BUREAU OF RECLAMATION

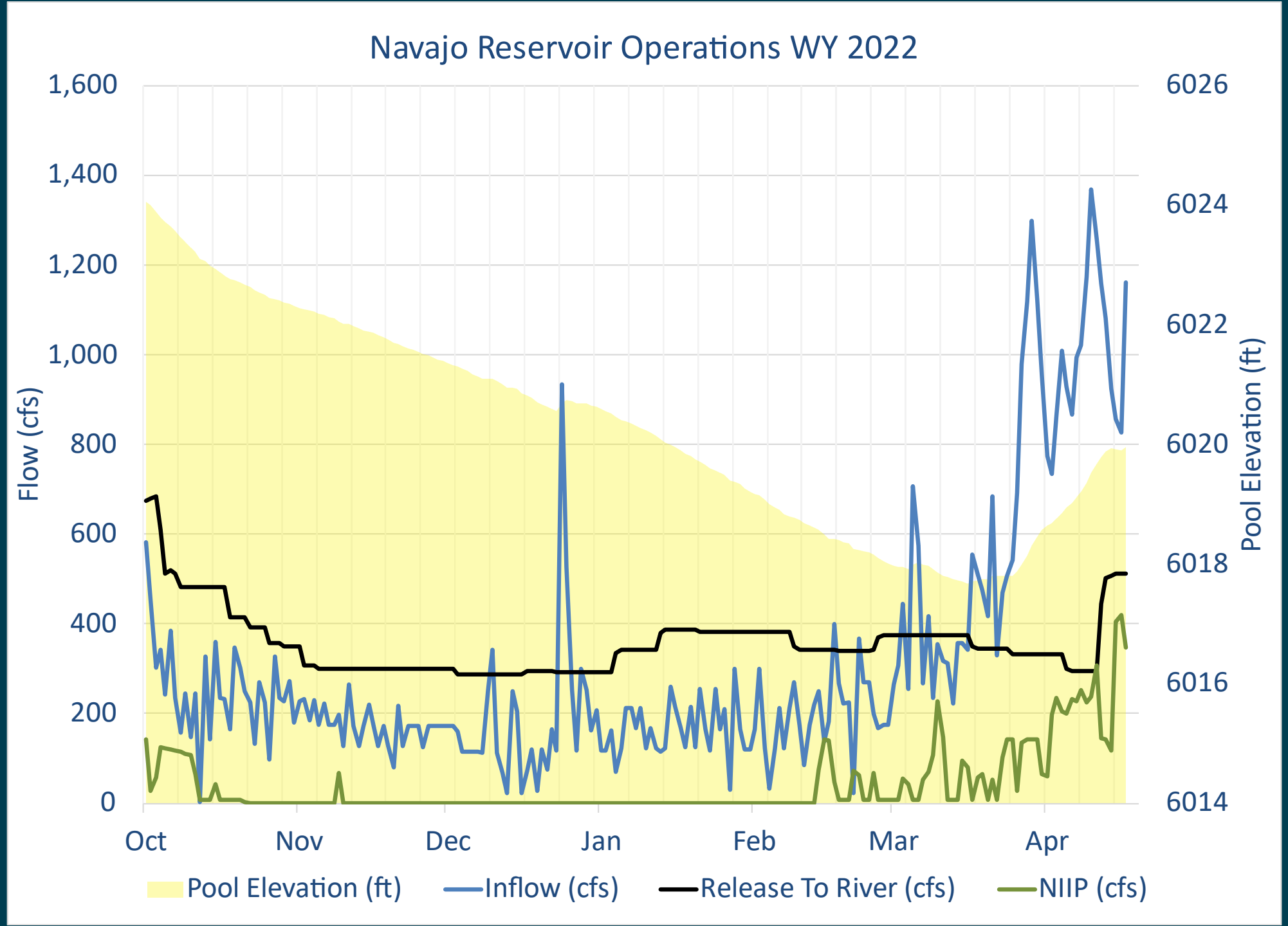
Navajo Unit Operations Coordination Meeting

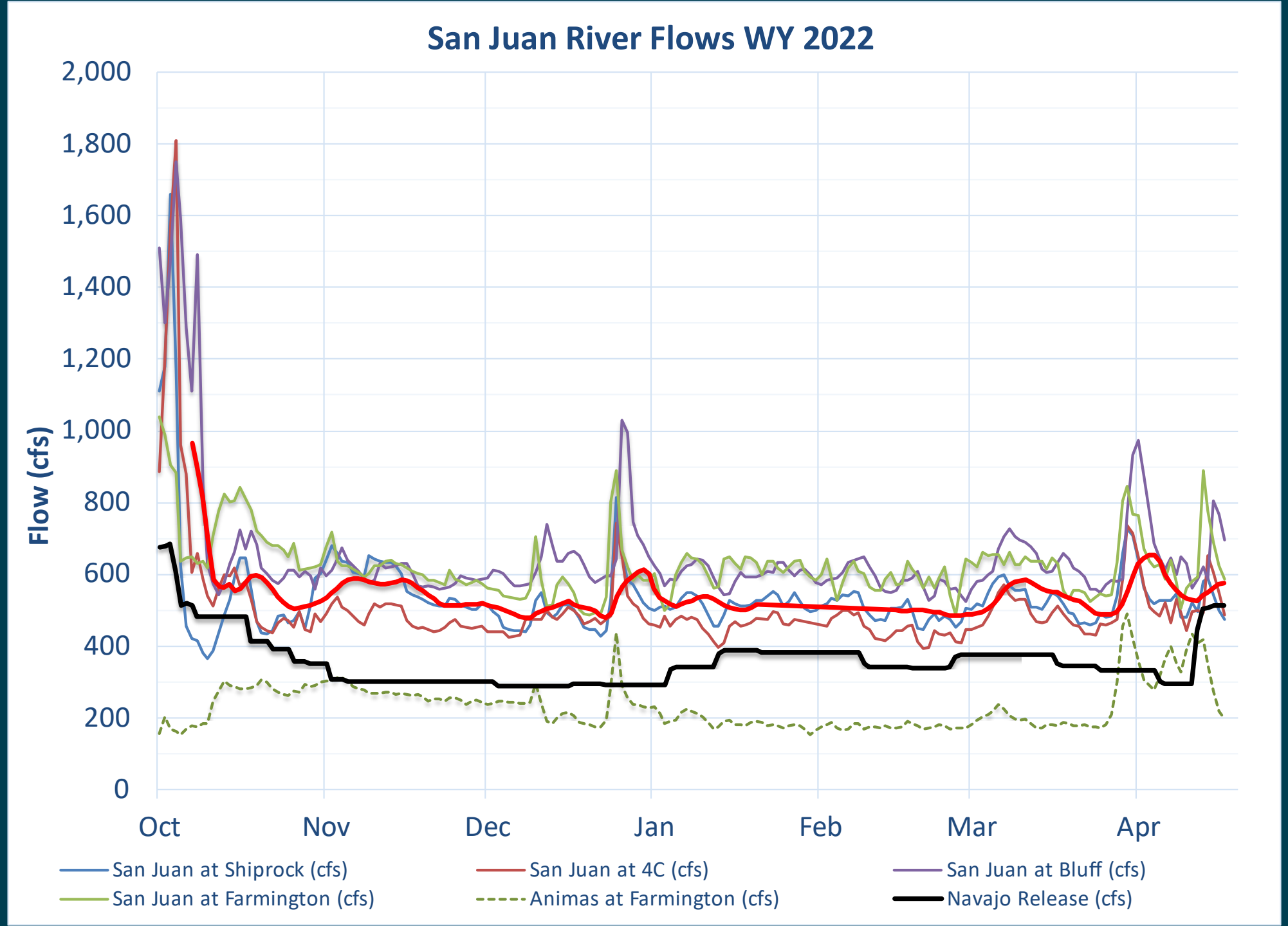
April 19th, 2022 1:00 PM

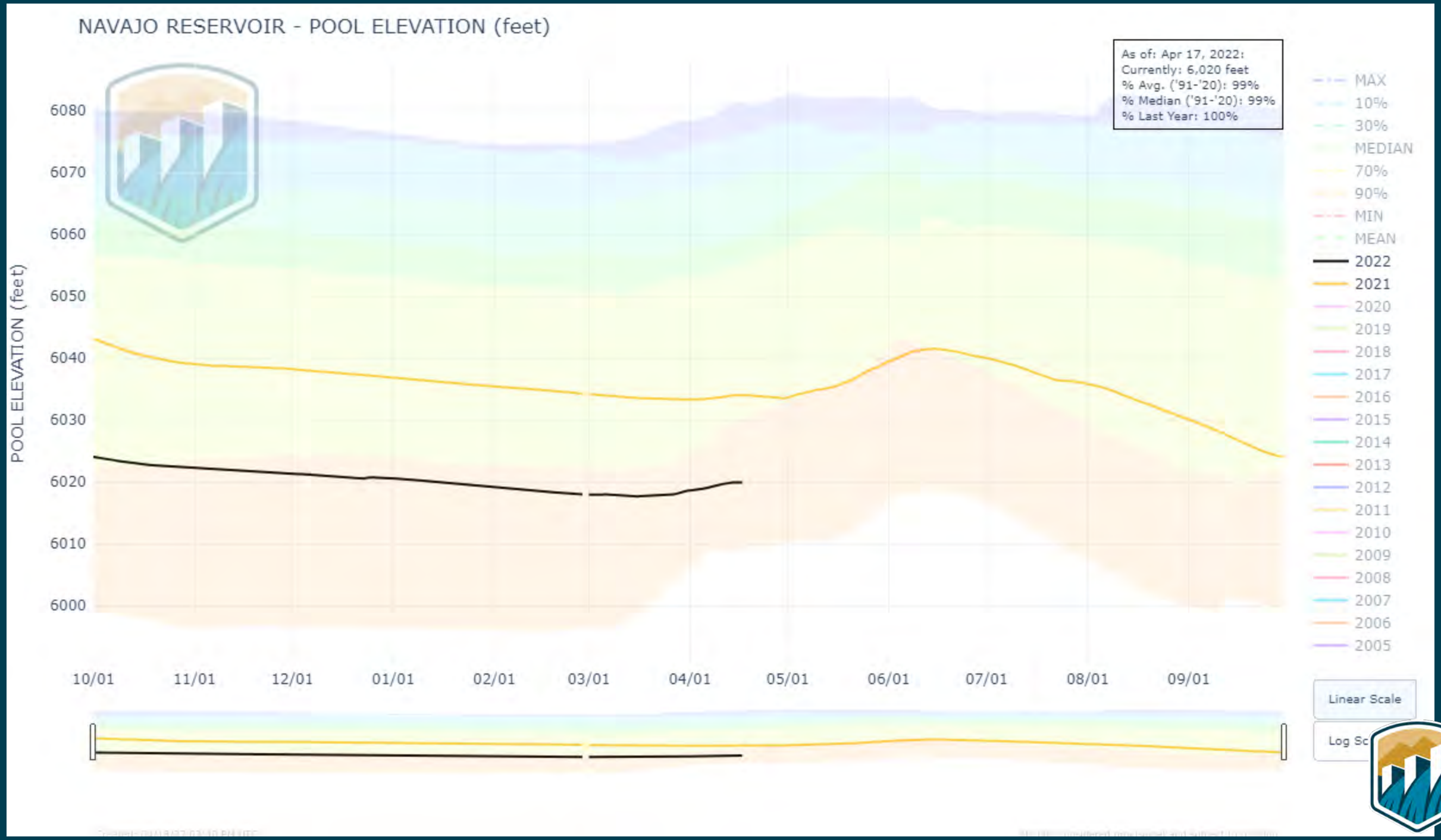
Microsoft Teams Virtual Meeting

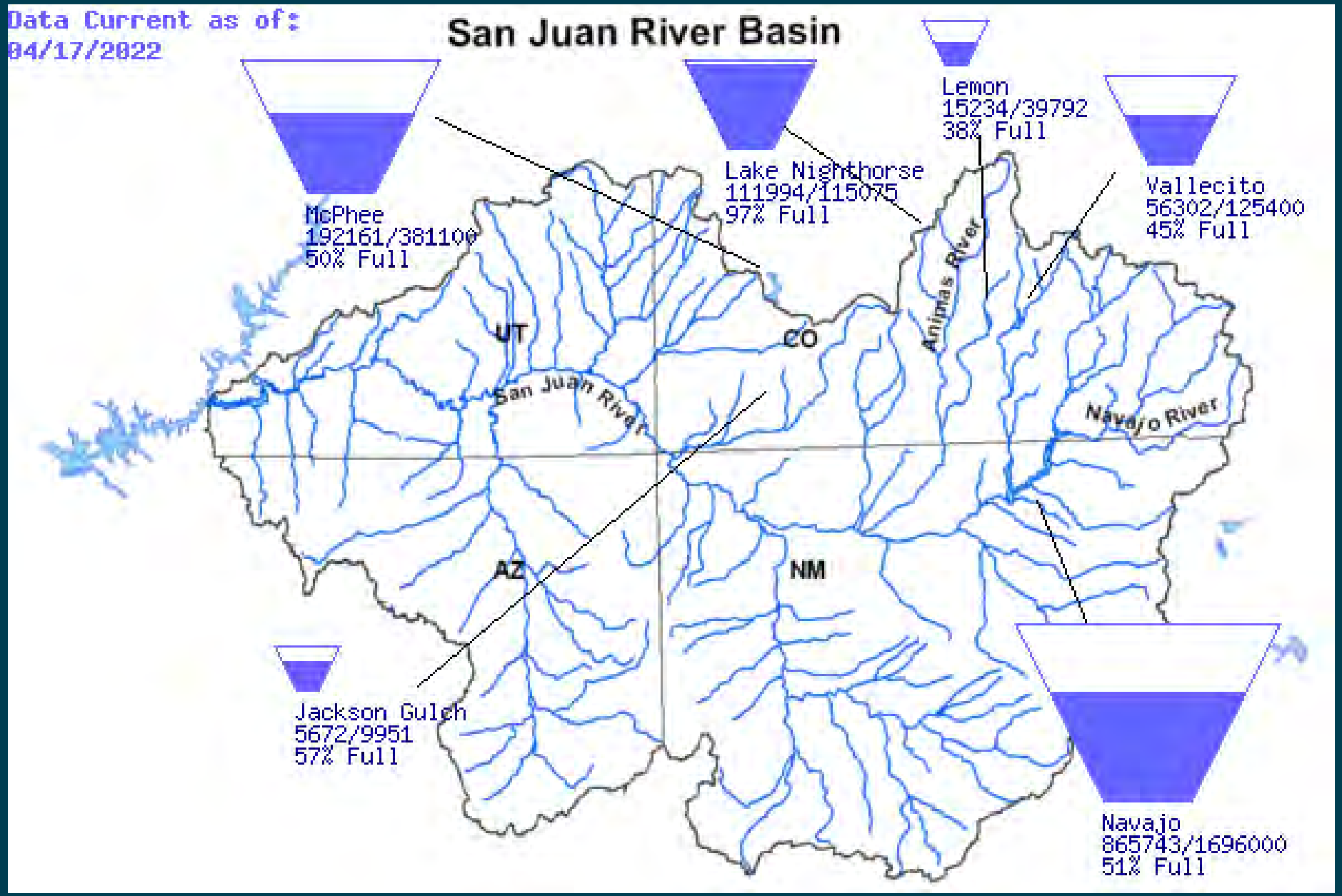
Agenda

- Introductions
- Review of operations to date WY 2022
- Weather Summary and Outlook – Aldis Strautins, NWS
- Streamflow Summary and Outlook – Ashley Nielson, CBRFC
- WY 2022 proposed operations
- Drought Response Operations Update
- Comments and Reports

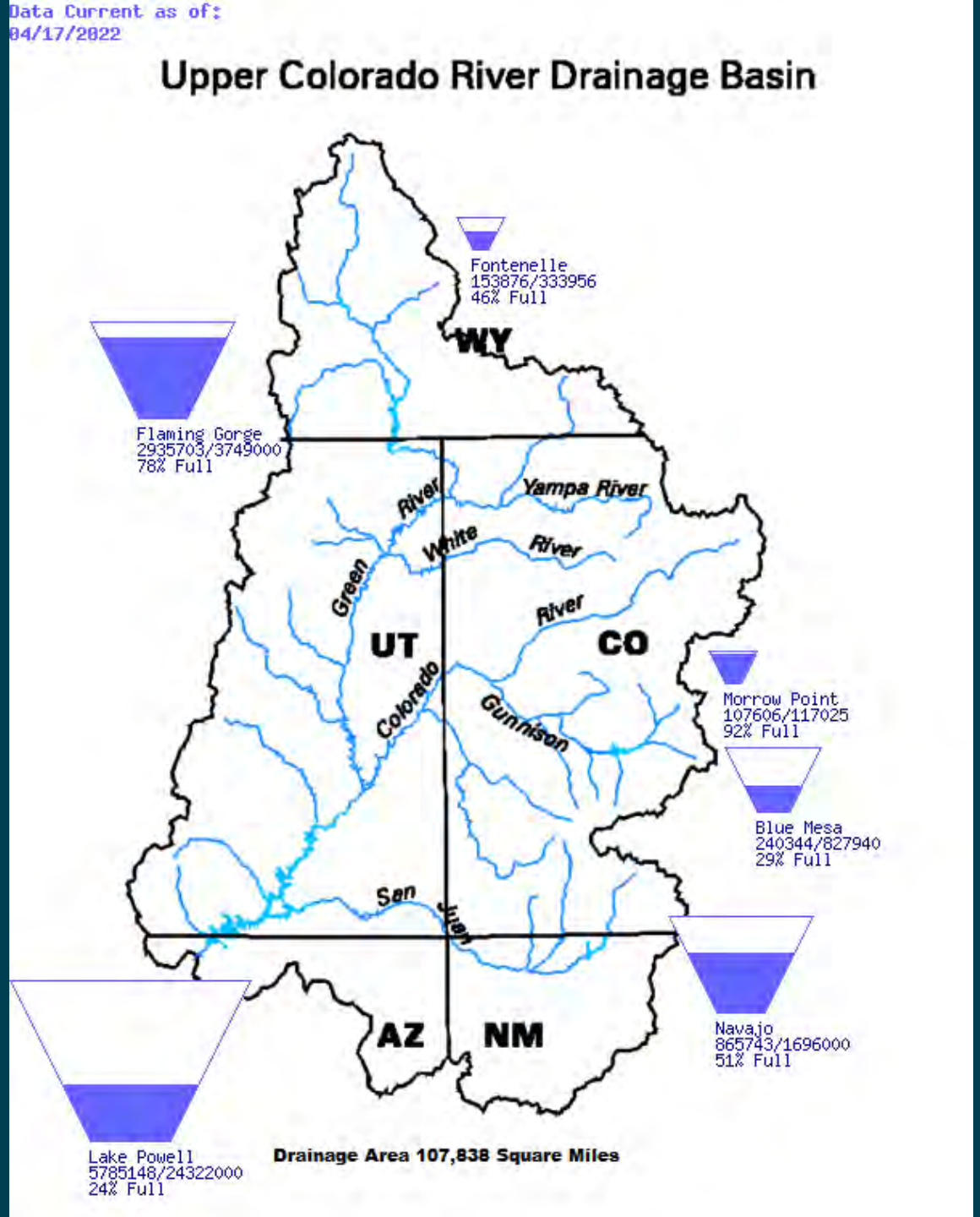

Navajo Reservoir Operations WY 2022
1,600
1,400
1,200
1,000
800
600
400
200
0
Flow (cfs)
6026
6024
6022
6020
6018
6016
6014
Pool Elevation (ft)
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Pool Elevation (ft)
Inflow (cfs)
Release To River (cfs)
NIIP (cfs)


San Juan River Flows WY 2022
Flow (cfs)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
San Juan at Shiprock (cfs)
San Juan at 4C (cfs)
San Juan at Bluff (cfs)
San Juan at Farmington (cfs)
Animas at Farmington (cfs)
Navajo Release (cfs)


NAVAJO RESERVOIR - POOL ELEVATION (feet)
As of: Apr 17, 2022:
Currently: 6,020 feet
% Avg. ('91-'20): 99%
% Median ('91-'20): 99%
% Last Year: 100%
POOL ELEVATION (feet)
6080
6070
6060
6050
6040
6030
6020
6010
6000
10/01
11/01
12/01
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
MAX
10%
30%
MEDIAN
70%
90%
MIN
MEAN
2022
2021
2020
2019
2018
2017
2016
2015
2014
2013
2012
2011
2010
2009
2008
2007
2006
2005
Linear Scale
Log Sc



Reclamation Teacup Diagrams
https://www.usbr.gov/uc/water/basin/index.html



Reclamation Teacup Diagrams
https://www.usbr.gov/uc/water/basin/index.html

Weather Outlook

Aldis Strautins

National Weather Service

Grand Junction, CO

http://www.weather.gov/gjt

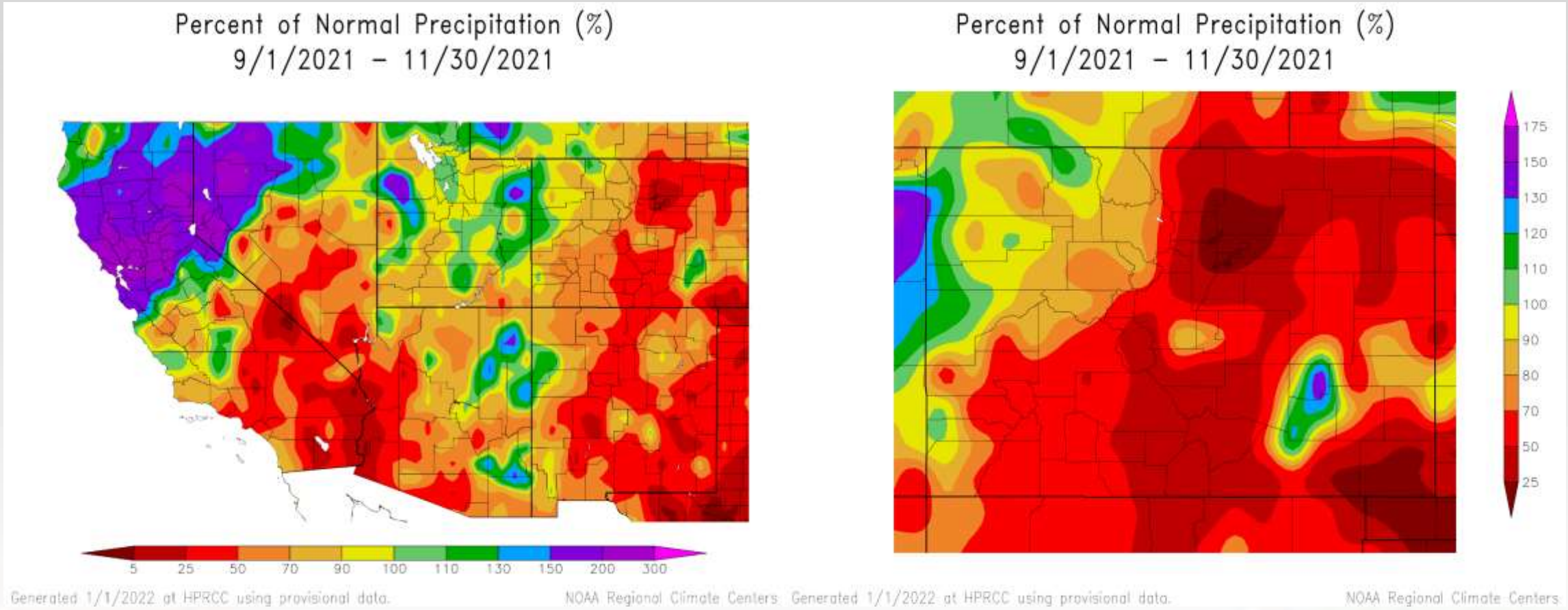
Outline

- Precipitation and Temperature
- Snow Water Equivalent
- Drought
- ENSO
- Weather outlook

Sep – Nov, 2021 - Precipitation

(percent of normal)

