

# Appendix M, Folsom Flow and Temperature

## **Attachment M.2 American River Water Temperature Analysis**

### **M.2.1 Model Overview**

This analysis enumerates the frequency at which mean monthly HEC-5Q simulated water temperatures exceed water temperature index values or occur outside index ranges for multiple fish species in the American River. Index values and ranges were obtained from the scientific literature and agency reports for each species and life stage at multiple locations within the river. Frequencies were calculated for the baseline and each alternative at one or more locations of life stage presence in the river by month of presence and water year type and the incremental change between the baseline and each alternative was then calculated.

### **M.2.2 Model Development**

#### **M.2.2.1 Methods**

Water temperature was simulated in HEC-5Q for water years 1923 through 2021 for the Sacramento River. Outputs from HEC-5Q were used as inputs to the analysis.

Water temperature index values were compiled for the life stages present in the American River for the only listed fish species present, Central Valley steelhead (Table M.2-1). These index values were primarily taken from Appendix C and D of the Biological Assessment and are based on the scientific literature. Water temperature index values and ranges were compiled for the life stages present in the Sacramento River for following non-listed species: fall-run Chinook salmon, white sturgeon, Pacific lamprey, river lamprey, hardhead, Sacramento hitch, Sacramento splittail, American shad, and largemouth bass (Table M.2-2). These values and ranges were primarily taken from the 2017 Sites Reservoir Project Draft EIR/EIS (Sites Project Authority and Bureau of Reclamation 2017), Appendix 12D, Water Temperature Index Value Selection Rationale, with supplemental information taken from the scientific literature as necessary. Index values and index ranges used in this analysis typically characterize the suitable, optimal, acceptable, and observed temperature range needed for survival, growth, or presence.

The analysis calculates the frequency that modeled water temperatures under the baseline and each alternative would either exceed the temperature index value or occur outside the index range for a given species and life stage. The analysis uses a monthly time step, and the percent of months exceeding the index value or occurring outside the index range is computed over the entire 98-water year simulation period for each month and water year type. Frequencies of exceedance for each alternative are compared to baseline conditions, in keeping with guidance

on the proper use of model outputs, to calculate the incremental effect of the alternative. To best characterize potential differences, the analysis evaluates frequencies by water year type for each month of life stage presence and within the reach of river where the life stage is present.

Table M.2-1. Water Temperature Index Values for Listed Fish Species in the American River.

Species	Life Stage	Months of Presence	Model Output Locations	Temperature Index Value/Range (°F)	Temperature Index References
Winter-run Chinook Salmon	Non-Natal Juvenile Rearing	Jan-Apr	Hazel Ave, Watt Ave	55.4-68	Optimum temperature without food limitation (Myrick and Cech 2002, Marine and Cech 2004)
Steelhead	Adult Migration and Holding	Jul-Apr	Hazel Ave, Watt Ave	41-66.2	Migration impairment (Keefer et al. 2009)
Steelhead	Adult Migration and Holding	Jul-Apr	Hazel Ave, Watt Ave	69.8	Lethal limit to adult migrants (Coutant 1970)
Steelhead	Adult Migration and Holding	Jul-Apr	Hazel Ave, Watt Ave	59.9	Pathogen virulence threshold (McCullough 1999)
Steelhead	Spawning	Dec-Mar	Hazel Ave, Watt Ave	45-55	Successful spawning range (Bell 1991, FERC 1993, Richter and Kolmes 2005)
Steelhead	Spawning	Dec-Mar	Hazel Ave, Watt Ave	59.9	Pathogen virulence threshold (McCullough 1999)
Steelhead	Kelt Emigration	Feb-Jun	Hazel Ave, Watt Ave	66.2	Migration impairment (Keefer et al. 2009)
Steelhead	Kelt Emigration	Feb-Jun	Hazel Ave, Watt Ave	69.8	Lethal to adult migrating steelhead (Coutant 1970)
Steelhead	Kelt Emigration	Feb-Jun	Hazel Ave, Watt Ave	59.9	Pathogen virulence threshold (McCullough 1999)
Steelhead	Egg Incubation and Fry Emergence	Dec-May	Hazel Ave, Watt Ave	42-52	Optimal incubation temperature (McCullough et al. 2001)
Steelhead	Egg Incubation and Fry Emergence	Dec-May	Hazel Ave, Watt Ave	59.9	Fry pathogen virulence threshold (McCullough 1999)

Species	Life Stage	Months of Presence	Model Output Locations	Temperature Index Value/Range (°F)	Temperature Index References
Steelhead	Juvenile Rearing	Year-round	Hazel Ave, Watt Ave	66.2	Upper limit of optimum temperatures for juvenile steelhead growth, assuming maximum ration levels (Myrick 1998; Myrick and Cech 2001)
Steelhead	Juvenile Rearing and Outmigration	Year-round	Hazel Ave, Watt Ave	59.9	Pathogen virulence threshold (McCullough 1999)
Steelhead	Juvenile Outmigration	Jan-May	Hazel Ave, Watt Ave	55	Upper limit of successful smoltification (Zaugg & Wagner 1973; Wedemeyer et al. 1980; U.S. Environmental Protection Agency 2003)

Table M.2-2. Water Temperature Index Values and Index Ranges for Non-Listed Fish Species in the American River.

Species	Life Stage	Months of Presence	Model Output Locations	Temperature Index Value/Range (°F)	Temperature Index References
Fall-run Chinook salmon	Adult Migration	Jun-Dec	Hazel Ave, Watt Ave	37.9-68	Successful migration range (Reiser and Bjornn 1979, Goniea et al. 2006)
Fall-run Chinook salmon	Adult Migration	Jun-Dec	Hazel Ave, Watt Ave	59.9	Pathogen virulence threshold (McCullough 1999)
Fall-run Chinook salmon	Adult Holding and Spawning	Jun-Dec	Hazel Ave, Watt Ave	42.1-55	Spawning initiation range (McCullough 1999)
Fall-run Chinook salmon	Adult Holding and Spawning	Jun-Dec	Hazel Ave, Watt Ave	59.9	Pathogen virulence threshold (McCullough 1999)
Fall-run Chinook salmon	Egg Incubation and Fry Emergence	Oct-Mar	Hazel Ave, Watt Ave	42.8-56 <sup>1</sup>	Slater 1963, USFWS 1999, Myrick and Cech 2004, Bratovich et al. 2012, Martin et al. 2017

<sup>1</sup> Exact endpoints fall somewhere between 53.6°F and 56°F, with recommended upper thermal optimum of 53.6°F to 55.9°F (Myrick and Cech 2004, Martin et al. 2017)

Species	Life Stage	Months of Presence	Model Output Locations	Temperature Index Value/Range (°F)	Temperature Index References
Fall-run Chinook salmon	Egg Incubation and Fry Emergence	Oct-Mar	Hazel Ave, Watt Ave	59.9	Pathogen virulence threshold (McCullough 1999)
Fall-run Chinook salmon	Juvenile Rearing and Outmigration	Jan-May	Hazel Ave, Watt Ave	55.4-68	Optimum temperature for growth, smoltification, and predation vulnerability (Myrick and Cech 2002, Marine and Cech 2004)
Fall-run Chinook salmon	Juvenile Rearing and Outmigration	Jan-May	Hazel Ave, Watt Ave	75.2	UILT (Brett 1952, Brett et al. 1982, Myrick and Cech 2004)
Fall-run Chinook salmon	Juvenile Rearing and Outmigration	Jan-May	Hazel Ave, Watt Ave	59.9	Pathogen virulence threshold (McCullough 1999)
White Sturgeon	Non-Spawning Adults	Year-round	Hazel Ave, Watt Ave	77	Upper limit of suitable water temperatures for adult white sturgeon (Israel et al. 2011).
Pacific Lamprey	Spawning and Egg Incubation	Mar-Jul	Hazel Ave, Watt Ave	50-64	Observed range of high survival and low occurrence of embryonic developmental abnormalities (Meeuwig et al. 2003, 2005).
Pacific Lamprey	Ammocoete Rearing and Emigration	Year-round	Hazel Ave, Watt Ave	72	Upper limit for high survival and low occurrence of developmental abnormalities (Meeuwig et al. 2003, 2005).
Western River Lamprey	Spawning and Egg Incubation	Feb- Jul	Hazel Ave , Watt Ave	50-64	Observed range of high survival and low occurrence of embryonic developmental abnormalities (Meeuwig et al. 2003, 2005).
Western River Lamprey	Ammocoete Rearing and Emigration	Year-round	Hazel Ave, Watt Ave	72	Upper limit for high survival and low developmental abnormalities (Meeuwig et al. 2003, 2005)

Species	Life Stage	Months of Presence	Model Output Locations	Temperature Index Value/Range (°F)	Temperature Index References
Sacramento Splittail	Spawning	Feb- May	Hazel Ave, Watt Ave	45-75	Observed range of suitable water temperatures (DWR 2004)
Hardhead	Spawning	Apr-Jun	Hazel Ave, Watt Ave	59-64	Optimal range (Wang 1986)
Hardhead	Non-Spawning Adults	Year-round	Hazel Ave, Watt Ave	57.2-78.8	Commonly observed range (Thompson et al. 2012)
Striped Bass	Adults	Year-round	Hazel Ave, Watt Ave	77	Stress initiated at this temperature, lethal above 86F (Moyle 2002).
Striped Bass	Juvenile Rearing	Year-round	Hazel Ave, Watt Ave	61-71	Optimal range (Fay et al. 1983)
American Shad	Spawning and Larval Rearing	Apr-Jun	Hazel Ave, Watt Ave	60-70	Optimal range (Painter et al. 1980)
American Shad	Juvenile Rearing and Emigration	Jul-Nov	Hazel Ave, Watt Ave	63-77	Optimal range (Moyle 2002)
Threadfin Shad	Spawning	Apr- Aug	Hazel Ave, Watt Ave	63-77	Optimal range (Moyle 2002)
Threadfin Shad	Non-Spawning Adult	Year-round	Hazel Ave, Watt Ave	63-77	Optimal range (Moyle 2002)
Largemouth Bass	Spawning	Apr-Jun	Hazel Ave, Watt Ave	59-75	Observed range (Stuber et al. 1982)
Largemouth Bass	Non-Spawning Adult	Year-round	Hazel Ave, Watt Ave	77-86	Optimal range for growth (Moyle 2002)
Smallmouth Bass	Spawning	May-Jul	Hazel Ave, Watt Ave	55-70	Optimal range (Brown et al. 2009)
Smallmouth Bass	Non-Spawning Adult	Jun-Aug	Hazel Ave, Watt Ave	> 66	Lower end of observed summer-time range (Moyle 2002)
Smallmouth Bass	Non-Spawning Adult	Year-round	Hazel Ave, Watt Ave	77-80	Optimal range for growth (Moyle 2002)
Spotted Bass	Spawning	Apr-Jun	Hazel Ave, Watt Ave	59-64	Aasen and Henry 1981
Spotted Bass	Non-Spawning Adult	Jun-Aug	Hazel Ave, Watt Ave	75-87	Preferred range (Moyle 2002)

### **M.2.2.2 Assumptions/Uncertainty**

One limitation of the analysis is that, due to model limitations, a monthly mean time step was the smallest time step available for water temperature model outputs. As a result, the intra-month variation around the monthly mean cannot be evaluated, which introduces uncertainty in the results.

Another limitation of the analysis is that it treats all exceedances above the temperature criteria as equal because no magnitude of exceedance was calculated. A 0.1°C magnitude of exceedance could be very different to a steelhead than a 10°C magnitude of exceedance.

An assumption of this analysis is that all fish at and around the model output locations experience the same temperature as the model output. Small-scale differences in water temperature related to depth, shade, water movement, and a large number of other factors are common in streams (Poole et al. 2001), but this was not accounted for in the analysis. This introduced uncertainty in the results.

### **M.2.2.3 Code and Data Repository**

Code and analysis outputs can be found at:

[https://icfonline.sharepoint.com/:f:/r/sites/EP/USBR\\_2021LTO/Public%20Draft%20Alternatives/Appendix%20M.%20Folsom%20Flow%20and%20Temperature/M.%20American%20River%20Water%20Temperature%20Analysis/Code%20and%20Data?csf=1&web=1&e=lbH5km](https://icfonline.sharepoint.com/:f:/r/sites/EP/USBR_2021LTO/Public%20Draft%20Alternatives/Appendix%20M.%20Folsom%20Flow%20and%20Temperature/M.%20American%20River%20Water%20Temperature%20Analysis/Code%20and%20Data?csf=1&web=1&e=lbH5km)

## M.2.3 Results

### M.2.3.1 Biological Assessment

#### M.2.3.1.1 HEC 5Q Water Temperature Model Outputs

HEC 5Q water temperature model outputs are provided in this attachment to aid the reader in visually interpreting the results of the analysis. By drawing or imagining a horizontal line that intersects the y-axis at each water temperature value listed in Table M.2-1 and Table M.2-2, the reader can determine the frequency above or below the value by viewing the resulting probability of exceedance along the x-axis for each model scenario. Model outputs are presented by month for two locations in the American River: Hazel Avenue and Watt Avenue. Figure M.2-1 presents exceedance curves of modeled monthly water temperatures at Hazel Avenue for all months and water year types combined for each model scenario. Figure M.2-2 through Figure M.2-13 present exceedance curves of modeled monthly water temperatures at Hazel Avenue for all water year types combined by month.

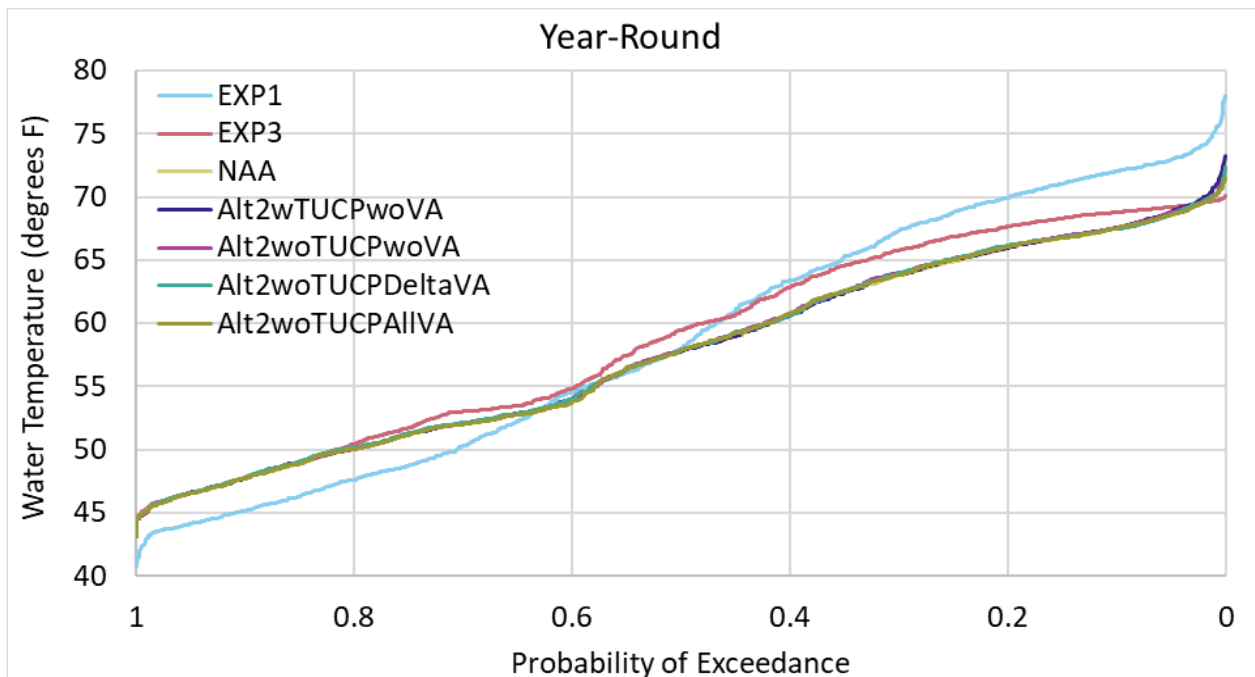


Figure M.2-1. Exceedance plot of modeled water temperatures, American River at Hazel Avenue, year-round.

