

Memorandum

May 18, 2020

To: John Palmer, R10 USEPSA

From: Peter Leinenbach, R10USEPA

Subject: Evaluation of tributary temperature values included in Table 2-3 of the Cold Water Refugia (CWR) plan.

Water temperatures for the twelve primary tributaries reported in Table 2-3 in the Cold Water Refugia (CWR) draft plan are Average August conditions calculated using the NorWeST model (www.fs.fed.us/rm/boise/AWAE/projects/NorWeST). This memorandum shows that modeled temperature conditions included in Table 2-3 are similar to available measured temperature conditions within these rivers. The result is not unexpected because the NorWeST model was calibrated to measured temperature data. There is a slight difference in temperature values presented in Table 2-3 and the tables on the following pages due to prediction period differences (i.e., Table 2-3 is a “1993 through 2011 average condition estimate”, while values presented in the tables on following pages are the average prediction for the years that measured data was available).

Tributary Name	River Mile	August Mean Mainstem Temperature (DART)	August Mean Tributary Temperature (NorWeST)	August Mean Temperature Difference	August Mean Tributary Flow (NHD & USGS*)	Plume CWR Volume (> 2°C Δ)	Stream CWR Volume (> 2°C Δ)	Total CWR Volume (> 2°C Δ)
		°C	°C	°C	cfs	m ³	m ³	m ³
Skamokawa Creek (WA)	30.9	21.3	16.2	-5.1	23	450	1,033	1,483
Mill Creek (WA)	51.3	21.3	14.5	-6.8	10	110	446	556
Abernethy Creek (WA)	51.7	21.3	15.7	-5.6	10	81	806	887
Germany Creek (WA)	53.6	21.3	15.4	-5.9	8	72	446	518
Cowlitz River (WA)	65.2	21.3	16.0	-5.4	3634	870,000	684,230	1,554,230
Kalama River ² (WA)	70.5	21.3	16.3	-5.0	314*	14,000	27,820	41,820
Lewis River (WA)	84.4	21.3	16.6	-4.8	1291*	120,000	493,455	613,455
Sandy River (OR)	117.1	21.3	18.8	-2.5	469	9,900	22,015	31,915
Washougal River ² (WA)	117.6	21.3	19.2	-2.1	107*	740	32,563	33,303
Bridal Veil Creek (WA)	128.9	21.3	11.7	-9.6	7	120	0	120
Wahkeena Creek (WA)	131.7	21.3	13.6	-7.7	15	220	0	220
Oneonta Creek (OR)	134.3	21.3	13.1	-8.2	29	820	54	874
Tanner Creek (OR)	140.9	21.3	11.7	-9.6	38	1,300	413	1,713
Eagle Creek (OR)	142.7	21.2	15.1	-6.1	72	2,100	888	2,988
Rock Creek ¹ (WA)	146.6	21.2	17.4	-3.8	47	530	1,178	1,708
Herman Creek (OR)	147.5	21.2	12.0	-9.2	45	168,000	1,698	169,698
Wind River (WA)	151.1	21.2	14.5	-6.7	293	60,800	44,420	105,220
Little White Salmon River (WA)	158.7	21.2	13.3	-7.9	88	1,097,000	4,126	1,101,126
White Salmon River (WA)	164.9	21.2	15.7	-5.5	715*	72,000	81,529	153,529
Hood River (OR)	165.7	21.4	15.5	-5.9	374	28,000	0	28,000
Klickitat River (WA)	176.8	21.4	16.4	-5.0	851*	73,000	149,029	222,029
Deschutes River (OR)	200.8	21.4	19.2	-2.2	4772*	300,000	580,124	880,124
Umatilla River ¹ (OR)	284.7	20.9	20.8	-0.1	169*	0	46,299	46,299

¹ Only provide intermittent cold water refugia; CWR volume represents volume when river is greater than 2°C colder than Columbia River.

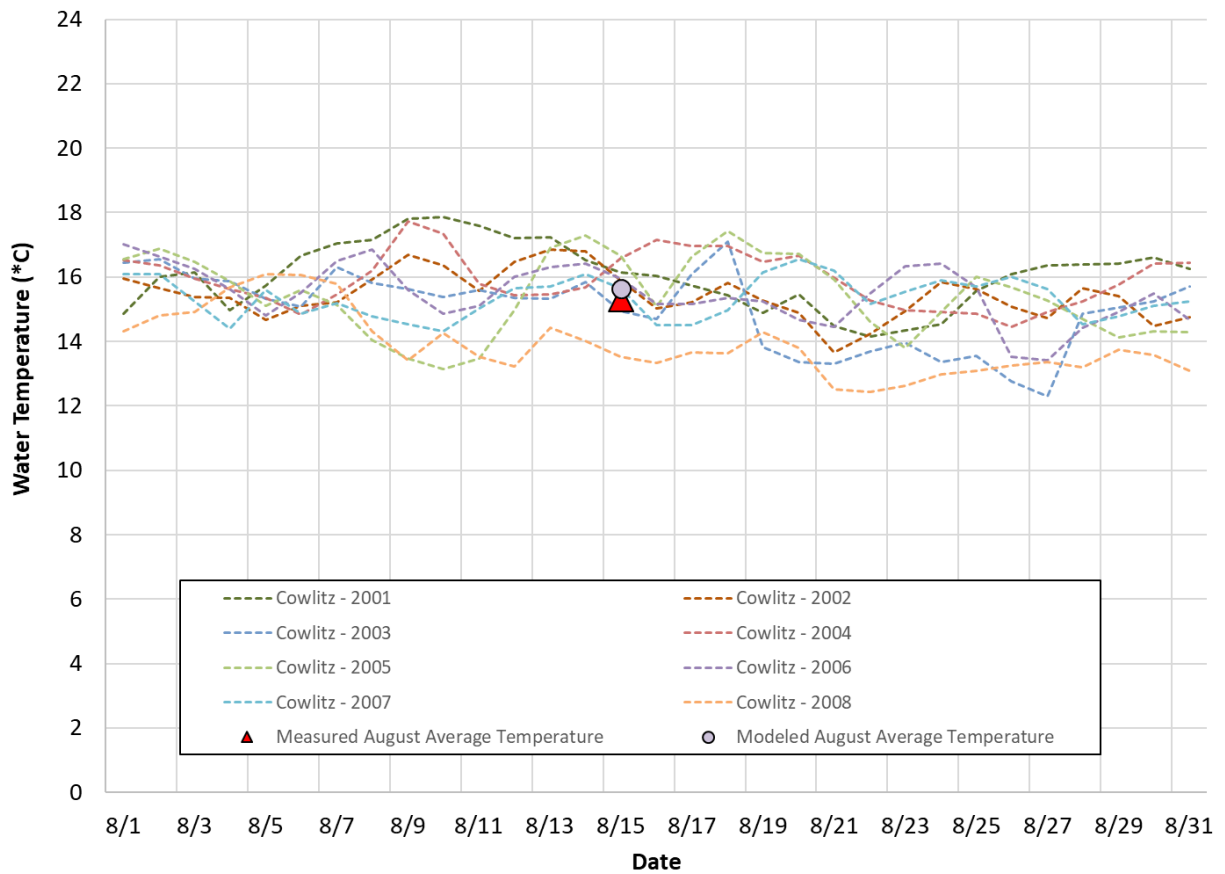
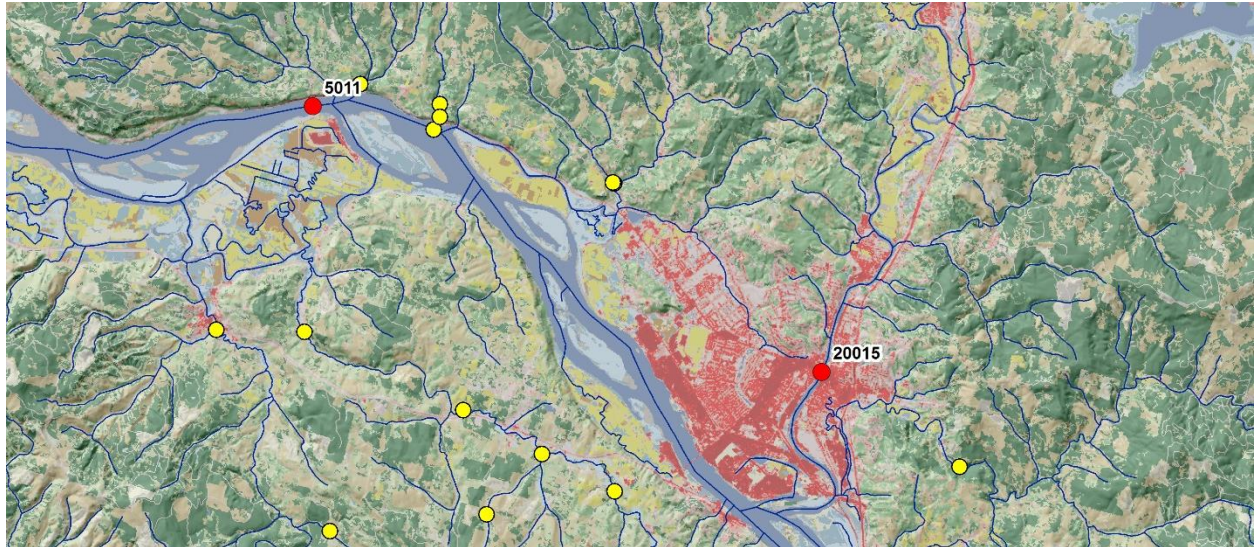
² Tidally influenced and may be inaccessible during low tides.

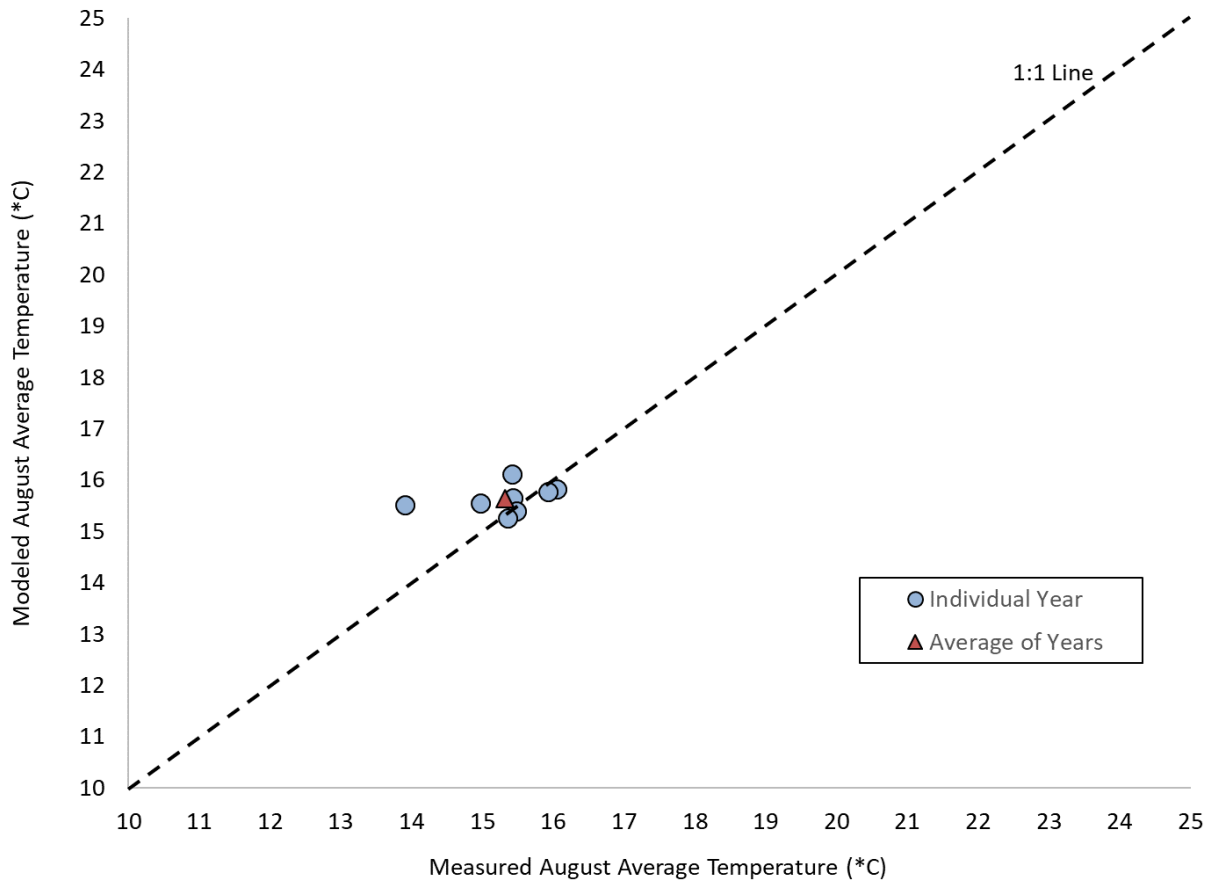
Table 2-3 Twelve primary CWR tributaries (highlighted in bold and color)

Cowlitz River

Monitoring Location – PERMA_FID 20015

The difference between measured and model August average temperatures was 0.3°C.

