

# Colorado River Water Supply Report

Total System Contents: 27.51 MAF

12/28/15

Agenda Number 6.

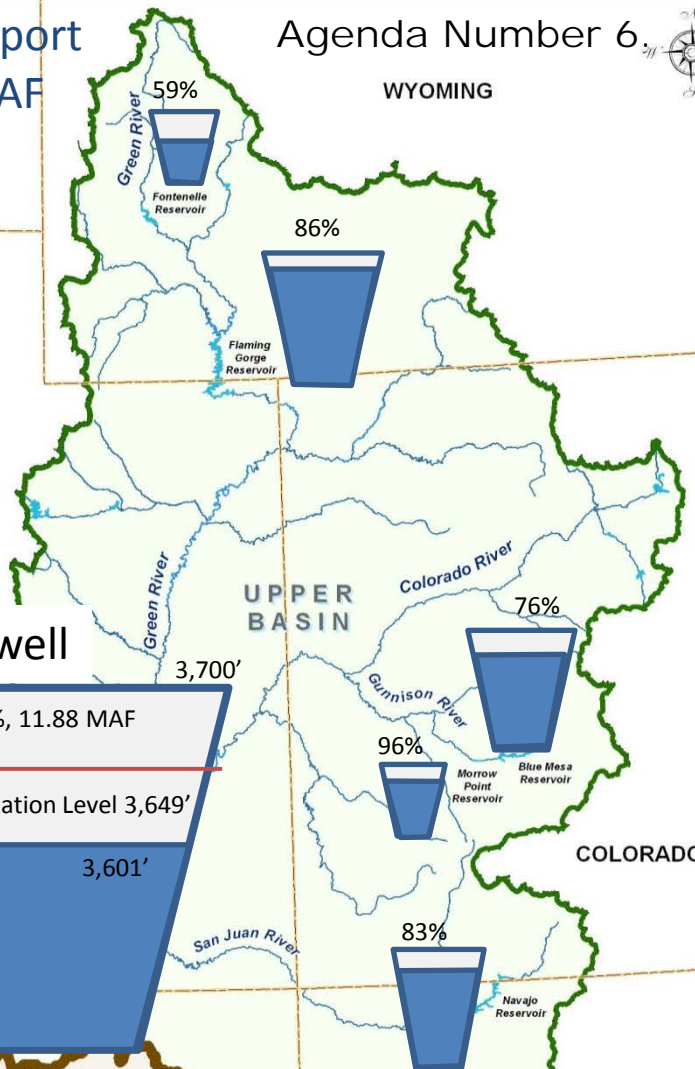


Reservoir Capacities (MAF)			
Reservoir	Current	Change	Maximum
Lake Mead	10.06	+ 0.21	25.90
Lake Powell	11.88	- 0.87	24.30
Flaming Gorge Reservoir	3.23	- 0.28	3.75
Navajo Reservoir	1.40	- 0.03	1.70
Blue Mesa Reservoir	0.63	- 0.15	0.83
Fontenelle Reservoir	0.20	- 0.09	0.34
Morrow Point Reservoir	0.11	0.00	0.12

