

Beyond the Drought

Contingency Planning for a Diminishing River



September 18, 2018

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Deputy Chief Engineer

Minding the source for more than 80 years

- Created by the General Assembly in 1937
- Represent Water Interests of 15 western Colorado counties
- Area Encompassing 28% of Colorado
- 80% of the Water but only 10% of the Population
- Board Representation from Each County
- Funded Exclusively Through Mill Levy & Water Activity Enterprise



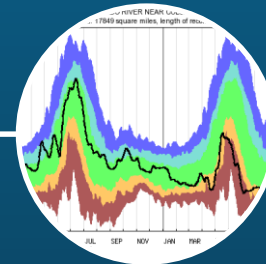
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Protecting and Supporting West Slope Water Uses



Legal



Technical

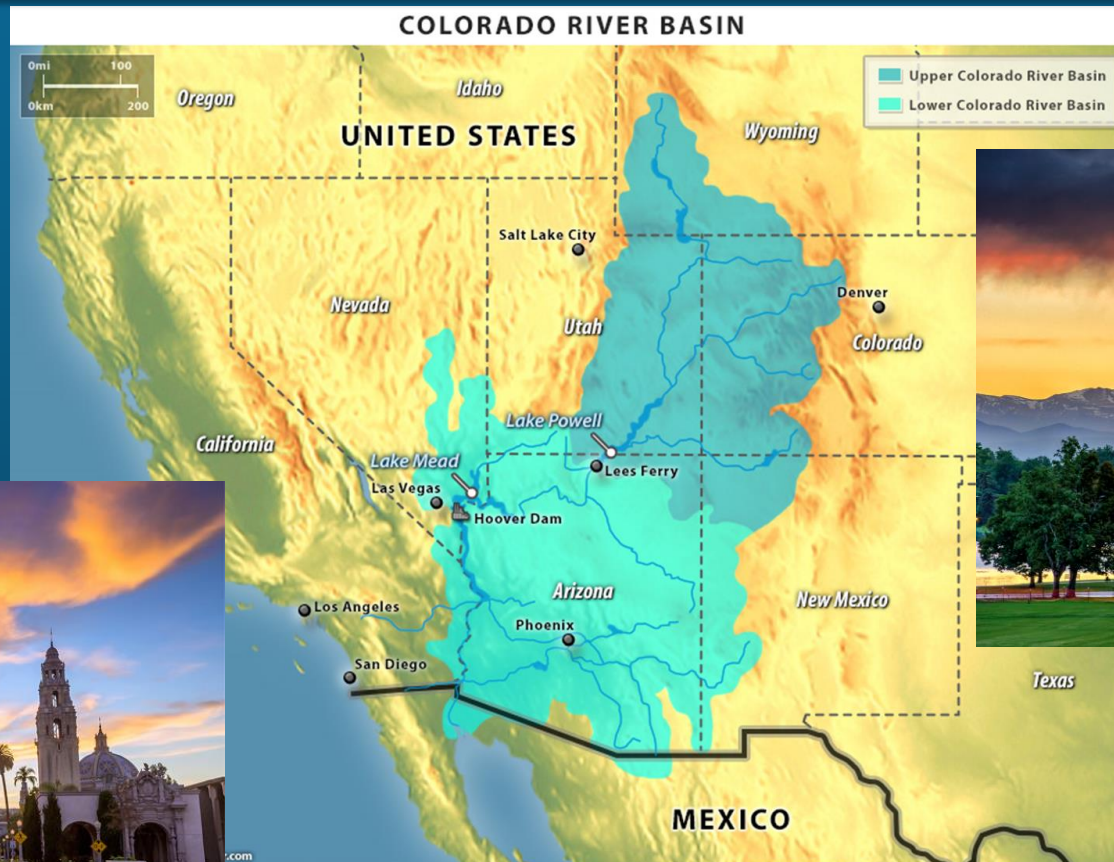


Legislative

Fighting to keep water for use on the Western Slope

- Watchdog of Colorado River transbasin diversions
- Hold and develop water rights for the benefit of western Colorado
- Own and control water in various reservoirs to support West Slope uses – municipal and industrial, agricultural, recreational and environmental
- Intrastate and Interstate role (*dual statutory charge*)

Challenges from the East and the West



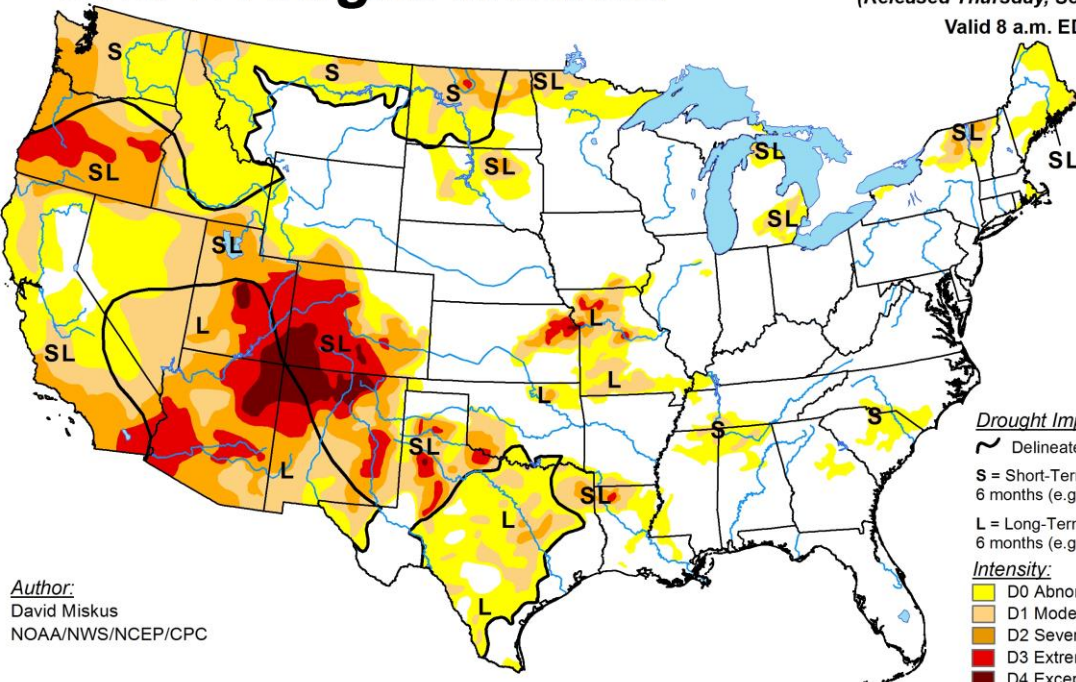
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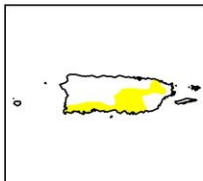
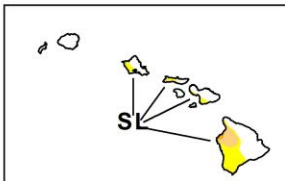
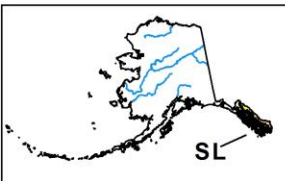
Current Conditions: Challenging at best...

