



The Sacramento River Group

Thursday, August 27, 2026

1:00 pm – 3:00 pm

Virtual (Online) Meeting Only

Teams Meeting: [JOIN HERE](#); +1 321-209-6143, 145576470#

Table 1. Agenda

No.	Topic	Presenter
1	Welcome, Roll Call, Agenda Review	Mia Schiappi, Kearns & West
2	Hydrology and Operations Update • Temperature Management Plan • Fall Flows Report Out Objective: report on the latest data and information regarding current hydrologic conditions, including temperatures and flows, and implications for the Sacramento River System	Tom Patton, Reclamation Catherine Morales-Sandoval, MBK Engineers
3	CDFW Sacramento River Fish Monitoring Update Objective: share the latest state agency information about fish movement and conditions that might affect temperature management • Carcass Surveys • Redd Counts • Stranding and Dewatering surveys	Matt Johnson, CDFW
4	USFWS Fish Conditions, Forecasts and Hatchery Updates Objective: share the latest federal agency information regarding hatchery activities, fish movement and related conditions that might affect temperature management. • Fall Run Chinook Salmon Update – Brett Galyean, Coleman National Fish Hatchery • No Current Updates • Winter Run Chinook Update – Kaitlin Dunham, Livingston Stone Hatchery • Estimated percentage of the population upstream of Red Bluff Diversion Dam for steelhead, winterrun, and spring-run Chinook salmon and RST updates– Bill Poytress, USFWS	Brett Gaylean, USFWS Kaitlin Dunham, USFWS Bill Poytress, USFWS

No.	Topic	Presenter
5	TDM Updates Objective: Discuss the TDM Model Updates • USBR Updates • SWFSC Updates	Lisa Elliot, USBR James Gilbert, SWFSC
6	TDM Model Assumptions Table Update Objective: Discuss the TDM Model Assumptions Table update process • Review Objectives • Initial Feedback and Discussion	Mia Schiappi, Kearns & West
7	SRG Guidance Document Update Objective: Share update on process of SRG Guidance updates	Mandy Migura, Reclamation
8	Additional Announcements & Review Action Items	Mia Schiappi, Kearns & West
9	Adjourn	All

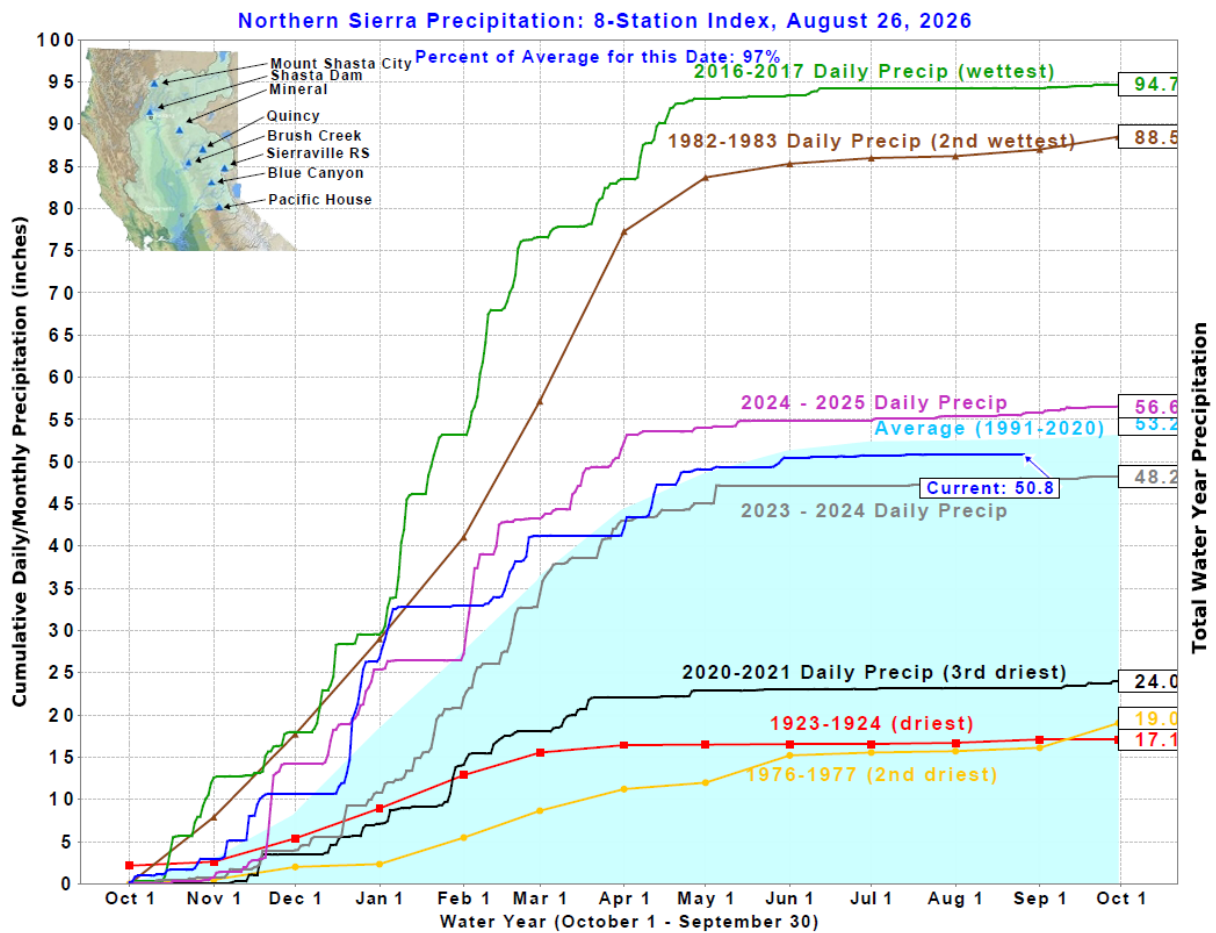


Figure 1. Northern Sierra Precipitation: 8-Station Index, August 26, 2026

The Northern Sierra 8-Station Index shows water year 2026 precipitation near average as of August 26, totaling about 50.8 inches, or 97% of average for the date. Precipitation accumulated steadily during winter and early spring before leveling off through summer. Current conditions are well below the wettest years shown, such as 2016–2017 and 1982–1983, but substantially above historically dry years including 1923–1924 and 1976–1977.

Table 2. Reservoir Releases in Cubic Feet/Second

Reservoir	Dam	WY 2025	WY 2026	15 Yr Median
Trinity	Lewiston	1,762	463	678
Sacramento	Keswick	9,318	10,077	9,109
Feather	Oroville (SWP)	6,504	8,001	6,000
American	Nimbus	1,690	3,499	2,489
Stanislaus	Goodwin	253	1,388	253
San Joaquin	Friant	260	370	370

Table 3. Storage in Major Reservoirs in Thousands of Acre-Feet

Reservoir	Capacity	15 Yr Avg	WY 2025	WY 2026	% of 15 Yr Avg
Trinity	2,448	1,435	1,977	1,793	125
Shasta	4,552	2,609	2,906	2,691	103
Folsom	977	494	482	478	97
New Melones	2,420	1,349	1,662	1,569	116
Fed. San Luis	966	293	244	412	141
Total North CVP	11,363	6,180	7,271	6,943	112
Millerton	521	281	249	241	86
Oroville (SWP)	3,425	1,869	2,400	2,067	111

Table 4. Accumulated Inflow for Water Year to Date in Thousands of Acre-Feet

Reservoir	Current WY 2026	WY 1977	WY 1983	15 Yr Avg	% of 15 Yr Avg
Trinity	1,088	205	2,845	1,056	103
Shasta	4,740	2,359	10,449	4,583	103
Folsom	2,332	327	6,361	2,424	96
New Melones	742	NA	2,682	933	79
Millerton	1,395	319	4,463	1,474	95

Table 5. Accumulated Precipitation for Water Year To Date in Inches

Reservoir	Current WY 2026	WY 1977	WY 1983	Average (N Years)	% of Average	Last 24 Hours
Trinity at Fish Hatchery	31.02	12.23	56.20	30.36 (66)	102	0.00
Sacramento at Shasta Dam	68.76	17.49	114.16	59.20 (71)	116	0.00
American at Blue Canyon	59.36	16.90	103.88	63.98 (52)	93	0.00
Stanislaus at New Melones	28.38	NA	45.73	26.71 (49)	106	0.00
San Joaquin at Huntington Lk	31.49	17.50	83.00	39.70 (53)	79	0.00

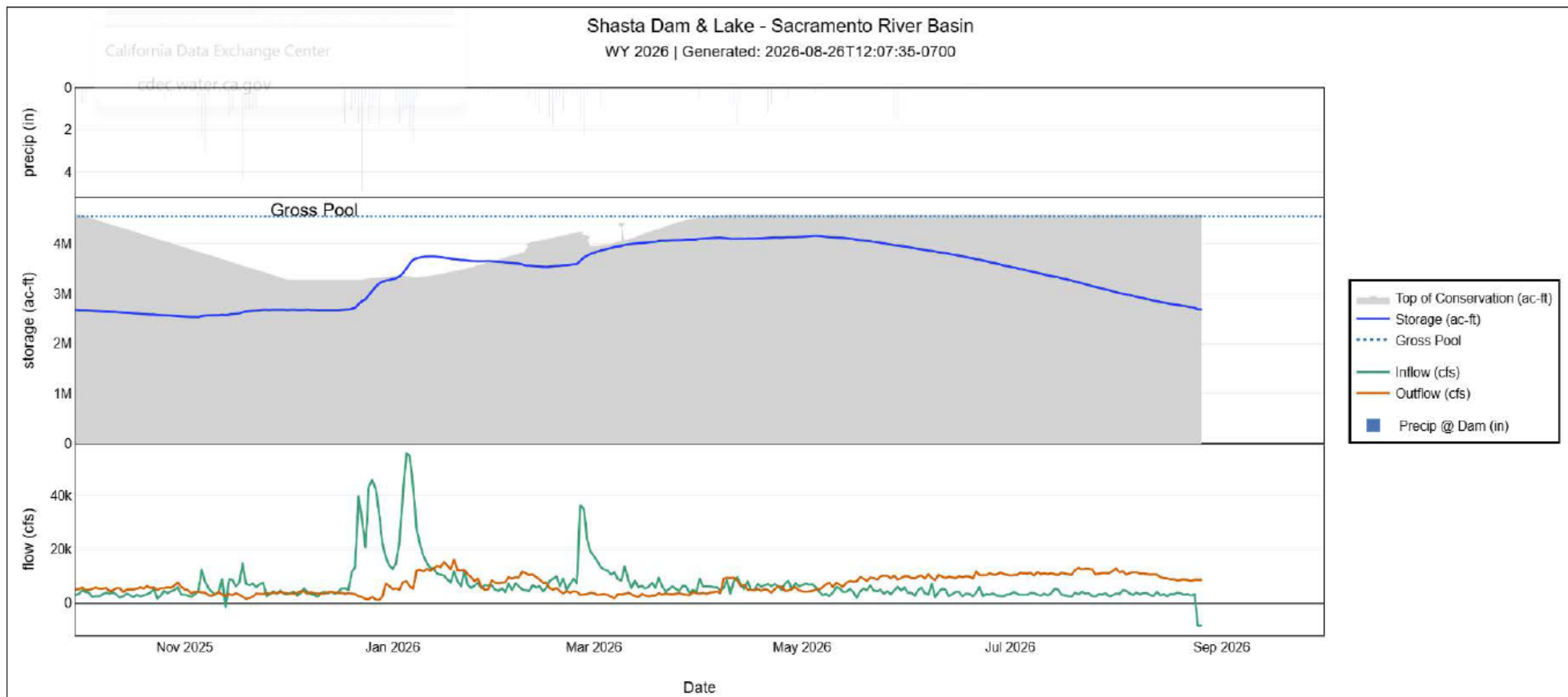


Figure 2. Shasta Dam & Lake – Sacramento River Basin

This chart summarizes Shasta Dam and Lake conditions for Water Year 2026, showing storage rising from about 2.6 million acre-feet in fall 2025 to roughly 4.1 million acre-feet in spring 2026 before declining through summer to about 2.7 million acre-feet by late August. Storage remained below the gross pool line and generally tracked within the top-of-conservation range. Inflows were elevated during winter storm periods, especially in late December, early January, and late February, while outflows increased into summer and then eased slightly toward the end of the period. Precipitation was concentrated during winter and early spring, with little activity shown during summer.

Table 6. Sacramento River Station Temperature Summary Report

Date	MDW T TCD ¹	MDW T SHD	MDW T SPP ¹	MDW T KWK	MDW T SAC	MDW T CCR ²	MDW T BSF	MDW T BND	MDW T RBD	MDW T IGO	MDW T LWS	MDW T DGC	MDW T NFH	MDR Shast a Gene- ra- tion	MDR Sprin g Creek PP	MDR Keswic k Total	MDA T RDD	MDA T BSF	MDA T RDB
Jul	51.3	50.4	57.5	52.2	52.7	53.3	54.9	56.3	58.2	59.3	51.0	59.9	65.4	11395	1428	12975	83.2	78.8	78.7
08/01	50.9	50.2	57.9	51.4	52.0	52.5	54.2	55.6	57.6	59.3 A	51.9	61.0	66.3	13098	286	12939	86.5	82.2	83.0
08/02	51.2	50.5	58.1	51.6	52.1	52.7	54.3	55.5	57.4 A	NA C	52.2	60.9	66.1	11630	973	13066	91.5	83.1	84.1
08/03	51.3	50.6	58.1	51.9	52.4	53.0	54.6	55.9	57.7	60.7 A	52.3	61.1	66.7	11974	939	13033	94.0	85.3	86.2
08/04	51.3	50.5 A	58.2	52.4	52.8	53.4	54.8	56.0	57.8	59.2	52.7	61.1	67.0	10730	1838	13079	86.5	81.6	82.1
08/05	51.4	50.6	58.3	52.4	52.9	53.5	55.0	56.4	58.2	59.3	51.7	61.7	67.3	11309	1839	13075	86.5	81.2	80.1
08/06	51.6	50.8	58.3	52.5	52.9	53.5	55.1	56.3	58.1	59.2	51.2	61.1	67.4	11630	1842	13074	86.5	81.2	81.6
08/07	51.6	50.8	58.3	52.3	52.9	53.5	55.0	56.3	58.1	59.2	51.1	60.8	67.0	11648	1054	13090	88.5	82.9	82.5
08/08	51.6	50.9	58.4	52.6	53.0	53.6	55.0	56.2	58.1	59.3	50.9	60.6	66.3	11070	1847	13133	89.5	83.5	83.2
08/09	51.7	50.9	58.5	52.8	53.2	53.8	55.3	56.6	58.3	59.2	50.7	60.0	65.7	11170	1842	13148	87.5	82.8	82.3
08/10	51.4 X	50.6	58.5	52.8	53.3	53.9	55.4	56.7	58.6	59.4	51.0	59.8	65.7	10969	1843	13139	87.5	82.1	81.0
08/11	51.5	50.5	58.6	52.6	53.1	53.7	55.1	56.6	58.5	59.2	51.1	60.5	66.3	10740	1845	13100	83.5	78.1	78.4

Date	MDW T TCD ¹	MDW T SHD	MDW T SPP ¹	MDW T KWK	MDW T SAC	MDW T CCR ²	MDW T BSF	MDW T BND	MDW T RBD	MDW T IGO	MDW T LWS	MDW T DGC	MDW T NFH	MDR Shast a Gene- ra- tion	MDR Sprin g Creek PP	MDR Keswic k Total	MDA T RDD	MDA T BSF	MDA T RDB
08/12	51.9	50.5	58.6	52.6	53.1	53.6	55.0	56.2	58.0	58.9	51.0	60.3	66.3	10800	1845	13105	81.5	76.5	76.5
08/13	52.2 X	50.7	58.7	52.4	53.0	53.6	55.0	56.2	57.9	58.8	50.9	59.9	65.7	10771	1532	12450	75.0	71.7	72.3
08/14	52.0	50.5	58.7	52.6	53.1	53.6	55.0	56.3	58.0	59.0	50.9	59.5	65.4	9806	1712	12021	75.5	71.3	70.6
08/15	51.8	50.5	58.7	52.7	53.1	53.7	55.1	56.4	58.1	58.5	50.7	58.8	64.4	9450	1743	11529	75.5	71.3	71.2
08/16	52.0	50.6	58.7	52.7	53.1	53.6	55.0	56.3	58.0	58.2	50.5	57.9	63.5	9360	1737	10964	78.5	74.2	75.3
08/17	52.2 X	50.8	58.7	52.7	53.1	53.7	55.0	56.2	57.9	58.6	50.4	58.0	63.7	8981	1743	10948	84.0	76.7	76.8
08/18	51.9X	50.7	58.7	53.0	53.4	54.0	55.4	56.7	58.2	59.0	50.4	58.5	64.2	9018	1730	10939	86.0	78.9	79.1
08/19	51.9	50.6	58.7	52.9	53.4	54.1	55.7	57.1	58.8	59.1	50.5	58.9	64.8	8607	1739	10681	84.0	77.9	77.3
08/20	52.0 X	50.7	58.7	52.6	53.2	53.9	55.4	56.9	58.7	58.5	50.5	58.9	64.6	8725	1026	10113	82.0	76.2	76.8
08/21	52.1	50.9	58.7	52.5	53.0	53.6	54.9	56.5	58.2	58.0	50.8	58.4	64.2	8840	1032	10090	80.0	75.4	75.8
08/22	52.2	51.0	58.7	52.6	53.1	53.8	55.2	56.5	58.0	58.5	51.1	58.0	63.3	8779	1038	9999	79.0	74.9	75.0
08/23	52.3	51.1	58.7	52.9	53.4	54.0	55.4	56.6	58.2	58.6	51.2	58.4	63.4	8452	910	10066	82.0	75.7	76.8
08/24	52.2 X	51.2	58.8	52.8	53.3	53.9	55.4	56.7	58.4	58.4	51.4	58.4	63.5	8843	989	10071	81.0	74.3	76.7

Date	MDW T TCD ¹	MDW T SHD	MDW T SPP ¹	MDW T KWK	MDW T SAC	MDW T CCR ²	MDW T BSF	MDW T BND	MDW T RBD	MDW T IGO	MDW T LWS	MDW T DGC	MDW T NFH	MDR Shasta Generation	MDR Spring Creek PP	MDR Keswick Total	MDA T RDD	MDA T BSF	MDA T RDB
08/25	52.2 X	51.2	58.4	52.8	53.3	53.9	55.3	56.6	58.1	58.4	51.5	58.3	63.1	8817	814	10077	79.5	73.8	73.7
08/26	52.0	51.2	58.5	52.8	53.3	54.0	55.4	56.7	58.2	58.4	51.3	58.3	62.9	8666	922	9503	79.5	74.3	75.6
Aug	51.8	50.7	58.5	52.5	53.0	53.6	55.1	56.4	58.1	58.9	51.1	59.6	65.2	10149	1410	11786	N/A	83.5	78.0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Total CFS	263883	36660	306432	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Total AF	523401	72714	607795	N/A	N/A	N/A

Legend

A = 1-9 hours of data missing (Average includes estimations)
B = 10 or more hours of data missing (Average not calculated)
C = Station out of service
D = Record high air temperature
E = Record low air temperature
MDWT = Mean Daily Water Temperature (Fahrenheit)
MDR = Mean Daily Release (CFS)
MDAT = Mean Daily Air Temperatures (Fahrenheit)

Notes

1 Temperatures are weighted averages based on individual penstock flow and temperature
X Highlighted cells in the TCD column indicate a TCD change was made on that day
2 Current Clear Creek River control point (see page 3 for more details)
3 Data is currently being collected locally and periodically downloaded.
Once downloaded and certified by USGS, missing data will be added.