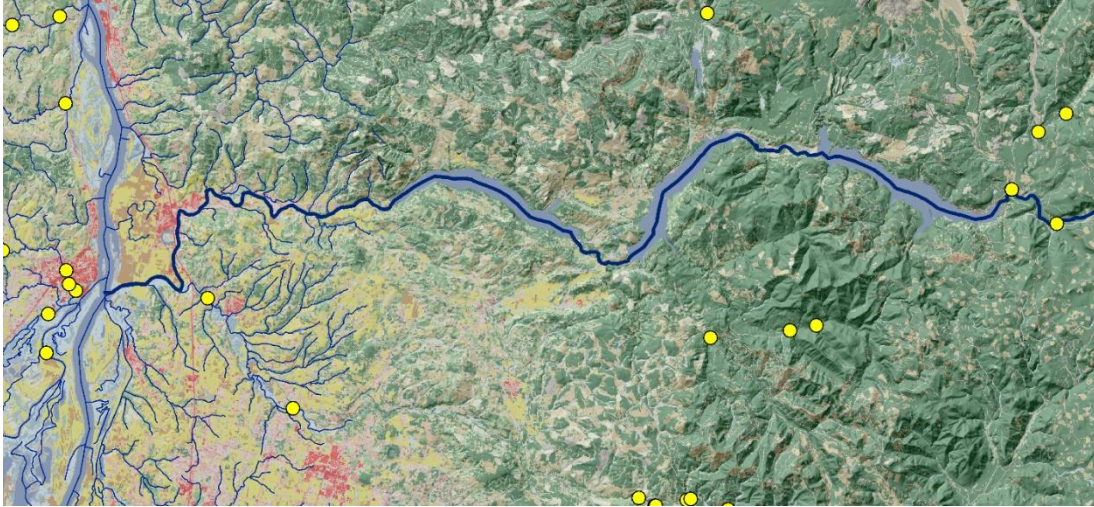




Average of measured August average temperature	15.3*C
Average of modeled August average temperature	15.6*C
Difference	0.3*C

Lewis River

Monitoring Location – There are no tributary monitoring sites along the Lewis River within 50 miles of the Columbia River.

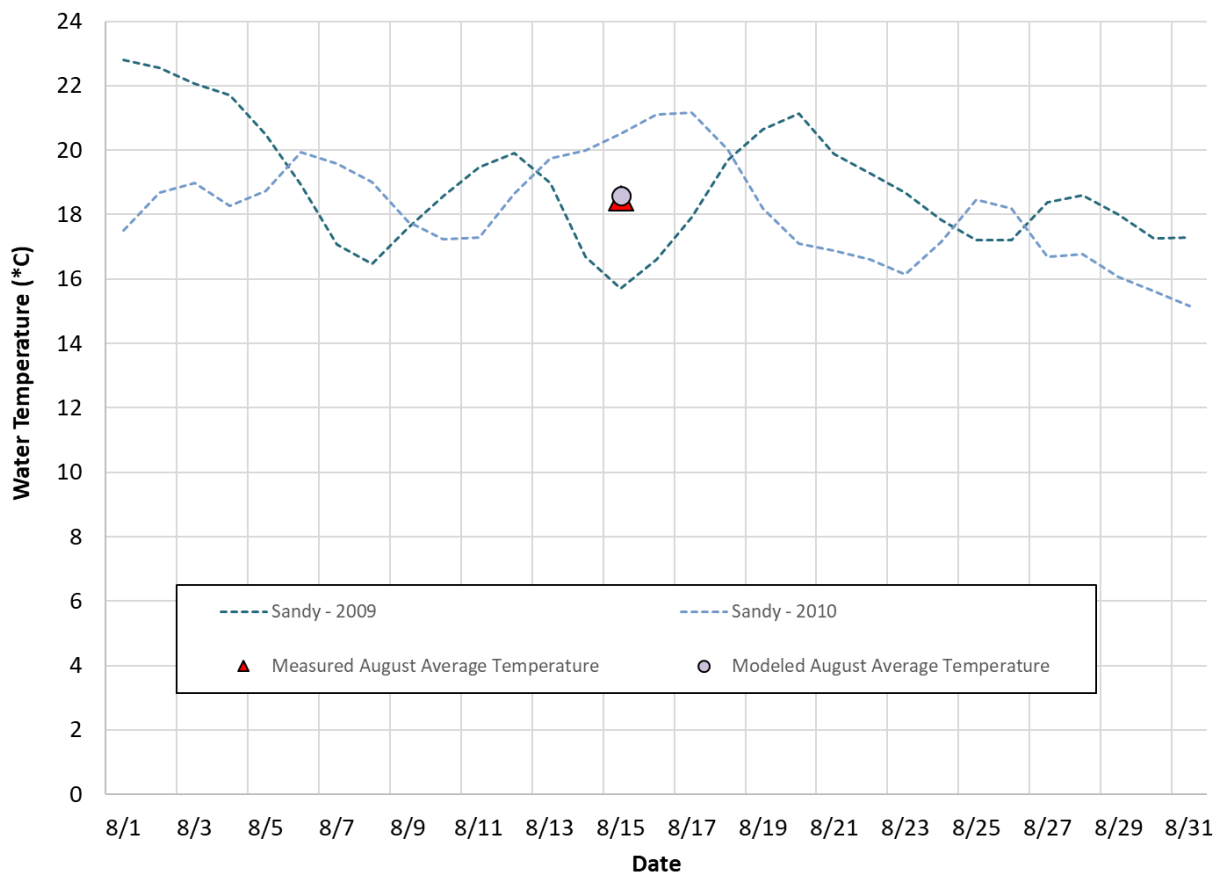


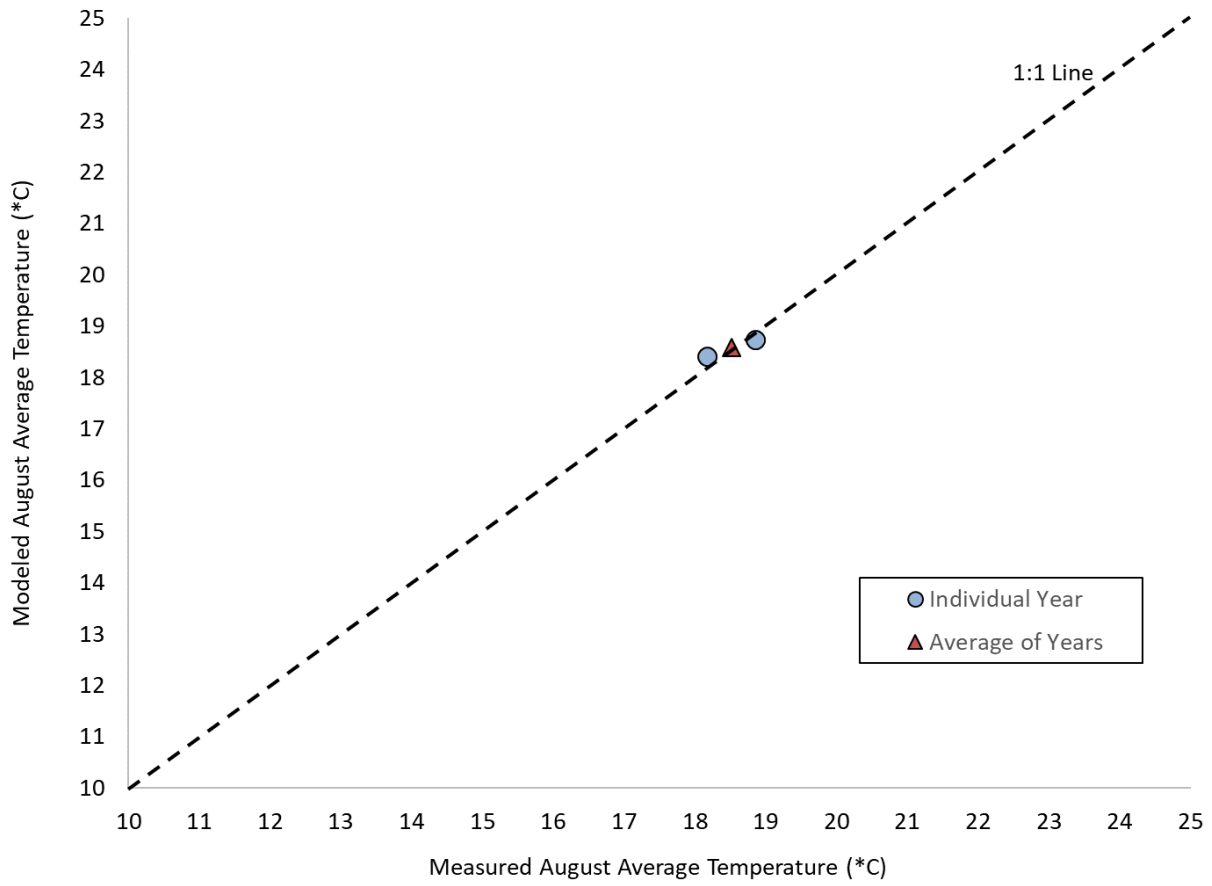
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Sandy River

Monitoring Location – PERMA_FID 19514

The difference between measured and model August average temperatures was 0.3°C.



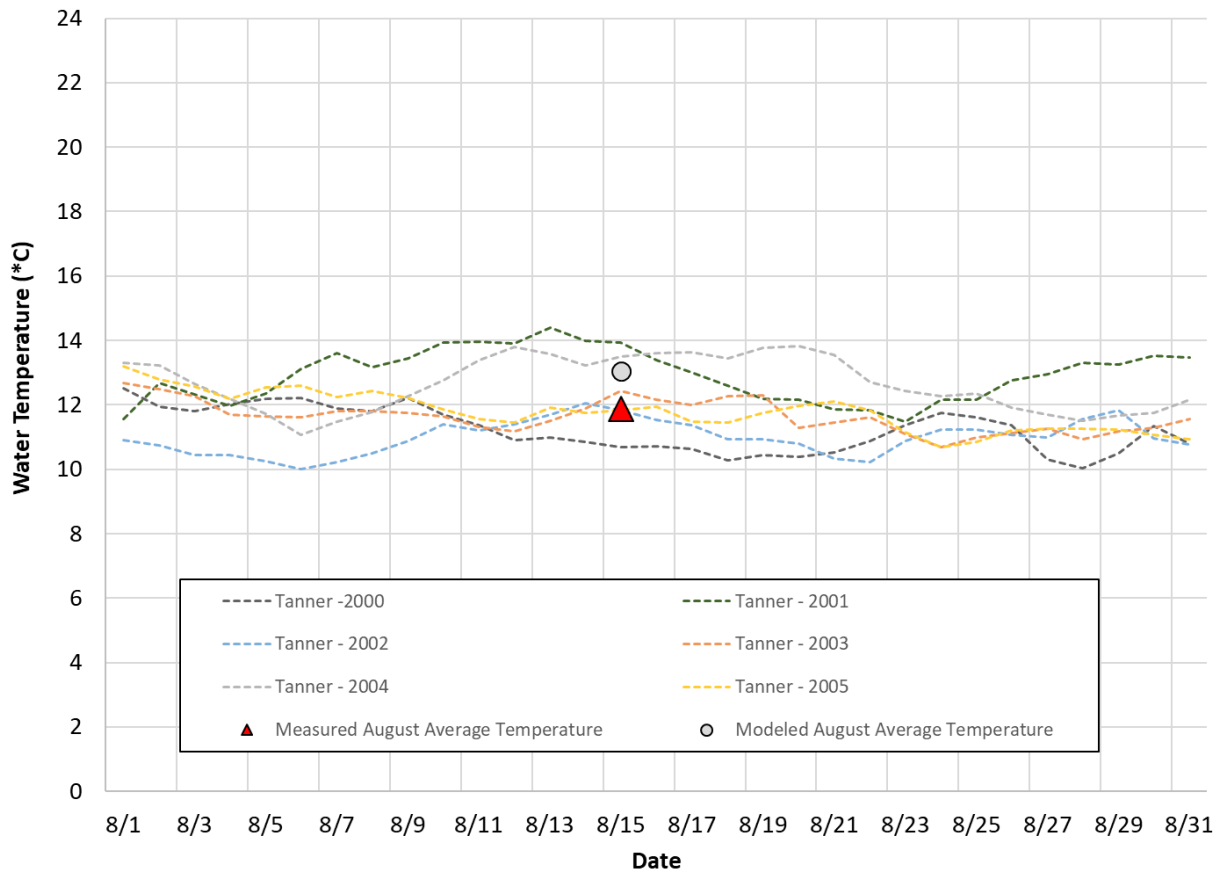
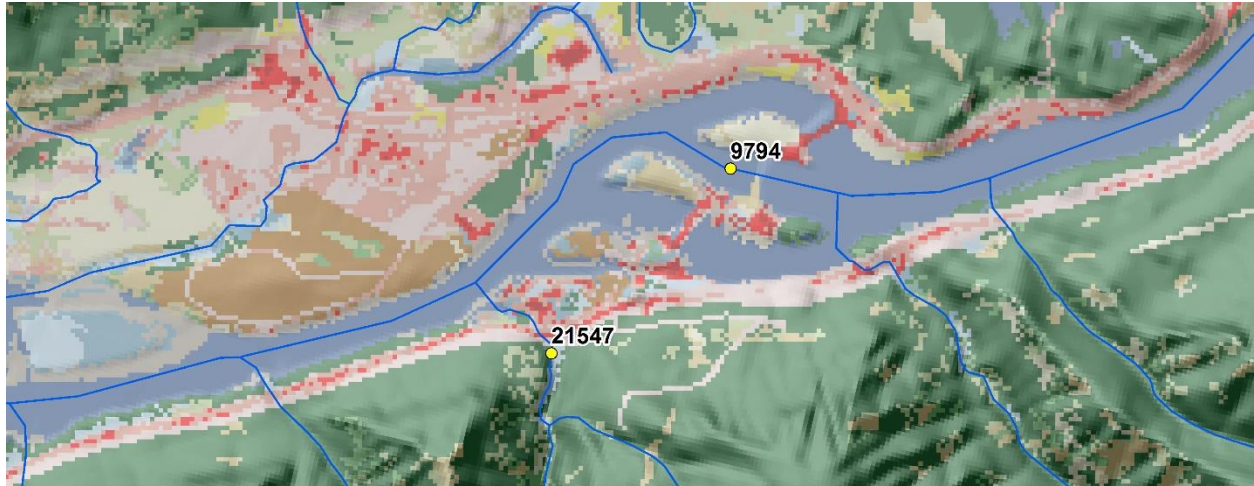


