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EXCEL ENERGY INC. BIRCH OIL SALES PIPELINE PRE-IMPACT FISHERIES HABITAT ASSESSMENT

Prepared by:

DIVERSIFIED ENVIRONMENTAL SERVICES

OCTOBER 1993

Prepared for:

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1.0 INTRODUCTION

Excel Energy Inc. plans to construct an oil pipeline in the area of the Birch oil field in northeastern British Columbia. The project involves the construction of approximately 36 kilometres of pipeline for the purpose of transporting crude oil from Excel's Birch Central oil battery, located near Aitken Creek, to the existing oil gathering system near the Alaska Highway (Figure 1).

This pre-impact fisheries habitat assessment was conducted on October 13 and 14, 1993 to identify and evaluate fish habitat along the proposed ROW's associated with this project.

2.0 GENERAL SITE DESCRIPTION

The project is situated within the Blueberry River watershed which is located in the Peace Lowlands ecoregion. Within this ecoregion, the entire proposed ROW lies within the Boreal White and Black Spruce (BWBS) biogeoclimatic zone.

A total of ten drainage courses are encountered along the proposed ROW. Three of these, Blueberry River, Inglis Creek and Aitken Creek, were confirmed to possess fisheries values and a forth, an unnamed tributary of Aitken Creek contains limited, marginal habitat.

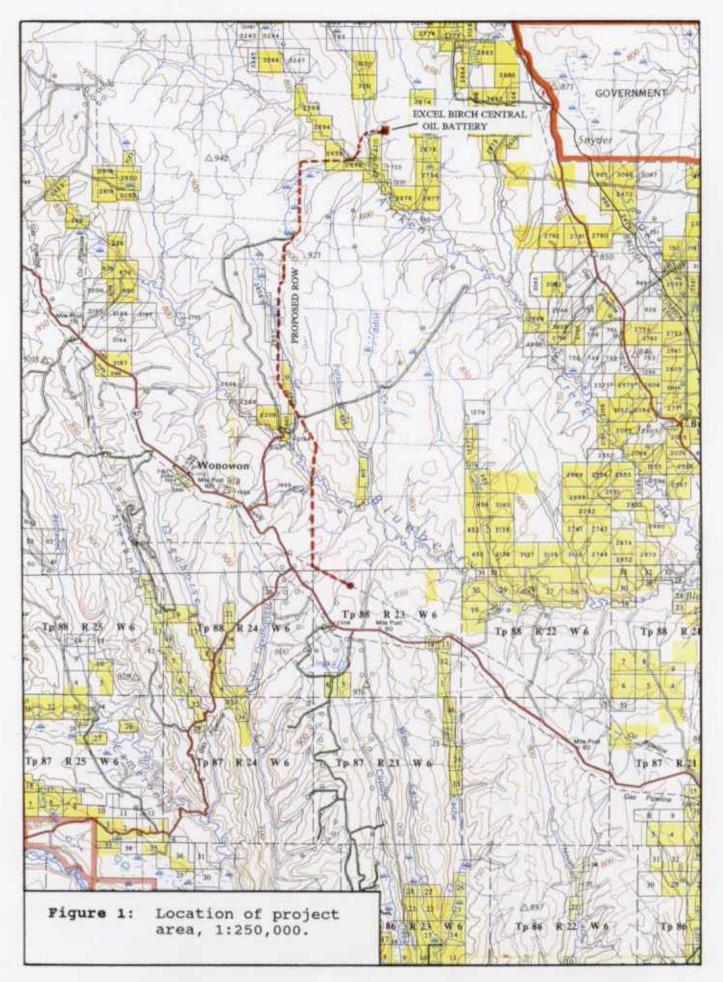
The remainder are small, possibly intermittent, feeder streams which were considered to have no fisheries values.

The proposed crossing of the Blueberry River is situated near the south end of the project and is located along an existing Mobil pipeline ROW (Figure 2).

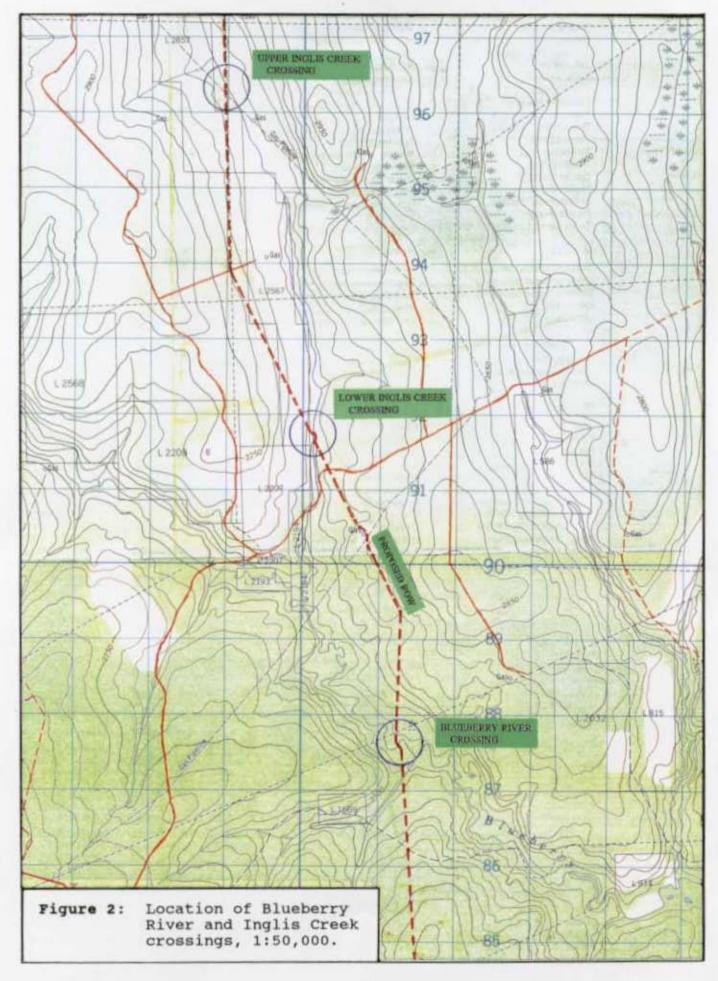
Moving north, the proposed ROW crosses Inglis Creek twice. The first Inglis crossing occurs along an existing pipeline ROW and the second, approximately 5 kilometres upstream, is on a new alignment.

Further north, the Aitken Creek crossing is located immediately adjacent to a newly installed road access and bridge (Figure 3).

