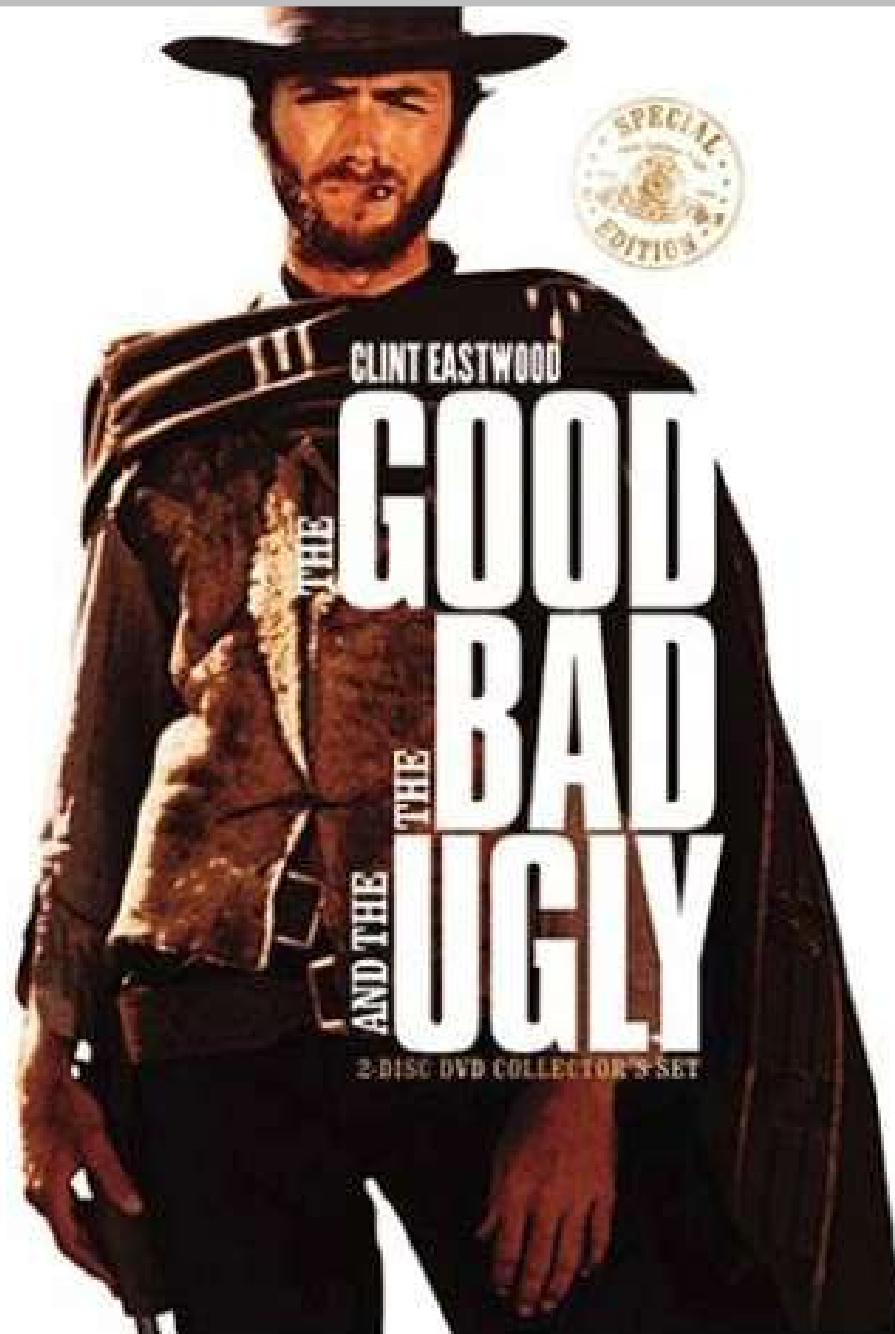


**AZ Water History,  
Drought Contingency Plan (“DCP”)  
&  
Pinal AMA**



**AZ Water history**  
**(“good” for the most part),**  
**DCP**  
**(could be really “bad”)**  
**&**  
**Pinal AMA**  
**(“ugly” until restructure)**

# Water Supply of Arizona

**Colorado River  
2.8 MAF**

**Groundwater  
2.9 MAF**

**Salt River  
1 MAF**

**Gila River  
0.4 MAF**



# History of Colorado River Water Agreements

## 1922 Colorado River Compact

The Compact divided the Colorado River Basin into an Upper Basin and a Lower Basin and allocated 7.5 million acre-feet annually (MAFA) of annual beneficial consumptive use to each basin with an additional 1.0 MAFA authorized for the Lower Basin.

The 1922 agreement was forged during one of the wettest periods in the past millennia.

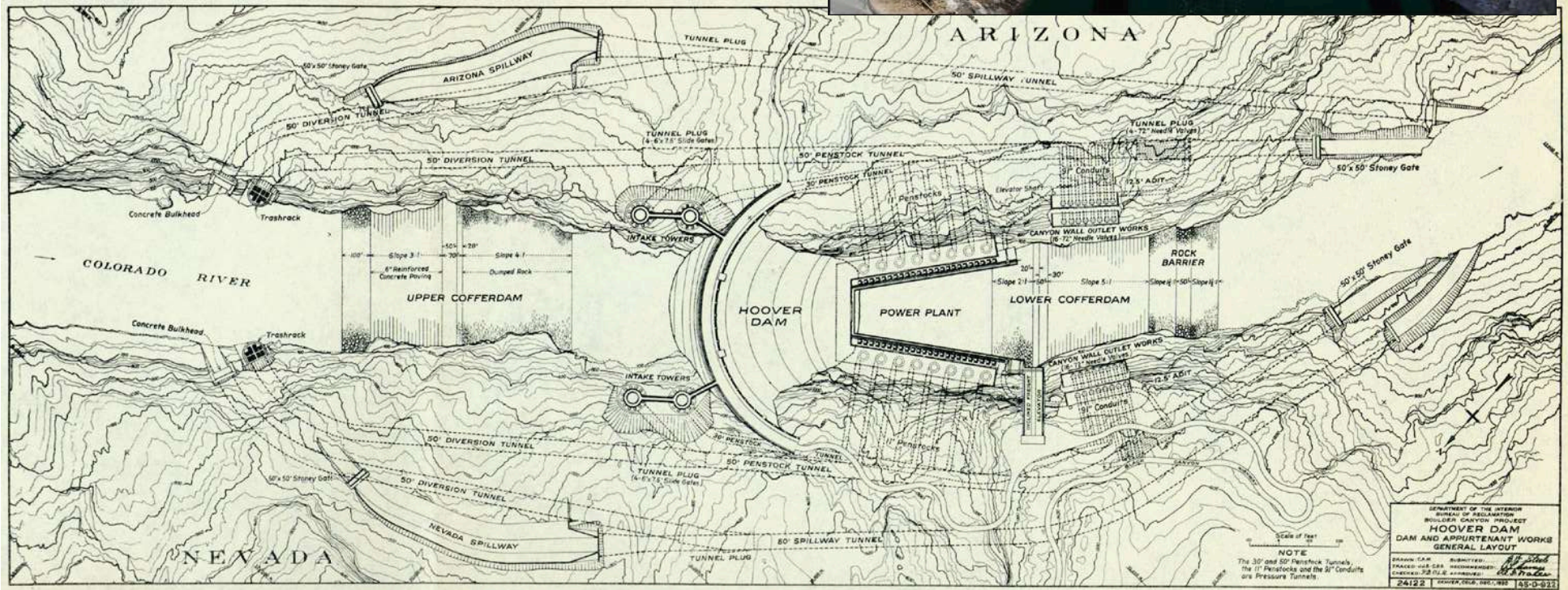




# 1929 Boulder Canyon Project Act (BCPA-Hoover Dam)

Provisions include

- California 4.4 MAFA + 50% surplus
- Arizona 2.8 MAFA + 50% surplus
- Nevada 300,000 AFA





## 1956 Colorado River Storage Project (CRSP) Act.

Upper Basin states (Colorado, New Mexico, Utah, and Wyoming) to utilize their Colorado River Compact apportionments. There are four initial storage units built as part of the CRSP:

[Wayne N. Aspinall Unit](#)

[Flaming Gorge Unit](#)

[Navajo Unit](#)

[Glen Canyon Unit](#)

Combined live storage of 30.6 million AF. [Glen Canyon Dam](#) is the largest of the CRSP facilities and is the key unit for controlling water releases to the Lower Basin.

8.23 million AF per year is targeted for downstream delivery.







## **CAP History**

- 1947** AZ introduced legislation for the CAP. California opposed the bill because they believed Arizona did not have any legal claim to the Colorado River water that would be transported through the Hoover Dam.
- 1964** AZ v. CA decree (Decree) endorsed the provisions of the BCPA, confirmed the Lower Basin allocations previously set forth, and excluded Arizona's tributary rivers from Colorado River accounting.
- 1968** The CAP was created by the Colorado River Basin Project Act of 1968. Construction began in 1973 and completed the 336 mile extension in 1993. In exchange for California withholding its opposition to a CAP bill, Arizona agreed that in times of shortage on the Colorado River, CAP diversions would not affect California's receipt of its full 4.4 MAFA allocation.

**The junior priority status of the CAP significantly impacts Arizona, particularly if there is a shortage on the Colorado River, and is now one of the major components of future water management planning in the state.**

## **Formation of CAWCD and CAGR**

- 1971**      **The Central Arizona Water Conservation District (CAWCD) was created to provide a single entity to repay the federal government for the \$4 billion construction of the CAP system.**
- 1993**      **Arizona created a groundwater replenishment authority operated by the CAWCD. This replenishment authority of CAWCD is commonly referred to as the Central Arizona Groundwater Replenishment District (CAGR).**
- 1999**      **Arizona expanded CAWCD's replenishment authorities and responsibilities by passing the Water Sufficiency and Availability Act. The purpose of the CAGR is to provide a mechanism for landowners and water providers to demonstrate an assured water supply under the new Assured Water Supply Rules ("AWS Rules") which became effective in 1995.**



# Central Arizona Groundwater Replenishment District (CAGRDR)

The CAGRDR provides a mechanism to meet the Arizona Department of Water Resources' (ADWR) Assured Water Supply Rules, which require developers to demonstrate the land they wish to develop has a 100-year water supply.

The CAGRDR provides a plan of operation every 10 years to ADWR to verify the CAGRDR its groundwater replenishment obligations. CAGRDR has three years after pumping occurs to replenish the ground water using a combination of

- Excess CAP water
- Other CAP supplies
- Effluent
- Colorado River supplies
- Underground storage credits
- Imported groundwater

Historically, there has been enough excess CAP water to meet the demand of any entity wishing to purchase it, including the CAGRDR to meet its groundwater replenishment obligations.

The Board has limited excess CAP water allocations available to nonagricultural users to only the CAGRDR, the Arizona Water Banking Authority (which stores unused Colorado River water for use in times of shortage), and Reclamation. **Even with this measure, the CAGRDR acknowledges that excess CAP water alone will not be not sufficient to meet its future obligations.**

# **What is the Drought Contingency Plan (DCP)**

During the period from 2000 to 2005, the Colorado River experienced the worst drought conditions in approximately one hundred years. In November 2007, after two years of negotiation with the basin states, the Bureau of the Interior issued the “Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead”

The guidelines from the agreement include 4 basic parts:

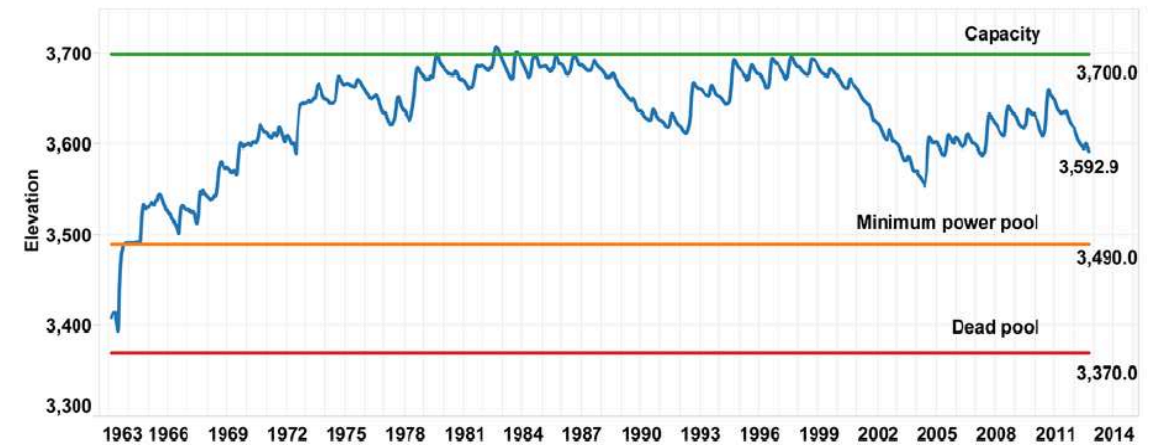
1. Lake Powell/Lake Mead Equalization
2. Reduce the water available for the lower basin states
3. Allow for storage and delivery under drought and low reservoir conditions
4. Determine conditions where surplus water may be available to lower basin states



## Mead & Powell equalization

- Set Equalization level of Lake Powell at +/-3,650 feet
- 8.23 maf released from Lake Powell to Lake Mead and additional if Lake Powell is above Equalization.
- If Lake Mead elevation is below elevation 1,105 feet, additional water released until reaches 20 feet below the equalization level

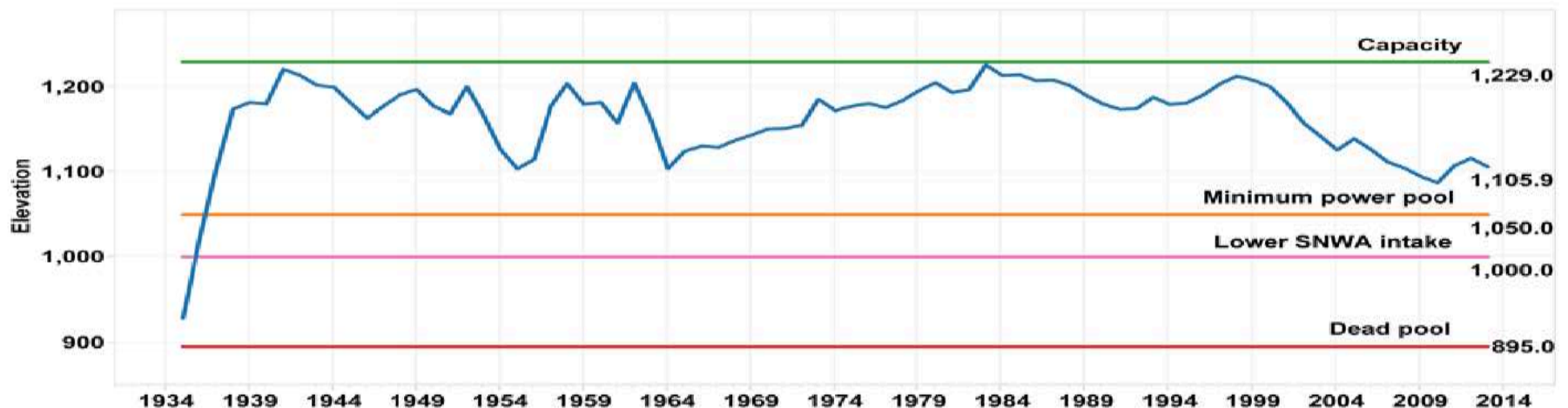
## Lake Powell daily elevation: 1964-2013