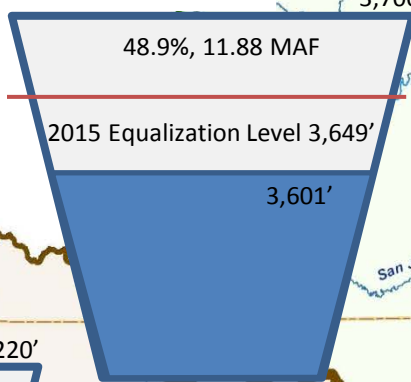
NEVADA

UTAH

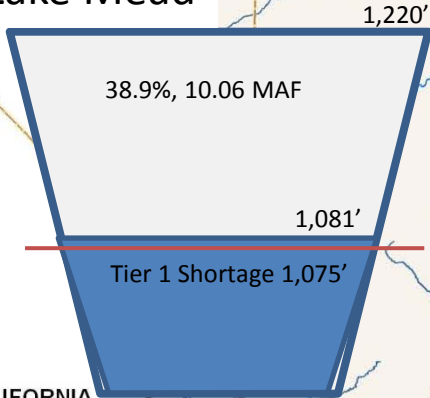
WYOMING



## Lake Powell



## Lake Mead



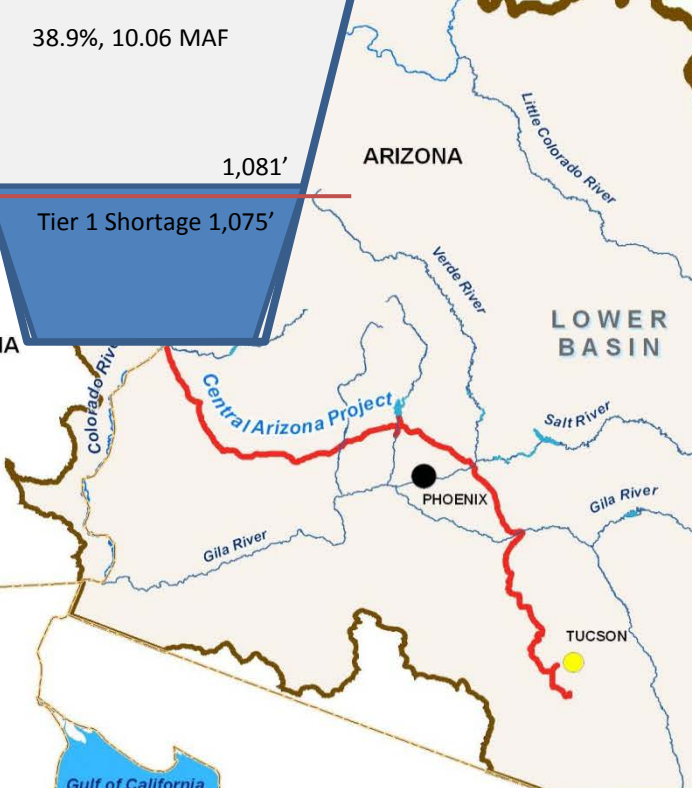
ARIZONA

COLORADO

NEW MEXICO

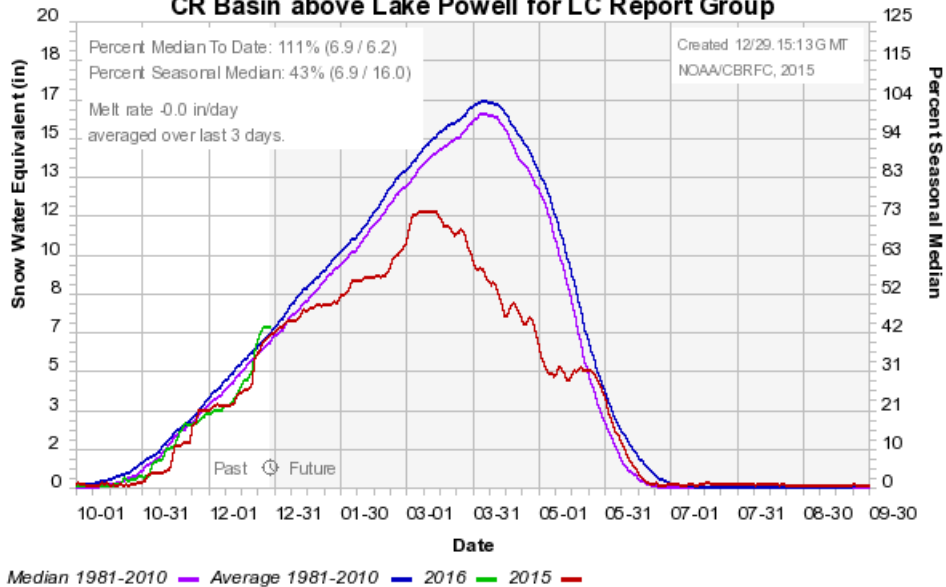
CALIFORNIA

LOWER BASIN



# Colorado Basin River Forecast Center

## CR Basin above Lake Powell for LC Report Group



As of 12/29/2015, the current SWE is at 111% (6.9 in) of the long-term average (1981-2010) of the water year to date (6.2 in). When compared to the seasonal long-term average (16 in) the current SWE is at 43% of the entire season for the current water year (2016). Though still early, it shows the current SWE to be roughly on track with, or higher than, that for the previous season.

