CBRFC
Water Year 2021
Early Season Water Supply Outlook

December 17, 2020

Cody Moser
Hydrologist

Please mute your microphone until the question period
Observed precipitation over the past several months

Soil moisture conditions entering winter

Current snow conditions

ESP method & water supply forecast evolution plot overview

2021 water supply - early season model guidance

Upcoming weather outlook & ENSO status

2021 water supply webinar schedule

Forecast points of contact
Anomalous ridging dominated the weather pattern from the late spring into the fall across the region.
Near/record dry Apr-Oct precipitation across the region.

35-40 year period of record.
## Water Year 2021
### Oct-Nov Precip Summary

<table>
<thead>
<tr>
<th>Basin</th>
<th>Precip (% Avg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Green</td>
<td>80%</td>
</tr>
<tr>
<td>Duchesne</td>
<td>60%</td>
</tr>
<tr>
<td>Price/San Rafael</td>
<td>50%</td>
</tr>
<tr>
<td>Yampa/White</td>
<td>50%</td>
</tr>
<tr>
<td>Upper CO Mainstem</td>
<td>65%</td>
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<tr>
<td>Gunnison</td>
<td>65%</td>
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<tr>
<td>Dolores</td>
<td>55%</td>
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<tr>
<td>San Juan</td>
<td>70%</td>
</tr>
<tr>
<td>Lake Powell</td>
<td>65%</td>
</tr>
<tr>
<td>Virgin</td>
<td>45%</td>
</tr>
<tr>
<td>Verde</td>
<td>20%</td>
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<tr>
<td>Salt</td>
<td>50%</td>
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<tr>
<td>Little Colorado</td>
<td>45%</td>
</tr>
<tr>
<td>Upper Gila</td>
<td>45%</td>
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<tr>
<td>Bear</td>
<td>70%</td>
</tr>
<tr>
<td>Weber</td>
<td>55%</td>
</tr>
<tr>
<td>Six Creeks</td>
<td>50%</td>
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<tr>
<td>Provo/UT Lake</td>
<td>50%</td>
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</tbody>
</table>
Current soil moisture conditions are worse off than they were a year ago due to near record low April-October 2020 precipitation across the region.

Model soil moisture is generally in the bottom 5 across the Upper Colorado over the 1981-2020 40-year period. The San Juan and Dolores are generally in the bottom 3 with some areas being record dry.
Mid-December Snow Conditions

SNOTEL (Observed)

<table>
<thead>
<tr>
<th>Basin</th>
<th>SWE (% Median)</th>
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<tbody>
<tr>
<td>Upper Green</td>
<td>75%</td>
</tr>
<tr>
<td>Duchesne</td>
<td>70%</td>
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<tr>
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<td>Dolores</td>
<td>75%</td>
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<tr>
<td>San Juan</td>
<td>90%</td>
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<tr>
<td>Lake Powell</td>
<td>70%</td>
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<tr>
<td>Virgin</td>
<td>45%</td>
</tr>
<tr>
<td>Verde</td>
<td>15%</td>
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<tr>
<td>Salt</td>
<td>30%</td>
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<tr>
<td>Little Colorado</td>
<td>20%</td>
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<tr>
<td>Upper Gila</td>
<td>35%</td>
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<tr>
<td>Bear</td>
<td>65%</td>
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<tr>
<td>Weber</td>
<td>60%</td>
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<td>Six Creeks</td>
<td>65%</td>
</tr>
<tr>
<td>Provo/UT Lake</td>
<td>60%</td>
</tr>
</tbody>
</table>

CBRFC (Model)

Dec 17 SWE Summary (SNOTEL)

Prepared by NWS, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov
Mid-December CBRFC Model Snow Conditions - 2019 / 2020 Comparison

WY21 snow season off to a worse start compared to a year ago.

WY21 starting off with widespread much below average soil moisture and SWE conditions.
At this point in time…

- Ideally model soil moisture & snow states are accurate and representative of current conditions.

- ESP model guidance is still heavily influenced by soil moisture.

- Early season forecast errors are generally 20-40% and typically improve through the spring; the primary source of forecast uncertainty is future weather.

- Snowpack - don’t put too much weight into mid-December conditions.
  - Typically around 30-35% of the seasonal snow has occurred by mid-December
  - Historical median (or normal) snowpack values are still small compared to later in the season
Ensemble Streamflow Prediction (ESP) Overview

ESP Methodology:
- current hydrologic model states (soil moisture, snow) + future weather (precip/temp) scenarios based on historical (1981-2015) observations = April-July streamflow volume

Example: Dillon Reservoir (Inflow)

2021 current model states + 1981 weather = 77 kaf (thousand acre-feet)
2021 current model states + 1982 weather = 141 kaf
2021 current model states + 1983 weather = 166 kaf
...
2021 current model states + 2015 weather = 148 kaf

Final result is 35 different possibilities of April-July streamflow volume
- use statistical analysis to determine probabilistic outcomes:
  - volume that has 50% chance of occurring (most probable) = 112 kaf
  - volume that has 10% chance of occurring (less likely) = 172 kaf
  - volume that has 90% chance of occurring (more likely) = 70 kaf

*Updated Daily
Water Supply Forecast Evolution Plot Overview

Daily ESP Model Guidance

10% (wetter future weather scenario)

90% (drier future weather scenario)

Colorado - Lake Powell, Glen Cyn Dam, At (GLDA3)
Period: Apr-Jul, ESP 50% Forecast (2020-12-17): 3680 kaf (51% Average, 57% Median)
ESP is Unregulated and No Precipitation Forecast Included

Max 1984: 15316.11
Min 2002: 963.96
Average: 7160
Median: 6470
ESP: 3680

50% (Most Probable)
Lake Powell summarizes the hydrologic conditions throughout the Upper Colorado River Basin.

