



# **Montana Water Supply Outlook Report**

April 1, 2025



Slagamelt Lakes SNOTEL in the Beaverhead Mountains. The SNOTEL was installed in 2020 and is co-located near the Slag-A-Melt Lake Snow Course that has been measured since 1961. Overlapping measurements at the SNOTEL and Snow Course are used to develop a relationship between data obtained at the manual and automated snow measurement stations. On April 1, the Slag-A-Melt Lake Snow Course was measured at 61" of snow and 20.6" of SWE, which was 95% of median. Ten years of record is required to create a median, therefore the SNOTEL does not have a percent of median yet. Snowpack conditions across most of the state are near normal. The St. Mary, Sun-Teton-Marias, and Powder River basins continue to have below normal snowpack, while central Montana continues to have slightly above normal snowpack for April 1. (Photo: Eric Larson assisted by Joe Kral – March 27, 2025)

**Snow Survey and Water Supply Forecasting Program** 

#### **Table of Contents**

| Statewide Overview                |    |
|-----------------------------------|----|
| Summary                           | 3  |
| Precipitation                     | 4  |
| Snowpack                          | 7  |
| Temperature                       | 11 |
| Soil Moisture                     | 12 |
| Drought Monitor                   | 13 |
| Weather Outlook                   | 14 |
| Reservoirs                        | 15 |
| Streamflow                        | 17 |
| Water Supply Forecasts            | 18 |
| Basin Overview                    |    |
| Kootenai                          | 20 |
| Flathead                          | 22 |
| Upper Clark Fork                  | 24 |
| Bitterroot                        | 26 |
| Lower Clark Fork                  | 28 |
| Jefferson                         | 30 |
| Madison                           |    |
| Gallatin                          | 34 |
| Upper Missouri                    | 36 |
| Smith-Judith-Musselshell          | 38 |
| Sun-Teton-Marias                  | 40 |
| St. Mary                          | 42 |
| Upper Yellowstone                 | 44 |
| Bighorn                           | 46 |
| Powder                            | 48 |
| Tongue                            | 50 |
| Bear Paw                          | 52 |
| Appendix                          |    |
| Water Supply Forecast Information | 53 |
| Monitoring Station Overview       | 54 |
| Report Information                | 55 |
| Links and Resources               | 56 |

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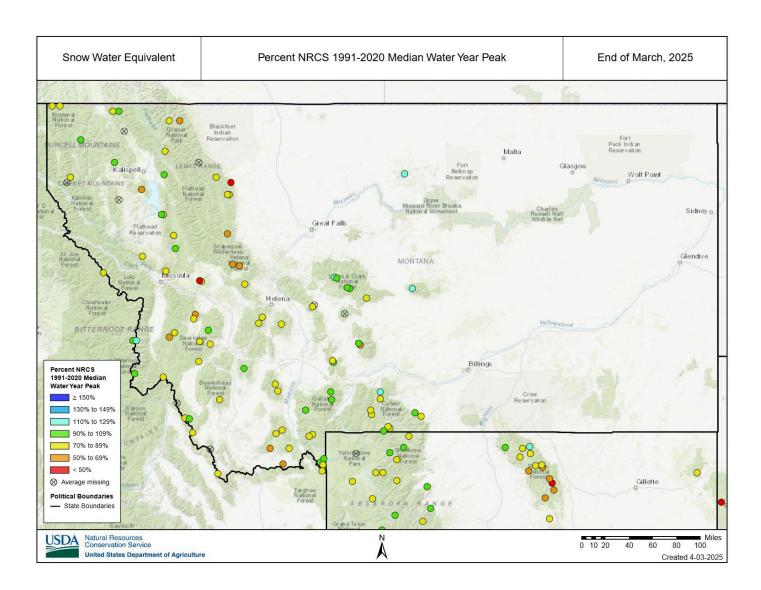
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#### **Summary**

March started off with little to no snow accumulation in most areas. The lull in accumulation gave time for snow water equivalent (SWE) deficits to increase in some locations. Near the middle of the month most areas began accumulating snow once again. By the end of the month most stations had SWE values that climbed closer to normal. Most stations in the southwest part of the state have SWE values close to normal. The northwest part of the state and the Rocky Mountain Front have more stations with below normal SWE. Deficits from earlier in the winter persist in these areas.

March temperatures were above normal in Montana. Above normal temperatures coincided with the lull in snow accumulation for the first part of the month. Snowpack across the state consolidated and warmed during this time. Snow density increases were seen across the SNOTEL network and lower elevations began to experience snowmelt. Cooler temperature and snow accumulation at the end of the month delayed snowmelt at some sites. Snowmelt is typical for this time of year at lower mountain elevations. The date of median peak SWE for SNOTELs in Montana ranges from mid-April to early-May.

The map below shows the percentages of peak SWE at SNOTELs. Although it feels like spring has sprung in the valleys, winter conditions will need to persist in the mountains for SWE to near the median peak at most sites.



#### **Precipitation**

March brought above normal precipitation across much of the state, with most basins receiving 120 - 140% of median precipitation. The Gallatin and Upper Yellowstone Basins received 100 - 115% of median precipitation, and the Bear Paw Basin received 77% of median monthly precipitation. The month began with smaller, scattered storms. Montana SNOTELs received 0 to 1" of precipitation the first week of March. During the second week of March most of the state received 0 to 0.5" of precipitation, while the northwest and West Yellowstone area received 0.5 to 2" of precipitation. Mid to late March storms picked up with most SNOTELs reporting 1 - 5" of precipitation. The northwest continued to be favored, with several higher elevation SNOTELs reporting 6 - 8" of precipitation. Snow depth spiked during this storm with several SNOTEL sites reporting over 100" of snow. An end of month storm brought 0.5 to 3" of precipitation along with a significant warm up that resulted in a mix of rain, snow, and snowmelt. SNOTEL sites across the state reported between 3" of SWE loss and 3" of SWE gain during this storm.

Above normal precipitation in February and March continued to improve water year precipitation to date. SNOTELs in the region extending from Missoula to Billings have slightly below (90% of median) to near normal (105% of median) water year to date precipitation. Central Montana continues to have above normal water year to date precipitation, with the Smith-Judith-Musselshell basin receiving 110% and the Bear Paw basin receiving 135% of median precipitation to date. Early season precipitation deficits persist in northwest Montana and Powder River basin but showed some recovery from March precipitation. Water year to date precipitation in these regions remains below normal at 75 – 90% of median. It's common for winter weather to continue into the spring in Montana. Summer streamflow will depend on continued precipitation to maintain or improve current moisture levels.

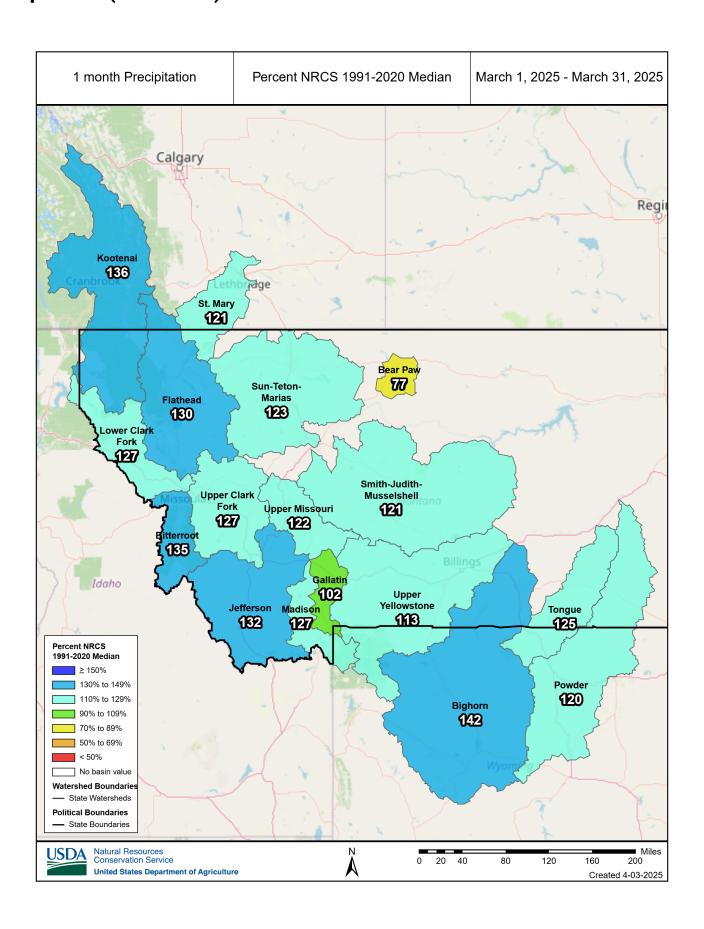
#### March - Highest Total Accumulated Precipitation - SNOTEL/SNOLITE

| Station       | Precipitation (Inches) | Median (Inches) | Elevation | Basin                         |
|---------------|------------------------|-----------------|-----------|-------------------------------|
| Bear Mountain | 14.2                   | 9.6             | 5460      | Kootenai, Lower<br>Clark Fork |
| Poorman Creek | 11.7                   | 7.8             | 5050      | Kootenai, Lower<br>Clark Fork |
| Hoodoo Basin  | 9.8                    | 6.0             | 6060      | Lower Clark Fork              |
| Chicago Ridge | 9.6                    | -               | 5700      | Lower Clark Fork              |
| Flattop Mtn.  | 9.0                    | 7.4             | 6290      | Flathead, St. Mary            |

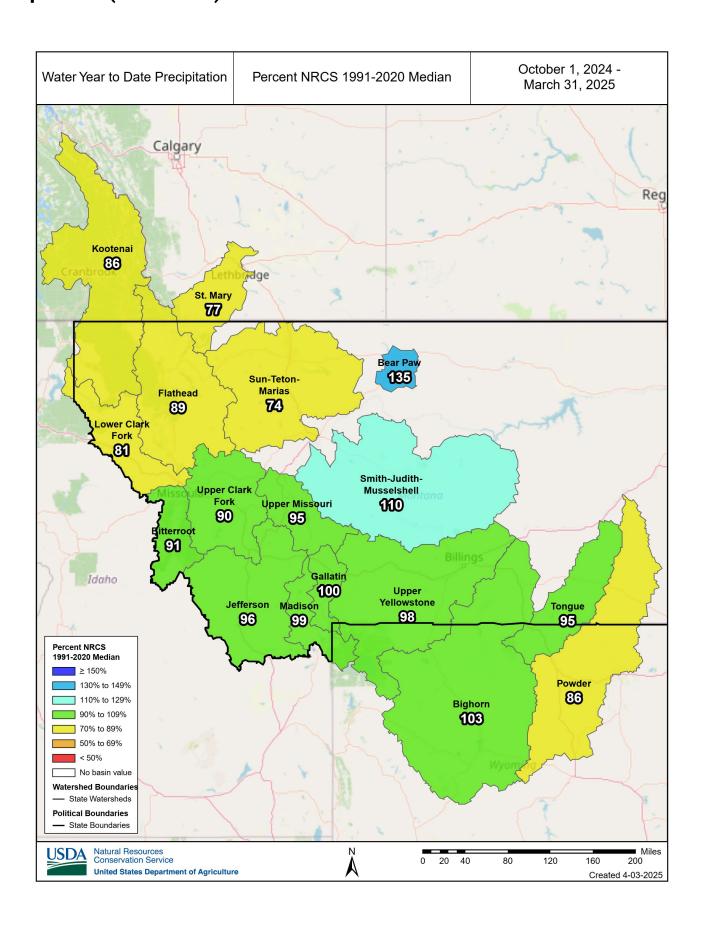
#### March - Lowest Total Accumulated Precipitation - SNOTEL/SNOLITE

| Station     | Precipitation (Inches) | Median (Inches) | Elevation | Basin            |
|-------------|------------------------|-----------------|-----------|------------------|
| Short Creek | 0.7                    | 1.2             | 6980      | Jefferson        |
| Tizer Basin | 1.0                    | 1.8             | 6880      | Upper Missouri   |
| Rocky Boy   | 1.0                    | 1.3             | 4730      | Bear Paw         |
| Combination | 1.2                    | 1.1             | 5620      | Upper Clark Fork |
| Daly Creek  | 1.7                    | 1.8             | 5780      | Bitterroot       |

### **Precipitation (Continued)**



### **Precipitation (Continued)**



#### **Snowpack**

March brought a combination of above normal precipitation and above normal temperatures. The result was a mixed bag of snowmelt and accumulation, leaving snowpack conditions largely unchanged from March 1 despite the above normal precipitation. Snowpack across most of the state is slightly below to near normal, ranging from 90% - 105% of median SWE for April 1. Maximum snow depths across the state range from to 70 - 100". Northwest Montana has below normal snowpack for April 1, with the Flathead and Upper Clark Fork basins reporting 85 – 90% of median SWE, and the St. Mary and Sun-Teton-Marias basins reporting 70 – 80% of median SWE. Central Montana basins maintained an above normal snowpack for April 1. Snowpack in the Powder River basin remains below normal at under 80% of median SWE for April 1.

