

## MEMORANDUM

**TO:** Wild and Scenic Stakeholder Group Monitoring Committee  
**FROM:** Bill Hoblitzell, Lotic Hydrological  
**DATE:** Monday, January 15, 2024  
**SUBJECT:** Temperature monitoring data review for Upper Colorado River 2023 field season

---

### 1 SEASON SUMMARY

Lotic Hydrological performed end-of-season analysis and graphical visualizations for stream temperature monitoring sites associated with Wild and Scenic Management Plan segments 4-7 of the Upper Colorado River. The Wild and Scenic (W&S) Stakeholder Group (SG) monitors Outstandingly Remarkable Values (ORVs) described in the management plan (Table 1). Water temperature is an ORV Resource Guide that contributes to understanding of whether natural climatic variations coupled with regional water administration and/or cooperative management actions continue to support values and goals tied to recreational fishing and water quality in segments 4-7.

The 2023 season was notable for above average snowpacks and good runoff conditions throughout much of the Upper Colorado region, Grand, Summit, and Eagle Counties however fared much lower and closer to long term averages. Summer air temperatures in the region were among the warmest 10-20% of the record since 1900 according to the Colorado State Climate Center. Reaches from Catamount to Dotsero experienced water temperature conditions that exceeded the chronic standard (MWAT) for extended periods in early August. Downstream below the Eagle confluence experienced these conditions for 3-4 weeks in duration. The Blue River location experienced temperature exceedances during shoulder season transitions.

After applying the state's Warming Event criteria<sup>1</sup> to screen exceedances, temperature conditions still logged MWAT exceedances below Dotsero. Notably, the temperature logger at Dotsero Landing above the Eagle confluence area did not survive the 2023 field season and no data was recorded in this location. Upstream at the Red Dirt monitoring location, MWAT observations slightly exceeded standards for an extended period in late July and August but the cumulative degree days did not exceed the regulatory impairment threshold. This analysis did not consider other criteria previously applied for air temperature and hydrologic excursions, and tallied shoulder season warming events separately from summer season warming events. An alternate assessment incorporating these caveats may result in a different or additional number of exceedances being counted. All results should not be understood as a legalistic standards analysis, which is only performed by the Water Quality Control Division. Much of this technical memorandum adopts information formatting and language used previously for the SG's annual monitoring reports.

---

<sup>1</sup> Appendix C, Section 303d Listing Methodology 2022 Listing Cycle  
<https://drive.google.com/file/d/1jlgq37fgFV5MpUC3HPA5misOmvhKeMrZ/view>

ORV Resource Guide	Measure/Metric	2023 Status
Water Temperature	Daily Maximum (DM)	No dates with observed exceedances on WS reaches  Observed exceedances on Blue River in October just after the change to winter water quality standards ('shoulder season')
	Maximum Weekly Average Temperature (MWAT)	Brief exceedances occur beginning as high as Catamount and Red Dirt Creek in early August. Exceedances below the Eagle River confluence (Glenwood Canyon) extend for 3 to 4 weeks in duration.  Exceedance accounting for WQCD Warming Event criteria meet the regulatory chronic temperature threshold for impairment occurred below the Eagle River confluence. Similar conditions may have occurred above Eagle River and below Red Dirt Creek, but data was unrecoverable at the Dotsero Landing location.  Extended Blue River exceedances occur in both the spring and fall shoulder seasons. Warming Event criteria threshold was exceeded during shoulder seasons days.

Table 1. Resource guide summary for 2023 season.

## 2 BACKGROUND

### *Stream Temperature Regulatory Framework*

The W&S Resource Guide for water temperature is based on the Colorado Water Quality Control Division's (WQCD; or, the Division) standard for segment COUCUC03 covering the Colorado River from the outlet of Lake Granby to the confluence with the Roaring Fork, set biannually in Regulations 31 and 33.<sup>2</sup> The temperature standards framework classification for the segment is Cold Stream Tier 2, with a site specific standard providing additional shoulder season criteria due to the presence of Mountain Whitefish spawning and early life stages. Regulations 31 and 33 provide both numeric and narrative guidance, stating that "temperature shall maintain a normal pattern of diurnal and seasonal fluctuations with no abrupt changes and shall have no increase in temperature of a magnitude, rate, and duration deemed deleterious to the resident aquatic life."

Table 2 shows the current numeric temperature standards for segment COUCUC03. Attainment of chronic temperature standards is based on the maximum of the Weekly Average Temperatures (MWAT), which is defined by taking the maximum value of a seven-day moving mean of observations. Attainment of the acute temperature standard is based on a Daily Maximum (DM), which is defined as the highest two-hour average water temperature in each 24-hour period. Temperature data are evaluated against numerical standards for chronic (MWAT) and acute (DM) seasonal maxima.

