

River Watch Items for the April 2023 UWP Board Meeting

- River Watch items of interest:
 - Samples from our six main River Watch sites were collected and analyzed between the 2nd and 8th of April 2023. Evidence of runoff was present in Cow Creek on the 8th.
 - The revised River Watch/water quality report is nearly completed after responding to comments by Amanda, Phil, and Dennis.
 - River Watch has developed a new tool that provides time series plots and box and whisker plots for all River Watch sites. It uses all data available for a site. The tool can be accessed using the link: <https://npgtesting.shinyapps.io/ShinyStationTool/>. An example in Figure 2 for Ridgway Town shows monthly box plots of field data (temperature, DO, alkalinity, and hardness).

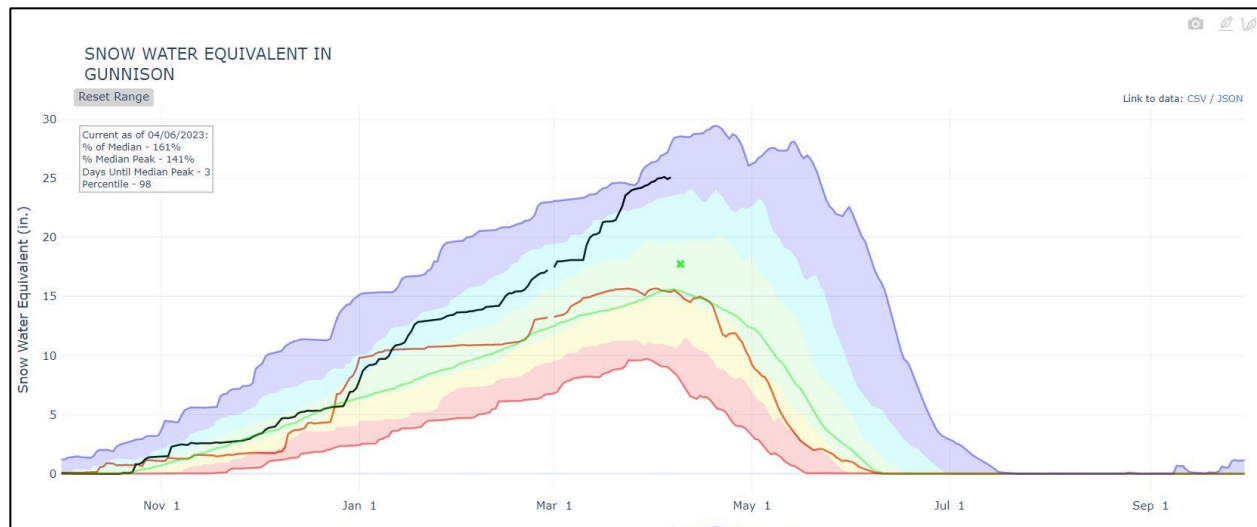


Figure 1. SWE plots for the Gunnison Basin. Dark line shows the current water year. Brown line represents the 2022 water year. Top line is the maximum observed SWE. Green x is the median peak SWE that occurs in mid-April.

- Precipitation, streamflow, and reservoir storage:
 - Snowpacks in Colorado continued to increase between 6 March and 6 April 2023. On April 6th the Gunnison Basin had 161% of its median Snow Water Equivalent (SWE), up from the 141% noted on March 5th. The April 6th value of 25 inches was about 7.5 inches above the median water year peak SWE (green x in Figure 1) which occurs on 9 April. Figure 1 shows current and historic SWE curves for the Gunnison Basin which includes data from 15 sites. The SWE percentage at the Idarado SNOTEL site went up from 121% of its median to 136% over the same period. The data as of 6 April indicated Idarado SWE was 4.4 inches above its median maximum. The SWE recorded at Columbine Pass on the Uncompahgre Plateau is a record for the years the SNOTEL network has been in operation; 46.3 inches and 288% of its median value on April 6th (note the SWE peak at Columbine typically occurs on 23 March).
 - Streamflow measurements at the USGS gauge near Ridgway showed the impact of “warm” storms between the 11th and 17th of March, with several peaks above 90 cfs. After March 18th flow at the Ridgway site dropped to values generally below 50 cfs, while the median flow rose to ~75 cfs by April 6th. The USGS gauge below Ridgway Reservoir indicated discharge from the reservoir was raised in steps from about 50 cfs on 6 March to 300 cfs by 6 April.
 - With the large increase in discharge noted above, storage in Ridgway Reservoir dropped rapidly to about 64,000 acre-feet on 6 April (median is 62,700 acre-feet) after peaking at 70,600 acre-feet on 16 March.

