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WATER RESOURCES RESEARCH CENTER

Water Issues faced by Arizona and the Central Arizona Project

Sharon B. Megdal, Ph.D.

May 10, 2022

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Education Academy**

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Elevations in Lake Mead over time.

Source: Municipal Leader Magazine, April 2022



GREATER DEPTH, BROADER PERSPECTIVE FOR A CLEAR WATER FUTURE

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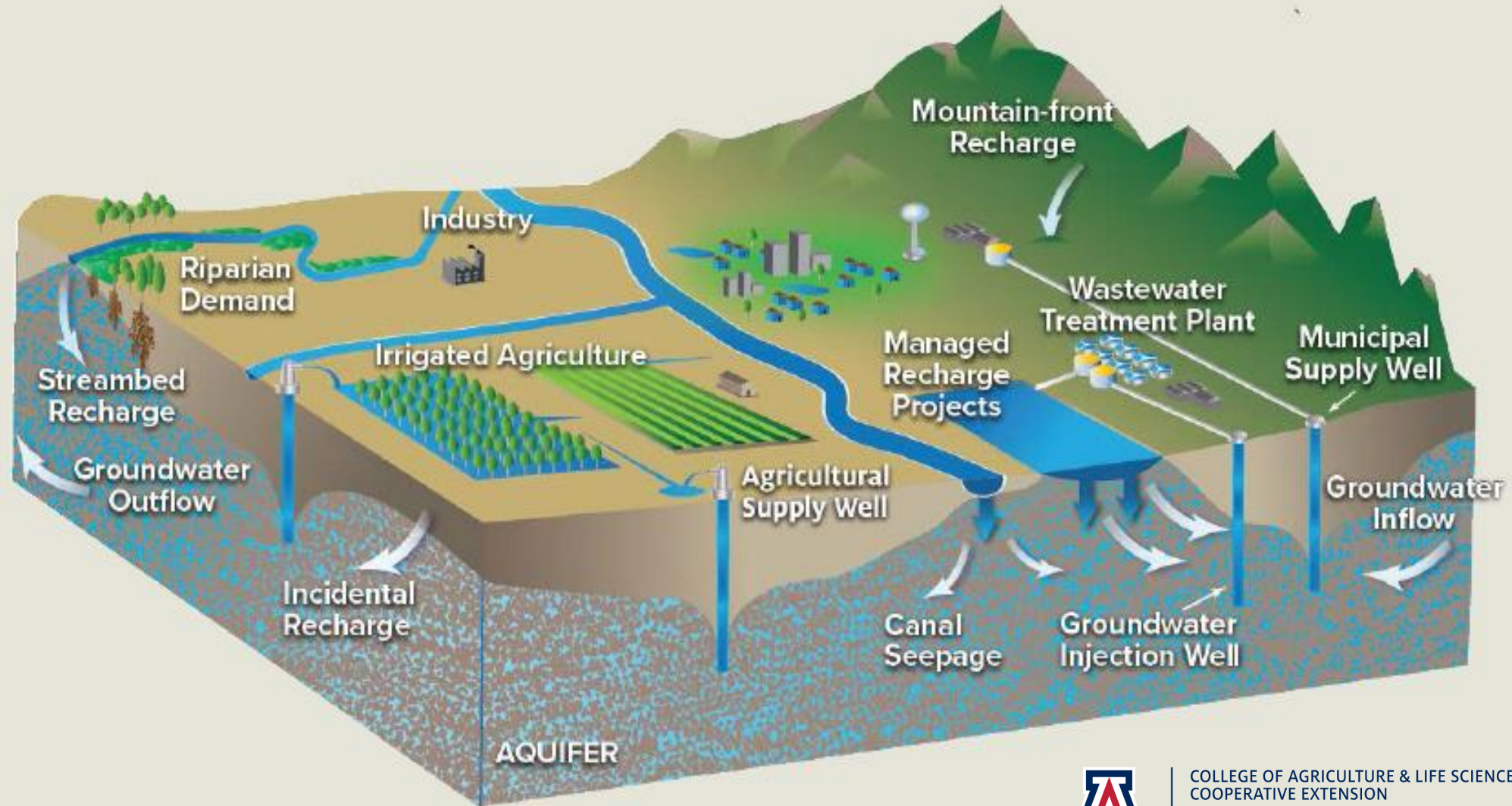
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Water policy and management reflect many determining factors

- Resource Availability
- Location of water demands and supplies
- Economics
- Historic and Current Legal/Institutional Framework
- The nature of involvement of multiple governmental and non-governmental entities, including the extent of centralized versus decentralized decision making
- Politics of Area
- Public values and socio-cultural factors
- Historical context
- Information
- Etc...

