Colorado Basin Water Supply Briefing

February 7 2018

Greg Smith - Sr. Hydrologist
Colorado Basin River Forecast Center

Phone: 1-877-929-0660
Passcode: 1706374

Please mute your phone until the question period
January weather – Mild and Dry, Again!

Current Snowpack Conditions - Record Low in Some Areas

2018 Water Supply Forecasts – February Update

Select Forecast Site Review – Any Chance to get to Average?

February Forecast Error – Much Improvement Over January?

Upcoming Weather – Below Average Precipitation Again in February?

Contacts & Questions

Phone: 1-877-929-0660  Passcode: 1706374

* Please mute your phone until the question period *
Early January storm system brought widespread (but light) precipitation amounts.
Early January storm system
January weather

Mean Atmospheric Pattern
January 2018

Mean high pressure in the west

Strong persistent Low in the east

Phone: 1-877-929-0660
Passcode: 1706374
January / Water Year Precipitation

Greatest impacts

Missing out on storms
January / Water Year Precipitation – primary contributing areas

Monthly Precipitation - January 2018
(Averaged by Basin)

Water Year Precipitation, October 2017 - January 2018
(Averaged by Basin)
Fall / Early Winter – Dry pattern becomes established and is persistent

Mean Atmospheric Pattern
Nov 15 – Nov 30

Dry conditions as a strong high pressure ridge becomes dominant feature over western U.S. / Pacific.

Mean Atmospheric Pattern
Dec 1 – Dec 31

Blocking high pressure ridge firmly established – strong Hudson Bay low
Snow Conditions – Just How Dry Has This Season Been?

SWE historical Rankings

January 8th 2018

Red – Lowest on record
Orange - Many in bottom 3 of record

February 6th 2018
Dry seasons have happened in the past (1990, 2002, 1977 etc.)

Previously 1976/77 winter was referenced because it stands out as one of the lowest snow years. There were also some similarities in the late fall / early winter atmospheric pattern. Many record low flows were established in 1977 or 2002.
Minimum snow ranking (pre-SNOTEL sites, various period of records, Min 45 years)

1977 Snow Ranking

2018 Snow Ranking

Areas impacted by storms rounding periphery of ridge

Very dry to the south & west
Comparing the January patterns.

Similarities in large scale features but some subtle differences as we get into January.

Location of ridge axis – strength of ridge – Pacific Ocean features
Comparing the January patterns.

January 1977: Greater amplified ridge/trough developed the 2\textsuperscript{nd} half of January and persisted through February.

January 2018: High pressure ridge remains dominant player but the pattern has recently become more progressive in a northwest flow.
Snow Conditions – SNOTEL Snow Water Equivalent (1981-2010 % of median)

January 8th 2018

February 6th 2018
Snow Condition (as represented in the hydrologic model)
Soil Moisture Impacts (entering winter, prior to the onset of snow)

Where snowpack conditions and soil moisture show the same signal
Below average precipitation dates back to August

Any precipitation events are unlikely to produce significant runoff initially

Snowmelt likely absorbed into the soil
Upper Colorado: Green-Yampa-White-Duchesne

Forecasts as of Feb 1 2018

Volume 1000's acre feet / % of 1981-2010 average

Green-Warren Bridge 275 / 112%
Fontenelle 750 / 103%
Yampa-Deerlodge 790 / 64%
Flaming Gorge 890 / 91%
Little Snake-Lily 185 / 54%
Duchesne-Randlett 154 / 40%
White-Watson 158 / 56%
Elk-Milner 245 / 77%

Forecast range: ~ 30%-110% average
Decrease of 0 to 12% of average
Upper Colorado: Colorado River Mainstem

Forecasts as of Feb 1 2018
Volume in 1000’s acre-feet / % of 1981-2010 average

Forecast range: ~ 35%-85% average
Decrease of 0-6 % of average

- Plateau Ck - Cameo: 45/ 36%
- Colorado-Cameo: 1620/ 69%
- Eagle-Gypsum: 1030/ 74%
- Williams Fork Res: 80/ 83%
- Ruedi Res: 93 / 67%
- Dillon Res: 140 / 86%
- Granby Res: 180/ 82%
- Roaring Fork-Glenwood: 450 / 65%
Upper Colorado: Gunnison and Dolores Basins

Forecasts as of Feb 1 2018

Volume in 1000’s acre-feet / % of 1981-2010 average

Forecast range: ~ 25%-75% average
Decrease of 0 to 15% of average
Upper Colorado: San Juan Basin

Forecasts as of Feb 1 2018
Volume in 1000’s acre-feet / % of 1981-2010 average

- San Juan-Bluff: 340 / 31%
- Animas-Durango: 165 / 40%
- Vallecito Res: 75 / 39%
- Lemon Res: 18 / 33%
- San Juan-Farmington: 370 / 34%
- Mancos-Mancos: 10 / 32%
- Navajo Res: 260 / 35%
- San Juan-Carracas: 175 / 46%

Forecast range: ~ 30%-45% average
Decrease of 8-17 % of average
Upper Colorado April-July Streamflow Volume Forecasts (% of 1981-2010 average)