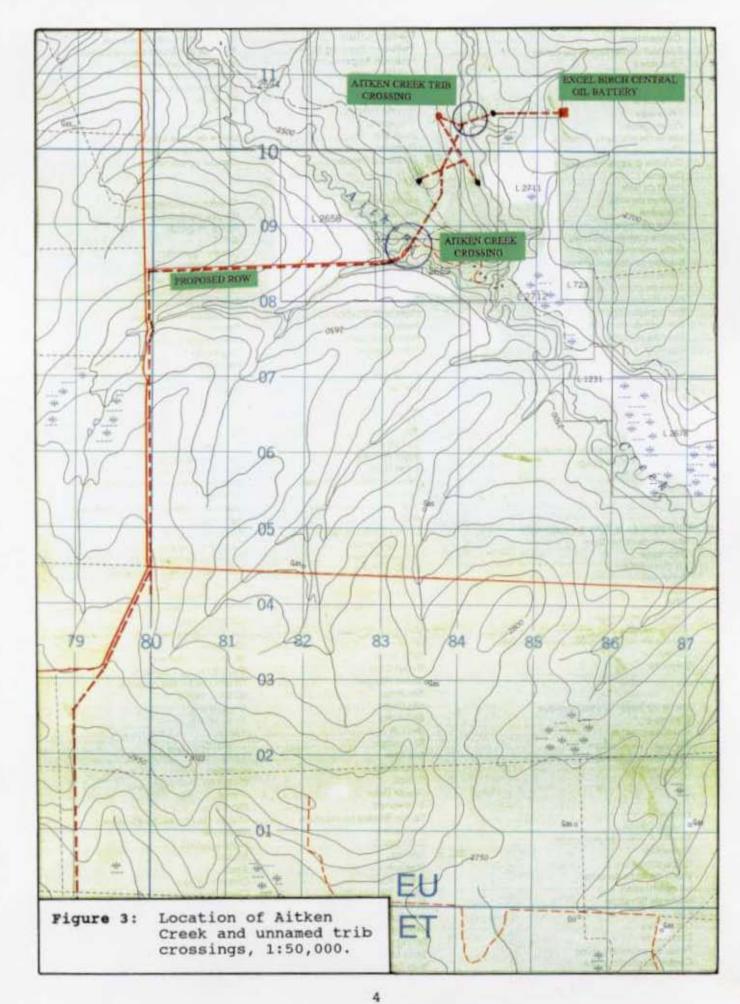
The unnamed tributary of Aitken Creek is crossed at the northern extremity of the proposed ROW, approximately 1,000 metres west of the Excel Birch Central battery.



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3.0 BLUEBERRY RIVER

3.1 METHODS

The Blueberry River was evaluated to determine possible impacts of the proposed pipeline crossing on fish and their habitat. This included an inventory of fish species present and an assessment of fish habitat and related biophysical environment.

Three 100 metre sections of the Blueberry River were evaluated, as per B.C. Environment's Appendix "A", Pre-Impact Assessment For Small Stream Crossings, Sampling Protocol and Mandatory Reporting (Appendix I). Site 1 lay immediately upstream of the proposed crossing, site 2 immediately downstream, and site 3 began 500 metres downstream of the proposed crossing.

All fisheries habitat work was conducted to the standards described in the Fish Habitat Inventory and Information Program (DFO & BCMOE, 1989). This included a photographic record of the sample sites and riparian area. A fish species inventory was undertaken using a Coffelt gas-generator electro-fisher.

3.2 RESULTS

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3.2.1 Biophysical Inventory

The proposed crossing of the Blueberry River is located approximately 70 kilometres upstream of its confluence with the Beatton River.

The river, in the area of the crossing, meanders through a relatively wide valley. Riparian vegetation is dominated by mature white spruce, trembling aspen and balsam poplar. The understory is comprised of willow, rose, grasses, clover, vetch and mosses.

The channel is contained by banks 3 to 4 metres in height. Flood sign was observed up an additional 4 metres above the water surface. At the time of this assessment the flow stage was low.

The river consists of low gradient, pool/riffle habitat, with a relatively low proportion of riffles. The substrate is comprised chiefly of silt and cobble with pockets of gravel throughout (Appendix II).

River banks are relatively unstable and subject to sloughing throughout. Large amounts of silt deposited during past flood conditions were observed. Water turbidity was high as a result of suspended silt, despite low flow conditions and a lack of recent precipitation. Discharge was measured at approximately 0.20 m3/s Water temperature at the time of the assessment was 1.0 degree Celsius. Extensive beaver activity was evident throughout the area. A well maintained beaver dam was located approximately 250 metres downstream of the proposed crossing. The resulting impoundment extended upstream to the crossing site.

3.2.2 Fish Species Inventory

Four species of fish were electro-fished in the three sample sections on the Blueberry River: 25 lake chub, 7 redside shiner, 3 longnose suckers and 4 trout-perch.

4.0 INGLIS CREEK (LOWER CROSSING)

4.1 METHODS

Inglis Creek was evaluated to determine possible impacts of the proposed pipeline crossing on fish and their habitat. This included an inventory of fish species present and an assessment of fish habitat and related biophysical environment.

Three 100 metre sections of Inglis Creek were evaluated, as per B.C. Environment's Appendix "A", Pre-Impact Assessment For Small Stream Crossings, Sampling Protocol and Mandatory Reporting (Appendix I). Site 1 lay immediately upstream of the proposed crossing, site 2 immediately downstream, and site 3 began 500 metres downstream of the proposed crossing.

All fisheries habitat work was conducted to the standards described in the Fish Habitat Inventory and Information Program (DFO & BCMOE, 1989). This included a photographic record of the sample sites and riparian area. A fish species inventory was undertaken using a Coffelt gas-generator electro-fisher.

4.2 RESULTS

4.2.1 Biophysical Inventory

The proposed lower crossing of Inglis Creek is located approximately 2.5 kilometres upstream of its confluence with the Blueberry River.

The stream, in the area of the crossing, is narrowly confined by a shallow valley. Riparian vegetation is dominated by bog birch, wiilow and grasses. No overstory exists.

The channel is contained by banks approximately 0.75 metres in height. Flood sign was observed an additional 2.0 metres above the water surface. At the time of this assessment the flow stage was low.

The stream consists of low gradient, pool/riffle habitat, with a roughly even distribution of pools and riffles. The substrate is comprised mainly of boulders and cobble with limited pockets of gravel. The average wetted width of the stream was 1.5 metres. Average maximum pool depth was approximately 65 centimetres.

Streambanks are relatively stable with the exception of some small scale sloughing and exposed soil. Water turbidity was approximately 30 centimetres. Discharge was measured at approximately 0.02 m3/s. Water temperature at the time of the assessment was 3.0 degrees Celsius.

4.2.2 Fish Species Inventory

Five juvenile arctic grayling were electro-fished in the three samples sections at the lower Inglis Creek crossing.

5.0 INGLIS CREEK (UPPER CROSSING)

5.1 METHODS

Because of the proximity to the lower crossing of Inglis Creek, the upper crossing was assessed comparatively by means of a general visual inspection. No specific sample sections were delineated and no fish species inventory was undertaken.

