USDA Natural Resources Conservation Service
U.S. DEPARTMENT OF AGRICULTURE

Montana Water Supply Outlook Report

April 1, 2026

The contradictions of Winter 2026 persisted through March, where despite a large mid-month storm, warm temperatures erased most gains, resulting in an early start to snowmelt driven runoff. Snow surveyors experienced the rapid melting firsthand on a trip to clear access to Holbrook Snow Course (4540 ft), which is one of 127 sites representing Montana's snowpack that are manually measured at the end of March. In this picture, low elevation snow melts into the South Fork of the Flathead River, where four days prior a storm deposited 1.5 feet of new snow. By the end of the month Holbrook lay free of snow for the fourth time since 1951. (Photo: Javier Colton – March 18th 2026)

Table of Contents

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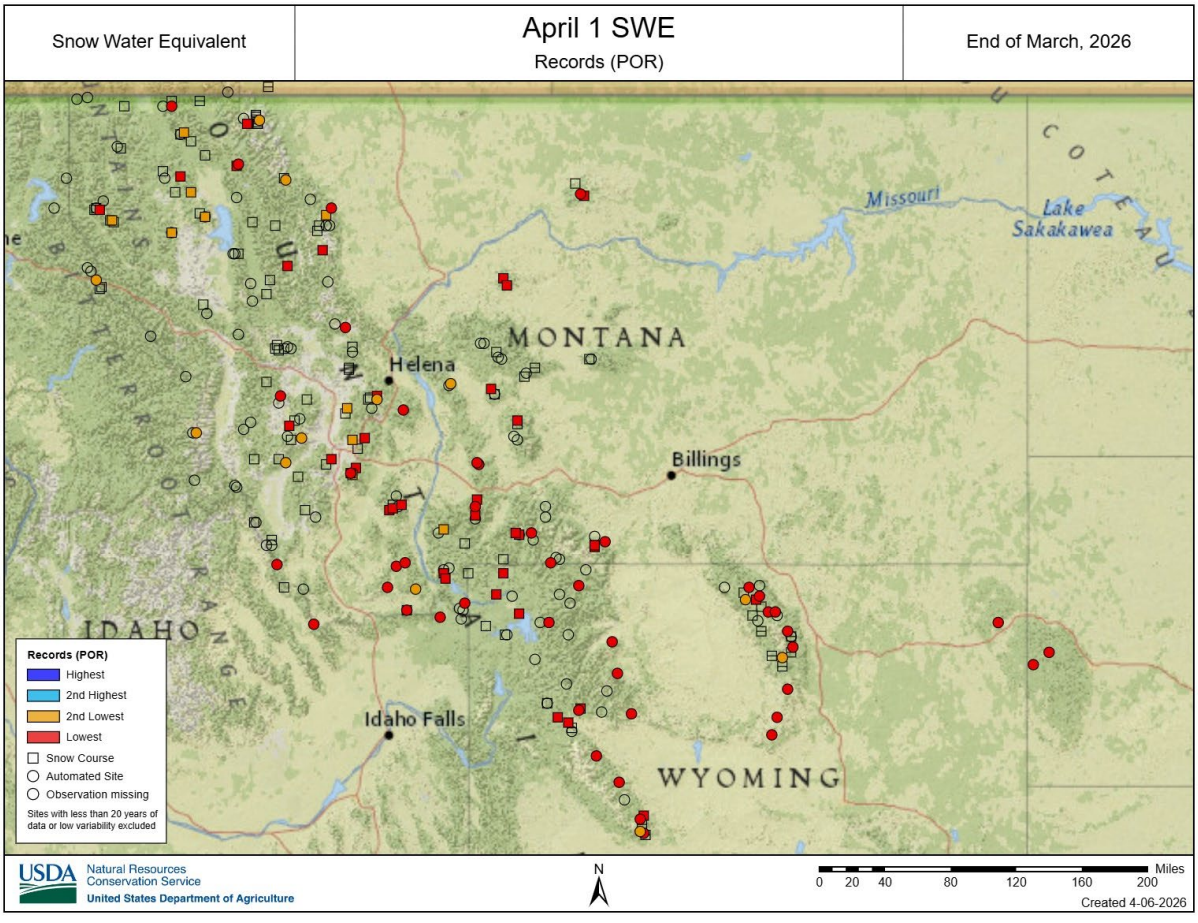
Statewide Overview

Summary

Snowpack totals remained below normal across all of Montana on April 1. A strong mid-month storm added several inches of snow water equivalent (SWE) across the western and central regions of the state. However, the new snow came short of rebuilding early season snowpack deficits. Warm temperatures melted most of the gains, leaving conditions worse by the end of the month. Calvert Creek SNOTEL at 6,400' in the Anaconda Range exemplified this pattern. It gained over 2" of SWE in the first half of March and then melted 7" inches by the end of the month. With many nights above freezing and daytime highs pushing into the 60s, low elevation sites completely melted out while many high elevation sites experienced their first major melting event of the season. Of the 250 monitoring stations with over 20 years of data on the map below, 84 are experiencing their lowest year on record (red) while 22 are experiencing their second lowest year on record (orange).

This year's abnormally warm temperatures combined with aspect and elevation dependent distribution of snow make it difficult to find comparable years. Both 2007 and 2015 shared similarly low snowpack and good water-year precipitation. Both years resulted in below median streamflow at most streamflow forecasting points.

The April 1NRCS Water Supply Forecasts project largely below normal streamflows for the April-July forecast period at 40-110% of median. However, streamflow forecasts are a range and depend on spring and summer weather. Snowmelt has already begun early this year. Late spring storms can prolong melting and runoff, and high elevation sites may continue to retain snow if stormy weather returns. Likewise, continued warm temperatures and dry conditions could further accelerate snowmelt and reduce forecasted streamflow.



Statewide Overview

Precipitation

March precipitation varied across the state. Basins in northwest and central Montana had well above normal monthly precipitation of 135-215% of median. Several SNOTELS broke March precipitation records due to winter storms around March 9-16 that centered on the region. The mid-March storm was not as impactful in southwest Montana and Wyoming. The Jefferson, Upper Yellowstone, and Bears Paw basins all recorded near normal precipitation. The Gallatin, Bighorn, Powder, and Tongue basins had below normal March precipitation of 65-85% of median. The Madison basin was well below normal at under 50% of median precipitation. SNOTELs in the Madison basin experienced record low or near record low March precipitation.

Water-year-to-date precipitation remains near or above normal for most basins, except for the Tongue basin at under 90% of median. The December atmospheric river event sustained these values throughout the winter. Where the mid-March storm was fruitful, water-year-to-date precipitation percentages increased slightly in March. The basins with below normal March precipitation saw slight decreases in water-year-to-date precipitation percentages.

Spring precipitation will be crucial to make up for snowpack deficits and maintain water-year-to-date precipitation. Spring precipitation is a large contributor to uncertainty in water supply forecasts. Future precipitation will determine drought and streamflow conditions as we progress through spring. In areas where snow melt has already occurred, more precipitation will be crucial to maintain soil moisture.

March - Highest Total Accumulated Precipitation - SNOTEL/SNOLITE

Station	Precipitation (Inches)	Median (Inches)	Elevation	Basin
Twin Lakes	13.2	6.2	6380	Bitterroot
Poorman Creek	12.1	7.8	5050	Kootenai
Moss Peak	11.3	6.0	6760	Flathead
Flattop Mtn.	11.2	7.4	6280	St. Mary, Flathead
North Fork Jocko	11.1	6.6	6110	Upper Clark Fork, Flathead

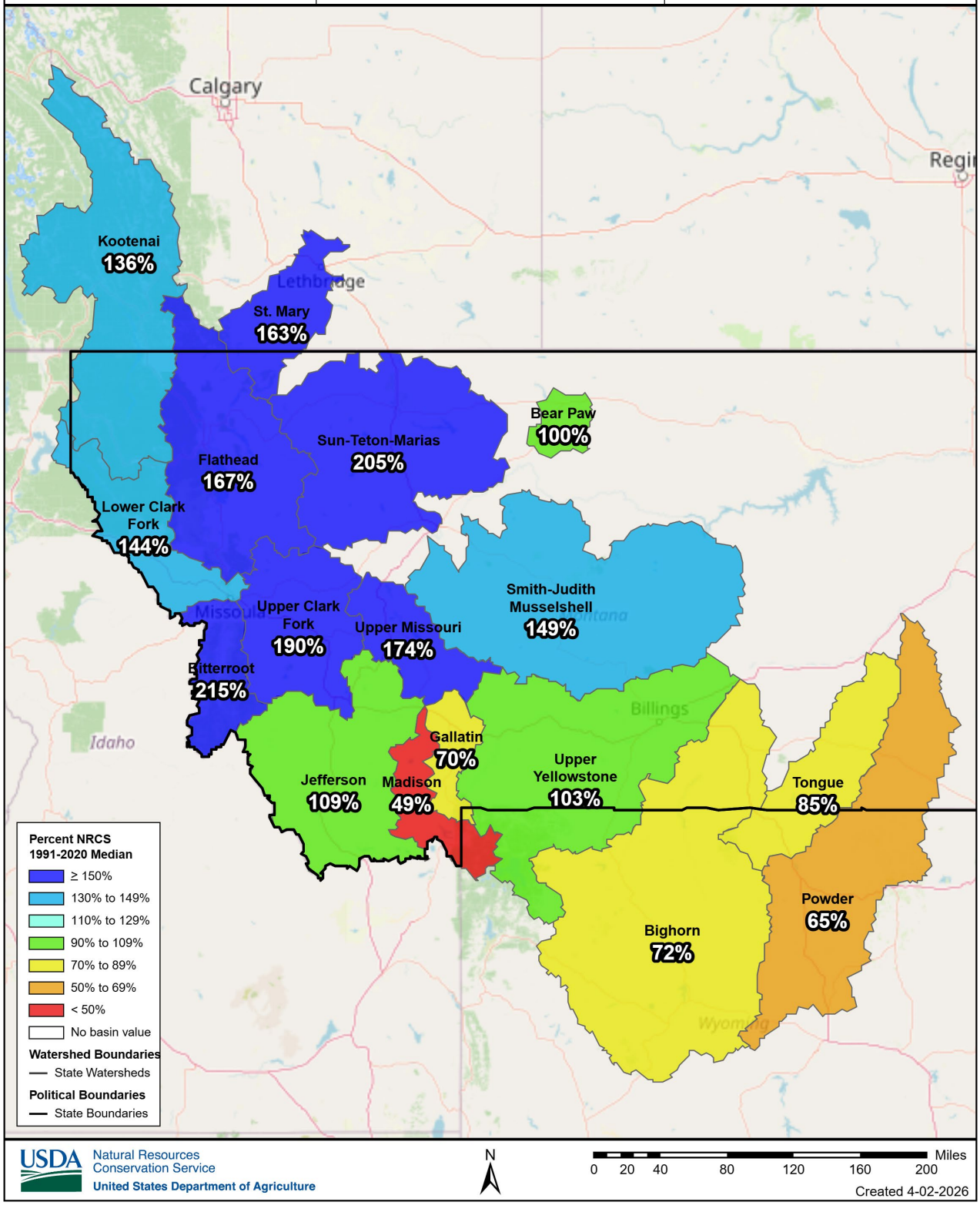
March - Lowest Total Accumulated Precipitation- SNOTEL/SNOLITE

Station	Precipitation (Inches)	Median (Inches)	Elevation	Basin
Timber Creek	0.1	1.6	7910	Bighorn
Short Creek	0.3	1.2	6990	Jefferson
West Yellowstone	0.4	2.0	6680	Madison
Lakeview Ridge	0.5	2.0	7340	Jefferson
Whiskey Creek	0.6	3.2	6790	Madison

Statewide Overview

Precipitation (Continued)

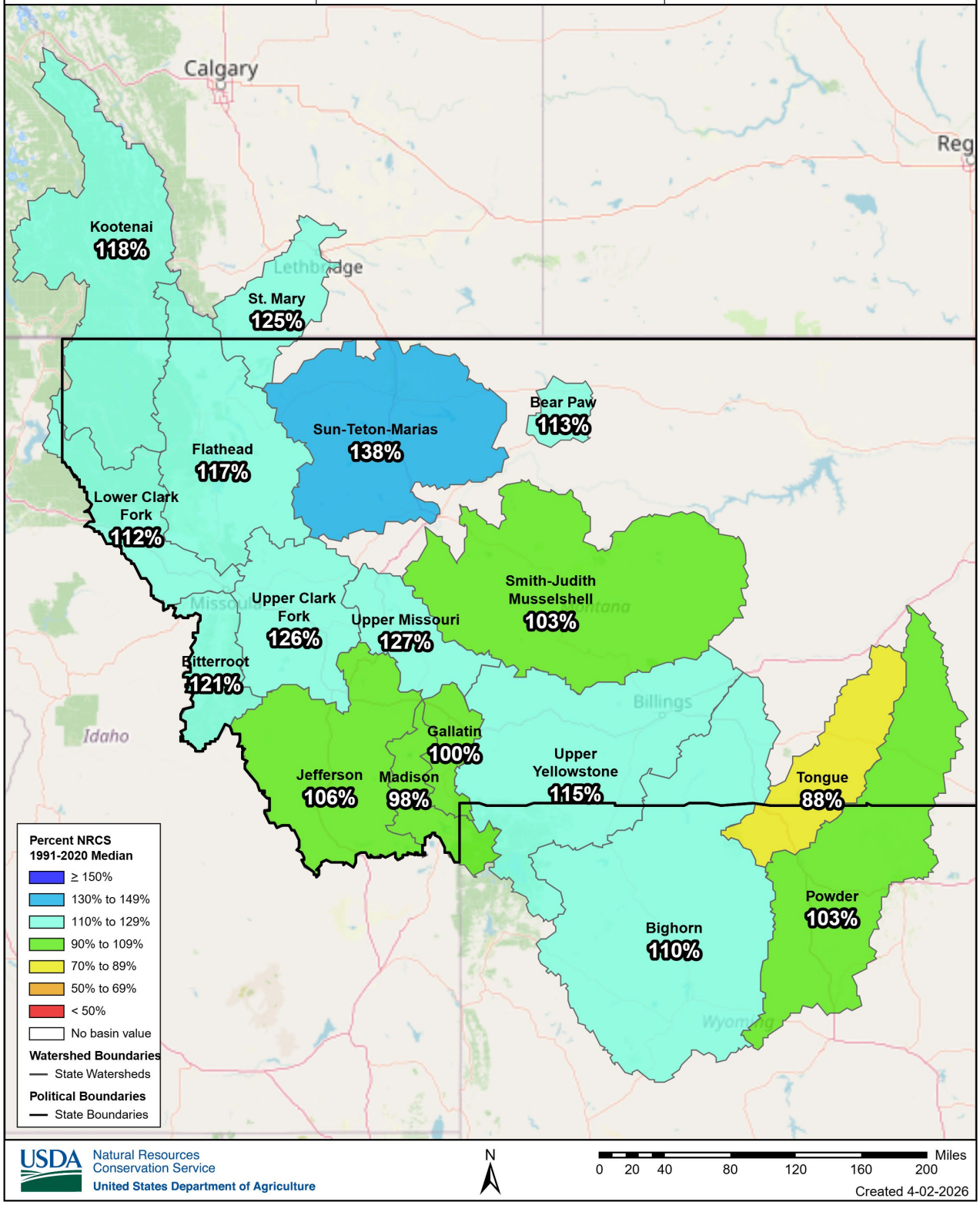
1 month Precipitation	Percent NRCS 1991-2020 Median	March 1, 2026 - March 31, 2026



Statewide Overview

Precipitation (Continued)

Water Year to Date Precipitation	Percent NRCS 1991-2020 Median	October 1, 2025 - March 31, 2026



Statewide Overview

Snowpack

Mid March storms added one to ten inches of SWE to Montana SNOTEL sites, mainly in the northwest, west, and central regions. Southwest Montana received the lower end of storm totals. Several weeks of above normal temperatures followed, causing widespread snowmelt ranging from a few tenths of an inch to eight inches of SWE loss. April 1 snowpack percentages reflect these fluctuations. Basins that benefited from early March storms saw quick gains and losses, ending near last month's levels of roughly 70-85% of median snowpack. Basins that largely missed the storm decreased to 60-70% of median snowpack. The Powder and Tongue basins sit significantly lower at around 25% and 50% of median, respectively. While snowpack percentages compare the amount of SWE on the ground to the median for that date, snowpack percentiles look at where this year's snowpack lines up compared to previous years. In the northwest, west, and central regions of the state, percentiles fall between the lowest 10th to 30th percentile. The Upper Clark Fork continues to be a bright spot on the map, with snowpack in the 66th percentile on April 1. In southwest Montana and Wyoming all basins are below the 10th percentile, with the Jefferson, Gallatin, Bighorn, Powder and Tongue basins all recording their worst year on record.

Snowpack remains elevation dependent, with higher elevation SNOTEL and Snow Courses reporting near to above normal snowpack, while middle and lower elevation stations are reporting severe deficits. As of April 1, 41 SNOTEL and Snow Courses have already melted out, with many reporting their earliest melt-out date on record. Additionally, 84 SNOTEL and Snow Courses reported record low April 1 SWE, with an additional 22 stations reporting their second lowest. This elevational disparity is statewide. In the Whitefish Range, Stahl Peak SNOTEL (6,040') had 94% of median SWE on April 1, while the nearby Weasel Divide Snow Course (5,350') had 76%, and Grave Creek SNOTEL (4,350') had 40%. In the Boulder drainage of the Absaroka-Beartooth Range, Monument Peak (8,740') reported 99% of median April 1 SWE, while Box Canyon (6,720') reported just 7%.

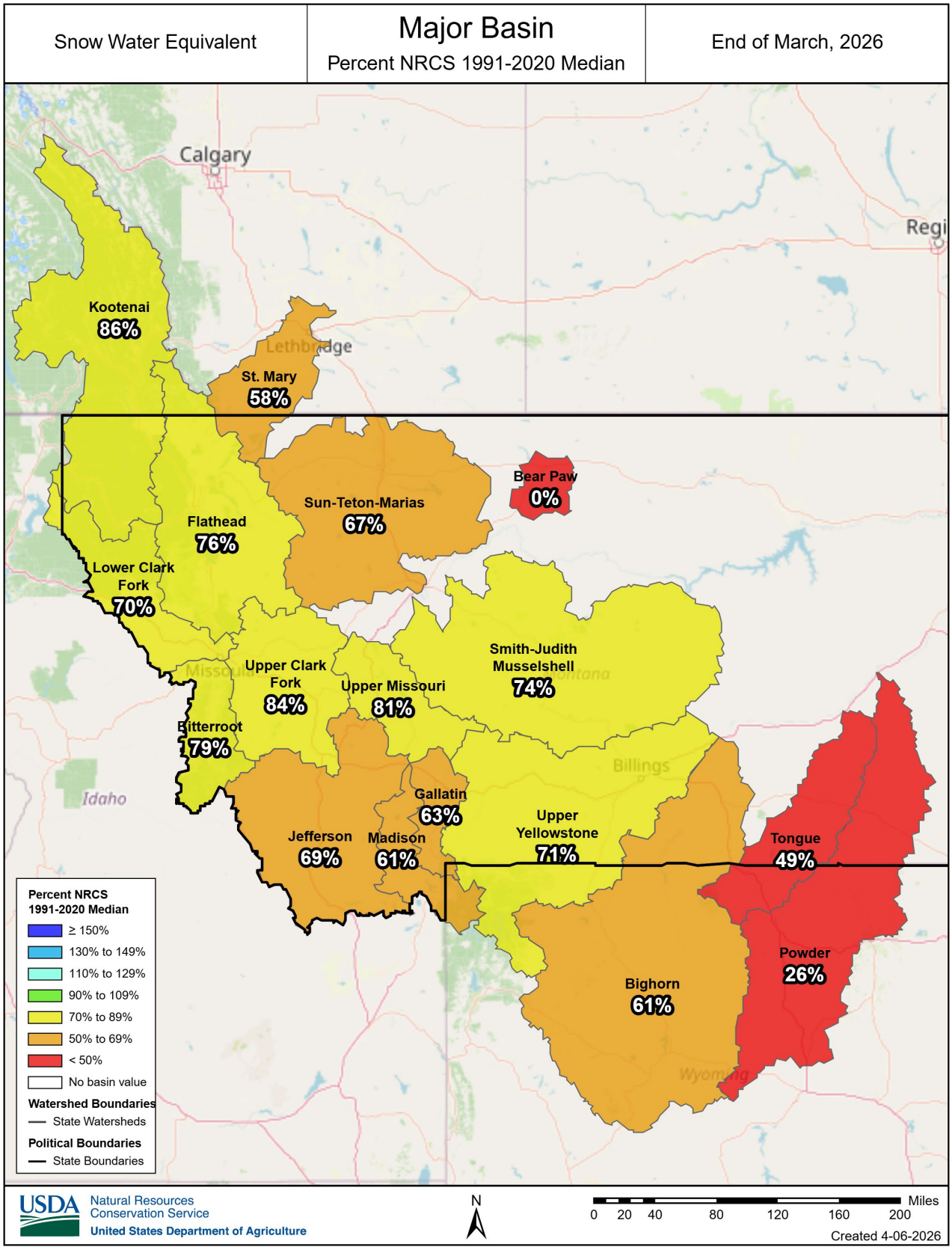
Montana snowpack typically peaks in early to late April. While spring storms may continue to build high elevation snowpack through April, basin wide snowpack deficits are now past the point of recovery. Snowmelt runoff began early in March. With an unusually warm snowpack for this time of year, the stage is set for continued early runoff.

Water Year 2026 - Major Basin - Snowpack Percent of Normal ('91-'20)

Basin	Nov 1	Dec 1	Jan 1	Feb 1	Mar 1	Apr 1	May 1	Jun 1
Kootenai	198	68	107	95	86	86	-	-
Flathead	208	93	109	82	73	76	-	-
Upper Clark Fork	161	60	101	84	84	84	-	-
Bitterroot	116	29	90	75	77	79	-	-
Lower Clark Fork	266	51	86	67	66	70	-	-
Jefferson	73	40	93	79	79	69	-	-
Madison	97	43	96	89	86	61	-	-
Gallatin	110	53	107	86	82	63	-	-
Upper Missouri	116	58	99	80	83	81	-	-
Smith-Judith-Musselshell	66	57	100	79	72	74	-	-
Sun-Teton-Marias	182	75	116	86	73	67	-	-
St. Mary	155	76	117	88	67	58	-	-
Upper Yellowstone	99	58	120	98	89	71	-	-
Bighorn	80	50	111	98	94	61	-	-
Powder	126	49	89	79	68	26	-	-
Tongue	40	28	73	68	63	49	-	-
Bear Paw	-	122	100	46	28	-	-	-

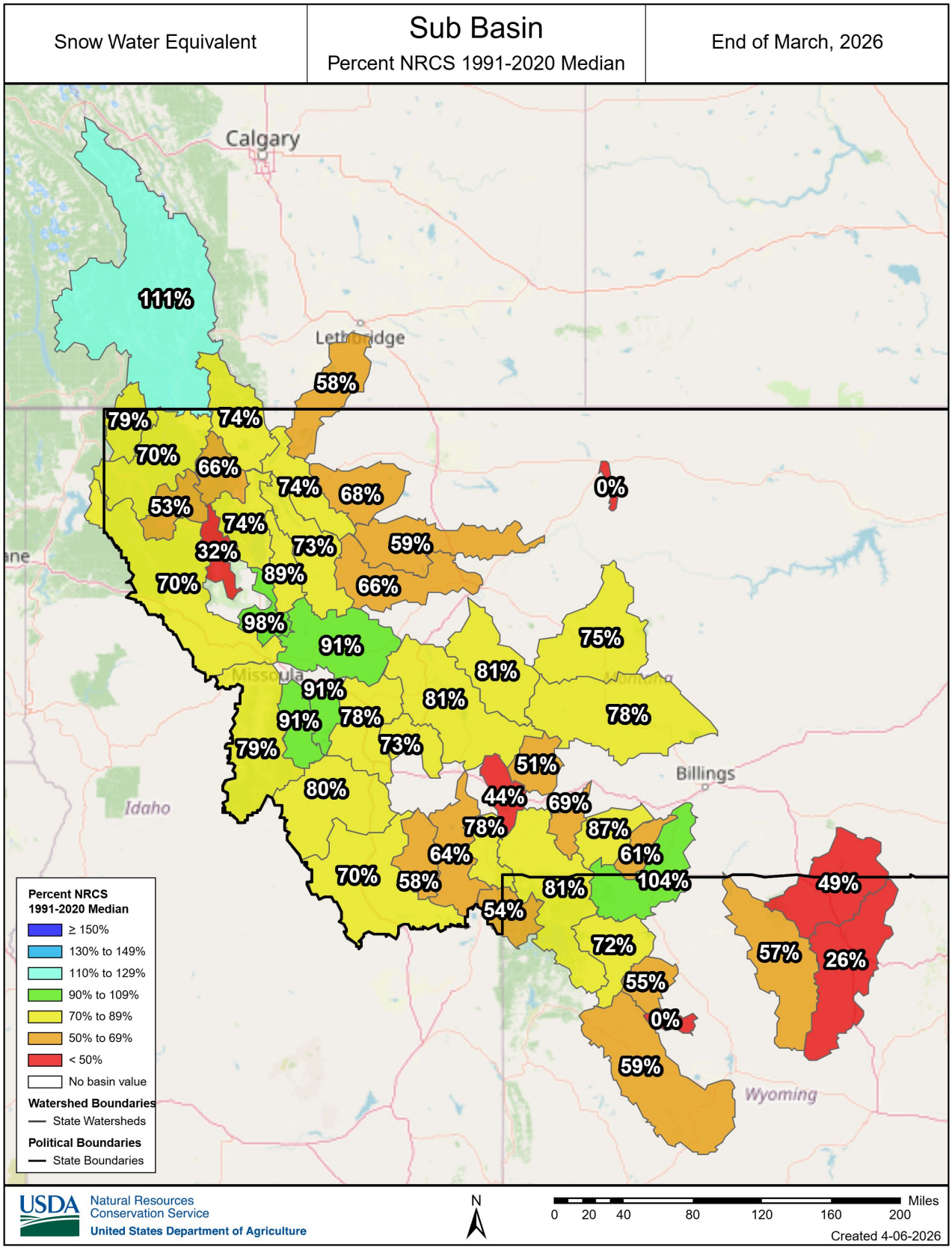
Statewide Overview

Snowpack (Continued)



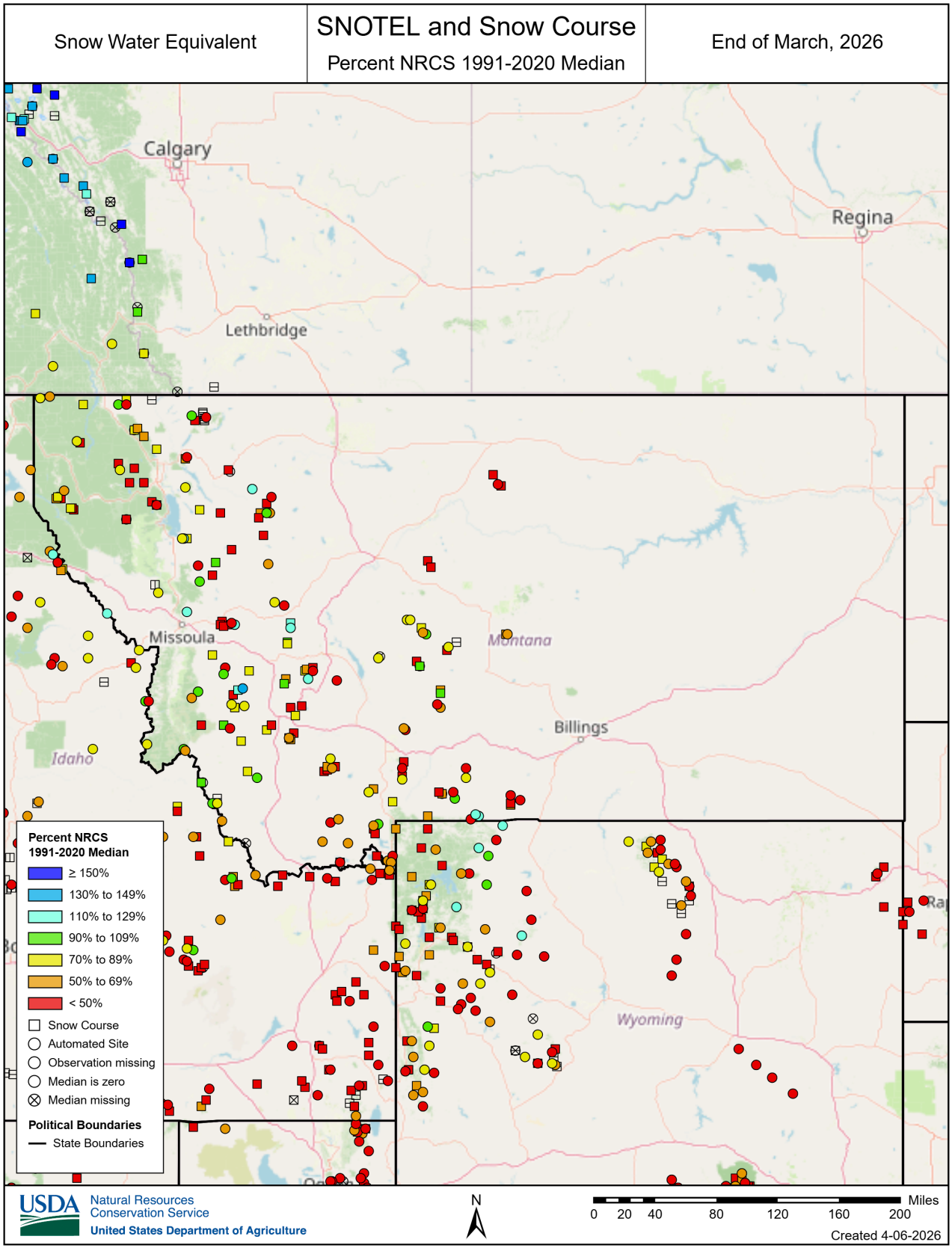
Statewide Overview

Snowpack (Continued)



Statewide Overview

Snowpack (Continued)



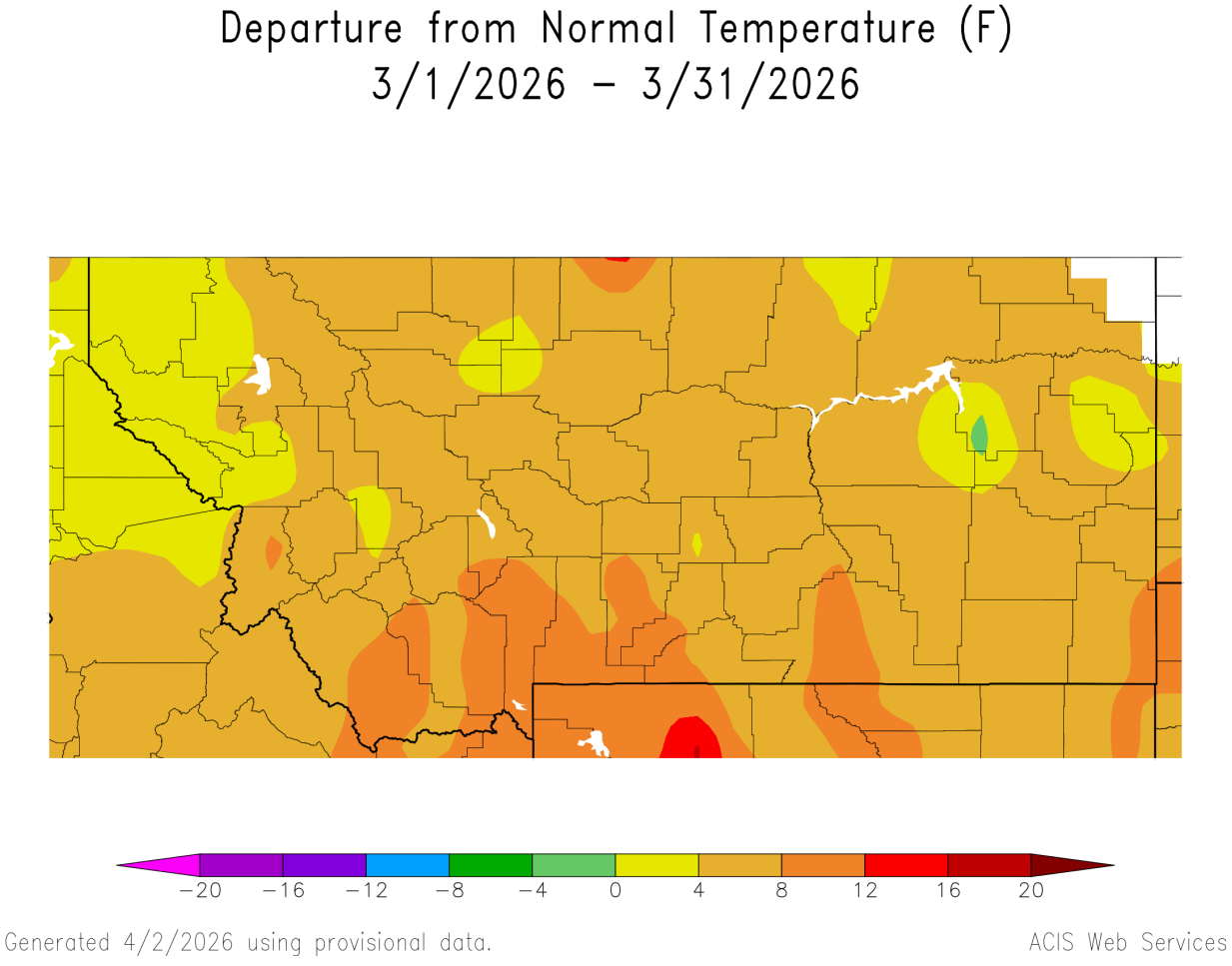
Statewide Overview

Temperature

Every month this snowpack accumulation season has brought above normal temperatures to Montana, and March was no different. Several strong heat waves caused much of the state to record monthly average temperatures 4-8˚F above normal. Isolated pockets in the plains and northwest Montana recorded slightly cooler but still above normal temperatures, while temperatures in south central Montana were especially warm, 8-12˚F above normal.