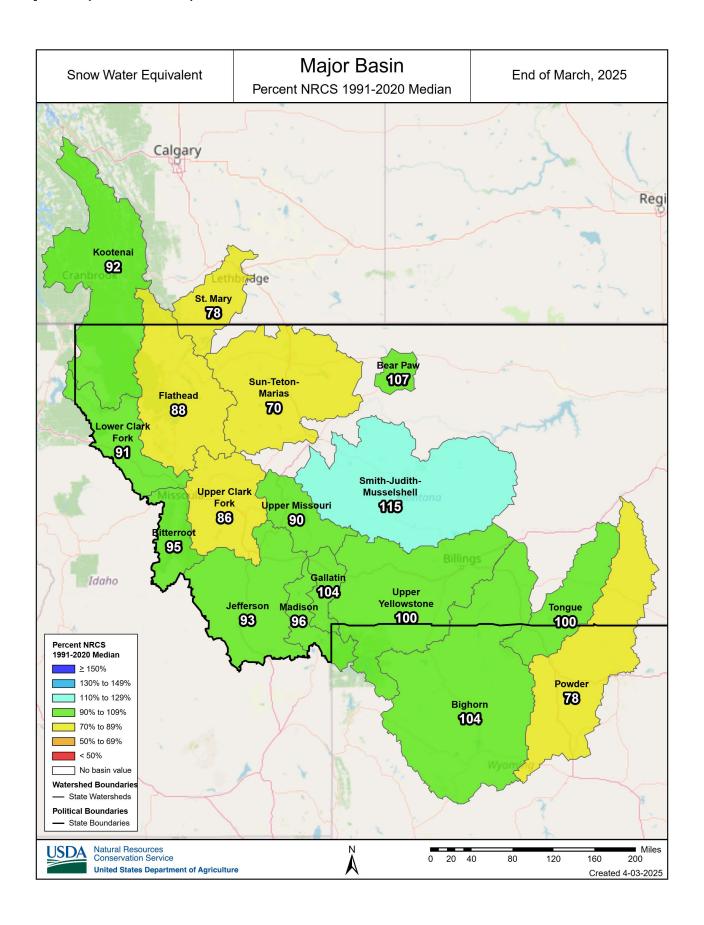
Across most of Montana SNOTELs and snow courses are reporting SWE values that range from 4" below to 4" above normal, comparable to conditions in 2019 or 2016. In the northwest, SWE deficits are widespread, mostly between normal and 6" below normal. However, some stations in the northwest are reporting up to a 5" surplus or 8" deficit. Snowpack in the northwest is similar to conditions in 2022 – where the snowpack recovered well, and 2016 – where an early melt increased the snowpack deficit. The Rocky Mountain Front has the largest SWE deficits ranging from 3" to 8" below normal, similar 2019 or 2010. In central Montana SWE values range from 2" below normal to 4" above normal, comparable to previous big snowpack years 2020 or 2018.

Many lower elevations sites have reached peak snowpack conditions for season, while upper elevation sites typically don't reach peak SWE until May. While spring can be an active time for precipitation in Montana, regions with snowpack deficits this late in the accumulation season are increasingly unlikely to fully recover. Continued snowfall and cold temperatures will be needed to reach peak SWE and maintain normal snowpack or improve upon below normal snowpack.

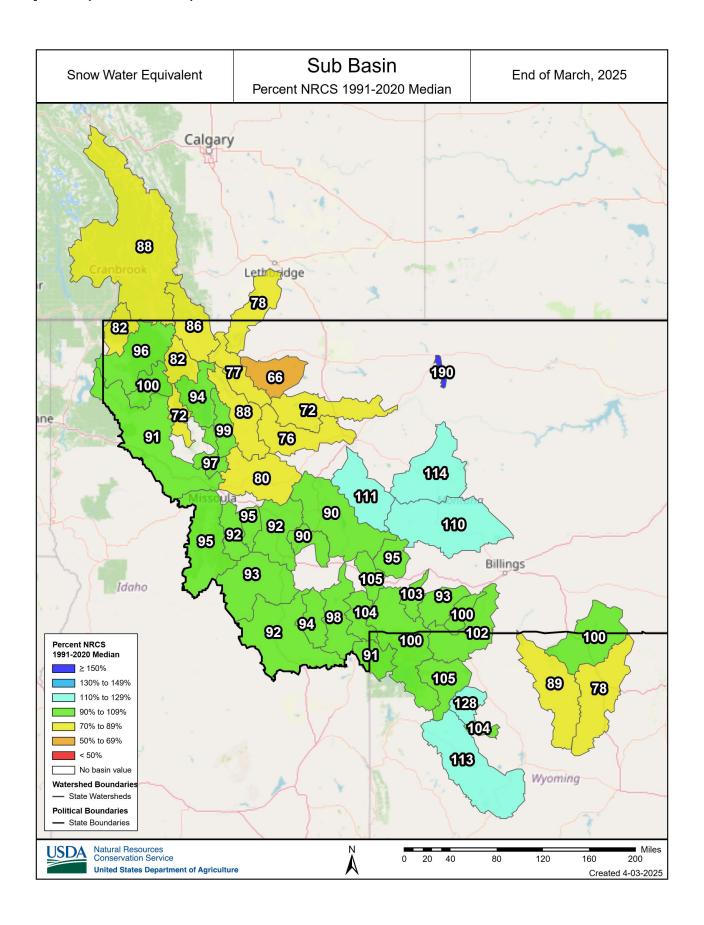
Water Year 2025 - Major Basin - Snowpack Percent of Normal ('91-'20)

| Basin                    | Nov 1 | Dec 1 | Jan 1 | Feb 1 | Mar 1 | Apr 1 | May 1 | Jun 1 |
|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Kootenai                 | 56    | 127   | 117   | 80    | 82    | 90    | -     | -     |
| Flathead                 | 51    | 124   | 105   | 79    | 84    | 87    | -     | -     |
| Upper Clark Fork         | 38    | 83    | 72    | 78    | 93    | 86    | -     | -     |
| Bitterroot               | 74    | 99    | 91    | 80    | 97    | 95    | -     | -     |
| Lower Clark Fork         | 55    | 134   | 112   | 80    | 85    | 91    | -     | -     |
| Jefferson                | 44    | 82    | 75    | 82    | 95    | 93    | -     | -     |
| Madison                  | 55    | 88    | 84    | 81    | 94    | 96    | -     | -     |
| Gallatin                 | 53    | 85    | 93    | 92    | 110   | 104   | -     | -     |
| Upper Missouri           | -     | 67    | 67    | 77    | 93    | 90    | -     | -     |
| Smith-Judith-Musselshell | 2     | 86    | 91    | 131   | 118   | 115   | -     | -     |
| Sun-Teton-Marias         | 25    | 81    | 70    | 56    | 71    | 70    | -     | -     |
| St. Mary                 | 50    | 106   | 94    | 67    | 72    | 77    | -     | -     |
| Upper Yellowstone        | 41    | 62    | 72    | 78    | 98    | 99    | -     | -     |
| Bighorn                  | 54    | 65    | 69    | 81    | 99    | 103   | -     | -     |
| Powder                   | 54    | 65    | 60    | 81    | 74    | 78    | -     | -     |
| Tongue                   | 80    | 81    | 65    | 95    | 94    | 100   | -     | -     |
| Bear Paw                 | -     | 222   | 136   | 228   | 158   | 107   | -     | -     |

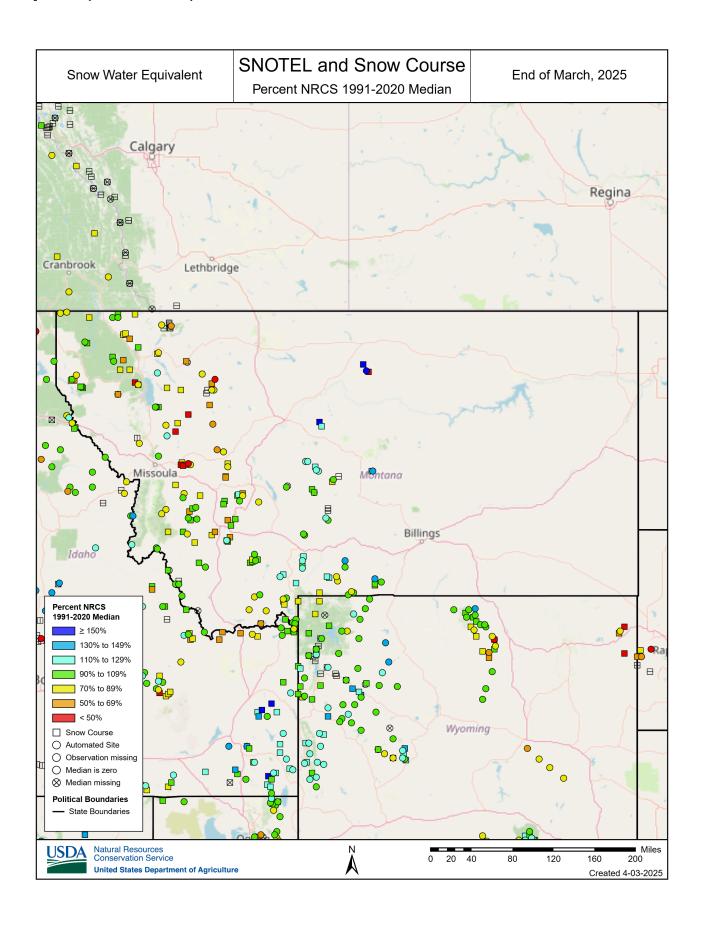
### **Snowpack (Continued)**



### **Snowpack (Continued)**



### **Snowpack (Continued)**

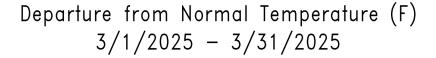


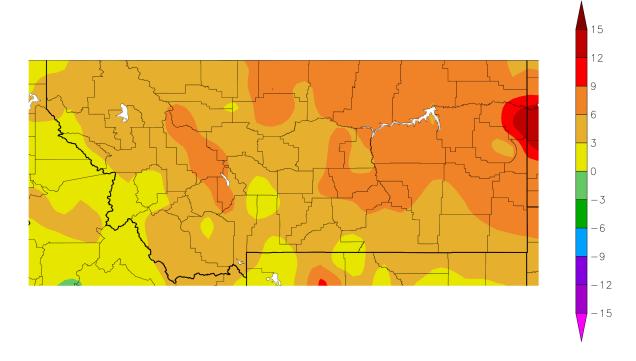
#### **Temperature**

March temperatures in Montana were above normal statewide. The eastern portion of the state had the highest monthly temperatures. This region had temperatures that were mostly 6-9 °F above normal. An isolated area by the North Dakota border had temperatures in the range of 9-15 °F above normal. Monthly temperatures in the western part of the state were 3-6 °F above normal in most areas, with some areas in the ranges of 0-3 °F and 6-9 °F above normal.

SNOTELs in Montana reported above normal temperatures during March. The daily average temperatures of all the SNOTELs were mostly above normal throughout the month. However, temperatures weren't consistent throughout the entire month. From March 1 to March 13, the daily average temperatures remained above normal. Except for few days of near normal temperatures from March 6-7. From March 13 to March 23, temperatures fluctuated from below to near normal. From March 23 to March 31 temperatures returned to above normal until temperatures returned to near normal at the end of the month.

Warm temperatures influenced snowpack across the region. Especially at lower elevations where widespread melt has already occurred. As the spring progresses, temperatures will have a great effect on when widespread runoff occurs. Near or below normal temperatures will be needed to delay widespread runoff from the snowpack at mid and higher elevations.





Generated 4/2/2025 at HPRCC using provisional data.

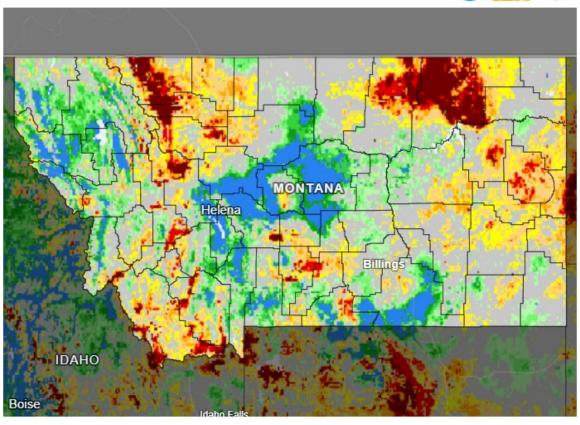
NOAA Regional Climate Centers

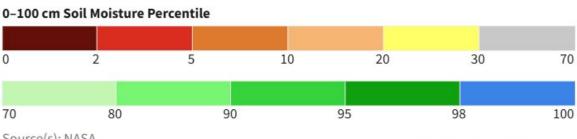
#### **Soil Moisture**

Soil moisture in the top 100 cm is mostly unchanged from last month. Some areas in Montana had soil moisture improvements and others worsened. The northwest part of the state had soil moisture percentile increases. With some areas entering the 98-100 percentile. The area south of Billings also had a similar increase in soil moisture. An area that worsened was the area above Fort Peck Reservoir. Soil moisture decreased to the 0-2 percentile in this area. For large portions of the state, increased precipitation will be needed to recover soil moisture.