5.2 RESULTS

The proposed upper crossing of Inglis Creek is located approximately 7.5 kilometres upstream of its confluence with the Blueberry River, 5 kilometres above the lower crossing.

The stream in this area is less confined, as the shallow valley is slightly wider. Riparian vegetation is dominated by dwarf birch, willow, lodgepole pine seedlings and grasses. No overstory exists.

The channel is contained by banks approximately 1.0 metre in height. Flood sign was observed up an additional 1.5 metres above the water surface. At the time of this assessment the flow stage was low.

This portion of the stream consists of low gradient, pool/riffle habitat, with a roughly even distribution of pools and riffles. The substrate is comprised mainly of cobble and large gravel.

Streambanks are composed of sod and fine materials and show evidence of erosion from high flows but are generally quite stable. Water turbidity was approximately 30 centimetres. Discharge was estimated to be comparable to the lower crossing, approximately 0.02 m3/s.

6.0 AITKEN CREEK

6.1 METHODS

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Aitken Creek was evaluated to determine possible impacts of the proposed pipeline crossing on fish and their habitat. This included an inventory of fish species present and an assessment of fish habitat and related biophysical environment.

Two 100 metre sections of Aitken Creek were evaluated, as per B.C. Environment's Appendix "A", Pre-Impact Assessment For Small Stream Crossings, Sampling Protocol and Mandatory Reporting (Appendix I). Site 1 was omitted due to active bridge construction on the upstream side of the proposed crossing. Site 2 lay immediately downstream of the proposed crossing and site 3 began 500 metres downstream.

All fisheries habitat work was conducted to the standards described in the Fish Habitat Inventory and Information Program (DFO & BCMOE, 1989). This included a photographic record of the sample sites and riparian area. A fish species inventory was undertaken using a Coffelt gas-generator electro-fisher.

6.2 RESULTS

6.2.1 Biophysical Inventory

The proposed crossing of Aitken Creek is located approximately 43 kilometres upstream of its confluence with the Blueberry River.

The stream, in the area of the crossing, winds relatively unconfined in a wide, shallow valley. Riparian vegetation is predominantly willow, bog birch, rose and grasses with scattered aspen and spruce. No overstory exists.

The channel is contained by banks up to 4 metres in height. Flood sign was observed an additional 3 to 4 metres above the water surface. At the time of this assessment the flow stage was low.

The stream consists of low gradient, pool/riffle habitat, with a very low proportion of riffles. The substrate is comprised mainly of silt and fines with gravel and small cobble occupying less than 30% of the streambed. The average wetted width of the stream was 4.0 metres.

Streambanks are composed of silt and fine materials and subject to sloughing throughout. The water was moderately turbid due to suspended silt and organic stain. Discharge was measured at approximately 0.10 m3/s. Water temperature at the time of the assessment was 3.0 degrees Celsius.

6.2.2 Fish Species Inventory

Six fish, representing two species, were captured in the two sample sections on Aitken Creek: five lake chub and one longnose sucker.

7.0 UNNAMED AITKEN CREEK TRIBUTARY

This stream is crossed by the proposed ROW at the north end of the project approximately one kilometre west of Excel's Birch Central battery. It is the largest unnamed stream on the ROW. The proposed crossing of this tributary is located approximately three kilometres upstream of its confluence with Aitken Creek.

After a general visual inspection, the stream was deemed to possess only marginal, seasonal fisheries values. Because of the formation of surface ice, electro-fishing was not attempted.

Flow rates were comparable to those in Inglis Creek, however, habitat quality was much lower. Silt and fines comprised a large proportion of the streambed material. Turbidity was relatively high and natural instream cover was lacking. In addition, habitat of similarly low quality is present in Aitken Creek adjacent to the mouth of the tributary.

8.0 DISCUSSION, GENERAL CONCERNS AND RECOMMENDATIONS

8.1 BLUEBERRY RIVER

The Blueberry River system supports a variety of non-sport fish species, and possibly restricted populations of arctic grayling in headwaters areas.

The proposed Excel crossing is located on relatively stable ground at the site of an existing Mobil pipeline crossing. Much of the substrate immediately below the crossing is composed of sand and silt. The beaver dam, located 250 metres below the site, and the resulting impoundment creates an effective silt trap and should allow disturbance-induced silt to slowly settle out before being carried downstream.

Large granular substrate at the crossing site should be replaced when trench backfilling is complete.

8.2 INGLIS CREEK

Inglis Creek was found to contain high quality rearing habitat for juvenile arctic grayling. Clean cobble and boulder substrate, moderately low turbidity and low silt content encourage production the aquatic invertebrate food sources. Deep pools and overhanging banks provide suitable cover.

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Arctic grayling are a high priority species throughout the region and are known to be extremely sensitive to habitat degradation. There are probably relatively few streams in the Blueberry system suitable for this species.

Juvenile grayling utilizing small tributaries as rearing habitat normally move to lower reaches as flow rates and water temperatures decrease in the fall. Deep pools and the presence of grayling in October may indicate overwintering capabilities in Inglis Creek.

Block and pump procedures may be required during trenching operations at both proposed Inglis Creek crossings.

The lower crossing occurs adjacent to an existing pipeline ROW. The proposed Excel ROW is currently being re-aligned or kinked at the crossing site to allow a right angle crossing of the stream.

The proposed upper crossing is located on new cut and is presently being adjusted or kinked at the crossing site to avoid straddling a small intermittent drainage channel on the east bank of the stream. This modification was made to address concerns about ROW erosion during run-off periods and resulting siltation into Inglis Creek.

8.3 AITKEN CREEK

No high quality fish habitat exists in the area of the Aitken Creek crossing. The streambanks and streambed are composed primarily of silt and fines. Clean granular substrate is limited.

The crossing and downstream stretch are located on private property. A high degree of in-stream disturbance is evident and ongoing. Sloughing of abandoned bridge abutments, heavy equipment fords and intensive use of the stream by livestock may have further reduced its suitability for all but the most tolerant of non-sport species.

The proposed ROW follows the edge of an existing road allowance and crosses the stream adjacent to a newly installed bridge.

8.4 UNNAMED AITKEN CREEK TRIBUTARY

No high quality fish habitat exists in the area of the crossing of the unnamed Aitken Creek tributary.

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Appendix I: Appendix "A" Pre-impact Assessment For Small Stream Crossings Sampling Protocol and Manadatory Reporting B.C. Environment

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APPENDIX 'A'

PRE-IMPACT ASSESSMENT FOR SMALL STREAM CROSSINGS. SAMPLING PROTOCOL AND MANDATORY REPORTING.