<sup>2</sup> Colorado Department of Public Health and Environment, Water Quality Control Commission 5 CCR 1002-31  
Colorado Department of Public Health and Environment, Water Quality Control Commission 5 CCR 1002-33

Standards Tier	Applicable Months	MWAT (Celsius)	DM (Celsius)
Cold Stream Tier II, CS-2	Jun 1 – Sep 30	18.3	23.9
	Nov 1 – Mar 31	9.0	13.0
	Apr 1 – May 31 & Oct 1 – Oct 31	16.9	21.2

Table 2. Temperature standards for Colorado River segment COUCUC03, covering the Wild and Scenic management reaches.

In 2023, the W&S Monitoring Committee reported water temperature data throughout segments 4-7 from three stakeholder group-sponsored sites, four USGS sites, and two BLM monitoring sites (Table 3). USGS data is publicly archived and hosted online via an automated web service API.<sup>3</sup> The UPCO-DOT site upstream of the Eagle River confluence in Dotsero was unrecoverable therefore no 2023 data was reported. W&SSG and BLM data is archived courtesy of Grand County Water Information Network (GCWIN) staff in the Colorado Data Sharing Network Ambient Water Quality Monitoring System (CDSN AWQMS) database, also available via a webservice API.<sup>4</sup>

Site ID	Description	Segment	Latitude	Longitude	Operator
BL-abvCOR	Blue River above Colorado River confluence	--	40.0333	-106.3924	BLM
09058000	COLORADO RIVER NEAR KREMMLING, CO	4	40.0366	-106.4400	USGS
COR-Pumphouse	Colorado River at Pumphouse	5	39.9899	-106.5084	BLM
COR-Rad	Colorado River at Radium	5	39.95467	-106.55	BLM
UPCO-SB	Upper Colorado River upstream of State Bridge	6	39.8555	-106.6445	WSSG
09060799	COLORADO RIVER AT CATAMOUNT BRIDGE, CO	6	39.8911	-106.8317	USGS
UPCO-RD	Upper Colorado River downstream of Red Dirt Creek	6	39.8005	-106.9740	WSSG
UPCO-DOT	Upper Colorado River upstream of Dotsero	6	39.6479	-107.0629	WSSG
09070500	COLORADO RIVER NEAR DOTESERO, CO	7	39.64461	-107.078	USGS
09071750	COLORADO RIVER ABOVE GLENWOOD SPRINGS, CO	7	39.5588	-107.2909	USGS

Table 3. Monitoring site location information.

## 2023 Climate and Hydrologic Context

### Temperature and precipitation patterns

Water temperature conditions are driven by multiple factors, with air temperature and flow conditions contributing strongly to daily and seasonal patterns. Water temperature in the Upper Colorado River is strongly influenced by intra-annual seasonal climate cycles as well as region-specific patterns and anomalies. It is useful to place the 2023 climate and hydrologic year in the context of previous weather and streamflow conditions experienced in the region. Overall precipitation much of the western portion of the state was much above average, however this was not the case in the upper Colorado and Blue River headwaters, which the winter precipitation was essentially very near-average for the 120+ year record (Figures 1 - 3). Despite the social hype surrounding snowpacks in much of the rest of the state, individual SNOTEL locations in the Colorado Headwaters largely hovered near 100% of average, while sites near Fremont and Hoosier Pass in the southern portion of the Wild and Scenic contributing area were as much as 19% below average prior to onset of runoff (Figure 3). The Colorado State Climate Center ranked 2023 summer air temperatures for a majority of the Upper Colorado headwaters region between the 20<sup>th</sup> and 10<sup>th</sup> warmest on record, and a significant remainder of the southern portion of the headwaters basin (Blue, Williams Fork, and Eagle drainages) in the top 10% of warmest years on record (Figure 3).<sup>5</sup>

<sup>3</sup> <https://nwis.waterservices.usgs.gov/rest/IV-Test-Tool.html>

<sup>4</sup> [https://www.awqms.com/files/AWQMS\\_Training/AWQMS%20Web%20Services%20User%20Guide.pdf](https://www.awqms.com/files/AWQMS_Training/AWQMS%20Web%20Services%20User%20Guide.pdf)

<sup>5</sup> [https://climate.colostate.edu/reports/wy2023\\_climate\\_summary.pdf](https://climate.colostate.edu/reports/wy2023_climate_summary.pdf)

Figure 1. Snow Water Equivalent (SWE) accumulation and melt patterns for aggregated SNOTEL sites in the Headwaters Colorado basin, which includes all drainage area to the Wild and Scenic reach above the Roaring Fork except the Blue and Eagle Rivers.