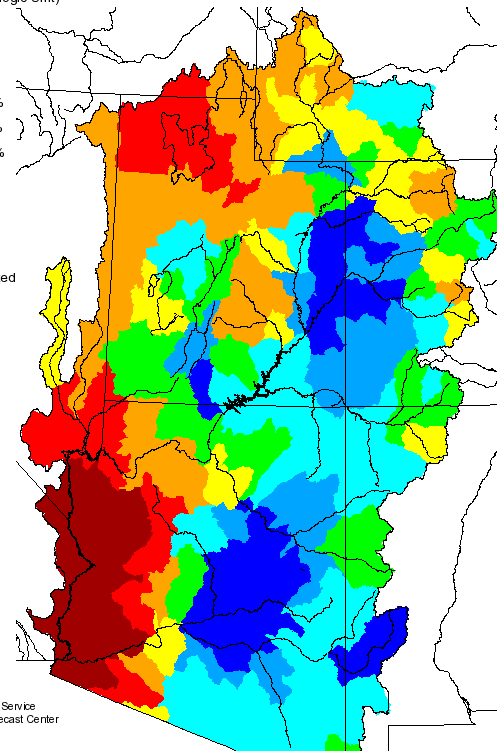
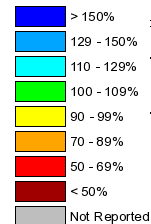
Precipitation for November 2015 was well above the monthly historical average for Central Arizona, the Western Slope of Colorado, and the Gila River headwaters area in Southwest New Mexico. Precipitation levels 50% above average or greater in the Lower Basin are consistent with the onset of an El Niño winter. Although still early in the season, anomalously low precipitation was recorded in Southwestern Wyoming, the Great Basin, and the headwaters of the Muddy/Virgin Rivers in Nevada. Precipitation levels 50% below average along the mainstem of the Colorado River, from Lake Mead south to the Mexican border, were also recorded.

The three month precipitation forecast provided from the National Oceanographic and Atmospheric Administration continues to show a higher than normal probability of precipitation over the Southern United States, Southern and Central Rockies, and Central Plains. The precipitation outlook is consistent with a strong El Niño signal, and the Lower Colorado River Basin has a 33-60% chance of above-normal precipitation. A 33-40% chance of below-normal precipitation exists for the headwaters of the Green River in Southwestern Wyoming.

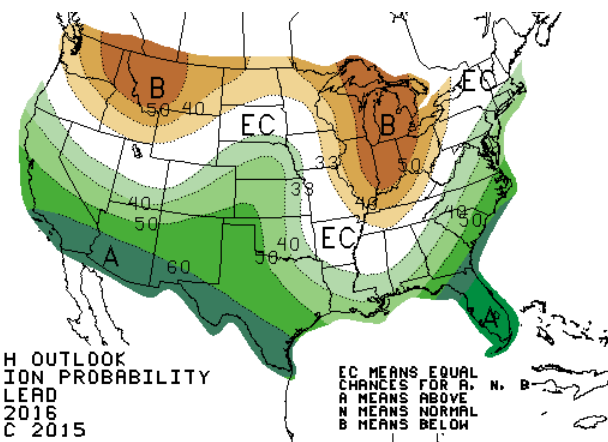
## Monthly Precipitation for November 2015

(Averaged by Hydrologic Unit)

### % Average



THREE-MONTH OUTLOOK  
 PRECIPITATION PROBABILITY  
 0.5 MONTH LEAD  
 VALID JFM 2016  
 MADE 17 DEC 2015



**Agenda Number 6.**

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**MEETING DATE:** January 7, 2016

**AGENDA ITEM:** Briefing on Colorado River Drought Contingency Planning Efforts

**LINKAGE TO STRATEGIC PLAN, POLICY, STATUTE OR GUIDING PRINCIPLE:**

2010 CAWCD Board of Directors Strategic Plan

- Water Supply: Reduce risks associated with CAP's junior priority
- Water Supply: Manage risks posed by climate change
- Water Supply: Manage Colorado River to optimize CAP water availability

**PREVIOUS BOARD ACTION/ACTIVITY:**

Sept. 3, 2015 Update and discussion on drought response and sustainability efforts, including the Pilot Drought Response MOU, Pilot System Conservation Agreement, structural deficit discussions, and other related programs, and the District's role in developing and implementing such programs.

June 5, 2014 Work/study session of the Board to discuss Colorado River status and developments.