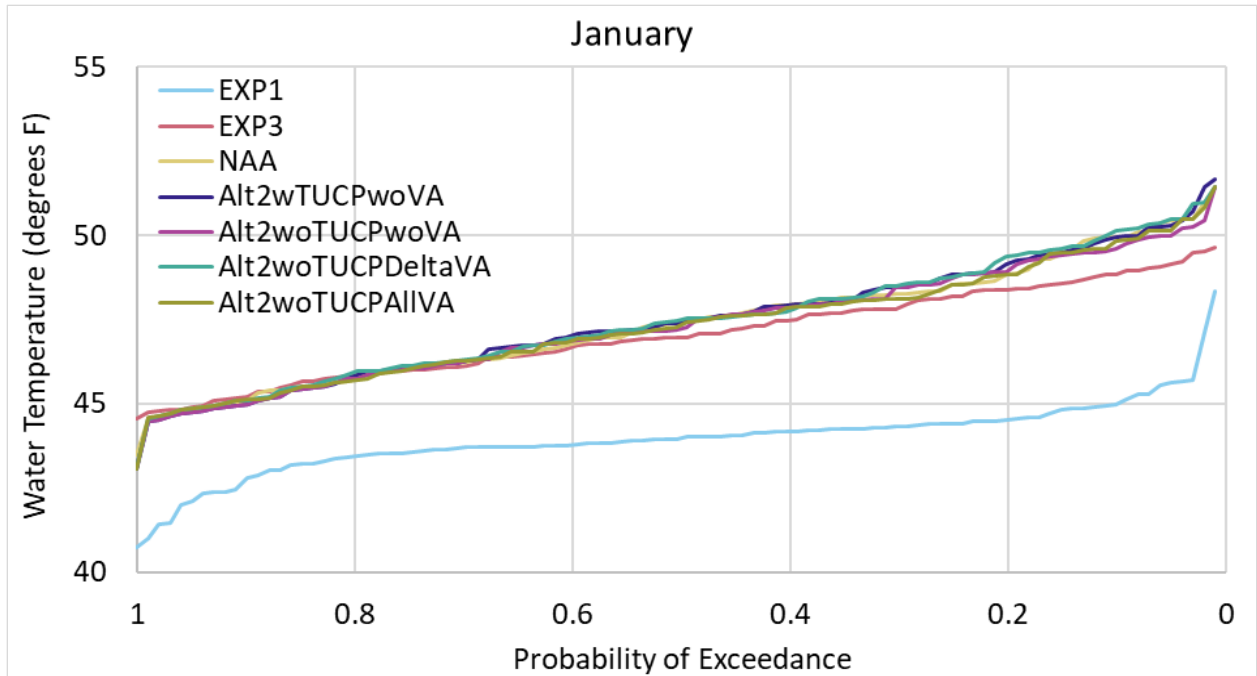


Figure M.2-2. Exceedance plot of modeled water temperatures, American River at Hazel Avenue, January.

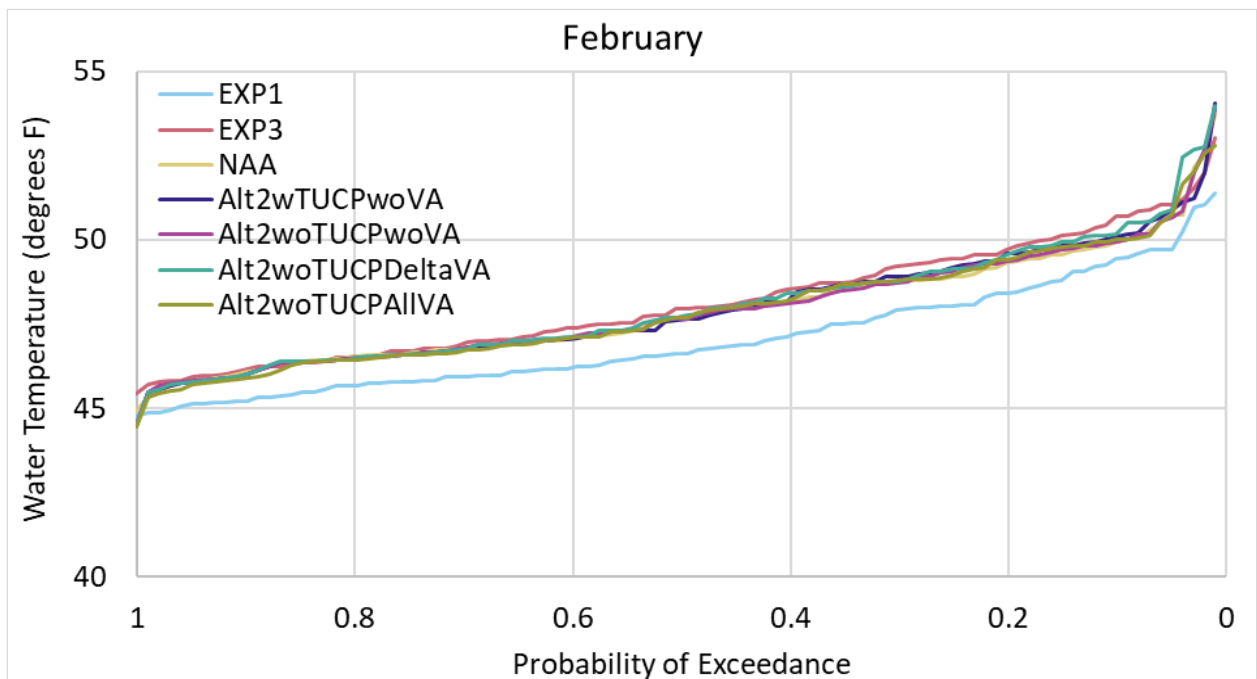


Figure M.2-3. Exceedance plot of modeled water temperatures, American River at Hazel Avenue, February.



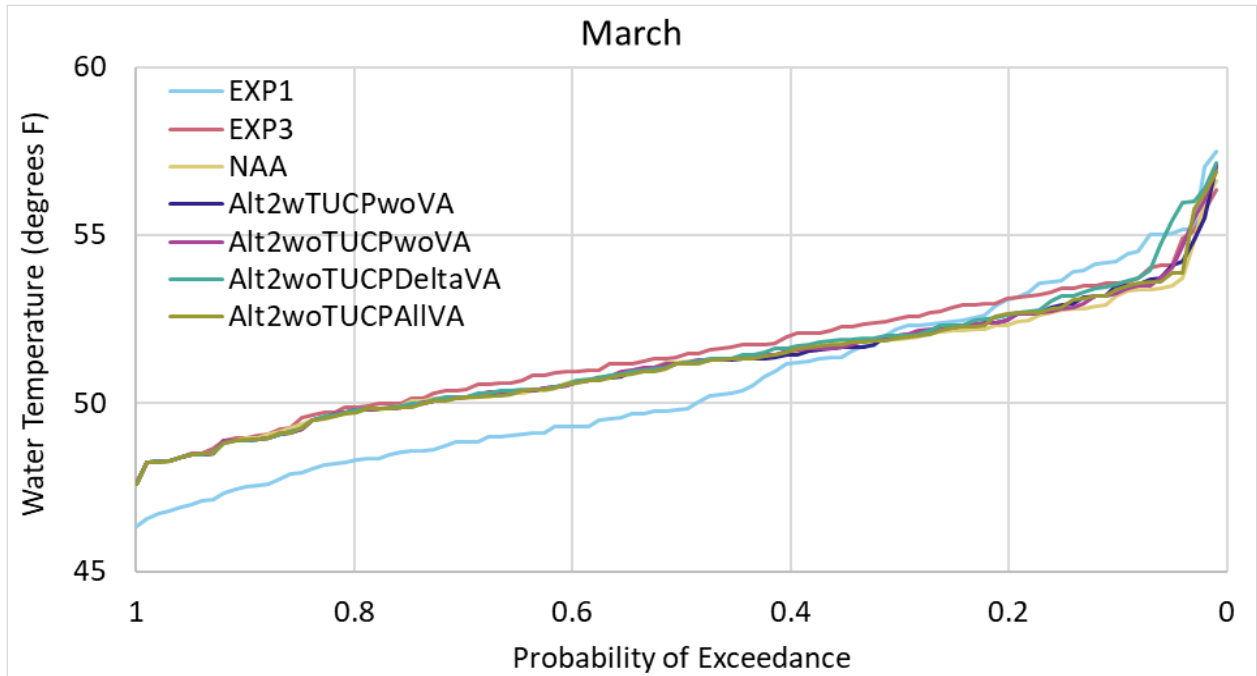


Figure M.2-4. Exceedance plot of modeled water temperatures, American River at Hazel Avenue, March.

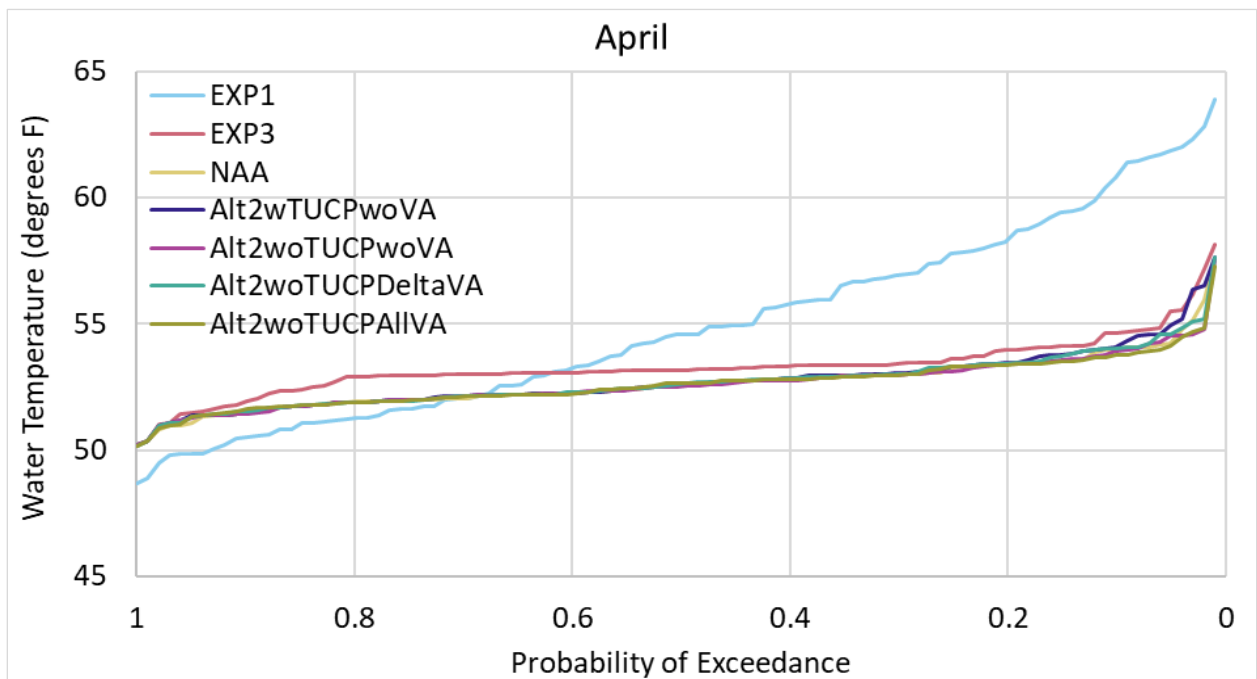


Figure M.2-5. Exceedance plot of modeled water temperatures, American River at Hazel Avenue, April.

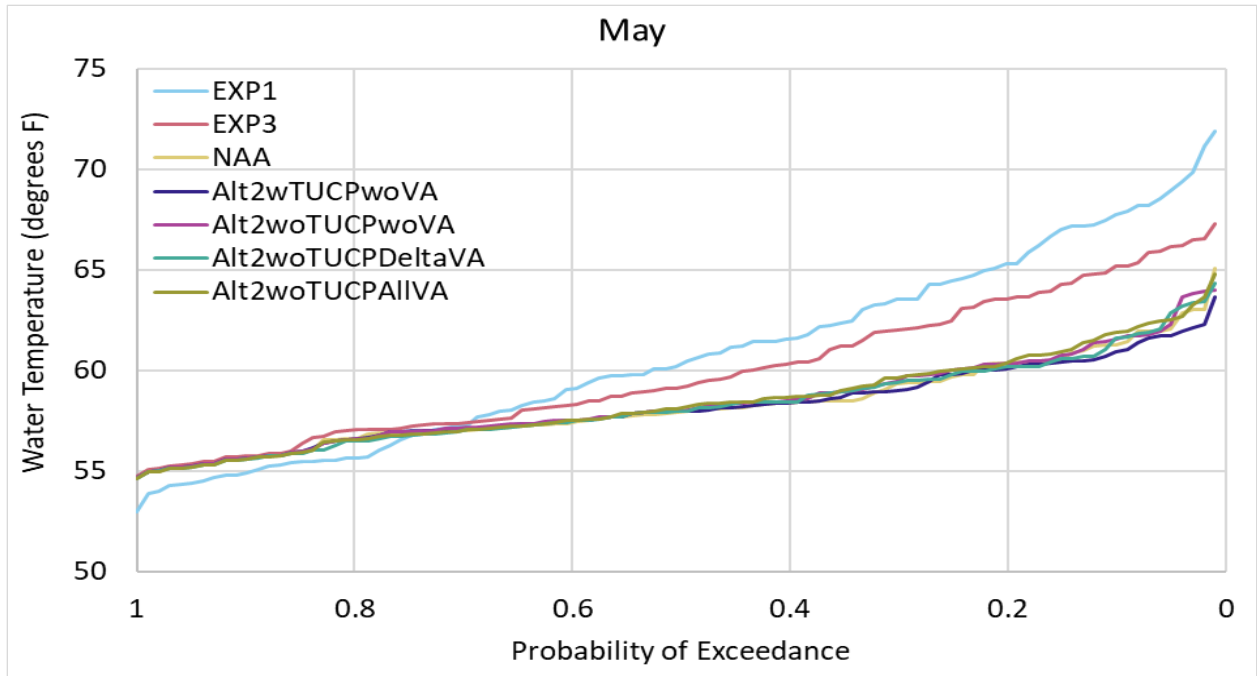


Figure M.2-6. Exceedance plot of modeled water temperatures, American River at Hazel Avenue, May.

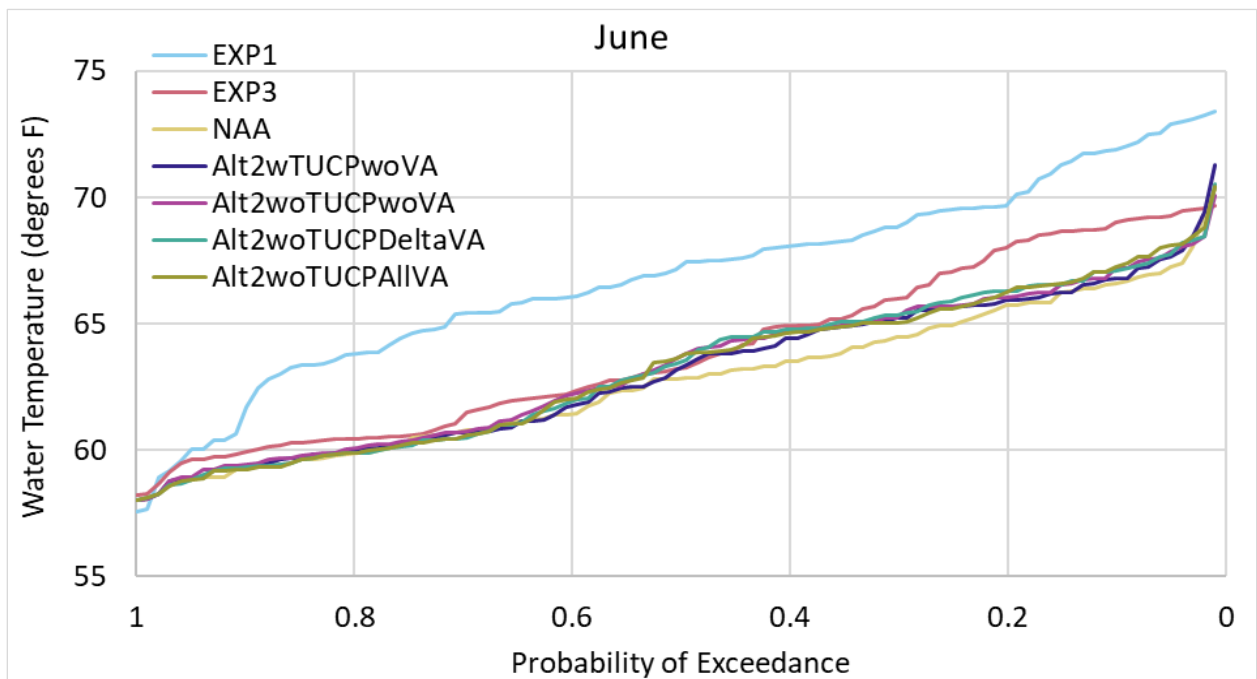


Figure M.2-7. Exceedance plot of modeled water temperatures, American River at Hazel Avenue, June.

