

APPENDIX B1: COLDSTREAM CREEK

Habitat Mapping

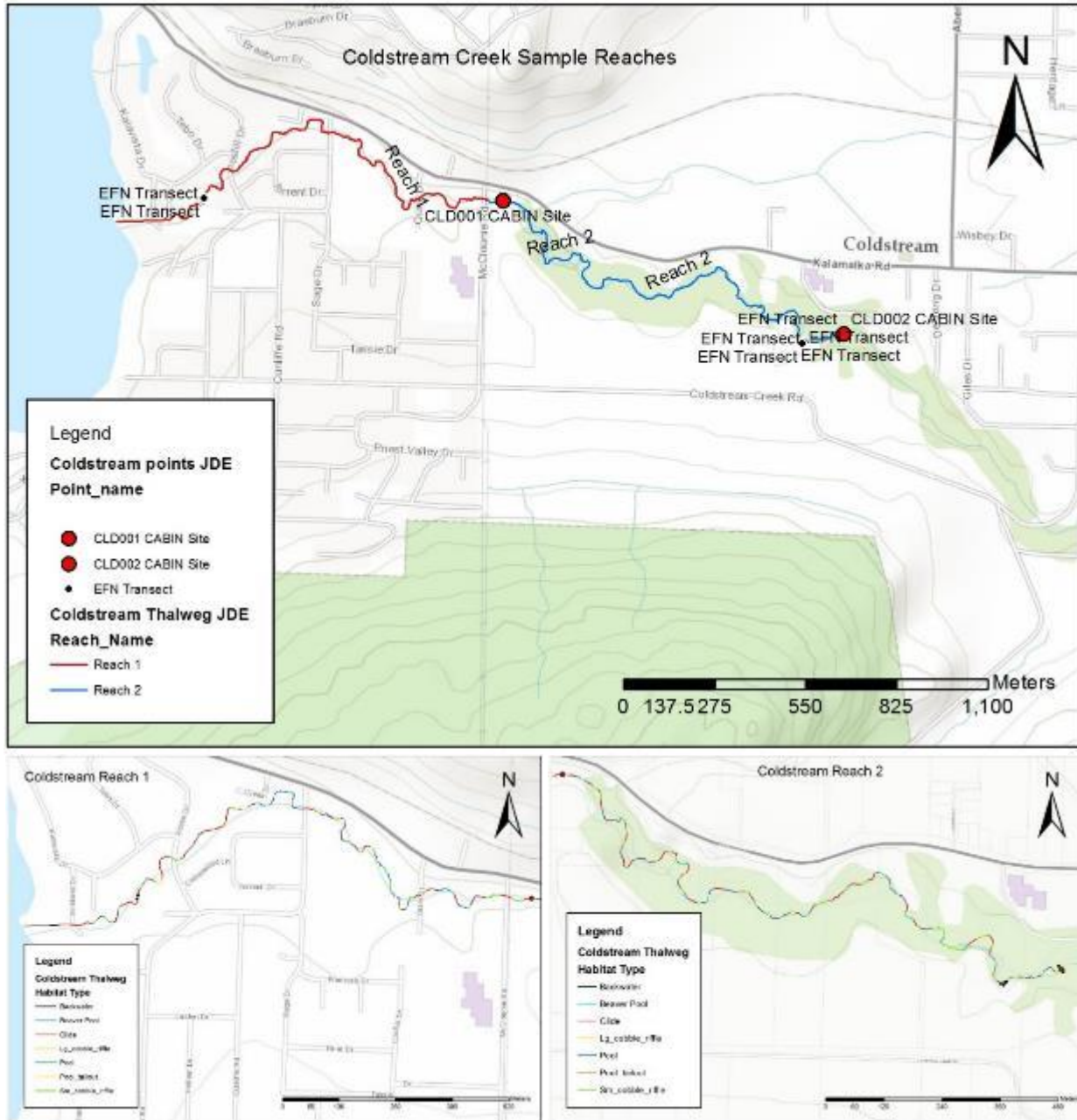


Figure B1-1: Map of habitat types recorded along Coldstream Creek in fall of 2016