**ISSUE SUMMARY/DESCRIPTION:**

As of December 28, 2015, Lake Mead storage is at 39% capacity with a water elevation of 1081' – just slightly above the shortage trigger elevation of 1075'. Lake Mead elevation has been generally in a state of decline since the year 2000 even with normal year releases, 8.23 MAF, from Lake Powell into Lake Mead. This is largely due to the Structural Deficit – a negative water budget in which deliveries from Lake Mead exceed inflow into the reservoir.

The initial step to address the risks of declining water supplies in Lake Mead was the adoption of the 2007 Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations of Lake Powell and Mead ('07 Guidelines). The '07 Guidelines provide certainty about reductions to CAP and Arizona between elevations 1075' – 1025'. The '07 Guidelines require reductions to Arizona, primarily by CAP, of 320 kaf, 400 kaf, and 480 kaf when Lake Mead falls below 1075', 1050', and 1025' respectively. However, recent studies by Reclamation show that the current operation of the '07 Guidelines may be insufficient to halt the decline in Lake Mead.

Beyond the risks of shortage to Arizona when Lake Mead drops below the three shortage elevation tiers and the decline in power generation from Hoover Dam, there is great vulnerability to CAP and Arizona when Lake Mead falls below 1025'. At elevation 1000', there is less than 4.4 MAF in storage, which is less than half the supply needed to meet the Lower Basin and Mexico entitlement of 9.0 MAF. In addition, studies by Reclamation indicate a significant reduction to power generation capabilities at low reservoir elevations. The '07 Guidelines allow the Secretary of the Interior to develop and employ measures to protect Lake Mead from falling below 1000'. It is very likely these actions will include additional reductions to Lower Basin users.

The uncertainty of what the Secretary of the Interior will do places Arizona water users in a vulnerable position. If the Secretary of the Interior opts to follow the priority scheme of the Law of the River, i.e. the priority language in the Colorado River Basin Project Act, Arizona users will be the first to suffer reduction when Lower Basin water orders exceed available water supply, with potential zero allocation to CAP users and impacts to Arizona on-river users.

The Basin States and the Bureau of Reclamation have collaborated on several planning strategies to target protection of Lake Mead's levels, such as the Pilot System Conservation Program and the 2014 Drought Response Memorandum of Understanding. However, analysis from modeling simulations indicates that further interim actions need to be adopted to prevent Lake Mead from falling below 1025' before the year 2026. In recognition of this finding, the Lower Basin states and the Bureau of Reclamation have been exploring voluntary reduction scenarios that can successfully keep Lake Mead above 1025'. This Drought Contingency Planning effort is currently underway.

The components necessary for a successful Lower Basin Drought Contingency Plan should include the following: operation within the '07 Guidelines; participation by all Lower Basin States to contribute voluntary reductions; participation by Reclamation to increase conservation of supplies in the Lower Basin; provision of certainty to Arizona and CAP on the timing and magnitude of additional reductions at low reservoir elevations; the beginning of the process to address the structural deficit; and, coordination with drought contingency efforts in the Upper Basin.

