.

Photo 8 – Proposed Barge Landing Location on the Yukon River (south side), on September 10, 2015.

Salmon Spawning

Adult salmon, or other indications of spawning (e.g. redds) were not observed during aerial spawning surveys of the Yukon River along the barging route in late July 2015. Yukon River Chinook salmon return to the mouth of the Yukon River from mid to late May through to early July, with peak migration into Canadian waters occurring in mid to late July. Spawning occurs from late July to mid-September (Yukon

River Panel, 2016). The majority of the Yukon River stock migrates past the area where barging is proposed, to spawning areas near Whitehorse, Teslin, and in the headwaters in northern BC (Milligan *et al*., 1985; Environment Canada, 2000). There is little information on the degree and distribution of mainstem Chinook spawning, however it is believed to contribute significantly to overall Chinook production in the watershed (de Graff, 2010). Mainstem Yukon River spawning areas have been documented close to, and upstream of, the Pelly River confluence (Milligan *et al*. 1985; Walker, 1976), which is approximately 100 km upstream from the barging route. Radio telemetry studies in the early 2000s found that approximately 60% of Chinook salmon migrating into the Canadian portion of Yukon River leave the mainstem to enter primary tributaries (Osborne *et al*., 2003; Osborne, 2004; Osborne, 2005). Similarly, Mercer (2005) indicated that mainstem Chinook spawning in the Canadian portion of the Yukon River accounted for about 25% of the spawning population.

Fall chum salmon return to the Yukon River mouth from mid-July through early September, with the peak migration timing into Canadian waters occurring in mid-September. Peak spawning occurs from October through to early November, in the upper watershed, from Tanana River confluence to the headwaters of the Yukon River (Yukon River Panel 2016; USFWS, 2010). Chum salmon also spawn in the project area, as determined during baseline studies in October 2014 when several salmon were observed in a Yukon River side channel adjacent to the Coffee Creek camp. Other known chum spawning sites in Canadian waters are located over 100 km upstream, between Tatchun Creek and the Pelly River confluence (de Graff, 2010).

Salmon Spawning Conclusions

Based on the fish habitat and spawning surveys conducted in 2015, a literature review of available regional fisheries information, and professional judgment, it was determined that salmon spawning in the immediate vicinity of the Yukon River barge landings is considered possible, though unlikely. Rationales for this conclusion are:

- The barge landing locations are downstream of the Pelly River. The Pelly River inputs significant quantities of silt and sand sized particles to the Yukon River, which reduces spawning habitat quality and early development success. The upper reaches of Yukon above the Pelly River are generally less turbid than the lower reaches (Bradford *et al*., 2008). Known Chinook spawning areas are located at, or upstream of, the Pelly River confluence, which suggests that Chinook salmon may be dissuaded from spawning until they reach mainstem areas higher in the watershed that are upstream of significant sediment inputs (Al von Finster, *pers. comm*. 2015).
- The depth sounder showed that the Yukon River thalweg was smooth from upstream of the north barge landing to downstream of the south landing, implying a lack of spawning dune or redd structures. Areas potentially suitable for spawning (e.g. gravel beds) were on submerged bars above the thalweg, along the south side of the river and upstream of the mouth of Coffee Creek.
- Chinook spawning downstream of the mouth of Coffee Creek is unlikely due to annual sediment deposition from Coffee Creek into the Yukon River during freshet. The extent to which the sediment plume would obstruct spawning would depend on the volume of sediment and Yukon River discharge fluctuations, in any given year (and those preceding), as the Yukon River would be carrying the sediment downstream. Generally, the stream bottom downstream and on the same side of an unregulated tributary is likely to be vertically unstable and salmon eggs laid there

would be at high risk of mortality due to scour or sediment deposition (Al von Finster, pers. comm.)

- Spawning surveys in late July did not yield any evidence of Chinook salmon spawning.
- Chum salmon spawning, if it occurs, would likely be along the shoreline, and at shallow depths. Fall chum salmon require ground water discharge for spawning and are generally visible when they spawn (de Graff, 2009). Chum salmon may even spawn in areas that will cease receiving creek (surface) flow in winter as water levels decrease. However groundwater upwelling can keep these areas wetted. The groundwater flow prevents desiccation of the eggs and maintains temperatures favourable for alevin development.
- Spawning chum salmon have been observed in a side channel of the Yukon River, along the south side of the river, approximately 1 km downstream of the location of the south barge landing (PECG, 2015). This observation demonstrates chum salmon preference for slow moving side channels, and that chum salmon spawning does occur in this reach of the Yukon River, close to the barging areas.
- Sonar returns consistent with chum salmon were detected during the field assessments in September 2015. However, these fish were likely migrating to their spawning grounds, as the timing coincided with the known migration of chum salmon into Canadian waters. While it is possible that these fish may have been occupying spawning areas, it is unlikely based on the low suitability of this area for spawning as noted above.

In addition to the potential for spawning, the reach in which the barging route is located is also an important migratory corridor for salmon. Returning adult salmon migrate upstream in late spring and early summer, to spawning areas higher in the watershed. Almost concurrently, 1+ Chinook (and 0+ chum, if present), migrate downstream on route on the Bering Sea. The timing of Chinook salmon outmigration appears related to annual thermal regimes, though 1+ Chinook are rarely captured in the Canadian portion of the Yukon River drainage after July 15 (Yukon River Panel, 2016). Young-of-the-year (age 0+) juvenile Chinook salmon, having left their natal streams, can be carried downstream. They seek slow water areas for feeding and rearing and in late June enter non-natal tributaries. River margins and near shore micro-habitats along large rivers can meet this criterion for still water, though high turbidity can be limiting (Yukon River Panel, 2015). Given this, habitat in the immediate vicinity of the barge landing (i.e. near shore, lower velocity area) could potentially be utilized for rearing.

4 Summary

The fish and aquatic resources baseline field investigation for the proposed northern road (Coffee to Dawson) and the Coffee-Casino road was conducted during the months of June, August and September of 2015. Fish habitat assessments were conducted at 66 locations along the northern route, and at 6 locations along the Coffee-Casino route. These assessments were conducted within the following watersheds: Sulphur Creek, the Indian River, Eureka Creek, Black Hills Creek, Maisy May Creek, the Stewart River, Barker Creek, Ballarat Creek, Coffee Creek and Canadian Creek. Surveys included an assessment of physical habitat parameters (e.g., stream size, gradient, habitat type), and determination of fish bearing status at each crossing. Fish passage barriers or obstructions were identified and documented. Fish sampling was conducted at selected watercourses that were identified as being likely fish bearing to determine fish community composition, life stages present, and relative abundance. Fish habitat assessments, including spawning surveys, were also conducted on the Yukon and Stewart Rivers at four barge landing sites (two per river) and along the barging routes. A side channel of the Stewart River was assessed as this area may require some infilling during road construction.

Key Findings:
The northern route followed existing placer mine roads and trails along the majority of its path. Most watercourse crossings spanned low quality tributaries and avoided more sensitive areas by frequently remaining on higher elevation ridge roads. Due to historic and ongoing placer mining in the proposed road corridor, habitat conditions were often in a degraded state, as evidenced by high turbidity, disturbed and unstable banks, flow disruptions, and lack of riparian vegetation and cover. The Yukon Placer Mining Secretariat habitat suitability classification has downgraded effluent standards for the vast majority of watercourses along the route (Yukon Placer Secretariat, 2016).

From the work completed, it was determined that of the 66 crossings along the northern route 20% (8 crossings) were fish bearing; 21% (19 crossings) were potentially fish bearing; and 59% (39 crossings) were non-fish bearing. Of the eight fish bearing watercourses, seven had mid- to high- quality habitat suitable for rearing and feeding of one or more fish species. The following watersheds: Maisy May, Barker, Ballarat, and Coffee Creeks, contained juvenile Chinook salmon rearing habitat. Potential overwintering habitat was also observed at a small number of sites, typically in larger, lower gradient streams. The one remaining fish bearing watercourse (#55 on mainstem Eureka Creek) and five potentially fish bearing crossings (#63.5, #97, #111, #113, and #118) had low quality habitat owing to both anthropogenic effects (placer mining, existing road crossings) and natural features (small channel size, obstructions, and lack of wetted habitat). The other 14 watercourses considered potentially fish bearing were typically small tributaries, and contained ephemeral habitat of low quality. Non-fish bearing sites often had no visible channel, were disconnected from downstream habitat, or were upstream of high gradient barriers.

An alternative route, “the Coffee-Casino Route” was also assessed, which runs southeast from the project to the Casino Mine property. The Coffee-Casino route had one fish bearing watercourse (on the mainstem of Coffee Creek); two potentially fish bearing watercourses; and three non-fish bearing watercourses.

The sections of the Yukon and Stewart Rivers where barge crossings are proposed are important migratory corridors for Chinook salmon moving upstream to spawning areas, and downstream to non-natal freshwater rearing areas or to marine feeding areas in the Bering Sea. Juvenile Chinook salmon may utilize the habitat at the barge landing sites during their 1-2 years spent rearing in freshwater. The probability of salmon spawning occurring in the vicinity of the barging areas at the Stewart and Yukon Rivers is considered low.

Watershed-specific results are summarized below for the northern route, and the Coffee-Casino route:

Northern Route:

Sulphur Creek

- A reconnaissance site visit was made to an existing culverted crossing on Sulphur Creek.
- The existing crossing likely obstructs fish passage upstream.
- The creek habitat is suitable for Arctic grayling as well as other non-anadromous fish species known to reside in the nearby Indian River (e.g. round whitefish, slimy sculpin, lake chub and longnose sucker).
- Sulphur Creek is unlikely to be utilized by juvenile Chinook salmon as the nearest documented Chinook salmon spawning areas are approximately 50 km downstream.

Indian River

- A reconnaissance site visit was made to an existing bridge crossing (#50) on the mainstem of the Indian River. Expected fish species at this location include Arctic grayling, slimy sculpin, round whitefish, lake chub and longnose sucker.
- Four tributary sites (#51-54) were assessed in the Indian River watershed.
- The tributary sites are potentially fish bearing as they may have temporary seasonal connection to the mainstem of the Indian River.
- Juvenile Chinook salmon are likely absent in the upper Indian River watershed as the habitat is unsuitable and the nearest documented spawning areas are approximately 47 km downstream.

Eureka Creek

- Eight crossings (one mainstem crossing site and seven tributary sites) were assessed in the Eureka Creek watershed.
- No fish were captured during sampling at site #55 (mainstem), which is considered fish bearing.
- Sites #57 and #61 are considered potentially fish bearing as they may have periodic connectivity to the mainstem. They are highly unlikely to support fish owing to poor channel definition, and limited habitat potential.
- Crossings #58, #59 and #62 were considered non-fish bearing due to lack of physical stream habitat.
- Crossings #54.5 and #60 were considered non-fish bearing due to high gradient barriers noted downstream.
- Juvenile Chinook salmon are likely absent in Eureka Creek considering the limited quantity and low quality of habitat, as well as distance from known spawning areas (approximately 40 km).

Black Hills Creek

- Ten crossings (one mainstem crossing site and nine tributary sites) were assessed in the Black Hills Creek watershed.
- Site #71 on the mainstem is fish bearing; five Arctic grayling (juveniles and adults) were captured during sampling.
- Site #63.5 is potentially fish bearing, however it was considered as likely to support fish based on habitat characteristics.
- Site #69.5 is potentially fish bearing; the habitat is low quality and unlikely to support fish other than low densities during brief high-flow periods.
- Crossings #63 and #64 had no visible stream channels, and crossings #65, #69, #70, #72, and #73 were upstream of high gradient barriers. These crossings were considered to be non-fish bearing.
- Juvenile Chinook salmon are likely absent from upper Black Hills Creek, given the distance (25 km) from the Stewart River and known Chinook salmon spawning areas.

Maisy May Creek

- Thirteen crossings were assessed in the Maisy May Creek watershed, including two mainstem crossing sites.
- Site #91, located on the lower mainstem, contained Arctic grayling, slimy sculpin, burbot, and juvenile Chinook salmon.
- Site #81, located on a mid-sized tributary, contained two Arctic grayling (lengths 254-294 mm).
- Sites #74, #75, #76, #77, #80, and #80.5 are considered non-fish bearing, based on existence of downstream high gradient barriers.
- Sites #82, #83, #84, #85, #86 are considered non-fish bearing, based on lack of physical habitat or connectivity to downstream areas.

Stewart River Unnamed Tributaries

- Six sites were assessed along drainages on the north side of the Stewart River.
- Site #97 was considered likely fish bearing, as the site was connected to the Stewart River 200 m downstream. However, the site was classified as potentially fish bearing, as fish presence has not been confirmed to-date. Fish species known to reside in the Stewart River include juvenile Chinook salmon, Arctic grayling, lake whitefish, round whitefish, slimy sculpin, pike, inconnu, burbot, least cisco, and longnose sucker
- Juvenile Chinook salmon may periodically enter the tributary on which site #97 is located, however the lack of pool habitat and natural obstructions likely limits usage.
- Sites #92-96 were considered non-fish bearing (no visible stream channels).

Barker Creek

- Seventeen sites were assessed in the Barker Creek watershed, including one mainstem site.
- Site #100 (mainstem) was considered fish bearing.
- Site #100 contained habitat suitable for Arctic grayling rearing and potentially spawning, as well as juvenile Chinook salmon rearing.
- Sites #111 and #113 were considered to be likely fish bearing, but were classified as potentially fish bearing as no fish have been captured to-date.

- Habitat at sites #111 and #113 was of low quality and both sites were heavily disturbed by placer mining.
- Sites #101-105, and #112 were considered potentially fish bearing as the habitat was of very low quality and had only intermittent connection to the permanent flows downstream.
- Sites #106-109 and #116 had no visible channel, and sites #110, #114, and #115 were upstream of high gradient barriers. These sites were considered non-fish bearing.

Ballarat Creek

- Four tributary sites were assessed in the Ballarat Creek watershed.
- Site #118 was considered potentially fish bearing due to its close proximity to Ballarat Creek, where Arctic grayling, juvenile Chinook salmon, and slimy sculpin have been captured previously.
- Crossings #117 and #120 had no visible channel, and crossing #119 was upstream of a high gradient barrier. These sites are considered non–fish bearing.

Coffee Creek

- Two sites were assessed in the Coffee Creek watershed along the winter road alignment.
- Site #125 on Coffee Creek mainstem is fish bearing; the creek supports Arctic graying, juvenile Chinook salmon, and slimy sculpin.
- Site #126 is on a disconnected oxbow lake, and is considered potentially fish bearing as it may temporarily connect with Coffee Creek during high flow or ice jam events.

Stewart River Side Channel:

The Stewart River side channel, which may require some infill for the road, was considered fish bearing due to its seasonal connection to the Stewart River. The channel is likely to backflood and provide temporary fish habitat during spring flood conditions. However, during summer baseflow conditions, the habitat was stagnant and deemed highly unlikely to support fish throughout the majority of the channel.

Barge Crossings:

Stewart River:

- Habitat at the proposed barge locations and along the barging route was considered primarily as rearing/migratory based on fish habitat assessment results and geographical location in the Stewart River watershed.
- Salmon spawning in the vicinity of the barge landings was considered highly unlikely based on fish habitat and spawning surveys and a literature review of available regional fisheries information.
- Known Chinook salmon spawning areas are over 100 km upstream, and chum salmon presence in the Stewart River is rare.
- Other fish species that may be present in the barging area include Arctic grayling, lake whitefish, round whitefish, slimy sculpin, northern pike, inconnu, burbot, least cisco, and longnose sucker.

Yukon River:

- Habitat at the proposed barge locations and along the barging route was considered as primarily rearing/migratory based on fish habitat assessment results.

- Salmon spawning in the immediate vicinity of the Yukon River barge landings is considered possible, though unlikely based on the fish habitat and spawning surveys, and a literature review of available regional fisheries information.
- Known Chinook salmon spawning areas are a long distance away, near and upstream of the Pelly River, and habitat conditions in the barging area did not meet criteria that is preferred by spawning Chinook salmon.
- Chum salmon were observed spawning in a side channel approximately 1 km downstream from the barging area. While this demonstrates that chum salmon do spawn in the area, they require groundwater discharge and prefer slow moving side channels for spawning.
- Other fish species that may be present in the barging area include Arctic grayling, lake whitefish, round whitefish, slimy sculpin, northern pike, inconnu, burbot, least cisco, Arctic lamprey, and longnose sucker.

Coffee-Casino Route:

Coffee Creek

- Five crossings were assessed in the Coffee Creek watershed that are along the Coffee-Casino road alignment.
- Site #1 was on the mainstem of Coffee Creek within a straight, low gradient riffle section of the creek dominated by cobble and gravel substrates. This site is fish bearing as Coffee Creek is known to support Arctic grayling, juvenile Chinook salmon, and slimy sculpin.
- Site #5 contained low quality habitat that was unlikely to support fish. However, no downstream barriers to fish passage were noted, and the site was considered to be potentially fish bearing.
- Site #3 was conservatively considered potentially fish bearing, although an aerial assessment suggested that the site could be classified as non-fish bearing in the future.
- Crossings #2 and #4 were considered non-fish bearing owing to underground flows, and a high gradient barrier noted downstream, respectively.

Britannia Creek

- One crossing site (#6) along the Coffee-Casino road alignment was located in the Britannia Creek watershed.
- The site is situated on upper Canadian Creek, upstream of a documented high gradient (>20%) cascade barrier.
- Site #6 was previously assessed and determined to be non-fish bearing (PECG, 2013).