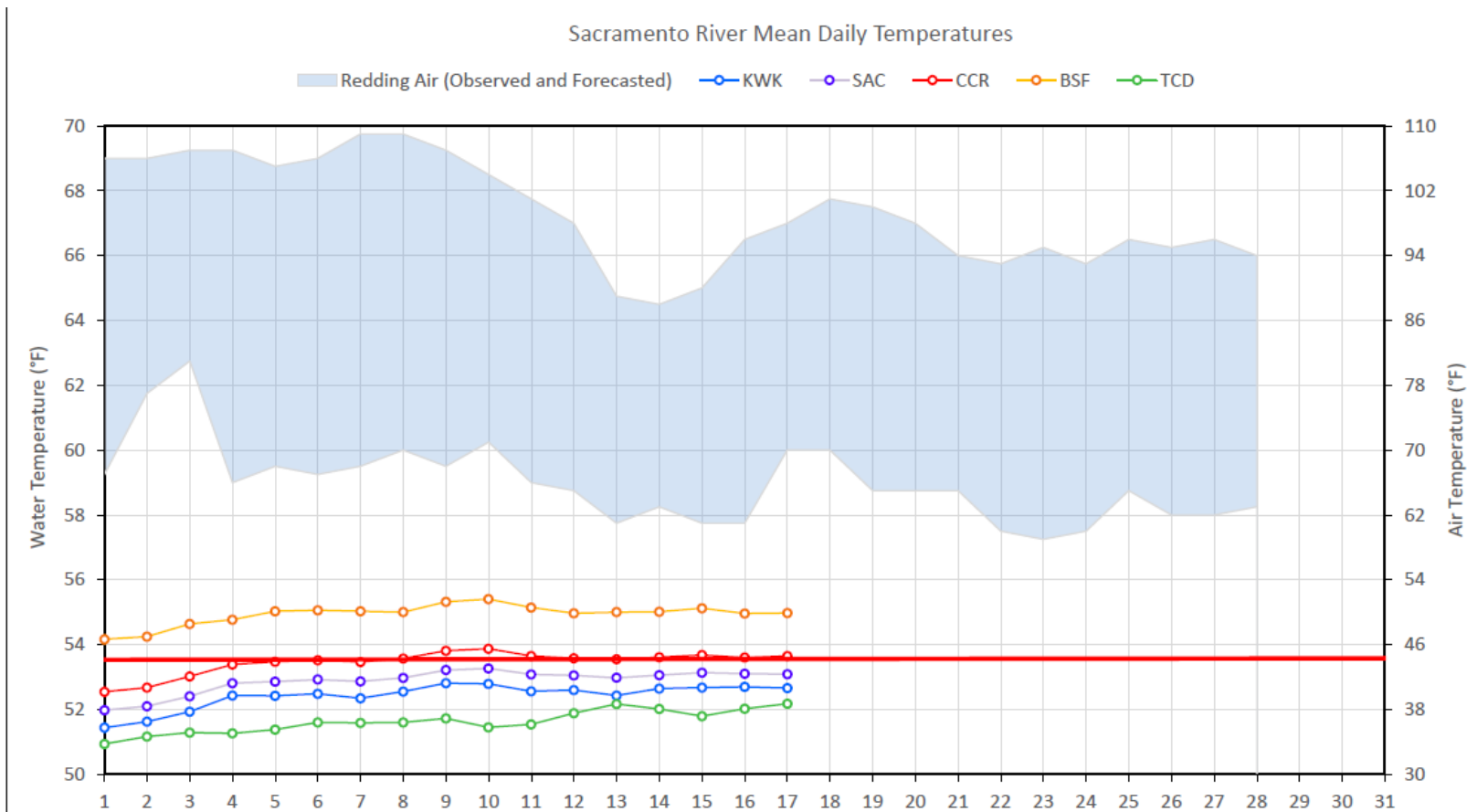


Figure 3. Sacramento River Mean Daily Temperatures

The Sacramento River mean daily temperature chart shows relatively stable water temperatures across monitoring locations for the first 17 days of the month, with TCD and KWK generally coolest near 51°F to 53°F and BSF warmest near 54°F to 55°F. CCR closely tracks the 53.5°F reference line, while SAC and KWK remain slightly below it. Redding air temperatures are higher and more variable, with daily ranges generally from the upper 50s to around 70°F, but these fluctuations correspond with only minor day-to-day changes in river temperatures.

Station Details

Code	Body of Water	Location ¹
TCD	N/A	Shasta Power Plant
SHD	Sacramento River	0.3 miles downstream of Shasta Power Plant
SPP	N/A	Spring Creek Power Plant
KWK	Sacramento River	0.8 miles downstream of Keswick Dam
SAC	Sacramento River	4.8 miles downstream of Keswick Dam
CCR	Sacramento River	9.7 miles downstream of Keswick Dam
BSF	Sacramento River	25 miles downstream of Keswick Dam
JLF	Sacramento River	34 miles downstream of Keswick Dam
BND	Sacramento River	41 miles downstream of Keswick Dam
RDB	Sacramento River	58 miles downstream of Keswick Dam
IGO	Clear Creek	7.3 miles downstream of Whiskeytown Dam

Water Right Temperature Control Points

River	Point	Temp (° F)	Begin Date	End Date
Sacramento	CCR	58.0	Mar-01	May-15
Sacramento	CCR	53.5	May-15	NA

Notes: 1 Distances are approximate

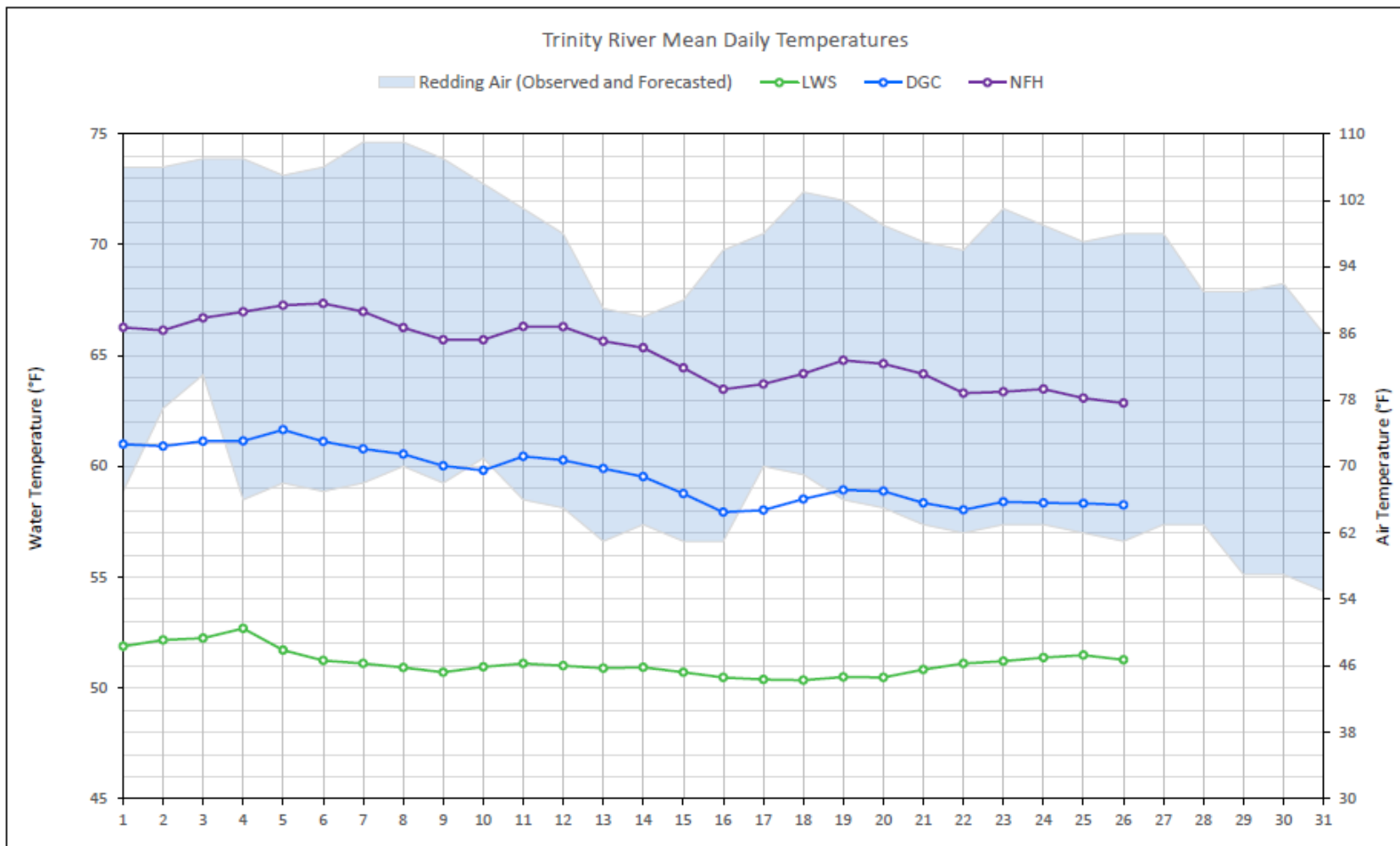


Figure 4. Trinity River Mean Daily Temperatures

The chart shows mean daily water temperatures at three Trinity River monitoring locations (LWS, DGC, and NFH) over the course of a month, alongside observed and forecasted Redding air temperatures. Water temperatures remain relatively stable, with LWS ranging from about 50°F to 52°F, DGC from 58°F to 61°F, and NFH from 63°F to 67°F. All three sites exhibit a slight cooling trend through mid-month, followed by minor fluctuations and stabilization later in the month. Air temperatures are more variable, generally ranging from the upper 50s to mid-70s °F, with warmer conditions early in the month and a gradual decline toward the end of the period.

Station Details

Code	Body of Water	Location ¹
LWS	Trinity River	1.1 miles downstream of Lewiston Dam
DGC	Trinity River	19 miles downstream of Lewiston Dam
NFH	Trinity River	38 miles downstream of Lewiston Dam

Water Right Temperature Control Points

River	Point	Temp (° F)	Begin Date	End Date
Trinity	DGC	56	Sep-15	Oct-01
Trinity	NFH	56	Oct-01	Dec-31

Notes: 1 Distances are approximate

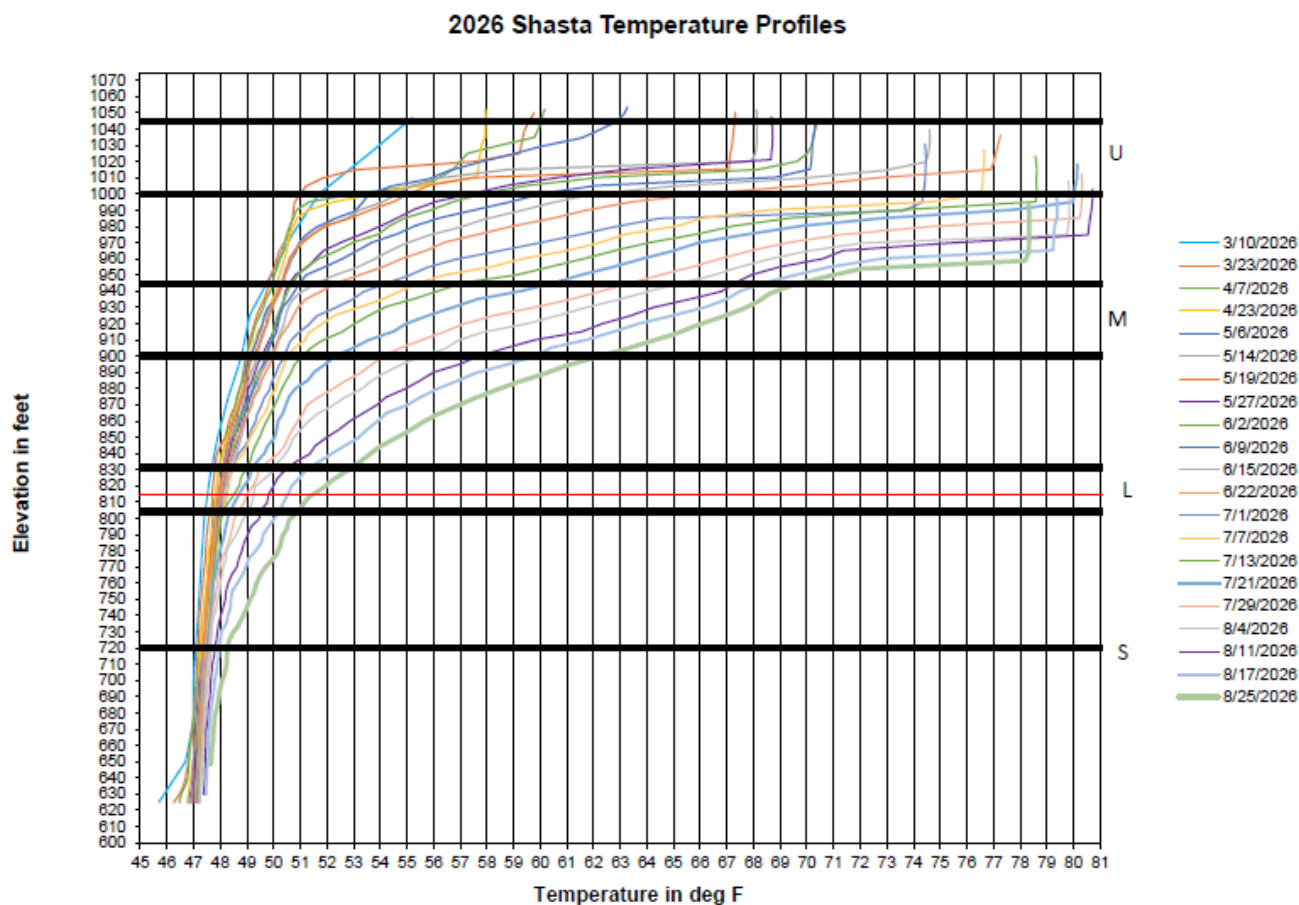


Figure 5. 2026 Shasta Temperature Profiles

The chart displays temperature profiles in Shasta Reservoir from March through August 2026, showing seasonal warming and increasing thermal stratification throughout the water column. Surface waters warmed substantially from the upper 40s°F in March to near 80°F by late summer, while deeper waters remained considerably cooler and changed more gradually. The increasing separation between surface and deep-water temperatures indicates the development and persistence of distinct thermal layers, with the strongest stratification occurring during the summer months.

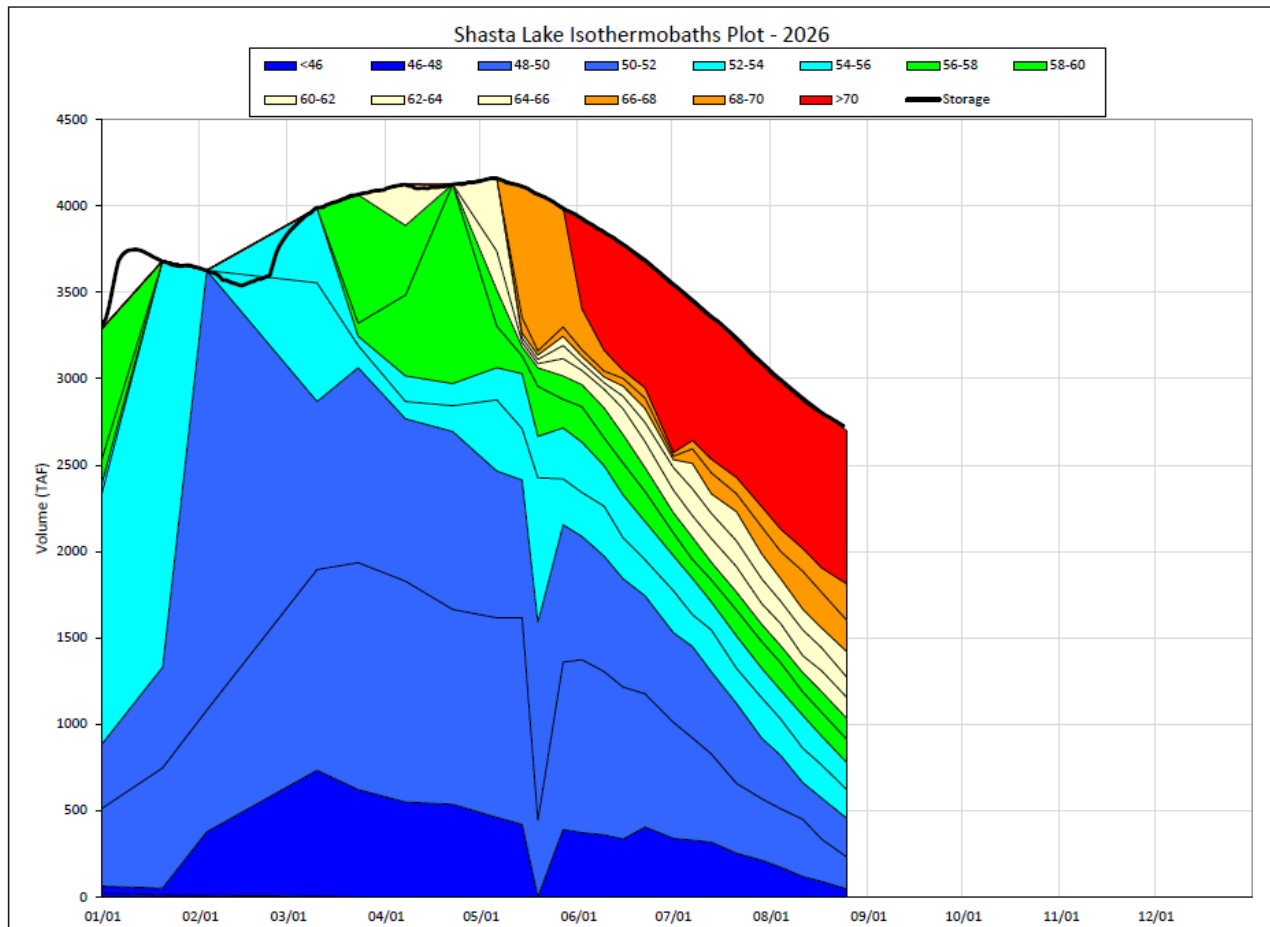


Figure 6. Shasta Lake Isothermobaths Plot - 2026

The chart illustrates the seasonal distribution of water temperatures within Shasta Lake during 2026, showing changes in temperature stratification and reservoir storage from January through August. Cooler water temperatures below 54°F dominated much of the reservoir volume during winter and spring, while warmer water layers expanded steadily through summer. By late summer, temperatures above 70°F occupied a substantial portion of the upper reservoir, while cooler water remained concentrated at depth. The black storage line indicates reservoir volume increased through spring, peaking in late May, before declining throughout the summer as warmer surface conditions became more widespread.

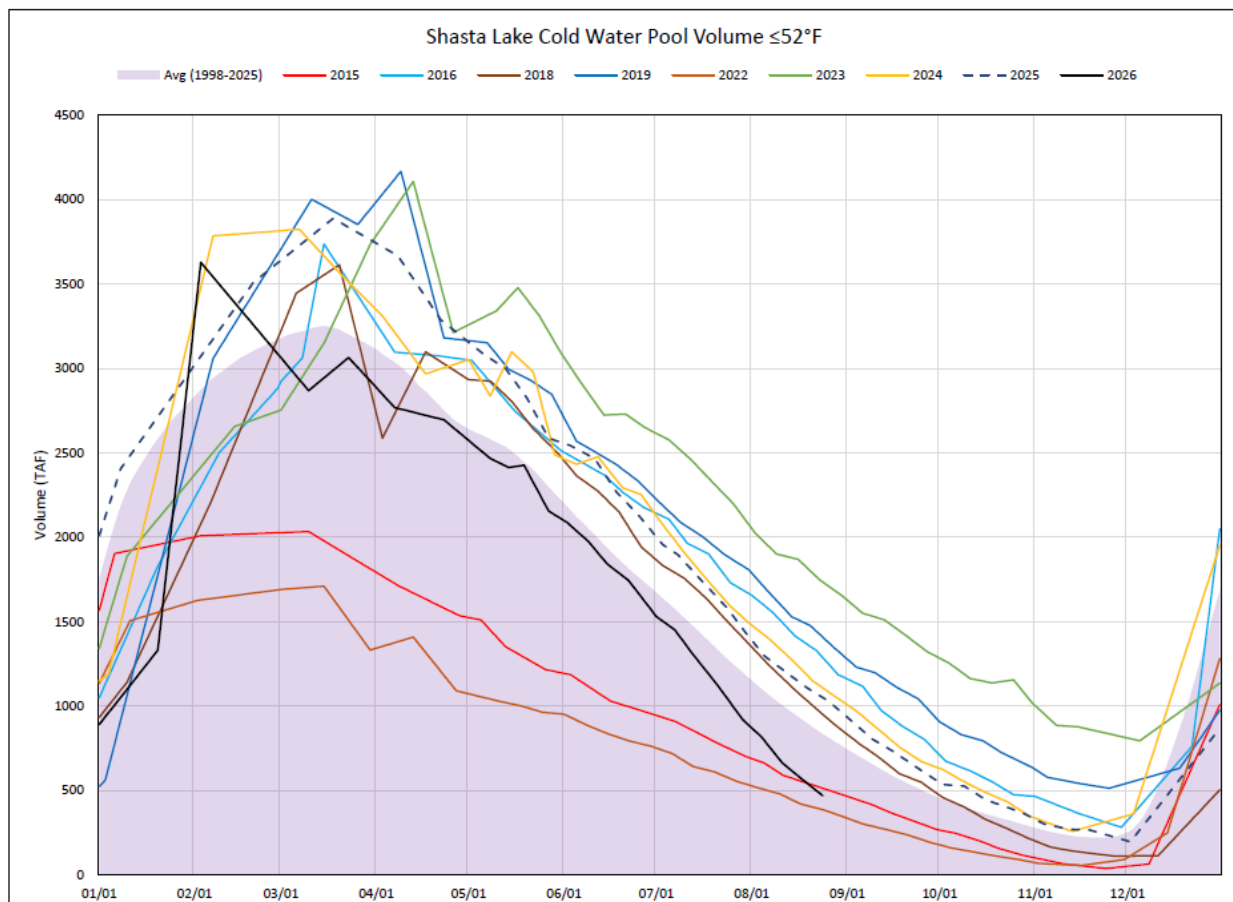


Figure 7. Shasta Lake Cold Water Pool Volume $\leq 52^{\circ}\text{F}$

The chart compares Shasta Lake's cold water pool volume (water at or below 52°F) in 2026 with historical conditions and selected years from 2015 to 2025. In 2026, the cold water pool increased rapidly during winter, reaching approximately 3.6 million acre-feet in early February, then gradually declined through spring and summer to about 500 thousand acre-feet by late August. Overall, 2026 tracked near or slightly above the long-term average early in the year but declined more quickly during summer, remaining below several wetter years such as 2019 and 2023 while staying above drought-affected conditions observed in 2015 and 2018.