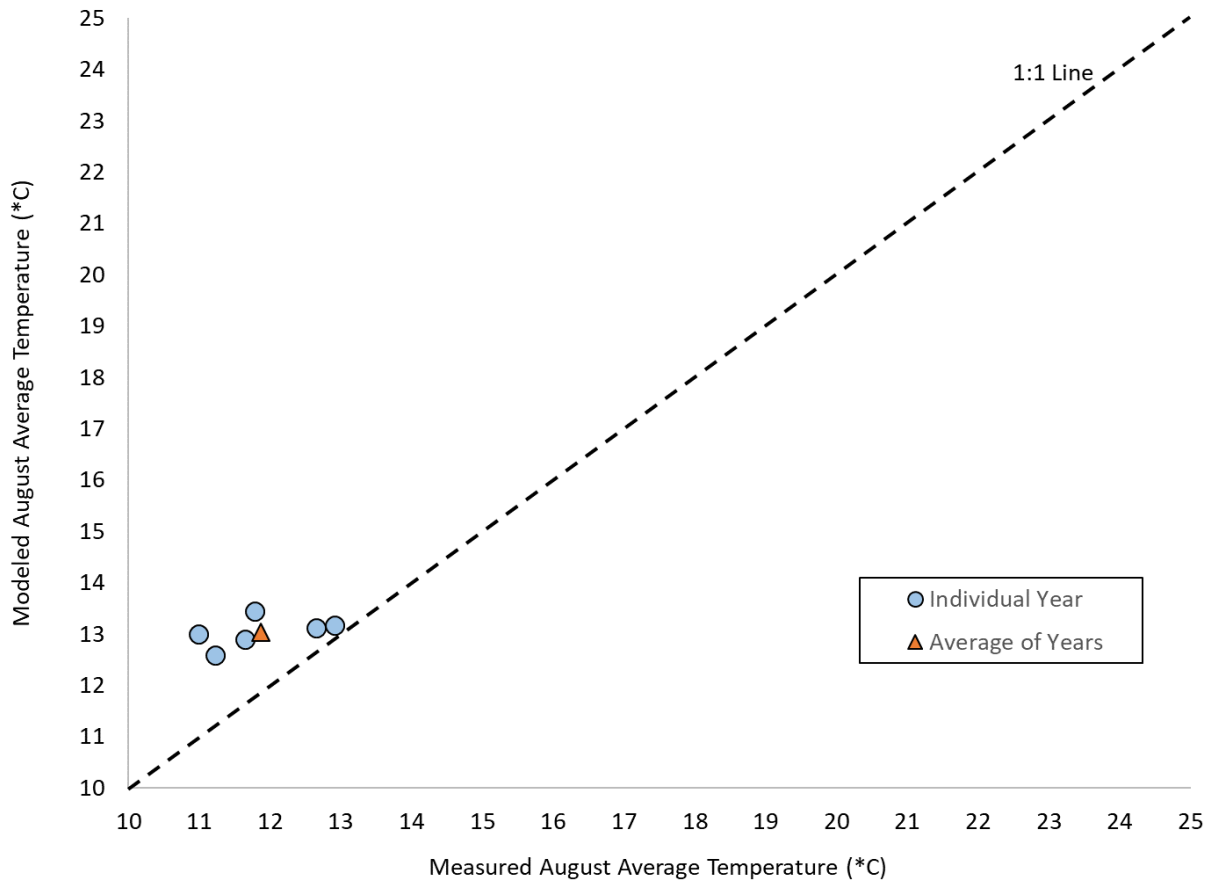
Average of measured August average temperature	18.5*C
Average of modeled August average temperature	18.6*C
Difference	0.1*C

Tanner Creek

Monitoring Location – PERMA_FID 21547

The difference between measured and model August average temperatures was 1.1°C.



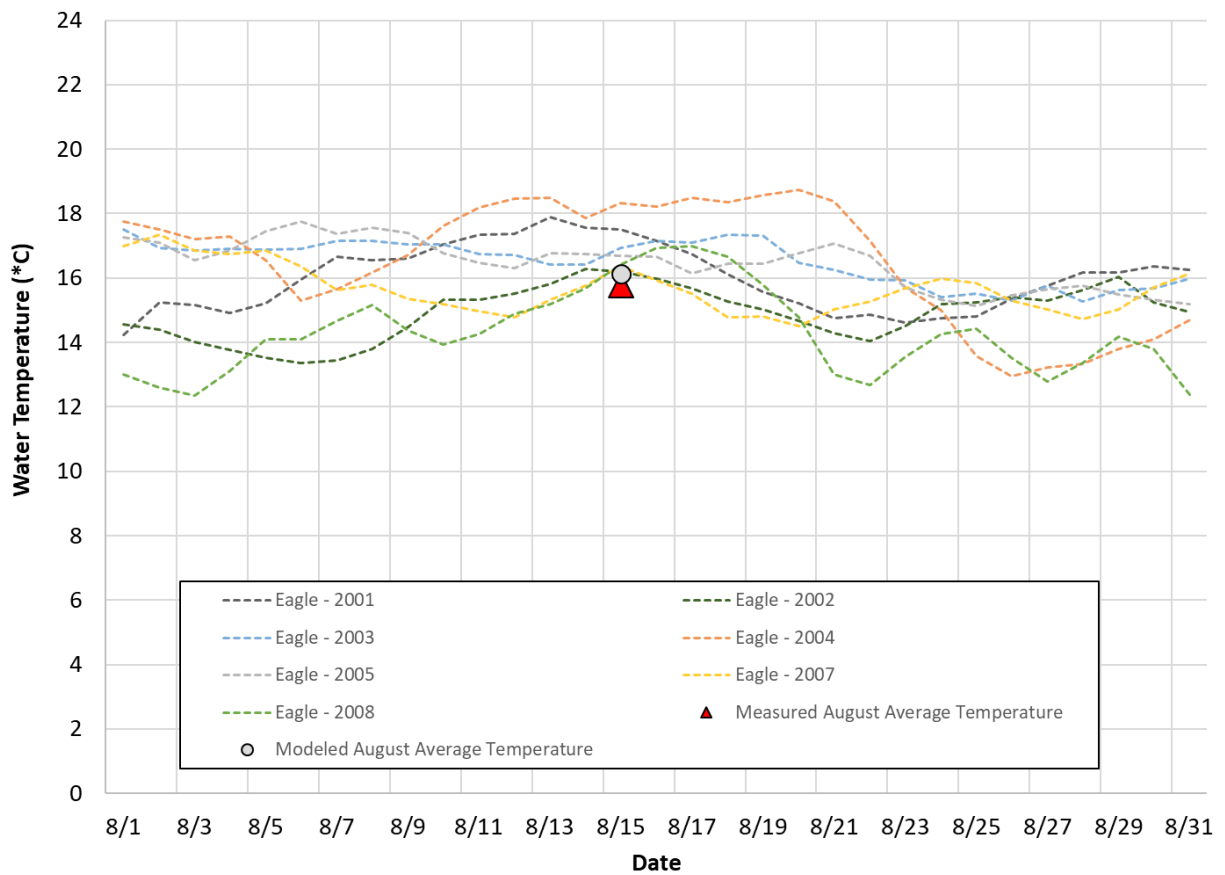
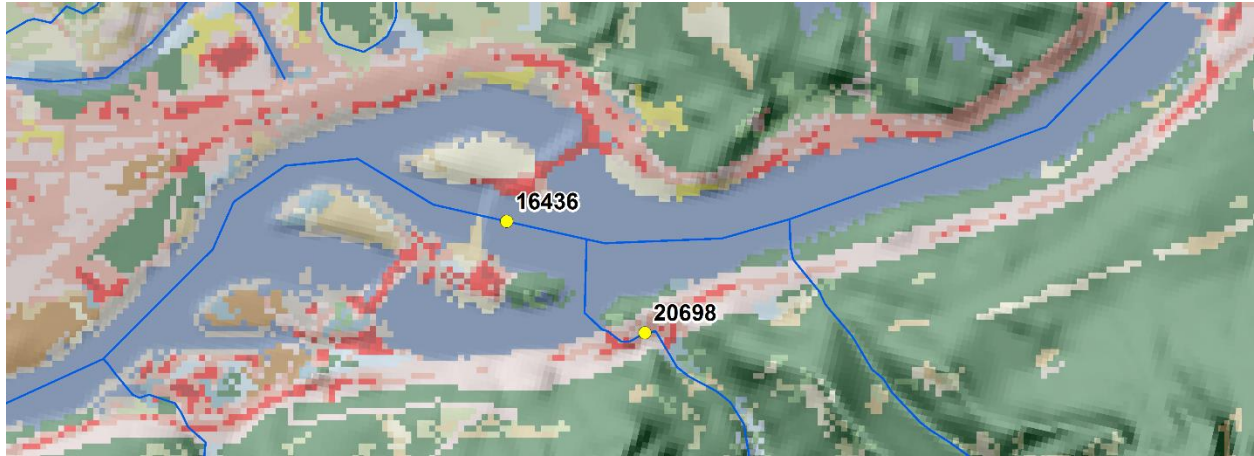


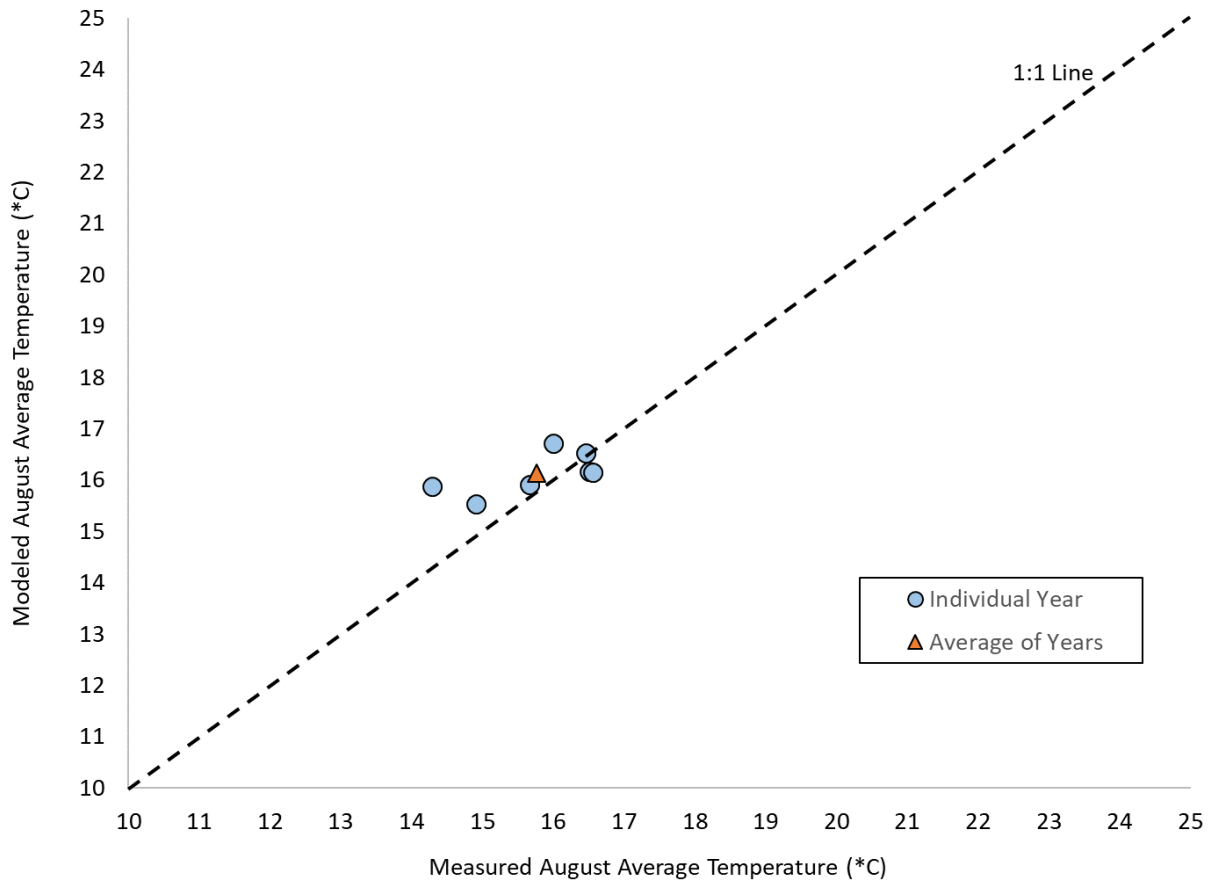
Average of measured August average temperature	11.9°C
Average of modeled August average temperature	13.0°C
Difference	1.1°C

Eagle Creek

Monitoring Location – PERMA_FID 20698

The difference between measured and model August average temperatures was 0.3°C.