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Appendix A

Fish Biological Characteristics, Coffee Gold Road Project, 2015

Appendix A. Fish Biological Characteristics, Coffee Gold Road Project, 2015

Date	Watercourse	Crossing ID	Method	Fish ID	Species	Length (mm)	Weight (g)	Comments
20-Aug-15	Maisy May Creek tributary	81	EF	1	GR	254	291	
20-Aug-15	Maisy May Creek tributary	81	EF	2	GR	294	297	
21-Aug-15	Black Hills Creek	71	EF	3	GR	118	221	
21-Aug-15	Black Hills Creek	71	EF	4	GR	52	1.0	
21-Aug-15	Black Hills Creek	71	EF	5	GR	50	1.3	
21-Aug-15	Black Hills Creek	71	EF	6	GR	47	0.9	
21-Aug-15	Black Hills Creek	71	EF	7	GR	49	0.8	
22-Aug-15	Maisy May Creek	91	EF	8	BB	250	101	Juvenile burbot.
22-Aug-15	Maisy May Creek	91	EF	9	GR	204	95	
22-Aug-15	Maisy May Creek	91	EF	10	GR	190	70	Photo 197 - injury to dorsal area.
22-Aug-15	Maisy May Creek	91	EF	11	GR	113	12.1	
22-Aug-15	Maisy May Creek	91	EF	12	GR	117	15.7	
22-Aug-15	Maisy May Creek	91	EF	13	CCG	63	2.6	
22-Aug-15	Maisy May Creek	91	EF	14	CCG	66	3.0	
22-Aug-15	Maisy May Creek	91	EF	15	CCG	63	3.4	
22-Aug-15	Maisy May Creek	91	EF	16	CCG	66	3.1	
22-Aug-15	Maisy May Creek	91	EF	17	CCG	58	1.5	
22-Aug-15	Maisy May Creek	91	EF	18	CCG	62	2.8	
22-Aug-15	Maisy May Creek	91	EF	19	CH	72	3.9	
22-Aug-15	Maisy May Creek	91	EF	20	CCG	62	2.4	
22-Aug-15	Maisy May Creek	91	EF	21	CH	66	4.2	
22-Aug-15	Maisy May Creek	91	EF	22	CH	59	3.4	
22-Aug-15	Maisy May Creek	91	EF	23	CH	62	3.2	

Notes: EF=Electrofishing, AG=Arctic grayling, CCG=slimy scupin, CH=juvenile Chinook salmon, BB=Burbot

Appendix B1

Northern Route Fish Habitat Site Cards and Crossing Photos, Coffee Gold Road Project, 2015

Appendix B1. Fish Habitat Site Cards and Crossing Photos, Coffee Gold Road Project, 2015

In Sheet key

-	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
DEC	Deciduous trees (general)
GR	Grass
MI	Mixed forest
PO	Poplar
SH	Shrub
SP	Spruce
WI	Willow

Channel Pattern:

ST	Straight
SI	Sinuous
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

d/s	downstream
u/s	upstream
GR	Arctic grayling
COND	Conductivity in μs/cm
xing	crossing
P#	Photo number

Coffee Gold Road Northern Route Crossing #51

			D/S (50m)	X	U/S (50m)
Coordinates:	611313	Gradient (%):	2	4	-
	7055107	Bankfull Width (m):	0.3	1.1	-
Site Visit Date:	18/08/15	Bankfull Depth (m):	0.1	0.1	-
Flow Conditions:	High	Wetted Widths (m):	0.3	1	-
Barrier (Y/N):	N	Wetted Depth (m):	0.1	0.1	-
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	F	F	-
Gee Trapping:	N	Substrate Bank:	F	F	-
Fish present?:	See below	Riparian Vegetation:	WI/SP	WI/SP	WI/SP
Site Length:	100m	Meander Pattern:	IM	IM	-
		Cover (%/Dom):	95%/OV	5%/OV	-

Photo #s	17 u/s	18 x	19 d/s	pH:	7.1	
Areas of Erosion:	-			Temperature:	5.1	
Locations:				Specific Conductivity:	102 (µs/cm)	COND = 63
				Dissolved Oxygen	10.80 (mg/L)	92 (% Sat)

Comments:
No Culvert
Indian River Tributary
Some instream vegetation
Some grasses and willows submerged = high water conditions
Very unlikely to support fish
At U/S site: Discontinuous flow; creek not well defined; permafrost melt driven (possible). No measurements possible.
At D/S site: Channel not well defined; rusty colored water (turbid); denser willow cover 100%, multiple dispersed shallow channels present.
at Xing: water spilling over road from upstream spring
Xing measurements just upstream of ponding water on upstream side of road

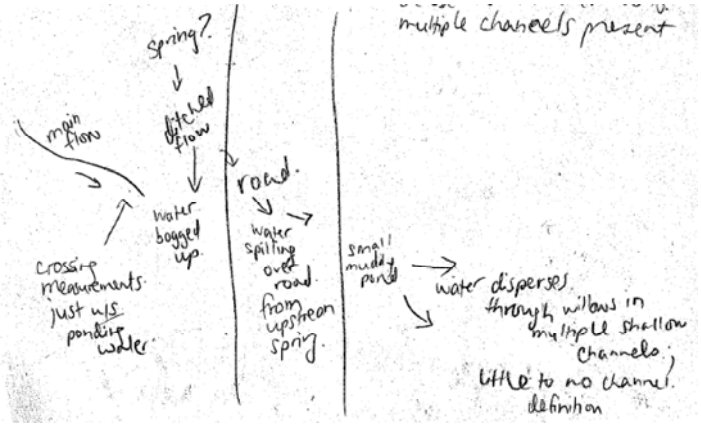
Upstream

Crossing

Coffee Gold Road Northern Route Crossing #51

Downstream

Site Illustration



Coffee Gold Road Northern Route Crossing #52

				D/S (50m)	X	U/S (50m)
Coordinates:	610129		Gradient (%):	3	5	5
	7055369		Bankfull Width (m):	1.4	2+	1.35
Site Visit Date:	18/08/15		Bankfull Depth (m):	0.08	0.09	0.22
Flow Conditions:	High		Wetted Widths (m):	1.4	2+	1.35
Barrier (Y/N):	N		Wetted Depth (m):	0.08	0.09	0.22
Electrofish effort:	N		Substrate Bed (Dom/SubDom):	G/C	F	F
Gee Trapping:	N		Substrate Bank:	G/F	F	F
Fish present?:	See below		Riparian Vegetation:	WI	WI	WI
Site Length:	100m		Meander Pattern:	IM	IR	IR
			Cover (%/Dom):	70/OV	100/OV	100/OV
Photo #s	20,21 u/s	22 x	23 d/s	pH:	7.9	
Areas of Erosion:	-			Temperature:	5.2 (°C)	
Locations:				Specific Conductivity:	295 (µs/cm)	COND = 183
				Dissolved Oxygen	11.02 (mg/L)	94 (% Sat)

Comments:
Indian River tributary
Flow through metal pipe under road, major ponding occuring upstream (Photo #21)
Turbid water before reaches road
Disturbed areas; gravel rock piles
Very unlikely to support fish
Photo #24, u/s at d/s site
xing measurements just upstream of large pond on upstream side of road

Upstream

Upstream view with major ponding

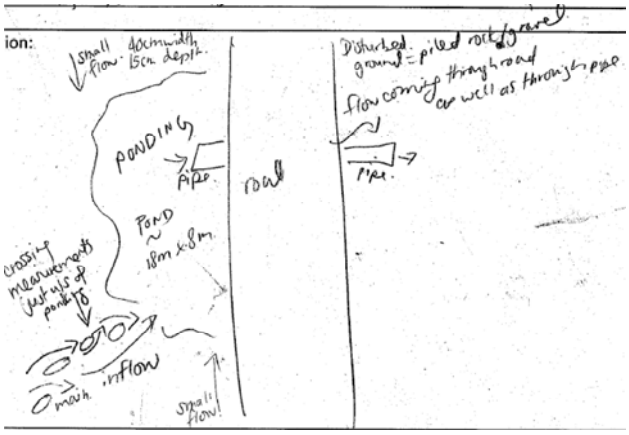
Coffee Gold Road Northern Route Crossing #52

Crossing

Downstream

Upsteam view at downstream site

Site Illustration



Coffee Gold Road Northern Route Crossing #53

			D/S (50m)	X	U/S (50m)
Coordinates:	609658	Gradient (%):	2	2	2
	7055218	Bankfull Width (m):	1	2.5	1
Site Visit Date:	18/08/15	Bankfull Depth (m):	0.18	0.06	0.12
Flow Conditions:	High	Wetted Widths (m):	1	2.5	1
Barrier (Y/N):	N	Wetted Depth (m):	0.18	0.06	0.12
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	F/G	G/F	F
Gee Trapping:	N	Substrate Bank:	F/G	F	F
Fish present?:	See below	Riparian Vegetation:	WI	WI/GR	WI
Site Length:	100m	Meander Pattern:	IM	SI	IM
		Cover (%/Dom):	90%/OV	5%/OV	90%/OV

Photo #s	25 u/s	26 x	27 d/s	pH:	7.8	
Areas of Erosion:	Y			Temperature:	6.4 (°C)	
Locations:	Disturbed areas around channel near road.			Specific Conductivity:	1365 (µs/cm)	COND = 879
				Dissolved Oxygen	10.61 (mg/L)	93.3 (% Sat)

Comments:	Indian River Trib
Water clearer than previous two crossings.	
Large pond formed u/s of metal pipe	
marl observed	
xing measurements upstream of ponding on upstream side of road	
downstream side: disturbed area, pipe is flattened, overgrowth of willows and channel not well defined	
upstream side: lots of disturbance and ponding	
very unlikely to support fish	

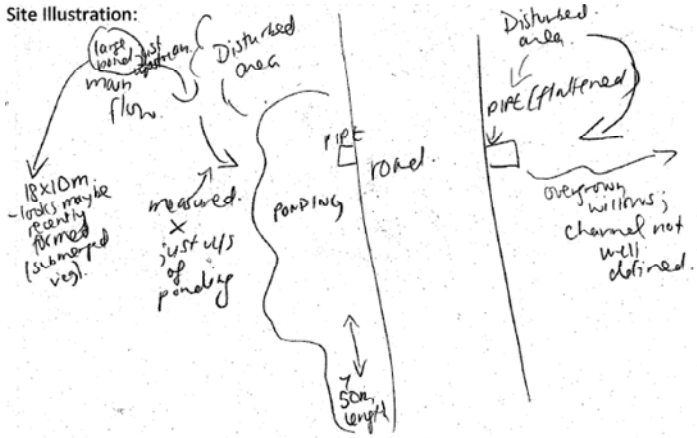
Upstream

Crossing

Coffee Gold Road Northern Route Crossing #53

Downstream

Site Illustration



Coffee Gold Road Northern Route Crossing #54

				D/S (50m)	X	U/S (50m)
Coordinates:	609204		Gradient (%):	-	-	-
	7055294		Bankfull Width (m):	-	-	-
Site Visit Date:	18/08/15		Bankfull Depth (m):	-	-	-
Flow Conditions:	none		Wetted Widths (m):	-	-	-
Barrier (Y/N):	N		Wetted Depth (m):	-	-	-
Electrofish effort:	N		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N		Substrate Bank:	-	-	-
Fish present?:	see below		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	29 u/s	28 x	d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

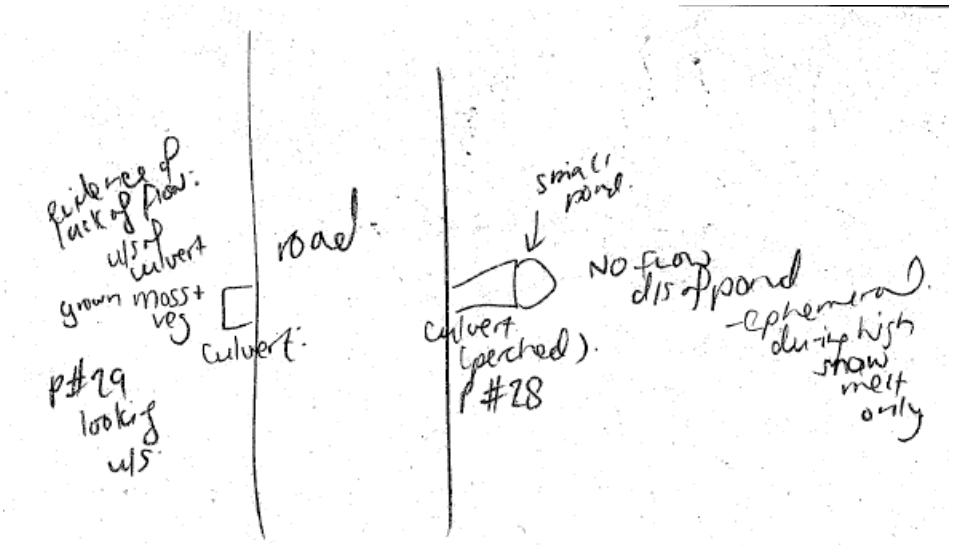
Comments:
No flow; likely only flows during high snow melt.
Very unlikely to support fish.
Limited, poor channel definition.
P#28 - perched culvert

Perched Culvert

Upstream from road

Coffee Gold Road Northern Route Crossing #54

Site Illustration



Coffee Gold Road Northern Route Crossing #54.5

			D/S (50m)	X	U/S (50m)
Coordinates:	607870	Gradient (%):	16	1	1
	7055247	Bankfull Width (m):	1.2	0.55	1
Site Visit Date:	18/08/15	Bankfull Depth (m):	0.3	0.07	0.04
Flow Conditions:	High	Wetted Widths (m):	0.6	0.55	1
Barrier (Y/N):	Y - Outlet to culvert very steep.	Wetted Depth (m):	0.02	0.07	0.04
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	G/C	F	F
Gee Trapping:	N	Substrate Bank:	F	F	F
Fish present?:	N	Riparian Vegetation:	WI	WI/DEC	WI/DEC
Site Length:	100m	Meander Pattern:	SI	IM	IM
		Cover (%/Dom):	10/OV	30/OV	80/OV

Photo #s	32 u/s	n/a x	30, 31 d/s	pH:	7.62
Areas of Erosion:	Y			Temperature:	7.9 (°C)
Locations:	Dirt slope on d/s side of road is eroding.			Specific Conductivity:	81.2 (µs/cm) COND = 54.7
				Dissolved Oxygen	10.03 (mg/L) 91.1 (% Sat)

Comments:	Eureka Creek Trib
High gradient barrier downstream (28%) over 10m	
Enters Eureka downstream	
very unlikely to support fish in downstream section	
barrier present just d/s road	
P#33 shows where tributary enters mainstem Eureka Creek	

Downstream

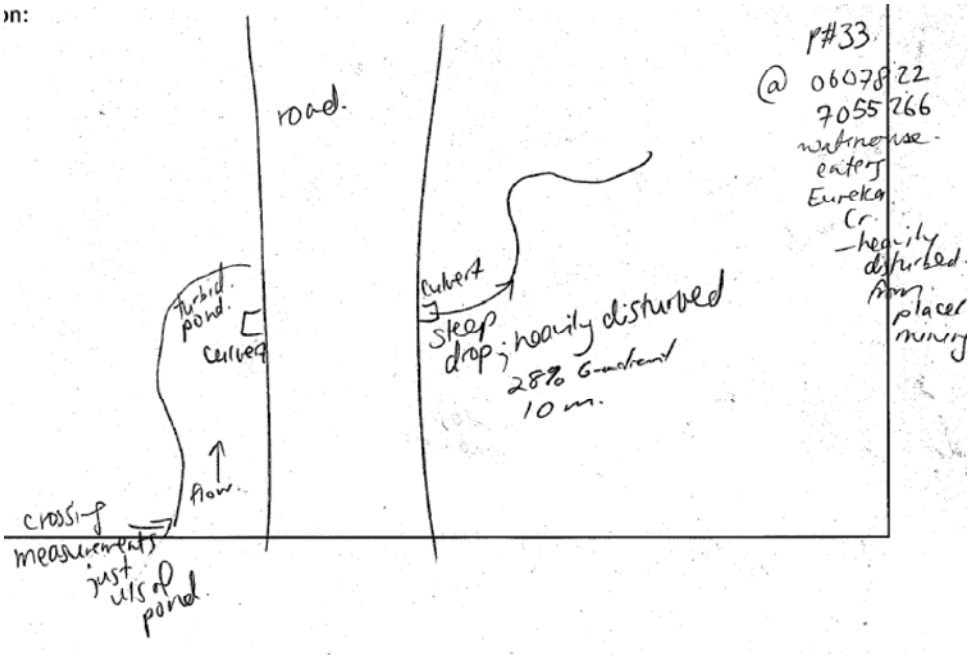
Downstream

Coffee Gold Road Northern Route Crossing #54.5

Upstream

Tributary enters mainstem Eureka Creek

Site Illustration



Coffee Gold Road Northern Route Crossing # 55

			D/S (50m)	X	U/S (50m)
Coordinates:	607647	Gradient (%):	2	2	2
	7054980	Bankfull Width (m):	16	~ 30 m	10
Site Visit Date:	18/08/15	Bankfull Depth (m):	0.4	0.63	~ 0.77
Flow Conditions:	mid-low	Wetted Widths (m):	4.3	2.4	3
Barrier (Y/N):	N	Wetted Depth (m):	0.1	0.18	0.17
Electrofish effort:	Y - see sampling data	Substrate Bed (Dom/SubDom):	G/F	G/C	G/F
Gee Trapping:	N	Substrate Bank:	G/F	F	G/F
Fish present?:	see below	Riparian Vegetation:	WI	WI/GR	WI/GR
Site Length:	100m	Meander Pattern:	IM	IM	SI
		Cover (%/Dom):	<5%/OV	<5%/OV	<5%/OV

Photo #s	34 u/s	36 x	35 d/s	pH:	7.62	
Areas of Erosion:	Y			Temperature:	10.4 (°C)	
Locations:	placer claim			Specific Conductivity:	512 (µs/cm)	COND = 369
				Dissolved Oxygen	992 (mg/L)	95.7 (% Sat)

Comments:	Eureka Creek mainstem
Heavily disturbed from placer activity	
Culvert - undersized and road eroding above it P#37	
unlikely to support fish under current flows, very shallow, turbid, fast-flowing water.	
no pool habitat and substrate quite embedded.	
P#38 looking downstream from placer pond at road	
Overall rank: likely fish-bearing	

Upstream

Downstream

Coffee Gold Road Northern Route Crossing # 55

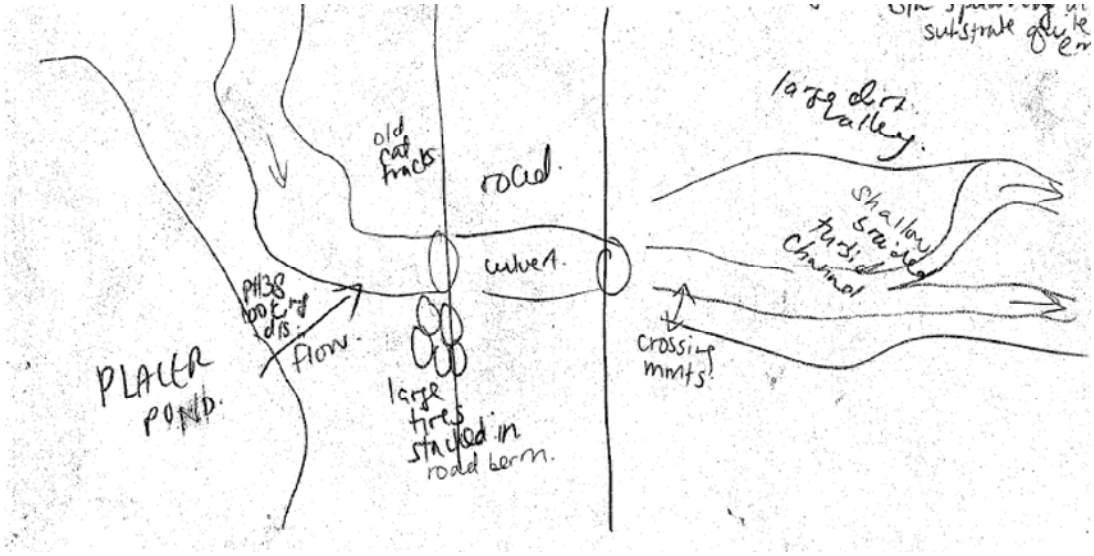
Crossing

Culvert

Looking d/s from placer pond

From top of EF site looking d/s

Site Illustration



Coffee Gold Road Northern Route Crossing #57

			D/S (50m)	X	U/S (50m)
Coordinates:	606801	Gradient (%):	-	-	-
	7053676	Bankfull Width (m):	-	-	-
Site Visit Date:	18/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	High	Wetted Widths (m):	0.3	-	0.25
Barrier (Y/N):	N	Wetted Depth (m):	0.14	-	0.02
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N	Substrate Bank:	-	-	-
Fish present?:	see below	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-
Photo #s	40 u/s	x 39 d/s	pH:	-	
Areas of Erosion:	-		Temperature:	-	
Locations:			Specific Conductivity:	-	
			Dissolved Oxygen	-	-

Comments:	Eureka Creek trib
No visible channel/ditch	
very small trickle flowing through small culvert	
spring off hillside, on u/s side follows road up for a while and then dries up -> no visible channel on u/s end	
shallow dispersed muddy flow near main stem Eureka	
very unlikely to support fish; not supporting fish at current flows	
Eureka Creek will backflood up to 7m from d/s end of culvert in spring	
Small drop at edge at 7m; marking floodplain of mainstem and will likely prohibit fish movement towards culvert (0.8m drop from road); Photo 46 shows Eureka Creek floodplain looking upstream towards road	

Downstream

Upstream

Coffee Gold Road Northern Route Crossing #57

Standing in Eureka Creek floodplain looking u/s at road

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #58

				D/S (50m)	X	U/S (50m)
Coordinates:	606489		Gradient (%):	-	-	-
	7053226		Bankfull Width (m):	-	-	-
Site Visit Date:	19/08/15		Bankfull Depth (m):	-	-	-
Flow Conditions:	n/a		Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a		Wetted Depth (m):	-	-	-
Electrofish effort:	n/a		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	48 u/s	x	47 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:
Gully; no evidence of water scour.
Not fish habitat.