Transect Descriptions

Coldstream Riffle 1

Install Date Aug 4, 2016

Lat./Long. 50.224869, -119.259985

Width (install) 4.30 m

Avg. width range 3.79 - 5.10 m

Depth (install) 0.18 m

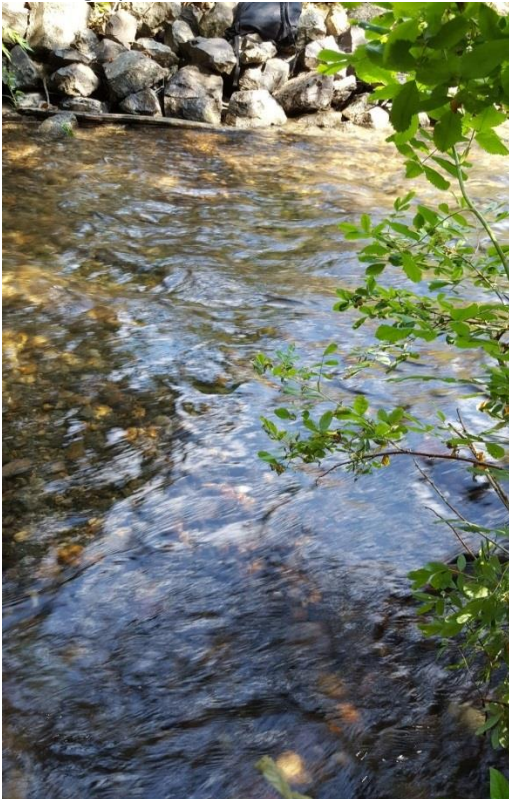
Avg. depth range 0.18 - 0.25 m



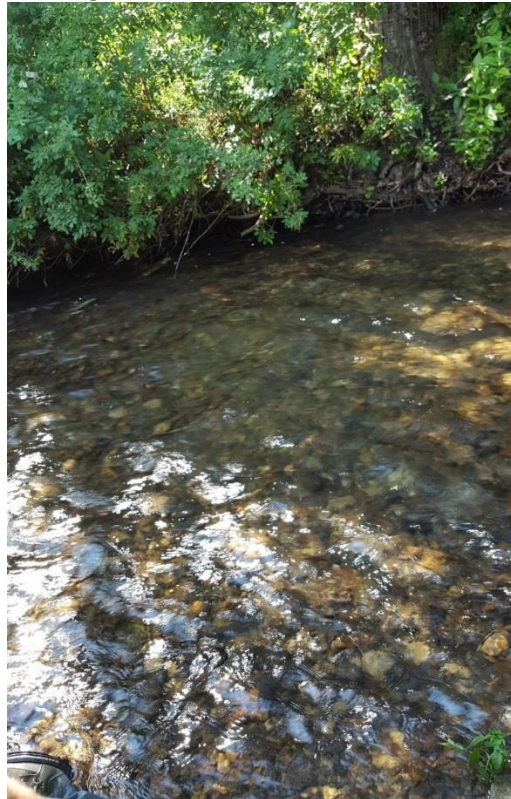
Looking upstream



Looking downstream



Looking right bank to left bank



Looking left bank to right bank

Coldstream Glide 1

Install Date	Aug 4, 2016		
Lat./Long.	50.224953, -119.259949		
Width (install)	4.05 m	Depth (install)	0.29 m
Avg. width range	4.18 - 4.98 m	Avg. depth range	0.23 - 0.28 m
Comment	Kokanee spawning observed in this transect		



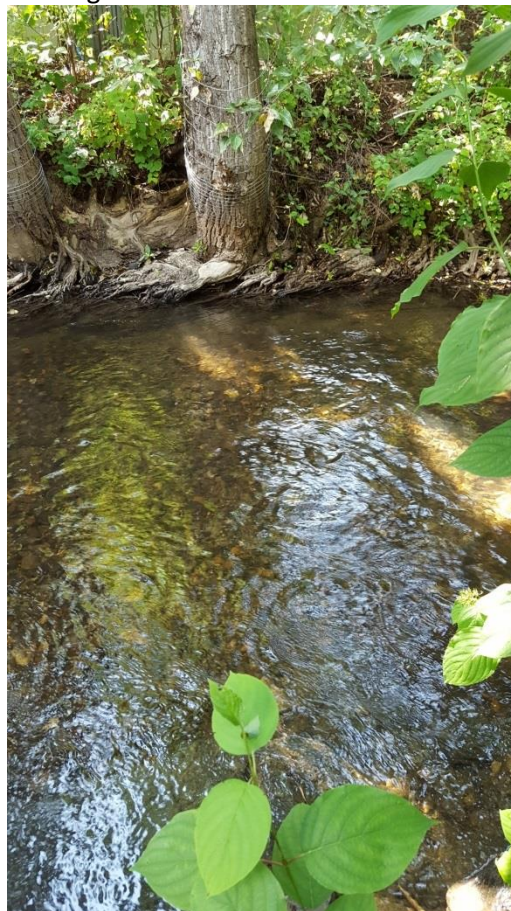
Looking upstream



Looking downstream



Looking right bank to left bank



Looking left bank to right bank

Coldstream Riffle 2

Install Date Aug 4, 2016

Lat./Long. 50.225079, -119.247204

Width (install) 5.10 m

Avg. width range 3.79 - 5.10 m

Depth (install) 0.21 m

Avg. depth range 0.18 - 0.25 m



Looking upstream



Looking downstream



Looking right bank to left bank



Looking left bank to right bank

Coldstream Glide 2

Install Date	Aug 4, 2016		
Lat./Long.	50.225069, -119.247132		
Width (install)	5.40 m	Depth (install)	0.28 m
Avg. width range	4.18 - 4.98 m	Avg. depth range	0.23 - 0.28 m
Comment	Kokanee spawning observed in this transect		



Looking upstream



Looking downstream



Looking right bank to left bank



Looking left bank to right bank

Coldstream Hydrometric Station

Install Date Aug 29, 2016

Lat./Long. 50.225112, -119.246897

Comment Installed on right bank on a poplar approximately 20 m upstream of Coldstream
Glide 2



Coldstream Riffle 3

Install Date Aug 4, 2016

Lat./Long. 50.221506, -119.234358

Width (install) 4.55 m

Avg. width range 3.79 - 5.10 m

Depth (install) 0.18 m

Avg. depth range 0.18 - 0.25 m



Looking upstream



Looking downstream



Looking right bank to left bank



Looking left bank to right bank

Coldstream Glide 3

Install Date	Aug 4, 2016		
Lat./Long.	50.221474, -119.234312		
Width (install)	4.70 m	Depth (install)	0.25 m
Avg. width range	4.18 - 4.98 m	Avg. depth range	0.23 - 0.28 m
Comment	Kokanee spawning observed in this transect		



Looking upstream



Looking downstream



Looking right bank to left bank



Looking left bank to right bank

Coldstream Riffle 4

Install Date	Aug 4, 2016		
Lat./Long.	50.221782, -119.232670		
Width (install)	5.0 m	Depth (install)	0.21 m
Avg. width range	3.79 - 5.10 m	Avg. depth range	0.18 - 0.25 m



Looking upstream



Looking downstream



Looking right bank to left bank



Looking left bank to right bank

Coldstream Glide 4

Install Date	Aug 4, 2016		
Lat./Long.	50.221884, -119.232671		
Width (install)	4.70 m	Depth (install)	0.27 m
Avg. width range	4.18 - 4.98 m	Avg. depth range	0.23 - 0.28 m
Comment	Kokanee spawning observed in this transect		