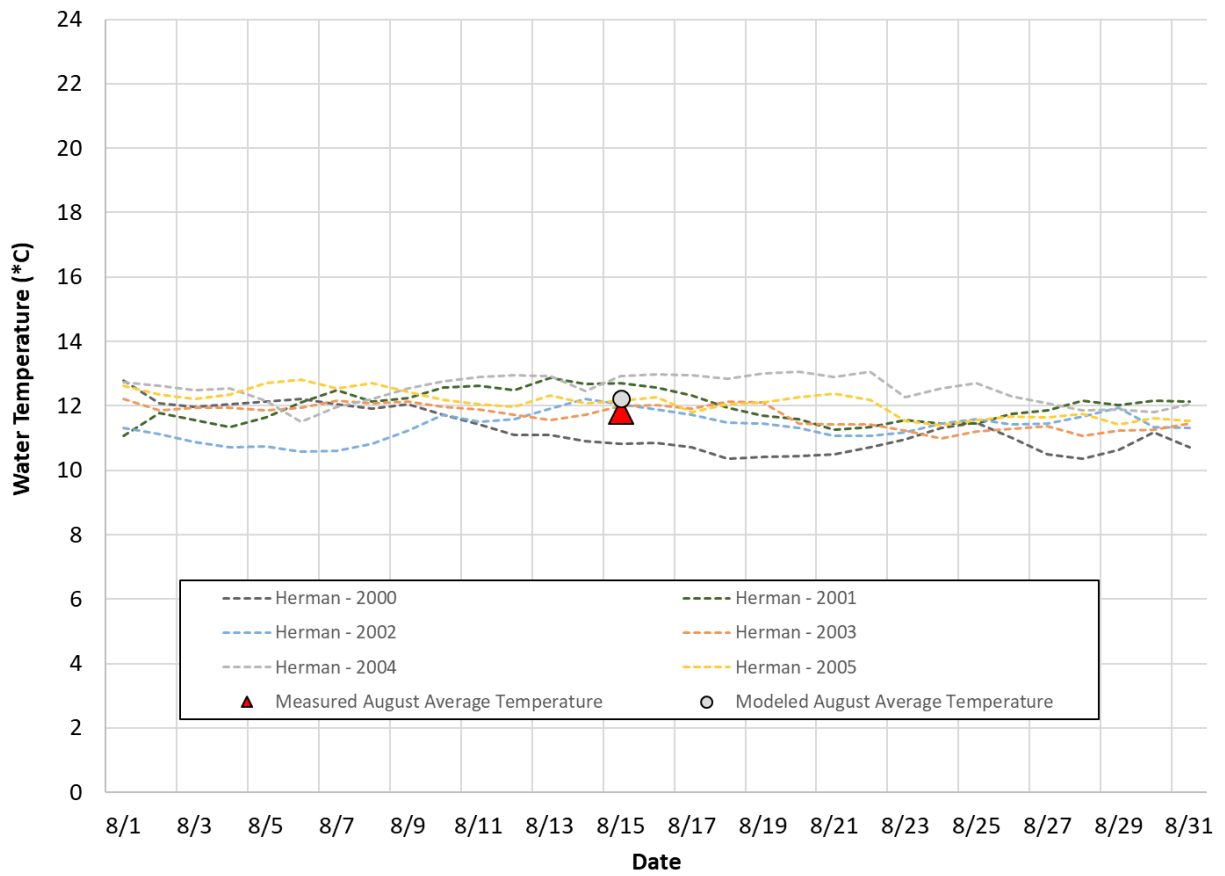
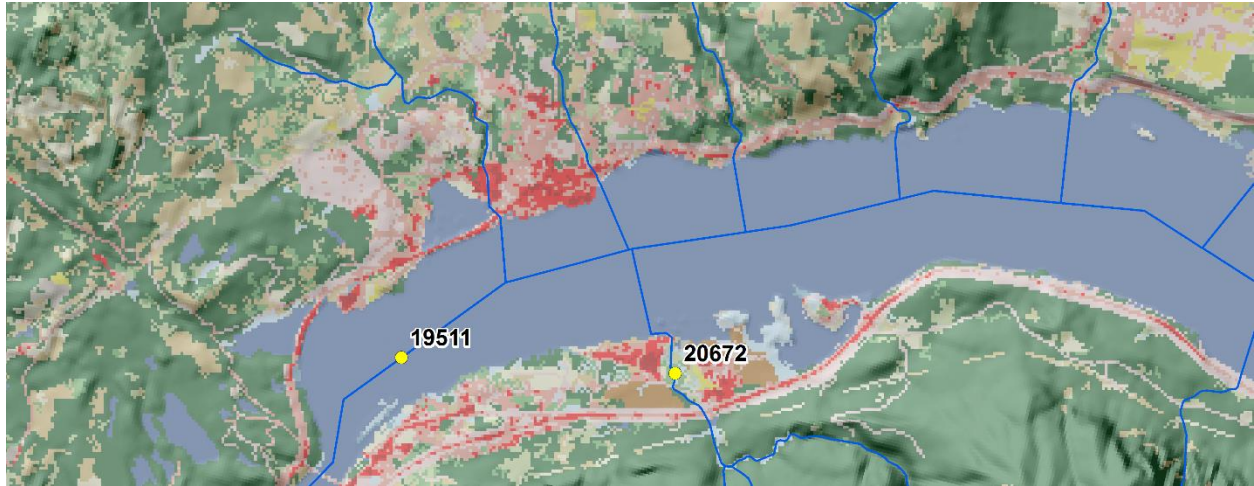


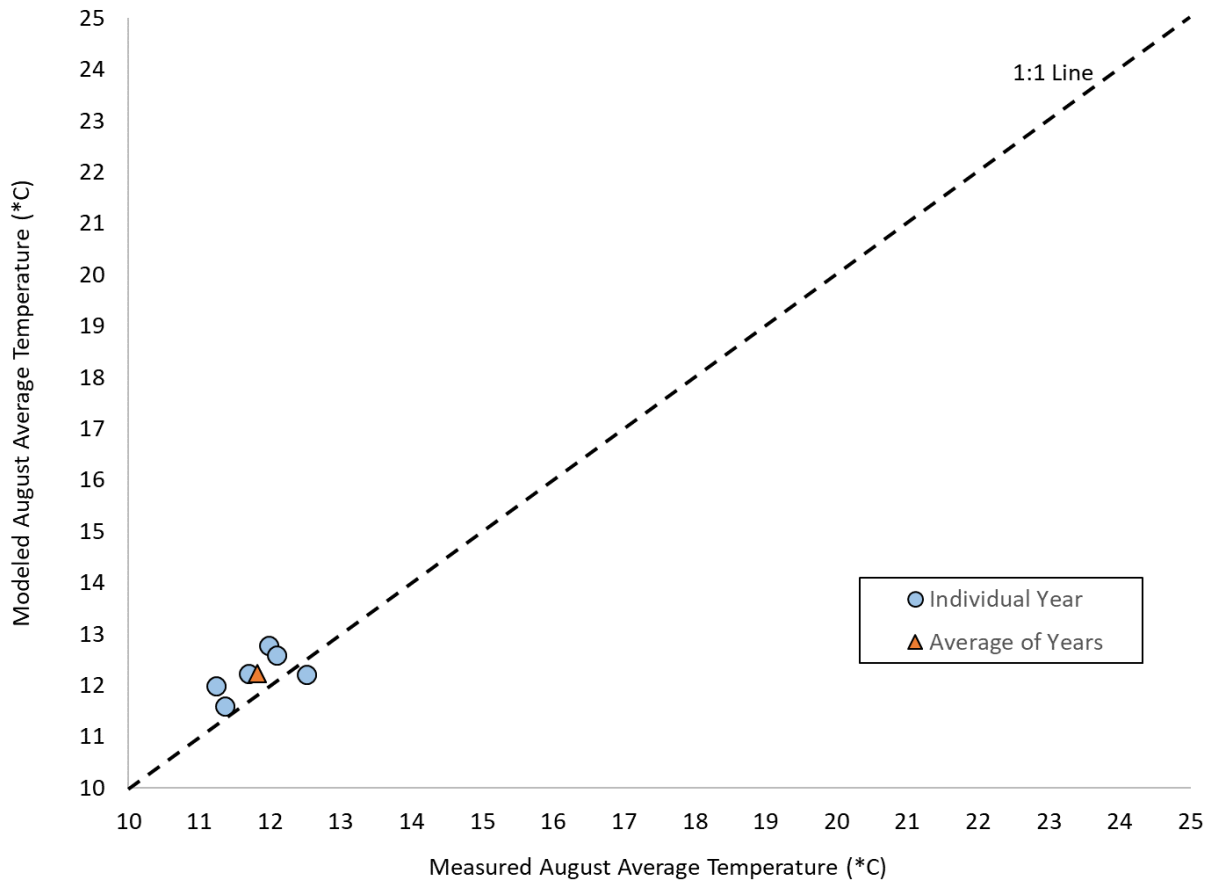
Average of measured August average temperature	15.8*C
Average of modeled August average temperature	16.1*C
Difference	0.3*C

Herman Creek

Monitoring Location – PERMA_FID 20672

The difference between measured and model August average temperatures was 0.4°C.