Downstream

Upstream

Coffee Gold Road Northern Route Crossing #59

				D/S (50m)	X	U/S (50m)
Coordinates:	605410		Gradient (%):	-	-	-
	7053301		Bankfull Width (m):	-	-	-
Site Visit Date:	19/08/15		Bankfull Depth (m):	-	-	-
Flow Conditions:	n/a		Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a		Wetted Depth (m):	-	-	-
Electrofish effort:	n/a		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	u/s	50 x 49	d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:
No channel or visible flow.
No fish habitat.

Downstream

Crossing

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #60

			D/S (50m)	X	U/S (50m)
Coordinates:	605323	Gradient (%):	-	-	-
	7053389	Bankfull Width (m):	-	-	-
Site Visit Date:	18/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	n/a	Wetted Widths (m):	-	-	-
Barrier (Y/N):	Y	Wetted Depth (m):	-	-	-
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-
Photo #s	u/s 45 x 44 d/s	pH:	-		
Areas of Erosion:	-	Temperature:	-		
Locations:		Specific Conductivity:	-		
		Dissolved Oxygen	-	-	

Comments:
No flow
No visible channel upstream
Some evidence of scour downstream; steep drop off slope > 30% (barrier to fish passage)
Not supporting fish

Downstream

Crossing

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #61

				D/S (50m)	X	U/S (50m)
Coordinates:	605095		Gradient (%):	-	-	-
	7053749		Bankfull Width (m):	-	-	-
Site Visit Date:	18/08/15		Bankfull Depth (m):	-	-	-
Flow Conditions:	none		Wetted Widths (m):	-	-	-
Barrier (Y/N):	N		Wetted Depth (m):	-	-	-
Electrofish effort:	N		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N		Substrate Bank:	-	-	-
Fish present?:	see below		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	41 u/s	43 x	42 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Eureka Creek trib
No flow.	
Very unlikely to support fish when flowing.	
Only flows likely at snowmelt	
< 1 m width	

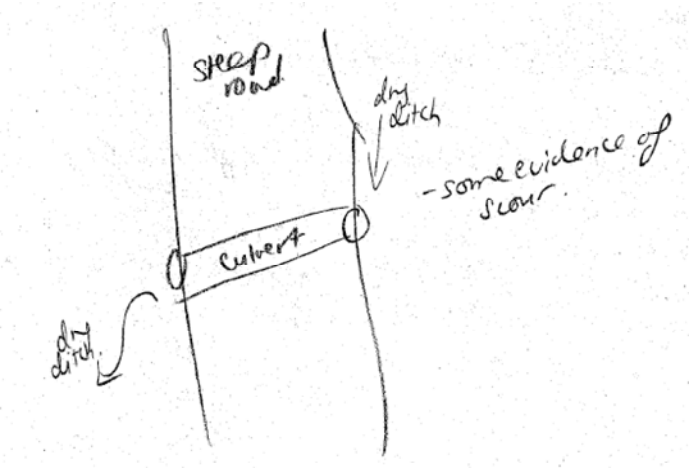
Upstream

Downstream

Coffee Gold Road Northern Route Crossing #61

Crossing

Site Illustration



Coffee Gold Road Northern Route Crossing #62

				D/S (50m)	X	U/S (50m)
Coordinates:	601660		Gradient (%):	-	-	-
	7052521		Bankfull Width (m):	-	-	-
Site Visit Date:	19/08/15		Bankfull Depth (m):	-	-	-
Flow Conditions:	none		Wetted Widths (m):	-	-	-
Barrier (Y/N):	Y		Wetted Depth (m):	-	-	-
Electrofish effort:	N		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	53 u/s	52 x	51 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Upper Eureka Creek drainage
No visible channel upstream	
Some scour (minor) across road	
Very limited evidence of scour downstream; vegetation growing in channel, a couple of puddles.	
Not fish habitat; may conduct minor flow at snowmelt but not accessible to fish	
Noted high gradient barrier using mapping downstream	

Downstream

Crossing

Coffee Gold Road Northern Route Crossing #62

Upstream

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #63

			D/S (50m)	X	U/S (50m)
Coordinates:	606312	Gradient (%):	-	-	-
	7042629	Bankfull Width (m):	-	-	-
Site Visit Date:	19/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	none	Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a	Wetted Depth (m):	-	-	-
Electrofish effort:	n/a	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	u/s	55 x	54 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Black Hills drainage
No visible channel	
No fish habitat	

Downstream

Crossing

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #63.5

				D/S (50m)	X	U/S (50m)
Coordinates:	606433		Gradient (%):	4	4	4
	7042377		Bankfull Width (m):	6	10.5	4.8
Site Visit Date:	19/08/15		Bankfull Depth (m):	0.4	0.17	0.22
Flow Conditions:	mid-flow		Wetted Widths (m):	2.5	7.7	2.8
Barrier (Y/N):	N		Wetted Depth (m):	0.15	0.07	0.1
Electrofish effort:	N		Substrate Bed (Dom/SubDom):	C/G	G/C	C/G
Gee Trapping:	N		Substrate Bank:	C/F	F/G	F
Fish present?:	see below		Riparian Vegetation:	WI/DEC	WI/DEC	WI/DEC
Site Length:	100m		Meander Pattern:	RM	IM	RM
			Cover (%/Dom):	<5%/OV	<5%/B	<5%/OV
Photo #s	56 u/s	58 x	57 d/s	pH:	7.85	
Areas of Erosion:	Y			Temperature:	5.7 (°C)	
Locations:	off of road/ford			Specific Conductivity:	229.6 µs/cm	COND = 145
				Dissolved Oxygen	11.85 (mg/L)	102 (% Sat)

Comments:	Black Hills Trib
Note: Road did not cross at #63 as marked on mapping, but instead further south here.	
Shallow fast riffle; no pool habitat.	
Water too low under current flow conditions to permit adult, sub-adult grayling passage.	
Note: evidence of old placer disturbance at upstream site, berms of large substrate forming banks with some shrub vegetation.	
Likely fish-bearing	

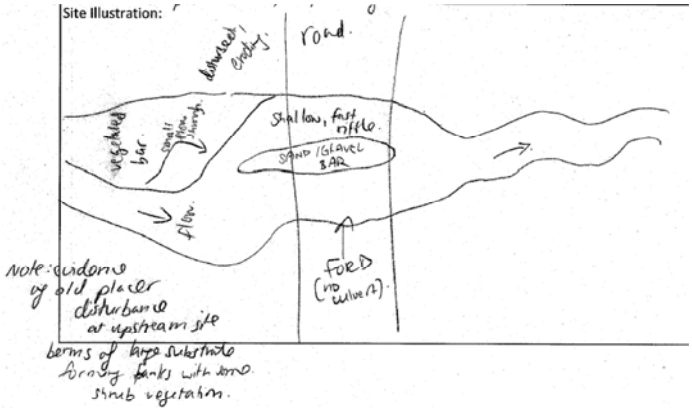
Upstream

Downstream

Coffee Gold Road Northern Route Crossing #63.5

Crossing

Site Illustration



Coffee Gold Road Northern Route Crossing #64

			D/S (50m)	X	U/S (50m)
Coordinates:	607120	Gradient (%):	-	-	-
	7041729	Bankfull Width (m):	-	-	-
Site Visit Date:	19/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	none	Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a	Wetted Depth (m):	-	-	-
Electrofish effort:	n/a	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	61 u/s	60 x	59 d/s	pH:	-
Areas of Erosion:	-			Temperature:	-
Locations:				Specific Conductivity:	-
				Dissolved Oxygen	-

Comments:
No visible channel
No fish habitat

Upstream

Crossing

Coffee Gold Road Northern Route Crossing #64

Downstream

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #65

			D/S (50m)	X	U/S (50m)
Coordinates:	607817	Gradient (%):	22	2	2
	7040618	Bankfull Width (m):	4.6	4.5	1
Site Visit Date:	19/08/15	Bankfull Depth (m):	0.45	0.14	0.1
Flow Conditions:	mid-high	Wetted Widths (m):	2.1	6.7	1
Barrier (Y/N):	Y	Wetted Depth (m):	0.1	0.11	0.1
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	B/G	G/F	F/G
Gee Trapping:	N	Substrate Bank:	C/G	F	F
Fish present?:	N	Riparian Vegetation:	NONE	WI/SH	WI/SH
Site Length:	100m	Meander Pattern:	SI	SI	IM
		Cover (%/Dom):	5%/B	5%/OV	100%/OV

Photo #s	62 u/s	63 x	64 d/s	pH:	7.55
Areas of Erosion:	Y		Temperature:	2.9 (°C)	
Locations:	at road and d/s		Specific Conductivity:	120.6 (µs/cm)	COND = 69.7
			Dissolved Oxygen	12.61 (mg/L)	100.3 (% Sat)

Comments:	Black Hills trib - not fish habitat
Approx 20-30 m u/s flow goes underground ~ 10 m (fish barrier).	
Photo #s 65-66 - from bottom high gradient barrier looking u/s (22%)	
Some natural vegetation upstream	
water fairly turbid	
distubed area with cobble/boulder pile downstream; no riparian vegetation	
artificial channel d/s of ford with high gradient barrier	

Upstream

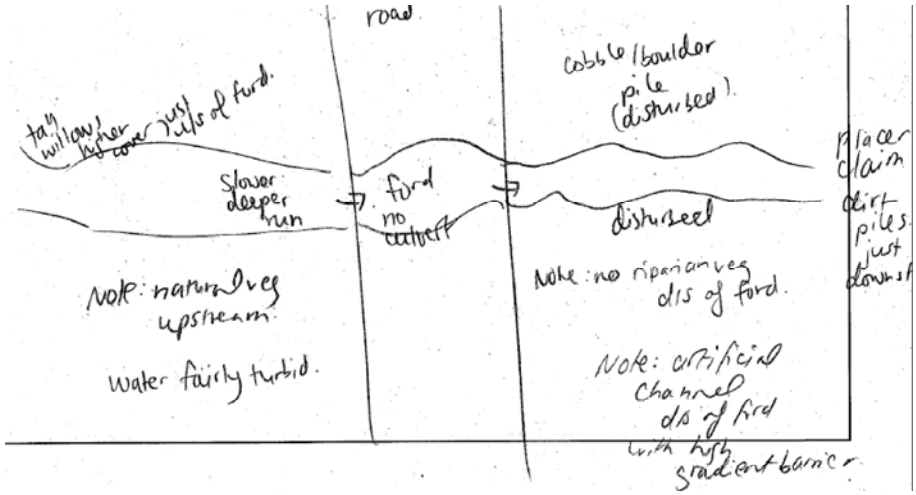
Crossing

Coffee Gold Road Northern Route Crossing #65

Downstream

From bottom of high gradient barrier looking u/s

Site Illustration



Coffee Gold Road Northern Route Crossing #69

			D/S (50m)	X	U/S (50m)
Coordinates:	608009	Gradient (%):	-	1	-
	7039938	Bankfull Width (m):	-	no defined channel (n/a)	-
Site Visit Date:	19/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	mid-flow	Wetted Widths (m):	-	0.4	-
Barrier (Y/N):	Y	Wetted Depth (m):	-	0.2	-
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	-	F	F
Gee Trapping:	N	Substrate Bank:	-	F	F
Fish present?:	N	Riparian Vegetation:	-	WI/DEC	WI/DEC
Site Length:	100m	Meander Pattern:	-	IM	-
		Cover (%/Dom):	-	100%/OV	-

Photo #s	70 u/s	69 x	67, 68 d/s	pH:	6.58
Areas of Erosion:	N			Temperature:	8.5 (°C)
Locations:				Specific Conductivity:	82.7 (µs/cm) COND = 56.7
				Dissolved Oxygen	2.85 (mg/L) 24.2 (% Sat)

Comments:	Black Hills Drainage - Not fish habitat
No culvert; draining through road; stagnant pond forming upstream.	
Photo # 67 shows where water comes through ground under the road. 68 shows slow flow looking d/s	
Downstream: No defined channel; flow disperses and runs through grass, not passable to fish. Photo #71	

Downstream

Downstream

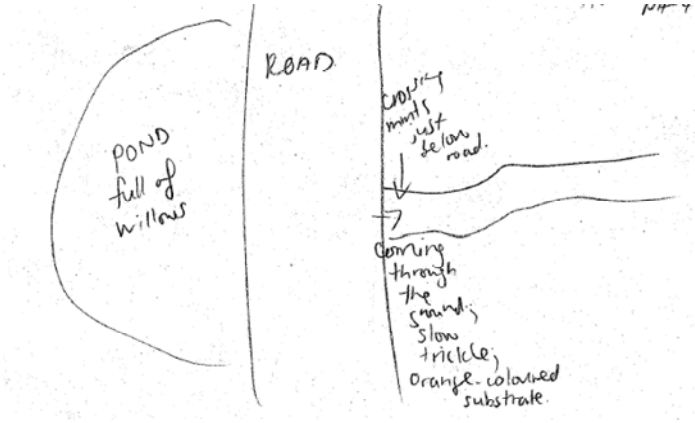
Coffee Gold Road Northern Route Crossing #69

Crossing

Upstream

Downstream - no defined channel

Site Illustration



Coffee Gold Road Northern Route Crossing #69.5 - unmapped

			D/S (50m)	X	U/S (50m)
Coordinates:	608013	Gradient (%):	2	2	WETLAND
	7039540	Bankfull Width (m):	0.4	0.65	-
Site Visit Date:	19/08/15	Bankfull Depth (m):	0.05	0.15	-
Flow Conditions:	mid to high	Wetted Widths (m):	0.4	0.65	-
Barrier (Y/N):	N	Wetted Depth (m):	0.05	0.15	-
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	F/G	G/F	-
Gee Trapping:	N	Substrate Bank:	F	F	-
Fish present?:	see below	Riparian Vegetation:	WI/MI	WI/DEC	-
Site Length:	100m	Meander Pattern:	IM	IM	-
		Cover (%/Dom):	80/OV	80/OV	-

Photo #s	72 u/s	73 x	74, 75 d/s	pH:	7.1	
Areas of Erosion:	N			Temperature:	7.10 (°C)	
Locations:				Specific Conductivity:	126.9 (µs/cm)	COND = 846
				Dissolved Oxygen	9.18 (mg/L)	82.2 (% Sat)

Comments:
Photo#72 - Flow unobservable under horsetails u/s.
Photo #74 - D/S view
Photo #75 - Water originating under road; no culvert.
Very unlikely to support fish; not passable to fish at current flow
No pools, very shallow, low channel definition.
crossing measurements taken just downstream of road
P #76 at downstream site looking d/s; water orange coloured

Upstream

Crossing

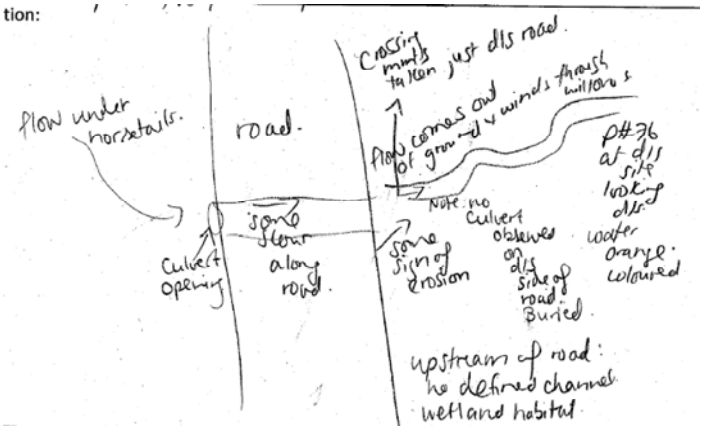
Coffee Gold Road Northern Route Crossing #69.5 - unmapped

Downstream

Downstream

Downstream looking downstream

Site Illustration



Coffee Gold Road Northern Route Crossing #70

			D/S (50m)	X	U/S (50m)
Coordinates:	608063	Gradient (%):	3	3	2
	7039220	Bankfull Width (m):	1.14	0.98	0.85
Site Visit Date:	19/08/15	Bankfull Depth (m):	0.18	0.05	0.22
Flow Conditions:	Mid to High	Wetted Widths (m):	0.42	0.98	0.5
Barrier (Y/N):	Y	Wetted Depth (m):	0.1	0.05	0.12
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	F	F/G	F
Gee Trapping:	N	Substrate Bank:	F	F	F
Fish present?:	N	Riparian Vegetation:	WI/MI	WI/MI	WI/MI
Site Length:	100m	Meander Pattern:	IM	IM	IM
		Cover (%/Dom):	80/OV	80/OV	80/OV

Photo #s	77 u/s	78 x	79 d/s	pH:	7.21
Areas of Erosion:	Y		Temperature:	4.9 (°C)	
Locations:	ford		Specific Conductivity:	124.2 (µs/cm)	COND = 76.3
			Dissolved Oxygen	11.75 (mg/L)	98.6 (% Sat)

Comments:	Black Hills Trib
High gradient drop just d/s of road barrier to fish passage - 34%	
No habitat definition, pools not present, muddy substrate.	