Looking upstream



Looking downstream



Looking right bank to left bank



Looking left bank to right bank

Discharge Records

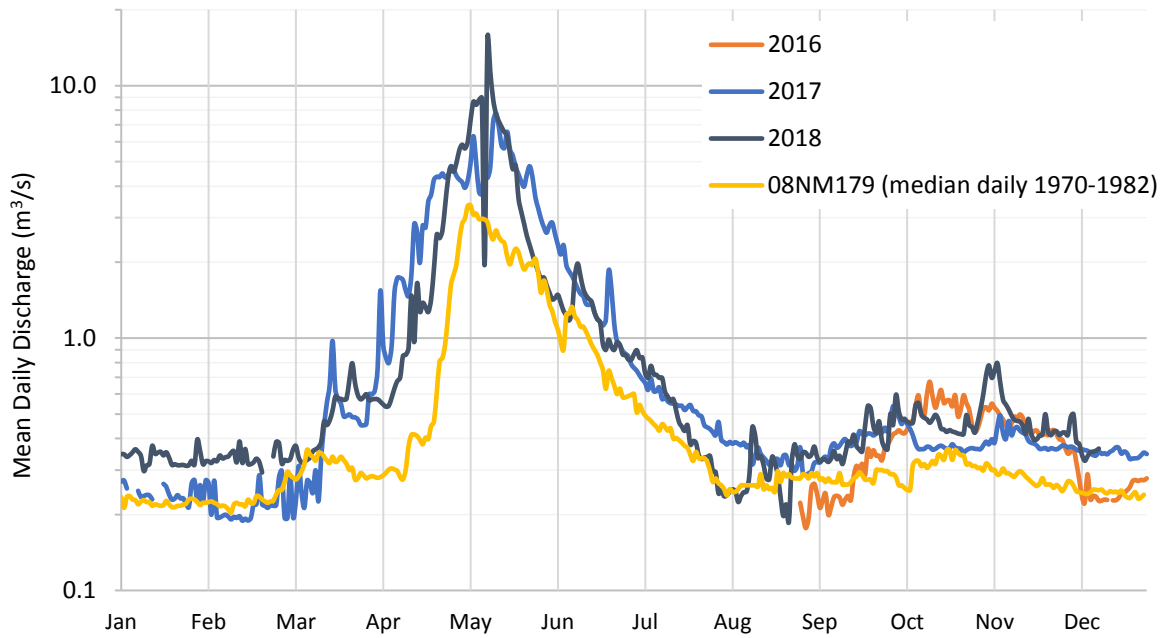


Figure B1-3: Mean daily discharge measured at the ONA Coldstream Hydrometric Station (08NM589) from 2016 to 2018, compared with the median daily historical discharge from WSC station 08NM179 (Coldstream Creek above Kalavista Diversion, 1970-1982)

Water Temperature Record



Figure B1-4: Daily maximum water temperatures recorded at the ONA Coldstream Hydrometric Station from 2016-2018

Flow standards and periodicity – Okanagan Tennant analysis for Coldstream Creek

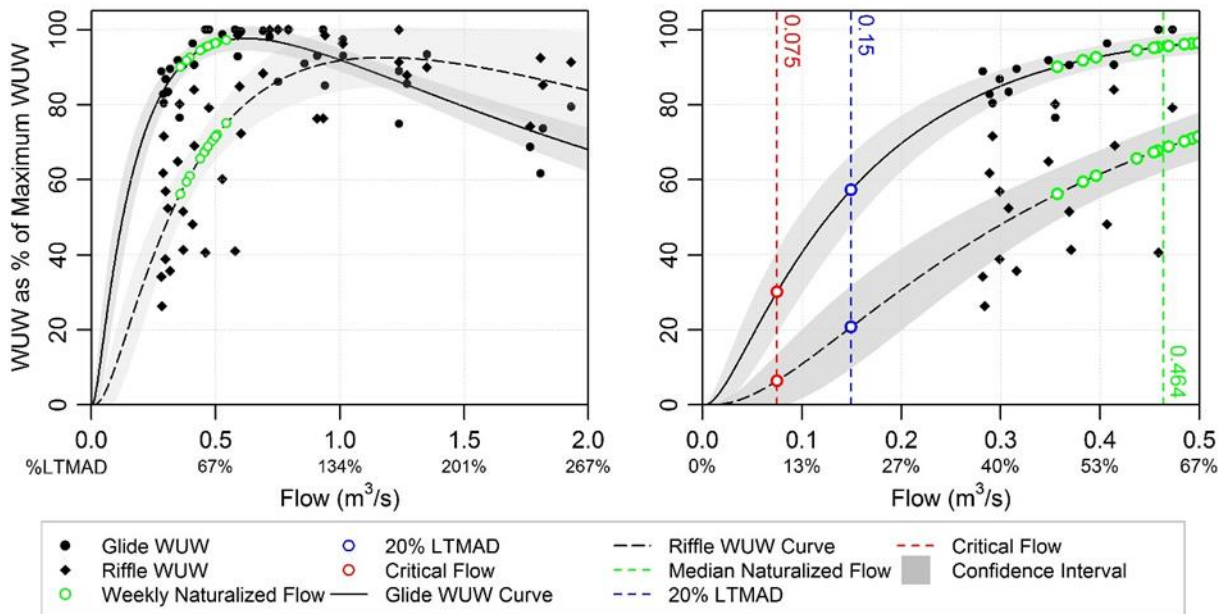
Week Ending	Week	Rainbow						Kokanee				Ecological Flows	
		Adult migration	Spawning	Incubation	Rearing	Juvenile migration	Over-wintering	Adult migration	Spawning	Incubation	Juvenile migration	Wetland, side channel linkage, flushing and channel maintenance flow	Cottonwood ecosystem
Jan							20%			20%			
Feb							20%			20%			
Mar							20%			20%			
1-Apr	13				20%						50%	<input checked="" type="checkbox"/>	
8-Apr	14				20%						50%	<input checked="" type="checkbox"/>	
15-Apr	15	164%			20%						50%	<input checked="" type="checkbox"/>	
22-Apr	16	164%			20%						50%	<input checked="" type="checkbox"/>	
29-Apr	17	164%			20%						50%	<input checked="" type="checkbox"/>	
6-May	18	164%			20%	50%					50%	730%	
13-May	19	164%			20%	50%					50%	730%	
20-May	20	164%	40%		20%	50%					50%	<input checked="" type="checkbox"/>	100%
27-May	21	164%	40%	20%	20%	50%					50%	<input checked="" type="checkbox"/>	100%
3-Jun	22	164%	40%	20%	20%	50%						<input checked="" type="checkbox"/>	100%
10-Jun	23	164%	40%	20%	20%	50%						<input checked="" type="checkbox"/>	100%
17-Jun	24	164%	40%	20%	20%	50%						<input checked="" type="checkbox"/>	100%
24-Jun	25	164%	40%	20%	20%	50%							100%
1-Jul	26	164%	40%	20%	20%	50%							100%
8-Jul	27	164%	40%	20%	20%	50%							100%
15-Jul	28			20%	20%	50%							100%
22-Jul	29			20%	20%								100%
29-Jul	30			20%	20%								100%
5-Aug	31				20%								
12-Aug	32				20%								
19-Aug	33				20%								
26-Aug	34				20%			20%					
2-Sep	35				20%			20%		20%			
9-Sep	36				20%			20%		20%			
16-Sep	37				20%			20%		20%			
23-Sep	38				20%			20%	20%	20%			
30-Sep	39				20%			20%	20%	20%			
7-Oct	40				20%			20%	20%	20%			
14-Oct	41				20%				20%	20%			
21-Oct	42				20%				20%	20%			
28-Oct	43				20%					20%			
Nov							20%			20%			
Dec							20%			20%			

