BUREAU OF RECLAMATION

Sacramento River Group

Thursday, Aug 20, 2026

10:00 am – 12:00 pm

Virtual (Online) Meeting Only

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Table 1. Agenda

No.	Topic	Presenter
1	**Welcome, Roll Call, Agenda Review**	Mia Schiappi, Kearns & West
2	**WTMP Updates** Objective: share updates to the WTMP model.	Mechele Pacheco, Reclamation
3	**Hydrology and Operations Update** • Temperature Management Plan 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
4	**Temperature Dependent Mortality Modeling** Objective: Share results of Temperature Dependent Mortality Models based on current conditions.	Lisa Elliot, USBR Miles Daniels, SWFSC
5	**Additional Announcements & Review Action Items**	Mia Schiappi, Kearns & West
6	**Adjourn**	All

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

August 19, 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 (received 8/14/2026). The scenario was forced with hydrology from the May B120 90th percentile Shasta inflow and meteorology from the historical year 2014, selected as a representative warm year consistent with the NOAA seasonal outlook for summer 2026. During this run, two downstream temperature targets at Clear Creek were simulated (53.6 °F & 56 °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). Additionally, carcass survey data were used as another method to estimate where and when spawning occurred relative to aerial redd survey data during the same 13 years. The carcass survey data as of 8/15/2026 were also included in the analysis as a provisional estimate of this year's carcass-based TDM. Similar to prior runs, water temperatures from USBR's Water Temperature Modeling Platform (WTMP) were included as a comparison to the SWFSC temperature models. Outputs from the WTMP were based on a start date of 8/16/2026.

Predicted mean monthly water temperatures from the SWFSC and USBR temperature model are shown in Table 1 and Table 2. These values represent monthly averages of daily mean water temperatures under the August forecast (90 scenario) at three sites - Shasta, Keswick, and CCR - from August through December. Predicted monthly mean water temperatures under the August Forecast_90 scenario were nearly identical between the SWFSC and USBR sources through summer and diverged modestly in the fall. From August through October the two sources agreed closely under the 53.6 °F target (within 0.3 °F at all three locations); under the 56 °F target differences were larger, up to 0.9 °F. In November the SWFSC model predicted warmer temperatures at both targets (0.1–1.3 °F).

Averaged over the 2013–2025 series, predicted TDM was driven more by the choice of mortality model and temperature target than by either temperature source or spawning distribution, although in individual years the temperature source and spawning distribution can each shift the estimate by more than 10 percentage points. The stage-independent model produced higher mortality than the stage-dependent model: 2013–2025 mean mortality of roughly 10–13% versus 2–4% for the 53.6 °F scenario and 44-50% versus 23-33% for the 56 °F scenario. Within each model, the USBR-based temperatures yielded marginally lower mortality than the SWFSC forecast (e.g., redd stage-independent mean of 12% versus 13%) for the 53.6 °F scenario, but marginally higher mortality (e.g., redd stage-independent mean of 50% versus 46%) for the 56 °F scenario. Redd and carcass-based

spawning distributions produced broadly similar long-term means (e.g., 13% versus 11% for the SWFSC stage-independent model), but the two diverged in individual years: carcass-based mortality exceeded redd-based in 2018, whereas the reverse occurred in 2025 under the 53.6 °F scenario, reflecting the different spatial and temporal egg placements the two methods assume. 2025 was often the highest TDM year across all methods, but not always.

Under the August forecast at the 53.6 °F target, the provisional 2026 carcass-year distribution yields a stage-independent temperature-dependent mortality of 16%, against 21% for the completed 2025 distribution. Under the 56 °F target, the provisional 2026 carcass-year distribution yields a stage-independent temperature-dependent mortality of 52%, against 58% for the completed 2025 distribution. The gap appears to be driven by spawn timing more than spawn location. Of the 5 point difference under the 53.6 °F target, 3.5 points are attributable to timing and only 1.5 points to location. The 2026 season ran earlier than 2025: median spawn day July 15 against July 19. Both remain late relative to the rest of the record; only 2025 and 2017 ran later than 2026. The much larger contrast in survey sections (65% of 2026 carcasses in section 1 against 39% in 2025) contributes comparatively little to the difference.

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

For additional details visit the Central Valley Temperature and Exposure Mapping and Prediction website.

Overview

Total release scenarios simulated: 1

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

TDM Forecast start date: 04/01/2026

Reservoir Forecast start date: 08/18/2026

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 2. Keswick Releases (CFS) — monthly mean

Label	Description	Aug	Sep	Oct	Nov	Dec
Forecast_90	USBR 90th exceedance flow forecast	12400	8000	7000	5150	4000

Table 3. Trinity Imports via Spring Creek PP (TAF/month)

Month	Aug	Sep	Oct	Nov	Dec
Release	115	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 August through October.

Initial Shasta Conditions

Temperature profile date: 08/17/2026

Temperature Window / Target Parameters

All scenarios share the same temperature window shaping parameters, but consist of two window temperature targets.

Table 4. Temperature Window and Target Parameters

Targets	Target location	Window temperature	Shoulder temperature	Window length	Center date	Window start (derived)	Window end (derived)
Target A	Clear Creek (CCR)	12.0°C (53.6°F)	NA	26 weeks	08/15/2026	05/16/2026	11/14/2026
Target B	Clear Creek (CCR)	13.3°C (56°F)	NA	26 weeks	08/15/2026	05/16/2026	11/14/2026

TDM Model Parameters

All scenarios estimated TDM based on two models.

Table 5. TDM Models

Model	Tcrit (°C)	bT (°C-1 day-1)	Critical window	Calibration 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 1 and Table 2) at three locations: Shasta Dam release, Keswick Dam release, and Clear Creek (CCR). Values are monthly means of daily mean water temperatures from the single meteorological year (2014) used to drive the simulation.

Table 6. Mean monthly water temperatures (°F) based on daily means at Shasta Reservoir, Keswick Reservoir, and Clear Creek Gage (CCR) for August–December 2026 under the August Forecast_90 scenario from the SWFSC and USBR temperature models under the 53.6 °F temperature target.

Temperature Target = 53.6 °F at CCR

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Month	SWFSC August Forecast_90 Shasta (°F)	SWFSC August Forecast_90 Keswick (°F)	SWFSC August Forecast_90 CCR (°F)	USBR August Forecast_90 Shasta (°F)	USBR August Forecast_90 Keswick (°F)	USBR August Forecast_90 CCR (°F)
August	50.5	52.4	53.1	50.6	52.2	53.3
September	51.0	53.4	54.1	51.0	53.2	54.1
October	55.1	55.6	55.9	55.1	55.8	56.2
November	58.7	57.6	57.5	57.9	57.5	57.0
December	57.2	56.4	56.0	NA	NA	NA

Table 7. Mean monthly water temperatures (°F) based on daily means at Shasta Reservoir, Keswick Reservoir, and Clear Creek Gage (CCR) for August–December 2026 under the August Forecast_90 scenario from the SWFSC and USBR temperature models under the 56 °F temperature target.

Temperature Target = 56 °F at CCR

Month	SWFSC August Forecast_90 Shasta (°F)	SWFSC August Forecast_90 Keswick (°F)	SWFSC August Forecast_90 CCR (°F)	USBR August Forecast_90 Shasta (°F)	USBR August Forecast_90 Keswick (°F)	USBR August Forecast_90 CCR (°F)
August	53.1	54.3	55.0	53.4	54.9	55.6
September	53.0	54.9	55.6	53.0	54.8	55.7
October	55.3	55.9	56.2	54.4	55.3	55.6
November	56.4	55.8	55.8	55.1	55.1	54.7
December	56.5	55.6	55.3	NA	NA	NA

TDM Results

For both temperature models (SWFSC and USBR) 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 8 summarizes the population-mean TDM (with range across years) and the year 2025 case. Full year-by-year values are provided in Table 9 and Table 10.

Table 8. Predicted TDM (%) 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	Temperature Target = 53.6 °F SWFSC Population mean (2013–2025)	Temperature Target = 53.6 °F SWFSC Year 2025	Temperature Target = 53.6 °F USBR Population mean (2013–2025)	Temperature Target = 53.6 °F USBR Year 2025	Temperature Target = 56 °F SWFSC Population mean (2013–2025)	Temperature Target = 56 °F SWFSC Year 2025	Temperature Target = 56 °F USBR Population mean (2013–2025)	Temperature Target = 56 °F USBR Year 2025
Redd Stage-independent	13 (6-37)	37	12 (5-35)	35	46 (35-70)	70	50 (38-71)	71
Carcass Stage-independent	11 (5-22)	21	10 (4-20)	19	44 (39-58)	58	48 (43-60)	60
Redd Stage-dependent	4 (0-13)	13	2 (0-9)	8	29 (13-69)	69	33 (16-74)	74
Carcass Stage-dependent	3 (1-10)	4	3 (1-9)	3	23 (11-46)	46	28 (13-54)	54

Table 9. Mean annual TDM (%) by redd and carcass year under the stage-independent model for the single flow scenario for the SWFSC and USBR temperature models. Values are mean TDM across all redds within each year (i.e., population average) for both temperature targets. *Estimates of uncertainty are available upon request.

Redd Year	Temperature Target = 53.6 °F SWFSC Redd	Temperature Target = 53.6 °F SWFSC Carcass	Temperature Target = 53.6 °F USBR Redd	Temperature Target = 53.6 °F USBR Carcass	Temperature Target = 56 °F SWFSC Redd	Temperature Target = 56 °F SWFSC Carcass	Temperature Target = 56 °F USBR Redd	Temperature Target = 56 °F USBR Carcass
2013	15	10	13	8	53	46	56	50
2014	8	8	6	6	42	42	47	46
2015	12	7	11	5	44	39	48	44
2016	15	11	14	10	39	41	43	45
2017	17	22	15	20	57	55	61	58
2018	7	17	5	15	40	53	45	56
2019	11	9	9	7	46	40	51	45
2020	8	8	7	7	41	42	46	46
2021	6	8	5	6	39	41	44	46
2022	8	8	7	7	42	39	46	43
2023	13	5	11	4	53	40	57	45
2024	14	12	14	11	35	40	38	44
2025	37	21	35	19	70	58	71	60
Population Mean (2013-2025)	13	11	12	10	46	44	50	48
Population Min (2013-2025)	6	5	5	4	35	39	38	43
Population Max (2013-2025)	37	22	35	20	70	58	71	60

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

Table 10. Mean annual TDM (%) by redd and carcass year under the stage-dependent model for the single flow scenario for the SWFSC and USBR temperature models. Values are mean TDM across all redds within each year (i.e., population average) for both temperature targets. *Estimates of uncertainty are available upon request.

