B7.2: Upper Shingle Creek

Transect Locations

Figure B7-1: Location of EFN transect along Upper Shingle Creek, upstream of the confluence with Shatford Creek

Transect Descriptions

Transect Name	**SHG100SCR2016**		
Install Date	August 11, 2016		
Lat./Long.	49.503932, -119.741384		
Width (install)	5.60 m	**Depth (install)**	0.13 m
Avg. width range	3.60 – 6.00 m	**Avg. depth range**	0.17 – 0.30 m

Looking upstream

Looking downstream

Looking left bank to right bank

Transect Name	**SHG110SCR2016**		
Install Date	August 11, 2016		
Lat./Long.	49.506121, -119.744294		
Width (install)	3.10 m	**Depth (install)**	0.14 m
Avg. width range	3.60 – 6.0m	**Avg. depth range**	0.17 – 0.30 m

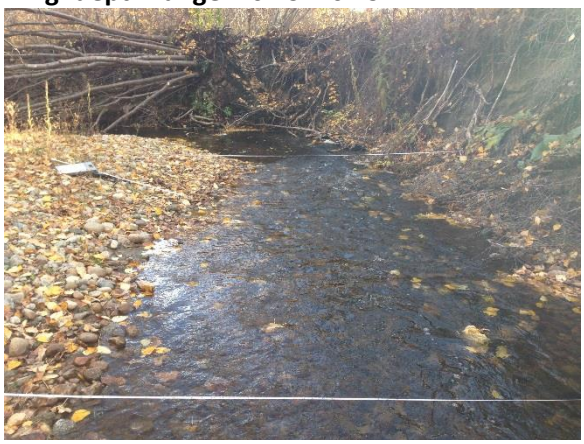
Looking upstream

Looking downstream

Looking left bank to right bank

Transect Name	**SHG120GL2016**		
Install Date	August 11, 2016		
Lat./Long.	49.506187, -119.744328		
Width (install)	3.25 m	**Depth (install)**	0.21 m
Avg. width range	2.75 – 3.56 m	**Avg. depth range**	0.19 – 0.29 m

Looking upstream



Looking downstream

Looking left bank to right bank

Transect Name	**SHG130SCR2016**		
Install Date	August 11, 2016		
Lat./Long.	49.506298, -119.744204		
Width (install)	4.80 m	**Depth (install)**	0.13 m
Avg. width range	3.6 – 6.0 m	**Avg. depth range**	0.17 – 0.30 m

Looking upstream

Looking downstream

Looking left bank to right bank

Transect Name	**SHG140SCR2016**		
Install Date	August 11, 2016		
Lat./Long.	49.506452, -119.744694		
Width (install)	5.45 m	**Depth (install)**	0.11 m
Avg. width range	3.6 – 6.0 m	**Avg. depth range**	0.17 – 0.30 m

Looking upstream

Looking downstream

Looking left bank to right bank

Upper Shingle Hydrometric Station – SHG150GL2016

Install Date	August 5, 2016
Latitude	49.506210, -119.750956
Comment	Gabriel Field

Logger and pool

Facing upstream

Facing downstream

Discharge Records

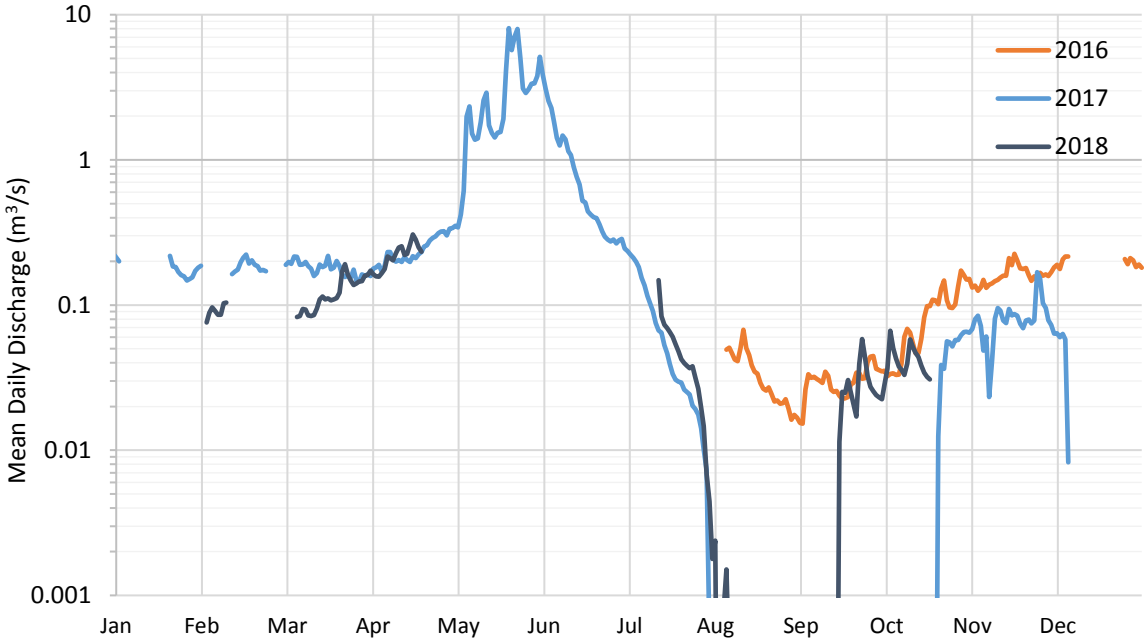


Figure B7-2: Mean daily discharge records collected from ONA hydrometric station 08NM170 (Shingle Creek at Gabriel fields) from 2016 to 2018