EFNs and Critical Flows for Coldstream Creek

Week Ending	Okanagan Tennant EFN					WUW EFN (m ³ /s)					FINAL EFN (m ³ /s)		CRITICAL FLOW (m ³ /s)				
	Flow standard (%LTMAD)	Flow standard EFN (m ³ /s)	Nat. median flow (m ³ /s)	Okanagan Tennant EFN	%LTMAD	Rainbow rearing	Insect production	Kokanee spawning	Rainbow spawning	FINAL	Value	Dominant Species / Life Stage	Rainbow rearing & overwintering	Kokanee spawning	Rainbow spawning	FINAL	
Jan	20%	0.150	0.262	0.150	20%						0.250	overwintering egg Incubation	0.075			0.075	
Feb	20%	0.150	0.251	0.150	20%						0.250	overwintering egg Incubation	0.075			0.075	
Mar	20%	0.150	0.295	0.150	20%						0.295	overwintering egg Incubation	0.075			0.075	
1-Apr	50%	0.374	0.439	0.374	50%						0.374	KO juvenile migration	0.075			0.075	
8-Apr	50%	0.374	0.575	0.374	50%						0.374	KO juvenile migration	0.075			0.075	
15-Apr	164%	1.227	1.599	1.227	164%						1.227	RB adult migration	0.075		0.419	0.419	
22-Apr	164%	1.227	1.846	1.227	164%	0.250	0.250			0.250	1.227	RB adult migration	0.075		0.419	0.419	
29-Apr	164%	1.227	2.126	1.227	164%	0.250	0.250			0.250	1.227	RB adult migration	0.075		0.419	0.419	
6-May	730%	5.460	3.149	3.149	421%	0.250	0.250			0.250	3.149	Ecosystem flows	0.075		0.419	0.419	
13-May	730%	5.460	2.242	2.242	300%	0.250	0.250			0.250	2.242	Ecosystem flows	0.075		0.419	0.419	
20-May	164%	1.227	2.060	1.227	164%	0.250	0.250			1.000	1.000	1.000	RB Spawning	0.075		0.419	0.419
27-May	164%	1.227	1.466	1.227	164%	0.250	0.250			1.000	1.000	1.000	RB Spawning	0.075		0.419	0.419
3-Jun	164%	1.227	1.451	1.227	164%	0.250	0.250			1.000	1.000	1.000	RB Spawning	0.075		0.419	0.419
10-Jun	164%	1.227	1.129	1.129	151%	0.250	0.250			1.000	1.000	1.000	RB Spawning	0.075		0.419	0.419
17-Jun	164%	1.227	0.990	0.990	132%	0.250	0.250			1.000	1.000	0.990	RB Spawning	0.075		0.419	0.419
24-Jun	164%	1.227	0.905	0.905	121%	0.250	0.250			1.000	1.000	0.905	RB Spawning	0.075		0.419	0.419
1-Jul	164%	1.227	0.834	0.834	112%	0.250	0.250			1.000	1.000	0.834	RB Spawning	0.075		0.419	0.419
8-Jul	164%	1.227	0.704	0.704	94%	0.250	0.250			1.000	1.000	0.704	RB Spawning	0.075		0.419	0.419
15-Jul	100%	0.748	0.543	0.543	73%	0.250	0.250				0.250	0.543	RB incubation	0.075			0.075
22-Jul	100%	0.748	0.492	0.492	66%	0.250	0.250				0.250	0.492	RB incubation	0.075			0.075
29-Jul	100%	0.748	0.505	0.505	68%	0.250	0.250				0.250	0.505	RB incubation	0.075			0.075
5-Aug	20%	0.150	0.485	0.150	20%	0.250	0.250				0.250	0.250	RB parr rearing	0.075			0.075
12-Aug	20%	0.150	0.458	0.150	20%	0.250	0.250				0.250	0.250	RB parr rearing	0.075			0.075
19-Aug	20%	0.150	0.454	0.150	20%	0.250	0.250				0.250	0.250	RB parr rearing	0.075			0.075
26-Aug	20%	0.150	0.499	0.150	20%	0.250	0.250				0.250	0.250	RB parr rearing	0.075			0.075
2-Sep	20%	0.150	0.469	0.150	20%	0.250	0.250				0.250	0.250	RB parr rearing	0.075			0.075
9-Sep	20%	0.150	0.437	0.150	20%	0.250	0.250				0.250	0.250	RB parr rearing	0.075			0.075
16-Sep	20%	0.150	0.396	0.150	20%	0.250	0.250				0.250	0.250	RB parr rearing	0.075			0.075
23-Sep	20%	0.150	0.383	0.150	20%	0.250	0.250	0.250			0.250	0.250	KO Spawning	0.075	0.164		0.164
30-Sep	20%	0.150	0.357	0.150	20%	0.250	0.250	0.250			0.250	0.250	KO Spawning	0.075	0.164		0.164
7-Oct	20%	0.150	0.370	0.150	20%	0.250	0.250	0.250			0.250	0.250	KO Spawning	0.075	0.164		0.164
14-Oct	20%	0.150	0.354	0.150	20%	0.250	0.250	0.250			0.250	0.250	KO Spawning	0.075	0.164		0.164
21-Oct	20%	0.150	0.362	0.150	20%	0.250	0.250	0.250			0.250	0.250	KO Spawning	0.075	0.164		0.164
28-Oct	20%	0.150	0.372	0.150	20%	0.250	0.250				0.250	0.250	RB parr rearing	0.075			0.075
Nov	20%	0.150	0.338	0.150	20%						0.250	overwintering egg Incubation	0.075				0.075
Dec	20%	0.150	0.298	0.150	20%						0.250	overwintering egg Incubation	0.075				0.075