Dry fall for three quarters of the western slope going into the winter season

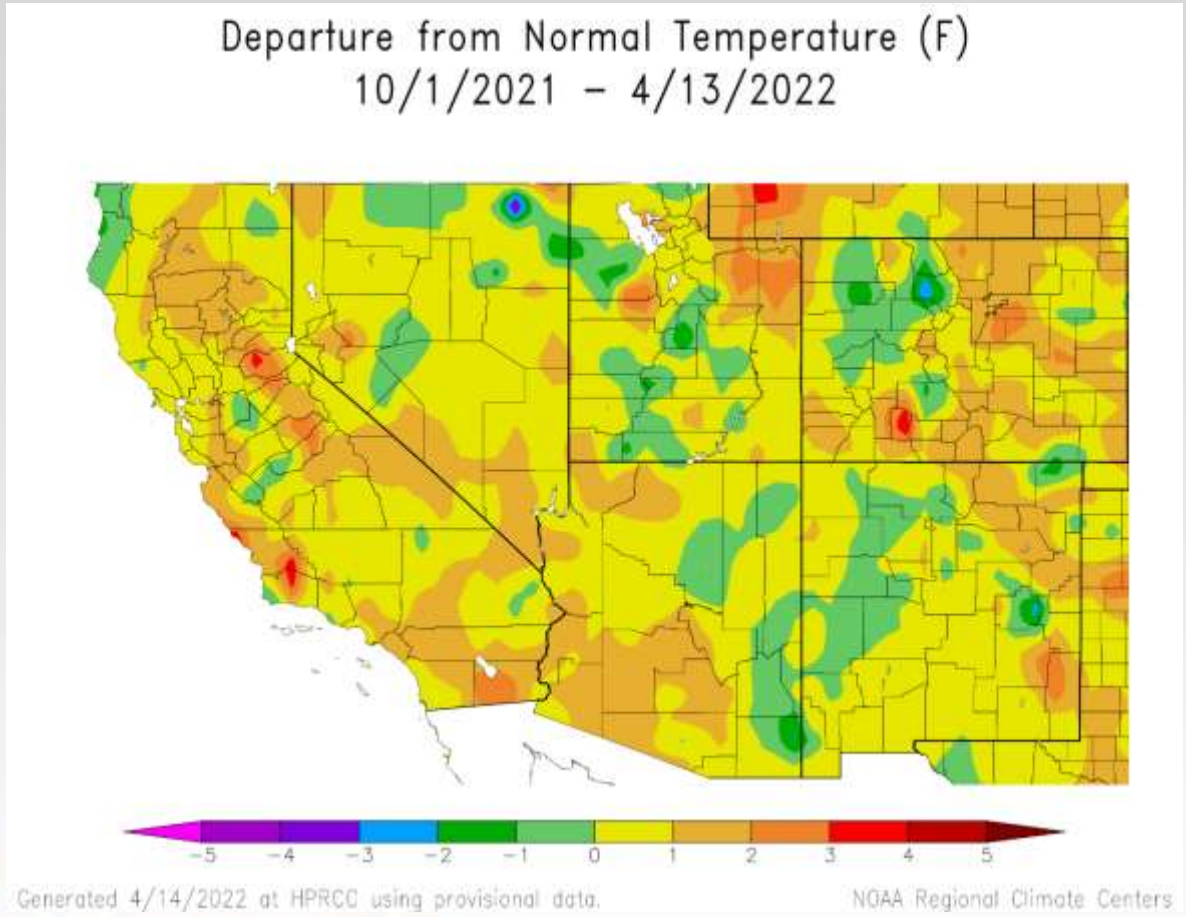


Water Year 2022 through mid April

April 2022

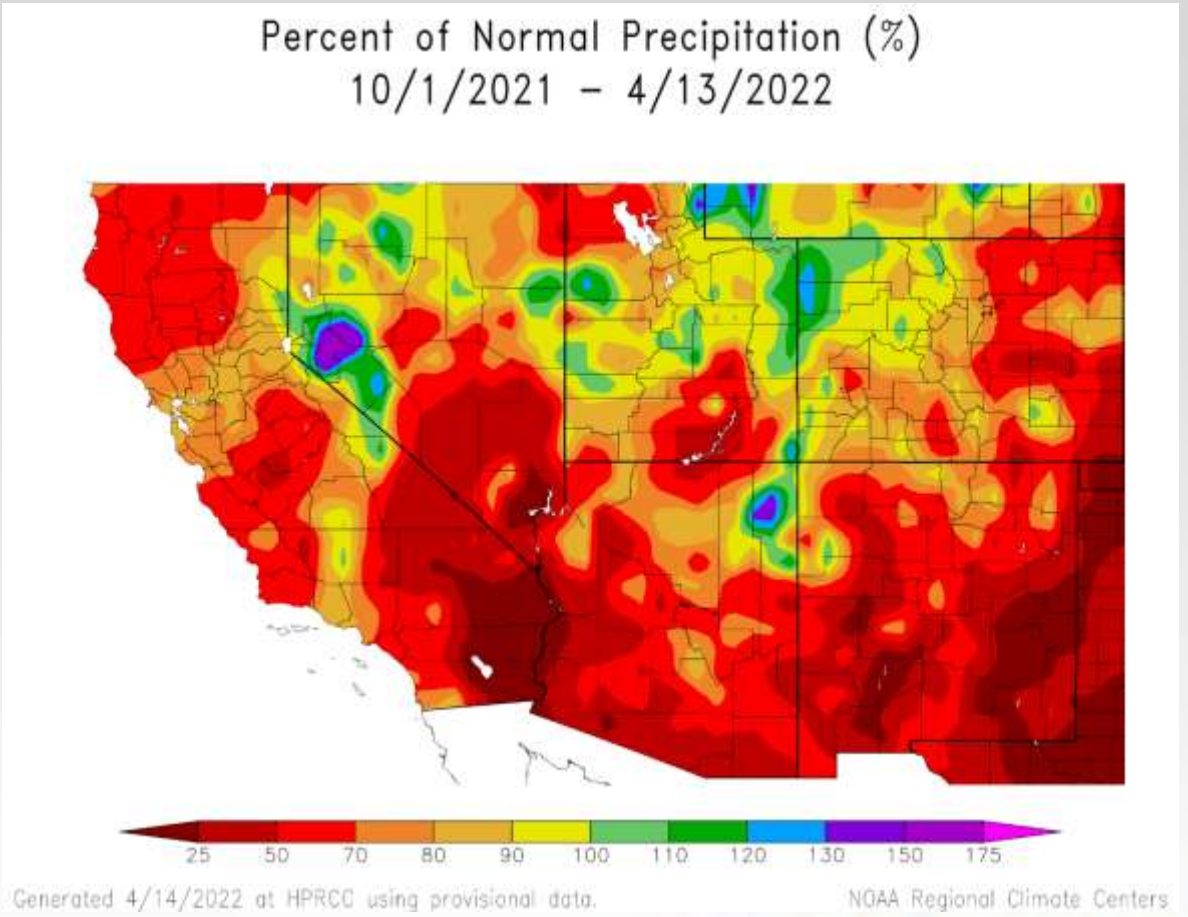
Temperature

Departure from normal



Precipitation

% of normal



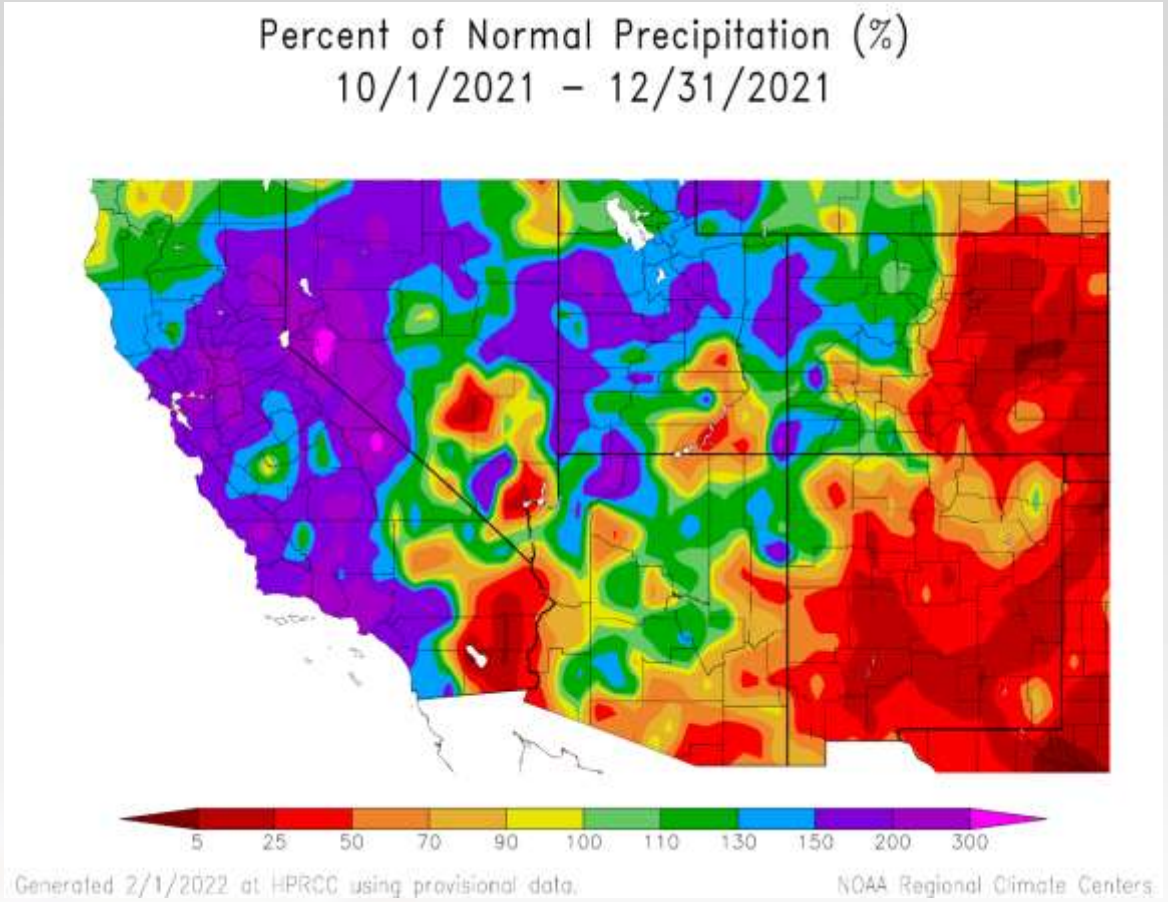
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

National Weather Service
Grand Junction, Colorado

Water year Precipitation (two stories)

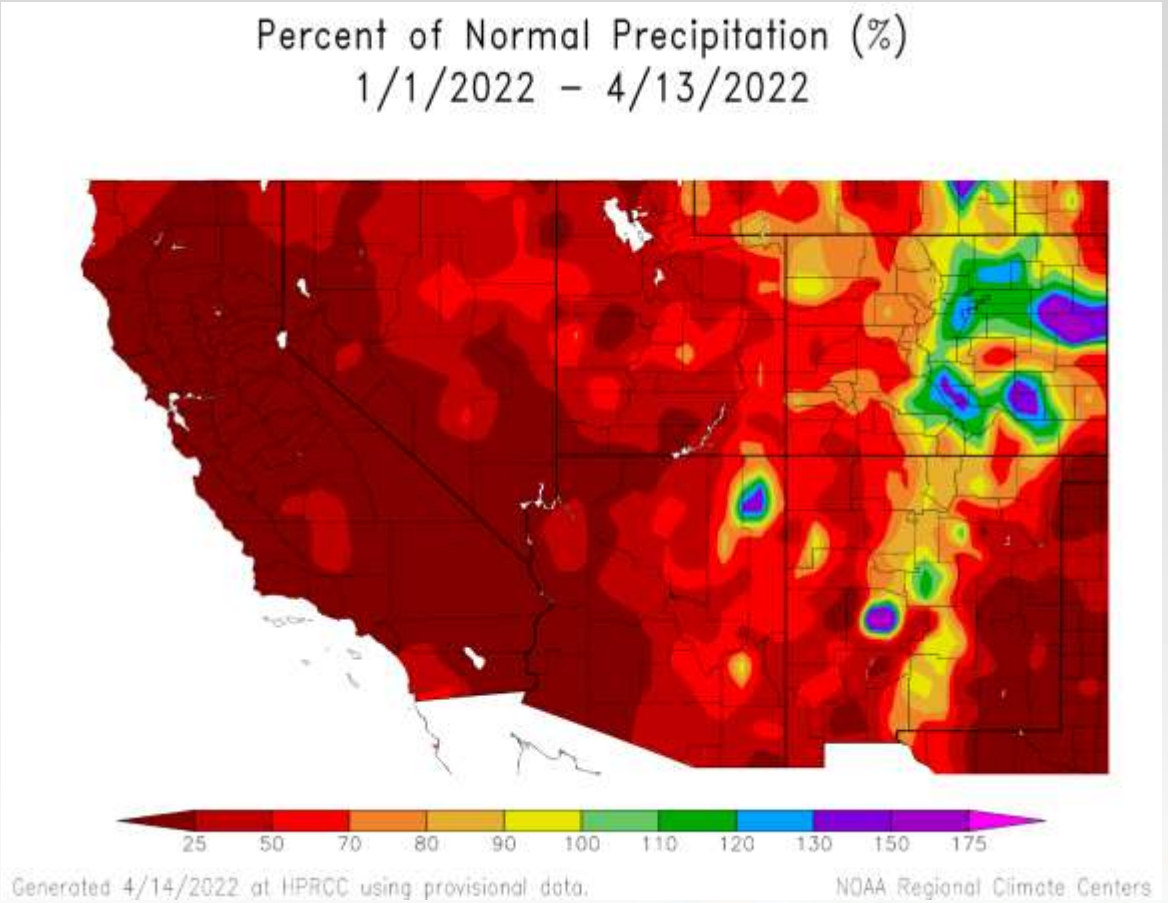
Oct 1 – Dec 31, 2021

Dry Nov and early Dec / Very wet late Dec



Jan 1 – Apr 13, 2022

Below normal since Jan 1

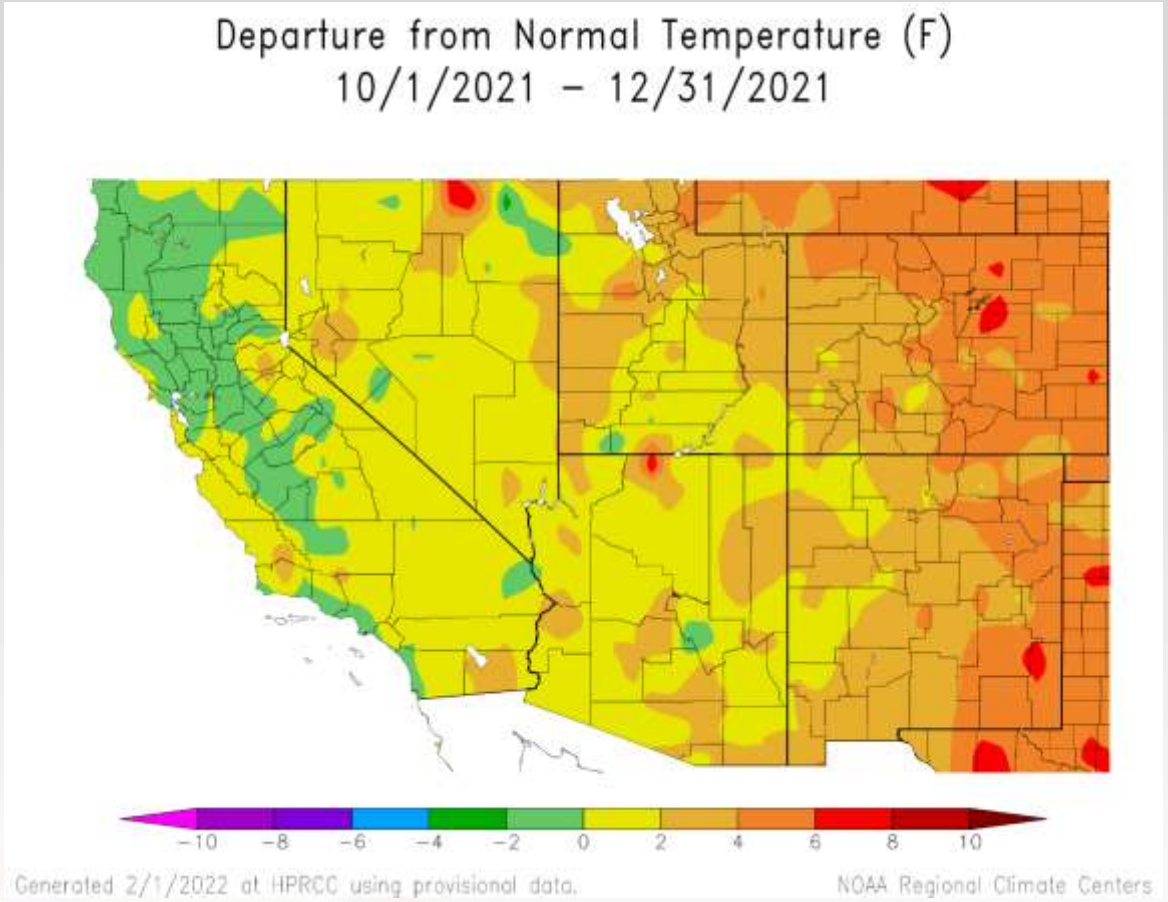


Water year Temperature (two stories)