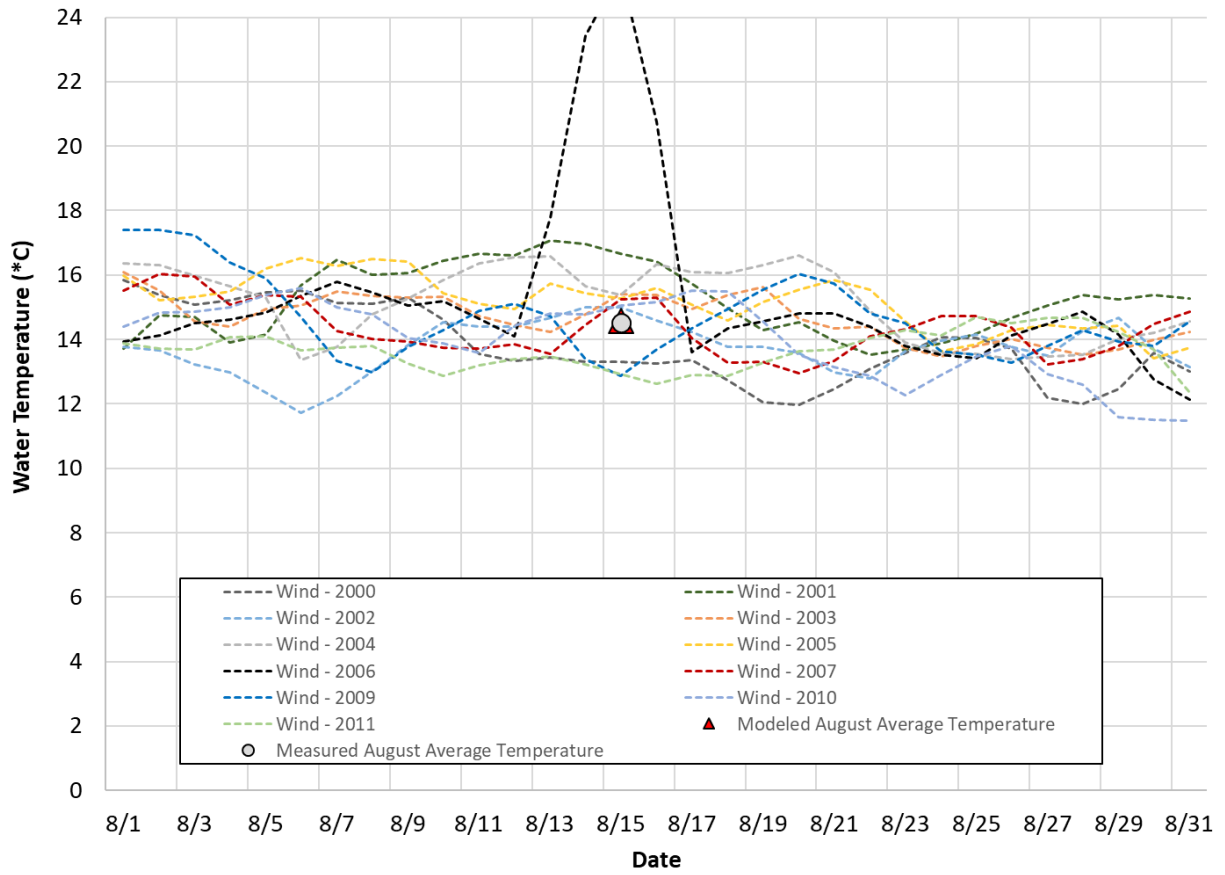


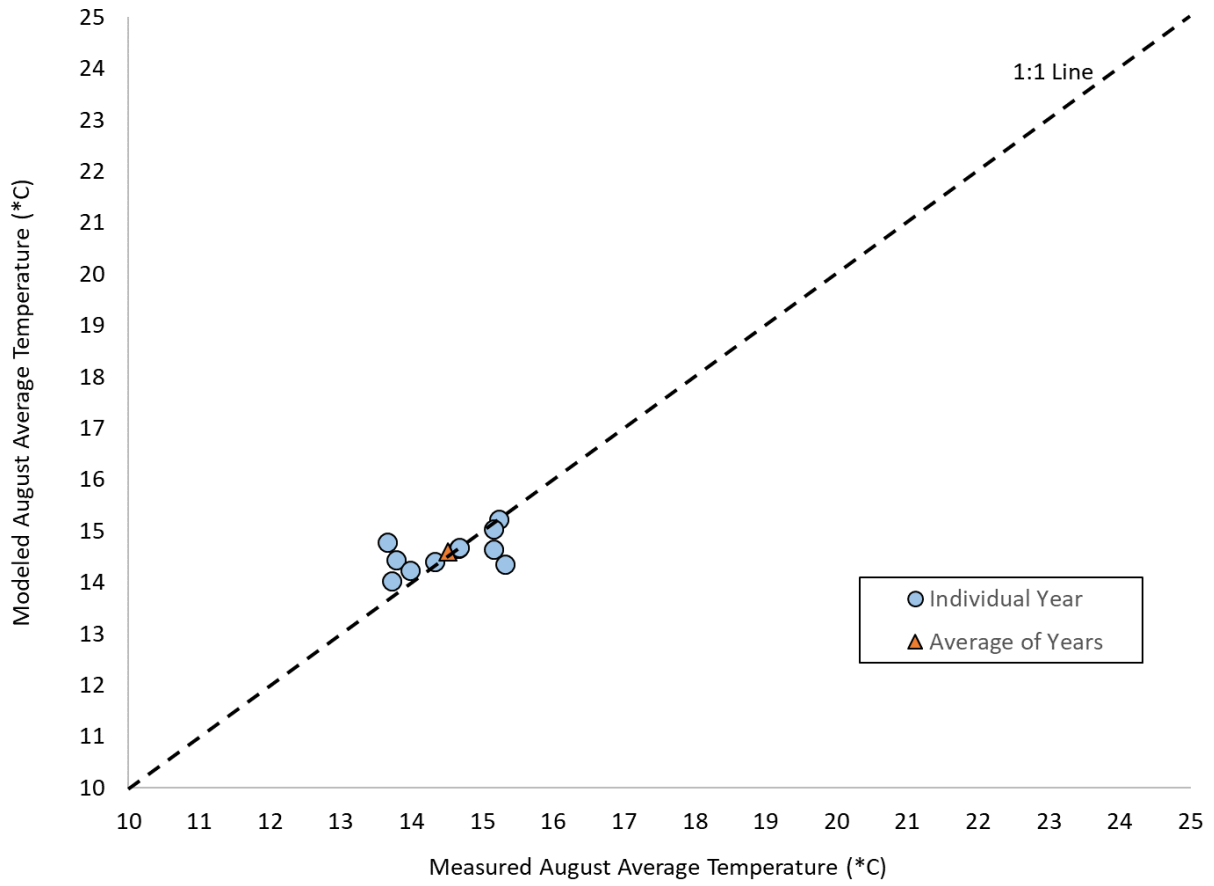
Average of measured August average temperature	11.8°C
Average of modeled August average temperature	12.2°C
Difference	0.4°C

Wind River

Monitoring Location – PERMA_FID 20290

The difference between measured and model August average temperatures was 0.1°C.



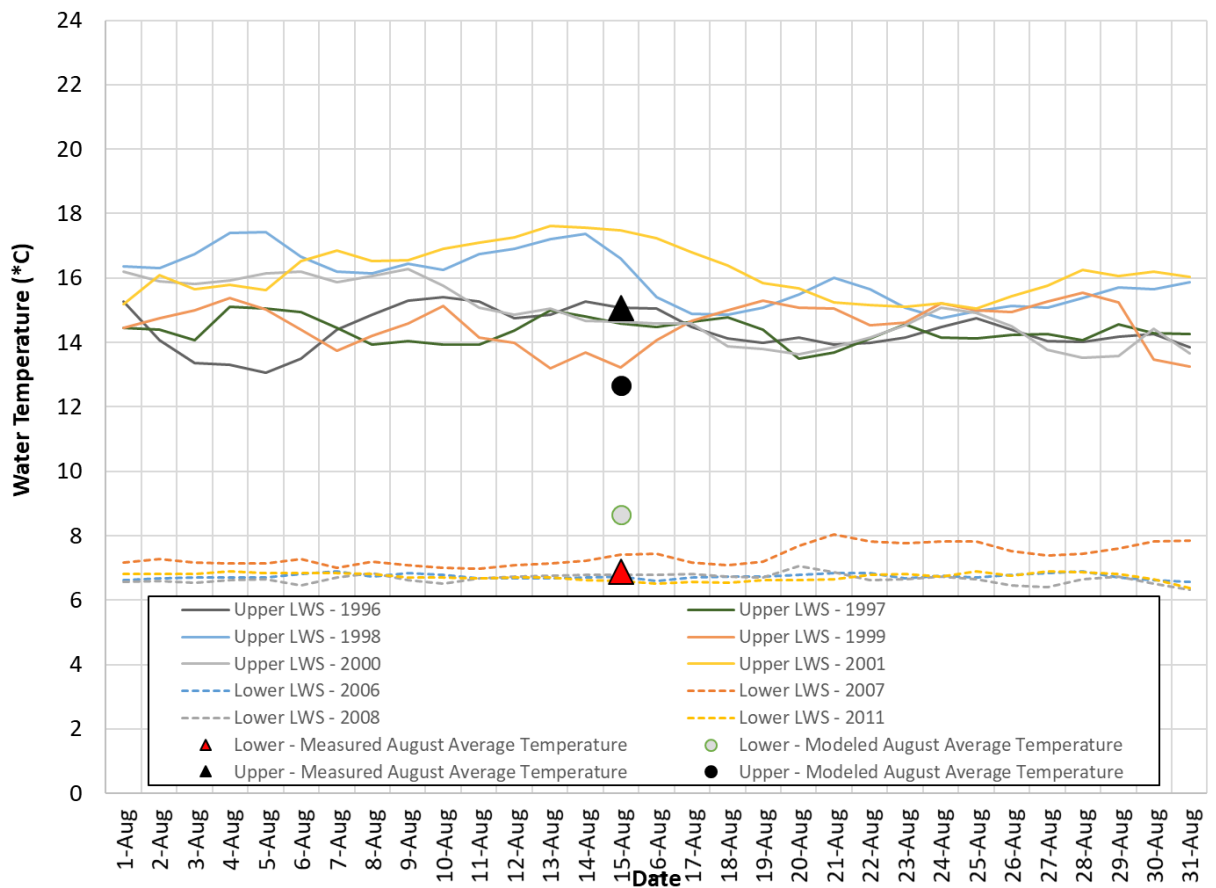
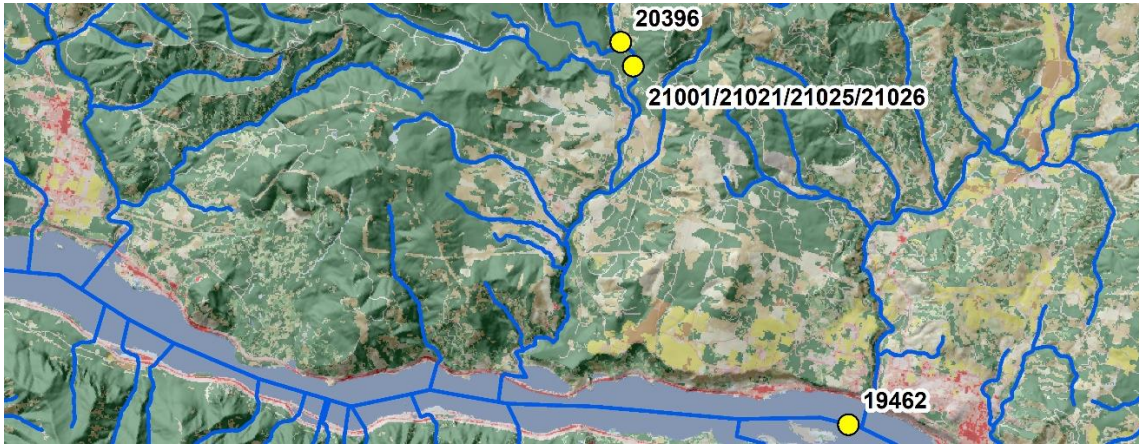


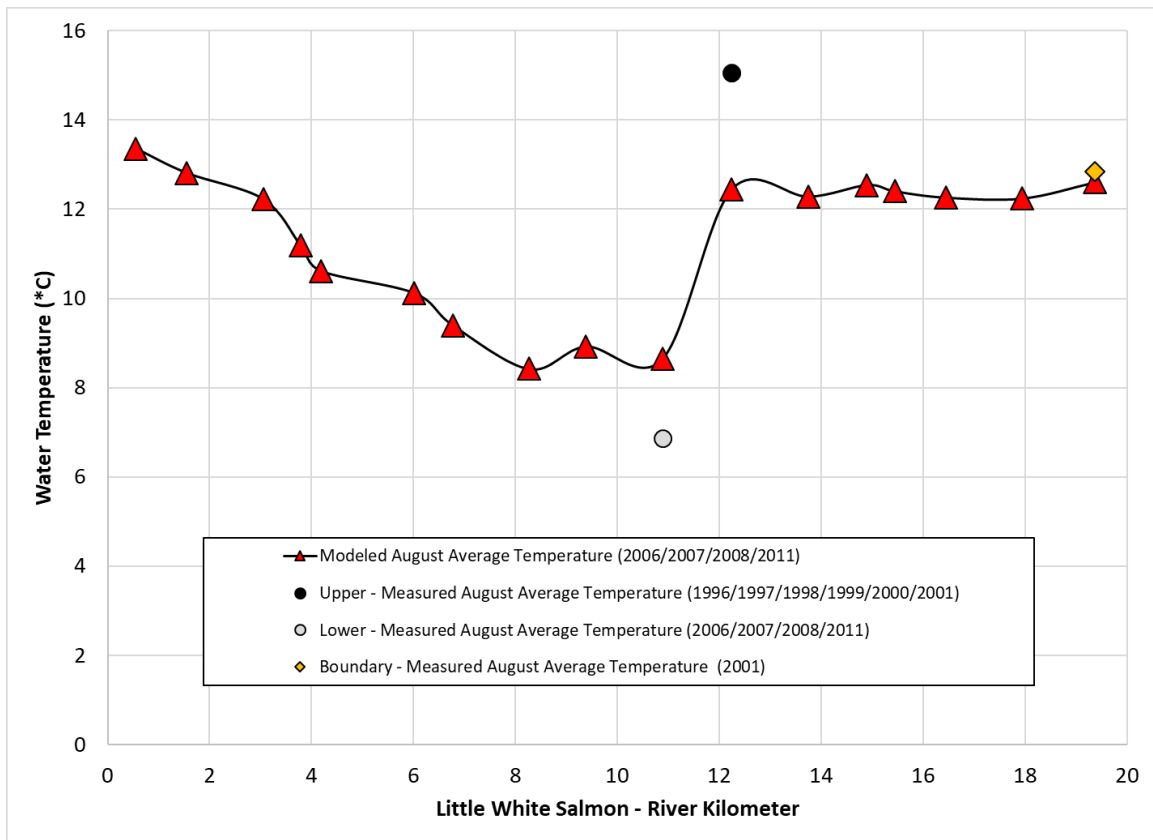
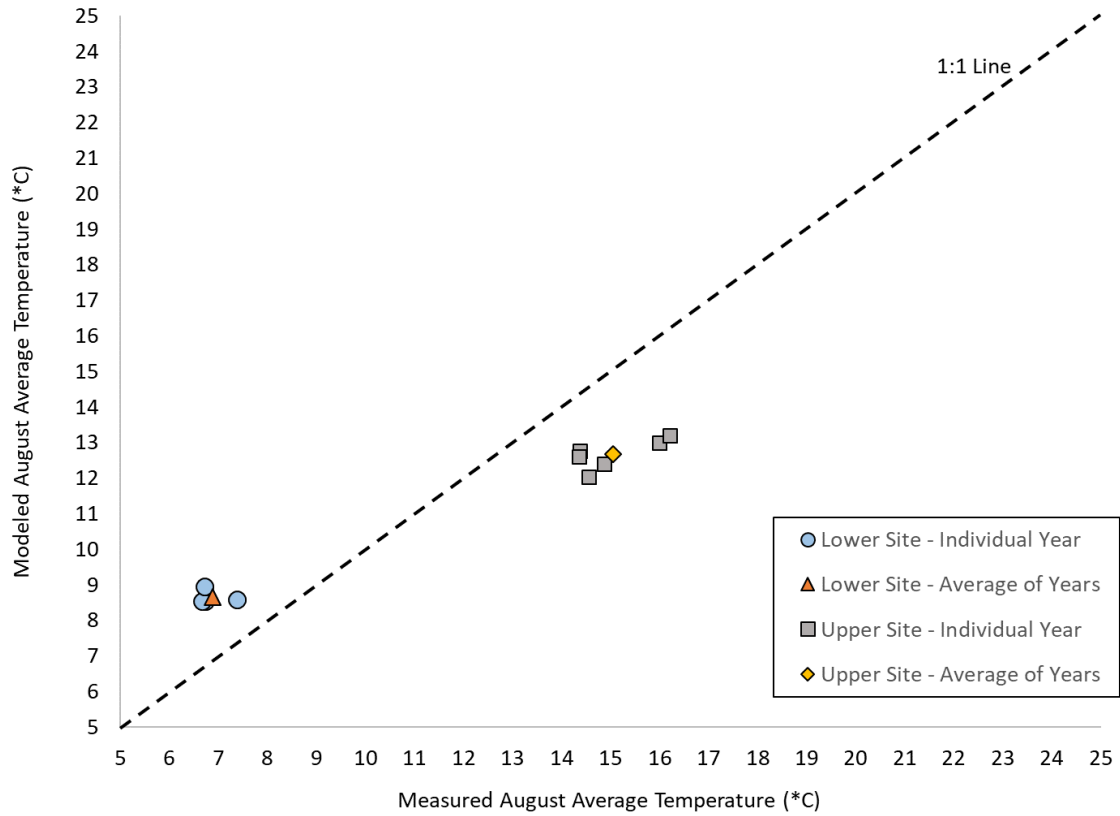
Average of measured August average temperature	14.5°C
Average of modeled August average temperature	14.6°C
Difference	0.1°C