EcoWest.org

Source: Bureau of Reclamation

## Lake Mead July 1 elevation: 1935-2013



EcoWest.org

Source: Bureau of Reclamation

# Lake Mead water Use Reductions

Lake Mead Elevation	AZ [2007]	AZ [Plan]	AZ TOTAL	NV [2007]	NV [Plan]	NV TOTAL	CA [2007]	CA [Plan]	CA TOTAL	BOR	TOTAL
1090-1075	0			0			0				
1075-1050	320K			13K			0				
1050-1045	400K			17K			0				
1045-1040	400K			17K			0				
1040-1035	400K			17K			0				
1035-1030	400K			17K			0				
1030-1025	400K			17K			0				
<1025	480K			20K			0				

Tier 1 reduction

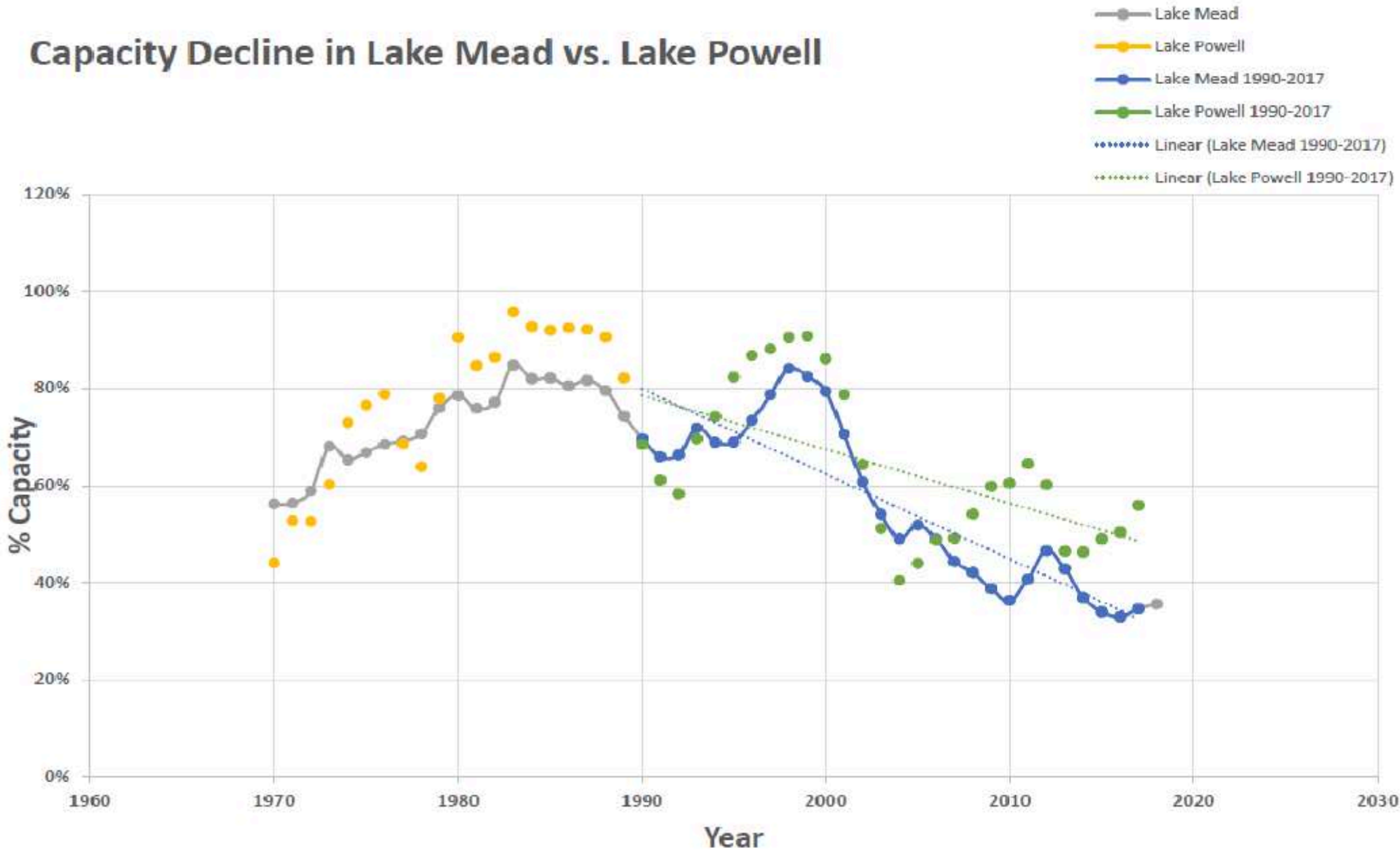
Tier 2 reduction

Tier 3 reduction



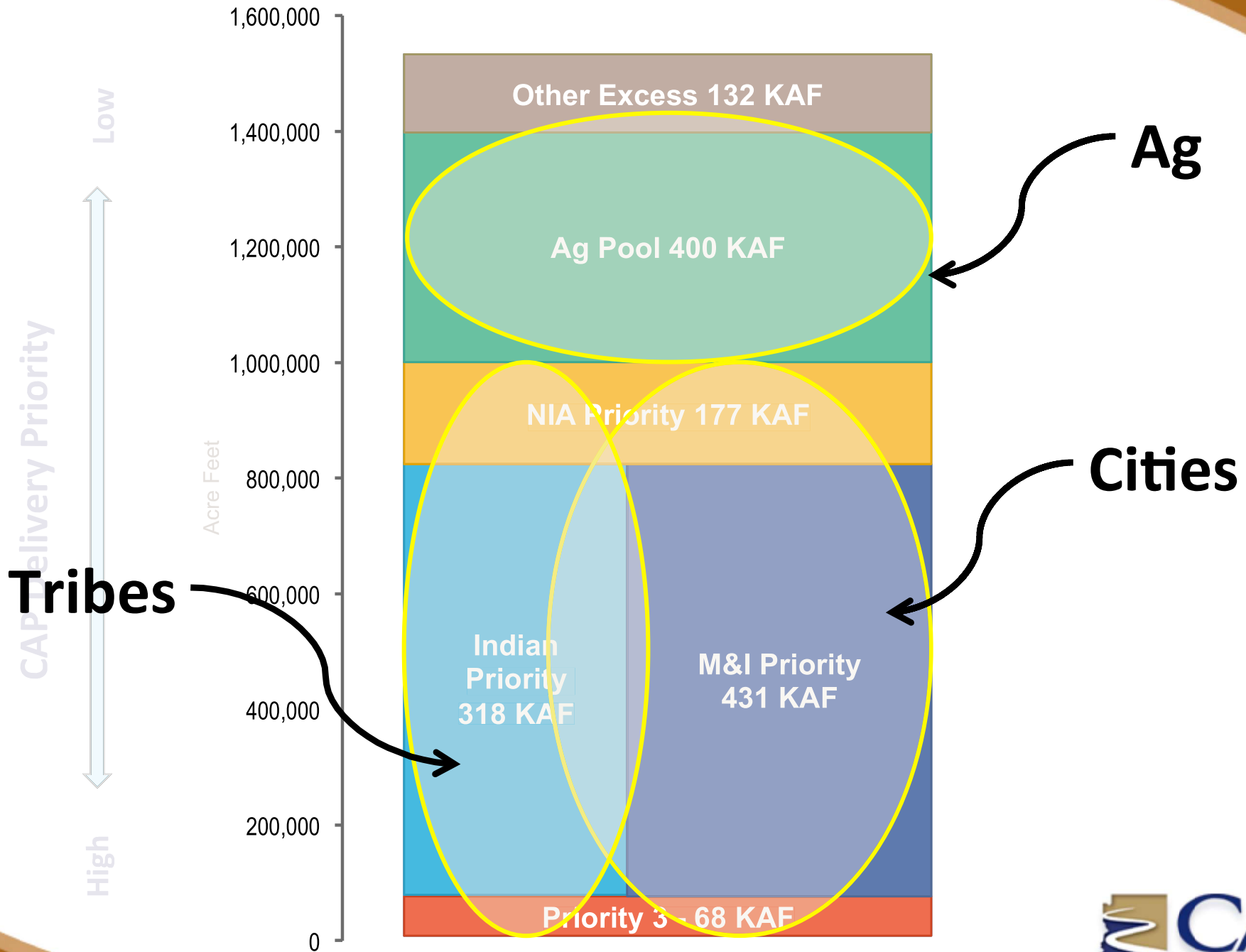


## Capacity Decline in Lake Mead vs. Lake Powell



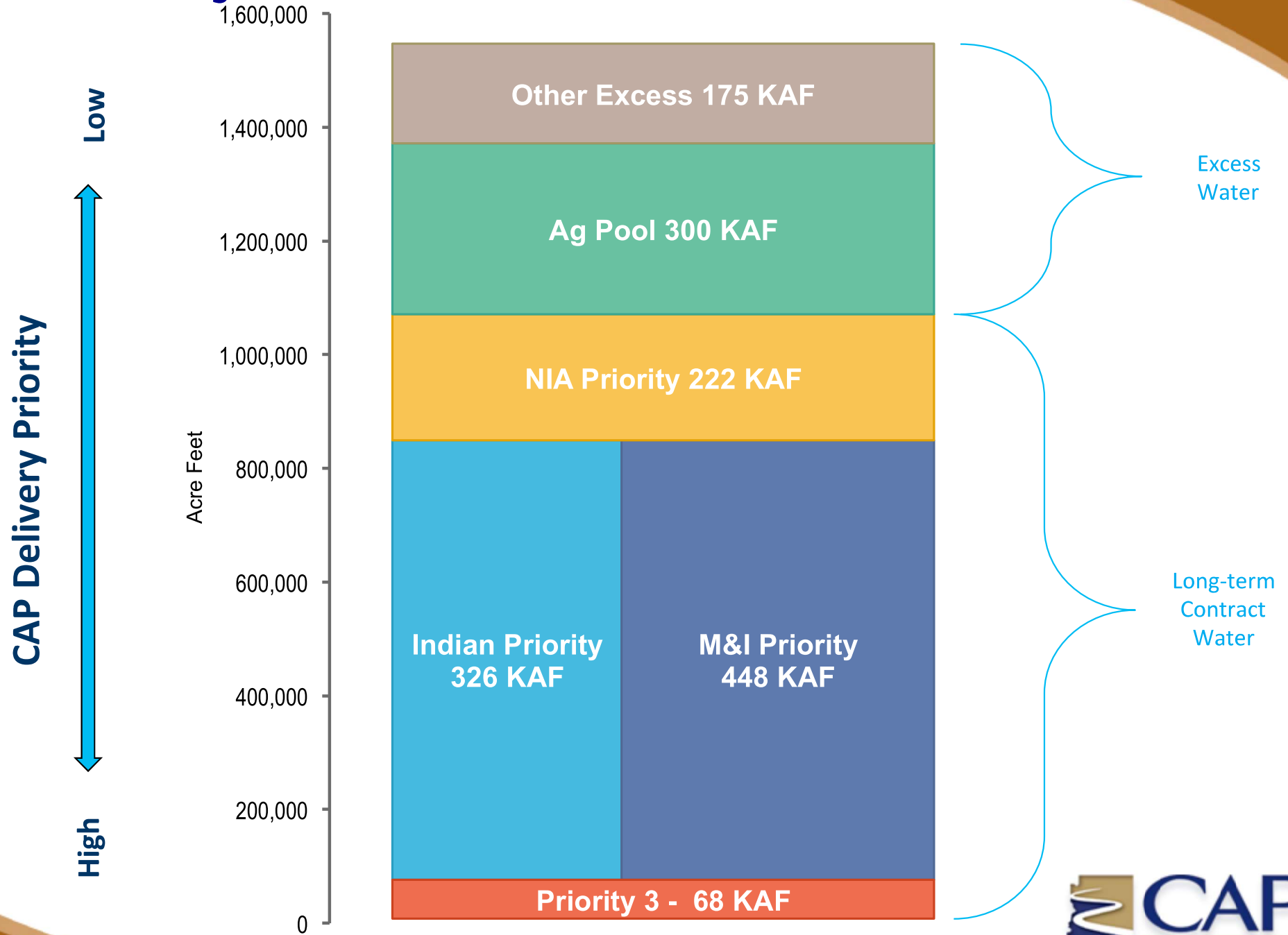