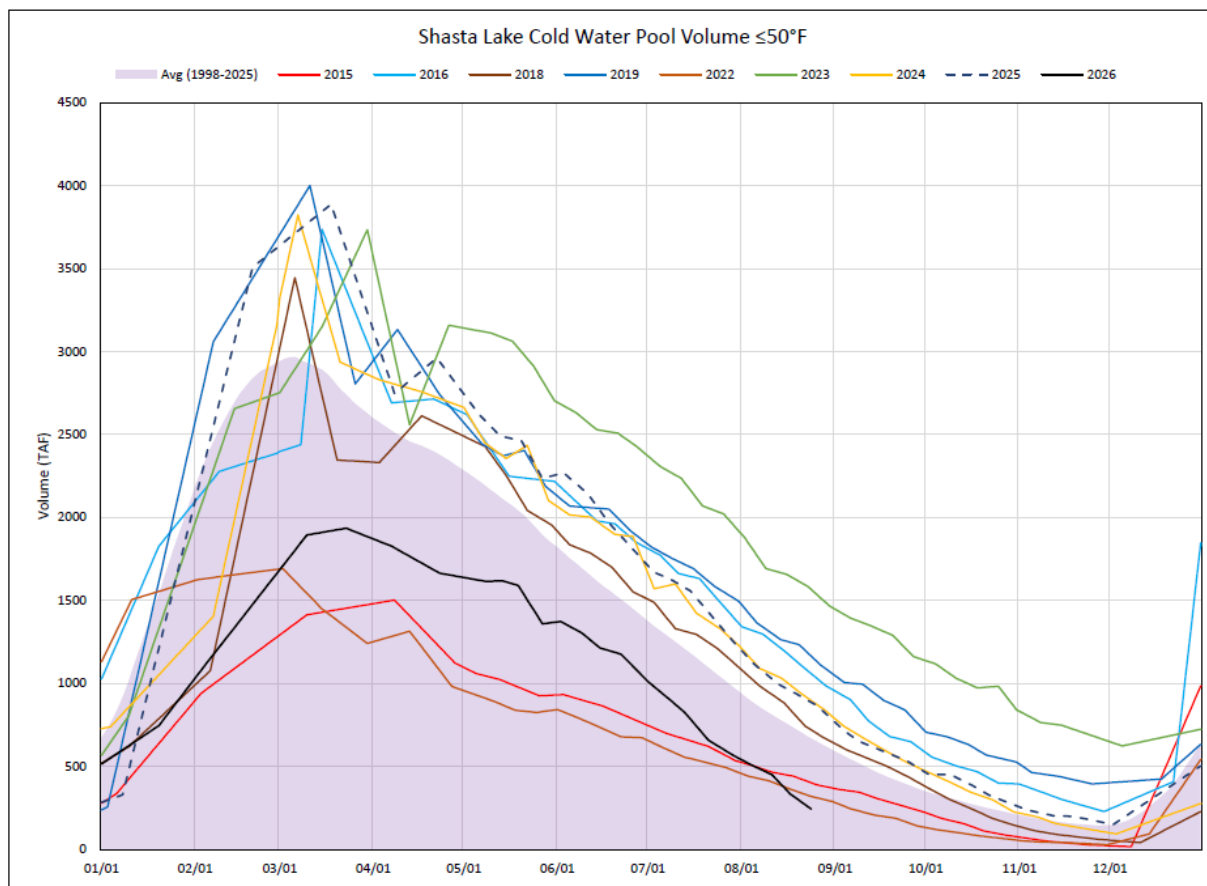


Figure 8. Shasta Lake Cold Water Pool Volume $\leq 50^{\circ}\text{F}$

The chart compares Shasta Lake's cold water pool volume at or below 50°F during 2026 against the long-term average (1998-2025) and selected historical years. In 2026, the cold water pool increased through winter and peaked at approximately 1.9 million acre-feet in late March, remaining below the historical average and well below wetter years such as 2019, 2023, and 2025. Volumes declined steadily through spring and summer, falling to about 250 thousand acre-feet by late August, indicating a smaller and more rapidly depleted reserve of the coldest water compared to many recent years.

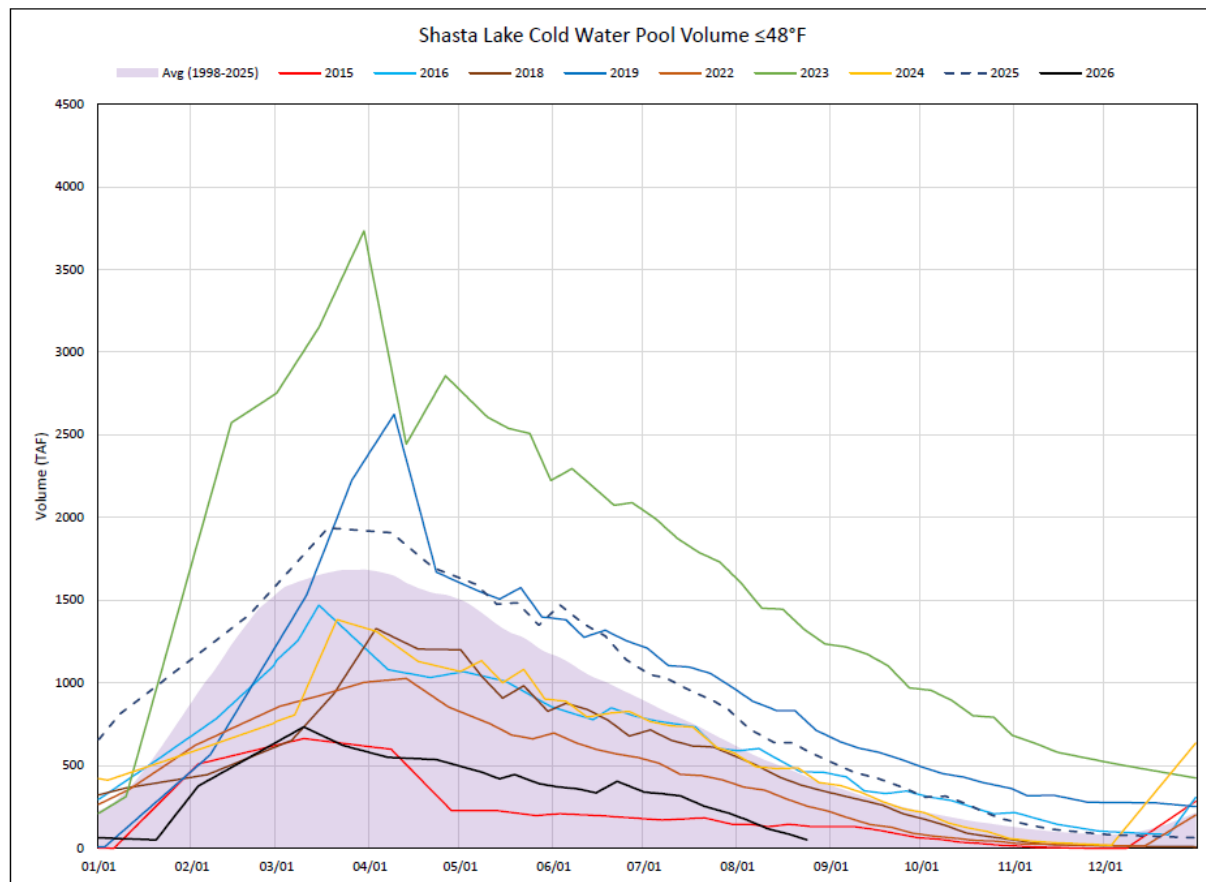


Figure 9. Shasta Lake Cold Water Pool Volume $\leq 48^{\circ}\text{F}$

The chart compares Shasta Lake's cold water pool volume at or below 48°F during 2026 with the long-term average (1998-2025) and selected historical years. In 2026, the volume of the coldest water increased gradually through winter, peaking at approximately 700 thousand acre-feet in late March, which was well below the historical average and substantially lower than wetter years such as 2019, 2023, and 2025. The cold water pool then declined steadily through spring and summer, reaching near-zero levels by late August, indicating a relatively limited reserve of the coldest water available during the warm season compared to most historical conditions.

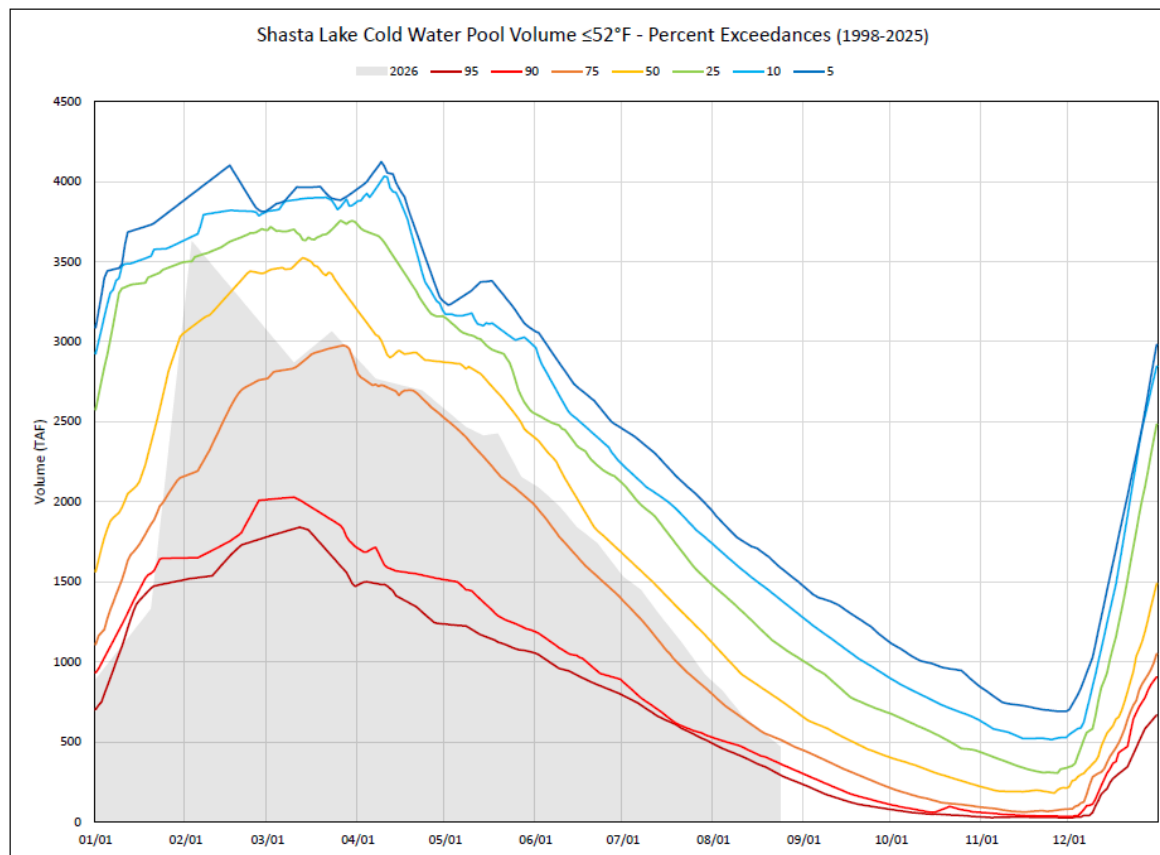


Figure 10. Shasta Lake Cold Water Pool Volume $\leq 52^{\circ}\text{F}$ - Percent Exceedances (1998-2025)

The chart compares 2026 Shasta Lake cold water pool volume at or below 52°F with historical exceedance percentiles from 1998-2025. In 2026, the cold water pool peaked at approximately 3.6 million acre-feet in early February, placing it near the 25th to 50th percentile range and below the larger volumes associated with the 10th and 5th percentile conditions. Volumes declined steadily through spring and summer, falling below the 50th percentile by early summer and approaching the 75th percentile range by late August. Overall, 2026 reflects below-average cold water storage relative to historical conditions, with a more rapid seasonal depletion than typically observed.

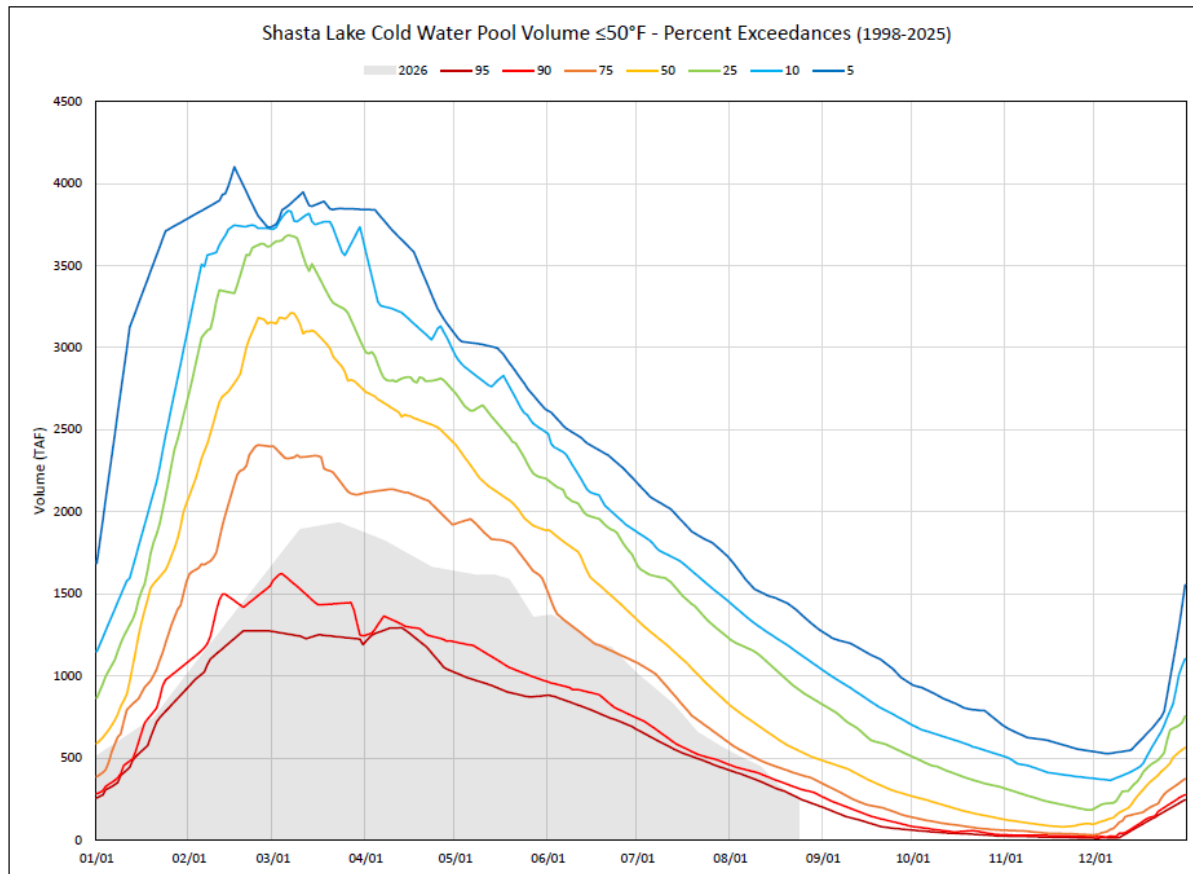


Figure 11. Shasta Lake Cold Water Pool Volume $\leq 50^{\circ}\text{F}$ - Percent Exceedances (1998-2025)

The chart compares 2026 Shasta Lake cold water pool volume at or below 50°F with historical exceedance percentiles from 1998-2025. In 2026, the cold water pool peaked at approximately 1.9 million acre-feet in late March, near the 75th percentile and well below median and wetter historical conditions. Volumes declined steadily through spring and summer, falling below the 75th percentile by early summer and reaching about 250 thousand acre-feet by late August. Overall, 2026 reflects below-average storage of the coldest water, with a smaller cold water reserve and faster seasonal depletion than is typical under historical conditions.

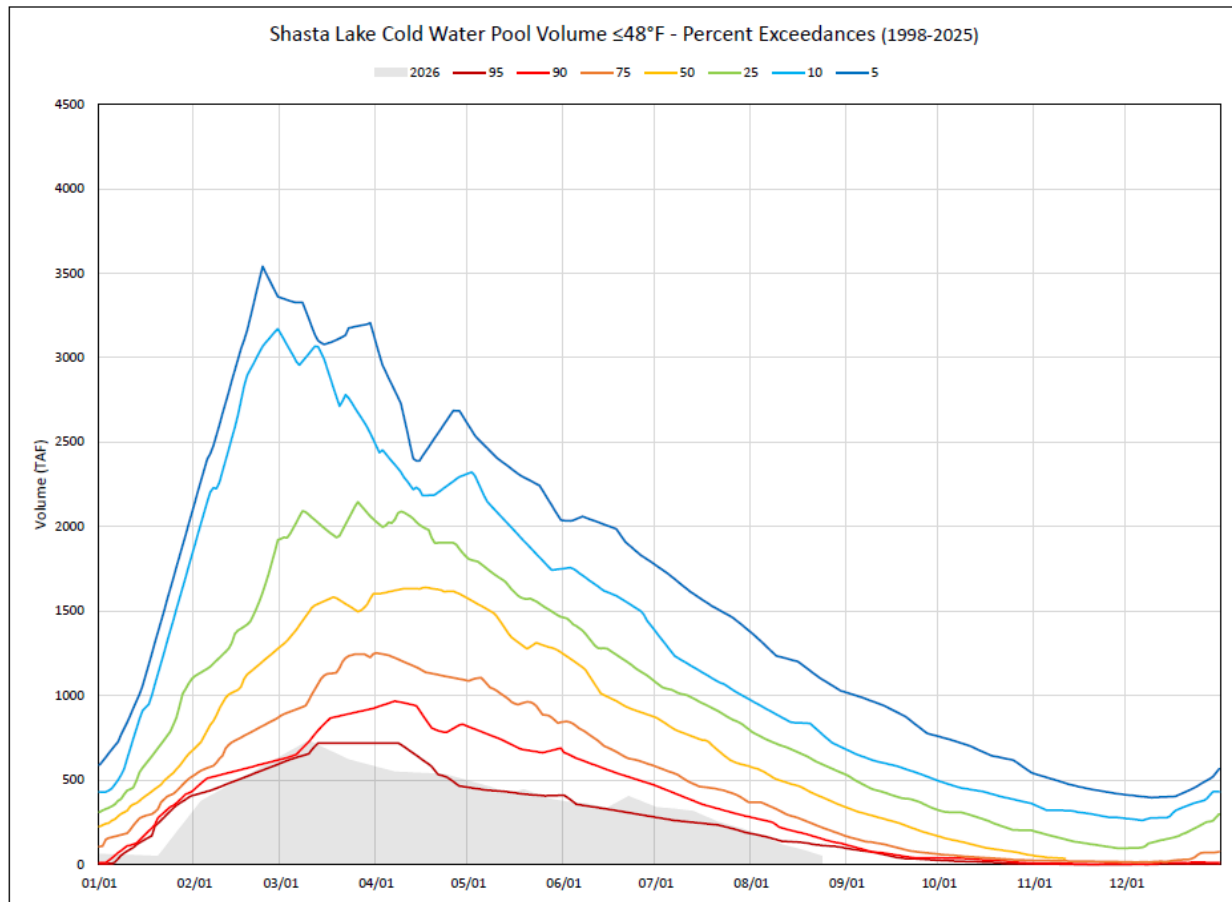


Figure 12. Shasta Lake Cold Water Pool Volume $\leq 48^{\circ}\text{F}$ - Percent Exceedances (1998-2025)

The chart compares 2026 Shasta Lake cold water pool volume at or below 48°F with historical exceedance percentiles from 1998-2025. In 2026, the volume of water at or below 48°F peaked at approximately 700 thousand acre-feet in late March, placing it near the 90th percentile and well below median historical conditions. The cold water pool declined steadily through spring and summer, reaching near-zero levels by late August. Overall, 2026 reflects a relatively small reserve of the coldest water compared to most years in the historical record, indicating below-average cold water storage and earlier seasonal depletion.