## Colorado River Drought Contingency Planning

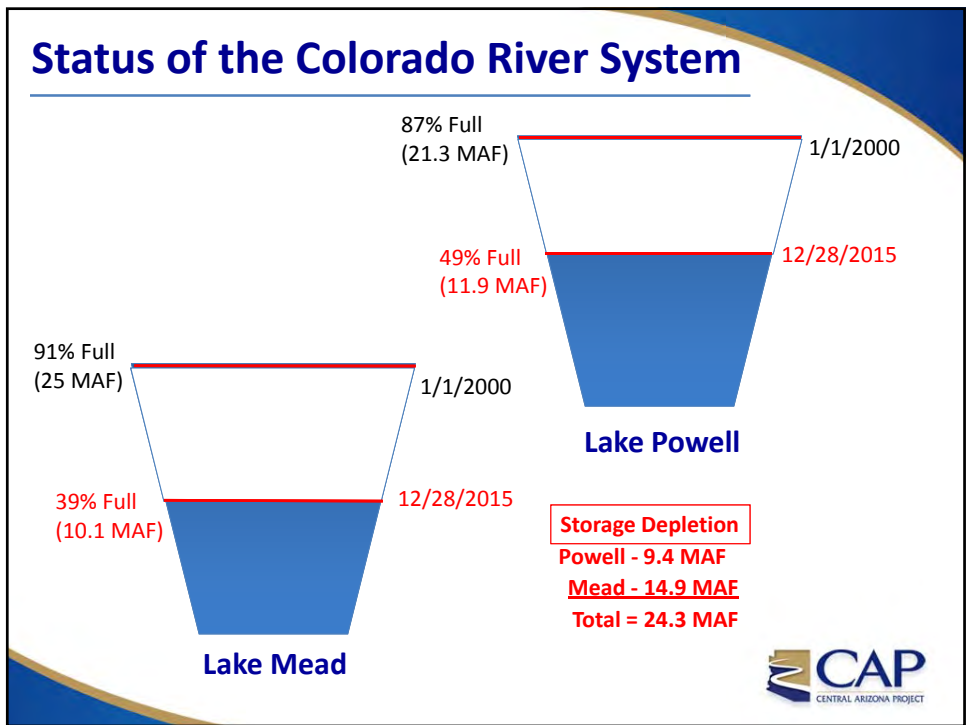
CAWCD Board Meeting  
January 7, 2015

Marie Pearthree  
Deputy General Manager

Chuck Cullom  
Colorado River Programs Manager



YOUR WATER. YOUR FUTURE.



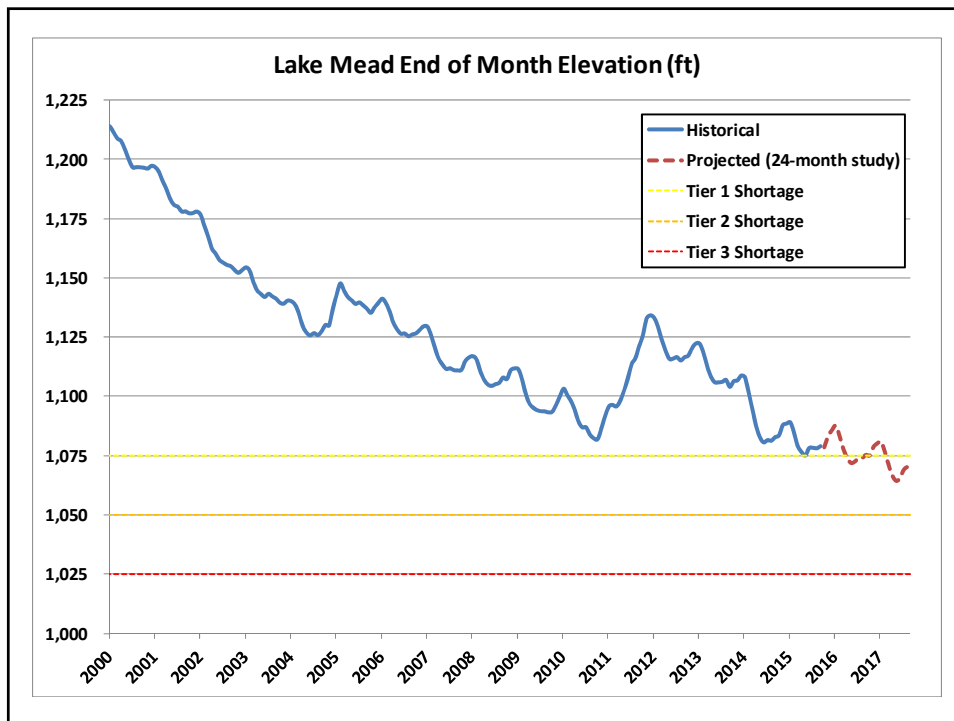


## Water Budget at Lake Mead

- Inflow (release from Powell + side inflows) = 9.0 maf
- Outflow (AZ, CA, NV, and Mexico delivery + downstream regulation and gains/losses) = - 9.6 maf
- Mead evaporation losses = - 0.6 maf
- Balance = - 1.2 maf

Given basic apportionments in the Lower Basin, the allotment to Mexico, and an 8.23 maf release from Lake Powell, Lake Mead storage declines about 12 feet each year

RECLAMATION



## Risks from Lake Mead Decline

### At 1075'

- Arizona takes 320 KAF shortage reduction

### At 1050'

- Arizona takes 400 KAF shortage reduction
- Reductions in hydropower generation

### At 1025'

- Arizona takes 480 KAF shortage reduction
- Secretary **will** take additional actions to protect Lake Mead
- Significant cavitation risk for hydropower generation

### At 1000'

- Active storage in Lake Mead is equal to CA's allocation (~4.4 MAF)
- "Run of River" operations - insufficient storage to meet deliveries to AZ, CA, NV, and MX