Water Temperature Records

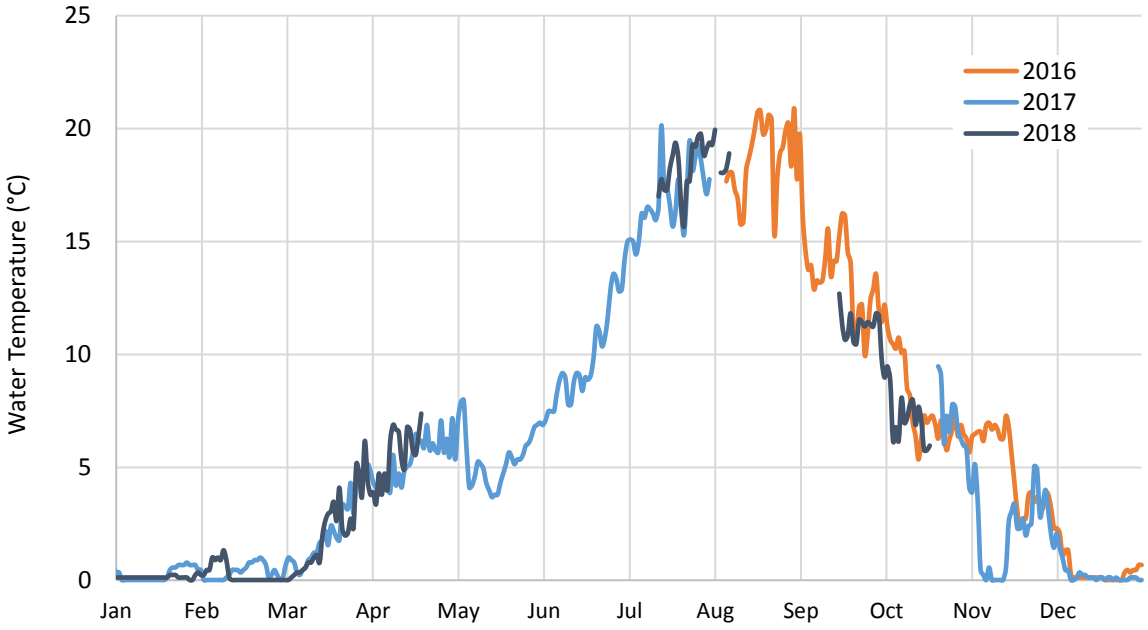


Figure B7-3: Maximum daily temperature records collected from ONA hydrometric station 08NM170 (Shingle Creek at Gabriel fields) from 2016 to 2018

Flow standards and periodicity – Okanagan Tennant analysis for Upper Shingle Creek

		Rainbow						Steelhead					Chinook (spring)						Ecological Flows	
Week Ending	Life Stage/ Week	Adult migration	Spawning	Incubation	Rearing	Juvenile migration	Over-wintering	Adult migration & spawning	Incubation	Rearing	Juvenile migration	Over-wintering	Adult migration	Spawning	Incubation	Rearing	Juvenile migration	Over-wintering	Wetland, side channel linkage, flushing and channel maintenance flow	Cottonwood ecosystems
Jan							20%					20%			20%			20%		
Feb							20%					20%			20%			20%		
Mar							20%					20%			20%			20%		
1-Apr	13				20%					20%						20%			☑	
8-Apr	14				20%					20%	50%					20%			☑	
15-Apr	15				20%					20%	50%					20%	50%		☑	
22-Apr	16	236%			20%			236%	20%	20%	50%					20%	50%		☑	
29-Apr	17	236%			20%			236%	20%	20%	50%					20%	50%		☑	
6-May	18	236%			20%	50%		236%	20%	20%	50%					20%	50%		☑	
13-May	19	236%			20%	50%		236%	20%	20%	50%					20%	50%		☑	
20-May	20	236%	40%		20%	50%		236%	20%	20%	50%					20%	50%		☑	
27-May	21	236%	40%	20%	20%	50%		236%	20%	20%	50%					20%	50%		1410%	
3-Jun	22	236%	40%	20%	20%	50%		236%	20%	20%	50%					20%	50%		1410%	
10-Jun	23	236%	40%	20%	20%	50%		236%	20%	20%	50%					20%	50%		☑	100%
17-Jun	24	236%	40%	20%	20%	50%		236%	20%	20%	50%					20%	50%		☑	100%
24-Jun	25	236%	40%	20%	20%	50%		236%	20%	20%						20%	50%			100%
1-Jul	26	236%	40%	20%	20%	50%			20%	20%			236%			20%				100%
8-Jul	27	236%	40%	20%	20%	50%			20%	20%			236%			20%				100%
15-Jul	28			20%	20%	50%				20%			236%			20%				100%
22-Jul	29			20%	20%					20%			236%			20%				100%
29-Jul	30			20%	20%					20%			236%			20%				100%
5-Aug	31				20%					20%			236%			20%				
12-Aug	32				20%					20%			236%			20%				
19-Aug	33				20%					20%			236%			20%				
26-Aug	34				20%					20%			236%	236%	20%	20%				
2-Sep	35				20%					20%			236%	236%	20%	20%				
9-Sep	36				20%					20%			236%	236%	20%	20%				
16-Sep	37				20%					20%				236%	20%	20%				
23-Sep	38				20%					20%				236%	20%	20%				
30-Sep	39				20%					20%				236%	20%	20%				
7-Oct	40				20%					20%					20%	20%				
14-Oct	41				20%					20%					20%	20%				
21-Oct	42				20%					20%					20%	20%				
28-Oct	43				20%					20%					20%	20%				
Nov							20%					20%			20%	20%		20%		
Dec							20%					20%			20%	20%		20%		