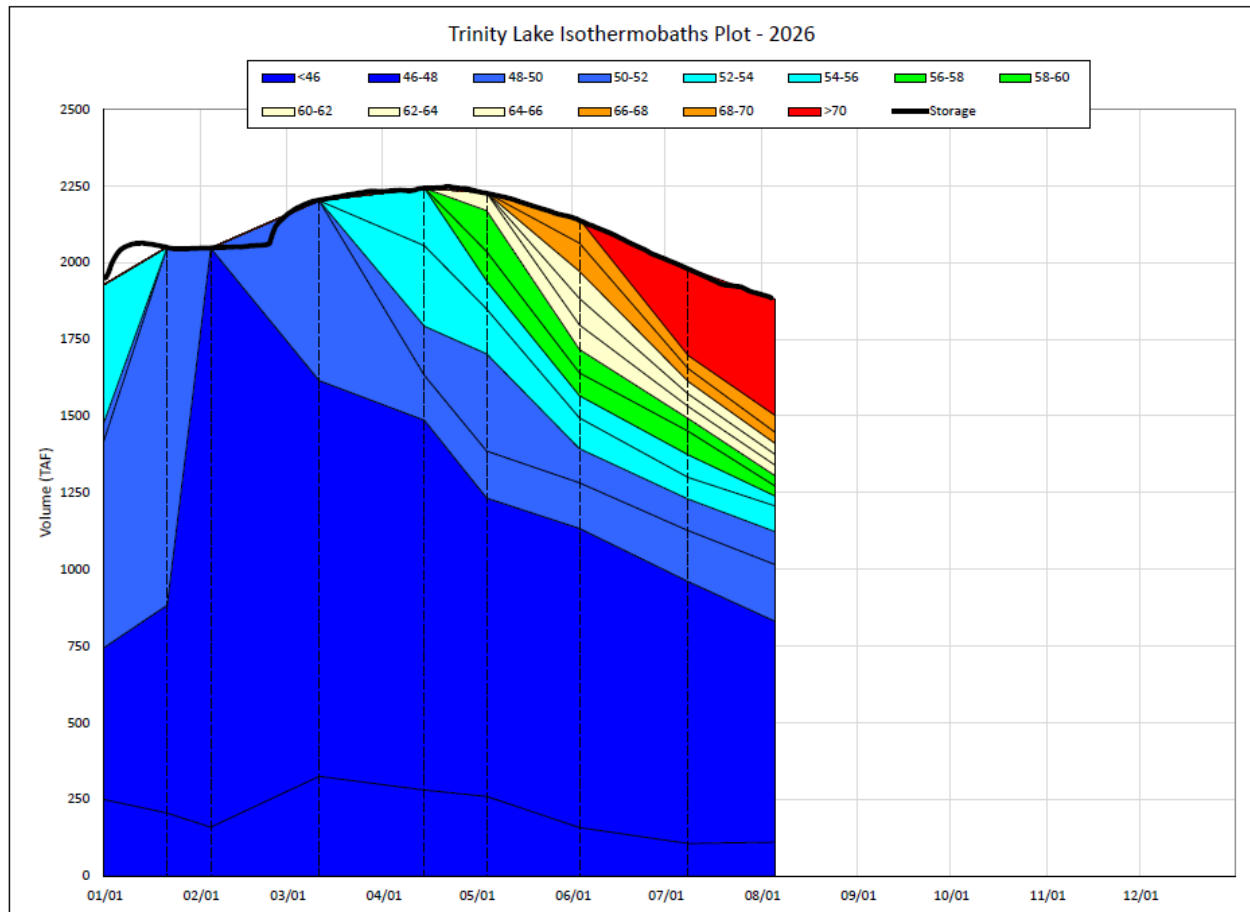


Figure 13. Trinity Lake Isothermobaths Plot - 2026.

The chart illustrates the seasonal distribution of water temperatures within Trinity Lake during 2026, along with changes in reservoir storage from January through August. Cold water temperatures below 50°F dominated the reservoir during winter and early spring, while warmer temperature layers gradually expanded as storage peaked in late spring and then declined through summer. By August, temperatures above 60°F occupied a larger portion of the reservoir volume, although a substantial cold water pool remained at depth. The storage curve shows reservoir volume increasing through spring before gradually decreasing during the summer drawdown period.

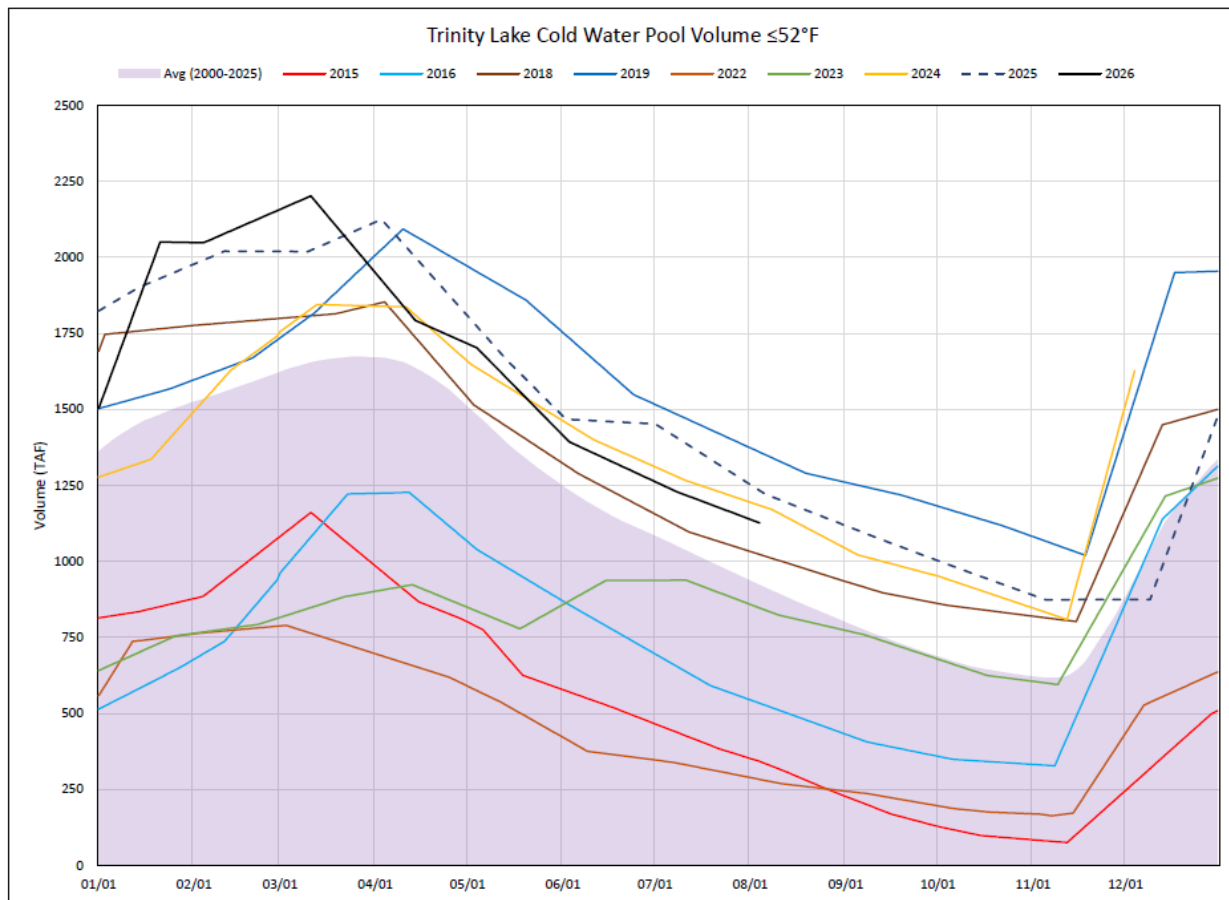


Figure 14. Trinity Lake Cold Water Pool Volume $\leq 52^{\circ}\text{F}$

The chart compares Trinity Lake's cold water pool volume at or below 52°F during 2026 with the long-term average (2000-2025) and selected historical years. In 2026, the cold water pool increased rapidly during winter, peaking at approximately 2.2 million acre-feet in March, well above the long-term average and among the highest values shown. Volumes gradually declined through spring and summer but remained above average through August at roughly 1.1 million acre-feet. Overall, 2026 reflects a relatively large and persistent cold water pool compared to most recent years.

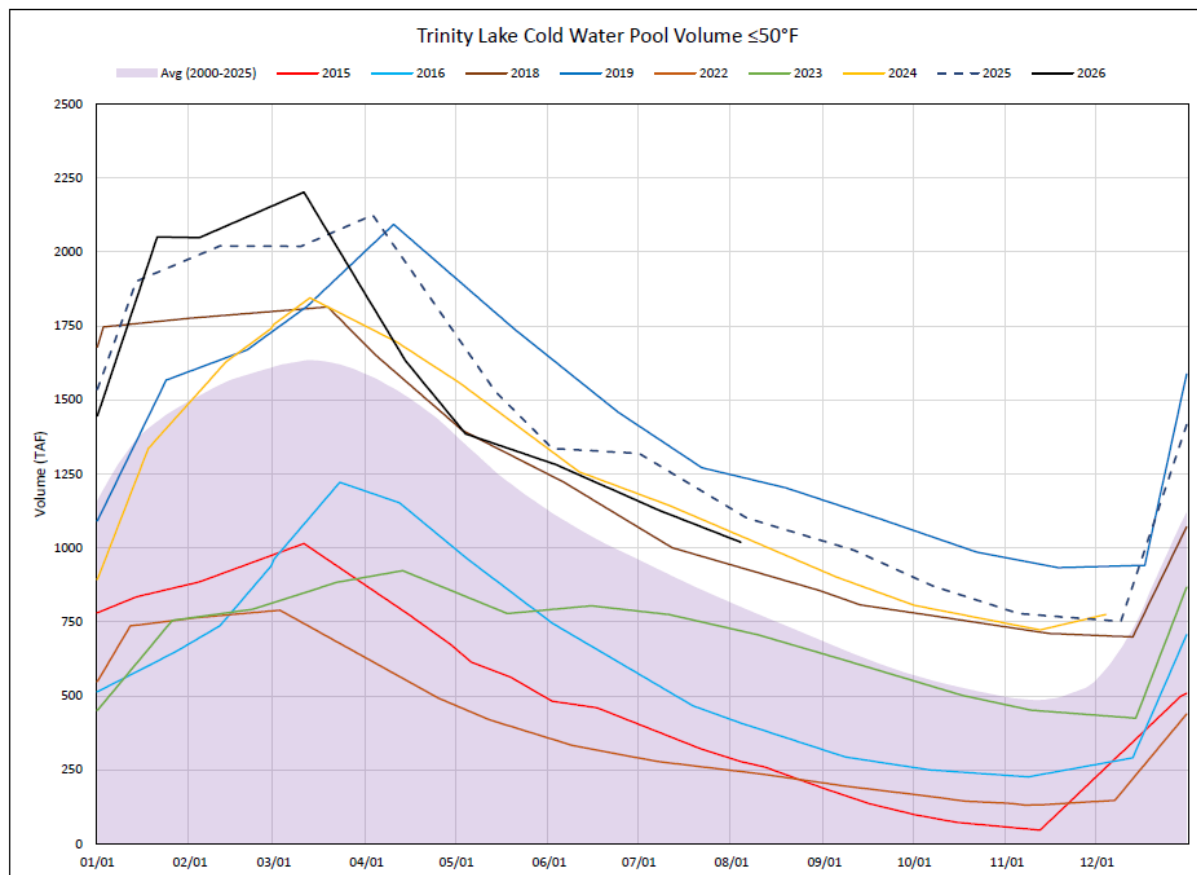


Figure 15. Trinity Lake Cold Water Pool Volume $\leq 50^{\circ}\text{F}$

The chart compares Trinity Lake's cold water pool volume at or below 50°F during 2026 with the long-term average (2000-2025) and selected historical years. In 2026, the cold water pool increased rapidly through winter, peaking at approximately 2.2 million acre-feet in March, well above the historical average and among the highest values shown. Volumes declined through spring and summer but remained above average through August at roughly 1.0 million acre-feet. Overall, 2026 indicates a relatively large and persistent reserve of cold water compared to most recent years.

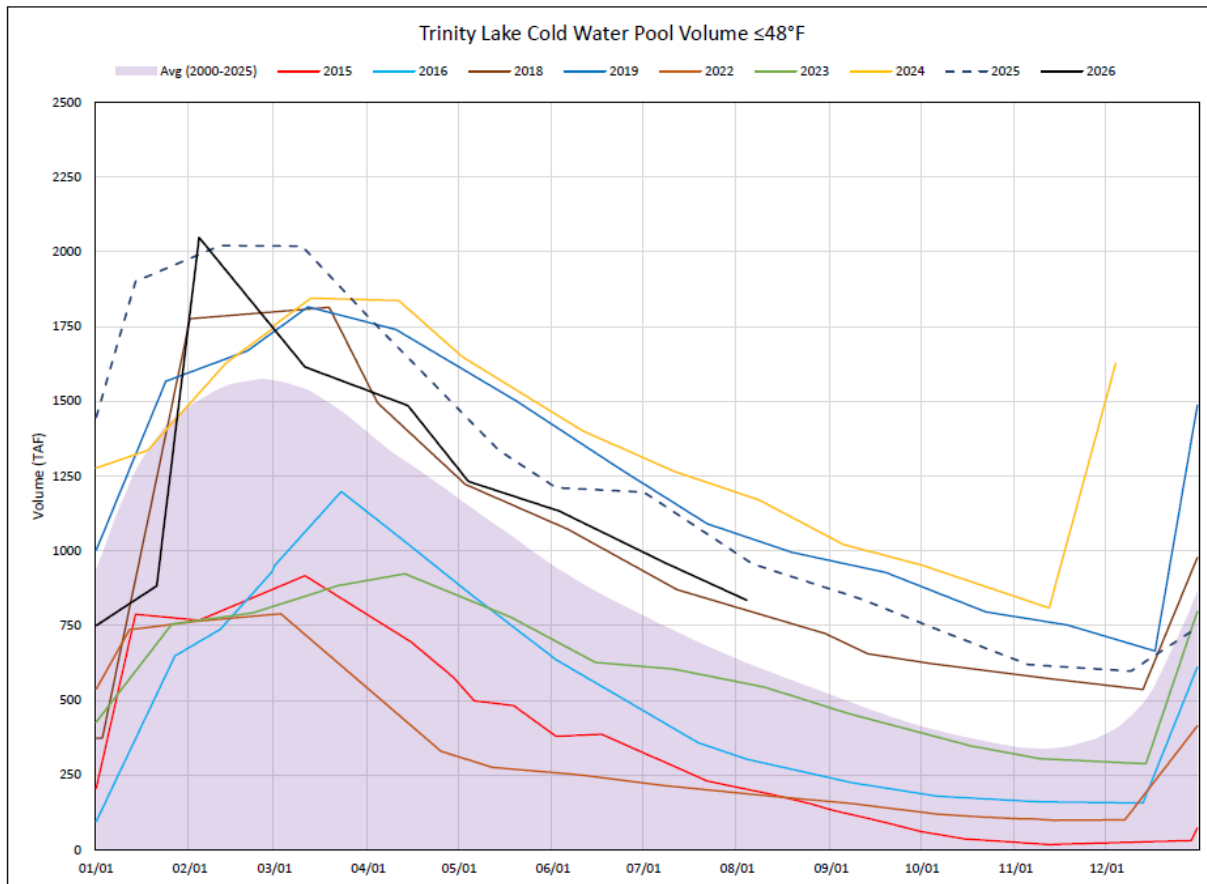


Figure 16. Trinity Lake Cold Water Pool Volume $\leq 48^{\circ}\text{F}$

The chart compares Trinity Lake's cold water pool volume at or below 48°F during 2026 with the long-term average (2000-2025) and selected historical years. In 2026, the cold water pool increased rapidly through winter, peaking at approximately 2.0 million acre-feet in early February, well above the long-term average and among the highest values shown. Volumes then declined steadily through spring and summer but remained above average through August at roughly 850 thousand acre-feet. Overall, 2026 reflects a relatively large and persistent reserve of the coldest water in Trinity Lake.

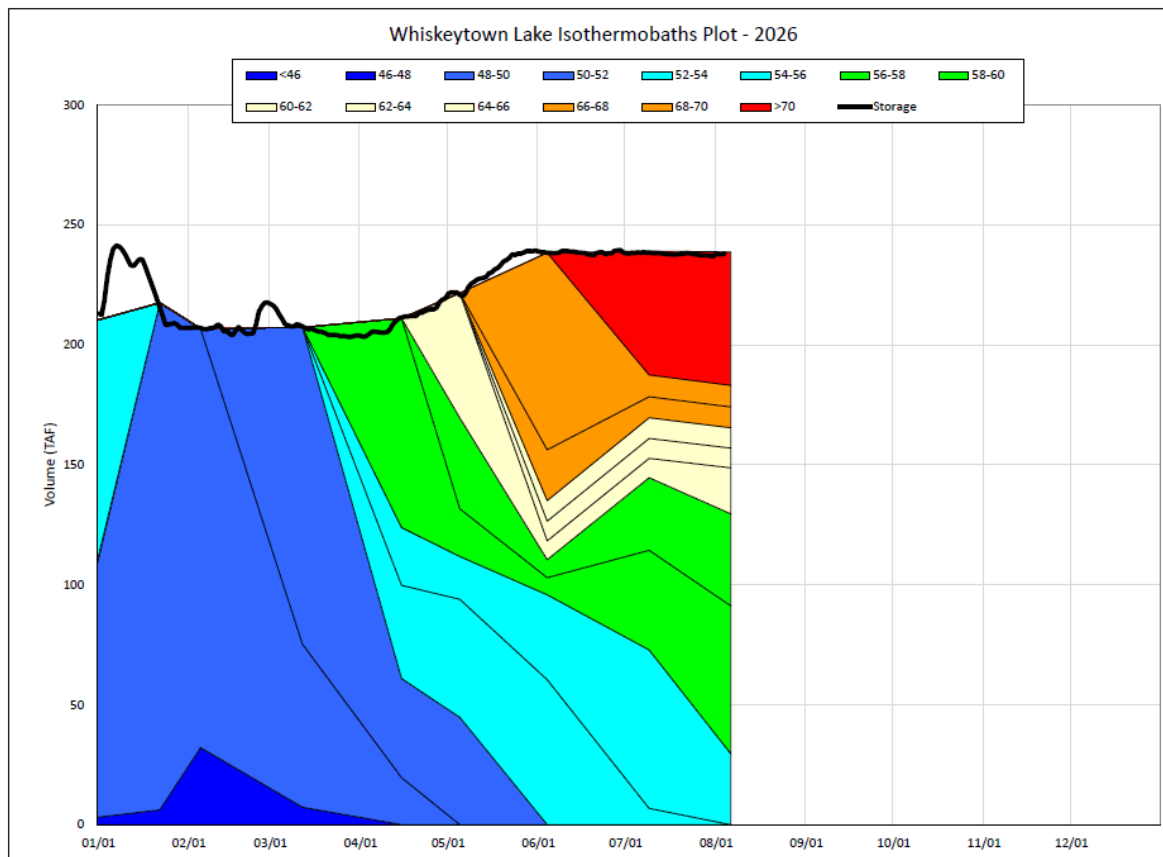


Figure 17. Whiskeytown Lake Isothermobaths Plot - 2026

The chart illustrates the seasonal distribution of water temperatures in Whiskeytown Lake during 2026, along with changes in reservoir storage from January through August. Cooler water temperatures below 54°F dominated the reservoir during winter and early spring, while warmer water layers expanded steadily as summer progressed. By June through August, temperatures above 60°F occupied much of the upper reservoir, with temperatures exceeding 70°F developing and increasing in volume. Reservoir storage remained relatively stable throughout the period, fluctuating between approximately 205 and 240 thousand acre-feet while gradually declining during the summer months.