The heat of February carried into the start of March with an extended period of well above normal temperatures. A handful of SNOTEL sites measured near record temperatures on March 4 and again on March 8 before finally falling on March 9. Colder than normal temperatures corresponded with an active winter weather pattern from March 9 to March 16 and impacted all mountainous regions in the state outside of the Gallatin and Madison basins. Temperatures then climbed back to record highs March 18-21. The statewide average for all SNOTELs on March 20 was 47˚F, the previous statewide record for that day was 40˚F in 2015. The median daily temperature for March 20 is 28˚F. Temperatures remained high through the end of the month, tipping past previous daily records on several occasions.

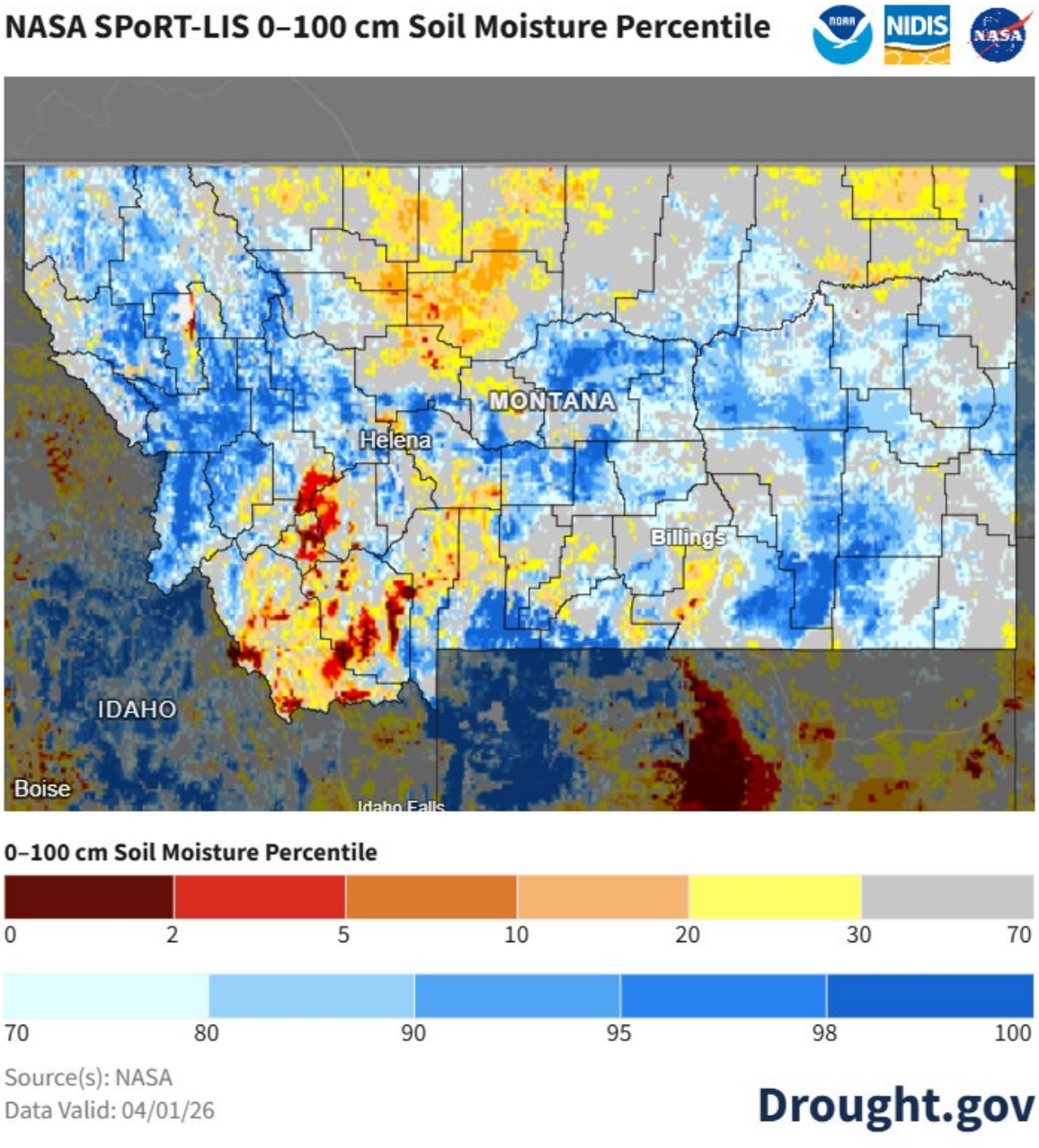
The average SNOTEL site spent six nights above freezing in March, while several sites recorded an unprecedented 14 nights above freezing. With such warm temperatures, even the mid-month winter weather was quicky counteracted. Like January and February, low elevations quickly returned to dry ground. However, as temperatures stayed high, mid and upper elevation sites experienced their first serious melting events of the season.



Statewide Overview

Soil Moisture

Soil moisture in the top 0-100 cm is similar to last month and varies across the state. Portions of southwest and northcentral Montana have the lowest soil moisture percentiles. Soil moisture has decreased in most areas of southwest Montana. The Golden Triangle region, as well as the northeast corner of the state, experienced a slight increase in soil moisture, but remain below normal. Northwest, central, and southeast Montana still have large areas of soil moisture above the 90th percentile. The Absaroka-Beartooth region has soil moisture near the 100th percentile. Spring precipitation will be crucial for maintaining or improving soil moisture.



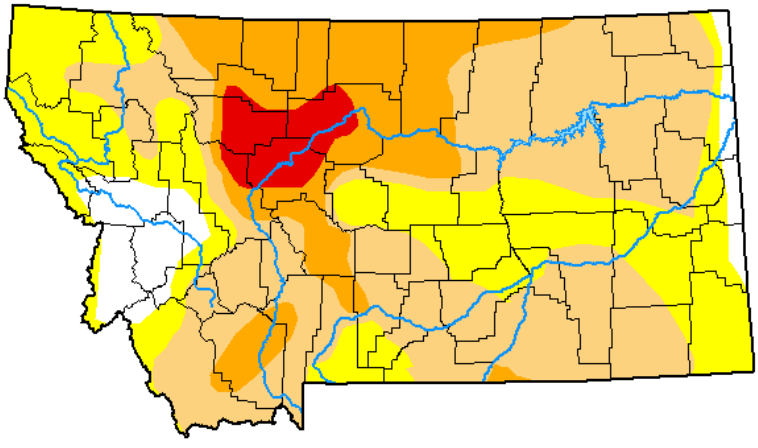
Statewide Overview

Drought Monitor

Since last month, drought conditions have remained similar across the state. The area around Great Falls has persistent extreme drought conditions. The Upper Clark Fork, Bitterroot, and eastern border of the state report no drought conditions. The Absaroka-Beartooth region went from no drought conditions to abnormally dry since last month. About 93% of the state is under drought conditions, compared to about 51% in late December. It remains to be seen how a near normal snowpack at high elevations and abundant water year precipitation mixed with record low snow levels at lower elevations and an early melt season will affect drought conditions across the state moving into spring and summer.

U.S. Drought Monitor

Montana



March 31, 2026

(Released Thursday, Apr. 2, 2026)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	6.49	27.93	44.40	17.22	3.96	0.00
Last Week 03-24-2026	7.57	25.73	48.40	14.33	3.96	0.00
3 Months Ago 12-30-2025	48.41	26.88	14.96	8.09	1.66	0.00
Start of Calendar Year 01-06-2026	48.61	31.60	11.71	6.63	1.46	0.00
Start of Water Year 09-30-2025	27.06	32.20	8.93	23.26	8.55	0.00
One Year Ago 04-01-2025	36.81	28.01	22.52	10.94	1.72	0.00

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

Author:

David Simeral

Western Regional Climate Center

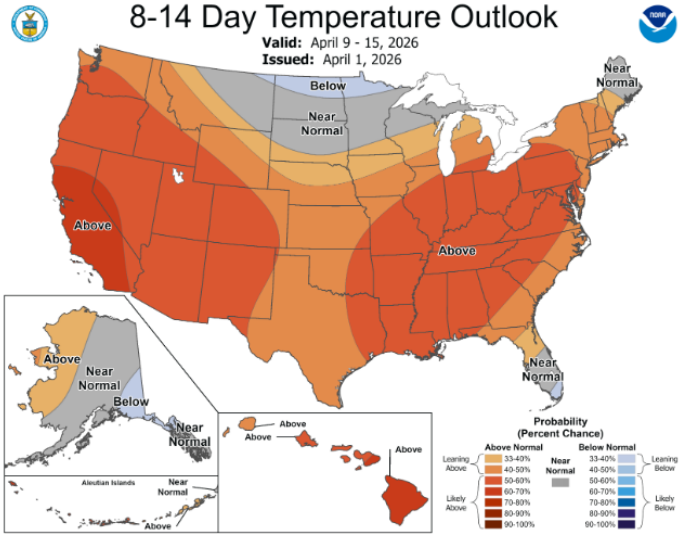
droughtmonitor.unl.edu

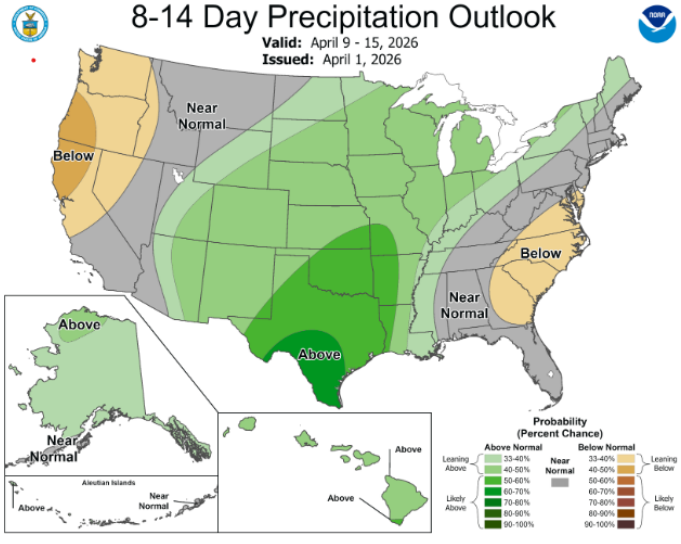
Statewide Overview

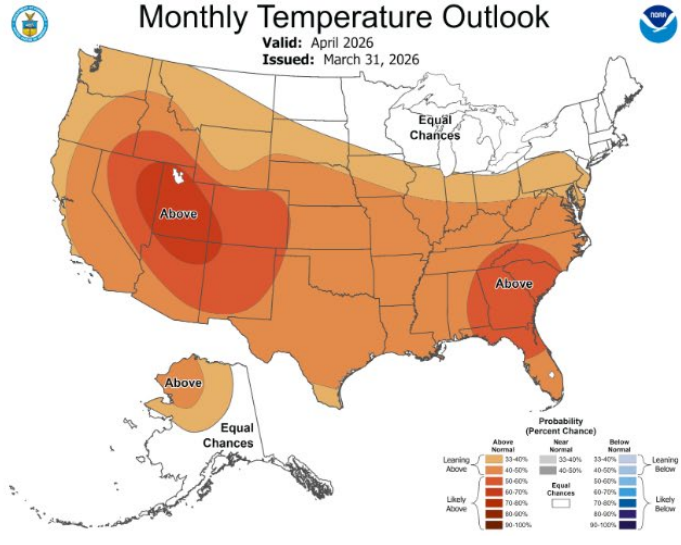
Weather Outlook

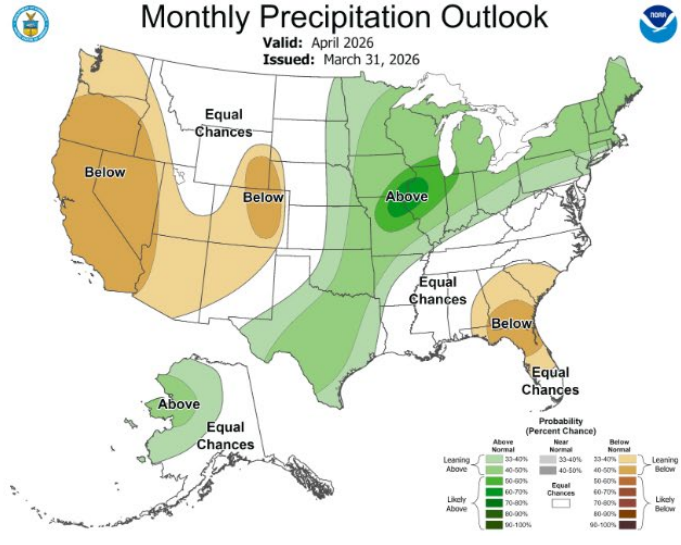
The NOAA Climate Prediction Center projects the western portion of Montana will have above normal temperatures over the next 8-14 days. The eastern portion of the state is one of the few places in the country projected to have near normal temperatures. Most of Montana is expected to have near normal precipitation in the next 8-14 days.

In the monthly outlook, all of Montana has equal chances of above or below normal precipitation. The northeast corner of the state has equal chances of above or below normal temperatures, while the rest of the state leans towards above normal temperatures over the next month.





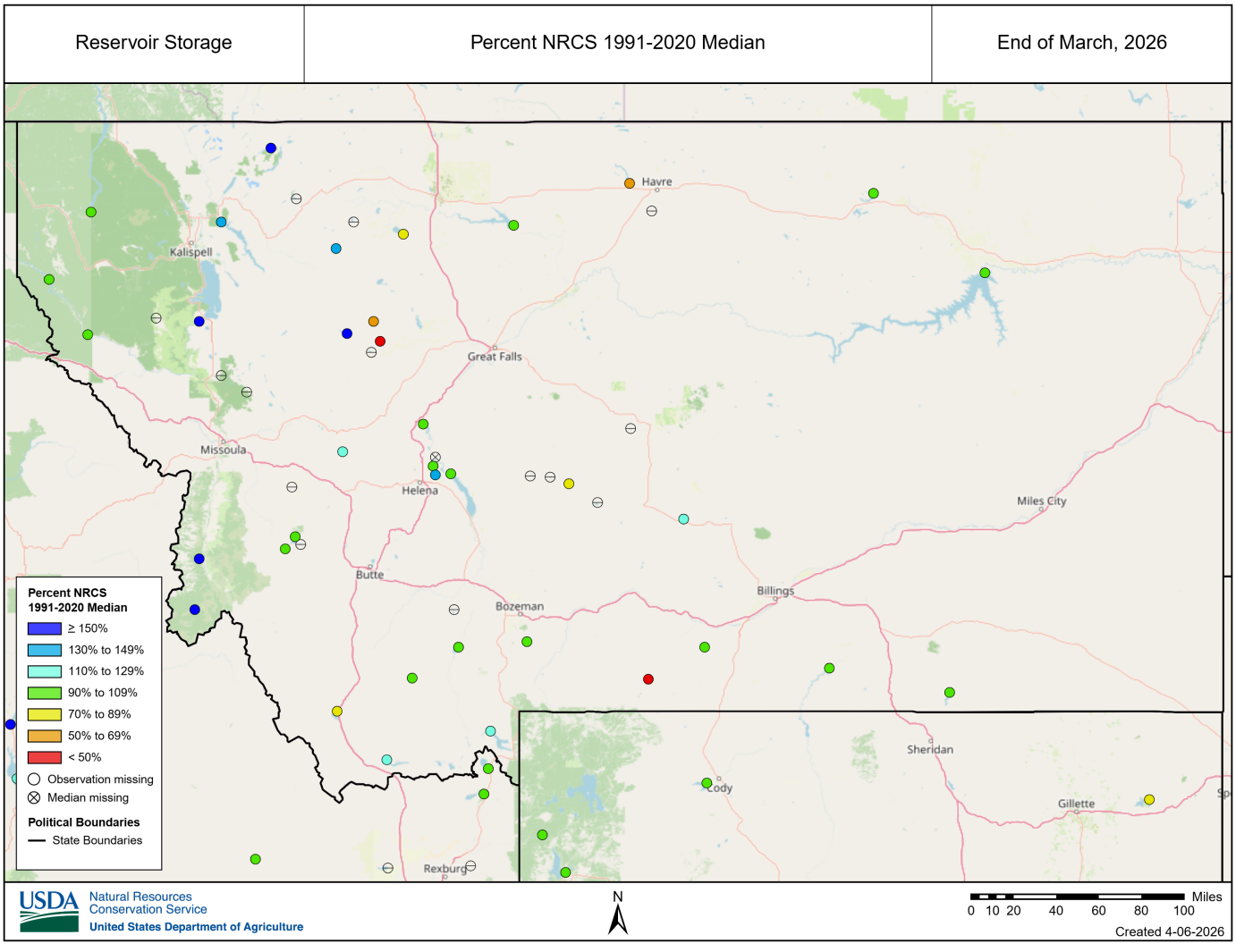




Statewide Overview

Reservoirs

Most Montana reservoirs reported near to above normal end of March storage levels. Above normal March streamflow and an early snowmelt runoff season have added to many reservoirs early this year. Deadman's Basin, Hebgen Lake, Helena Valley, Hungry Horse Lake, Lima, Nevada Creek, and Swift Reservoirs reported above normal reservoir levels of 110-145% of median for end of March. Flathead Lake, Gibson, Lake Como, Lake Sherburne, and Painted Rocks Lake Reservoirs reported well above normal reservoir levels ranging from 160% to over 200% of median. Bair, Clark Canyon, and Lake Frances Reservoirs had below normal end of March reservoir levels of 70-80% of median. Fresno, Mystic Lake, Pishkun, and Willow Creek-Augusta Reservoirs reported well below normal reservoir fill at 35-60% of median. The remaining reservoir storage facilities across the state reported near normal reservoir storage.



Statewide Overview

Reservoirs (Continued)

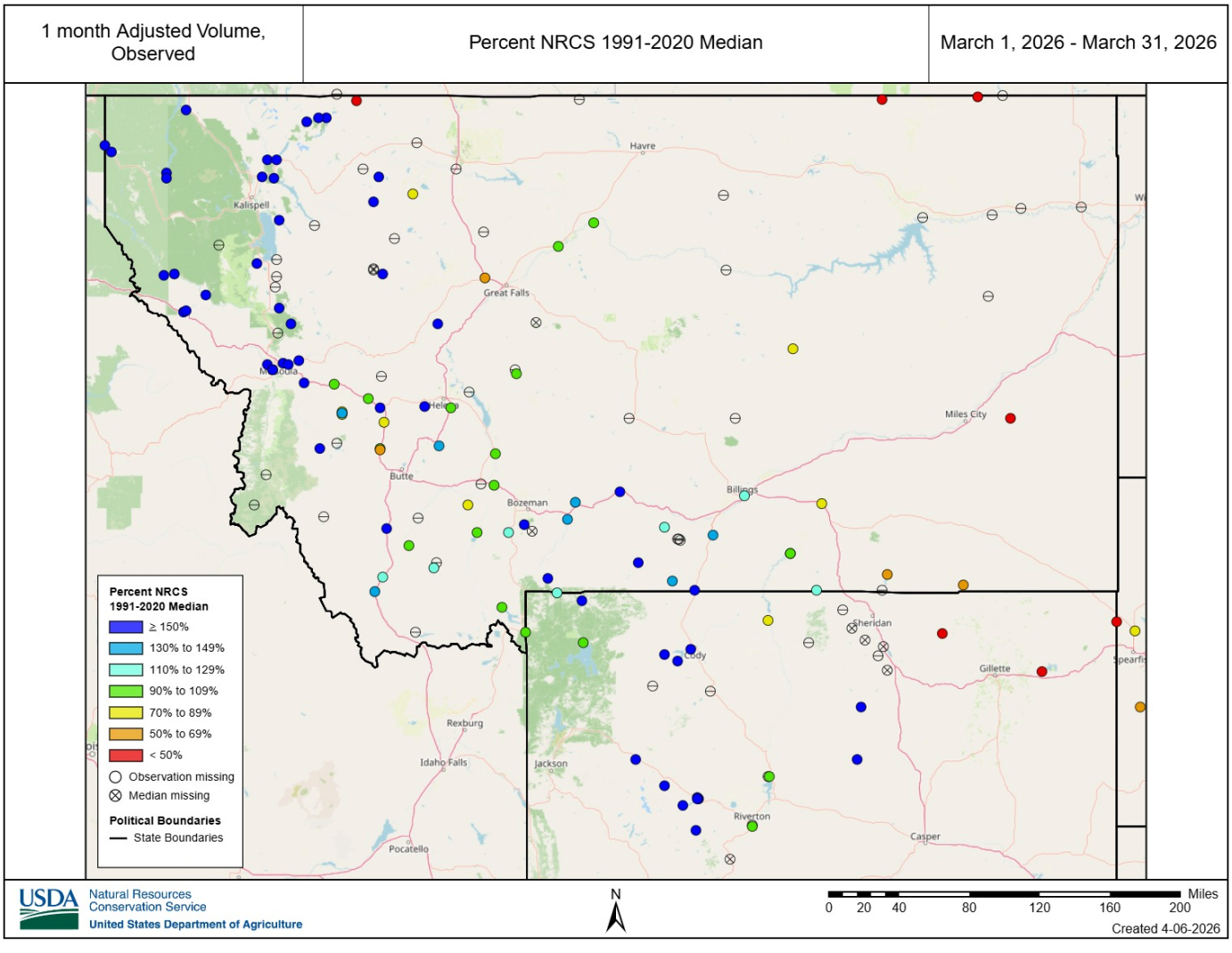
End of March - Reservoir Storage Percent of Capacity

Reservoir	Basin	Current % Capacity	Last Year % Capacity	Median % Capacity
Lake Sherburne	St. Mary	92	62	48
Clark Canyon Res	Jefferson	42	57	51
Lima Reservoir	Jefferson	62	55	54
Ruby River Reservoir	Jefferson	87	81	80
Ennis Lake	Madison	77	77	72
Hebgen Lake	Madison	82	80	73
Middle Creek Res	Gallatin	60	56	61
Canyon Ferry Lake	Upper Missouri	73	71	71
Helena Valley Reservoir	Upper Missouri	69	57	52
Holter Lake	Upper Missouri	99	99	99
Lake Helena	Upper Missouri	78	78	86
Bair Res	Smith-Judith-Musselshell	44	41	60
Deadman's Basin Res	Smith-Judith-Musselshell	96	92	78
Smith River Res	Smith-Judith-Musselshell	-	69	67
Gibson Res	Sun-Teton-Marias	81	10	36
Lake Elwell (Tiber)	Sun-Teton-Marias	59	50	54
Lake Frances	Sun-Teton-Marias	37	34	53
Swift Res	Sun-Teton-Marias	82	73	57
Fort Peck Lake	Lower Missouri	67	72	73
Fresno Res	Milk	25	32	51
Nelson Res	Milk	56	75	57
Cooney Res	Upper Yellowstone	82	92	78
Mystic Lake	Upper Yellowstone	2	13	5
Bighorn Lake	Bighorn	56	58	59
Boysen	Bighorn	65	63	71
Buffalo Bill	Bighorn	67	60	67
Bull Lake	Bighorn	28	24	53
Tongue River Res	Tongue	68	75	71
Lake Koocanusa	Kootenai	49	62	55
Georgetown Lake	Upper Clark Fork	94	94	91
Nevada Creek Res	Upper Clark Fork	82	34	69
Noxon Rapids Reservoir	Lower Clark Fork	93	89	96
Lake Como	Bitterroot	75	40	46
Painted Rocks Lake	Bitterroot	87	31	33
Flathead Lake	Flathead	66	55	41
Hungry Horse Lake	Flathead	90	71	68

Statewide Overview

Streamflow

Streamflows in Montana have increased since last month due to the widespread late March snowmelt event. The above normal temperatures over the last few months set the stage for early snowmelt and runoff to occur. Northwest Montana had well above normal March streamflow. The rest of the state had mostly near and above normal streamflow. Streamflow stations on the Tongue and Powder rivers were the exception reporting well below normal March streamflows. Increased precipitation and cooler temperatures are needed to delay runoff into the summer. If warm temperatures persist, continued early runoff can be expected.



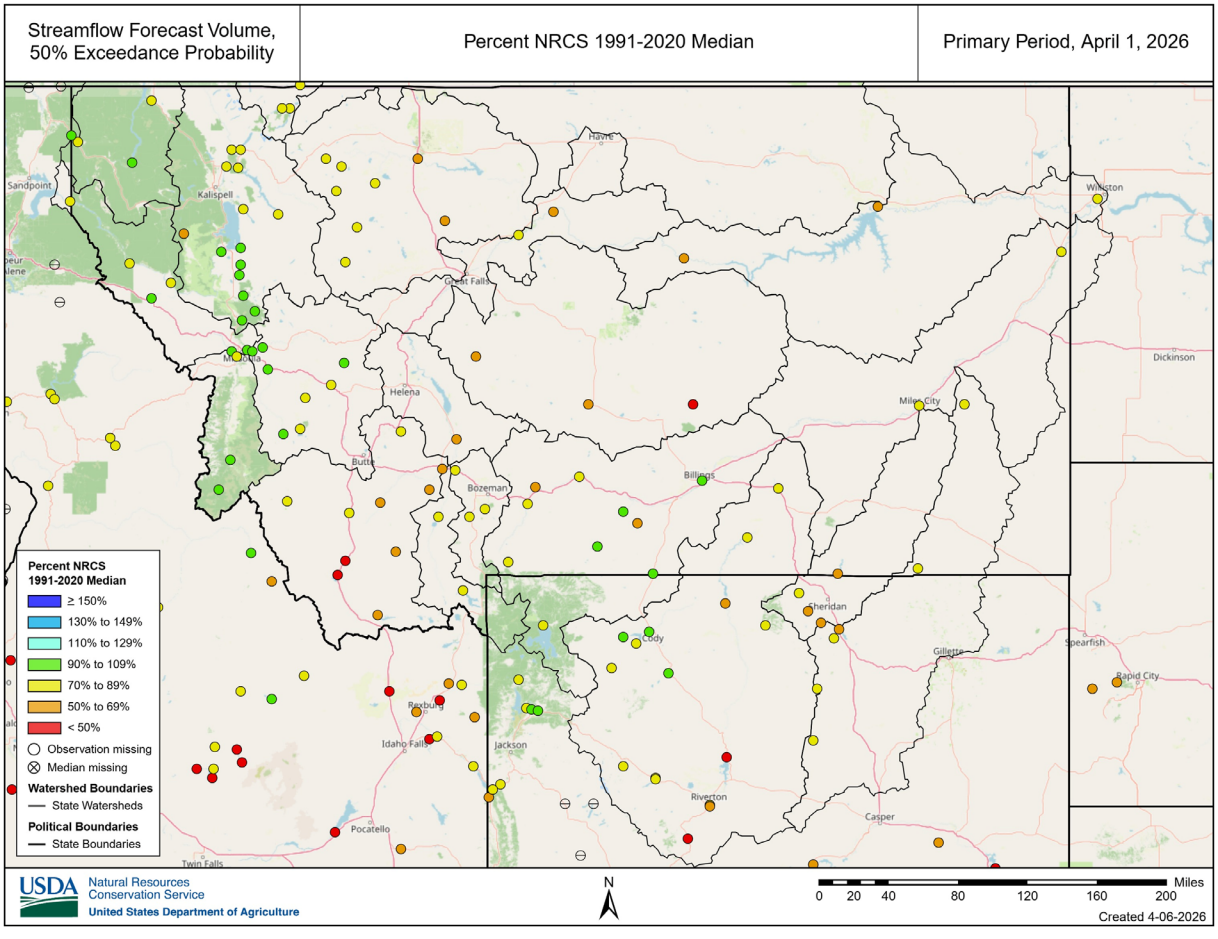
Statewide Overview

Water Supply Forecasts

Most forecast points for the April 1 water supply forecasts have decreased compared to the March 1 forecasts. West of the continental divide has a better outlook than most areas east of the divide. The 50% exceedance probability forecasts for the Mission Mountain area, Upper Clark Fork, and Bitterroot, indicate 90-110% of normal streamflow volume for the April-July period. The Flathead and Kootenai forecasts are 75-95% of normal flow. East of the divide, forecasts range from 50-90% of normal. In watersheds with a larger higher elevation area, such as the Stillwater and Clarks Fork of the Yellowstone, forecasts range from 95-100% of normal. Meanwhile, the Beaverhead River, Musselshell River near Roundup, and Boysen Reservoir inflow are forecasted to have below 50% of normal streamflow.

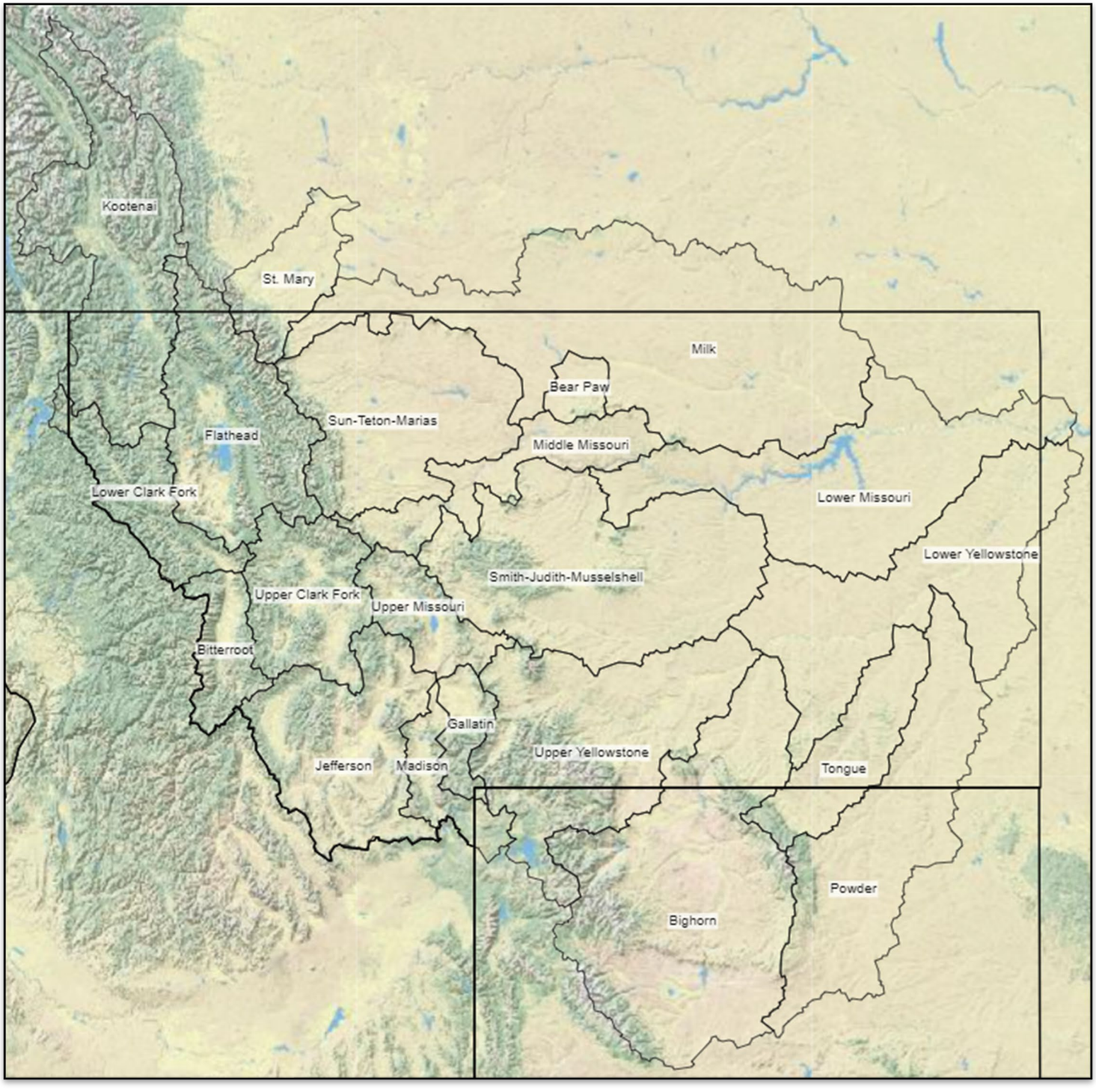
When using forecasts, it is important to account for the full suite of exceedance probabilities, not just the 50% exceedance volume. For example, on the Beaverhead River at Barretts all exceedance probabilities are below the median streamflow and both the 90% and 70% exceedance forecasts are near record low. Additionally, it is useful to consider percentiles along with the median, most forecasts range from around the lower 10th to 40th percentile across the state.

It is unlikely that snowpack and forecasts will improve to normal levels this year. In a shift from February, melting occurred at nearly all elevations including many upper elevation stations. This brought an early onset to runoff and elevated streamflow volumes. As discussed elsewhere in this report, due to the unusual distribution of snowpack, there are many uncertainties in water forecasting this year. However, reduced streamflow volumes are very likely this year across most of the state, along with an earlier shift in when that water will be available.