EFNs and Critical Flows for Upper Shingle Creek

	Okanagan Tennant EFN					WUW EFN (m^3/s)					FINAL EFN		CRITICAL FLOWS (m^3/s)			
Week Ending	EFN - all factors (%LTMAD)	EFN based on flow standards (m^3/s)	Nat. median weekly Q (m^3/s)	Discharge m^3/s	%LTMAD	Rainbow rearing & insect production	Spring Chinook spawning	Steelhead spawning	Rainbow spawning	FINAL	**Value (m^3/s)**	Dominant Species / Life Stage	Rainbow rearing & over wintering	Spring Chinook Spawning	Rainbow spawning	**FINAL**
Jan	20%	0.054	0.022	0.022	8%						0.022	overwintering egg Incubation	0.020			**0.020**
Feb	20%	0.054	0.021	0.021	8%						0.021	overwintering egg Incubation	0.020			**0.020**
Mar	20%	0.054	0.023	0.023	9%						0.023	overwintering egg Incubation	0.020			**0.020**
1-Apr	20%	0.054	0.031	0.031	11%	0.064				0.064	0.031	juvenile migration	0.020			**0.020**
8-Apr	50%	0.136	0.041	0.041	15%	0.064				0.064	0.041	juvenile migration	0.020			**0.020**
15-Apr	50%	0.136	0.048	0.048	18%	0.064				0.064	0.048	juvenile migration	0.020			**0.020**
22-Apr	236%	0.641	0.074	0.074	27%	0.064		0.900		0.900	0.074	ST spawning	0.020		0.074	**0.074**
29-Apr	236%	0.641	0.167	0.167	61%	0.064		0.900		0.900	0.167	ST spawning	0.020		0.167	**0.167**
6-May	236%	0.641	0.238	0.238	88%	0.064		0.900		0.900	0.238	ST spawning	0.020		0.238	**0.238**
13-May	236%	0.641	0.277	0.277	102%	0.064		0.900		0.900	0.277	ST spawning	0.020		0.277	**0.277**
20-May	236%	0.641	0.965	0.641	236%	0.064		0.900	0.900	0.900	0.900	ST spawning	0.020		0.306	**0.306**
27-May	1410%	3.832	1.744	1.744	642%	0.064		0.900	0.900	0.900	1.744	Ecosystem	0.020		0.306	**0.306**
3-Jun	1410%	3.832	1.557	1.557	573%	0.064		0.900	0.900	0.900	1.557	Ecosystem	0.020		0.306	**0.306**
10-Jun	236%	0.641	1.204	0.641	236%	0.064		0.900	0.900	0.900	0.900	RB Spawning	0.020		0.306	**0.306**
17-Jun	236%	0.641	1.438	0.641	236%	0.064		0.900	0.900	0.900	0.900	RB Spawning	0.020		0.306	**0.306**
24-Jun	236%	0.641	0.707	0.641	236%	0.064		0.900	0.900	0.900	0.707	RB Spawning	0.020		0.306	**0.306**
1-Jul	236%	0.641	0.613	0.613	226%	0.064			0.900	0.900	0.613	RB Spawning	0.020	0.054	0.306	**0.306**
8-Jul	236%	0.641	0.352	0.352	129%	0.064			0.900	0.900	0.352	RB Spawning	0.020	0.054	0.306	**0.306**
15-Jul	236%	0.641	0.240	0.240	88%	0.064				0.064	0.240	RB/ST incubation	0.020	0.054		**0.054**
22-Jul	236%	0.641	0.226	0.226	83%	0.064				0.064	0.226	RB/ST incubation	0.020	0.054		**0.054**
29-Jul	236%	0.641	0.161	0.161	59%	0.064				0.064	0.161	RB/ST incubation	0.020	0.054		**0.054**
5-Aug	236%	0.641	0.115	0.115	42%	0.064				0.064	0.115	CH Migration	0.020	0.054		**0.054**
12-Aug	236%	0.641	0.096	0.096	35%	0.064				0.064	0.096	CH Migration	0.020	0.054		**0.054**
19-Aug	236%	0.641	0.066	0.066	24%	0.064				0.064	0.066	CH Migration	0.020	0.054		**0.054**
26-Aug	236%	0.641	0.063	0.063	23%	0.064	0.063			0.064	0.063	CH Spawning	0.020	0.027		**0.027**
2-Sep	236%	0.641	0.053	0.053	20%	0.064	0.063			0.064	0.053	CH Spawning	0.020	0.027		**0.027**
9-Sep	236%	0.641	0.048	0.048	18%	0.064	0.063			0.064	0.048	CH Spawning	0.020	0.027		**0.027**
16-Sep	236%	0.641	0.035	0.035	13%	0.064	0.063			0.064	0.035	CH Spawning	0.020	0.027		**0.027**
23-Sep	236%	0.641	0.034	0.034	12%	0.064	0.063			0.064	0.034	CH Spawning	0.020	0.027		**0.027**
30-Sep	236%	0.641	0.032	0.032	12%	0.064	0.063			0.064	0.032	CH Spawning	0.020	0.027		**0.027**
7-Oct	20%	0.054	0.045	0.045	16%	0.064				0.064	0.045	juvenile rearing	0.020			**0.020**
14-Oct	20%	0.054	0.043	0.043	16%	0.064				0.064	0.043	juvenile rearing	0.020			**0.020**
21-Oct	20%	0.054	0.043	0.043	16%	0.064				0.064	0.043	juvenile rearing	0.020			**0.020**
28-Oct	20%	0.054	0.042	0.042	16%	0.064				0.064	0.042	juvenile rearing	0.020			**0.020**
Nov	20%	0.054	0.038	0.038	14%						0.038	overwintering egg Incubation	0.020			**0.020**
Dec	20%	0.054	0.028	0.028	10%						0.028	overwintering egg Incubation	0.020			**0.020**