April 2022

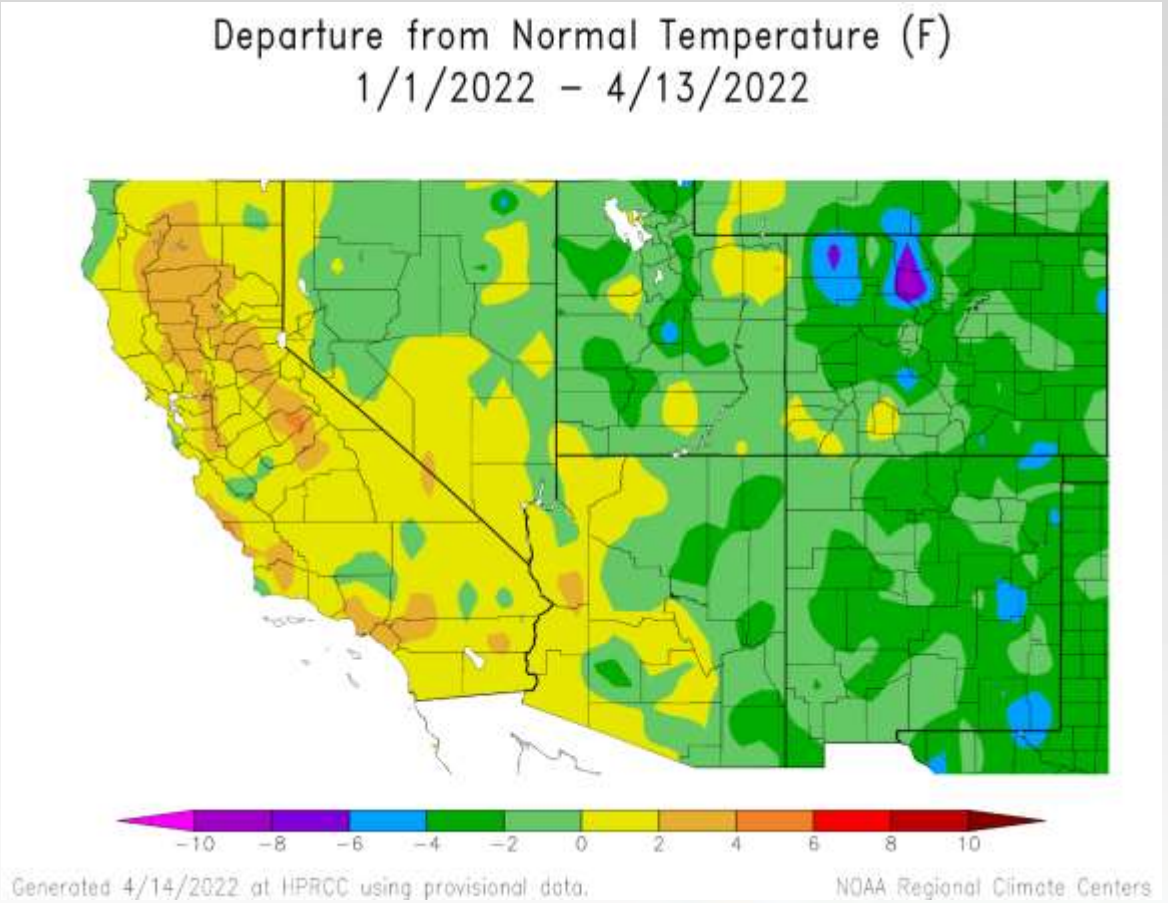
Oct 1 – Dec 31, 2021

Dry Nov and early Dec / Very wet late Dec

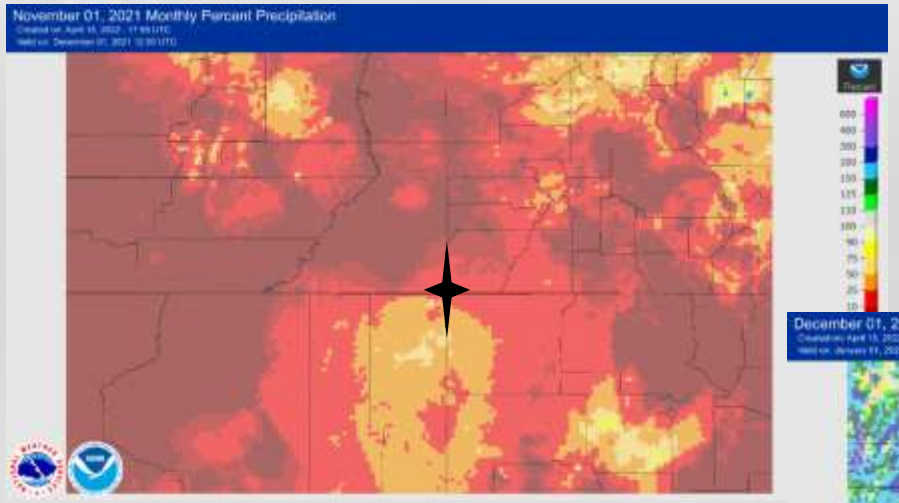


Jan 1 – Apr 13, 2022

Below normal since Jan 1

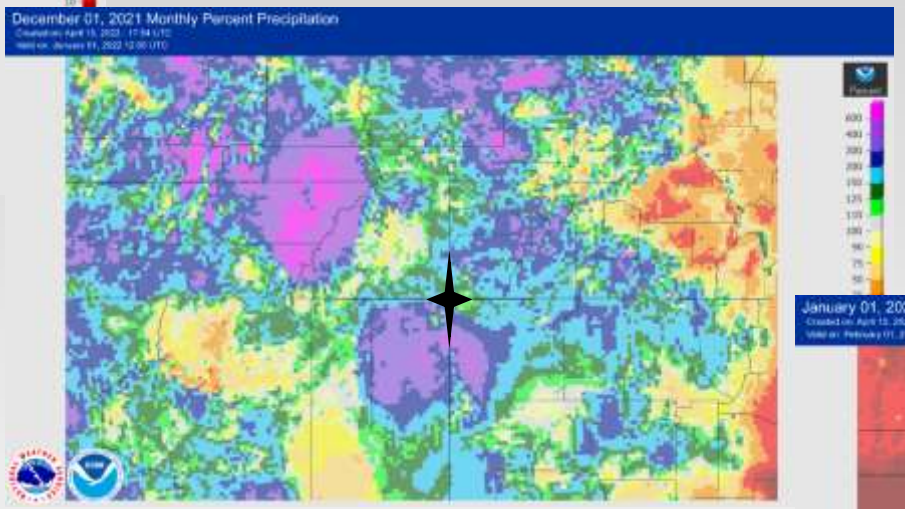


Percent of Normal - Monthly QPE

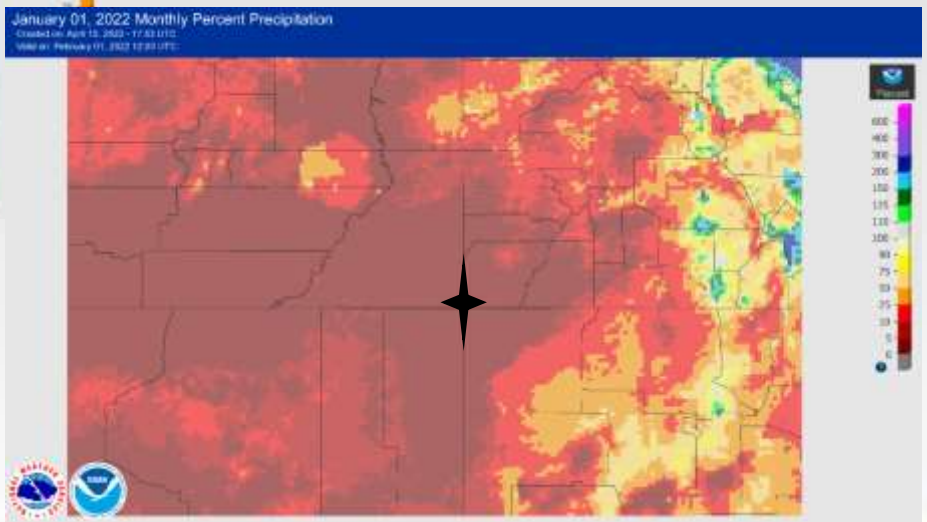


November 2021

December 2021



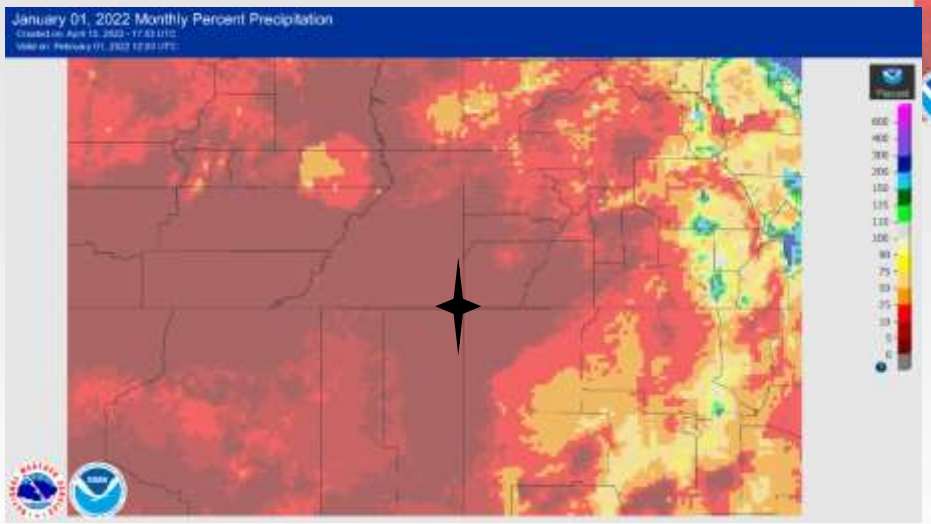
January 2022



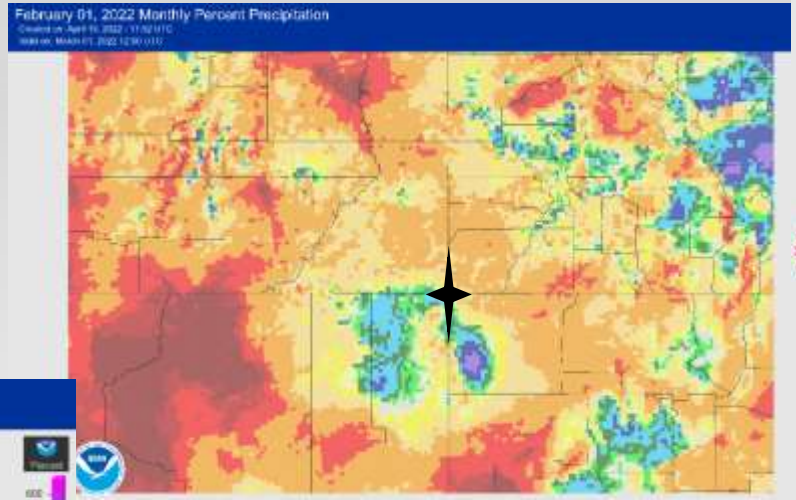
Quantitative precipitation estimation or QPE is a method of approximating the amount of precipitation that has fallen at a location or across a region.

Percent of Normal - Monthly QPE

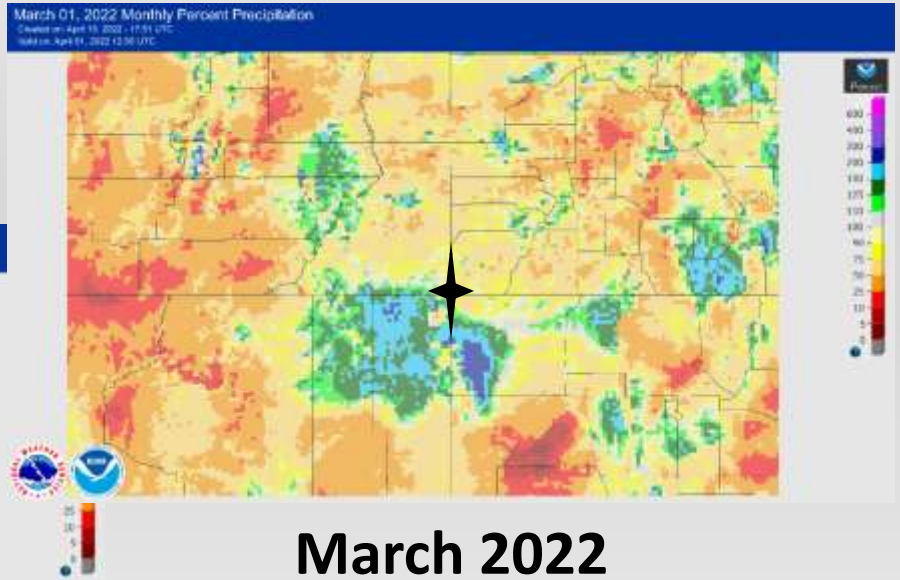
April 2022



January 2022



February 2022

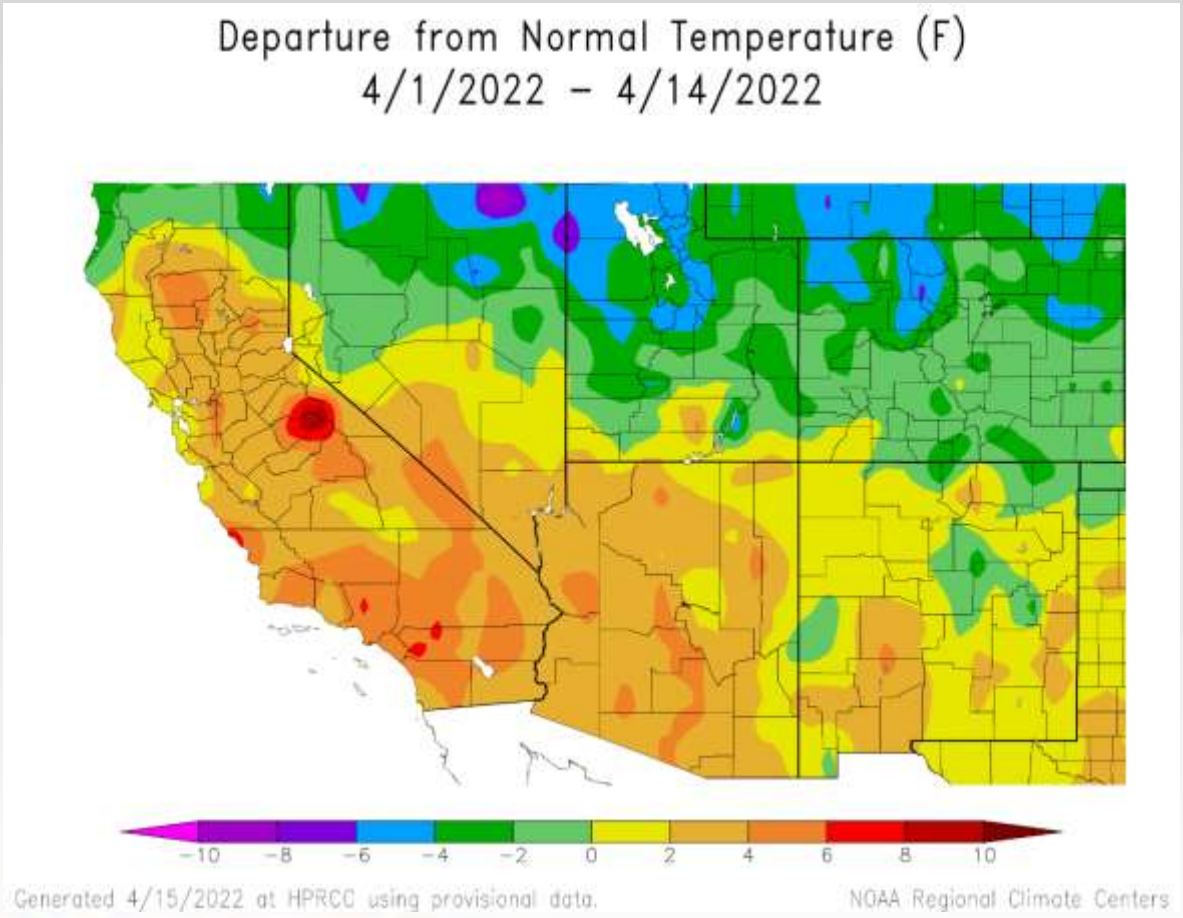


March 2022

April 2022

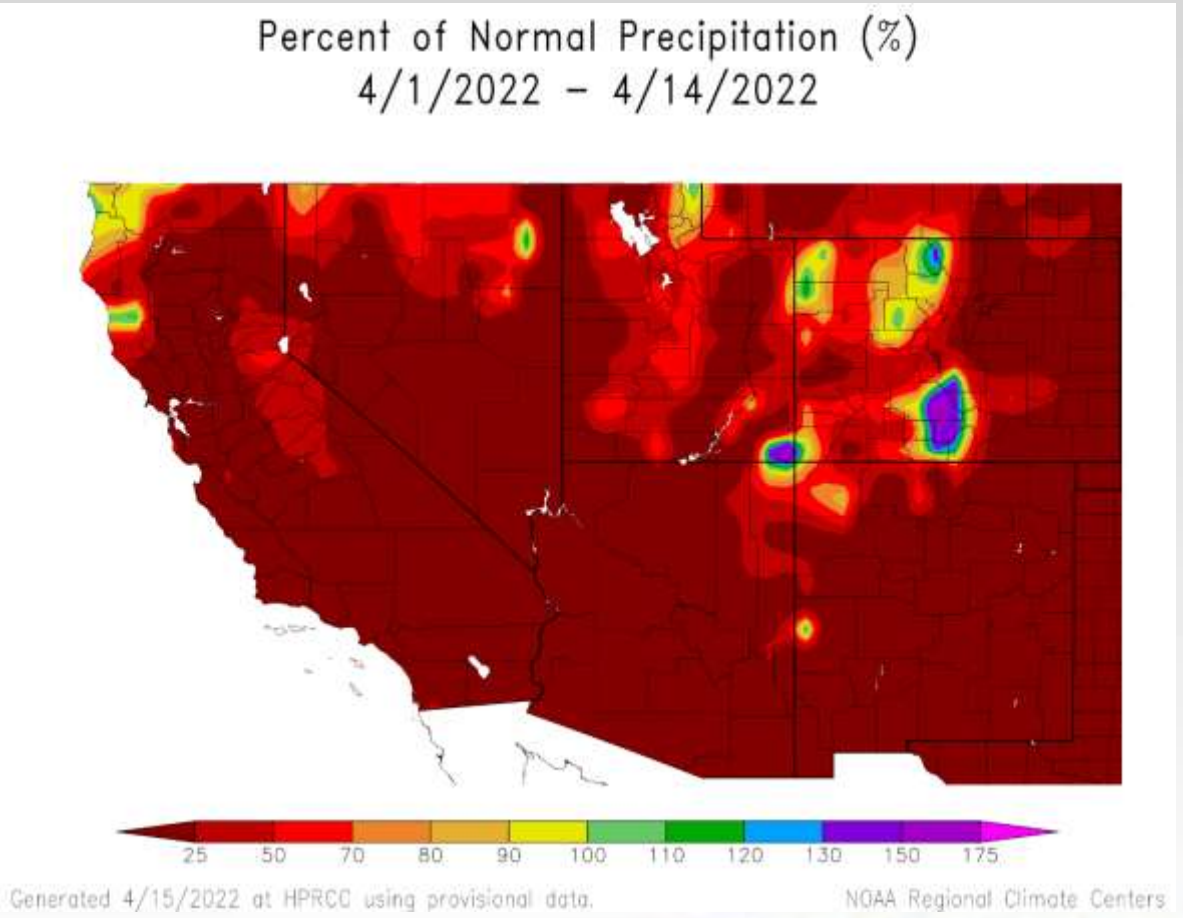
Temperature

Departure from normal



Precipitation

% of normal



SNOTEL Snow Water Equivalent – NRCS

April 2022

Southwestern Colorado

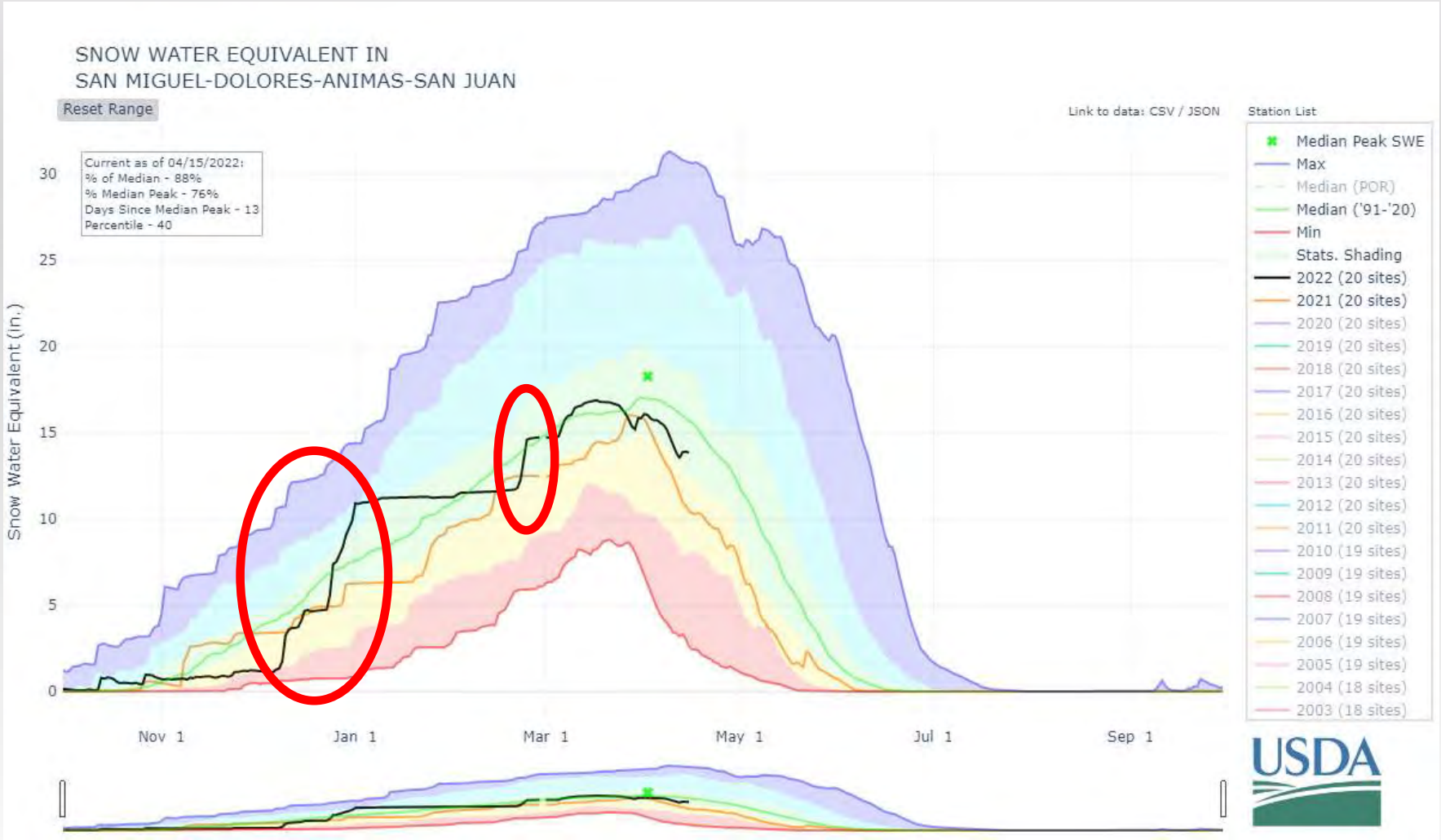
88% of Median

Yay…Late December Snow

Increased from 5in to over 10in (SWE) (124% of Median)

Yay…Late February Snow

Ok…Some March Snow

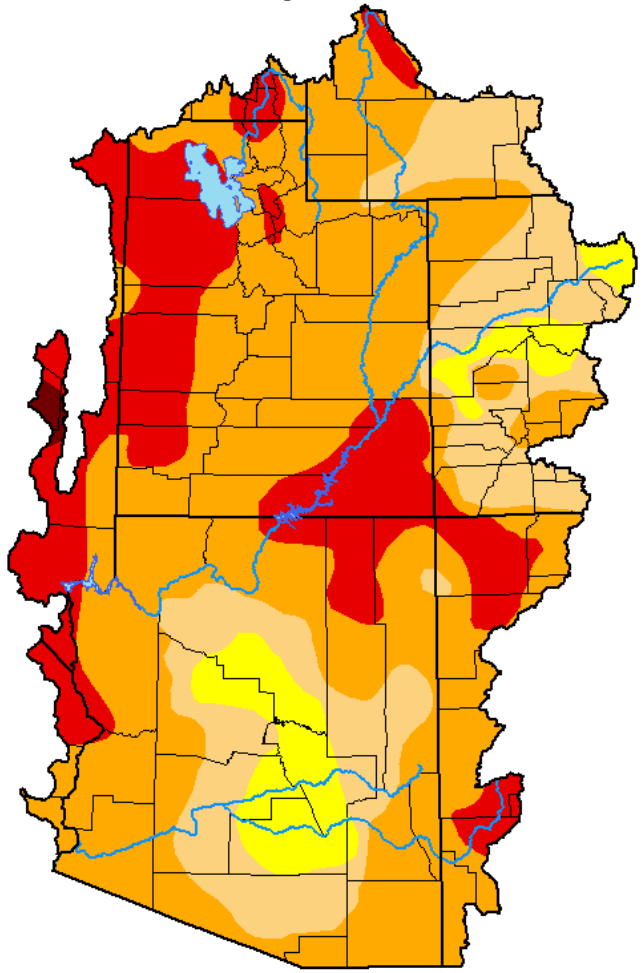


Drought

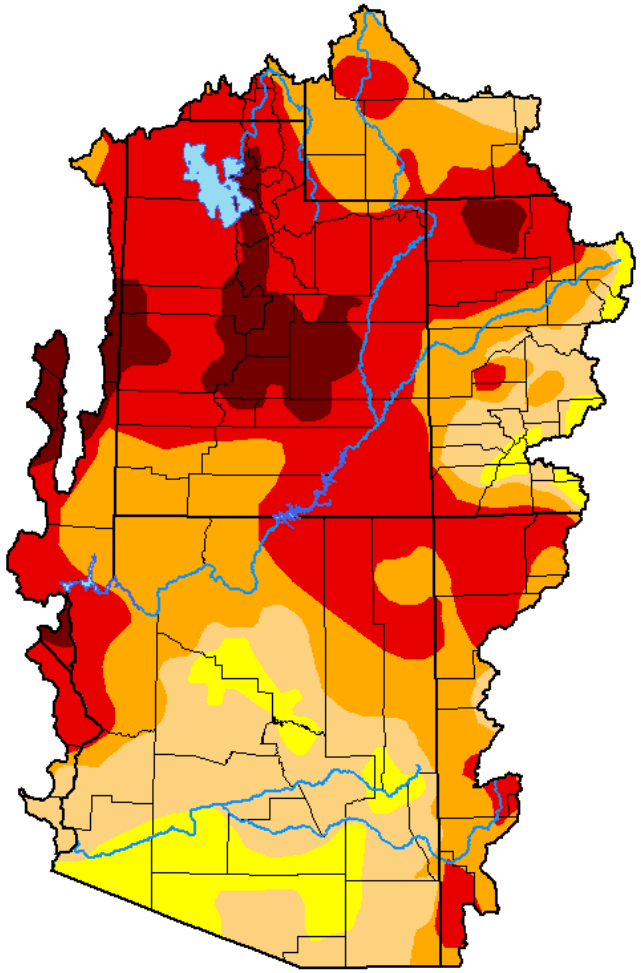
April 2022

Drought Monitor (Colorado Basin View)

April 12, 2022



October 5, 2021



Intensity:

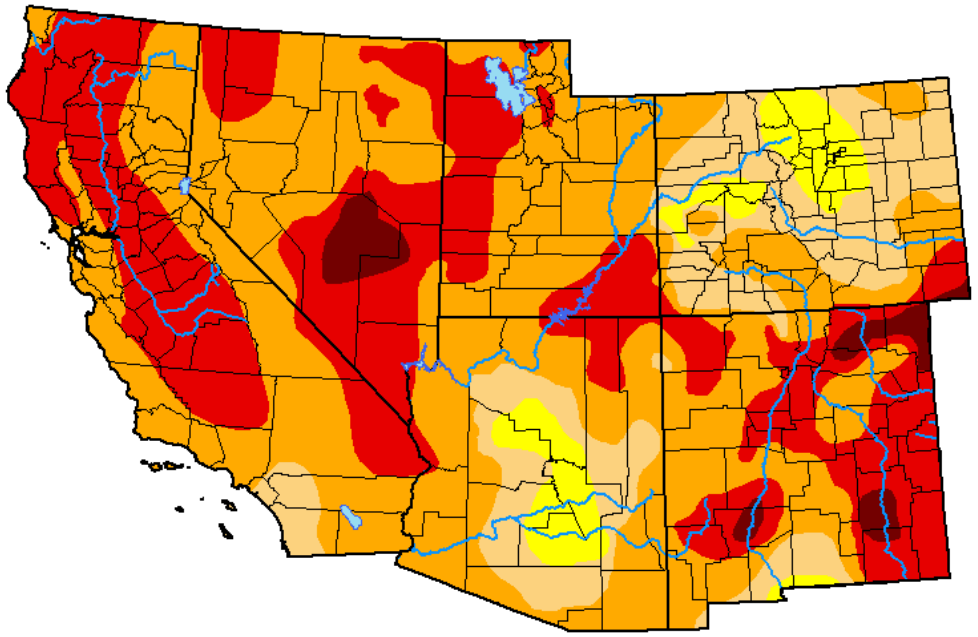
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

Drought

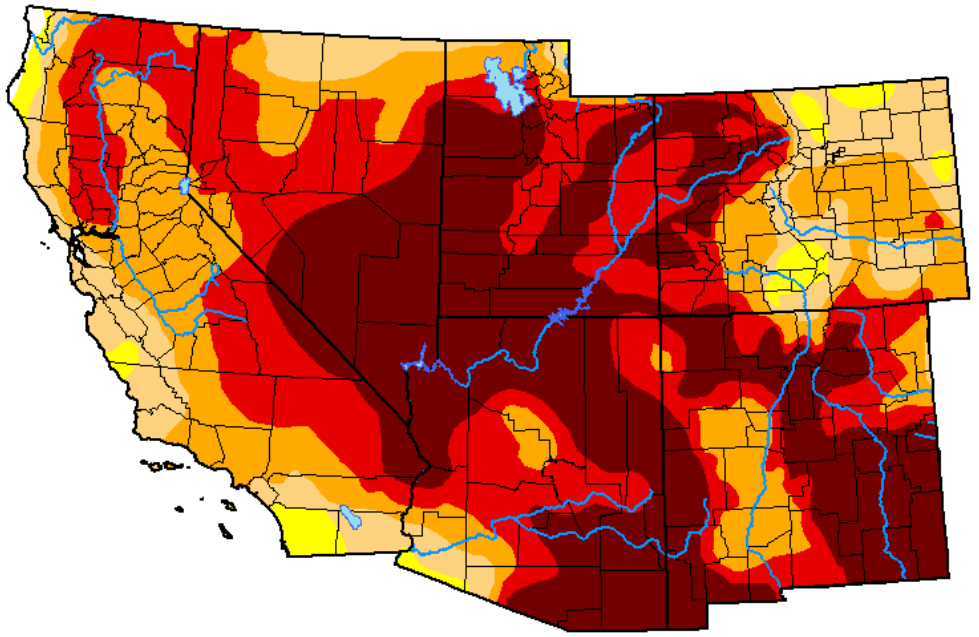
April 2022

Drought Monitor (State View)