Historical Field Data Water Quality Trends - Station 402

Station: *Ridgway Town River: Uncompahgre County: Ouray* WBID: *COGUUN03C*.

This document shows historic field data for your station. You are the first line of defense for this data. Field data fluctuates depending on the parameter. Use this tool to verify that your results are in line with historical trends. You will find guidance on the back of the page for what to do if your measurements are outside historical trends.

Table 1: River Watch Station 402 Summary Statistics

	# samples	min	max	median	range
Temperature (°C)	113	-2.0	21.1	8.0	23.1
pH	112	7.3	8.4	7.8	1.1
Dissolved Oxygen (mg/L)	2	6.0	9.9	8.0	3.9
Total Hardness (mg/L CaCO ₃)	112	76.0	380.0	280.0	304.0
Phenolphthalein Alkalinity (mg/L CaCO ₃)	108	0.0	4.0	0.0	4.0
Total Alkalinity (mg/L CaCO ₃)	112	24.0	136.0	86.0	112.0

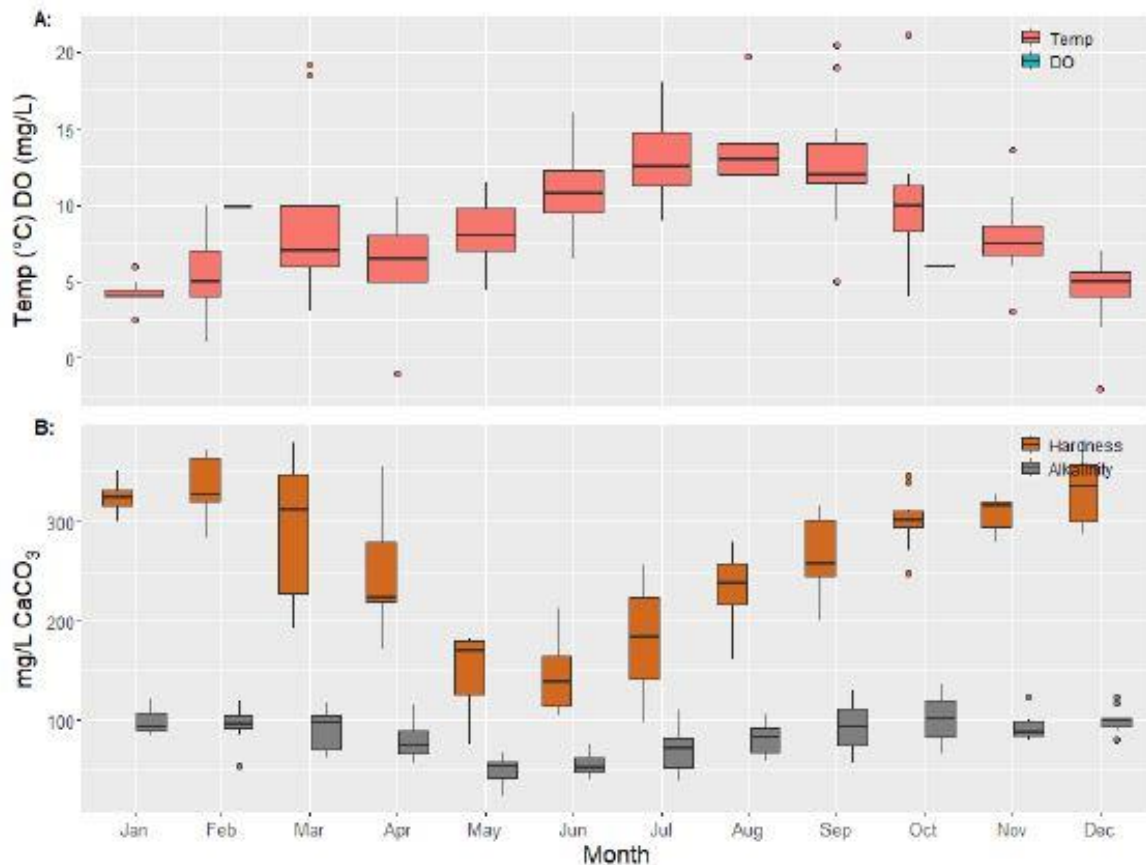


Figure 1. Field data showing monthly trends in A) temperature and dissolved oxygen (DO), and B) total hardness and total alkalinity presented as a box and whisker plot. The 25th and 75th percentiles of the data are represented as the lower and upper endpoints of the box. The bold line in each box represents the median. Whiskers, or the lines extending vertically from the boxes, represent the variability outside the upper and lower quartiles. Outliers are shown as dots.

Figure 2. Box plots from the River Watch data tool. Top: monthly temperature and dissolved oxygen data. Bottom: monthly hardness and alkalinity data.

- 2002-2023 SWE and Streamflow Data