Weighted Usable Width

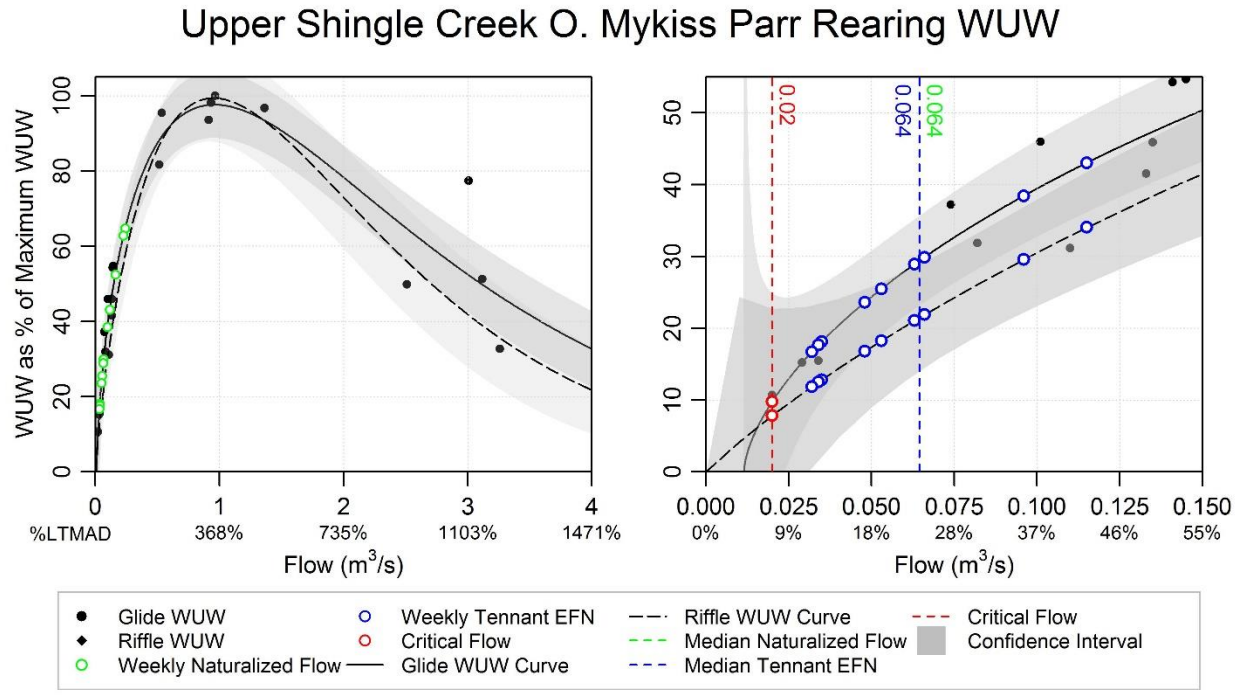


Figure B7-4: WUW curves for *O. Mykiss* rearing in Upper Shingle Creek for all flows (left) and low flows (right)