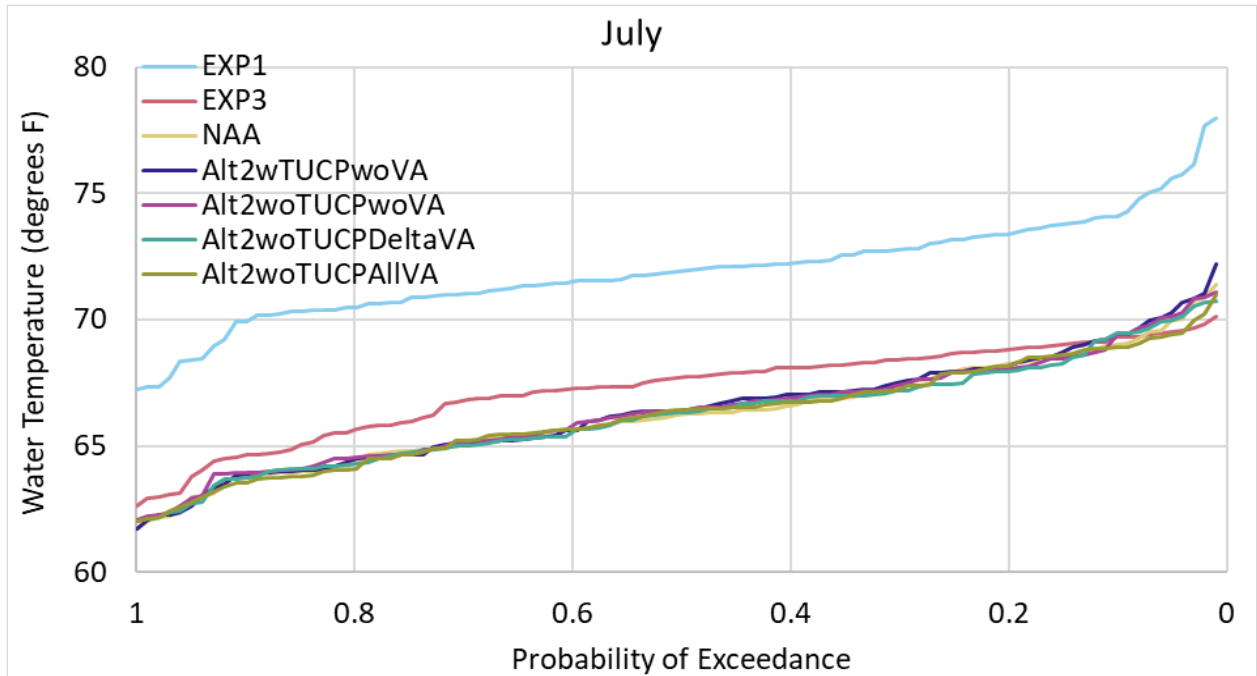


Figure M.2-8. Exceedance plot of modeled water temperatures, American River at Hazel Avenue, July.

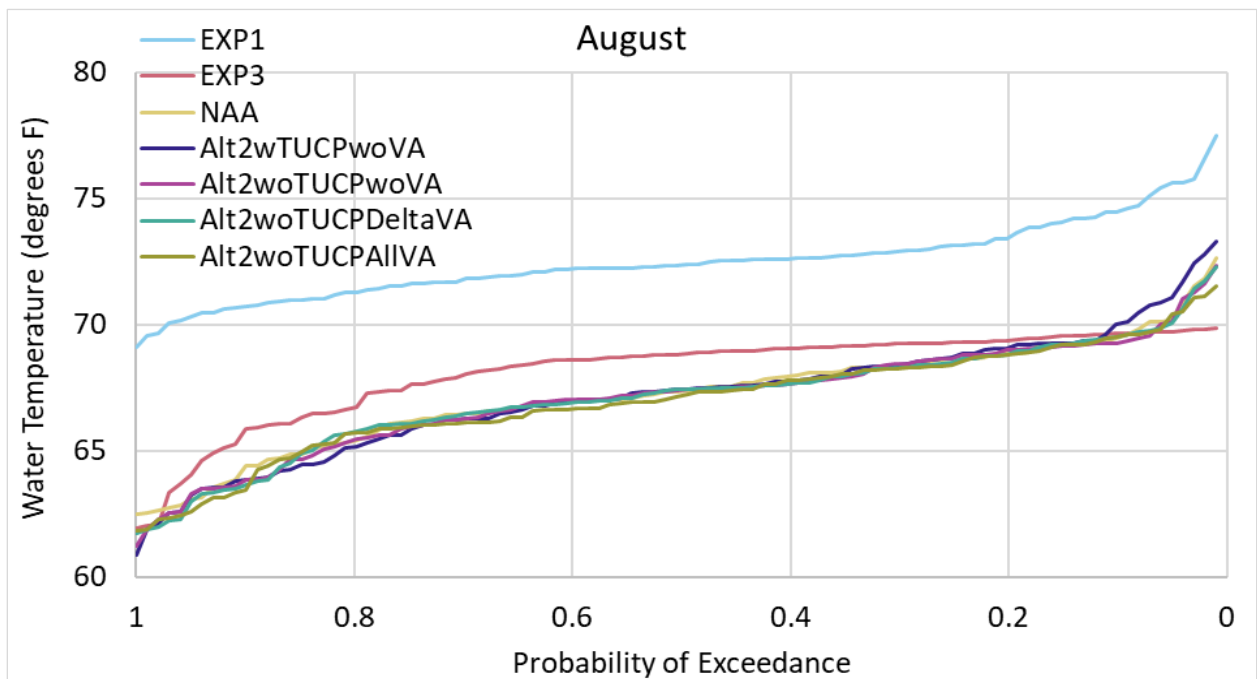


Figure M.2-9. Exceedance plot of modeled water temperatures, American River at Hazel Avenue, August.

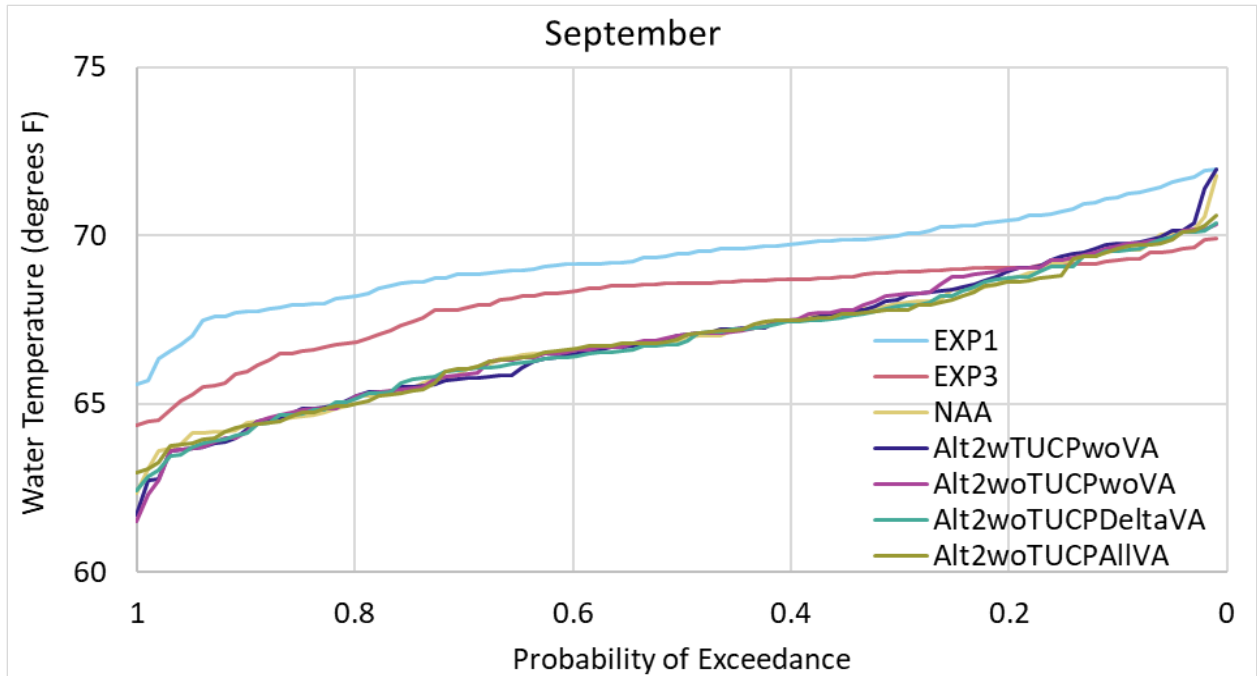


Figure M.2-10. Exceedance plot of modeled water temperatures, American River at Hazel Avenue, September.

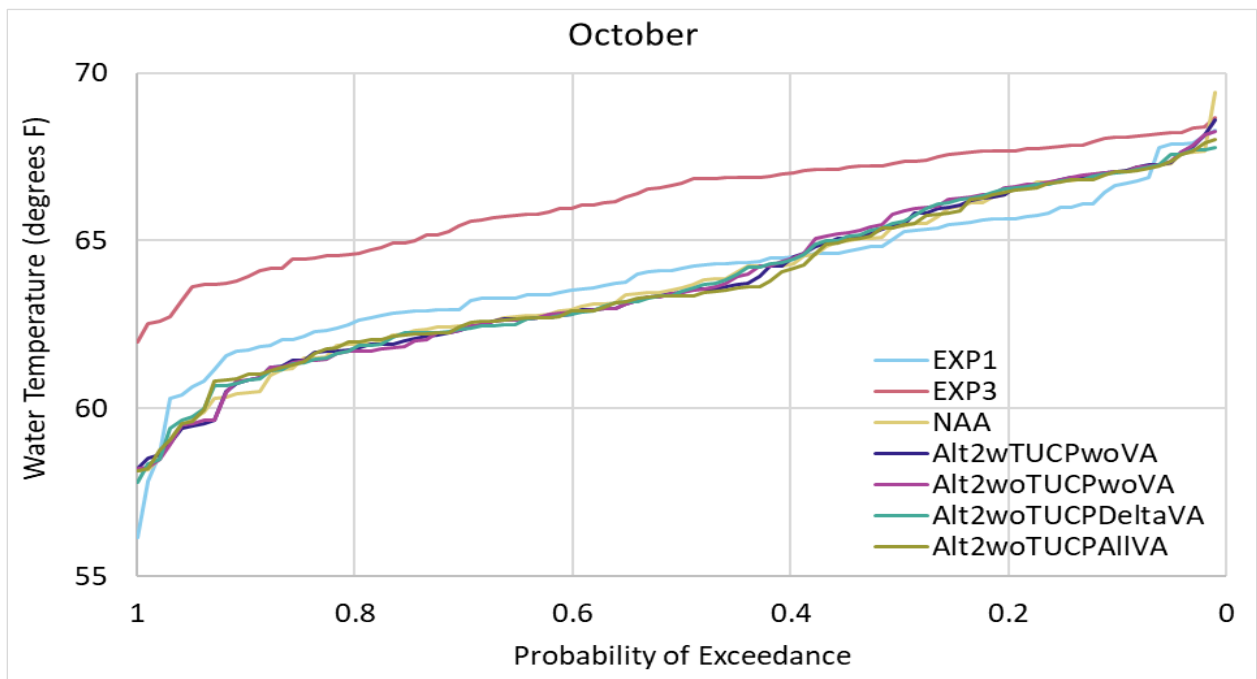


Figure M.2-11. Exceedance plot of modeled water temperatures, American River at Hazel Avenue, October.

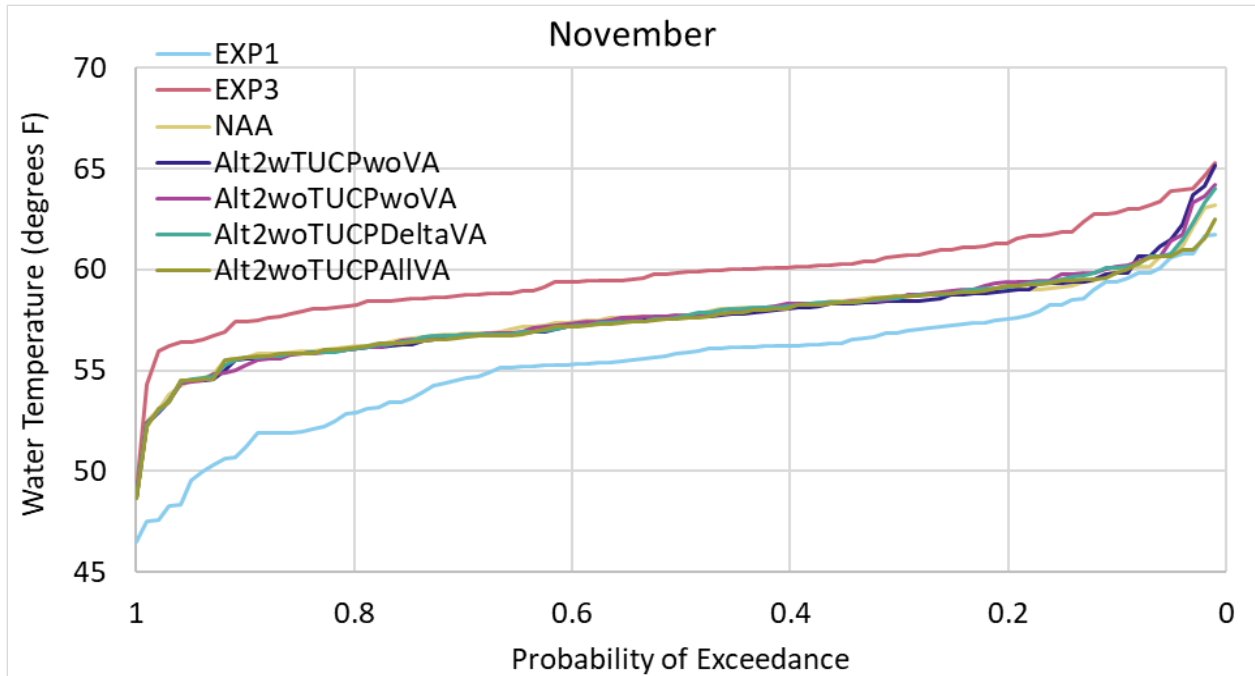


Figure M.2-12. Exceedance plot of modeled water temperatures, American River at Hazel Avenue, November.

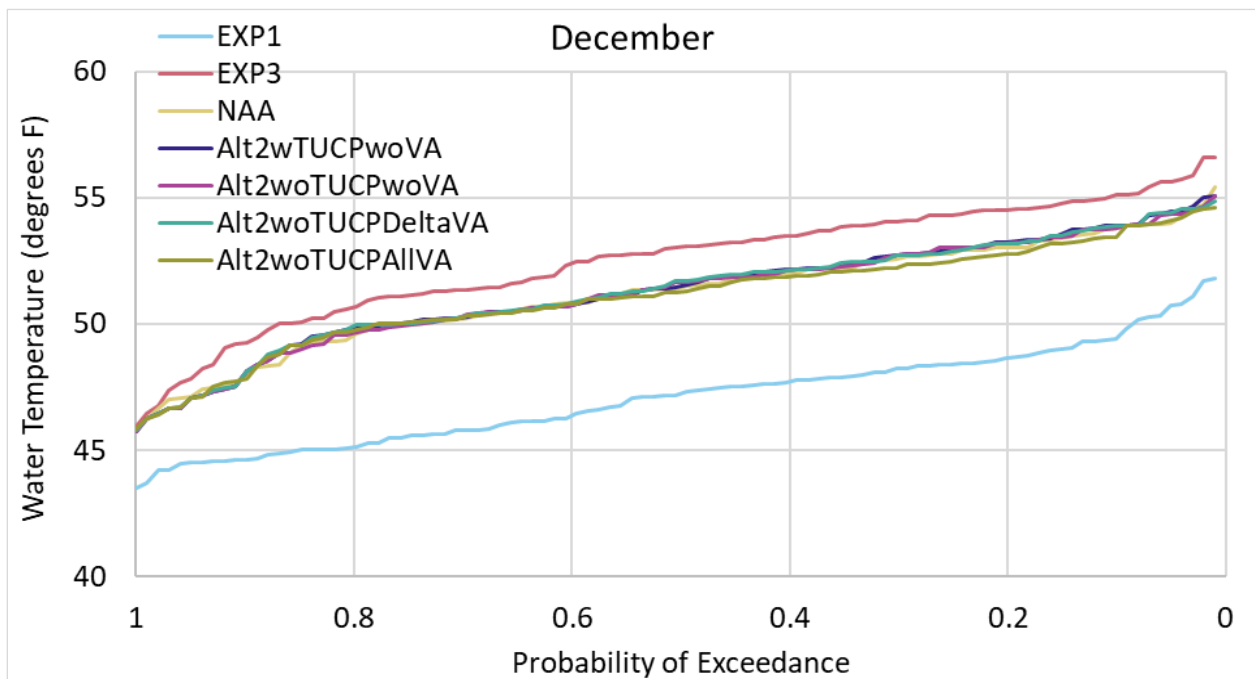


Figure M.2-13. Exceedance plot of modeled water temperatures, American River at Hazel Avenue, December.