Importance of Context

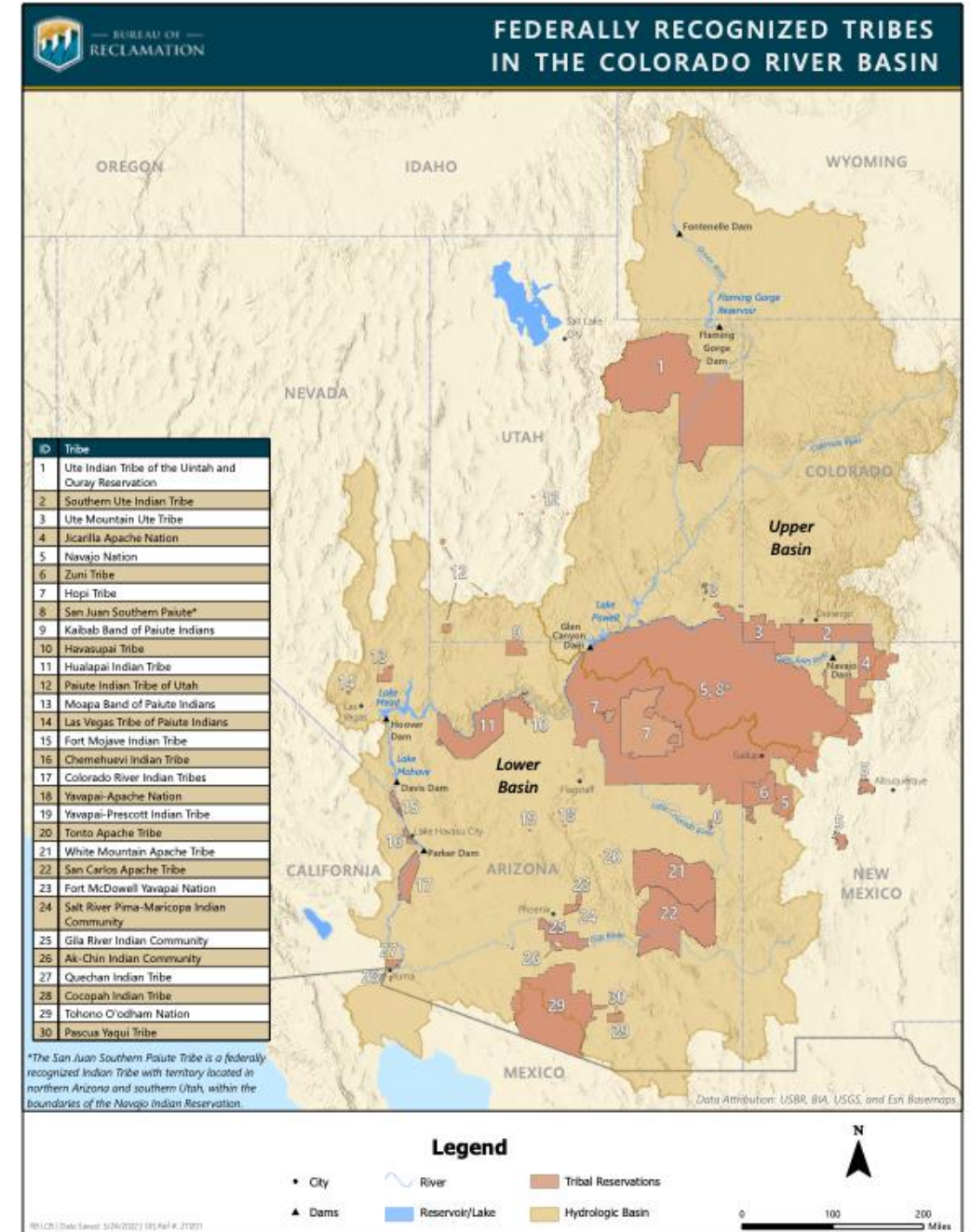
Water Cycle Context



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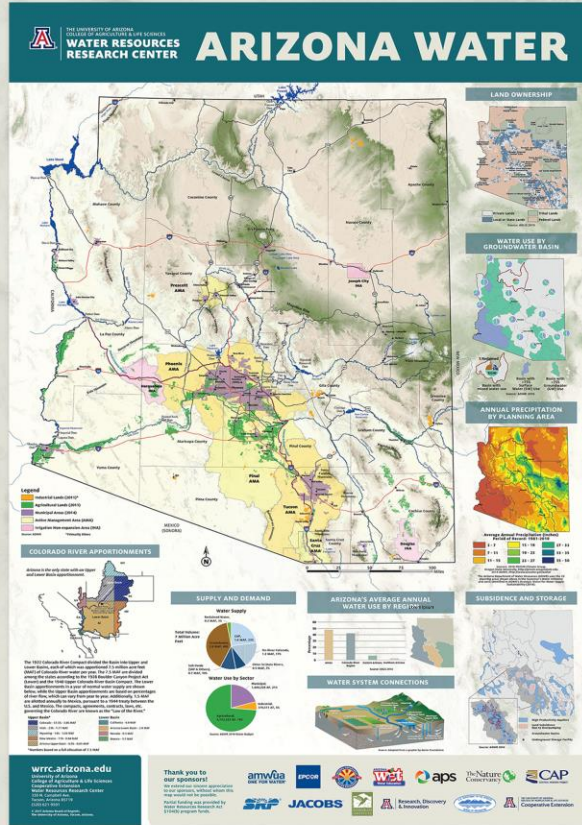
Geographic context