All fisheries habitat survey work must be conducted to the standards described in the "Fish Habitat Inventory & Information Program" (D.F.O. & B.C.M.O.E., 1989). Copies of the guide and the appropriate forms to be used are available c/o the MOE Fisheries Branch, Inventory and Data Systems Unit, 780 Blanshard St., Victoria B.C., V8V 1X5.

For proposed stream crossings requiring a pre-impact assessment, a habitat survey will be conducted for at least 100m upstream and 100m downstream of the proposed crossing site. An additional 100m section of river will be surveyed approximately 500m downstream the proposed crossing site. Fish presence and abundance will be assessed for each of the sections of river surveyed using appropriate techniques (usually some combination of electrofishing, seining and angling).

Every effort should be made to maintain captured fish alive and in good condition so that they can be released back into the waters from which they were captured. All fish captured should be identified to species and the total number of each species captured will be recorded. All indivduals of sport species should be measured (fork length) to the nearest mm and a non-lethal aging structure should be collected (scales from all species other than Percids from which dorsal spines should be collected). Anaesthetics may be used to quiet fish prior to sampling but fish should be fully recovered before being released into the wild. The following information will be recorded for individuals that die incidentally during capture or handling: weight; sex; maturity; stomach contents; parisites or other lesions. Otoliths should be removed and saved from any char that die. If fish ages are not specifically required for the study in question then aging structures will be included with all the relevant data as part of the final report.

For non-sport species the total number captured and the range of fork lengths for each species will be recorded. A representative sample of each non-sports species (up to 20 individuals representing the full size range captured with the exception that suckers and squawfish longer than 15 cm need not be kept) should be fixed in 10% formalin and delivered to the Regional Fisheries Biologist in Fort St. John.

The final report must include the following information as a minimum:

-a map (1:50,000 scale or less) showing the precise location of all sampling sites;

-a completed Stream Survey Card for each sample location;

-a photographic record with at least one upstream and one downstream shot at each sample location; -all fish data collected, summarized in tabular form;

-techniques, effort (eg. electroshocking seconds), and area sampled (square meters) for each sample location;

-problems encountered that might influence the results;

-a summary of the major habitat components and the fisheries potential for the stream surveyed, comments indicating how typical the surveyed area was relative to the stream as a whole; -an assessment of the probable impacts as a result of the planned in-stream activities.

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Appendix II: Blueberry River Stream Survey Forms, Site Photographs and Fish Data Sheets

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Stream Survey Form; Blueberry River - Site 1, the uppermost site.



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Blueberry River site 1, above proposed crossing: View downstream; 50 m up from bottom of site.



Blueberry River site 1, above proposed crossing: View downstream; from top of site.

STREAM NAME Blueberry River

LOCATION Upstream of proposed crossing

DATE Oct. 13 / 93 SITE NO. 1 UTM 10.5812.62876

ELECTROSHOCKING SECONDS 515 AREA SAMPLED 900 m2

NO	SP	LENGTH (mm)	COMMENTS	NO	SP	LENGTH (mm)	COMMENTS
1	LKC	119	PRESERVED	26			
2	LKC	71	PRESERVED	27			
3	LKC	75	PRESERVED	28			
4	LKC	90	PRESERVED	29			
5	LKC	48	RELEASED	30			
6	LKC	65	RELEASED	31			
7	LKC	81	PRESERVED	32			
8	LKC	62	RELEASED	33			
9	LKC	64	RELEASED	34			
10	LKC	46	RELEASED	35		-	
11	LKC	59	RELEASED	36			
12	LNS	85	PRESERVED	37		-	
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1	COMMENTS
	Channel Stability
	HIGH DEGREE OF SWARZHDED SILT IN WATER INCREMES COVER. FINES COMPRISED CHIEFLY OF SAND. FINES SETTLED OUT DUE TO DOWNSTREAM BEANER DAM
3	100% POOL DUE TO BEAVER DAM DOWNSTREAM
	BANKS GENERALLY 3.4 M LOWER 20 M OF SITE WIDENS AND LEPT BANK REDUCED TO IM AT INSIDE BEND
5	BEAVER DAM APORON 150 M DOWNSTREAM OF SITE.
6	DECTROSHOCKING SECONDS - 320. CHUB ANDRAGE - 52 mm
	RIDARIAN VEGETATION - SPRUCE, ASPEN, BAUSAN DOPUR BALLED BY DC
	ADRE WILLOW AND GRASS UNDERSTURY DEPTHD 931015

Stream Survey Form; Blueberry River - Site 2, the middle site.



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Blueberry River site 2, below proposed crossing: View downstream; from top of site.



Blueberry River site 2, below proposed crossing: View downstream; from 50 m down from top of site.

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STREAM NAME Blueberry River

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LOCATION Downstream of proposed crossing

DATE Oct. 13 / 93 SITE NO. 2 UTM 10.5813.62877

ELECTROSHOCKING SECONDS 320 AREA SAMPLED 2000 m2

NO	SP	LENGTH (mm)	COMMENTS	NO	SP	LENGTH (mm)	COMMENTS
1	LKC	56	RELEASED	26			
2	LKC	70	RELEASED	27			
3	LKC	75	RELEASED	28			
4	LKC	68	RELEASED	29			
5	LKC	44	RELEASED	30			
6	LKC	52	RELEASED	31			-
7	LKC	50	RELEASED	32			
8	LKC	45	RELEASED	33			
9	LKC	45	RELEASED	34			
10	LKC	47	RELEASED	35			
11	LKC	46	RELEASED	36			
12	LKC	42	RELEASED	37			
13	LKC	39	RELEASED	38			
14	RSC	60	RELEASED	39			
15	RSC	75	RELEASED	40			
16	RSC	72	RELEASED	41			
17	RSC	66	RELEASED	42			
18				43			
19				44			
20				45			
21				46			
22				47			
23				48			
24				49			10
25				50			
	LKC	AV = 52			RSC	AV = 68	