Figure M.2-14 presents exceedance curves of modeled monthly water temperatures for the American River at Watt Avenue for all months combined for each model scenario. Figure M.2-15 through Figure M.2-26 present exceedance curves of modeled monthly water temperatures above the San Joaquin River confluence for each month separately.

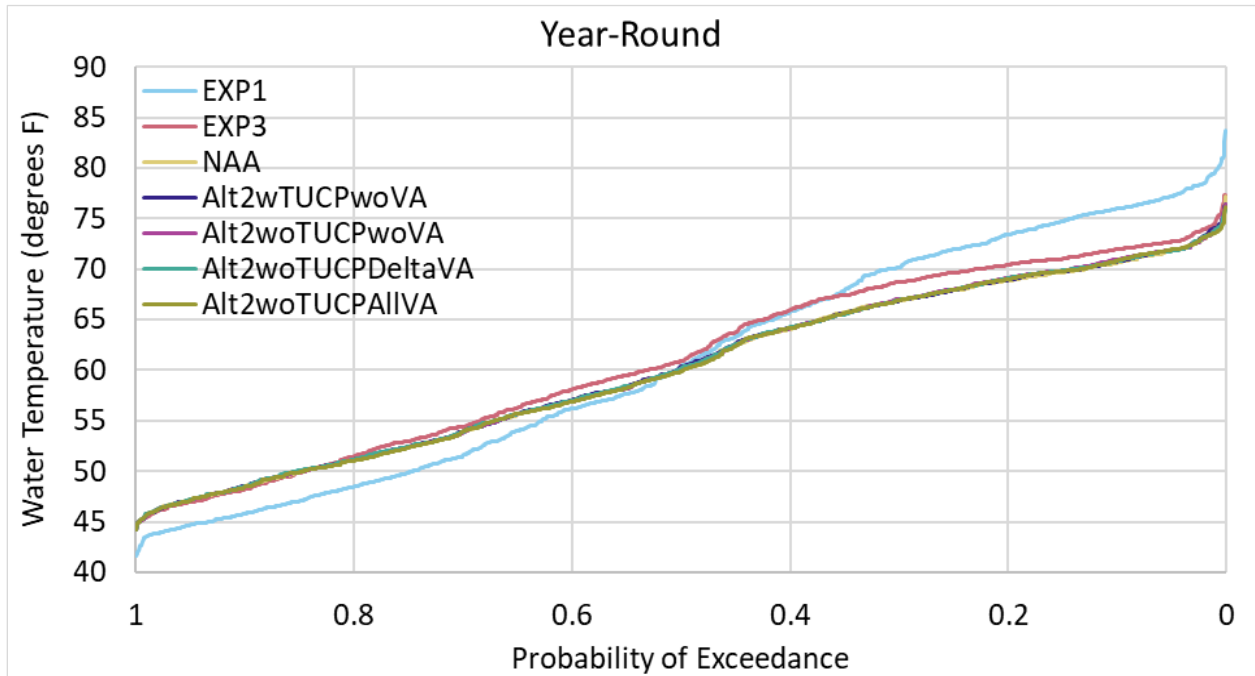


Figure M.2-14. Exceedance plot of modeled water temperatures, American River at Watt Avenue, year-round.

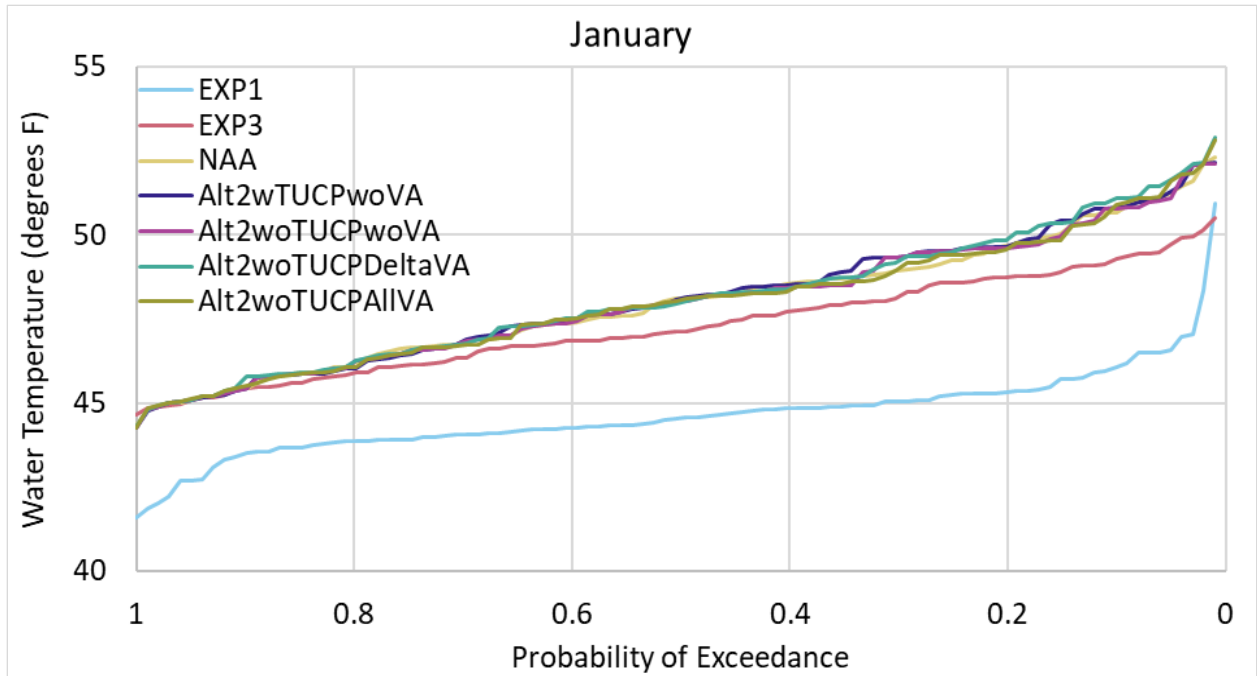


Figure M.2-15. Exceedance plot of modeled water temperatures, American River at Watt Avenue, January.

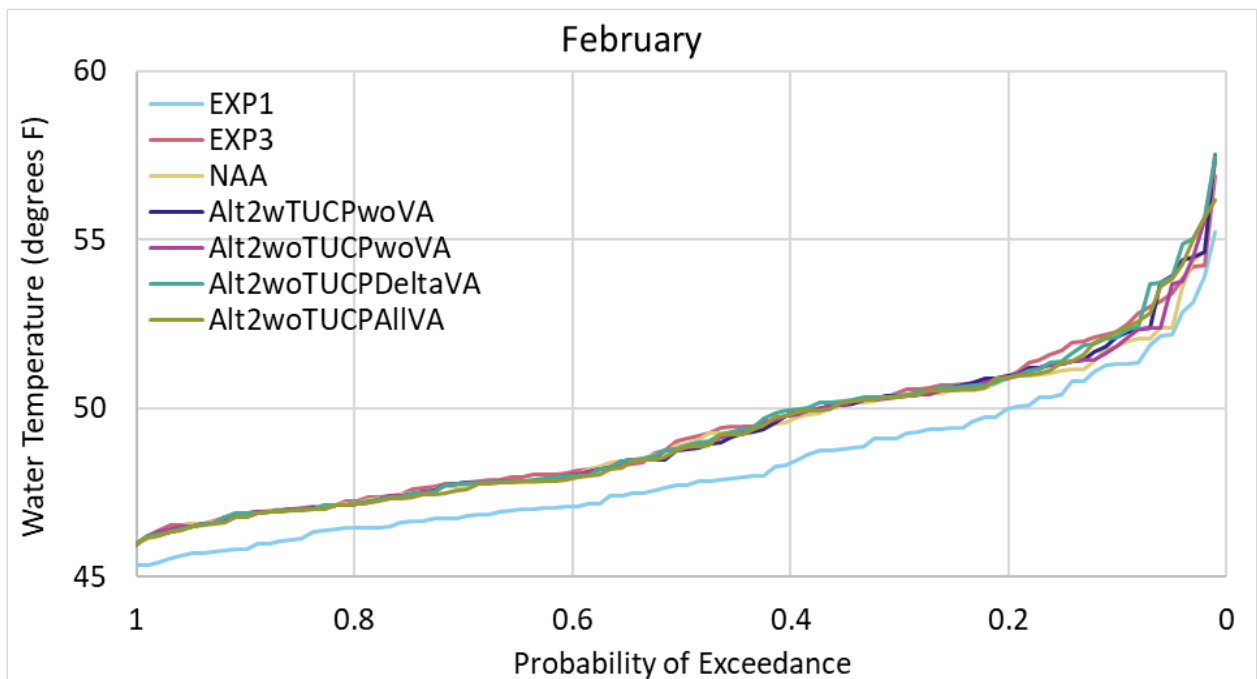


Figure M.2-16. Exceedance plot of modeled water temperatures, American River at Watt Avenue, February.

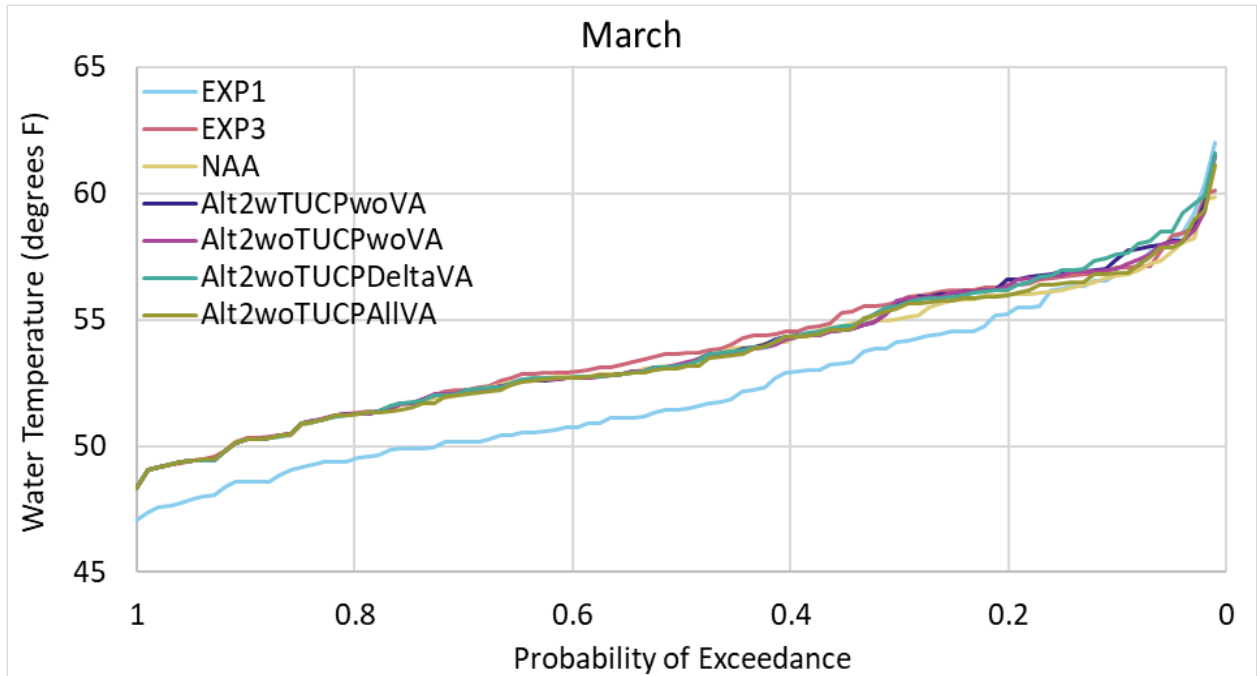


Figure M.2-17. Exceedance plot of modeled water temperatures, American River at Watt Avenue, March.

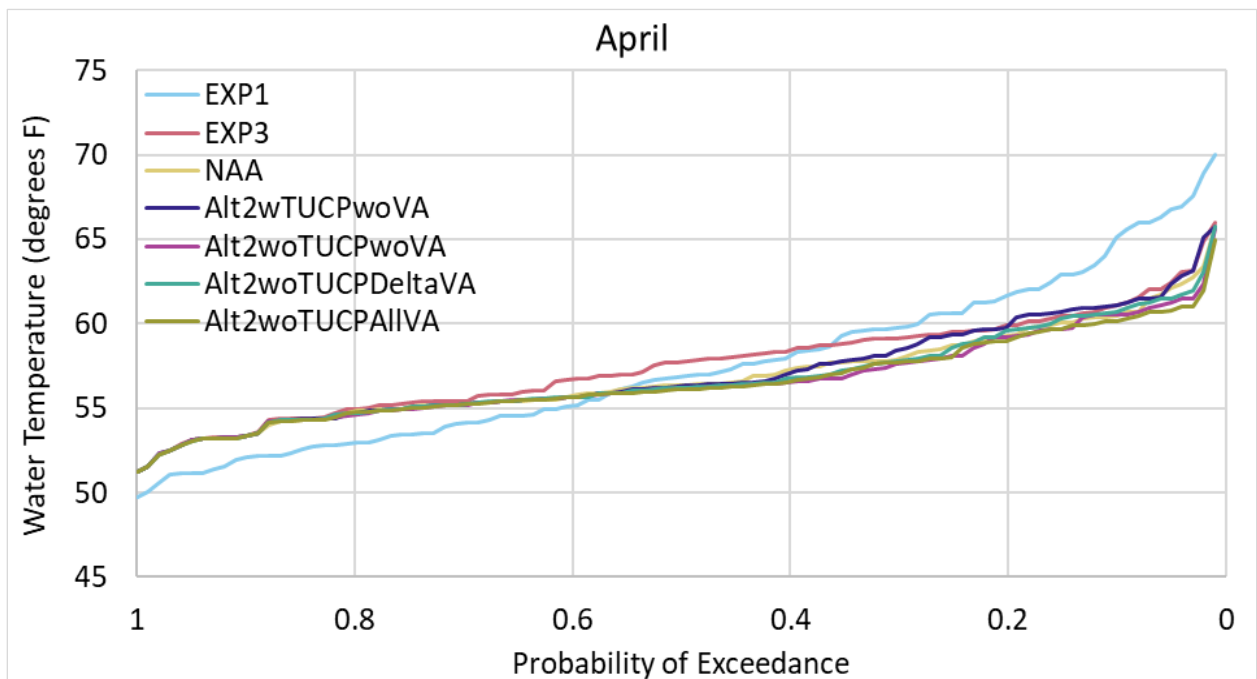


Figure M.2-18. Exceedance plot of modeled water temperatures, American River at Watt Avenue, April.