Basin Overview

Montana River Basin Definitions

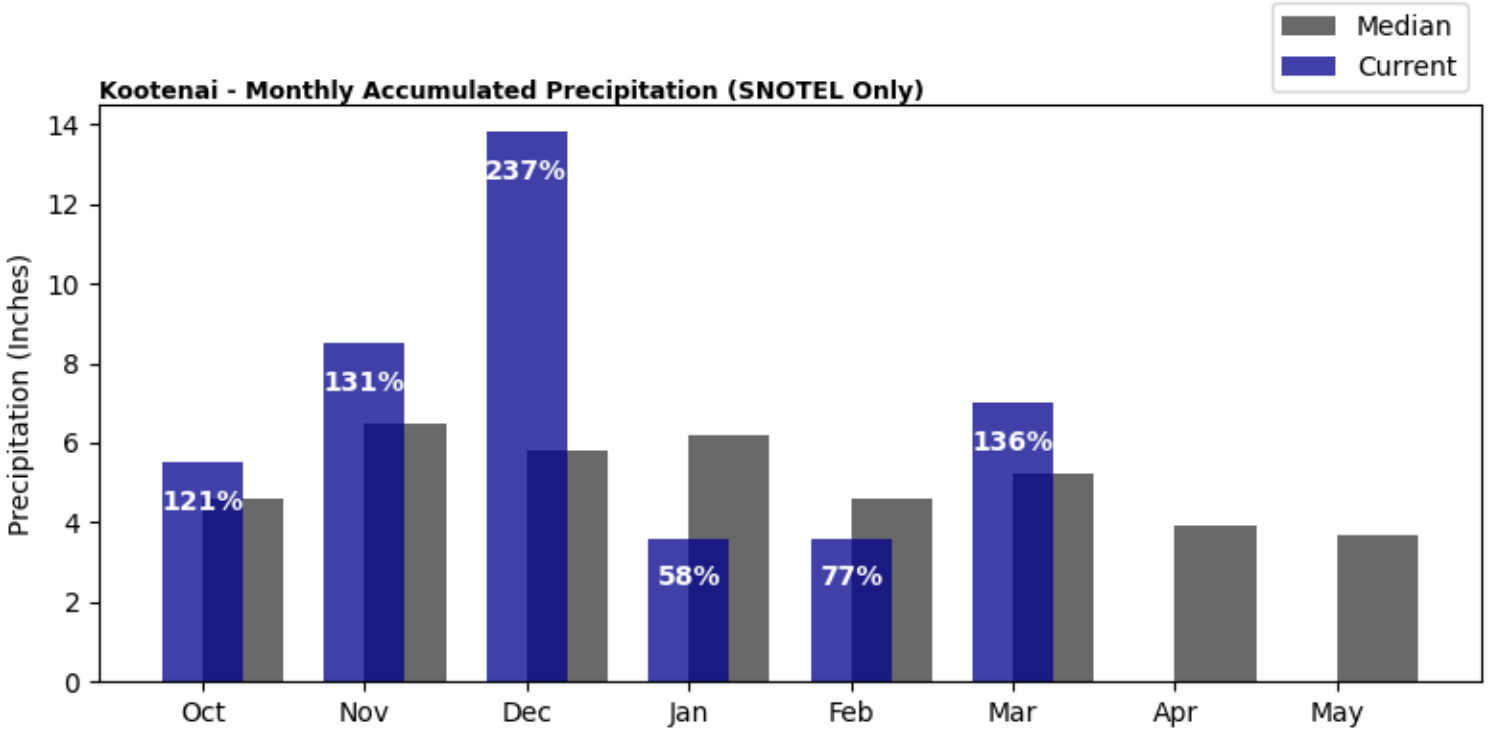


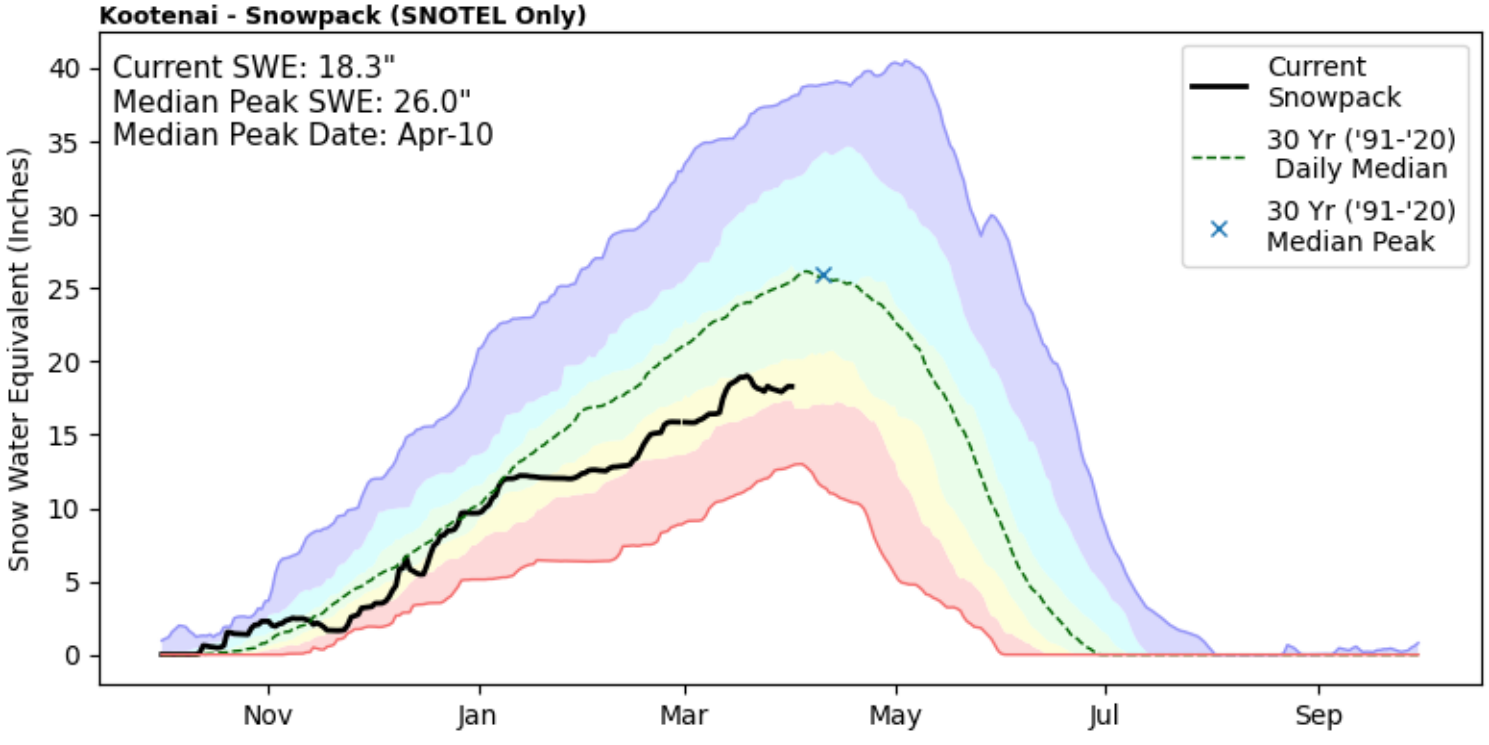
The following basin overview sections only include basins that have SNOTEL sites. For example, there is no basin overview for the Lower Yellowstone, because there are no SNOTEL sites associated with that basin. Water supply information for basins not included in the following sections can be found at https://nwcc-apps.sc.egov.usda.gov/

Basin Overview

Kootenai

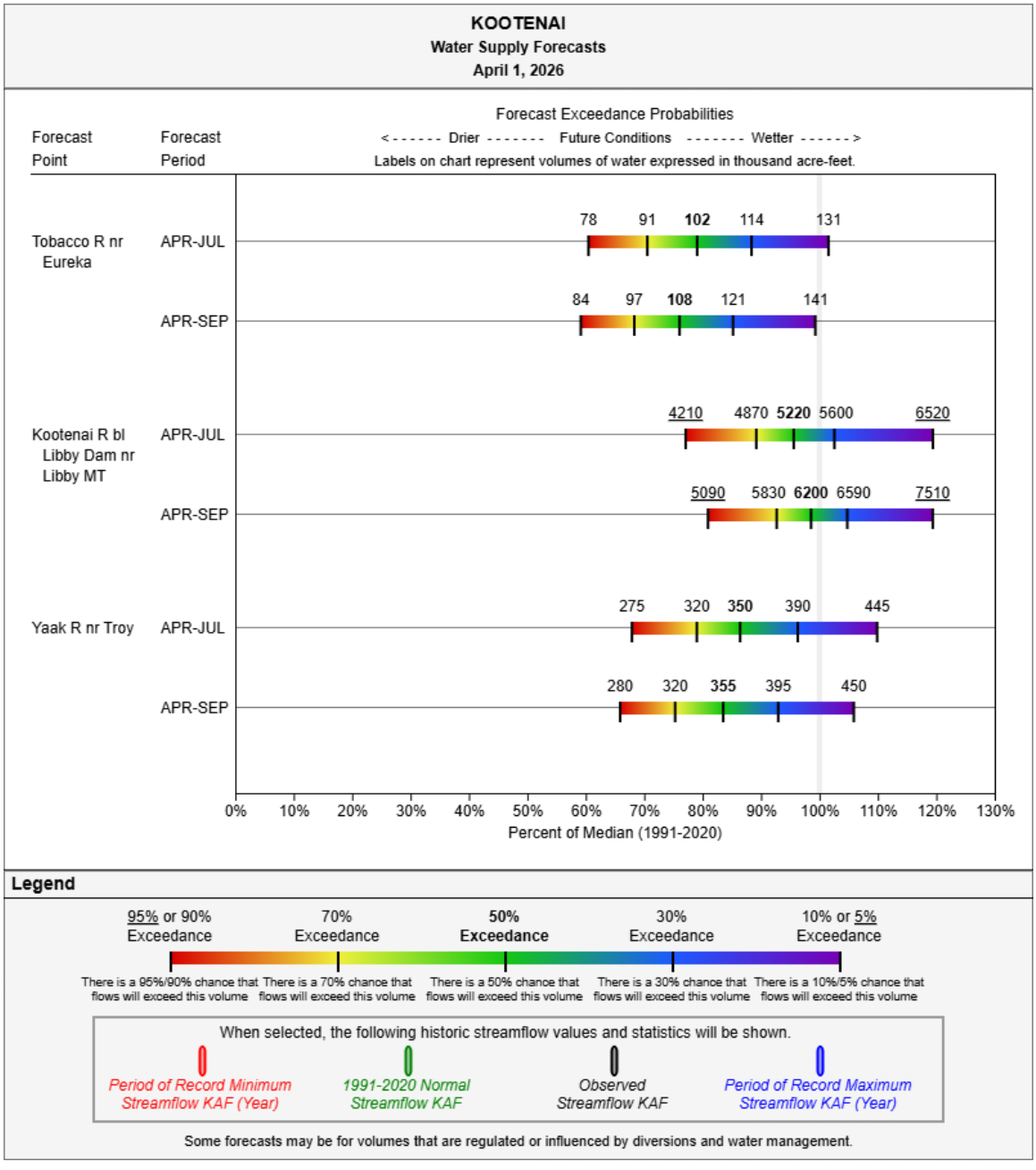
Precipitation in March was well above normal at 136%, which brings the seasonal accumulation (October-March) to 118% of median. The snowpack in the Kootenai is below normal at 86% of median, compared to 90% at this time last year.





Basin Overview

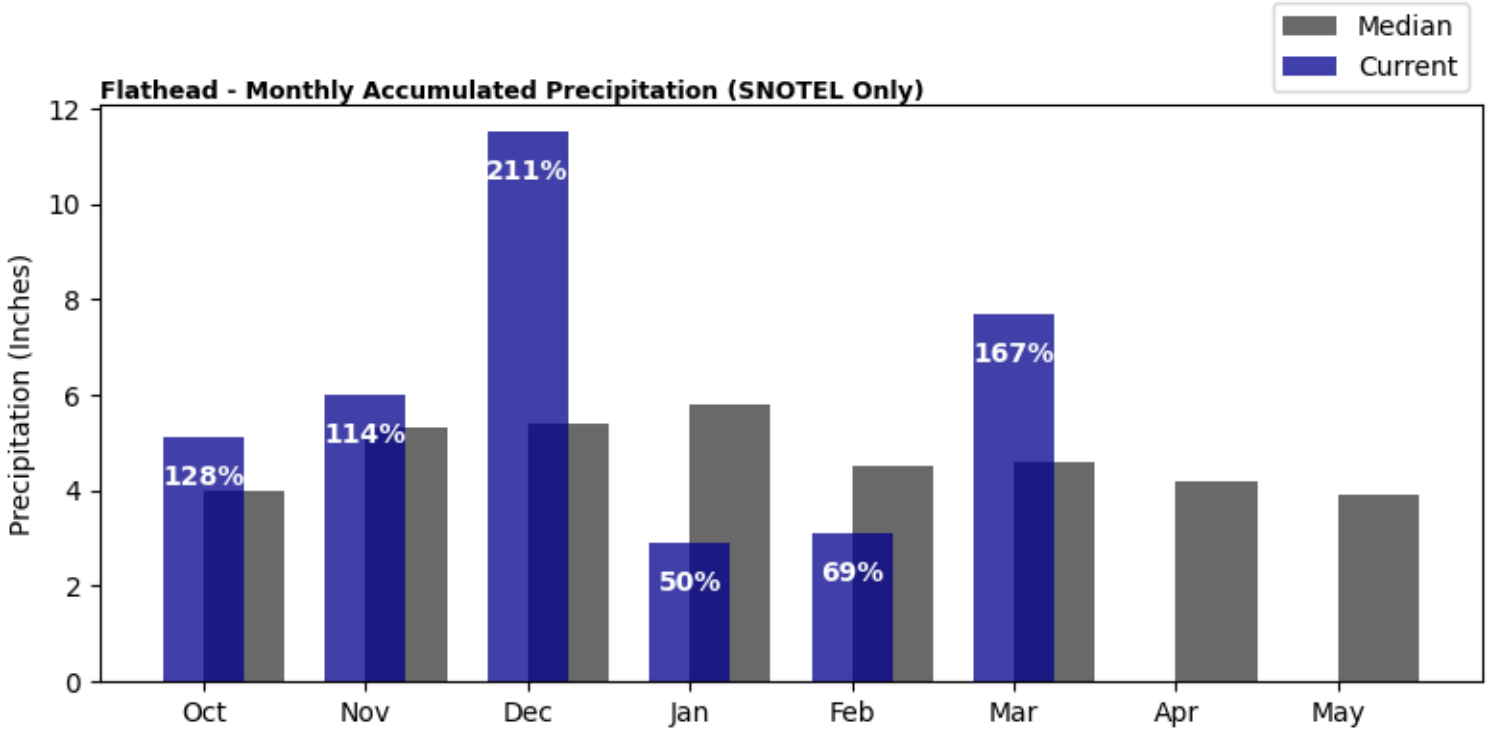
Kootenai (Continued)

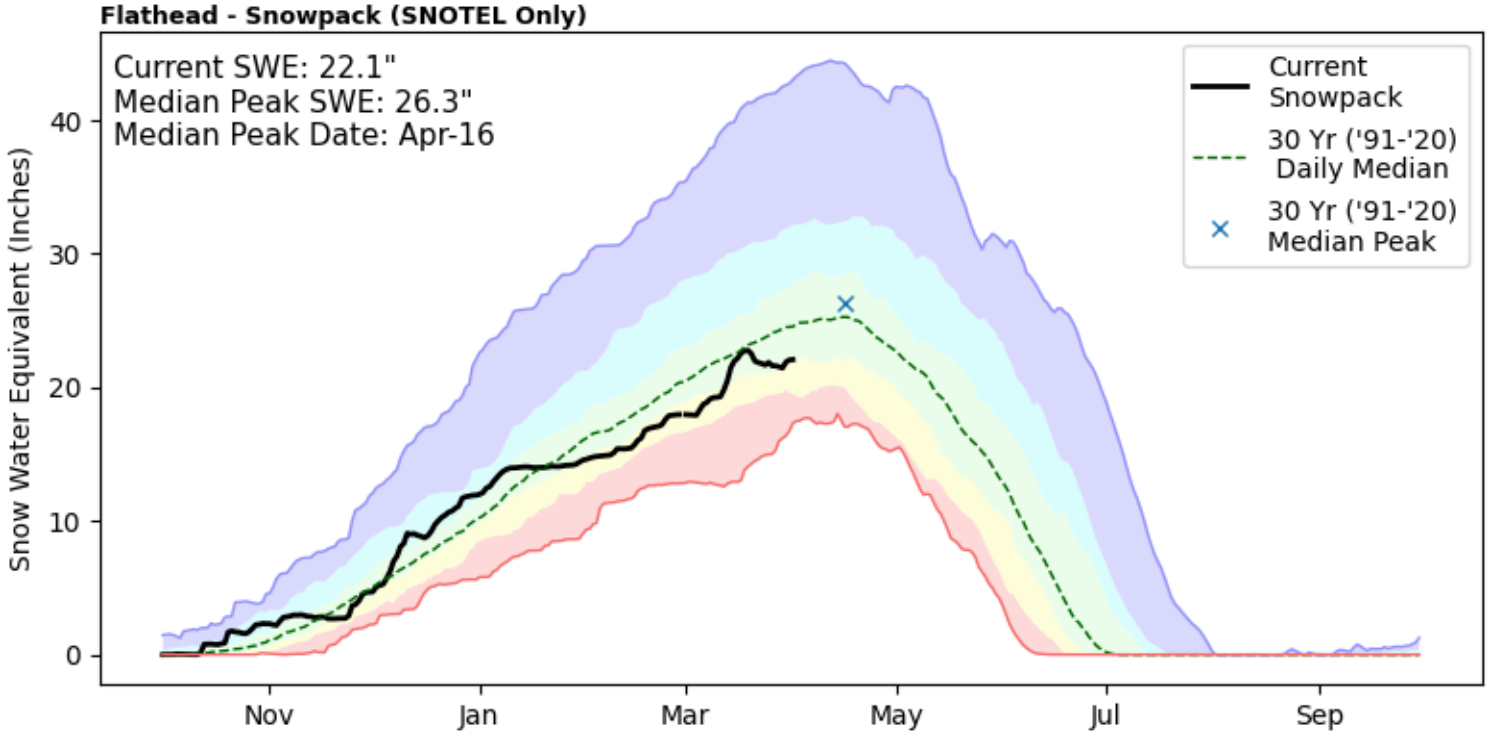


Basin Overview

Flathead

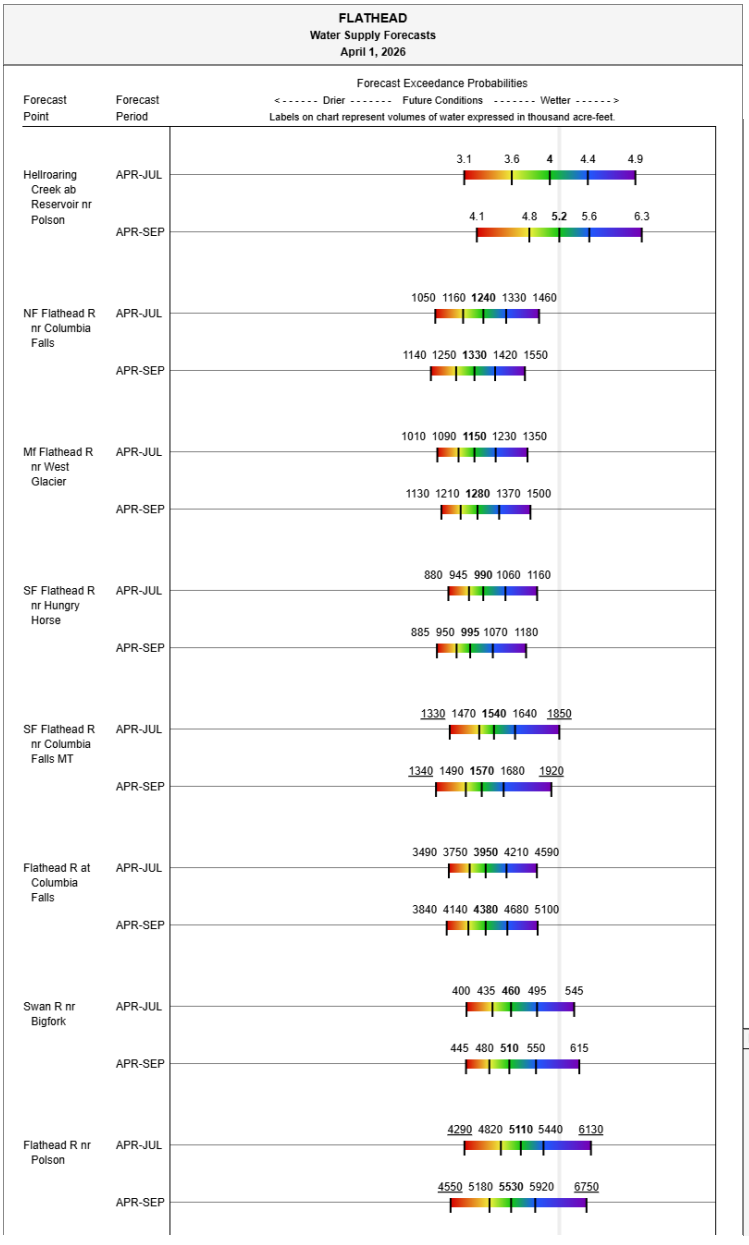
Precipitation in March was well above normal at 167%, which brings the seasonal accumulation (October-March) to 117% of median. The snowpack in the Flathead is well below normal at 76% of median, compared to 87% at this time last year.

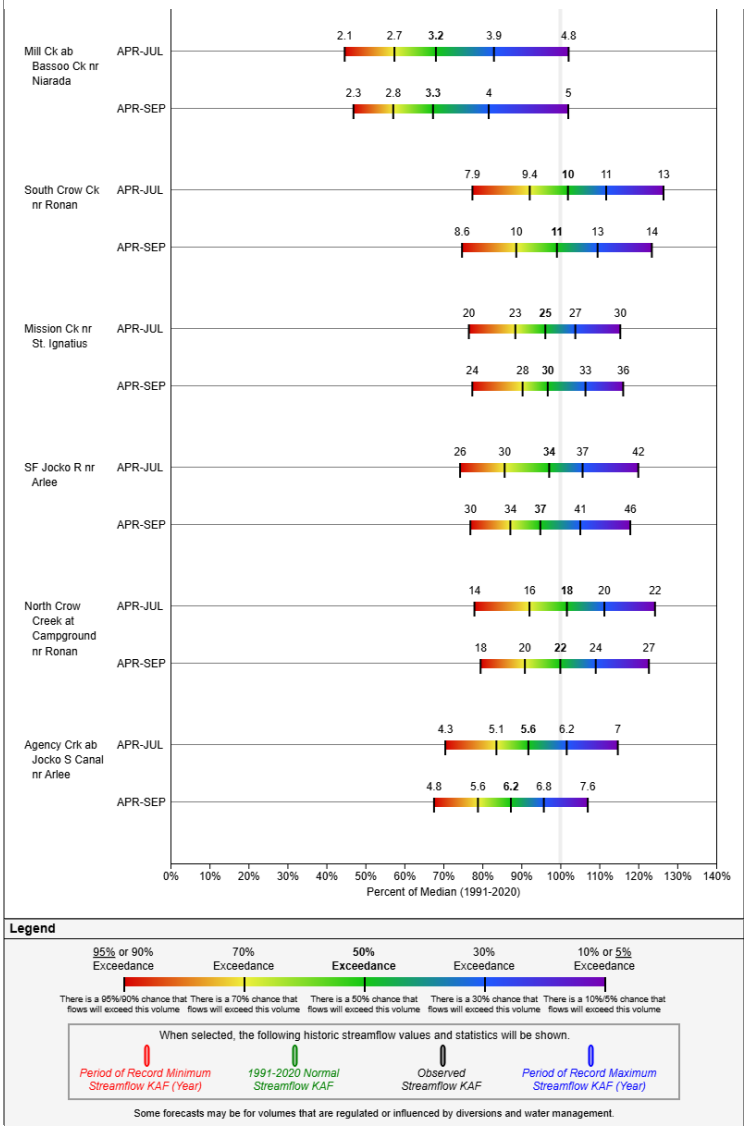




Basin Overview

Flathead (Continued)

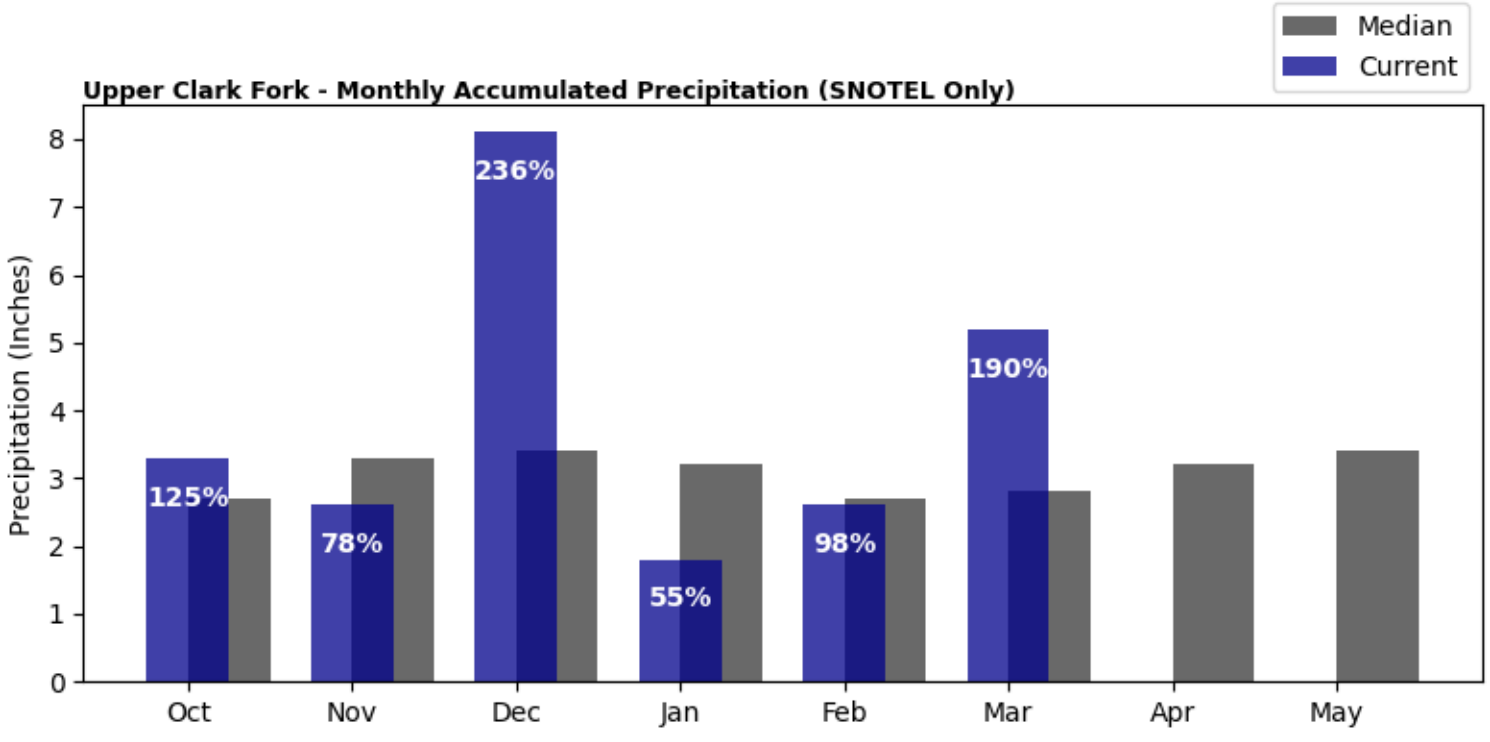


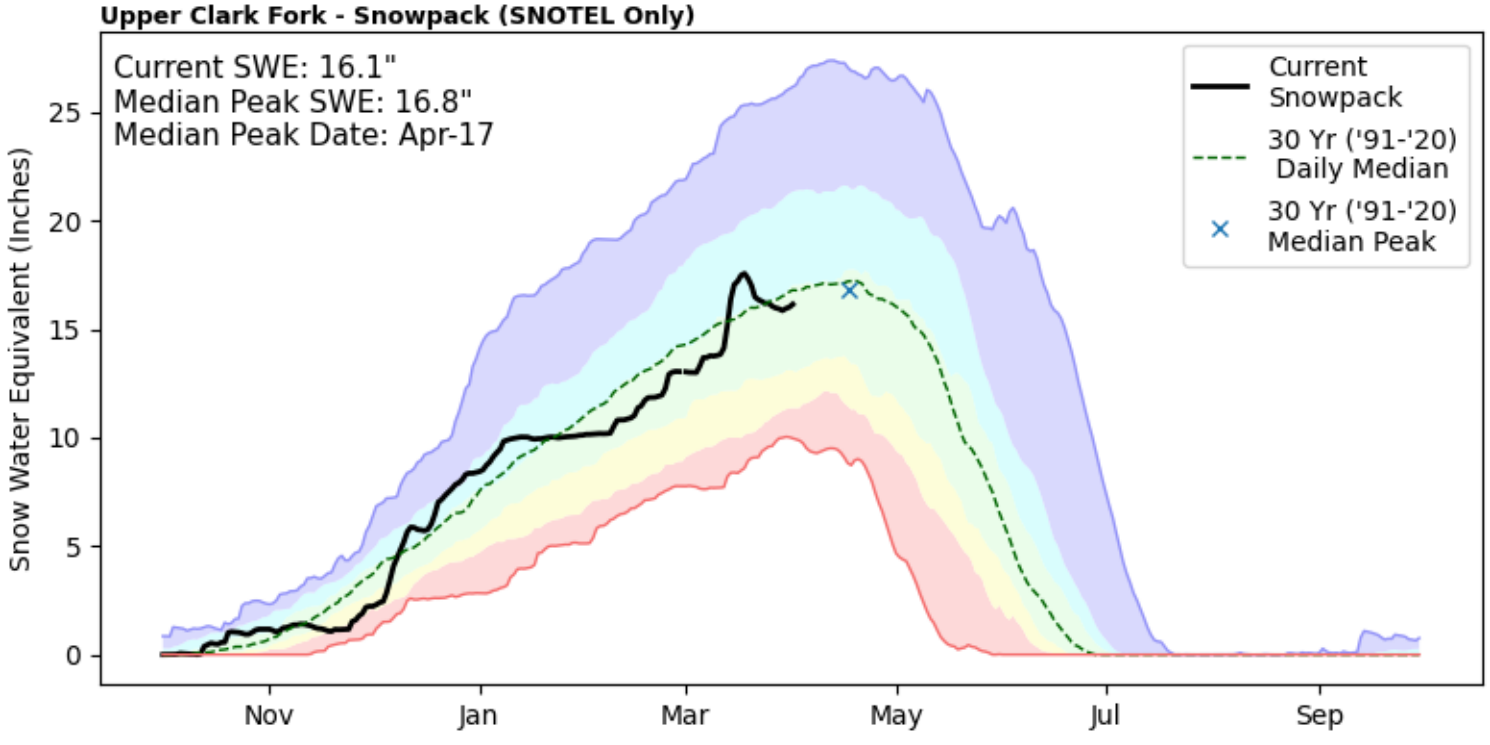


Basin Overview

Upper Clark Fork

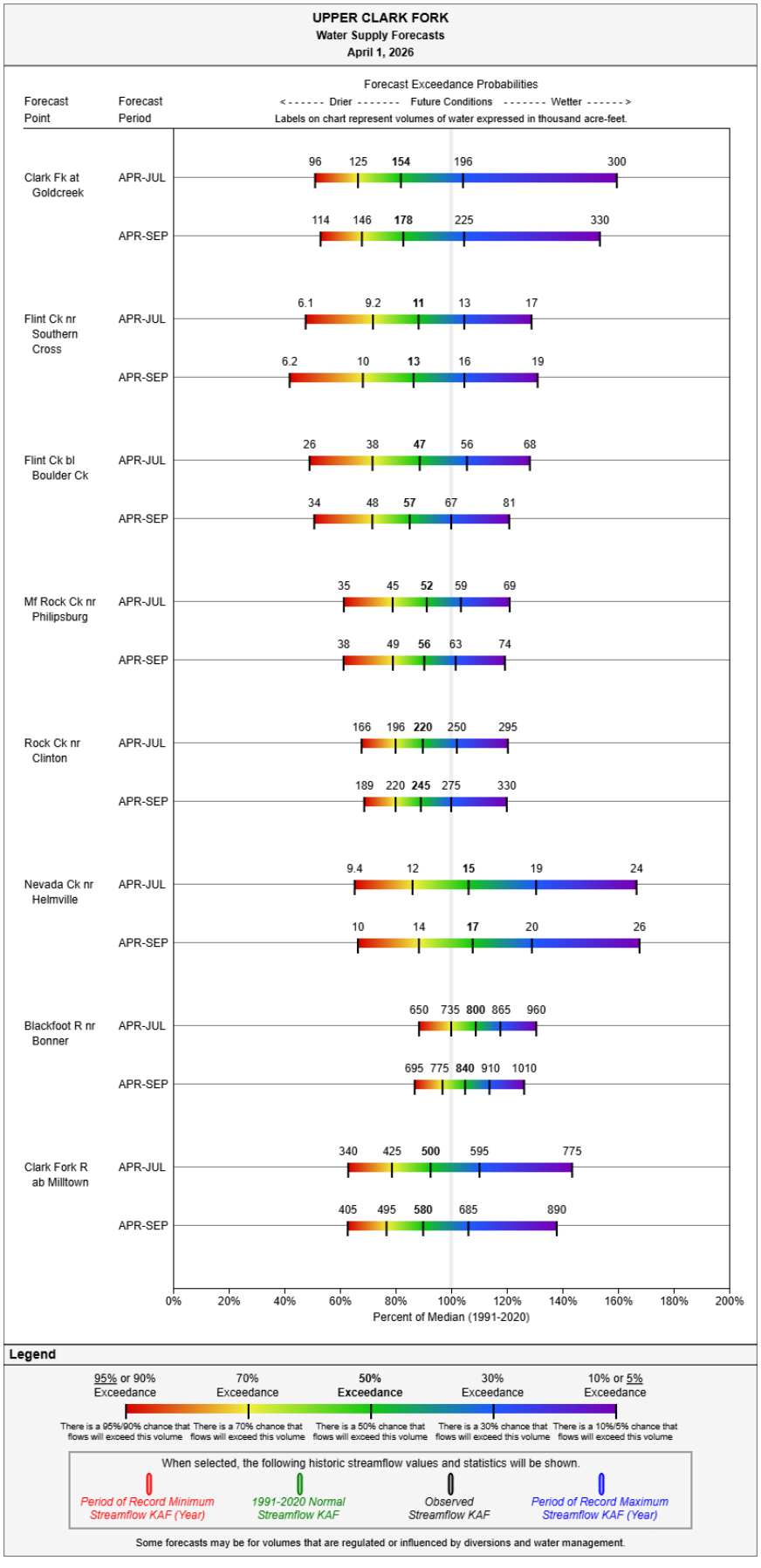
Precipitation in March was well above normal at 190%, which brings the seasonal accumulation (October-March) to 126% of median. The snowpack in the Upper Clark Fork is below normal at 84% of median, compared to 86% at this time last year.