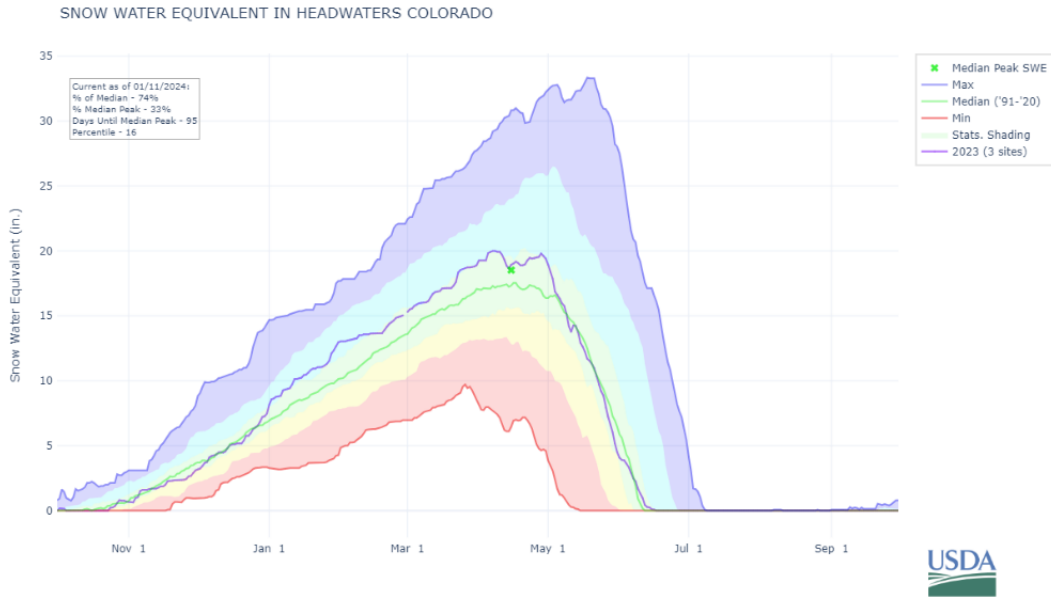


Figure 2. Snow Water Equivalent (SWE) accumulation and melt patterns for aggregated SNOTEL sites in the Blue River Basin.

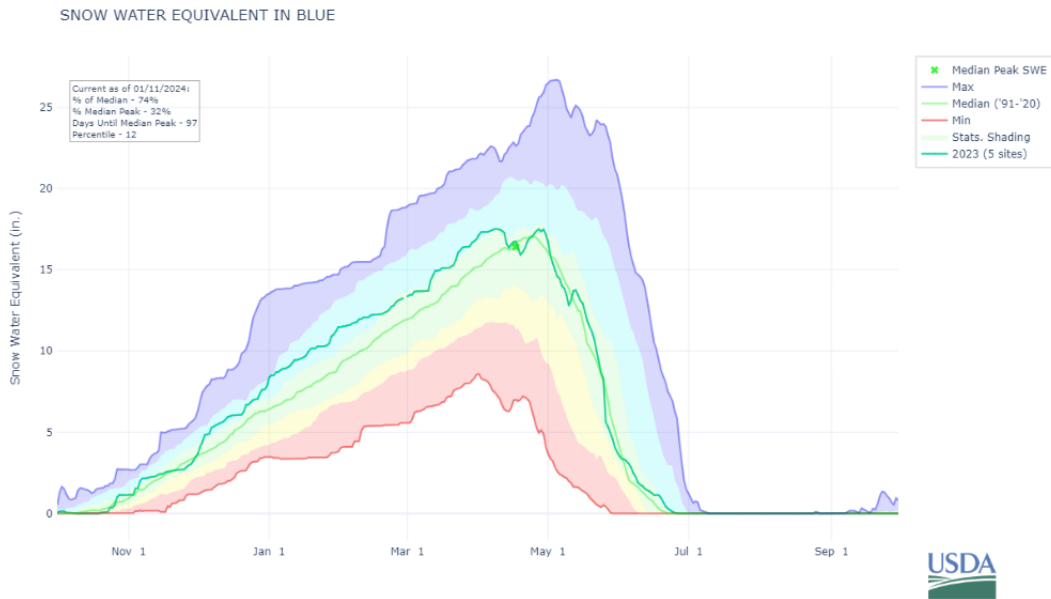


Figure 3. Accumulated SWE percentages for the 2022/23 winter in the Wild and Scenic regions. Figure from NRCS Interactive Snotel Map.