### At 895'

- Dead pool; only 2 MAF in storage



## Current Adaptation Strategies

### **Pilot System Conservation Project(s)**

- Interstate funding to conserve system water to protect Lake Mead (target 75 kaf)

### **Lower Basin Drought Response MOU**

- Interstate plan targeting 740 KAF of system water in Lake Mead

### **Groundwater Storage**

- Nearly 4 MAF stored by CAP through the AWBA

### **Bypass and Excess Flows Workgroup (ADWR-BOR co-chairs)**

- Options for reducing, replacing, and/or recovering bypass flows to Mexico, saving 100 kaf/yr – may include partial operation of YDP

### **Augmentation Projects**

- Cloud seeding projects in Wyoming, Colorado, and Utah
- Desalination concepts (brackish and seawater)



## What Happens when Mead < 1025' ?

The Secretary of the Interior can choose to do the following:

1. **Follow the Law of River** – allow Mead to decline and allocate Lower Basin supply according priorities per Law of the River
  - When orders exceed available supply, Arizona/CAP will be reduced first
  - **Potentially zero allocation to CAP + Reductions to Arizona On-River users**
2. **Exercise New Authority** – Secretary applies discretion to reprioritize deliveries to the Lower Basin and/or protect Mead elevation by reallocating user reductions
  - Huge uncertainty in how Secretarial action will affect Arizona
  - **Potentially significant reductions to Arizona On-River users + CAP**

**OPTION 1 & 2 PLACE CAP, ARIZONA, & NEVADA IN AN EXTREMELY VULNERABLE POSITION**  
**OPTION 2 CREATES UNCERTAINTY FOR CALIFORNIA CONTRACTORS**



Hydrology	Lake Mead Elevation 1,020'			Lake Mead Elevation 1,000'		
	Maximum in any year (MAF)	First Year that Maximum Occurs	Average through 2026 (MAF)	Maximum in any year (MAF)	First Year that Maximum Occurs	Average through 2026 (MAF)
Observed	2.1	2019	0.74	1.9	2019	0.49
Climate Change	6.1	2025	1.7	6.0	2025	1.8
Combined	6.1	2025	1.5	6.0	2025	1.6





## Addressing the Structural Deficit

### Long-term (2020-2026+):

- Augment the system
- Attempt to address the structural deficit as part of the new guidelines beginning in 2027 (post-2007 Guidelines)

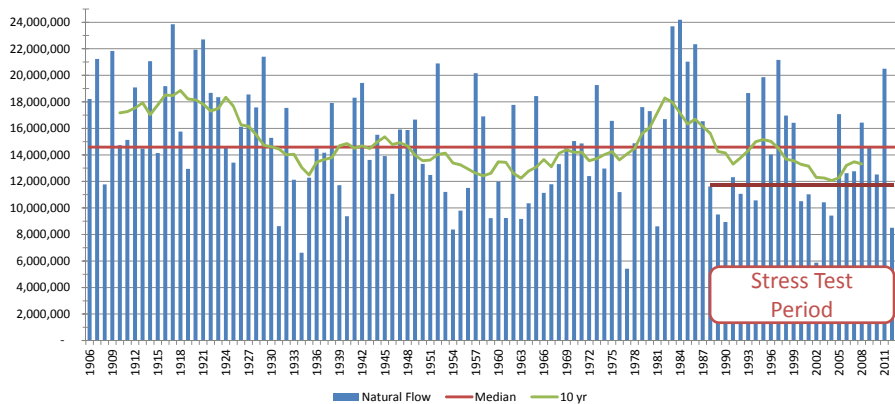
### Short-term (2016-2026):

- Implement MOU and Pilot System Conservation projects (through 2017)
- Develop a Drought Contingency Plan that provides certainty for measures adopted by the Secretary below 1025'