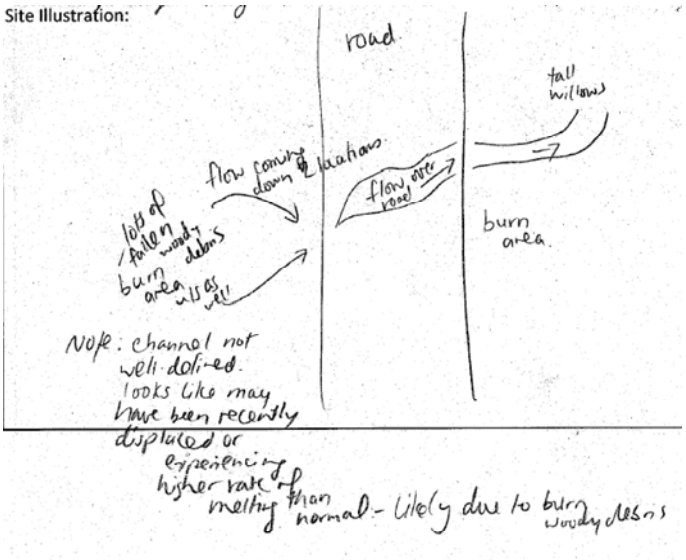
Upstream

Crossing

Coffee Gold Road Northern Route Crossing #70

Downstream

Site Illustration



Coffee Gold Road Northern Route Crossing #71

				D/S (50m)	X	U/S (50m)
Coordinates:	607960		Gradient (%):	2	2	2
	7038666		Bankfull Width (m):	8	13	9.5
Site Visit Date:	19/08/15		Bankfull Depth (m):	0.3	0.25	0.37
Flow Conditions:	Mid to High		Wetted Widths (m):	6.6	11	5.7
Barrier (Y/N):	N		Wetted Depth (m):	0.26	0.2	0.23
Electrofish effort:	Y		Substrate Bed (Dom/SubDom):	G/C	F/G	C/B
Gee Trapping:	Y		Substrate Bank:	G/F	F	F/C
Fish present?:	Y		Riparian Vegetation:	WI/DEC	WI/DEC	WI/DEC
Site Length:	100m		Meander Pattern:	IM	RM	SI
			Cover (%/Dom):	10/OV	<5%/OV	10%/OV
Photo #s	80 u/s	81 x	82 d/s	pH:	7.87	
Areas of Erosion:	Y			Temperature:	7.8 (°C)	
Locations:	ford, banks made of bermed material			Specific Conductivity:	213 (µs/cm)	COND = 143.2
				Dissolved Oxygen	10.84 (mg/L)	97.4 (% Sat)

Comments:	Mainstem Black Hills Creek
Water very turbid - visibility poor and high flows	
Potential migratory corridor for GR if good pool habitat upstream.	
Pool habitat scarce.	
Fast shallow riffles uniform along site.	
sand, gravel debris piles make up some stream banks; previously disturbed areas	

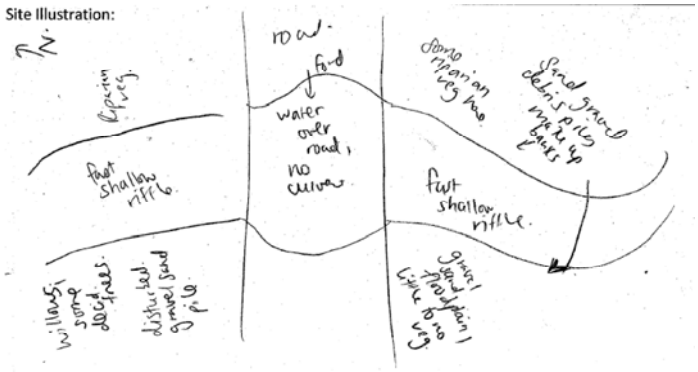
Upstream

Crossing

Coffee Gold Road Northern Route Crossing #71

Downstream

Site Illustration



Coffee Gold Road Northern Route Crossing #72

			D/S (50m)	X - across rd	U/S (50m)
Coordinates:	598186	Gradient (%):	-	68	-
	7038992	Bankfull Width (m):	-	6	-
Site Visit Date:	19/08/15	Bankfull Depth (m):	-	0.01	-
Flow Conditions:	Mid	Wetted Widths (m):	-	6	-
Barrier (Y/N):	Y - high gradient d/s road, 68%	Wetted Depth (m):	-	0.01	-
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	83 u/s	84 x	85 d/s	pH:	7.63
Areas of Erosion:	-		Temperature:	1.2 (°C)	
Locations:			Specific Conductivity:	127.2 (µs/cm)	COND = 69.3
			Dissolved Oxygen	12.48 (mg/L)	99 (% Sat)

Comments:	Dome Creek trib - Black Hills watershed
Not fish habitat; steep gradient drop d/s of road	

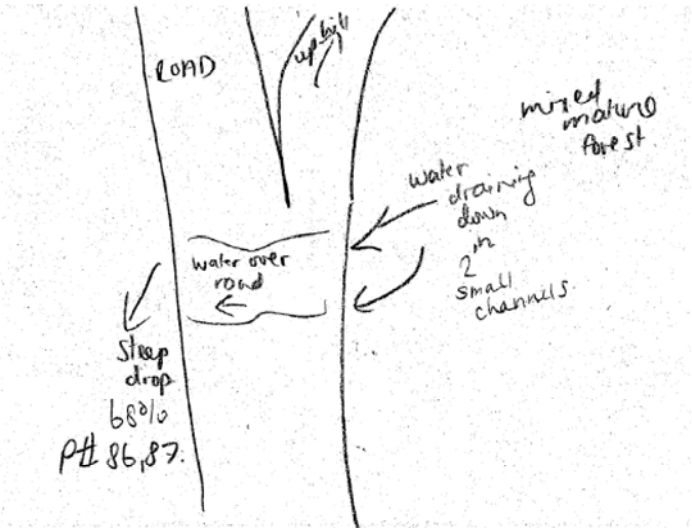
Upstream

Crossing

Coffee Gold Road Northern Route Crossing #72

Downstream

Site Illustration



Showing steep drop 68% barrier

Coffee Gold Road Northern Route Crossing #73

			D/S (50m)	X	U/S (50m)
Coordinates:	597985	Gradient (%):	-	-	-
	7087893	Bankfull Width (m):	-	-	-
Site Visit Date:	19/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	mid	Wetted Widths (m):	-	-	0.2
Barrier (Y/N):	Y - 38% gradient	Wetted Depth (m):	-	-	0.04
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	89 u/s	x	88 d/s	pH:	-
Areas of Erosion:	-			Temperature:	-
Locations:				Specific Conductivity:	-
				Dissolved Oxygen	-

Comments:
Not fish habitat
High gradient barrier 38% d/s of road.
Water flows along road ditch ~ 80 m.
No culvert.
measurements taken where water comes in from upstream next to road (P#90)

Downstream

Upstream

Coffee Gold Road Northern Route Crossing #73

Where water comes in u/s next to road

Coffee Gold Road Northern Route Crossing #74

			D/S (50m)	X	U/S (50m)
Coordinates:	598743	Gradient (%):	35-38%	-	-
	7029092	Bankfull Width (m):	-	-	-
Site Visit Date:	19/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	n/a	Wetted Widths (m):	-	0.37	-
Barrier (Y/N):	Y	Wetted Depth (m):	-	0.08	-
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	97 u/s	98 x	94, 95 d/s	pH:	7.17	
Areas of Erosion:	-			Temperature:	3.3 (°C)	
Locations:				Specific Conductivity:	74.6 (µs/cm)	COND = 43.6
				Dissolved Oxygen	12.10 (mg/L)	98.8 (% Sat)

Comments:	Maisy May tributary
Photo # 94 - U/S view at culvert downstream	
Photo # 95 - d/s view d/s of road	
Shallow high gradient barrier (> 30%) downstream.	
Not fish habitat	

Downstream

Downstream

Coffee Gold Road Northern Route Crossing #74

Crossing

Upstream

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #75

				D/S (50m)	X	U/S
Coordinates:	598946		Gradient (%):	-	-	-
	7027771		Bankfull Width (m):	-	-	2.42
Site Visit Date:	19/08/15		Bankfull Depth (m):	-	-	0.42
Flow Conditions:	Mid		Wetted Widths (m):	-	-	1.42
Barrier (Y/N):	Y		Wetted Depth (m):	-	-	0.25
Electrofish effort:	N		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	Y		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	98 u/s	99 x	100 d/s	pH:	-	
Areas of Erosion:	Y			Temperature:	-	
Locations:	placer disturbance			Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Maisy May upper watershed
Perched culvert prevents fish passage to upstream tributary (P#104 shows culvert drop)	
Note: another concern is the side channel that comes in parallel to the road and very close	
No perennial habitat noted upstream during flyover; active placer mining upstream	

Upstream

Crossing

Coffee Gold Road Northern Route Crossing #75

Downstream

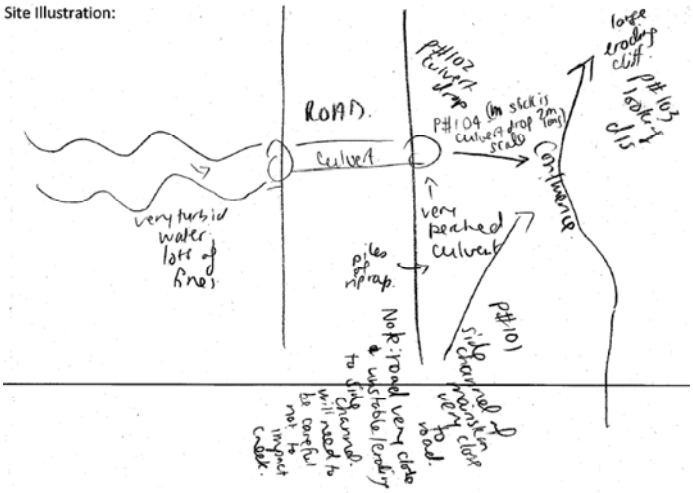
Side channel of mainstem

Perched culvert drop

Downstream

Culvert drop with metre stick

Site Illustration



Coffee Gold Road Northern Route Crossing #76

				D/S (50m)	X	U/S (50m)
Coordinates:	599266		Gradient (%):	37	-	-
	7027499		Bankfull Width (m):	-	-	2.6
Site Visit Date:	20/08/15		Bankfull Depth (m):	-	-	0.18
Flow Conditions:	Mid		Wetted Widths (m):	-	-	2.1
Barrier (Y/N):	Y		Wetted Depth (m):	-	-	0.1
Electrofish effort:	N		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	105 u/s	106 x	107-108 d/s	pH:	7.9	
Areas of Erosion:	Y			Temperature:	2.9 (°C)	
Locations:	Placer disturbance and road			Specific Conductivity:	180 (µs/cm)	COND = 105
				Dissolved Oxygen	12.88 (mg/L)	102 (% Sat)
Comments:	Maisy May trib					
Not fish habitat - high gradient barrier just below road, and continues steeply down to Maisy May.						

Upstream

Crossing

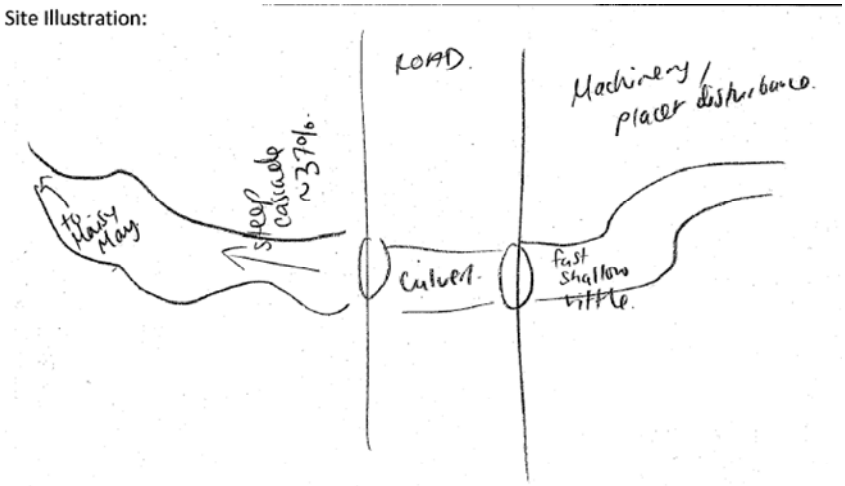
Coffee Gold Road Northern Route Crossing #76

Downstream

Downstream

Site Illustration

Site Illustration:



Coffee Gold Road Northern Route Crossing #77

				D/S (50m)	X	U/S (50m)
Coordinates:	599646		Gradient (%):	46	-	-
	7027033		Bankfull Width (m):	-	1.9	-
Site Visit Date:	20/80/15		Bankfull Depth (m):	-	0.36	-
Flow Conditions:	Mid		Wetted Widths (m):	-	1.7	-
Barrier (Y/N):	Y		Wetted Depth (m):	-	0.26	-
Electrofish effort:	N		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	109 u/s	110 x	111 d/s	pH:	7.56	
Areas of Erosion:	Y			Temperature:	2.3 (°C)	
Locations:	Road			Specific Conductivity:	171.6 (µs/cm)	COND = 97.3
				Dissolved Oxygen	12.75 (mg/L)	99.8 (% Sat)
Comments:	Maisy May trib					
Not fish habitat; high gradient barrier downstream						
P#112 from bottom of barrier looking upstream						

Upstream

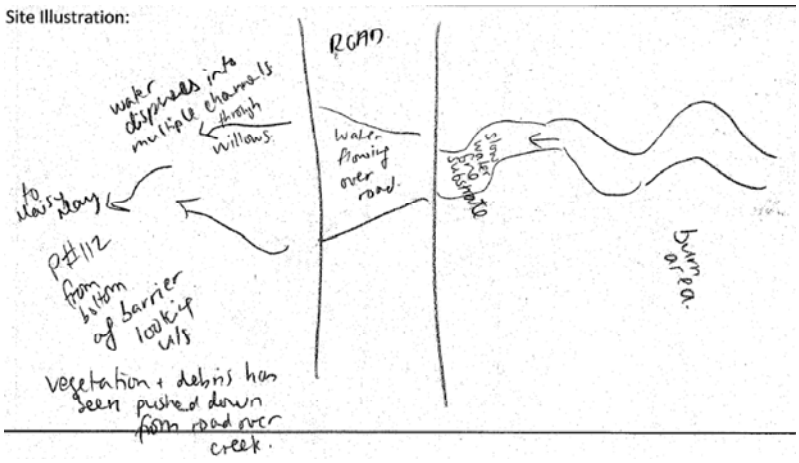
Crossing

Coffee Gold Road Northern Route Crossing #77

Downstream

From bottom barrier looking upstream

Site Illustration



Coffee Gold Road Northern Route Crossing #80

				D/S (50m)	X	U/S (50m)
Coordinates:	600659		Gradient (%):	26	-	-
	7025479		Bankfull Width (m):	-	1	-
Site Visit Date:	20/08/15		Bankfull Depth (m):	-	0.19	-
Flow Conditions:	Mid		Wetted Widths (m):	-	0.76	-
Barrier (Y/N):	Y		Wetted Depth (m):	-	0.07	-
Electrofish effort:	N		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	120 u/s	119 x	121 d/s	pH:	7.91	
Areas of Erosion:	Y			Temperature:	3.1 (°C)	
Locations:	Road; old gravel/sand piles.			Specific Conductivity:	284.5 (µs/cm)	COND = 166.2
				Dissolved Oxygen	12.54 (mg/L)	100.8 (% Sat)

Comments:	Maisy May trib
Not fish habitat - high gradient barrier d/s	
P#122 high gradient barrier 26%	
P#123 potentially old reservoir upstream, <1m deep and heavily silted in	
Creek above reservoir is steep and small	

Crossing

Upstream

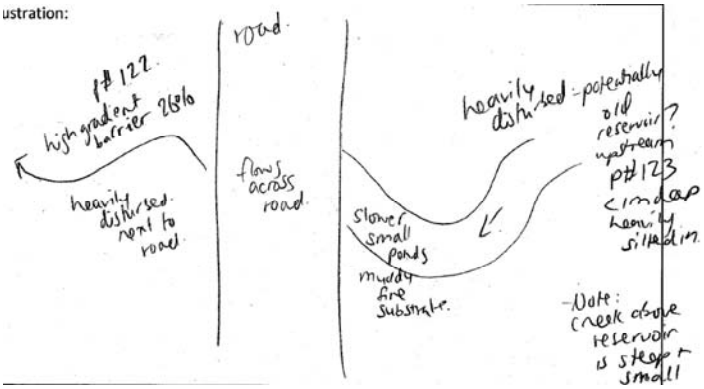
Coffee Gold Road Northern Route Crossing #80

Downstream

Potentially old reservoir

High gradient barrier 26%

Site Illustration



Coffee Gold Road Northern Route Crossing #80.5 - unmapped

			D/S (50m)	X	U/S (50m)
Coordinates:	601475	Gradient (%):	71	-	-
	7024366	Bankfull Width (m):	-	0.6	-
Site Visit Date:	20/08/15	Bankfull Depth (m):	-	0.15	-
Flow Conditions:	Mid	Wetted Widths (m):	-	0.5	-
Barrier (Y/N):	Y	Wetted Depth (m):	-	0.05	-
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	124 u/s	125 x	126 d/s	pH:	7.28	
Areas of Erosion:	-			Temperature:	1.7 (°C)	
Locations:				Specific Conductivity:	140.8 (µs/cm)	COND = 78.1
				Dissolved Oxygen	12.59 (mg/L)	96.9 (% Sat)

Comments:	Maisy May trib
very steep drop - not accessible to fish	

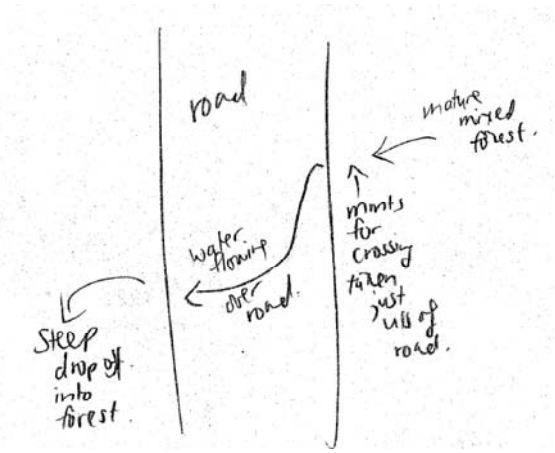
Upstream

Crossing

Coffee Gold Road Northern Route Crossing #80.5 - unmapped

Downstream

Site Illustration



Coffee Gold Road Northern Route Crossing #81

			D/S (50m)	X	U/S (50m)
Coordinates:	603009	Gradient (%):	4	1	3
	7021543	Bankfull Width (m):	0.55	3.6	1.3
Site Visit Date:	20/08/15	Bankfull Depth (m):	0.24	0.45	0.4
Flow Conditions:	High	Wetted Widths (m):	0.55	3.6	1.3
Barrier (Y/N):	N	Wetted Depth (m):	0.24	0.45	0.4
Electrofish effort:	Y	Substrate Bed (Dom/SubDom):	G/C	F	C/G
Gee Trapping:	Y	Substrate Bank:	F	F	F
Fish present?:	Y	Riparian Vegetation:	WI/Al	WI/SP	WI/SP
Site Length:	100m	Meander Pattern:	SI	RM	SI
		Cover (%/Dom):	5%/OV	10%/OV,U	70 /OV,U

Photo #s	127 u/s	128 x	129 d/s	pH:	7.95
Areas of Erosion:	Y - Road			Temperature:	3.0 (°C)
Locations:				Specific Conductivity:	262.9 (µs/cm) COND = 152.4
				Dissolved Oxygen	12.58 (mg/L) 98.7 (% Sat)

Comments:	Maisy May trib - only pool habitat noted u/s of the road ford. Pools shallower than 1m.
Saw 2 adult GR in pool u/s of road.	
Crossing measurements taken just upstream of ford	
Note: U/S site fast deep straight riffle; no pool habitat	
Some gravel substrate but fairly embedded.	
Fast medium gradient riffle habitat downstream to Maisy May	
Narrow riparian vegetation buffer around watercourse	

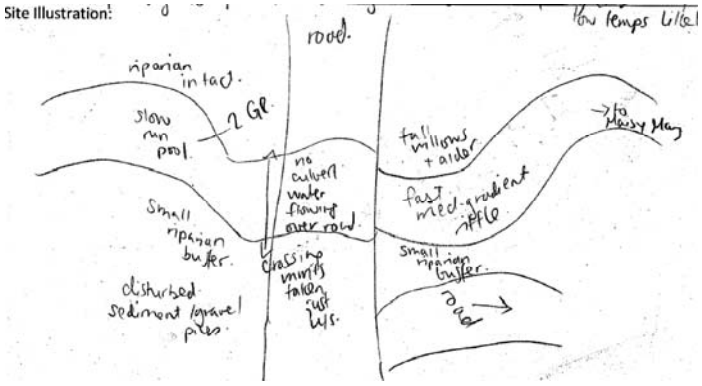
Upstream

Crossing

Coffee Gold Road Northern Route Crossing #81

Downstream

Site Illustration



Coffee Gold Road Northern Route Crossing #82

				D/S (50m)	X	U/S (50m)
Coordinates:	604813		Gradient (%):	-	-	-
	7019422		Bankfull Width (m):	-	-	-
Site Visit Date:	20/08/15		Bankfull Depth (m):	-	-	-
Flow Conditions:	none		Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a		Wetted Depth (m):	-	-	-
Electrofish effort:	n/a		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	131 u/s	132 x	130 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Maisy May drainage
No visible channel, no fish habitat	
Dry gully	