U.S. Drought Monitor

September 11, 2018
(Released Thursday, Sep. 13, 2018)
Valid 8 a.m. EDT



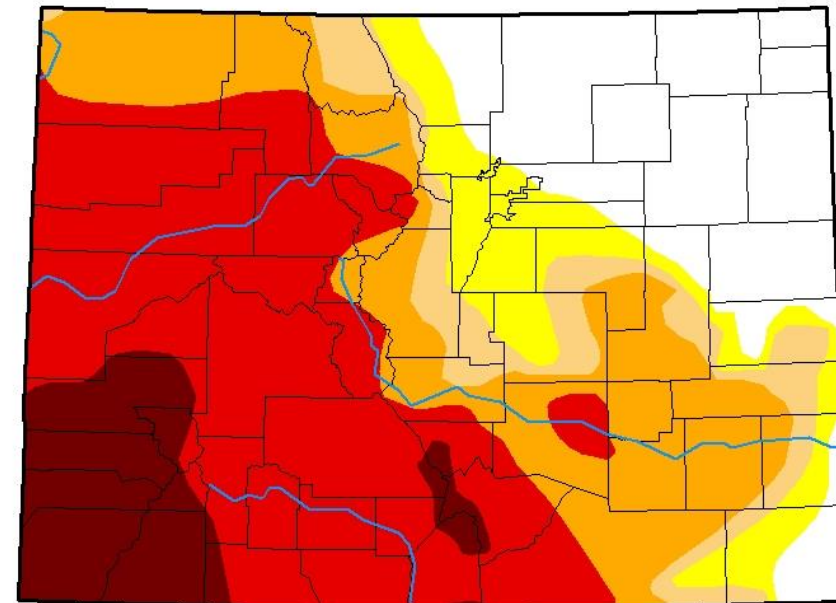
Author:
David Miskus
NOAA/NWS/NCEP/CPC



<http://droughtmonitor.unl.edu/>

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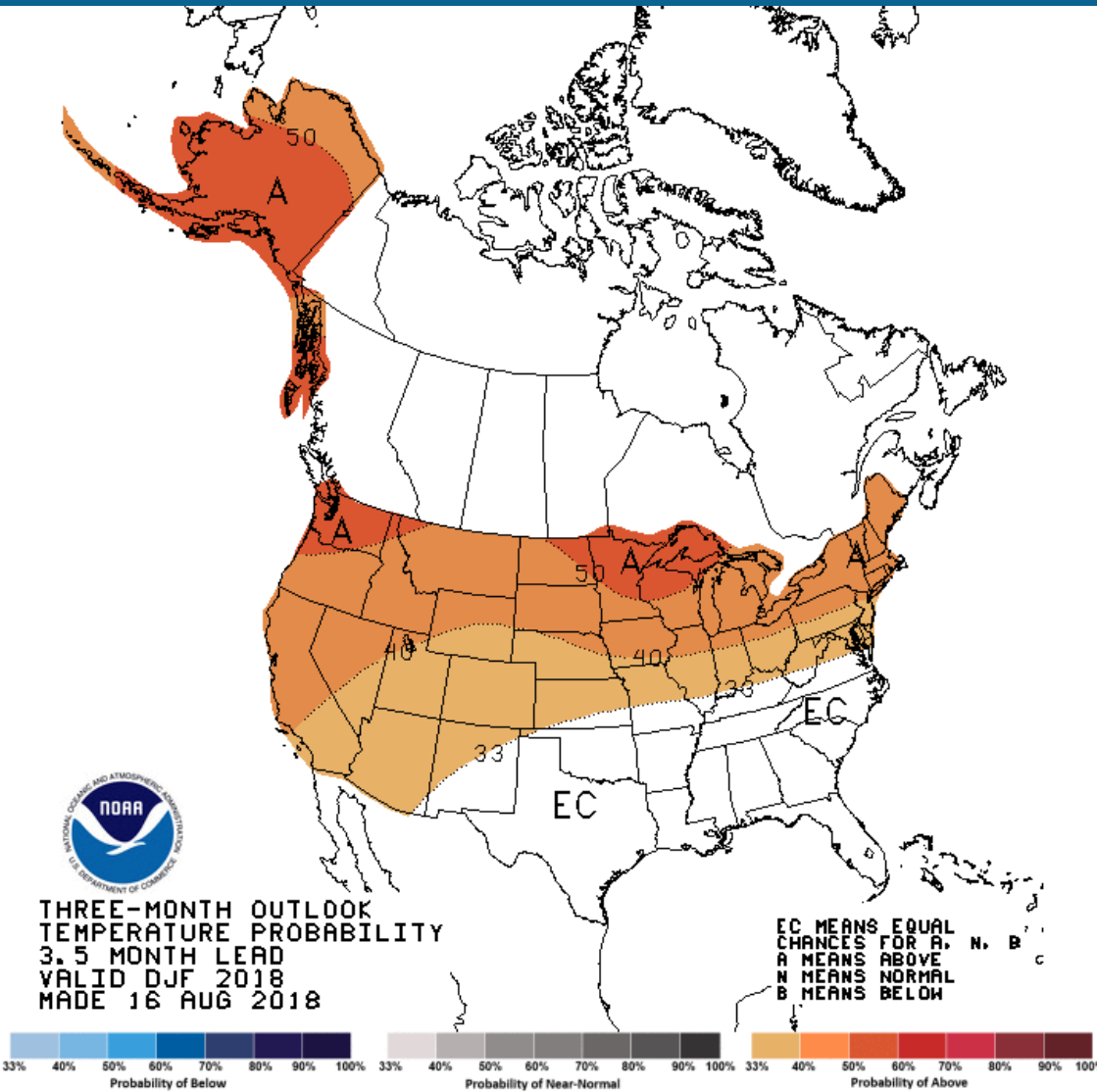
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
David Miskus
NOAA/NWS/NCEP/CPC