April 12, 2022



April 13, 2021



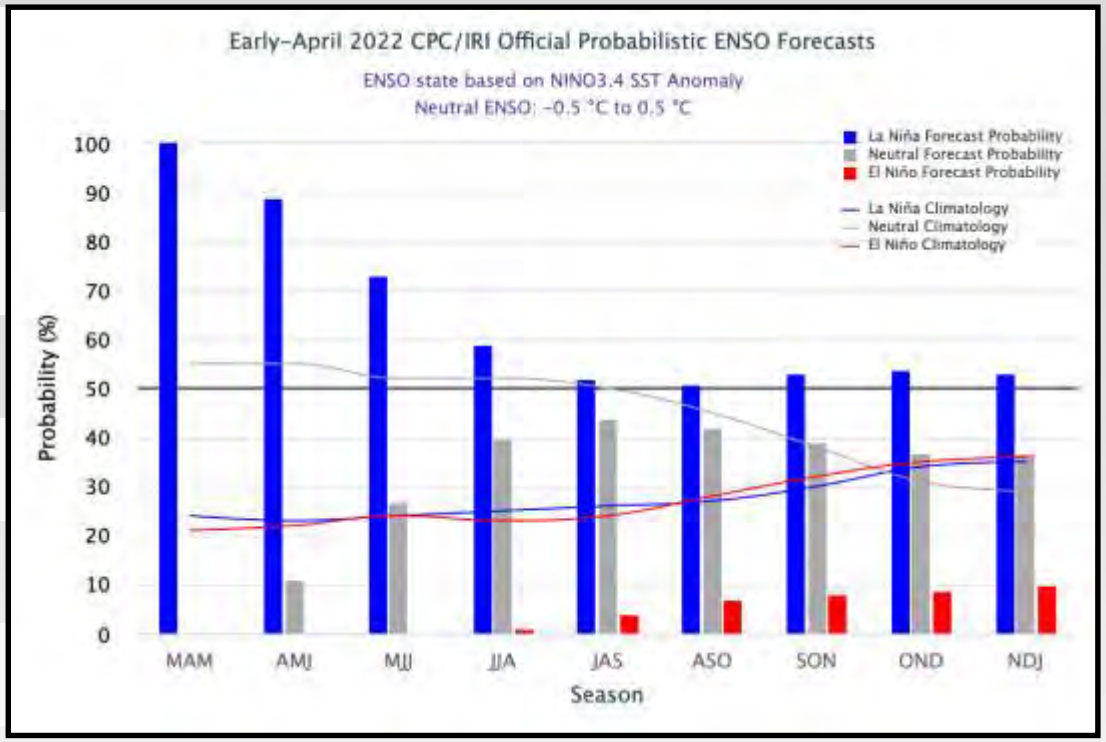
Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

ENSO - Outlook

La Nina this Spring - Maybe Neutral late this Summer

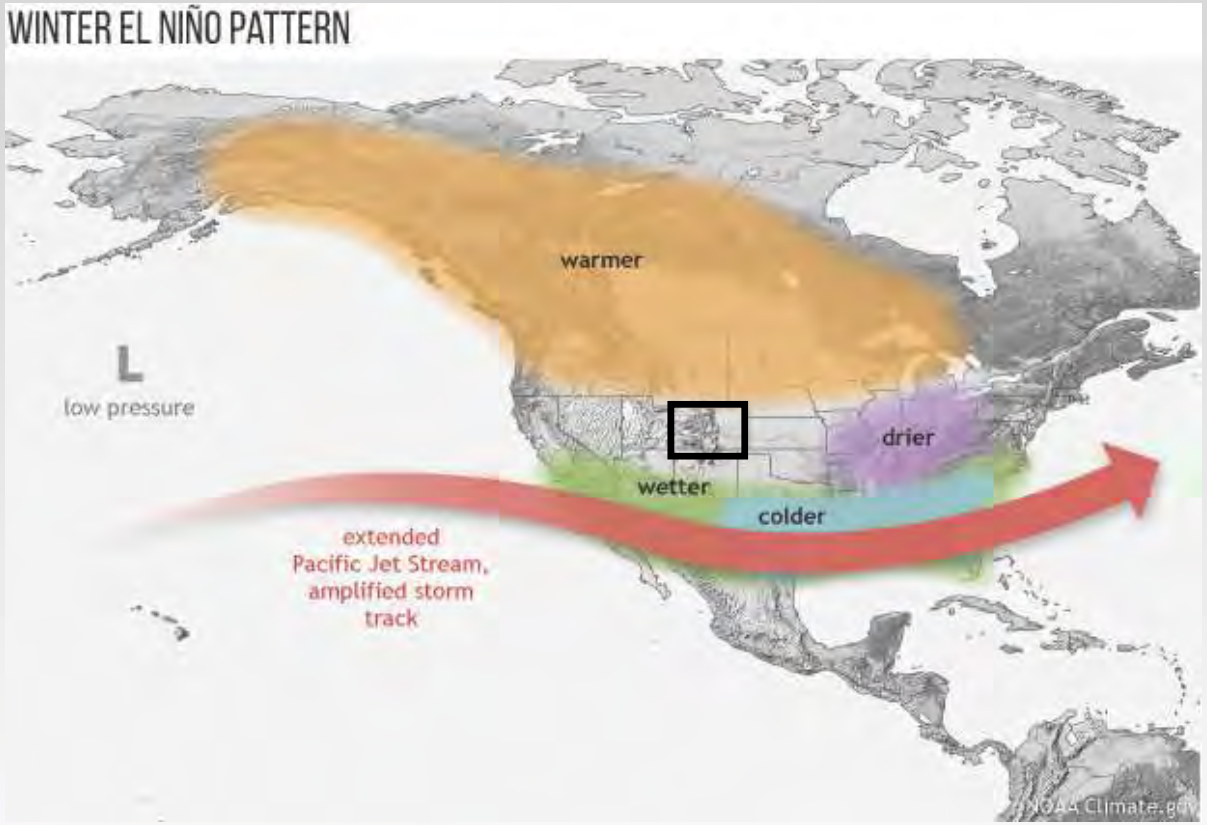
Season	La Niña	Neutral	El Niño
MAM	100	0	0
AMJ	89	11	0
MJJ	73	27	0
JJA	59	40	1
JAS	52	44	4
ASO	51	42	7
SON	53	39	8
OND	54	37	9
NDJ	53	37	10



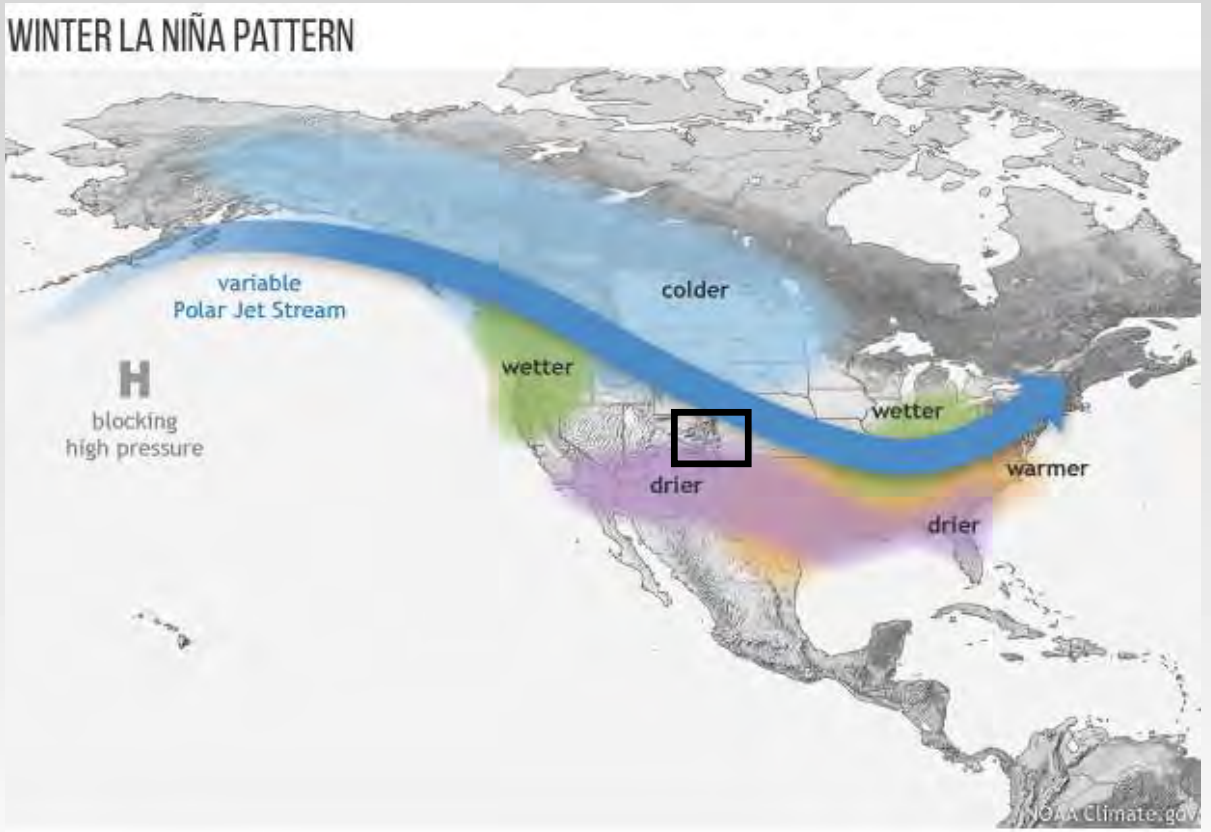
CPC/IRI Early-Month Consensus ENSO Forecast Probabilities
(using NWS CPC classification system)

ENSO

North of Colorado – Dry and Warm
South of Colorado – Wet and Cool



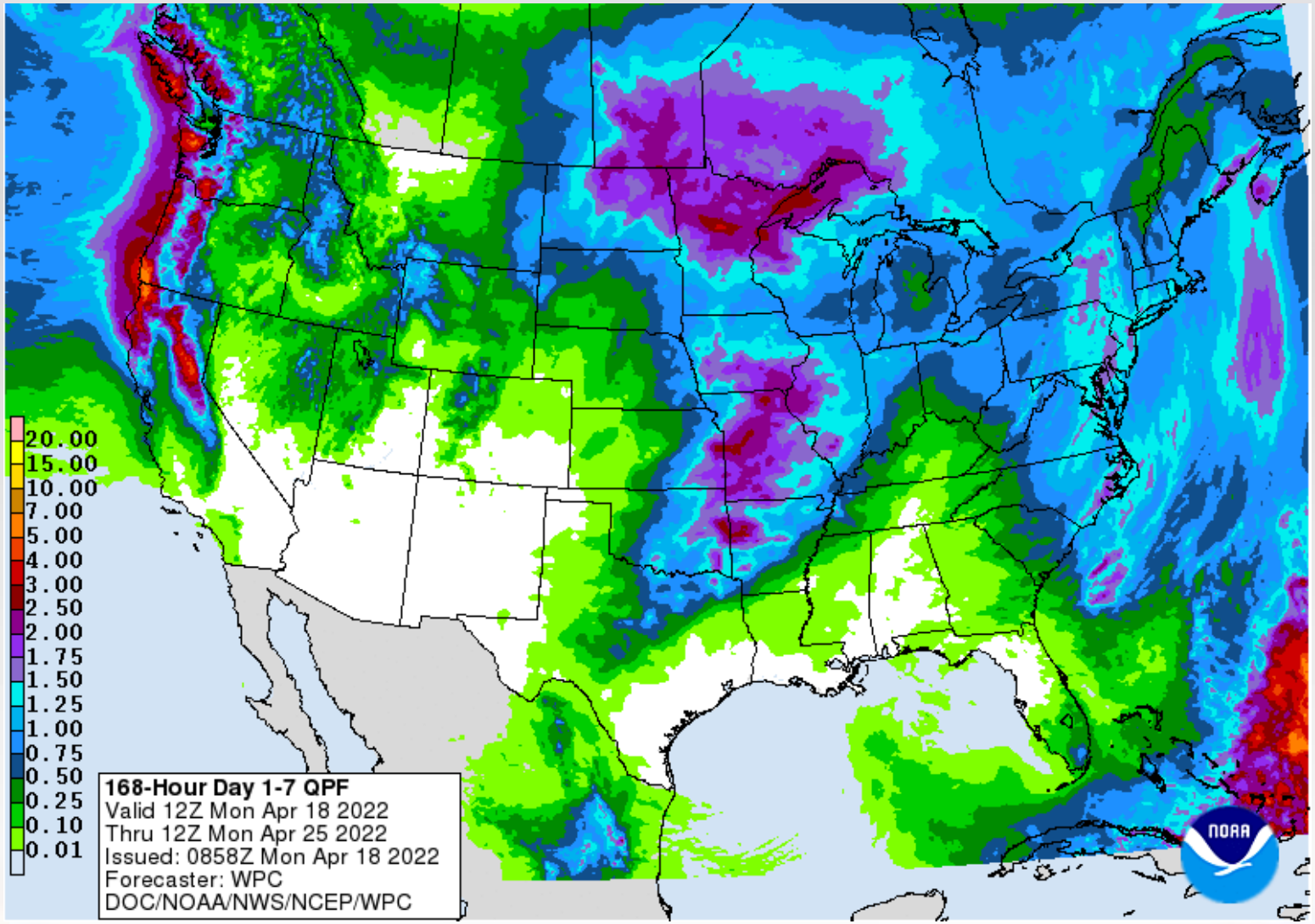
North of Colorado – Wet and Cool
South of Colorado – Dry and Warm