Water year 2023 is attaining one of the larger snowpacks of the past 22 years. Figure 3 shows the peak SWE values recorded at the Red Mountain Pass SNOTEL for water years 2002 through 2023. This period was chosen so SWE and discharge can be compared with River Watch data which has been continuous since 2002 at many sites on the Uncompahgre River. Three of the four peak SWE values prior to 2023, and greater than 30 inches, were found in May, so the 2023 peak of 30.5 inches could possibly continue to increase. In the past 11 years only 2019 reached a SWE peak greater than 30 inches.

Assuming discharge on the Uncompahgre River is related to peak SWE, the average monthly discharges at the USGS stream gauge near Ouray were summed for April through July of water years 2002 through 2022. These months were used to best represent runoff from snowpack, and exclude runoff from monsoon storms. The discharge totals could be refined by examining the individual water year discharge curves and selecting a more specific period for snowpack runoff. Using the April to July discharge data a comparison of total discharge to maximum SWE at Red Mtn Pass is shown by the scatter plot in Figure 4. The linear fit to the data had a relatively high correlation, with an R^2 of 0.81. Most of the variability was found in the mid-range of peak SWE values between 20 to 25 inches where total discharge varied from about 800 cfs to 1350 cfs. The large year-to-year differences could be due to a variety of factors including soil moisture conditions, the actual timing of the runoff period, and added runoff from monsoon storms in July of some years.