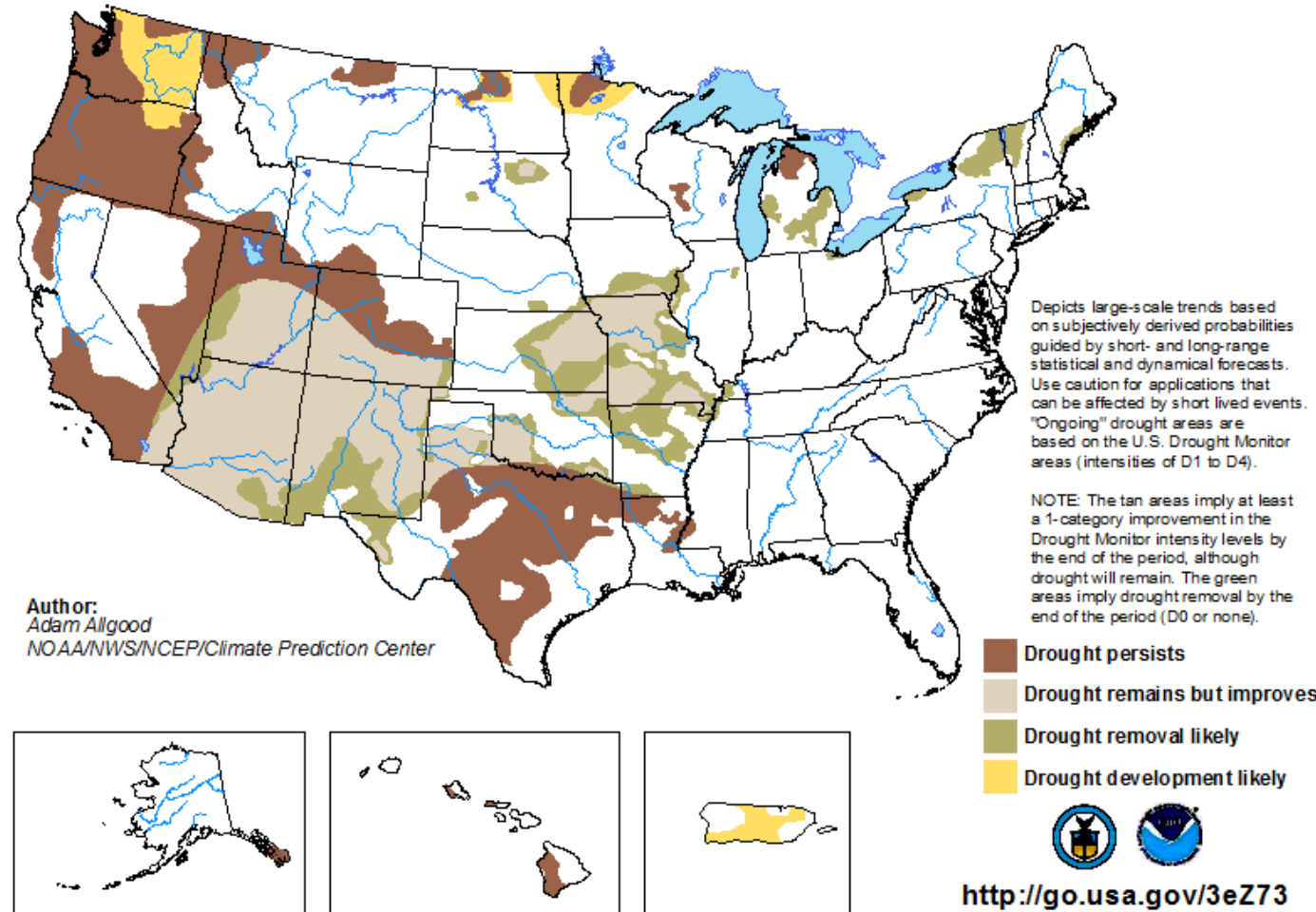
<http://droughtmonitor.unl.edu/>

Forecasted Drought Conditions to Continue



U.S. Seasonal Drought Outlook Drought Tendency During the Valid Period

Valid for August 16 - November 30, 2018
Released August 16, 2018



The Colorado River Compact: In a Nutshell



- Compact divides the Colorado River, including all tributaries, into an Upper Basin and a Lower Basin.
- Boundary between the two basins is Lee Ferry, Arizona
- III (a). “There is hereby apportioned
- . . . in perpetuity to the Upper Basin and to the Lower Basin . . . the exclusive beneficial consumptive use of 7,500,000 acre feet per annum

The 1922 Colorado River Compact: Drilling Down

- Divides the Colorado River (including tributaries), into an **Upper** and **Lower** Basin
- Boundary between the two basins is Lee Ferry, Arizona
- **Lower Division: Nevada, California & Arizona**
- **Upper Division: Wyoming, Colorado, New Mexico & Utah**
- Arizona, Utah and New Mexico have lands within both basins

The 1922 Colorado River Compact: Drilling Deeper

Colorado, like all Upper Division states, shares obligations to the Lower Division

- III (d) the Upper Division shall “not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any ten consecutive years.”
- III (c) regarding Mexico...the Upper Division must “deliver at Lee Ferry water to supply one-half of the deficiency so recognized in addition to that provided in paragraph (d).”



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The Upper Colorado River Basin Compact: 1948

Purposes include:

- “...equitable division and apportionment of the use of the waters...apportioned in perpetuity to the Upper Basin”
- “...establish the obligations of each State of the Upper Division with respect to deliveries of water required to be made at Lee Ferry”
- procedures and methodology for determining how much water Colorado would have to provide in the event the “curtailment of the use of water...becomes necessary in order that the flow at Lee Ferry shall not be depleted below that required by Article III (of the 1922 Compact).”



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The Upper Colorado River Basin Compact: 1948

Provides Arizona with **50,000 AF** consumptive use per year, the remainder of the consumptive use is divided as follows:

51.75% to Colorado

23.00% to Utah

14.00% to Wyoming

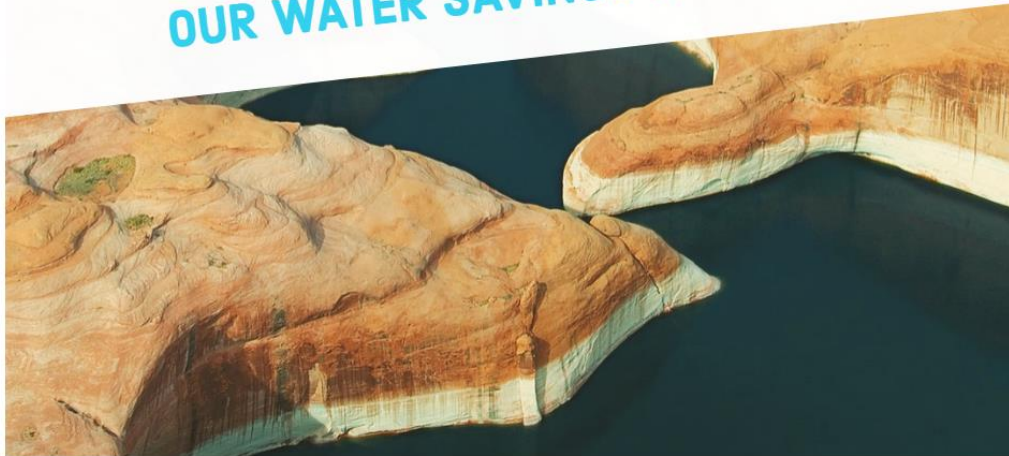
11.25% to New Mexico

“Consumptive use” is defined as man-made depletions to the natural (undepleted) flow at Lee Ferry. (NOTE: This definition includes CRSP reservoir evaporation.)



LAKE POWELL:

OUR WATER SAVINGS ACCOUNT



EOY 2000, Lake Powell was nearly 95% full and held more than **22 Million Acre Feet**

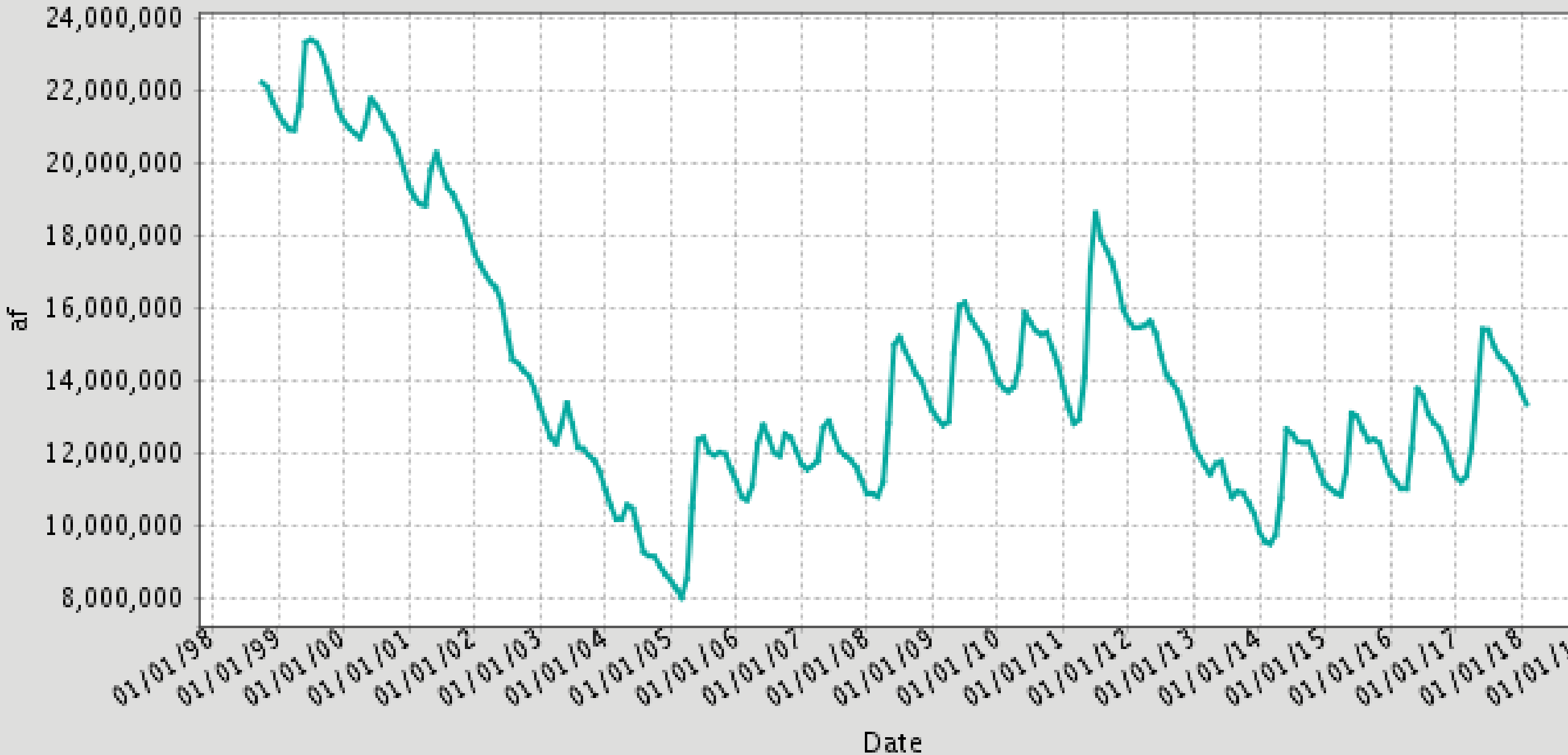
End of 2018, Powell is projected to be only 45% full with **~10 Million Acre Feet**