# NASA SPoRT-LIS 0-100 cm Soil Moisture Percentile







Source(s): NASA
Data Valid: 04/02/25

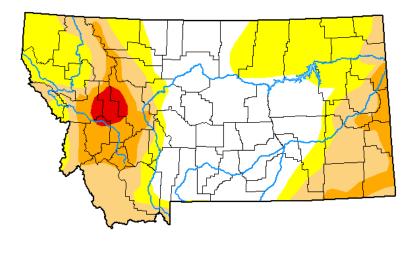
Drought.gov

#### **Drought Monitor**

Drought conditions in Montana are similar to last month. The central portion of the state mostly has no drought conditions. Drought conditions persist in the western portion of the state. Portions of the Upper Clark Fork and Blackfoot basins are classified as severe to extreme drought. However, the percent area of this region that's in extreme drought has decreased slightly. A large portion of the region north of Fort Peck Reservoir changed from no drought conditions to abnormally dry. The eastern portion of the state remains under drought conditions. The area near the North Dakota border, along the Yellowstone River, had an improvement from extreme to severe drought. For drought conditions to improve in most areas, spring precipitation will be crucial.

U.S. Drought Monitor

Montana



#### April 1, 2025 (Released Thursday, Apr. 3, 2025) Valid 8 a.m. EDT

Drought Conditions (Percent Area)

|   | None  | D0    | D1    | D2    | D3    | D4   |
|---|-------|-------|-------|-------|-------|------|
| Current                                 | 36.81 | 28.01 | 22.52 | 10.94 | 1.72  | 0.00 |
| Last Week<br>03-25-2025                 | 40.87 | 23.95 | 23.53 | 9.93  | 1.72  | 0.00 |
| 3 Month's Ago<br>12-31-2024             | 5.53  | 40.25 | 26.98 | 13.46 | 13.79 | 0.00 |
| Start of<br>Calendar Year<br>01-07-2025 | 6.70  | 39.08 | 26.98 | 13.46 | 13.79 | 0.00 |
| Start of<br>Water Year<br>10-01-2024    | 15.18 | 42.58 | 21.19 | 11.61 | 8.54  | 0.90 |
| One Year Ago<br>04-02-2024              | 5.76  | 52.94 | 24.78 | 15.52 | 1.00  | 0.00 |

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

<u>Author.</u>
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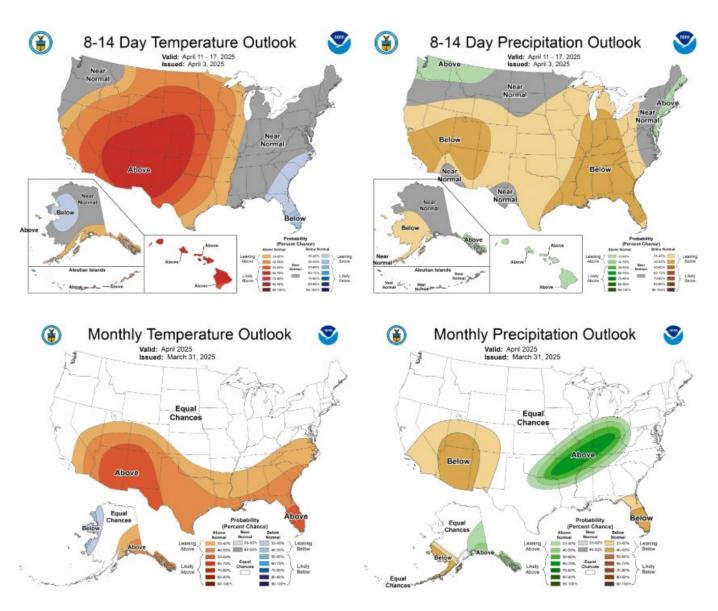


droughtmonitor.unl.edu

#### **Weather Outlook**

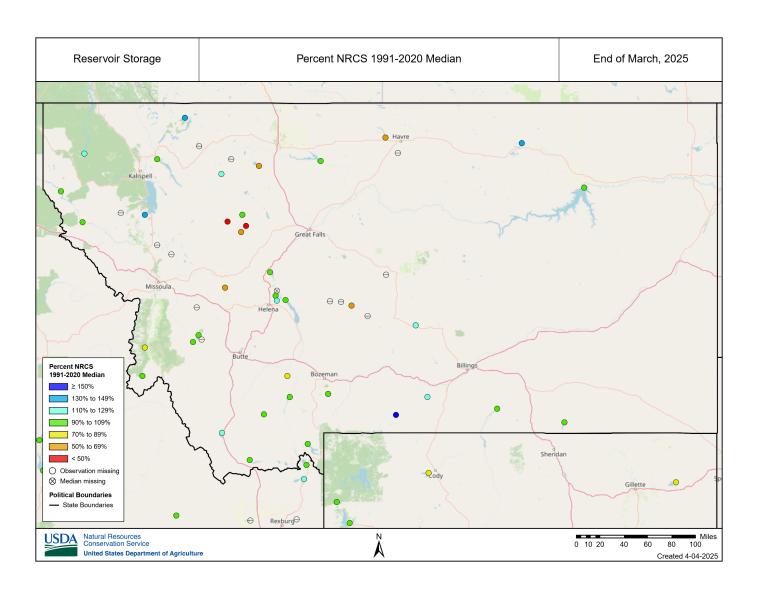
According to the NOAA Climate Prediction Center, temperatures in Montana will likely be above normal in the next 8-14 days. The northwest part of the state has a higher probability of near normal temperatures. The southeast portion of the state has the highest probability of above normal temperatures. Most of the state shows a probability of near normal precipitation in the next 8-14 days. Except for the northwest portion of the state where the probability leans towards slightly above normal precipitation.

The April outlooks for Montana show equal chances of above or below normal precipitation and temperatures.



#### Reservoirs

Most Montana reservoirs reported near normal end of March storage levels, with some reservoirs reporting above or below normal levels. Clark Canyon, Cooney, Deadman's Basin, Flathead Lake, Helena Valley, Lake Koocanusa, Lake Sherburne, Mystic Lake, Nelson, and Swift Reservoirs had above normal reservoir levels of around 110 – 135% of normal for the end of March. Willow Creek (Harrison) and Lake Como Reservoirs reported below normal reservoir levels of 80 – 90% of normal. Bair, Fresno, Gibson, Lake Frances, Nevada Creek, Nilan, and Willow Creek (Augusta) Reservoirs reported below well normal reservoir levels with less than 70% of normal storage for end or March. The remaining reservoirs across the state reported near normal reservoir storage.



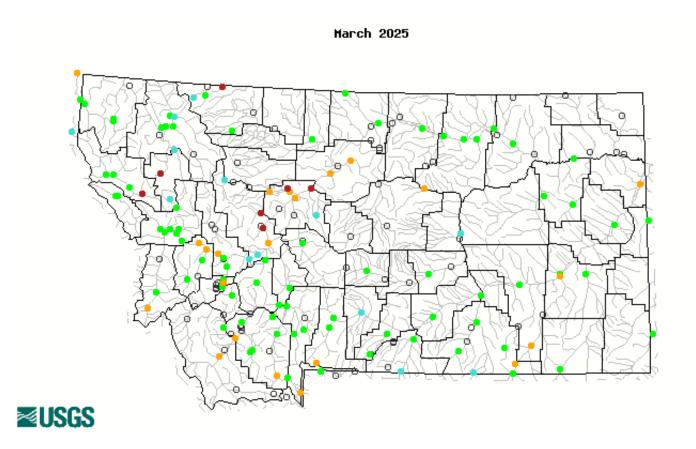
### **Reservoirs (Continued)**

#### **End of March - Reservoir Storage Percent of Capacity**

| Reservoir                  | Basin                        | Current % Capacity | Last Year % Capacity | Median % Capacity |
|----------------------------|------------------------------|--------------------|----------------------|-------------------|
| Smith River Res            | Smith-Judith-<br>Musselshell | -                  | 91                   | 67                |
| Deadman's Basin Res        | Smith-Judith-<br>Musselshell | 92                 | 90                   | 78                |
| Bair Res                   | Smith-Judith-<br>Musselshell | 41                 | 72                   | 60                |
| Swift Res                  | Sun-Teton-Marias             | 73                 | 52                   | 57                |
| Lake Frances               | Sun-Teton-Marias             | 34                 | 46                   | 53                |
| Lake Elwell (Tiber)        | Sun-Teton-Marias             | 50                 | 51                   | 54                |
| Gibson Res                 | Sun-Teton-Marias             | 10                 | 15                   | 36                |
| Mystic Lake                | Upper Yellowstone            | 13                 | 2                    | 5                 |
| Cooney Res                 | Upper Yellowstone            | 92                 | 94                   | 78                |
| Ruby River Reservoir       | Jefferson                    | 81                 | 84                   | 80                |
| Lima Reservoir             | Jefferson                    | 50                 | 77                   | 54                |
| Clark Canyon Res           | Jefferson                    | 57                 | 67                   | 51                |
| Painted Rocks Lake         | Bitterroot                   | 31                 | 40                   | 33                |
| Lake Como                  | Bitterroot                   | 40                 | 45                   | 46                |
| Bull Lake                  | Bighorn                      | 24                 | 47                   | 53                |
| Buffalo Bill               | Bighorn                      | 60                 | 75                   | 67                |
| Boysen                     | Bighorn                      | 63                 | 77                   | 71                |
| Bighorn Lake               | Bighorn                      | 58                 | 59                   | 59                |
| Lake Helena                | Upper Missouri               | 78                 | 78                   | 86                |
| Holter Lake                | Upper Missouri               | 99                 | 99                   | 99                |
| Helena Valley<br>Reservoir | Upper Missouri               | 57                 | 70                   | 52                |
| Canyon Ferry Lake          | Upper Missouri               | 71                 | 76                   | 71                |
| Lake Koocanusa             | Kootenai                     | 62                 | 68                   | 55                |
| Hungry Horse Lake          | Flathead                     | 71                 | 83                   | 68                |
| Flathead Lake              | Flathead                     | 55                 | 44                   | 41                |
| Nelson Res                 | Milk                         | 75                 | 79                   | 57                |
| Fresno Res                 | Milk                         | 32                 | 24                   | 51                |
| Noxon Rapids<br>Reservoir  | Lower Clark Fork             | 89                 | 93                   | 96                |
| Fort Peck Lake             | Lower Missouri               | 72                 | 76                   | 73                |
| Nevada Creek Res           | Upper Clark Fork             | 34                 | 56                   | 69                |
| Georgetown Lake            | Upper Clark Fork             | 94                 | 93                   | 91                |
| Tongue River Res           | Tongue                       | 75                 | 71                   | 71                |
| Lake Sherburne             | St. Mary                     | 62                 | 69                   | 48                |
| Hebgen Lake                | Madison                      | 80                 | 86                   | 73                |
| Ennis Lake                 | Madison                      | 77                 | 77                   | 72                |
| Middle Creek Res           | Gallatin                     | 56                 | 57                   | 61                |

#### **Streamflow**

Streamflow was variable across the state in the month of March. Most stations had near normal streamflow. A few stations had above normal streamflow in various parts of the state. Some stations along the Missouri River had below normal streamflow. Lower elevation snowmelt might have influenced streamflow in some areas. Increases in streamflow will occur as more areas have snowmelt. Especially as the low and mid elevation snowpacks start producing more runoff. Spring weather in the following months will also have a great impact on streamflow.

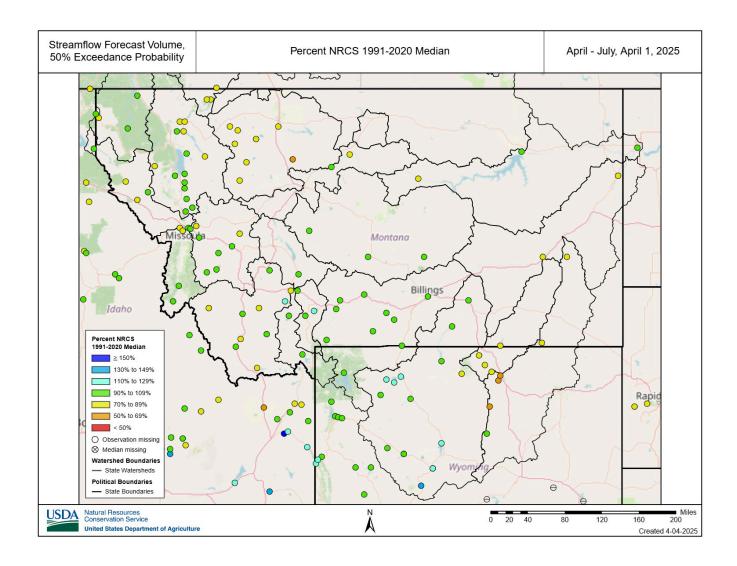


|     |                      | Explar          | nation - I | Percenti        | ile classe           | s    |            |
|-----|----------------------|-----------------|------------|-----------------|----------------------|------|------------|
| •   | •                    | •               | •          |                 | •                    | •    | 0          |
| Low | <10                  | 10-24           | 25-75      | 76-90           | >90                  | High | Not-ranked |
| LOW | Much below<br>normal | Below<br>normal | Normal     | Above<br>normal | Much above<br>normal |      | Not-ranked |