Basin Overview

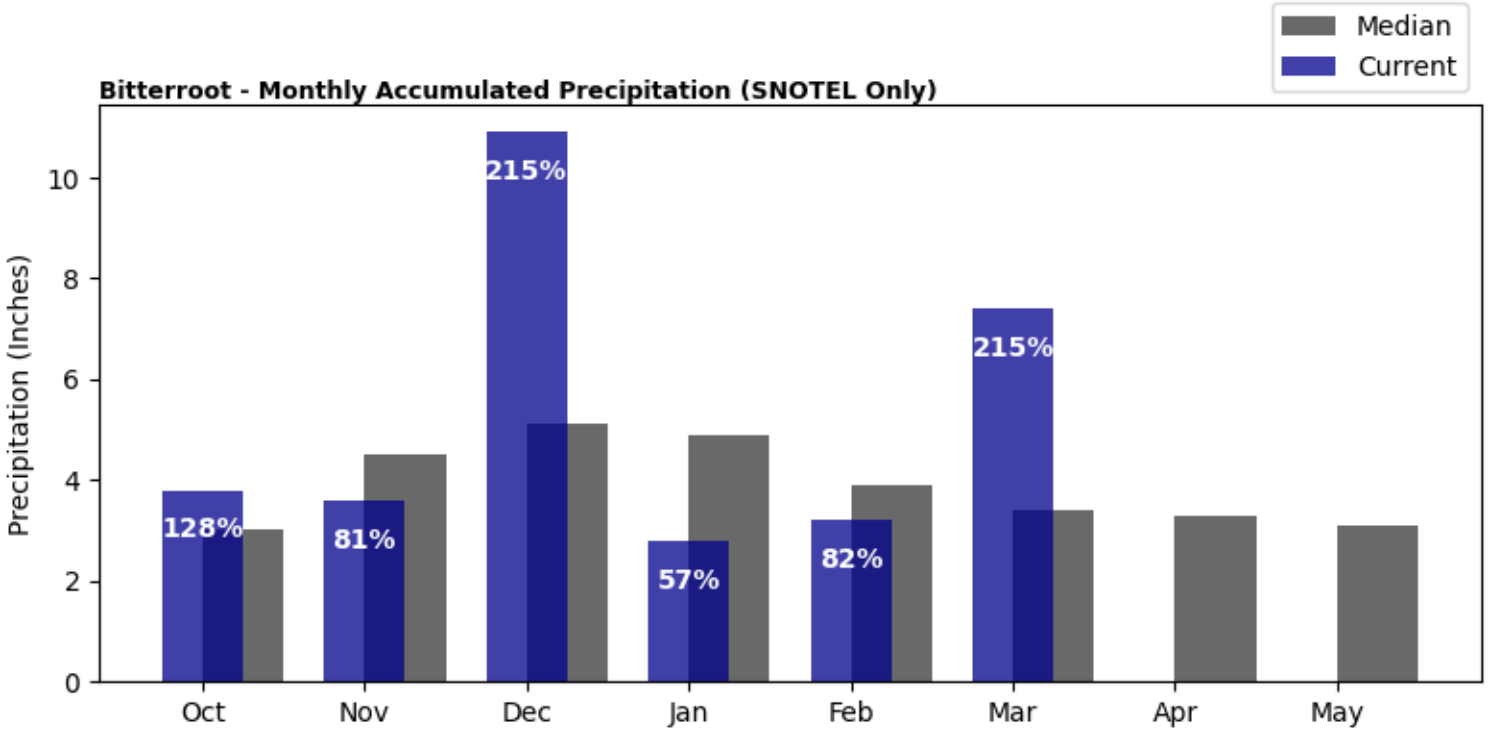
Upper Clark Fork (Continued)

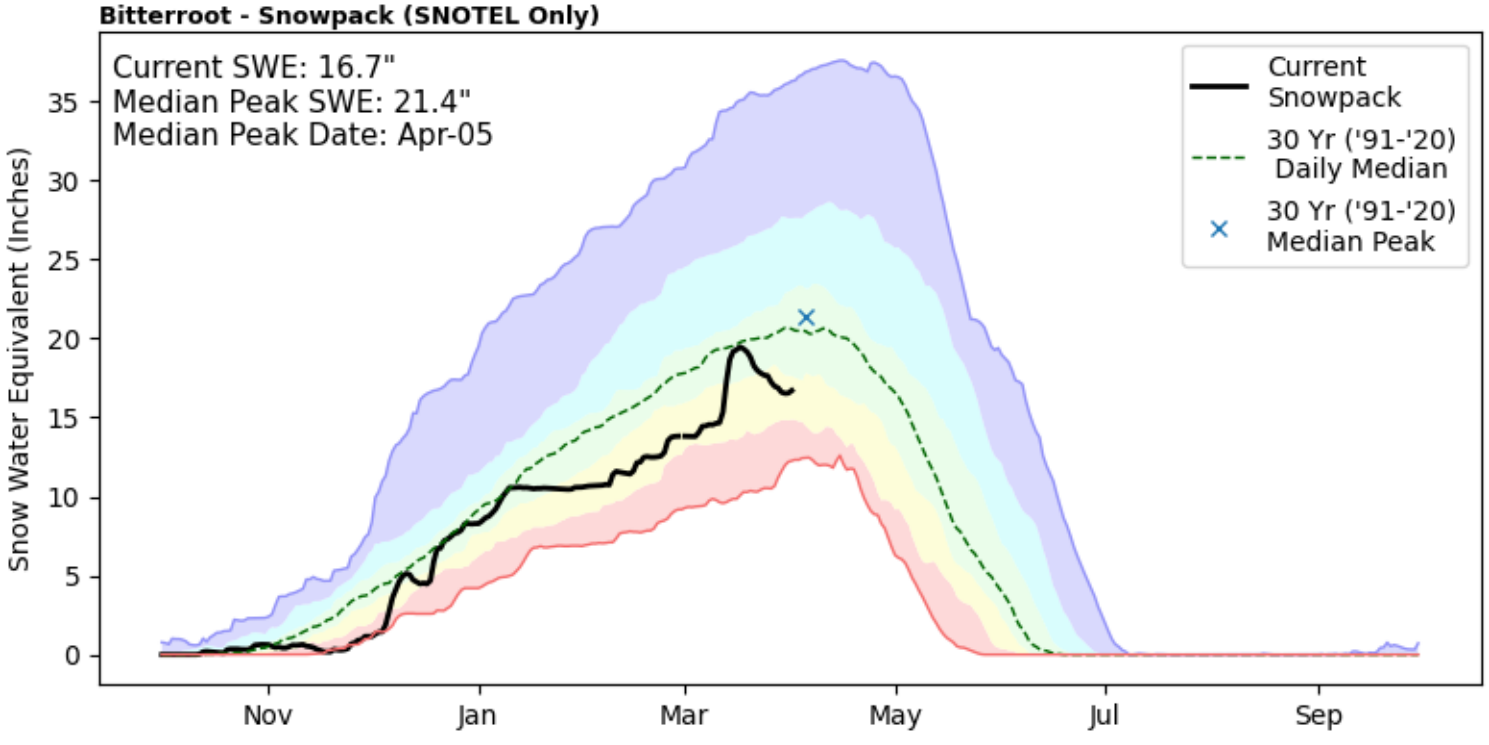


Basin Overview

Bitterroot

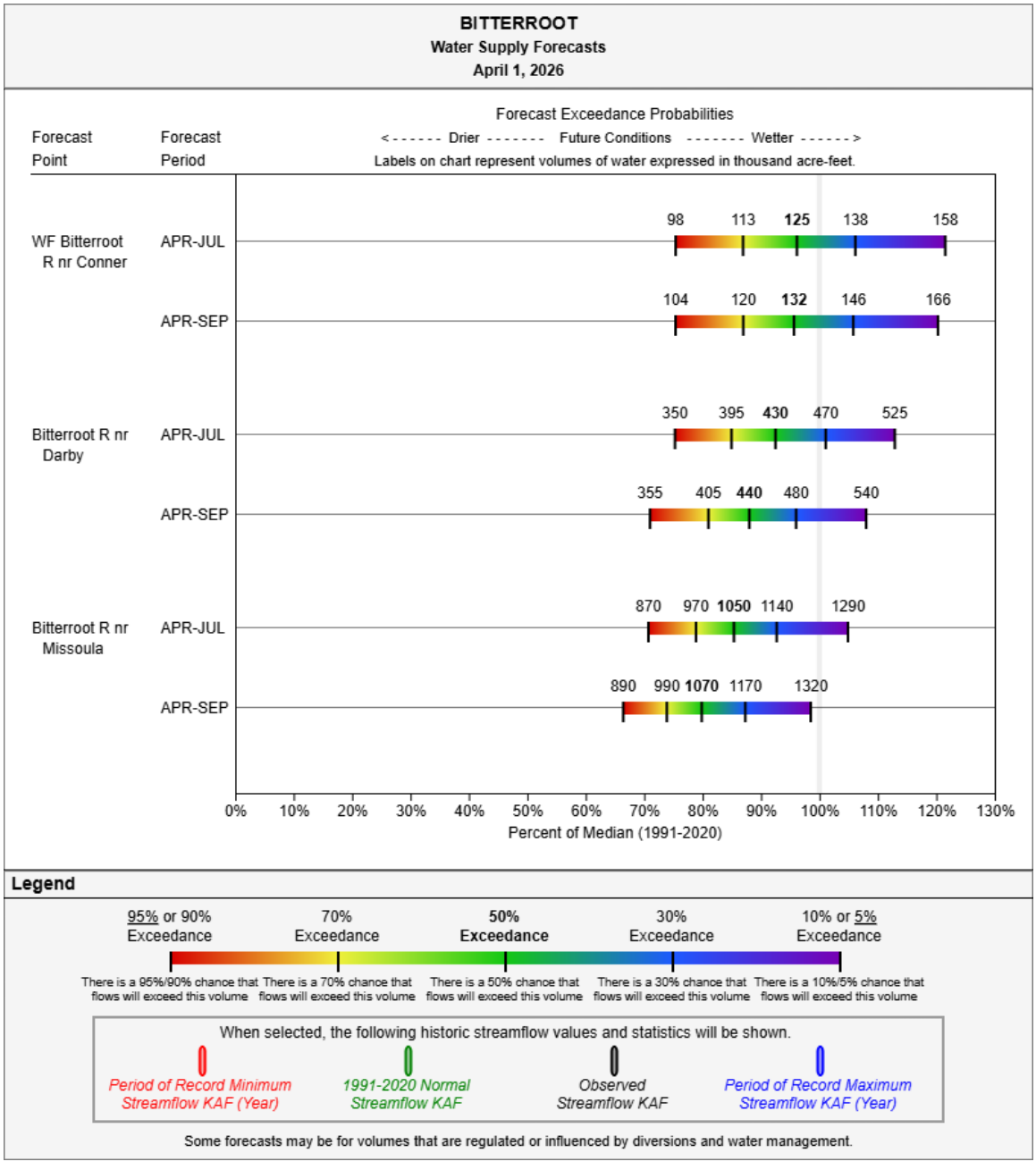
Precipitation in March was well above normal at 215%, which brings the seasonal accumulation (October-March) to 121% of median. The snowpack in the Bitterroot is well below normal at 79% of median, compared to 95% at this time last year.





Basin Overview

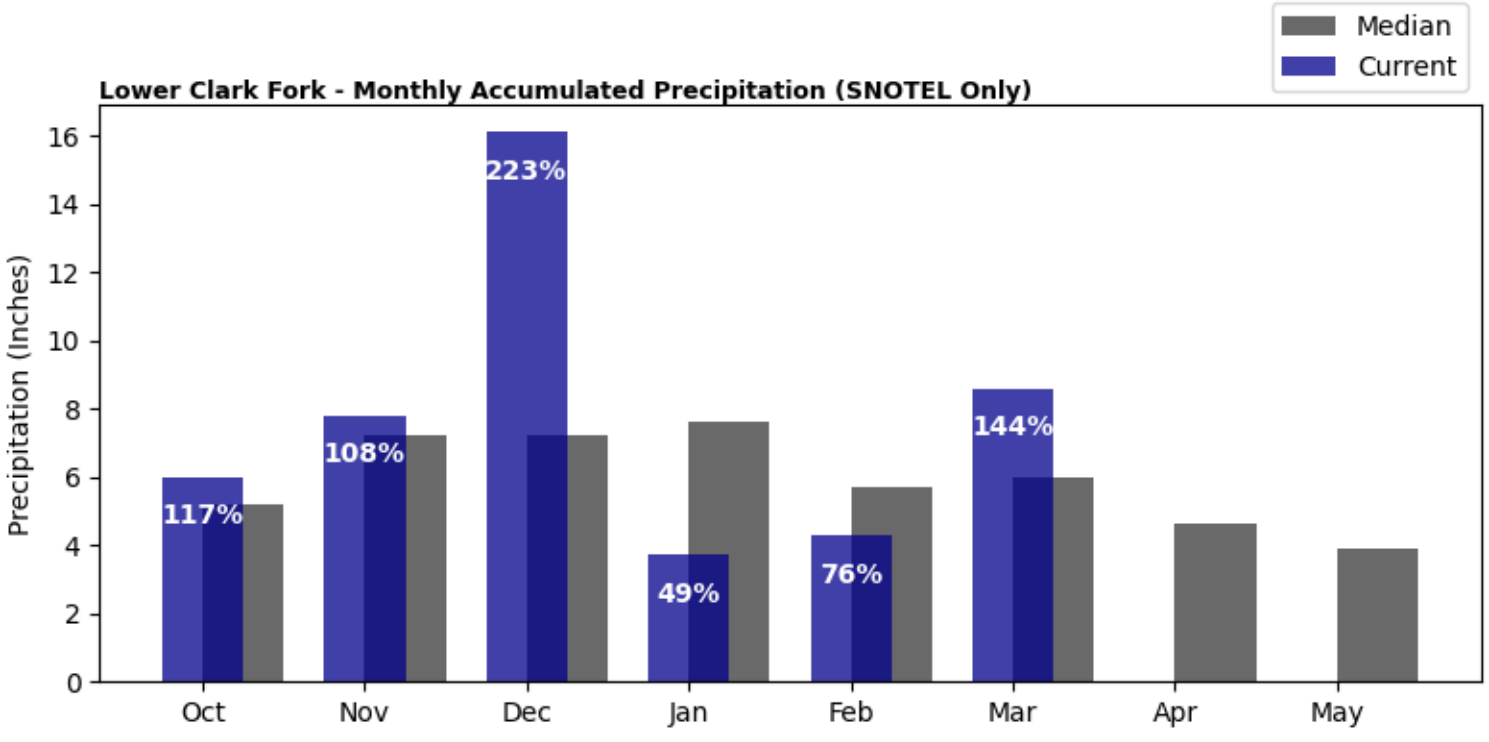
Bitterroot (Continued)

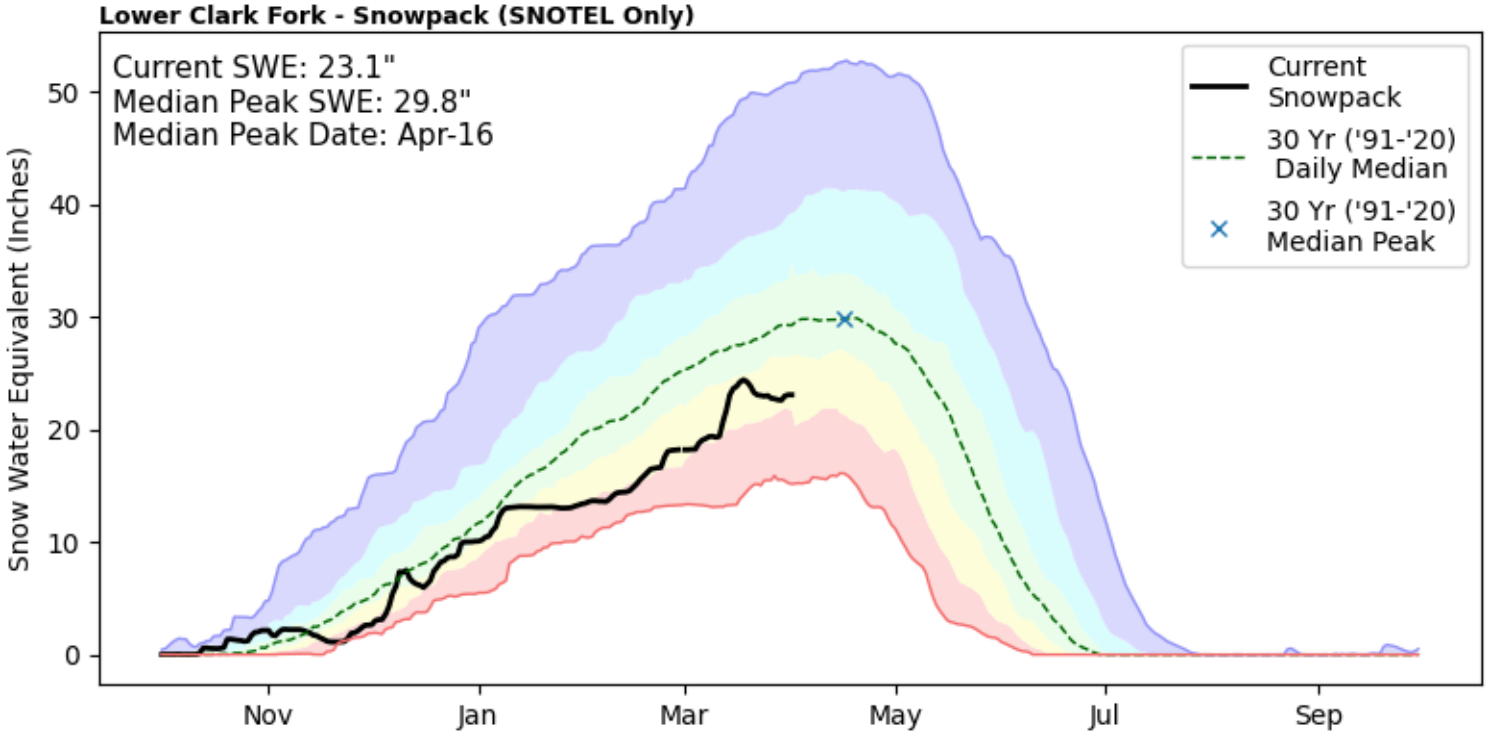


Basin Overview

Lower Clark Fork

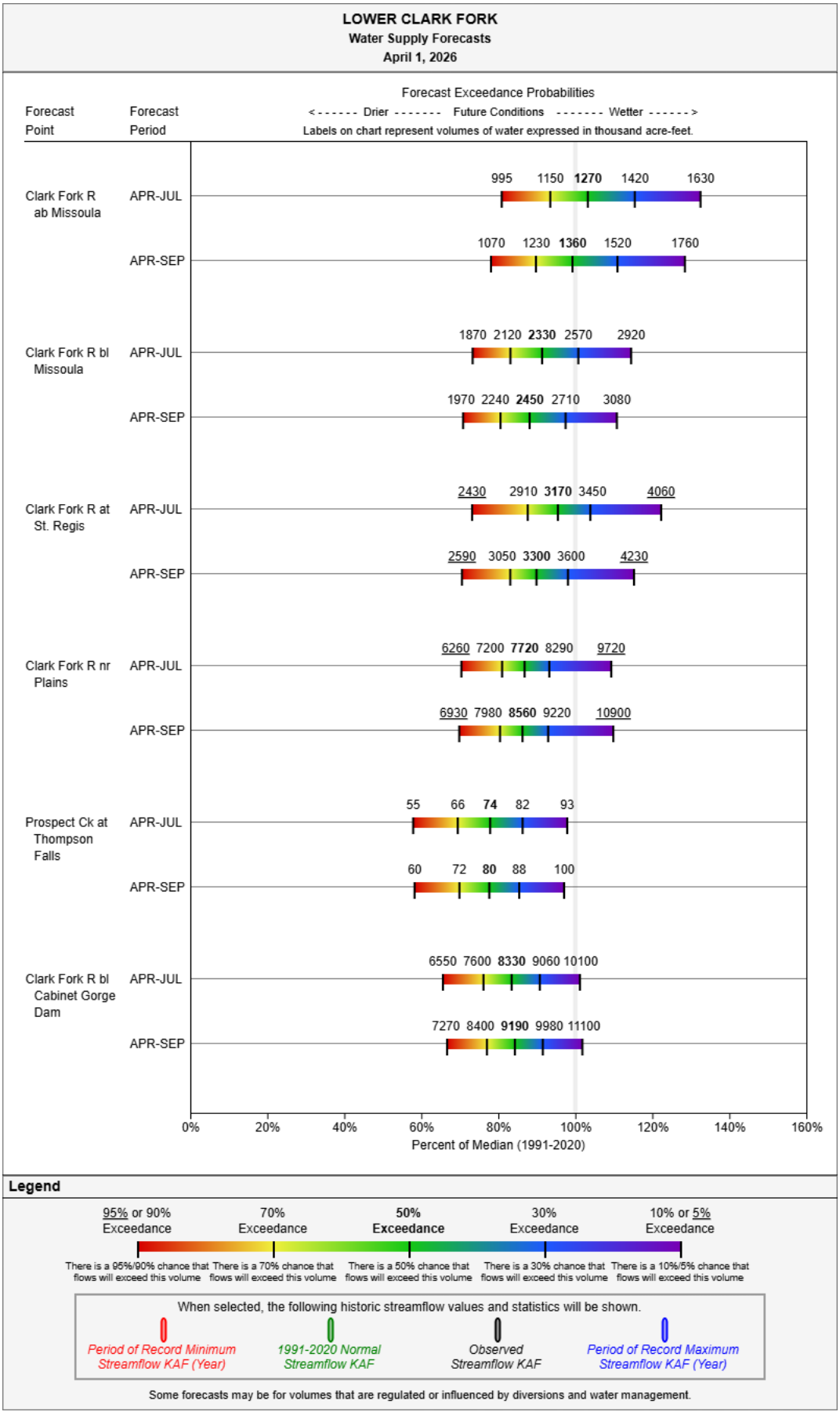
Precipitation in March was well above normal at 144%, which brings the seasonal accumulation (October-March) to 112% of median. The snowpack in the Lower Clark Fork is well below normal at 70% of median, compared to 91% at this time last year.





Basin Overview

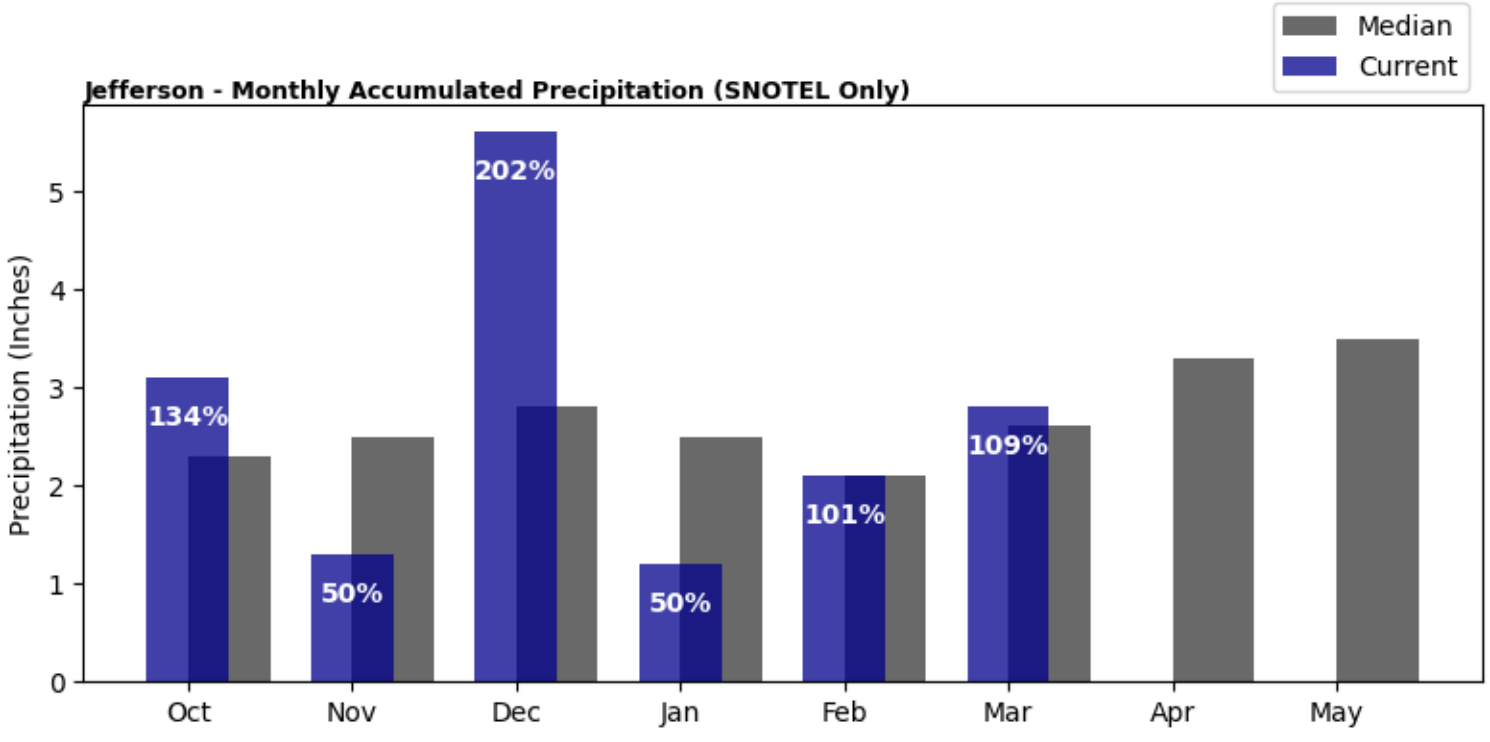
Lower Clark Fork (Continued)

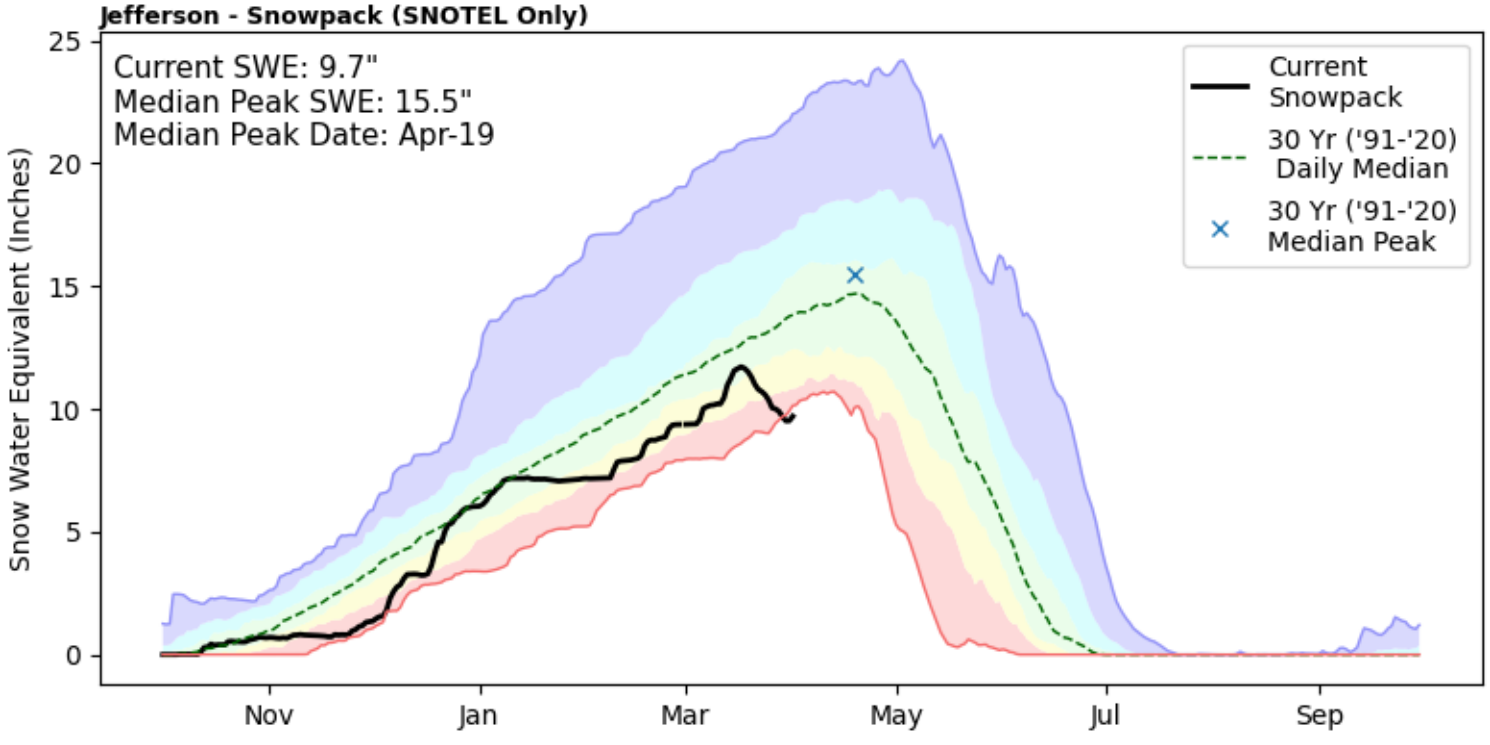


Basin Overview

Jefferson

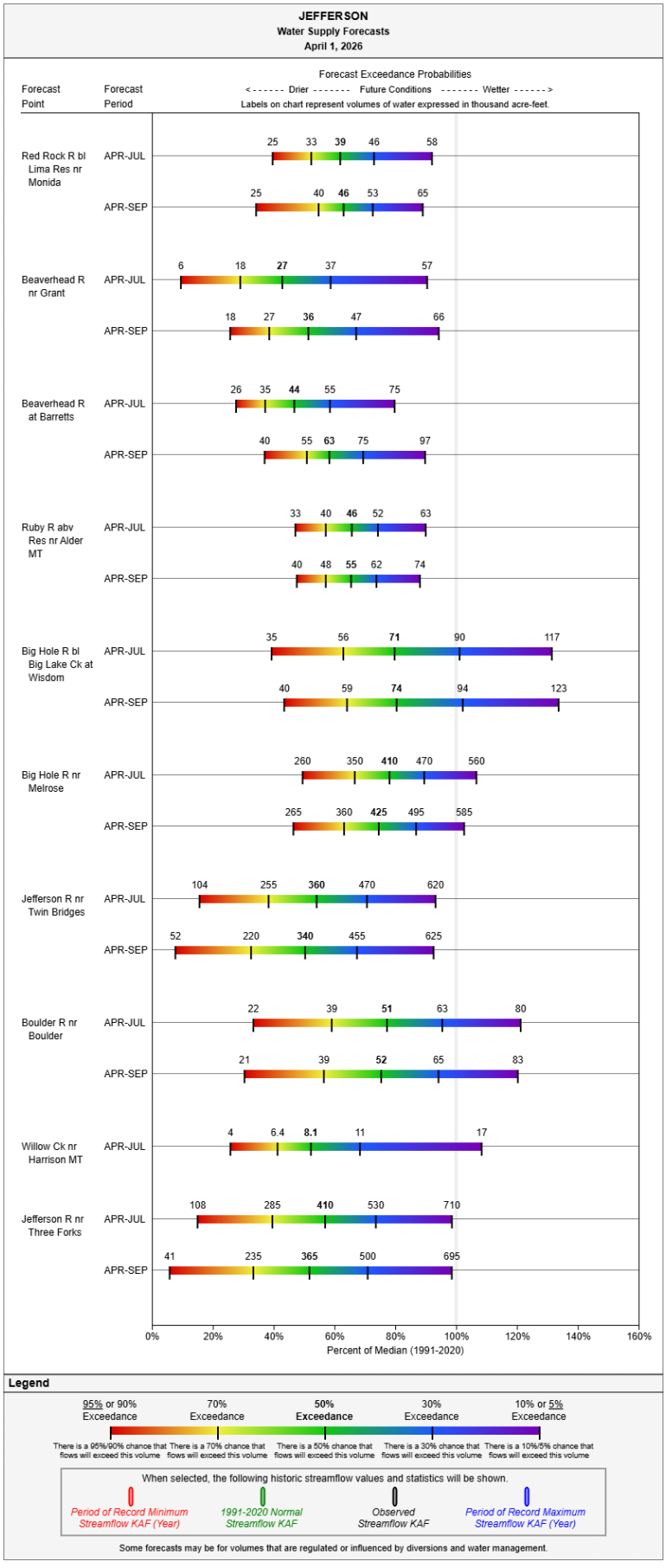
Precipitation in March was above normal at 109%, which brings the seasonal accumulation (October-March) to 106% of median. The snowpack in the Jefferson is well below normal at 69% of median, compared to 93% at this time last year.