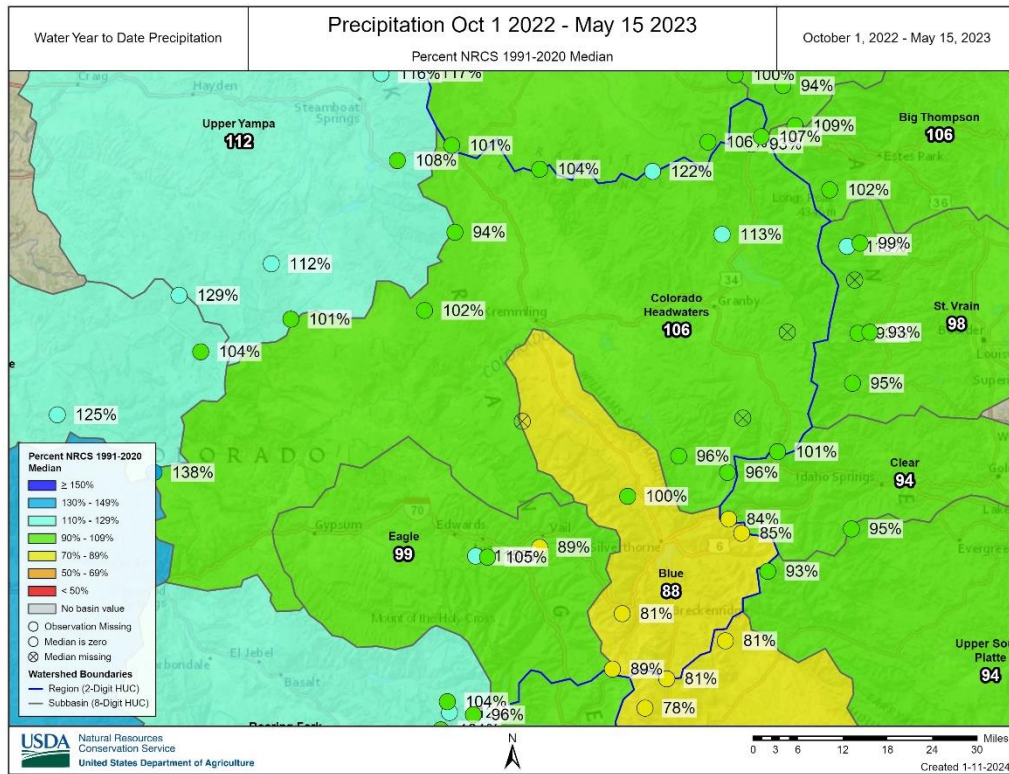


Figure 4. Statewide precipitation rankings for winter 2022/23. Figure from Colorado State Climate Center.

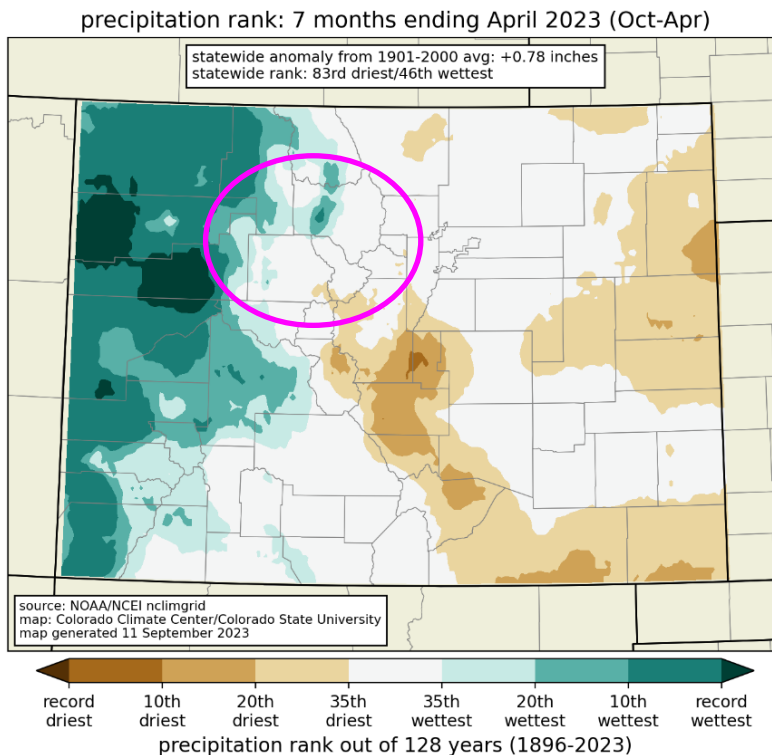
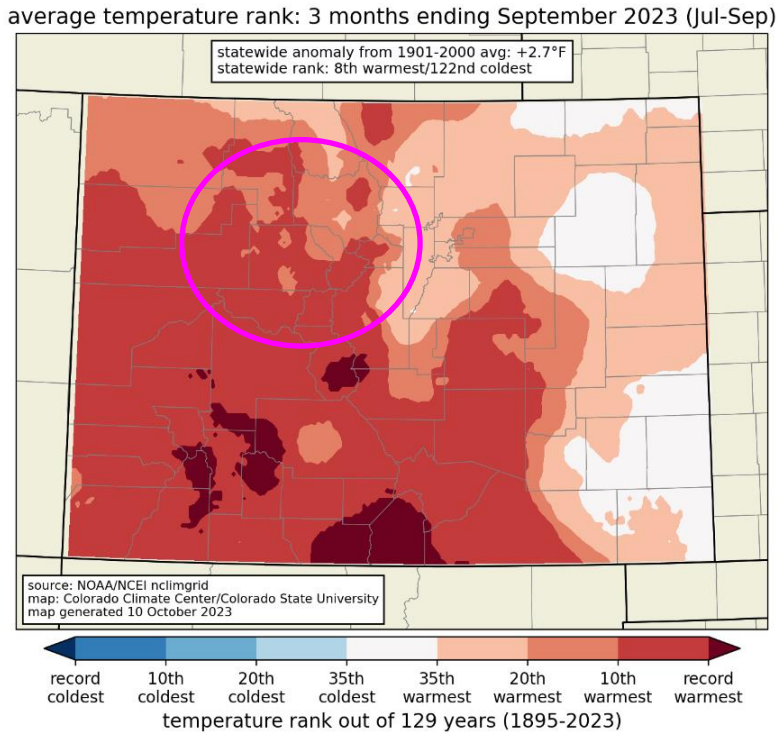