Little White Salmon River

Monitoring Location – PERMA_FID Upper Site - 20396 and Lower Site -22001/21021/21025/21026. These two sites are over 10 kilometers upstream of the confluence with the Columbia. The temperature difference between the two adjacent sites are very different, indicating groundwater inputs.

The difference between measured and model August average temperatures was 1.8°C and 2.4°C, respectively. This high level of difference is likely due to the dramatic change in river temperature over a very short distance (Note – the boundary temperatures were very similar – 0.3°C difference)





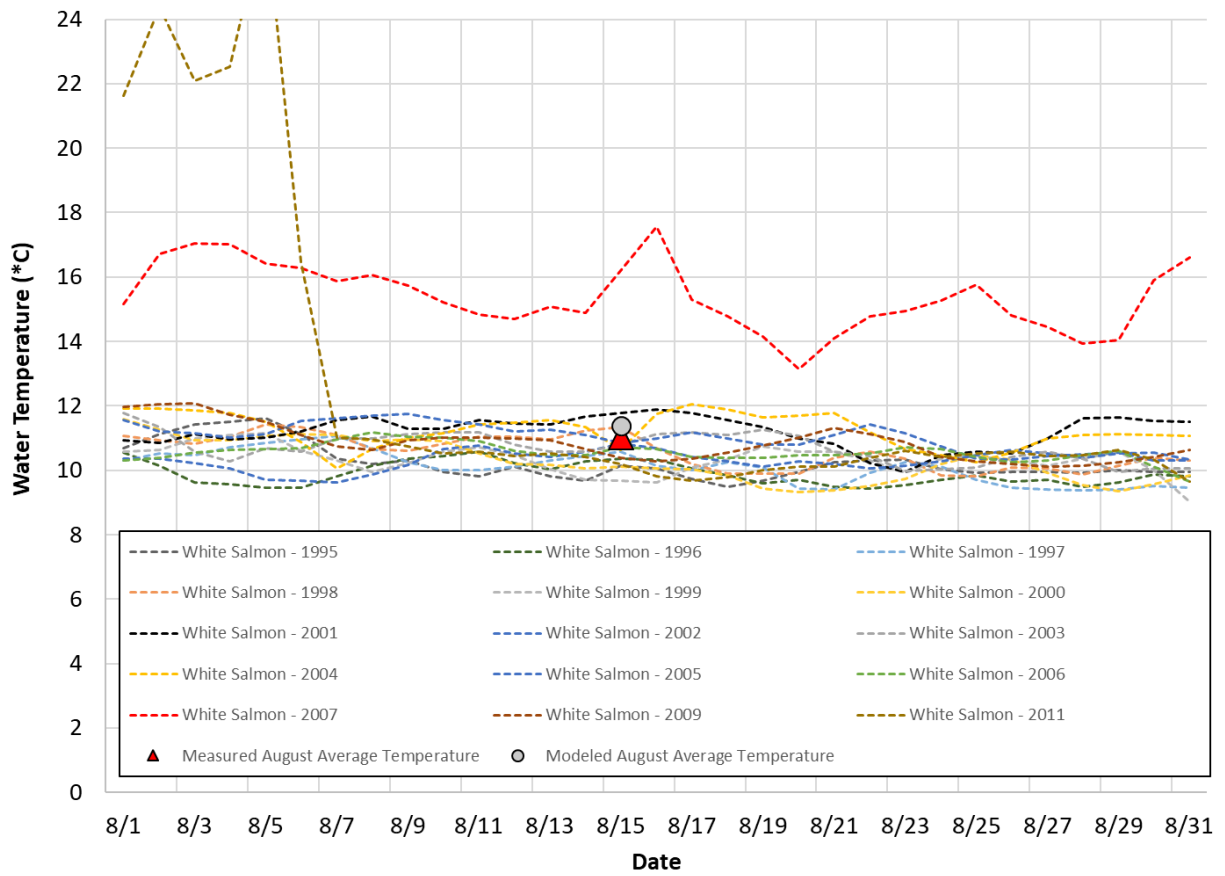
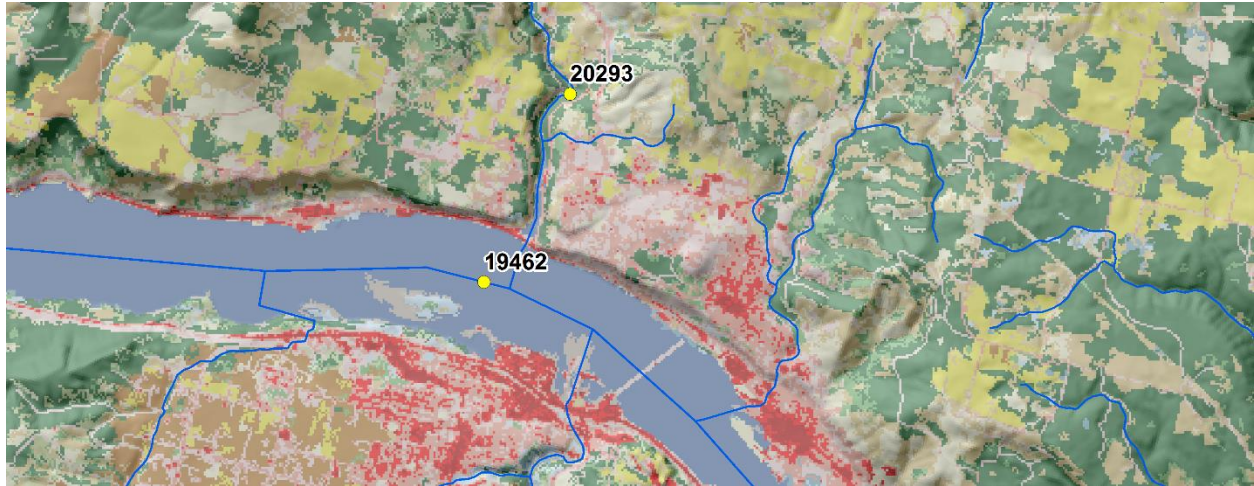
Boundary Average of measured August average temperature	12.9°C
Boundary Average of modeled August average temperature	12.6°C
Boundary Difference	0.3°C
Upper Average of measured August average temperature	6.9°C
Upper Average of modeled August average temperature	8.7°C
Upper Difference	- 1.8°C
Lower Average of measured August average temperature	15.1°C
Lower Average of modeled August average temperature	12.7°C
Lower Difference	2.4°C

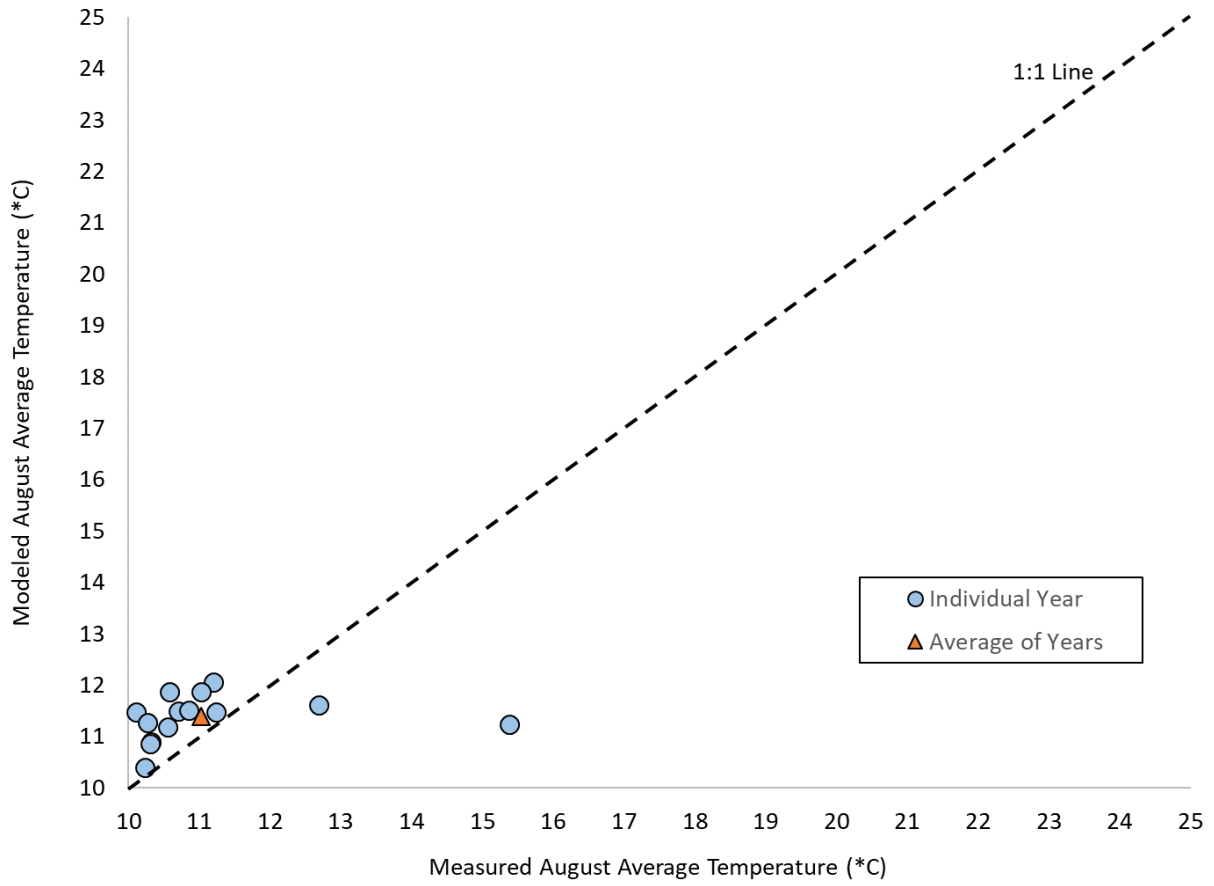
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White Salmon River

Monitoring Location – PERMA_FID 20293

The difference between measured and model August average temperatures was 0.4°C.