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Str	eam Nan	ne fo	82 1 To		BERRY	R		(Id	call							Act	20.65	V	4	Method
	tershed a					III	1	Loc H	L i a l	and D	11.12	In	1.1	Reach	No.	Long	thum		-	
Loc	ation	FR.	OHA :	300	H BE	ren	CI	Ross	NG	Map#	94	A	13	Site No	3	LINE	riv(m)	100	5	HC
1	min				UR 100					UTM.	150	SMO.	0.00	Fish Ca	rd Y	0	C	Field		Hist.
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C	P	ARA	METER	-	VALUE	METH		0.0			PECIF	IC D	ATA				0	BSTR	UCTI	ONS
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-	Side Cha	100	and the second	and the second second	2-40 240	GE		Graveka	smail 52-16	COUNT	30	20	1	lexture .	00	LR	1			
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1			rotal %		60	GE	100	LINGHS	Ige cubble r		10	5			Age	Dry	0	M	H	Flood
	Sum -			10000	In Veg Over Veg		100	10000	boulder (22)	Septem 1	-	0		in the second se	ins Hilm)	3	Braid	100	-	0
-	100%	11111111	_	10	C Aspect	20	120	Bedros	Ter.	-	0			Bars (%) Water Temp	20	pH	-	-	2 ppm	-
-	Crown C	ADBUI		0		HARGE		Deolon	12	Compactio	wird	2 "	Same.	a aner senta		Turb.icm)	20	Love	12840	1
-	Pa	rame	téc:	Value	Mathod	HANGE	_	Sór	ofic Data	_		-			HEA	(Fish)	ABOL			
	Wetted	_	1	-			-			_										
100	Mean D	epth	(m)			-	-	-	-				1			1			-	
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-				-											_					
100	College	1	FIS	SH SU	MMARY	1. Call	10	11			STRE	AM	/VALL	EY CR	OSS-SEC	TION	R		-	6
0.	Species	No		All and the set	Lite Phase	Use Me	thod	IRIa1	Y.			11	Lookin	g Down	straami	Service 1	21			RB
3	LSU	1	115	11.7.	EBUQHUN0053		EL	Contraction of the	È.		PLAN	VIME	TRIC	VIEW		1				2
-	RSC	1	108					10	en la											3
	TP	4	62-						000000											10
	LKC	7	43.					1												1
	-Di-	1						4	house											-
					1 2			-	- 7										10	<u> -</u>
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						COM	AMENTS			
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			The state of the s	A second s	the lot of			unco de constante	and a manufacture of the	17112030
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			WE 5					Auc a	10000	· 68 m
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RI	PAR	ernd i	ing s	Picon (SOR SOR	30. L	SPEN,		NERMAR	
RI	PAR	ernd i	ing s	Picon (SOR SOR	30. 4	SPEN,			
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RI	PAR	ernd i	ing s	Picon (SOR SOR	30. L	SPEN,		M DODING	

Stream Survey Form; Blueberry River - Site 3, the lowermost site.



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Blueberry River site 3, 300 m below proposed crossing: View downstream; from top of site.



Blueberry River site 3, 300 m below proposed crossing: View upstream; from bottom of site.

STREAM NAME Blueberry River

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LOCATION 300 m downstream of proposed crossing

DATE Oct. 13 / 93 SITE NO. 3 UTM 10.5814.62876

ELECTROSHOCKING SECONDS 530 AREA SAMPLED 1500 m2

NO	SP	LENGTH (mm)	COMMENTS	NO	SP	LENGTH (mm)	COMMENTS
1	LKC	99	PRESERVED	26			
2	LKC	74	RELEASED	27			
3	LKC	73	RELEASED	28			
4	LKC	59	RELEASED	29			
5	LKC	67	RELEASED	30			
6	LKC	62	RELEASED	31			
7	LKC	43	RELEASED	32			
8	LNS	115	PRESERVED	33			
9	RSC	68	RELEASED	34			
10	TP	70	PRESERVED	35			
11	TP	67	PRESERVED	36			-
12	TP	62	PRESERVED	37			
13	TP	67	RELEASED	38			
14				39			
15				40			
16				41			
17				42			
18				43			
19				44			
20				45			
21				46			
22				47			
23				48			
24			-	49			
25				50			
	LKC	AV = 68			TP	AV = 67	

Appendix III: Inglis Creek Stream Survey Forms, Site Photographs and Fish Data Sheets

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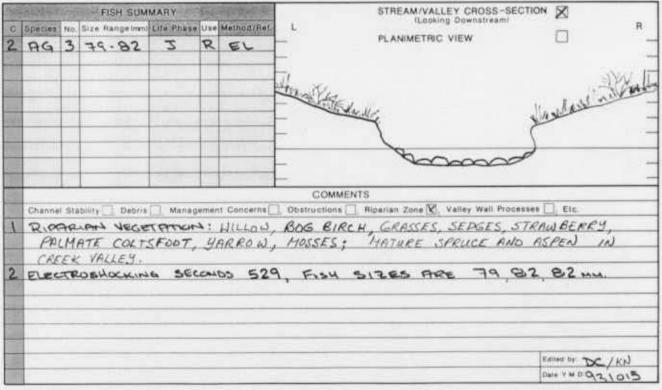
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DFO/MOE STREAM SURVEY FORM

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.00	ation 5	SURV	biet	FR	Mo	PRU	Pose	0	PIP	THILS	Map# c	14	A/	3	Site No	1 102		LUC NA	n) 10	00	HC
				100		up	STR	EM	M		U.T.M. VO	58	01.6	29.18	Fish C	ard Y	0	G.	Eit	id X	Hist.
					ime 1	1600	Agency	De	Craw	BC	oc P	0108			All Ph	atos					
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	Ave We	et.Widtt	i fimi	and the second	1.	5	GE		-		-	_	-	_	_	_		10			
-	Ave.Ma	ax Bitti	Dept	ts (cm)	15	5	T			_	_	_		-							
	Ave.Ma	as Pool	Depth	(cm)	6	5	T		-			_						15			
42	Gradie	ent 🐄 🗌	100	1	0	.5	CL	0	Print He	ED MAT	ERIAL		5	C		BANKS		1			
	S Pool	10	110 3	Onun	01	iner .	GE	223	Fines	ciay,silt,sa	me (Cammi	10	10	-	ieightsmi	75 %Ukm	table 24	0			
	Side Ch	M.ne	OCX	0-10 -0	-40]=+0	GE		10 01	smail:12!-1	6.mml		10	1	exture	0 6	LH				
	Deblis	A:65%	OOK	Q-4 0 =	-15	315	GE		Gravels	targe II n-	64mm)	-50	20		Çø	ntinement	EN C	9	FIC	OC U	C NIA
	No.	Stable	*				1		230	sm.cobbie	164-528mm1	104	15		atley O	hannel Ratio	0-2	2-	5 5-	10 10	N/A
	COV	ER: To	ital 🛸		30	2	GE		Larges	ige cobbie	(128-256 mm)	60	20	1	S	tage	Dry	C))	и н	Fibo
2		Dp Pp#	LOD	Roulder	In Veg	Over Veg		1	Sec.	boulder (3)	256mml	18	25		lood Si	gna Htim)	1.5	Bri	inded.	Y	Q
2	\$U(1) 100%	80	0	10	0	0	10	1.1	Bearon	A (R)	S HI INCOME	0	0	-	iars (%)	0	pH			Gyippr	ŵ
	Grown	Closure		0	C	Aspect	5		Duolom	25 0	Compaction	14.1	ME		rater Tem	1 3	Turkism	30	0 0	nd 125*1	¢1
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	Mean 5	Oepth la	eil.	0.11		T															
	Mean 1	Velocity	im/s	0.24		F	12,54			See See											
	Oischa	rge (m	int.	0.02	-		Des Cal			100	TO STREET			Width	Valley:O	tannel.Biope				Bail	Mittelii



Stream Survey Form; Inglis Creek - Site 1, the uppermost site.