## Observed Hydrology and "Stress Test"

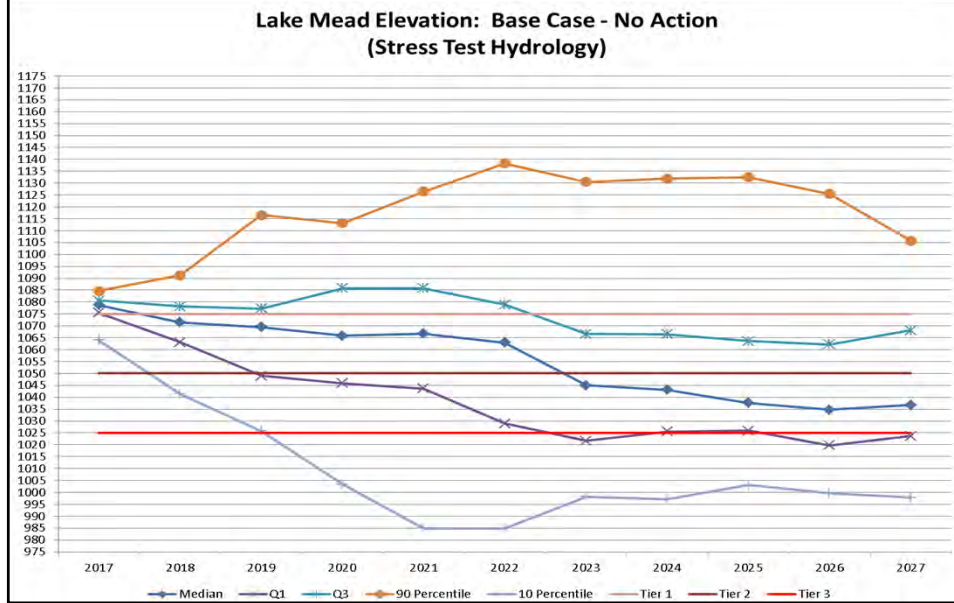
Natural Flow at Lee Ferry (1906 - 2013)



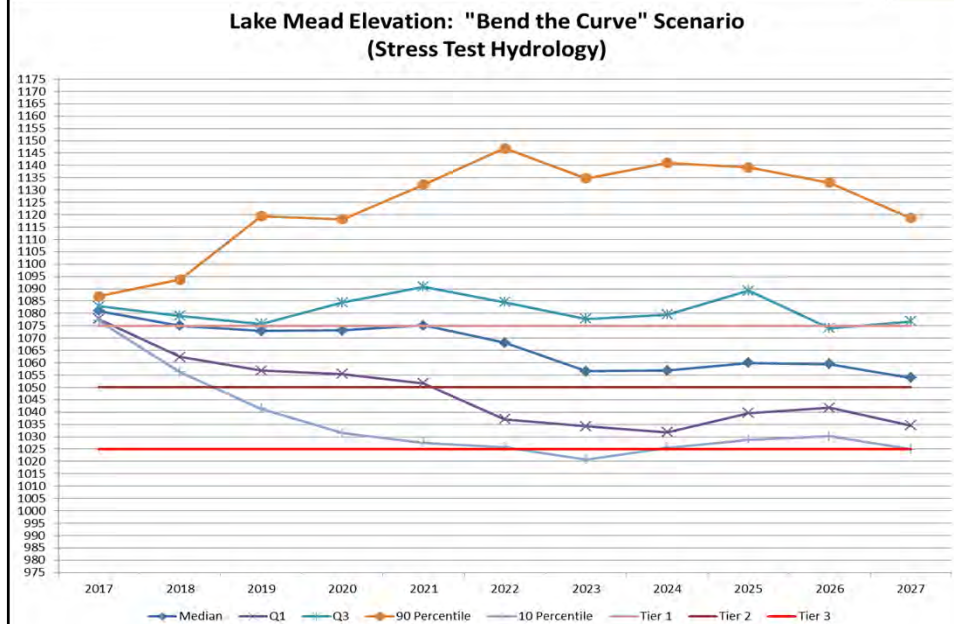
	Observed	Stress Test	%
Median	14.6 MAF	12.3 MAF	84%
Q1 (25 <sup>th</sup> )	11.2 MAF	10.5 MAF	94%
Q3 (75 <sup>th</sup> )	17.6 MAF	16.2 MAF	92%