Figure 5. Statewide temperature ranking for summer 2023. Figure from Colorado State Climate Center.



**Runoff patterns**

The Upper Colorado River had above average runoff flows, albeit with a truncated hydrograph peak June during reservoir fills (Figure 5). Mean July flows at the below Kremmling gauge hovered near the 75<sup>th</sup> percentile while mean August were more middling (Figure 6). The peak flow for the season of a little over 5000 cfs occurred in the final week of June. Near the first week of August, declining summer flows stabilized from upstream reservoir releases transiting water to other western water rights.

Figure 6. Summer 2023 runoff patterns at the USGS streamflow gauge below Kremmling.

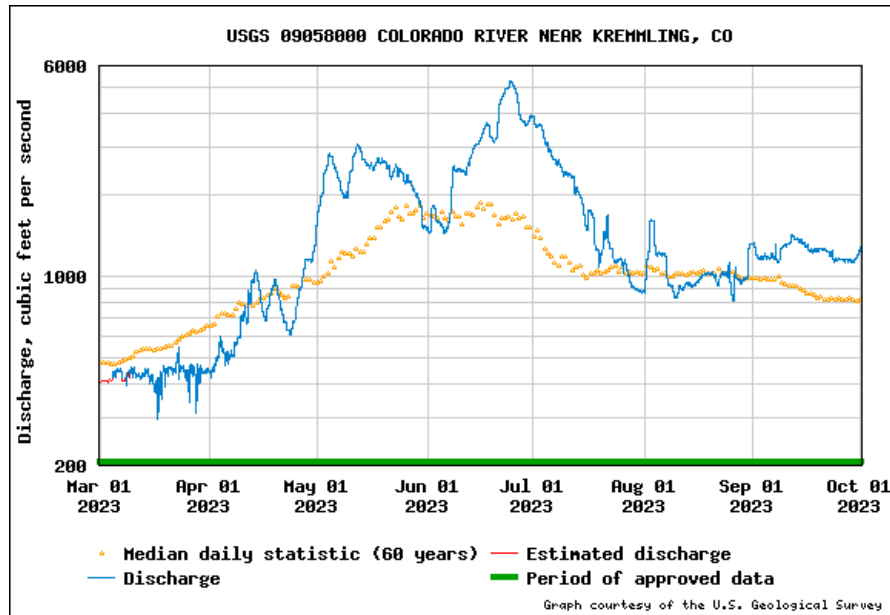
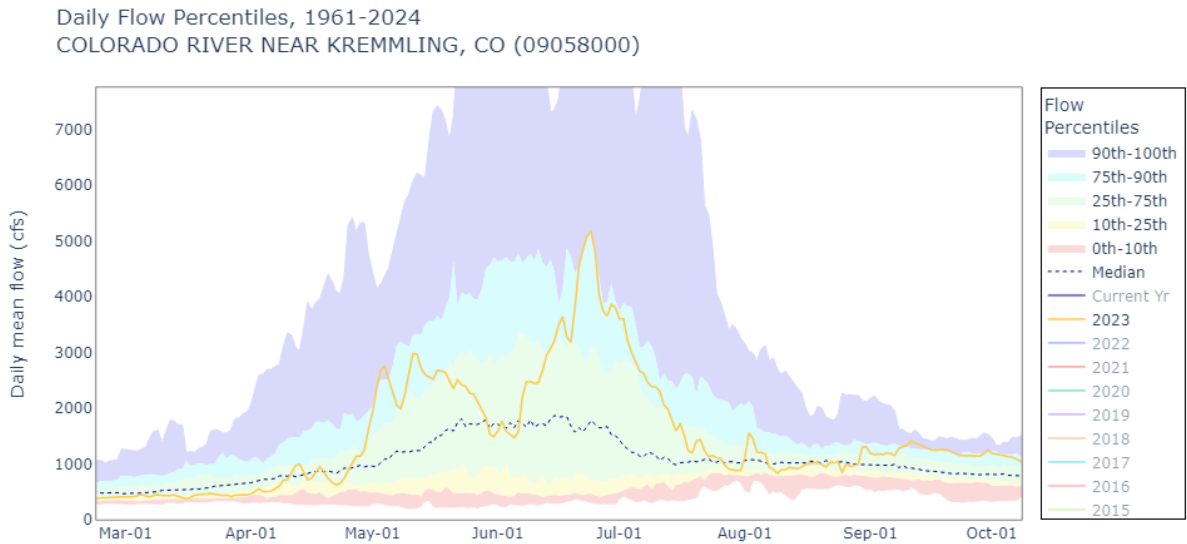