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ARIZONA WATER MAP POSTER



LAND OWNERSHIP



WATER USE BY GROUNDWATER BASIN



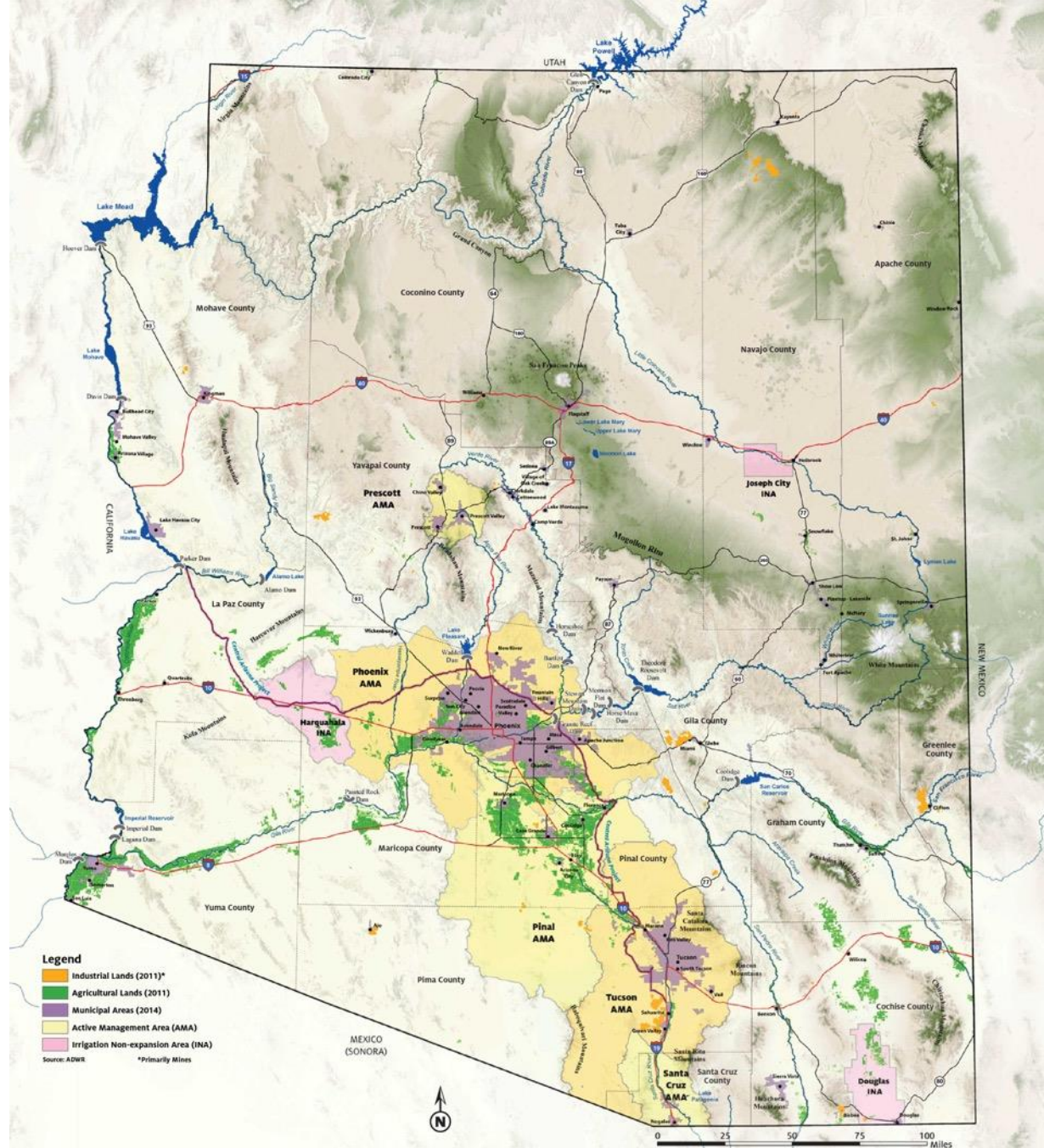
COLORADO RIVER APPORTIONMENTS



The 1922 Colorado River Compact divided the Basin into Upper and Lower Basins, each of which was apportioned 7.5 million acre feet (MAF) of Colorado River water per year. The 7.5 MAF are divided among the states according to the 1929 Boulder Canyon Project Act (Lower) and the 1944 Upper Colorado River Basin Compact. The lower basin apportionments in a year of normal water supply are shown below, while the upper basin apportionments are based on percentages of river flow, which can vary from year to