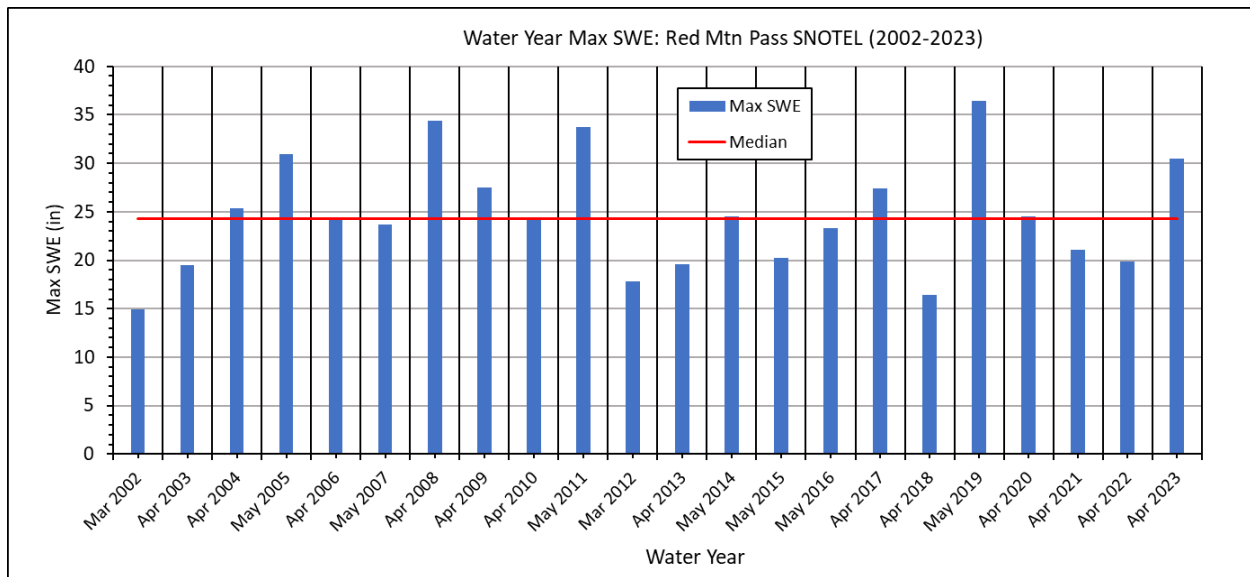


Figure 3. Peak SWE recorded at the Red Mountain Pass SNOTEL site (2000-2023). 2023 value is based on April 9th data. Red line shows the median peak SWE over the same period.

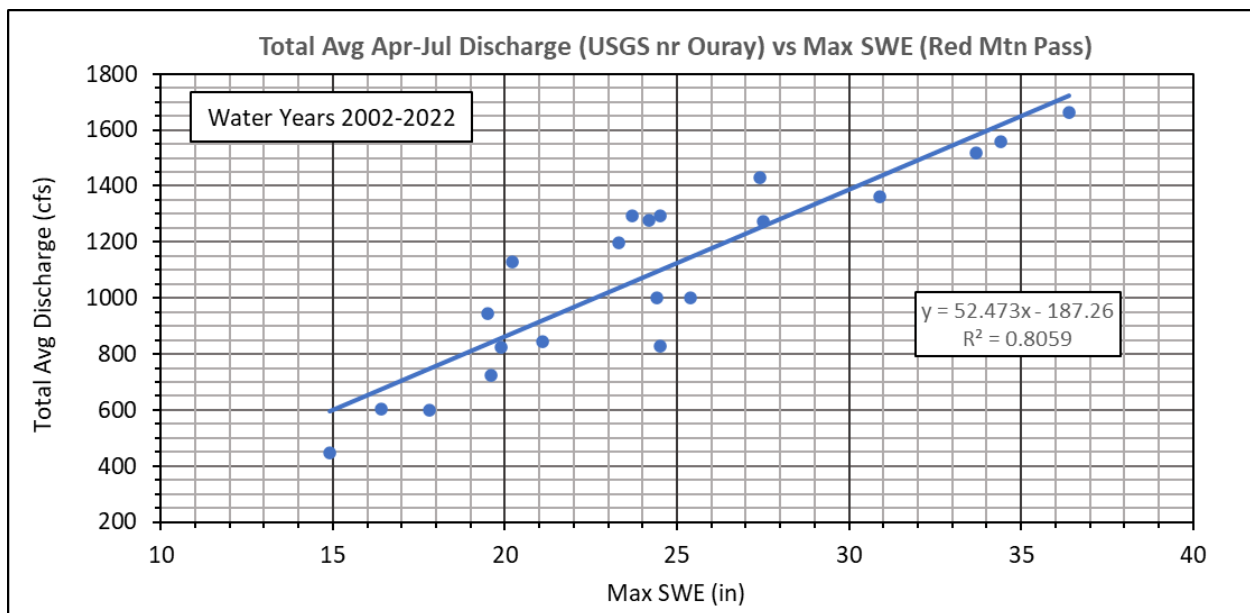


Figure 4. Total average April to July discharge at the USGS gauge near Ouray versus the maximum water year SWE recorded at the Red Mtn Pass SNOTEL. Water years 2002 through 2022 are represented. Linear fit to the data is shown by the blue line with an R^2 value of 0.81.