# CAP Allocations

# 2014 Deliveries by Priority (AF)

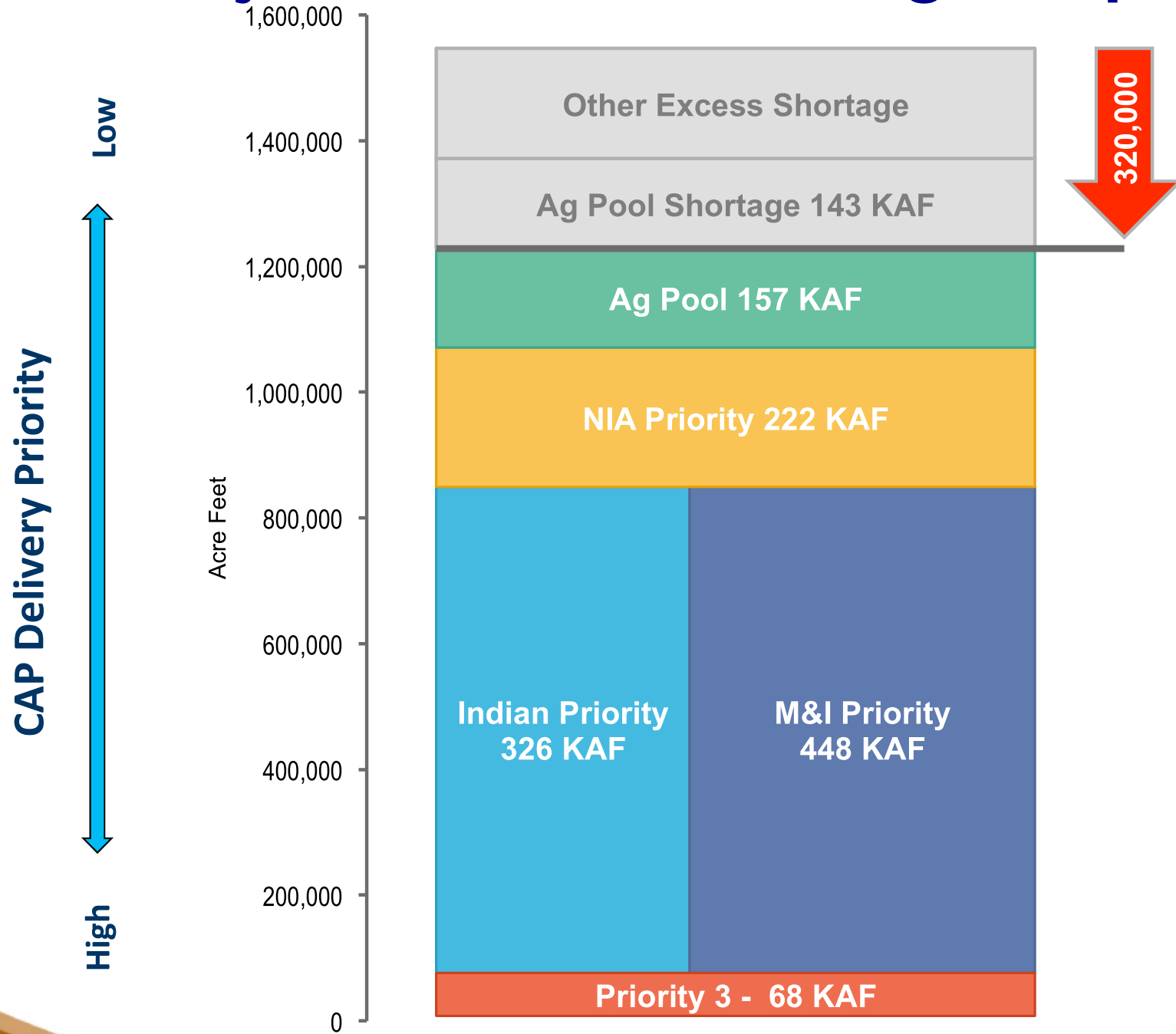




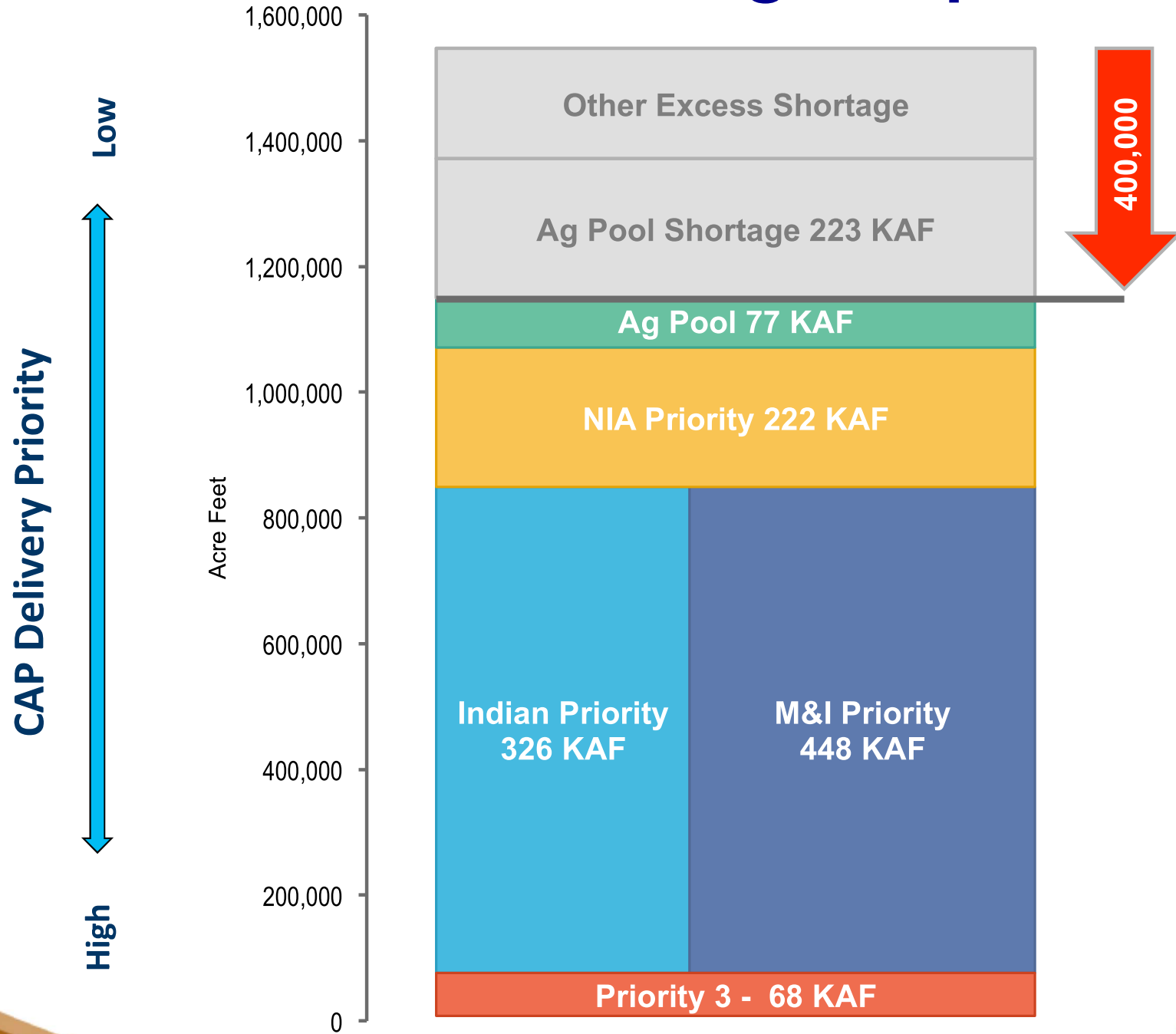
# 2017 Projected CAP Orders



# 2017 Projected Tier 1 Shortage Impact



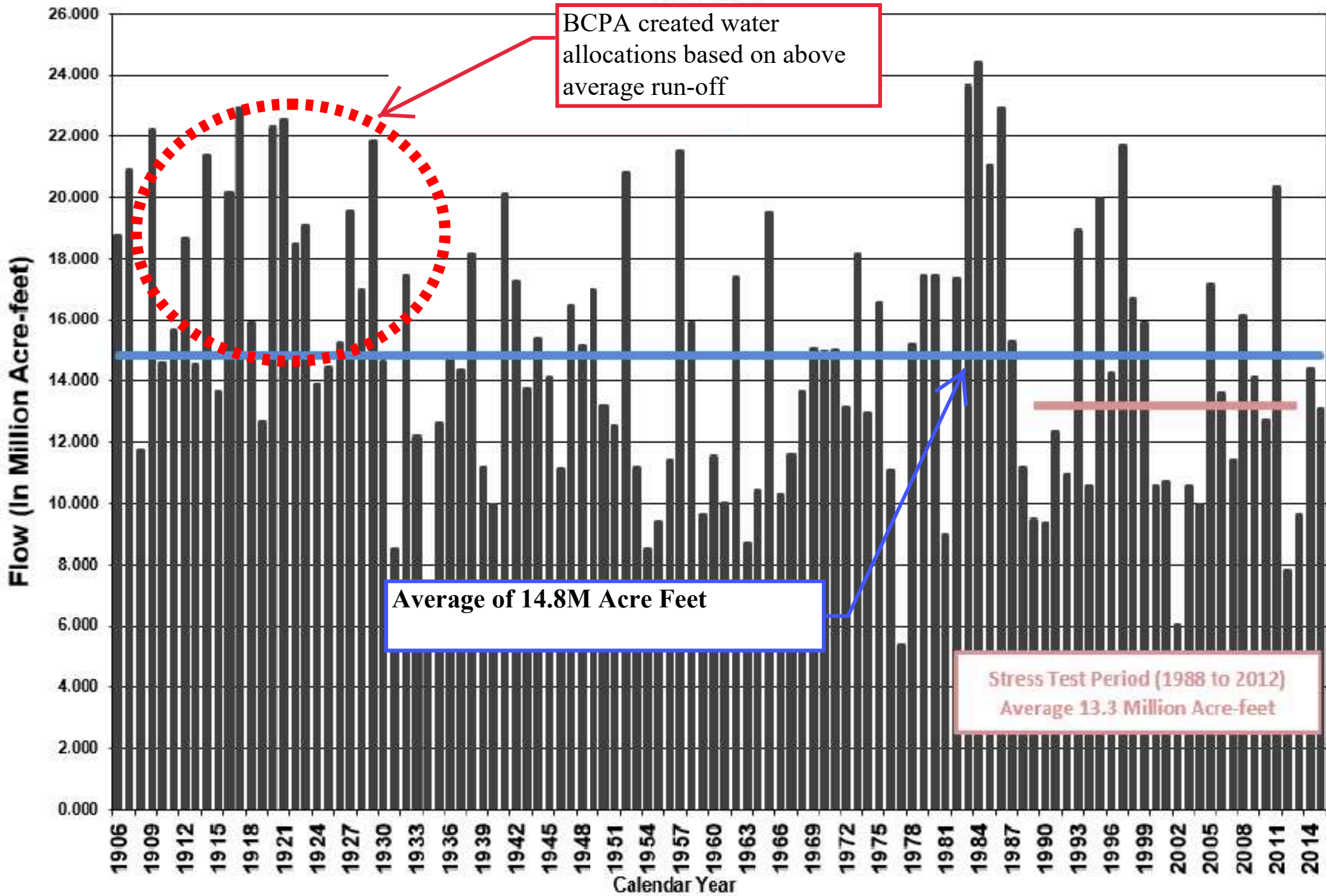
# Near-term Tier 2 Shortage Impact



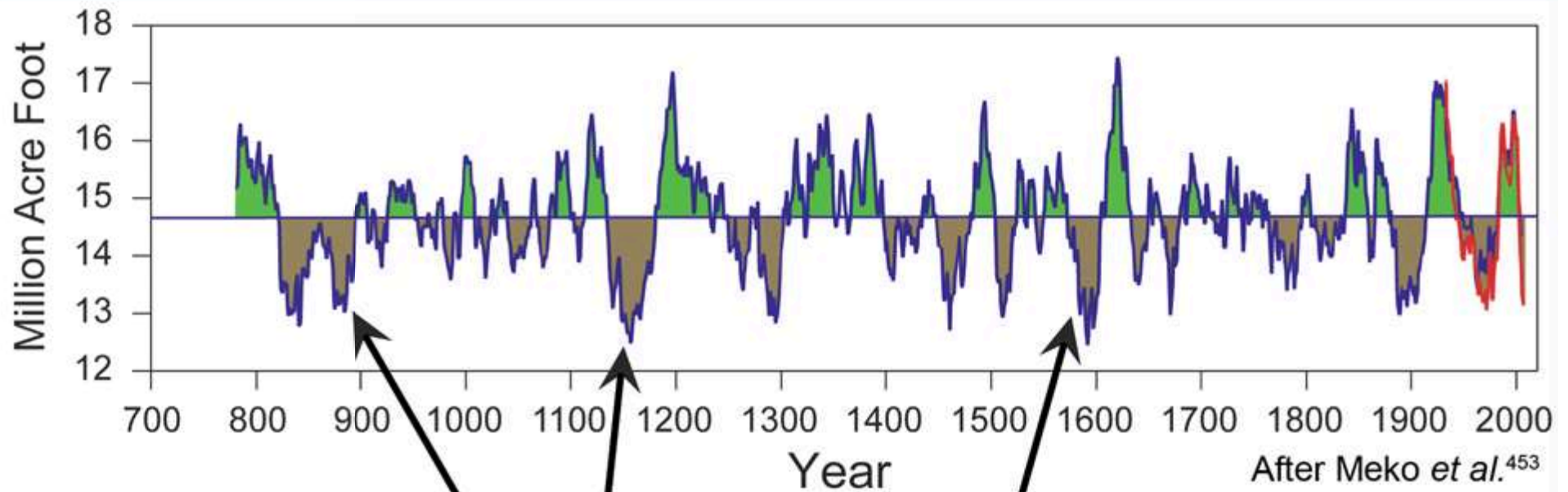
How does this drought compare with  
past droughts



# Colorado River Calendar Year Natural Flow Into Lake Powell 1906-2015



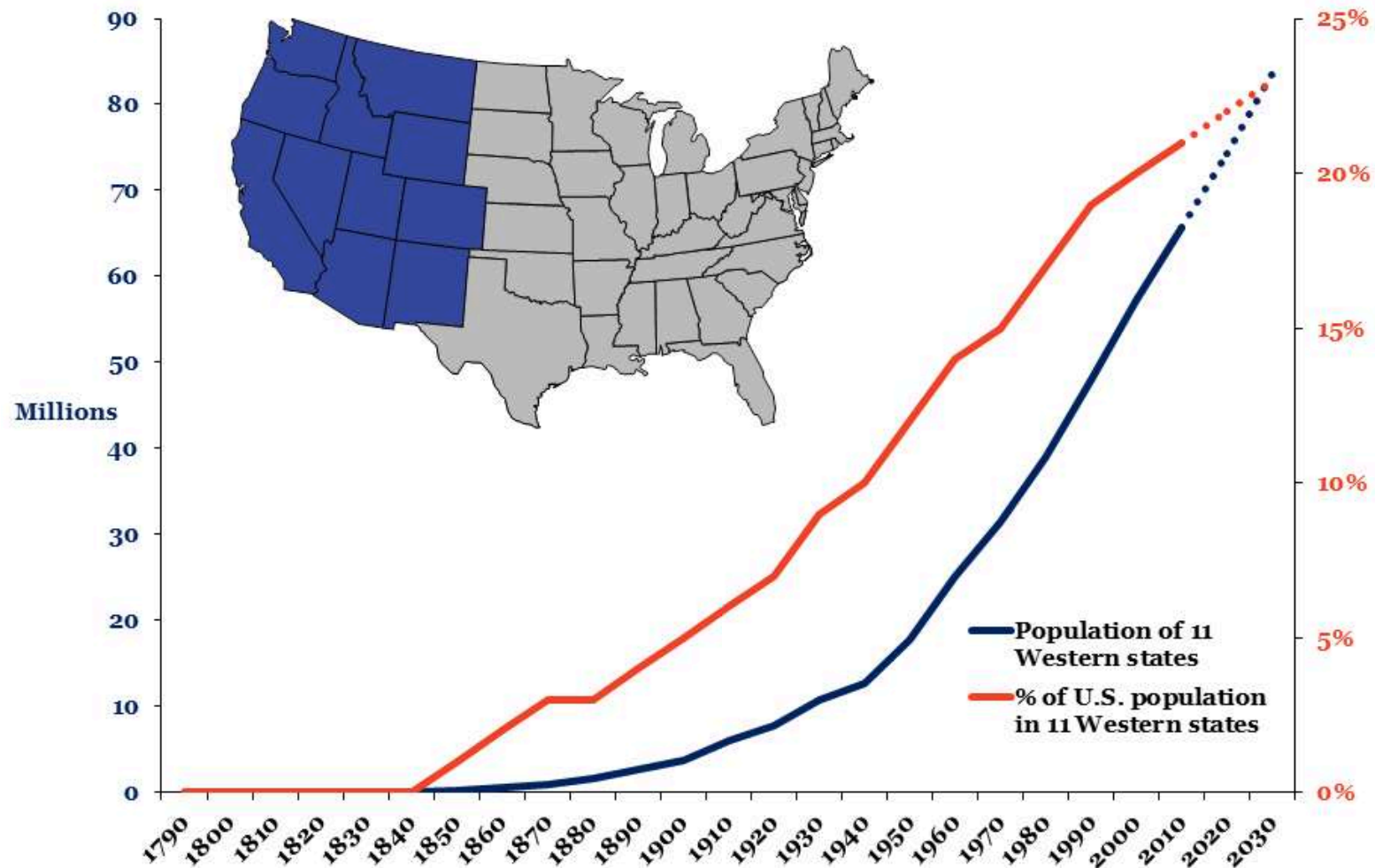
## Recent droughts less severe for Colorado River



Some droughts in the past have been more severe and longer lasting than any in the last century.