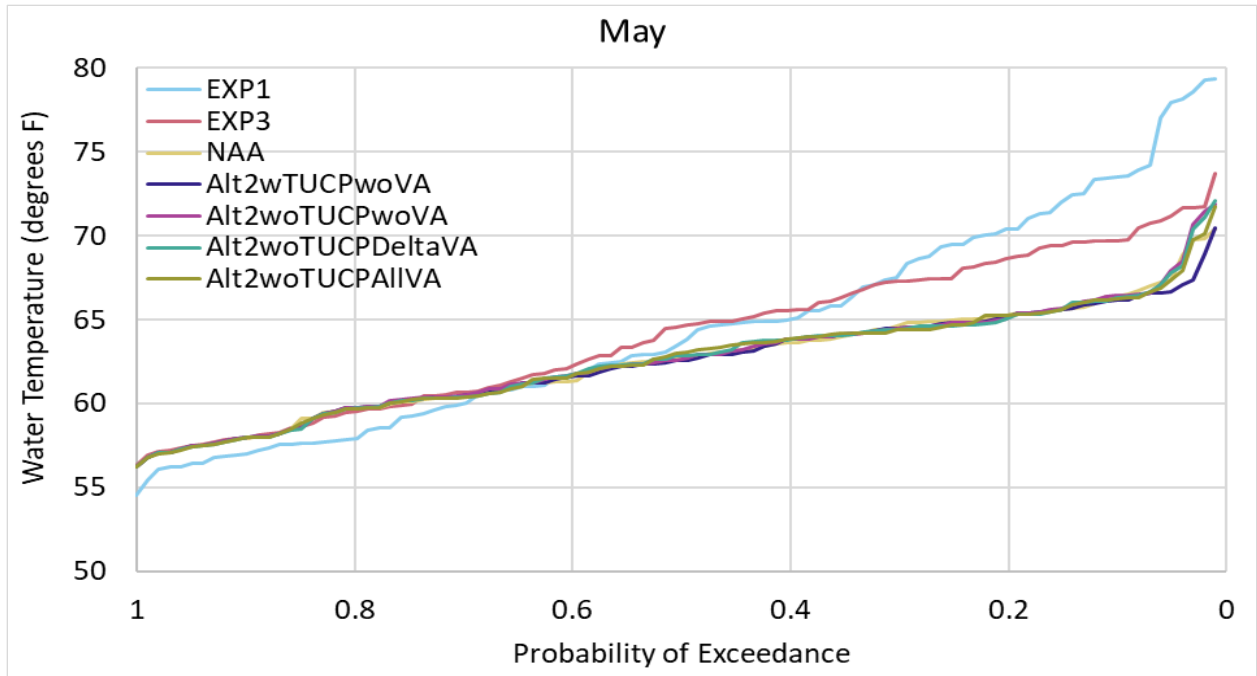


Figure M.2-19. Exceedance plot of modeled water temperatures, American River at Watt Avenue, May.

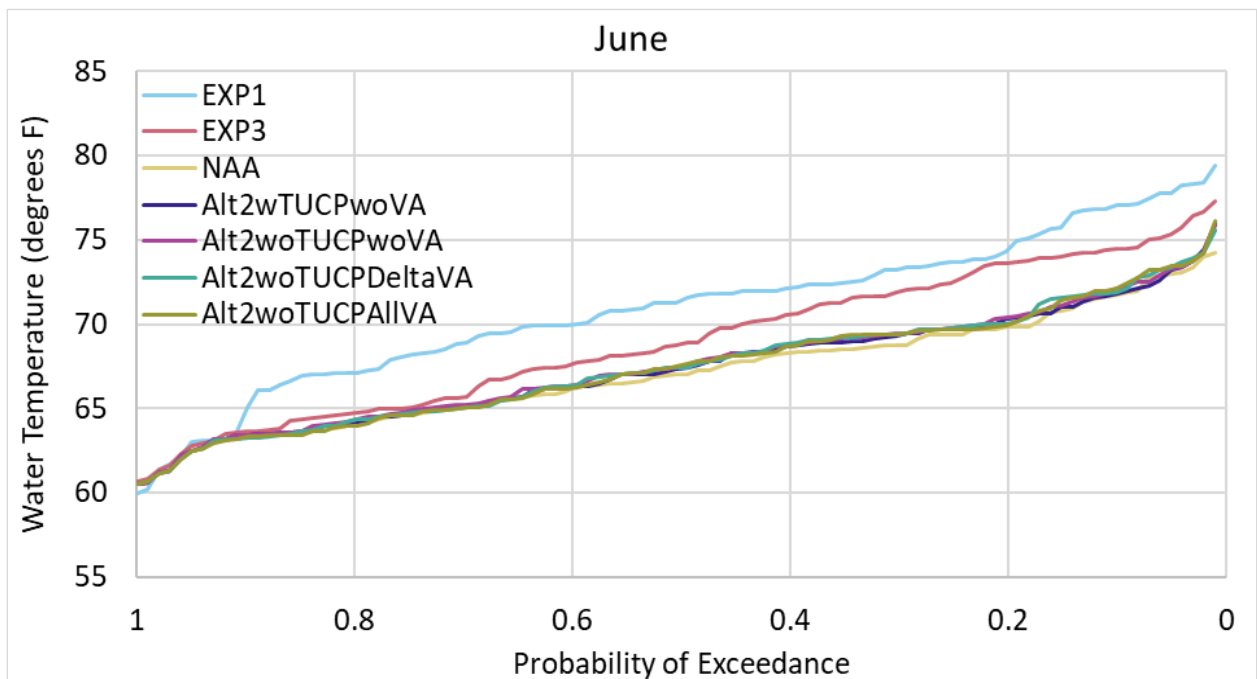


Figure M.2-20. Exceedance plot of modeled water temperatures, American River at Watt Avenue, June

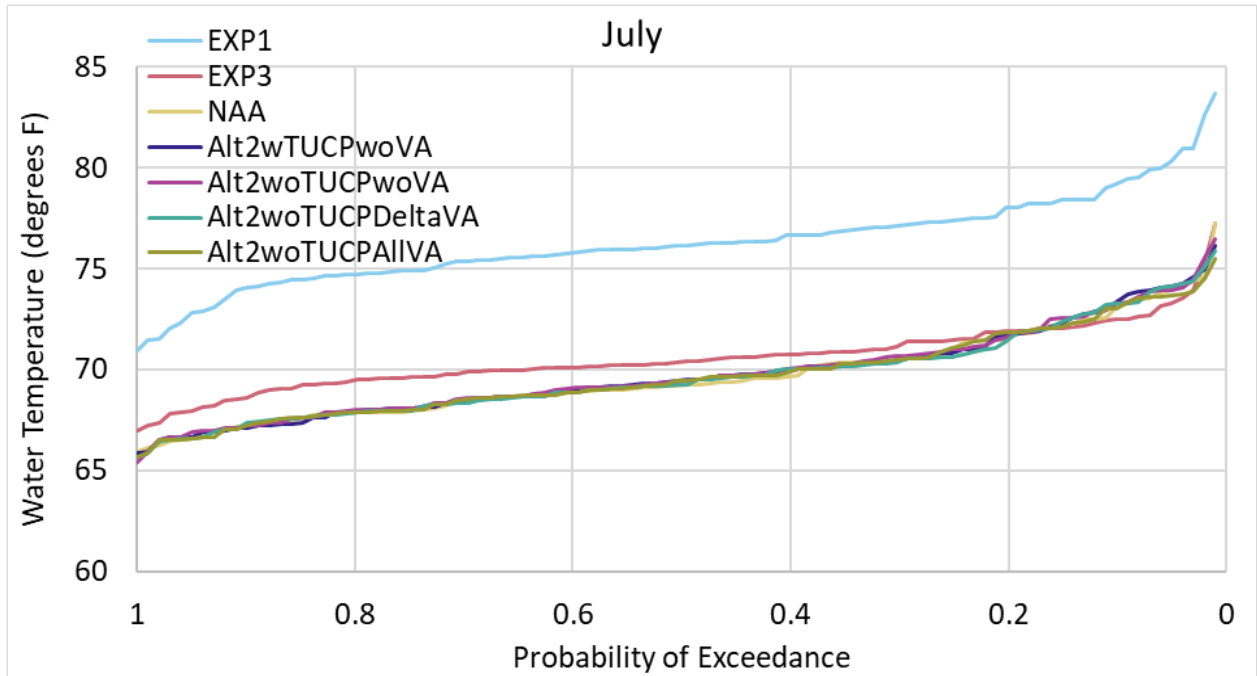


Figure M.2-21. Exceedance plot of modeled water temperatures, American River at Watt Avenue, July.

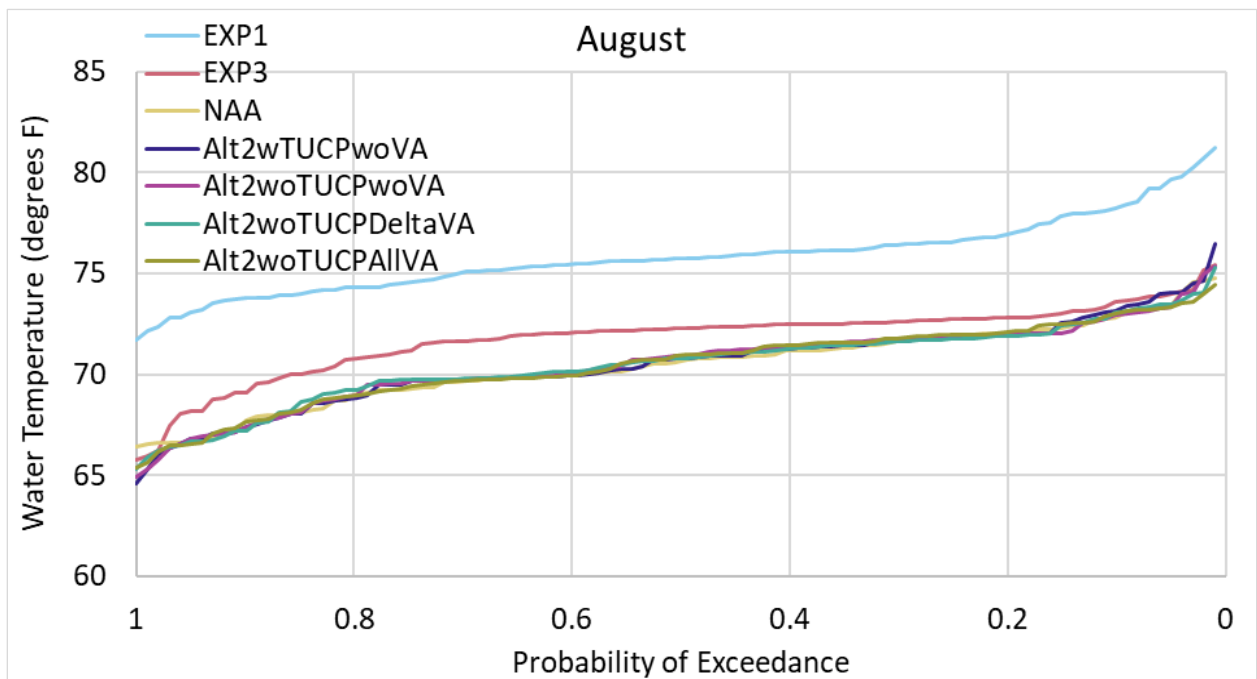


Figure M.2-22. Exceedance plot of modeled water temperatures, American River at Watt Avenue, August.

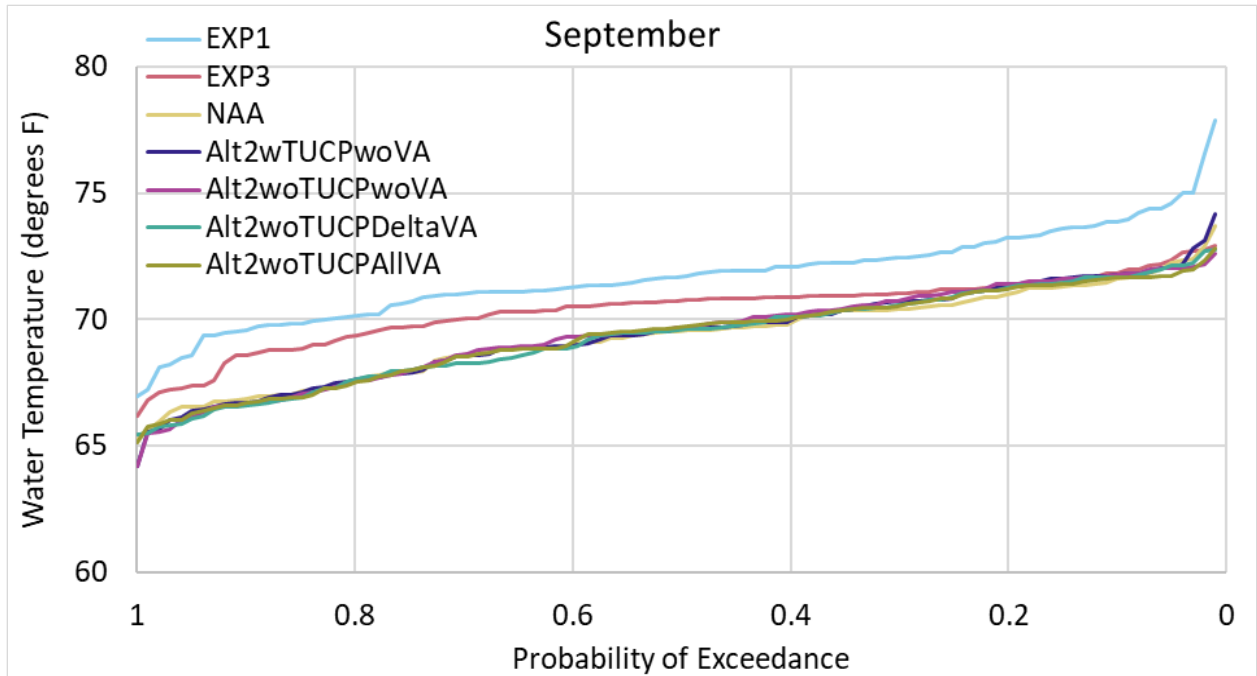


Figure M.2-23. Exceedance plot of modeled water temperatures, American River at Watt Avenue, September.

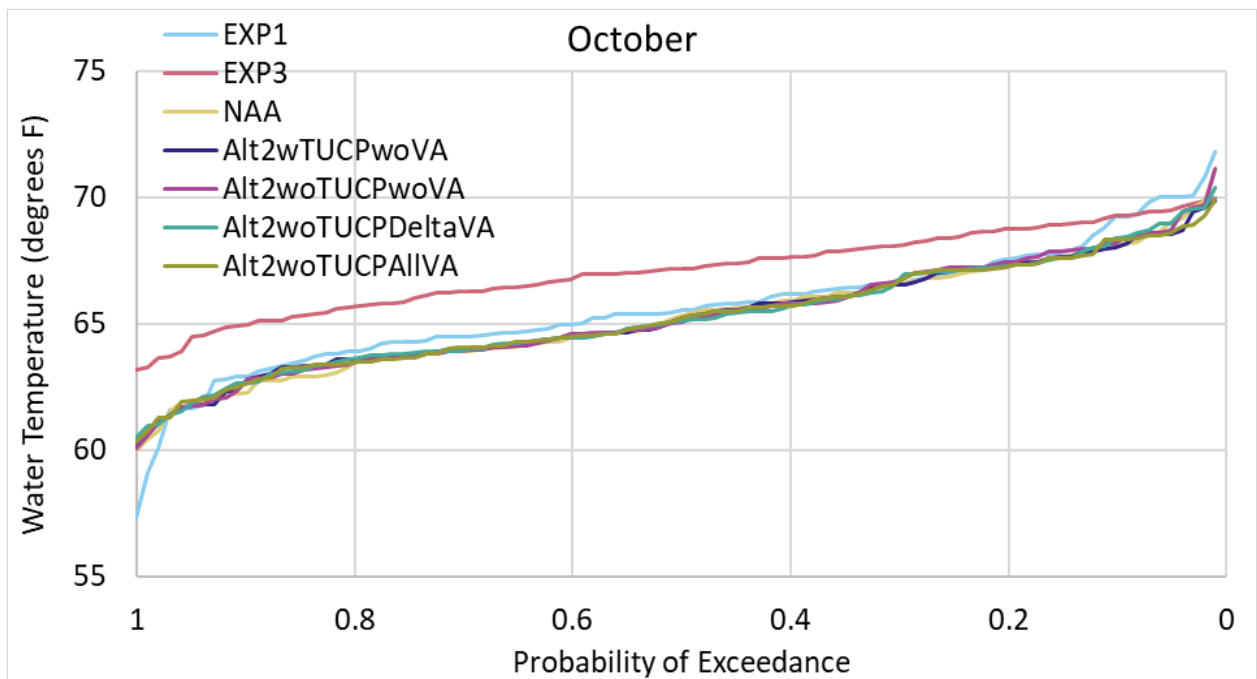


Figure M.2-24. Exceedance plot of modeled water temperatures, American River at Watt Avenue, October.

