Colorado River Basin Water Supply Briefing

May 7, 2021

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Colorado Basin River Forecast Center

Please mute your phone until the question period
Today’s Presentation

April Weather Review

April Observed Streamflow

Current Snowpack

2021 Water Supply Forecasts

May Forecast Error

Upcoming Weather

CBRFC Model Snow Plots

Contacts & Questions

Webinar recording & slides will be made available on CBRFC webpage
Another month of generally below to well below normal.
Water year precipitation deficits continue to grow.
Several SNOTELs in Colorado were below the 15th percentile for April precipitation. This April was similar to the very dry conditions of last April. In fact, for much of the Upper Basin, one can argue that this April was slightly worse.
April Temperatures

April temperatures were generally slightly above normal across the south and slightly below normal over the north.

Above normal temperatures during the beginning and end of April generated the bulk of the runoff during the month and into early May.

First five days were near record highs.
Despite low and mid elevation snowmelt, April unregulated streamflow volumes were record or near record low at many locations.
Early May Snow Conditions

**SNOTEL (Observed)**

**CBRFC (Model)**

<table>
<thead>
<tr>
<th>Basin</th>
<th>SWE (% Median)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Green</td>
<td>75%</td>
</tr>
<tr>
<td>Duchesne</td>
<td>50%</td>
</tr>
<tr>
<td>Price/San Rafael</td>
<td>15%</td>
</tr>
<tr>
<td>Yampa/White</td>
<td>65%</td>
</tr>
<tr>
<td>Upper CO Mainstem</td>
<td>75%</td>
</tr>
<tr>
<td>Gunnison</td>
<td>55%</td>
</tr>
<tr>
<td>Dolores</td>
<td>2%</td>
</tr>
<tr>
<td>San Juan</td>
<td>55%</td>
</tr>
<tr>
<td>Lake Powell</td>
<td>71%</td>
</tr>
</tbody>
</table>

Lower Colorado River Basin SWE has melted out

*Percent normal (median) snow water equivalent (SWE) can be misleading and vary significantly day to day in the spring after peak snowpack has passed and during the snowmelt season.
May 1st 2021 Forecasts

Volume (kaf) / % of 1981-2010 avg

Forecast Ranges & (1-month Trend)

Upper Green: 35 - 70% avg  
(5 - 10% decrease)

Yampa/White: 40 - 55% avg  
(10 - 20% decrease)

Duchesne: 10 - 55% avg  
(5 - 15% decrease)
### Upper Green Water Supply Forecasts & Snow Conditions

#### Green - Flaming Gorge Reservoir (GRNUG)

Period: Apr-Jul, Official 50% Forecast [2021-05-01]: 450 kaf (46% Average, 54% Median)

ESP is Unregulated and No Precipitation Forecast Included

<table>
<thead>
<tr>
<th>Average</th>
<th>Median</th>
<th>Min</th>
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<tbody>
<tr>
<td>10%</td>
<td>90%</td>
<td>50%</td>
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</tbody>
</table>

### Daily Model Run

- **May Forecast:** May-July forecast + April observed runoff

### Chart: Green River Headwater: Pine Creek (Wind Rivers)

#### CBRFC Model Snow: 10,500'-13,000+'

- SNOTEL Elevation Range: 7,500'-9,500'

#### Historical Max/Min Model SWE

- **2021 Model SWE**
Yampa River Water Supply Forecasts & Snow Conditions

- Forecast decreased by 22% of average from April to May
  - April precipitation = 35% of normal
  - April streamflow volumes were record low
- Greater than 10% chance for below record low volumes

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2002</td>
</tr>
<tr>
<td>2</td>
<td>2012</td>
</tr>
<tr>
<td>3</td>
<td>2021</td>
</tr>
<tr>
<td>4</td>
<td>1992</td>
</tr>
<tr>
<td>5</td>
<td>1989</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Upper Elevation (&gt;10,000')</th>
<th>April 1 SWE (inches)</th>
<th>May 1 SWE (inches)</th>
<th>Change (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>30.4</td>
<td>31.5</td>
<td>+1.1</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>33.4</td>
<td>40</td>
<td>+6.6</td>
<td></td>
</tr>
</tbody>
</table>
May 1\textsuperscript{st} Water Supply Forecasts: Upper Colorado River Mainstem

Forecast Ranges & (1-month Trend):

- Granby to Kremmling: 45 - 75% avg (5-15% decrease)
- Kremmling to Cameo: 25 - 60% avg (10-15% decrease)

April-July Volumes (kaf) / % of avg
Majority of runoff comes from upstream headwater basin along the Continental Divide (FPTC2).