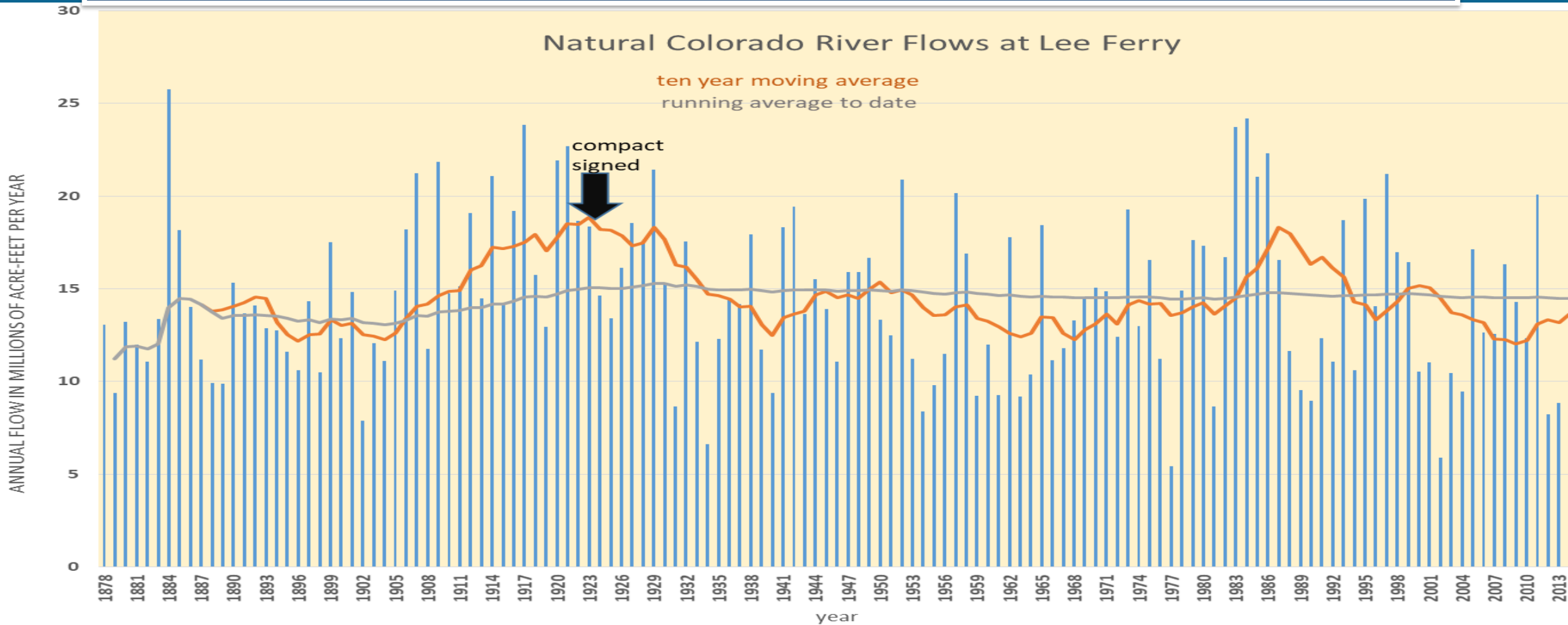
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Lake Powell: We have a long-term problem



Allocation of the River: Timing is Everything



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Current Use Estimates

	MAF/year
<u>Upper Basin uses (incl. reservoir evap.)</u>	<u>4.0 - 4.5</u>
Lower Basin mainstream uses	7.5 - 7.5
Lower Basin reservoir evap.	1.0 - 1.5
<u>Lower Basin tributaries</u>	<u>2.0 - 2.5</u>
Total Lower Basin	10.5 - 11.5
Subtotal	14.5 - 16.0
<u>Mexico</u>	<u>1.5 1.5</u>
<u>TOTAL</u>	<u>16.0 – 17.5</u>



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COLORADO RIVER LOWER BASIN

STRUCTURAL DEFICIT

DIVERSIONS ARE:

CA - 4.4 MAF
NV - 0.3 MAF
AZ - 2.8 MAF
MEXICO - 1.5 MAF

LAKE MEAD

DROPS 12 FEET PER YEAR EVEN IN NORMAL INFLOWS
BECAUSE CURRENT USE EXCEEDS AVAILABLE SUPPLY.



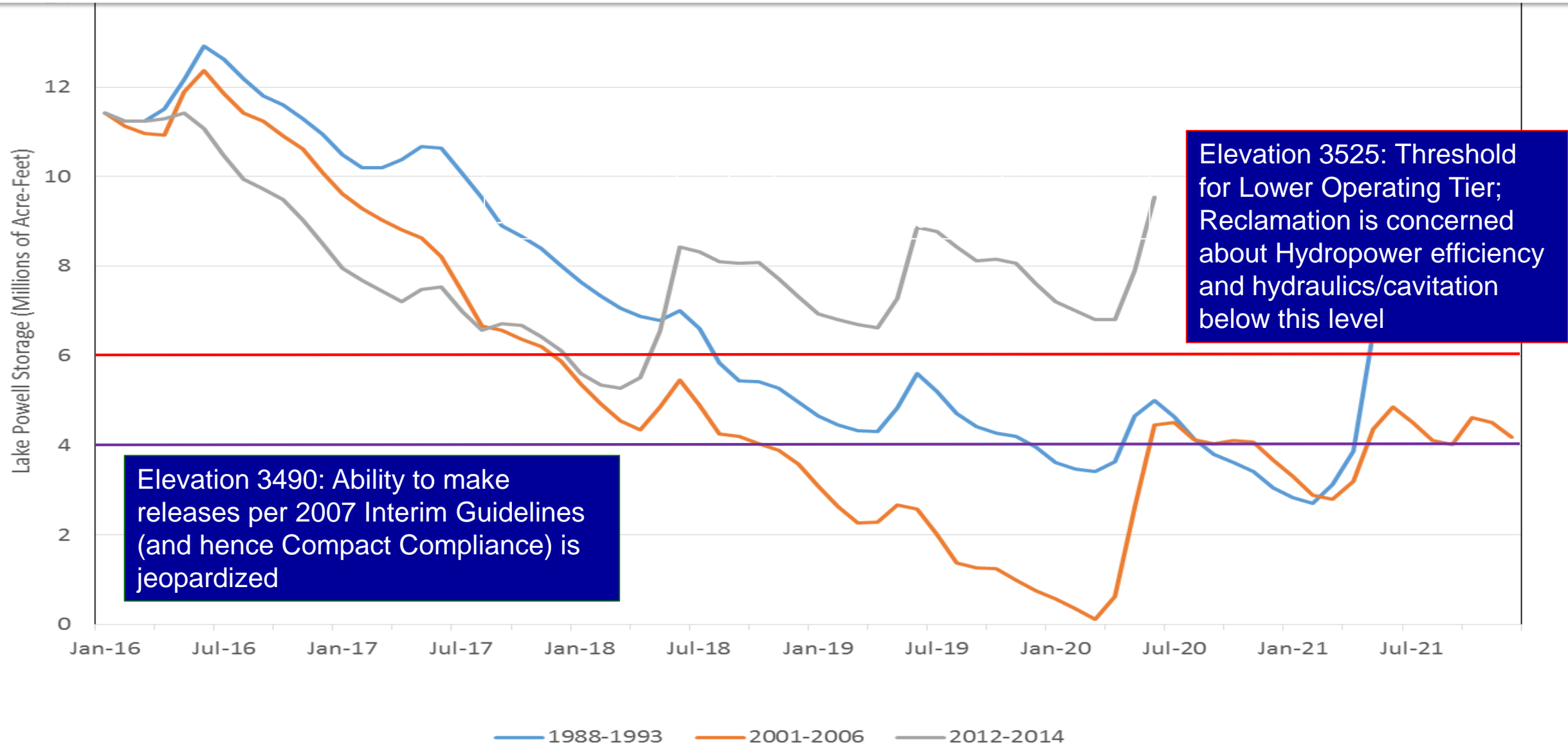
THE RESULTING DEFICIT **MUST BE ADDRESSED** TO
PROTECT THE RELIABILITY OF THE COLORADO RIVER SYSTEM