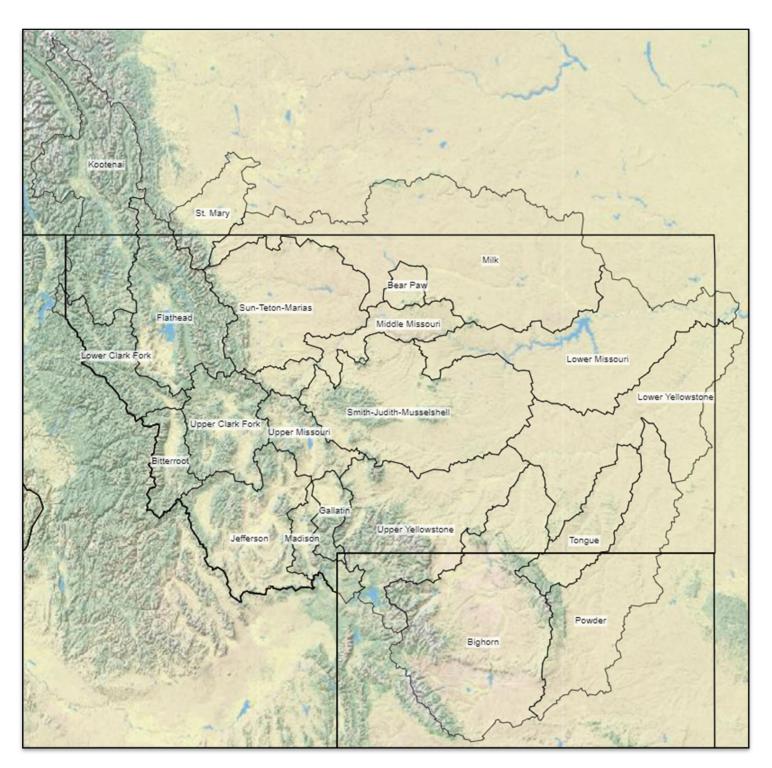
#### **Water Supply Forecasts**

April 1 water supply forecasts currently trend with the water year precipitation and snowpack accumulation to date. Most April-July streamflows across the state are forecasted to be near to below normal at 80 – 105% of median. Heavy April precipitation in the Bighorn basin increased streamflow forecasts in the Shoshone and Upper Wind to near to above normal at 100 – 130% of median. A few other pockets favored by winter precipitation such as Middle Creek below Hyalite Reservoir are predicting above normal streamflow as well. Regions with a larger water year precipitation and snowpack deficits such as the St. Mary, Sun-Teton-Marias, Powder, and Tongue River basins are predicting below normal streamflow of 60-90% of median.

April 1 forecasts will typically have greater resolution than the March 1 forecasts. As the snowpack accumulation season is progressing and nearing peak SWE it is becoming less likely to see drastic changes in the water supply outlook. However, spring can continue to be an active time for weather in Montana. Water supply forecasts predict a range of probable volumes dependent on future weather conditions. The 50% exceedance volume is reflective of normal weather conditions and runoff. Heavy precipitation and cool temperatures could swing the forecast towards the 30% or 10% exceedance volumes while minimal precipitation and warm temperatures could swing the forecast towards the 70% and 90% exceedance volumes. Considering the full suite of forecast predictions, not just the 50% exceedance, will provide a better picture of the range of possible streamflows to expect.



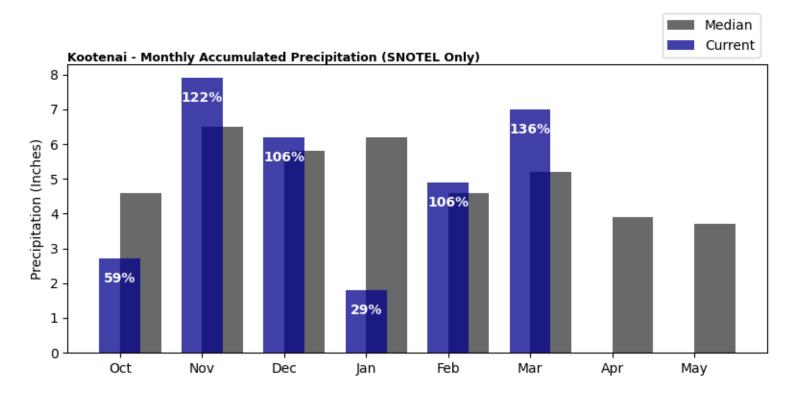
#### **Montana River Basin Definitions**

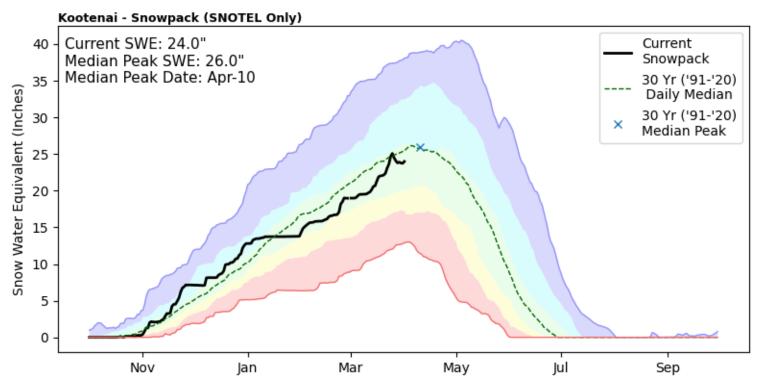


The following basin overview sections only include basins that have SNOTEL sites. For example, there is no basin overview for the Lower Yellowstone, because there are no SNOTEL sites associated with that basin. Water supply information for basins not included in the following sections can be found at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

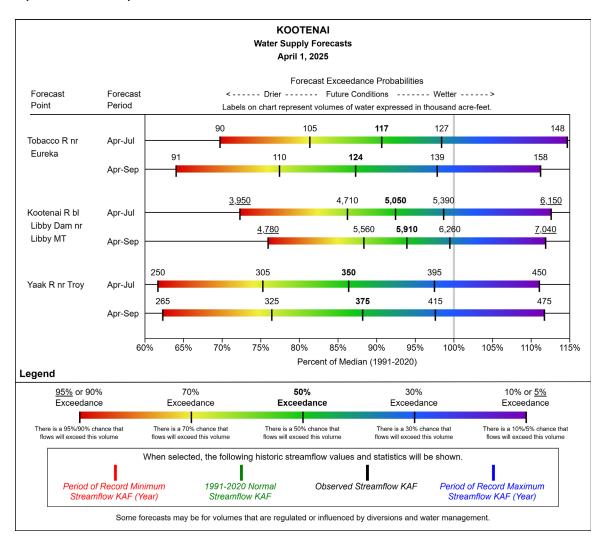
#### Kootenai

Precipitation in March was well above normal at 136%, which brings the seasonal accumulation (October-March) to 86% of median. The snowpack in the Kootenai is below normal at 90% of median, compared to 80% at this time last year.



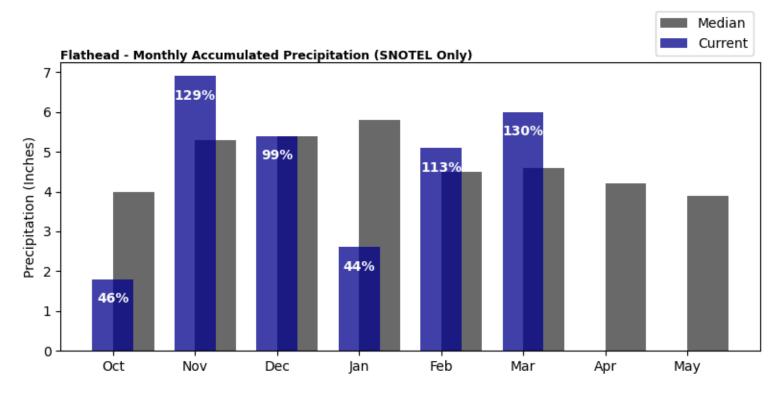


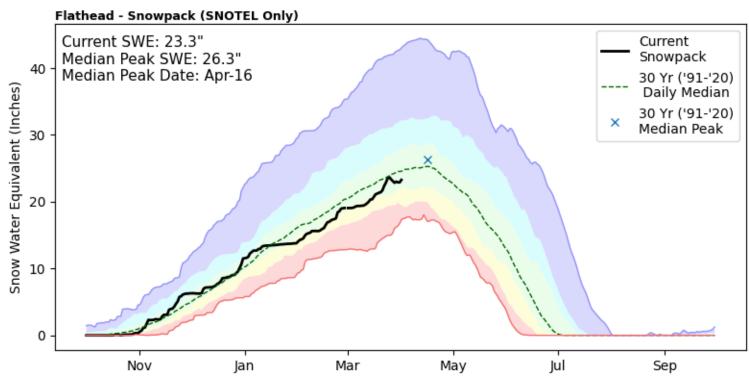
### **Kootenai (Continued)**



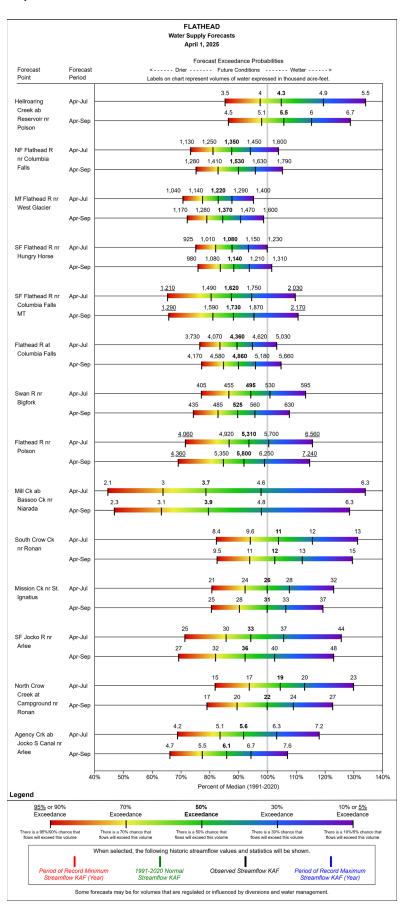
#### **Flathead**

Precipitation in March was well above normal at 130%, which brings the seasonal accumulation (October-March) to 89% of median. The snowpack in the Flathead is below normal at 87% of median, compared to 74% at this time last year.



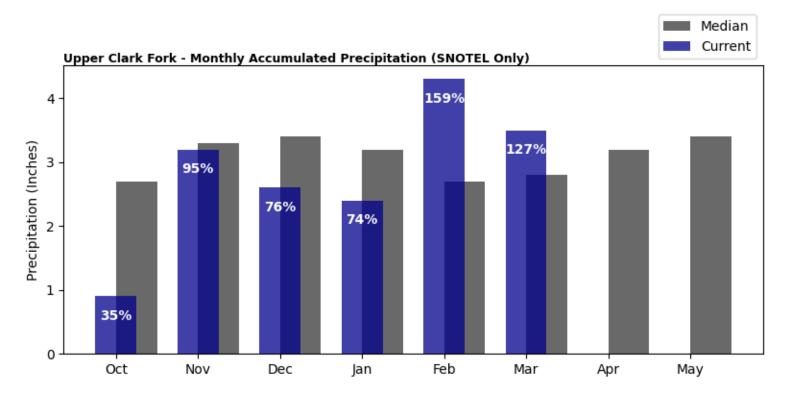


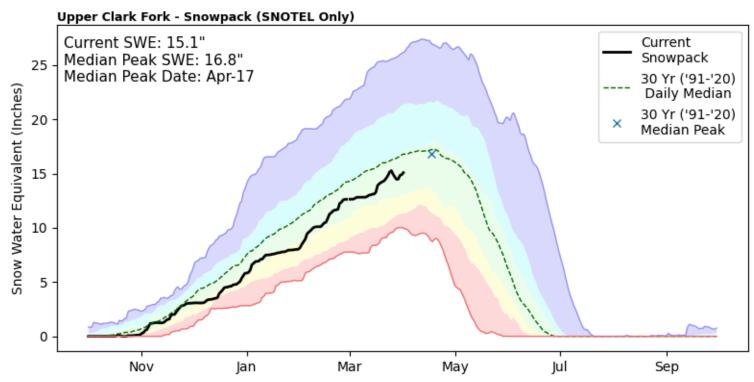
### Flathead (Continued)



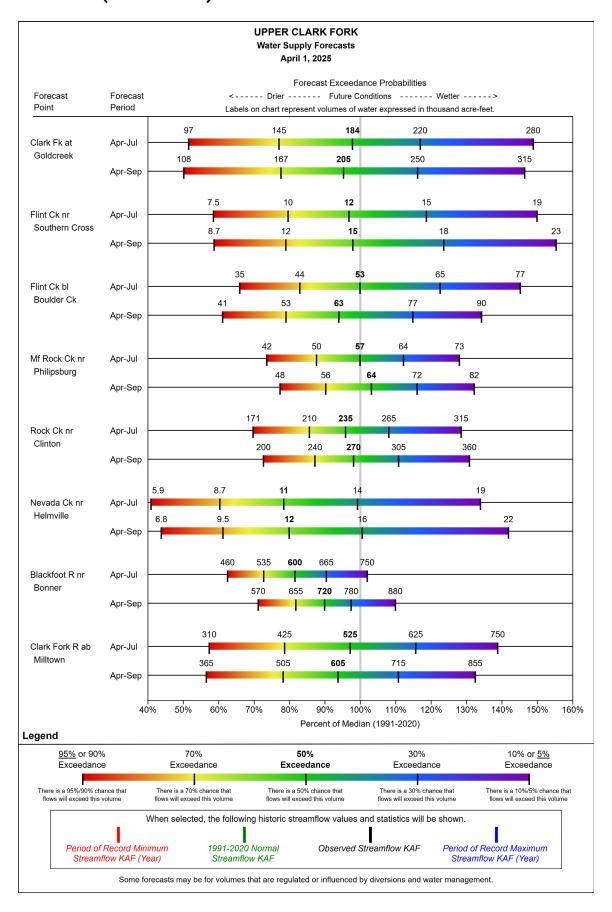
#### **Upper Clark Fork**

Precipitation in March was well above normal at 127%, which brings the seasonal accumulation (October-March) to 90% of median. The snowpack in the Upper Clark Fork is below normal at 86% of median, compared to 67% at this time last year.