Monthly Temperature Outlook

Valid: September 2026
Issued: August 20, 2026

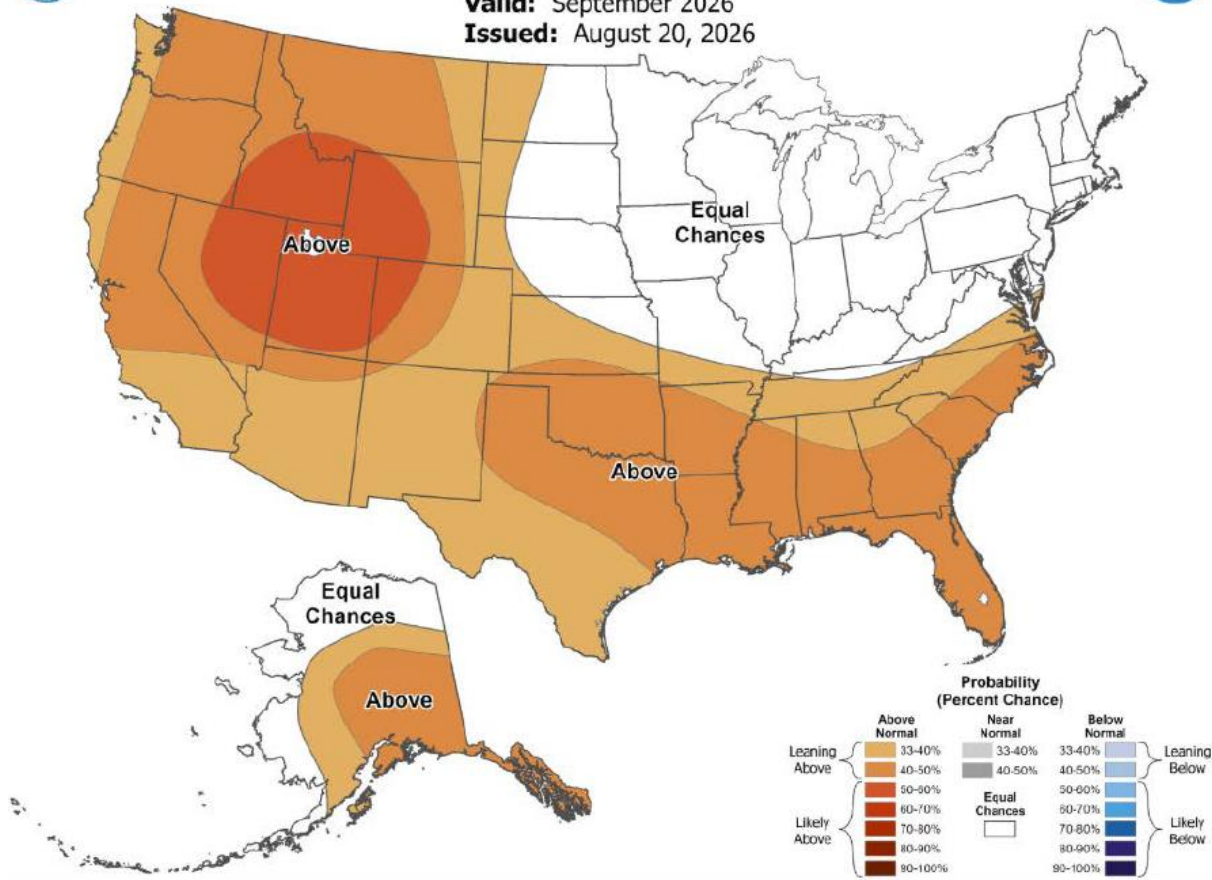


Figure 18. Monthly Temperature Outlook

The NOAA Climate Prediction Center outlook for September 2026 indicates an increased likelihood of above-normal temperatures across much of the western and southern United States. The highest probabilities of warmer-than-average conditions are centered over the Great Basin and central Rocky Mountain region, with additional areas of elevated warmth extending across the Southeast and parts of Alaska. Much of the Midwest and Northeast are forecast to have equal chances of above-, near-, or below-normal temperatures, indicating no strong temperature signal for those regions.

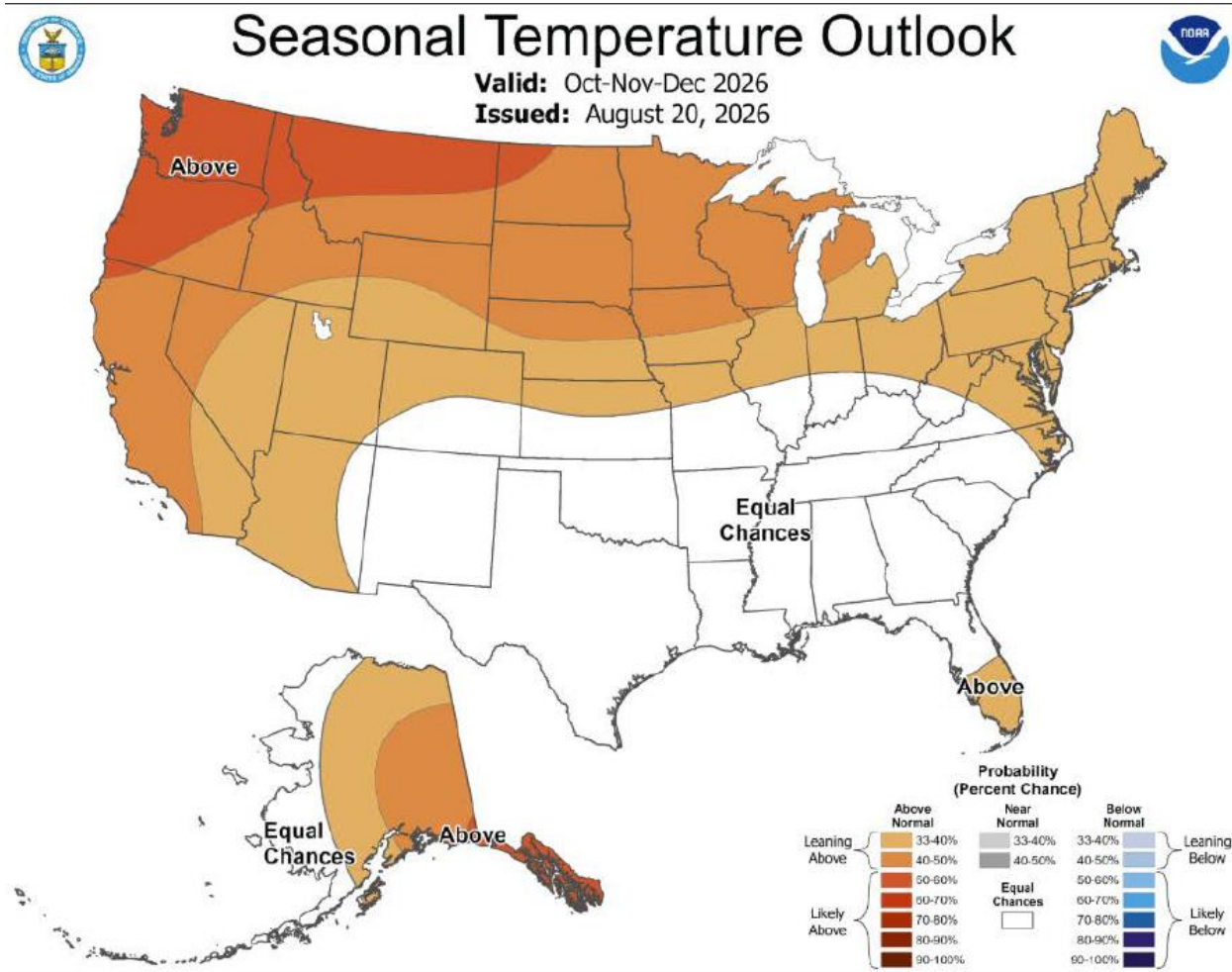


Figure 20. Seasonal Temperature Outlook

The NOAA Climate Prediction Center seasonal outlook for October through December 2026 indicates an increased likelihood of above-normal temperatures across much of the western, northern, and northeastern United States. The strongest warm signal is centered over the Pacific Northwest, with elevated chances for warmer-than-average conditions extending across the northern tier of states and much of the East Coast. Equal chances of above-, near-, or below-normal temperatures are forecast across much of the southern and south-central United States, indicating no strong seasonal temperature signal in those regions.



Seasonal Precipitation Outlook

Valid: Oct-Nov-Dec 2026

Issued: August 20, 2026

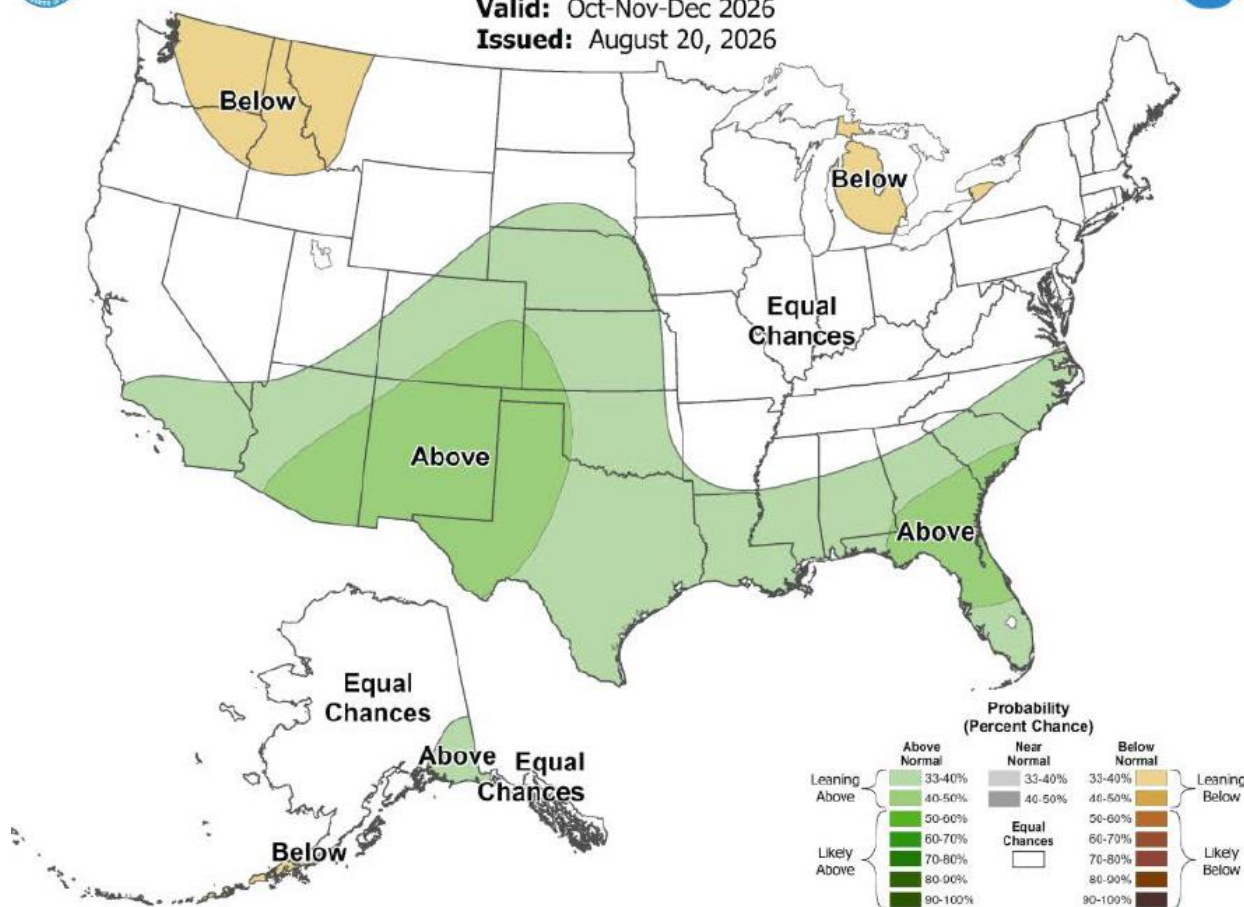


Figure 21. Seasonal Precipitation Outlook

The NOAA Climate Prediction Center seasonal outlook for October through December 2026 indicates increased chances of above-normal precipitation across portions of the Southwest, southern Plains, lower Mississippi Valley, Southeast, and parts of the Mid-Atlantic. The strongest wet signal is centered over New Mexico and west Texas, with additional areas of enhanced precipitation potential extending across the Gulf Coast and southeastern United States. Below-normal precipitation is favored in parts of the Pacific Northwest, the western Great Lakes region, and portions of the Aleutian Islands, while much of the central United States is forecast to have equal chances of above-, near-, or below-normal precipitation.

Estimated CVP Operations 50% Exceedance

Table 7. Storages – Federal End of the Month Storage/Elevation (TAF/Feet)

Facility	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Trinity	1898	1778	1642	1584	1551	1529	1593	1705	1834	1963	1793	1666	1560
Trinity Elev.	NA	2325	2315	2310	2307	2306	2311	2319	2329	2338	2326	2316	2308
Whiskeytown	267	238	238	206	206	206	206	206	206	206	238	238	238
Whiskeytown Elev.	NA	1209	1209	1199	1199	1199	1199	1199	1199	1199	1209	1209	1209
Shasta	3054	2545	2351	2225	2318	2655	3058	3633	4212	4430	4493	4182	3662
Shasta Elev.	NA	987	977	970	975	992	1010	1034	1055	1063	1065	1054	1035
Folsom	648	436	311	279	279	299	390	556	745	873	937	909	696
Folsom Elev.	NA	408	389	383	383	387	402	423	444	456	462	460	439
New Melones	1617	1557	1509	1459	1471	1489	1525	1554	1615	1625	1712	1716	1643
New Melones Elev.	NA	1009	1004	999	1000	1002	1006	1009	1015	1016	1025	1025	1018
Federal San Luis	392	299	234	267	238	294	476	590	720	711	592	470	197
Total	7876	6853	6286	6020	6062	6471	7248	8243	9331	9807	9765	9180	7996

Table 8. State End of the Month Reservoir Storage (TAF)

Facility	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Oroville	2513	2000	1604	1386	1350	1396	1614	2005	2388	2798	2967	2792	2280	2000
Oroville Elev.	NA	783	742	717	712	718	743	783	817	849	862	849	808	783
State San Luis	750	757	842	848	803	980	956	931	824	694	522	356	370	757
Total San Luis (TAF)	1142	1056	1076	1114	1041	1274	1432	1521	1545	1406	1114	826	567	1056
Total San Luis Elev.	NA	458	460	464	457	479	493	501	503	491	464	435	405	458

Table 9. Monthly River Releases (TAF/cfs)

Facility	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Trinity (TAF)	53	52	23	18	78	18	17	18	59	258	126	28
Trinity (cfs)	857	870	373	300	1,276	300	300	300	1,000	4,189	2,120	450
Clear Creek (TAF)	6	7	10	12	16	18	17	18	15	18	13	7
Clear Creek (cfs)	100	120	157	210	260	293	300	286	247	295	215	113

Facility	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Sacramento (TAF)	776	422	430	244	200	200	180	246	416	492	684	818
Sacramento (cfs)	12630	7100	7000	4100	3250	3250	3250	4000	7000	8000	11500	13300
American (TAF)	287	178	114	93	93	61	67	123	297	400	249	332
American (cfs)	4661	3000	1851	1569	1512	1000	1200	2000	5000	6500	4183	5400
Stanislaus (TAF)	12	12	39	12	12	12	28	32	53	54	37	12
Stanislaus (cfs)	200	200	635	200	200	200	497	523	898	880	630	200
Feather (TAF)	498	482	246	74	77	65	58	65	62	65	226	467
Feather (cfs)	8100	8100	4000	1250	1250	1050	1050	1050	1050	1050	3800	7600

Table 10. Trinity Diversions (TAF)

Diversion Facility	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Carr PP	67	87	45	46	0	0	0	0	16	126	97	96
Spring Creek PP	90	80	70	40	0	17	28	20	25	90	90	90

Table 11. Delta Summary (TAF)

Facility	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Tracy	256	143	214	70	109	235	225	250	163	183	249	149
USBR Banks	22	57	22	0	0	0	0	0	0	0	0	0
Contra Costa	12.7	14.0	14.0	16.0	18.0	14.0	14.0	12.7	12.7	12.7	9.8	11.1
Total USBR	291	209	250	86	127	249	239	263	175	196	259	160
State Export	377	339	232	149	350	155	150	171	60	49	130	341
Total Export	668	548	482	235	477	404	389	434	235	245	389	501
COA Balance	0	0	-1	0	0	0	0	0	0	0	0	-1
Vernalis (TAF)	49	54	108	83	83	91	127	140	143	146	84	51
Vernalis (cfs)	802	906	1757	1393	1355	1485	2280	2280	2398	2380	1420	834
Old/Middle River calc.	-8,593	-7,275	-5,837	-3,005	-5,955	-4,982	-4,959	-4,997	-2,551	-2,583	-4,983	-6,491
Computed DOI	9500	8506	8004	8001	8004	13665	18767	19976	17600	12981	9497	11501
Excess Outflow	0	504	0	0	0	5661	7366	8573	6203	2554	0	0
% Export/Inflow	44%	43%	43%	29%	47%	33%	27%	25%	17%	20%	33%	33%

Facility	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
% Export/inflow std.	65%	65%	65%	65%	65%	65%	45%	35%	35%	35%	35%	65%

Table 12. Hydrology

Statistic	Trinity	Shasta	Folsom	New Melones
Water Year Inflow (TAF)	1102	4938	2416	781
Year to Date + Forecasted % of mean	91%	89%	89%	74%

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.

CVP operational forecasts or outlooks represent general system-wide dynamics and do not necessarily address specific watershed/tributary details.

CVP releases or export values represent monthly averages.

CVP Operations are updated monthly as new hydrology information is made available December through May.

Estimated CVP Operations 90% Exceedance

Table 13. Storages – Federal End of the Month Storage/Elevation (TAF/Feet)

Facility	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Trinity	1898	1722	1555	1476	1420	1350	1353	1384	1442	1545	1376	1260	1133
Trinity Elev.	NA	2321	2308	2301	2296	2290	2290	2293	2298	2307	2293	2282	2269
Whiskeytown	237	238	238	206	206	206	206	206	206	206	238	238	238
Whiskeytown Elev.	NA	1209	1209	1199	1199	1199	1199	1199	1199	1199	1209	1209	1209
Shasta	3054	2584	2351	2200	2161	2220	2337	2520	2731	2817	2682	2336	1868
Shasta Elev.	NA	988	977	969	966	970	976	985	995	999	993	976	949
Folsom	648	446	386	334	294	298	312	371	494	652	757	650	505
Folsom Elev.	NA	410	401	393	386	387	389	399	416	434	445	434	417
New Melones	1617	1555	1507	1447	1444	1442	1448	1406	1385	1295	1195	1074	998
New Melones Elev.	NA	1009	1004	997	997	997	997	993	990	980	968	952	942
Federal San Luis	392	381	374	356	324	328	438	478	549	521	380	244	81
Total	7846	6928	6412	6020	5849	5843	6093	6365	6806	7035	6628	5802	4822

Table 14. State End of the Month Reservoir Storage (TAF)

Facility	Jun	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Oroville	2513	2016	1665	1426	1299	1226	1282	1422	1636	1736	1656	1350	968
Oroville Elev.	NA	784	749	722	706	696	704	721	746	756	748	712	659
State San Luis	750	860	907	885	827	728	764	800	757	662	500	345	101
Total San Luis (TAF)	1142	1241	1281	1242	1151	1056	1202	1278	1306	1183	880	589	182
Total San Luis Elev.	NA	476	480	476	468	458	472	479	482	471	441	408	349

Table 15. Monthly River Releases (TAF/cfs)

Facility	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Trinity (TAF)	53	52	23	18	78	18	17	28	32	180	47	28
Trinity (cfs)	857	870	373	300	1,276	300	300	450	540	2,924	783	450
Clear Creek (TAF)	6	7	10	12	16	18	17	18	15	18	13	7
Clear Creek (cfs)	100	120	157	210	260	293	300	286	247	295	215	113
Sacramento (TAF)	762	476	430	306	200	200	194	307	357	553	684	768
Sacramento (cfs)	12400	8000	7000	5150	3250	3250	3500	5000	6000	9000	11500	12500
American (TAF)	277	110	92	83	49	49	44	49	48	69	178	205
American (cfs)	4500	1853	1500	1393	800	802	800	800	813	1128	3000	3342
Stanislaus (TAF)	12	12	39	12	12	12	57	54	68	72	53	12
Stanislaus (cfs)	200	200	635	200	200	200	1019	881	1151	1167	899	200
Feather (TAF)	473	422	227	74	77	77	58	65	134	105	250	277
Feather (cfs)	7700	7100	3700	1250	1250	1250	1050	1050	2250	1700	4200	4500

Table 16. Trinity Diversions (TAF)

Diversion Facility	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Carr PP	124	118	61	51	12	10	5	0	1	134	121	122
Spring Creek PP	115	110	85	40	0	0	0	2	1	90	110	115

Table 17. Delta Summary (TAF)

Facility	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Tracy	283	170	137	58	50	153	132	160	84	55	98	93
USBR Banks	13	43	13	0	0	0	0	0	0	0	0	0
Contra Costa	12.0	12.0	14.0	14.0	14.0	14.0	14.0	12.0	12.0	12.0	10.0	11.0
Total USBR	308	225	164	72	64	167	146	172	96	67	108	104
State Export	386	288	208	112	54	180	176	168	36	37	61	48
Total Export	694	513	372	184	118	347	322	340	132	104	169	152
COA Balance	11	0	0	0	-63	-64	-63	-63	-145	-153	-153	-153
Vernalis (TAF)	40	46	98	74	75	75	127	140	125	132	84	45
Vernalis (cfs)	655	772	1595	1242	1225	1225	2280	2280	2109	2143	1420	737
Old/Middle River calc.	-8,988	-6,883	-4,532	-2,413	-1,517	-4,385	-4,030	-3,823	-1,347	-931	-2,138	-2,162
Computed DOI	7499	7497	7646	7497	7499	7499	7510	10395	8539	7499	9010	9500
Excess Outflow	0	0	146	0	0	0	0	2896	0	0	0	0
% Export/Inflow	49%	45%	38%	25%	17%	44%	43%	35%	17%	13%	17%	14%
% Export/inflow std.	65%	65%	65%	65%	65%	65%	45%	35%	35%	35%	35%	65%

Table 18. Hydrology

Statistic	Trinity	Shasta	Folsom	New Melones
Water Year Inflow (TAF)	1102	4923	2412	778.266449
Year to Date + Forecasted % of mean	91%	89%	89%	74%

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.