Redd Year	Temperature Target = 53.6 °F SWFSC Redd	Temperature Target = 53.6 °F SWFSC Carcass	Temperature Target = 53.6 °F USBR Redd	Temperature Target = 53.6 °F USBR Carcass	Temperature Target = 56 °F SWFSC Redd	Temperature Target = 56 °F SWFSC Carcass	Temperature Target = 56 °F USBR Redd	Temperature Target = 56 °F USBR Carcass
2013	2	2	0	1	38	23	42	30
2014	1	1	1	1	17	19	23	24
2015	1	1	0	1	30	14	32	18
2016	10	2	9	1	23	22	24	28
2017	4	10	1	9	45	41	51	49
2018	0	4	0	4	16	35	17	42
2019	7	3	7	3	17	18	21	22
2020	1	2	0	2	13	17	16	22
2021	0	2	0	2	16	17	18	22
2022	0	1	0	1	22	18	24	22
2023	6	1	3	1	43	11	57	13
2024	2	5	1	4	25	20	27	24
2025	13	4	8	3	69	46	74	54
Population Mean (2013-2025)	4	3	2	3	29	23	33	28
Population Min (2013-2025)	0	1	0	1	13	11	16	13
Population Max (2013-2025)	13	10	9	9	69	46	74	54

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

To further assess TDM for 2026, a provisional estimate using 2026 carcass survey data is presented below.

Methods

1. All values below are from the stage-independent model.
2. Shared temperature field. Each carcass year supplies only a spawning distribution: a set of (date, river location) pairs. Within each target scenario, every year's pairs are evaluated against the same modeled temperature landscape, so differences between years reflect the spawning distribution alone. Two landscapes are used, one for the 53.6 °F target and one for the 56 °F target.
3. Carcass survey data. Counts come from the winter-run carcass survey (spawned and fresh females), aggregated by date and by one of four river sections, with section 1 nearest Keswick Dam and section 4 furthest downstream. Each carcass is assigned a spawning date by subtracting a fixed seven-day spawn-to-death lag.
4. In-season season completion. The 2026 survey has data through 15 August 2026, before the season has ended (complete seasons in the record ran to between 20 August and 12 September). To fill in the rest of the season, we ask two questions of the complete historical years: how many more carcasses come in after this point in the calendar, and when and where they show up. The "how many" comes from a fit relating the size of the late tail to how early or late the season has been running; the "when and where" comes from each complete year's own late-season pattern. Combining the two across all those years gives a range of possible season totals, reported as p10, p50 and p90. The p50 is the value used in the summary tables.
5. Attribution. 2026 and 2025 differ in two ways: when fish spawned, and where. To separate the two, each year's spawning dates and river sections were split apart and recombined into all four pairings, 2025 timing with 2025 locations, 2025 timing with 2026 locations, and so on, each run through the same temperature landscape. Comparing across the rows of the resulting table isolates timing; comparing down the columns isolates location.

Results

Spawning distributions by year

Table 11 summarizes every carcass year in the comparison window. 2026 is the largest season in the record (2273 observed carcasses) and the most strongly upstream-weighted since 2022, while 2025 is the latest-running season in the record. The dates in Table 6 are carcass recovery dates taken straight from the survey and for 2026 it also includes the projected carcasses, which at this point in the season no longer move the median. Applying the seven-day spawn-to-death lag, the median spawn day is July 15 for 2026 against July 19 for 2025.

Table 11. Carcass survey seasons, section shares, survey end, median carcass recovery date and resulting TDM under the August 2026 forecast, at each window temperature target (53.6 °F and 56.0 °F). The survey columns are identical under both targets; only the TDM columns differ.

Carcass year	Carcasses (n)	Section 1 (%)	Section 2 (%)	Last survey	Median carcass recovery	TDM 53.6 °F (%)	TDM 56.0 °F (%)
2013	1029	60	30	Sep 05	Jul 16	10	46
2014	413	71	23	Aug 26	Jul 14	8	42
2015	391	59	33	Aug 30	Jul 11	7	39
2016	127	35	55	Aug 20	Jul 09	11	41
2017	59	15	51	Aug 31	Jul 23	22	55
2018	404	28	55	Sep 05	Jul 22	17	53
2019	1083	47	34	Sep 12	Jul 09	9	40
2020	1575	49	37	Sep 09	Jul 11	8	42
2021	1588	58	31	Sep 05	Jul 13	8	41
2022	604	67	28	Aug 29	Jul 12	8	39
2023	224	52	37	Aug 22	Jul 11	5	40
2024	90	41	36	Aug 28	Jul 08	12	40
2025	1427	39	46	Sep 12	Jul 26	21	58
2026	2273	65	28	Aug 15	Jul 22	16	52

Attributing the 2026–2025 difference

Tables 12 and 13 separate timing from location by crossing each year's spawning-date distribution with each year's section distribution and evaluating all four combinations against the same temperature field within each target. At the 53.6 °F target, timing accounts for 3.5 of the 5-point difference and location for 1.5; at 56 °F, timing accounts for 4 of 6 points and location for 2.

Table 12. Mean TDM (%) at the 53.6 °F target, from crossing each year's spawn timing with each year's spawn location on the shared temperature landscape.

Timing	2025 location	2026 location
2025 timing	21	19
2026 timing	17	16

Table 13. Mean TDM (%) at the 56 °F target, from crossing each year's spawn timing with each year's spawn location on the shared temperature landscape.

Timing	2025 location	2026 location
2025 timing	58	56
2026 timing	54	52

Provisional 2026 estimate

Table 14 shows the provisional 2026 estimate. The 2,273 carcasses observed through 15 August yield 14% (53.6 °F) and 51% (56 °F) on their own; these are floors, since any later recoveries represent later spawning and warmer incubation. Season completion projects roughly 50, 83 and 200 additional carcasses at p10, p50 and p90, giving a reported p50 of 16% and 52%.

Table 14. Provisional 2026 estimate, at both window temperature targets. Carcass counts are survey data and are identical in the two columns.

Parameter	53.6 °F target	56.0 °F target
Carcasses observed (through 15 Aug 2026)	2273	2273
Projected p10/p50/p90	50/83/200	50/83/200
Observed-only TDM (a floor)	14%	51%
Projection p10	15%	51%
Projection p50 (reported value)	16%	52%

Parameter	53.6 °F target	56.0 °F target
Projection p90	21%	55%
2025 actual, for comparison	21%	58%

References

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Table 15. Reservoir Releases in Cubic Feet/Second

Reservoir	Dam	WY 2025	WY 2026	15 Yr Median
Trinity	Lewiston	448	450	450
Sacramento	Keswick	9,465	10,939	9,944
Feather	Oroville (SWP)	7,000	8,001	5,500
American	Nimbus	2,005	4,495	2,746
Stanislaus	Goodwin	227	225	253
San Joaquin	Friant	249	355	355

Table 16. 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	1,464	2,006	1,817	124
Shasta	4,552	2,680	2,974	2,790	104
Folsom	977	512	492	514	100
New Melones	2,420	1,364	1,676	1,578	116
Fed. San Luis	966	295	252	399	135
Total North CVP	11,363	6,315	7,400	7,098	112
Millerton	521	291	262	251	86
Oroville (SWP)	3,425	1,936	2,482	2,177	112

Table 17. 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	1,087	202	2,835	1,054	103
Shasta	4,715	2,311	10,385	4,545	104
Folsom	2,306	319	6,321	2,401	96
New Melones	731	NA	2,669	924	79
Millerton	1,376	305	4,402	1,451	95

Table 18. 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	12.11	55.19	30.27 (66)	102	0.00
Sacramento at Shasta Dam	68.76	17.42	112.58	59.09 (71)	116	0.00
American at Blue Canyon	59.36	15.64	103.88	63.90 (52)	93	0.00
Stanislaus at New Melones	28.38	NA	45.33	26.70 (49)	106	0.00
San Joaquin at Huntington Lk	31.49	17.50	82.80	39.64 (53)	79	0.00

Table 19. Sacramento River Station Temperature Summary Report

Date	MDWT TCD[1]	MDWT SHD	MDWT SPP[1]	MDWT KWK	MDWT SAC	MDWT CCR[2]	MDWT BSF	MDWT BND	MDWT RBD	MDWT IGO	MDWT LWS	MDWT DGC	MDWT NFH	MDR Shasta Gene-ra-tion	MDR Spring Creek PP	MDR Keswick Total	MDAT RDD	MDAT BSF	MDAT RDB
Jul	51.3	50.4	57.5	51.4	52.0	52.5	54.2	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	51.6	52.1	52.7	54.3	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	50.5A	58.1	51.9	52.4	53.0	54.6	55.5	57.4A	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	52.4	52.8	53.4	54.8	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	58.2	52.4	52.9	53.5	55.0	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	52.5	52.9	53.5	55.1	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	52.3	52.9	53.5	55.0	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	52.6	53.0	53.6	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	52.8	53.2	53.8	55.3	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	53.3	53.9	55.4	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	50.6	58.5	52.6	53.1	53.7	55.1	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	53.6	55.0	56.6	58.5	59.2	51.1	60.5	66.3	10740	1845	13100	83.5	78.1	78.4

Date	MDWT TCD[1]	MDWT SHD	MDWT SPP[1]	MDWT KWK	MDWT SAC	MDWT CCR[2]	MDWT BSF	MDWT BND	MDWT RBD	MDWT IGO	MDWT LWS	MDWT DGC	MDWT NFH	MDR Shasta Gene-ration	MDR Spring Creek PP	MDR Keswick Total	MDAT RDD	MDAT BSF	MDAT RDB
08/12	51.9	50.5	58.6	52.4	53.0	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	50.7	58.7	52.6	53.1	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	52.7	53.1	53.7	55.1	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	53.6	55.0	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	53.7	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	50.8	58.7	51.4	52.0	52.5	54.2	56.2	57.9	58.6	50.4	58.0	63.7	8981	1743	10948	84.0	76.7	76.8
Aug	51.6	50.6	58.4	52.4	52.9	53.5	54.9	56.2	58.0	59.1	51.2	60.2	65.9	10890	1556	12641	84.6	79.1	79.2
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	185136	26460	214893	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	367210	52482	426231	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.