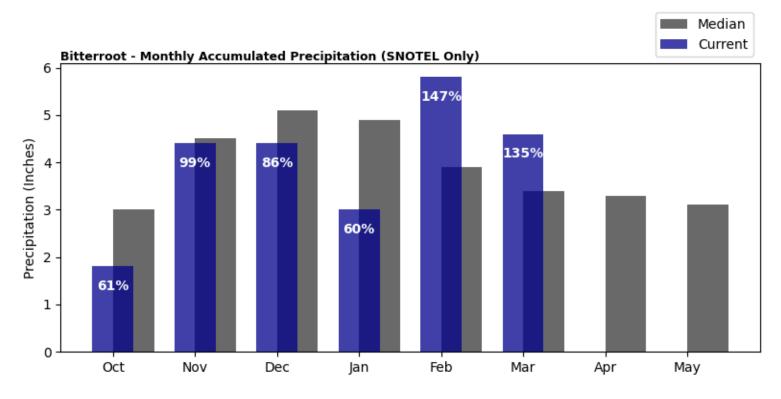


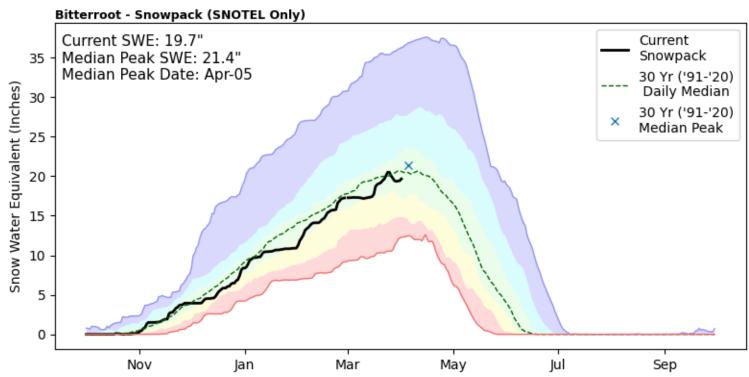
#### **Upper Clark Fork (Continued)**



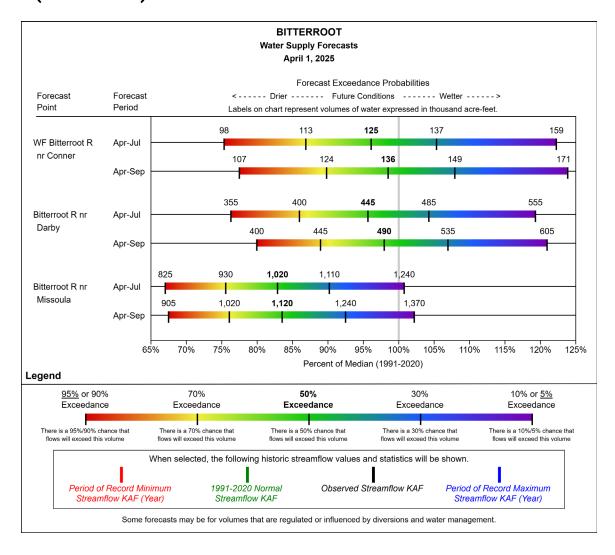
#### **Bitterroot**

Precipitation in March was well above normal at 135%, which brings the seasonal accumulation (October-March) to 91% of median. The snowpack in the Bitterroot is near normal at 95% of median, compared to 72% at this time last year.



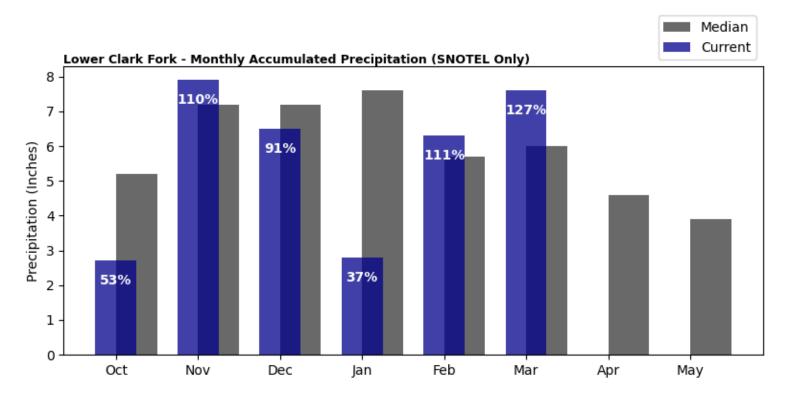


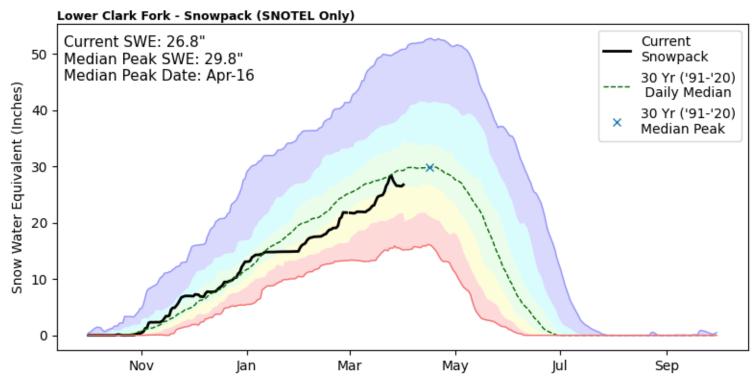
#### **Bitterroot (Continued)**



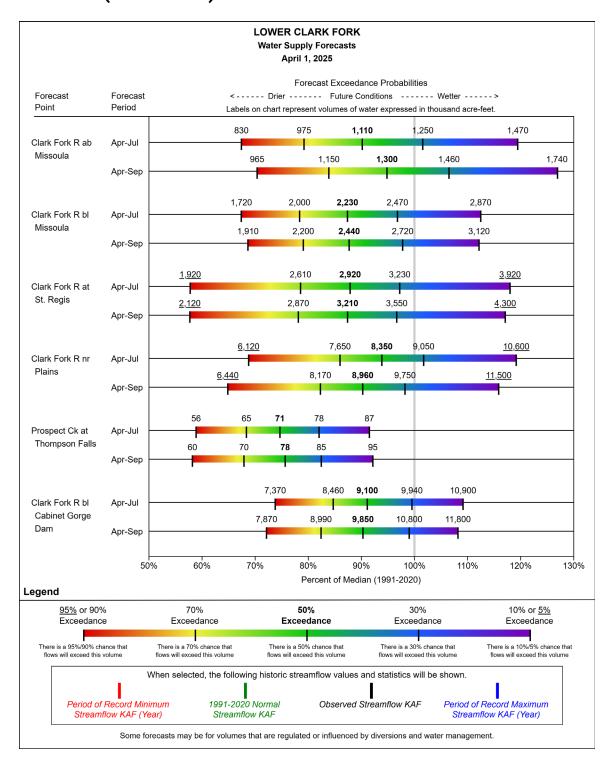
#### **Lower Clark Fork**

Precipitation in March was well above normal at 127%, which brings the seasonal accumulation (October-March) to 81% of median. The snowpack in the Lower Clark Fork is below normal at 91% of median, compared to 73% at this time last year.



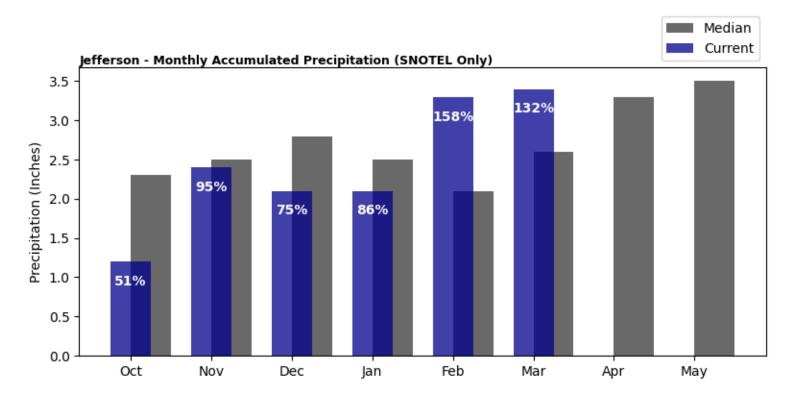


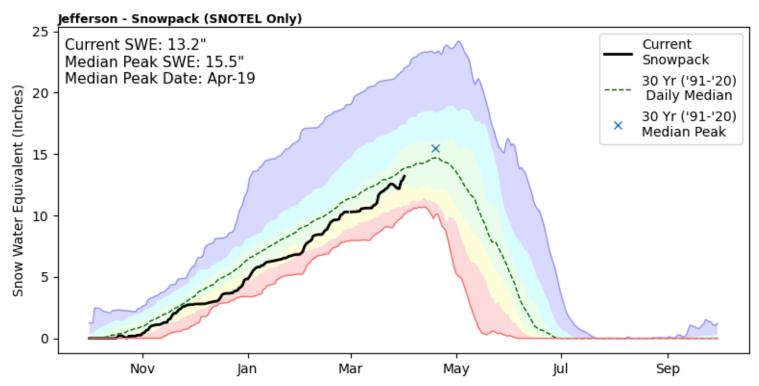
#### **Lower Clark Fork (Continued)**



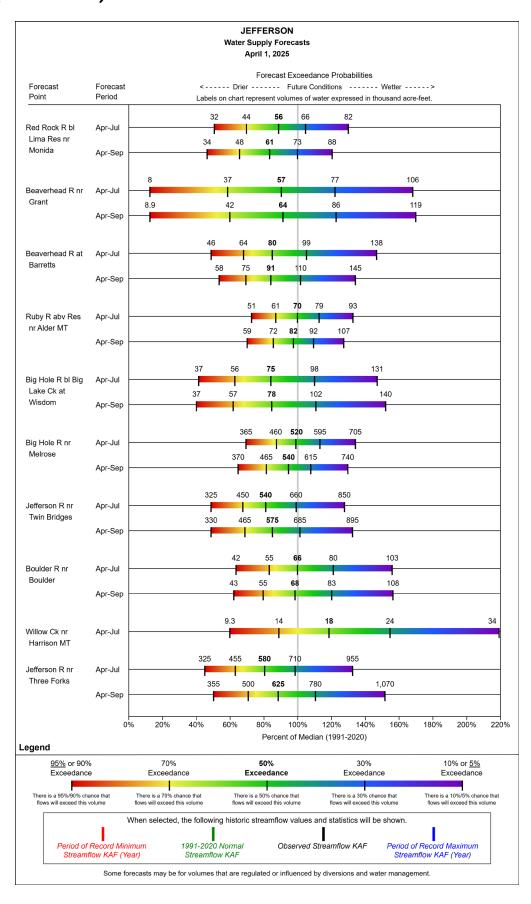
#### **Jefferson**

Precipitation in March was well above normal at 132%, which brings the seasonal accumulation (October-March) to 96% of median. The snowpack in the Jefferson is below normal at 93% of median, compared to 80% at this time last year.