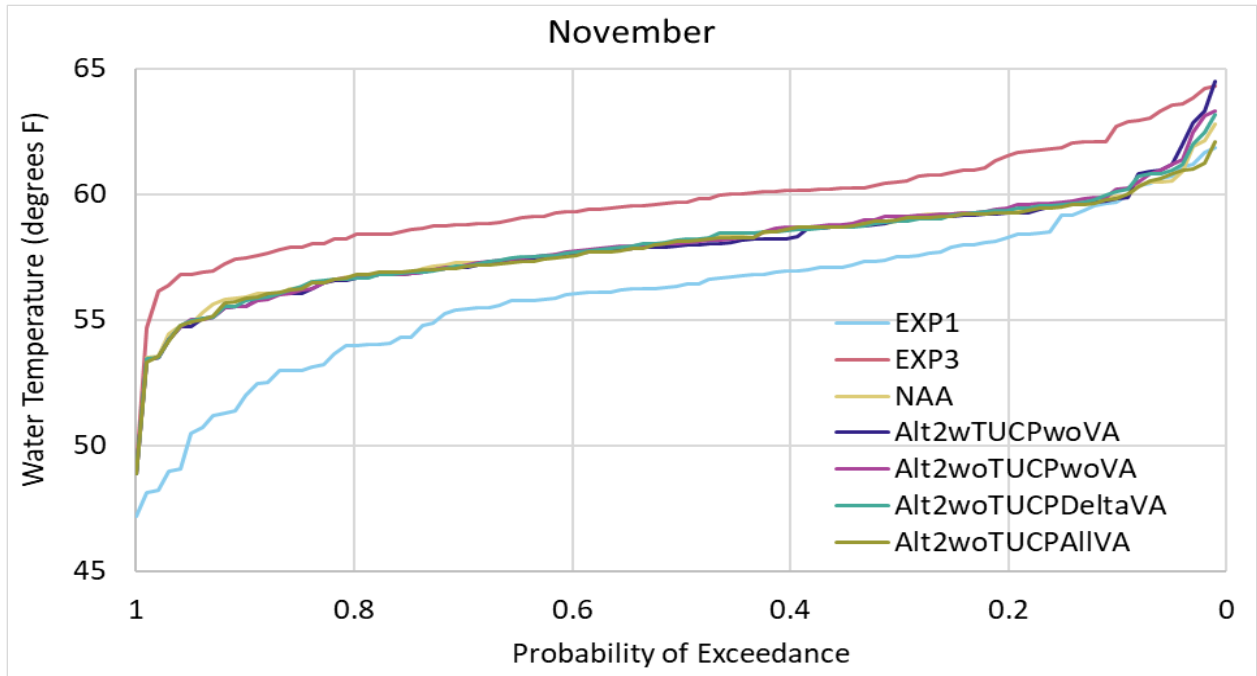


Figure M.2-25. Exceedance plot of modeled water temperatures, American River at Watt Avenue, November.

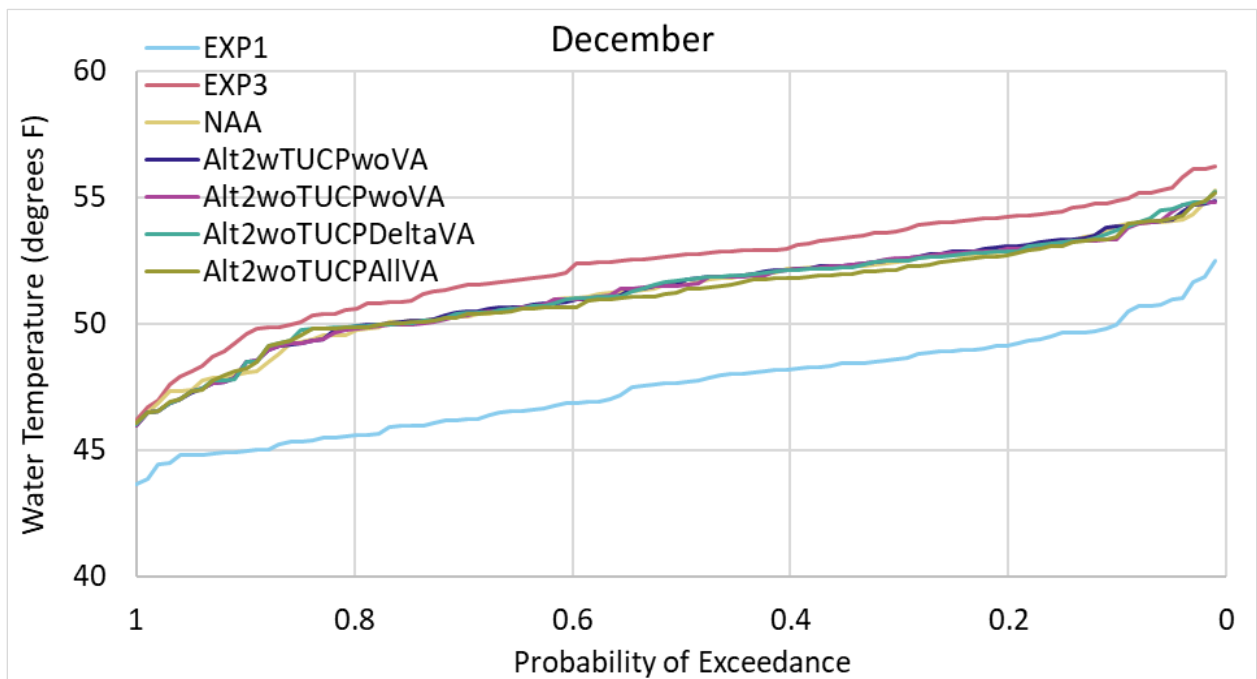


Figure M.2-26. Exceedance plot of modeled water temperatures, American River at Watt Avenue at Watt Avenue, December.

**M.2.3.1.2 Winter-run Chinook Salmon**

**Non-Natal Juvenile Rearing**

Table M.2-3. Percent of months outside the 55.4°F to 68°F optimal water temperature range without food limitation for winter-run Chinook salmon non-natal rearing by water year type and month, and for all years combined, American River at Hazel Avenue, January through April.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	3	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	4	92.9	100.0	100.0	100.0	100.0	100.0	100.0
AN	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	3	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	4	76.9	100.0	100.0	100.0	100.0	100.0	100.0
BN	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	3	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	4	61.1	100.0	100.0	100.0	100.0	100.0	100.0
D	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	3	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	4	33.3	95.8	100.0	100.0	100.0	100.0	100.0
C	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	3	87.5	87.5	87.5	87.5	81.3	68.8	81.3
C	4	12.5	75.0	87.5	81.3	93.8	93.8	93.8
All	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	3	98.0	98.0	98.0	98.0	97.0	94.9	97.0
All	4	57.6	94.9	98.0	97.0	99.0	99.0	99.0

Table M.2-4. Percent of months outside the 55.4°F to 68°F optimal water temperature range without food limitation for winter-run Chinook salmon non-natal rearing by water year type and month, and for all years combined, American River at Watt Avenue, January through April.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	3	100.0	96.4	96.4	96.4	96.4	96.4	96.4
W	4	78.6	71.4	75.0	75.0	75.0	75.0	75.0
AN	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	3	100.0	84.6	84.6	92.3	92.3	92.3	92.3
AN	4	53.8	23.1	38.5	30.8	30.8	38.5	38.5
BN	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	3	94.4	72.2	83.3	83.3	83.3	77.8	77.8
BN	4	44.4	22.2	22.2	22.2	22.2	22.2	27.8
D	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	3	75.0	54.2	66.7	54.2	54.2	54.2	58.3
D	4	12.5	8.3	16.7	16.7	16.7	12.5	12.5
C	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	2	100.0	93.8	93.8	93.8	87.5	87.5	87.5
C	3	25.0	12.5	18.8	12.5	12.5	12.5	12.5
C	4	18.8	0.0	0.0	0.0	0.0	0.0	0.0
All	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	2	100.0	99.0	99.0	99.0	98.0	98.0	98.0
All	3	80.8	66.7	72.7	69.7	69.7	68.7	69.7
All	4	43.4	29.3	34.3	33.3	33.3	33.3	34.3

**M.2.3.1.3 Central Valley Steelhead**

**Adult Migration and Holding**

Table M.2-5. Percent of months outside the 41°F to 66.2°F water temperature range for minimal adult steelhead migration impairment water year type and month, and for all years combined, American River at Hazel Avenue, July through April.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	7	100.0	46.4	39.3	42.9	42.9	39.3	39.3
W	8	100.0	78.6	78.6	82.1	82.1	82.1	78.6
W	9	92.9	85.7	78.6	82.1	82.1	78.6	82.1
W	10	0.0	39.3	39.3	46.4	46.4	46.4	46.4
W	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	7	100.0	76.9	53.8	61.5	61.5	61.5	53.8
AN	8	100.0	61.5	53.8	53.8	53.8	53.8	38.5
AN	9	100.0	76.9	53.8	46.2	53.8	46.2	61.5
AN	10	0.0	38.5	0.0	7.7	7.7	0.0	7.7
AN	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	7	100.0	88.9	55.6	61.1	55.6	55.6	55.6
BN	8	100.0	88.9	66.7	61.1	61.1	66.7	66.7
BN	9	100.0	83.3	50.0	38.9	38.9	38.9	44.4
BN	10	0.0	50.0	16.7	5.6	5.6	5.6	11.1
BN	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AIIVA
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	7	100.0	79.2	45.8	50.0	50.0	50.0	58.3
D	8	100.0	91.7	75.0	75.0	70.8	79.2	54.2
D	9	100.0	91.7	62.5	62.5	66.7	62.5	62.5
D	10	12.5	62.5	8.3	16.7	16.7	8.3	4.2
D	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	1	4.2	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	7	100.0	87.5	68.8	75.0	75.0	68.8	62.5
C	8	100.0	100.0	87.5	75.0	81.3	68.8	81.3
C	9	100.0	100.0	81.3	75.0	87.5	87.5	81.3
C	10	53.3	93.3	33.3	26.7	40.0	53.3	40.0
C	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	7	100.0	72.7	50.5	55.6	54.5	52.5	52.5
All	8	100.0	84.8	73.7	71.7	71.7	72.7	65.7
All	9	98.0	87.9	66.7	63.6	67.7	64.6	67.7
All	10	11.2	55.1	21.4	23.5	25.5	24.5	23.5
All	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	1	1.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Table M.2-6. Percent of months outside the 41°F to 66.2°F water temperature range for minimal adult steelhead migration impairment water year type and month, and for all years combined, American River at Watt Avenue, July through April.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	7	100.0	100.0	96.4	96.4	96.4	96.4	96.4
W	8	100.0	96.4	100.0	96.4	96.4	100.0	100.0
W	9	100.0	100.0	89.3	85.7	85.7	85.7	85.7
W	10	14.3	50.0	46.4	57.1	57.1	53.6	53.6
W	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	7	100.0	100.0	92.3	92.3	92.3	92.3	92.3
AN	8	100.0	92.3	100.0	100.0	100.0	100.0	100.0
AN	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	10	23.1	76.9	15.4	15.4	15.4	15.4	7.7
AN	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	8	100.0	100.0	100.0	94.4	94.4	88.9	94.4
BN	9	100.0	100.0	100.0	100.0	94.4	94.4	100.0
BN	10	33.3	66.7	16.7	16.7	11.1	11.1	11.1
BN	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AIIVA
D	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	8	100.0	100.0	100.0	95.8	95.8	100.0	91.7
D	9	100.0	100.0	100.0	95.8	95.8	91.7	95.8
D	10	41.7	83.3	29.2	16.7	16.7	12.5	12.5
D	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	4.2	0.0	0.0	0.0	0.0	0.0	0.0
C	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	10	93.3	100.0	66.7	53.3	60.0	66.7	73.3
C	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	4	31.3	0.0	0.0	0.0	0.0	0.0	0.0
All	7	100.0	100.0	98.0	98.0	98.0	98.0	98.0
All	8	100.0	98.0	100.0	97.0	97.0	98.0	97.0
All	9	100.0	100.0	97.0	94.9	93.9	92.9	94.9
All	10	37.8	72.4	35.7	33.7	33.7	32.7	32.7
All	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	4	6.1	0.0	0.0	0.0	0.0	0.0	0.0

Table M.2-7. Percent of months above the 69.8°F lethal water temperature limit for adult steelhead migration by water year type and month, for all years combined, American River at Hazel Avenue, July through April.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	7	75.0	0.0	0.0	0.0	0.0	0.0	0.0
W	8	96.4	3.6	0.0	0.0	0.0	0.0	0.0
W	9	10.7	0.0	7.1	14.3	14.3	14.3	14.3
W	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	7	92.3	0.0	0.0	0.0	0.0	0.0	0.0
AN	8	92.3	7.7	0.0	7.7	7.7	0.0	0.0
AN	9	7.7	7.7	0.0	7.7	7.7	7.7	0.0
AN	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	7	94.4	0.0	5.6	5.6	5.6	5.6	0.0
BN	8	94.4	0.0	5.6	11.1	11.1	11.1	16.7
BN	9	33.3	0.0	0.0	0.0	0.0	0.0	5.6
BN	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AIIVA
D	7	100.0	8.3	4.2	8.3	8.3	8.3	4.2
D	8	100.0	0.0	8.3	4.2	4.2	4.2	4.2
D	9	50.0	4.2	4.2	4.2	4.2	4.2	0.0
D	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	7	100.0	0.0	18.8	25.0	18.8	18.8	12.5
C	8	100.0	0.0	31.3	37.5	12.5	18.8	12.5
C	9	93.8	0.0	18.8	12.5	6.3	0.0	0.0
C	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	7	90.9	2.0	5.1	7.1	6.1	6.1	3.0
All	8	97.0	2.0	8.1	10.1	6.1	6.1	6.1
All	9	37.4	2.0	6.1	8.1	7.1	6.1	5.1
All	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table M.2-8. Percent of months above the 69.8°F lethal water temperature limit for adult steelhead migration by water year type and month, and for all years combined, American River at Watt Avenue, July through April.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	7	100.0	42.9	17.9	25.0	25.0	21.4	21.4
W	8	100.0	89.3	75.0	71.4	67.9	71.4	71.4
W	9	78.6	60.7	32.1	39.3	39.3	39.3	46.4
W	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	7	100.0	61.5	23.1	23.1	23.1	23.1	23.1
AN	8	100.0	61.5	46.2	53.8	46.2	46.2	30.8
AN	9	84.6	61.5	23.1	30.8	30.8	23.1	23.1
AN	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	7	100.0	72.2	33.3	33.3	33.3	38.9	38.9
BN	8	100.0	83.3	55.6	50.0	50.0	50.0	61.1
BN	9	83.3	66.7	16.7	27.8	27.8	27.8	33.3
BN	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AIIVA
D	7	100.0	83.3	37.5	45.8	45.8	41.7	37.5
D	8	100.0	91.7	66.7	66.7	70.8	75.0	58.3
D	9	91.7	83.3	45.8	50.0	50.0	41.7	45.8
D	10	8.3	4.2	0.0	0.0	0.0	0.0	0.0
D	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	7	100.0	100.0	93.8	93.8	93.8	93.8	93.8
C	8	100.0	100.0	87.5	87.5	100.0	100.0	100.0
C	9	100.0	93.8	81.3	75.0	93.8	93.8	87.5
C	10	33.3	6.7	13.3	6.7	6.7	6.7	6.7
C	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	4	6.3	0.0	0.0	0.0	0.0	0.0	0.0
All	7	100.0	69.7	38.4	42.4	42.4	41.4	40.4
All	8	100.0	86.9	67.7	66.7	67.7	69.7	65.7
All	9	86.9	72.7	39.4	44.4	47.5	44.4	47.5
All	10	7.1	2.0	2.0	1.0	1.0	1.0	1.0
All	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	4	1.0	0.0	0.0	0.0	0.0	0.0	0.0