Note:

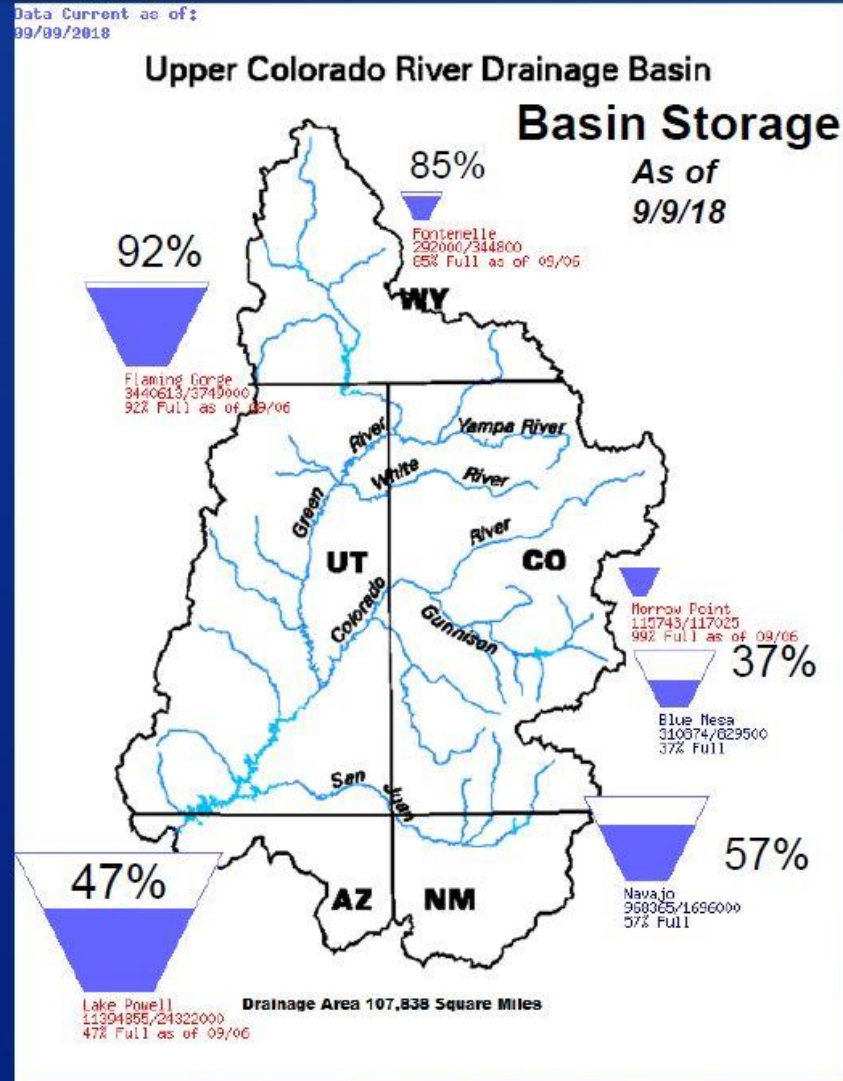
**This Does not
Account for
Reservoir
Evaporation!**

**Add Another
1.3 MAF**

What if drought periods of past 25 years repeated?



Current 2018 Conditions – Upper Basin



<https://www.usbr.gov/uc/water/basin/index.html>

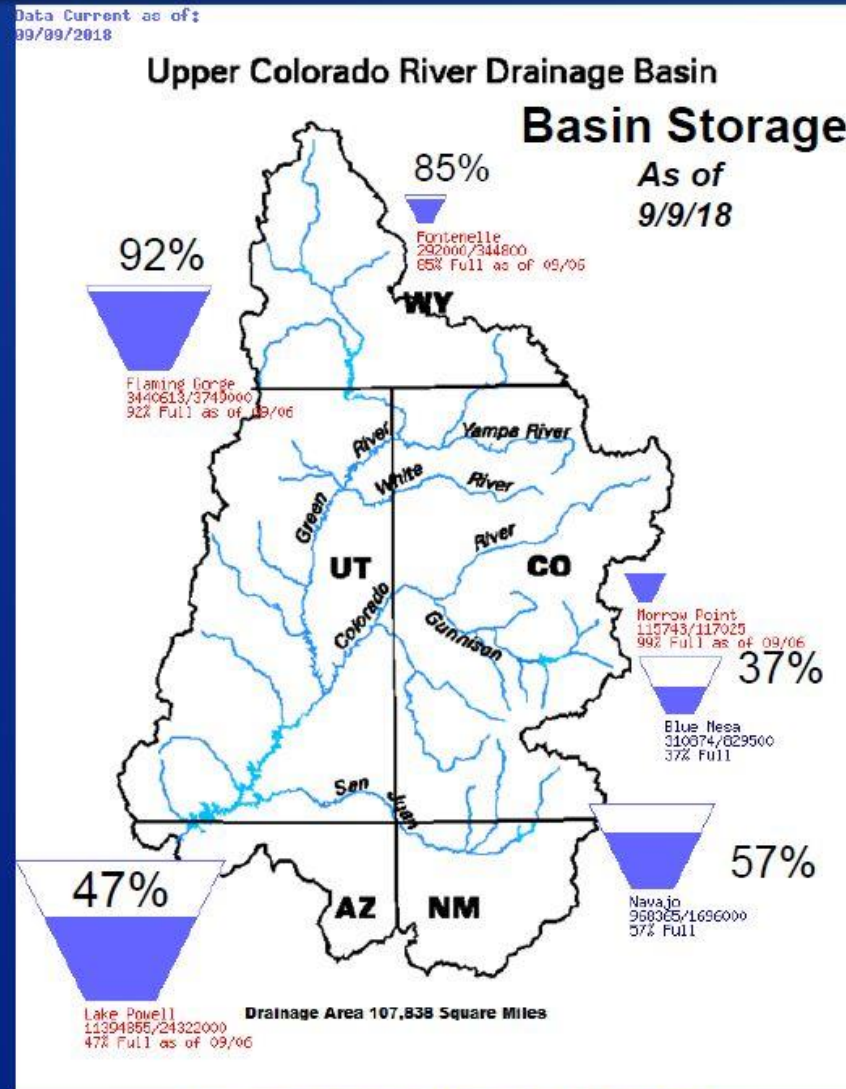
Observed 2018 April-July Inflow Issued August 1, 2018

Reservoir	Observed Inflow (KAF)	Percent of Average ¹
Fontenelle	997	138%
Flaming Gorge	1,118	114%
Blue Mesa	238	35%
Navajo	155	21%
Powell	2,602	36%