CVP operational forecasts or outlooks represent general system-wide dynamics and do not necessarily address specific watershed/tributary details.

CVP releases or export values represent monthly averages.

CVP Operations are updated monthly as new hydrology information is made available December through May.

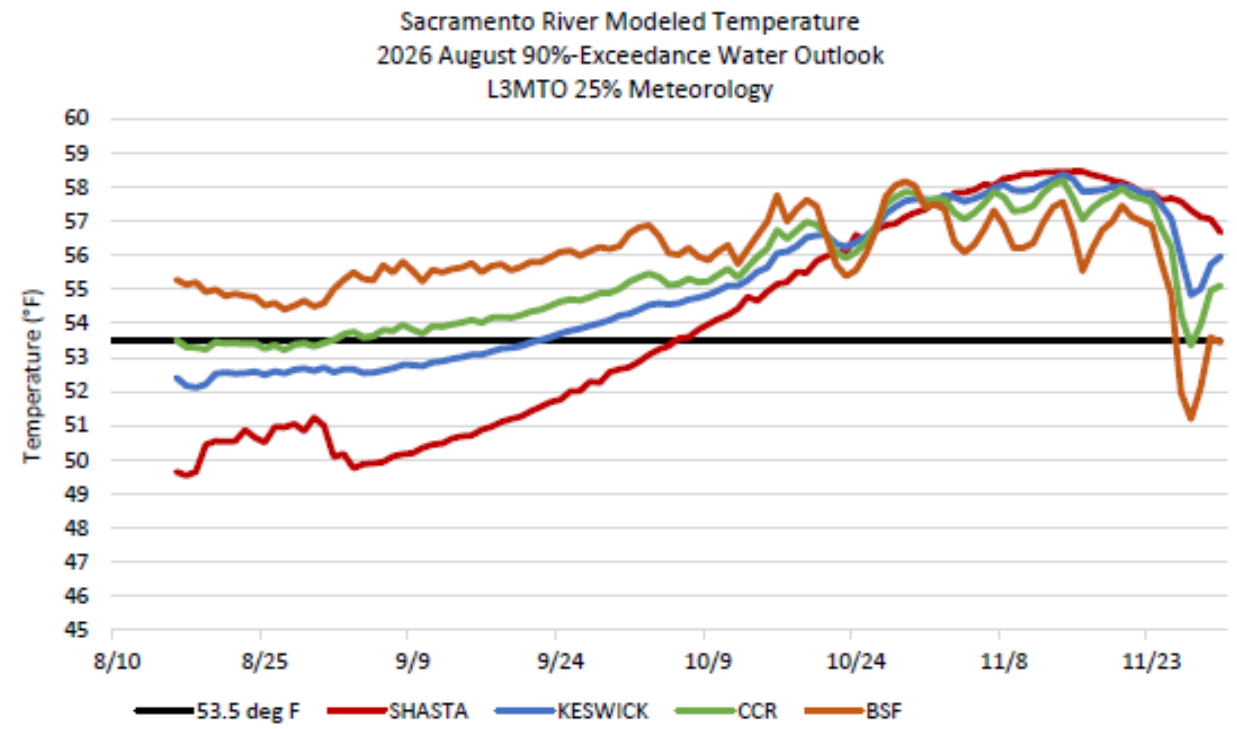


Figure 22. Sacramento River Modeled Temperature

The chart presents modeled Sacramento River water temperatures under the August 2026 90% exceedance water outlook scenario at four locations: Shasta, Keswick, Clear Creek Road (CCR), and Balls Ferry (BSF). Temperatures generally increase from mid-August through mid-November, with most locations rising from about 50-55°F to 57-59°F before declining slightly in late November. Throughout the period, modeled temperatures remain near or above the 53.5°F reference line, with BSF generally exhibiting the warmest temperatures. Short-term fluctuations occur during October and November, but overall trends indicate gradual seasonal warming followed by late-autumn cooling.

Run date: 08/11/2026

EOM Sept storage: 2.3 MAF

Trinity profile date: 08/05/2026

Whiskeytown profile date: 08/06/2026

Shasta profile date: 08/11/2026

Projected Side gates: First N/A Full Sep 2nd

End of September Cold-Water-Pool less than 56 deg F: 254 TAF

End of September Cold-Water-Pool less than 52 deg F: 87 TAF

End of September Cold-Water-Pool less than 48 deg F: 16 TAF

Table 19. Facility Temperature Outlook in Degrees Fahrenheit

Month	Shasta	Keswick	CCR
September	51.0	53.2	54.2
October	55.1	55.8	56.2
November	57.9	57.5	57.0

Table 20. May Forecast

CWP	Pre-Fix 31-May	Post-Fix 31-May	Pre-Fix 30-June	Post-Fix 30-June	Pre-Fix 31-Jul	Post-Fix 31-Jul	Pre-Fix 31-Aug	Post-Fix 31-Aug	Pre-Fix 30-Sep	Post-Fix 30-Sep
CWP < 56	2569	2513	1994	1961	1437	1404	701	666	333	308
CWP < 52	2178	2155	1668	1674	1040	1040	466	462	146	142
CWP < 48	435	443	353	365	205	215	99	107	26	28

Table 21. June Forecast

CWP	Pre-Fix 30-June	Post-Fix 30-June	Pre-Fix 31-Jul	Post-Fix 31-Jul	Pre-Fix 31-Aug	Post-Fix 31-Aug	Pre-Fix 30-Sep	Post-Fix 30-Sep
CWP < 56	1991	1956	1327	1314	618	585	268	241
CWP < 52	1554	1520	838	833	396	376	110	98
CWP < 48	309	310	196	197	91	92	30	30

Table 22. July Forecast

CWP	Pre-Fix 31-Jul	Post-Fix 31-Jul	Pre-Fix 31-Aug	Post-Fix 31-Aug	Pre-Fix 30-Sep	Post-Fix 30-Sep
CWP < 56	1226	1223	500	494	174	175
CWP < 52	740	742	290	275	58	57
CWP < 48	166	166	62	57	17	17

Temperature-Dependent Mortality (TDM) Estimates for the 2026 Sacramento River Temperature Management Season

August 25, 2026

Southwest Fisheries Science Center · UC Santa Cruz · CVTEMP Operational Platform

The Southwest Fisheries Science Center (SWFSC) simulated one Keswick release scenario, a USBR 90th-exceedance forecast (Forecast_90), to evaluate temperature-dependent mortality (TDM). The Forecast_90 values were provided by USBR in the August 90% forecast. The scenario was forced with hydrology from the May B120 90th percentile Shasta inflow, meteorology from the historical year 2014, selected as a representative warm year consistent with the NOAA seasonal outlook for summer 2026, and a downstream temperature target at Clear Creek of 53.6 °F. TDM was estimated using the stage-independent egg-mortality model (Martin et al., 2017) and the stage-dependent model (Anderson et al., 2022) over 13 historical redd-year distributions (2013–2025).

Carcass survey data were used as a second method of estimating where and when spawning occurred, alongside the aerial redd survey data, over the same 13 years. Carcass survey data from the 2026 season were also carried forward as a provisional estimate of this year's carcass-based TDM. Unlike previous runs, no comparison to USBR's Water Temperature Modeling Platform (WTMP) is included.

Predicted mean monthly water temperatures are shown in Table 1. These are monthly averages of daily mean water temperatures under the August Forecast_90 scenario at three sites, Shasta, Keswick, and CCR, from August through December. Temperatures rise steadily from August through a November peak and then ease in December. At CCR the monthly mean climbs from 53.3 °F in August to 57.6 °F in November before falling back to 56.1 °F in December. At CCR, the 53.6 °F target is held only in the early part of the window. Modeled CCR temperatures exceed the target on 28 of 30 days in September and on every day in October and November.

Averaged over the 2013–2025 series, predicted TDM was driven more by the choice of mortality model than by the spawning distribution. The stage-independent model produced higher mortality than the stage-dependent model: population means of 17 (8-43) versus 4 (1-17) using redd-based spawning distributions, and 14 (8-26) versus 4 (1-12) using carcass-based distributions (percent, with the range across years in parentheses). Within each model, redd- and carcass-based distributions gave broadly similar long-term means, but they diverged sharply in individual years, reflecting the different spatial and temporal egg placements the two methods assume. 2025 was the highest-mortality year under both redd-based combinations (43% stage-independent, 17% stage-dependent) but not under the carcass-based ones: 2017 matched or exceeded it, at 26% under the stage-independent model and 12% versus 6% under the stage-dependent model.

Carcass survey data for 2026 added further context (Table 5). The 2026 distribution is strongly upstream-weighted, with 64% of carcasses recovered in section 1 (nearest Keswick Dam) against 39% in 2025, and it has run earlier: the median spawn date is 12 July for 2026 against 19 July for 2025. Both differences reduce exposure to the fall warming described below. The carcass survey is still in progress, but the resulting provisional 2026 stage-independent TDM is 19%.

Below is a summary of the model setup, followed by results.

For additional details visit the [Central Valley Temperature and Exposure webpage](#).

Overview

Total release scenarios simulated: 1

- Keswick (KWK) release scenario based on USBR July 90% operations forecast (Forecast_90)

TDM Forecast start date: 04/01/2026

Reservoir Forecast start date: 08/25/2026

Simulation start date: 08/17/2026

Simulation end date: 12/31/2026

Models used:

Shasta Reservoir: CE-QUAL-W2 hydrodynamic model (Cole & Wells, 2006; Daniels et al., 2018)

Keswick Reservoir: CE-QUAL-W2 hydrodynamic model (Cole & Wells, 2006)

Upper Sacramento River: RAFT river temperature model (Pike et al., 2013; Daniels et al., 2018)

Temperature-dependent egg mortality: Stage-independent model (Martin et al., 2017) & Stage-dependent model (Anderson et al., 2022)

Reservoir Release Scenarios

A single reservoir release scenario was simulated and paired with a Spring Creek (SPP; Trinity import) profile.

Table 23. Keswick Releases (CFS) — monthly mean

Label	Description	Sep	Oct	Nov	Dec
Forecast_90	USBR 90th exceedance flow forecast	8000	7000	5150	4000

Table 24. Trinity Imports via Spring Creek PP (TAF/month)

Month	Sep	Oct	Nov	Dec
Release	110	85	40	0

Hydrology

All simulations were forced with DWR Bulletin 120 (B120) Shasta Reservoir inflow forecasts at the exceedance level of 90th percentile. Exceedance level affects only Shasta Reservoir inflow.

Inflow method: B120 (DWR Bulletin 120)

B120 file date: May 2026

Exceedance level: 90th percentile

Meteorology

All simulations used the meteorological time series from the historical record for year 2014 applied over the full forecast window (8/18/2026 – 12/31/2026). Over the hindcast window (4/01/2026 – 8/18/2026) output from the Global Forecast System (GFS; NCEP 2004) was used. The 2014 meteorological year was selected for this single-year simulation as a representative warm-year condition. Previous analyses (shared 5/11/2026) identified 2014 as a comparatively warm year in the historical record, and the NOAA 90-day seasonal outlook (as of 7/16/2026) projects above-normal temperatures across the Shasta region for July through September.

Initial Shasta Conditions

Temperature profile date: 08/17/2026

Temperature Window / Target Parameters

All scenarios share the same temperature window shaping parameters.

Target location: Clear Creek (CCR)

Window temperature: 12.0°C (53.6°F)

Shoulder temperature: NA

Window length: 26 weeks

Center date: 08/15/2026

Window start (derived): 05/16/2026

Window end (derived): 11/14/2026

TDM Model Parameters

All scenarios estimated TDM based on two models.

Table 25. TDM Models

Model	Tcrit (°C)	bT (°C-1 day-1)	Critical window	Egg data source
Stage-independent	12.00	0.0240	Deposition to emergence	Aerial and carcass survey **
Stage-dependent	11.82	0.4361	4 days prior to hatch	Aerial and carcass survey **

*see references for more information

**note, stage-independent model was calibrated with aerial survey data and stage-dependent model was calibrated using carcass survey data

Disclaimer

Results presented here are derived from numerical simulation and statistical models. All models are simplifications of complex physical and biological systems subject to structural uncertainty, parameter uncertainty, and errors in boundary condition data. Model outputs should not be interpreted as precise predictions or relied upon as the sole basis for operational or regulatory decisions without independent validation and expert judgment. Specifically, the CE-QUAL-W2 simulations include an automated Temperature Control Device (TCD) gate selection algorithm that adjusts Shasta Dam outlet configurations to minimize deviation from a prescribed downstream temperature target. This algorithm may achieve temperature targets with greater consistency than is attainable in real-world operations.

These simulations carry additional biological uncertainty as well: the temperature-dependent mortality (TDM) estimates translate simulated water temperatures into predicted mortality using relationships that are themselves simplified statistical representations calibrated from laboratory and field observations. Therefore, simulation results are intended to evaluate the relative merit of alternative strategies, not to guarantee achievable outcomes.

Results

Mean Monthly Temperatures

To provide context for the TDM results that follow, mean monthly water temperatures from the SWFSC and USBR simulations are shown (Table 25) at three locations: Shasta Dam release, Keswick Dam release, and Clear Creek (CCR). Values represent the mean across a single meteorology source used to drive the simulation.

Table 25. Mean monthly water temperatures (°F) based on daily means at Shasta Reservoir, Keswick Reservoir, and Clear Creek Gage (CCR) for September–December 2026 under the August Forecast_90 scenario from the SWFSC models.

Month	SWFSC Forecast_90 Shasta (°F)	SWFSC Forecast_90 Keswick (°F)	SWFSC Forecast_90 CCR (°F)
September	51.4	53.7	54.4
October	55.4	55.8	56.1
November	58.8	57.7	57.6
December	57.3	56.5	56.1

TDM Results

For the SWFSC temperature model, TDM is computed using the stage-independent temperature dependent egg mortality model (Martin et al., 2017) and the stage-dependent model (Anderson et al., 2022), run over 13 historical year distributions of redd and carcass data (2013–2025). Table 26 summarizes the population-mean TDM (with range across years) and the year 2025 case. Full year-by-year values are provided in Table 27 and Table 28.

Table 26. Predicted egg-to-fry mortality (%) under the August Forecast_90 scenario for two temperature sources (SWFSC and USBR), two mortality models (stage-independent and stage-dependent), and redd- and carcass-based spawning distributions. Each source shows the 2013–2025 population mean (range in parentheses) and the 2025 value.

Model	SWFSC Forecast_90 Population mean (2013–2025)	SWFSC Forecast_90 Year 2025
Redd Stage-independent	17 (8-43)	43
Carcass Stage-independent	14 (8-26)	26
Redd Stage-dependent	4 (1-17)	17
Carcass Stage-dependent	4 (1-12)	6

Table 27. Mean annual TDM (%) by redd and carcass year under the stage-independent model for the single flow scenario for the SWFSC temperature models. Values are mean TDM across all redds within each year (i.e., population average).

*Estimates of uncertainty are available upon request.

Redd Year	SWFSC Forecast_90 Redd stage-independent model	SWFSC Forecast_90 Carcass stage-independent model
2013	19	14
2014	11	11

Redd Year	SWFSC Forecast_90 Redd stage-independent model	SWFSC Forecast_90 Carcass stage-independent model
2015	15	9
2016	19	14
2017	23	26
2018	10	22
2019	14	11
2020	10	11
2021	8	11
2022	11	11
2023	18	8
2024	17	15
2025	43	26
Population Mean (2013-2025)	17	14
Population Min (2013-2025)	8	8
Population Max (2013-2025)	43	26

Notes: Values are weighted by observed count per year and represent an annual mean value of TDM for a population.

Table 28. Mean annual TDM (%) by redd and carcass year under the stage-dependent model for the single flow scenario for the SWFSC temperature models. Values are mean TDM across all redds within each year (i.e., population average). *Estimates of uncertainty are available upon request.

Redd Year	SWFSC Forecast_90 Redd stage-dependent model	SWFSC Forecast_90 Carcass stage-dependent model
2013	2	2
2014	2	1
2015	3	1
2016	9	2
2017	2	12
2018	1	6
2019	8	4
2020	1	3
2021	1	2
2022	1	1
2023	5	2
2024	5	6
2025	17	6
Population Mean (2013-2025)	4	4

Redd Year	SWFSC Forecast_90 Redd stage-dependent model	SWFSC Forecast_90 Carcass stage-dependent model
Population Min (2013-2025)	1	1
Population Max (2013-2025)	17	12

Notes: Values are weighted by observed count per year and represent an annual mean value of TDM for a population.

Provisional 2026 Carcass-Year Temperature-Dependent Mortality

Under the August forecast, the provisional 2026 carcass-year distribution yields a stage-independent temperature-dependent mortality of 19%, against 26% for the completed 2025 distribution. Season completion at p10/p50/p90 are shown. See document shared on 8/19/26 for more details.

Table 29. Provisional 2026 estimate. Carcass counts are survey data and are identical in the two columns.

Parameter	Result
Carcasses observed (through 15 Aug 2026)	2273
Projected p10/p50/p90	50/83/200
Observed-only TDM (a floor)	14%
Projection p10	16%
Projection p50 (reported value)	19%
Projection p90	25%
2025 actual, for comparison	26%

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Attachment 3 - Winter-run Chinook Salmon Temperature Dependent Mortality Estimates

Background

To update forecasts of temperature dependent mortality (TDM) of winter-run Chinook salmon for the 2026 Sacramento River Temperature Management Plan, two scenarios were developed on 08/11/2026 (Table 1). Scenario A targeted 53.5°F at Clear Creek (CCR) and Scenario B targeted 56°F at Clear Creek (CCR). A third scenario was added for comparison at the request of SRG on 8/21/2026 that evaluated a targeted 55°F at Clear Creek (CCR; Scenario C).

The modeling framework used spatially explicit, daily average water temperature forecasts from the WTMP model. These forecasts were applied at five locations along the Sacramento River: Keswick Dam (RKM 483), Sacramento River at Clear Creek (RKM 474), Anderson Airport Rd Bridge (RKM 467), Balls Ferry (RKM 458), and Jellys Ferry (RKM 451). RKM values for the three downstream stations were derived from published USGS/CDEC station coordinates by two-point calibration to the SacPAS-documented anchor RKMs at Keswick (483) and CCR (474), extended via great-circle distance — see Table 2 description. For locations between gauges, daily temperatures were estimated by linear interpolation along the river-kilometer axis. These temperature estimates were then matched to the river-kilometer locations of simulated winter-run Chinook redds.

Two redd-distribution data sources were used in parallel to bracket the structural sensitivity of TDM estimates to redd-source choice: (1) carcass-survey-derived redd locations and timing from the winter-run carcass survey record, brood years 2013–2025; and (2) aerial-survey-derived redd locations and timing, brood years 2013–2025. Carcass-derived redds occupy four reach bands between Keswick (RKM 483) and approximately RKM 454. Aerial-derived redds occupy six reach centroids between Keswick (RKM 482) and Jellys Ferry (RKM 452), reflecting the broader spatial coverage of aerial surveys. Both sources were carried through the analysis independently (Fig. 1-6); results are reported in parallel and are not combined into a single weighted estimate.

TDM was estimated by simulating the thermal history of each redd throughout its incubation period using two mortality kernels, both of which are referenced in the 2025 Long-Term Operations Record of Decision and supported by SacPAS Fish Model documentation. The stage-independent kernel (Martin et al. 2017) accumulates mortality continuously throughout the incubation period from spawn to emergence using a single critical-temperature threshold. The stage-dependent kernel (Anderson 2022) accumulates mortality only during a 4-day pre-hatch critical window. Both kernels use the linear development model of Zeug et al. (2012), with hatching at 400 accumulated thermal units (ATU) and emergence at 958 ATU. Aggregate TDM is reported as $100 \times (1 - \text{mean } V)$, where V is per-redd thermal survival and the mean is taken across all redds for the year. TDM was computed separately for each brood year using that year's observed redd distribution, and pooled values reported below are the simple mean across years.