year. Additionally, 1.5 MAF are allotted annually to Mexico, pursuant to a 1944 treaty between the U.S. and Mexico. The compacts, agreements, contracts, laws, etc., governing the Colorado River are known as the "Law of the River."

Upper Basin*	Lower Basin
Colorado: 11.33: 1.89 MAF	California: 4.4 MAF
Utah: 2.00: 3.11 MAF	Arizona: 2.8 MAF
Wyoming: 1.00: 1.00 MAF	Nevada: 1.5 MAF
New Mexico: 1.15: 0.85 MAF	Lower Basin Total: 10.7 MAF
Arizona Upper Basin: 0.50: 0.50 MAF	

*Numbers based on a full allocation of 7.5 MAF



ARIZONA'S WATER SUPPLY



SOURCE: ADWR, 2020

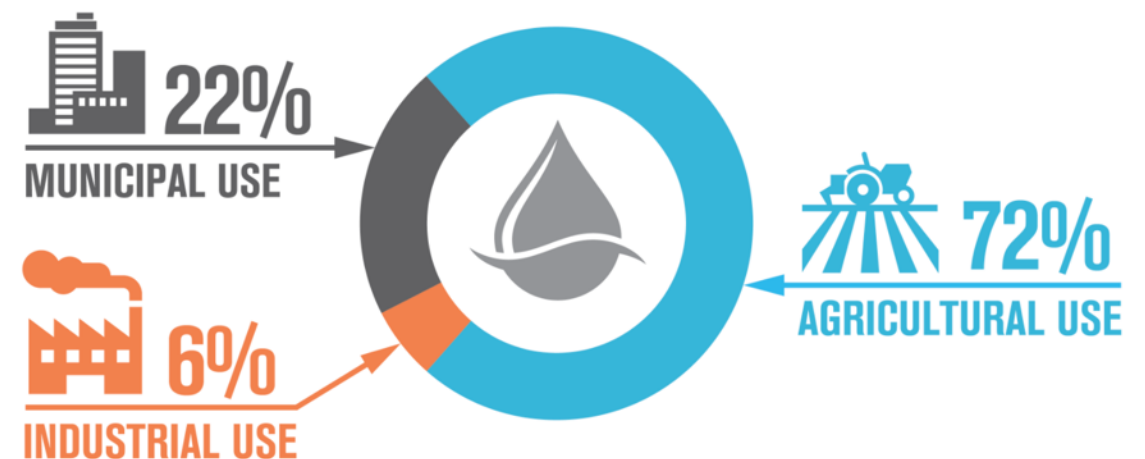
Regulation of water varies across the state, but there are rights to use the water that are difficult to change