Downstream

Crossing

Coffee Gold Road Northern Route Crossing #82

Upstream

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #83

			D/S (50m)	X	U/S (50m)
Coordinates:	605027	Gradient (%):	-	-	-
	7018975	Bankfull Width (m):	-	-	-
Site Visit Date:	20/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	mid	Wetted Widths (m):	-	0.57	-
Barrier (Y/N):	Y	Wetted Depth (m):	-	0.02	-
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	136 u/s	135 x	134 d/s	pH:	8.32	
Areas of Erosion:	Y			Temperature:	3.7 (°C)	
Locations:	road, overburden			Specific Conductivity:	1034 (µs/cm)	COND = 613
				Dissolved Oxygen	12.55 (mg/L)	99.9 (% Sat)

Comments:	Maisy May trib
large overburden pile approx 30 m d/s of road crossing; flow seeping into it and no direct connectivity to Maisy May.	
Photo # 133	
No fish habitat	

Overburden pile

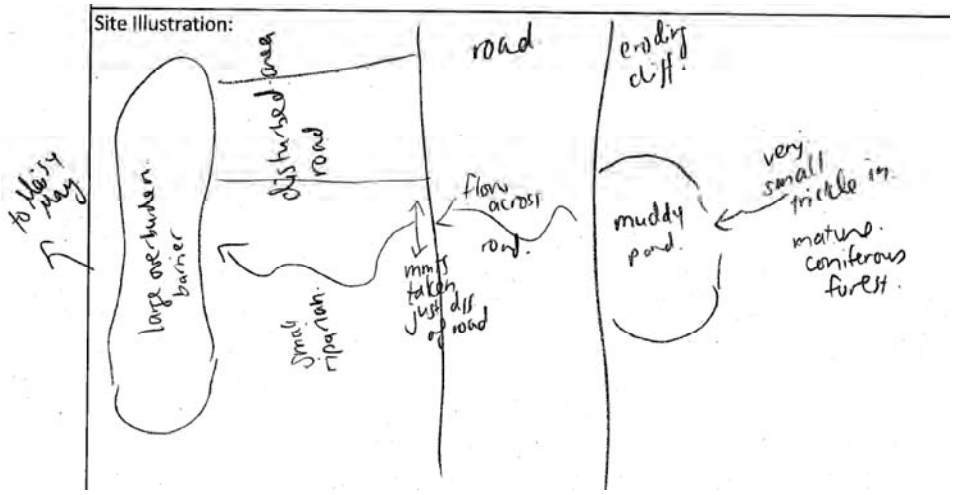
Downstream

Coffee Gold Road Northern Route Crossing #83

Crossing

Upstream

Site Illustration



Coffee Gold Road Northern Route Crossing #84

			D/S (50m)	X	U/S (50m)
Coordinates:	606584	Gradient (%):	-	-	-
	7017635	Bankfull Width (m):	-	-	-
Site Visit Date:	20/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	mid-high	Wetted Widths (m):	-	0.45	-
Barrier (Y/N):	Y	Wetted Depth (m):	-	0.17	-
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	141 u/s	140 x	139 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Maisy May drainage
~ 30 - 40 m d/s of road, no more visible pond/channel. Photo #137 - does not connect to Maisy May	
Photo #138 - showing pond d/s of road (u/s view) before it dries up.	
No fish habitat	
No culvert	

Approx 30-40 m d/s of road

Pond d/s of road

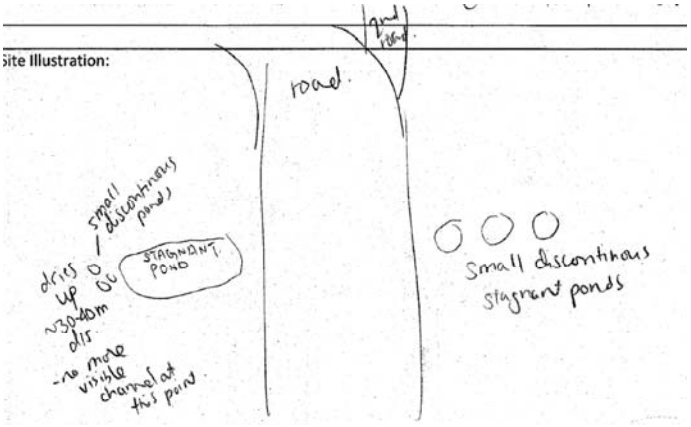
Coffee Gold Road Northern Route Crossing #84

Downstream

Crossing

Upstream

Site Illustration



Coffee Gold Road Northern Route Crossing #85

			D/S (50m)	X	U/S (50m)
Coordinates:	607856	Gradient (%):	-	-	-
	7015989	Bankfull Width (m):	-	-	-
Site Visit Date:	20/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	mid to high	Wetted Widths (m):	-	-	-
Barrier (Y/N):	Y	Wetted Depth (m):	-	-	-
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-
Photo #s	145, 146 u/s	144 x 142, 143 d/s	pH:	-	
Areas of Erosion:	-		Temperature:	-	
Locations:			Specific Conductivity:	-	
			Dissolved Oxygen	-	-

Comments:	Maisy May trib
Not fish habitat, channel not well defined, and small although at mid flow conditions.	
Several natural obstructions to fish passage d/s of perched culvert.	
very perched culvert and drop to shallow stagnant pool restricts passage of fish	
downstream site: stagnant discontinuous shallow pools	
upstream site: immediately dries up above road P#146; lots of deadfall	

Perched culvert

Downstream

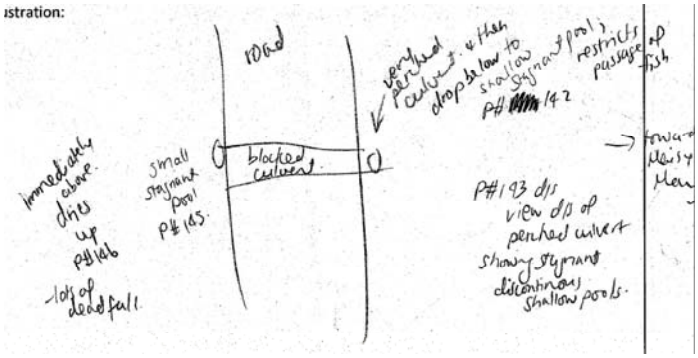
Coffee Gold Road Northern Route Crossing #85

Crossing

Upstream

Upstream

Site Illustration



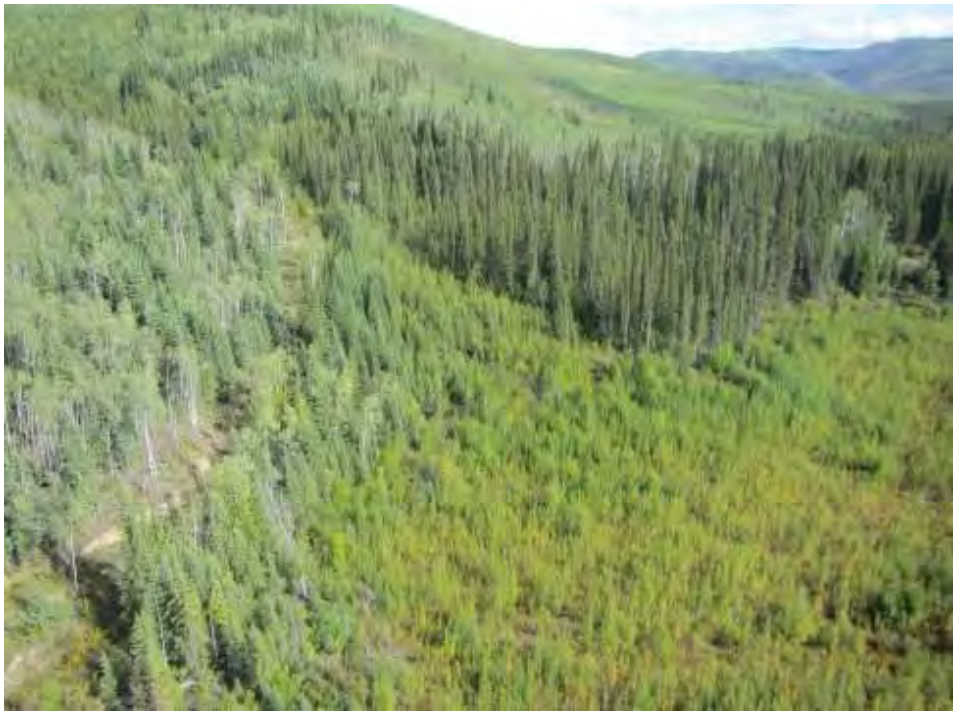
Coffee Gold Road Northern Route Crossing #86

			D/S (50m)	X	U/S (50m)
Coordinates:	608437	Gradient (%):	-	-	-
	7015678	Bankfull Width (m):	-	-	-
Site Visit Date:	21/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	none	Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a	Wetted Depth (m):	-	-	-
Electrofish effort:	n/a	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	u/s	x	d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	
No visible channel from air, P#148	

Photo from air; no visible channel



Coffee Gold Road Northern Route Crossing #91

				D/S (50m)	X	U/S (50m)
Coordinates:	609062		Gradient (%):	2	2	2
	7014665		Bankfull Width (m):	4.7	4.9	5.6
Site Visit Date:	22/08/15		Bankfull Depth (m):	0.68	0.78	0.88
Flow Conditions:	Mid		Wetted Widths (m):	4.35	4.7	5.3
Barrier (Y/N):	N		Wetted Depth (m):	0.48	0.43	0.58
Electrofish effort:	Y		Substrate Bed (Dom/SubDom):	F/G	F/G	F
Gee Trapping:	N		Substrate Bank:	F	F	F
Fish present?:	Y		Riparian Vegetation:	MIXED MATURE FOREST		
Site Length:	100m		Meander Pattern:	IM	IM	IM
			Cover (%/Dom):	20/LWD, DP	20/LWD	40/LWD, DP
Photo #s	168 u/s	169 x	170 d/s	pH:	7.95	
Areas of Erosion:	N			Temperature:	4.3 (°C)	
Locations:				Specific Conductivity:	348 (µs/cm)	COND = 210
				Dissolved Oxygen	12.43 (mg/L)	105 (% Sat)

Comments:	Maisy May mainstem
Water quite turbid - difficult visibility for EF	
Some deep pools noted	
Lots of woody debris	

Arctic grayling with injury to dorsal area

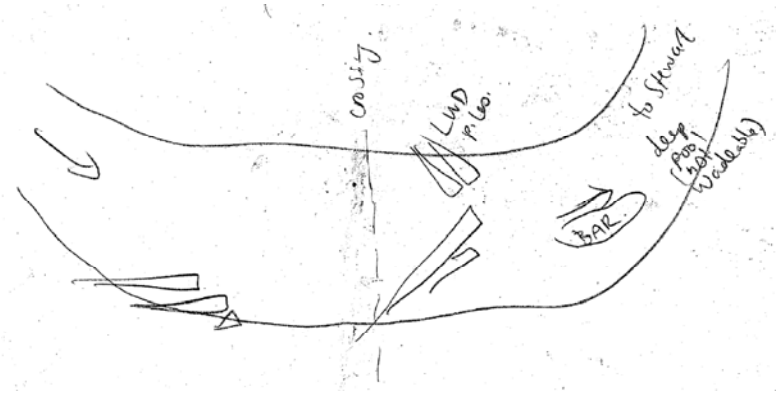
Upstream

Coffee Gold Road Northern Route Crossing #91

Crossing

Downstream

Site Illustration



Coffee Gold Road Northern Route Crossing # 92

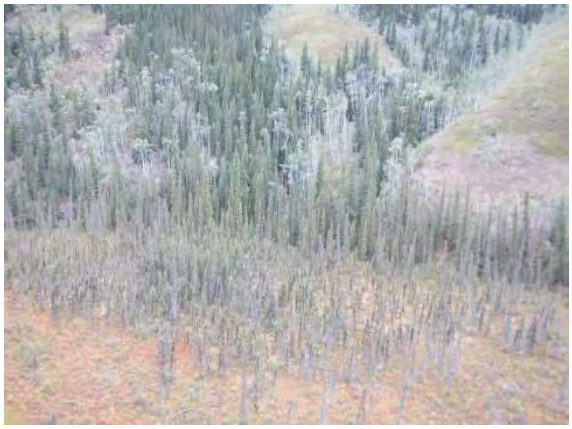
			D/S (50m)	X	U/S (50m)
Coordinates:	609258.304	Gradient (%):	-	-	-
	7013777.13	Bankfull Width (m):	-	-	-
Site Visit Date:	22/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	none	Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a	Wetted Depth (m):	-	-	-
Electrofish effort:	n/a	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	u/s	x	d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Stewart River drainage
Onsite provided information regarding no connected drainage at this site	
Verified by flyover; Photo #165-166	
very small pond wetland not connected to Stewart River. Swale goes downstream and is discontinuous	
not fish habitat	

Photo from air; no visible channel

Photo from air; no visible channel



Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing # 93

			D/S (50m)	X	U/S (50m)
Coordinates:	608907.247	Gradient (%):	-	-	-
	7012376.35	Bankfull Width (m):	-	-	-
Site Visit Date:	22/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	none	Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a	Wetted Depth (m):	-	-	-
Electrofish effort:	n/a	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	u/s	x	d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Stewart River drainage
Onsite provided information regarding no drainage at this site	
Verified by flyover; Photo #159	

Photo from air; no visible channel

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing # 94

			D/S (50m)	X	U/S (50m)
Coordinates:	608837.181	Gradient (%):	-	-	-
	7012183.67	Bankfull Width (m):	-	-	-
Site Visit Date:	22/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	none	Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a	Wetted Depth (m):	-	-	-
Electrofish effort:	n/a	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	u/s	x	d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Stewart River drainage
Onsite provided information regarding no drainage at this site	
Verified by flyover; Photo #158	

Photo from air; no visible channel

Site Illustration

Not Available

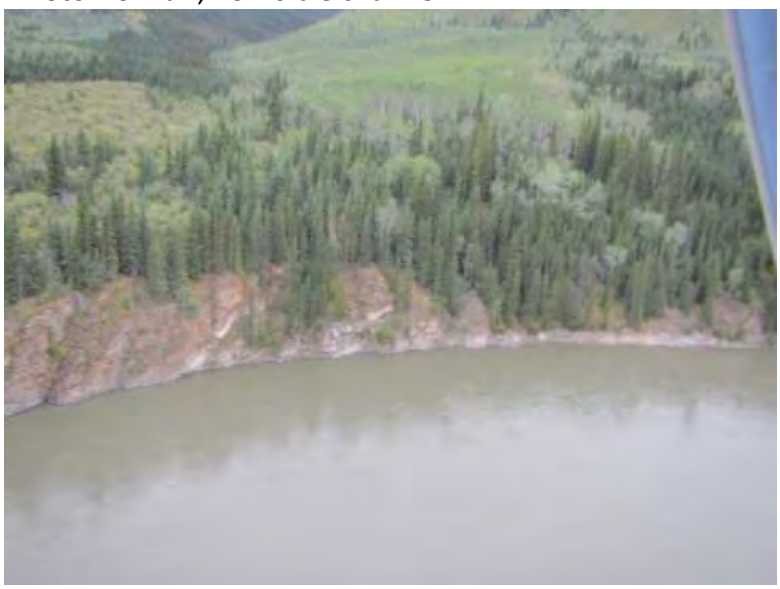
Coffee Gold Road Northern Route Crossing # 95

			D/S (50m)	X	U/S (50m)
Coordinates:	608588.083	Gradient (%):	-	-	-
	7011441.37	Bankfull Width (m):	-	-	-
Site Visit Date:	22/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	none	Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a	Wetted Depth (m):	-	-	-
Electrofish effort:	n/a	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	u/s	x	d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Stewart River drainage
Onsite provided information regarding no drainage at this site	
Verified by flyover; Photo #157	

Photo from air; no visible channel



Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #96

			D/S (50m)	X	U/S (50m)
Coordinates:	607267	Gradient (%):	-	-	-
	7009765	Bankfull Width (m):	-	-	-
Site Visit Date:	22/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	none	Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a	Wetted Depth (m):	-	-	-
Electrofish effort:	n/a	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	u/s	x	d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Stewart River drainage
No visible channel ~ 100 m d/s of road coordinate	
No fish habitat	
Photo #156	

No visible channel ~ 100 m d/s of road coordinate

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #97

			D/S (50m)	X	U/S (50m)
Coordinates:	606808	Gradient (%):	4	2	4
	7009556	Bankfull Width (m):	1	0.7	0.62
Site Visit Date:	21/08/15	Bankfull Depth (m):	0.27	0.38	0.2
Flow Conditions:	High	Wetted Widths (m):	1	0.7	0.62
Barrier (Y/N):	N	Wetted Depth (m):	0.27	0.38	0.2
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	F	F	F
Gee Trapping:	N	Substrate Bank:	F	F	F
Fish present?:	see below	Riparian Vegetation:	MIXED MATURE		
Site Length:	100m	Meander Pattern:	IM	IM	IM
		Cover (%/Dom):	20/SWD	20/SWD	70/U

Photo #s	153 u/s	152 x	154 d/s	pH:	-
Areas of Erosion:	N			Temperature:	-
Locations:				Specific Conductivity:	-
				Dissolved Oxygen	-

Comments:	Stewart River trib
Large amounts LWD causing obstructions to fish passage	
Creek flows underground briefly at crossing site	
Likely fish bearing due to close proximity of Stewart River	
Only shallow pool habitat available	
Slow flow and fine substrate	
Small irregularly meandering channel, thick riparian.	
Note: evidence of permafrost melt, trees are falling into creek.	