Weighted Usable Width

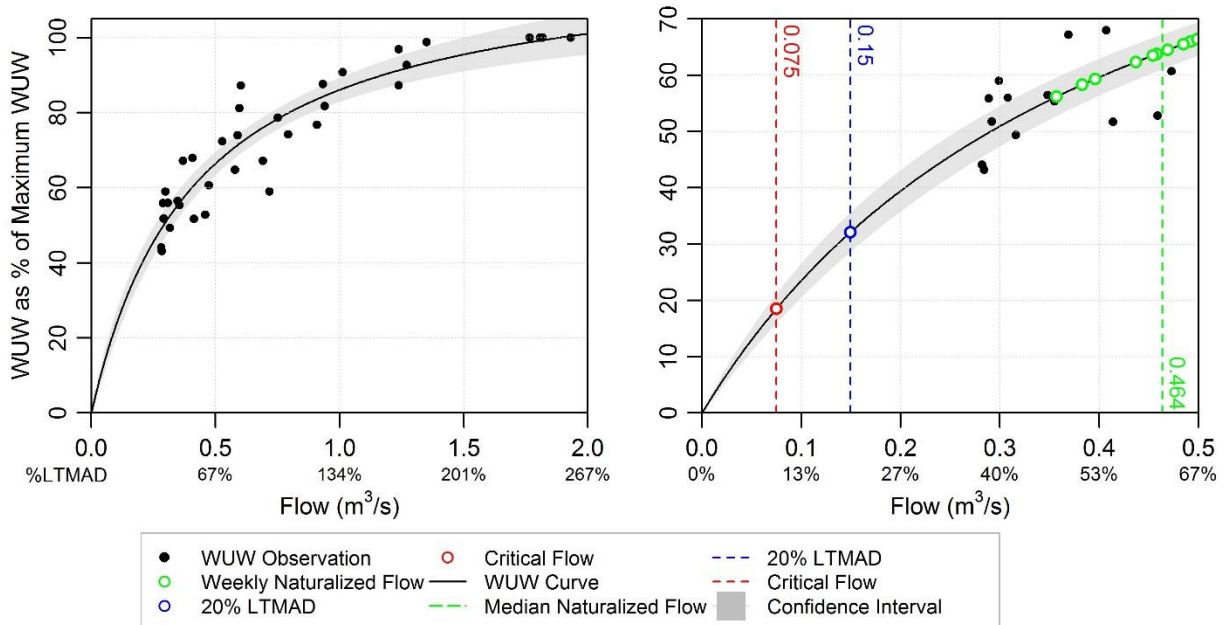
Coldstream Creek Rainbow Parr Rearing WUW



Median values from mid-July to end of September (week 28-39)

Figure B1-5: WUW curve for Rainbow rearing in Coldstream Creek for all flows (left) and low flows (right)