# How to balance the water supply, long term drought vs. growth

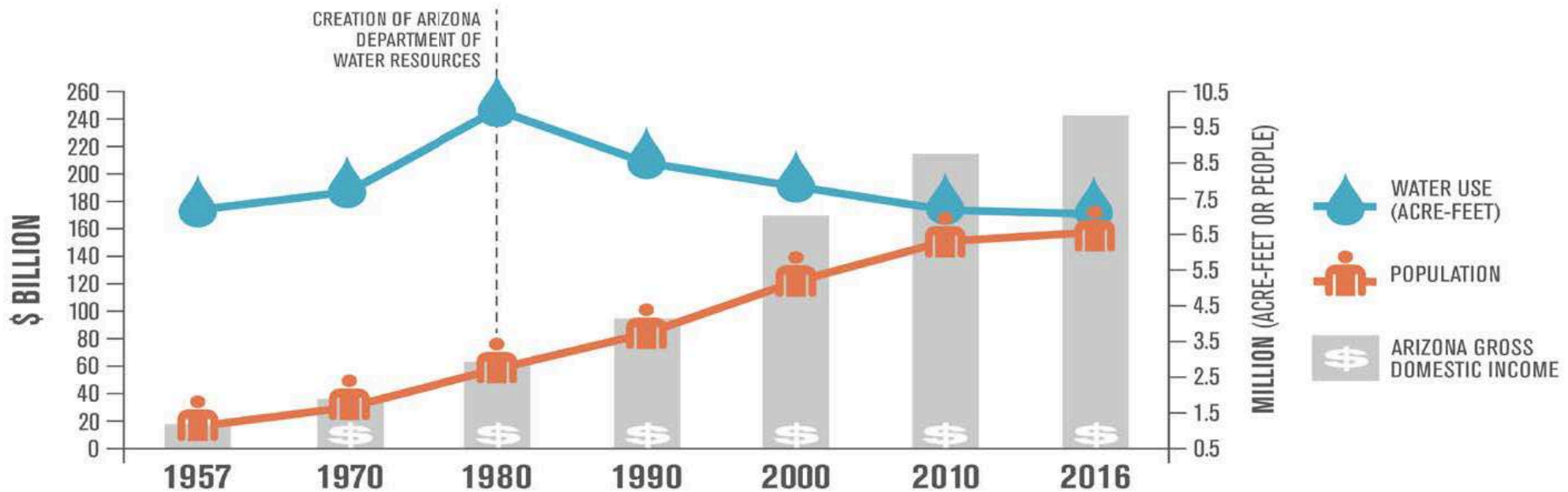
## Growing share of U.S. population lives in West





# ARIZONA'S WATER MANAGEMENT SUCCESS

## ARIZONA WATER USE, POPULATION, AND ECONOMIC GROWTH (1957-2016)



### TOTAL WATER USE (IN MILLIONS ACRE/FEET)

1957 7.1 MAF  
 2016 7 MAF

**-2%** CHANGE FROM 1957-2016

### POPULATION (IN MILLIONS)

1957 1.1  
 2016 6.8

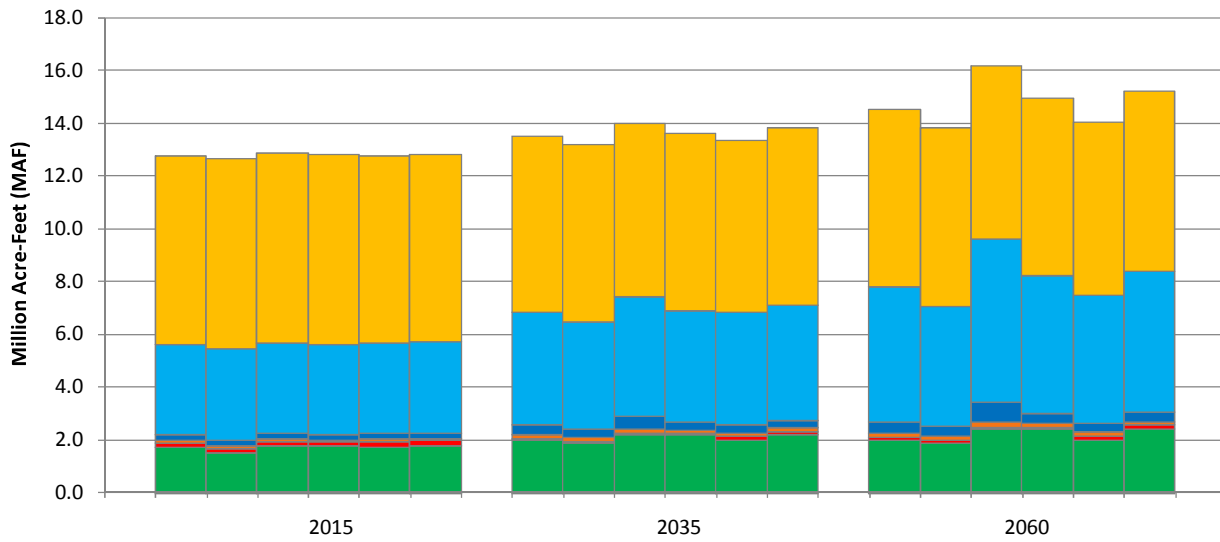
**504%** CHANGE FROM 1957-2016

### GROSS DOMESTIC INCOME (IN BILLIONS)

1957 13.4  
 2016 251.4

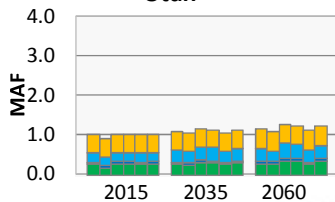
**1,778%** CHANGE FROM 1957-2016

### Colorado River Demand

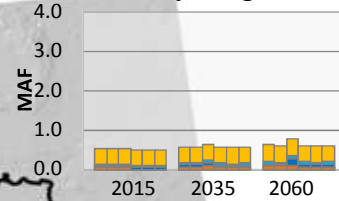


Six columns per time period represent six scenarios. From left to right: A, B, C1, C2, D1, D2