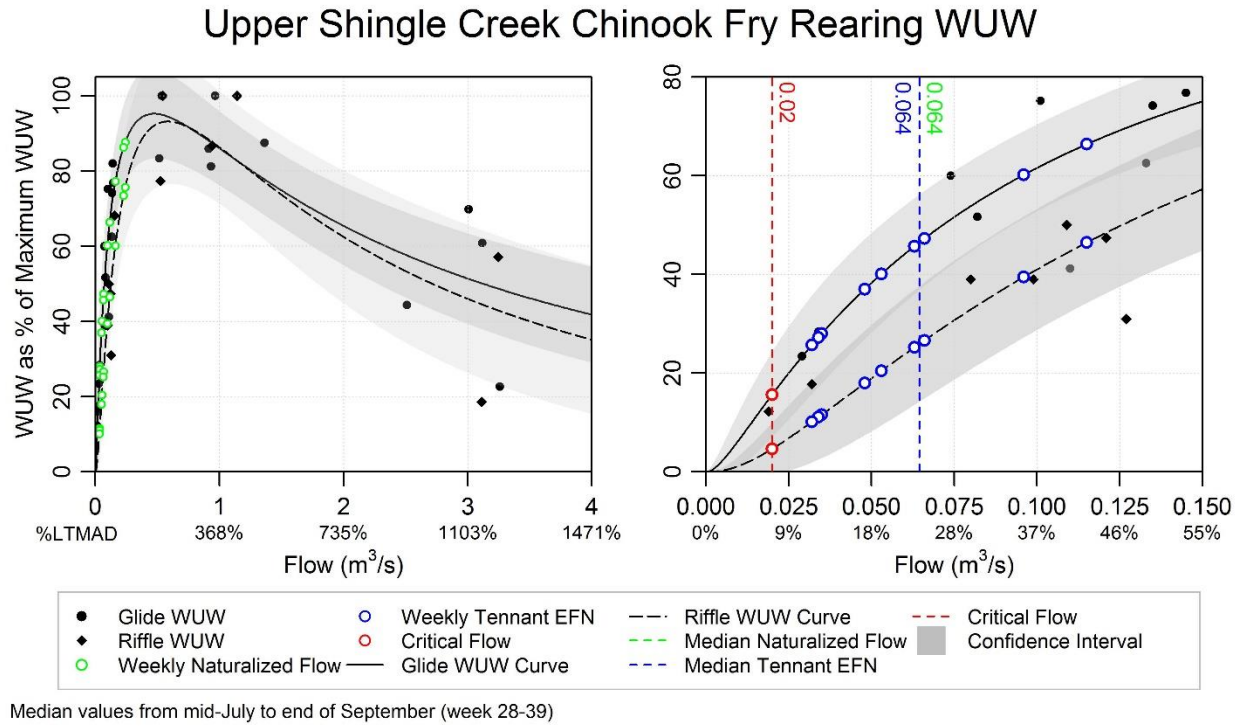
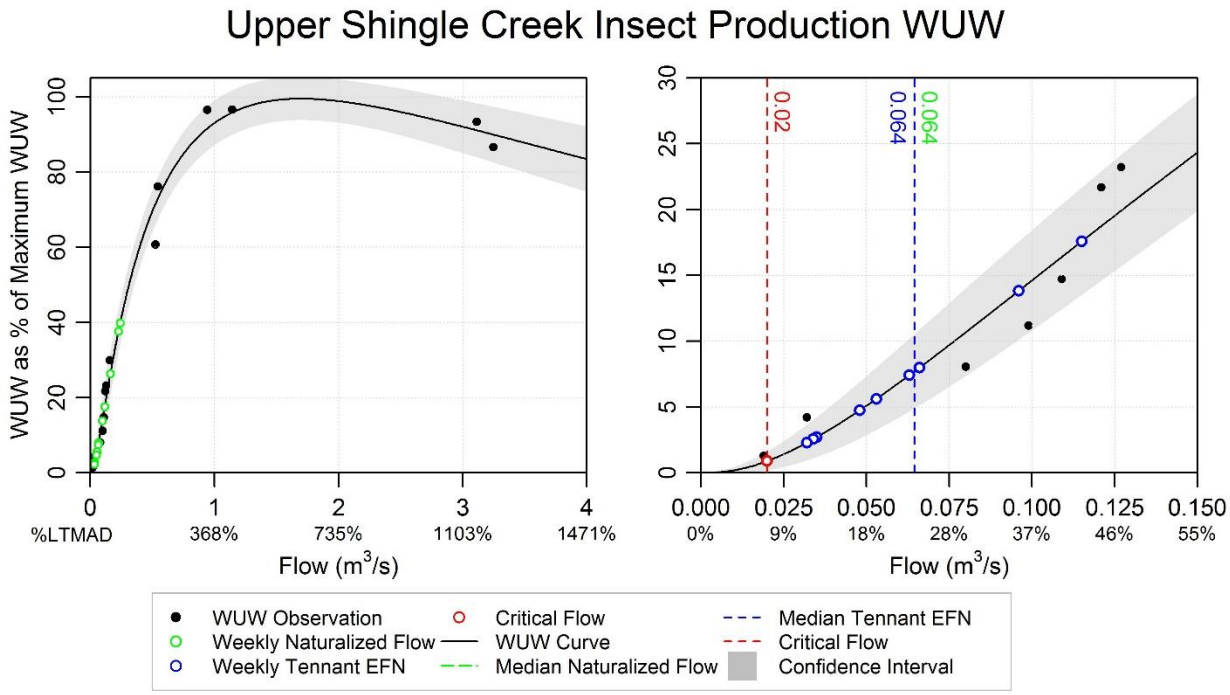
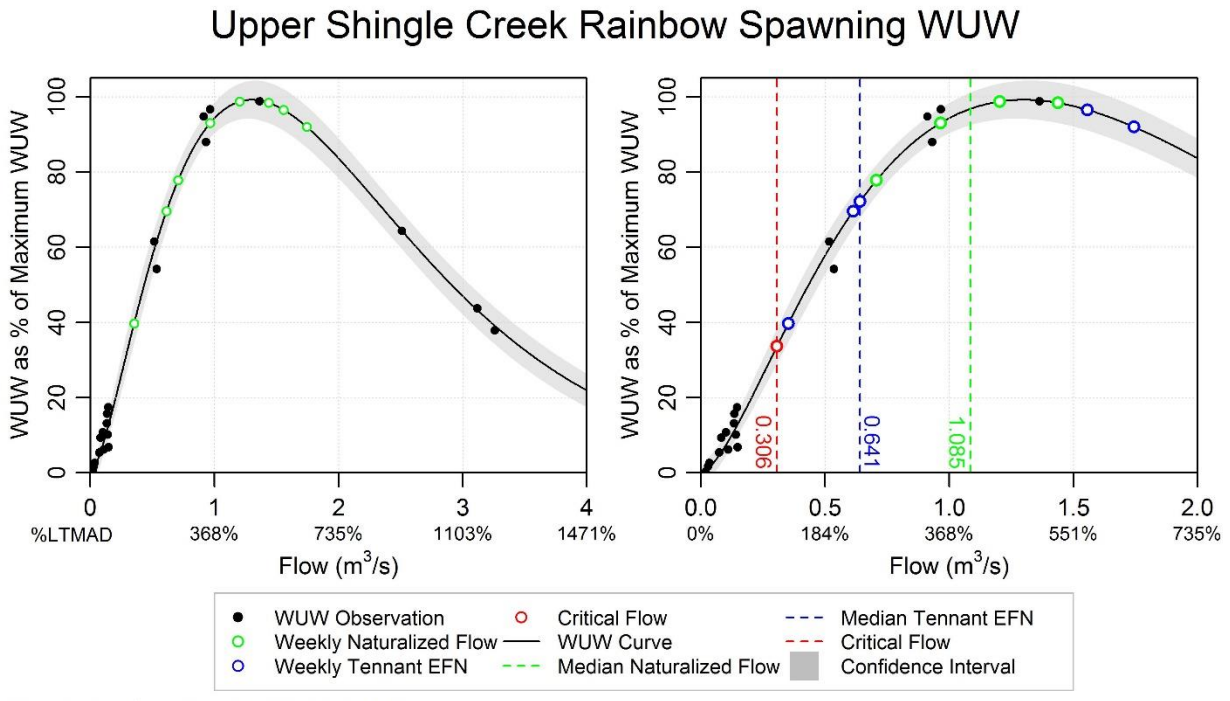


Figure B7-5: WUW curves for Chinook fry rearing in Upper Shingle Creek for all flows (left) and low flows (right)