FPTC2 Model SWE
Percent of normal SWE for each day & basin zone plotted.

Upstream of Ruedi Reservoir (Fryingpan River headwaters) is one of the few areas that reached near normal SWE this season.

Both evolution plots show impact of significant storms that occurred in early February and mid-March.
## May 1st Water Supply Forecasts: Gunnison, Dolores

### Forecast Ranges & (1-month Trend):

<table>
<thead>
<tr>
<th>Location</th>
<th>April-July Volumes (kaf) / % of avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gunnison</td>
<td>25 - 60% avg (10-20% decrease)</td>
</tr>
<tr>
<td>Dolores</td>
<td>15 - 40% avg (15-25% decrease)</td>
</tr>
</tbody>
</table>

The map visualizes the distribution of water supply forecasts across various locations, with color coding indicating the percentage of average volumes.
May 1st Water Supply Forecasts: San Juan

Forecast Range & (1-month Trend):
25 - 60% of average  (5-15% decrease)
Southwest Colorado Water Supply Forecasts & Snow Conditions

Middle Elevation Model Snow Median: 9,500’-11,000’
Upper Elevation Model Snow: >11,000’
Middle Elevation 2021 Model Snow: 9,500’-11,000’
Upper Elevation Model Snow Median: >11,000’
Beartown SNOTEL: 11,600’
Red Mountain Pass SNOTEL: 11,200’

2021/05/01:
Min 2002: 156.65
Average: 675
Median: 575
Observed Accumulation: 47.4
Observed Total: 57.2
Normal Accumulation: 84.5
ESP: 345
Official 30: 460
Official 30: 400
Official 50: 340
Official 70: 290
Official 90: 240

Lower elevation model snow peak magnitude was near normal but short-lived.

Higher elevation model snow peak was ~80% of normal peak SWE magnitude.

Historical Volumes

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2002</td>
</tr>
<tr>
<td>2</td>
<td>1977</td>
</tr>
<tr>
<td>3</td>
<td>2018</td>
</tr>
<tr>
<td>4</td>
<td>1934</td>
</tr>
<tr>
<td>5</td>
<td>2021</td>
</tr>
</tbody>
</table>
May 1st Water Supply Forecasts: Upper Colorado (Lake Powell)

Lake Powell summarizes the hydrologic conditions throughout the Upper Colorado River Basin.

<table>
<thead>
<tr>
<th>Year</th>
<th>April-July Volume (kaf)</th>
<th>% of avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>946</td>
<td>13%</td>
</tr>
<tr>
<td>1977</td>
<td>1208</td>
<td>17%</td>
</tr>
<tr>
<td>2012</td>
<td>2063</td>
<td>29%</td>
</tr>
<tr>
<td>2013</td>
<td>2558</td>
<td>36%</td>
</tr>
<tr>
<td>2018</td>
<td>2602</td>
<td>36%</td>
</tr>
<tr>
<td>2021 FCST</td>
<td>2000 KAF</td>
<td>28%</td>
</tr>
</tbody>
</table>

2021/05/01:
Min 2002: 963.96
Average: 7160
Median: 6470

ESP is Unregulated and No Precipitation Forecast Included

[Graph showing water levels and forecasts]
Lake Powell Forecast Inflow Distribution

April - July Unregulated Inflow into Lake Powell
As of 2021-05-01

**Average Streamflow Contribution**
- Green: 33.6%
- San Juan: 12.5%
- Colorado: 26.8%
- Cameo: 16.8%
- Other: 10.3%

**May Final Forecast**
- Green: 32.6%
- San Juan: 11.0%
- Colorado: 35.3%
- Cameo: 17.6%
- Other: 3.4%

**Current Forecast:**
- 2000 KAF
- Min. Predictable: 1140 KAF
- Max. Predictable: 3790 KAF

**Historical Data**
- Historical Min (year): 964 KAF (2002)
- Historical Avg: 7160 KAF

Averages are over the 1981 - 2010 period
May 1st Water Supply Forecasts: Virgin River Basin