Table 30. Summary of winter-run Chinook salmon TDM estimates for the 08/11/2026 proposed 2026 Sacramento River Temperature Management Plan Scenario A (53.5°F at CCR target) and Scenario B (56°F at CCR target) and 8/21/2026 Scenario C (55°F at CCR target). Pooled values are the simple mean of per-brood-year TDM estimates across the 13 years available for each redd source. Range columns show the minimum and maximum per-year value across the same set of years; the 2025 column is the single-year estimate for brood year 2025 (the most recent year).

Redd source × Kernel	Scenario A Pooled mean (%)	Scenario A Range minimum (%)	Scenario A Range maximum (%)	Scenario A Brood year 2025 (%)	Scenario B Pooled mean (%)	Scenario B Range minimum (%)	Scenario B Range maximum (%)	Scenario B Brood year 2025 (%)	Scenario C* Pooled mean (%)	Scenario C* Range minimum (%)	Scenario C* Range maximum (%)	Scenario C* Brood year 2025 (%)
Carcass × Stage-dependent (Anderson, 2022)	1.7	0.2	8.7	1.0	29.1	13.9	54.3	54.3	18.8	8.4	38.0	34.8
Carcass × Stage-independent (Martin et al., 2017)	10.4	4.7	22.4	19.9	49.1	43.7	60.4	60.4	17.9	12.3	32.3	24.5
Aerial × Stage-dependent (Anderson, 2022)	14.6	4.5	30.5	30.5	41.9	20.2	80.3	80.3	34.7	15.9	65.7	65.7
Aerial × Stage-independent (Martin et al., 2017)	18.3	7.9	47.7	47.7	57.1	48.2	79.3	79.3	34.0	22.4	56.7	56.7

*Note that Scenario C uses observed temperatures through 8/21/2026 rather than 8/16/2026.

Table 28. Modeling assumptions for the TDM estimates in Table 1.

Parameter	Associated information
Meteorology source	25% exceedance L3MTO
Time period	1/1/2026 – 08/15/2026: observed temperatures; 08/16/2026 – 11/30/2026: simulated temperatures
Reservoir model	WTMP CE-QUAL-W2
River model	WTMP HEC-ResSim
Shasta profile date	08/11/2026
TCD gate operations	WTMP CE-QUAL-W2
Sacramento River water temperatures	WTMP CE-QUAL-W2 daily mean output at five gauge stations: Keswick Dam, Sacramento River at Clear Creek, Anderson Airport Rd Bridge, Balls Ferry, and Jellys Ferry.
Gauge station RKM convention	Keswick = RKM 483 and CCR = RKM 474 are SacPAS Fish Model conventions documented in Anderson (2022) and SacPAS notes. RKM values for the three downstream stations (Airport, BSF, JLF) are derived programmatically from the published USGS/CDEC station coordinates by two-point calibration: a linear relationship between great-circle distance from Keswick and SacPAS RKM is fit to the two anchor stations (slope ≈ -0.821 RKM/km), then extrapolated downstream. The result is RKM 467 (Airport), RKM 458 (BSF), and RKM 451 (JLF). This convention is used because (a) it reproduces both anchor RKMs by construction, (b) it extends the same proportionality SacPAS implies between Keswick and CCR, and (c) it is fully reproducible from the published station coordinates.
Spatial interpolation between gauges	Linear interpolation along the river-kilometer axis between adjacent gauge stations. Nearest-endpoint extrapolation is applied only outside the Keswick–Jellys Ferry envelope (RKM 483–451); all redds in this analysis fall within the envelope and receive a properly interpolated trace.
Biological framework	SacPAS Fish Model framework (temperature effect only). Kernel parameters, ATU thresholds, and integration conventions match SacPAS v3 manual specifications.
Temperature mortality kernels	Both kernels referenced in the 2025 LTO ROD: stage-independent (Martin et al., 2017) — continuous hazard over the full incubation period; stage-dependent (Anderson, 2022) — hazard concentrated in a 4-day pre-hatch critical window.
Kernel functional form	Both kernels of the form $V = \exp(-b \times \sum \max(T - T_{crit}, 0))$, where the summation window and the parameter values differ between kernels. Aggregate TDM = $100 \times (1 - \text{mean } V)$ across redds.
Egg-emergence timing model	Linear (Zeug et al., 2012, as implemented in SacPAS): hatch at 400 ATU (accumulated thermal units, °C·days); emergence at 958 ATU.
T_crit (50th percentile)	Stage-independent: 12.10°C (53.78°F). Stage-dependent: 11.82°C (53.28°F). Both values are 50th-percentile point estimates from the original calibrations and match SacPAS Fish Model defaults.

Parameter	Associated information
Kernel rate parameter (50th percentile)	Stage-independent (α): 0.026 °C ⁻¹ ·d ⁻¹ . Stage-dependent ($b\delta$): 0.436 °C ⁻¹ ·d ⁻¹ . Both values are 50th-percentile point estimates and match SacPAS Fish Model defaults. No parameter uncertainty is propagated; estimates are deterministic at these values.
Critical days (mortality accumulation window)	Stage-independent: full incubation period (spawn through emergence; ~120–180 days depending on incubation temperature). Stage-dependent: 4 days immediately preceding hatch.
Redd time distribution — source 1	Carcass-survey daily redd counts from the SacPAS dbcarcass record, brood years 2013–2025.
Redd time distribution — source 2	Aerial-survey daily redd counts, brood years 2013–2025.
Redd space distribution — source 1	Carcass-survey reach reporting at four RKMs: 483, 479 (KWK_ACID), 474 (ACID_HWY44), 454 (downstream of CCR).
Redd space distribution — source 2	Aerial-survey reach reporting at six reach-centroid RKMs: 482 (KWK_ACID), 474 (ACID_HWY44), 470 (HWY44_BTL), 463 (Airport→Balls Ferry), 456 (Balls Ferry→Battle Creek), 452 (Battle Creek→Jellys Ferry).
Per-year analysis	TDM was computed for each brood year separately using that year's redd distribution and the same proposed 2026 temperature scenario. Pooled values are the simple mean of per-year TDM.
Treatment of redd sources	The two redd sources are not combined into a single weighted estimate. Both are reported in parallel because each represents real signal-plus-noise from a different sampling method, with different detection biases and different spatial coverage.
Uncertainty propagation	None. Estimates are deterministic at the 50th-percentile parameter values and at the single proposed 2026 temperature scenario. Year-to-year variation in Table 1 reflects only the variability in observed redd distributions across brood years, not parameter uncertainty or temperature-scenario uncertainty.

Limitations and interpretation

These are deterministic forward projections based on single proposed temperature scenarios and the 50th-percentile point estimates of each kernel's parameters. They do not propagate parameter uncertainty, weather variability, or operational uncertainty in the temperature scenario itself. Year-to-year variation in Table 1 reflects only the variability in observed redd distributions across brood years.

Please refer to the original Attachment 3 for a more detailed discussion of limitations and interpretations of the carcass-derived versus aerial-derived redd data and the stage-dependent versus stage-independent kernels.

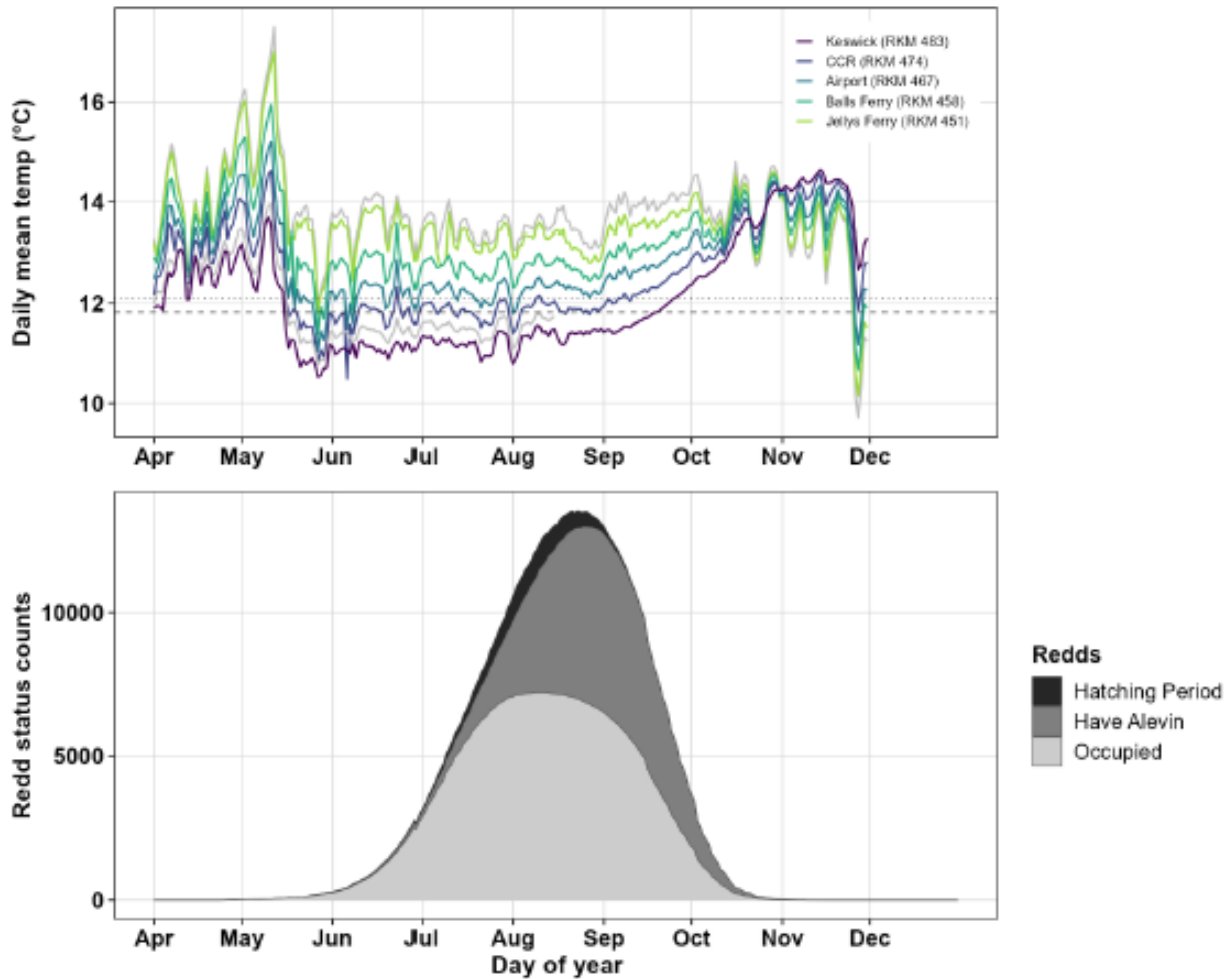


Figure 23. Daily Mean Water Temperature and Redd Status Counts

Daily mean water temperature at the five WTMP gauge stations (Keswick at RKM 483, Clear Creek at RKM 474, Airport Rd Bridge at RKM 467, Balls Ferry at RKM 458, Jellys Ferry at RKM 451) under the 08/11/2026 proposed 2026 Sacramento River Temperature Management Plan scenario A (53.5°F target at CCR), with daily winter-run Chinook salmon redd-deposition counts summed across reaches and brood years 2013–2025 (carcass-derived). Observed temperatures shown through 18 August 2026; CE-QUAL-W2 simulated temperatures thereafter. Horizontal dashed line: $T_{crit} = 11.82^{\circ}\text{C}$ (stage-dependent kernel; Anderson 2022), horizontal dotted line: $T_{crit} = 12.10^{\circ}\text{C}$ (stage-independent kernel; Martin et al. 2017).

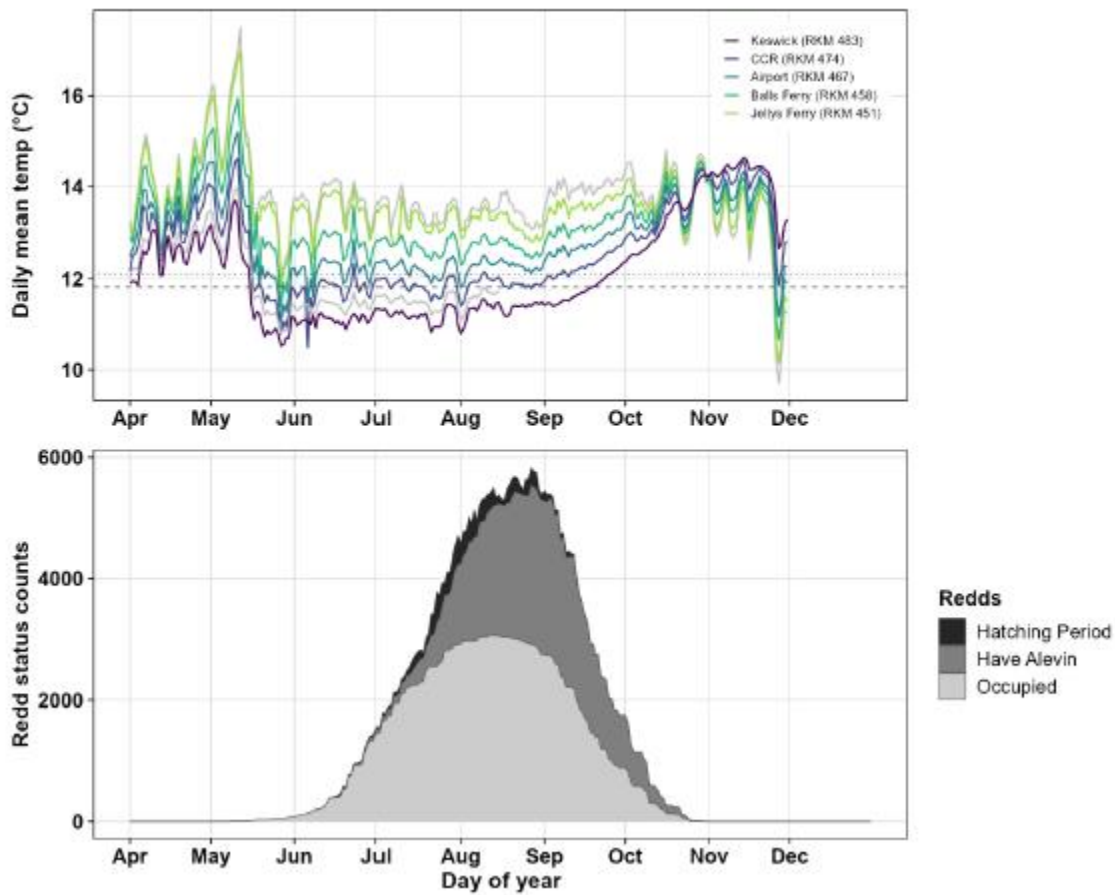


Figure 24. Daily Mean Water Temperature and Redd Status Counts

Daily mean water temperature at the five WTMP gauge stations (Keswick, CCR, Airport Rd, Balls Ferry, Jellys Ferry) under the 08/11/2026 proposed 2026 Sacramento River Temperature Management Plan scenario A (53.5°F target at CCR), with daily winter-run Chinook salmon redd-deposition counts summed across reaches and brood years 2013–2025 (aerial-derived). Observed temperatures shown through 18 August 2026; CE-QUAL-W2 simulated temperatures thereafter. Horizontal dashed line: $T_{crit} = 11.82^{\circ}\text{C}$ (stage-dependent kernel; Anderson 2022), horizontal dotted line: $T_{crit} = 12.10^{\circ}\text{C}$ (stage-independent kernel; Martin et al. 2017).

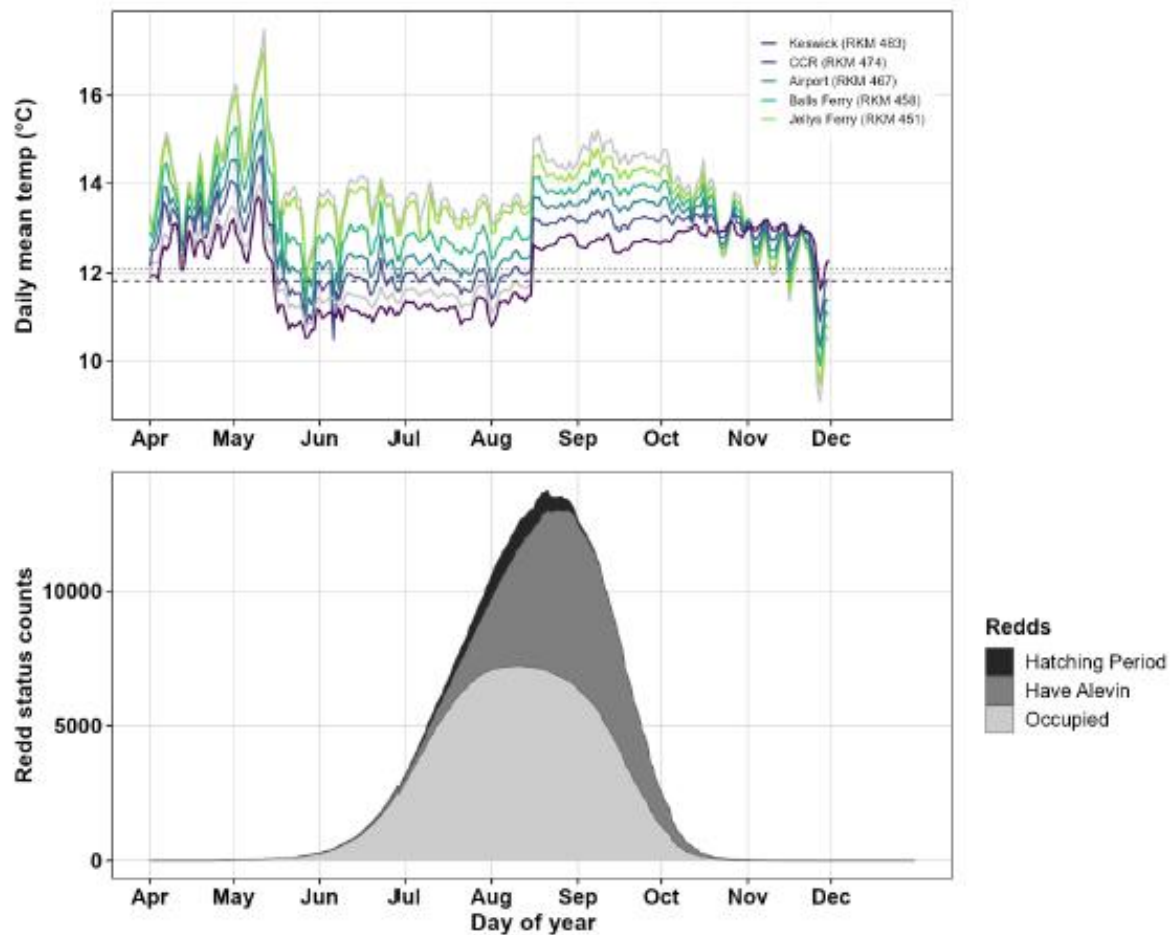


Figure 25. Daily Mean Water Temperature and Redd Status Counts

Daily mean water temperature at the five WTMP gauge stations (Keswick at RKM 483, Clear Creek at RKM 474, Airport Rd Bridge at RKM 467, Balls Ferry at RKM 458, Jellys Ferry at RKM 451) under the 08/11/2026 proposed 2026 Sacramento River Temperature Management Plan scenario B (56°F target at CCR), with daily winter-run Chinook salmon redd-deposition counts summed across reaches and brood years 2013–2025 (carcass-derived). Observed temperatures shown through 18 August 2026; CE-QUAL-W2 simulated temperatures thereafter. Horizontal dashed line: $T_{crit} = 11.82^{\circ}\text{C}$ (stage-dependent kernel; Anderson 2022), horizontal dotted line: $T_{crit} = 12.10^{\circ}\text{C}$ (stage-independent kernel; Martin et al. 2017).