WPC 7-Day Precipitation Outlook

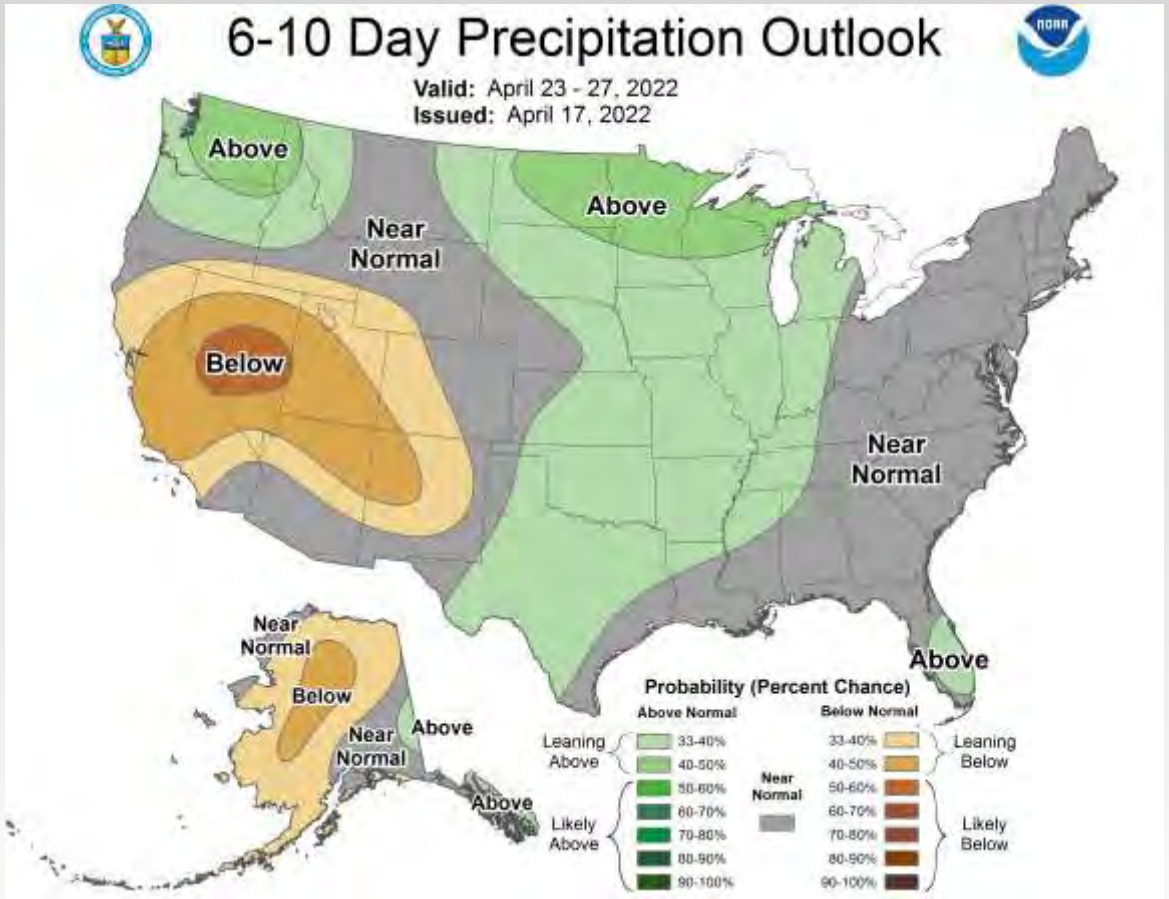
April 2022

Accumulation period from Apr 18-25

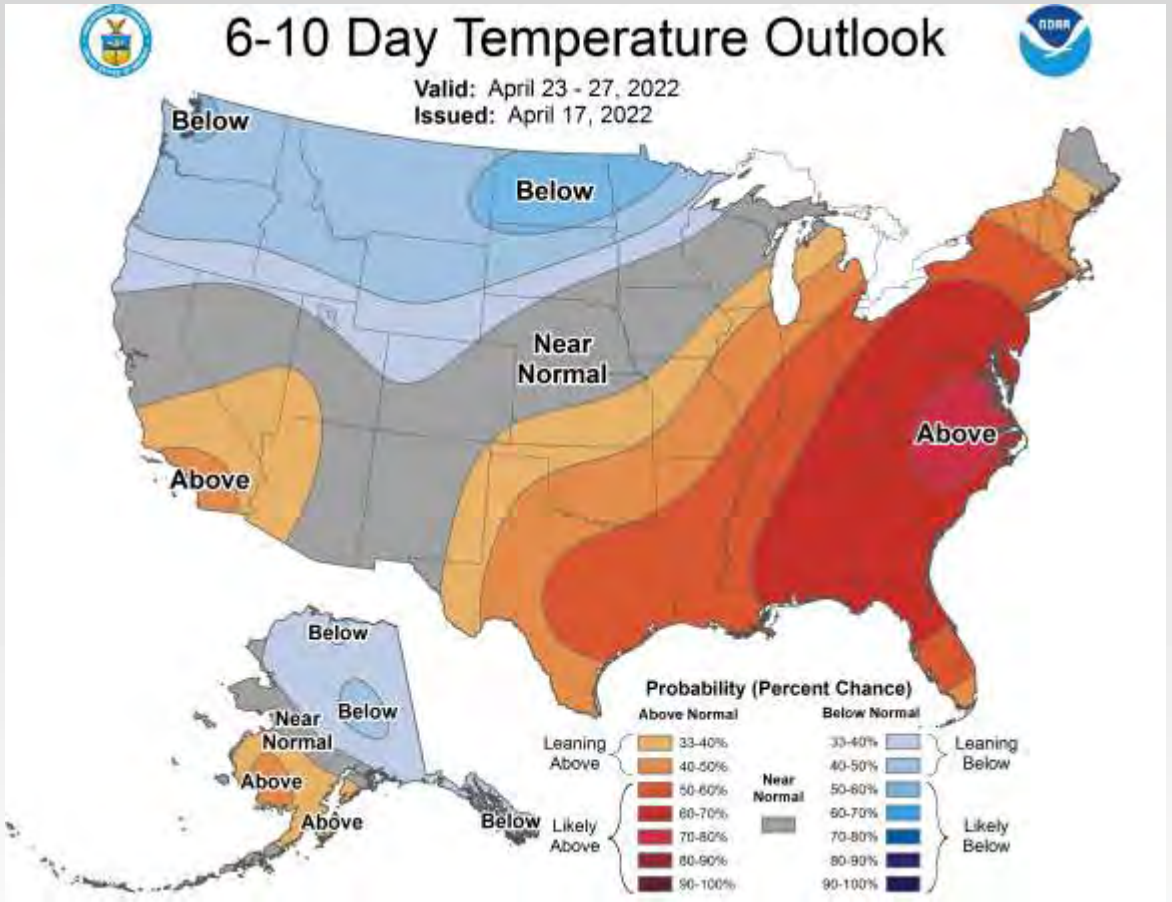


Outlook

April 23 - 27

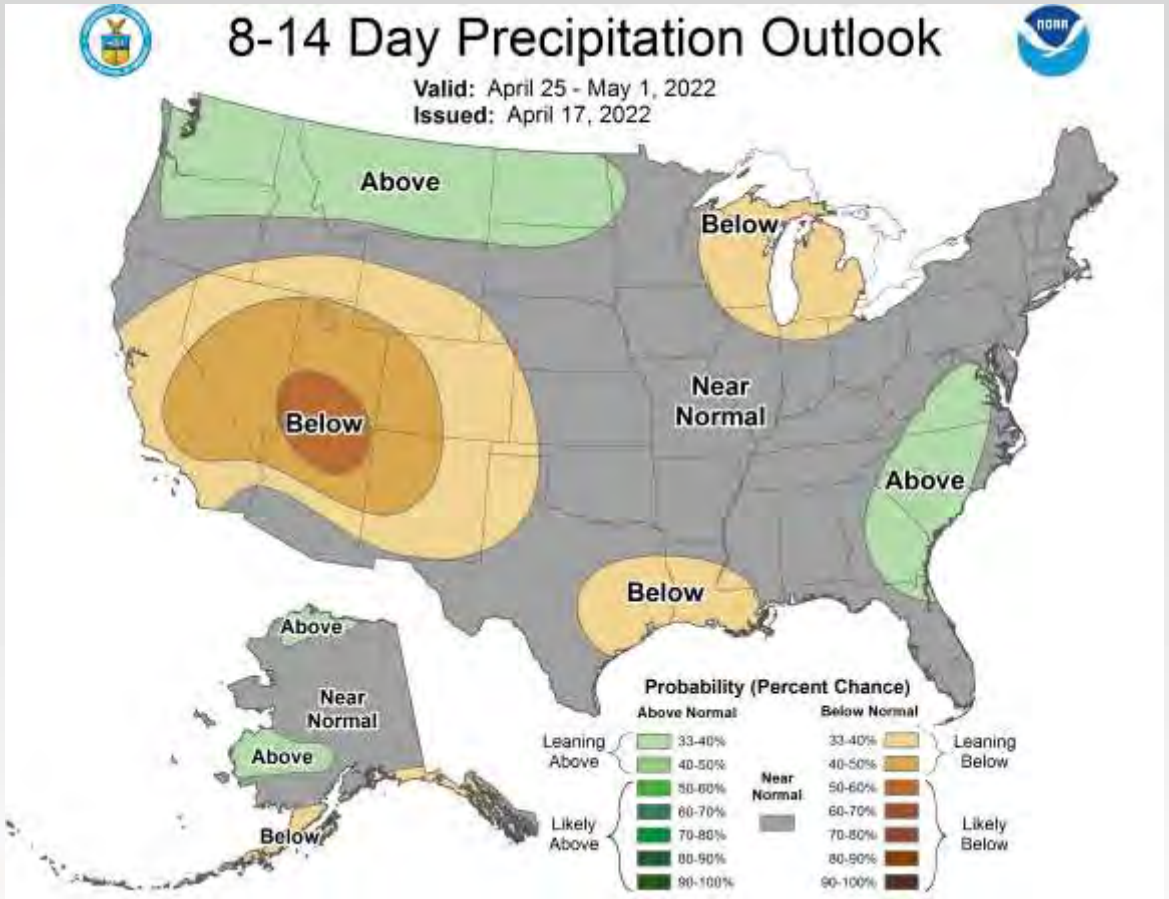


April 23 – 27

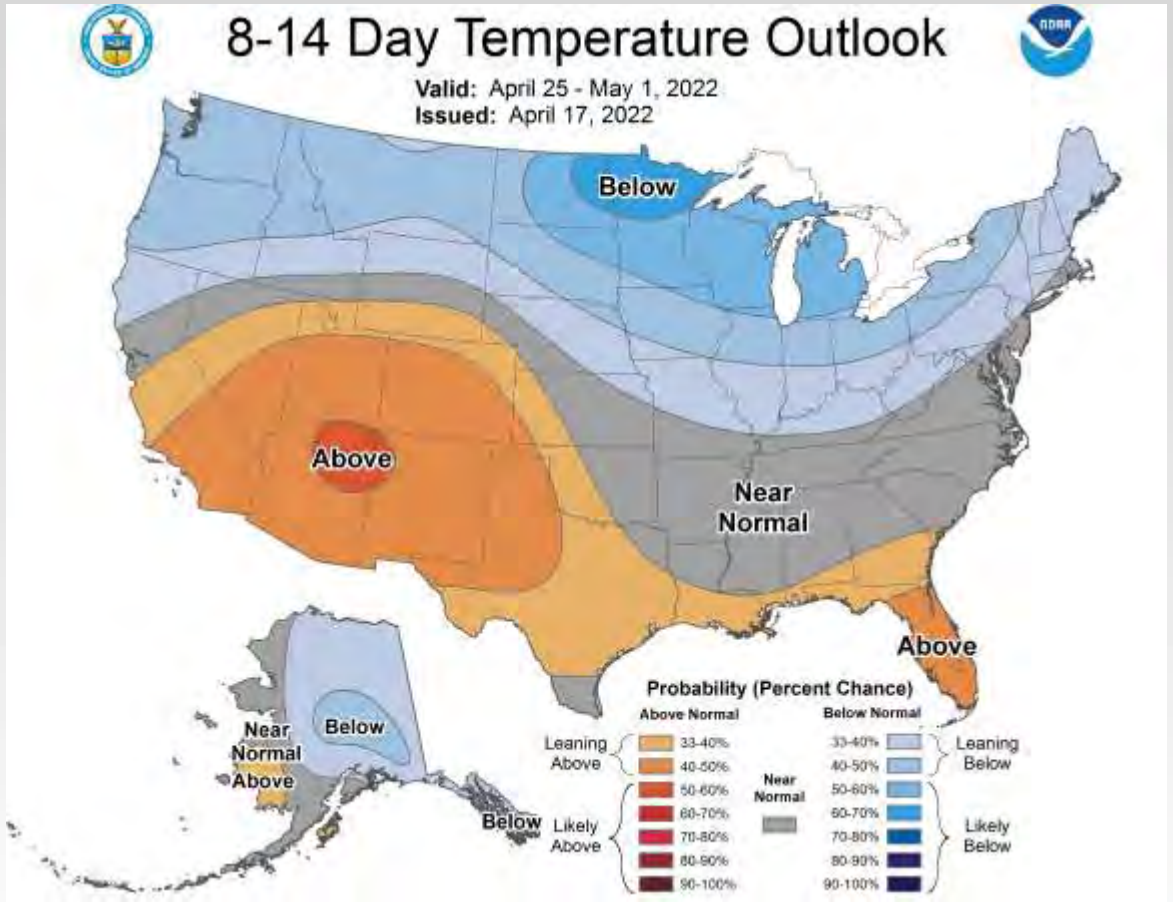


Outlook

April 25 – May 1



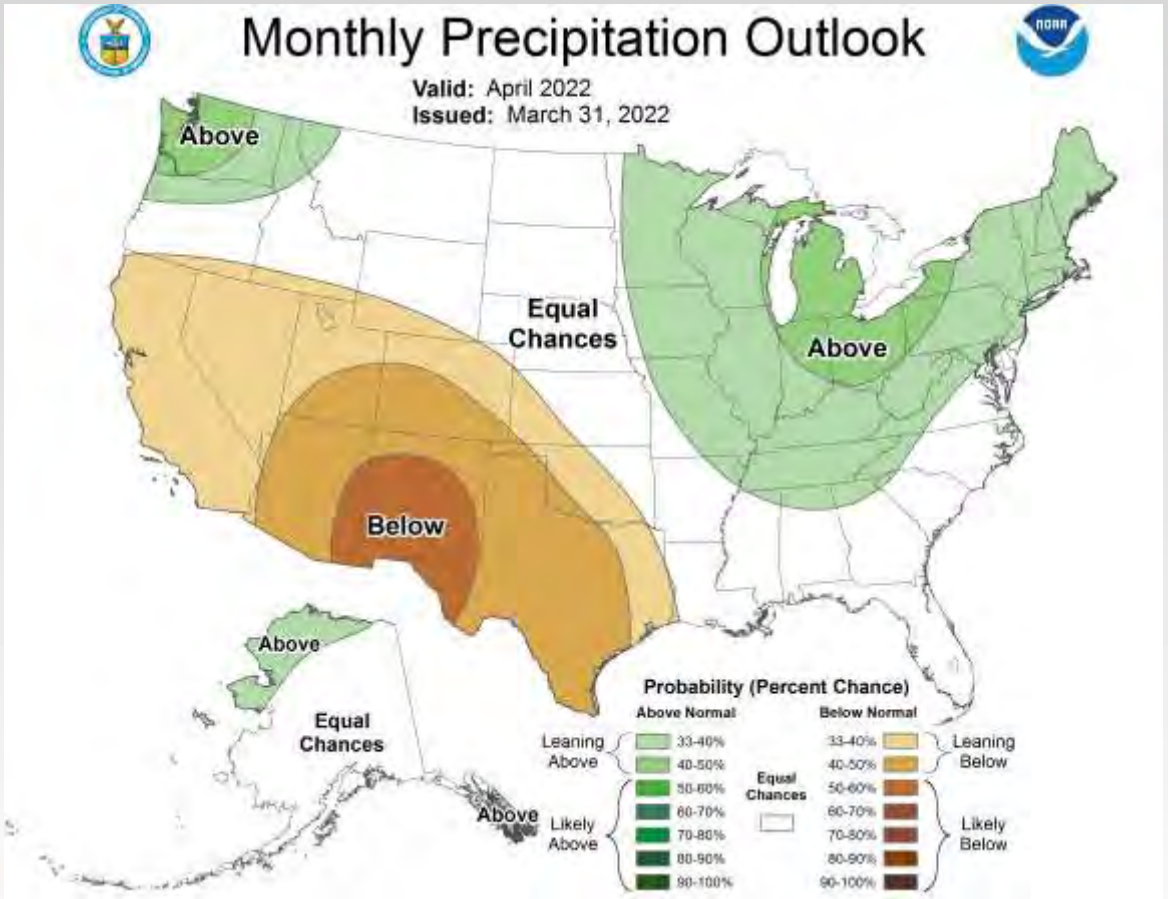
April 25 – May 1



Monthly Outlook

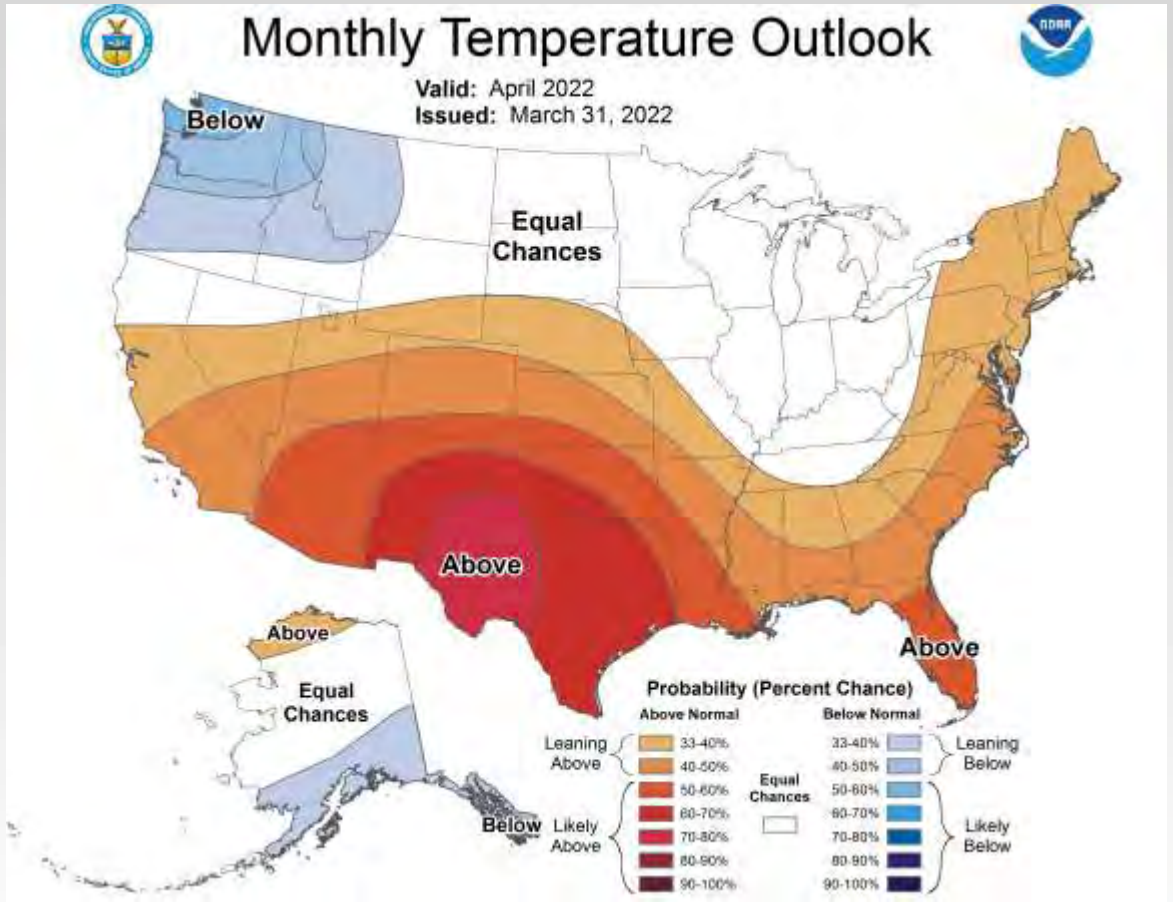
Precipitation

April



Temperature

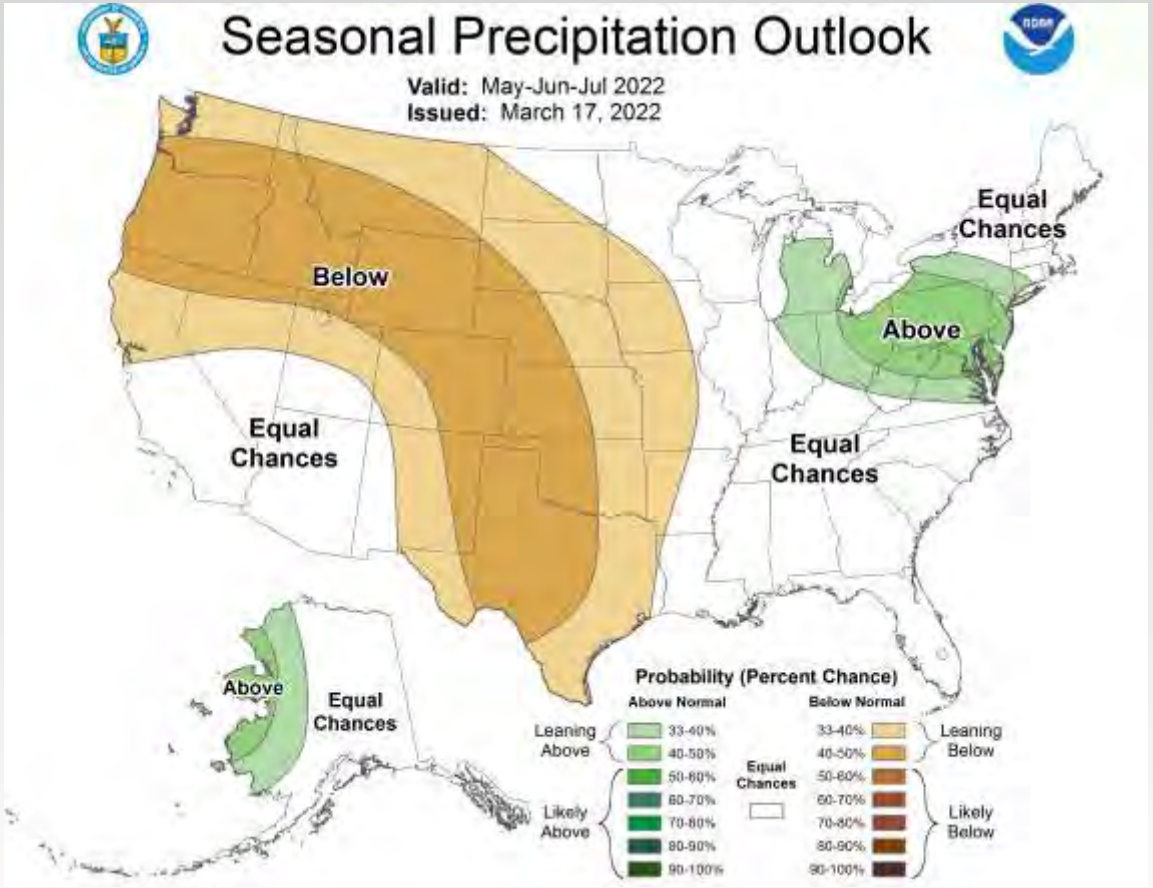
April



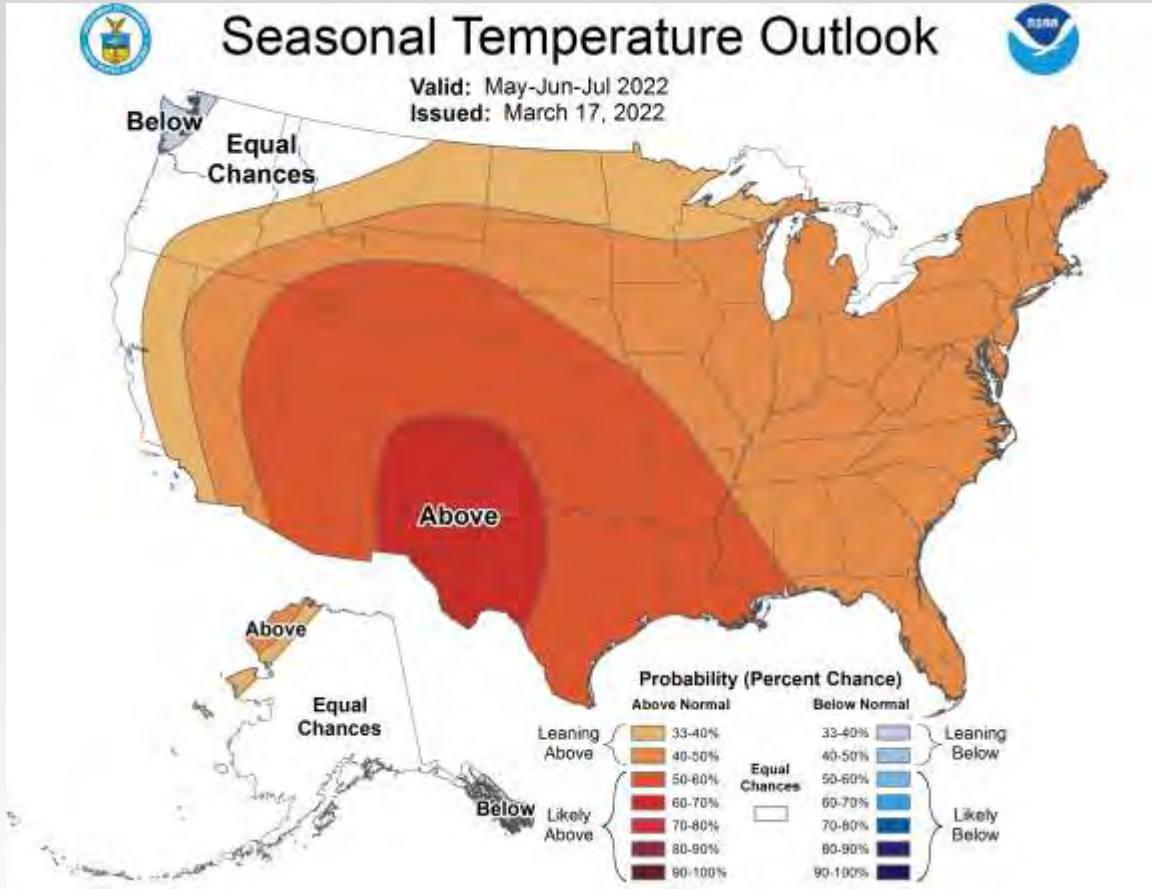
Seasonal Outlook

April 2022

Precipitation
May/Jun/Jul



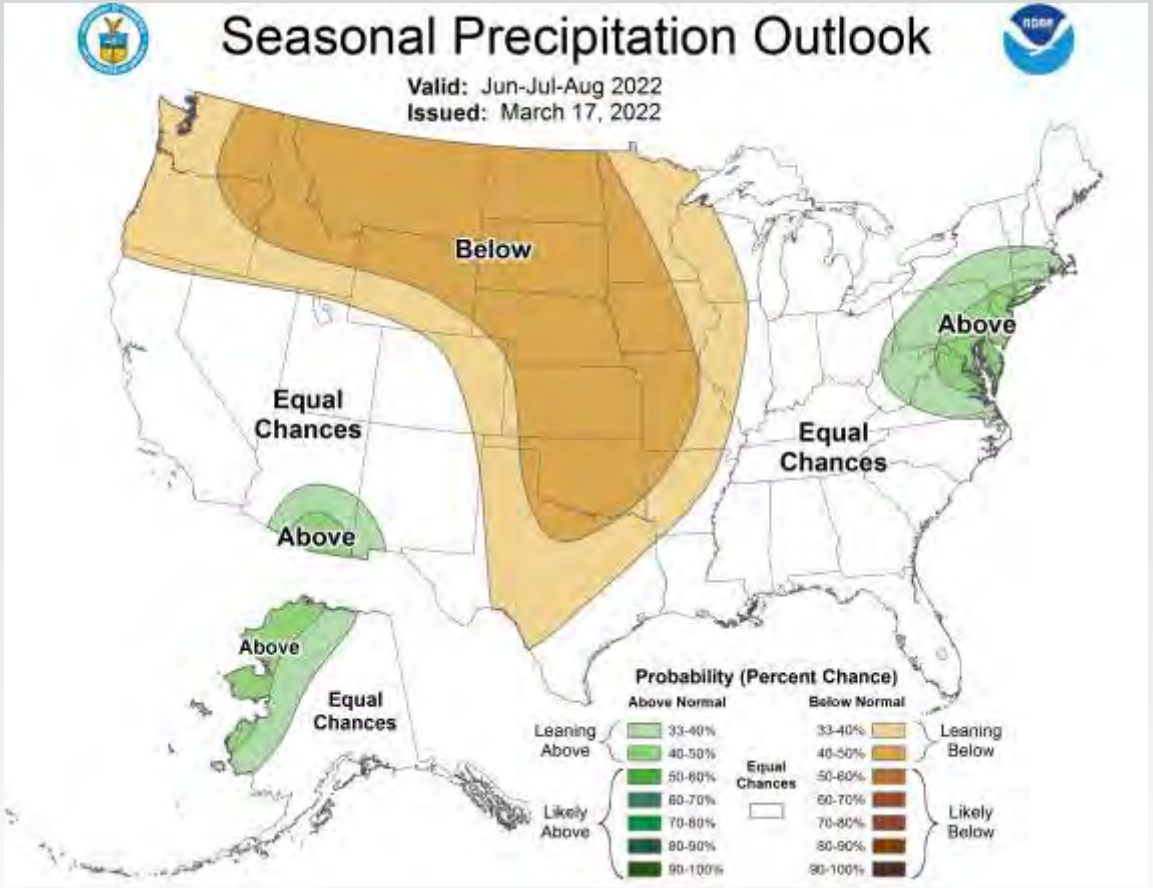
Temperature
May/Jun/Jul



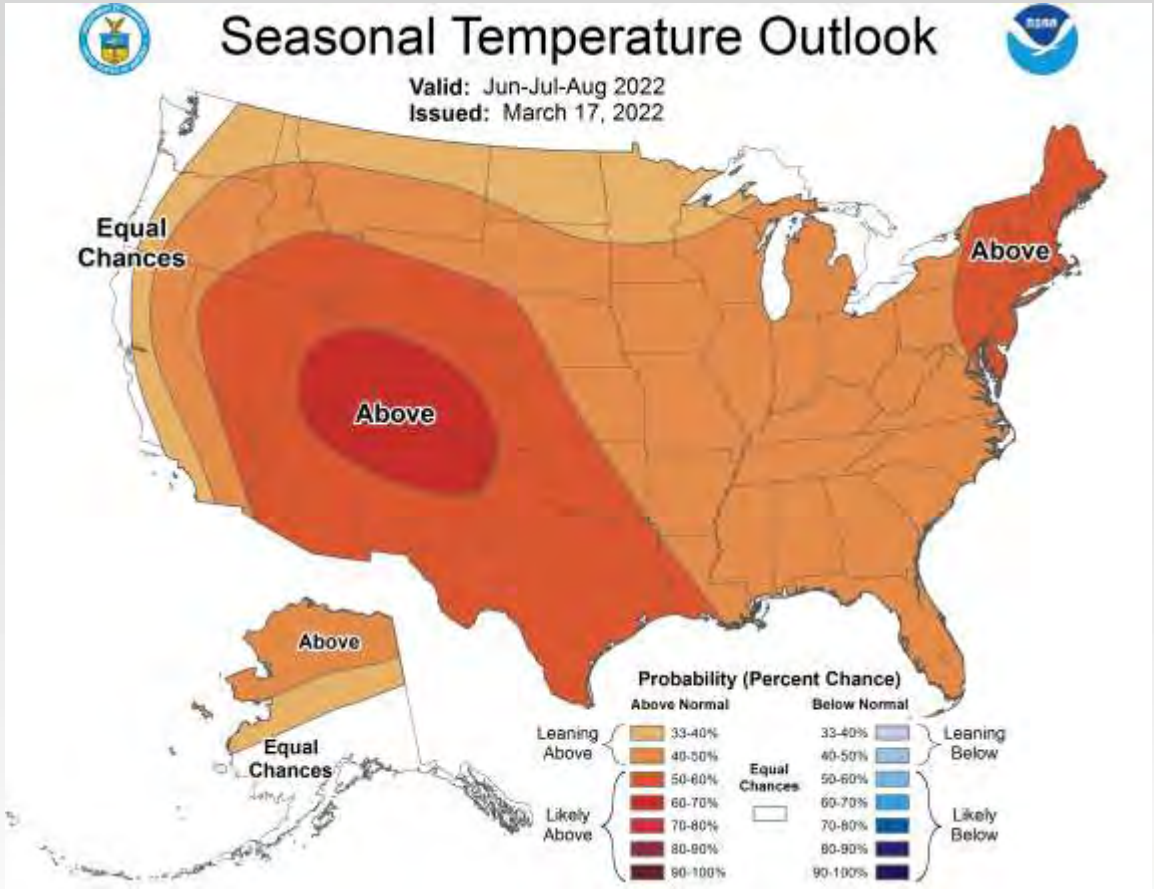
Seasonal Outlook

April 2022

Precipitation
Jun/Jul/Aug



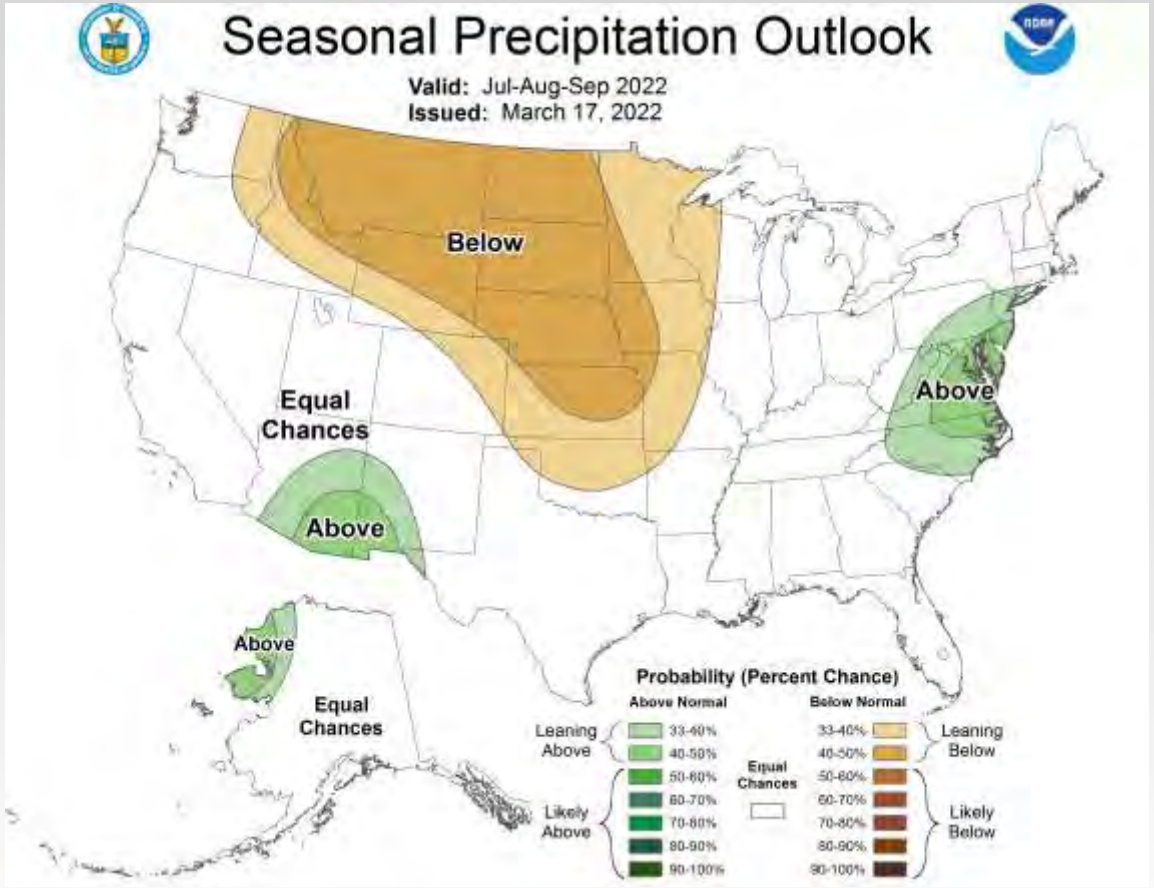
Temperature
Jun/Jul/Aug



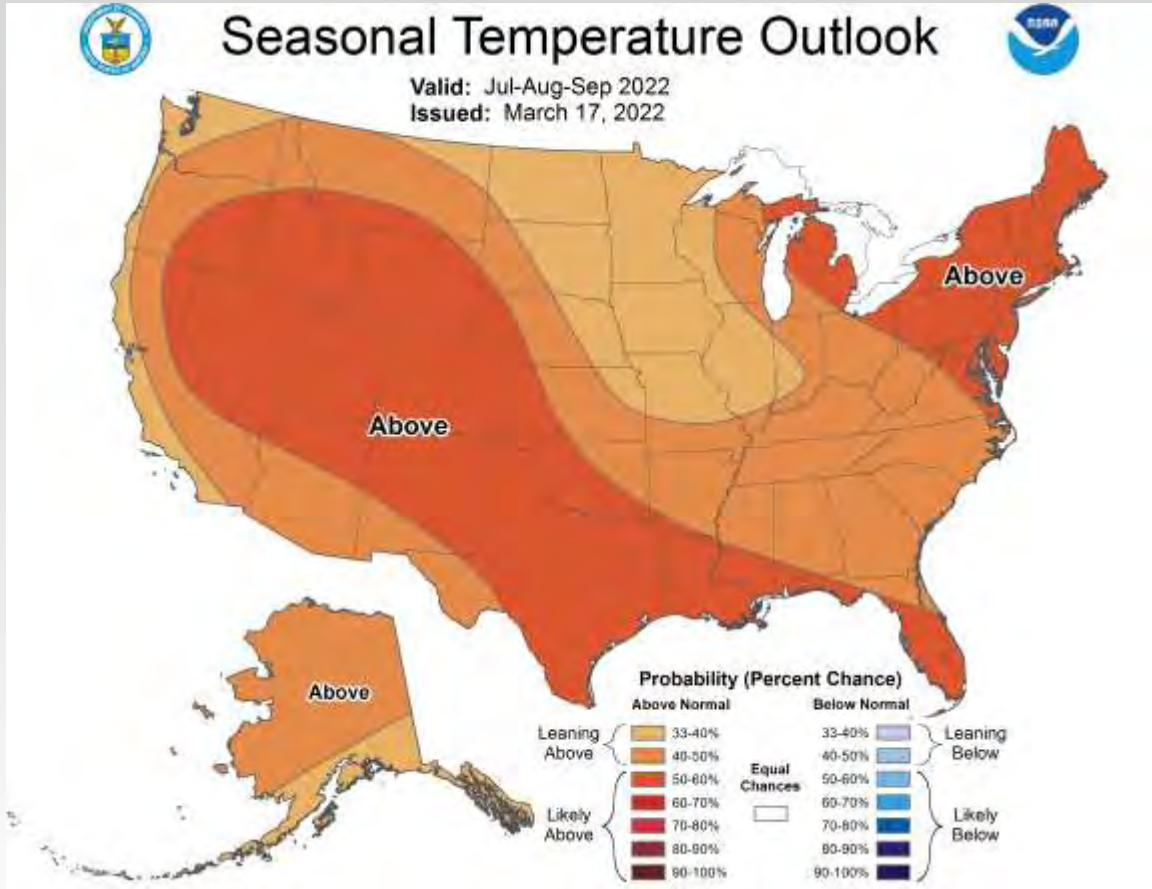
Seasonal Outlook

April 2022

Precipitation
Jul/Aug/Sep



Temperature
Jul/Aug/Sep



Navajo Reservoir/San Juan Basin Water Supply Outlook April 2022

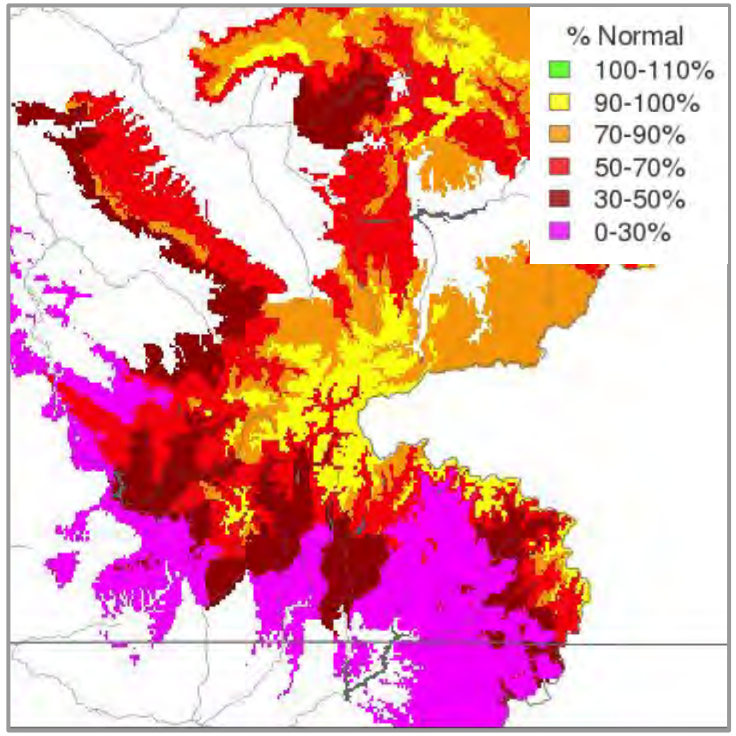
Ashley Nielson
Senior Hydrologist
Colorado Basin River Forecast Center
National Weather Service/NOAA

Fall Modeled Soil Moisture Conditions: 2020 vs. 2021

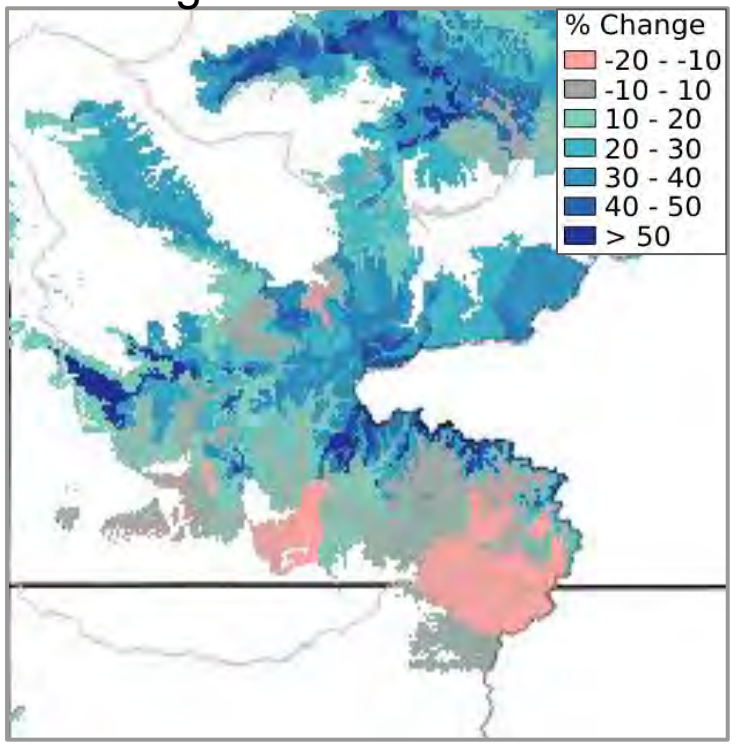
- Soil moisture conditions improved from record/near record dry levels last year but remain below normal across the majority of the San Juan River Basin.