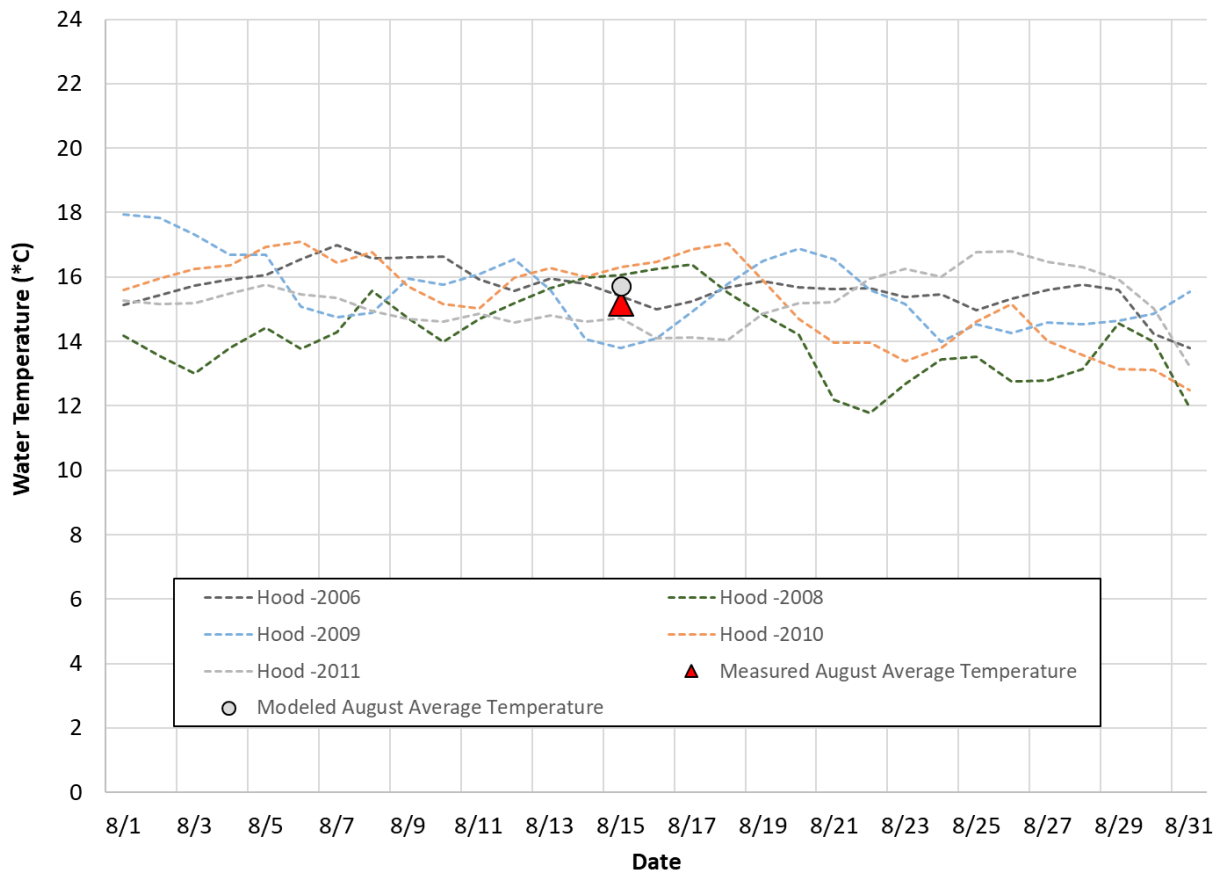
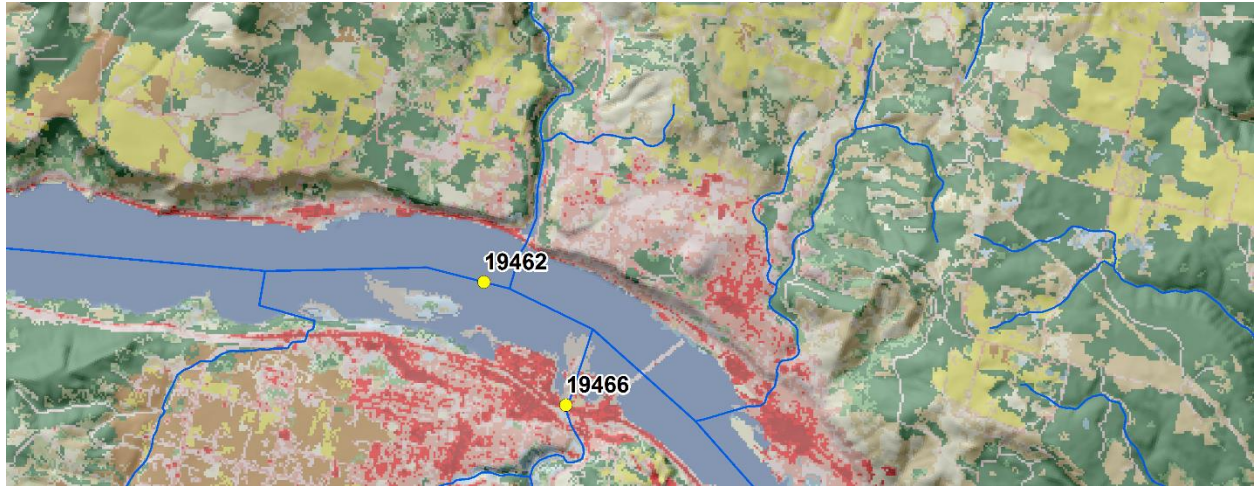


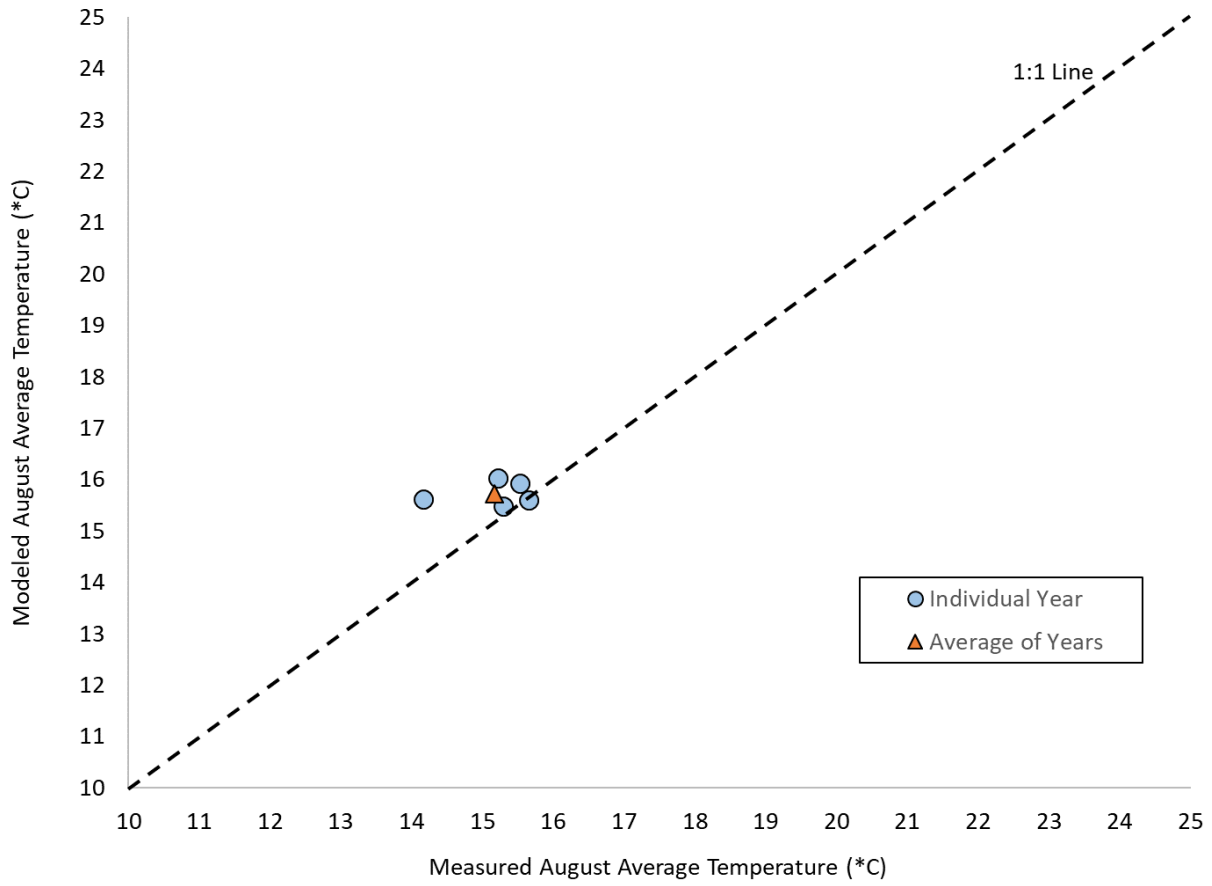
Average of measured August average temperature	11.0*C
Average of modeled August average temperature	11.4*C
Difference	0.4*C

Hood River

Monitoring Location – PERMA_FID 19466

The difference between measured and model August average temperatures was 0.5°C.



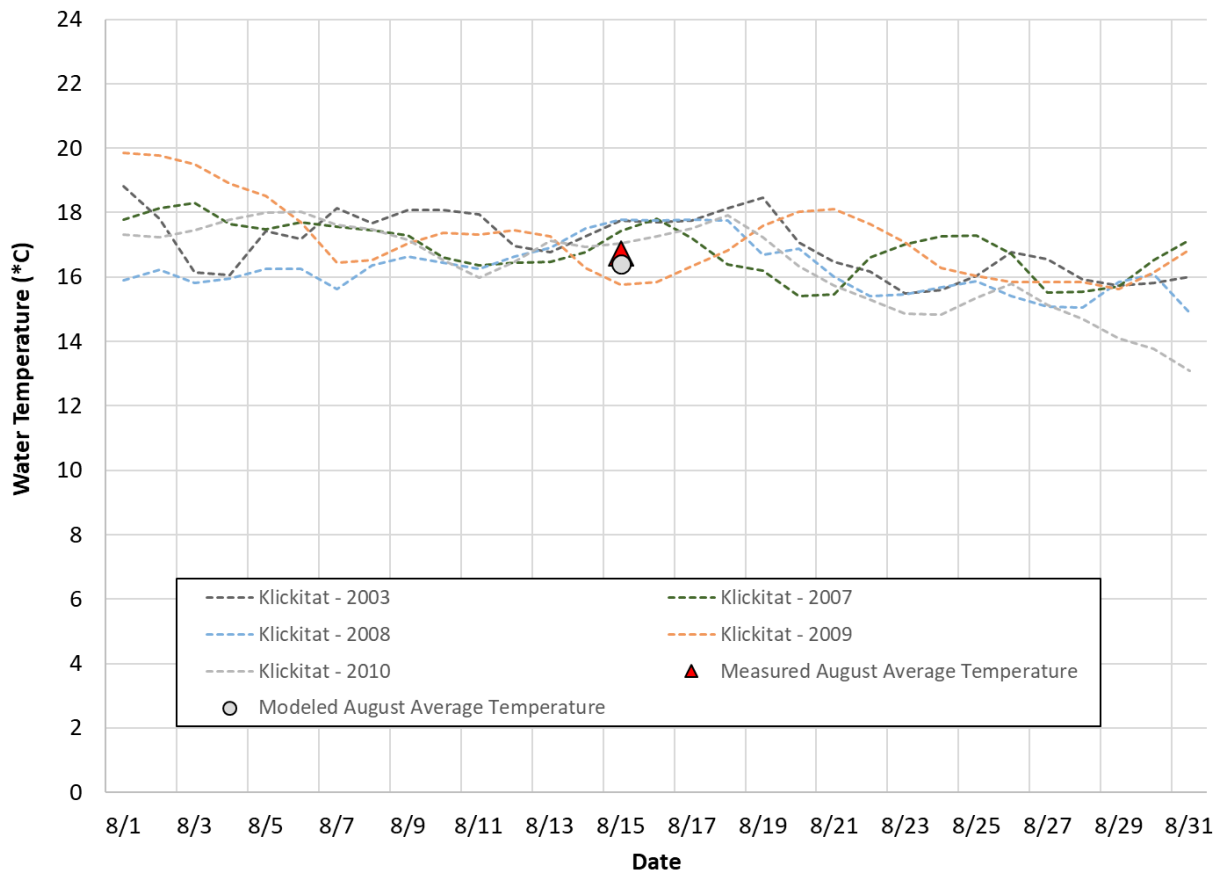
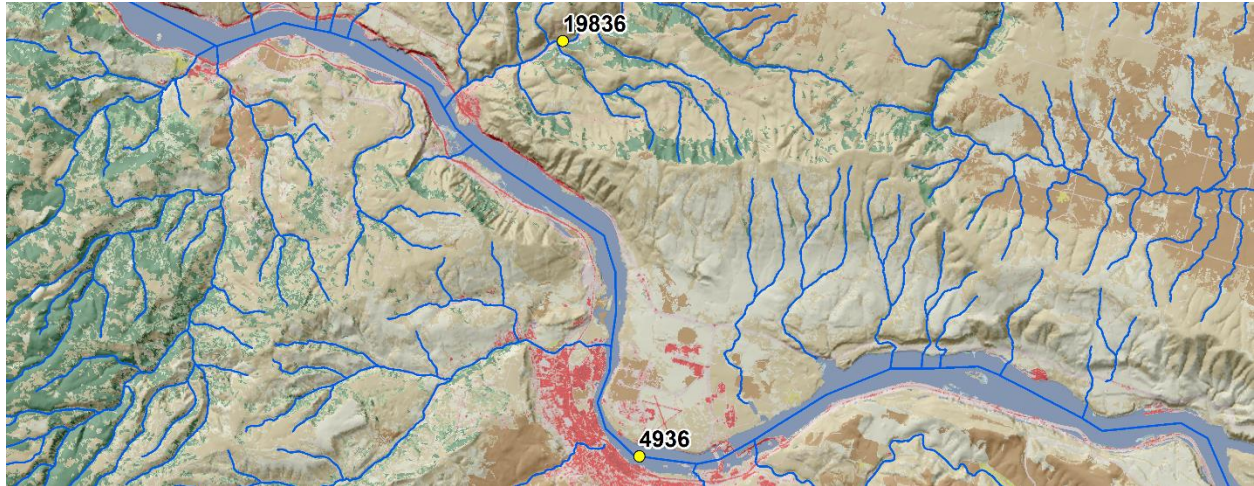