Table M.2-9. Percent of months above the 59.9°F pathogen virulence water temperature threshold for adult steelhead migration by water year type and month, and for all years combined, American River at Hazel Avenue, July through April.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	10	96.4	100.0	96.4	96.4	96.4	100.0	100.0
W	11	0.0	35.7	3.6	7.1	7.1	3.6	7.1
W	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	10	100.0	100.0	84.6	84.6	84.6	84.6	84.6
AN	11	0.0	28.6	0.0	0.0	0.0	7.1	7.1
AN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	10	94.4	100.0	83.3	77.8	77.8	83.3	83.3
BN	11	0.0	55.6	0.0	0.0	0.0	0.0	0.0
BN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
D	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	10	95.8	100.0	95.8	95.8	95.8	95.8	95.8
D	11	4.2	54.2	4.2	4.2	4.2	8.3	4.2
D	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	8.3	0.0	0.0	0.0	0.0	0.0	0.0
C	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	10	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	11	33.3	80.0	46.7	33.3	53.3	46.7	33.3
C	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	4	56.3	0.0	0.0	0.0	0.0	0.0	0.0
All	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	10	96.9	100.0	92.9	91.8	91.8	93.9	93.9
All	11	6.1	49.5	9.1	8.1	11.1	11.1	9.1
All	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	4	11.1	0.0	0.0	0.0	0.0	0.0	0.0



Table M.2-10. Percent of months above the 59.9°F pathogen virulence water temperature threshold for adult steelhead migration by water year type and month, and for all years combined, American River at Watt Avenue, July through April.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	10	96.4	100.0	100.0	100.0	100.0	100.0	100.0
W	11	0.0	42.9	3.6	7.1	7.1	3.6	7.1
W	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	3.6	0.0	0.0	0.0	0.0	0.0	0.0
AN	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	10	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	11	0.0	21.4	0.0	0.0	0.0	7.1	7.1
AN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	15.4	7.7	0.0	0.0	0.0	0.0	0.0
BN	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	10	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	11	11.1	55.6	0.0	0.0	0.0	0.0	0.0
BN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	27.8	5.6	5.6	11.1	11.1	16.7	11.1

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
D	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	10	95.8	100.0	100.0	100.0	100.0	100.0	100.0
D	11	12.5	50.0	4.2	4.2	4.2	12.5	4.2
D	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	33.3	25.0	16.7	20.8	20.8	20.8	20.8
C	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	10	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	11	26.7	60.0	53.3	33.3	46.7	40.0	33.3
C	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	12.5	12.5	0.0	6.3	6.3	12.5	6.3
C	4	75.0	68.8	62.5	75.0	37.5	50.0	43.8
All	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	10	98.0	100.0	100.0	100.0	100.0	100.0	100.0
All	11	9.1	46.5	10.1	8.1	10.1	11.1	9.1
All	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	2.0	2.0	0.0	1.0	1.0	2.0	1.0
All	4	28.3	19.2	15.2	19.2	13.1	16.2	14.1

## Spawning

Table M.2-11. Percent of months outside the 45°F to 55°F water temperature range for successful steelhead spawning by water year type and month, and for all years combined, American River at Hazel Avenue, December through March.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	12	21.4	7.1	0.0	3.6	3.6	0.0	0.0
W	1	100.0	21.4	21.4	25.0	25.0	21.4	21.4
W	2	10.7	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	12	21.4	7.1	0.0	0.0	0.0	0.0	0.0
AN	1	100.0	7.7	7.7	7.7	7.7	7.7	7.7
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	12	11.1	11.1	0.0	0.0	0.0	0.0	0.0
BN	1	83.3	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	5.6	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	12	16.7	16.7	4.2	0.0	0.0	0.0	0.0
D	1	87.5	0.0	4.2	12.5	12.5	4.2	4.2
D	2	0.0	0.0	4.2	4.2	4.2	4.2	4.2
D	3	4.2	0.0	0.0	0.0	0.0	0.0	0.0
C	12	0.0	6.7	0.0	6.7	0.0	0.0	0.0
C	1	81.3	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	37.5	18.8	12.5	12.5	18.8	31.3	18.8
All	12	15.2	10.1	1.0	2.0	1.0	0.0	0.0
All	1	90.9	7.1	8.1	11.1	11.1	8.1	8.1
All	2	4.0	0.0	1.0	1.0	1.0	1.0	1.0
All	3	7.1	3.0	2.0	2.0	3.0	5.1	3.0

Table M.2-12. Percent of months outside the 45°F to 55°F water temperature range for successful steelhead spawning by water year type and month, and for all years combined, American River at Watt Avenue, December through March.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	12	14.3	7.1	0.0	0.0	0.0	0.0	0.0
W	1	89.3	14.3	3.6	7.1	3.6	3.6	3.6
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	3.6	3.6	3.6	3.6	3.6	3.6
AN	12	14.3	7.1	0.0	0.0	0.0	0.0	0.0
AN	1	53.8	7.7	7.7	7.7	7.7	7.7	7.7
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	15.4	15.4	15.4	15.4	15.4	15.4
BN	12	11.1	5.6	0.0	0.0	0.0	0.0	0.0
BN	1	66.7	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	5.6	33.3	16.7	16.7	16.7	22.2	22.2
D	12	12.5	12.5	4.2	0.0	0.0	0.0	0.0
D	1	70.8	0.0	4.2	4.2	4.2	4.2	4.2
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	33.3	45.8	37.5	45.8	45.8	45.8	45.8
C	12	0.0	6.7	0.0	0.0	0.0	6.7	6.7
C	1	43.8	0.0	0.0	0.0	0.0	0.0	0.0
C	2	6.3	6.3	6.3	6.3	12.5	18.8	12.5
C	3	75.0	93.8	87.5	87.5	87.5	93.8	93.8
All	12	11.1	8.1	1.0	0.0	0.0	1.0	1.0
All	1	68.7	5.1	3.0	4.0	3.0	3.0	3.0
All	2	1.0	1.0	1.0	1.0	2.0	3.0	2.0
All	3	21.2	35.4	29.3	31.3	31.3	33.3	33.3

Table M.2-13. Percent of months above the 59.9°F pathogen virulence water temperature threshold for steelhead spawning by water year type and month, and for all years combined, American River at Hazel Avenue, December through March.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table M.2-14. Percent of months above the 59.9°F pathogen virulence water temperature threshold for steelhead spawning by water year type and month, and for all years combined, American River at Watt Avenue, December through March.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	12.5	12.5	0.0	6.3	6.3	12.5	6.3
All	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	2.0	2.0	0.0	1.0	1.0	2.0	1.0

## Kelt Emigration

Table M.2-15. Percent of months above the 66.2°F migration impairment water temperature limit for steelhead kelt emigration by water year type and month, and for all years combined, American River at Hazel Avenue, February through June.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	6	25.0	7.1	7.1	3.6	3.6	7.1	7.1
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	6	69.2	7.7	23.1	23.1	23.1	23.1	15.4
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	5	11.1	5.6	0.0	0.0	0.0	0.0	0.0
BN	6	66.7	27.8	22.2	16.7	16.7	33.3	38.9
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	5	25.0	8.3	0.0	0.0	0.0	0.0	0.0
D	6	62.5	37.5	4.2	12.5	12.5	12.5	8.3
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	5	56.3	6.3	0.0	0.0	0.0	0.0	0.0
C	6	93.8	68.8	31.3	31.3	43.8	50.0	43.8
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	5	17.2	4.0	0.0	0.0	0.0	0.0	0.0
All	6	58.6	28.3	15.2	15.2	17.2	22.2	20.2

Table M.2-16. Percent of months above the 66.2°F migration impairment water temperature limit for steelhead kelt emigration by water year type and month, and for all years combined, American River at Watt Avenue, February through June.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	5	10.7	7.1	0.0	0.0	0.0	0.0	0.0
W	6	67.9	28.6	17.9	17.9	17.9	17.9	14.3
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	5	30.8	15.4	0.0	0.0	0.0	0.0	0.0
AN	6	84.6	69.2	53.8	61.5	61.5	61.5	53.8
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	5	38.9	27.8	11.1	11.1	11.1	11.1	11.1
BN	6	88.9	83.3	77.8	77.8	77.8	77.8	77.8
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	4.2	0.0	0.0	0.0	0.0	0.0	0.0
D	5	29.2	50.0	4.2	0.0	0.0	0.0	4.2
D	6	100.0	87.5	75.0	79.2	79.2	79.2	79.2
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	4	31.3	0.0	0.0	0.0	0.0	0.0	0.0
C	5	81.3	87.5	50.0	37.5	56.3	50.0	43.8
C	6	100.0	93.8	93.8	93.8	100.0	100.0	93.8
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	4	6.1	0.0	0.0	0.0	0.0	0.0	0.0
All	5	34.3	35.4	11.1	8.1	11.1	10.1	10.1
All	6	86.9	68.7	59.6	61.6	62.6	62.6	59.6



Table M.2-17. Percent of months above the 69.8°F lethal water temperature limit for steelhead kelt emigration by water year type and month, and for all years combined, American River at Hazel Avenue, February through June.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	6	15.4	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	6	5.6	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	5	4.2	0.0	0.0	0.0	0.0	0.0	0.0
D	6	29.2	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	5	12.5	0.0	0.0	0.0	0.0	0.0	0.0
C	6	56.3	0.0	6.3	6.3	6.3	6.3	6.3
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	5	3.0	0.0	0.0	0.0	0.0	0.0	0.0
All	6	19.2	0.0	1.0	1.0	1.0	1.0	1.0

Table M.2-18. Percent of months above the 69.8°F lethal water temperature limit for steelhead kelt emigration by water year type and month, and for all years combined, American River at Watt Avenue, February through June.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	5	3.6	0.0	0.0	0.0	0.0	0.0	0.0
W	6	25.0	7.1	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	5	7.7	0.0	0.0	0.0	0.0	0.0	0.0
AN	6	69.2	30.8	15.4	23.1	23.1	15.4	7.7
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	5	16.7	5.6	0.0	0.0	0.0	0.0	0.0
BN	6	83.3	44.4	16.7	16.7	16.7	16.7	22.2
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	5	29.2	16.7	0.0	0.0	0.0	0.0	0.0
D	6	75.0	66.7	20.8	33.3	33.3	33.3	25.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	4	6.3	0.0	0.0	0.0	0.0	0.0	0.0
C	5	68.8	18.8	12.5	6.3	18.8	18.8	12.5
C	6	93.8	87.5	62.5	56.3	62.5	68.8	62.5
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	4	1.0	0.0	0.0	0.0	0.0	0.0	0.0
All	5	23.2	8.1	2.0	1.0	3.0	3.0	2.0
All	6	64.6	44.4	20.2	23.2	24.2	24.2	21.2

Table M.2-19. Percent of months above the 59.9°F pathogen virulence water temperature threshold for steelhead kelt emigration by water year type and month, and for all years combined, American River at Hazel Avenue, February through June.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	5	17.9	7.1	3.6	3.6	3.6	3.6	3.6
W	6	82.1	67.9	50.0	50.0	50.0	46.4	46.4
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	5	38.5	38.5	0.0	0.0	0.0	0.0	0.0
AN	6	100.0	100.0	84.6	84.6	84.6	84.6	84.6
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	5	72.2	44.4	33.3	33.3	33.3	27.8	27.8
BN	6	100.0	94.4	94.4	94.4	94.4	88.9	94.4
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	8.3	0.0	0.0	0.0	0.0	0.0	0.0
D	5	62.5	58.3	37.5	45.8	45.8	41.7	45.8
D	6	100.0	100.0	91.7	95.8	95.8	95.8	95.8
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	4	56.3	0.0	0.0	0.0	0.0	0.0	0.0
C	5	87.5	93.8	37.5	31.3	43.8	50.0	56.3
C	6	100.0	100.0	93.8	93.8	100.0	100.0	100.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	4	11.1	0.0	0.0	0.0	0.0	0.0	0.0
All	5	52.5	44.4	22.2	23.2	25.3	24.2	26.3
All	6	94.9	89.9	79.8	80.8	81.8	79.8	80.8

Table M.2-20. Percent of months above the 59.9°F pathogen virulence water temperature threshold for steelhead kelt emigration by water year type and month, and for all years combined, American River at Watt Avenue, February through June.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	3.6	0.0	0.0	0.0	0.0	0.0	0.0
W	5	28.6	35.7	35.7	35.7	35.7	35.7	35.7
W	6	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	15.4	7.7	0.0	0.0	0.0	0.0	0.0
AN	5	76.9	84.6	92.3	92.3	92.3	92.3	92.3
AN	6	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	27.8	5.6	5.6	11.1	11.1	16.7	11.1
BN	5	77.8	83.3	83.3	83.3	83.3	83.3	83.3
BN	6	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	33.3	25.0	16.7	20.8	20.8	20.8	20.8
D	5	91.7	95.8	95.8	95.8	95.8	95.8	95.8
D	6	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	12.5	12.5	0.0	6.3	6.3	12.5	6.3
C	4	75.0	68.8	62.5	75.0	37.5	50.0	43.8
C	5	93.8	93.8	100.0	100.0	100.0	100.0	100.0
C	6	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	2.0	2.0	0.0	1.0	1.0	2.0	1.0
All	4	28.3	19.2	15.2	19.2	13.1	16.2	14.1
All	5	69.7	74.7	76.8	76.8	76.8	76.8	76.8
All	6	100.0	100.0	100.0	100.0	100.0	100.0	100.0

### Egg Incubation and Fry Emergence

Table M.2-21. Percent of months outside the 45°F to 52°F optimal egg incubation water temperature range steelhead by water year type and month, and for all years combined, American River at Hazel Avenue, December through May.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	12	21.4	50.0	46.4	39.3	39.3	46.4	42.9
W	1	100.0	21.4	21.4	25.0	25.0	21.4	21.4
W	2	10.7	0.0	0.0	0.0	0.0	0.0	0.0
W	3	3.6	7.1	3.6	3.6	3.6	3.6	3.6
W	4	32.1	60.7	35.7	35.7	35.7	35.7	35.7
W	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	12	21.4	64.3	42.9	35.7	35.7	35.7	35.7
AN	1	100.0	7.7	7.7	7.7	7.7	7.7	7.7
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	7.7	15.4	15.4	7.7	7.7	7.7	7.7
AN	4	76.9	100.0	76.9	69.2	69.2	69.2	76.9
AN	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	12	11.1	44.4	33.3	38.9	38.9	27.8	22.2
BN	1	83.3	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	5.6	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	22.2	38.9	16.7	16.7	16.7	22.2	22.2
BN	4	72.2	100.0	100.0	100.0	100.0	100.0	100.0
BN	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	12	16.7	70.8	41.7	45.8	45.8	58.3	37.5
D	1	87.5	0.0	4.2	12.5	12.5	4.2	4.2
D	2	0.0	0.0	4.2	4.2	4.2	4.2	4.2
D	3	45.8	58.3	37.5	50.0	50.0	41.7	41.7
D	4	91.7	100.0	75.0	79.2	79.2	83.3	79.2
D	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	12	0.0	80.0	40.0	53.3	40.0	40.0	40.0
C	1	81.3	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	12.5	18.8	6.3	12.5	25.0	18.8
C	3	87.5	87.5	75.0	81.3	81.3	81.3	75.0
C	4	100.0	100.0	93.8	100.0	100.0	93.8	93.8

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
C	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	12	15.2	60.6	41.4	42.4	40.4	43.4	36.4
All	1	90.9	7.1	8.1	11.1	11.1	8.1	8.1
All	2	4.0	2.0	4.0	2.0	3.0	5.1	4.0
All	3	31.3	39.4	27.3	30.3	30.3	29.3	28.3
All	4	70.7	88.9	71.7	72.7	72.7	72.7	72.7
All	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table M.2-22. Percent of months outside the 45°F to 52°F optimal egg incubation water temperature range steelhead by water year type and month, and for all years combined, American River at Watt Avenue, December through May.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	12	14.3	50.0	42.9	39.3	39.3	42.9	42.9
W	1	89.3	14.3	3.6	7.1	3.6	3.6	3.6
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	10.7	32.1	32.1	32.1	32.1	32.1	32.1
W	4	67.9	92.9	92.9	92.9	92.9	92.9	92.9
W	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	12	14.3	64.3	42.9	35.7	35.7	35.7	35.7
AN	1	53.8	7.7	7.7	7.7	7.7	7.7	7.7
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	23.1	46.2	46.2	46.2	46.2	46.2	46.2
AN	4	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	12	11.1	44.4	33.3	38.9	38.9	27.8	16.7
BN	1	66.7	0.0	5.6	5.6	5.6	5.6	5.6
BN	2	5.6	5.6	0.0	0.0	0.0	0.0	0.0
BN	3	44.4	100.0	94.4	94.4	100.0	100.0	94.4
BN	4	94.4	100.0	100.0	100.0	100.0	100.0	100.0
BN	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	12	16.7	70.8	41.7	45.8	45.8	54.2	33.3
D	1	70.8	0.0	4.2	8.3	8.3	8.3	4.2
D	2	0.0	16.7	4.2	4.2	4.2	4.2	4.2