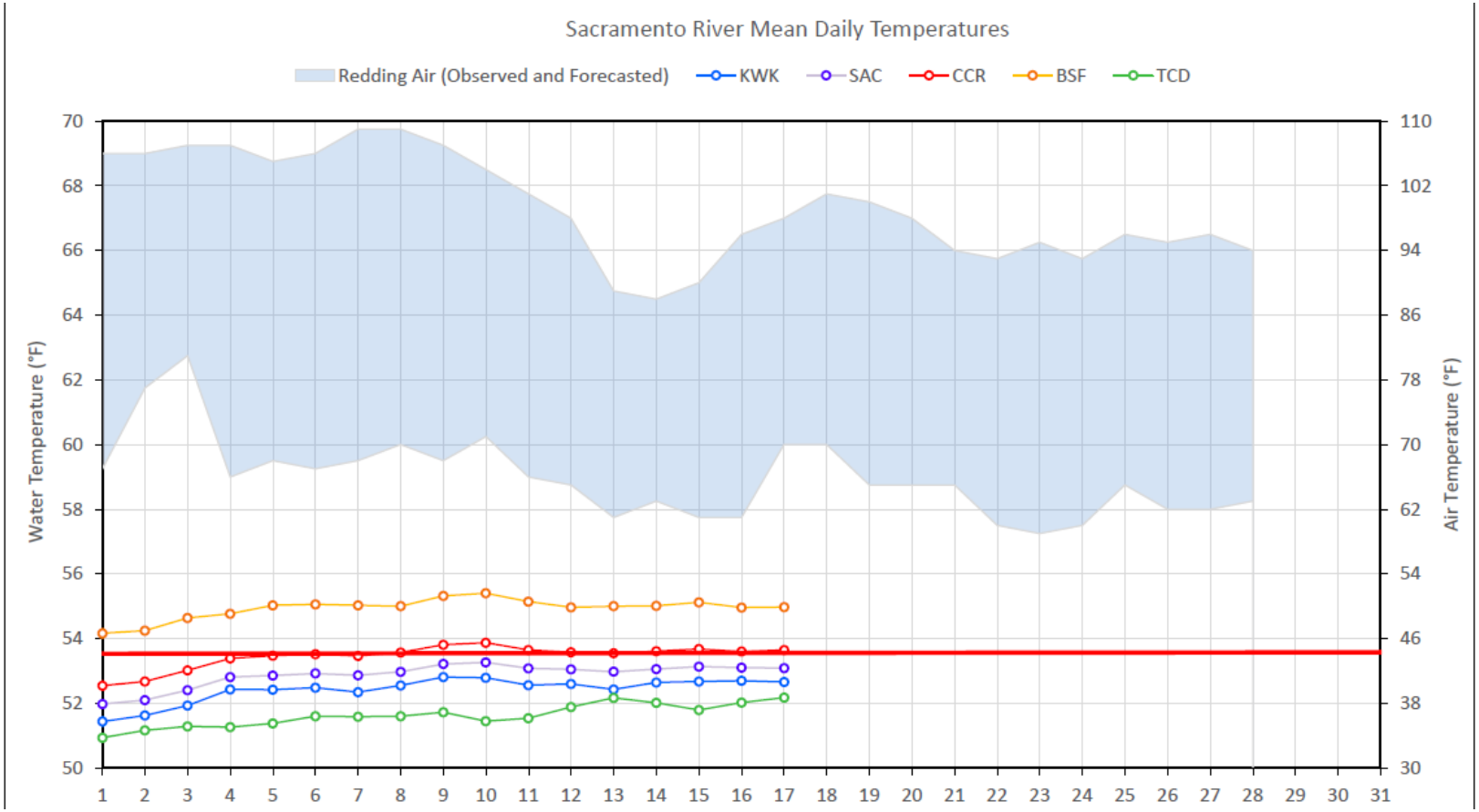

Figure 1. Sacramento River Mean Daily Temperatures

This chart shows mean daily water temperatures in the Sacramento River at five monitoring locations (KWK, SAC, CCR, BSF, and TCD) during the first 17 days of the month, along with a shaded band representing observed and forecasted air temperatures in Redding. Water temperatures remain relatively stable, ranging from about 51°F to 55.5°F. BSF records the highest water temperatures, near 54°F to 55.5°F, while TCD records the lowest, near 51°F to 52°F. A horizontal red reference line is shown at approximately 53.5°F. Air temperatures are substantially higher and more variable, with daily lows generally in the upper 50s to low 60s °F and highs in the mid-60s to around 70°F. Overall, water temperatures show only minor day-to-day changes despite larger fluctuations in air temperature.

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
ILF	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

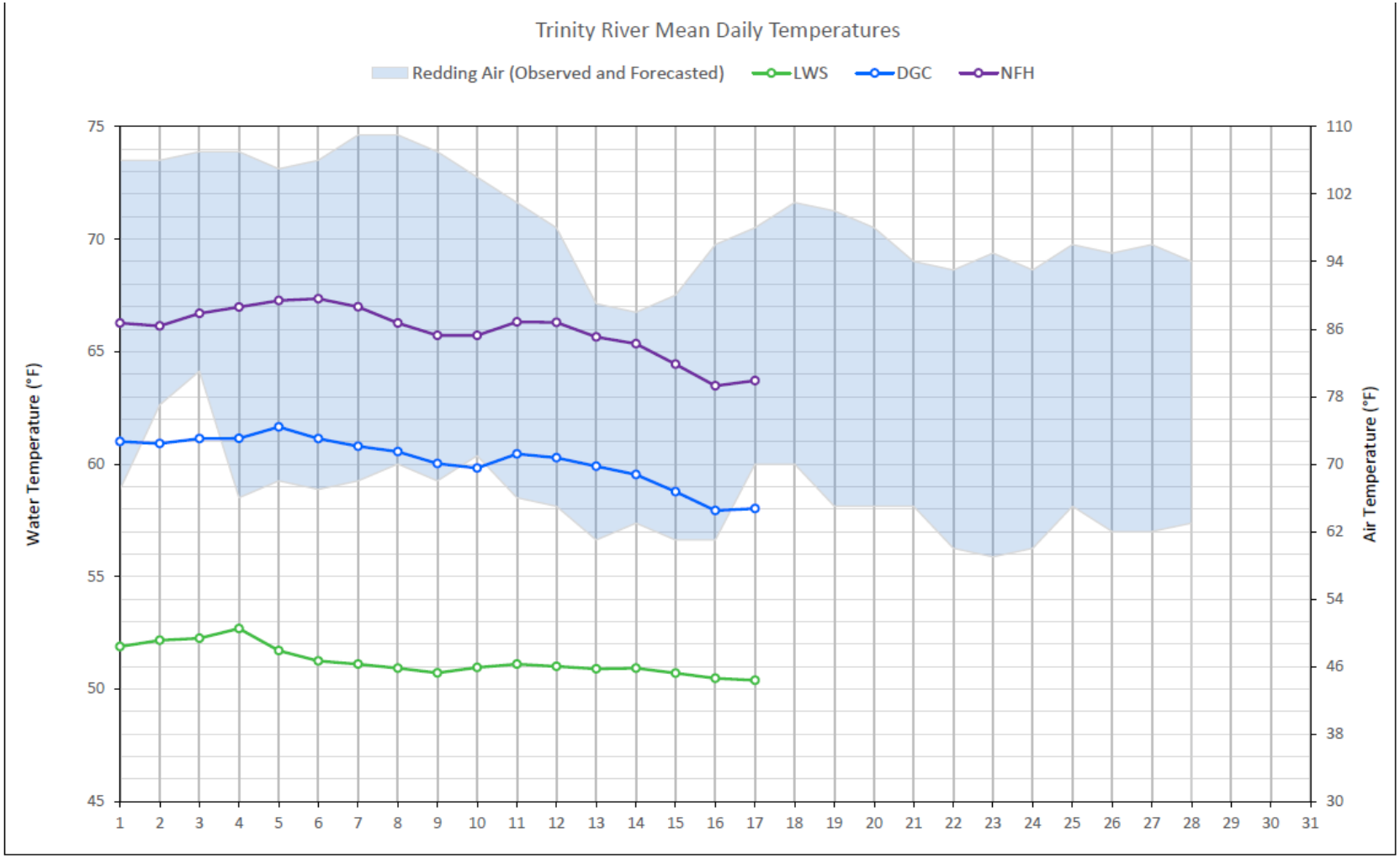

Figure 2. Trinity River Mean Daily Temperatures

This chart displays mean daily water temperatures for three Trinity River monitoring locations (LWS, DGC, and NFH) during the first 17 days of the month, with a shaded band showing observed and forecasted Redding air temperatures. Water temperatures remain relatively stable, with NFH recording the highest values, declining from about 66°F to 64°F; DGC decreasing from about 61°F to 58°F; and LWS remaining the coolest, near 50°F to 52°F. Air temperatures are consistently warmer and more variable, with daily lows generally ranging from the upper 50s to around 60°F and highs from the upper 60s to mid-70s°F. Overall, all three river locations show a slight cooling trend over the period despite fluctuations in air temperature.