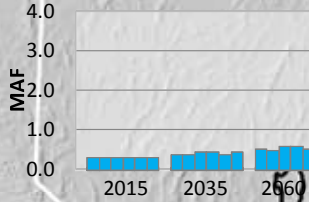
### Utah



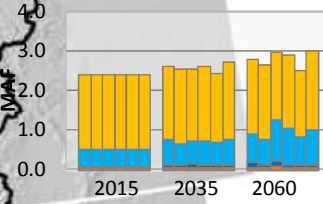
### Wyoming



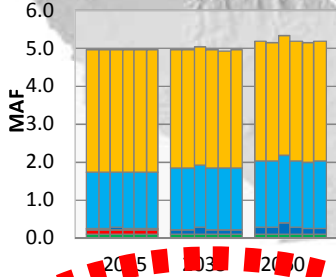
### Nevada



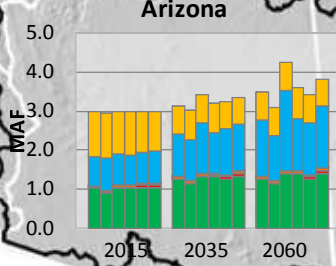
### Colorado



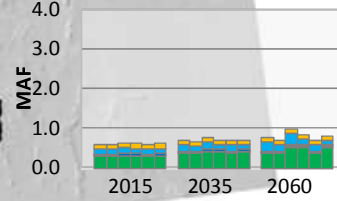
### California



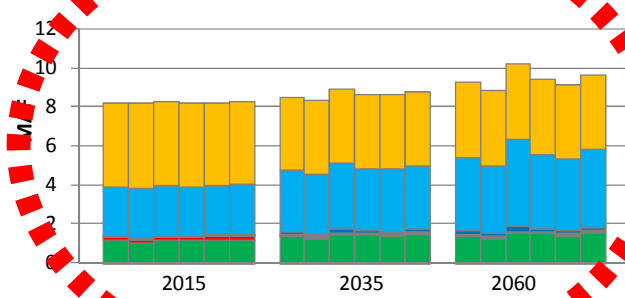
### Arizona



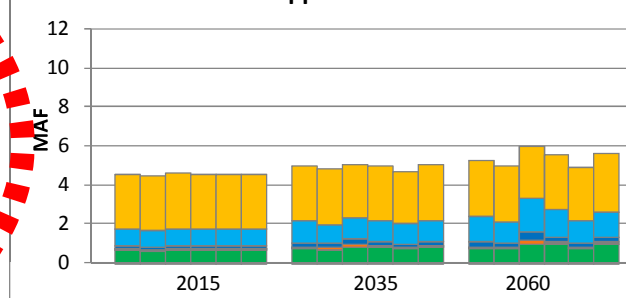
### New Mexico



### Lower Basin



### Upper Basin



■ Agricultural

■ Energy

■ Fish and Wildlife and Recreation

■ Municipal and Industrial

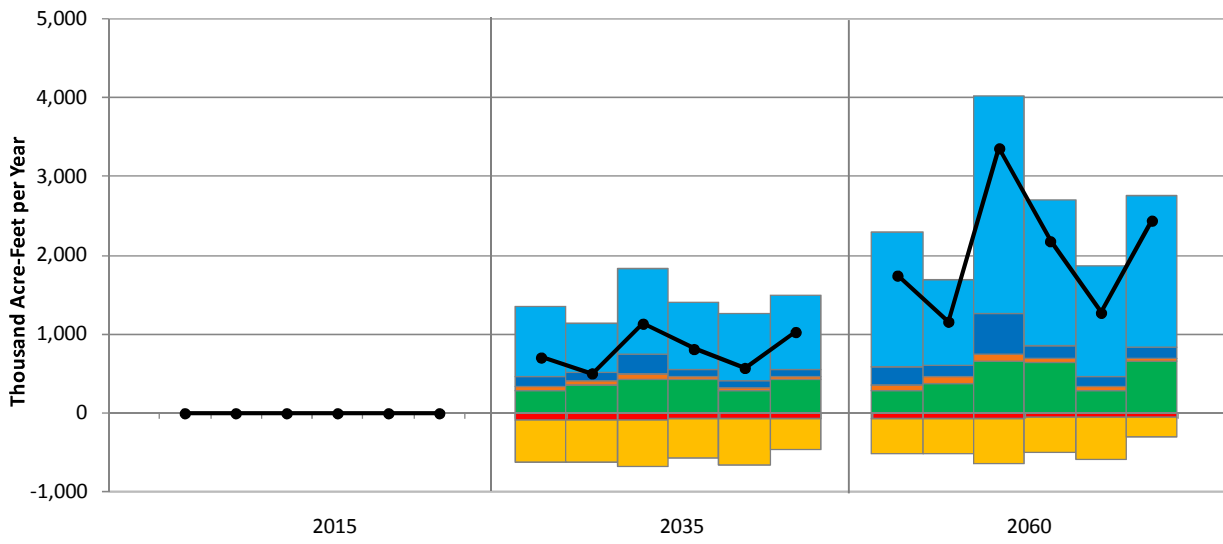
■ Minerals

■ Tribal

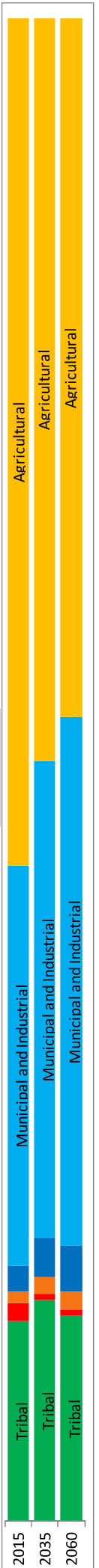
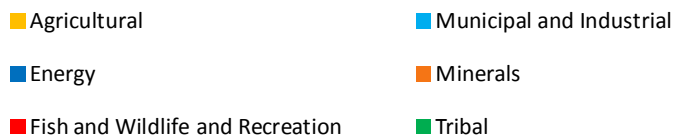
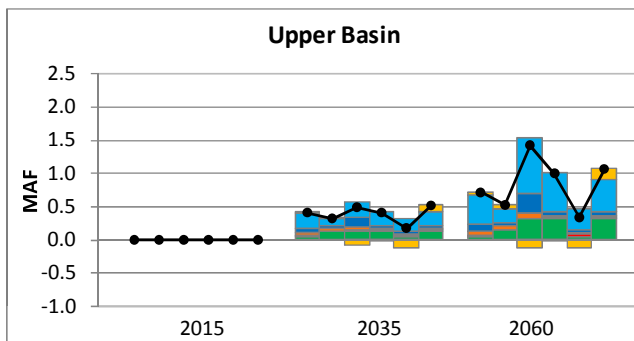
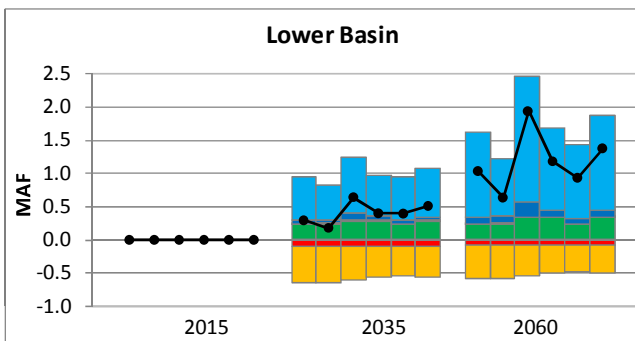
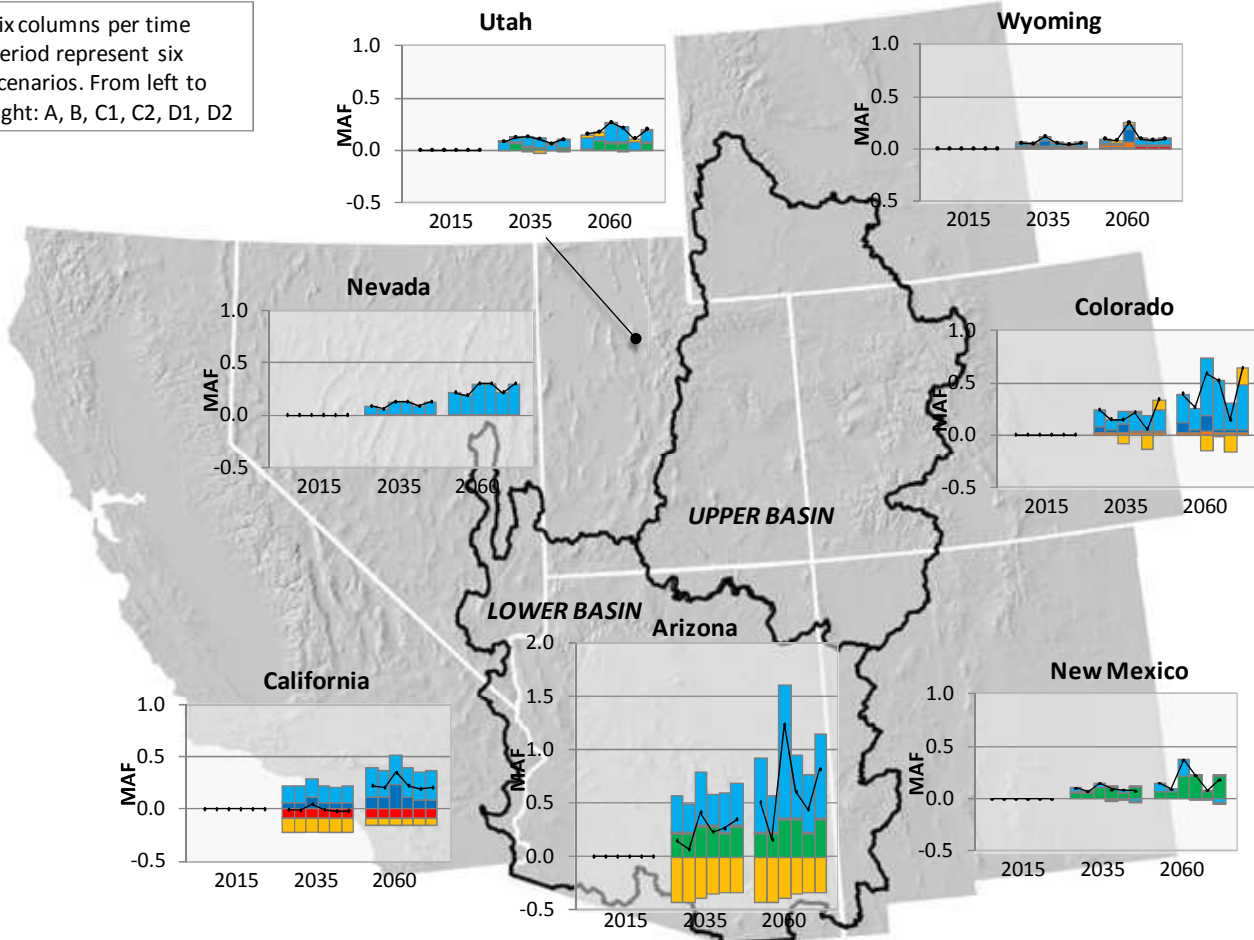


2015  
2035  
2060

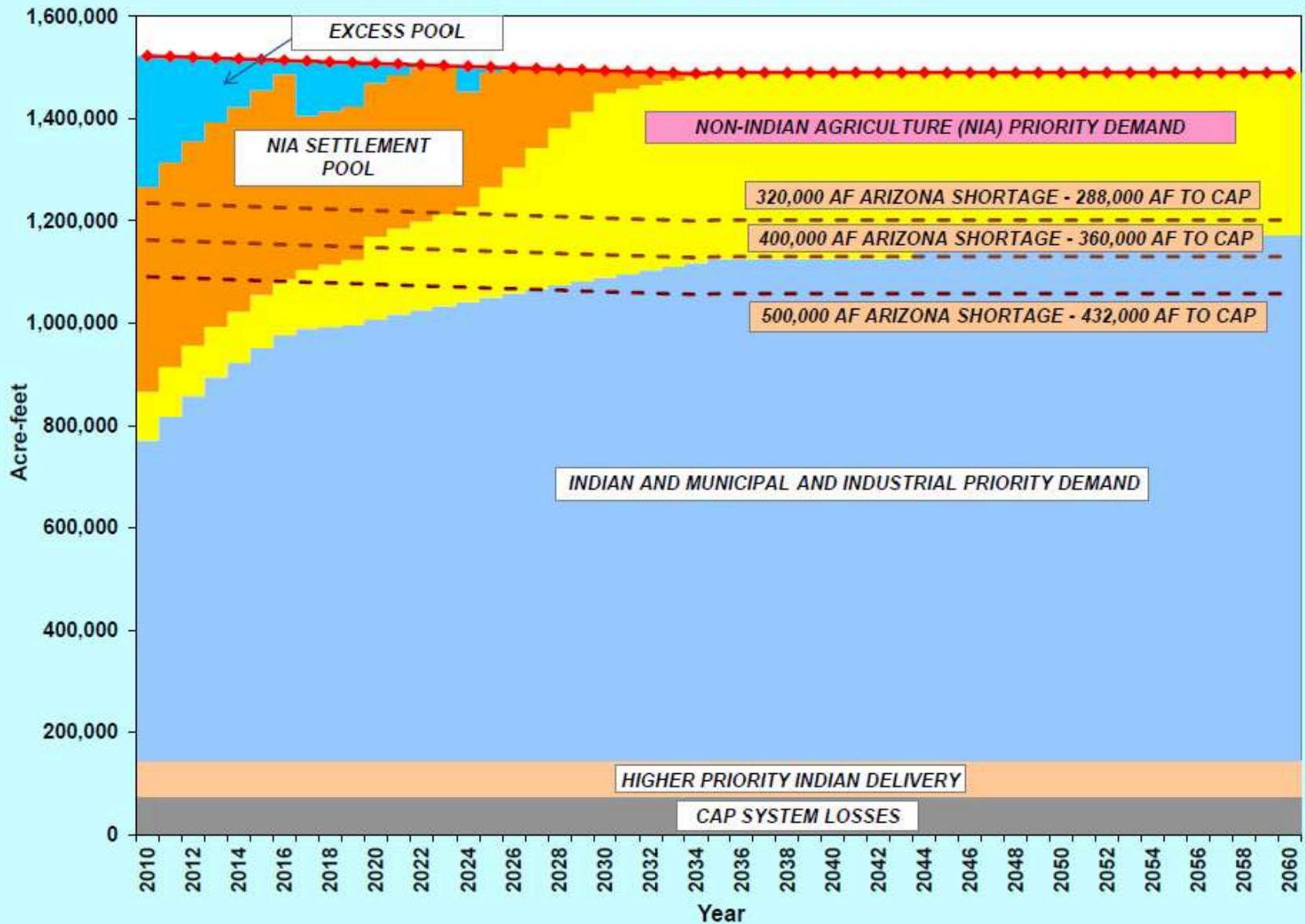
# Change in Colorado River Demand, from 2015



Six columns per time period represent six scenarios. From left to right: A, B, C1, C2, D1, D2

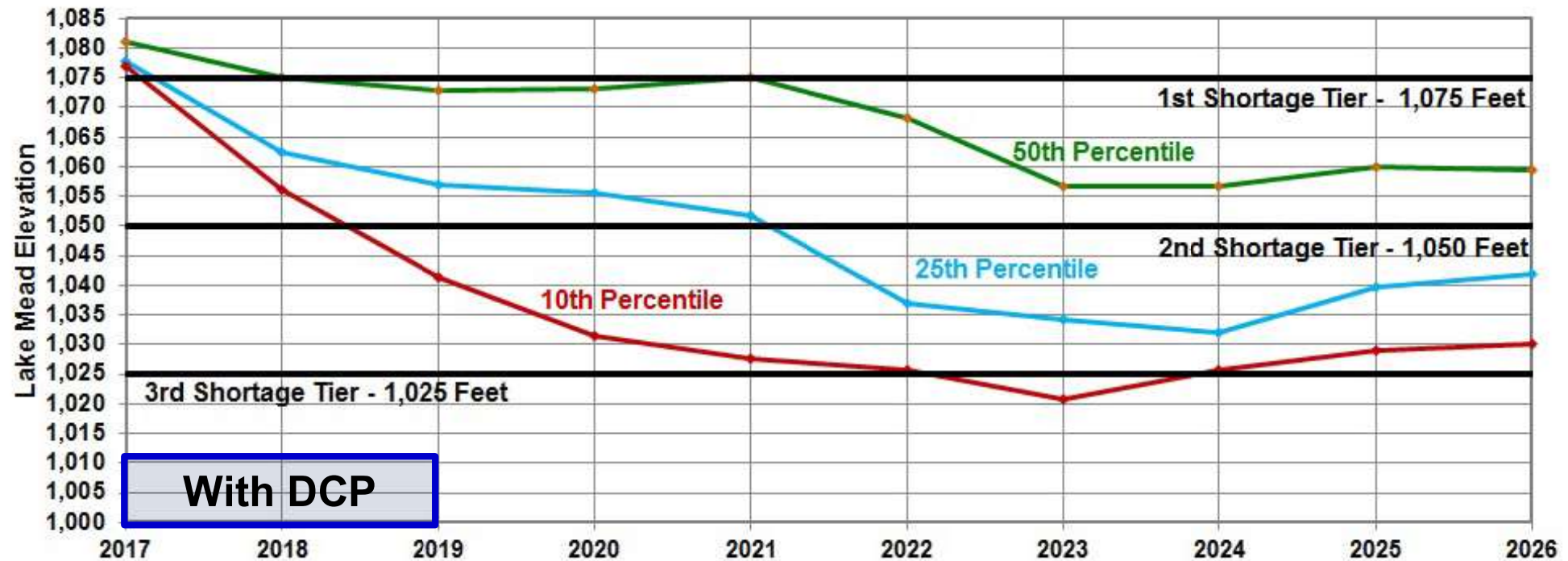
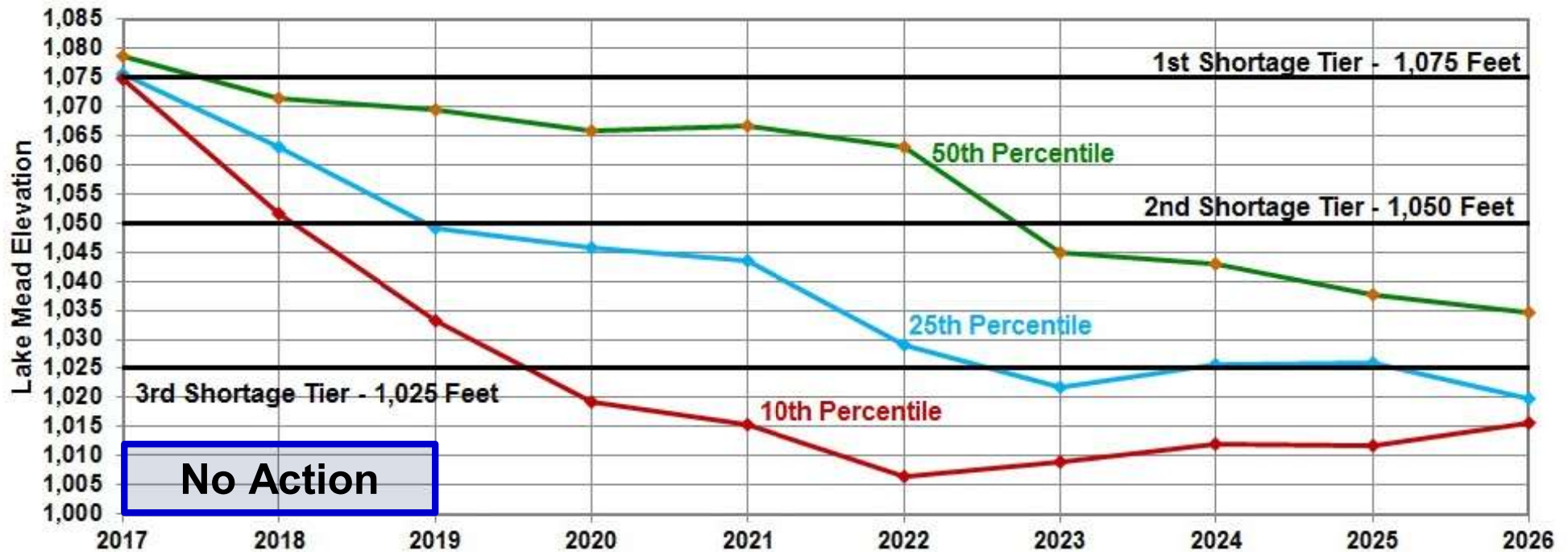


### Projected Central Arizona Project Supplies and Subcontract Deliveries 2010 - 2060





## Lake Mead – Selected Percentile Elevations Stress Test Hydrology – “No Action” and With DCP



**Table 2**  
**Reductions to Arizona’s Colorado River water entitlement per the federal 2007 Interim Guidelines**

	Lake Mead level	Reduction	Impact
Tier 1 shortage	1,051 to 1,075 feet	320,000 acre-feet	Excess water is no longer available to the CAGR D to help developers meet 100-year assured water supply requirements or to the AWBA to bank water for the future. A large portion of the excess water that fills the agricultural settlement pool would also no longer be available.
Tier 2 shortage	1,026 to 1,050 feet	400,000 acre-feet	No water available at all to the agricultural settlement pool for irrigation districts and a reduction to non-Indian agriculture water entitlement holders, including Maricopa County municipalities and two tribes.
Tier 3 shortage	1,025 feet or below	480,000 acre-feet	Substantial reductions to entitlement holders of non-Indian agriculture priority water.