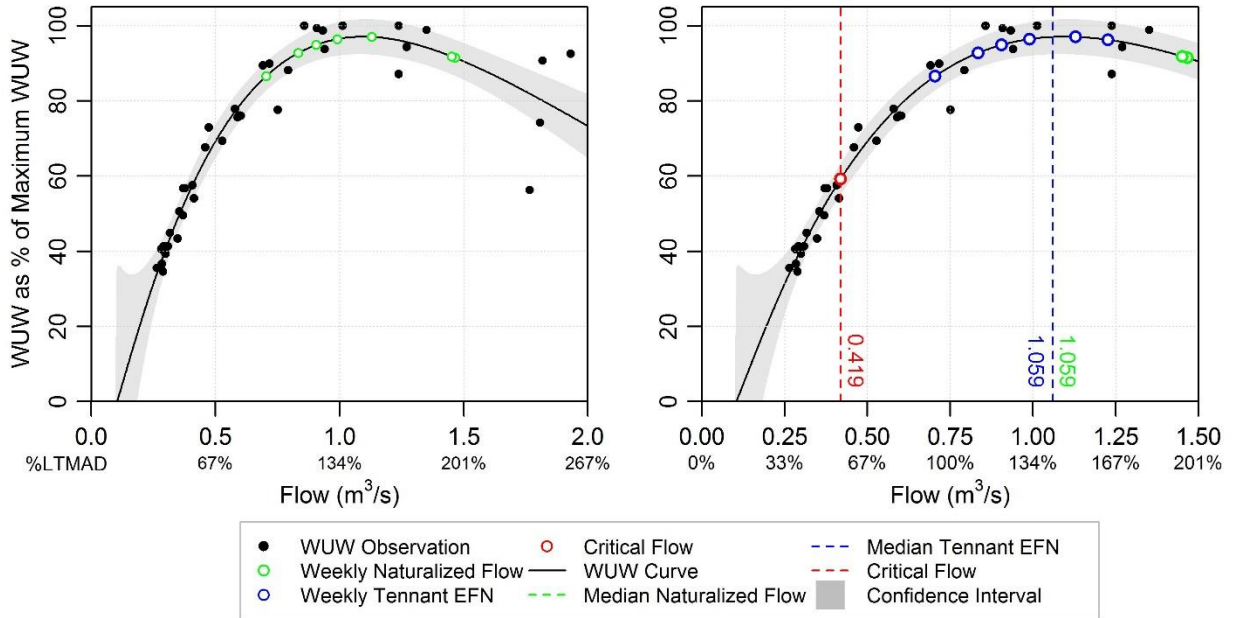
Coldstream Creek Insect Production WUW



Median values from mid-July to end of September (week 28-39)

Figure B1-6: WUW curve for insect production in Coldstream Creek for all flows (left) and low flows (right)

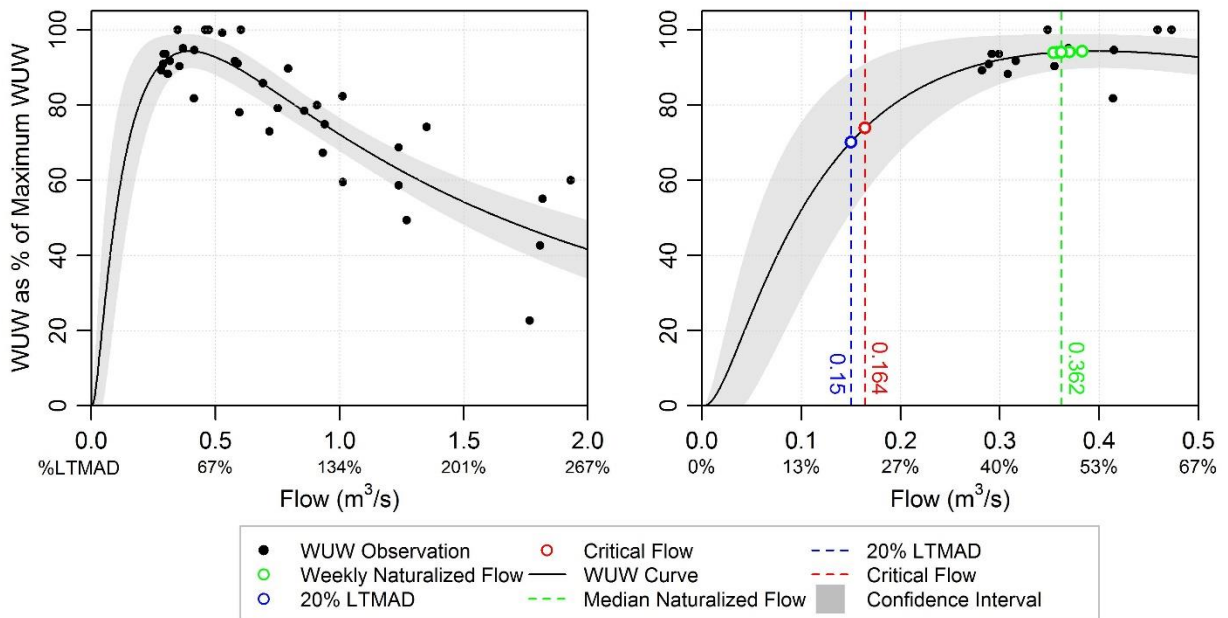
Coldstream Creek Rainbow Spawning WUW



Median values from May 20 to July 10 (week 20-27)

Figure B1-7: WUW curve for Rainbow spawning in Coldstream Creek for all flows (left) and low flows (right)

Coldstream Creek Kokanee Spawning WUW



Median values from September 22 to October 23 (week 38-42)

Figure B1-8: WUW curve for Kokanee spawning in Coldstream Creek for all flows (left) and low flows (right)

Critical Flows

Table B1-2: Critical flow analysis for Coldstream Creek

Species / Life stage	Critical Flow Criteria	Riffle 1	Riffle 2	Riffle 3	Riffle 4	Average
		(m ³ /s) LTMAD	(m ³ /s) LTMAD	(m ³ /s) LTMAD	(m ³ /s) LTMAD	(m ³ /s) LTMAD
	Naturalized LTMAD					0.748 100%
	Wetted Width at 100% LTMAD (m)	4.30	5.71	5.17	5.55	
Rainbow rearing, overwintering & insect production	60% of width at 100% LTMAD	0.044 6%	0.099 13%	0.035 5%	0.042 6%	0.055 7%
Rainbow Spawning	25% of width at 100% LTMAD ≥0.18m deep	0.116 15%	0.551 74%	0.529 71%	0.479 64%	0.419 56%
Kokanee spawning	25% of width at 100% LTMAD ≥0.12m deep	0.072 10%	0.255 34%	0.167 22%	0.164 22%	0.164 22%

Table B1-3: Final critical flows for Coldstream Creek

Species/Life stage	Final Critical Flow (m ³ /s)	% LTMAD	Criteria Used
Rainbow rearing & insect production	0.075	10%	10% LTMAD
Rainbow spawning	0.419	56%	0.18m depth criterion
Kokanee spawning	0.164	22%	0.12m depth criterion
Rainbow overwintering	0.075	10%	10% LTMAD