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

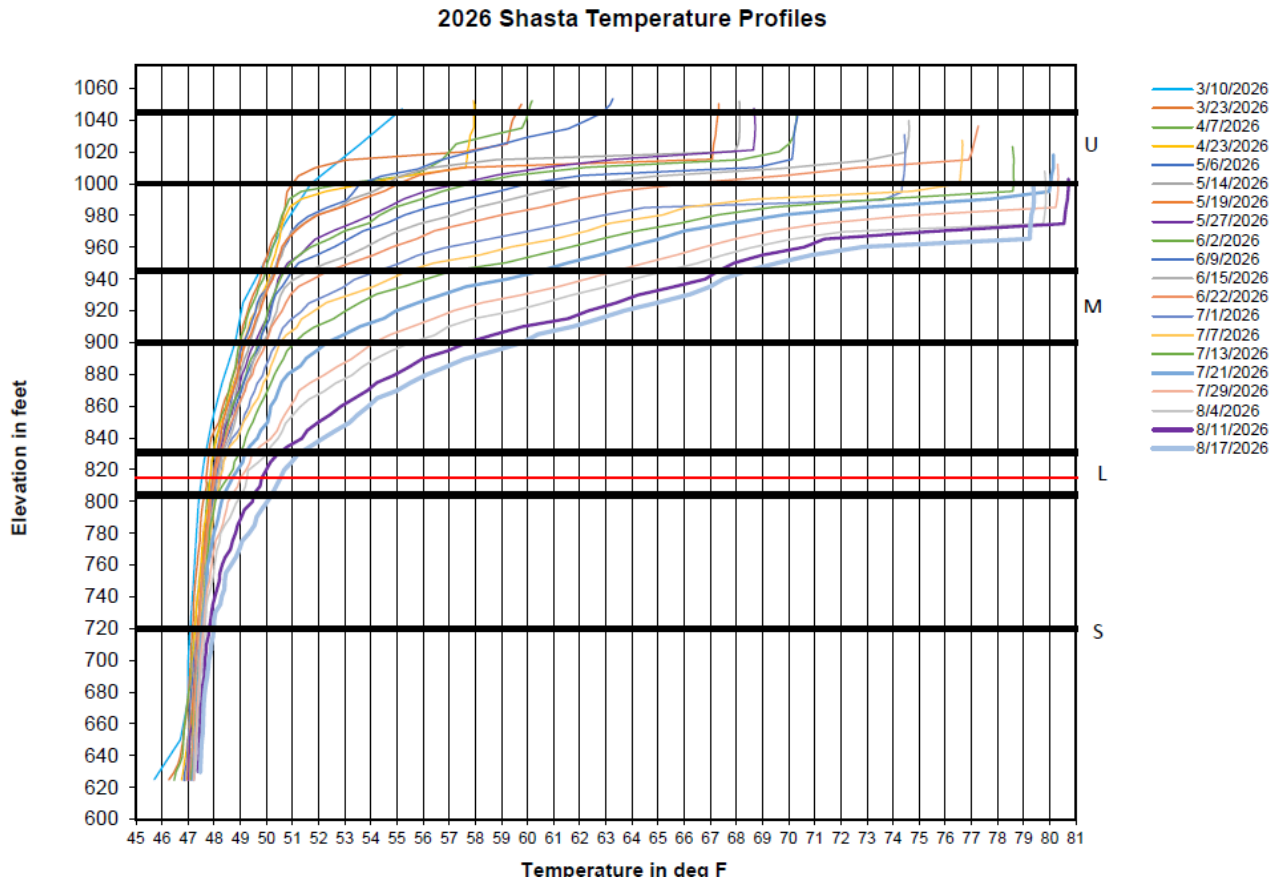

Figure 3. 2026 Shasta Temperature Profiles

This chart shows Shasta Reservoir temperature profiles collected between March 10 and August 17, 2026, plotting water temperature (approximately 45°F to 81°F) against reservoir elevation (about 620 to 1,060 feet). Early-season profiles are relatively uniform, while later profiles show increasing thermal stratification, with warmer surface waters reaching about 79 to 81°F near elevations around 975 to 1,000 feet and cooler deeper waters remaining near 47 to 50°F. Distinct stratified layers develop through spring and summer, with the strongest temperature gradients occurring between approximately 820 and 950 feet elevation. Horizontal reference lines mark operational elevation zones labeled S, L, M, and U. Overall, the reservoir transitions from a well-mixed condition in March to a strongly layered thermal structure by mid-summer.

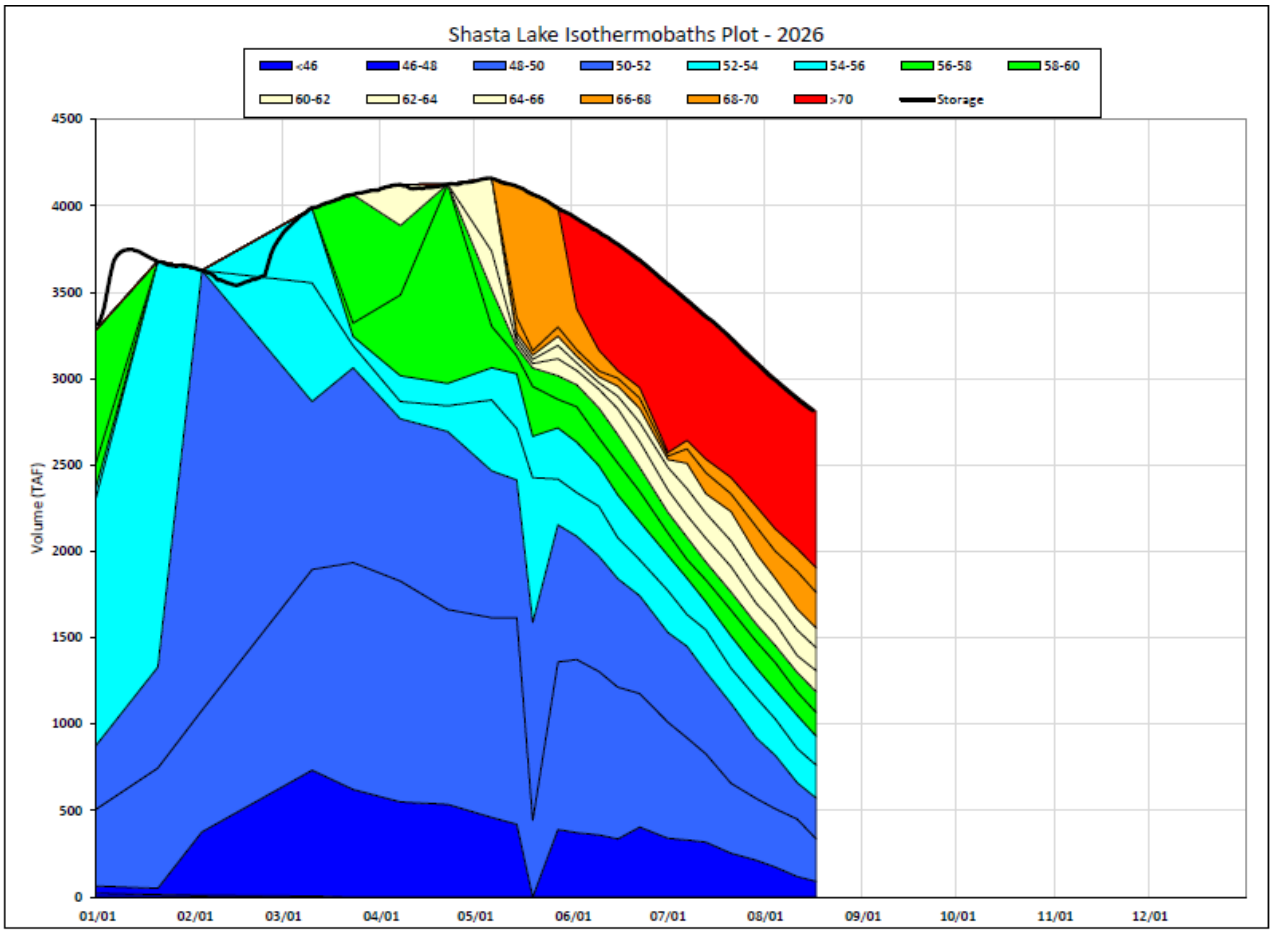

Figure 4. Shasta Lake Isothermobaths Plot - 2026

This chart illustrates the distribution of Shasta Lake water volume by temperature range from January through mid-August 2026. The black line shows total reservoir storage, which rises from about 3,300 thousand acre-feet in January to a peak near 4,150 thousand acre-feet in May before declining to about 2,800 thousand acre-feet by mid-August. Cooler water temperatures below 52°F dominate the reservoir volume through spring, while warmer water temperatures progressively increase during summer. By July and August, water warmer than 70°F occupies a substantial portion of the reservoir, and intermediate temperature bands from 60°F to 70°F expand as thermal stratification develops. Overall, the chart shows seasonal warming of the reservoir and declining storage during the summer months.

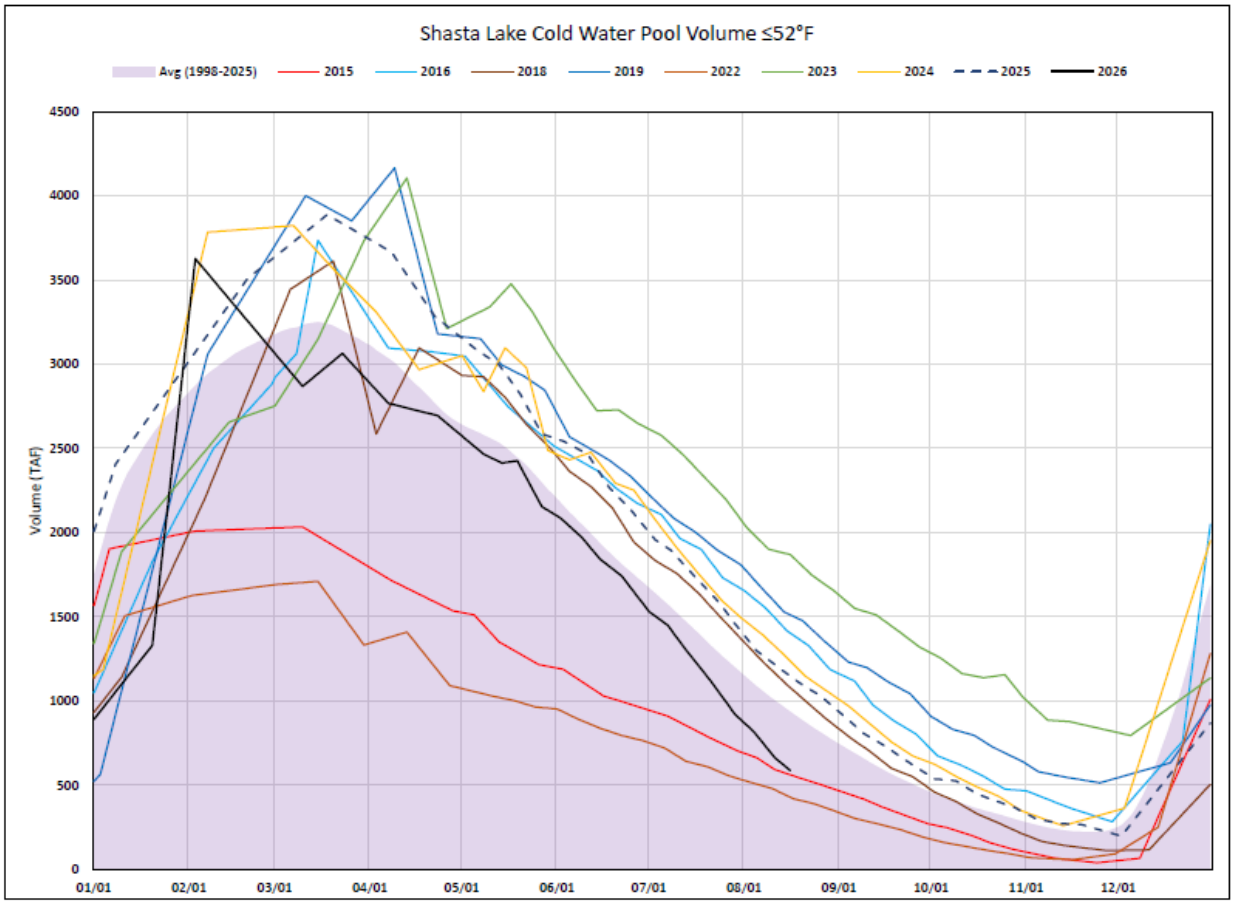

Figure 5. Shasta Lake Cold Water Pool Volume ≤52°F

This chart compares Shasta Lake cold water pool volume below 52°F during 2026 with the historical average (1998–2025) and selected years from 2015 through 2025. The 2026 cold water pool volume (black line) begins near 900 thousand acre-feet (TAF), increases to about 3,600 TAF in early February, and then steadily declines through the year, reaching approximately 600 TAF by mid-August. Compared with the historical average (shaded band), 2026 volumes are generally above average in winter and early spring but fall below average by summer. Most years shown follow a similar seasonal pattern, with cold water storage peaking between late winter and spring and decreasing through summer and autumn. Overall, the chart highlights the seasonal accumulation and depletion of Shasta Lake's cold water reserves and places 2026 conditions within the context of recent years and long-term average conditions.