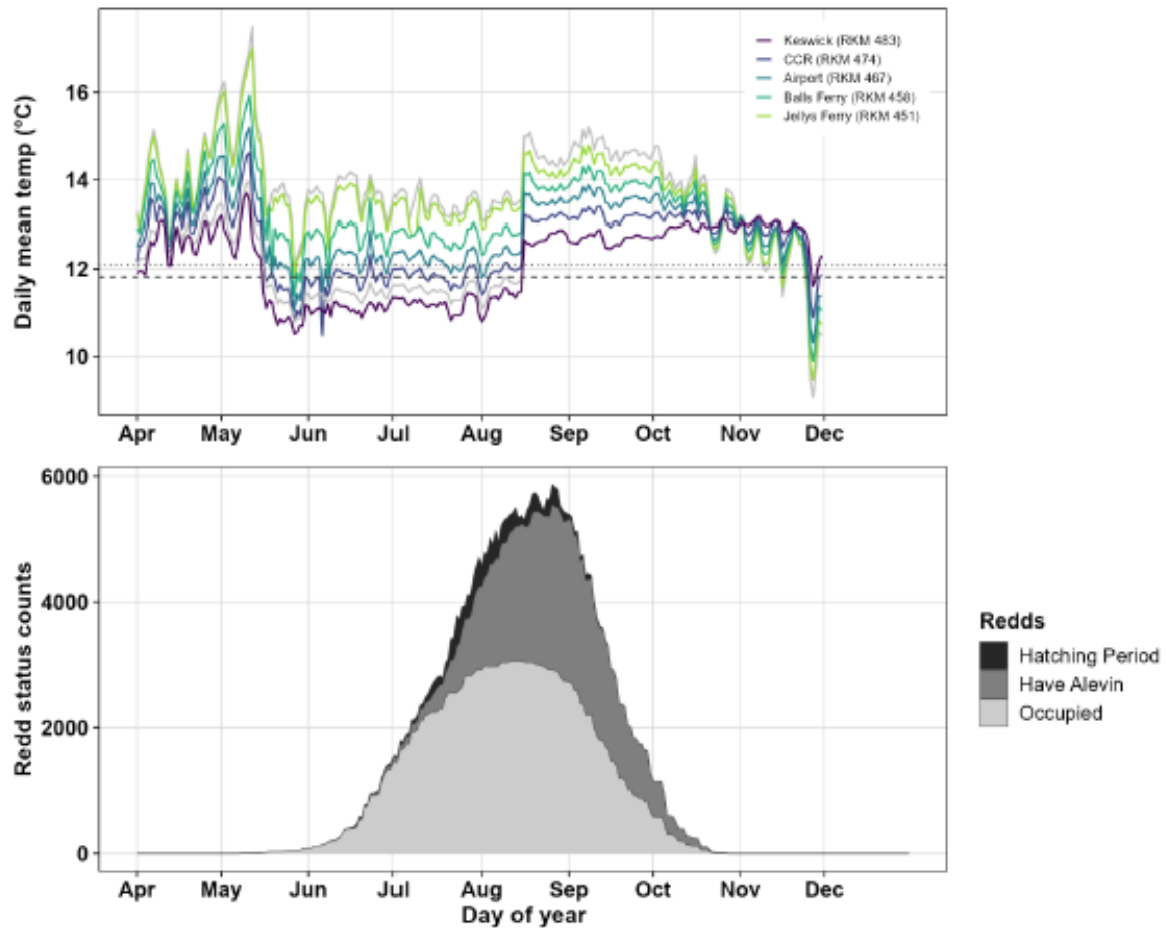


Figure 26. Daily Mean Water Temperature and Redd Status Counts

Daily mean water temperature at the five WTMP gauge stations (Keswick, CCR, Airport Rd, Balls Ferry, Jellys Ferry) under the 08/11/2026 proposed 2026 Sacramento River Temperature Management Plan scenario B (56°F target at CCR), with daily winter-run Chinook salmon redd-deposition counts summed across reaches and brood years 2013–2025 (aerial-derived). Observed temperatures shown through 18 August 2026; CE-QUAL-W2 simulated temperatures thereafter. Horizontal dashed line: $T_{crit} = 11.82^{\circ}\text{C}$ (stage-dependent kernel; Anderson 2022), horizontal dotted line: $T_{crit} = 12.10^{\circ}\text{C}$ (stage-independent kernel; Martin et al. 2017).

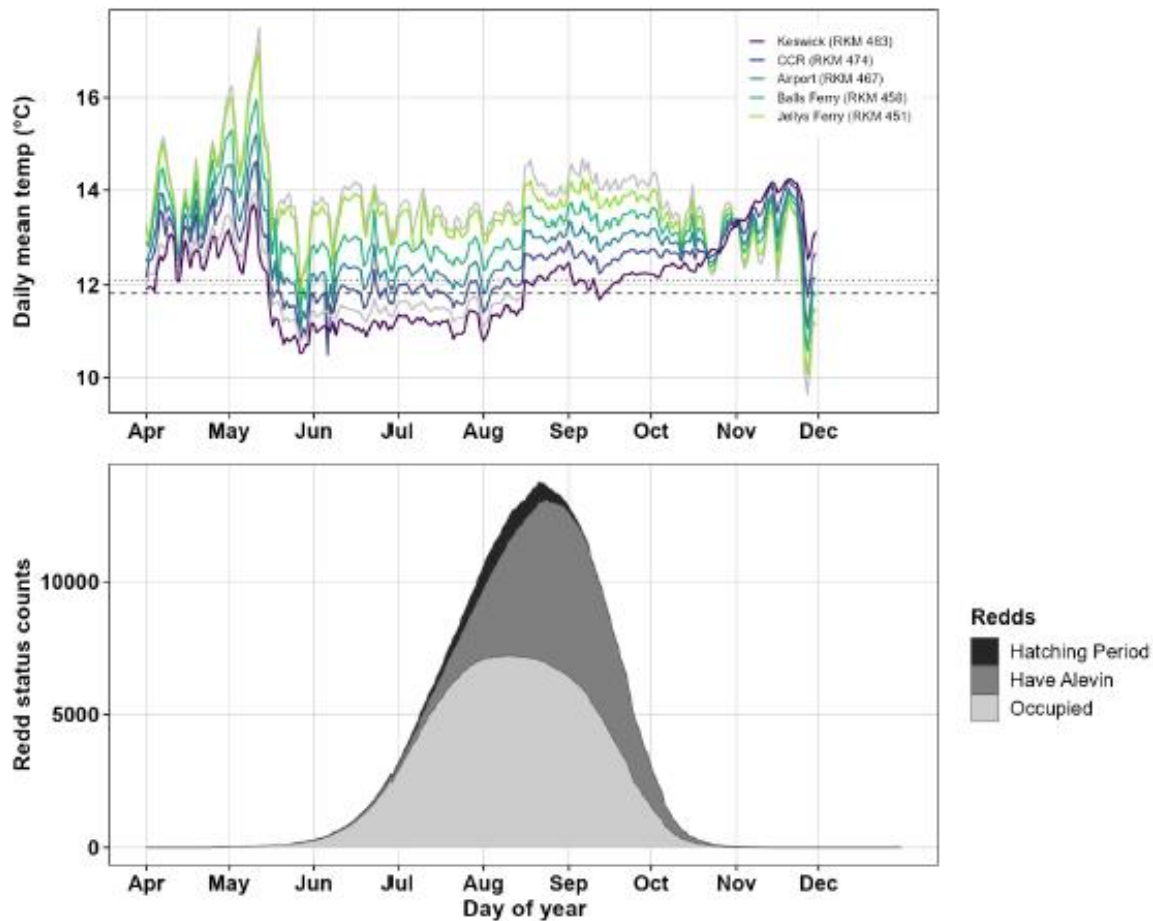


Figure 27. Daily Mean Water Temperature and Redd Status Counts

Daily mean water temperature at the five WTMP gauge stations (Keswick at RKM 483, Clear Creek at RKM 474, Airport Rd Bridge at RKM 467, Balls Ferry at RKM 458, Jellys Ferry at RKM 451) under the 08/11/2026 proposed 2026 Sacramento River Temperature Management Plan scenario C (55°F target at CCR), with daily winter-run Chinook salmon redd-deposition counts summed across reaches and brood years 2013–2025 (carcass-derived). Observed temperatures shown through 21 August 2026; CE-QUAL-W2 simulated temperatures thereafter. Horizontal dashed line: $T_{crit} = 11.82^{\circ}\text{C}$ (stage-dependent kernel; Anderson 2022), horizontal dotted line: $T_{crit} = 12.10^{\circ}\text{C}$ (stage-independent kernel; Martin et al. 2017).

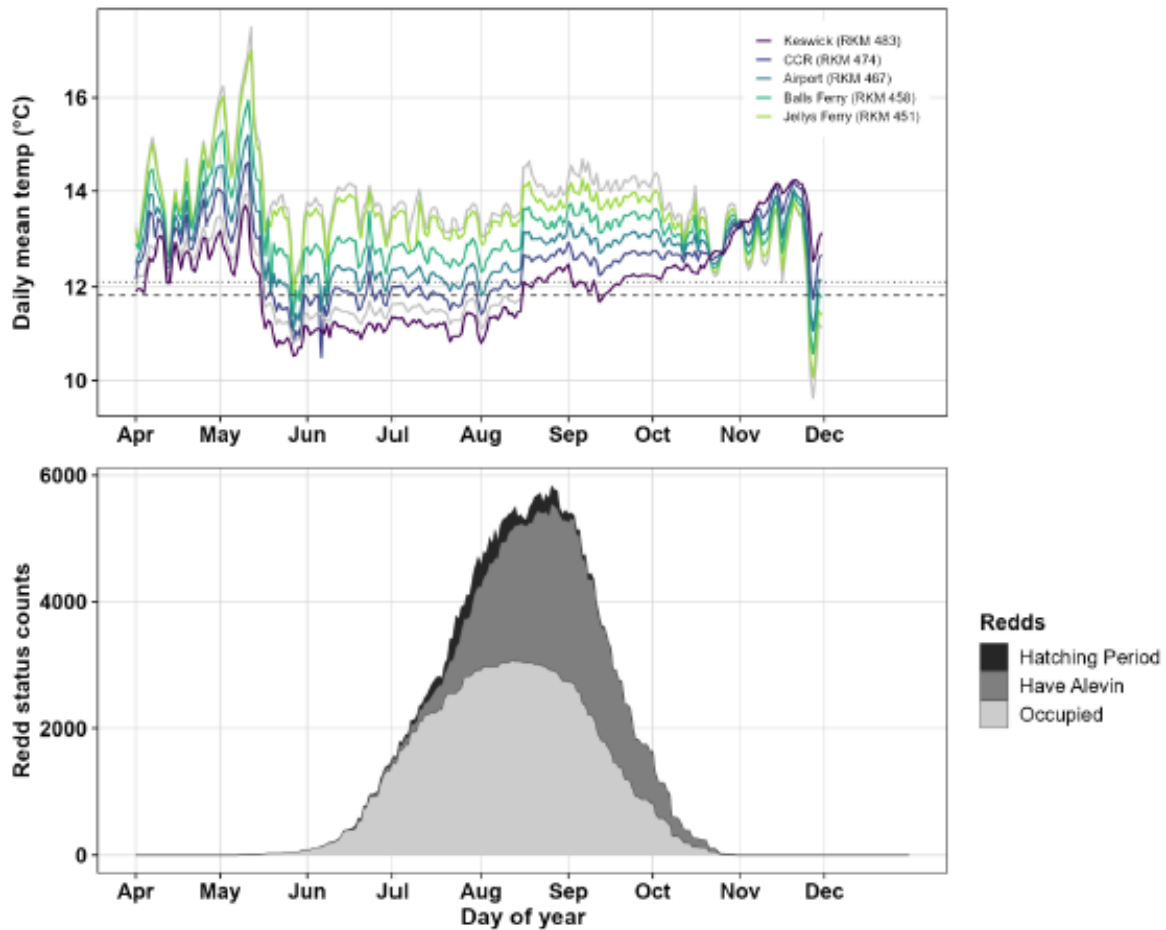


Figure 28. Daily Mean Water Temperature and Redd Status Counts

Daily mean water temperature at the five WTMP gauge stations (Keswick, CCR, Airport Rd, Balls Ferry, Jellys Ferry) under the 08/11/2026 proposed 2026 Sacramento River Temperature Management Plan scenario C (55°F target at CCR), with daily winter-run Chinook salmon redd-deposition counts summed across reaches and brood years 2013–2025 (aerial-derived). Observed temperatures shown through 21 August 2026; CE-QUAL-W2 simulated temperatures thereafter. Horizontal dashed line: $T_{crit} = 11.82^{\circ}\text{C}$ (stage-dependent kernel; Anderson 2022), horizontal dotted line: $T_{crit} = 12.10^{\circ}\text{C}$ (stage-independent kernel; Martin et al. 2017).

Winter-run TDM under the 2026 proposed TMP temperature scenario
Carcass vs. aerial redd distributions, both evaluated against the same fixed 2026 temperature trace

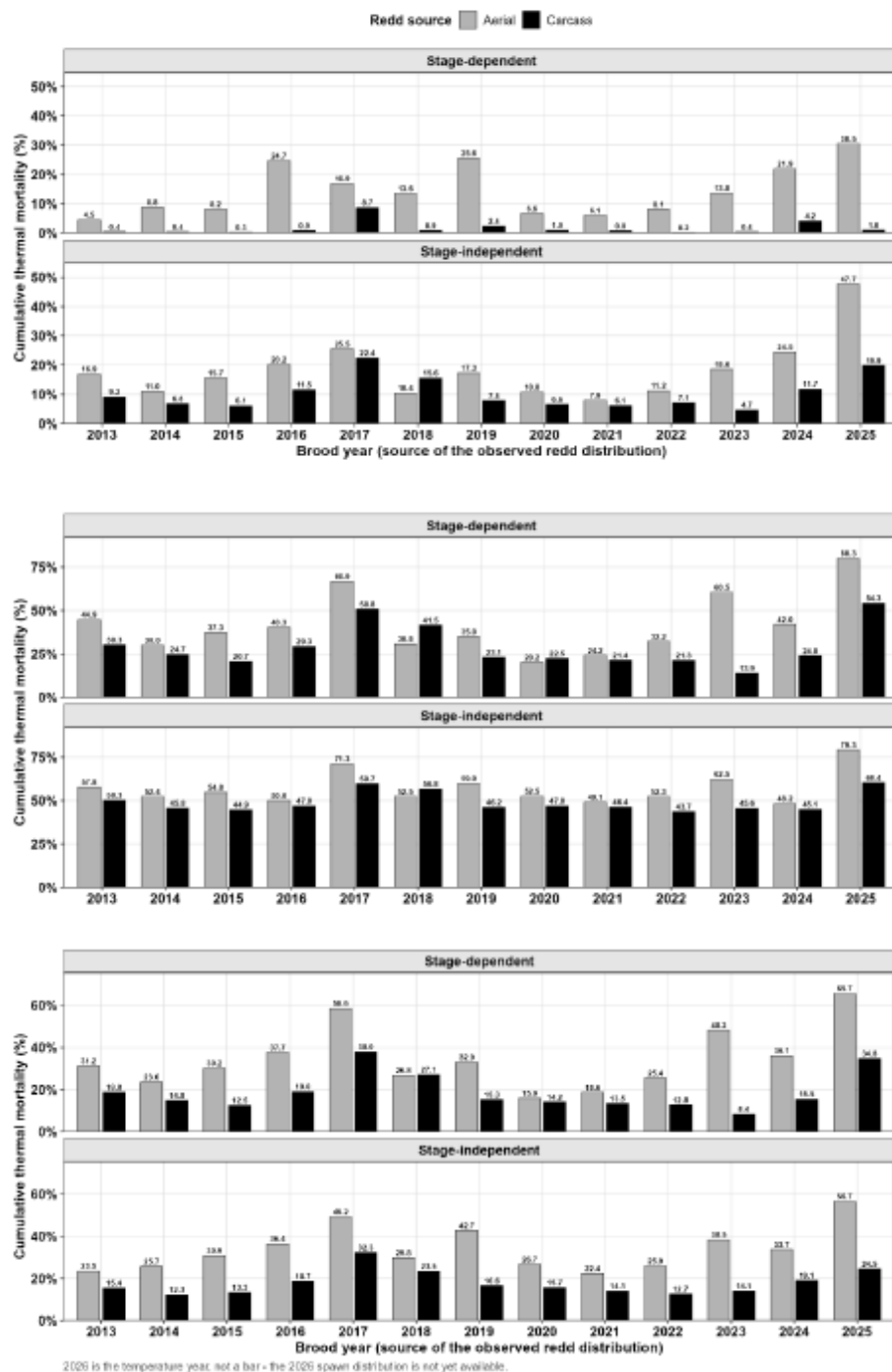


Figure 29. Egg to Emergence Temperature Dependent Mortality

Predicted egg-to-emergence temperature dependent mortality (TDM, %) for winter-run Chinook salmon under the 08/11/2026 proposed 2026 Sacramento River Temperature Management Plan scenarios (Top panel: Scenario A, 53.5°F at CCR; Middle panel: Scenario B: 56°F at CCR, Bottom panel: Scenario C: 55°F at CCR), by brood year (2013–2025), data source, and kernel. Each year's observed redd distribution was applied to the proposed-scenario temperature trace. Top panel: stage-dependent kernel (Anderson 2022). Bottom panel: stage-independent kernel (Martin et al. 2017). Fill: redd source (carcass-derived, black; aerial-derived, gray). Pooled-across-year means for each source × kernel combination are reported in Table 30.

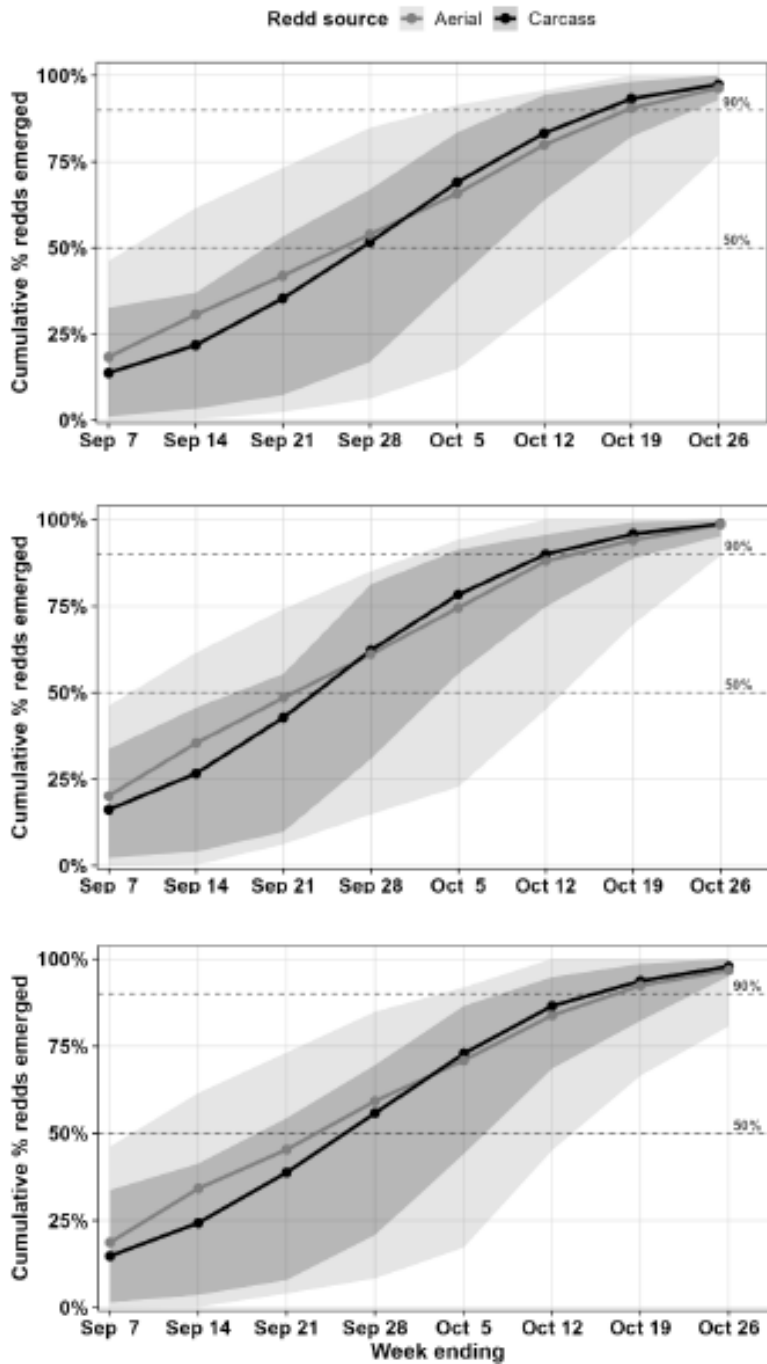


Figure 30. Scenario weekly cumulative percentage of winter-run Chinook salmon redds emerged

Weekly cumulative percentage of winter-run Chinook salmon redds emerged under the proposed 2026 TMP scenarios (Top panel: Scenario A, 53.5°F at CCR; Middle panel: Scenario B: 56°F at CCR, Bottom panel: Scenario C: 55°F at CCR), pooled across brood years 2013–2025. Per-redd emergence dates are projected forward from each redd's spawn date using the daily WTMP CE-QUAL-W2 trace at that redd's RKM and the Zeug et al. (2012) constant-ATU development model (hatch at 400 ATU, emerge at 958 ATU). Lines show mean cumulative percent emerged across the 13 brood years; ribbons show the across-year min-max. Black = carcass-derived redd distribution; grey = aerial-derived. Dashed horizontal lines at 50% and 90% mark the dates by which half and most of the cohort have completed incubation in a typical year.