April-July Runoff Volumes
% of 1981-2010 Average

- White/Yampa: 60-85%
- Upper CO: 65-80%
- Gunnison: 45-80%
- Dolores: 50-65%
- San Juan: 50-85%
- San Rafael/Dirty Devel: 40-55%
- Lower Green: 40-55%
- Duchesne/Price: 35-65%
- Upper Green: 60-75%
- Lake Powell: 50%

Dec 17 / 0qpf
**ESP Model Guidance: Sevier, Virgin, Lower Colorado**

**Sevier & Virgin**
April-July Runoff Volumes
% of 1981-2010 **Average**

- Sevier: 10-80%
- Virgin: 35-50%

**Lower Colorado**
January-May Runoff Volumes
% of 1981-2010 **Median**

- Lower Colorado: 30-40%
- Verde: 70%
- Salt: 35-50%
- Upper Gila: 45-65%

Dec 17 / 0qpf
ESP Model Guidance: Great Basin

April-July Runoff Volumes
% of 1981-2010 Average

Provo/Utah Lake: 35-70%

Bear: 40-80%

Weber: 45-65%

Six Creeks: 35-60%

Provo/Utah Lake: 35-70%
A storm system will move across the Upper Basin today/tomorrow with 1-1.5 inches of precip over the mountains of northern Utah and Wyoming.

Ridging/dry conditions return by this weekend and persist through much of next week.

Unfortunately, the heaviest amounts over the next 7 days are across the Pacific Northwest and outside our area.
Upcoming Weather: 8-14 Day Outlook (December 24-30)

Increased probability of below average precipitation with enhanced ridging across the Intermountain West. Would expect ESP volume guidance to decrease slightly at most points through the end of the year.
La Niña is likely to continue through the Northern Hemisphere winter 2020-21 (~95% chance during January-March), with a potential transition during the spring 2021 (~50% chance of Neutral during April-June).

- Increased chances of drier winter weather in Arizona/LCRB
- Much weaker correlation/winter weather signal elsewhere in basin
Best odds of below normal precipitation is across the Lower Basin, especially Arizona. Much of the Upper Basin has equal chances for above and below normal precipitation.
Summary

● Near/record dry April-October 2020 period across the majority of the Colorado River/Great Basins

● Near/record low antecedent soil moisture conditions entering the water year 2021 snow accumulation & runoff season

● Slow start to the snow season
  ○ Current snowpack (SWE) conditions are below to well below normal across the majority of the region

● Current storm system having a positive impact to northern Utah/Great Basin and Upper Green water supply outlook

● Increased chances of below average precipitation for remainder of December across the region
  ○ ESP volume guidance expected to decrease between now and Jan 1

● Increased chances of drier winter weather in Arizona/LCRB due to La Niña conditions

● Most likely going to need above average snowpack to see near average water supply volumes given the dry conditions. Spring weather always a factor.
ESP model guidance is now available on our website (forecast evolution plots).
  - Water supply forecasts are issued starting early January
  - Peak flow forecasts issued 2x/month starting early March

Currently, soil moisture states (also represented by baseflow) in the model have a larger influence on hydrologic guidance compared to later in the season.

As we progress into the winter, snowpack conditions will have a larger impact on forecasts in the Upper Colorado and Great Basins.

Winter rain events will have largest impacts on Lower Colorado River Basin forecasts.
2021 Water Supply Webinar Schedule

*All Times Mountain Time (MT)

<table>
<thead>
<tr>
<th>Colorado River Basin</th>
<th>Great Basin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friday Jan 8&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Friday Jan 8&lt;sup&gt;th&lt;/sup&gt; 11:30 am</td>
</tr>
<tr>
<td>Friday Feb 5&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Friday Feb 5&lt;sup&gt;th&lt;/sup&gt; 11:30 am</td>
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<tr>
<td>Friday Mar 5&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Friday Mar 5&lt;sup&gt;th&lt;/sup&gt; 11:30 am</td>
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<tr>
<td>Wednesday Apr 7&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Wednesday Apr 7&lt;sup&gt;th&lt;/sup&gt; 11:30 am</td>
</tr>
<tr>
<td>Friday May 7&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Friday May 7&lt;sup&gt;th&lt;/sup&gt; 11:30 am</td>
</tr>
</tbody>
</table>

Peak flow forecast webinar Thursday, March 18<sup>th</sup>, 10 am MT

Additional briefings scheduled as needed

Webinar schedule & registration information has been posted to the CBRFC web page
CBRFC Webinar Registration & Email List

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.
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

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CBRFC Water Supply Presentations
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