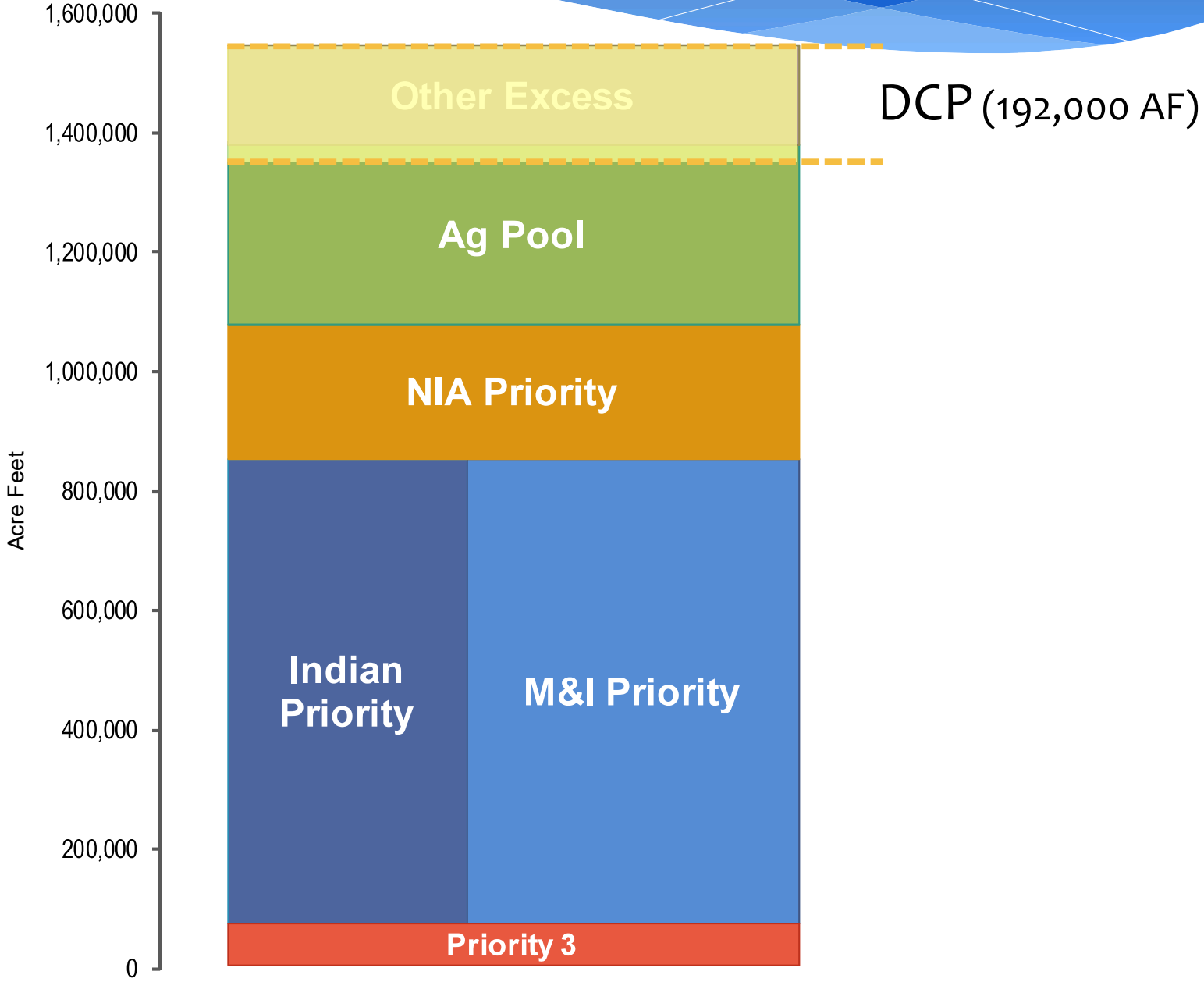
Source: Auditor General staff review of the federal 2007 Interim Guidelines and district documents.

# DCP Plus

# DCP plus proposed by AZ

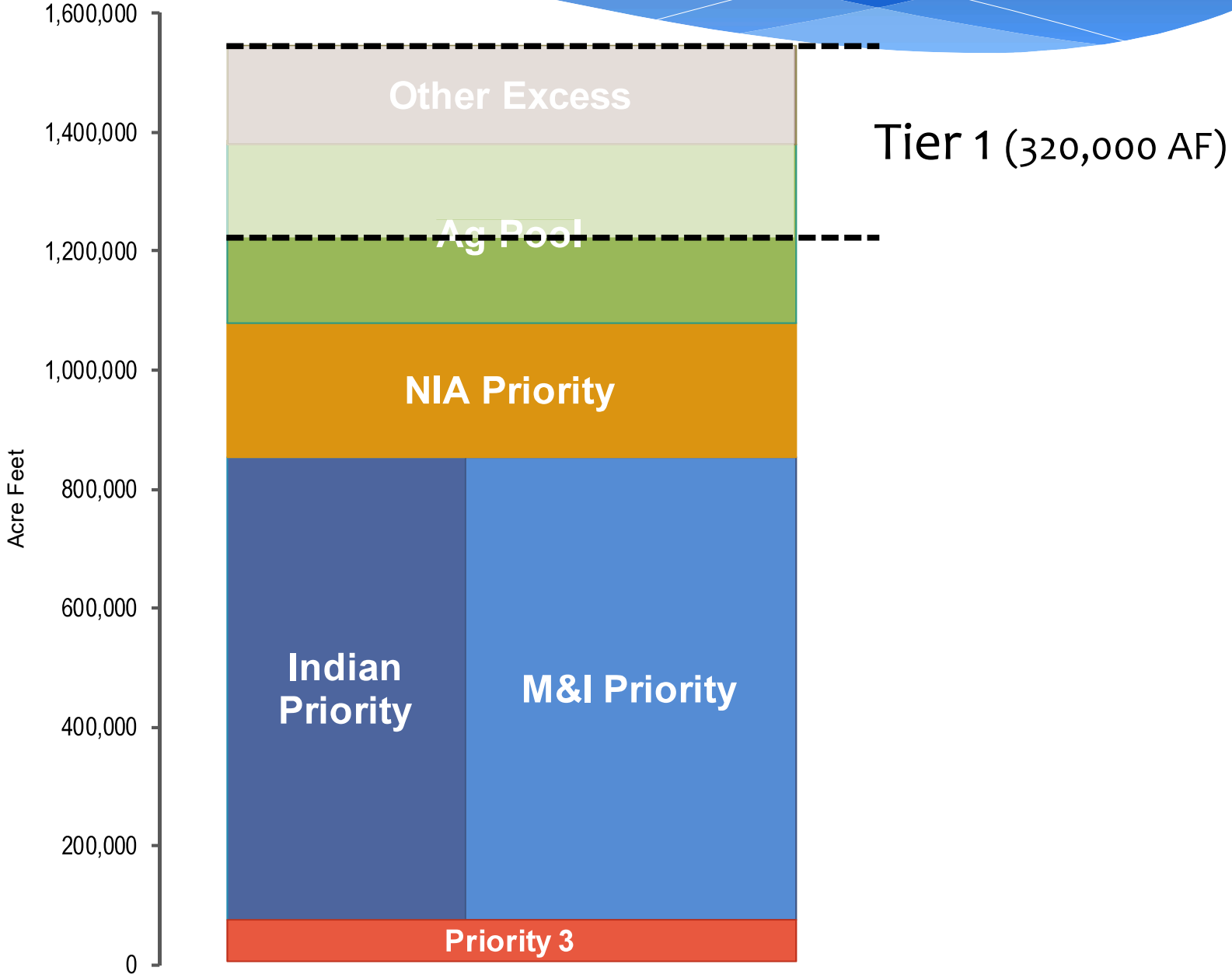
Lake Mead Elevation	AZ [2007]	AZ [Plan]	AZ TOTAL	NV [2007]	NV [Plan]	NV TOTAL	CA [2007]	CA [Plan]	CA TOTAL	BOR	TOTAL
Voluntary 1090-1075	0	192K	192K	0	8K	8K	0	0	0	100k	300k
Tier 1 1075-1050	320K	192K	512K	13K	8K	21K	0	0	0	100k	633k
Tier 2A 1050-1045	400K	192K	592K	17K	8K	25K	0	0	0	100k	717k
Tier 2B 1045-1040	400K	240K	640K	17K	10K	27K	0	200K	200K	100k	967k
1040-1035	400K	240K	640K	17K	10K	27K	0	250K	250K	100k	1,017k
1035-1030	400K	240K	640K	17K	10K	27K	0	300K	300K	100k	1,067k
1030-1025	400K	240K	640K	17K	10K	27K	0	350K	350K	100k	1,117k
Tier 3 <1025	480K	240K	720K	20K	10K	30K	0	350K	350K	100k	1,200k