Table B1-4: 30-day naturalized low flows for summer and winter provided by Associated (2019)

	(m ³ /s)	% LTMAD
Summer (July 1 to September 30) Minimum		
Summer 1:2-year return period 30 Day Naturalized Low	0.360	48%
Summer 1:5-year return period 30 Day Naturalized Low	0.317	42%
Summer 1:10-year return period 30 Day Naturalized Low	0.302	40%
Summer 1:20-year return period 30 Day Naturalized Low	0.292	39%
Winter (November 1 to March 31) Minimum		
Winter 1:2-year return period 30 Day Naturalized Low	0.248	33%
Winter 1:5-year return period 30 Day Naturalized Low	0.201	27%
Winter 1:10-year return period 30 Day Naturalized Low	0.180	24%
Winter 1:20-year return period 30 Day Naturalized Low	0.165	22%

Percentile Flows for Coldstream Creek

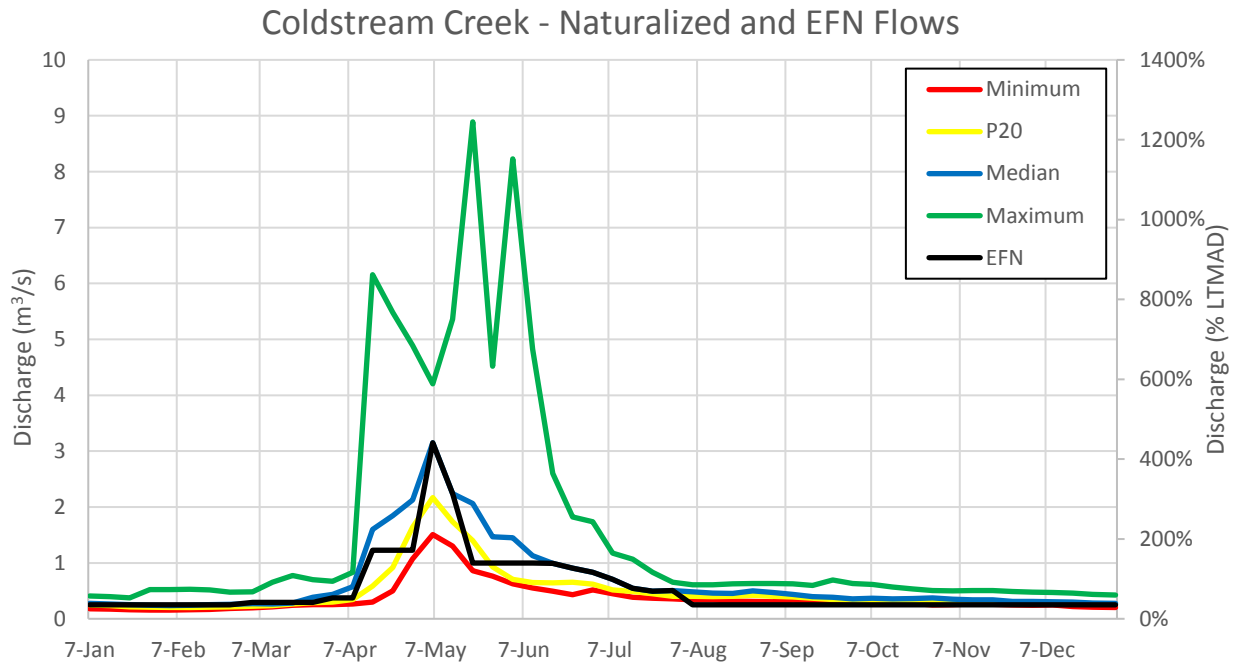


Figure B1-9: EFN flows compared with naturalized flow percentiles for Coldstream Creek (Discharge & %LTMAD)