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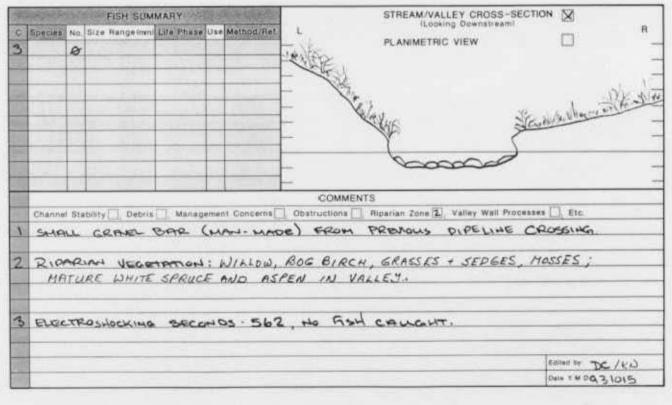
Inglis Creek site 1, above proposed crossing: View downstream; from top of site.

Inglis Creek site 1, above proposed crossing: View upstream; from proposed crossing at bottom of site.



DFO/MOE STREAM SURVEY FORM

Stiri	am Name (gaz.)	lo 4 G		2020	-		-	Part Part	call		1.0/11		-			Acc	ess	N	1	Methos
and a		2.7	121	C.		71	11	11 1	1	ing and	1.1.1.1.1	THE ST	1111	Reach	No	-	tham	-	1	
_	tershed Code 2						1.1	11		Map#			-	Site No	1100	Lina	_			ine.
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			- ali		1.120			Email	- C		NO.58	21.6	2011/0	Air Pho	Concerning of the local distribution of the	0	ACCURE.	Filling		man.
_	PARAMET		131	VAL		METH.	CC 9	P COM	BC D		SPECIF	10.0	67.6	Ind Plic	101		100	DOTE	UCTI	ONC
C	Ave Chan Width		1000				-		_		SPEUR	10.0	ALA	_			C	- and the second	Type	40000
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_	Stable %		1		_			24	sm.cobdie	64-128mm		15		alley: 🖸	hanner Ratio	6-2	2-5	5-10	10+	N/A
	COVER: Total	*		40	5	GE	123	Larges	lge cobible	1128-256.4	- 60	15		5	age .	Dry	0	м	H	Floo
	Camp. De Podi L	0.0	Bookler	in Veg	Over Veg			and the second	bouider (>2	semmi	1 miles	30		Flood Sk	gris Httimi	2	Braid	led	¥ (2
	100% 60 0	0	15	0	10	15	100	Bedros	K IRI	- THIN	0	0	1	Sars (%)	0	pН		¢	Jopmi	
2	Crown Closure %		9	C	Aspect	5	1	Denlom	30 0	Compac		M.C		Water Samp	100 13	fusioni	30	Cane	US*C	
		-	-	-	DISC	HARGE	_		1 Second and				-		REA	CH SYI	ABOL			
14	Parameter		Value	N	tethod		-	Spe	cific Data							(Fish)				
	Wetted Width in	1																		
	Mean Depth (m)	-	11.2							15				_						
	Mean Velocity In	n/s)	1			1.18														
	Discharge (m ³ /s					1		_					INIO	N/WHIHESO	winel(Sider)				Bec.	инсегіні



Stream Survey Form; Inglis Creek - Site 2, the middle site.





Inglis Creek site 2, below proposed crossing: View downstream; from proposed crossing at top of site.

Inglis Creek site 2, below proposed crossing: View upstream; from bottom of site. STREAM NAME Inglis Creek

LOCATION From proposed crossing downstream for 100 m

DATE Oct. 13 / 93 SITE NO. 2 UTM 10.5801.62916

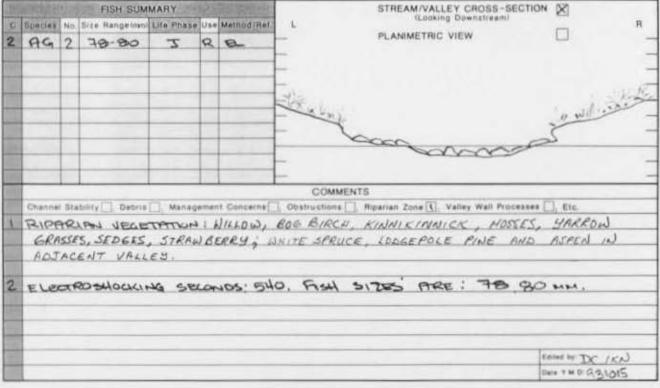
ELECTROSHOCKING SECONDS 562 AREA SAMPLED 200 m2

NO	SP	LENGTH (mm)	COMMENTS	NO	SP	LENGTH (mm)	COMMENTS
1			NO FISH	26			
2				27			
3				28			
4				29			
5				30	_		
6				31			
7				32			
8				33			
9				34			
10				35			
11				36			
12				37			
13				38			
14				39			
15				40			
16				41			
17				42			
18				43			
19				44			
20				45			
21				46			
22				47			
23				48			
24				49			1.1.1
25				50			

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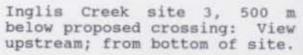
DFO / MOE STREAM SURVEY FORM