¹ Percent of average based on period 1981-2010

RECLAMATION

Forecasted 2019 Conditions – Upper Basin



<https://www.usbr.gov/uc/water/basin/index.html>

CBRFC Unregulated Inflow Forecast Issued August 1, 2018

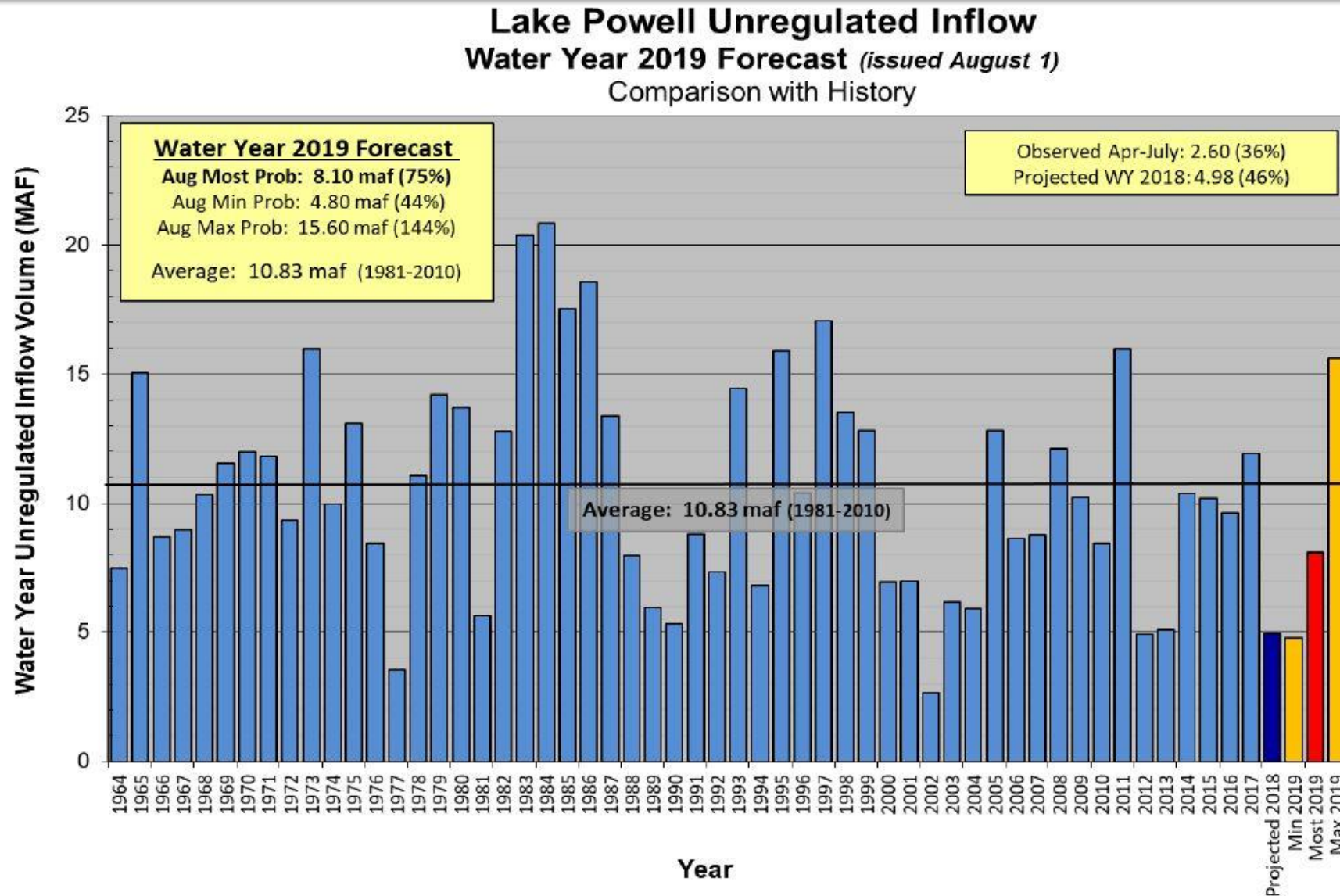
Water Year 2019 Forecasted Inflow

Reservoir	WY Forecast (KAF)	Percent of Average ¹
Fontenelle	1,040	96%
Flaming Gorge	1,320	91%
Blue Mesa	760	80%
Navajo	745	69%
Powell	8,100	75%

¹ Percent of average based on period 1981-2010.