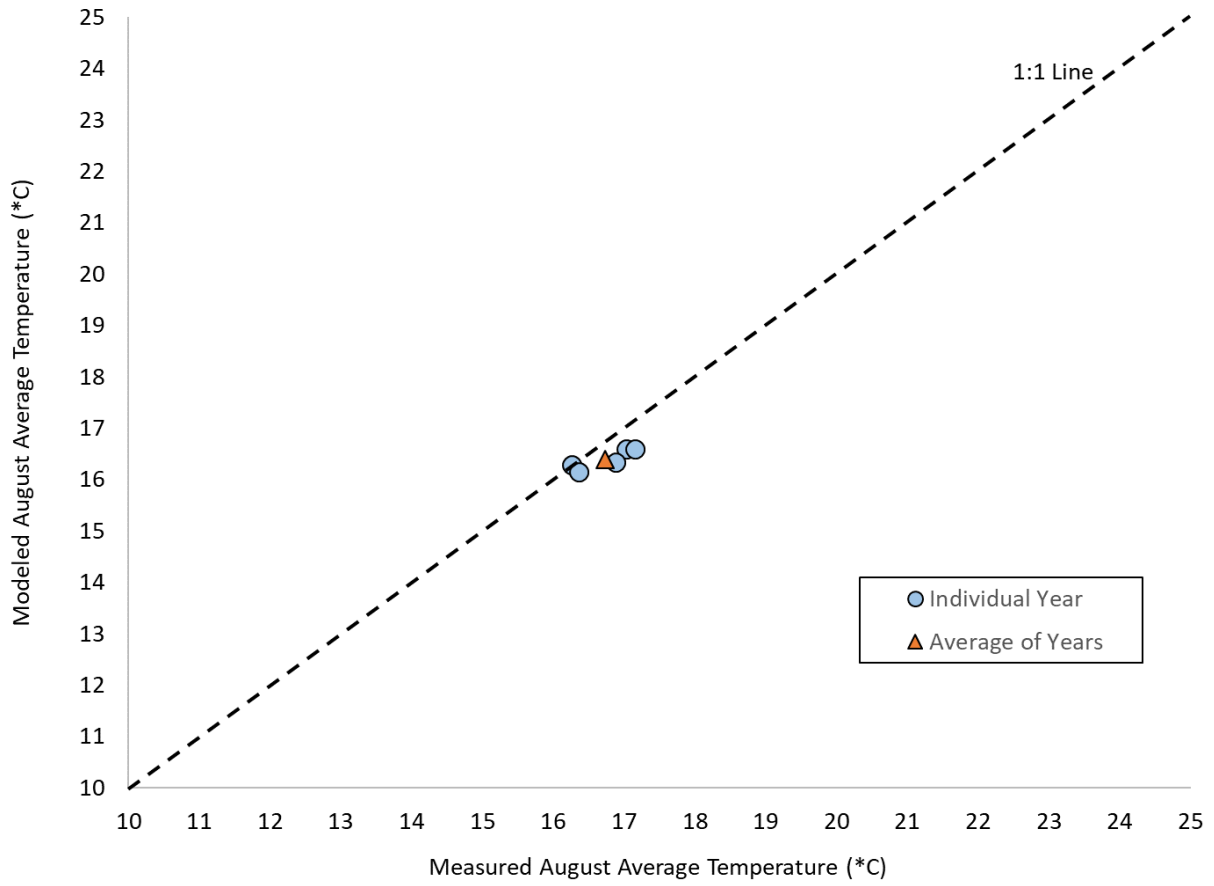
Average of measured August average temperature	15.7*C
Average of modeled August average temperature	15.2*C
Difference	0.5*C

Klickitat River

Monitoring Location – PERMA_FID 19836

The difference between measured and model August average temperatures was 0.3°C.



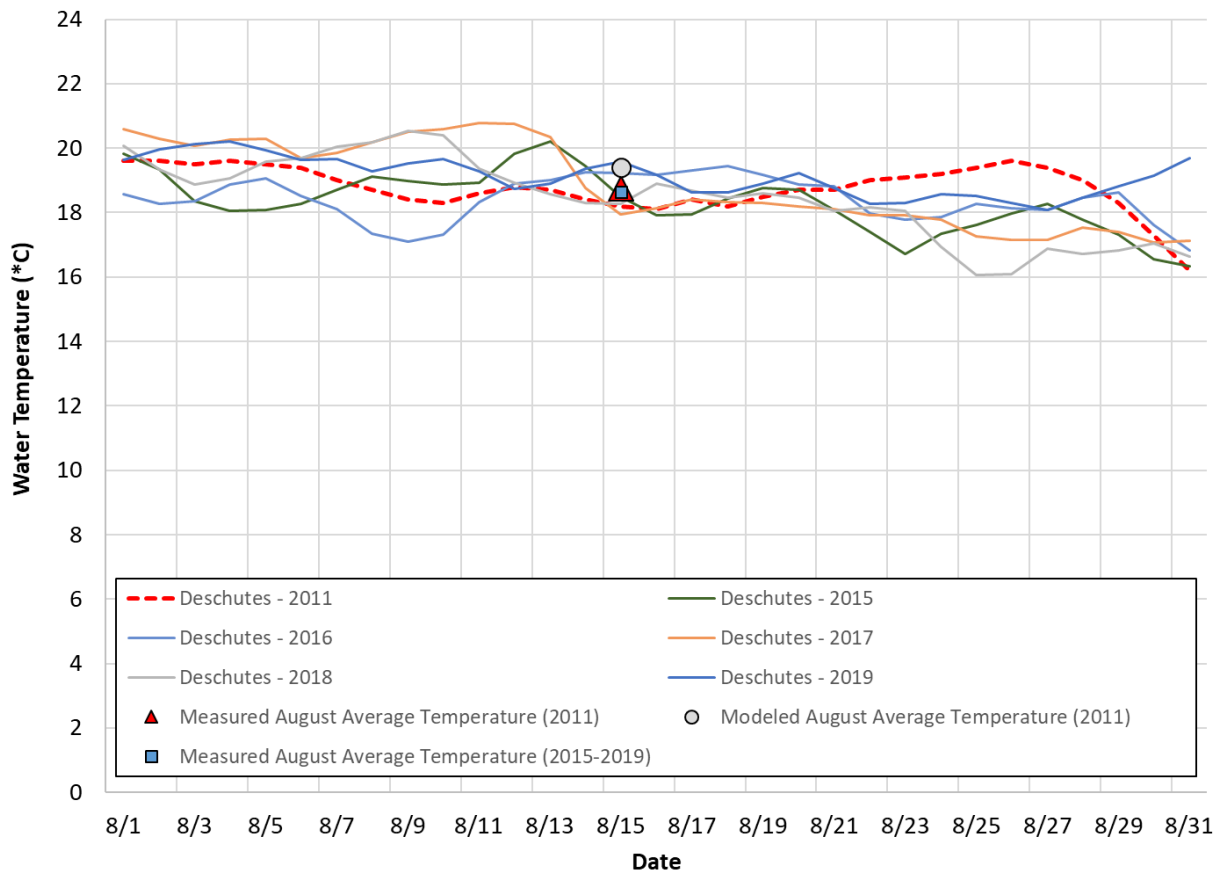
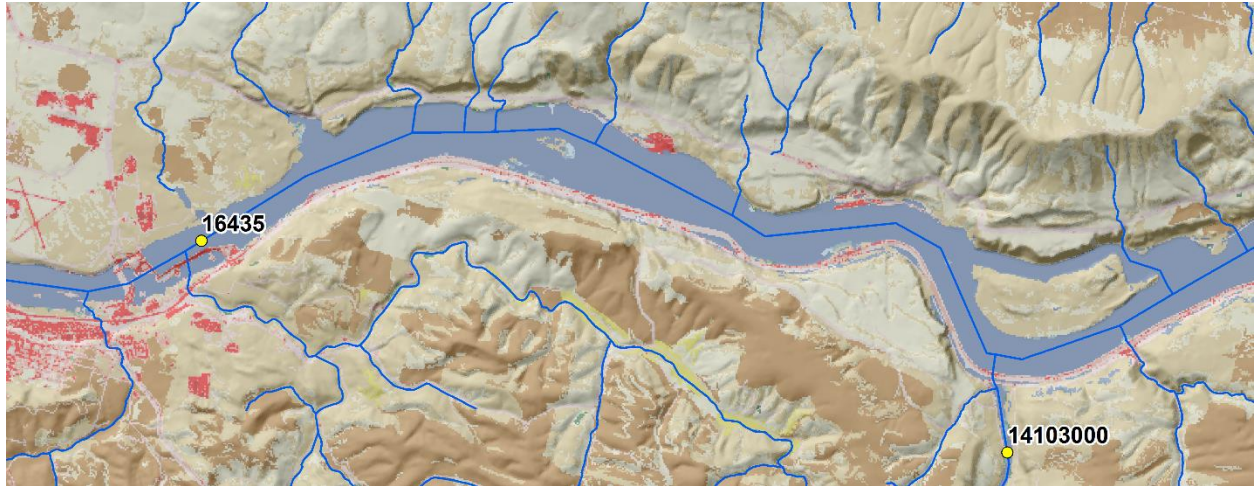


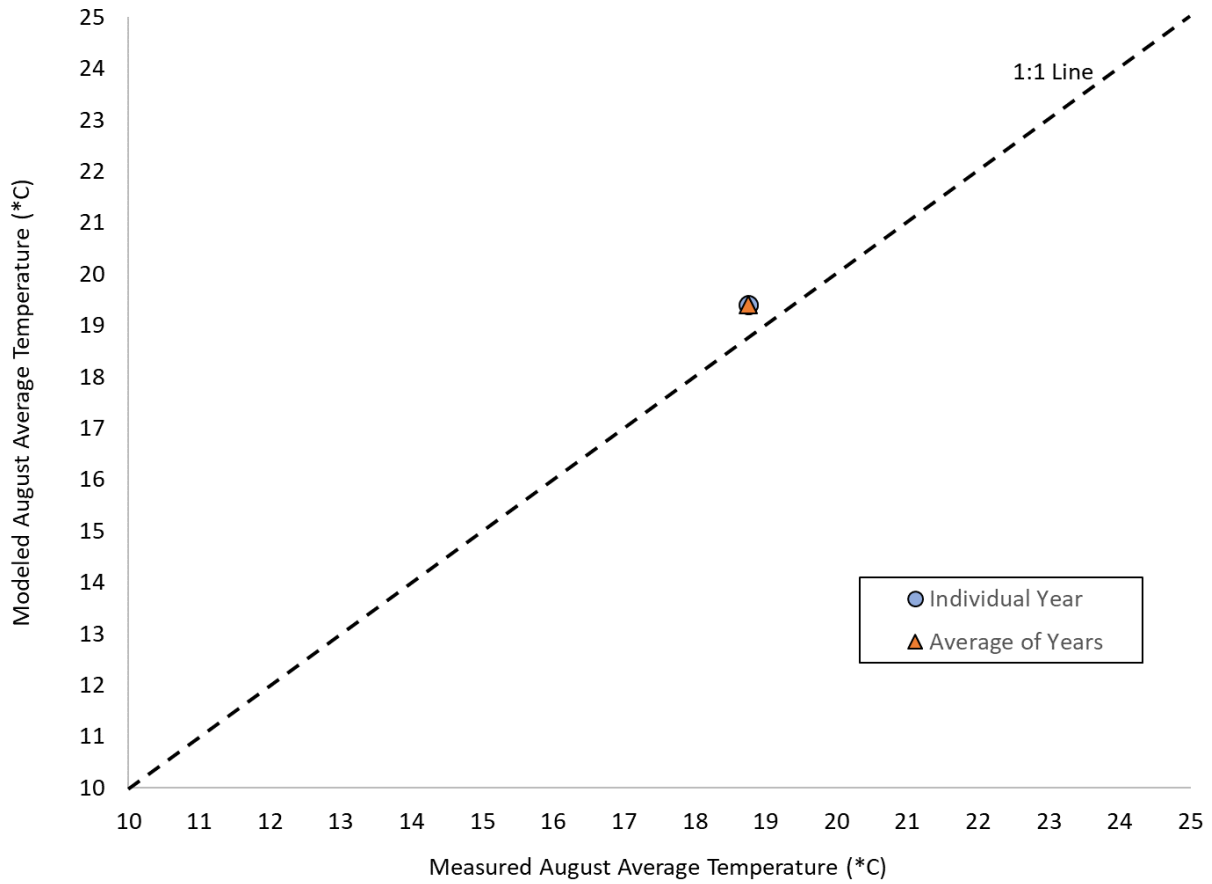
Average of measured August average temperature	16.7*C
Average of modeled August average temperature	16.4*C
Difference	0.3*C

Deschutes River

Monitoring Location – PERMA_FID 4935 (2011)/USGS Gauge 14103000 (2015/2019)

The difference between measured and model August average temperatures was 0.6°C.





Average of measured August average temperature (2011)	18.8*C
Average of modeled August average temperature (2011)	19.4*C
Difference (2011)	0.6*C
Average of measured August average temperature (2015-2019)	18.6*C