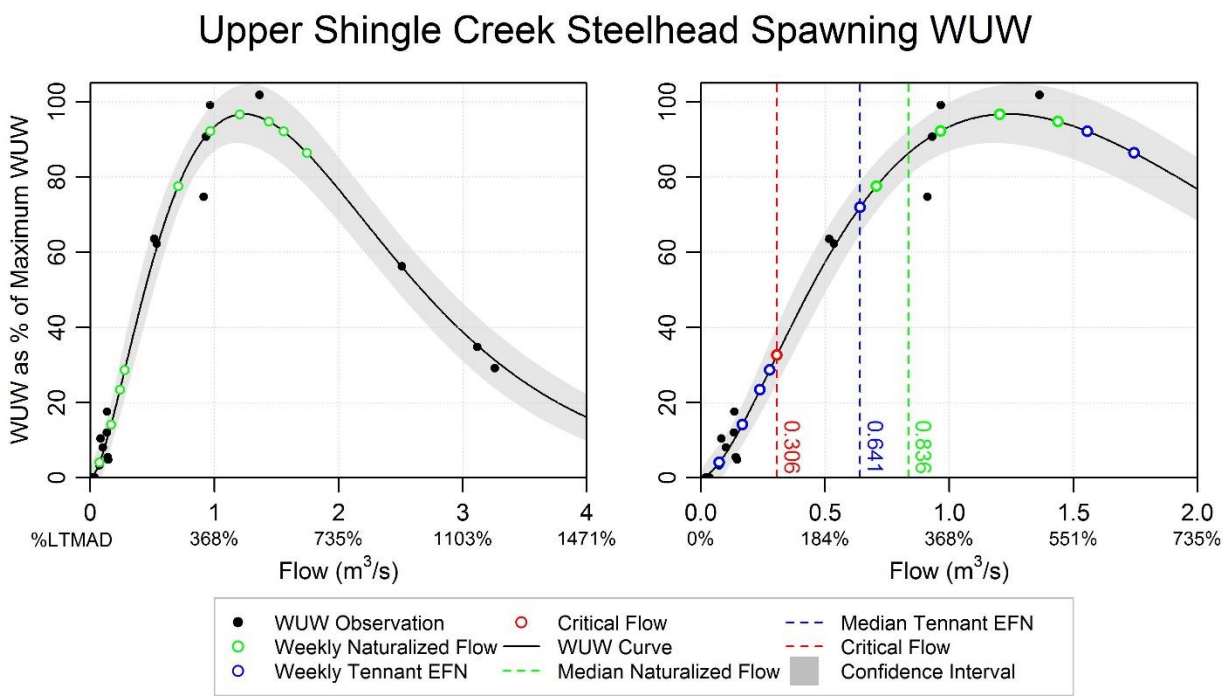
Median values from mid-July to end of September (week 28-39)

Figure B7-6: WUW curves for insect production in Upper Shingle Creek for all flows (left) and low flows (right)



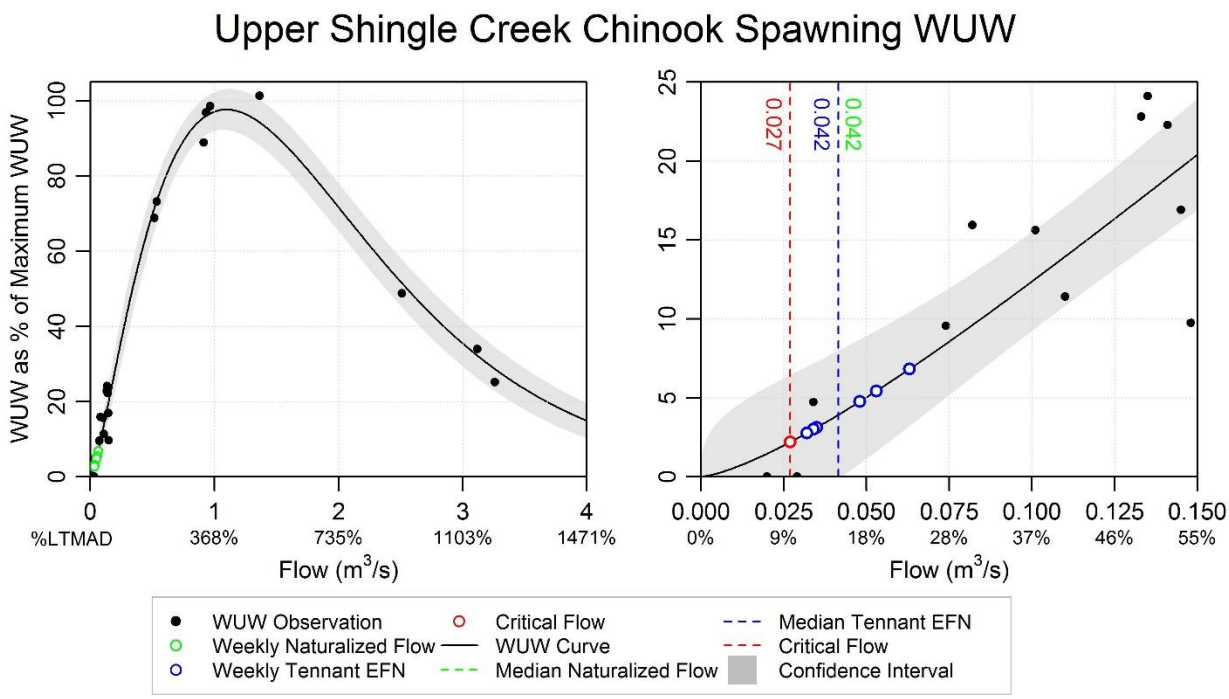
Median values from May 20 to July 10 (week 20-27)

Figure B7-7: WUW curves Rainbow spawning in Upper Shingle Creek for all flows (left) and low flows (right)



Median values from April 16 to June 25 (week 16-25)

Figure B7-8: WUW curves for Steelhead spawning in Upper Shingle Creek for all flows (left) and low flows (right)



Median values from August 20 to September 30 (week 34-39)

Figure B7-9: WUW curves for Chinook spawning in Upper Shingle Creek for all flows (left) and low flows (right)

Critical Flow Analysis

Table B7-1: Critical flow analysis for Upper Shingle Creek

Species / Life stage	Critical Flow Criteria	SHG10SCR2016		SHG30SCR2016		Average	
		(m^3/s)	% LTMAD	(m^3/s)	% LTMAD	(m^3/s)	% LTMAD
	Naturalized LTMAD	0.272	100%	0.272	100%		
	Wetted Width at 100% LTMAD (m)	7.20		5.88			
Insect production, Rainbow rearing & overwintering	60% of width at 100% LTMAD	0.017	6%	0.023	8%	0.020	7%
Chinook spawning & migration	> 25% of width at 100% LTMAD is ≥0.24m deep	1.38	507%	0.763	280%	1.07	394
Rainbow & Steelhead spawning,	> 25% of width at 100% LTMAD is ≥0.18m deep	0.866	318%	0.306	112%	0.586	215%