Photo 151

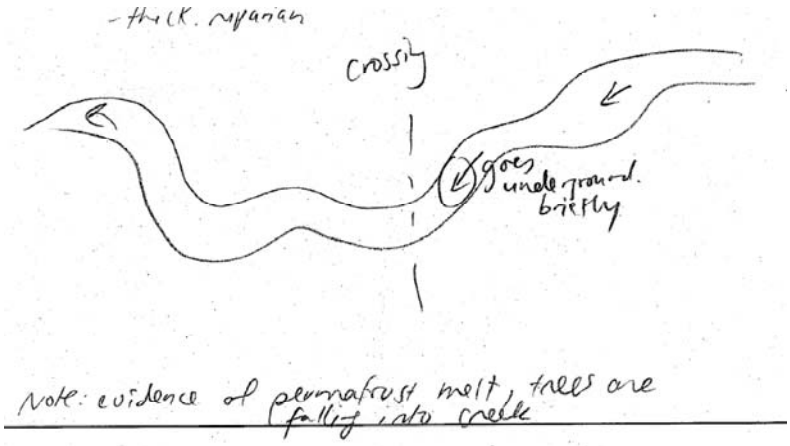
Crossing

Coffee Gold Road Northern Route Crossing #97

Upstream

Downstream

Site Illustration



Coffee Gold Road Northern Route Crossing #100

				D/S (50m)	X	U/S (50m)
Coordinates:	605754		Gradient (%):	2	2	2
	7007136		Bankfull Width (m):	~12	~10	~11
Site Visit Date:	25/08/15		Bankfull Depth (m):	~1.4	0.9	~14
Flow Conditions:	Mid		Wetted Widths (m):	~11	~9	~9
Barrier (Y/N):	N		Wetted Depth (m):	1.2	0.6	~0.7
Electrofish effort:	N		Substrate Bed (Dom/SubDom):	F/G	G/C	F/G
Gee Trapping:	Y		Substrate Bank:	F	F	F
Fish present?:	Y		Riparian Vegetation:	MI	MI	MI
Site Length:	100m		Meander Pattern:	RM	SI	RM
			Cover (%/Dom):	20/DP, LWD	15/DP	20/DP, LWD
Photo #s	248 u/s	250 x	249 d/s	pH:	7.84	
Areas of Erosion:	Y			Temperature:	6.2 (°C)	
Locations:	Ford; one bank u/s			Specific Conductivity:	207.5 (µs/cm)	COND = 132.9
				Dissolved Oxygen	11.61 (mg/L)	97.4 (% Sat)

Comments:	Barker Cr mainstem
Water turbid	
Note widths estimated - too deep to wade across.	
Deep pools noted	

Upstream

Downstream

Coffee Gold Road Northern Route Crossing #100

Crossing

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #101

				D/S (50m) - 2 channels	X - 3 channels	U/S (50m) - 2 channels
Coordinates:	605703		Gradient (%):	7	5	10
	7006526		Bankfull Width (m):	N/A - new channel		
Site Visit Date:	25/08/15		Bankfull Depth (m):	N/A - new channel		
Flow Conditions:	mid to high		Wetted Widths (m):	0.58	0.59	0.9
Barrier (Y/N):	N		Wetted Depth (m):	0.03	0.17	0.11
Electrofish effort:	N		Substrate Bed (Dom/SubDom):	F	F	F
Gee Trapping:	N		Substrate Bank:	F	F	F
Fish present?:	see below		Riparian Vegetation:	WI/SP	WI/SP	WI/SP
Site Length:	100m		Meander Pattern:	IM	IM	IM
			Cover (%/Dom):	30/OV	30/OV	20/OV
Photo #s	246 u/s	247 x	245 d/s	pH:	7.41	
Areas of Erosion:	Y			Temperature:	8.7 (°C)	
Locations:	upstream burn area			Specific Conductivity:	89.3 (µs/cm)	COND = 61.5
				Dissolved Oxygen	10.65 (mg/L)	95.5(% Sat)

Comments:	Barker Cr trib - muddy /turbid water
Water flowing through what appears to be recently new areas	
Muddy small discontinuous stream at current flow - natural obstructions to fish passage.	
Very unlikely to support fish - no pool habitat, very small, discontinuous	
dispersed undefined channels through grass	

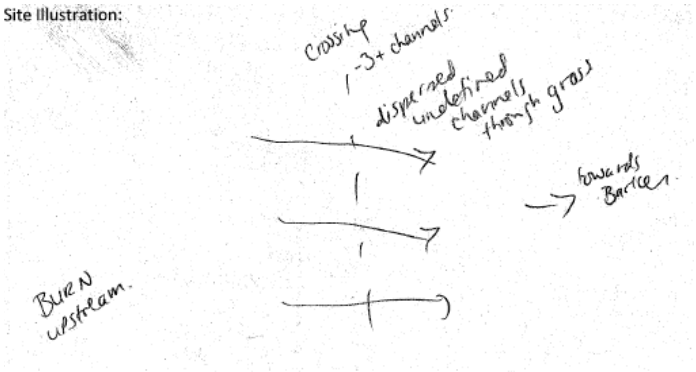
Downstream

Upstream

Coffee Gold Road Northern Route Crossing #101

Crossing

Site Illustration



Coffee Gold Road Northern Route Crossing #102

			D/S (50m)	X	U/S (50m)
Coordinates:	605802	Gradient (%):	3	3	2
	7005863	Bankfull Width (m):	0.38	0.67	0.55
Site Visit Date:	25/08/15	Bankfull Depth (m):	0.2	0.07	0.2
Flow Conditions:	High	Wetted Widths (m):	0.38	0.67	0.55
Barrier (Y/N):	N	Wetted Depth (m):	0.2	0.07	0.2
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	F	F	F
Gee Trapping:	N	Substrate Bank:	F	F	F
Fish present?:	see below	Riparian Vegetation:	WI/MI	WI/SP	WI/SP
Site Length:	100m	Meander Pattern:	IM	IM	IM
		Cover (%/Dom):	80/OV	80/OV	80/OV

Photo #s	242 u/s	244 x	243 d/s	pH:	7.56
Areas of Erosion:	N			Temperature:	5.5 (°C)
Locations:				Specific Conductivity:	129.5 (µs/cm) COND = 81.4
				Dissolved Oxygen	10.53 (mg/L) 87 (% Sat)

Comments:	Barker Creek trib
Poorly defined channel; disconnected areas.	
Water flowing through grass is dispersed and discontinuous	
Very unlikely to support fish; natural fish passage obstructions present; muddy small creek no pool habitat.	

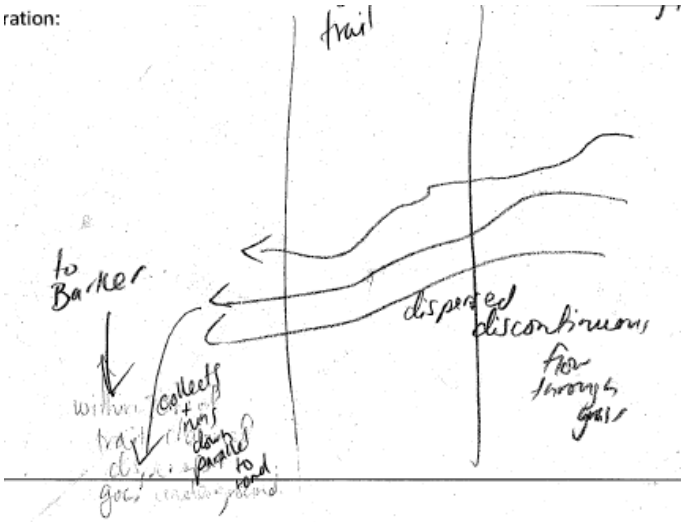
Upstream

Downstream

Coffee Gold Road Northern Route Crossing #102

Crossing

Site Illustration



Coffee Gold Road Northern Route Crossing #103

			D/S (50m)	X	U/S (50m)
Coordinates:	605666	Gradient (%):	16	1	5
	7005507	Bankfull Width (m):	0.75	1.25	1.2
Site Visit Date:	24/08/15	Bankfull Depth (m):	0.33	0.15	0.18
Flow Conditions:	Mid	Wetted Widths (m):	0.4	0.42	0.54
Barrier (Y/N):	N	Wetted Depth (m):	0.25	0.02	0.08
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	F	F	F
Gee Trapping:	N	Substrate Bank:	F	F	F
Fish present?:	see below	Riparian Vegetation:	WI/burn	WI/DEC	WI/burn
Site Length:	100m	Meander Pattern:	SI	IM	SI
		Cover (%/Dom):	70/OV, LWD	70/OV	70/OV

Photo #s	191 u/s	193 x	192 d/s	pH:	7.77
Areas of Erosion:	Y		Temperature:	5.2 (°C)	
Locations:	around burn/permafrost melt.		Specific Conductivity:	125 (µs/cm)	COND = 70
			Dissolved Oxygen	12.8 (mg/L)	105 (% Sat)

Comments:	Barker Creek trib
Some small vertical drops, increased gradient in stretches.	
Note: Crossing coordinates d/s of assessment, but road crossed higher up,	
Very unlikely to support fish - small muddy channel - not passable to fish at current flow level	
No pool habitat or gravel substrate noted	
Note: Many small permafrost melt channels crossing rd between 103 and 104 due to u/s burn area.	

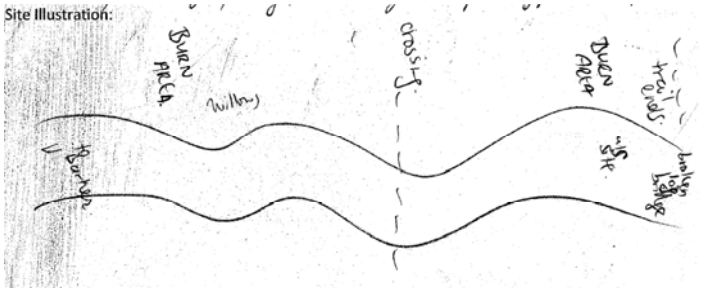
Upstream

Downstream

Coffee Gold Road Northern Route Crossing #103

Crossing

Site Illustration



Coffee Gold Road Northern Route Crossing #104

			D/S (50m)	X (2 channels)	U/S (50m)
Coordinates:	605661	Gradient (%):	5	8	5
	7004399	Bankfull Width (m):	1.6	0.62	0.47
Site Visit Date:	25/08/15	Bankfull Depth (m):	0.08	0.22	0.12
Flow Conditions:	Mid	Wetted Widths (m):	0.7	0.62	0.32
Barrier (Y/N):	N	Wetted Depth (m):	0.06	0.13	0.05
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	F	F	F
Gee Trapping:	N	Substrate Bank:	F	F	F
Fish present?:	see below	Riparian Vegetation:	SH/DEC	GR	WI
Site Length:	100m	Meander Pattern:	SI	IM	IM
		Cover (%/Dom):	50/OV	20/OV	50/OV

Photo #s	197 u/s	198 x	199 d/s	pH:	7.36
Areas of Erosion:	Y			Temperature:	1.8 (°C)
Locations:	burn area u/s			Specific Conductivity:	118.2 (µs/cm) COND = 65.7
				Dissolved Oxygen	12.54 (mg/L) 94.0 (% Sat)

Comments:	Barker Cr. Trib
Photos of more northern (larger) branch - photo #s 197 - 199	
Small muddy; no pool habitat	
Very unlikely to support fish	
S. channel disappears underground ~ 20 m u/s of road - photo#200	
N. channel - small muddy irregular channel with some natural obstructions to fish passage (steep drops and underground flow)	

Upstream

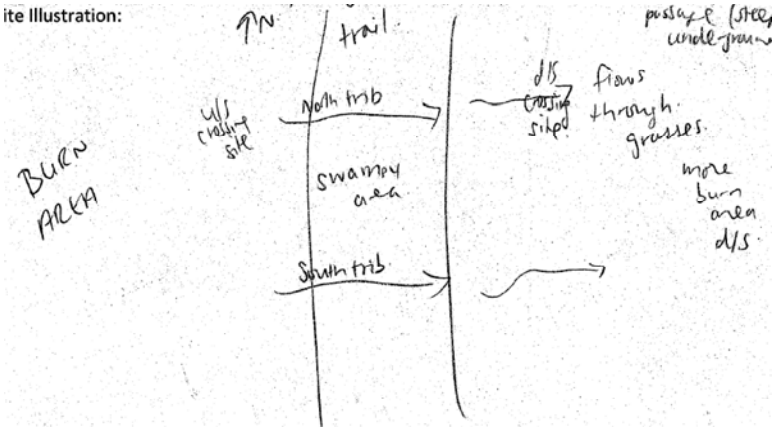
Crossing

Coffee Gold Road Northern Route Crossing #104

Downstream

Southern channel disappears

Site Illustration



Coffee Gold Road Northern Route Crossing #105

			D/S (50m)	X	U/S (50m)
Coordinates:	605378	Gradient (%):	2	8	14
	7003446	Bankfull Width (m):	0.7	0.42	0.58
Site Visit Date:	25/08/15	Bankfull Depth (m):	0.07	0.12	0.16
Flow Conditions:	Mid	Wetted Widths (m):	0.32	0.22	0.35
Barrier (Y/N):	N	Wetted Depth (m):	0.05	0.06	0.06
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	F	C/F	F
Gee Trapping:	N	Substrate Bank:	F	C/F	F
Fish present?:	see below	Riparian Vegetation:	WI	WI	WI/burn
Site Length:	100m	Meander Pattern:	IM	IM	IM
		Cover (%/Dom):	50/OV	20/OV	50/OV

Photo #s	203, 204 u/s	202 x	201 d/s	pH:	7.97	
Areas of Erosion:	Y			Temperature:	3.5 (°C)	
Locations:	road; burn areas			Specific Conductivity:	259.7 (µs/cm)	COND = 153.5
				Dissolved Oxygen	12.45 (mg/L)	99.1(% Sat)

Comments:	Barker Cr. Trib
P#203 - shows where water disappears vertically into connection to culvert.	
P#204 - shows channel looking upstream, vertical drop is obstruction to fish passage.	
Not passable to fish at current flows - very shallow and obstruction present.	
Very unlikely to support fish - muddy, small, many natural obstructions to fish passage; no pool habitat; no gravel substrate.	

Downstream

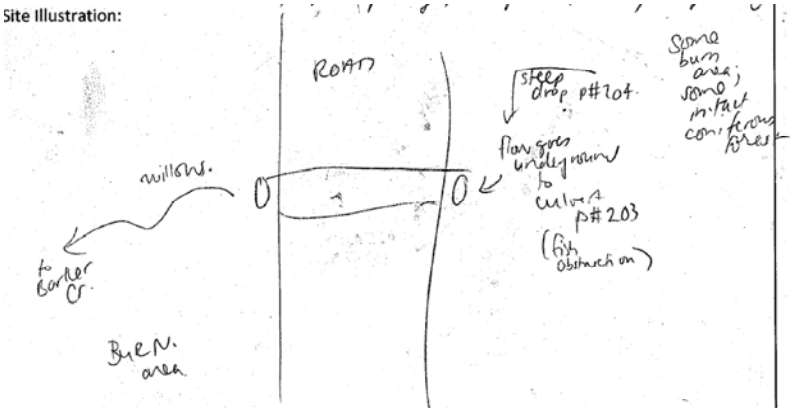
Crossing

Coffee Gold Road Northern Route Crossing #105

Upstream - water disappears

Upstream - vertical drop

Site Illustration



Coffee Gold Road Northern Route Crossing #106

				D/S (50m)	X	U/S (50m)
Coordinates:	605172		Gradient (%):	-	-	-
	7002703		Bankfull Width (m):	-	-	-
Site Visit Date:	25/08/15		Bankfull Depth (m):	-	-	-
Flow Conditions:	none		Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a		Wetted Depth (m):	-	-	-
Electrofish effort:	n/a		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	205 u/s	206 x	207 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-
Comments:	Barker Cr drainage					
No visible flow/channel						

Upstream

Crossing

Coffee Gold Road Northern Route Crossing #106

Downstream

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #107

				D/S (50m)	X	U/S (50m)
Coordinates:	604784		Gradient (%):	-	-	-
	7002121		Bankfull Width (m):	-	-	-
Site Visit Date:	25/08/15		Bankfull Depth (m):	-	-	-
Flow Conditions:	n/a		Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a		Wetted Depth (m):	-	-	-
Electrofish effort:	n/a		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	208 u/s	209 x	210 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Barker drainage
No visible channel	
Minor scour evidence across road	

Upstream

Crossing

Coffee Gold Road Northern Route Crossing #107

Downstream

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #108

				D/S (50m)	X	U/S (50m)
Coordinates:	604460		Gradient (%):	-	-	-
	7001380		Bankfull Width (m):	-	-	-
Site Visit Date:	25/08/15		Bankfull Depth (m):	-	-	-
Flow Conditions:	none		Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a		Wetted Depth (m):	-	-	-
Electrofish effort:	n/a		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	211 u/s	212 x	213 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-
Comments:	Barker drainage					
No flow/visible channel						

Upstream

Crossing

Coffee Gold Road Northern Route Crossing #108

Downstream

Site Illustration

Not Avaialable

Coffee Gold Road Northern Route Crossing #109

			D/S (50m)	X	U/S (50m)
Coordinates:	604153	Gradient (%):	-	-	-
	7001035	Bankfull Width (m):	-	-	-
Site Visit Date:	25/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	none	Wetted Widths (m):	-	0.23	-
Barrier (Y/N):	n/a	Wetted Depth (m):	-	0.02	-
Electrofish effort:	n/a	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-

Photo #s	214 u/s	215, 216 x	217 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Barker Cr drainage
Wetted width and depth measurement taken in ditch just u/s of road.	
Minor evidence of scour on upstream side of road - no visible channel; disperses over road	
Dries up/disperses d/s of road	
Not fish habitat	

Upstream

Crossing

Coffee Gold Road Northern Route Crossing #109

Crossing

Downstream

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #110

			D/S (50m)	X	U/S (50m)
Coordinates:	603702	Gradient (%):	30	3	-
	7000405	Bankfull Width (m):	1	0.81	-
Site Visit Date:	25/08/15	Bankfull Depth (m):	0.15	0.1	-
Flow Conditions:	Mid	Wetted Widths (m):	0.4	0.36	-
Barrier (Y/N):	Y	Wetted Depth (m):	0.05	0.02	-
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	F	G/F	-
Gee Trapping:	N	Substrate Bank:	F	F	-
Fish present?:	N	Riparian Vegetation:	WI	WI/AL	-
Site Length:	100m	Meander Pattern:	IM	IM	-
		Cover (%/Dom):	50/OV	50/OV	-

Photo #s	218 u/s	219 x	221 d/s	pH:	7.3	
Areas of Erosion:	Y			Temperature:	3.0 (°C)	
Locations:	road/burn areas			Specific Conductivity:	142.4 (µs/cm)	COND = 82.6
				Dissolved Oxygen	12.18 (mg/L)	94.8 (% Sat)

Comments:	Barker Cr trib
High gradient barrier downstream to fish passage	
Not accessible to fish	
Habitat quality low - muddy, shallow, steep, no pools	
P#222 shows where flow goes underground immediately upstream of road	
P#223 shows 30% gradient drop over 8m horizontal downstream of road	
P#220 - dry culvert in abandoned channel on d/s side road	

Upstream

Crossing

Coffee Gold Road Northern Route Crossing #110

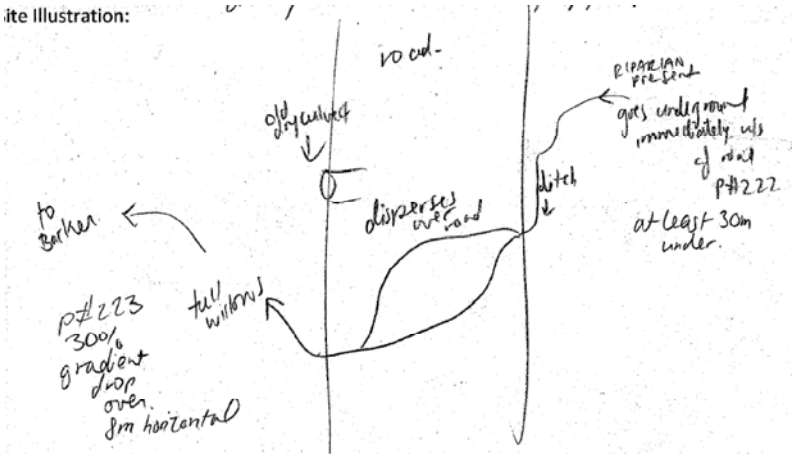
Dry culvert in abandoned channel (#220)

Downstream

Flow goes underground (#222)

30% gradient drop (#223)