CBRFC Modeled Soil Moisture:
- Represents the deep soil layer
- Source of longer-term (weeks to years) streamflow
- Impacts water supply forecasts
  - Below average conditions = lower forecasts
  - Above average conditions = higher forecasts

Fall 2021

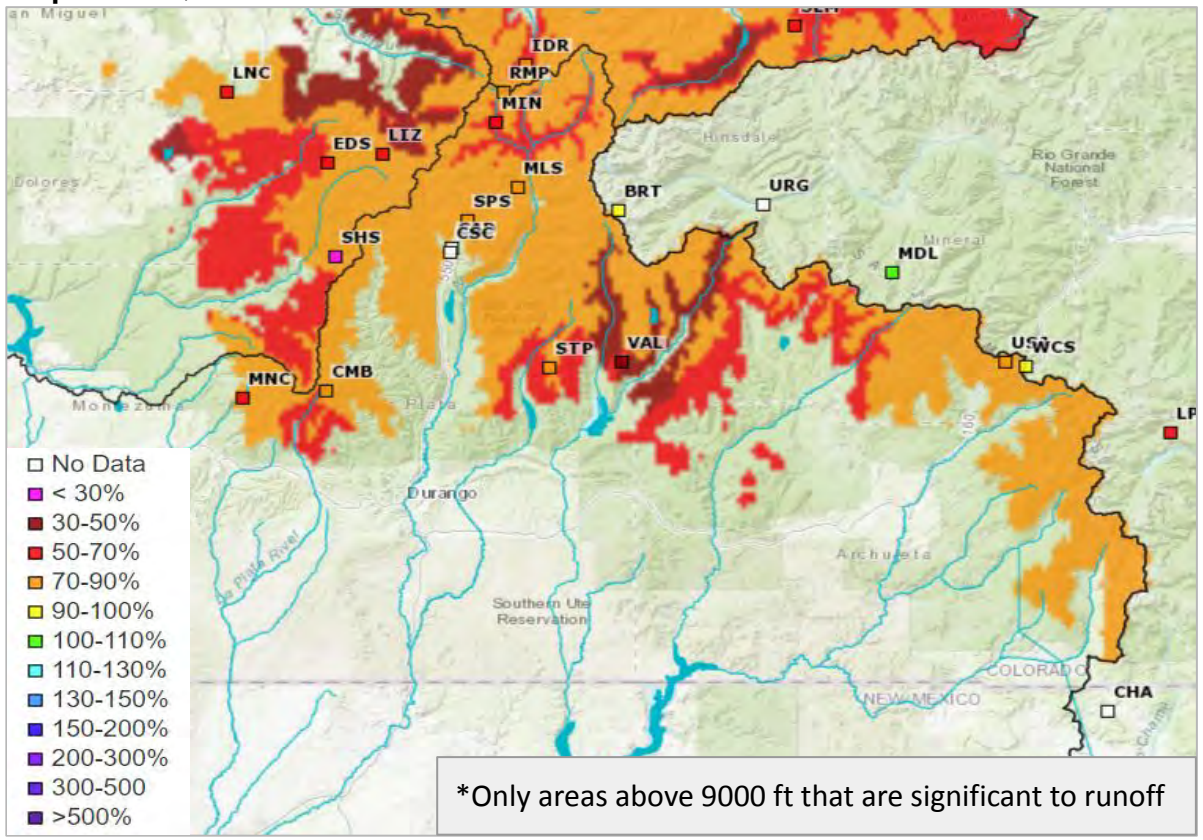


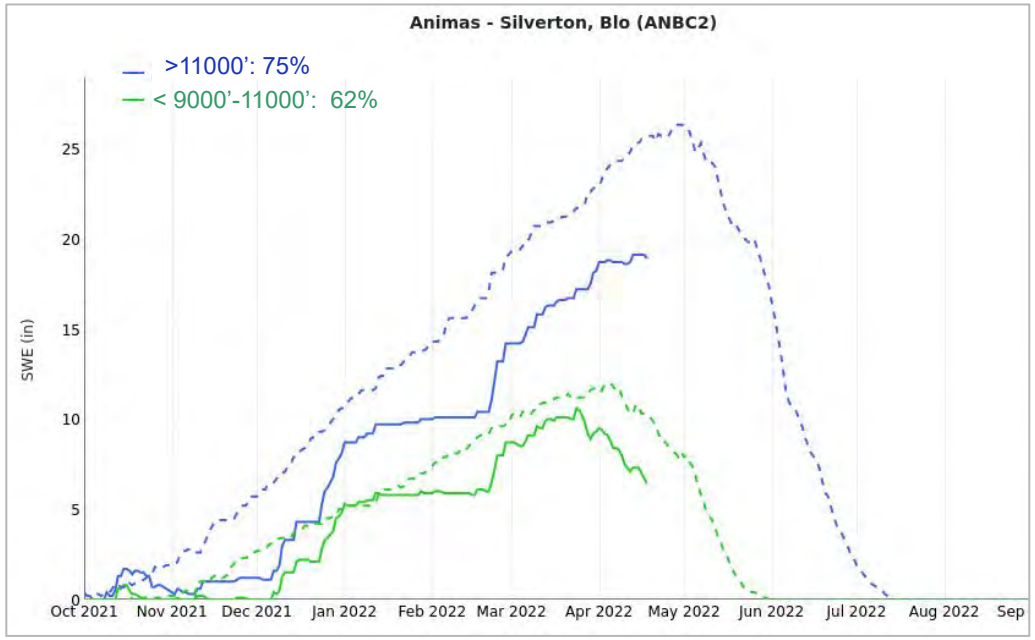
% Change: 2021-2020

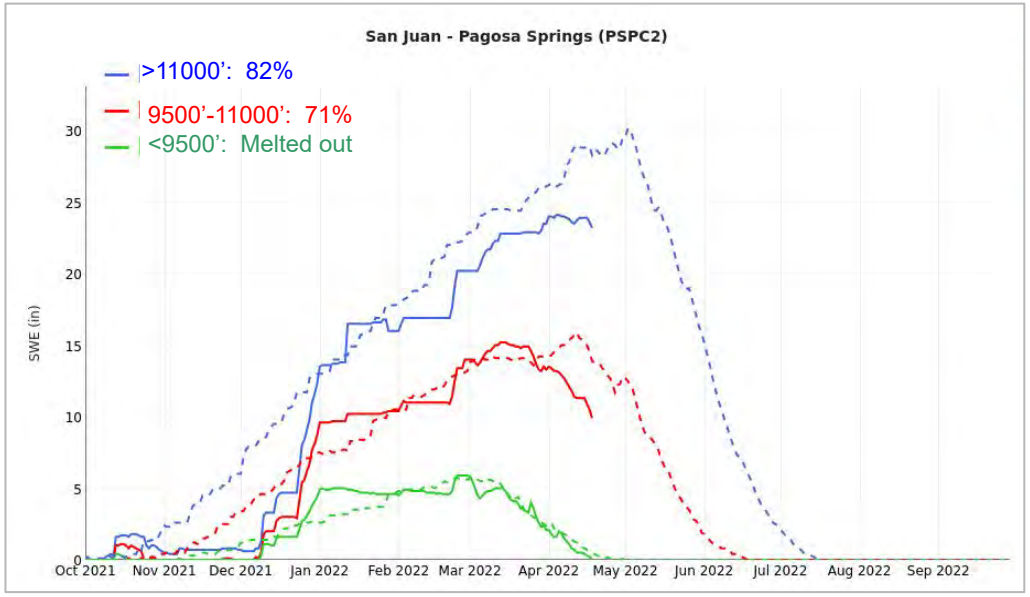


Snow Conditions: CBRFC Model Snow Water Equivalent

April 18, 2022



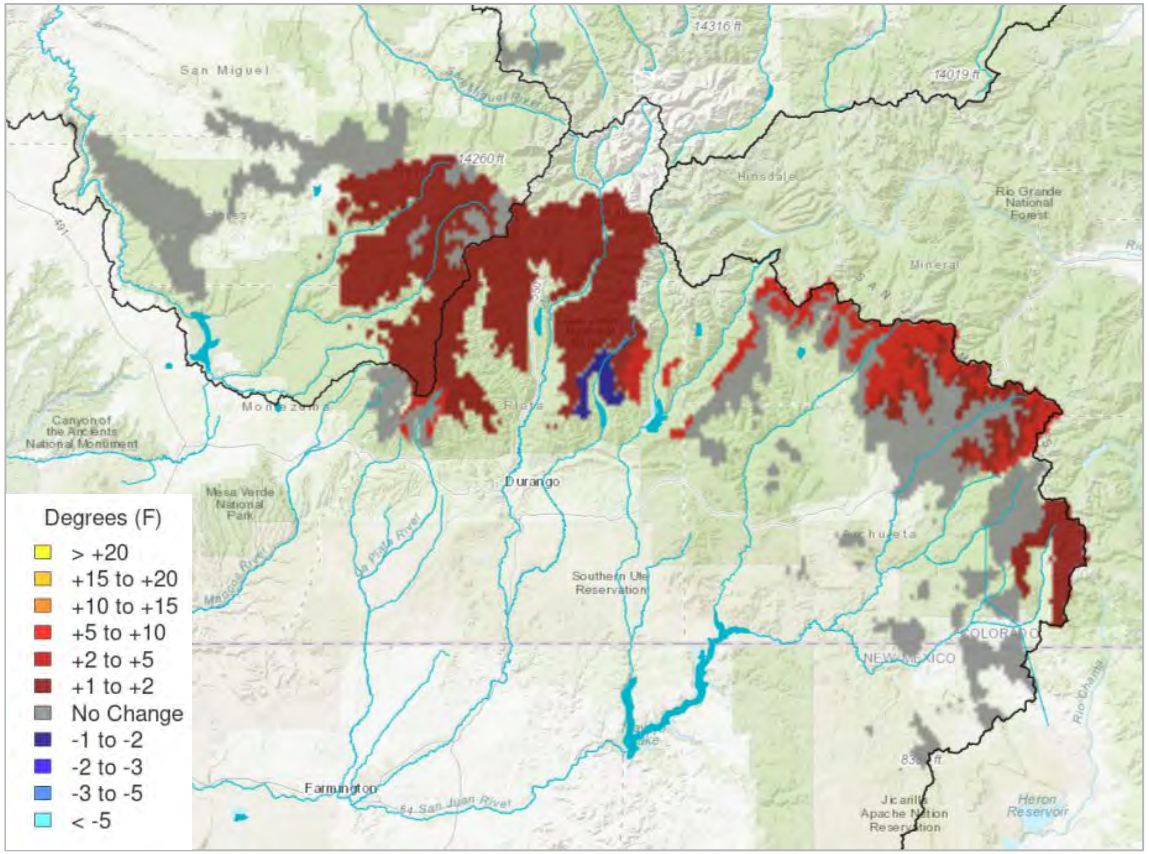




- Modeled snow is below normal at all elevations.
  - Slightly better conditions above Navajo Reservoir
- Significant melt has occurred below 11,000'; earlier than normal.
- Snow accumulation still possible above 11,000'
  - Normal time of peak of SWE = Early May

Dust Accounting: CBRFC Model

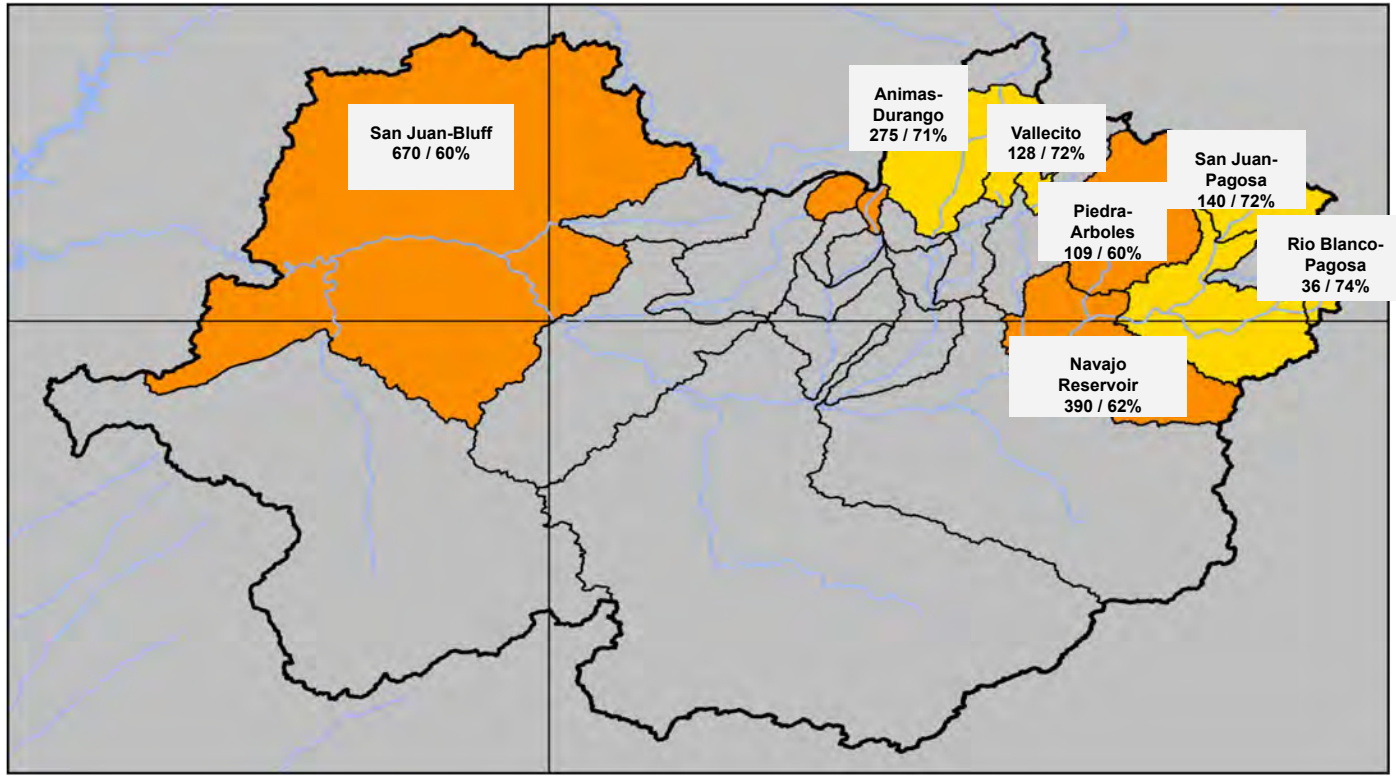
April 18, 2022



- Snow Contamination Grids from NASA/Jet Propulsion Lab
  - “Dust-on-snow” data
- Grids are used both in model calibration and daily operations
  - Calibration:
    - Grids used for 2000-2020 period
    - Help to fine tune snowmelt timing at high elevations
  - Daily operations:
    - Can apply a temperature adjustment to the snow model based on daily contamination grids.
    - Temperature adjustment can helps improve model streamflow simulations and short term forecasts.