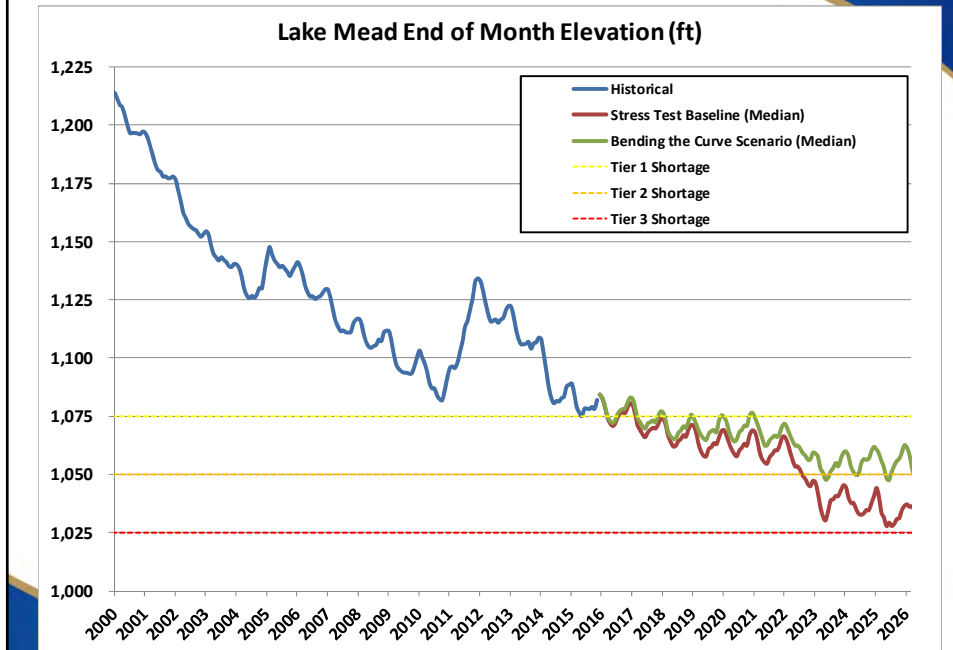
## Stress Test – No Action



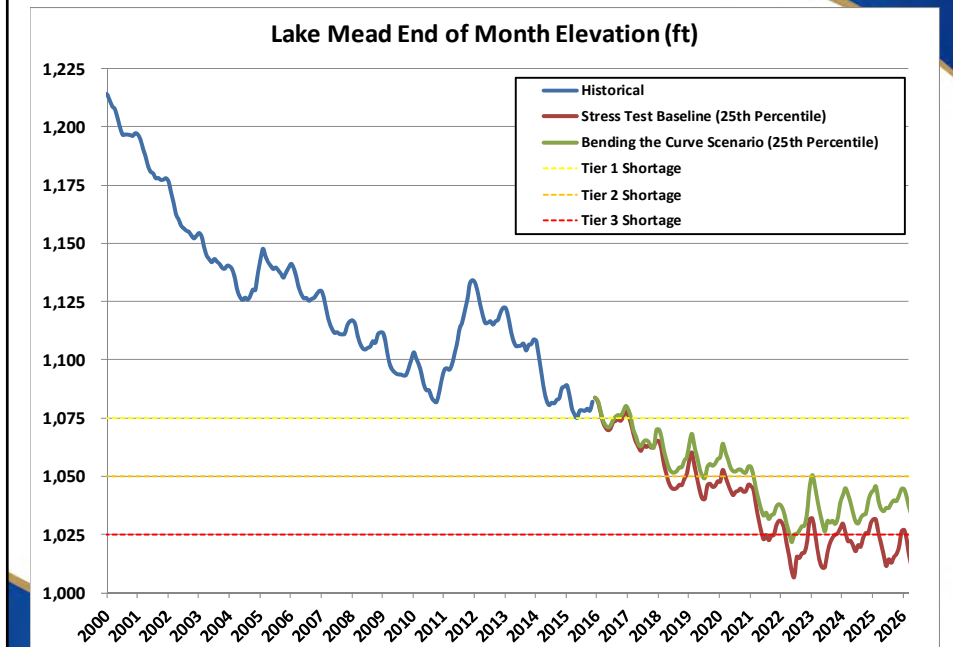
## Stress Test – “Bending the Curve”



## Stress Test – Median Elevation



## Stress Test – 25<sup>th</sup> Percentile (Q1)



## Steps for the Drought Contingency Plan

- Collaborative process between the Lower Basin states, key agencies, and the Bureau of Reclamation
- All Lower Basin States and Reclamation to participate in voluntary reductions or increase conservation
- Goal to improve protection of Lake Mead above 1025'
- Ensure that interim actions operate within the framework of the 2007 Guidelines and in coordination with the Upper Basin
- Arizona process to frame options, approaches, and allocate impacts of a Drought Contingency Plan among Arizona users