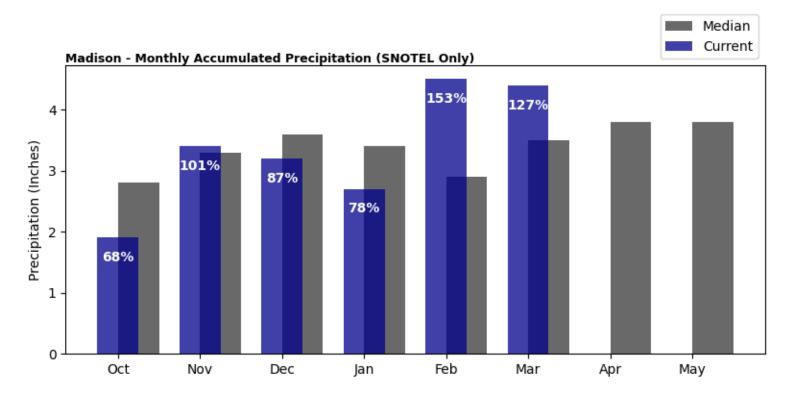


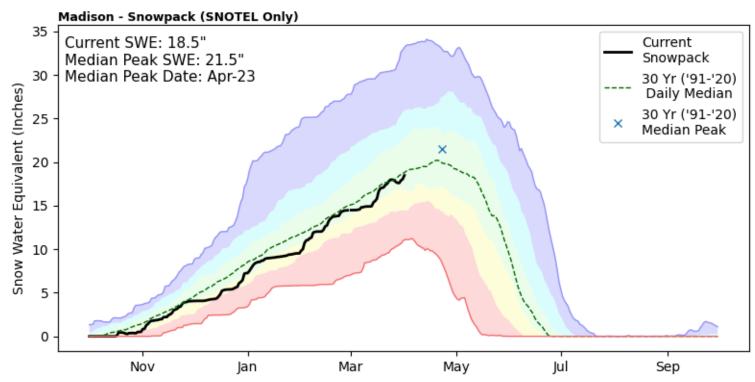
### **Jefferson (Continued)**



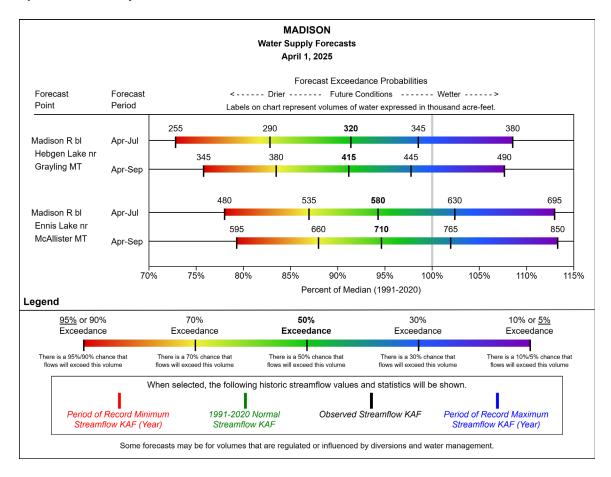
#### **Madison**

Precipitation in March was well above normal at 127%, which brings the seasonal accumulation (October-March) to 99% of median. The snowpack in the Madison is near normal at 96% of median, compared to 85% at this time last year.



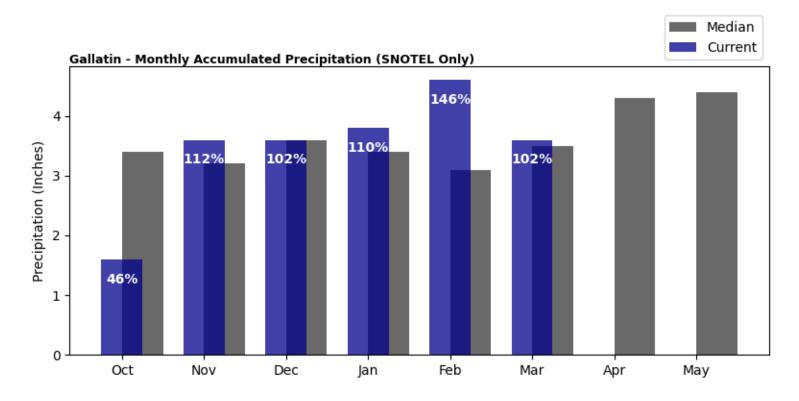


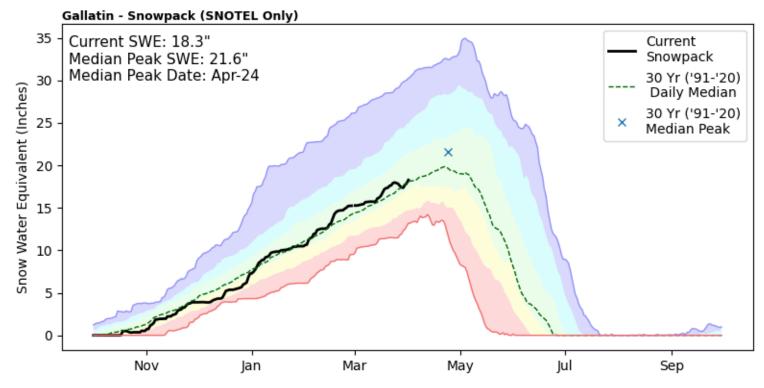
### **Madison (Continued)**



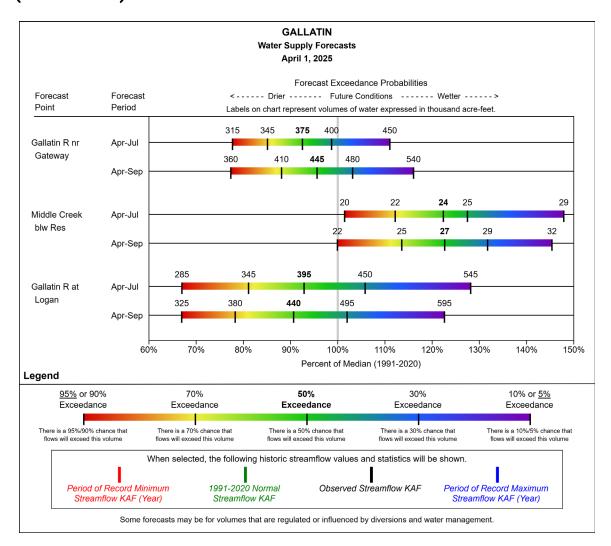
#### **Gallatin**

Precipitation in March was near normal at 102%, which brings the seasonal accumulation (October-March) to 100% of median. The snowpack in the Gallatin is near normal at 104% of median, compared to 76% at this time last year.



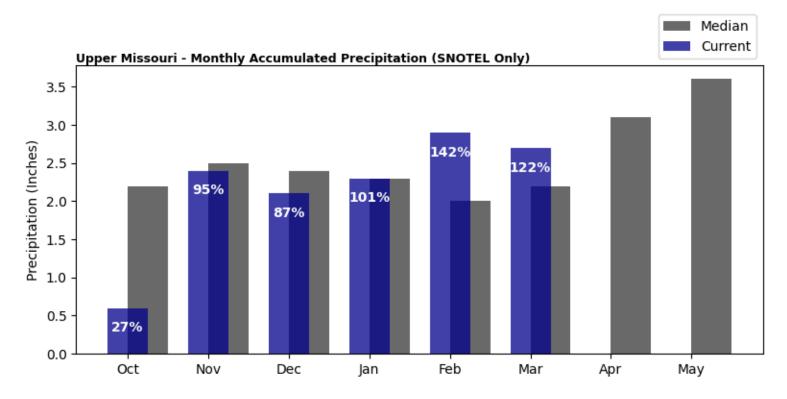


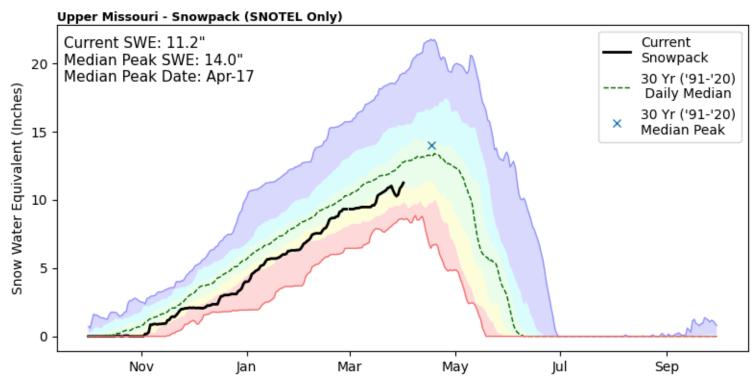
#### **Gallatin (Continued)**



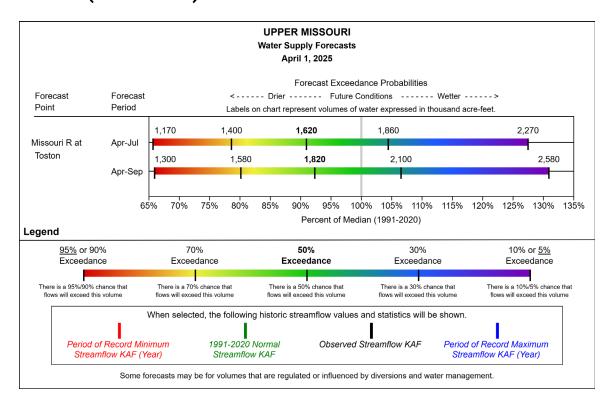
#### **Upper Missouri**

Precipitation in March was well above normal at 122%, which brings the seasonal accumulation (October-March) to 95% of median. The snowpack in the Upper Missouri is below normal at 90% of median, compared to 73% at this time last year.



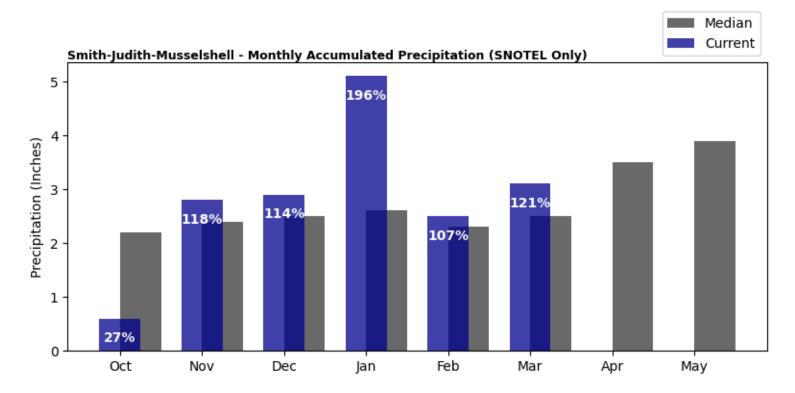


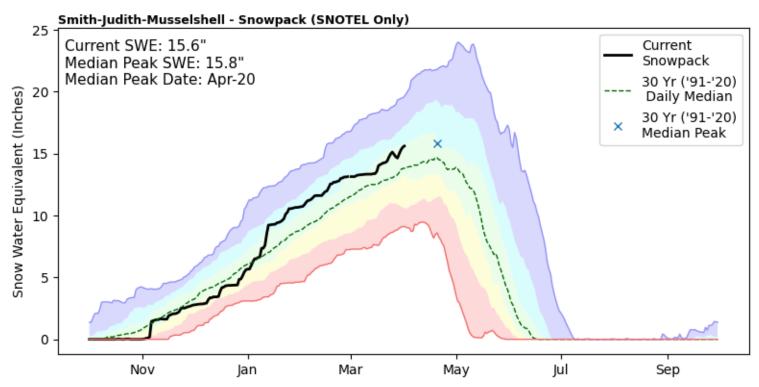
## **Upper Missouri (Continued)**



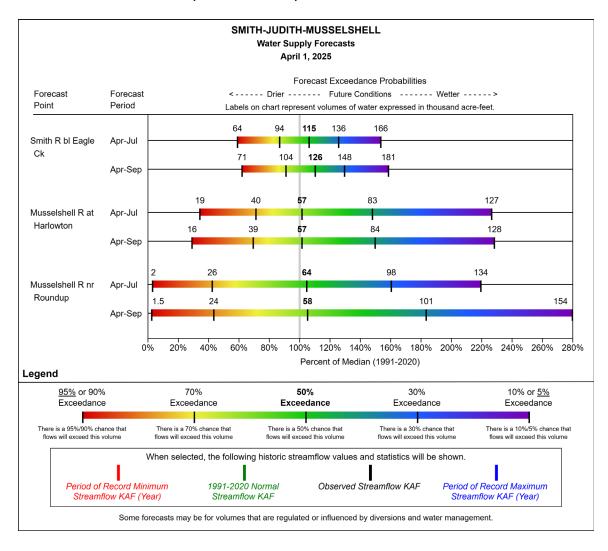
### **Smith-Judith-Musselshell**

Precipitation in March was well above normal at 121%, which brings the seasonal accumulation (October-March) to 110% of median. The snowpack in the Smith-Judith-Musselshell is above normal at 115% of median, compared to 67% at this time last year.