Forecast as of Feb 1 2018

Lake Powell: 3400 KAF / 47% average

Decrease of 7% of average
Lower Colorado (Virgin River) April-July Streamflow Volume Forecasts

Forecasts as of Feb 1 2018

- Santa Clara – Pine Valley: 1.6 / 32%
- Virgin - Virgin: 28 / 48%

Forecast range:
~ 25%-50% average
~45-70% median
Decrease of 0-3% of average
Lower Colorado Feb-May forecast streamflow volumes
(1000’s acre-feet / % of 1981-2010 median)

Forecasts as of Feb 1 2018

- Verde-Horseshoe: 64 / 47%
- Chevelon Ck-Winslow: 1.5 / 11%
- Salt-Roosevelt: 69 / 24%
- San Francisco-Glenwood: 5.8 / 32%
- Little Co.-Lyman*: 1.5 / 23%
- Gila-Gila: 12.9 / 26%

Forecast range: ~ 8%-50% median

* Feb-June forecast period
Forecast Evolution Plot: Fontenelle Reservoir Inflow

Forecast: 103% of average

Water Supply Forecast

Green - Fontenelle Res, Fontenelle Nr (GBRW4)
Period: Apr-Jul, Official 50% Forecast (2018-02-01): 750 kaf (103% Average, 115% Median)
ESP is Unregulated and No Precipitation Forecast Included

1800
1600
1400
1200
1000
800
600
400
200
0


Jan 1 Fcst Feb 1 Fcst

50% exceedance forecast (the “official” forecast)

70% chance above the historical median

2018/02/02:
Max 1986: 1682.87
Min 1977: 213.31
Average: 725
Median: 650
ESP: 723

Official 10: 1100
Official 30: 870
Official 50: 750
Official 70: 670
Official 90: 530
Forecast Evolution Plot: Yampa River @ Deerlodge

Forecast 64% of average

Water Supply Forecast

Yampa - Deerlodge Park (YDLC2)
Period: Apr-Jul, Official 50% Forecast (2018-02-01): 790 kaf (64% Average, 68% Median)
ESP is Unregulated and No Precipitation Forecast Included

Model calibration period is 1981-2015
We use climatology from those 35 years going forward from today
35 possible runoff scenarios
Median of those 35 scenarios is the 50% exceedance value

Less than 10% chance of reaching average

2018/02/01:
Max 2011: 2860.52
Min 2002: 366.16
Average: 1240
Median: 1170
ESP: 777
Official 10: 1150
Official 30: 900
Official 50: 790
Official 70: 610
Official 90: 440
Forecast Evolution Plot: Dillon Reservoir Inflow

Forecast 86% of average

Water Supply Forecast

Blue - Dillon Res (DIRC2)
Period: Apr-Jul, Official 50% Forecast (2018-02-01): 140 kaf (86% Average, 88% Median)
ESP is Unregulated and No Precipitation Forecast Included

About a 30% chance of reaching average

Future weather

Wetter scenario

Drier scenario

2018/02/01:
Max 1984: 275.99
Min 2002: 54.07
Average: 163
Median: 159
ESP: 142
Official 10: 188
Official 30: 160
Official 50: 140
Official 70: 120
Official 90: 94
Forecast Evolution Plot: Blue Mesa Reservoir Inflow

Forecast 59% of average

Select probability traces on the plot menu
Blue Mesa Reservoir Inflow – What happened in those max/min years.

You might ask: Why doesn’t a 2002 scenario from this point on end up as a record minimum?

- Current conditions matter (2002 had lower base flow and soil moisture entering season)
- Model forecast error in February is higher than in future months
Forecast Evolution Plot: Navajo Reservoir Inflow

Forecast 35% of average

The maximum forecast trace is 518 KAF (70% of average)
The minimum forecast trace is 109 KAF (15% of average)
Forecast Evolution Plot: McPhee Reservoir Inflow

Forecast 37% of average

Water Supply Forecast

Dolores - Mcphee Res (MPHC2)
Period: Apr-Jul, Official 50% Forecast (2018-02-01): 110 kaf (37% Average, 44% Median)
ESP is Unregulated and No Precipitation Forecast Included

2018/02/01:
Max 1993: 519.12
Min 2002: 45.16
Average: 295
Median: 250
ESP max: 258
ESP 10: 191
ESP 30: 128
ESP 50: 108
ESP 70: 91.4
ESP 90: 66.4
ESP min: 42.6
Official 10: 200
Official 30: 155
Official 50: 110
Official 70: 86
Official 90: 61

Less than 3% chance of reaching average runoff

Assumes climatology (normal conditions) into future
Forecast Evolution Plot: Lake Powell Inflow

47% of Average

Current forecast is 7th lowest in 54 years of record

Water Supply Forecast

Colorado - Lake Powell, Glen Cyn Dam, At (GLDA3)
Period: Apr-Jul, Official 50% Forecast (2018-02-01): 3400 kaf (47% Average, 53% Median)
ESP is Unregulated and No Precipitation Forecast Included