Basin Overview

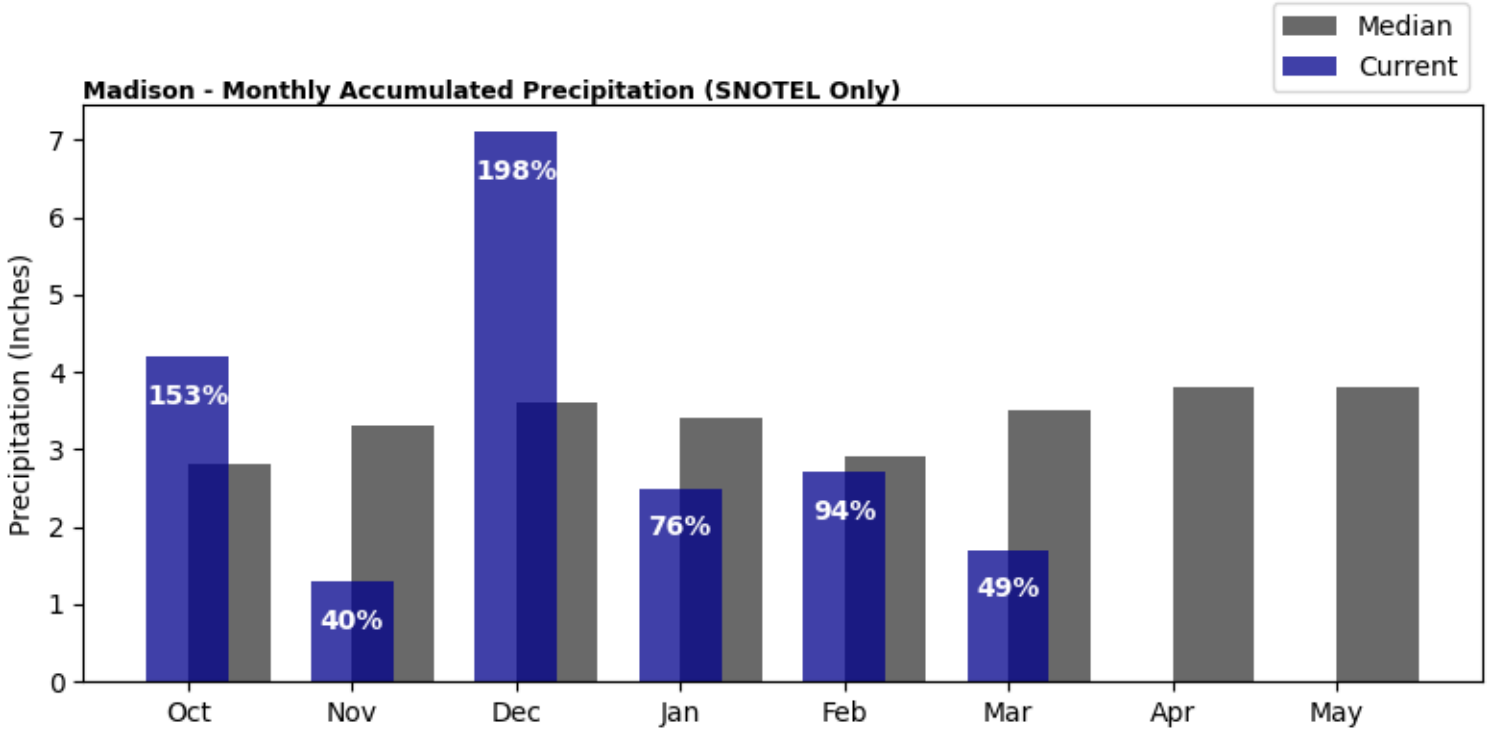
Jefferson (Continued)

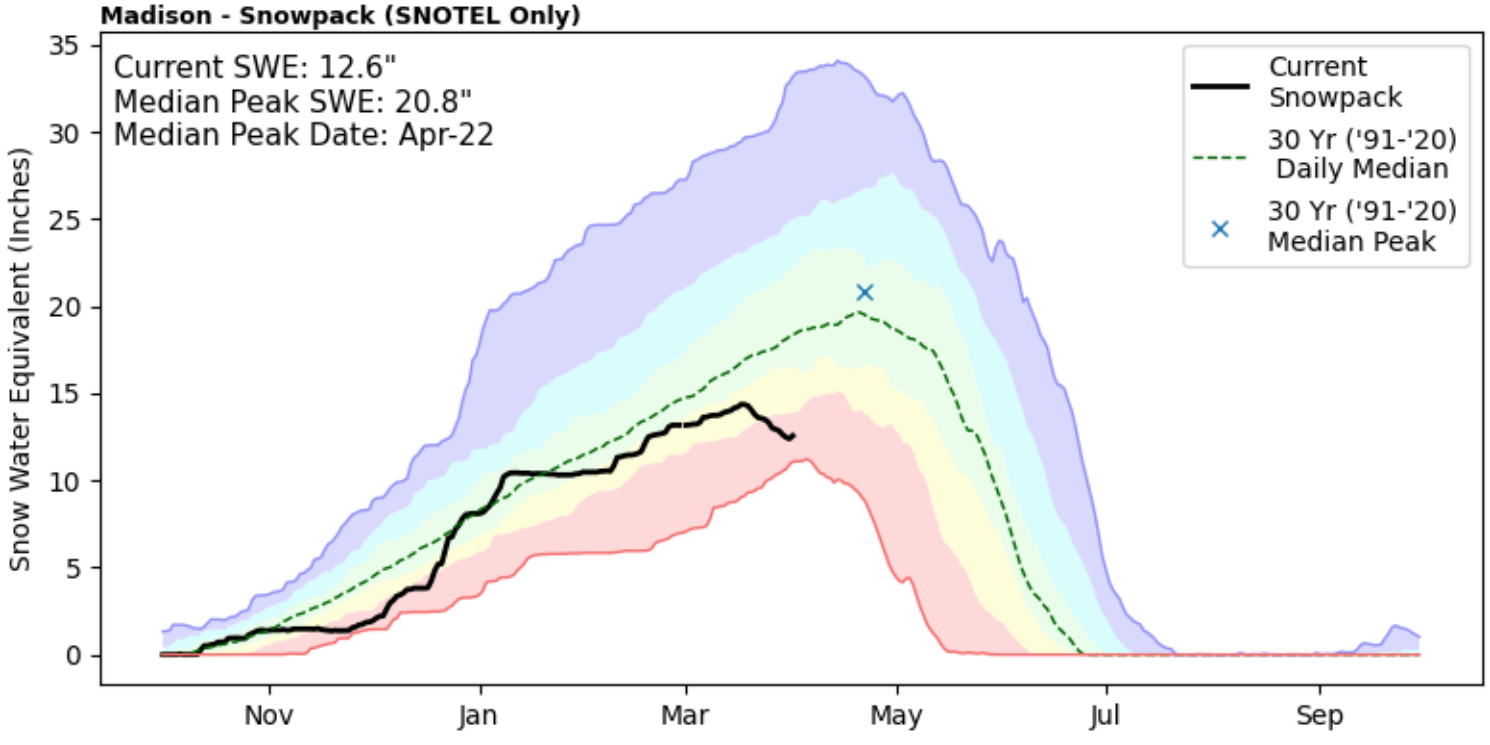


Basin Overview

Madison

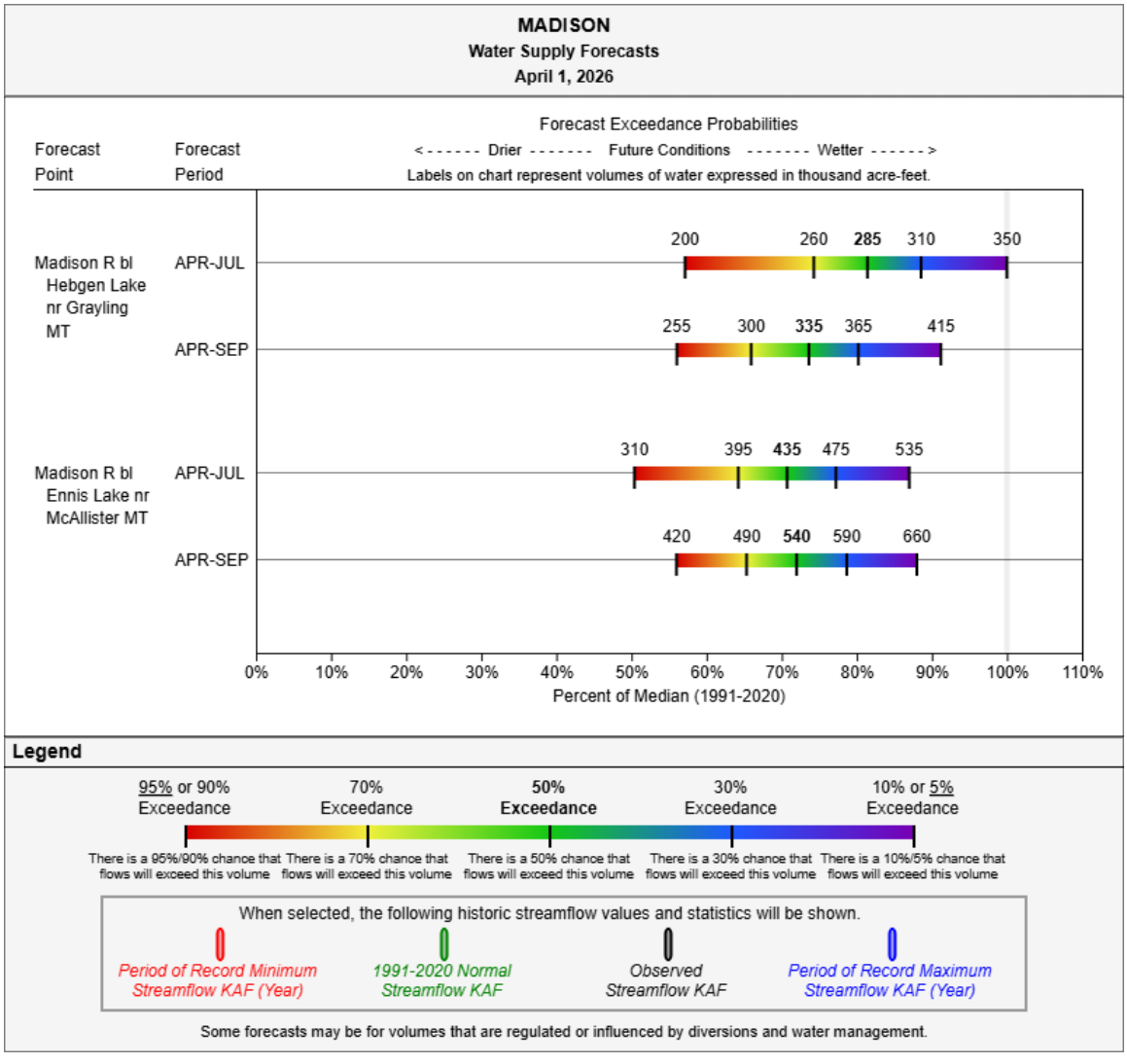
Precipitation in March was well below normal at 49%, which brings the seasonal accumulation (October-March) to 98% of median. The snowpack in the Madison is well below normal at 61% of median, compared to 96% at this time last year.





Basin Overview

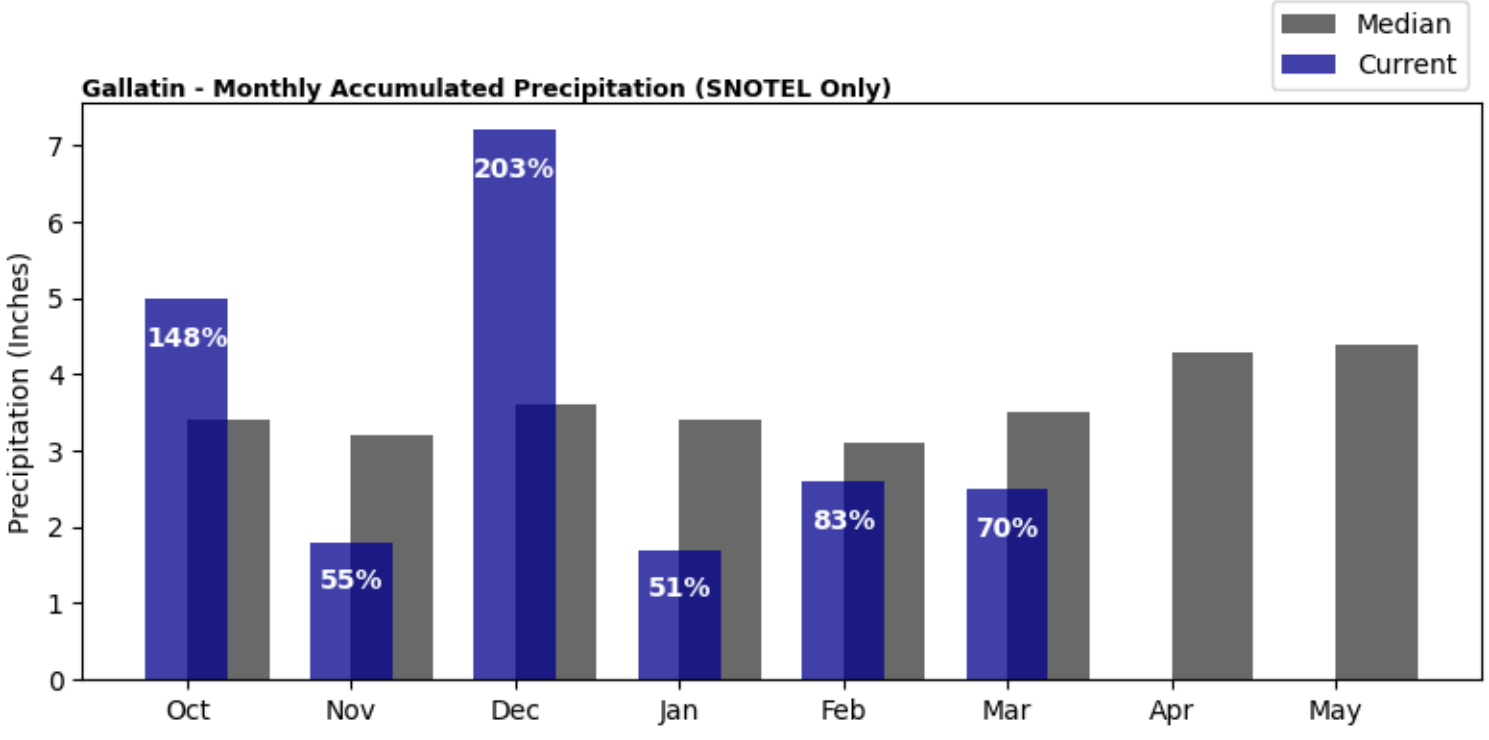
Madison (Continued)

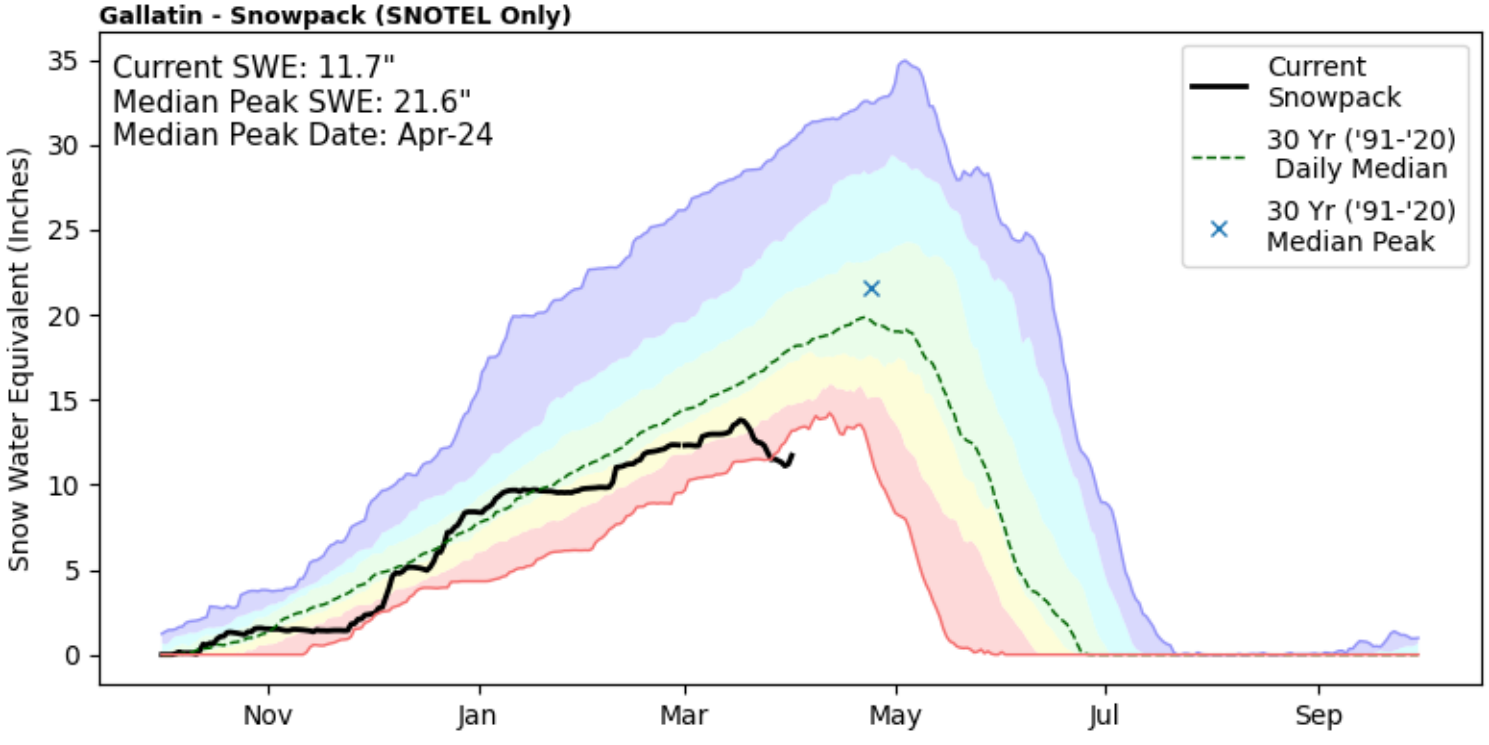


Basin Overview

Gallatin

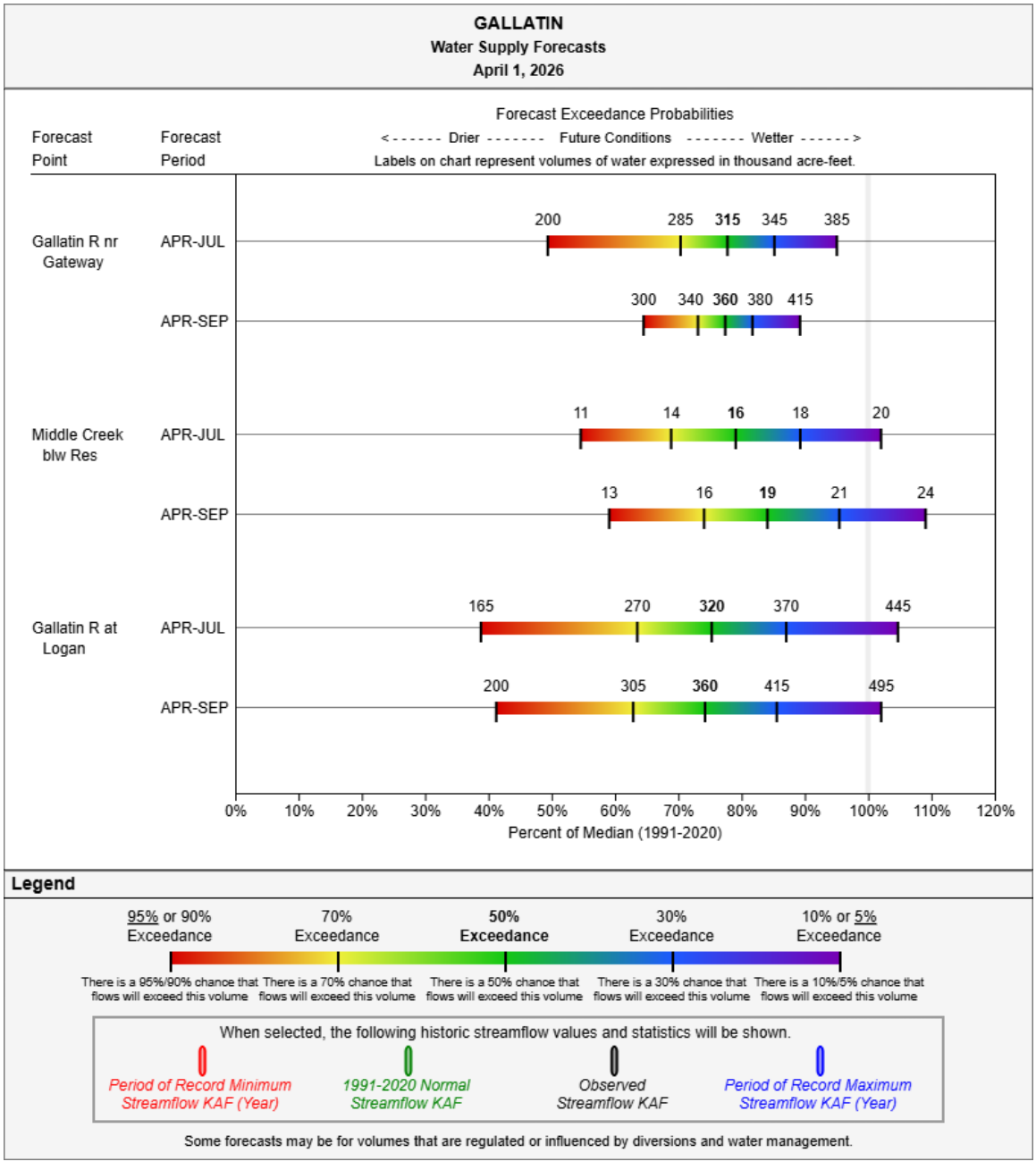
Precipitation in March was well below normal at 70%, which brings the seasonal accumulation (October-March) to 100% of median. The snowpack in the Gallatin is well below normal at 63% of median, compared to 104% at this time last year.





Basin Overview

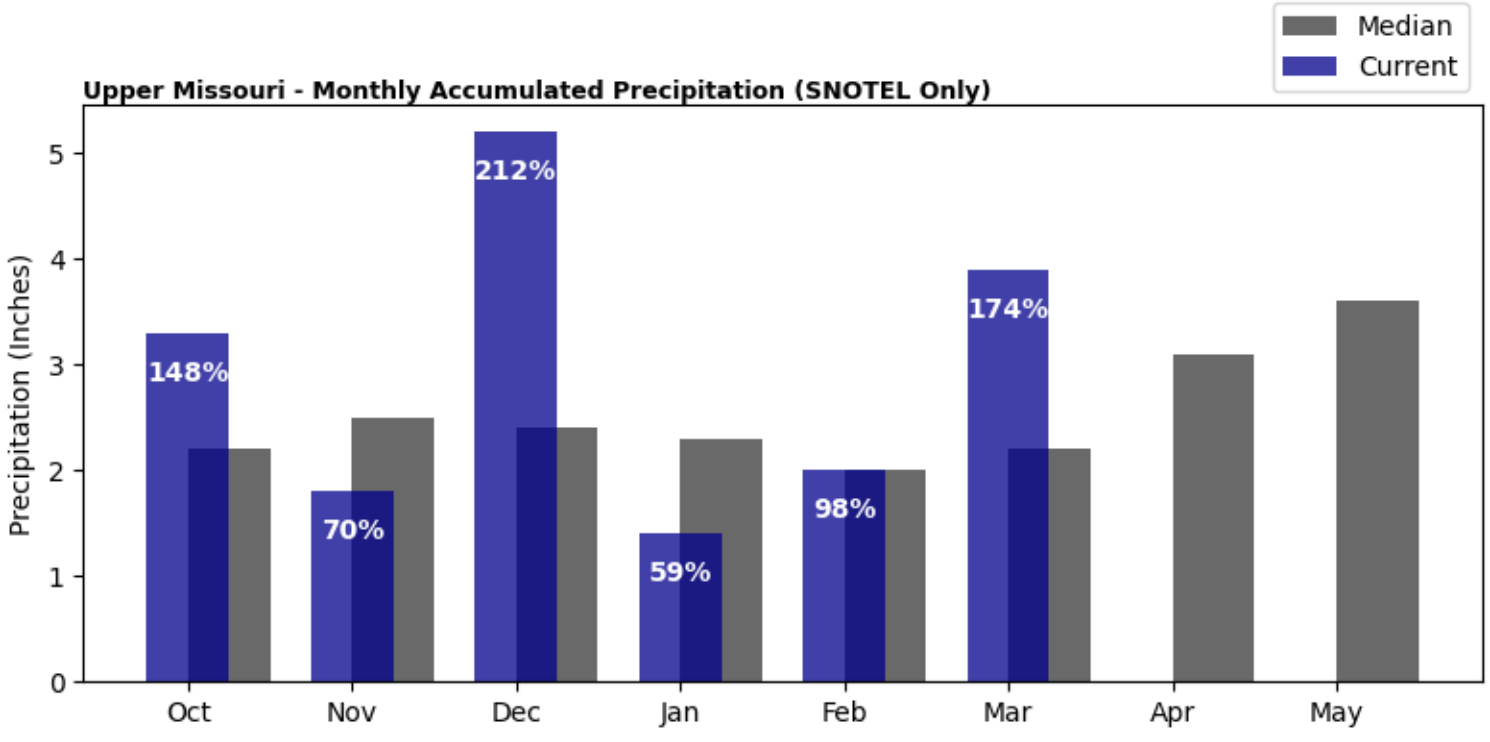
Gallatin (Continued)

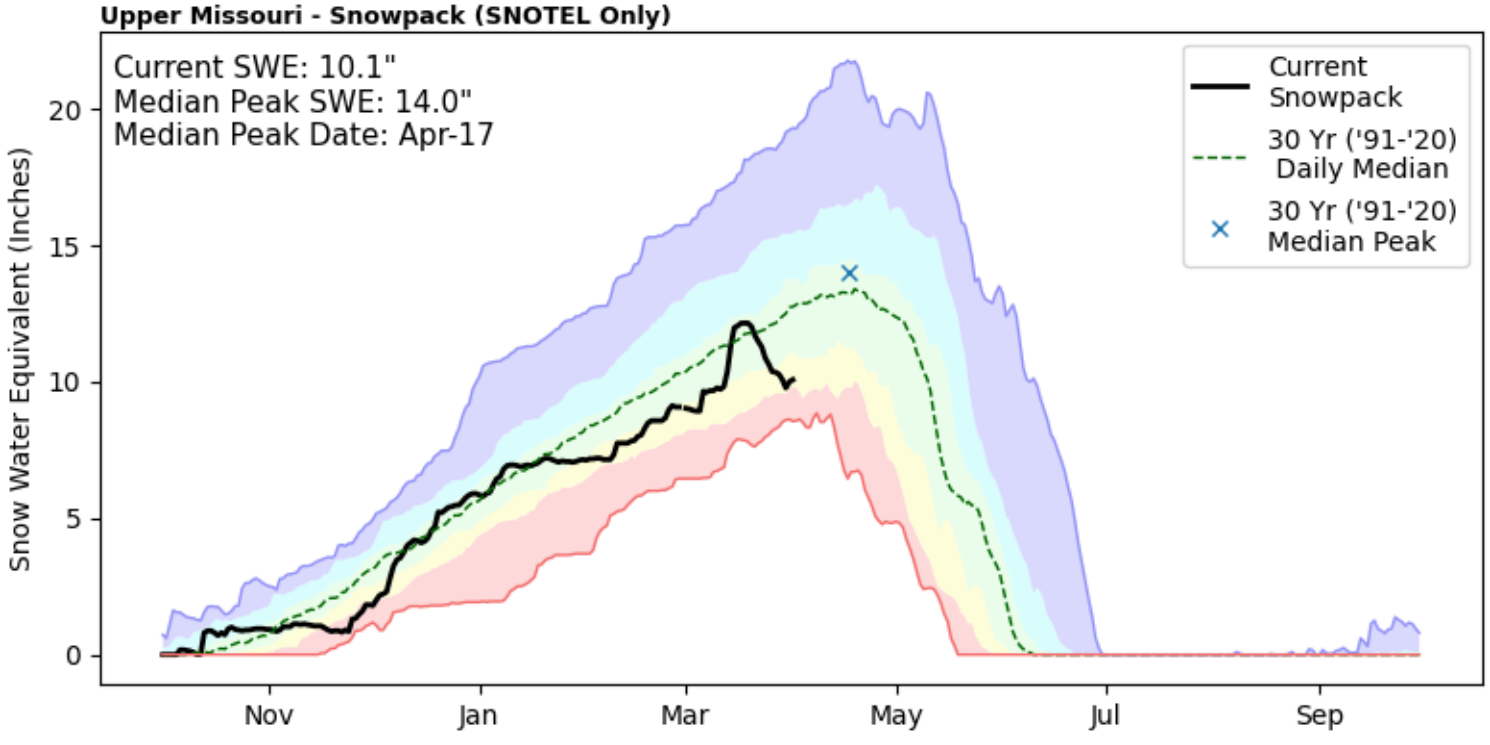


Basin Overview

Upper Missouri

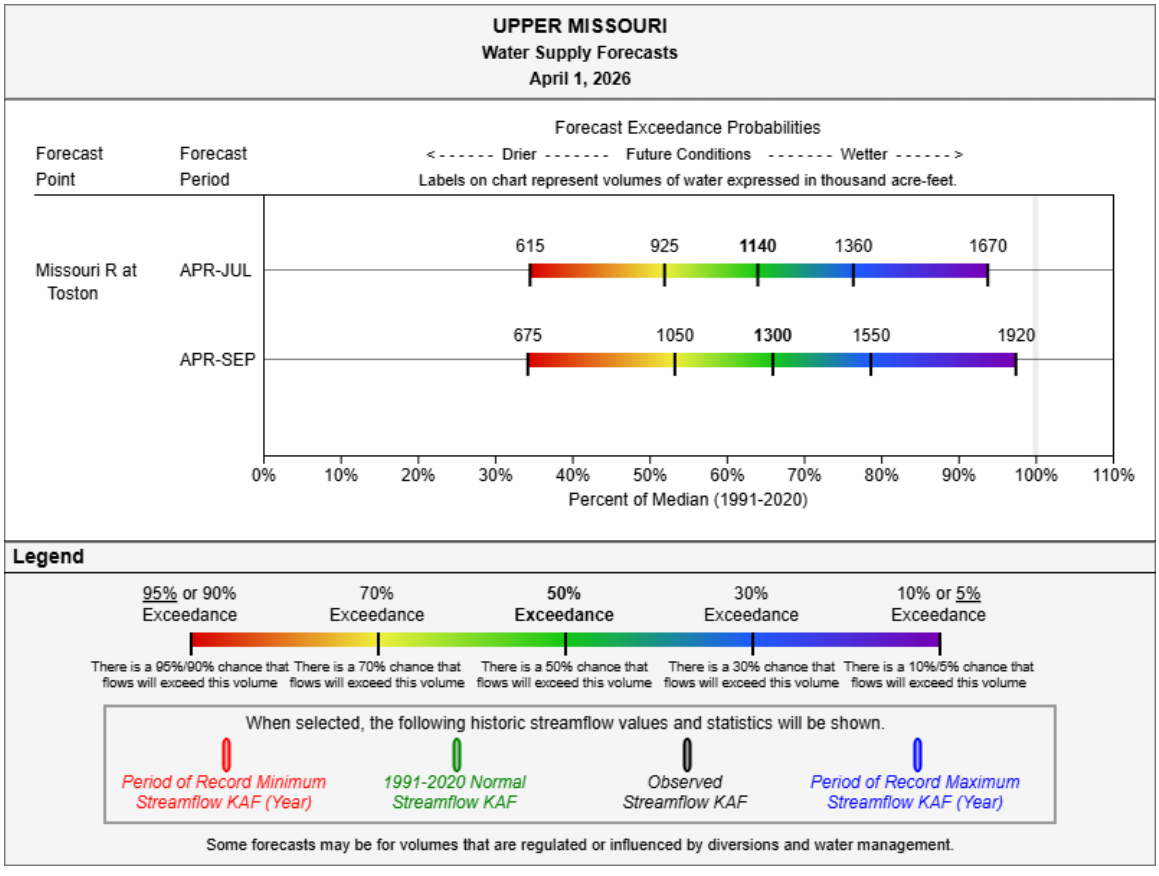
Precipitation in March was well above normal at 174%, which brings the seasonal accumulation (October-March) to 127% of median. The snowpack in the Upper Missouri is below normal at 81% of median, compared to 90% at this time last year.