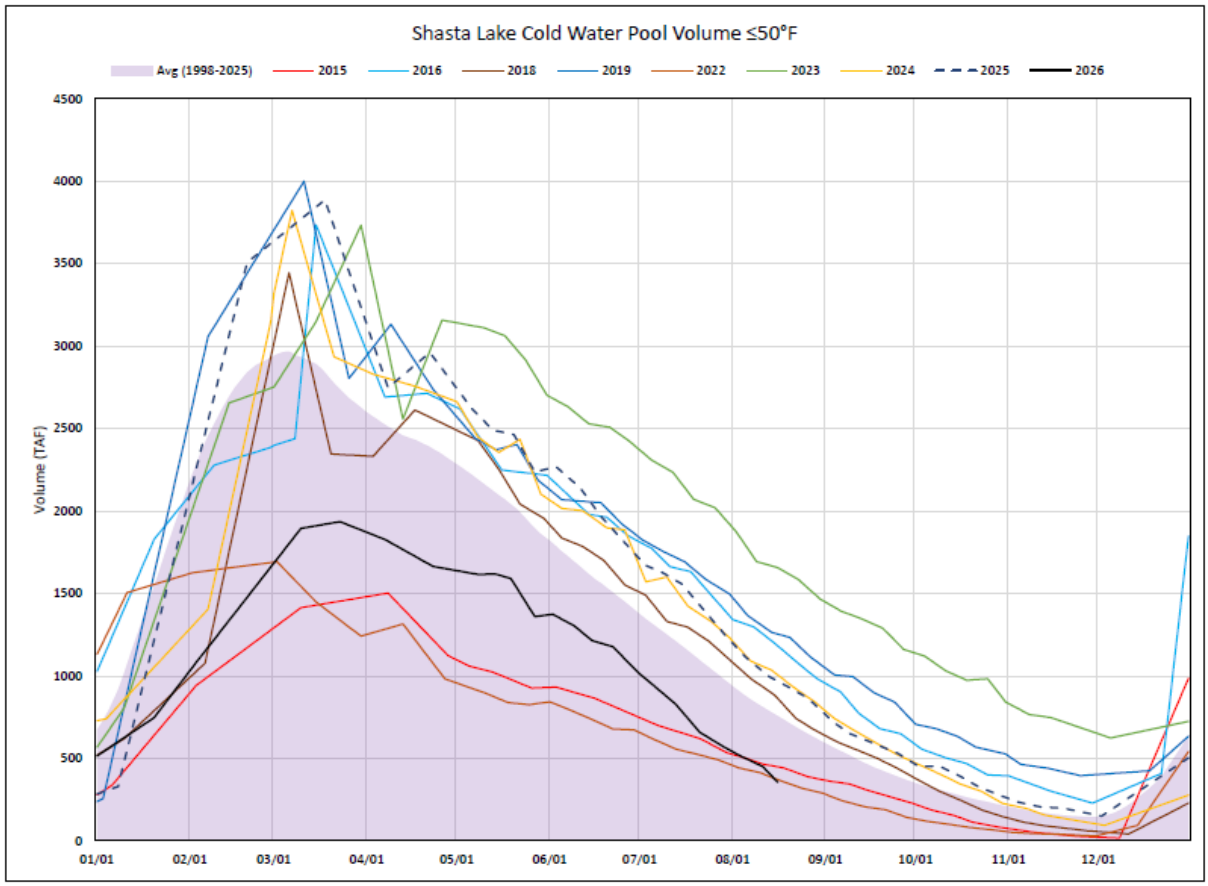

Figure 6. Shasta Lake Cold Water Pool Volume ≤50°F

This chart compares Shasta Lake cold water pool volume at or below 50°F during 2026 with the historical average (1998–2025) and selected years from 2015 through 2025. The 2026 volume (black line) rises from about 500 thousand acre-feet (TAF) in early January to a peak near 1,900 TAF in late March, then steadily declines to approximately 350 TAF by mid-August. Compared with the historical average (shaded band), 2026 volumes are generally below average throughout most of the year. Other years shown exhibit similar seasonal patterns, with cold water storage increasing during winter and spring and decreasing through summer and fall, although peak volumes and rates of decline vary considerably among years. Overall, the chart highlights the seasonal depletion of Shasta Lake's coldest water reserves and shows that 2026 levels are lower than average for much of the period displayed.

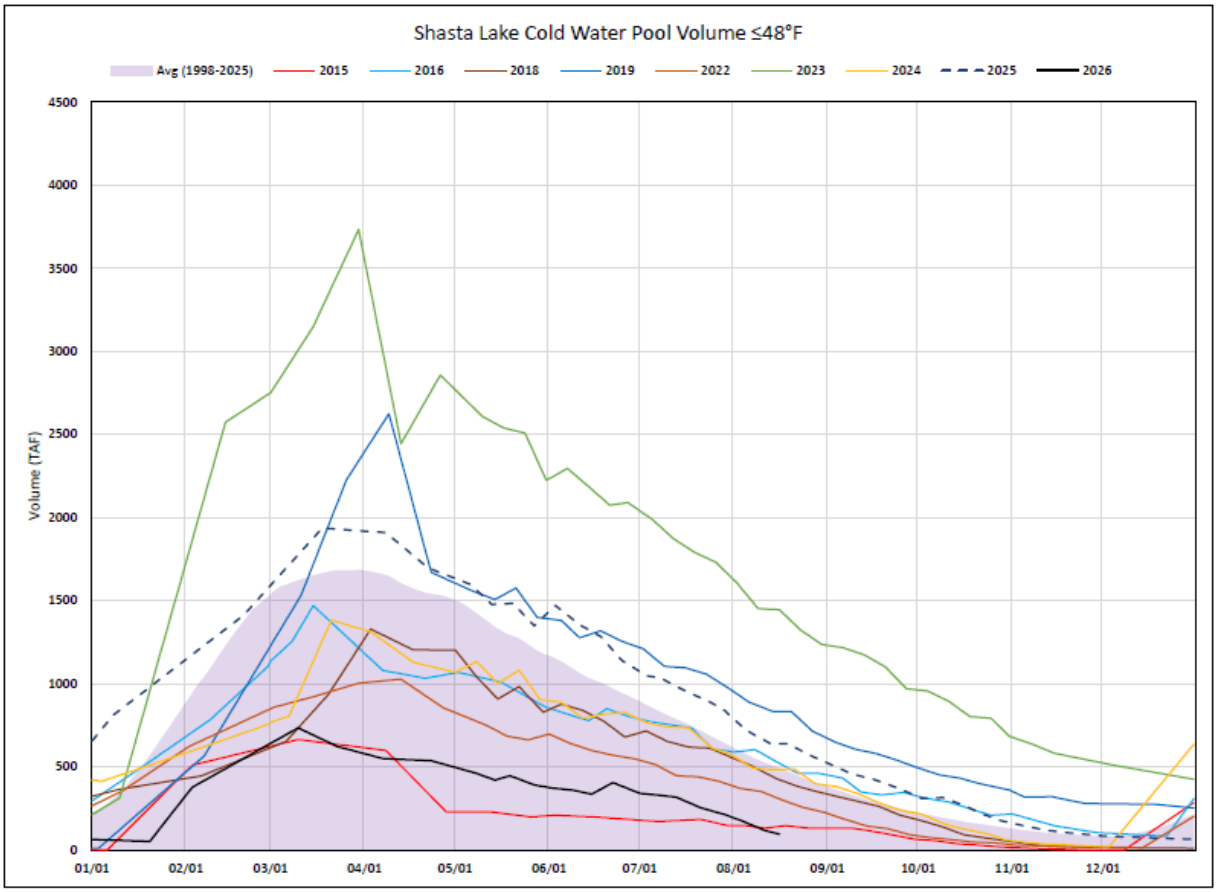

Figure 7. Shasta Lake Cold Water Pool Volume ≤48°F

This chart compares Shasta Lake cold water pool volume at or below 48°F during 2026 with the historical average (1998–2025) and selected years from 2015 through 2025. The 2026 volume (black line) starts near zero in January, rises to a peak of about 700 thousand acre-feet (TAF) in March, and then steadily declines to roughly 100 TAF by mid-August. Compared with the historical average (shaded area), 2026 remains substantially below average throughout most of the year. Other years show similar seasonal patterns of winter and spring accumulation followed by summer depletion, although peak volumes vary widely, with some years exceeding 2,000 to 3,500 TAF. Overall, the chart indicates that the volume of the coldest water in Shasta Lake during 2026 is relatively low compared to both historical average conditions and several recent years.

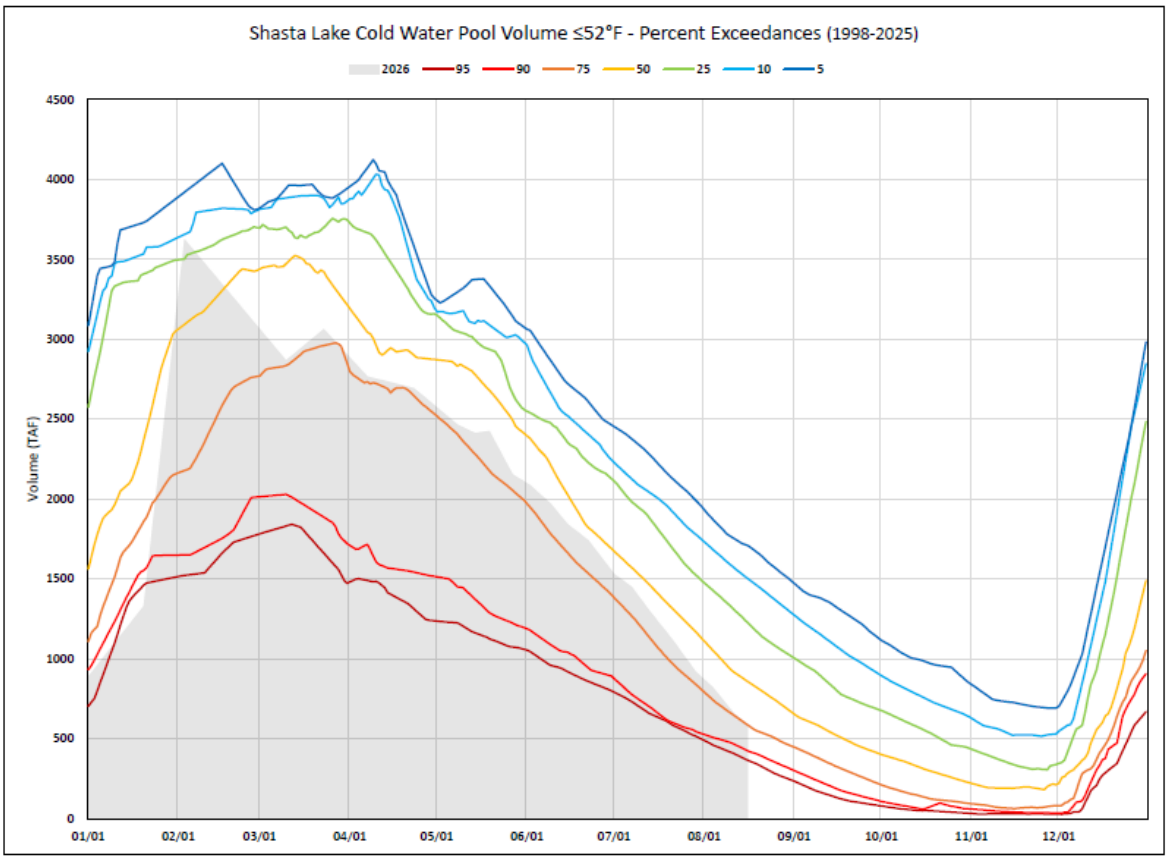

Figure 8. Shasta Lake Cold Water Pool Volume ≤52°F - Percent Exceedances (1998-2025)