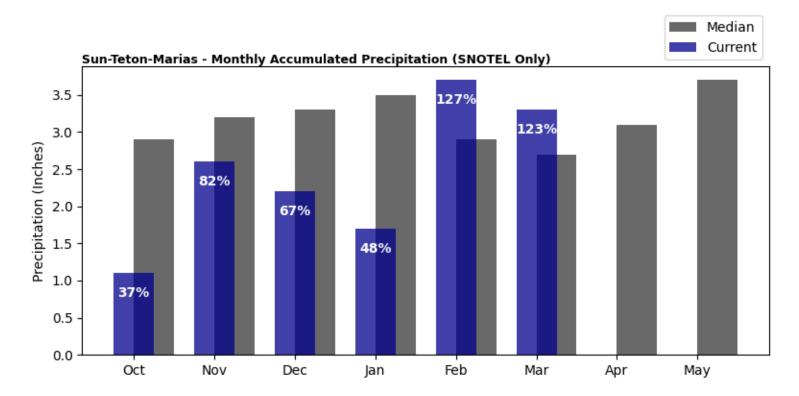


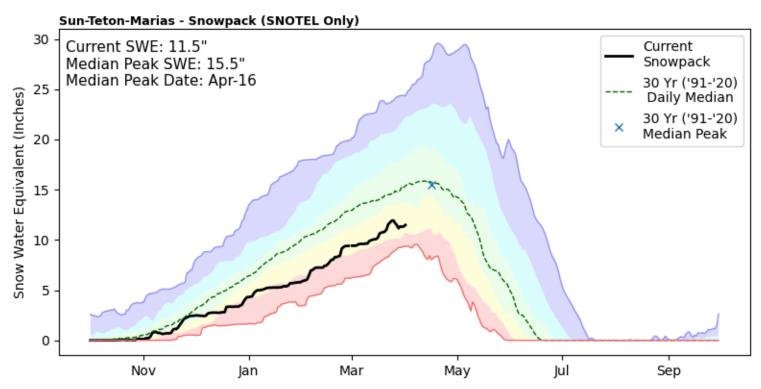
## **Smith-Judith-Musselshell (Continued)**



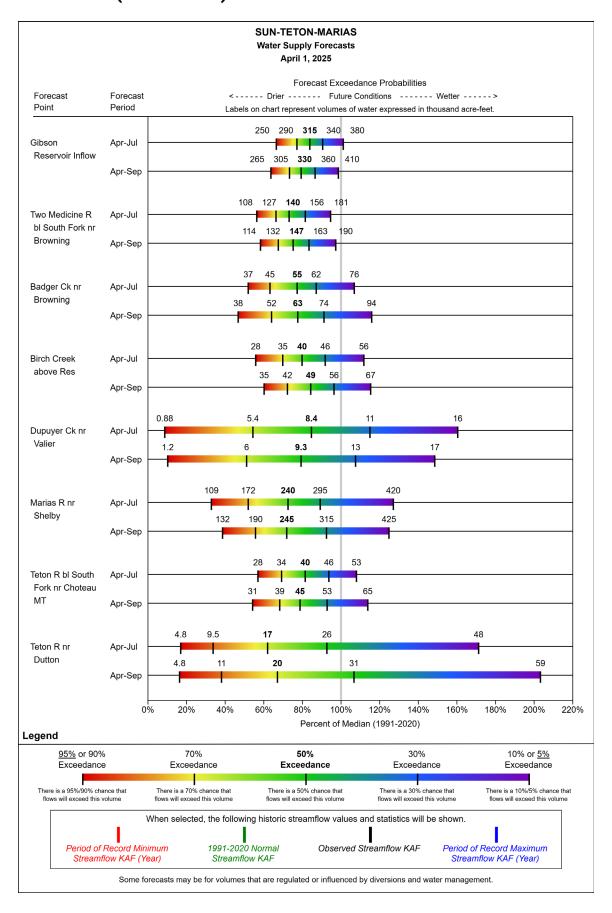
### **Sun-Teton-Marias**

Precipitation in March was well above normal at 123%, which brings the seasonal accumulation (October-March) to 74% of median. The snowpack in the Sun-Teton-Marias is well below normal at 70% of median, compared to 57% at this time last year.



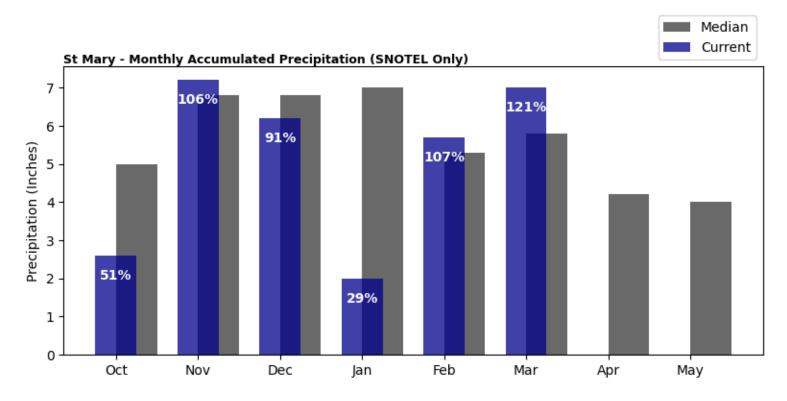


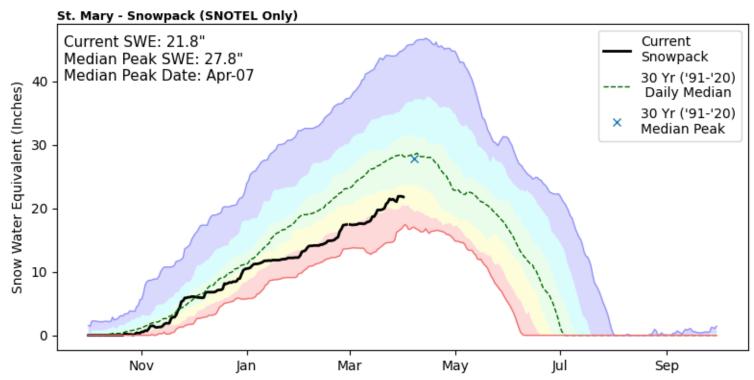
## **Sun-Teton-Marias (Continued)**



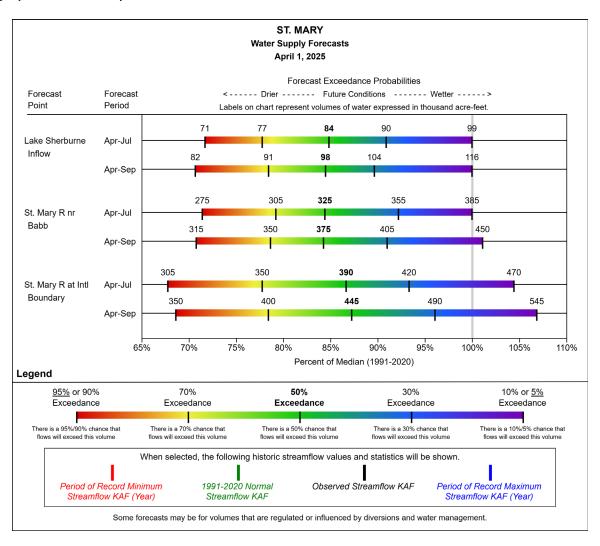
## St. Mary

Precipitation in March was well above normal at 121%, which brings the seasonal accumulation (October-March) to 77% of median. The snowpack in the St. Mary is well below normal at 77% of median, compared to 73% at this time last year.



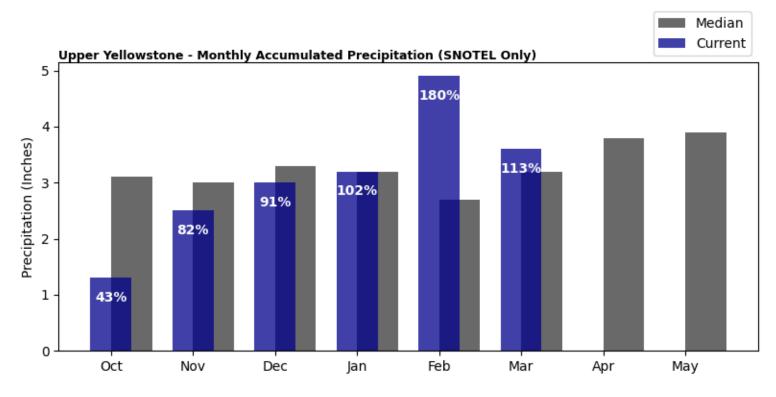


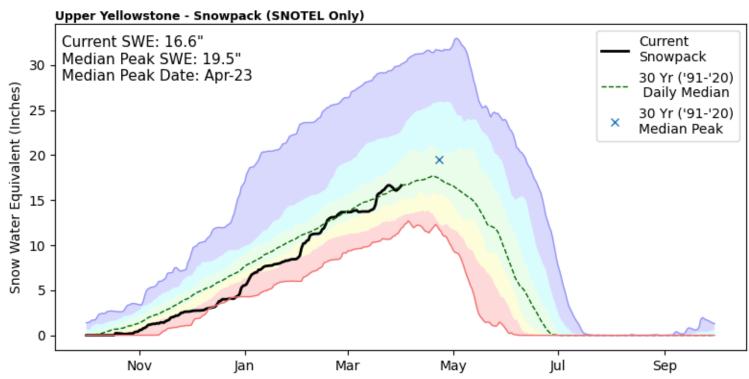
## St. Mary (Continued)



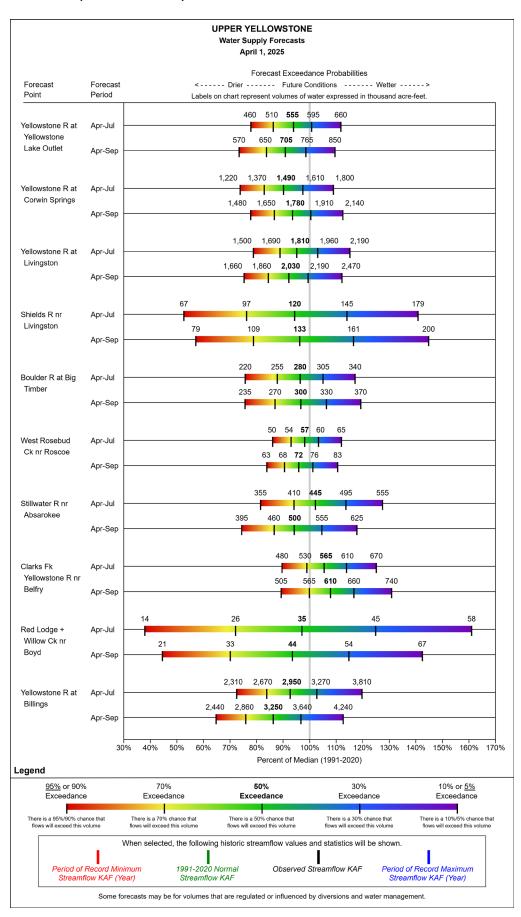
## **Upper Yellowstone**

Precipitation in March was above normal at 113%, which brings the seasonal accumulation (October-March) to 98% of median. The snowpack in the Upper Yellowstone is near normal at 99% of median, compared to 79% at this time last year.



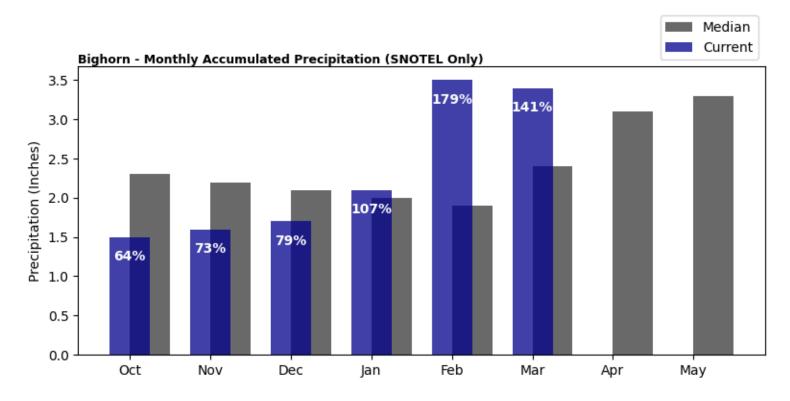


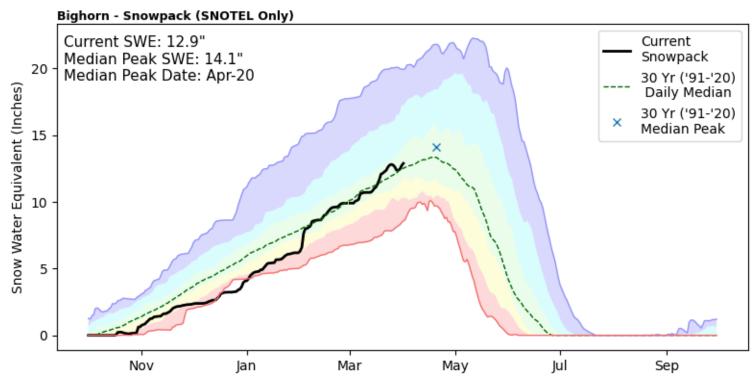
## **Upper Yellowstone (Continued)**



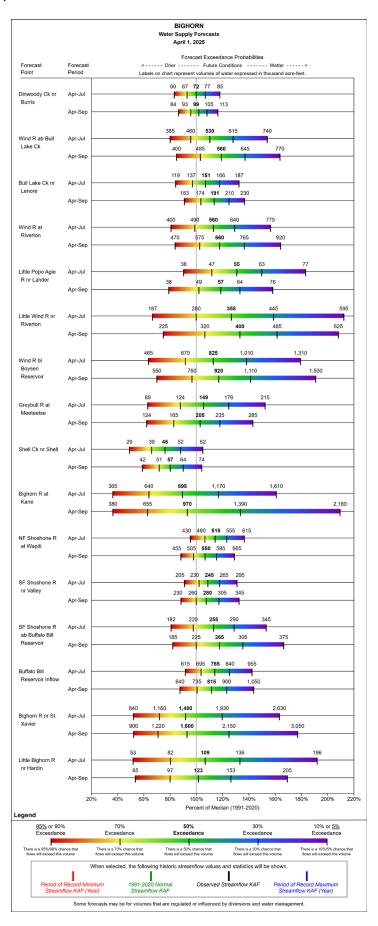
## **Bighorn**

Precipitation in March was well above normal at 141%, which brings the seasonal accumulation (October-March) to 103% of median. The snowpack in the Bighorn is near normal at 103% of median, compared to 95% at this time last year.