# CAP Priority Pools

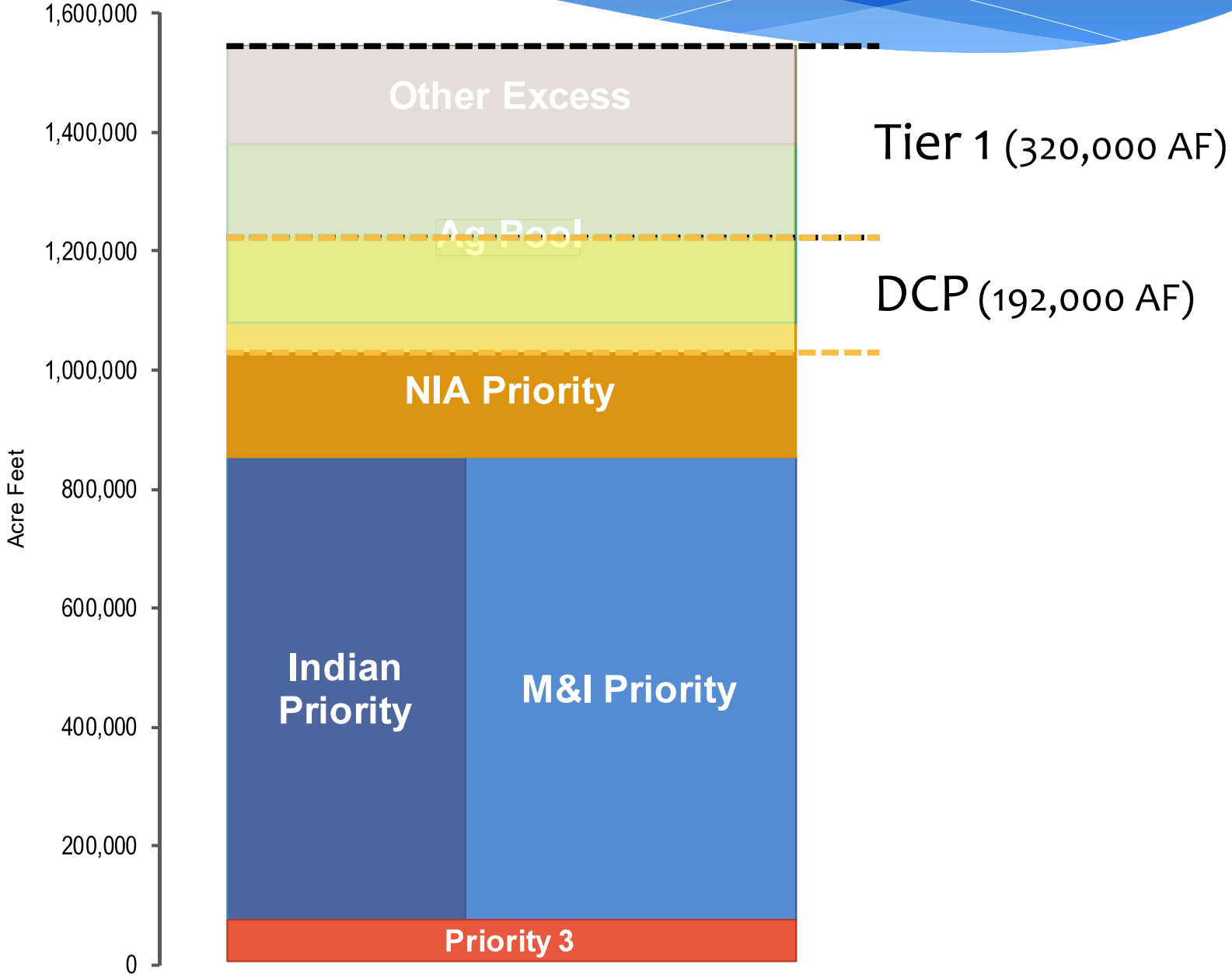




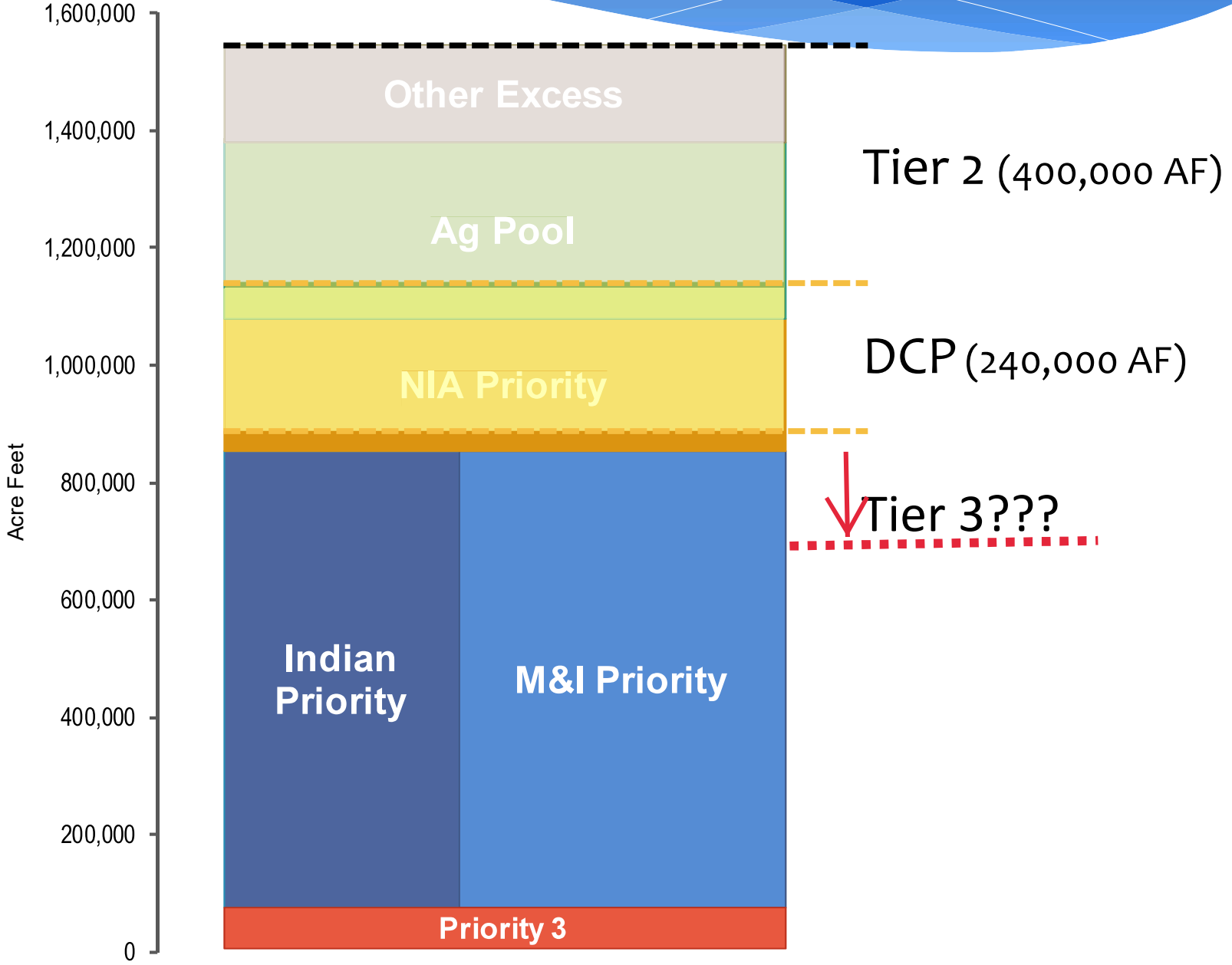
# CAP Priority Pools



# CAP Priority Pools



# CAP Priority Pools

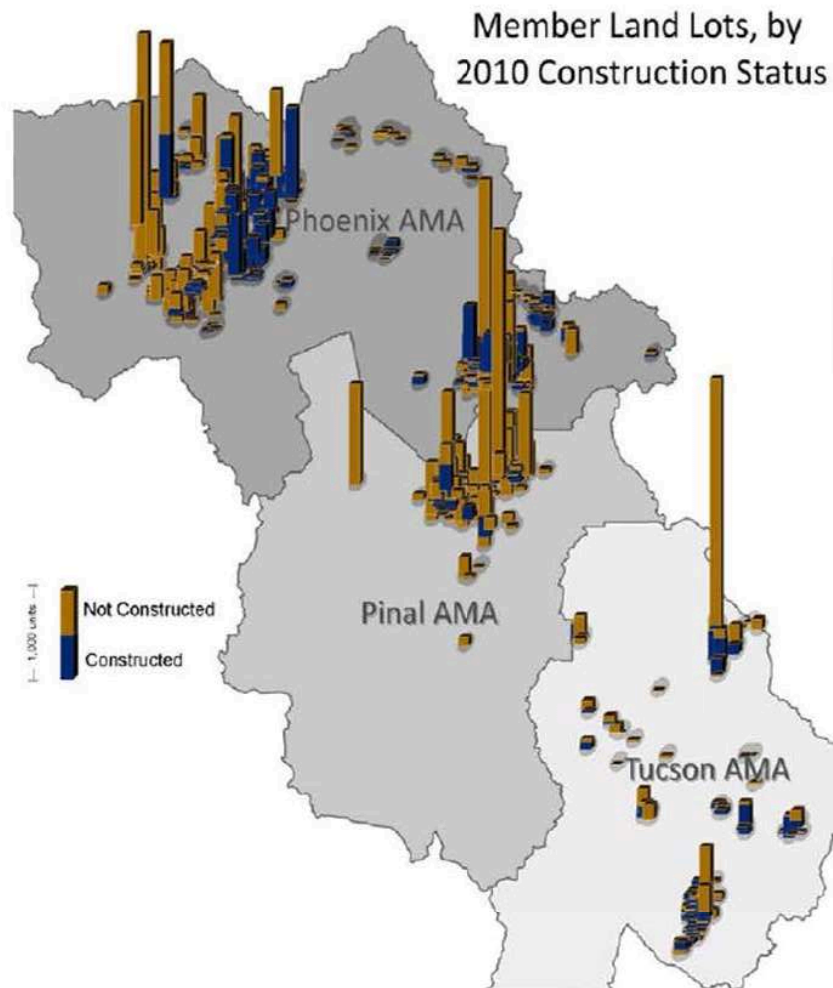


**Why is the CAP supply so important to our growth?**

# Ranking of the CAGR by Residents

Phoenix	1.6 million
<b>CAGR</b>	<b>950,000</b>
Tucson	530,000
Mesa	484,000
Chandler	247,000
Scottsdale	246,000
Glendale	245,000
Gilbert	237,000

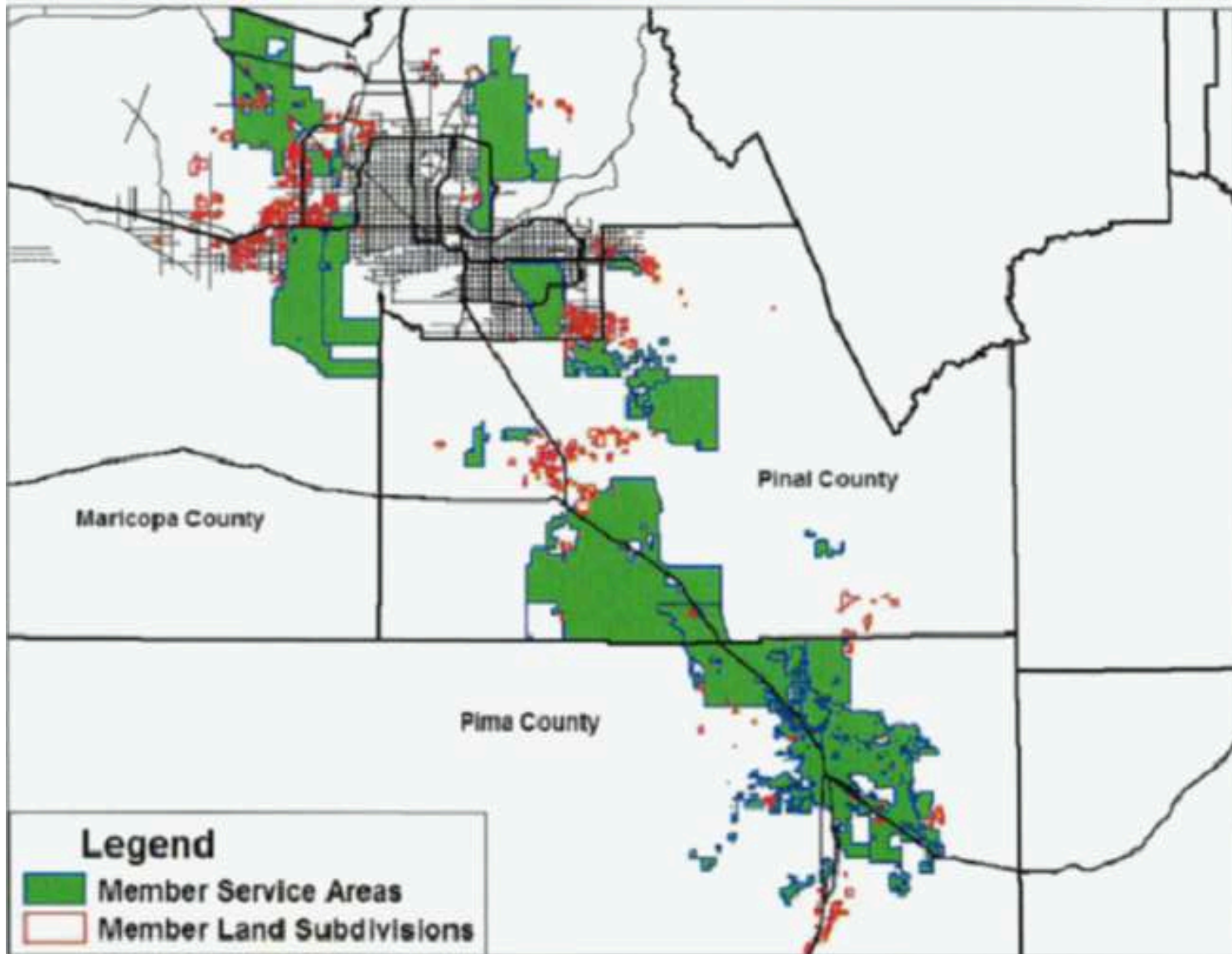




Member Lands	2010
Constructed Units	99,800
Unconstructed Units	161,900

**Per ADWR, 1 acre-foot of water will supply 2-3 families/year. To provide for unconstructed lots would require +/- 54-80k AF**

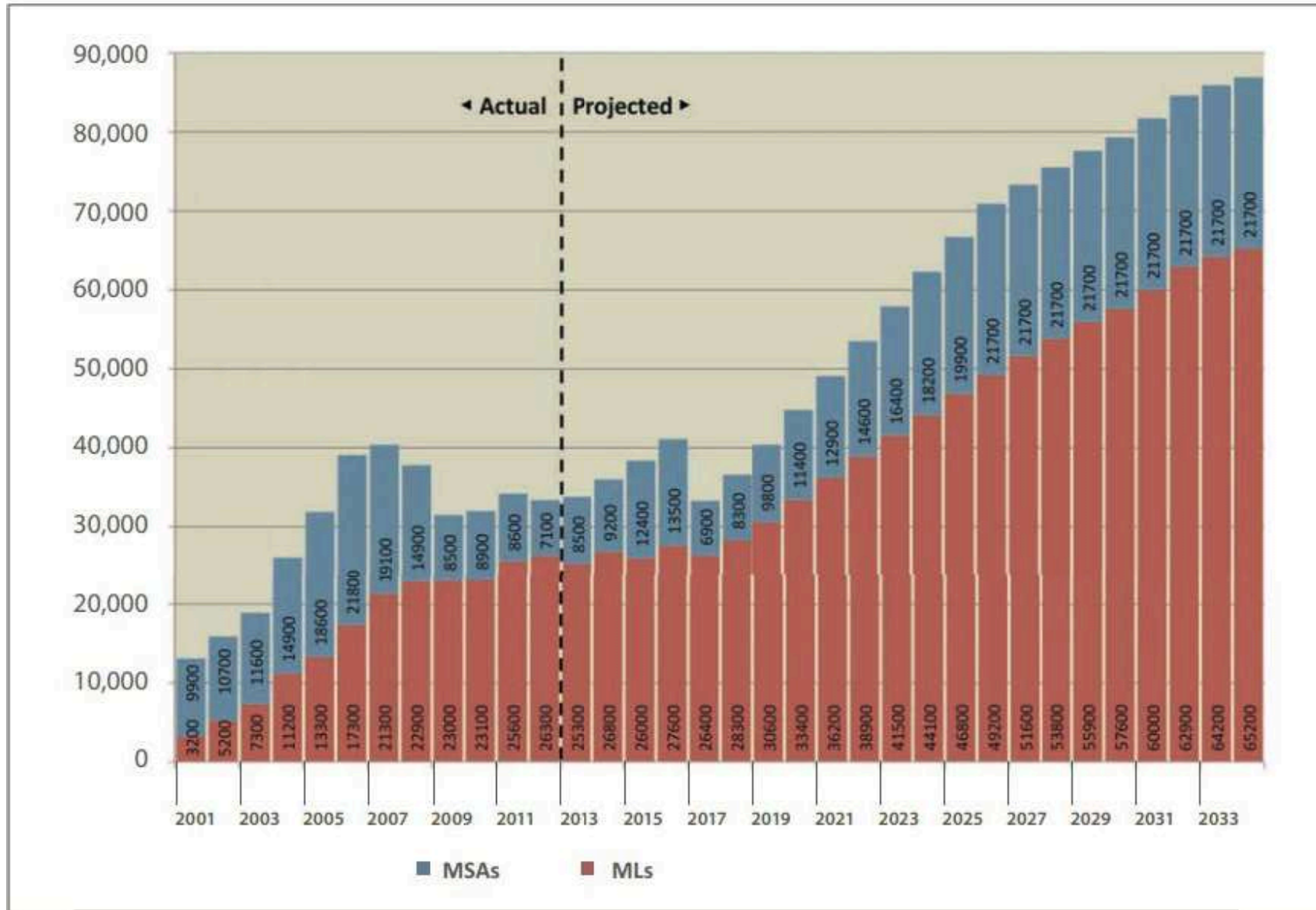




From 2015 Plan of Operation:

# PROJECTED CAGR OBLIGATION

From New and Existing Housing Units (AF)



WATER SUPPLY	DESCRIPTION	QUANTITY (ACRE-FEET)		LOCATION	YEAR SUPPLY FIRST AVAILABLE	TERMS OF ACQUISITION
		TOTAL	ANNUAL <sup>1</sup>			
CAP Water (M&I Priority)	M&I Subcontract entitlements transferred from Litchfield Park Service Co. (LPSCO), New River Utility Co., Sunrise Water Co., West End Water Co., and Valley Utilities Water Co.	---	7,996	Phoenix AMA	2006	Contract is for permanent water service
CAP Water (NIA Priority)	Recommended volume for CAGRD in ADWR's NIA Reallocation recommendation	---	18,185 <sup>2</sup>	Within CAP Service Area	2017	Contract will be for permanent water service
Tribal lease of CAP NIA Priority Water	Lease of White Mountain Apache Tribe NIA Priority water	---	2,500	Within CAP Service Area	2017	100-year lease
Long-term Storage Credits	Storage credits acquired through 2014	64,879	649	Phoenix AMA	2014	One-time purchases and credit purchase agreements
Long-term Storage Credits	Storage credits to be acquired in the future	335,982	3,360	Phoenix AMA	2015	Credit purchase agreements
Long-term Storage Credits	Storage credits acquired through 2014	25,093	251	Tucson AMA	2014	One-time purchases and credit purchase agreements
Long-term Storage Credits	Storage credits to be acquired in the future	119,264	1,193	Tucson AMA	2015	Credit purchase agreements
Effluent	Long-term lease of effluent from Water Reclamation Facility operated by Liberty Utility; includes access to infrastructure sufficient to recharge the purchased effluent at USF to be built by Liberty	---	2,400	Phoenix AMA	2016	100-year lease of 2,400 AF of effluent
<b>TOTAL ANNUALIZED SUPPLY:</b>		<b>36,534</b>				

28,681 AF for CAGRD credits from CAP.  
 Projected need of:  
 2035=87,000 AF  
 2114=113,000 AF

## **CAGR Economic Value to AZ**

### 2016

- 118,000 jobs & \$13.4 billion in economic impact.
- \$1.7 billion in state and local taxes.
- 8% of the revenues to the State General Fund

.