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SU	eam Name (gaz.) 163	5115	0.	000	×.		- 69	patt							Ac	OFER	14		Arthod
wea	tershed Code 2.3	326	1.3	7.2	1	1.1	1.1	1 march	1.1.1	100	1.	4	Reach	NO.	Leng	(Diken)			
Lo	Cation FROM 50	OH	124	non	I CR	055	-		Mapie	94	AI	13	Site No	3	Lina	ut wirm?	10	2	HC
	CUINISTREAM	600		00		200	-	,	UT.M.	10.580	n 167	9.13	Fish C	y bie	0	G	Field	_	
	*YM09310		17	130	Apericy	UES	Crem	BC D		Photos:		_	Air Pho	tes		-			
C			VALU		METH.		-			SPECIF	FIC D	ATA		1.0	_	0	BSTRU	JC TIC	INS
	Ave Chan Width Im!	de	3.0	0	GE											C	Httm	Type	Loc'n
	Ave Wet Width Incl	200	2.0		GE														
	Ave Mas Hittle Depth	(011)	10		T												-		
-	Ave Max Pour Depth	lgml.	50	>	T					- 1-	- 5				_	120			
	Gradient %	1 10	1.0	2	CL	C	- E	ED MAT	ERIAL		5	C		BANKS		100			
	NPOLIA O MITTIN 60	man	QIP		GRE	1000	Fines	clay, sill, sa	nit =C(triim)	10	10		neightim)	1.0 %00	utatile 40		1.11		
16	Sale Charles O P No		42	1 245	GE	100	and the	email (2-1)	(immi	20	10	-	Feature	00	LR				
-	Debris Areas Dicks		-11	200	GE	10.0	Graves	laige it this	4.000	20	10	12.25	Co	thearters	EN CO	O) FC	OC.	UÇ	N/A
194	Stable %							an cobine	164-128mm	r. 198	VO	1 Street	/alley. ©	hannel Hab	0 00	2-5	5-10	10-	N/A
	COVER: Total %		40		GE		Laigus	fge zübble	128-256-	- 70	20		. 5	ta ga	Dey	0	м	*	Flood
	Comp De Pour LO.D.	Badder	in the	Oier Yeg	Cutters	100		bounder 112	S&mm)	18	40		Flood Sk	gins Helles	2	Braid	ed	4 (0
10	100 50 0	35	0	0	15	1	Bedroo	CR IPLE		0	0	1000	Bars (%)	20	gH		04	(mag	
100	Crown Obsure %	0	C	Aspect	5	1000	D _{po} lom	40 0	Compact			1	materi Tarra	1013	Tathini	30	Core	25*01	
				DISCI	HARGE									RE/	ACH SYN	MBOL			
	Parameter	Value	M	shod			5pe	ofic Data			- 11				(Fish)				
	Wetted Width imi					1.00		1	-										
	Mean Depth (m)																		
	Mean Velocity (m/s)																		
	Discharge (m??s)	1			1							With	Valley O	ente: Sige	el la la		19	Ber M	Internet



Stream Survey Form; Inglis Creek - Site 3, the lowermost site.

Inglis Creek site 3, 500 m below proposed crossing: View downstream; from top of site.



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STREAM NAME Inglis Creek

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LOCATION Downstream of the proposed crossing 250 m

DATE Oct. 13 / 93 SITE NO. 3 UTM 10.5801.62913

ELECTROSHOCKING SECONDS 540 AREA SAMPLED 200 m2

NO	SP	LENGTH (mm)	COMMENTS	NO	SP .	LENGTH (mm)	COMMENTS
1	AG	78	RELEASED	26			
2	AG	80	RELEASED	27			
3				28			
4				29			
5				30			
6				31			
7				32			
8				33			
9				34			
10				35			
11	_			36			
12				37			
13	_			38			
14	_			39	_		
15	_			40			
16				41			
17	_			42			
18				43			
19			· · · · · · · · · · · · · · · · · · ·	44			
20				45	1.1		
21		_		46	_		
22				47			
23	_			48			
24	÷			49			2
25				50			

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Appendix IV: Aitken Creek

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Stream Survey Forms, Site Photographs and Fish Data Sheets

			ST	TREAM SU	RVEY	FORM							
Stream Name igaz I A 174	EN C.			(local)						Ato	823	Va	Metho
Watershed Code 2332		61	1 I. 1	11111	111	1.1.1	1.1	Resch No.		Lengt	filant		
Location FROM CROSSI					Map#	94 A	1.2	Site No.	1	K.ttsmut	wim	1.00	> HC
ALL AND A STATE OF A S				MANUAL CONT	and the second second	15631		Fish Card	Y	(N)	C	Field p	Contract of the local division of the local
Date YMDA 3 1013	1.00 1220	Agency	DES	BC /DO	And and a state of the	hotes	-20,4p.1	Air Photos		-	_		
C PARAMETER	VALUE	METH.				PECIFIC	DATA				0	BSTRU	CTIONS
Ave Chan Width Im!	8.0	HC									C	HEREN	Type Loc
Ave Wet Witth Init	4.0	HC.											
Ave Max Rittle Depth (cm)	15.0	T											
Ave Max Pool Depth (cm)	60.0	T				15							
Gradient %	2.0	CL	C	BED MATE	RIAL	8 5	C	BA	NKS		11000		
NPINI 9 D HITTE / OHUN	Other	GE	Fin	BE	1. (Cženni)	606	0	Hoghtimi 1	Sunat	Die ID			
Sete Chan N O pt o-to	I las a las at	GE	10.000	amail 12-16	mini	1	- Contraction	Taxture (F)	0	LB			
Avera Districter	Contraction of the second s	GE	Gra	inrya 111-64	Latera i	20 1	-	Continer	nert .	EN CO	FC	00	(UC) NO
Oebria Stable %			0.4	em cabbie id	4-128mml	10		Valley: Cherin	e Ratio	0-2	2-5	5-10	10.9 NI
2 COVER: Total %	20	GE	5 ta	ges lps sobtle it	28-256.000		_	litage	100	Dry (0	M	H F300
Comp De Pour LOS Brush		a statement	_	Boulder (125	dimin)	5		Flood Signs	HEIMI	4	Braid	ed	10
100% 95 & 5	00	Ø	500	TIDEA IRI	115	PE	-	5ars (%)	50	7184		04	ppenl
Orbern Obsure %	C Aspect	SE	0.	1cm1 12 C	Conpecto	m () H	-	Water Temp /101	+ 3	(unb.icen)	30	Cune	
	DISC	HARGE				~	-		READ	H SYM	BOL	-	
Parameter Valu	e Method	1		Specific Data			1			(Figh)			
Wetted Width (m) 2-	IT				1111		1						
Mean Depthimi .19	3 T			1			1						
Mean Velocity Imfal .3													
Discharge (m ³ /s) . 10	Contraction of the second second						Will!	In Party Channe	(Stepel				Dell Maleria
						_			-				
FISH SI	MMARY-	TONY	10/10/10			STREAM	A/VAL	LEY CROSS	-SEC	TION D	R		
C Species No. Size Rangets	man and the second second	Use Met	hod/het	L			IL OOKI	ng Downstrea	uni				R
3 LSU 1 B7			EL	-		PLANIN	ETRIC	VIEW		0	3		
1KC 1 72			=1	1									
100 1 100			-	1-1									1000
				HAR									AL +
			-	13YE	a -								SV.
	1 1 1 1			Skand	the-							13	1x24
				1	6							1	-
				1		-	-			-	1	-	
			1	1.				-		-			
				I.s									
				CON	MENTS								
Channel Stability Deb	vis . Manage	ement C	oncerne]	/ Obstructio	6.8 🗍 . Ai	parian Zo	n# 4	Valley Wall	Proces	545 [].	Etc.	-	

DFO/MOE

Stream Survey Form; Aitken Creek - Site 1, below the bridge.