This chart shows Shasta Lake cold water pool volume below 52°F during 2026 compared with historical percent exceedance curves derived from 1998–2025 data. The gray shaded area represents 2026 conditions through mid-August, with cold water volume increasing to about 4,100 thousand acre-feet (TAF) in early spring before steadily declining to roughly 600 TAF by mid-August. Throughout most of the year, 2026 tracks between the 25th and 50th percentile exceedance curves, indicating below-average to near-average cold water storage relative to historical conditions. All percentile curves show a similar seasonal pattern, with cold water volume peaking in late winter and spring, declining through summer and fall, and increasing again at the start of winter. Overall, the chart places 2026 cold water pool conditions within the historical range and shows a seasonal depletion of cold water storage over time.

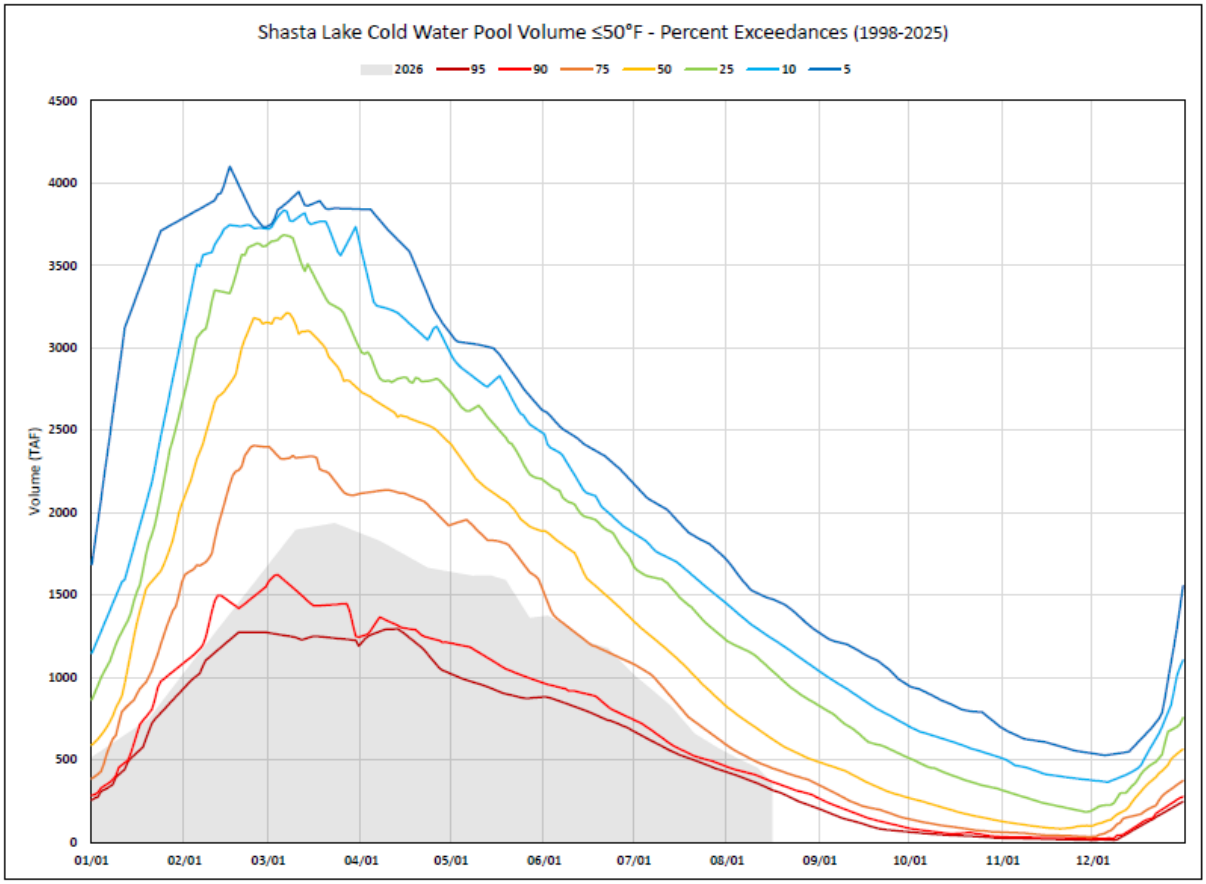

Figure 9. Shasta Lake Cold Water Pool Volume ≤50°F - Percent Exceedances (1998-2025)

This chart compares 2026 Shasta Lake cold water pool volume at or below 50°F with historical percent exceedance curves derived from 1998–2025 data. The gray shaded area represents 2026 conditions through mid-August, showing cold water volume increasing from approximately 400 thousand acre-feet (TAF) in January to a peak near 1,900 TAF in late March, then steadily declining to about 350 TAF by mid-August. Relative to the historical exceedance curves, 2026 remains generally between the 75th and 90th percentile levels, indicating lower-than-average cold water storage compared to most historical years. All exceedance curves show a similar seasonal pattern, with cold water volumes peaking in late winter or spring and declining through summer and fall. Overall, the chart indicates that 2026 cold water pool volumes at or below 50°F are below typical historical conditions and decrease steadily during the summer season.

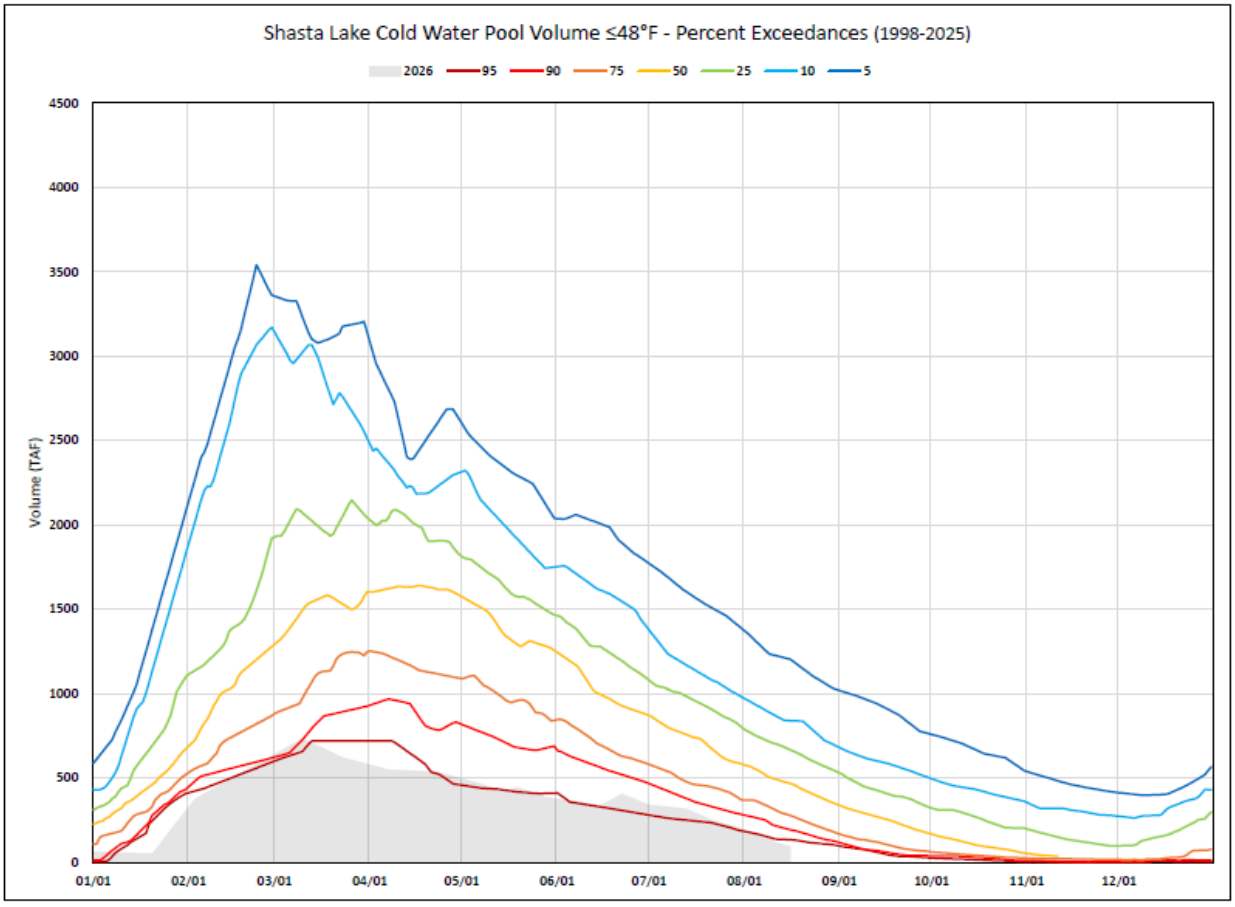

Figure 10. Shasta Lake Cold Water Pool Volume ≤48°F - Percent Exceedances (1998-2025)

This chart compares 2026 Shasta Lake cold water pool volume at or below 48°F with historical percent exceedance curves based on 1998–2025 data. The gray shaded area represents 2026 conditions through mid-August, showing volumes increasing from near zero in January to a peak of about 700 thousand acre-feet (TAF) in March before steadily declining to approximately 100 TAF by mid-August. Relative to the historical exceedance curves, 2026 remains near or below the 90th percentile for most of the year, indicating substantially lower volumes of the coldest water than are typically observed. All historical curves show a similar seasonal pattern, with cold water volumes peaking in late winter or spring and declining through summer and fall. Overall, the chart indicates that 2026 cold water pool volumes below 48°F are well below average and among the lower historical conditions for much of the year.