Basin Overview

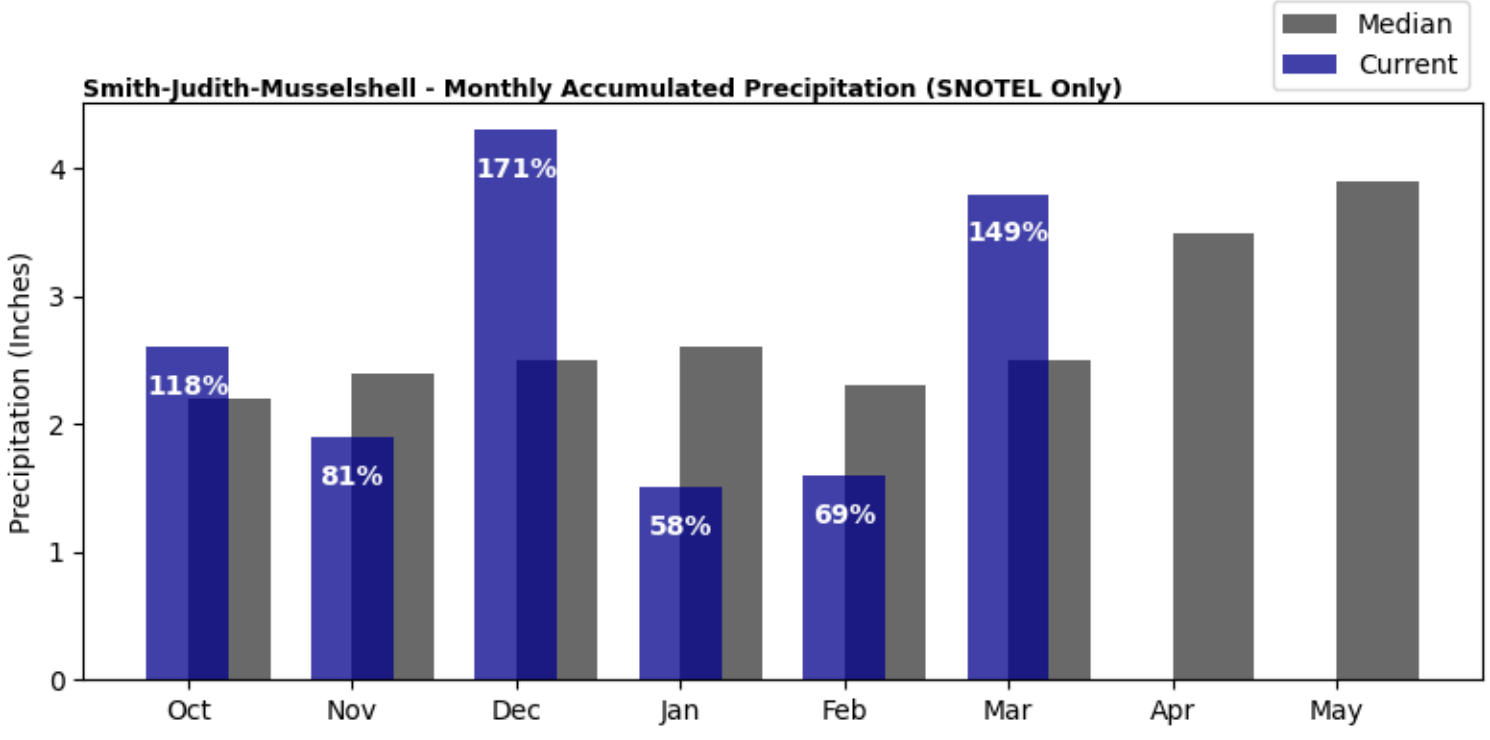
Upper Missouri (Continued)

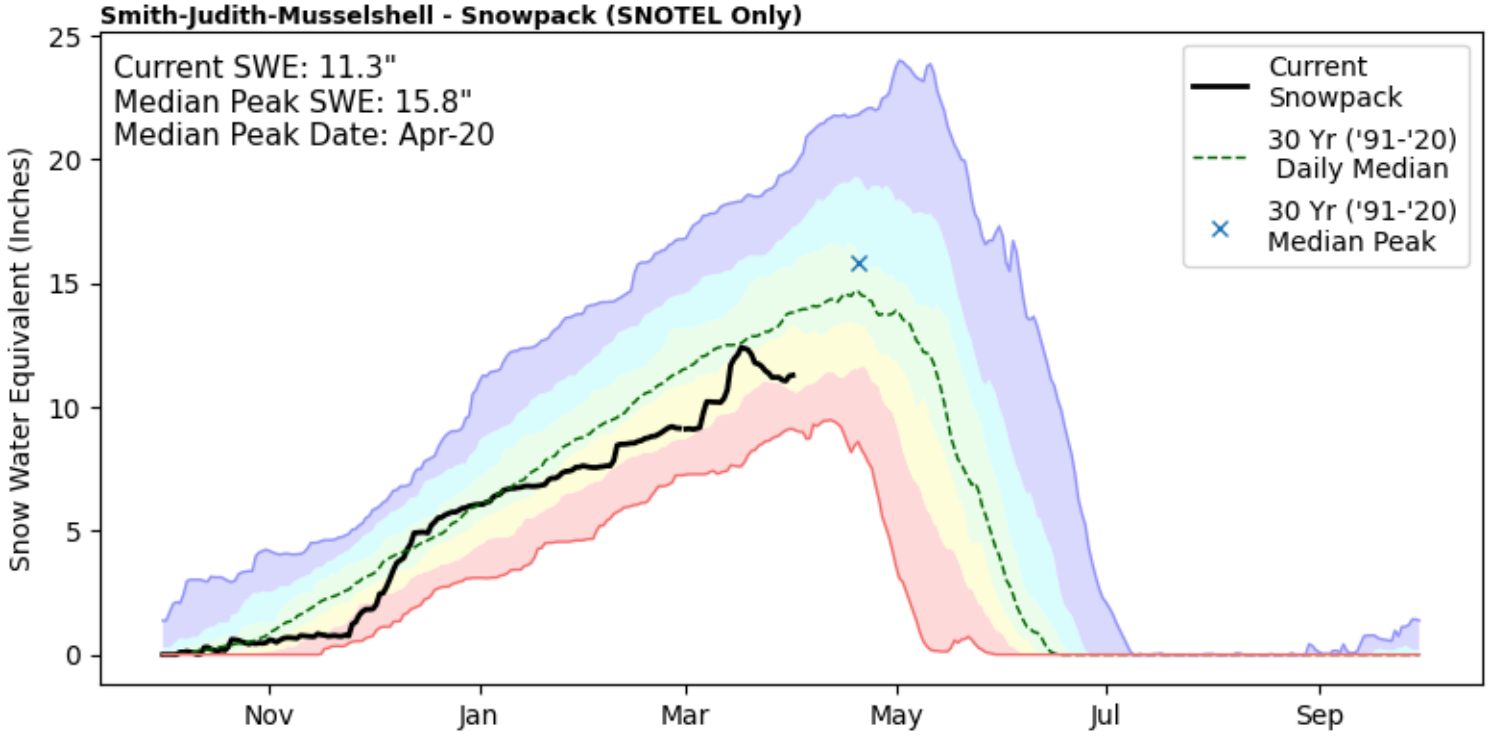


Basin Overview

Smith-Judith-Musselshell

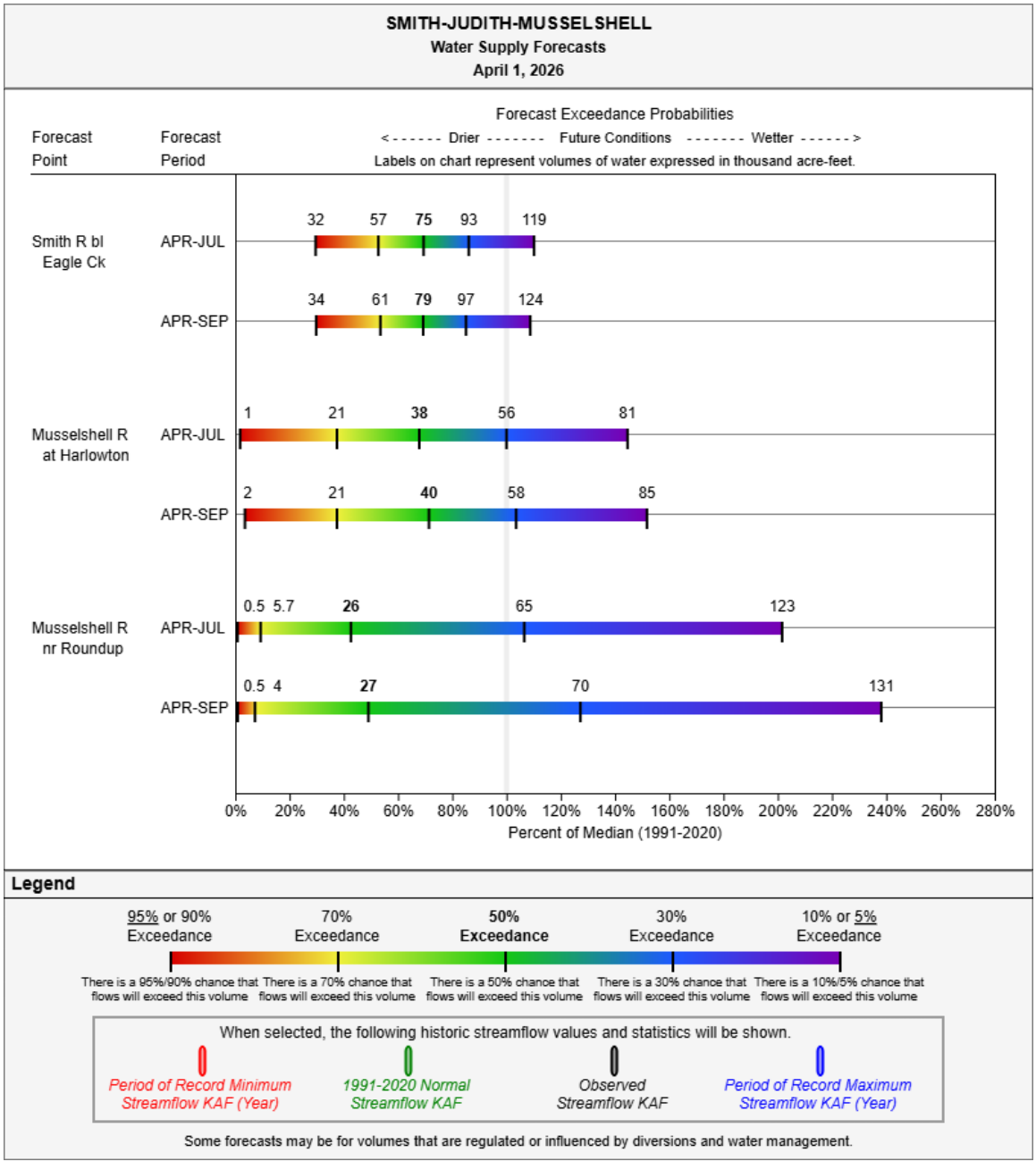
Precipitation in March was well above normal at 149%, which brings the seasonal accumulation (October-March) to 103% of median. The snowpack in the Smith-Judith-Musselshell is well below normal at 74% of median, compared to 115% at this time last year.





Basin Overview

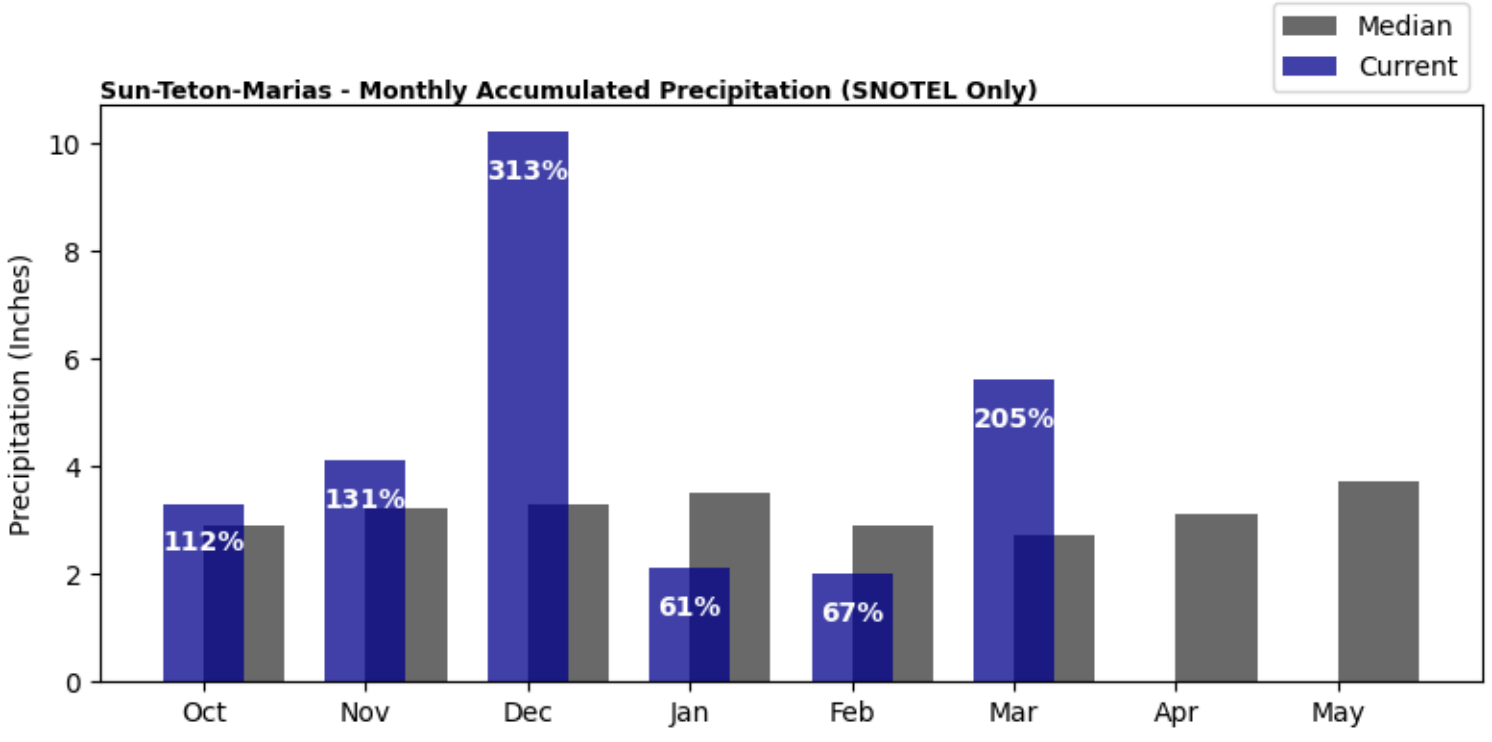
Smith-Judith-Musselshell (Continued)

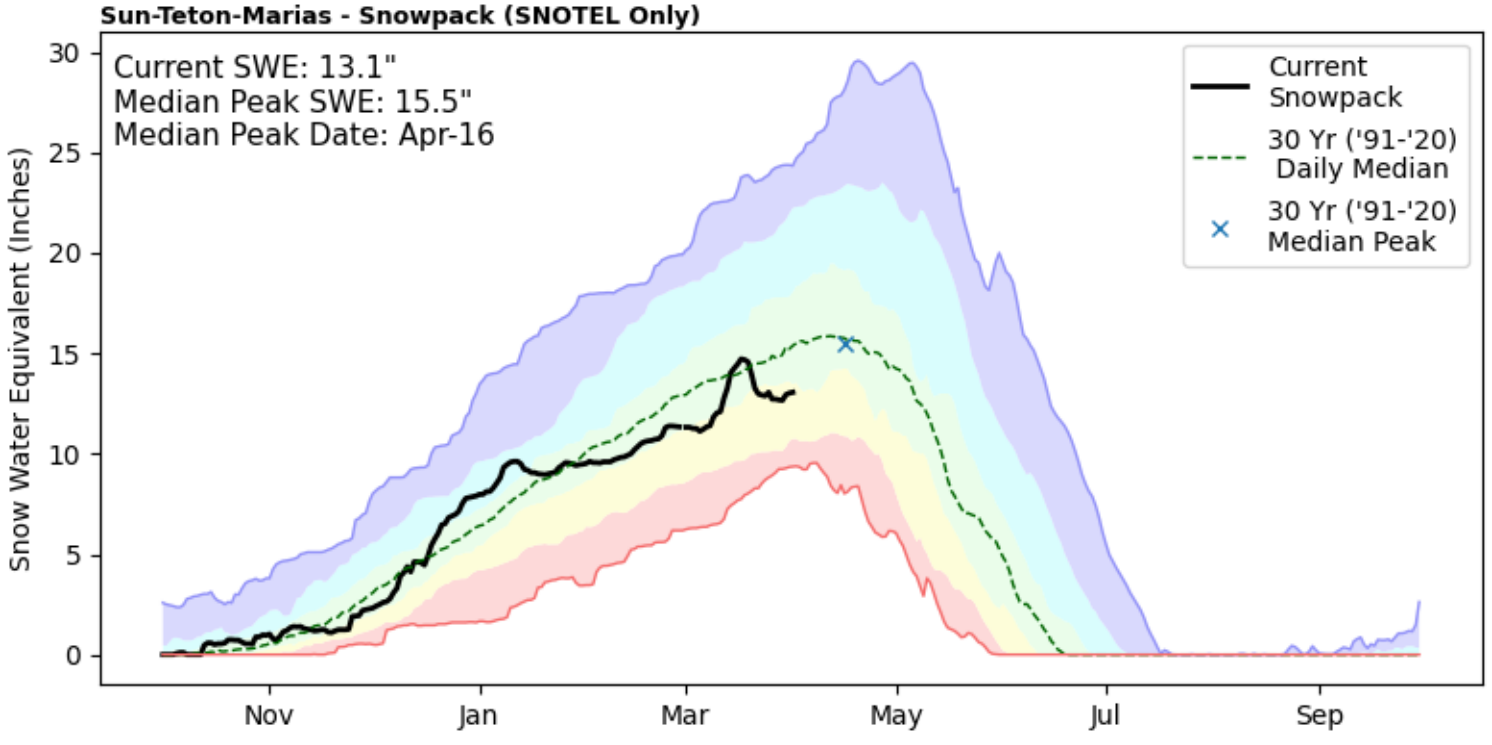


Basin Overview

Sun-Teton-Marias

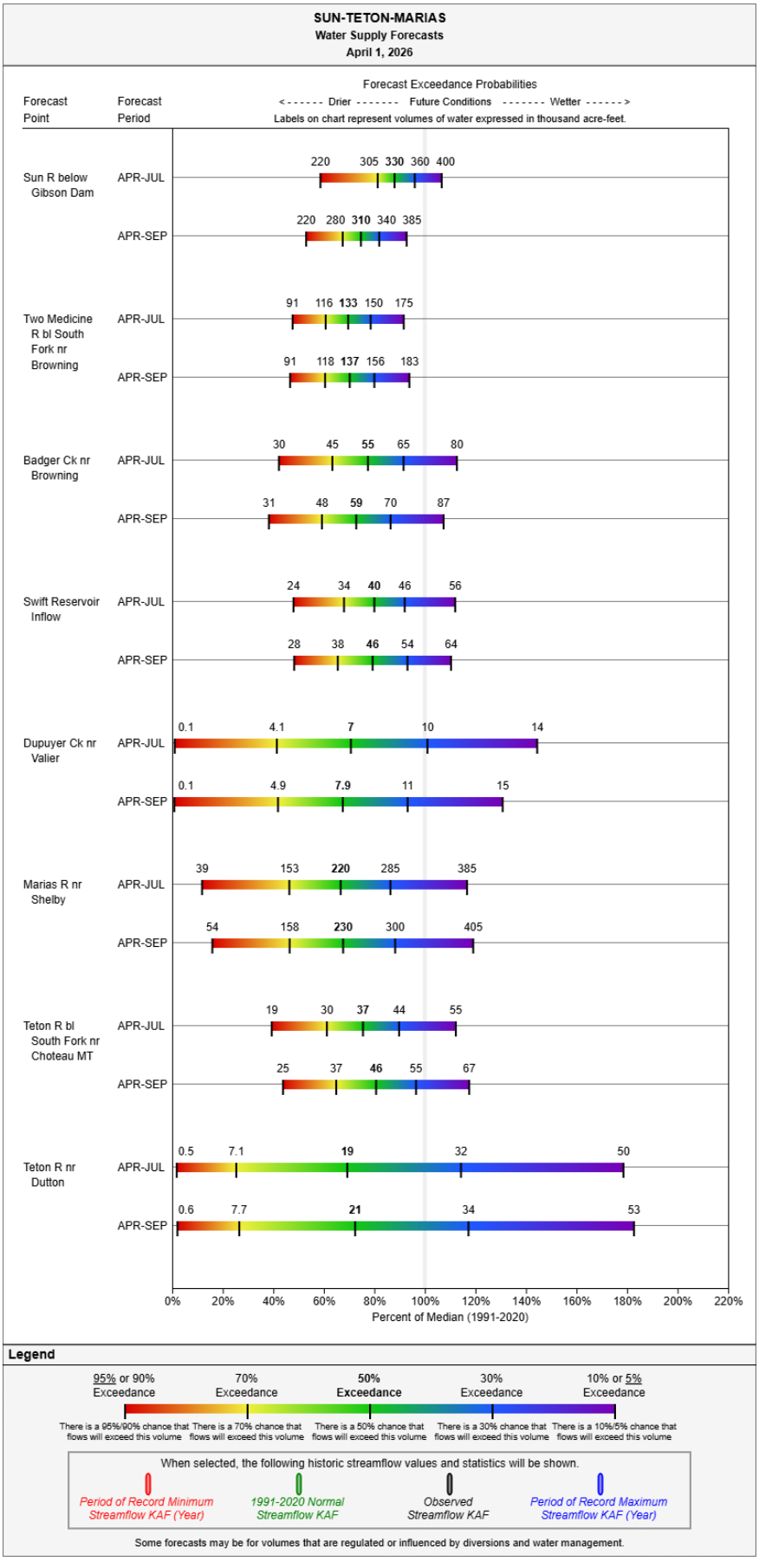
Precipitation in March was well above normal at 205%, which brings the seasonal accumulation (October-March) to 138% of median. The snowpack in the Sun-Teton-Marias is well below normal at 67% of median, compared to 70% at this time last year.





Basin Overview

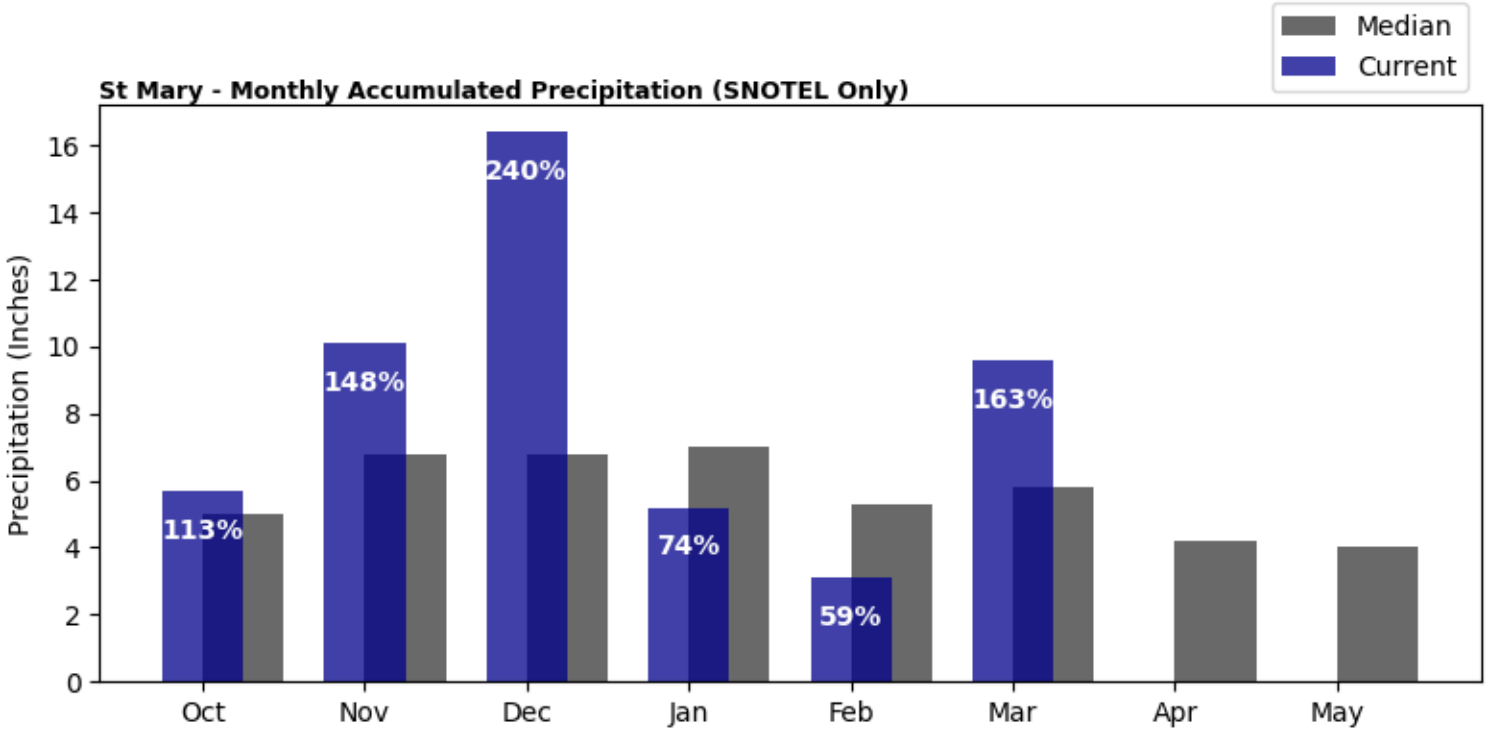
Sun-Teton-Marias (Continued)

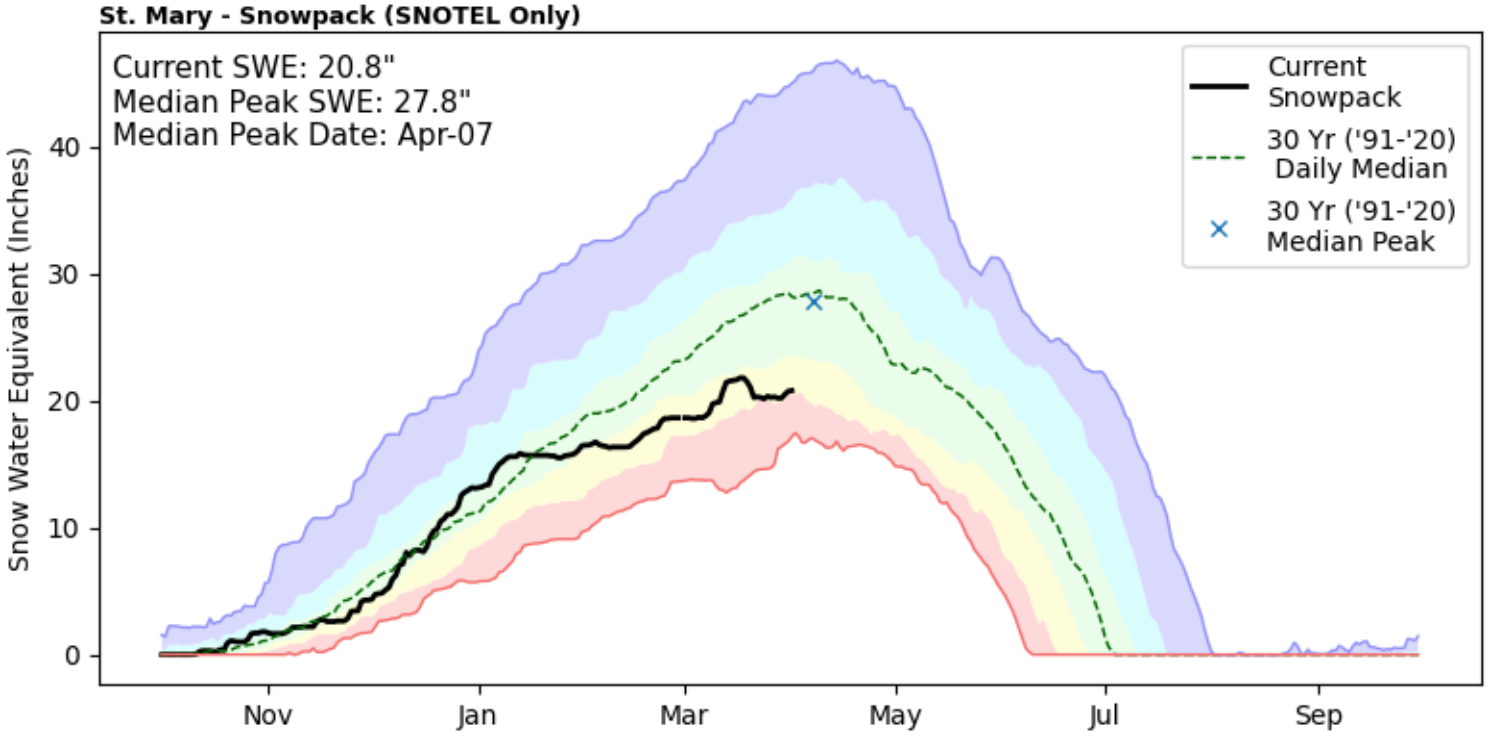


Basin Overview

St. Mary

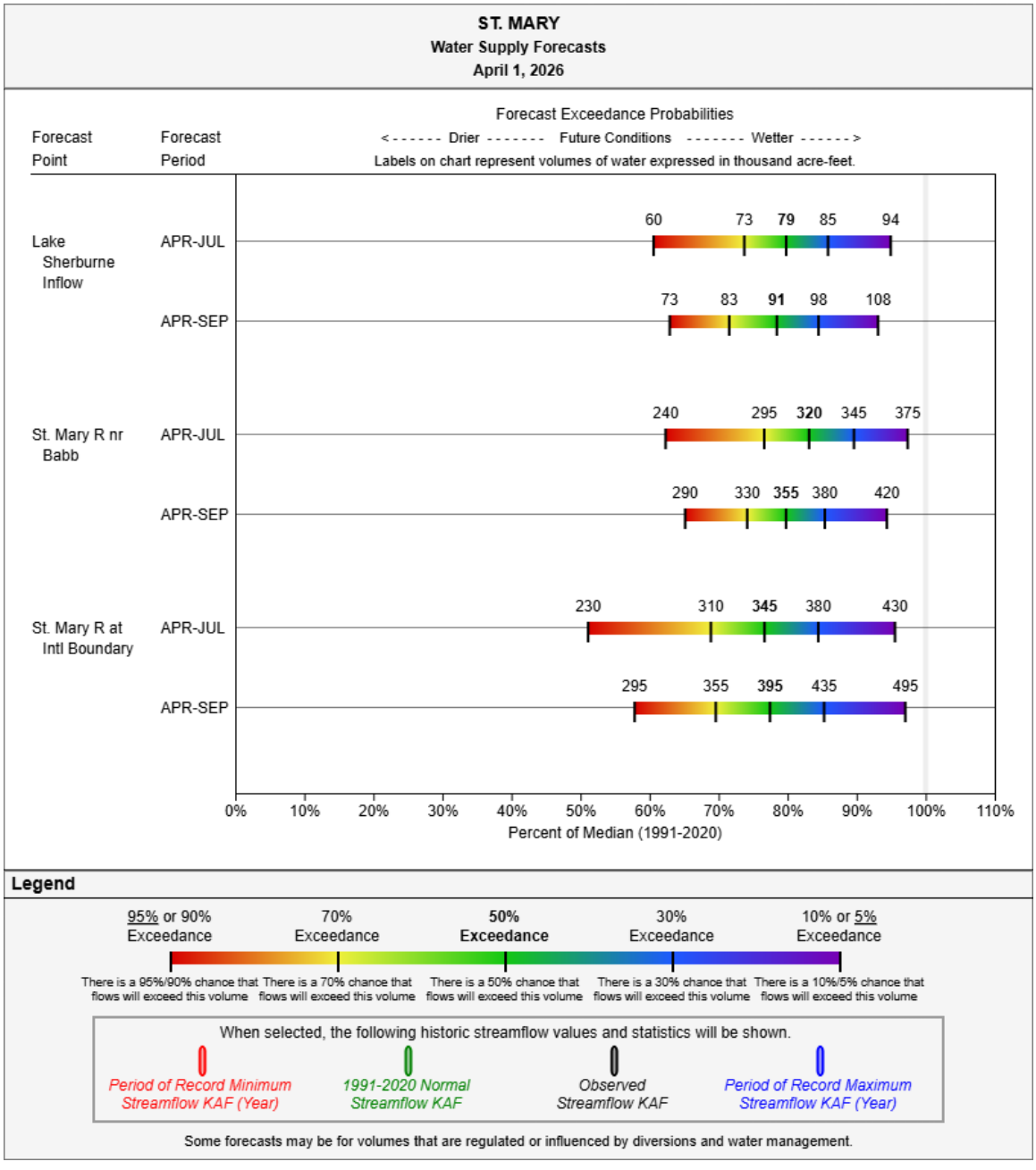
Precipitation in March was well above normal at 163%, which brings the seasonal accumulation (October-March) to 125% of median. The snowpack in the St. Mary is well below normal at 58% of median, compared to 77% at this time last year.