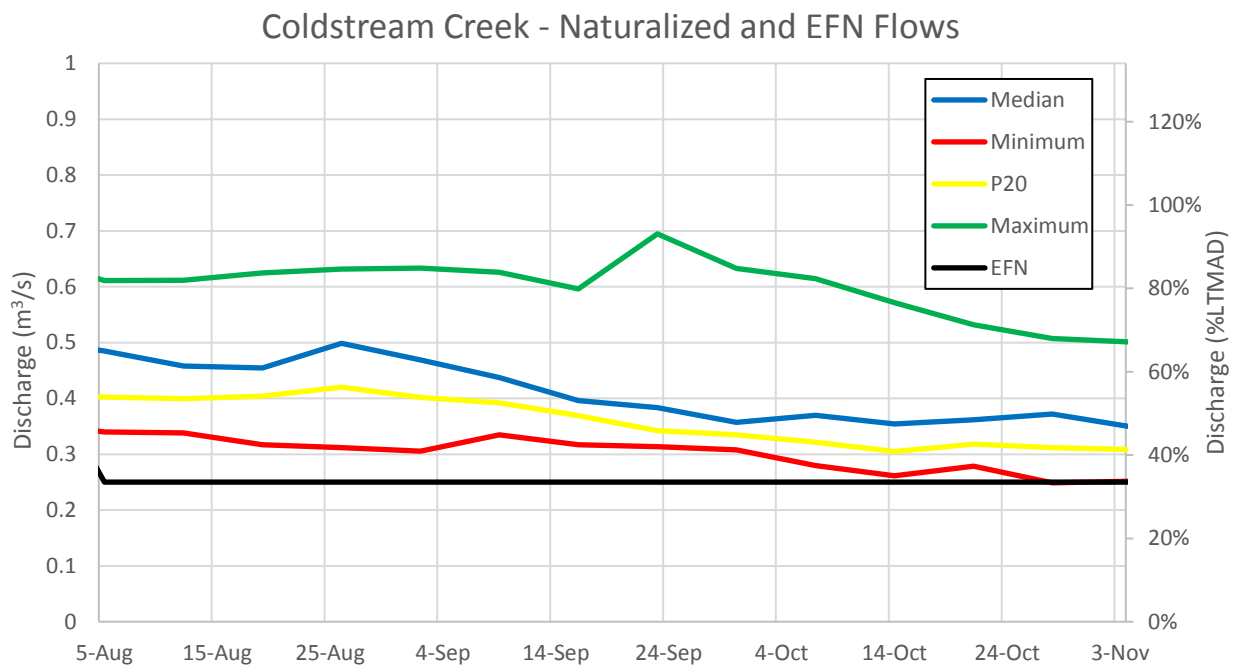


Figure B1-10: EFN flows compared with naturalized flow percentiles for Coldstream Creek Aug-Nov (Discharge & %LTMAD)

Percentile flows for Coldstream Creek

NATURALIZED FLOW		as m ³ /s				as % LTMAD			
Week	Ending	Min	P20	Median	Max	Min	P20	Median	Max
01	7-Jan	0.181	0.249	0.278	0.408	24%	33%	37%	55%
02	14-Jan	0.171	0.238	0.266	0.398	23%	32%	36%	53%
03	21-Jan	0.162	0.212	0.255	0.375	22%	28%	34%	50%
04	28-Jan	0.158	0.206	0.242	0.523	21%	28%	32%	70%
05	4-Feb	0.156	0.203	0.237	0.522	21%	27%	32%	70%
06	11-Feb	0.160	0.204	0.241	0.527	21%	27%	32%	70%
07	18-Feb	0.170	0.210	0.252	0.519	23%	28%	34%	69%
08	25-Feb	0.187	0.214	0.257	0.477	25%	29%	34%	64%
09	4-Mar	0.198	0.227	0.268	0.483	26%	30%	36%	65%
10	11-Mar	0.215	0.239	0.266	0.652	29%	32%	36%	87%
11	18-Mar	0.242	0.267	0.283	0.772	32%	36%	38%	103%
12	25-Mar	0.253	0.287	0.383	0.703	34%	38%	51%	94%
13	1-Apr	0.255	0.298	0.439	0.673	34%	40%	59%	90%
14	8-Apr	0.266	0.344	0.575	0.831	36%	46%	77%	111%
15	15-Apr	0.301	0.586	1.599	6.156	40%	78%	214%	823%
16	22-Apr	0.501	0.919	1.846	5.479	67%	123%	247%	733%
17	29-Apr	1.071	1.637	2.126	4.889	143%	219%	284%	654%
18	6-May	1.507	2.169	3.149	4.206	202%	290%	421%	562%
19	13-May	1.300	1.739	2.242	5.361	174%	232%	300%	717%
20	20-May	0.863	1.397	2.060	8.891	115%	187%	275%	1189%
21	27-May	0.762	0.930	1.466	4.520	102%	124%	196%	604%
22	3-Jun	0.628	0.707	1.451	8.232	84%	95%	194%	1101%
23	10-Jun	0.550	0.647	1.129	4.828	74%	86%	151%	645%
24	17-Jun	0.493	0.641	0.990	2.603	66%	86%	132%	348%
25	24-Jun	0.430	0.657	0.905	1.820	58%	88%	121%	243%
26	1-Jul	0.515	0.619	0.834	1.737	69%	83%	112%	232%
27	8-Jul	0.449	0.515	0.704	1.175	60%	69%	94%	157%
28	15-Jul	0.386	0.489	0.543	1.067	52%	65%	73%	143%
29	22-Jul	0.365	0.451	0.492	0.832	49%	60%	66%	111%
30	29-Jul	0.358	0.405	0.505	0.655	48%	54%	68%	88%
31	5-Aug	0.340	0.402	0.485	0.611	45%	54%	65%	82%
32	12-Aug	0.338	0.399	0.458	0.611	45%	53%	61%	82%
33	19-Aug	0.317	0.404	0.454	0.625	42%	54%	61%	84%
34	26-Aug	0.312	0.420	0.499	0.632	42%	56%	67%	84%
35	2-Sep	0.305	0.402	0.469	0.633	41%	54%	63%	85%
36	9-Sep	0.335	0.392	0.437	0.626	45%	52%	58%	84%
37	16-Sep	0.317	0.369	0.396	0.596	42%	49%	53%	80%
38	23-Sep	0.314	0.342	0.383	0.695	42%	46%	51%	93%
39	30-Sep	0.308	0.335	0.357	0.633	41%	45%	48%	85%
40	7-Oct	0.280	0.322	0.370	0.614	37%	43%	49%	82%
41	14-Oct	0.261	0.305	0.354	0.571	35%	41%	47%	76%
42	21-Oct	0.278	0.318	0.362	0.532	37%	43%	48%	71%
43	28-Oct	0.249	0.312	0.372	0.507	33%	42%	50%	68%
44	4-Nov	0.252	0.308	0.349	0.501	34%	41%	47%	67%
45	11-Nov	0.267	0.290	0.337	0.505	36%	39%	45%	68%
46	18-Nov	0.261	0.293	0.339	0.503	35%	39%	45%	67%
47	25-Nov	0.247	0.286	0.312	0.486	33%	38%	42%	65%
48	2-Dec	0.244	0.260	0.311	0.476	33%	35%	42%	64%
49	9-Dec	0.247	0.259	0.306	0.473	33%	35%	41%	63%
50	16-Dec	0.218	0.272	0.298	0.460	29%	36%	40%	62%
51	23-Dec	0.210	0.267	0.283	0.439	28%	36%	38%	59%
52	31-Dec	0.202	0.263	0.274	0.427	27%	35%	37%	57%

Residual and maximum licensed flows are not available at this time.