Forecast Range & (1-month Trend):
15 - 30% avg  (5 - 10% decrease)

Santa Clara
Pine Valley
0.75 / 15%

Virgin-Hurricane
12.2 / 19%

Virgin-Virgin
16.4 / 28%

Virgin-Littlefield
17.3 / 27%

Snow is pretty much gone, about three weeks earlier than normal.
Historical (1981-2010) Forecast Verification

Forecasts are better than just going with average
Error tends to decrease each month into the spring

Where Forecasts are Better:
- Headwaters
- Primarily snow melt basins
- Known diversions / demands

Where Forecasts are Worse:
- Lower elevations (rain or early melt)
- Downstream of diversions / irrigation
- Little is known about diversions / demands

May Forecast Error: April-July Volume

<table>
<thead>
<tr>
<th>Location</th>
<th>Avg May Forecast Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green River - Warren Bridge</td>
<td>12%</td>
</tr>
<tr>
<td>Fontenelle Reservoir</td>
<td>17%</td>
</tr>
<tr>
<td>Yampa River - Deerlodge</td>
<td>15%</td>
</tr>
<tr>
<td>Blue River - Dillon Reservoir</td>
<td>11%</td>
</tr>
<tr>
<td>Colorado River - Cameo</td>
<td>11%</td>
</tr>
<tr>
<td>Blue Mesa Reservoir (Gunnison)</td>
<td>11%</td>
</tr>
<tr>
<td>McPhee Reservoir (Dolores)</td>
<td>12%</td>
</tr>
<tr>
<td>Navajo Reservoir (San Juan)</td>
<td>15%</td>
</tr>
<tr>
<td>Lake Powell</td>
<td>15%</td>
</tr>
</tbody>
</table>
Upcoming Weather: May 7-14 Precipitation Outlook

- Warm and windy today with above normal temperatures expected.
- Storm system will move across Wyoming over the weekend through Monday.
- Cooler temperatures and scattered showers are expected, heaviest over northern Colorado. 0.75-1.25 inches is forecasted over the Upper Colorado headwaters.
Upcoming Weather: 8-14 Day Outlook (May 14-20)

There are slightly elevated odds for below normal precipitation and above normal temperatures. There are currently no signs of a prolonged period of anomalously wet conditions.
Summary

- **April precipitation**
  - Below to much below normal across the region

- **Early May snowpack (SWE) conditions**
  - Below to much below normal
  - Rapid melt has occurred in southern basins.
  - Only significant snow remains at the highest elevations.

- **April Observed Streamflow**
  - Below to much below normal; record low in some areas despite low and mid elevation snowmelt.
  - Reflects extremely dry soils and low baseflow conditions.
  - Slower melt rates recharge baseflow.
  - Higher melt rates have a better chance of producing streamflow.

- **April water supply forecasts (% of normal):**
  - Upper Colorado: 15-75%
  - **Record low April-July volumes are possible in many areas**

- The current weather forecast is not showing any sign of an extended wet period.

- Time has run out for any significant improvements in water supply conditions.
CBRFC Model Snow Plots

Model daily snow water equivalent (SWE) for each basin elevation zone in CBRFC model
- each river point in the model is called a segment
- each segment is broken into 2-3 elevation zones based on similar land cover/vegetation and snow accumulation/melt characteristics
- downstream segments only model the 'local' area below the upstream segment

View total segment areas by turning on ‘Basin’ Boundaries

View segment connections in stick diagrams:
https://www.cbrfc.noaa.gov/wsup/guide/sticks.php

Segment naming convention:
- headwater ends in ‘H’
- local (downstream) ends in ‘L’
Model snow is what drives CBRFC water supply, peak flow and daily streamflow runoff forecasts
- model is able to track snow above and below SNOTEL locations
- very few SNOTEL’s above 11,000 feet, but a large percentage of snowmelt runoff comes from these areas
- just because SNOTEL’s are dry does not mean there is no snow left in a basin

Examples of highest SNOTEL in a basin vs. highest model elevation zone
CBRFC Model Snow Plots

From CBRFC homepage:
- hover over SNOW in top menu
- click on Model Snow in dropdown