Less than 10% chance of reaching average

2018/02/01:
Max 1984: 15316.11
Min 2002: 963.96
Average: 7160
Median: 6470
ESP: 3390
Official 10: 6200
Official 30: 4200
Official 50: 3400
Official 70: 2750
Official 90: 1950
Forecast Validation: Historical model error improves January to February

Historical Model Error 1981-2010

Generally improvement in model mean absolute forecast error between January and February

Forecasts are better than just going with average

Error tends to decrease each month into the spring

Where We Do Better:
- Headwaters
  - Primarily snow melt basins
  - Known diversions / demands

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

% Model Error for January to February for April-July Forecast

- Green-Warren Bridge: Jan: 19% Feb: 15%
- Yampa-Deerlodge: Jan: 27% Feb: 25%
- Lake Powell: Jan: 27% Feb: 24%
- Blue Mesa: Jan: 23% Feb: 20%
- Blue – Dillon: Jan: 16% Feb: 17%
- Navajo: Jan: 25% Feb: 22%
Upcoming Weather: Current Pattern as of Today

This Morning
Feb 7th 2018

Strong High Pressure

Northwest Flow
Upcoming Weather: Weak storms in a northwest flow may impact the upper Green River Basin (Wyoming).
Upcoming Weather: Light precipitation amounts possible along the eastern boundary, high elevation headwater areas, of the CBRFC Forecast area.

Sat Feb 10th

Only light precipitation amounts are likely
Upcoming Weather: Another storm system drops southward. The model splits and weakens the storm system. Precipitation amounts likely to be light.

Tue Feb 13th

Weakening and splitting storm system in northwest flow
Upcoming Weather: Models have been struggling with a scenario of developing a closed low pressure over southern California. Confidence is quite low at this time.

Wed Feb 14th

This scenario would result in a very weak system with light precipitation amounts possible over the southwest.
Upcoming Weather: Not much change 10 days out with a northwest flow over the area. Ridge. The ridge axis has shifted east. This would decrease precipitation chances.

Sat Feb 17th

Strong High Pressure has shifted slightly east in this forecast scenario
Upcoming Weather
NWS Weather Prediction Center: Precipitation Forecast Feb 7 – Feb 14

Greatest precipitation impacts are likely over the same areas that have seen it all winter.
Upcoming Weather and Impacts to Water Supply Forecasts

NWS Climate Prediction Center: Temperatures & Precipitation probability Feb 14- Feb 20

Temperature Probabilities

Precipitation Probabilities
Long Range Weather Outlook: Storm systems appear weak at best as they encounter and move around the high pressure ridge. Models are inconsistent so confidence is low.

Weak storms and light precipitation in this scenario
The Dry fall and early winter continued into January with below average precipitation.

Outside of the upper Green headwaters in Wyoming and eastern Colorado River mainstem headwaters, the snow situation is pretty grim. The worst conditions are in the San Juan, Dolores, parts of the Gunnison, and from central/southern Utah into the Lower Colorado Basin of Arizona and New Mexico.

Soil moisture and snowpack signals are both on the positive (wet) side in the northern Green headwaters. The signals are negative (dry) in southwest Colorado (Dolores / western San Juan Basin) and the Lower Colorado River Basin.

Forecasts decreased everywhere from those issued in January except for some sites in the upper Green and Colorado River headwaters. Largest decrease were in parts of the Duchesne, parts of the Gunnison, Dolores, and San Juan Basins.

Generally less than 30 percent of median runoff is anticipated for Feb-May in the Lower Colorado River Basin.

Long term our official forecast uses average conditions (climatology). A wet month in the future mix would result in some rebound in water supply forecasts but reaching near average runoff would take abnormally wet spring conditions in many areas.
2018 monthly water supply briefings for the Colorado Basin

Wednesday Mar 7th @ 11 am MT
Thursday Apr 5th @ 11 am MT
Monday May 7th @ 11 am MT

Great Basin webinars are same dates at 1:30 pm MT (there is one today)

Peak flow briefing early March. Additional briefings scheduled as needed.

Date/Times are subject to change. All registration information has been posted to the CBRFC web page.
CBRFC Water Supply Contacts

Please contact us with any questions

Michelle Stokes – Hydrologist In Charge
michelle.stokes@noaa.gov

Paul Miller– Service Coordination Hydrologist
paul.miller@noaa.gov

Basin Focal Points (Forecasters)

Greg Smith – San Juan, Gunnison, Dolores Focal Point
greg.smith@noaa.gov

Ashley Nielson – Green River Basin, Lake Powell Focal Point
ashley.nielson@noaa.gov

Cody Moser – Upper Colorado Mainstem Focal Point
cody.moser@noaa.gov

Tracy Cox and Zach Finch – Lower Colorado Basin, Virgin Focal Point
tracy.cox@noaa.gov
zach.finch@noaa.gov

Brent Bernard – Six Creeks, Provo, Sevier Focal Point
brent.bernard@noaa.gov

Patrick Kormos – Bear, Weber Focal Point
patrick.kormos@noaa.gov