Site Illustration



Coffee Gold Road Northern Route Crossing #111

				D/S (50m)	X	U/S (50m)
Coordinates:	603058		Gradient (%):	6	14	12
	6998497		Bankfull Width (m):	> 40	2.25	2.2
Site Visit Date:	25/08/15		Bankfull Depth (m):	N/A	0.4	0.5
Flow Conditions:	Mid		Wetted Widths (m):	3.4	1.7	1.6
Barrier (Y/N):	N		Wetted Depth (m):	0.09	0.15	0.2
Electrofish effort:	N		Substrate Bed (Dom/SubDom):	G/C	C/G	F/G
Gee Trapping:	N		Substrate Bank:	C/F	F/C	F/G
Fish present?:	see below		Riparian Vegetation:	none	none	WI
Site Length:	100m		Meander Pattern:	IM	IM	IM
			Cover (%/Dom):	<5%/B	<5%/B	50/LWD, OV
Photo #s	224 u/s	225 x	226 d/s	pH:	8.02	
Areas of Erosion:	Y			Temperature:	2.6 (°C)	
Locations:	road and placer disturbed banks			Specific Conductivity:	211.5 (µs/cm)	COND = 120.8
				Dissolved Oxygen	12.77 (mg/L)	98.2 (% Sat)

Comments:	Barker Cr trib
burn area upstream	
Water moderately turbid	
Upstream site: trees are falling into creek; lots of woody debris; some small pool habitat available; no deep pools.	
Some natural obstructions to fish passage at current flow; shallow extended riffles and some vertical drops.	
Likely fish-bearing	

Upstream

Crossing

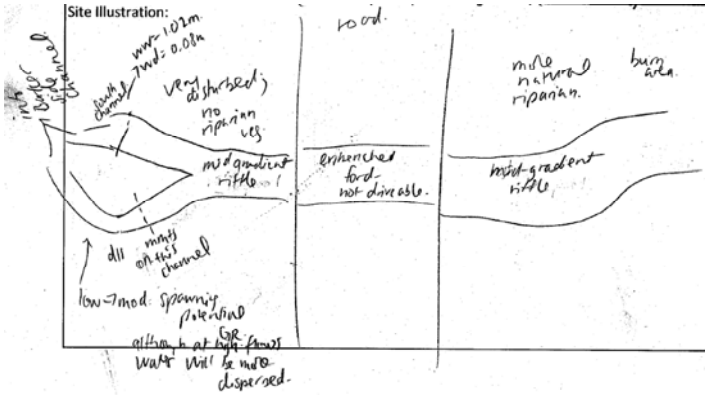
Coffee Gold Road Northern Route Crossing #111

Downstream

Upstream view at upstream site (#227)

Downstream view at upstream site (#228)

Site Illustration



Coffee Gold Road Northern Route Crossing #112

			D/S (50m)	X	U/S (50m)
Coordinates:	603136	Gradient (%):	2	2	POND
	6997805	Bankfull Width (m):	Floodplain	Floodplain	90 m x 15 m
Site Visit Date:	24/08/15	Bankfull Depth (m):	Floodplain	Floodplain	< 1 m depth
Flow Conditions:	Low	Wetted Widths (m):	1	1.03	-
Barrier (Y/N):	N	Wetted Depth (m):	0.09	0.06	-
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	G/F	G/F	-
Gee Trapping:	N	Substrate Bank:	G/F	G/F	-
Fish present?:	see below	Riparian Vegetation:	GR	GR	-
Site Length:	100m	Meander Pattern:	IM	IM	-
		Cover (%/Dom):	<5%/OV	None	-

Photo #s	188 u/s	x	187 d/s	pH:	8.23	
Areas of Erosion:	Y			Temperature:	7.7 (°C)	
Locations:	Lots of placer disturbance			Specific Conductivity:	345 (µs/cm)	COND = 264
				Dissolved Oxygen	11.64 (mg/L)	102 (% Sat)

Comments:	Barker Creek drainage
Photo # 187 - Where creek enters nearby creek that continues downstream and parallels road.	
Very unlikely to support fish	
Very shallow habitat; no pool habitat noted	
Disturbed overburden piles; little to no riparian vegetation	
Note: ~ 150 m u/s of pond is high gradient cascade > 50%; Photo #190.	
Pond at u/s site: P#189 -> shallow, stagnant, fairly shallow (< 1 m).	

Downstream

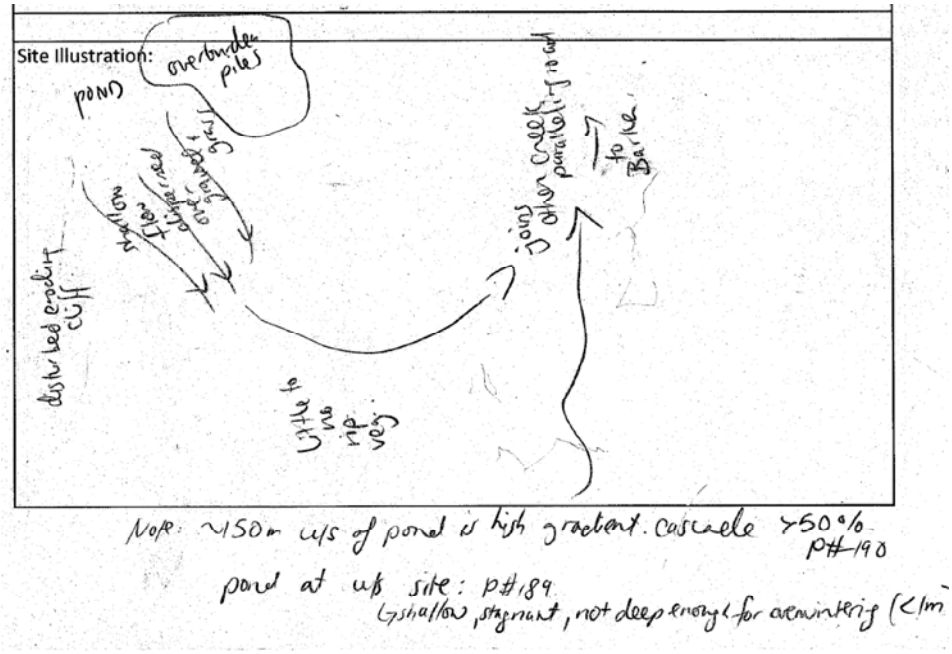
Upstream

Coffee Gold Road Northern Route Crossing #112

Pond at upstream site

Approximately 150 m upstream of pond

Site Illustration



Coffee Gold Road Northern Route Crossing #113

			D/S (50m)	X	U/S (50m)
Coordinates:	603212	Gradient (%):	3	2	5
	6997209	Bankfull Width (m):	15	7.4	11.6
Site Visit Date:	24/08/15	Bankfull Depth (m):	1.14	0.81	0.4
Flow Conditions:	low-mid	Wetted Widths (m):	3.4	3.6	4.1
Barrier (Y/N):	N	Wetted Depth (m):	0.14	0.16	0.1
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	G/F	F/G	C/G
Gee Trapping:	N	Substrate Bank:	F	F	F/G
Fish present?:	see below	Riparian Vegetation:	GR/DISTURBED		SP
Site Length:	100m	Meander Pattern:	RM	IM	IM
		Cover (%/Dom):	<5%/B	NONE	50/LWD

Photo #s	183 u/s	185 x	184 d/s	pH:	8	
Areas of Erosion:	Y			Temperature:	3.7 (°C)	
Locations:	Banks are disturbed, placer sediments			Specific Conductivity:	259 (µs/cm)	COND = 153.9
				Dissolved Oxygen	12.95 (mg/L)	100 (% Sat)

Comments:	Barker Creek trib
Photo #186 U/S view at u/s site just above creek split. UTM: 0603129 6997173.	
No pools habitat noted	
Very limited fish cover, quite disturbed	
water moderately turbid	
side channel splits off downstream and follows the road quite a distance before reaching mainstem Barker	
placer disturbance and burn areas; little to no riparian vegetation; piles of sand/gravel	
Likely fish-bearing	

Upstream

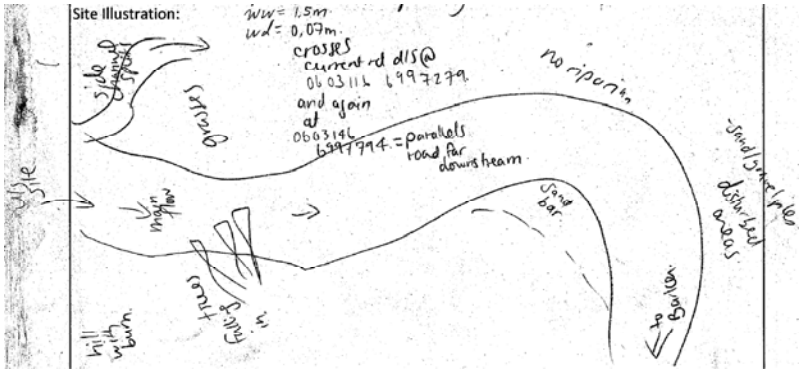
Downstream

Coffee Gold Road Northern Route Crossing #113

Crossing

Upstream view at upstream site

Site Illustration



Coffee Gold Road Northern Route Crossing #114

				D/S (50m)	X	U/S (50m)
Coordinates:	603541		Gradient (%):	30	-	-
	6996485		Bankfull Width (m):	-	-	-
Site Visit Date:	24/08/15		Bankfull Depth (m):	-	-	-
Flow Conditions:	low-mid		Wetted Widths (m):	-	-	-
Barrier (Y/N):	Y		Wetted Depth (m):	-	-	-
Electrofish effort:	n/a		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	181 u/s	182 x	180 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Barker Creek trib
Water goes underground >50 m at site and is high gradient (not passable to fish)	
Not fish habitat	

Downstream

Upstream

Coffee Gold Road Northern Route Crossing #114

Crossing

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #115

			D/S (50m)	X	U/S (50m)
Coordinates:	603602	Gradient (%):	56	-	-
	699106	Bankfull Width (m):	-	-	-
Site Visit Date:	24/08/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	low-mid	Wetted Widths (m):	-	-	0.3
Barrier (Y/N):	Y	Wetted Depth (m):	-	-	0.05
Electrofish effort:	n/a	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-
Photo #s	179 u/s	178 x 176-177 d/s	pH:	-	
Areas of Erosion:	-		Temperature:	-	
Locations:			Specific Conductivity:	-	
			Dissolved Oxygen	-	-

Comments:	Barker Creek trib
Creek displaced from original channel and carrying sediment - maybe fire disturbance.	
high gradient barrier downstream, not passable to fish	

Downstream

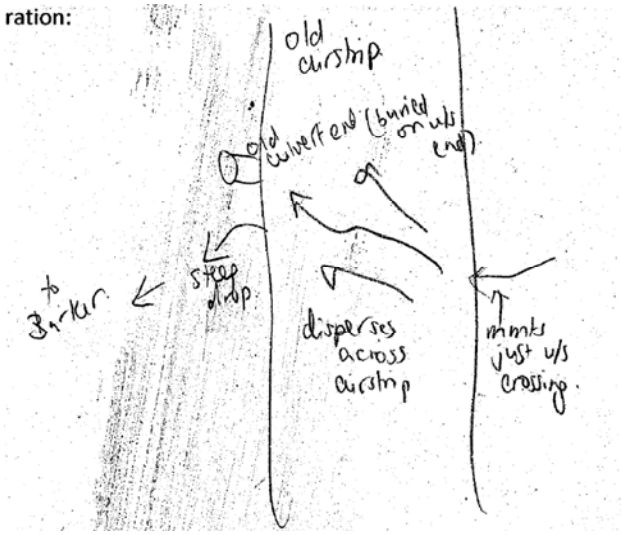
Downstream

Coffee Gold Road Northern Route Crossing #115

Crossing

Upstream

Site Illustration



Coffee Gold Road Northern Route Crossing #116

				D/S (50m)	X	U/S (50m)
Coordinates:	603368		Gradient (%):	-	-	-
	6995151		Bankfull Width (m):	-	-	-
Site Visit Date:	24/08/15		Bankfull Depth (m):	-	-	-
Flow Conditions:	none		Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a		Wetted Depth (m):	-	-	-
Electrofish effort:	n/a		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	173 u/s	174 x	175 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-
Comments:	Barker Creek drainage					
No visible channel						

Upstream

Crossing

Coffee Gold Road Northern Route Crossing #116

Downstream

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #117

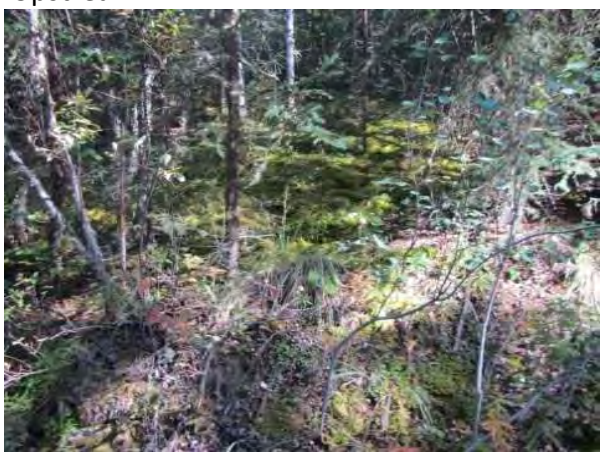
				D/S (50m)	X	U/S (50m)
Coordinates:	603541		Gradient (%):	-	-	-
	6979534		Bankfull Width (m):	-	-	-
Site Visit Date:	25-Aug-15		Bankfull Depth (m):	-	-	-
Flow Conditions:	none		Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a		Wetted Depth (m):	-	-	-
Electrofish effort:	n/a		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	235 u/s	234 x	233 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-
Comments:	Ballarat Cr drainage					
No visible channel						

Downstream

Crossing

Coffee Gold Road Northern Route Crossing #117

Upstream



Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #118

			D/S (50m)	X	U/S (50m)
Coordinates:	603925	Gradient (%):	16	5	10
	6978337	Bankfull Width (m):	1.8	11	1.45
Site Visit Date:	25/08/15	Bankfull Depth (m):	0.32	0.1	0.43
Flow Conditions:	Mid	Wetted Widths (m):	1.42	6	1.32
Barrier (Y/N):	N	Wetted Depth (m):	0.2	0.07	0.33
Electrofish effort:	Y	Substrate Bed (Dom/SubDom):	G/F	G/C	F
Gee Trapping:	Y	Substrate Bank:	F	F	F
Fish present?:	see below	Riparian Vegetation:	WI/SP	WI/SP	WI/SP
Site Length:	100m	Meander Pattern:	IM	IM	IM
		Cover (%/Dom):	70/LWD,OV, U	<5%/OV	70/LWD,OV, U
Photo #s	236 u/s	237 x 238 d/s	pH:	7.97	
Areas of Erosion:	Y		Temperature:	2.7 (°C)	
Locations:	ford		Specific Conductivity:	25.9 (µs/cm)	COND = 148
			Dissolved Oxygen	12.95 (mg/L)	99.8 (% Sat)

Comments:	Ballarat Cr - water moderately turbid
Upstream: heavily incised; some deep run-pool area	
Fast water, little to no pool habitat	
No deep pools	
Close to Ballarat mainstem	
Likely fish-bearing	

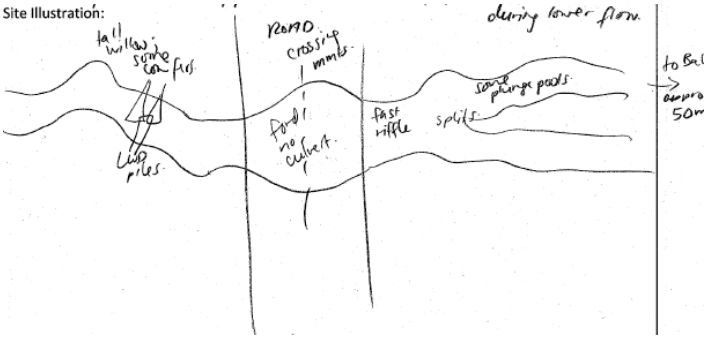
Upstream

Crossing

Coffee Gold Road Northern Route Crossing #118

Downstream

Site Illustration



Coffee Gold Road Northern Route Crossing # 119

				D/S (50m)	X	U/S (50m)
Coordinates:	604279.725		Gradient (%):	-	-	-
	6977495.38		Bankfull Width (m):	-	-	-
Site Visit Date:	24-Aug-15		Bankfull Depth (m):	-	-	-
Flow Conditions:	low-mid		Wetted Widths (m):	-	-	-
Barrier (Y/N):	Y		Wetted Depth (m):	-	-	-
Electrofish effort:	N		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	N		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	196 u/s	195 x	194 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-
Comments:	Ballarat Creek tributary					
high gradient barrier downstream of road 35%; not passable to fish; not fish habitat						

Upstream

Crossing

Coffee Gold Road Northern Route Crossing # 119

Upstream

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #120

				D/S (50m)	X	U/S (50m)
Coordinates:	604514		Gradient (%):	-	-	-
	6976425		Bankfull Width (m):	-	-	-
Site Visit Date:	25/08/15		Bankfull Depth (m):	-	-	-
Flow Conditions:	none		Wetted Widths (m):	-	-	-
Barrier (Y/N):	n/a		Wetted Depth (m):	-	-	-
Electrofish effort:	n/a		Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	n/a		Substrate Bank:	-	-	-
Fish present?:	N		Riparian Vegetation:	-	-	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	-	-
Photo #s	239 u/s	240 x	241 d/s	pH:	-	
Areas of Erosion:	-			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-
Comments:	Ballarat Cr drainage					
No visible channel						

Upstream

Crossing

Coffee Gold Road Northern Route Crossing #120

Downstream

Site Illustration

Not Available

Coffee Gold Road Northern Route Crossing #125

			D/S (50m)	X	U/S (50m)
Coordinates:	598904	Gradient (%):	1	1	1
	6976194	Bankfull Width (m):	19	19	19
Site Visit Date:	15/09/15	Bankfull Depth (m):	0.7	0.7	0.7
Flow Conditions:	Low	Wetted Widths (m):	18.2	18.2	18.2
Barrier (Y/N):	N	Wetted Depth (m):	0.4	0.4	0.4
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	C/G	C/G	C/G
Gee Trapping:	N	Substrate Bank:	F	F	F
Fish present?:	Y	Riparian Vegetation:	MI	MI	MI
Site Length:	100m	Meander Pattern:	RM	RM	RM
		Cover (%/Dom):	5/LWD	5/LWD	5/LWD

Photo #s	209 u/s	208 x	210 d/s	pH:	7.81
Areas of Erosion:			Temperature:	4.2 (°C)	
Locations:			Specific Conductivity:	143.0 (µs/cm)	COND = 86.2
			Dissolved Oxygen	12.57 (mg/L)	102.4 (% Sat)

Comments:	Coffee Creek mainstem
Long straight riffle section	
Moved crossing location 100 m d/s to area flagged by engineers.	