April Water Supply Forecasts: San Juan River Basin

April-July Forecasts
Volume in 1000's acre-feet / Percent of 1991-2020 average



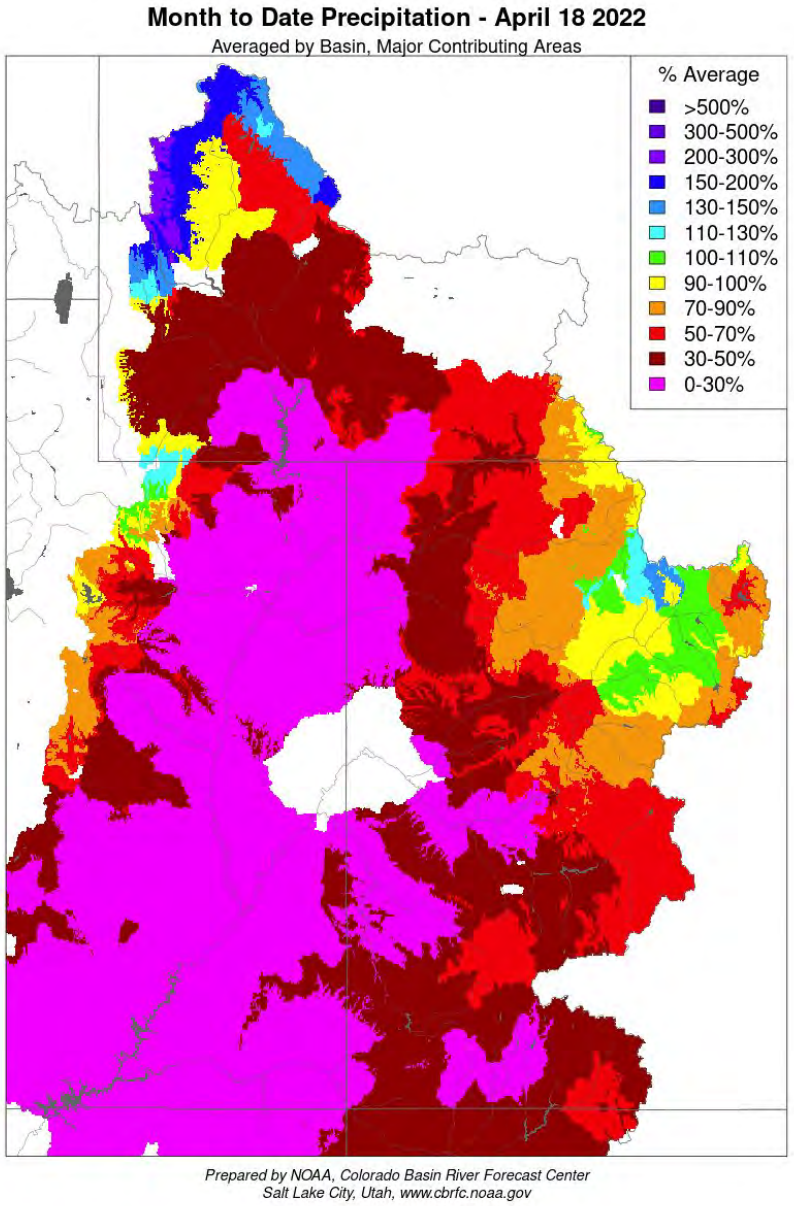
April 50% exceedance forecasts range from 55-75% average.

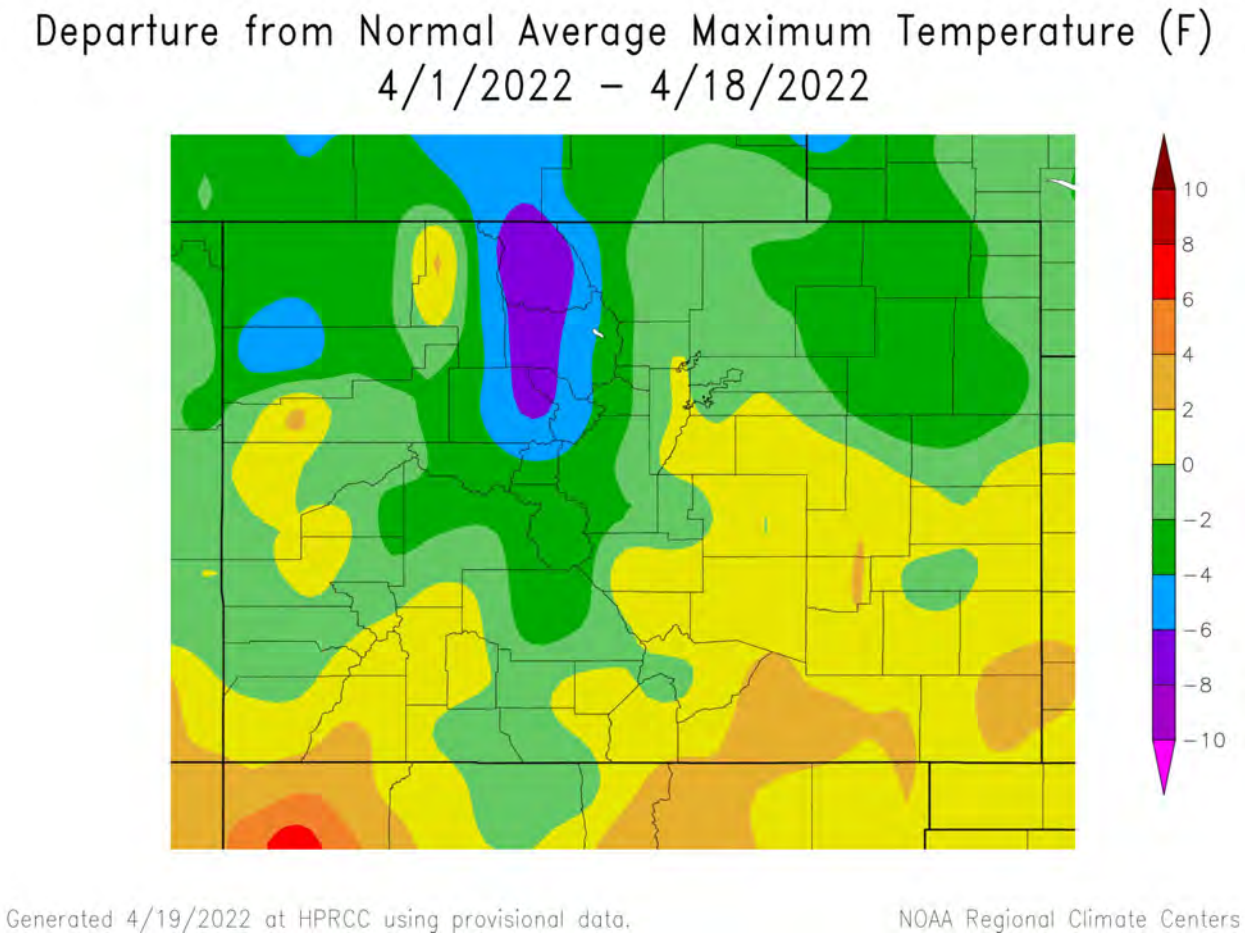
Location	April 2022 Forecast KAF/ % of AVG	2021 April-July Observed Volume KAF/ % of AVG
San Juan River -Pagosa	140 / 72%	135 / 69%
Piedra nr Arboles	109 / 60%	101 / 55%
Navajo Reservoir	390 / 62%	378 / 60%
Lemon Reservoir	32 / 67%	29 / 60%
Vallecito Reservoir	128 / 72%	127 / 72%
Animas-Durango	275 / 71%	210 / 55%

The April 50% exceedance forecasts are very similar to the observed April-July volumes in 2021.

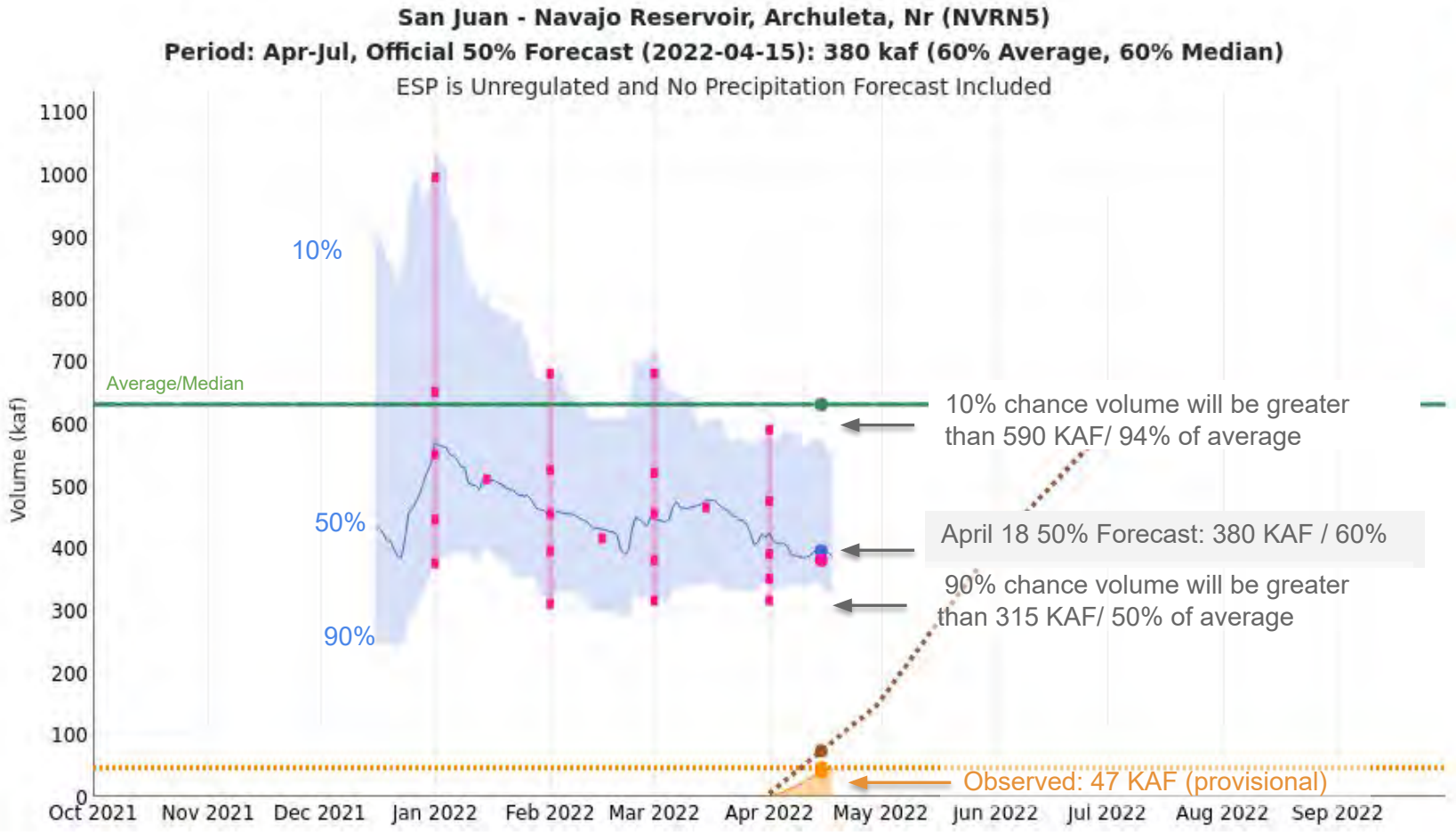
Forecast guidance has decreased by 5-10% of average since early April.

April Precipitation and Temperature to Date





Water Supply Forecast Evolution: Navajo Reservoir



2022/04/15:
Average: 630
Median: 630
Observed Accumulation: 38.8
Observed Total: 46.6
Normal Accumulation: 73.5
ESP: 395
Official 50: 380

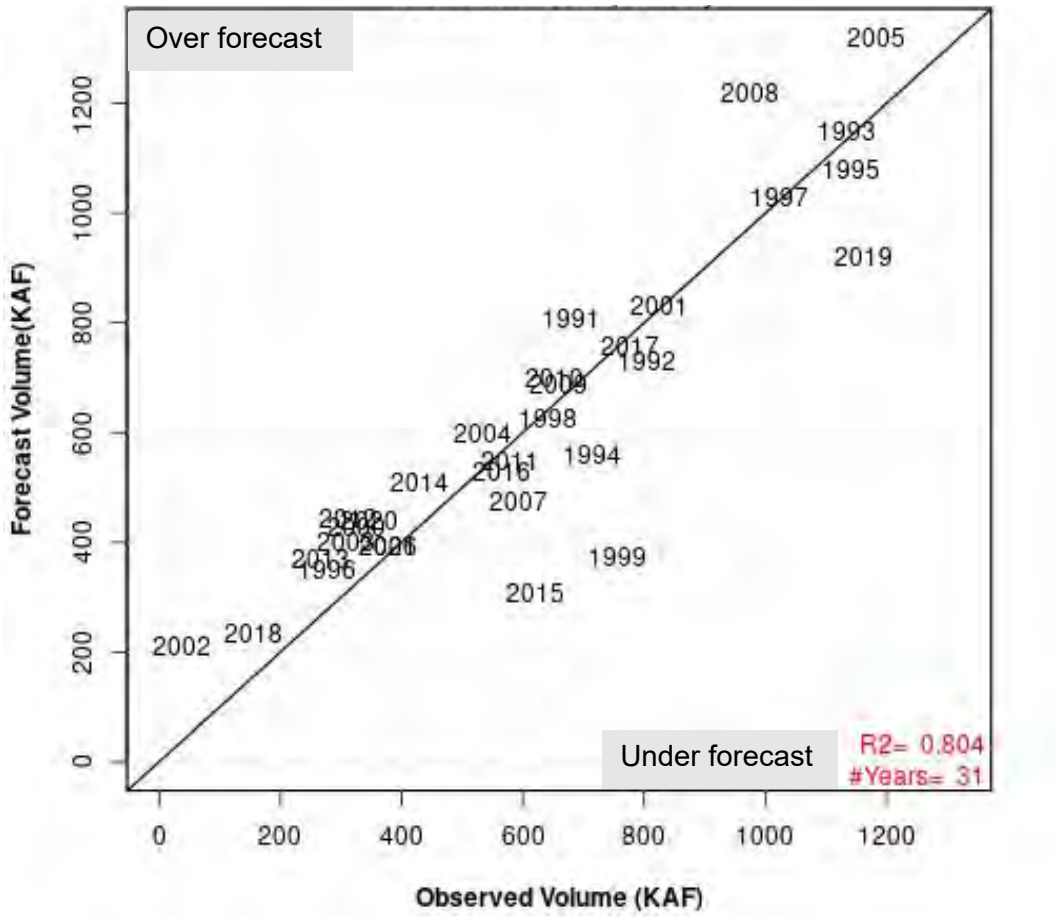
Blue shading: Daily Raw Model Guidance 90% - 10% exceedance range
Blue line: Daily Raw Model Guidance 50% exceedance
Pink line: Official forecast 90%, 70%, 50%, 30%, 10% exceedance

Brown dotted: Average observed
Orange dashed: 2022 Observed Streamflow

Navajo Reservoir Inflow Forecast Plot Link
San Juan River Forecast Plots Link

Forecast Verification

Navajo Reservoir Inflow
April 1st Forecast 1991-2021



Mar 1st average error: 22%
Apr 1st average error: 18%
May 1st average error: 15%

Historical Forecast Errors with similar April 1 Forecasts

YEAR	APR 1 FCST (KAF)	OBSERVED (KAF)	Error KAF / %
2003	400	307	93 / 30%: over
2006	395	379	16 / 4%: over
2021	395	378	17 / 4% over
2022	**390**	**?**	**?**
1999	375	755	380 / 50%:under

Primary Sources of Forecast Error:

- Future Weather
  - Uncertainty in precipitation and temperature forecasts
  - Extreme dry/wet events results in larger errors
    - Rarely forecast in advance
- Model States: Is the model representative of reality?
  - Snow
    - SNOTELs and Satellite images used to verify
  - Soil moisture
    - Extensive analysis done in Fall

Summary

- **Soil moisture**
  - Conditions have improved from last year but are still below normal.
  - Soil moisture deficits still exist and will need to be overcome before runoff can occur.
  - Impact on runoff uncertain and depends on spring weather and snowmelt pattern.

- **Snow**
  - Below normal conditions at all elevations
  - Significant melt at elevations below 11,000’
  - Another year with early melt

- **April Water Supply Forecasts**
  - Early April forecasts range from 55-75% of average
  - Forecast guidance has decreased by 5-10% of average
  - Forecasts are similar to the observed volumes in 2021

- **Early Runoff Implications:**
  - Impacts depend on specific basin characteristics
  - Could be less efficient early in the melt due to dry soils
  - Could be more efficient due to faster melting snow pack
  - Could cause increased evapotranspiration in the later portion of the normal runoff period as bare ground and soils dry out sooner; ultimately leading to lower flows.

CBRFC Contacts

Basin Focal Points (Forecasters)

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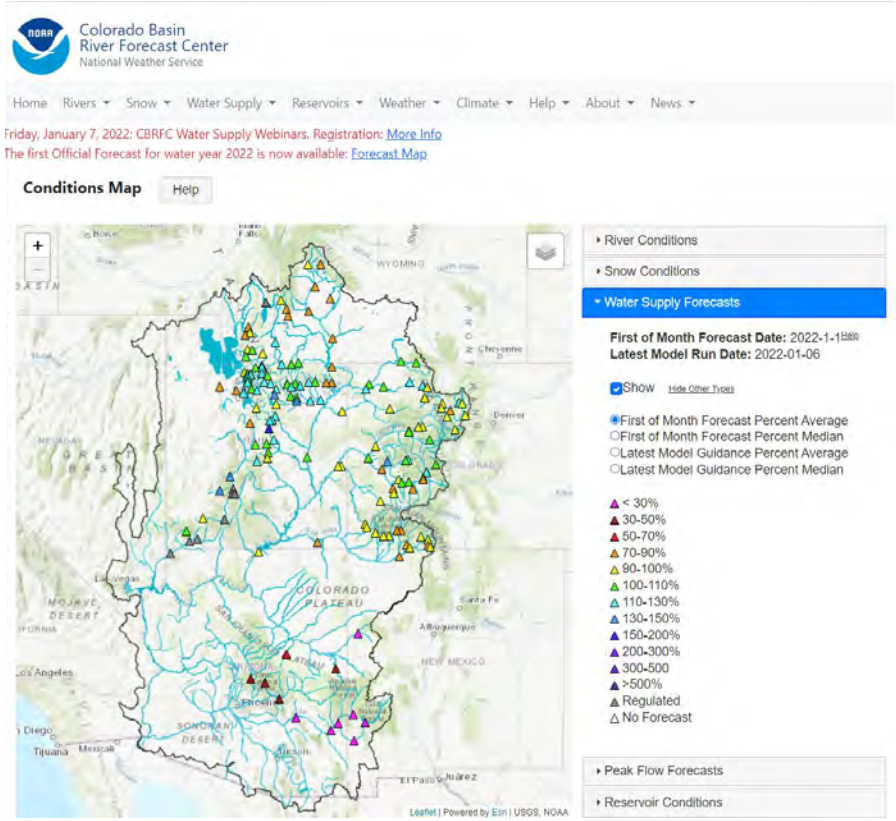
CBRFC Operations
cbrfc.operations@noaa.gov
801-524-4004

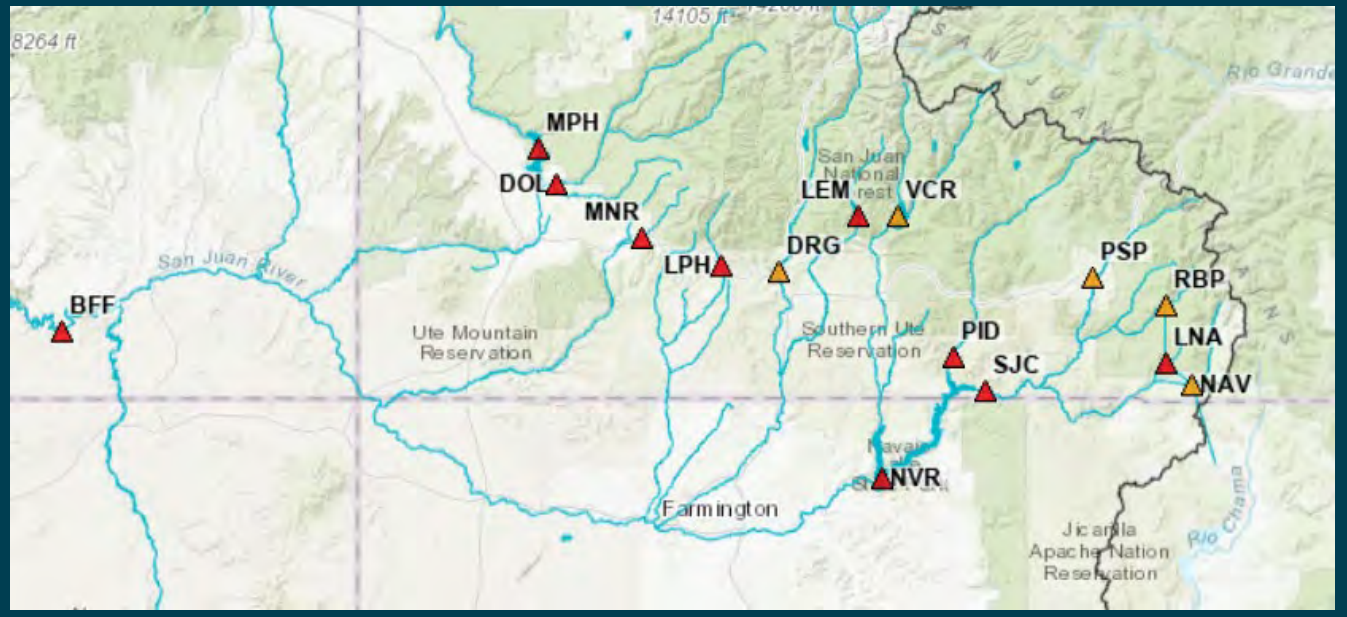
CBRFC Water Supply Presentations
https://www.cbrfc.noaa.gov/present/present.php



Official Water Supply Forecast (April-July)

Navajo:	390 kaf (62% avg)
Vallecito:	128 kaf (72% avg)
Lemon:	32 kaf (67% avg)
Animas:	275 kaf (71% avg)
McPhee:	152 kaf (60% avg)
Powell:	4,100 kaf (64% avg)