Basin Overview

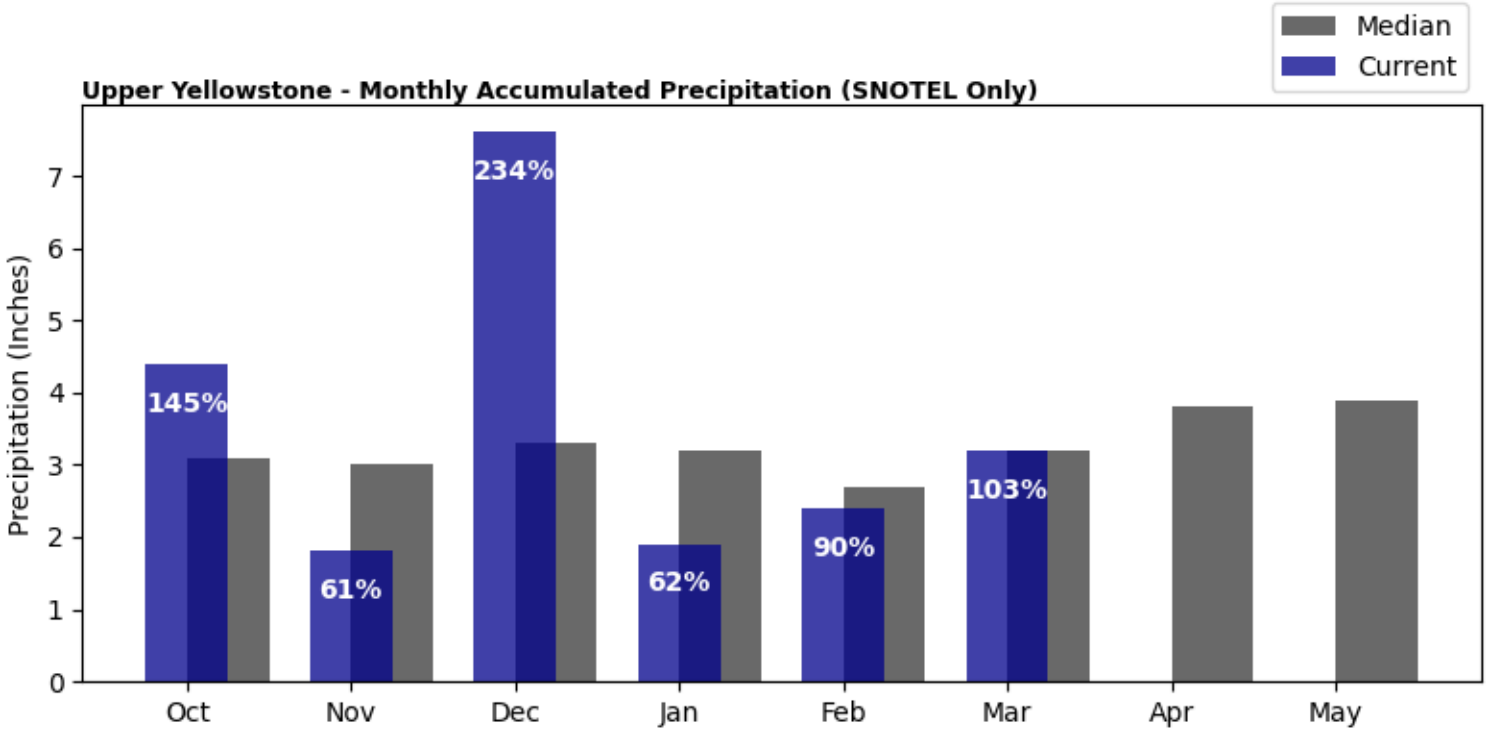
St. Mary (Continued)

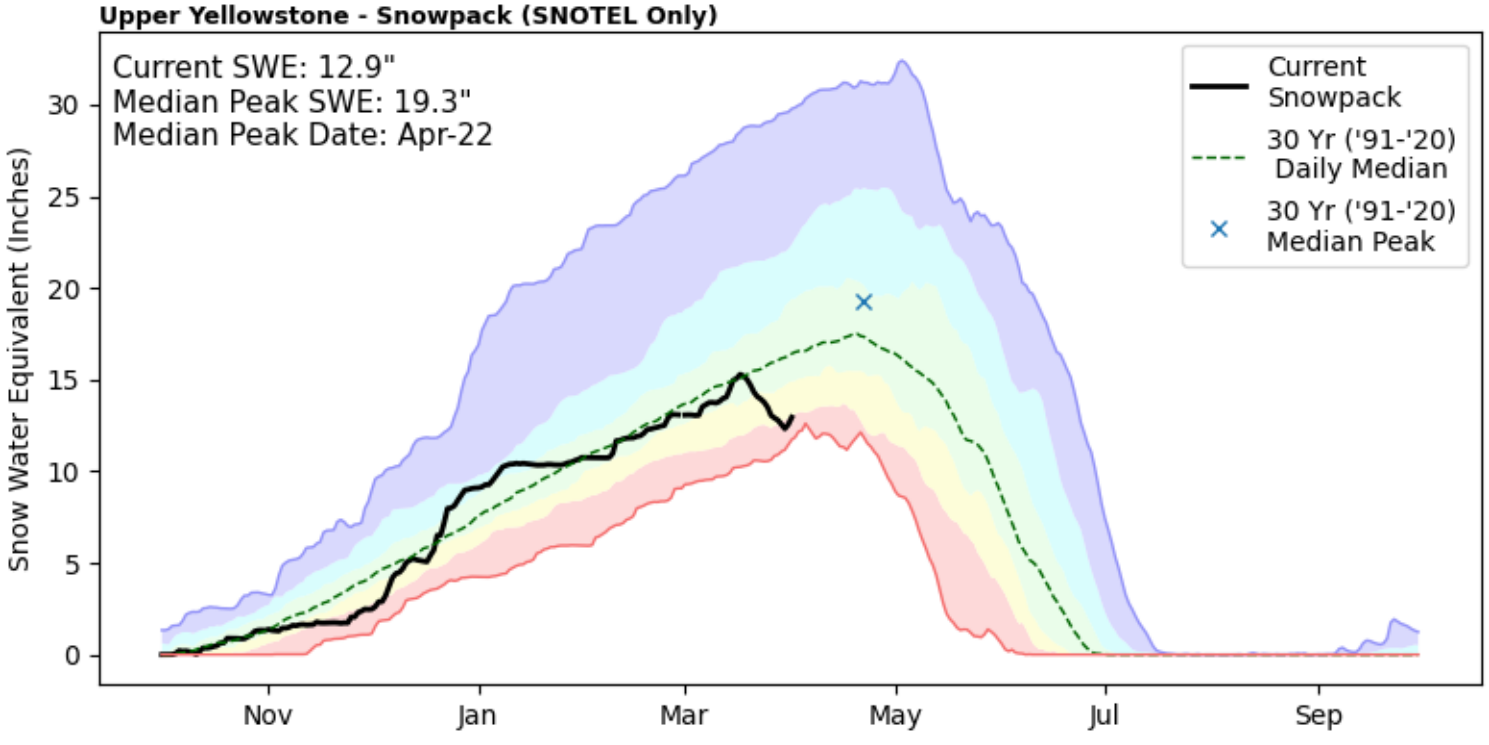


Basin Overview

Upper Yellowstone

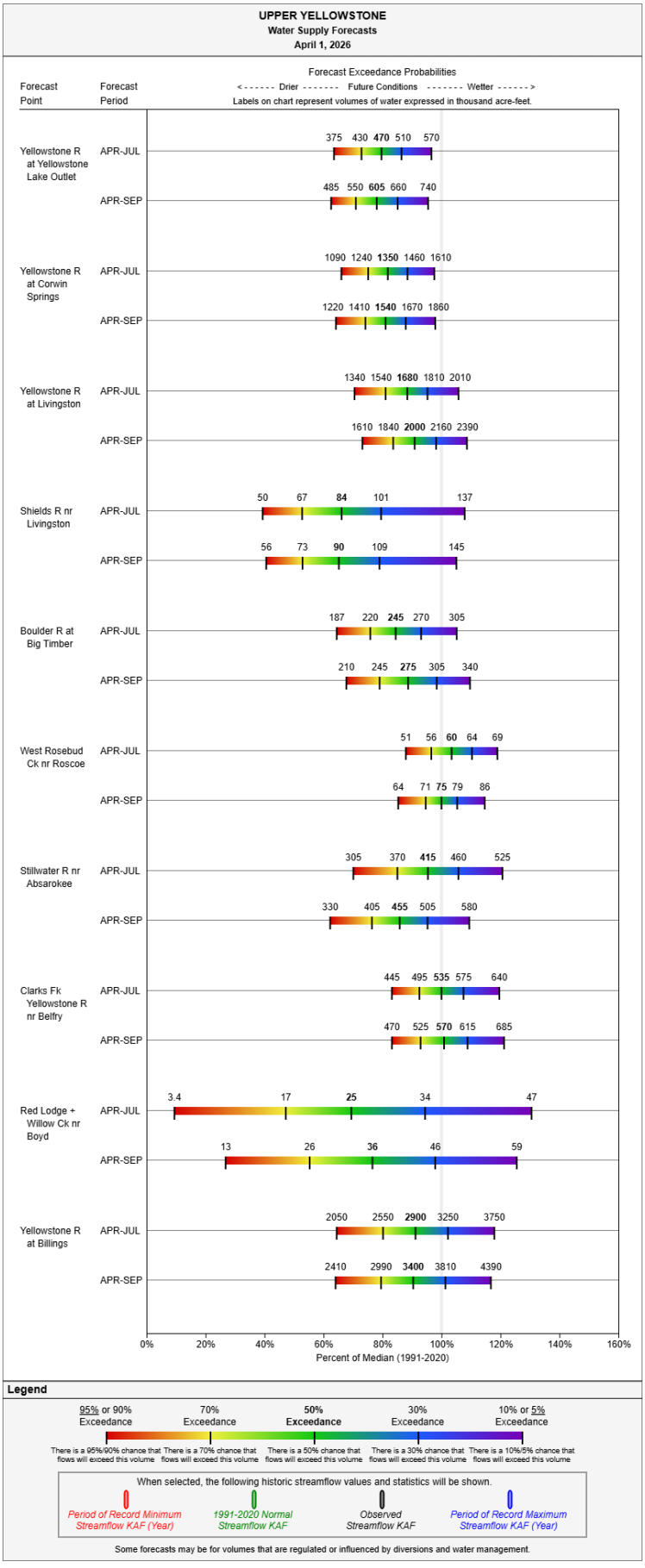
Precipitation in March was near normal at 103%, which brings the seasonal accumulation (October-March) to 115% of median. The snowpack in the Upper Yellowstone is well below normal at 71% of median, compared to 99% at this time last year.





Basin Overview

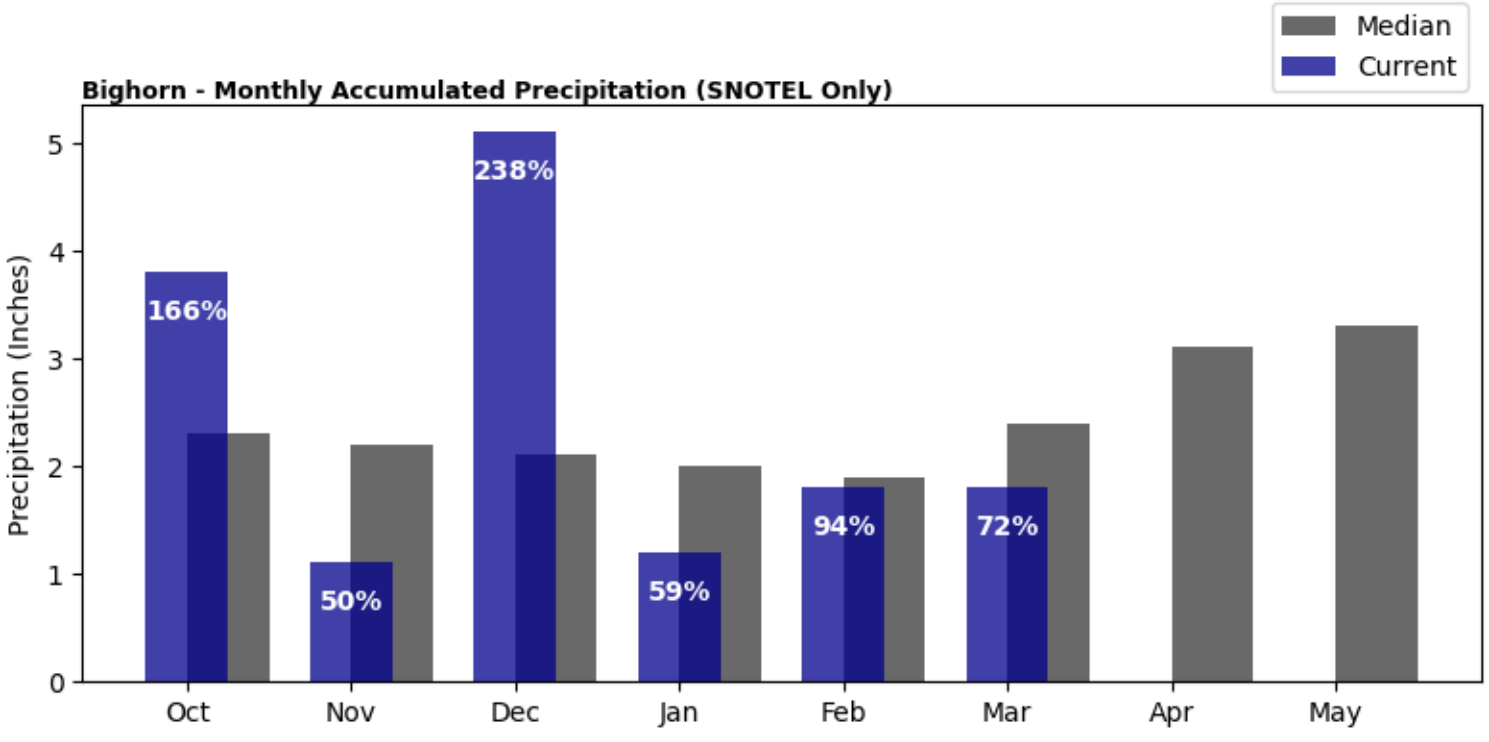
Upper Yellowstone (Continued)

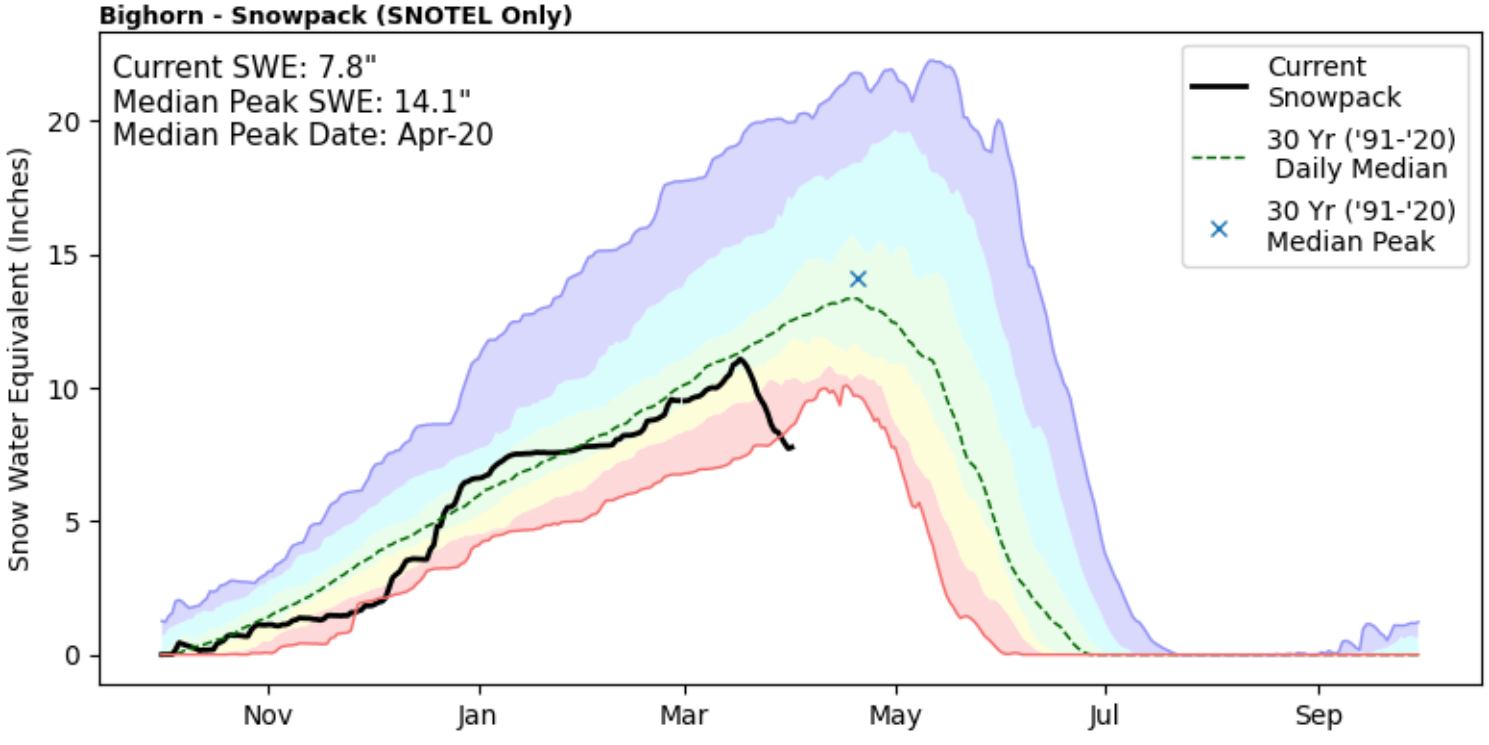


Basin Overview

Bighorn

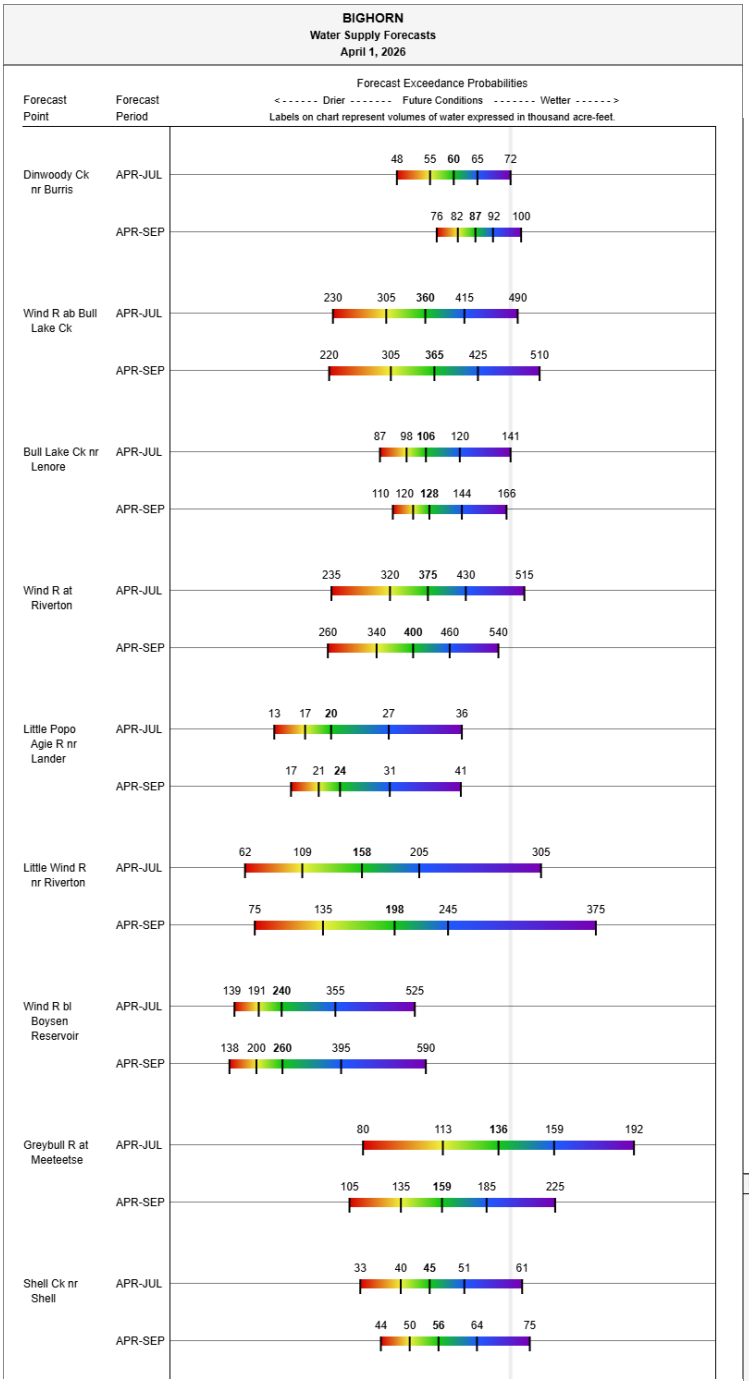
Precipitation in March was well below normal at 72%, which brings the seasonal accumulation (October-March) to 110% of median. The snowpack in the Bighorn is well below normal at 61% of median, compared to 103% at this time last year.

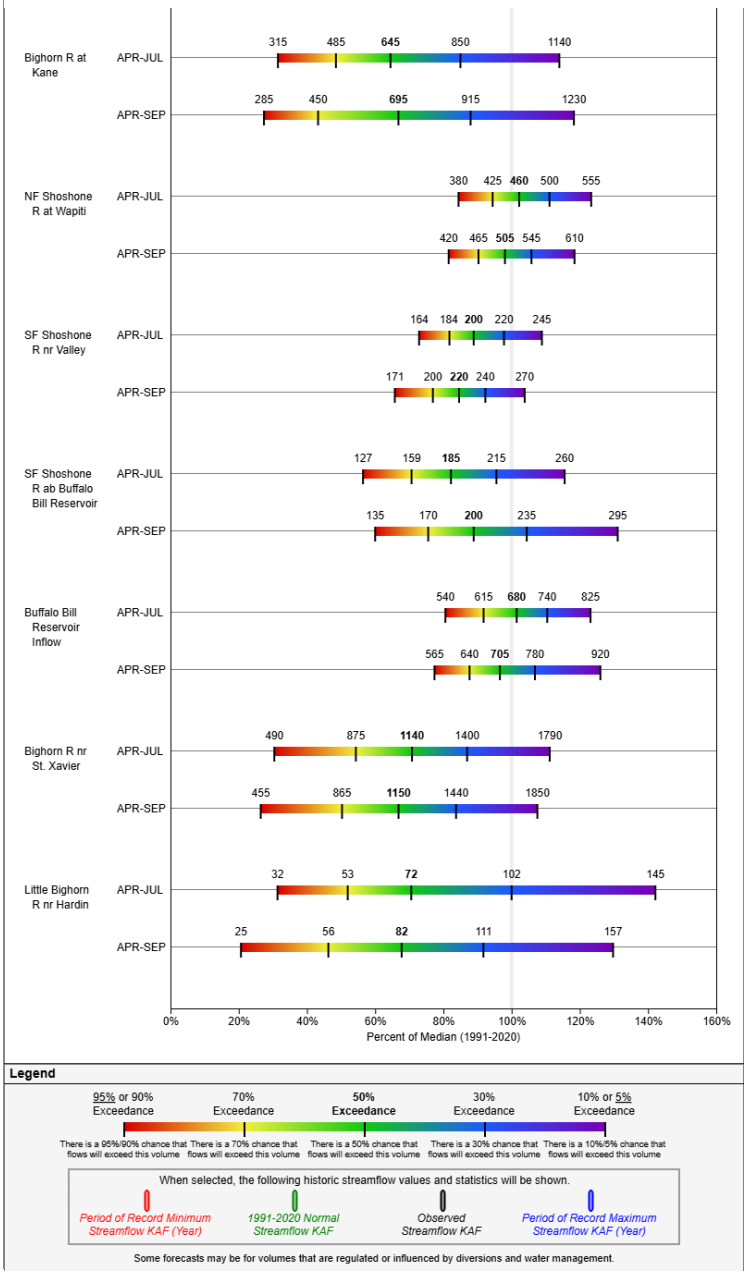




Basin Overview

Bighorn (Continued)

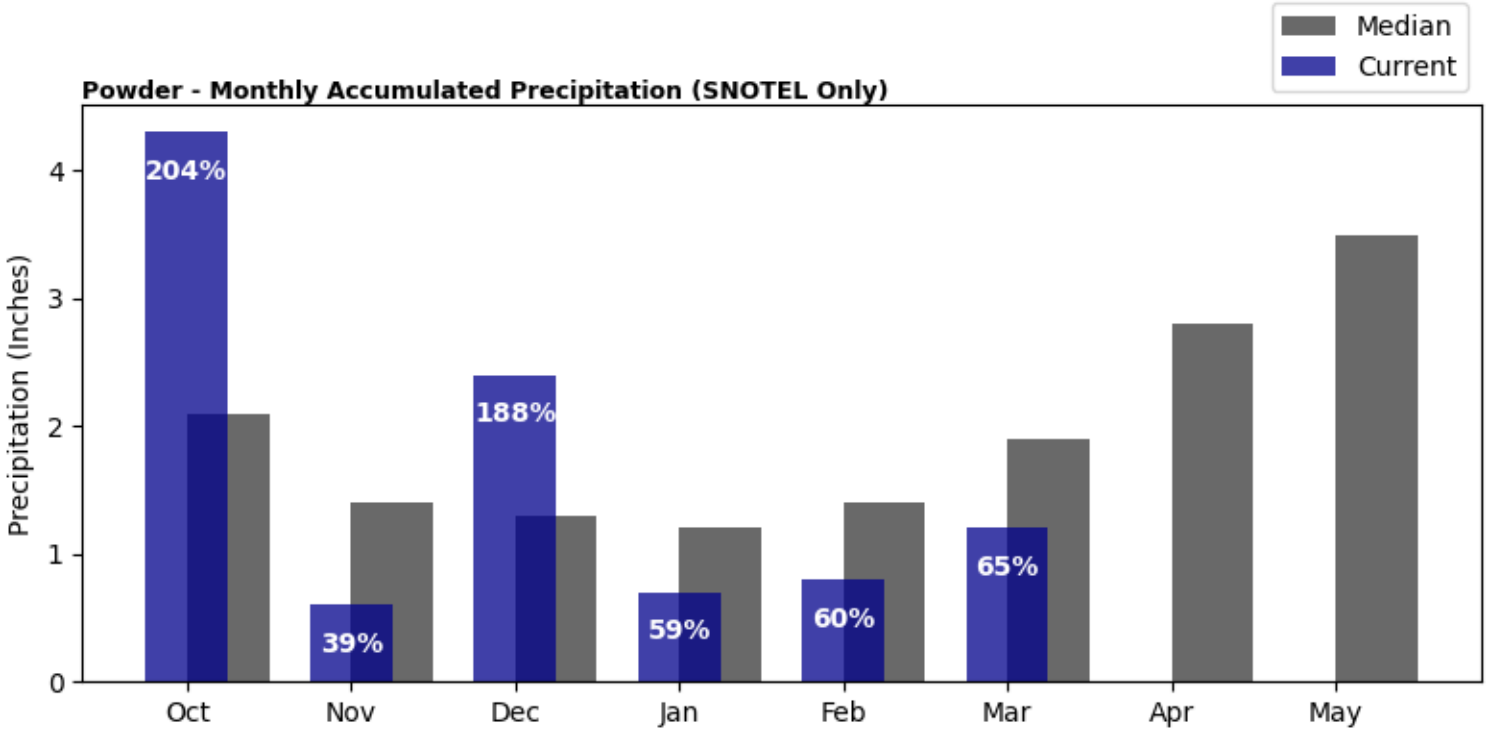


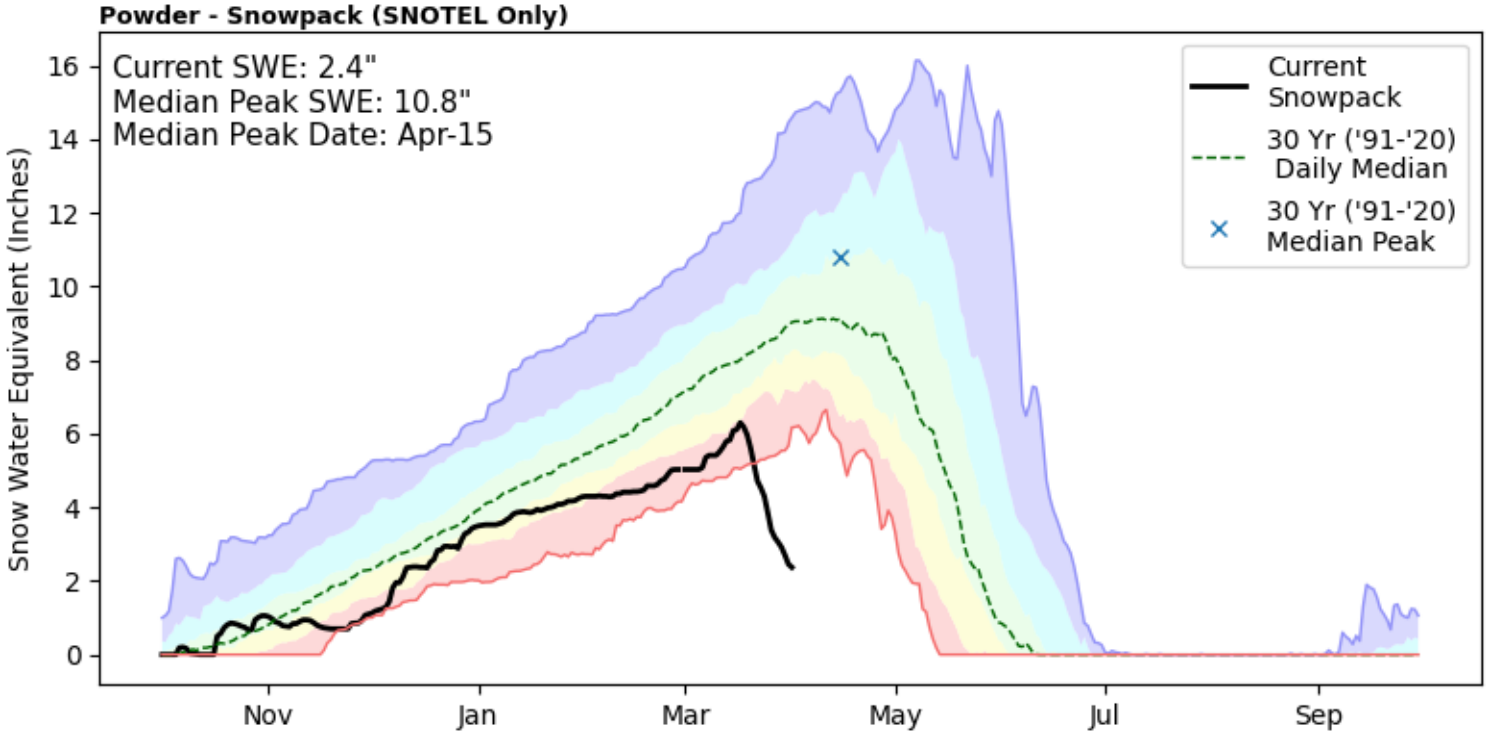


Basin Overview

Powder

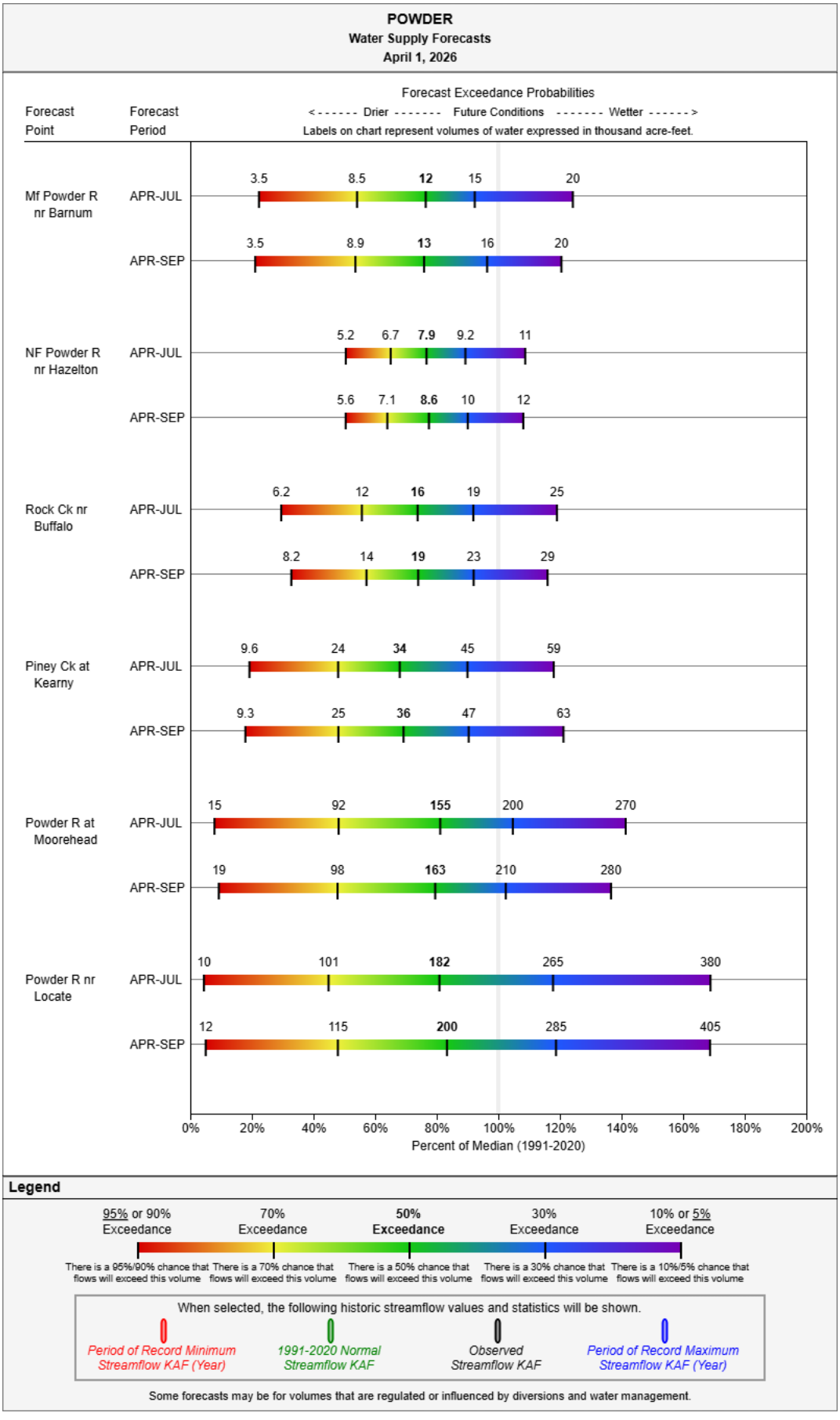
Precipitation in March was well below normal at 65%, which brings the seasonal accumulation (October-March) to 103% of median. The snowpack in the Powder is well below normal at 26% of median, compared to 78% at this time last year.