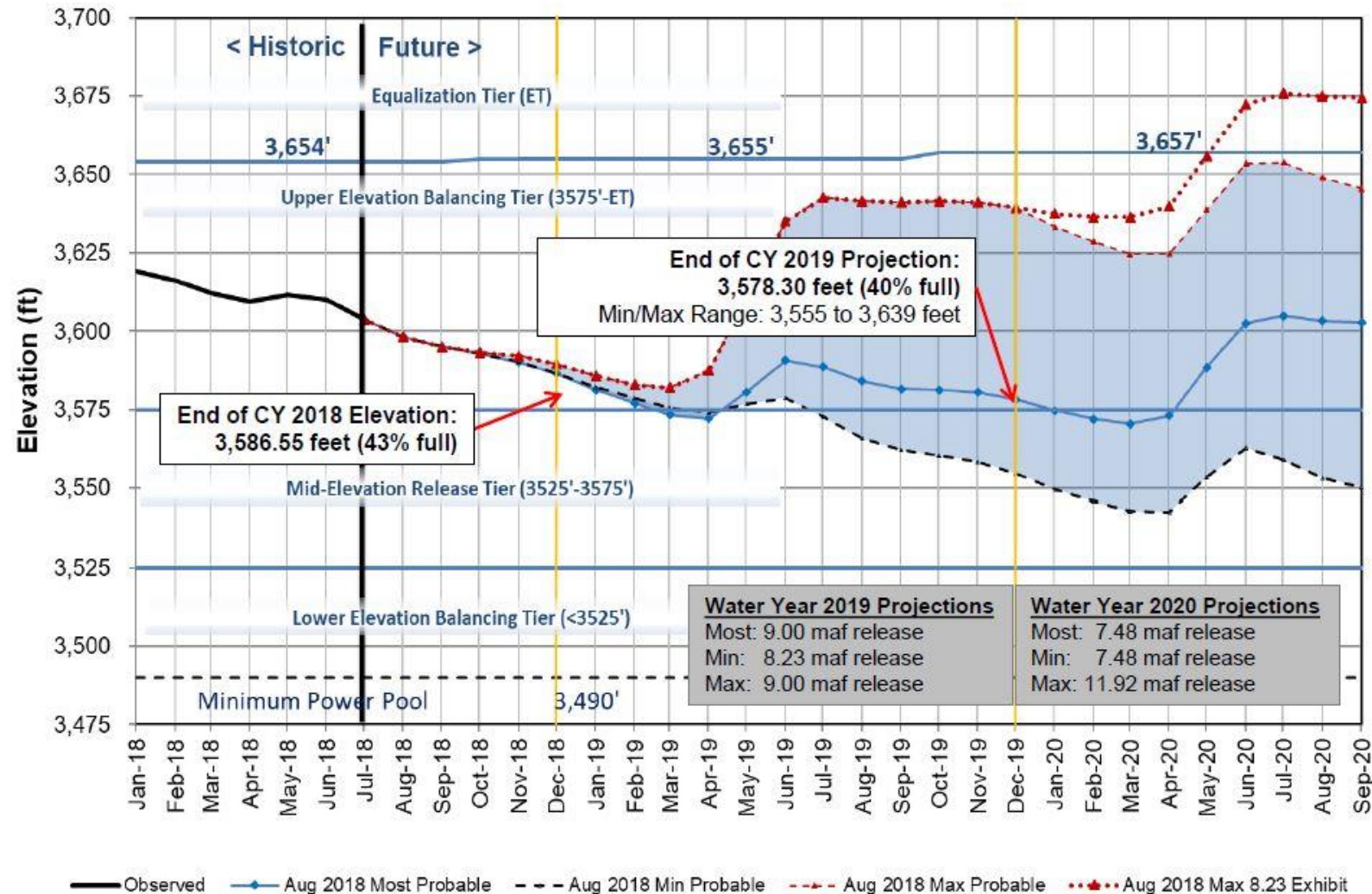
RECLAMATION

Lake Powell Inflows – Upper Basin

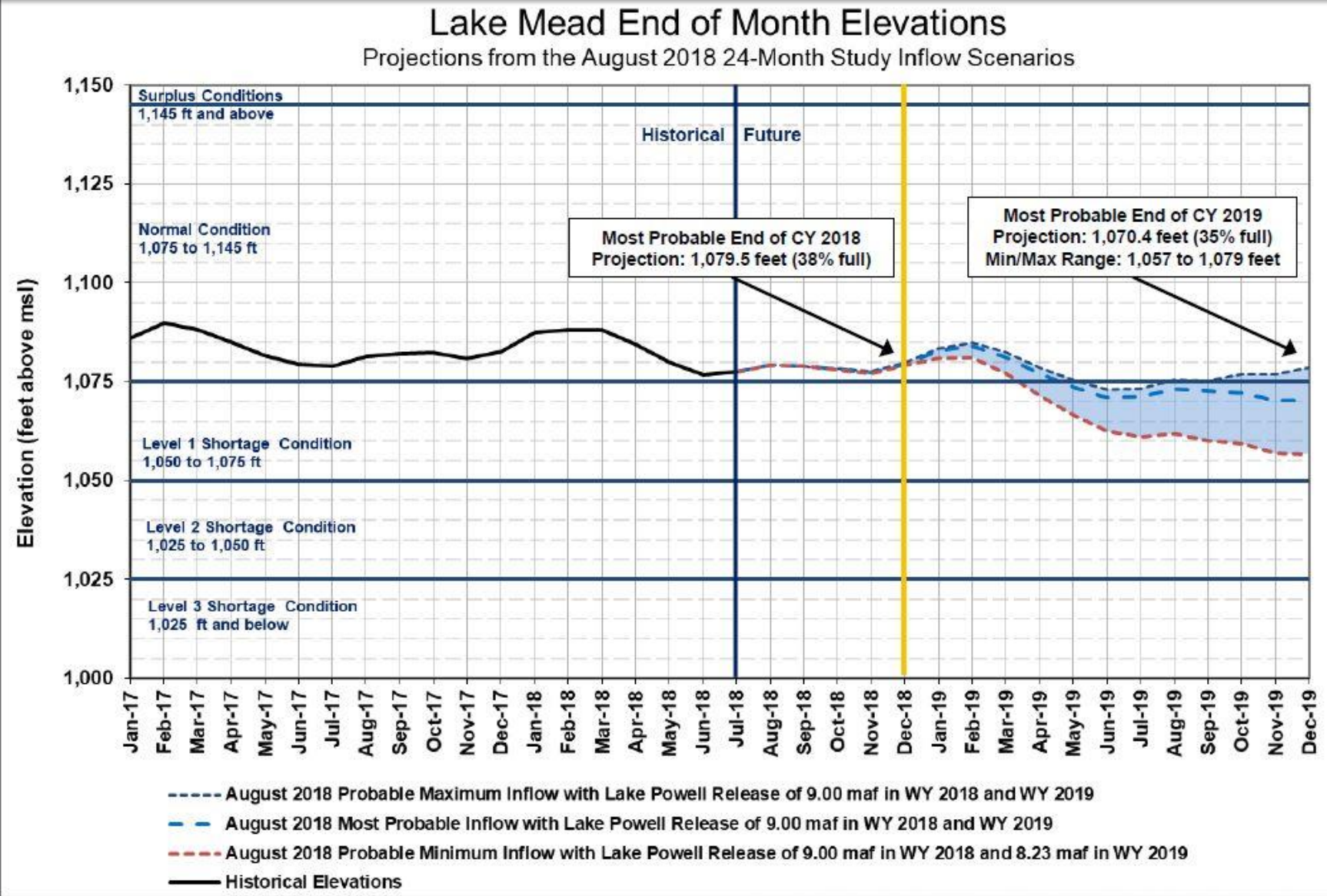


Projected Conditions – Upper Basin

Lake Powell End of Month Elevations
Historic and Projected based on August 2018 Modeling



Projected Conditions – Lower Basin



How Might Climate Change Impact Future Flows?



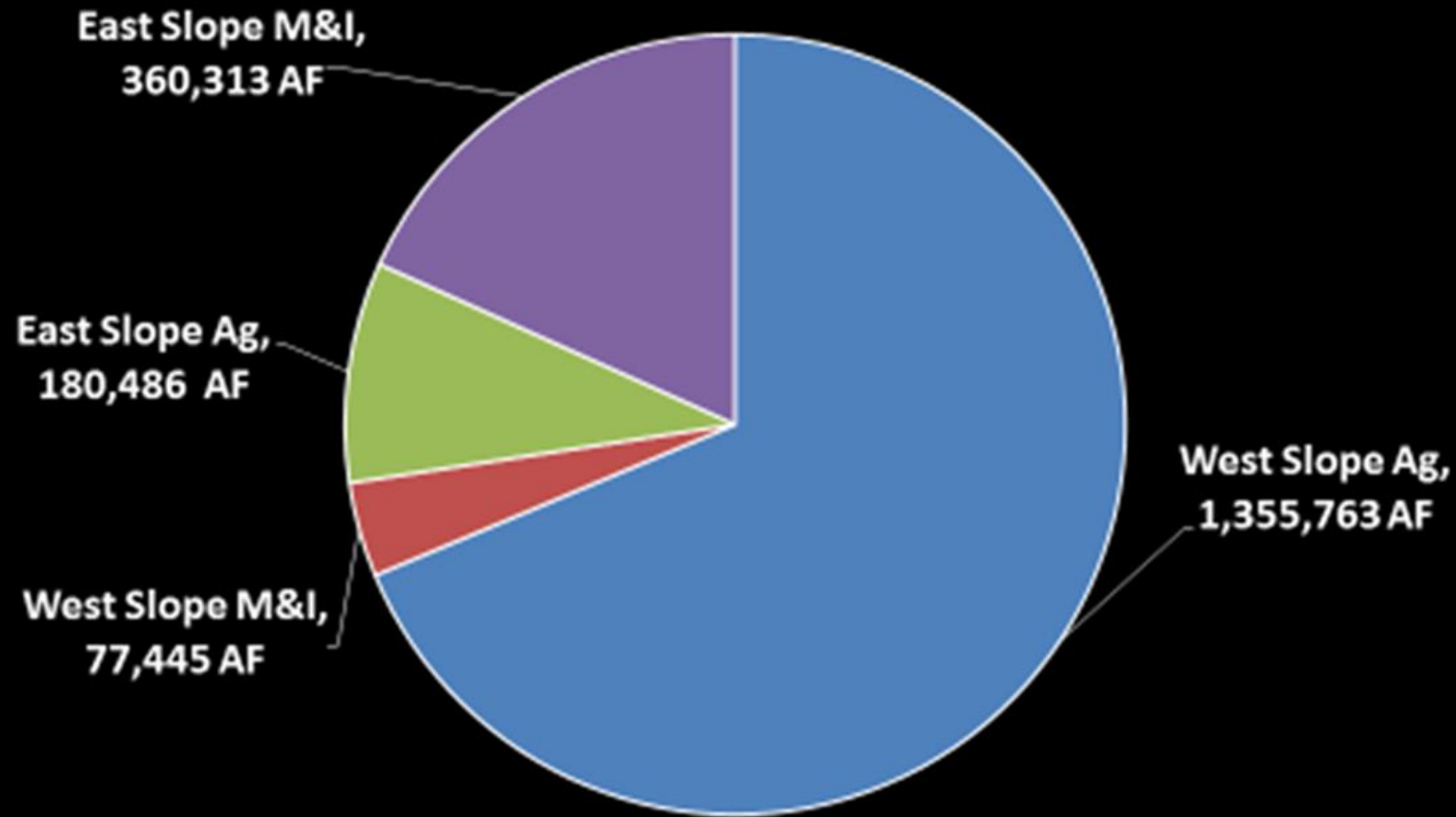
Recently published estimates of Colorado River flow sensitivity to temperature indicate that continued business-as-usual warming will drive temperature-induced declines in river flow, conservatively –20% by midcentury and –35% by end-century.

-- Brad Udall, Jonathan Overpeck
"The twenty-first century Colorado River hot drought and implications for the future"

What is Compact Curtailment and How Would it Impact Western Colorado Communities ?