### CAGR residents

- spending has provided \$20 billion in state & local taxes over last 22 years.
- spend \$9.9 billion annually in goods





# Threats to the CAGR

- Loss of CAP Excess water
- Prohibiting the CAGR from buying water supplies
  - Colorado River – Quartzsite and Mohave
- Restricting membership
- “Unsustainable” – Regulatory hurdles
- “Forcing” the CAGR to purchase certain water supplies





# What happens without CAGR

- CAGR “fails” if it can’t replenish enough water within 3 years of pumping
- Failure means
  - No new subdivision can join
  - Without CAGR, subdivisions cannot record plat
  - Member cities lose assured water supply status
  - Major disruption to housing market and Arizona economy
  - Perception that AZ is out of water

# Measures to minimize the water shortfall

# Acquisition of water rights

## **Phoenix, SRP reach historic water agreement 3/18/2018**

Phoenix will pay a one-time fee of \$12.3 million to reserve pumping capacity in SRP's wells. In addition, Phoenix will pay SRP \$55.82 for each acre-foot of water up to 100,000 acre-feet and \$151.17 for each acre-foot above 100,000 acre-feet pumped by SRP for Phoenix during the term of the agreement. Those prices will be adjusted annually for inflation.



The Central Arizona Project's governing board approved the 34-million-dollar purchase of seven Mohave County farms. They come with nearly 14 thousand acre-feet of Colorado River water rights.

In 2007, Prescott Valley auctioned off 2,724 AF of its recycled water for \$67 million.

## Conservation measures in other basin states

**Basin States Augmentation Program**—The District supported and completed an augmentation study to increase Colorado River water flows during the 2014-2015 biennial budget period. This led to the formation of the Basin States Augmentation Work Group. One initiative entailed the District providing \$150,000 to pilot snowpack augmentation programs in Colorado, Utah, and Wyoming to increase winter snowpack and resulting flow into the Colorado River.

**Agricultural forbearance**—To improve water elevations in Lake Mead, the District implemented agricultural forbearance programs to allow ag. users to reduce their CAP water usage so the balance may be left in Lake Mead in exchange for an incentive.

1. 2015/2016-Reduce CAP water orders and water they did order at a reduced rate.
2. 2016-By reducing CAP water orders in 2016, a reduced rate was provided for water delivered in 2017/2018.
3. 2016-2030. As an incentive to reduce CAP water orders, the District is allowing eligible entities to act as a groundwater savings facility. This allows entities providing water to irrigation districts to earn long-term storage credits.
4. 2018. As an incentive to reduce CAP water deliveries in 2018, the District is offering a reduced rate for water delivered in 2019.

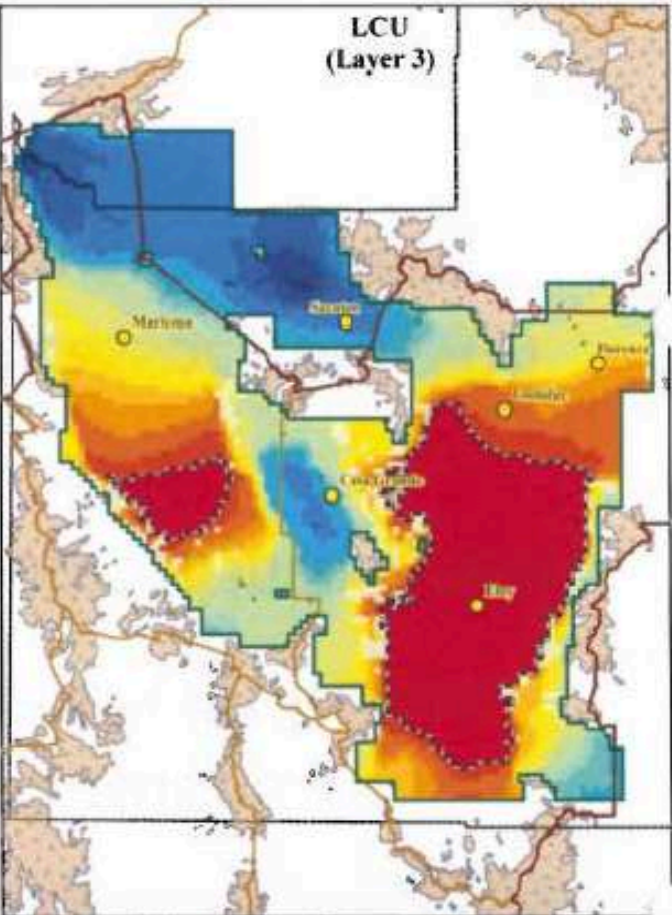
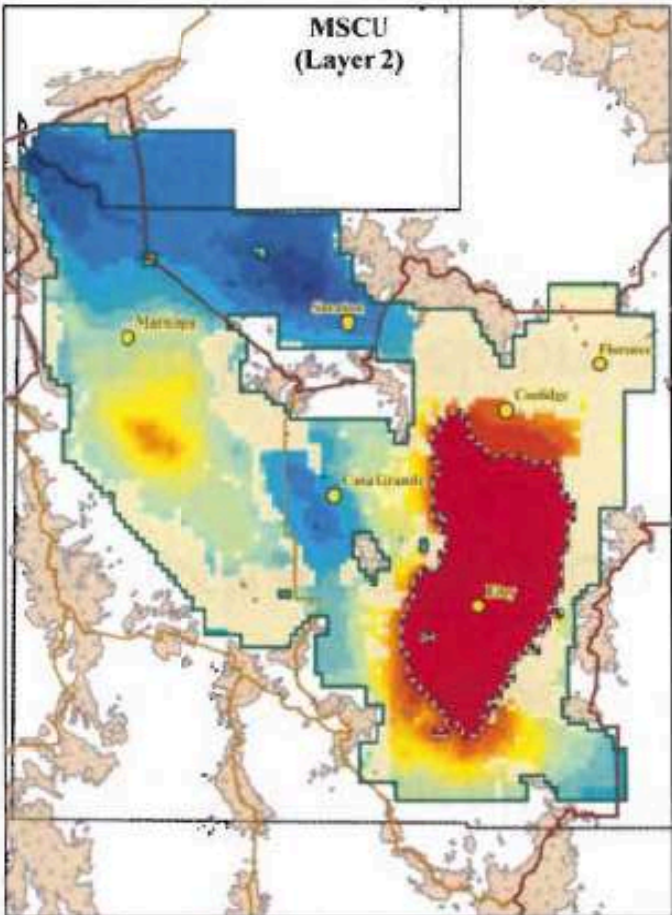
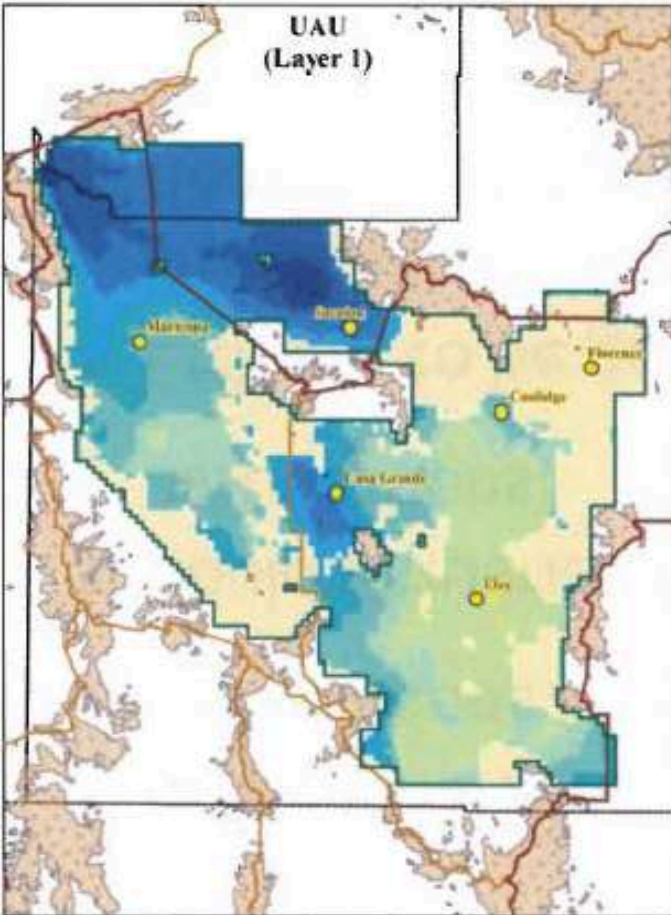
Pinal AMA



Mar 9, 2018



- Current ADWR modeling indicates groundwater over-allocation for assured water supply (AWS)
  - About 8.4 MAF deficit over 100 years
  - Split of 100-year water use is approx:
    - - 75% agriculture
    - - 25% M&I (Designations/CAWS/AAWS)
- Impact on assured water supply approvals
- Possible impact on ADWR rules on Analysis of Assured Water Supply
- Pinal AMA has a management goal referred to as "planned depletion". Their intent is to preserve an agricultural economy as long as they can but also account for municipal and industrial growth over time. In reality this would mean that they expect farming to be reduced thus reducing the amount of groundwater withdrawal (similar to the change in the Phoenix AMA outskirts during the 1980's) and therefore providing more water for residential/commercial growth



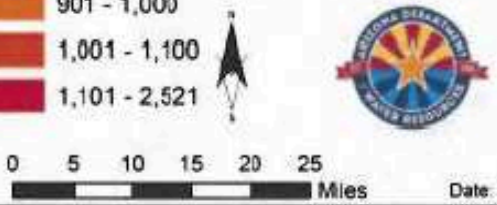
- Explanation**
- City or Town
  - Area Where Depth to Water > 1,100 feet
  - ⊕ Active Model Boundary
  - ⊕ Pinal AMA Boundary
  - ⊕ Sub-basin Boundary For discussion purposes only
  - ⊕ Hardrock

**Depth to Water (ft bgs)**

0 - 10
11 - 25
26 - 50
51 - 100

101 - 150	601 - 700
151 - 200	701 - 800
201 - 250	801 - 900
251 - 300	901 - 1,000
301 - 400	1,001 - 1,100
401 - 500	1,101 - 2,521
501 - 600	

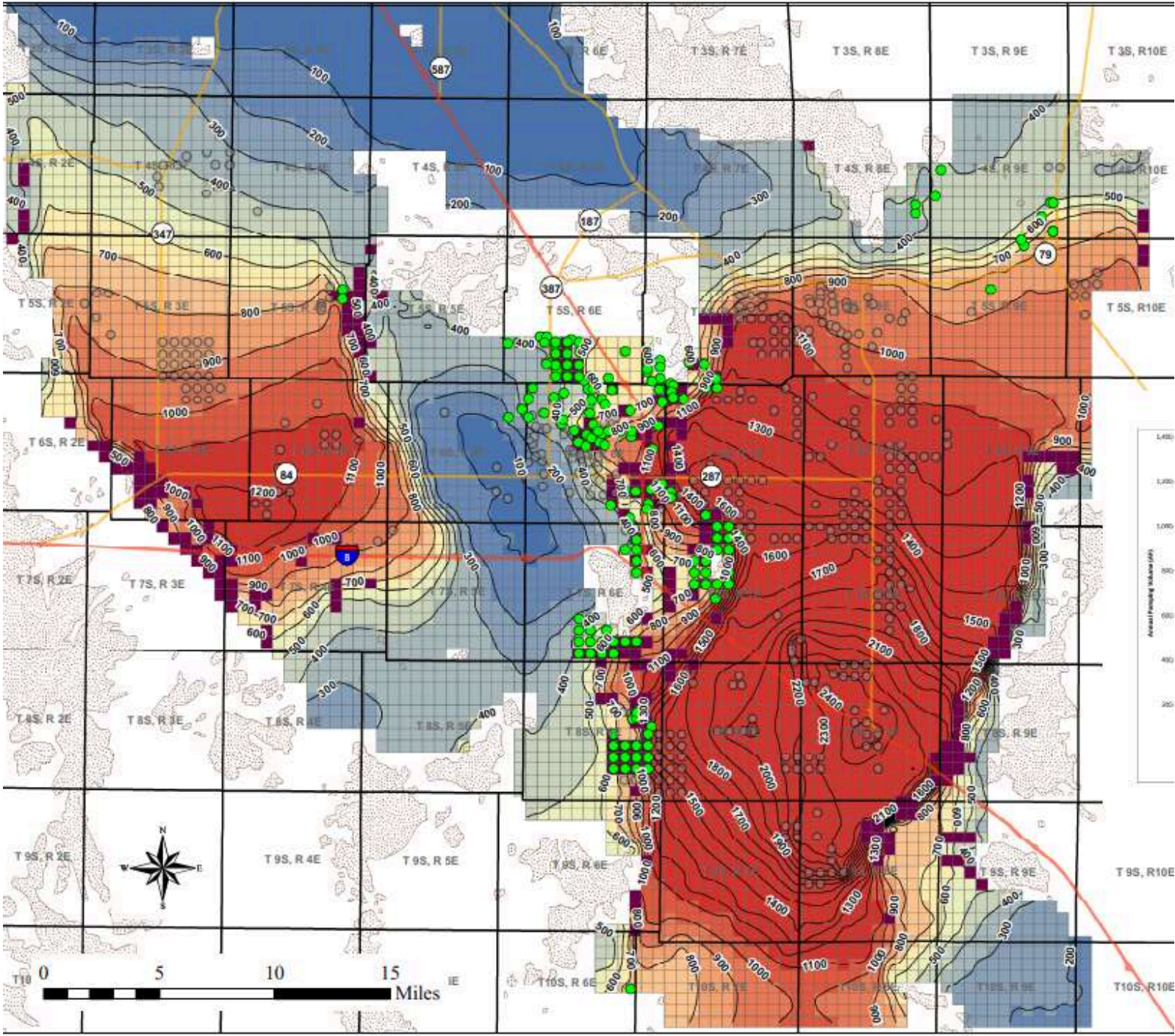
- Dry Cells in this Layer
- Area Where Depth to Water > 1,100 feet



**Full Baseline Simulated Projected  
Depth To Water  
Per Model Layer After  
100 Years of Pumping  
(2015 through 2114)  
Pinal Groundwater Model Projections  
Baseline Run for Issued  
Assured and Adequate Water Supply  
(AAWS) Demands**

Date: 3/13/2017





- ADWR revising current model to:
  - Adjust bedrock depths
  - Update M&I demand numbers
  - Update estimated agricultural acres over 100 years
  - Include effluent supplies
  - Include CAGR D replenishment
- New ADWR modeling projected Spring 2018

- Pinal Stakeholder Group exploring:
  - Options for additional surface water supply
  - Options for financing water supply
  - Possible revisions to ADWR rules on AAWS
    - Focus on term of AAWS and renewals
  - Next steps: What happens if new model is positive?
  - Stop development now for future projected problem? or Create and implement plan to address problem?



## Takeaways

1. The CAGR 10 year plan was approved in 2015. Unless there's some other legislative action, CAGR is solvent until 2024.
  - .
2. CAP, ADWR and Governor's office are very aware of the negative publicity that a water shortage will create and as such they're trying to create a solution to benefit all.
  - .
3. If the drought continues, water rights will not just be a necessity of housing but a valuable commodity
  - .
4. If the drought continues, the value of projects with existing water rights will have a marked increase