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
D	3	62.5	95.8	91.7	95.8	95.8	91.7	87.5
D	4	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	12	0.0	80.0	53.3	53.3	46.7	46.7	33.3
C	1	43.8	0.0	6.3	6.3	6.3	6.3	6.3
C	2	31.3	50.0	43.8	56.3	50.0	62.5	62.5
C	3	93.8	100.0	100.0	100.0	100.0	100.0	100.0
C	4	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	12	12.1	60.6	42.4	42.4	41.4	42.4	33.3
All	1	68.7	5.1	5.1	7.1	6.1	6.1	5.1
All	2	6.1	13.1	8.1	10.1	9.1	11.1	11.1
All	3	44.4	72.7	70.7	71.7	72.7	71.7	69.7
All	4	89.9	98.0	98.0	98.0	98.0	98.0	98.0
All	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table M.2-23. Percent of months above the 59.9°F pathogen virulence water temperature threshold for steelhead fry by water year type and month, and for all years combined, American River at Hazel Avenue, December through May.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	5	17.9	7.1	3.6	3.6	3.6	3.6	3.6
AN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	5	38.5	38.5	0.0	0.0	0.0	0.0	0.0
BN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	5	72.2	44.4	33.3	33.3	33.3	27.8	27.8
D	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	8.3	0.0	0.0	0.0	0.0	0.0	0.0
D	5	62.5	58.3	37.5	45.8	45.8	41.7	45.8
C	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	4	56.3	0.0	0.0	0.0	0.0	0.0	0.0
C	5	87.5	93.8	37.5	31.3	43.8	50.0	56.3
All	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	4	11.1	0.0	0.0	0.0	0.0	0.0	0.0
All	5	52.5	44.4	22.2	23.2	25.3	24.2	26.3

Table M.2-24. Percent of months above the 59.9°F pathogen virulence water temperature threshold for steelhead fry by water year type and month, and for all years combined, American River at Watt Avenue, December through May.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	3.6	0.0	0.0	0.0	0.0	0.0	0.0



WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	5	28.6	35.7	35.7	35.7	35.7	35.7	35.7
AN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	15.4	7.7	0.0	0.0	0.0	0.0	0.0
AN	5	76.9	84.6	92.3	92.3	92.3	92.3	92.3
BN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	27.8	5.6	5.6	11.1	11.1	16.7	11.1
BN	5	77.8	83.3	83.3	83.3	83.3	83.3	83.3
D	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	33.3	25.0	16.7	20.8	20.8	20.8	20.8
D	5	91.7	95.8	95.8	95.8	95.8	95.8	95.8
C	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	12.5	12.5	0.0	6.3	6.3	12.5	6.3
C	4	75.0	68.8	62.5	75.0	37.5	50.0	43.8
C	5	93.8	93.8	100.0	100.0	100.0	100.0	100.0
All	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	2.0	2.0	0.0	1.0	1.0	2.0	1.0
All	4	28.3	19.2	15.2	19.2	13.1	16.2	14.1
All	5	69.7	74.7	76.8	76.8	76.8	76.8	76.8

### Juvenile Rearing and Outmigration

Table M.2-25. Percent of months above the 66.2°F upper optimal limit for rearing steelhead juveniles by water year type and month, and for all years combined, American River at Hazel Avenue, Year-round.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	6	25.0	7.1	7.1	3.6	3.6	7.1	7.1
W	7	100.0	46.4	39.3	42.9	42.9	39.3	39.3
W	8	100.0	78.6	78.6	82.1	82.1	82.1	78.6
W	9	92.9	85.7	78.6	82.1	82.1	78.6	82.1
W	10	0.0	39.3	39.3	46.4	46.4	46.4	46.4
W	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	6	69.2	7.7	23.1	23.1	23.1	23.1	15.4
AN	7	100.0	76.9	53.8	61.5	61.5	61.5	53.8
AN	8	100.0	61.5	53.8	53.8	53.8	53.8	38.5
AN	9	100.0	76.9	53.8	46.2	53.8	46.2	61.5
AN	10	0.0	38.5	0.0	7.7	7.7	0.0	7.7
AN	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	5	11.1	5.6	0.0	0.0	0.0	0.0	0.0

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
BN	6	66.7	27.8	22.2	16.7	16.7	33.3	38.9
BN	7	100.0	88.9	55.6	61.1	55.6	55.6	55.6
BN	8	100.0	88.9	66.7	61.1	61.1	66.7	66.7
BN	9	100.0	83.3	50.0	38.9	38.9	38.9	44.4
BN	10	0.0	50.0	16.7	5.6	5.6	5.6	11.1
BN	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	5	25.0	8.3	0.0	0.0	0.0	0.0	0.0
D	6	62.5	37.5	4.2	12.5	12.5	12.5	8.3
D	7	100.0	79.2	45.8	50.0	50.0	50.0	58.3
D	8	100.0	91.7	75.0	75.0	70.8	79.2	54.2
D	9	100.0	91.7	62.5	62.5	66.7	62.5	62.5
D	10	12.5	62.5	8.3	16.7	16.7	8.3	4.2
D	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	5	56.3	6.3	0.0	0.0	0.0	0.0	0.0
C	6	93.8	68.8	31.3	31.3	43.8	50.0	43.8
C	7	100.0	87.5	68.8	75.0	75.0	68.8	62.5
C	8	100.0	100.0	87.5	75.0	81.3	68.8	81.3
C	9	100.0	100.0	81.3	75.0	87.5	87.5	81.3
C	10	53.3	93.3	33.3	26.7	40.0	53.3	40.0
C	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
All	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	5	17.2	4.0	0.0	0.0	0.0	0.0	0.0
All	6	58.6	28.3	15.2	15.2	17.2	22.2	20.2
All	7	100.0	72.7	50.5	55.6	54.5	52.5	52.5
All	8	100.0	84.8	73.7	71.7	71.7	72.7	65.7
All	9	98.0	87.9	66.7	63.6	67.7	64.6	67.7
All	10	11.2	55.1	21.4	23.5	25.5	24.5	23.5
All	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table M.2-26. Percent of months above the 66.2°F upper optimal growth limit for rearing steelhead juveniles by water year type and month, and for all years combined, American River at Watt Avenue, Year-round.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	5	10.7	7.1	0.0	0.0	0.0	0.0	0.0
W	6	67.9	28.6	17.9	17.9	17.9	17.9	14.3
W	7	100.0	100.0	96.4	96.4	96.4	96.4	96.4
W	8	100.0	96.4	100.0	96.4	96.4	100.0	100.0
W	9	100.0	100.0	89.3	85.7	85.7	85.7	85.7
W	10	14.3	50.0	46.4	57.1	57.1	53.6	53.6
W	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	5	30.8	15.4	0.0	0.0	0.0	0.0	0.0
AN	6	84.6	69.2	53.8	61.5	61.5	61.5	53.8
AN	7	100.0	100.0	92.3	92.3	92.3	92.3	92.3

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
AN	8	100.0	92.3	100.0	100.0	100.0	100.0	100.0
AN	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	10	23.1	76.9	15.4	15.4	15.4	15.4	7.7
AN	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	5	38.9	27.8	11.1	11.1	11.1	11.1	11.1
BN	6	88.9	83.3	77.8	77.8	77.8	77.8	77.8
BN	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	8	100.0	100.0	100.0	94.4	94.4	88.9	94.4
BN	9	100.0	100.0	100.0	100.0	94.4	94.4	100.0
BN	10	33.3	66.7	16.7	16.7	11.1	11.1	11.1
BN	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	4.2	0.0	0.0	0.0	0.0	0.0	0.0
D	5	29.2	50.0	4.2	0.0	0.0	0.0	4.2
D	6	100.0	87.5	75.0	79.2	79.2	79.2	79.2
D	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	8	100.0	100.0	100.0	95.8	95.8	100.0	91.7
D	9	100.0	100.0	100.0	95.8	95.8	91.7	95.8
D	10	41.7	83.3	29.2	16.7	16.7	12.5	12.5
D	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	4	31.3	0.0	0.0	0.0	0.0	0.0	0.0
C	5	81.3	87.5	50.0	37.5	56.3	50.0	43.8

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
C	6	100.0	93.8	93.8	93.8	100.0	100.0	93.8
C	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	10	93.3	100.0	66.7	53.3	60.0	66.7	73.3
C	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	4	6.1	0.0	0.0	0.0	0.0	0.0	0.0
All	5	34.3	35.4	11.1	8.1	11.1	10.1	10.1
All	6	86.9	68.7	59.6	61.6	62.6	62.6	59.6
All	7	100.0	100.0	98.0	98.0	98.0	98.0	98.0
All	8	100.0	98.0	100.0	97.0	97.0	98.0	97.0
All	9	100.0	100.0	97.0	94.9	93.9	92.9	94.9
All	10	37.8	72.4	35.7	33.7	33.7	32.7	32.7
All	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table M.2-27. Percent of months above the 59.9°F pathogen virulence water temperature threshold for juvenile steelhead rearing and outmigration by water year type and month, and for all years combined, American River at Hazel Avenue, Year-round.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	5	17.9	7.1	3.6	3.6	3.6	3.6	3.6
W	6	82.1	67.9	50.0	50.0	50.0	46.4	46.4
W	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AIIVA
W	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	10	96.4	100.0	96.4	96.4	96.4	100.0	100.0
W	11	0.0	35.7	3.6	7.1	7.1	3.6	7.1
W	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	5	38.5	38.5	0.0	0.0	0.0	0.0	0.0
AN	6	100.0	100.0	84.6	84.6	84.6	84.6	84.6
AN	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	10	100.0	100.0	84.6	84.6	84.6	84.6	84.6
AN	11	0.0	28.6	0.0	0.0	0.0	7.1	7.1
AN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	5	72.2	44.4	33.3	33.3	33.3	27.8	27.8
BN	6	100.0	94.4	94.4	94.4	94.4	88.9	94.4
BN	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	10	94.4	100.0	83.3	77.8	77.8	83.3	83.3
BN	11	0.0	55.6	0.0	0.0	0.0	0.0	0.0
BN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	8.3	0.0	0.0	0.0	0.0	0.0	0.0
D	5	62.5	58.3	37.5	45.8	45.8	41.7	45.8
D	6	100.0	100.0	91.7	95.8	95.8	95.8	95.8

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AIIVA
D	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	10	95.8	100.0	95.8	95.8	95.8	95.8	95.8
D	11	4.2	54.2	4.2	4.2	4.2	8.3	4.2
D	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	4	56.3	0.0	0.0	0.0	0.0	0.0	0.0
C	5	87.5	93.8	37.5	31.3	43.8	50.0	56.3
C	6	100.0	100.0	93.8	93.8	100.0	100.0	100.0
C	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	10	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	11	33.3	80.0	46.7	33.3	53.3	46.7	33.3
C	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	4	11.1	0.0	0.0	0.0	0.0	0.0	0.0
All	5	52.5	44.4	22.2	23.2	25.3	24.2	26.3
All	6	94.9	89.9	79.8	80.8	81.8	79.8	80.8
All	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	10	96.9	100.0	92.9	91.8	91.8	93.9	93.9
All	11	6.1	49.5	9.1	8.1	11.1	11.1	9.1
All	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Table M.2-28. Percent of months above the 59.9°F pathogen virulence water temperature threshold for juvenile steelhead rearing and outmigration by water year type and month, and for all years combined, American River at Watt Avenue, Year-round.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	3.6	0.0	0.0	0.0	0.0	0.0	0.0
W	5	28.6	35.7	35.7	35.7	35.7	35.7	35.7
W	6	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W	10	96.4	100.0	100.0	100.0	100.0	100.0	100.0
W	11	0.0	42.9	3.6	7.1	7.1	3.6	7.1
W	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	15.4	7.7	0.0	0.0	0.0	0.0	0.0
AN	5	76.9	84.6	92.3	92.3	92.3	92.3	92.3
AN	6	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	10	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AN	11	0.0	21.4	0.0	0.0	0.0	7.1	7.1
AN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	27.8	5.6	5.6	11.1	11.1	16.7	11.1
BN	5	77.8	83.3	83.3	83.3	83.3	83.3	83.3

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
BN	6	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	10	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	11	11.1	55.6	0.0	0.0	0.0	0.0	0.0
BN	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4	33.3	25.0	16.7	20.8	20.8	20.8	20.8
D	5	91.7	95.8	95.8	95.8	95.8	95.8	95.8
D	6	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	10	95.8	100.0	100.0	100.0	100.0	100.0	100.0
D	11	12.5	50.0	4.2	4.2	4.2	12.5	4.2
D	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	12.5	12.5	0.0	6.3	6.3	12.5	6.3
C	4	75.0	68.8	62.5	75.0	37.5	50.0	43.8
C	5	93.8	93.8	100.0	100.0	100.0	100.0	100.0
C	6	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	10	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	11	26.7	60.0	53.3	33.3	46.7	40.0	33.3
C	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	2.0	2.0	0.0	1.0	1.0	2.0	1.0

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
All	4	28.3	19.2	15.2	19.2	13.1	16.2	14.1
All	5	69.7	74.7	76.8	76.8	76.8	76.8	76.8
All	6	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	10	98.0	100.0	100.0	100.0	100.0	100.0	100.0
All	11	9.1	46.5	10.1	8.1	10.1	11.1	9.1
All	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table M.2-29. Percent of months above the 55°F successful smoltification water temperature limit for steelhead by water year type and month, and for all years combined, American River at Hazel Avenue, January through May.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	4	7.1	0.0	0.0	0.0	0.0	0.0	0.0
W	5	64.3	96.4	89.3	92.9	92.9	92.9	89.3
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	4	23.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	4	38.9	0.0	0.0	0.0	0.0	0.0	0.0
BN	5	94.4	100.0	100.0	100.0	100.0	100.0	100.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	3	4.2	0.0	0.0	0.0	0.0	0.0	0.0
D	4	66.7	4.2	0.0	0.0	0.0	0.0	0.0

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
D	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	3	37.5	18.8	12.5	12.5	18.8	31.3	18.8
C	4	87.5	25.0	18.8	25.0	6.3	18.8	6.3
C	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	3	7.1	3.0	2.0	2.0	3.0	5.1	3.0
All	4	42.4	5.1	3.0	4.0	1.0	3.0	1.0
All	5	88.9	99.0	97.0	98.0	98.0	98.0	97.0

Table M.2-30. Percent of months above the 55°F successful smoltification water temperature limit for steelhead by water year type and month, and for all years combined, American River at Watt Avenue, January through May.

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
W	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	3	0.0	3.6	3.6	3.6	3.6	3.6	3.6
W	4	21.4	35.7	28.6	28.6	28.6	28.6	28.6
W	5	96.4	100.0	100.0	100.0	100.0	100.0	100.0
AN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	3	0.0	15.4	15.4	15.4	15.4	15.4	15.4
AN	4	53.8	84.6	84.6	84.6	84.6	84.6	84.6
AN	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BN	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	3	5.6	33.3	16.7	16.7	16.7	22.2	22.2
BN	4	55.6	94.4	94.4	94.4	94.4	94.4	94.4
BN	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

WYT	Month	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
D	3	33.3	45.8	37.5	45.8	45.8	45.8	45.8
D	4	87.5	100.0	91.7	91.7	87.5	91.7	87.5
D	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	2	6.3	6.3	6.3	6.3	12.5	18.8	12.5
C	3	75.0	93.8	87.5	87.5	87.5	93.8	93.8
C	4	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C	5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
All	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	2	1.0	1.0	1.0	1.0	2.0	3.0	2.0
All	3	21.2	35.4	29.3	31.3	31.3	33.3	33.3
All	4	60.6	78.8	74.7	74.7	73.7	74.7	73.7
All	5	99.0	100.0	100.0	100.0	100.0	100.0	100.0

### **M.2.3.2 EIS**

#### ***M.2.3.2.1 HEC 5Q Water Temperature Model Outputs***

#### ***M.2.3.2.2 Central Valley Steelhead***

## **M.2.4 References**

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