From CBRFC default snow map:
- select Model tab in right menu
- Show Points

From Forecast Evolution Plot:
- select Snow from Data listing
Available options:
- Hover over for more information
- See defined elevation ranges and turn off/on under Basin Zone
- See SNOTEL’s used in the segment and turn on/off under Basin SNOTEL
- Select any SNOTEL to plot under All SNOTEL
- Plot a previous Water Year
- Snap Shot - creates an easily downloadable image

● Model snow data/plots are most relevant in headwater basins

● Use cautiously in downstream (local) basins
  ○ model snow only represents the snow within each basin elevation zone of CBRFC hydrologic model
  ○ For downstream/lower elevation basins, it’s likely better to view snow conditions in upstream/higher elevation basins since that’s the more likely source of water/runoff making it downstream

  ■ Assumes users have some hydrologic knowledge within their area of interest

● Lots of development ideas/additions yet to be implemented
## 2021 Water Supply Webinar Schedule

*All Times Mountain Time (MT)*

<table>
<thead>
<tr>
<th>Colorado River Basin</th>
<th>Great Basin</th>
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</thead>
<tbody>
<tr>
<td><strong>Friday</strong></td>
<td><strong>Friday</strong></td>
</tr>
<tr>
<td>Jan 8&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Jan 8&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>10 am</td>
<td>41:30 am</td>
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<tr>
<td><strong>Friday</strong></td>
<td><strong>Friday</strong></td>
</tr>
<tr>
<td>Feb 5&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Feb 5&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>10 am</td>
<td>41:30 am</td>
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<tr>
<td><strong>Friday</strong></td>
<td><strong>Friday</strong></td>
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<td><strong>Wednesday</strong></td>
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<tr>
<td>Apr 7&lt;sup&gt;th&lt;/sup&gt;</td>
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<td>41:30 am</td>
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</table>

Additional briefings scheduled as needed

Webinar schedule & registration information has been posted to the CBRFC web page
CBRFC Contacts & WY21 Basin Focal Points

Michelle Stokes
Hydrologist In Charge

John Lhotak
Development and Operations Hydrologist

Paul Miller
Service Coordination Hydrologist

Cass Goodman
Computer Systems Analyst

Valerie Offutt
Administrative Assistant

Ashley Nielson
Upper Green, Yampa
San Juan, Dolores, Powell

Patrick Kormos
Lower Green, Duchesne
Weber, Provo

Cody Moser
Upper CO Mainstem, Gunnison

Brent Bernard
Bear, Sevier, Six Creeks

Zach Finch
Lower Colorado River Basin

Brenda Alcorn
Senior Hydrologist

Craig Peterson
Senior Hydrometeorologist

Tracy Cox
Hydrometeorologist

CBRFC Webpage
https://www.cbrfc.noaa.gov/

CBRFC Operations
cbrfc.operations@noaa.gov
801-524-4004

CBRFC Water Supply Presentations
https://www.cbrfc.noaa.gov/present/present.php

firstname.lastname@noaa.gov
CBRFC Water Supply Forecast Webinar Schedule & Registration - Water Year 2021
The Colorado Basin River Forecast Center (CBRFC) produces water supply forecasts for the Colorado River Basin and the east CBRFC conducts December through May webinars explaining the forecasts and current conditions.

Follow the links below to register for a webinar.

Early Season Water Supply Outlook Webinar
Thursday Dec 17 @ 1 pm MT

Colorado River Basin Water Supply Webinars
Friday January 8th @ 10 am MT
Friday February 5th @ 10 am MT
Friday March 5th @ 10 am MT
Wednesday April 7th @ 10 am MT
Friday May 7th @ 10 am MT

Utah Water Supply Webinars
Friday January 8th @ 11:30 am MT
Friday February 5th @ 11:30 am MT
Friday March 5th @ 11:30 am MT
Wednesday April 7th @ 11:30 am MT
Friday May 7th @ 11:30 am MT

Peak Flow Webinar
Thursday March 18th @ 10 am MT

A notification email will be sent if a date or time change occurs. Additional webinars are scheduled as needed. The webinar slides will be available from the CBRFC presentations page soon after each briefing.

email cbrfc.webmasters@noaa.gov
subject line: email notification list

This list is used to provide notification when webinars are scheduled, water supply forecasts are updated, and for other news of interest to our stakeholders regarding CBRFC operations.