Figure 7. Daily flow percentiles in 2023 at the USGS streamflow gauge near Kremmling. Data provided by USGS.



### 3 2023 DATA REVIEW

The 2023 temperature data displays the typical natural downstream warming trend between Kremmling and Glenwood Springs (Figures 1-3). During peak runoff periods, a smaller differential between the most-upstream and downstream sites is observable than later in the summer. The reach gains heat consistently between Gore Canyon and Glenwood Springs during late summer and early fall periods. The No Name site in Glenwood Canyon is often cooler than upstream sites during early season due to influences from the Eagle River and local tributaries during snowmelt runoff. Once peak flows have subsided and the Eagle and other tributaries provide less cooling influence, this reach (characterized by the monitoring sites 09070500 below Dotsero and at No Name 09071750) often faces the most persistent late summer concerns. This year, flows in the Eagle River providing little cooling influence below Dotsero.

Sites from Catamount downstream exceeded the MWAT criteria at least once in 2023 and sites from Dotsero downstream exceeded it for extended time periods (Figures 9, 10, Tables 4, 4). After application of Warming Event criteria to the summer season, sites from Dotsero downstream still exceeded criteria.

The lower Blue River displays a unique seasonal pattern compared to the Colorado, facing regular temperature concerns during the late spring shoulder season in May. During this period, Dillon and Green Mountain Reservoirs are filling, attenuating or fully eliminating the natural springtime rise, peak, and recession of cold snowmelt flows.

Figure 8. Daily Maximum temperatures (DM) in 2023 and the applicable summer, shoulder, and winter season standards. The Blue River is not included for figure clarity, as it has a different WQ standard.