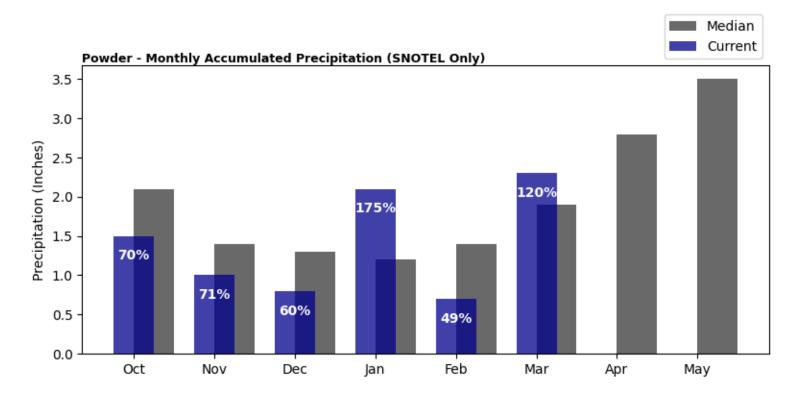


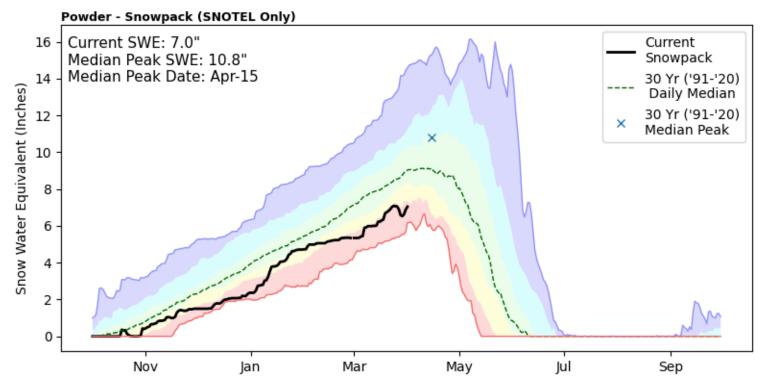
## **Bighorn (Continued)**



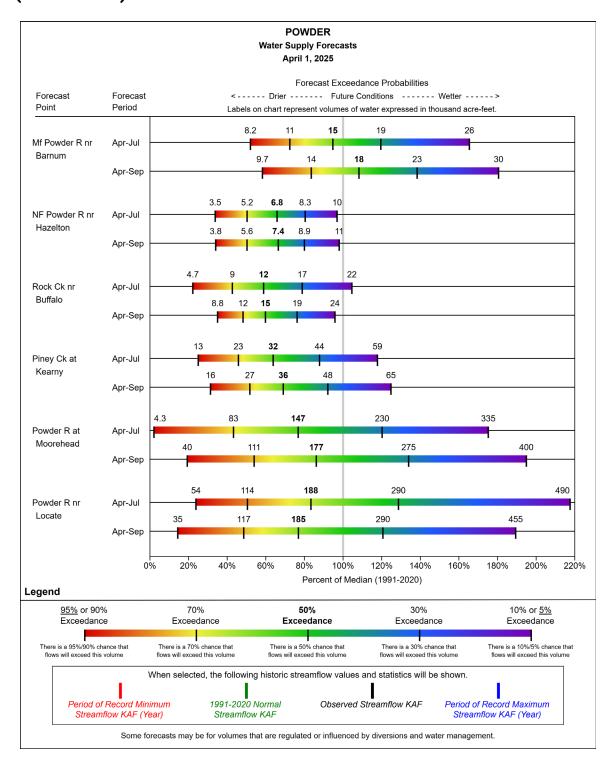
### **Powder**

Precipitation in March was None at 120%, which brings the seasonal accumulation (October-March) to 86% of median. The snowpack in the Powder is well below normal at 78% of median, compared to 67% at this time last year.



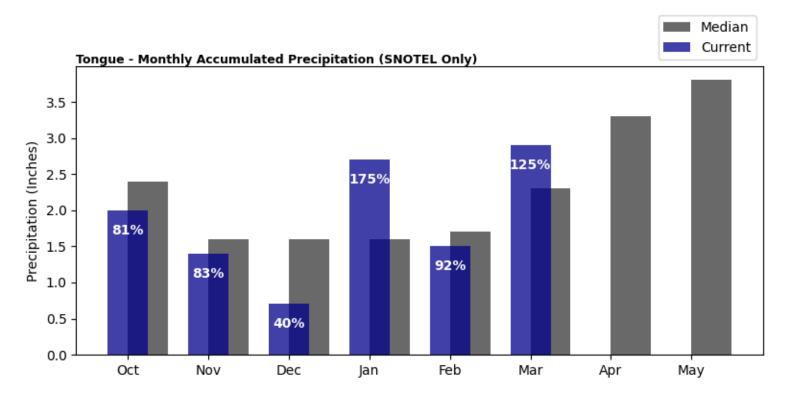


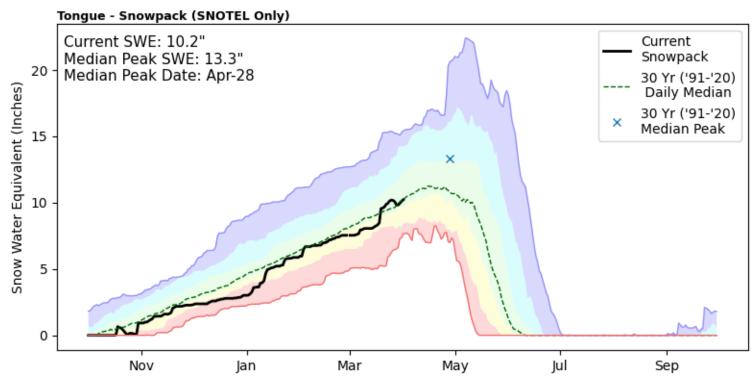
## **Powder (Continued)**



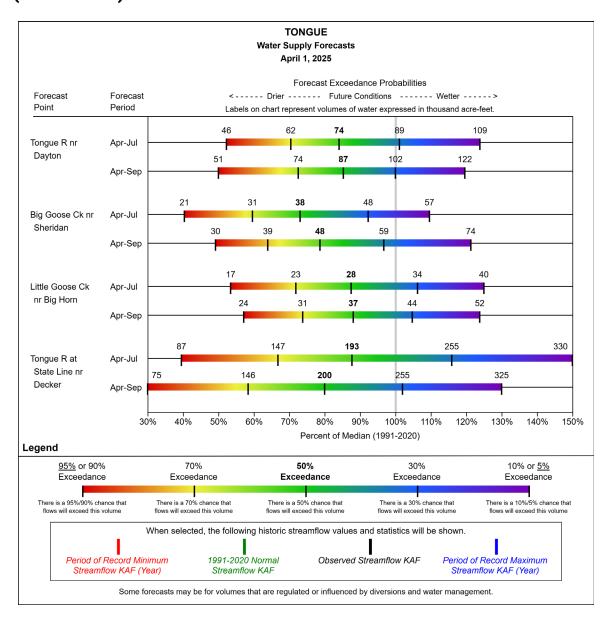
## **Tongue**

Precipitation in March was well above normal at 125%, which brings the seasonal accumulation (October-March) to 95% of median. The snowpack in the Tongue is near normal at 100% of median, compared to 73% at this time last year.



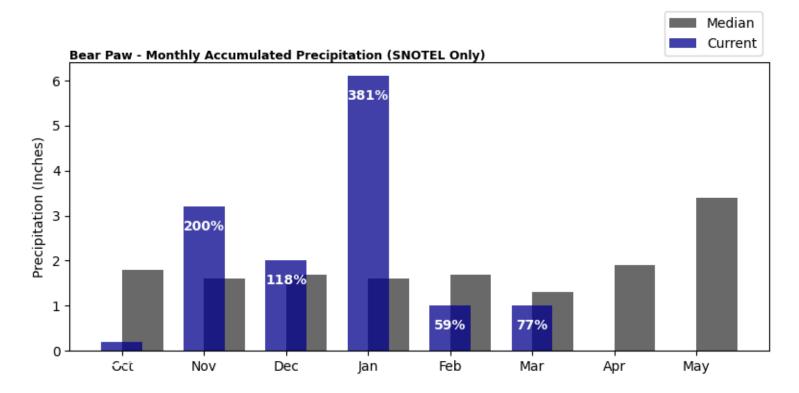


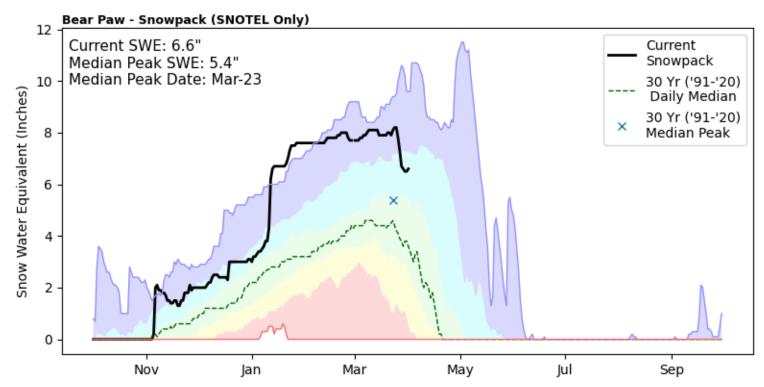
## **Tongue (Continued)**



### **Bear Paw**

Precipitation in March was well below normal at 77%, which brings the seasonal accumulation (October-March) to 135% of median. The snowpack in the Bear Paw is above normal at 107% of median, compared to 67% at this time last year.





### **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.

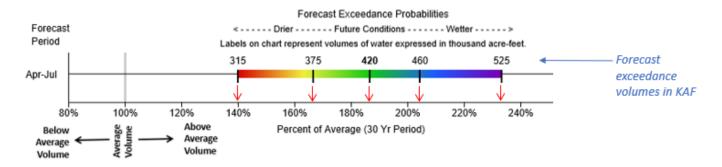
Forecast uncertainty originates from two sources: (1) uncertainty of future hydrologic and climatic conditions, and (2) error in the forecasting procedure. To express the uncertainty in the most probable forecast, four additional forecasts are provided. The actual streamflow can be expected to exceed 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<br>Chance that actual volume will exceed forecast |              |              |       |              |              |                   |
|--------------------|---|--------------|--------------|-------|--------------|--------------|-------------------|
| Forecast<br>Period | 90%<br>(KAF)  | 70%<br>(KAF) | 50%<br>(KAF) | % Avg | 30%<br>(KAF) | 10%<br>(KAF) | 30yr Avg<br>(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.

### **Monitoring Station Overview**

#### **SNOTEL**

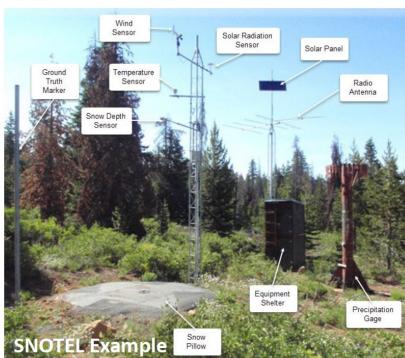
The NRCS operates an extensive, automated data collection network called SNOTEL (short for Snow Telemetry). SNOTEL sites are designed to operate unattended in remote mountain locations. Data are collected and transmitted hourly and available on the internet. Daily data (midnight values) are quality checked 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.





Weight of

frozen water — liquid water

Snow core inside snow tubes

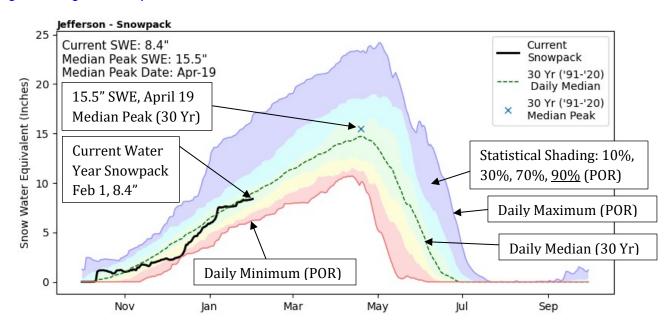
### **Additional Information**

### **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: <a href="https://www.nrcs.usda.gov/resources/data-and-reports/climatic-and-hydrologic-normals">https://www.nrcs.usda.gov/resources/data-and-reports/climatic-and-hydrologic-normals</a>

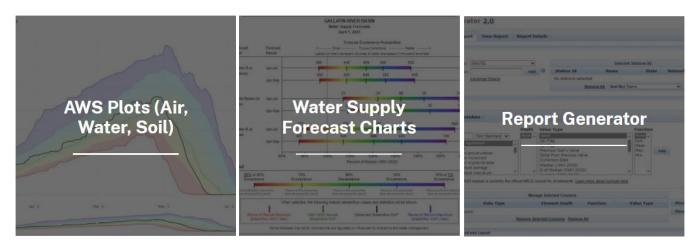
### **Interpreting Snowpack Charts**

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: <a href="https://nwcc-apps.sc.egov.usda.gov/basin-plots/#mt">https://nwcc-apps.sc.egov.usda.gov/basin-plots/#mt</a>



### **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 > <u>Stations</u>
- 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 > <u>Stations</u> | <u>Basins</u>

### Reservoir Storage

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

### Other

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

## **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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Bozeman, Montana

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Bozeman, Montana

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https://www.nrcs.usda.gov/montana/snow-survey





# Montana Water Supply Outlook Report

**Natural Resources Conservation Service** 