Basin Overview

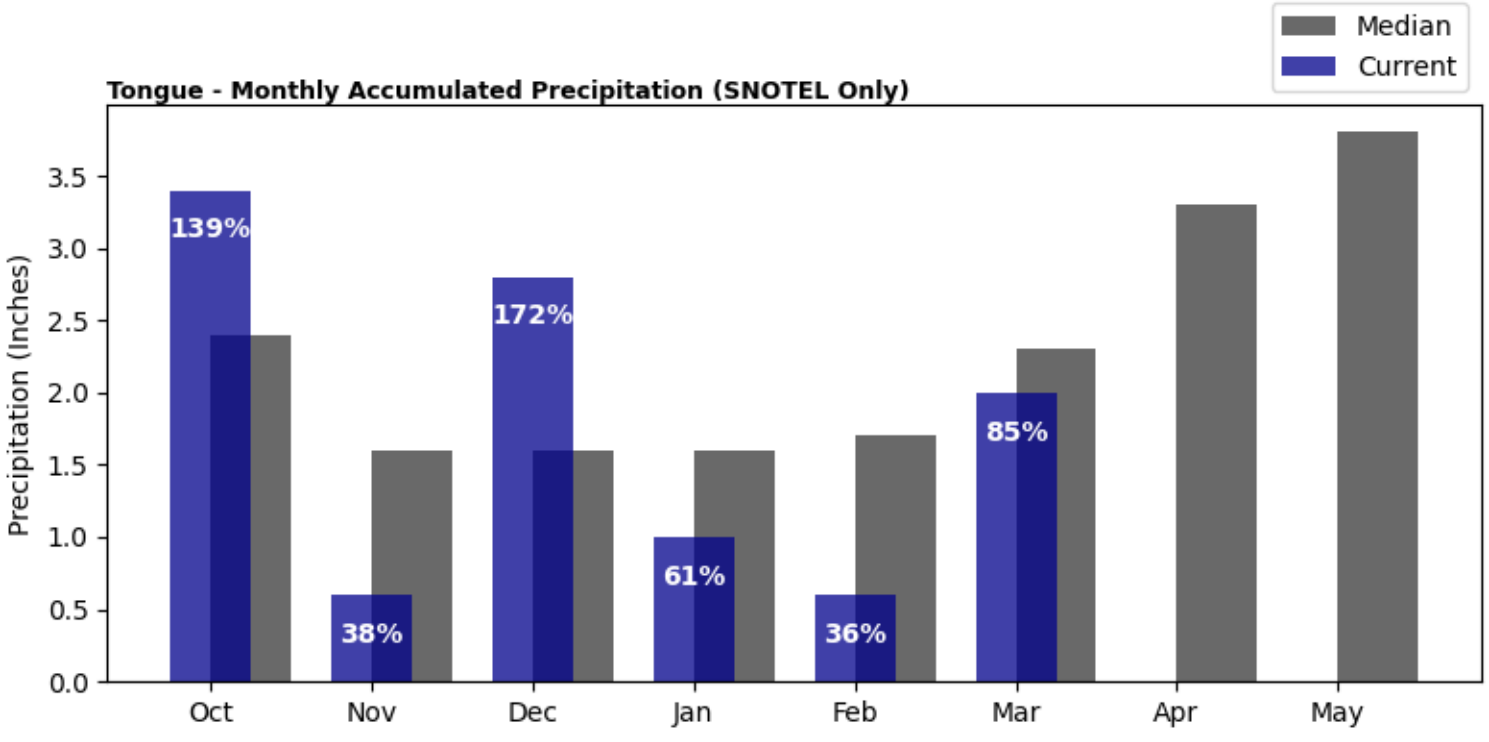
Powder (Continued)

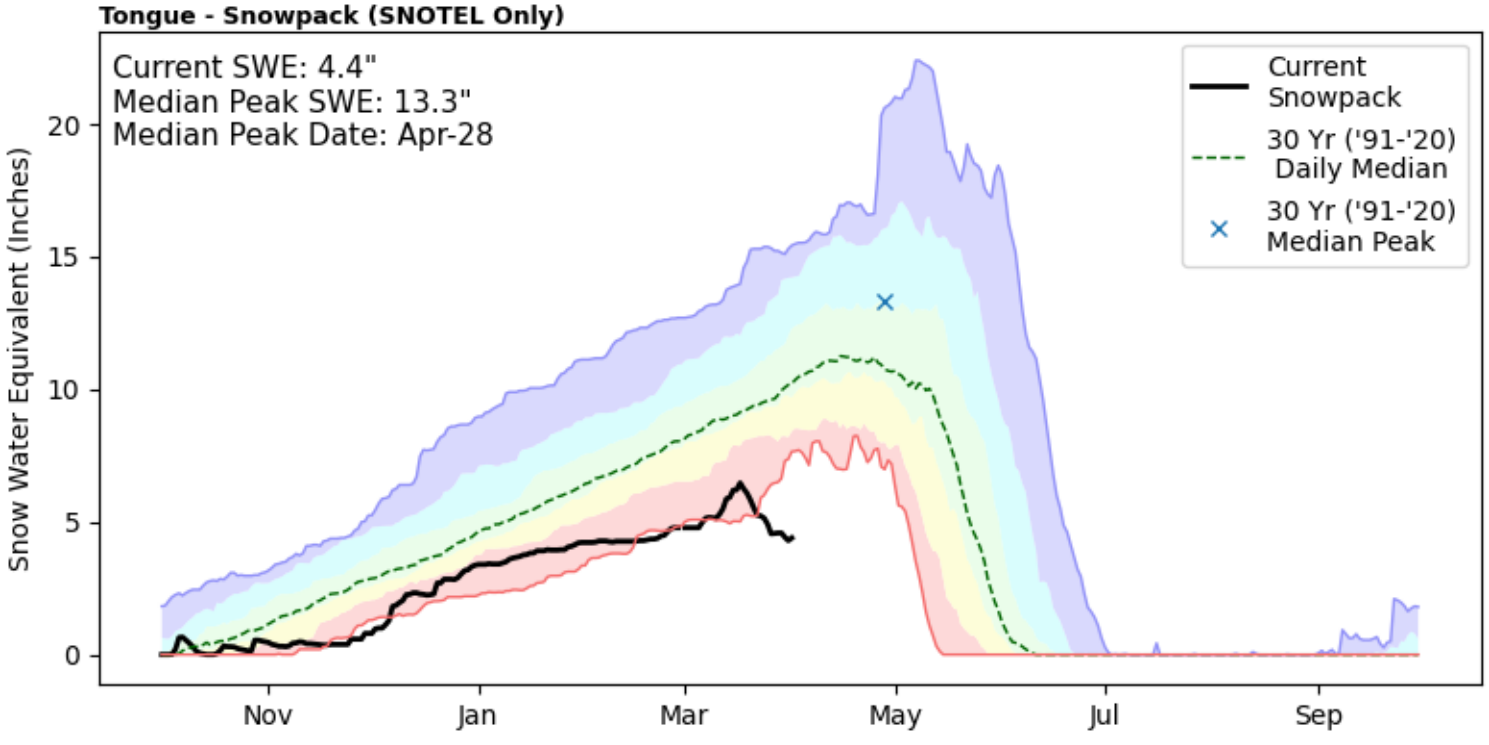


Basin Overview

Tongue

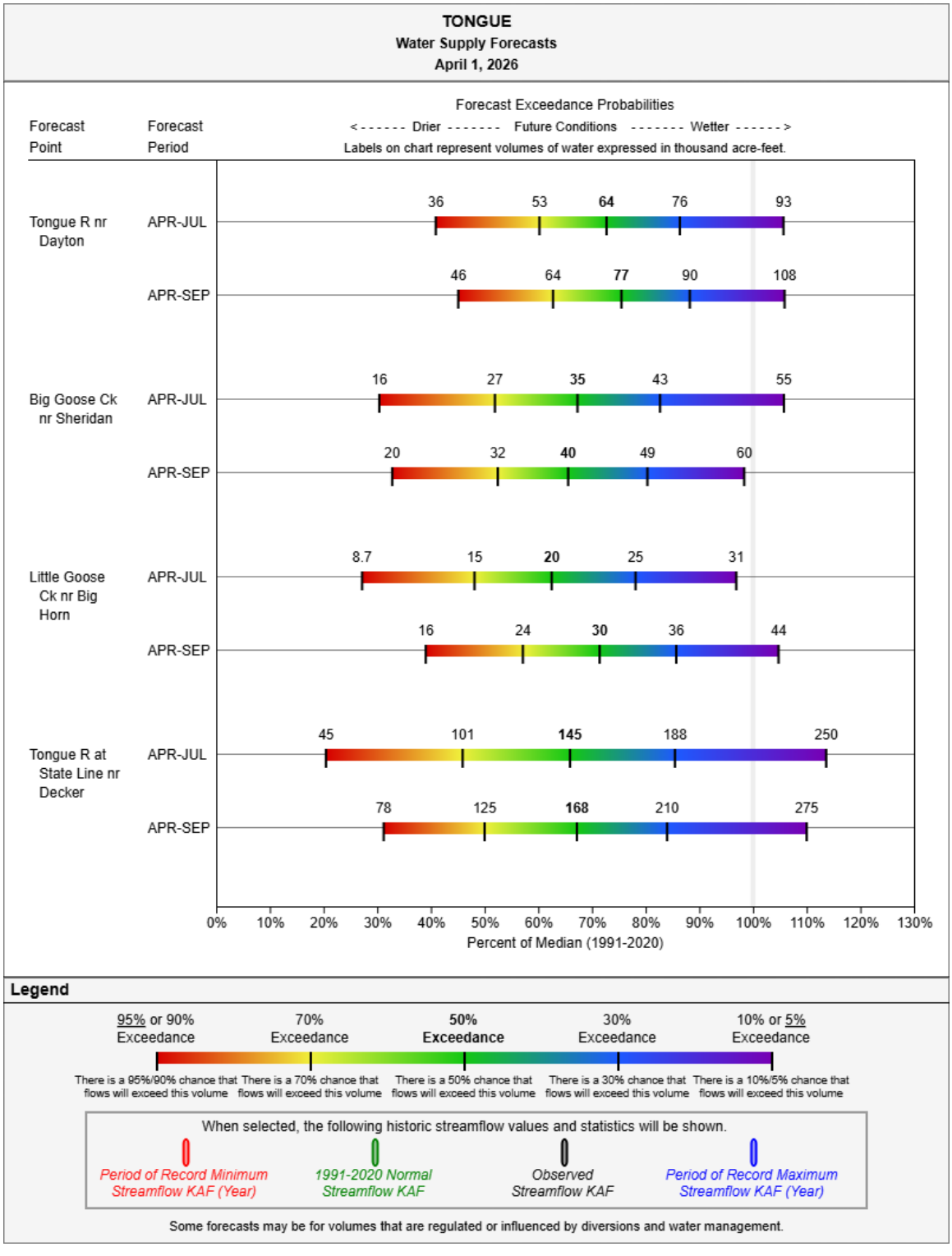
Precipitation in March was below normal at 85%, which brings the seasonal accumulation (October-March) to 88% of median. The snowpack in the Tongue is well below normal at 49% of median, compared to 100% at this time last year.





Basin Overview

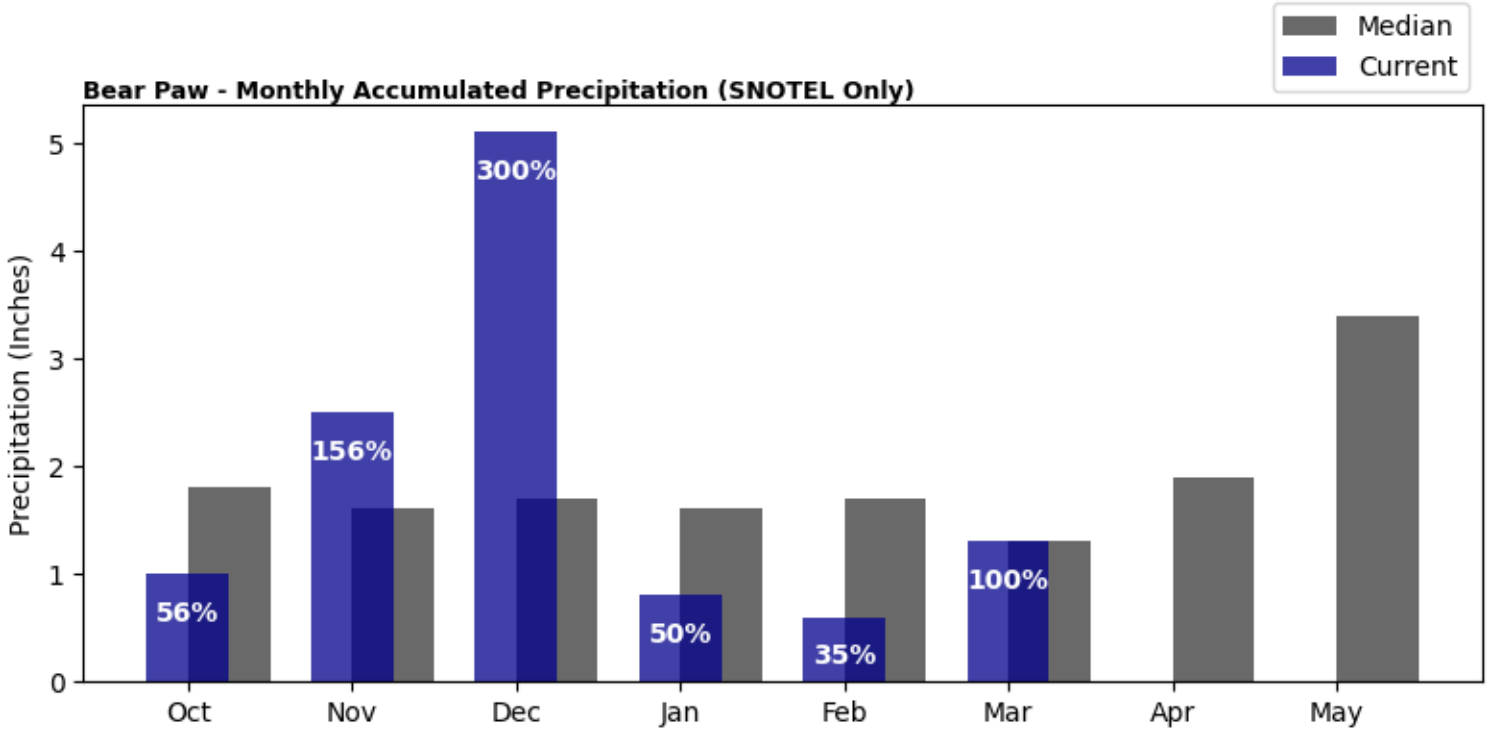
Tongue (Continued)

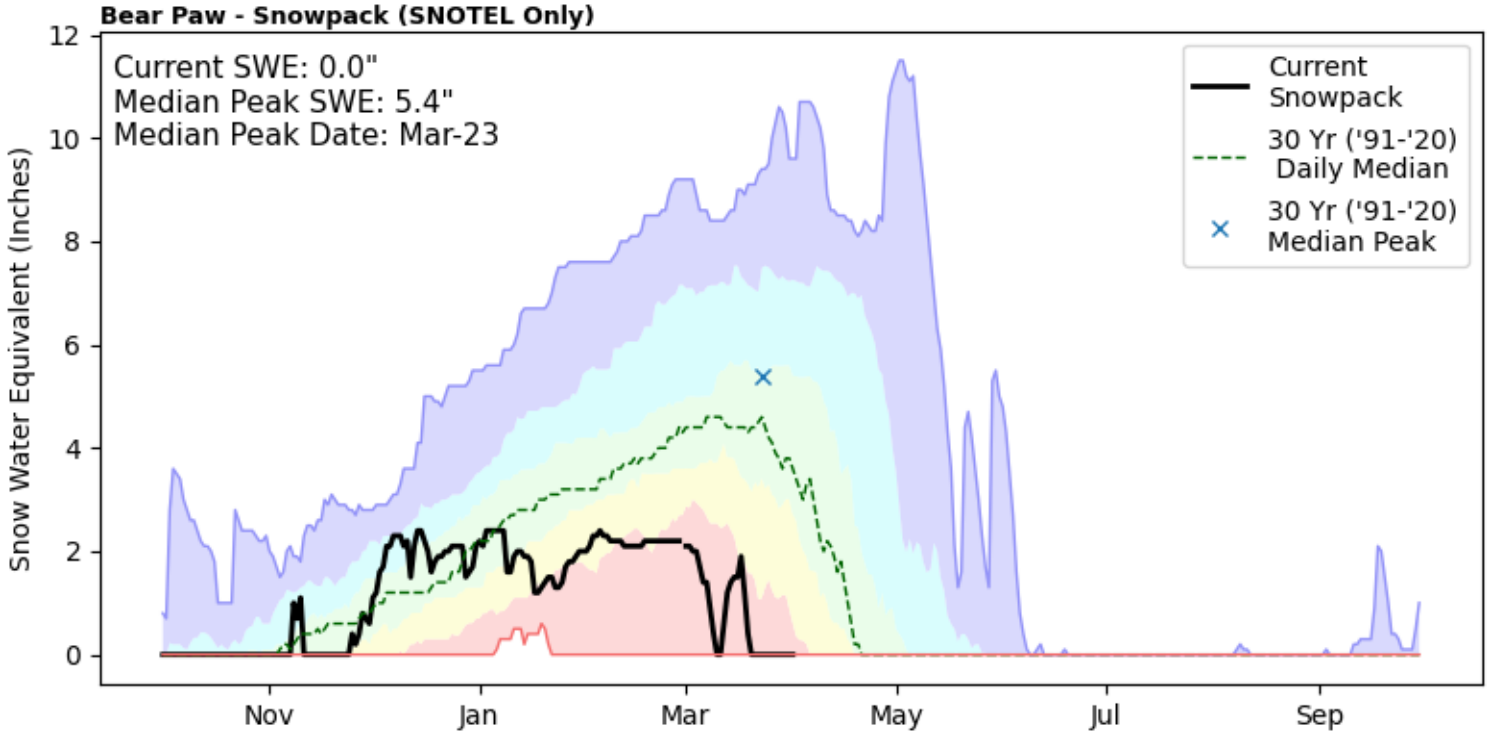


Basin Overview

Bear Paw

Precipitation in March was near normal at 100%, which brings the seasonal accumulation (October-March) to 113% of median. The snowpack in the Bear Paw is None at None% of median, compared to 107% at this time last year.





Appendix

Water Supply Forecast Information

Most of the annual streamflow in the Western United States originates as snowfall that has accumulated high in the mountains during winter and early spring. As the snowpack accumulates, hydrologists estimate the runoff that will occur when it melts. Predictions are based on careful measurements of snow water equivalent at selected index points. Precipitation, temperature, soil moisture and antecedent streamflow data are combined with snowpack data to prepare runoff forecasts.

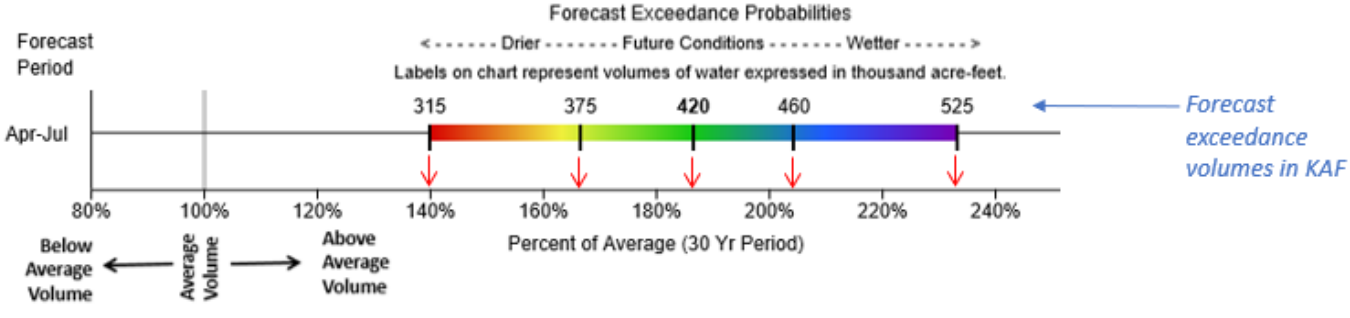
Forecast uncertainty originates from two sources: (1) uncertainty of future hydrologic and climatic conditions, and (2) error in the forecasting procedure. To express the uncertainty in the most probable forecast, four additional forecasts are provided. The actual streamflow can be expected to exceed the most probable forecast 50% of the time. Similarly, the actual streamflow volume can be expected to exceed the 90% forecast volume 90% of the time. The same is true for the 70%, 30%, and 10% forecasts. Generally, the 90% and 70% forecasts reflect drier than normal hydrologic and climatic conditions in the coming months; the 30% and 10% forecasts reflect wetter than normal conditions. As the forecast season progresses, a greater portion of the future hydrologic and climatic uncertainty will become known, and the additional forecasts will move closer to the most probable forecasts.

Interpreting Water Supply Forecast Charts

Typically, the Natural Resources Conservation Service (NRCS) has presented streamflow forecasts as a table format showing the five exceedance probabilities compared to the 30-year average as follows:

	Forecast Exceedance Probabilities for Risk Assessment Chance that actual volume will exceed forecast						
Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
APR-JUL	315	375	420	187%	460	525	225

The Forecast Chart provides a visual alternative to the table. The forecast range is represented by a colored bar. Vertical lines on the bar signify the five forecast exceedances. Below is an example. The numbers above the forecast bar are the five exceedance probability volumes in thousand acre-feet (KAF). Each exceedance forecasts percent of median can be estimated by looking at the horizontal axis. The gray line centered above 100% on the horizontal axis represents the 1991-2020 historical median streamflow for the forecast period.



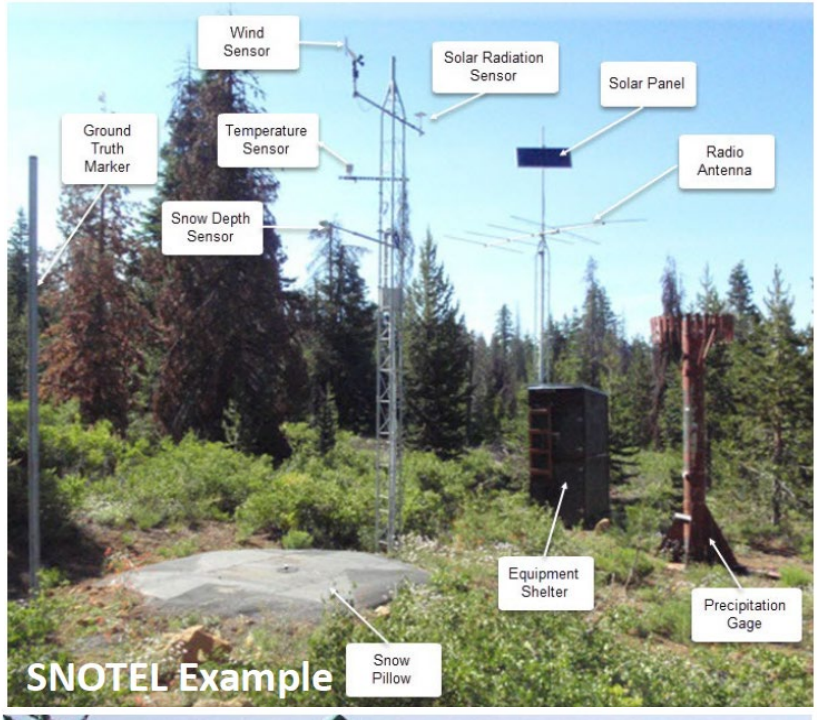
In the example, the entire forecast bar is shifted right of the gray line indicating a forecast for above normal streamflow. The 50% exceedance is represented by the black line in the green portion of the colored bar. This represents a forecast volume of 420KAF which is ~185% of average. If drier than normal future conditions occur the 70% exceedance forecast may be more likely (375KAF or ~165% of average). If future conditions turn wetter than normal, the 30% exceedance forecast may be more likely (460KAF or ~205% of average). Water users are encouraged to consider the range of forecast exceedances instead of relying solely only on the 50% forecast.

Appendix

Monitoring Station Overview

SNOTEL

The NRCS operates an extensive, automated data collection network called SNOTEL (short for Snow Telemetry). SNOTEL sites are designed to operate unattended in remote mountain locations. Data are collected and transmitted hourly and available on the internet. Daily data (midnight values) are quality checked by NRCS hydrologists on at least a weekly basis. SNOTEL sites provide snowpack water content data via a pressure-sensing snow pillow. Other data include snow depth, water year precipitation accumulation, air temperature with daily maximums, minimums, and averages. The earliest NRCS SNOTEL sites have data back to the mid-1970s.



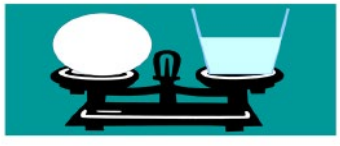
Snow Course

Snow courses are measurement transects where snow tubes are used by snow surveyors during the winter season to determine the depth and water content of the snowpack. Hollow snow tubes are used to vertically core the snowpack. The tubes are then weighed to determine the water content of the snow. Generally, snow courses are situated in meadows or forest openings protected from the wind. A snow course measurement is the average of a number of sample points, typically 5 or 10. Snow courses are measured on a monthly basis typically between January 1 and June 1. Snow courses provide a longer record than SNOTEL. The earliest snow courses in the Montana have data back to the 1920s.

Snow Water Equivalent (SWE)

Sometimes also called snow water content, this is the amount of water contained within the snowpack. It can be thought of as the depth of water (in inches) that would result if you melted the snowpack. For example, if a snowpack containing 12 inches of SWE melted instantaneously, there would be a puddle of water 12 inches deep on the ground.

SWE measurements made by snow pillows or snow tubes rely on the fact that water weighs the same whether it is liquid or frozen.



Weight of frozen water = Weight of liquid water

Snow core inside snow tubes

Appendix

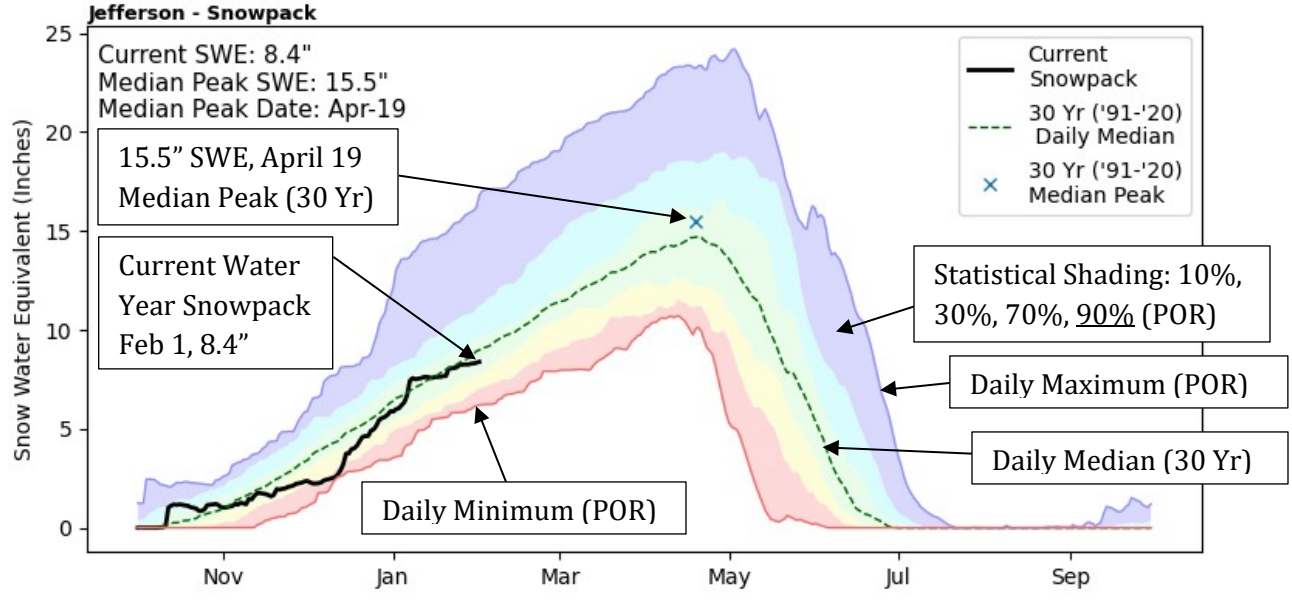
Additional Information

Climatic and Hydrologic Normals

The Snow Survey and Water Supply Forecasting (SSWSF) normals are site-specific measures of central tendency (either the median or average) for a data type, such as snow water equivalent (SWE). The statistics are calculated over a 30-year period and updated each decade, in agreement with World Meteorological Organization (WMO) standards. This 30-year reference period was chosen to characterize the current hydroclimatology at each station. The most recent medians and averages have been updated to include data for the water years 1991-2020. The National Water and Climate Center (NWCC) also provides medians and averages for the 1981-2010 and 1971-2000 reference periods for stations with sufficient data. The normals available from the NWCC include the median and average for SWE, snow depth (snow courses only), precipitation, volumetric streamflow, and reservoir storage. Values are calculated from data collected by NRCS-managed stations and external agencies such as the U.S. Geological Survey (USGS), National Weather Service (NWS), state agencies, and private organizations. Normal is calculated for various durations including daily, month-to-date, semi-monthly, monthly, seasonal, and annual based on the data type. More information is available here: https://www.nrcs.usda.gov/resources/data-and-reports/climatic-and-hydrologic-normals

Interpreting Snowpack Charts

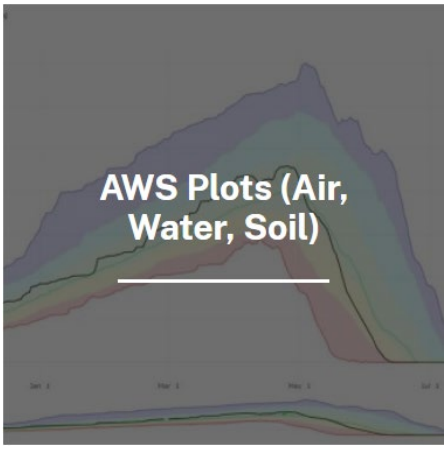
Snowpack charts displayed in this report are created using daily (midnight) snow water equivalent (SWE) values at SNOTEL sites determined to represent the basin. Snow Course data is not included. Plotted lines are the average of each SNOTEL's individual values. For example, the "Current Snowpack" on January 1st is the average all SNOTEL SWE values in that basin for that day. The "30 Yr. ('91-'20) Daily Median" is the average of each SNOTEL's median SWE value for a given day. The upper and lower extent (blue/red lines) show the maximum/minimum daily SWE values, which is determined using the "Current Snowpack" SWE value for all days in the period of record (POR). Snowpack peak SWE dates differ from season to season, as a result the high point on the "30 Yr. ('91-'20) Daily Median" line is not the true median peak SWE. The point "X" is plotted by calculating the median peak date and median peak value independently. Similar charts with other basin definitions are available here: https://nwcc-apps.sc.egov.usda.gov/basin-plots/#mt

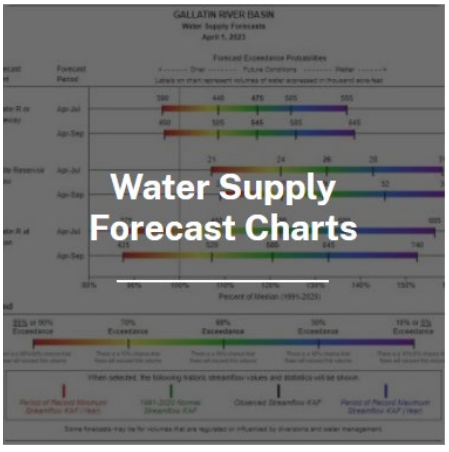


Appendix

Links and Resources

Products and Reports (click image)





Interactive Map Predefined Links

Snow

- Snow Water Equivalent > Daily > Percent of 1991-2020 Median > **Stations** | **Basins**
- Snow Water Equivalent > End of Previous Month (SNOTEL and Snow Course) > Percent of 1991-2020 Median > **Stations** | **Basins**
- Snow Depth > Daily > **Stations**
- Snow Density > End of Previous Month (SNOTEL and Snow Course) > **Stations**

Precipitation

- Month-to-Date > Daily > **Stations**
- Water Year-to-Date > Daily > Percent of 1991-2020 Median > **Stations** | **Basins**
- Previous Month > Percent of 1991-2020 Median > **Stations** | **Basins**
- Previous 3 Months > Percent of 1991-2020 Average > **Stations** | **Basins**

Streamflow

- Observed (Adjusted Volume) > Previous Month > Percent of 1991-2020 Median > **Stations** | **Basins**
- Forecast (Adjusted Volume) > Most Recent (Available March 1 through June 1) > Percent of 1991-2020 Median > **Stations** | **Basins**

Reservoir Storage

- End of Previous Month > Percent of 1991-2020 Median > **Stations**

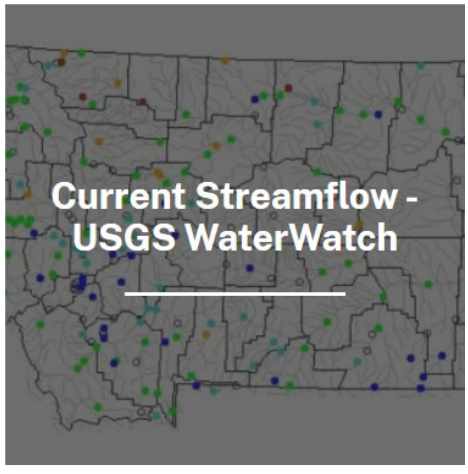
Other

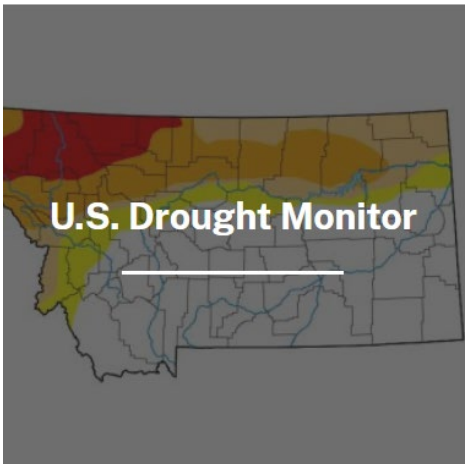
- Snow Water Equivalent > Daily > Compared to POR > **Stations**
- Snow Water Equivalent > End of Previous Month (SNOTEL and Snow Course) > Percentile > **Stations**
- Water Year-to-Date Precipitation > Daily > Compared to POR > **Stations**

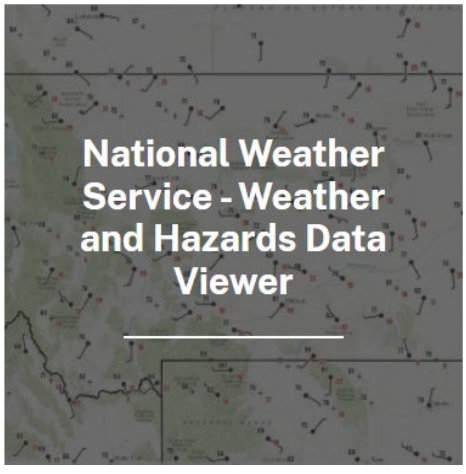
Appendix

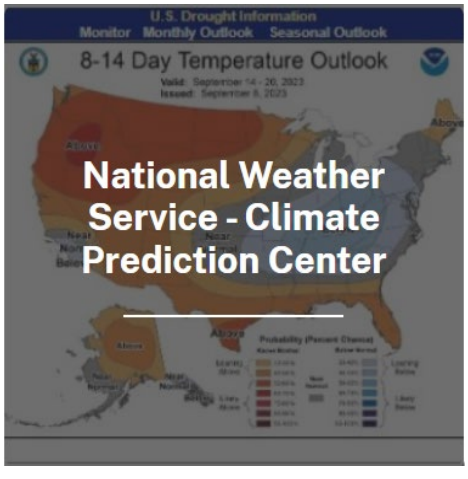
Links and Resources (Continued)

External Agencies (click image)









Additional Drought Information

- U.S. Drought Monitor
- National Integrated Drought System (Drought.gov)
- USDA Drought Portal (News and Resources)
- Farm Services Agency Montana (Information on Programs and Deadlines)
- Farm Services Agency Disaster Assistance Programs
- Montana Department of Natural Resources and Conservation Drought Management

Snow Survey Program FAQ

Frequently Asked Snow Survey Questions - Montana | Natural Resources Conservation Service (usda.gov)

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