Table B7-2: Final critical flows for Upper Shingle Creek

Species/Life stage	Final Critical Flow (m^3/s)	% LTMAD	Criteria Used
Rainbow, Steelhead & Chinook rearing; insect production	0.020	7%	60% max wetted width
Rainbow & Steelhead spawning	0.306	113%	0.18m depth criterion (SHG30SCR2016 only)
Chinook migration	0.054	20%	20% LTMAD
Chinook spawning	0.027	10%	10% LTMAD
Overwintering salmonids	0.020	7%	60% max wetted width

Table B7-3: 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	0.036	13%
Summer 1:5-year return period 30 Day Naturalized Low	0.021	8%
Summer 1:10-year return period 30 Day Naturalized Low	0.016	6%
Summer 1:20-year return period 30 Day Naturalized Low	0.013	5%
Winter (November 1 to March 31) Minimum		
Winter 1:2-year return period 30 Day Naturalized Low	0.023	17%
Winter 1:5-year return period 30 Day Naturalized Low	0.018	14%
Winter 1:10-year return period 30 Day Naturalized Low	0.016	12%
Winter 1:20-year return period 30 Day Naturalized Low	0.015	11%

Percentile Flows for Upper Shingle Creek

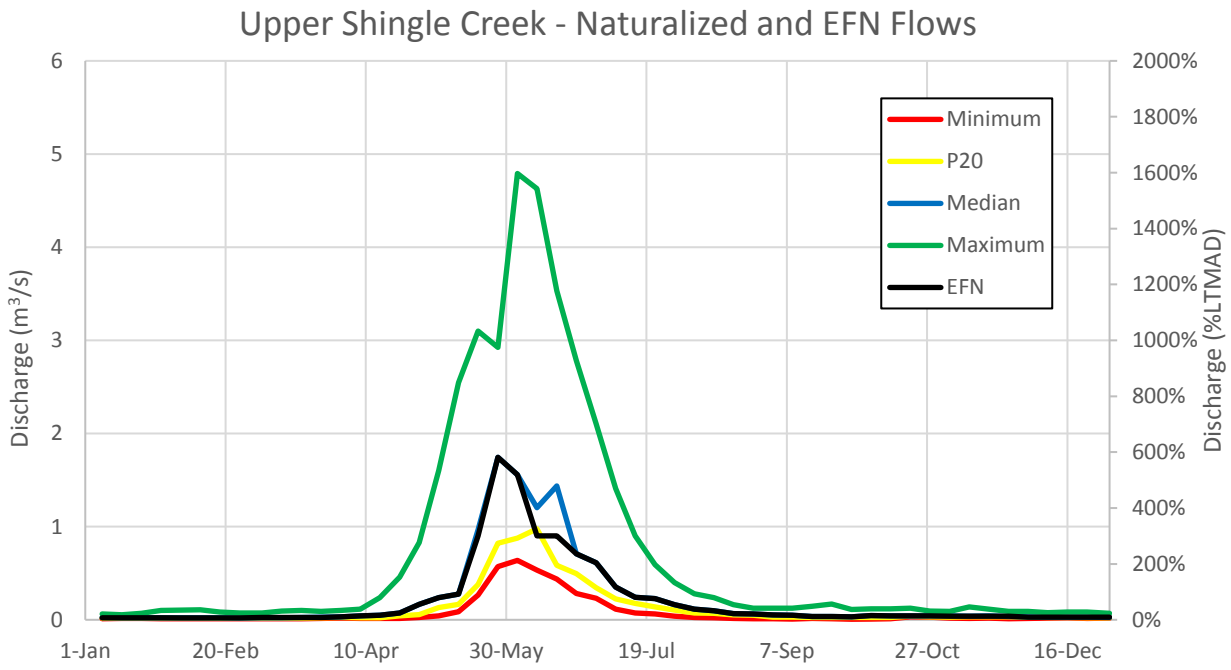


Figure B7-10: EFNs compared with naturalized flow percentiles in Upper Shingle Creek (Discharge & %LTMAD)