I HIGH DEGREE OF DISTURBANCE BOTH UPSTREAM + DOWNSTREAM OF PROPOSED CROSSING SITE: O LIVESTOCK ACCESS TO CREEK (B) NEW BRIDGE CURRENTLY BEING INSTALLED IMMEDIATELY UPSTREAM OF PROPOSED CROSSING (C) OLD BRIDGE APPROXIMATELY 50M

45 M DOWNSTREAM.

Estate by DC/KN

Dale THE 931015

DOWNSTREAM D BULLDOZER CROSSING OF CREEK APPROXIMATELY

STREAM SURVEY MODIFIED TO AVOID NERVY EQUIPMENT ZONE

DANDELION, AMERICAN VETCH, WILD STRAWBERRY, GRASSES

RIP.RAP UNDER OLD BRIDGE DECK CLASSIFIED AS BOULDERS

2 SILT LOAD, COMEMIED WITH SLIGHTLY TAWLIC WATER, WORKAGED COVER IN POOLS. 3 ELECTROSHOCKING SECONDS 425 ; 2 FISH CAUGHT. 4 RIPPRIAN VEGETATION. BOG BIRCH, WILLOW, ROSE, WHITE SPRUCE, ASPEN

Aitken Creek site 1 below proposed crossing: View upstream; from middle of site.



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Aitken Creek site 1, below proposed crossing: View upstream; from bottom of site.



STREAM NAME Aitken Creek

LOCATION From crossing site, 100 metres downstream

DATE Oct. 13 / 93 SITE NO. 1 UTM 10.5834.63087

ELECTROSHOCKING SECONDS 425 AREA SAMPLED 400 m2

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NO	SP	LENGTH (mm)	COMMENTS	NO	SP	LENGTH (mm)	COMMENTS
1	LSU	87	PRESERVED	26			
2	LKC	72	PRESERVED	27			
3				28			
4				29			
5				30			
6				31			
7				32			
8				33			
9				34			
10				35			
11				36			
12				37			
13				38			
14				39			
15				40	_		
16				41			
17				42	_	_	
18				43			
19				44			
20				45			
21				46			
22				47			
23				48	_		
24				49			×
25	_			50			

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Stre	sam Name igaz istra	icani	c					cáli				-			Aco	44.9	V2	Method
Wat	Intented Code 2.3	324	0.10	335	6	101	11	1.1.1	1.1.1	1.0	1.5		Beach N	0.	Lengt	trami	-	
	ation 500 H]								Map# c	34	A /	12	Site No.	2	Lthau	extent	100	WK.
	CROSSING									503			5 Fish Car	d Y	O	4	Field N	Hist.
Det	*YMD RG 10	13	time /	420	Agency	bes	Citra	DC P		lotos			Air Phot	08				
C	PARAMETER		VAL	UE	METH				SF	PE CIF	10.0	ATA	10 m			OB	STRU	CTIONS
	Ave.Chan.Wigth Im/	0.00	10	0.0	HC									_		C	Httimi 1	Type Loc'n
	Ave.Wet.Width imJ	the state	6	é.0	HC									_	-			
	Ave Max Riffle Dept	i licrei	15	5.0	T						_							
12	Ave.Max.Poor Depth	femi	61	0.0	T	_				-	_	_	-		_			
110	Gradient %	1000	1	.0	CL	C	6	BED MAT	ERIAL	and street	÷ .	C		BANKS	1	1000	-	
mil	* Poor 8 0 Mille 20) Millin	01	her	GE		Finna	1741, 411, 84	nd scanno	70	90		Hanghtimit 2	5 SUMER	the 30			
TP	Side Chan % O o (2)	e-m[]s	0-40]>40[]]	6E		Gravita	1-11 IZ-11	nml	20	10		Testure	F) G	L R	1000		
	Depna Area 50	0-31	0-11		GE	-		large It 8-8	# monvil		10	16	Cont	(internet))	EN CO	3 FC	0C	UB NIA
-	Stable %		50	0	GE		100	em cottale	#4-178mmr	120	5		Valley Cha	rine Ratio	0-2	2-5	5-10 (10.) N/A
1	COVER: Total %		2	5	GE		Laiges	109-215574	178-255-000	10	5	1	Sta	ge	Dry	\odot	м	H Flood
	Comp. Dp Pour LO.D.	Boulder		Owr Yep	Cuttere		32	beulder 11-2	56.mm1		0	12.5	Flood Sign	is Hilmi	4	Braide	d 1	
15	100x 85 5	ø	ø	5	5	100	Bedroe	CA INI		ø	ø	1	Bars (%)	40	pH.		04	(pint)
1	Crown Closure %	ø	C	Aspect	SE.	10	D solon	12 0	Compactio	0	MH	18	Water Terror	0+3	General and	30	Cohē,13	5.01
-		-	-	DISC	HARGE	_	1						-	REAC	H SYN	BOL	-	1.
1000	Parameter	Vature		Nethod			Spe	ofic Data							(Fiah)			
	Wetted Width (m)							-				1					_	-
	Mean Depthimi				1													
	Mean Velocity Im/al																	
	Discharge (m3/s)											300	eth Valley Cha	trial.Stoper	1			led Materiali
0 24	Fit Specine No. 5-2+ Hi KKC 4 39-1	ngetm				EL		X	C				LLEY CRO ing Downst C VIEW	SS-SEC	TION [/	
		-						5.4	_	_		_				_		
									MMENTS				_					
1	Channel Stability								one [], Rip			_				Etc.	_	
2	SILT LOAD, CO ELECTRO-SHO RIPARIAN VI AMERICAN	CKIN EGET	IG :	SECON	ROG :	RU	RCH,	WE CH	W, ROS	ES!	39, ASI	40 PEA	0, 42,	86 m	12			sES,
4	LIVESTOCK 1										-	_	_		_	-	-	

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Stream Survey Form; Aitken Creek - Site 2, the lowermost site.

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Aitken Creek site 2, 500 m below proposed crossing: View upstream; from bottom of site.



Aitken Creek site 2, 500 m below proposed crossing: View downstream; from middle of site.

STREAM NAME Aitken Creek

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LOCATION 500 metres downstream of proposed crossing

DATE Oct. 13 / 93 SITE NO. 2 UTM 10.5834.63085

ELECTROSHOCKING SECONDS 379 AREA SAMPLED 600 m2

NO	SP	LENGTH (mm)	COMMENTS	NO	SP	LENGTH (mm)	COMMENTS
1	LKC	39	PRESERVED	26			
2	LKC	40	PRESERVED	27			
3	LKC	42	PRESERVED	28			
4	LKC	86	PRESERVED	29			
5				30			
6				31	-		
7				32			
8				33			
9				34			
10				35			
11				36	2		
12				37			
13	_			38			
14				39			
15				40			
16				41			
17	_			42			
18				43			
19	_			44	- ÷		_
20				45			
21				46			
22				47			
23				48			
24				49	4		2
25				50			