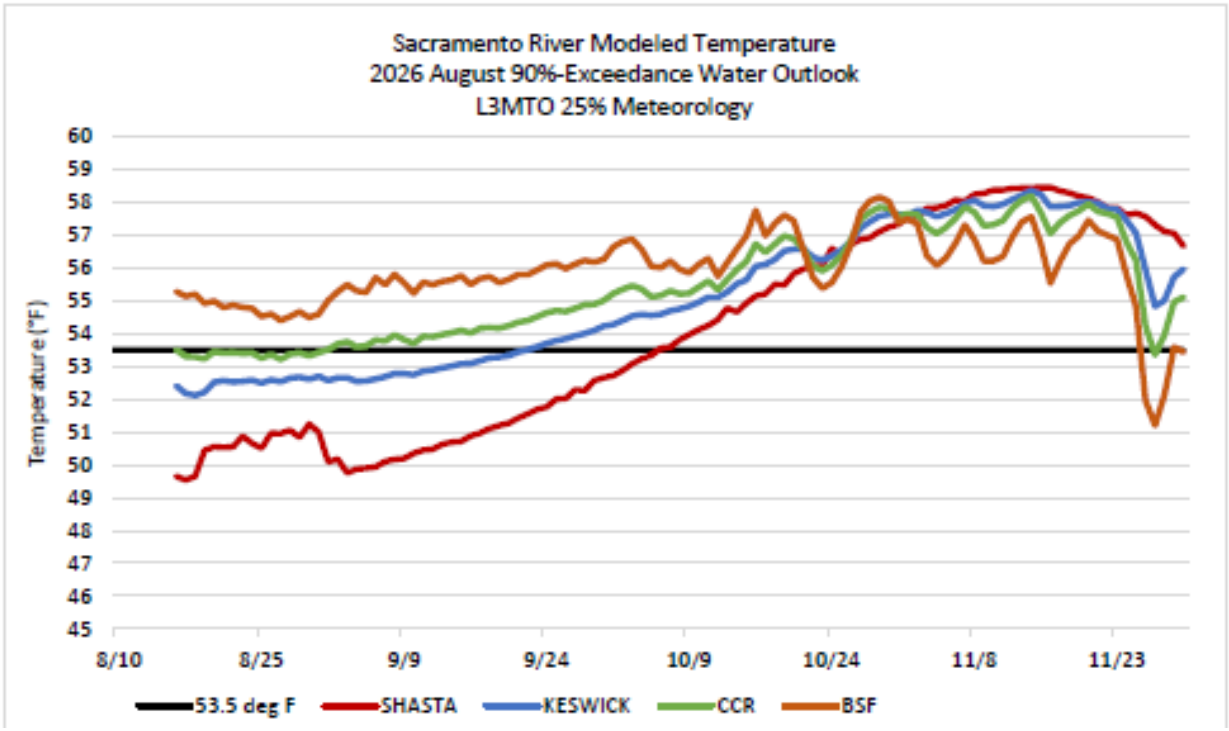

Figure 11. Sacramento River Modeled Temperature – August 2026 90%-Exceedance Water Outlook L3MTO 25% Meteorology.

This chart presents modeled Sacramento River water temperatures from mid-August through late November 2026 at four locations: Shasta, Keswick, CCR, and BSF. Temperatures generally increase from approximately 50°F to 56°F in August and September to between 57°F and 59°F during October and November. A horizontal reference line marks 53.5°F. Shasta begins as the coolest location and gradually warms past the reference line in early October, while BSF remains the warmest location for most of the period. All locations show similar temperature patterns, peaking near 58°F to 59°F in November before declining sharply near the end of the forecast period. Overall, modeled temperatures trend upward through fall and remain above 53.5°F for most locations after early October.

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 20. 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

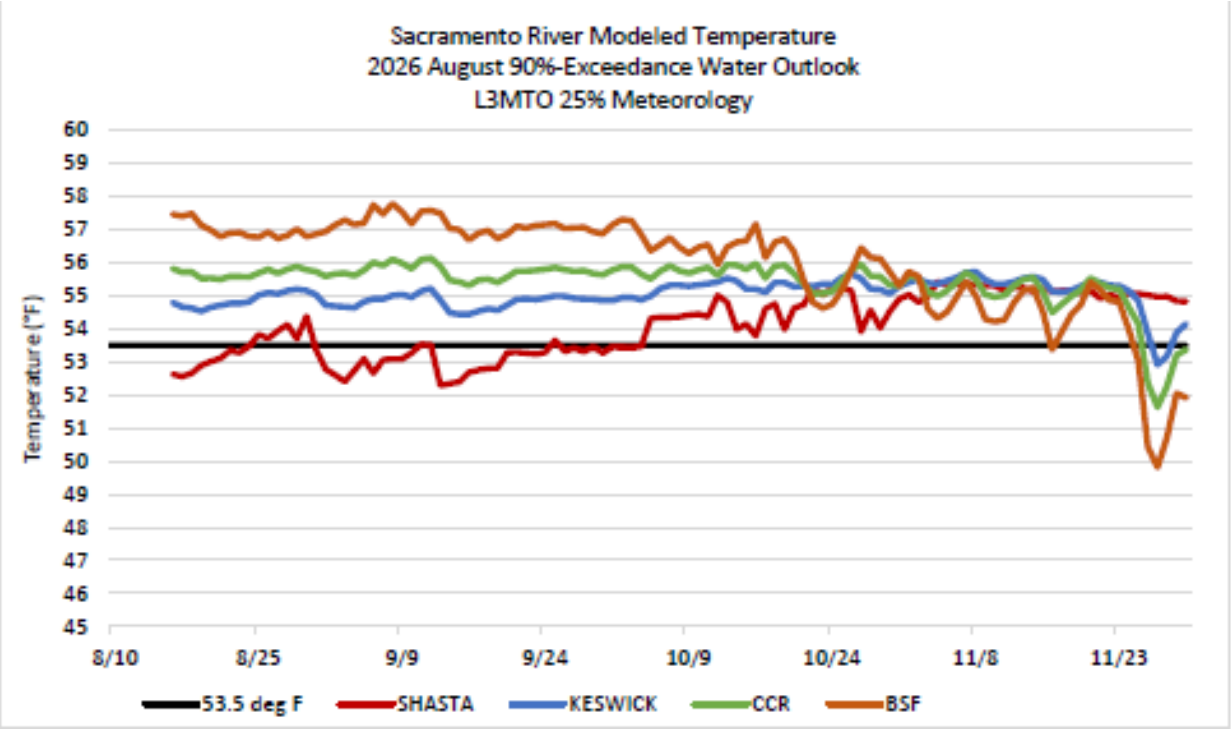

Figure 12. Sacramento River Modeled Temperature – August 2026 90%-Exceedance Water Outlook L3MTO 25% Meteorology.

This chart shows modeled Sacramento River water temperatures from mid-August through late November 2026 at four locations: Shasta, Keswick, CCR, and BSF, with a reference line at 53.5°F. Temperatures generally range from about 52°F to 58°F, with BSF remaining the warmest location and Shasta the coolest for much of the period. Most locations stay near or above 53.5°F, with modest fluctuations through fall and temperatures converging near 55°F by November. Near the end of the forecast period, all locations show a sharp decline, with BSF dropping to about 50°F before partially recovering. Overall, modeled temperatures remain relatively stable through autumn before cooling in late November.

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 Sep 13th Full Oct 16

End of September Cold-Water-Pool less than 56 deg F: 389 TAF

End of September Cold-Water-Pool less than 52 deg F: 270 TAF

End of September Cold-Water-Pool less than 48 deg F: 65 TAF

Table 21. Facility Temperature Outlook in Degrees Fahrenheit

Month	Shasta	Keswick	CCR
September	53.0	54.8	55.7
October	54.4	55.3	55.7
November	55.1	55.1	54.7

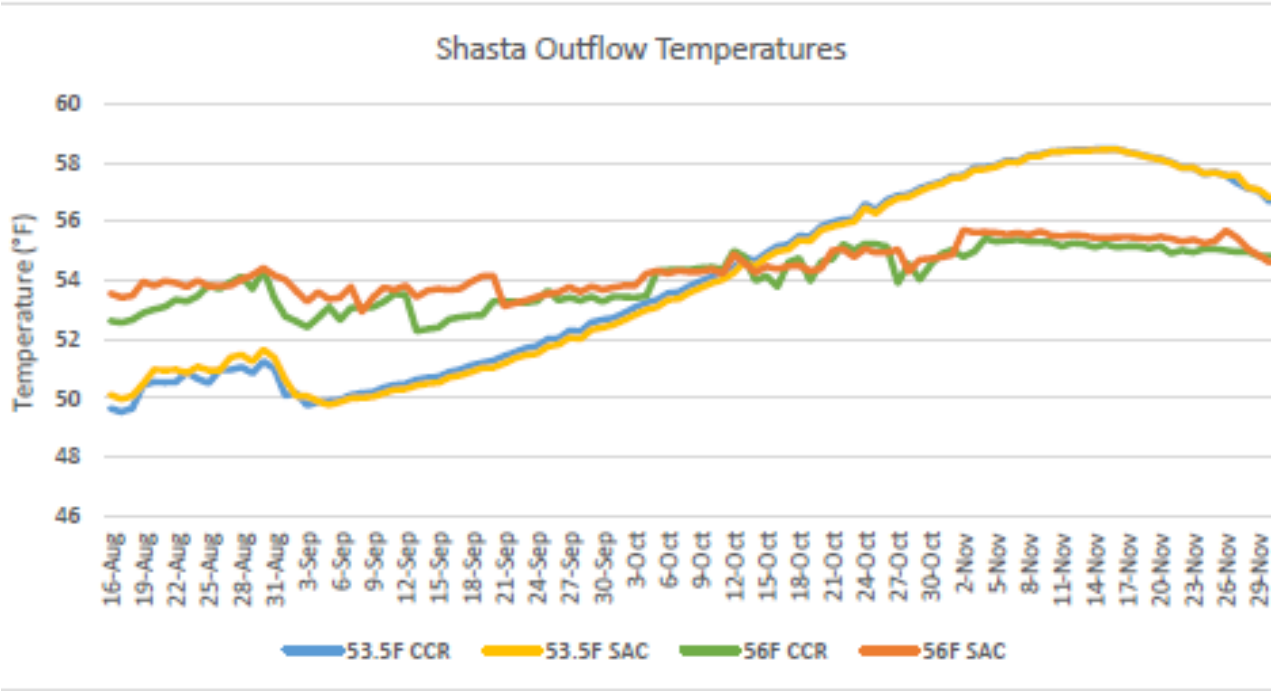

Figure 13. Shasta Outflow Temperatures.

This chart compares projected Shasta Reservoir outflow temperatures under two management targets, 53.5°F and 56°F, at the Sacramento River (SAC) and Clear Creek Road (CCR) locations from mid-August through late November. Temperatures under the 53.5°F target begin near 50°F in August and steadily rise to about 58.5°F by mid-November before slightly declining. Temperatures under the 56°F target remain more stable, generally ranging from 53°F to 56°F throughout the period. By October and November, the 53.5°F target scenarios are consistently warmer than the 56°F target scenarios. Overall, all scenarios show gradual warming through autumn, with the greatest warming occurring under the 53.5°F target.