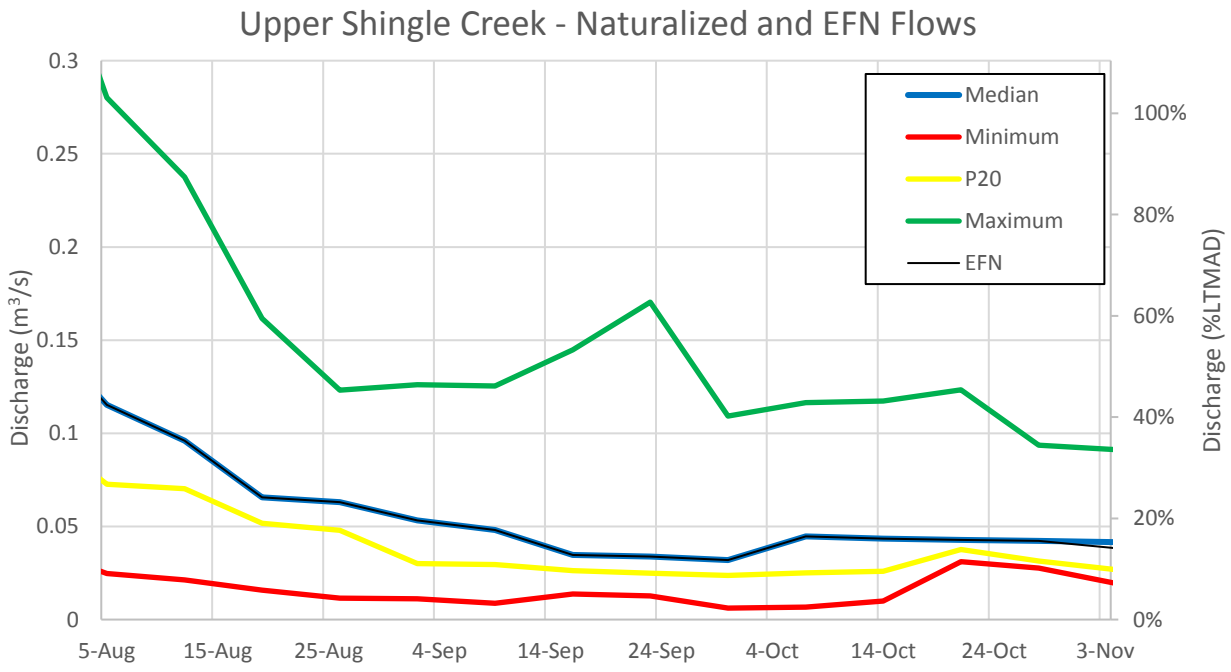


Figure B7-11: EFNs compared with naturalized flow percentiles in Upper Shingle Creek Aug-Nov (Discharge & %LTMAD)

Naturalized Percentile Flows for Upper Shingle Creek

NATURALIZED FLOW		as m^3/s				as %LTMAD			
Week	Ending	Min	P20	Median	Max	Min	P20	Median	Max
01	7-Jan	0.010	0.019	0.024	0.064	4%	7%	9%	24%
02	14-Jan	0.013	0.019	0.023	0.054	5%	7%	9%	20%
03	21-Jan	0.013	0.018	0.022	0.069	5%	7%	8%	25%
04	28-Jan	0.011	0.017	0.021	0.102	4%	6%	8%	38%
05	4-Feb	0.011	0.016	0.021	0.105	4%	6%	8%	39%
06	11-Feb	0.011	0.017	0.020	0.106	4%	6%	7%	39%
07	18-Feb	0.013	0.016	0.021	0.085	5%	6%	8%	31%
08	25-Feb	0.012	0.018	0.019	0.072	4%	6%	7%	26%
09	4-Mar	0.012	0.017	0.022	0.073	4%	6%	8%	27%
10	11-Mar	0.011	0.019	0.020	0.094	4%	7%	8%	35%
11	18-Mar	0.012	0.019	0.026	0.100	4%	7%	10%	37%
12	25-Mar	0.016	0.022	0.028	0.091	6%	8%	10%	34%
13	1-Apr	0.017	0.025	0.031	0.100	6%	9%	11%	37%
14	8-Apr	0.016	0.023	0.041	0.114	6%	8%	15%	42%
15	15-Apr	0.014	0.023	0.048	0.239	5%	8%	18%	88%
16	22-Apr	0.016	0.042	0.074	0.459	6%	16%	27%	169%
17	29-Apr	0.024	0.054	0.167	0.828	9%	20%	61%	305%
18	6-May	0.041	0.133	0.238	1.601	15%	49%	88%	589%
19	13-May	0.085	0.165	0.277	2.547	31%	61%	102%	937%
20	20-May	0.264	0.379	0.965	3.100	97%	139%	355%	1141%
21	27-May	0.570	0.820	1.744	2.926	210%	302%	642%	1077%
22	3-Jun	0.638	0.875	1.557	4.791	235%	322%	573%	1763%
23	10-Jun	0.533	0.976	1.204	4.630	196%	359%	443%	1704%
24	17-Jun	0.436	0.585	1.438	3.531	161%	215%	529%	1299%
25	24-Jun	0.283	0.497	0.707	2.785	104%	183%	260%	1025%
26	1-Jul	0.231	0.344	0.613	2.103	85%	127%	226%	774%
27	8-Jul	0.113	0.224	0.352	1.410	42%	82%	129%	519%
28	15-Jul	0.073	0.175	0.240	0.902	27%	64%	88%	332%
29	22-Jul	0.064	0.137	0.226	0.592	24%	51%	83%	218%
30	29-Jul	0.040	0.105	0.161	0.398	15%	39%	59%	147%
31	5-Aug	0.025	0.073	0.115	0.280	9%	27%	42%	103%
32	12-Aug	0.021	0.070	0.096	0.238	8%	26%	35%	87%
33	19-Aug	0.016	0.052	0.066	0.162	6%	19%	24%	59%
34	26-Aug	0.011	0.048	0.063	0.123	4%	18%	23%	45%
35	2-Sep	0.011	0.030	0.053	0.126	4%	11%	20%	46%
36	9-Sep	0.009	0.030	0.048	0.125	3%	11%	18%	46%
37	16-Sep	0.014	0.026	0.035	0.145	5%	10%	13%	53%
38	23-Sep	0.013	0.025	0.034	0.170	5%	9%	12%	63%
39	30-Sep	0.006	0.024	0.032	0.109	2%	9%	12%	40%
40	7-Oct	0.007	0.025	0.045	0.117	2%	9%	16%	43%
41	14-Oct	0.010	0.026	0.043	0.117	4%	10%	16%	43%
42	21-Oct	0.031	0.038	0.043	0.123	11%	14%	16%	45%
43	28-Oct	0.028	0.031	0.042	0.094	10%	12%	16%	34%
44	4-Nov	0.019	0.027	0.041	0.091	7%	10%	15%	34%
45	11-Nov	0.014	0.032	0.040	0.137	5%	12%	15%	50%
46	18-Nov	0.019	0.030	0.041	0.114	7%	11%	15%	42%
47	25-Nov	0.011	0.031	0.036	0.090	4%	11%	13%	33%
48	2-Dec	0.015	0.027	0.031	0.090	6%	10%	11%	33%
49	9-Dec	0.017	0.025	0.027	0.078	6%	9%	10%	29%
50	16-Dec	0.021	0.024	0.029	0.082	8%	9%	11%	30%
51	23-Dec	0.016	0.023	0.027	0.082	6%	9%	10%	30%
52	31-Dec	0.017	0.021	0.025	0.071	6%	8%	9%	26%

Residual and max licensed residual percentile flows are not available at this time.