Depletions from the Colorado River Basin



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Colorado River Risk Study and Important Assumptions

- Determine risk and actions to protect minimum power pool 3490' above mean sea level
3525' = 2 MAF above minimum power minimizes risk
- Future hydrology will be similar to 1988-2018
(natural flow @ Lee Ferry of about 13.2 million acre-feet since 2000 it has been only 12.4 million acre-feet)
- Lower Basin will successfully implement its Drought Contingency Plan (DCP)

West Slope Colorado River “Risk Study”

To understand the “Big River” imbalances to address water supply / demand issues within Colorado

Questions Addressed in Phases I&II:

1. What are magnitude and duration of potential Powell shortages below elevation 3525'?
(A: multiple years, millions acre-feet)
2. How much of the above shortages can be met by contributions from Drought Operations of large upstream (CRSP) reservoirs? (A: up to about 2 MAF)
3. How much consumptive use reduction (“**demand management**”) would be needed by Upper Basin states - AFTER use of CRSP water - to maintain Powell pool elevations?
(A: in extended droughts well over a million acre-feet)
4. What are implications to Compact deliveries? (A: storage in Powell is key)
5. What is range of volumes that Colorado might need to conserve? (A: up to a million acre-feet; too much for one year – must use a water bank to build up a reserve)
6. Can we use CRSS & StateMod together to answer detailed questions? (A:yes)



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Risk Study Conclusions to Date

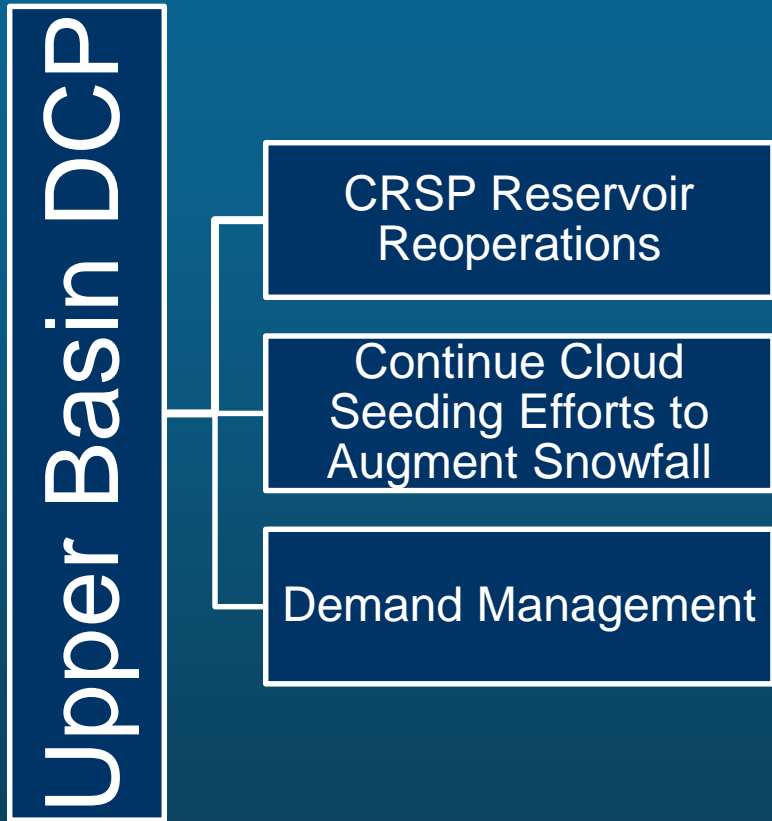
- The higher the consumptive use in the UB, the higher the risk to all users
- Drought Contingency Planning is Essential
- Demand management is required in severe droughts (*e.g.*, 1988-1993 & 2001-2005)
- Demand management volumes are very large, requiring multi-year efforts and storage (*e.g.*, Powell and other places)
- “Water Bank”
 - Could limit the Annual impact to CU by spreading Conservation over many years- 50K over ten years = 500K
 - Would provide greater control over conserved water

Summary of Curtailment Risk and Actions

- Risk of Powell dropping below critical levels is real (10-20%)
- During extended dry periods, big river reservoir re-ops will be insufficient to maintain Powell above 3,525'
- Demand management will be needed under multiple scenarios in conjunction with other actions
- As much as 1 to 2 MAF of additional demand management water could be required
- A projected increase of 10%↑ in Upper Basin depletions doubles the frequency that demand management is needed
- Demand management pool will have to be designated as a protected 'water bank' or reserve account.

Upper Basin Drought Contingency Planning (UB DCP)

Key Observations and Needs



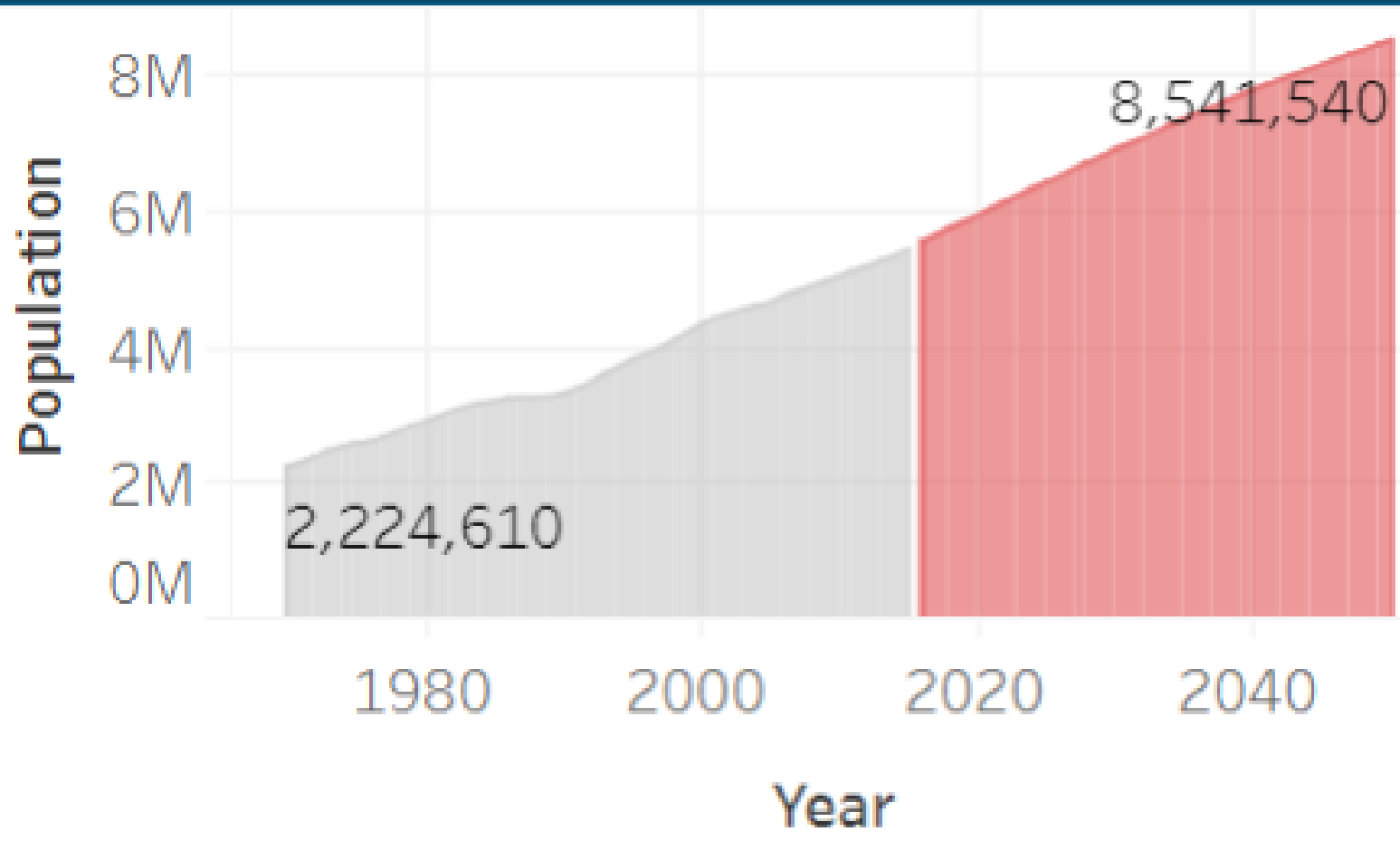
- We Can't Afford to Wait for a Crisis
- Lower Basin States Must Address and Reduce Their Historic Overuse (Structural Deficit)
- Demand Management Will Require Careful Study and Negotiation

➤ Must be Voluntary, Temporary and Compensated

➤ West Slope Agriculture Cannot be the Sacrifice Zone

Colorado Projected Population Growth

1970 – 2050



Colorado's population could increase to 8.5 million by 2050, an increase of more than 50 percent from 2015.

Land Use is Connected to Water Consumption

More suburban development requires more lawns and more water – broader infrastructure taking water farther from the source.



How we grow in the coming years will have tremendous impacts on water quantity and quality.

Discussion



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