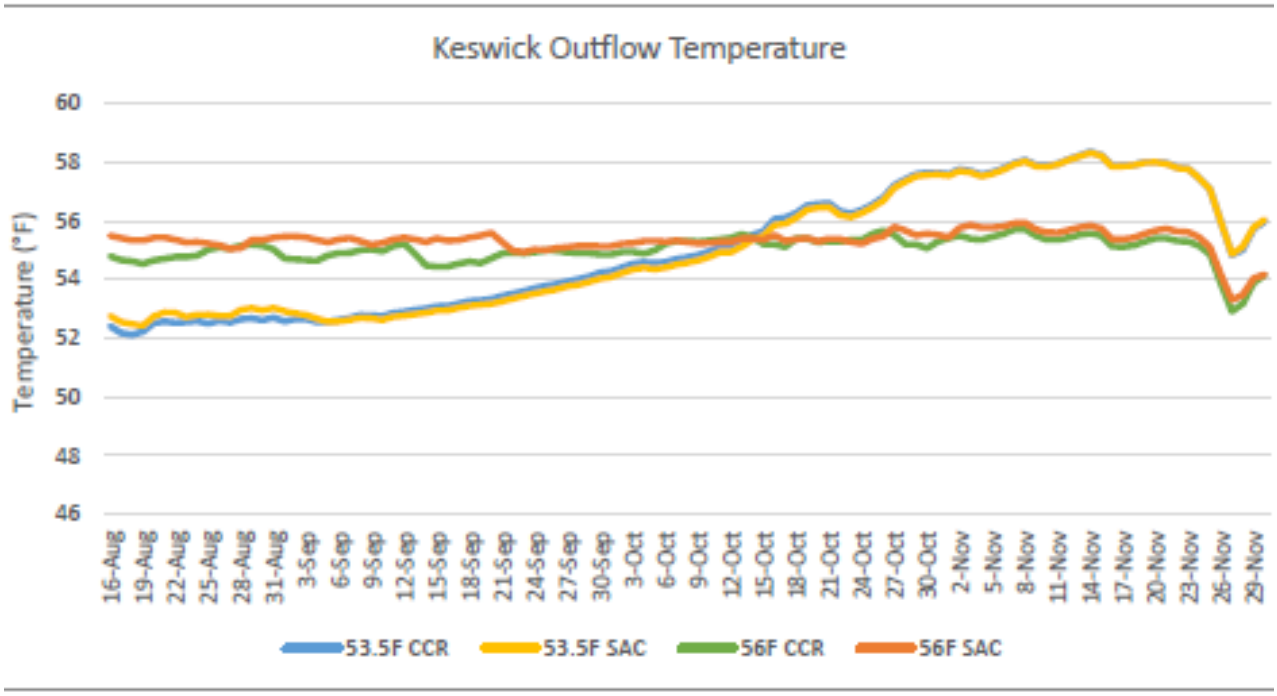

Figure 14. Keswick Outflow Temperatures.

This chart shows projected Keswick outflow temperatures from mid-August through late November under two management targets, 53.5°F and 56°F, at the Sacramento River (SAC) and Clear Creek Road (CCR) locations. Under the 53.5°F target, temperatures rise from about 52.5°F in August to a peak near 58°F in mid-November before declining sharply at the end of the period. Under the 56°F target, temperatures remain relatively stable, generally between 54.5°F and 56°F throughout the forecast. By October and November, the 53.5°F target scenarios are consistently warmer than the 56°F target scenarios. Overall, the chart shows gradual warming through autumn followed by cooling in late November, with greater temperature increases under the 53.5°F target.

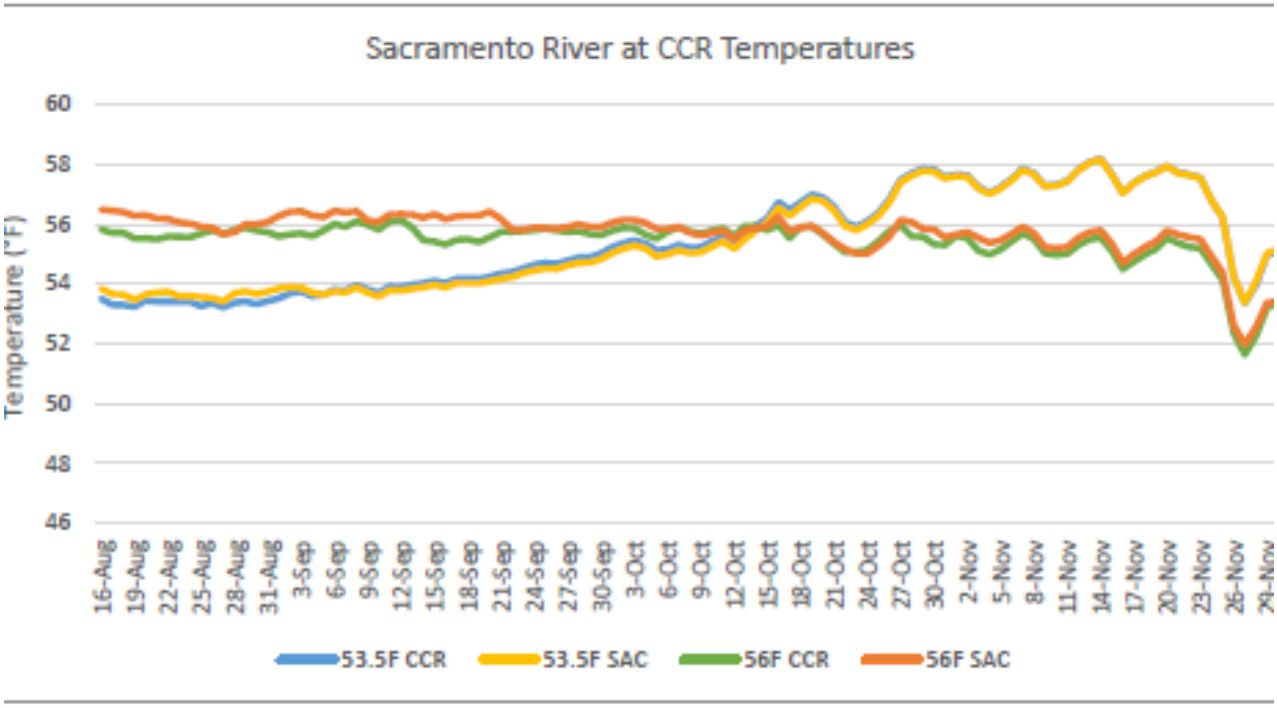

Figure 16. Sacramento River at CCR Temperatures.

This chart shows projected Sacramento River water temperatures at the CCR location from mid-August through late November under two management targets, 53.5°F and 56°F, for Sacramento River and CCR conditions. Temperatures under the 53.5°F target increase from about 53.5°F in August to around 58°F in November, while temperatures under the 56°F target remain relatively stable between about 55°F and 56°F. In late November, all scenarios show a sharp decline, with temperatures dropping to approximately 52°F to 54°F before partially recovering. Overall, the 53.5°F target scenarios produce warmer fall temperatures than the 56°F target scenarios.

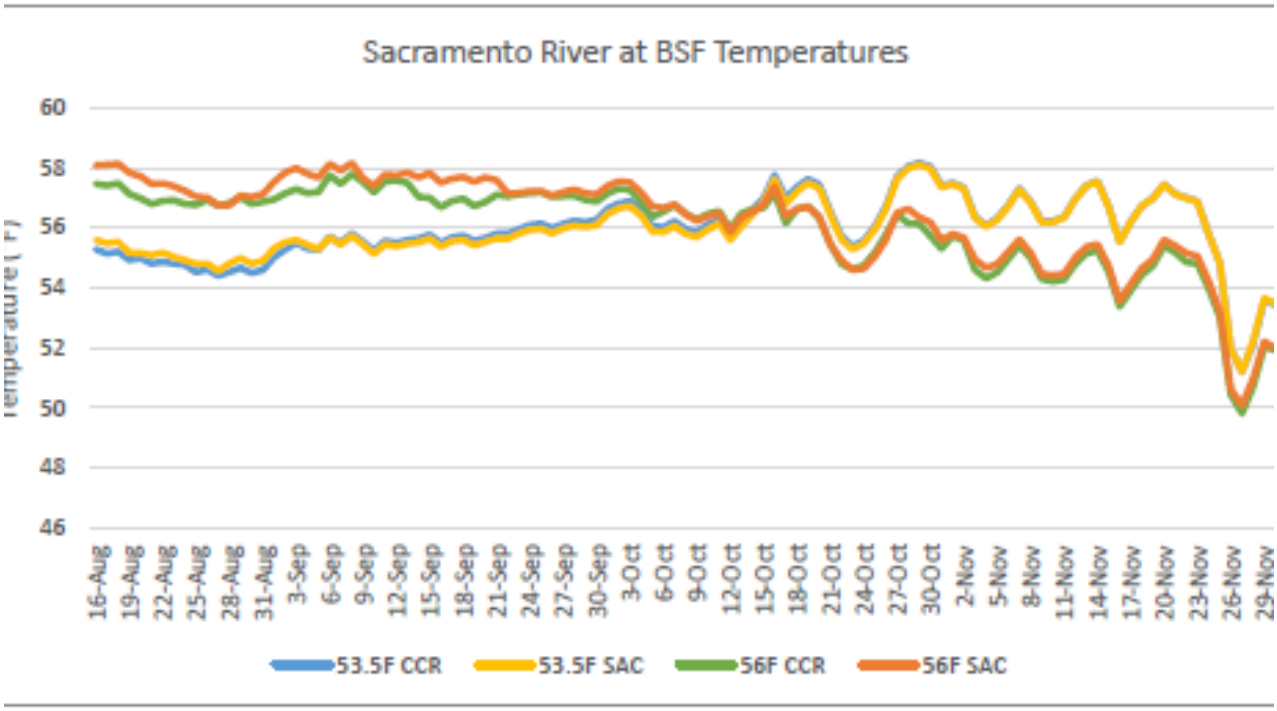

Figure 17. Sacramento River at BSF Temperatures.

This chart shows projected Sacramento River water temperatures at the BSF location from mid-August through late November under two management targets, 53.5°F and 56°F, for Sacramento River and CCR conditions. Temperatures generally range from about 54°F to 58°F through most of the period. Under the 53.5°F target, temperatures remain slightly warmer and reach about 58°F in late October and November, while temperatures under the 56°F target stay mostly between 55°F and 57°F. All scenarios exhibit short-term fluctuations during October and November and a sharp cooling event in late November, when temperatures briefly drop to about 50°F to 52°F before partially recovering. Overall, temperatures remain relatively stable through autumn, with warmer conditions under the 53.5°F target scenarios.