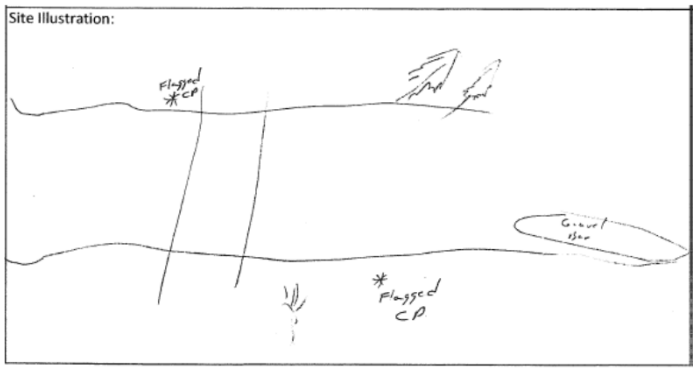
Upstream

Crossing

Coffee Gold Road Northern Route Crossing #125

Downstream

Site Illustration



Coffee Gold Road Northern Route Crossing #126

				D/S (50m)	X	U/S (50m)
Coordinates:	598836		Gradient (%):	-	0	-
	6976567		Bankfull Width (m):	-	-	-
Site Visit Date:	14/09/15		Bankfull Depth (m):	-	-	-
Flow Conditions:	Low		Wetted Widths (m):	-	4	-
Barrier (Y/N):	N		Wetted Depth (m):	-	0.15	-
Electrofish effort:	N		Substrate Bed (Dom/SubDom):	-	F	-
Gee Trapping:	N		Substrate Bank:	-	F	-
Fish present?:	see below		Riparian Vegetation:	-	MI	-
Site Length:	100m		Meander Pattern:	-	-	-
			Cover (%/Dom):	-	80/OV	-
Photo #s	197 u/s	196 x	198 d/s	pH:	-	
Areas of Erosion:	N			Temperature:	-	
Locations:				Specific Conductivity:	-	
				Dissolved Oxygen	-	-

Comments:	Yukon River tributary drainage - disconnected oxbow with potential connection at high flow
Only crossing on new road route to winter road (to be built as permanent road)	
Photos 196-198	
4 m across average, 0.15 m depth	
No flow - may handle some surface run-off, copious debris, wetland grasses.	
Drains to pond (photo 199), 07V 0598782 6976559.	
Channel on other end drains to same pond -> no access to Coffee Ck.	
Very unlikely to support fish	

Upstream

Downstream

Coffee Gold Road Northern Route Crossing #126

Crossing

Site Illustration

Not Available

Pond

Appendix B2

Coffee-Casino Route Fish Habitat Site Cards and Crossing Photos, Coffee Gold Road Project, 2015

Appendix B2. Fish Habitat Site Cards and Crossing Photos, Coffee Gold Road Project, 2015

In Sheet key

-	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
DEC	Deciduous trees (general)
GR	Grass
MI	Mixed forest
PO	Poplar
SH	Shrub
SP	Spruce
WI	Willow

Channel Pattern:

ST	Straight
SI	Sinuous
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

d/s	downstream
u/s	upstream
GR	Arctic grayling
COND	Conductivity in µs/cm
xing	crossing
P#	Photo number

Coffee - Casino Road Crossing # 1

			D/S (50m)	X	U/S (50m)
Coordinates:	598086	Gradient (%):	0.5	0.5	0.5
	6975054	Bankfull Width (m):	14.8	14.8	17.9
Site Visit Date:	19/06/15	Bankfull Depth (m):	1	1.1	1
Flow Conditions:	Low	Wetted Widths (m):	11	8.9	9.7
Barrier (Y/N):	N	Wetted Depth (m):	0.25	0.38	0.33
Electrofish effort:	N	Substrate Bed (Dom/SubDom):	C/G	C/G	C/G
Gee Trapping:	N	Substrate Bank:	F	F	F
Fish present?:	Y	Riparian Vegetation:	Mature mixed forest, some alder		
Site Length:	100m	Meander Pattern:	SI	SI	IM
		Cover (%/Dom):	10/OV	10/LWD	10/OV

Photo #s	19 u/s	20 x	18 d/s	pH:	7.32	
Areas of Erosion:	Y			Temperature:	10.2 (°C)	
Locations:	some at left bank at crossing, undercut bank			Specific Conductivity:	233 (µs/cm)	COND = 167
				Dissolved Oxygen	10.1 (mg/L)	94.9 (% Sat)

Comments:	Mainstem Coffee Creek
Area of proposed crossing is fairly straight, shallow section	
Observed four adult Arctic grayling	

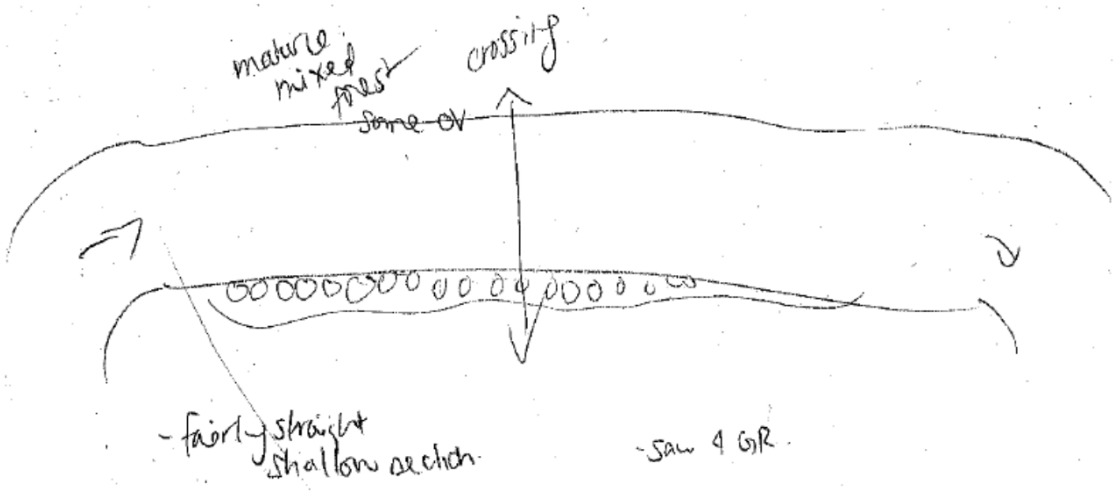
Upstream

Downstream

Coffee - Casino Road Crossing # 1

Crossing

Site Illustration



Coffee - Casino Road Crossing # 2

			D/S (50m)	X	U/S (50m)
Coordinates:	597985	Gradient (%):	0-5	5	3
	6974486	Bankfull Width (m):	2.2	2.7	0.7
Site Visit Date:	19/06/15	Bankfull Depth (m):	0.4	0.85	0.7
Flow Conditions:	Low	Wetted Widths (m):	1.6	0.8	0.4
Barrier (Y/N):	Y	Wetted Depth (m):	0.25	0.51	0.54
Electrofish effort:	Y	Substrate Bed (Dom/SubDom):	F/C	F/C	F/C
Gee Trapping:	N	Substrate Bank:	F	F	F
Fish present?:	N	Riparian Vegetation:	AL	AL	AL
Site Length:	100m	Meander Pattern:	IM	IM	IM
		Cover (%/Dom):	50/SWD	50/SWD	50/SWD

Photo #s	007 u/s	009 x	010 d/s	pH:	7.05	
Areas of Erosion:	Y			Temperature:	6.6 (°C)	
Locations:	minor undercut banks			Specific Conductivity:	162 (µs/cm)	
				Dissolved Oxygen	11.4 (mg/L)	96.5 (% Sat)

Comments:	Coffee Creek tributary

Photos 103-004, and 103-005 looking downstream and upstream respectively approximately 50m upstream of crossing and showing disconnect in creek flows (0598010 6974431).

uneven irregular morphology

drop pools, some very deep >1m

areas where very little surficial connection

channel not well defined

step-pool in some areas; dispersed irregular long runs in others

electrofishing was carried out prior to finding the barrier to fish passage downstream (effort 525s, section length approx 75m)

Discovered creek flows underground downstream:
Photo 12 at 07V 0597946 6974499 shows intermediate surficial flow between underground sections
Photo 16 is at 07V 0597951 6974503 and shows where main creek first goes underground
Photo 14 shows abandoned dry creek channel

Conclusion: the underground flow and instability of the creek prevent fish from accessing the crossing area

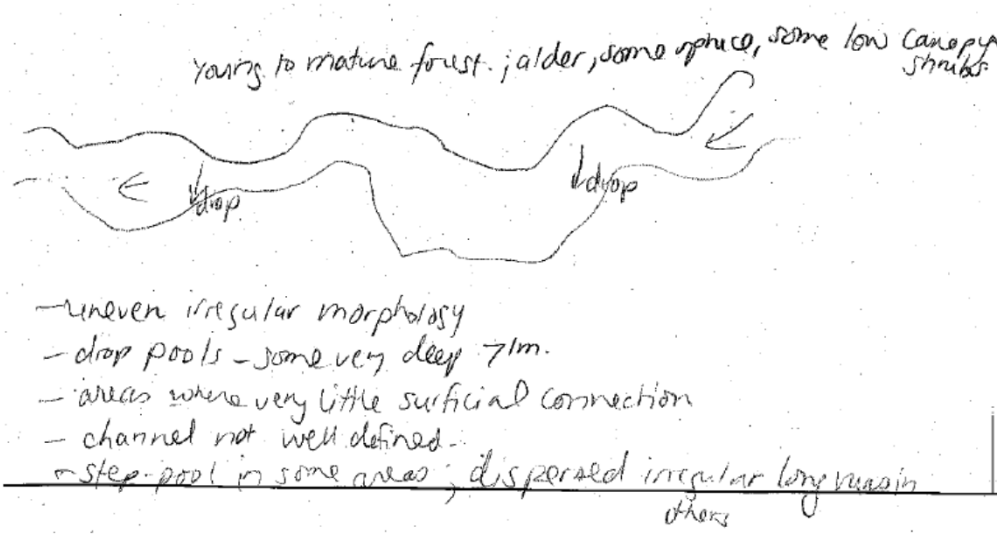
Coffee - Casino Road Crossing # 2

Upstream

Downstream

Crossing

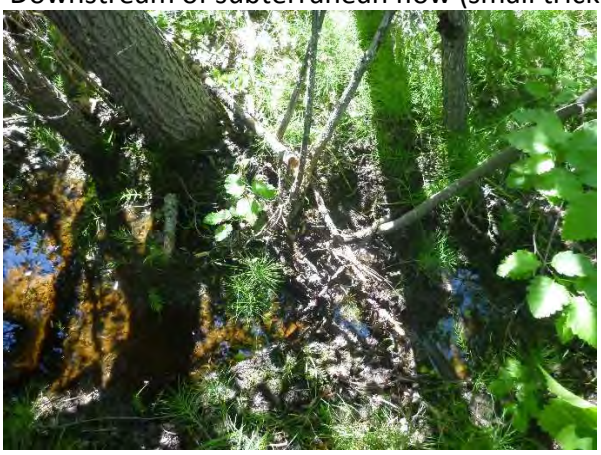
Site Illustration



Coffee - Casino Road Crossing # 2

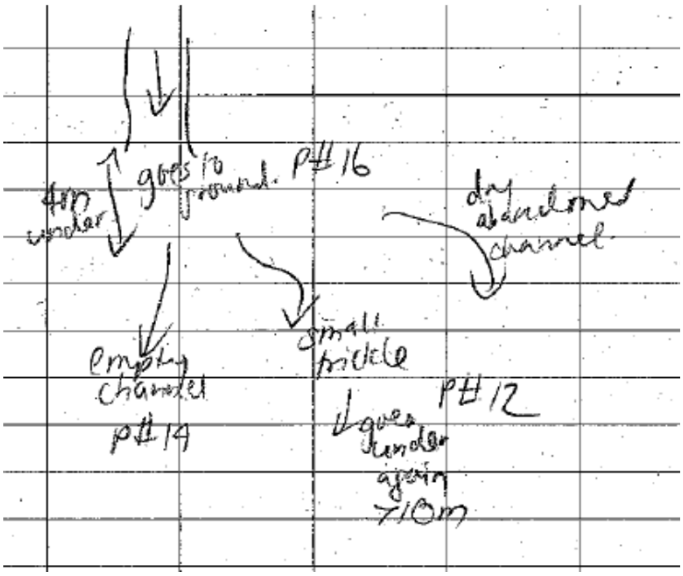
Area of subterranean flow

Downstream of subterranean flow (small trickle)



Dry creek channel

Illustration of subterranean flow area



Coffee - Casino Road Crossing # 3

			D/S (50m)	X	U/S (50m)
Coordinates:	596893	Gradient (%):	-	-	-
	6972743	Bankfull Width (m):	-	-	-
Site Visit Date:	20/06/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	-	Wetted Widths (m):	-	-	-
Barrier (Y/N):	Y (likely)	Wetted Depth (m):	-	-	-
Electrofish effort:	-	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	-	Substrate Bank:	-	-	-
Fish present?:	See below	Riparian Vegetation:	-	-	-
Site Length:	-	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-
Photo #s	See below		pH:	-	
Areas of Erosion:	-		Temperature:	-	
Locations:			Specific Conductivity:	-	
			Dissolved Oxygen	-	-

Comments:
Coffee Creek tributary
No good landing area; flew the creek from crossing location down towards Coffee Creek
Photo #s 100-0025 to 100-0027
Channel meanders; noted several dispersed channels and then flow seems to dissipate completely at 07V 0596730 6973183
Could not locate outlet to Coffee Creek; the trib is likely non-fish bearing

Photo from air:

Coffee - Casino Road Crossing # 4

			D/S (50m)	X	U/S (50m)
Coordinates:	596775	Gradient (%):	-	-	-
	6969427	Bankfull Width (m):	-	-	-
Site Visit Date:	20/06/15	Bankfull Depth (m):	-	-	-
Flow Conditions:	-	Wetted Widths (m):	-	-	-
Barrier (Y/N):	Y - likely*	Wetted Depth (m):	-	-	-
Electrofish effort:	-	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	-	Substrate Bank:	-	-	-
Fish present?:	See below	Riparian Vegetation:	-	-	-
Site Length:	100m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-
Photo #s	No photos		pH:	-	
Areas of Erosion:	-		Temperature:	-	
Locations:			Specific Conductivity:	-	
			Dissolved Oxygen	-	-

Comments:
Coffee Creek tributary
too steep to land
creek very small and steep
observed ice and snow still in valley, although flowing water visible at crossing
very low quality habitat and likely non-fish bearing (*gradient assessment also shows areas likely over 20% downstream)
No photos (technical difficulties with camera)

Coffee - Casino Road Crossing # 5

				D/S (50m)	X	U/S (50m)
Coordinates:	603927		Gradient (%):	14	18	13
	6959320		Bankfull Width (m):	4.5	3.9	5.8
Site Visit Date:	20/06/15		Bankfull Depth (m):	0.7	0.85	0.6
Flow Conditions:	Low		Wetted Widths (m):	4.1	3.5	4.9
Barrier (Y/N):	N		Wetted Depth (m):	0.26	0.2	0.14
Electrofish effort:	-		Substrate Bed (Dom/SubDom):	B/C	B/C	B/C
Gee Trapping:	-		Substrate Bank:	B/F	B/F	B/F
Fish present?:	See below		Riparian Vegetation:	WI	WI	WI
Site Length:	100m		Meander Pattern:	SI	SI	SI
			Cover (%/Dom):	>20/B and OV	20/B	>20/B
Photo #s	103-0021 u/s	23, 24 x	22 d/s	pH:	7.59	
Areas of Erosion:	N			Temperature:	4.2 (°C)	
Locations:				Specific Conductivity:	86.5 (µs/cm)	
				Dissolved Oxygen	12.47 (mg/L)	109.3 (% Sat)

Comments:	Upper Coffee Creek tributary
medium to high gradient cascade upstream	
lower gradient downstream	
step-pool morphology; large substrate	
some ice still present; water quite low	
Unlikely fish presence based on the quality of habitat (lack of deep pools for adult Arctic grayling feeding and resting, steepness of the channel) and long distance to good quality habitat downstream	
No spawning or overwintering habitat present for Arctic grayling	
However; no barriers to passage noted so it is potentially fish bearing	

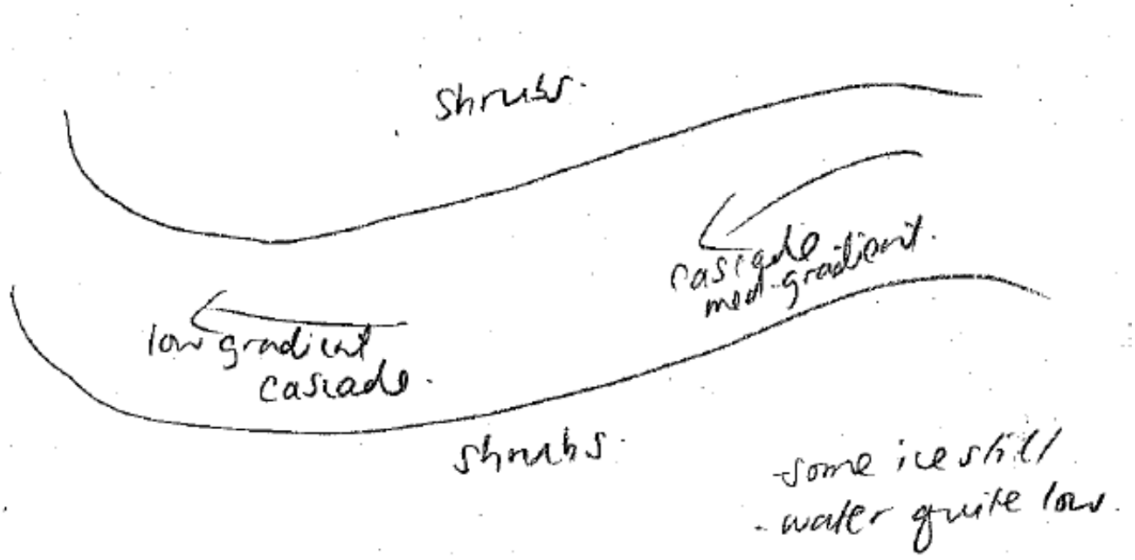
Upstream

Downstream

Coffee - Casino Road Crossing # 5

Crossing

Site Illustration



Coffee - Casino Road Crossing # 6

			D/S (50m)	X	U/S (50m)
Coordinates:	609679	Gradient (%):	-	-	-
	6959953	Bankfull Width (m):	-	-	-
Site Visit Date:	2008, 2010*	Bankfull Depth (m):	-	-	-
Flow Conditions:		Wetted Widths (m):	-	-	-
Barrier (Y/N):	Y	Wetted Depth (m):	-	-	-
Electrofish effort:	Y	Substrate Bed (Dom/SubDom):	-	-	-
Gee Trapping:	Y	Substrate Bank:	-	-	-
Fish present?:	N	Riparian Vegetation:	-	-	-
Site Length:	250 m	Meander Pattern:	-	-	-
		Cover (%/Dom):	-	-	-
Photo #s	u/s x d/s	pH:	-		
Areas of Erosion:	Y/N	Temperature:	-		
Locations:		Specific Conductivity:	-		
		Dissolved Oxygen	-	-	
Comments:					

*The crossing site is within a non-fish-bearing section of Canadian Creek, just north of the proposed Casino Mine open pit. The site is located upstream of a documented high gradient (>20%) cascade barrier and was determined to be not-fish bearing during confirmatory sampling in 2008 and 2010.

Fish sampling dates, methods, and effort (no fish caught):
09-Jul-2008 (EF, 577 s over 226 m)
11-Jul-2008 (MT, 72 hrs)
12-Aug-2010 (1278 s over 250 m)
10-Aug-2010 (MT, 83 hrs)

For more details on Canadian Creek aquatic sampling and barrier assessment please see the Casino Fish and Aquatic Resources Baseline Report (Appendix 10A of the Project Proposal), which is available online at www.casinomining.com