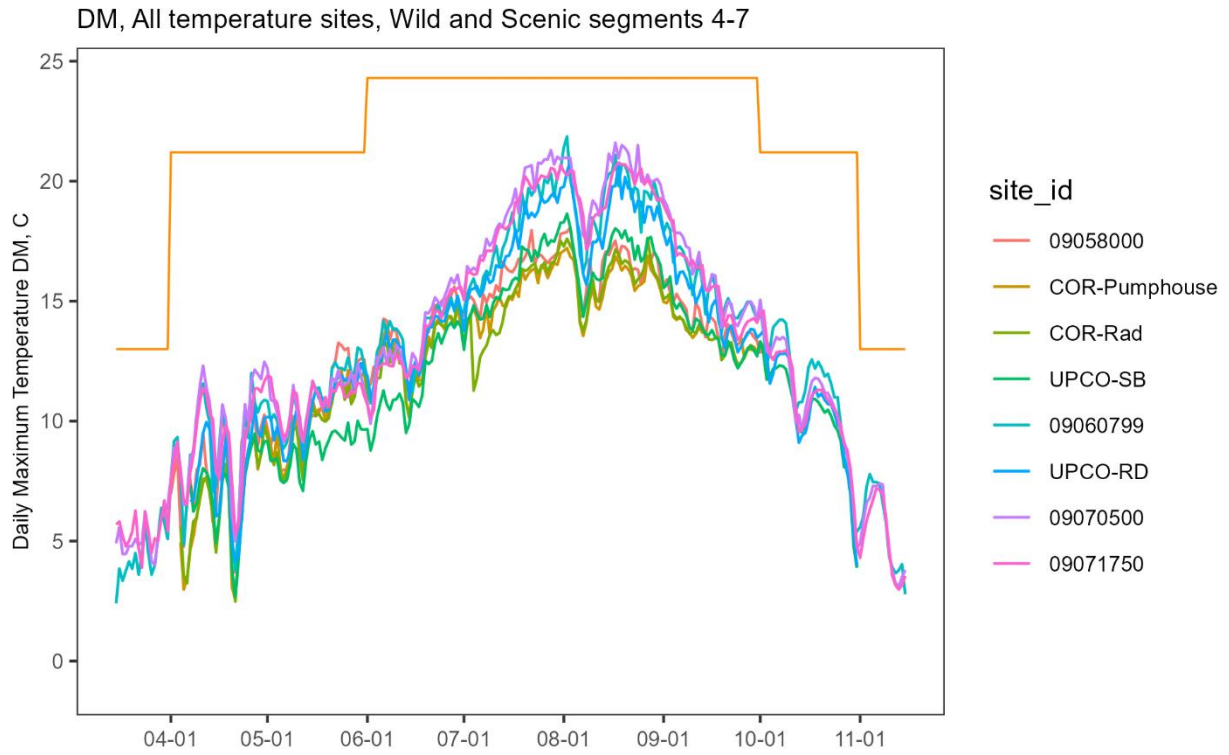




Figure 9. Weekly Average Temperature (WAT) in 2023 and the applicable summer, shoulder, and winter season MWAT standards. Blue River is not included for figure clarity, as it has a different WQ standard applied.

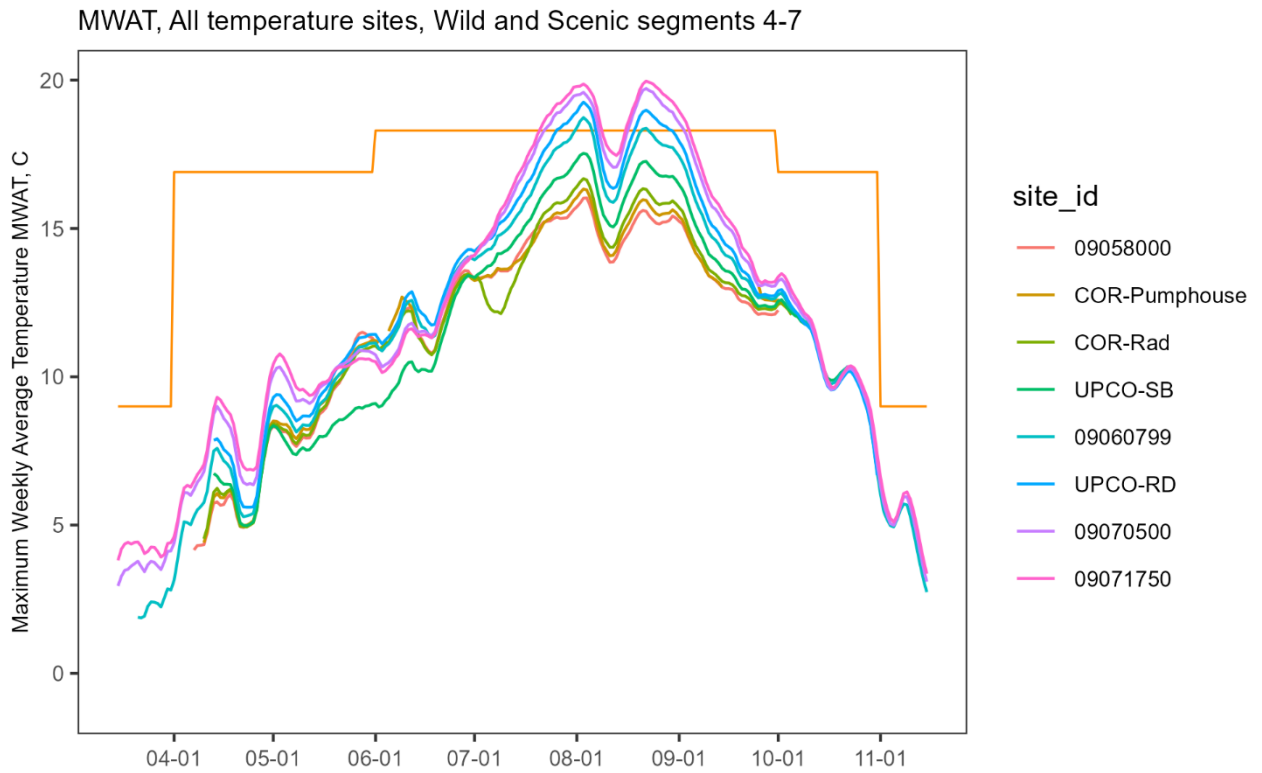
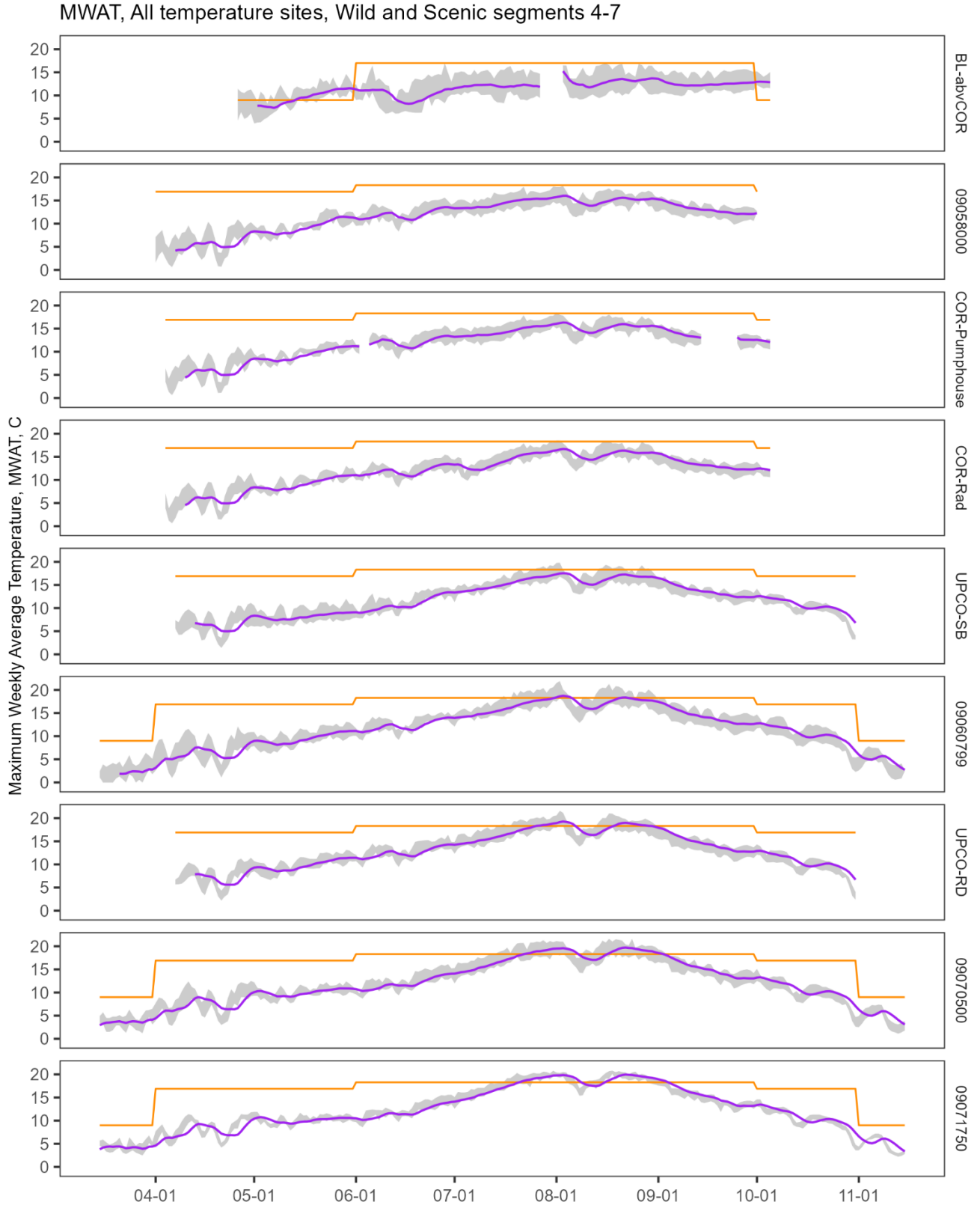