April Official



Runoff observed so far

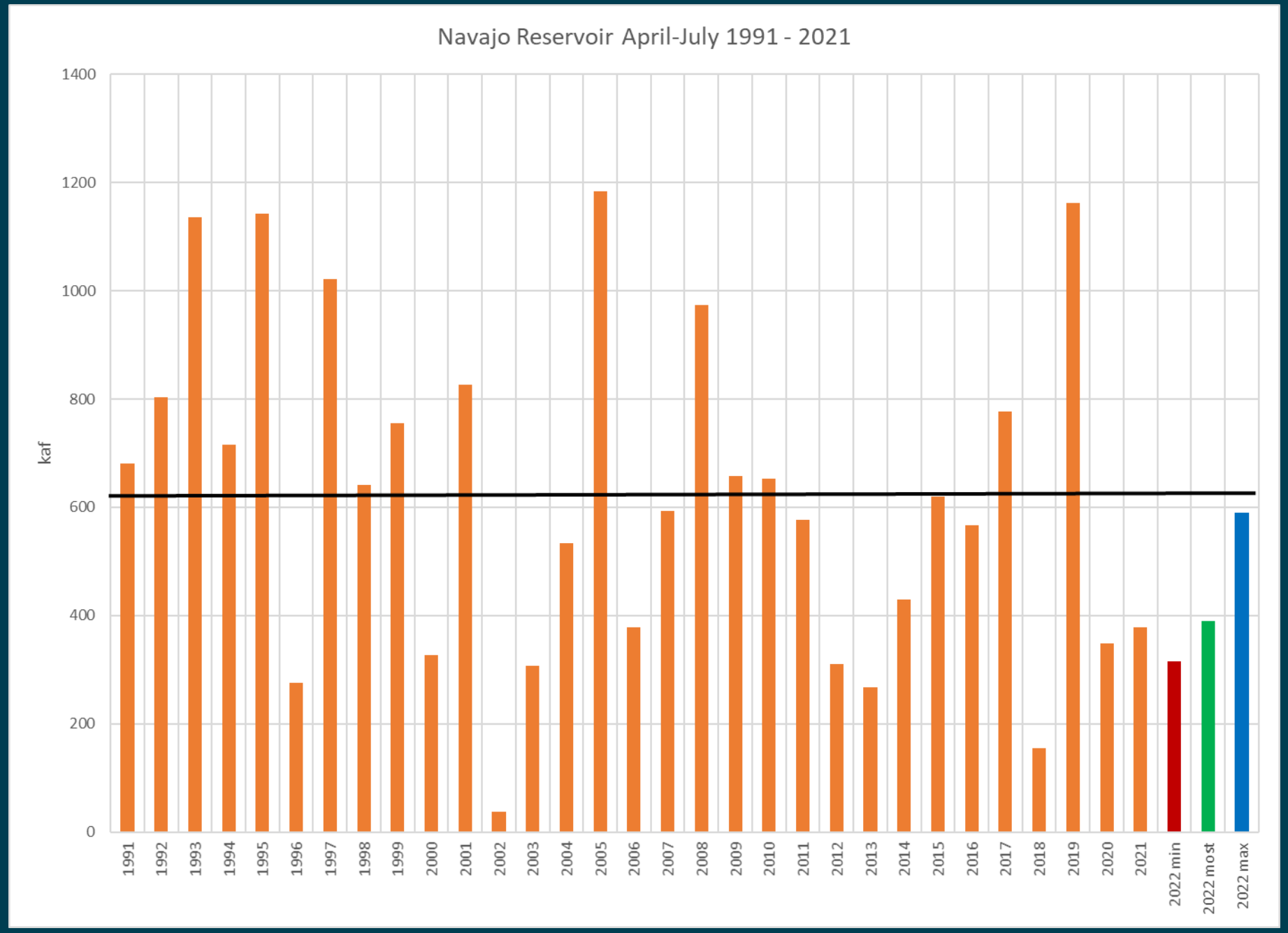
April 2022

MUI Forecast* = 83 kaf
Observed so far = 46.6 kaf
% of MUI observed so far = 56%

April-July 2022

MUI Forecast* = 390 kaf
Observed so far = 46.6 kaf
% of MUI observed so far = 12%

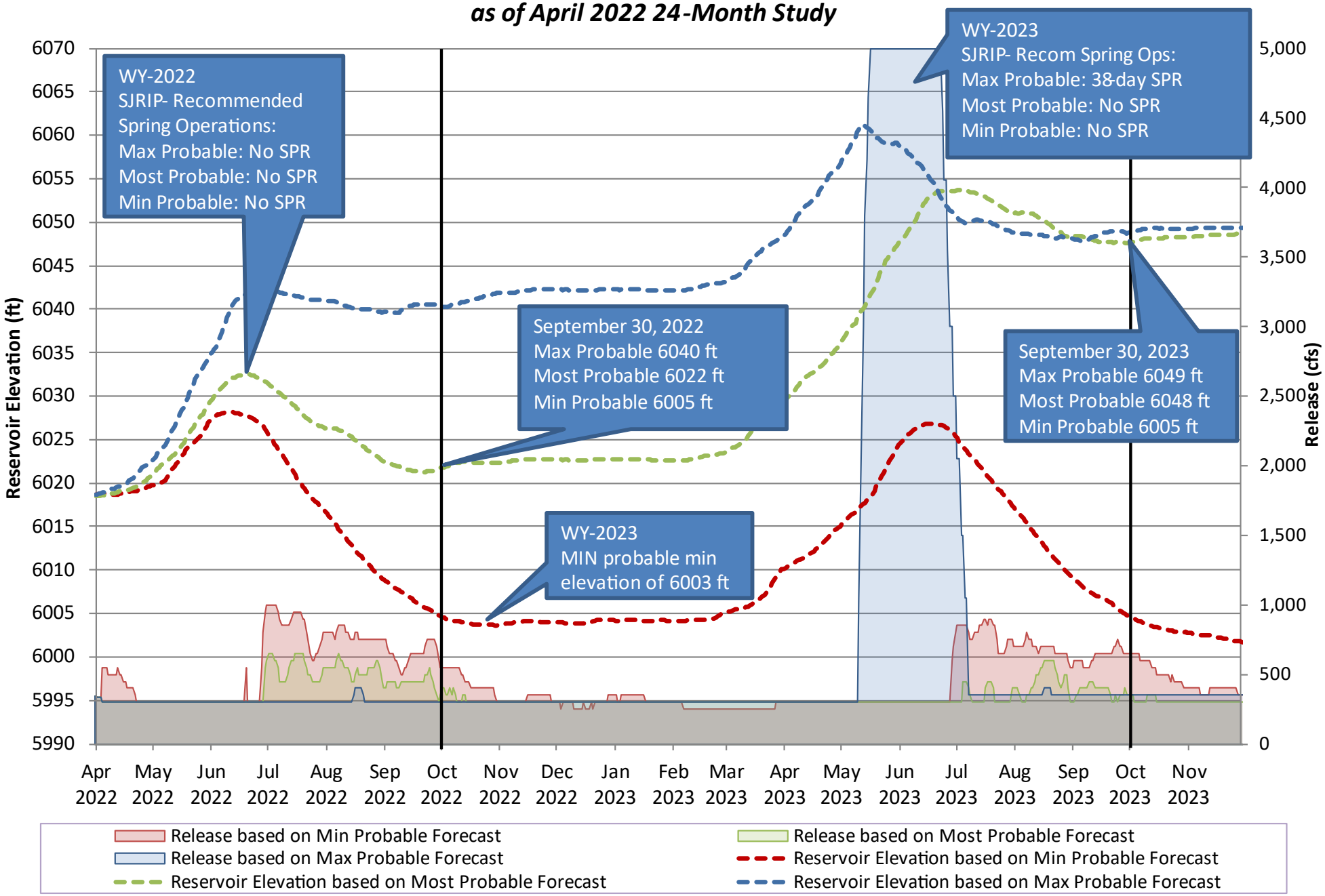
* April Most Probable CBRFC Forecast



April 1 Forecast

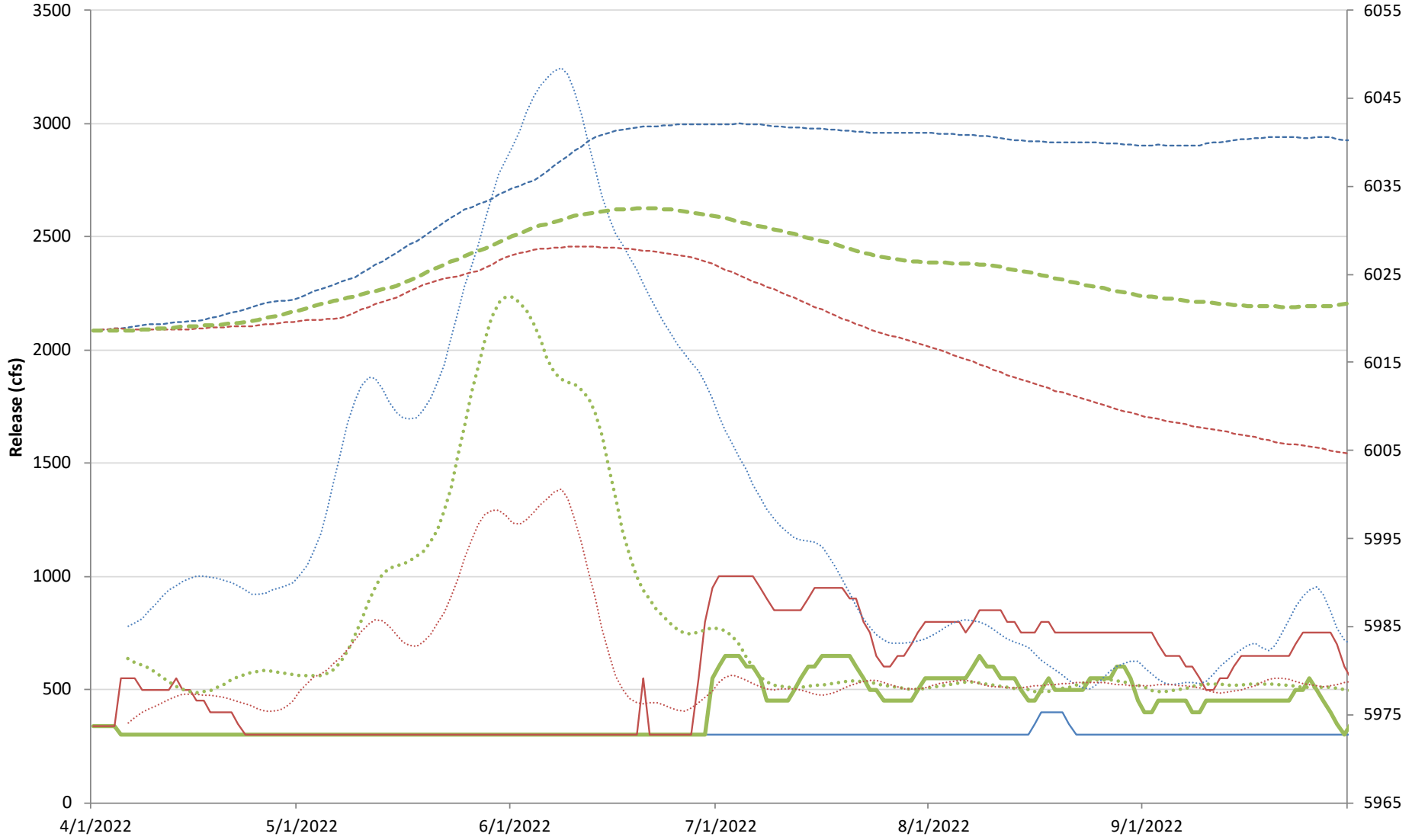
Navajo Reservoir Forecast Elevation and Release

as of April 2022 24-Month Study



Navajo Reservoir Forecast Operations - Summer 2022

as of April 2022 24-Month Study



Projected Operations WY 2022

Based on current streamflow conditions, storage levels, and statistical outlooks based on 35 years of historical hydrology,

- April-July runoff projections range from 315 kaf (50% avg) – 590 kaf (94% avg) with a median projection of 390 kaf (62% avg).
- No planned SJRIP-prescribed Spring Peak Release in WY 2022. Summer releases will likely range from 600 cfs to 1,000 cfs.
- No projected shortage to contracted water users in WY 2022
- End of Water Year Storage: 740 kaf live/112 kaf active (6005 ft, 45% full) – 1,060 kaf live/434 kaf active (6040 ft, 64% full) with a median projection of 880 kaf live/254 active (6022 ft, 53% full)

Lemon Reservoir:

- Forecast runoff 58% average
- Forecast peak 62% full

Vallecito Reservoir:

- Forecast runoff 90% average
- Forecast peak 77% full

McPhee Reservoir:

- Forecast runoff 61% average
- Forecast peak 64% full

Lake Nighthorse:

- Animas forecast runoff 71% average
- Anticipated pumping 30 days at 64 cfs, total volume of 3779 af

Updates (reminder):

- Statistical Averages
  - The 30-year average used across agencies progresses every decade
  - The time period for statistics has been updated to 1991 - 2020
  - Navajo April – July Modified Unregulated Inflow averages:
    - 1981 – 2010: 737 kaf
    - 1991 – 2020: 628 kaf
- Navajo Area-Capacity Tables were updated and implemented in October of 2021. Updated live storage is 1.65 maf (1.70 maf previously)

Drought Response Operation Agreement (DROA)

- DROA is an element of the Drought Contingency Plan to address water elevations in key Colorado River reservoirs. (Signed May 2019)
- Purpose: minimize risk of Lake Powell falling below the target elevation (3525') and thereby:
  - Fulfill Compact obligations
  - Maintain Hydropower production
  - Minimize adverse effects to resources and infrastructure
- Directed Upper Basin States (WY, UT, CO, NM) and Reclamation to develop a Drought Response Operation Plan

https://www.usbr.gov/dcp/finaldocs.html

Attachment A1 to the Agreement Concerning Colorado River Drought Contingency Management and Operations ("Companion Agreement")

AGREEMENT FOR DROUGHT RESPONSE OPERATIONS AT THE INITIAL UNITS OF THE COLORADO RIVER STORAGE PROJECT ACT

This Agreement for Drought Response Operations ("Drought Response Operations Agreement") at the Glen Canyon Dam, Flaming Gorge Dam, Curecanti (the "Aspinall Unit"), and Navajo Dam authorized by the Colorado River Storage Project Act (collectively referred to as the "CRSPA Initial Units" and individually as "CRSPA Initial Unit"), an element of the Upper Colorado River Basin's Drought Contingency Plan, is hereby made and entered into this 20th day of May, 2019 by and among the Upper Colorado River Division States of Colorado, New Mexico, Utah, and Wyoming ("Upper Division States"), through the Upper Colorado River Commission ("Commission"), and the Secretary of the Interior ("Secretary") hereinafter collectively referred to as the "Parties." The Secretary may delegate his or her duties under this Drought Response Operations Agreement to the Bureau of Reclamation ("Reclamation").

I. INTRODUCTION

A. BACKGROUND/OBJECTIVE

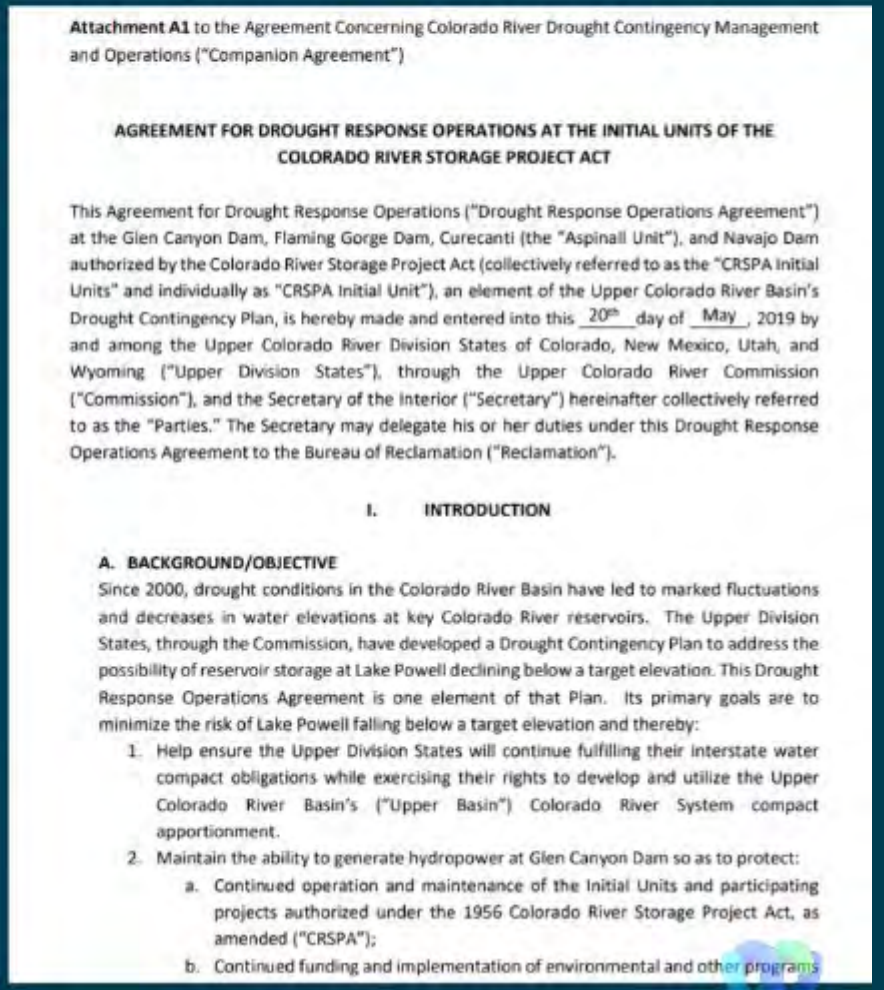
Since 2000, drought conditions in the Colorado River Basin have led to marked fluctuations and decreases in water elevations at key Colorado River reservoirs. The Upper Division States, through the Commission, have developed a Drought Contingency Plan to address the possibility of reservoir storage at Lake Powell declining below a target elevation. This Drought Response Operations Agreement is one element of that Plan. Its primary goals are to minimize the risk of Lake Powell falling below a target elevation and thereby:

1. Help ensure the Upper Division States will continue fulfilling their interstate water compact obligations while exercising their rights to develop and utilize the Upper Colorado River Basin's ("Upper Basin") Colorado River System compact apportionment.
2. Maintain the ability to generate hydropower at Glen Canyon Dam so as to protect:
   a. Continued operation and maintenance of the Initial Units and participating projects authorized under the 1956 Colorado River Storage Project Act, as amended ("CRSPA");
   b. Continued funding and implementation of environmental and other programs

Drought Response Operation Agreement (DROA)

- II.A.3.c - Participation from all CRSPA Initial Units
  - "DROA shall ensure that ALL CRSPA Initial Units will be considered for drought response operations:
    1. Operational Adjustments at Lake Powell
    2. All Initial Units Considered uniformly based on factors including:
       - Water availability
       - Hydrology
       - Resource conditions
       - Operational limitations
- II.A.3.d – Effectiveness
  - Releases "may not be recommended if they are ultimately determined to be futile to achieve the goals or intent of this Drought Response Operations Agreement"

https://www.usbr.gov/dcp/finaldocs.html



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Drought Response Operations Plan

- Plan Framework – Static Guidance
  1. Introduction/Background
  2. Authorities governing DROA
  3. Hydrology and Projections summary
  4. Drought Response Operations summary
  5. Application of DROA
     1) DROA Planning Timeline
     2) Scope of DROA at initial units
     3) Effectiveness/futility
     4) Natural Resource Considerations
     5) Impacts to Basin Fund
     6) Transit Losses and Optimization
  6. Accounting/Recovery
  7. Consultation/Coordination/Outreach
  8. Monitoring/Amendments

- Plan Attachments – Specific to current year
  A. Summary of current year (2022) DRO Plan
  B. Glen Canyon Operational Adjustments
  C. Flaming Gorge Operations
  D. Aspinall Unit (Blue Mesa) Operations
  E. Navajo Operations
  F. Natural Resource Considerations
  G. Basin Fund Considerations
  H. Outreach Summary

https://www.usbr.gov/dcp/droa.html

Upper Basin DROA Initial Unit Emergency Releases in 2021

DROA Releases for the July 24MS Model Run

	Jul (kaf)	Aug (kaf)	Sep (kaf)	Oct (kaf)	Nov (kaf)	Dec (kaf)	Sum
Flaming Gorge	13	42	43	27	0	0	125
Blue Mesa	0	18	18	0	0	0	36
Navajo	0	0	0	0	0	0	0
Sum:	13	60	61	27	0	0	161

2022 DROA Scenarios considered

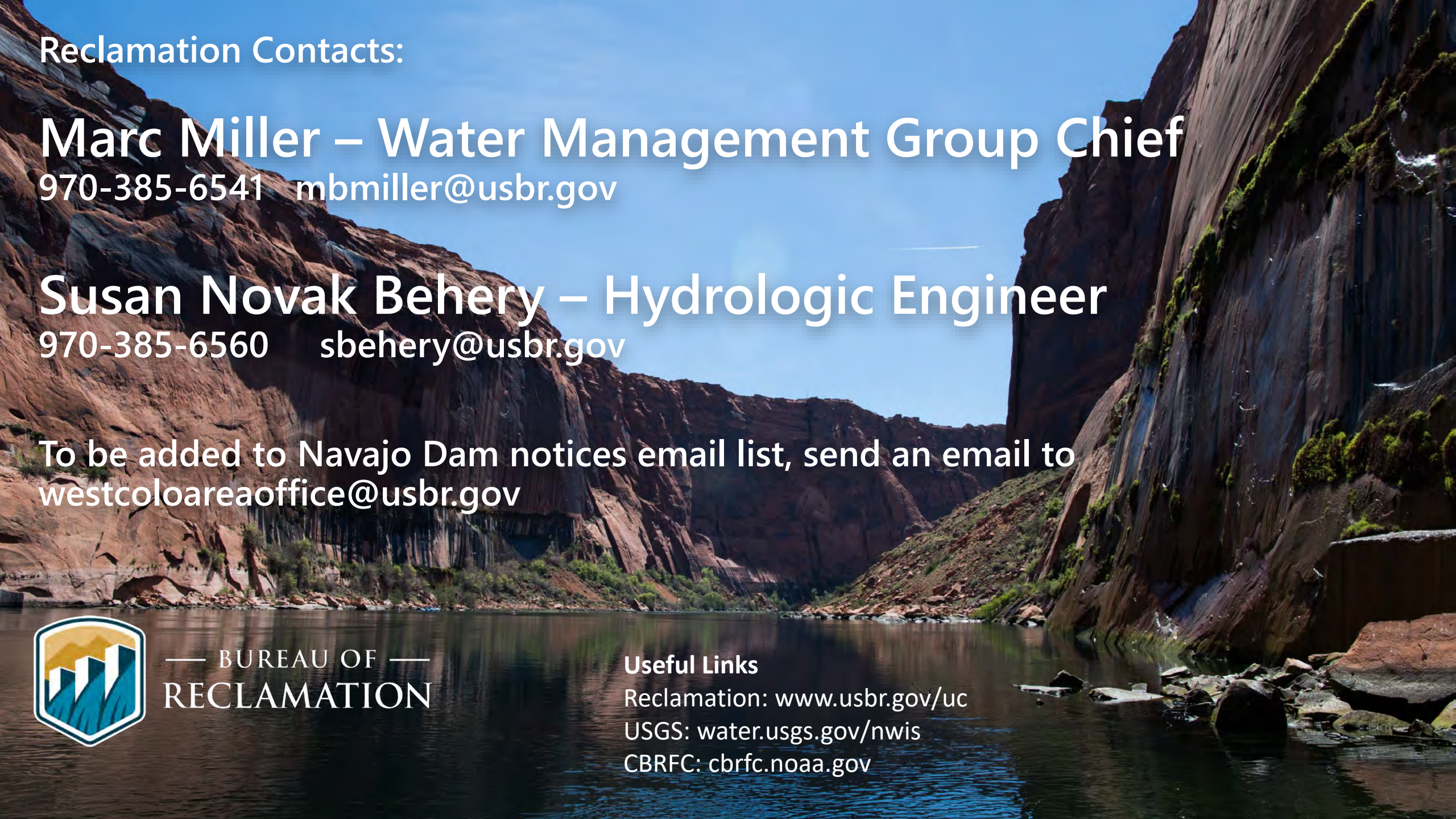
CRSP Unit	No DROA	DROA Scenario 0.5 A	DROA Scenario A	DROA Scenario B	DROA Scenario C	
Flaming Gorge	-	250,000	500,000	600,000	724,000	acft release
Aspinall	-	.		100,000	100,000	acft release
Navajo	-	-		-	-	acft release
Scenario total	-	250,000	500,000	700,000	824,000	acft

Next Meeting August 23rd 2022

Tuesday, 1:00 PM

Planning in-person with a virtual/phone option.

Farmington Civic Center, Farmington, NM



Reclamation Contacts:

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Susan Novak Behery – Hydrologic Engineer

970-385-6560 sbehery@usbr.gov

To be added to Navajo Dam notices email list, send an email to westcoloareaoffice@usbr.gov

BUREAU OF RECLAMATION

Useful Links

Reclamation: www.usbr.gov/uc

USGS: water.usgs.gov/nwis

CBRFC: cbrfc.noaa.gov