Figure 10. MWAT for all sites on W&S reach in 2023, with standards overlay. Warming events were accumulated separately for summer and winter seasons in this analysis.



Site	Year	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Annual_total
BL-abvCOR	2023		0	0	0	0	0	0	0	0
09058000	2023		0	0	0	0	0	0	0	0
COR-Pumphouse	2023		0	0	0	0	0	0	0	0
COR-Rad	2023		0	0	0	0	0	0	0	0
UPCO-SB	2023		0	0	0	0	0	0	0	0
09060799	2023	0	0	0	0	0	0	0	0	0
UPCO-RD	2023		0	0	0	0	0	0	0	0
09070500	2023	0	0	0	0	0	0	0	0	0
09071750	2023	0	0	0	0	0	0	0	0	0

Table 4. DM site regulatory exceedance summary by month (estimated number of weeks exceeding standards criteria after a warming event analysis has been applied). Empty cells indicate months with no reported data.

Site	Year	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Annual_total
BL-abvCOR	2023		0	1	0	0	0	0	1	2
09058000	2023		0	0	0	0	0	0	0	0
COR-Pumphouse	2023		0	0	0	0	0	0	0	0
COR-Rad	2023		0	0	0	0	0	0	0	0
UPCO-SB	2023		0	0	0	0	0	0	0	0
09060799	2023	0	0	0	0	0	0	0	0	0
UPCO-RD	2023		0	0	0	0	0	0	0	0
09070500	2023	0	0	0	0	0	2	1	0	3
09071750	2023	0	0	0	0	0	4	0	0	4

Table 5. MWAT site regulatory exceedance summary by month (number of days exceeding standards criteria after a warming event analysis has been applied). Empty cells indicate months without data.

#### 4 ADDITIONAL DELIVERABLES

Individual site analysis reports and plots.

Compiled and formatted datasets