Surface water and groundwater are not regulated in an integrated way

Environmental water not measured – natural systems are not a recognized water using sector

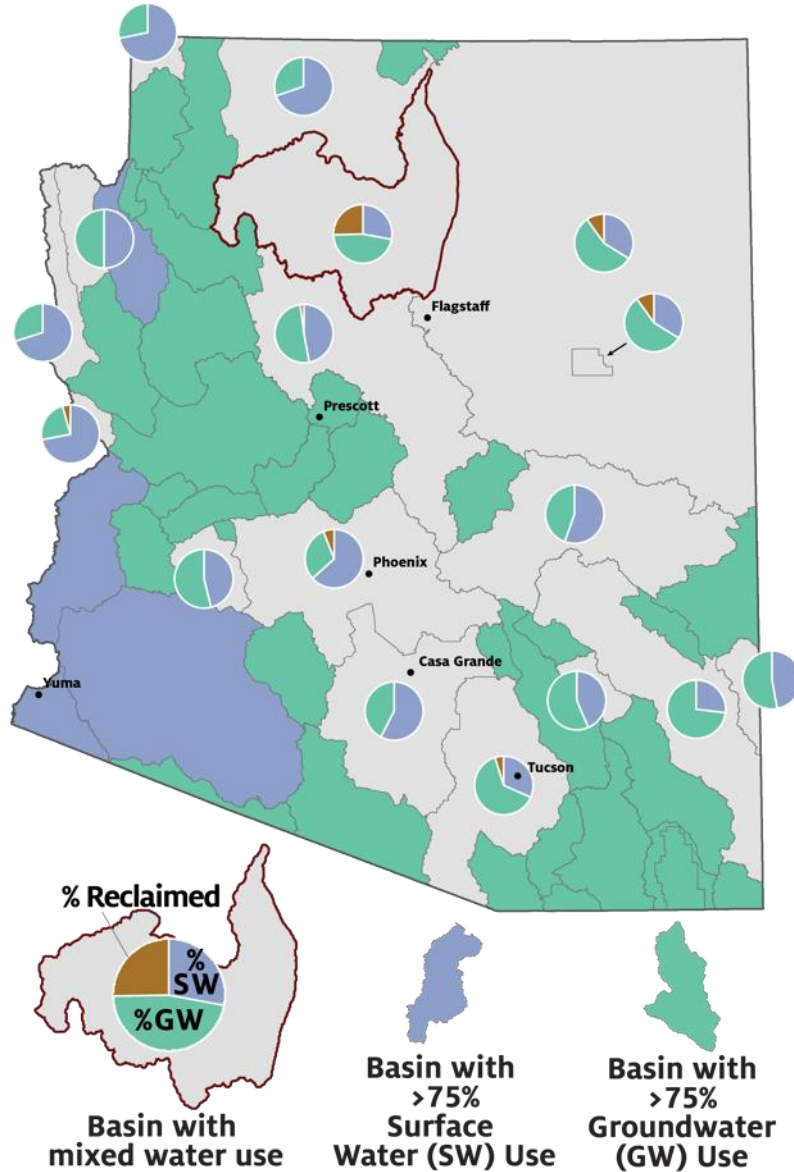
Most municipal water provision is by publicly operated water systems, though 15-18% of residents are supplied water by privately operated companies.

ARIZONA'S WATER USE BY SECTOR (2019)



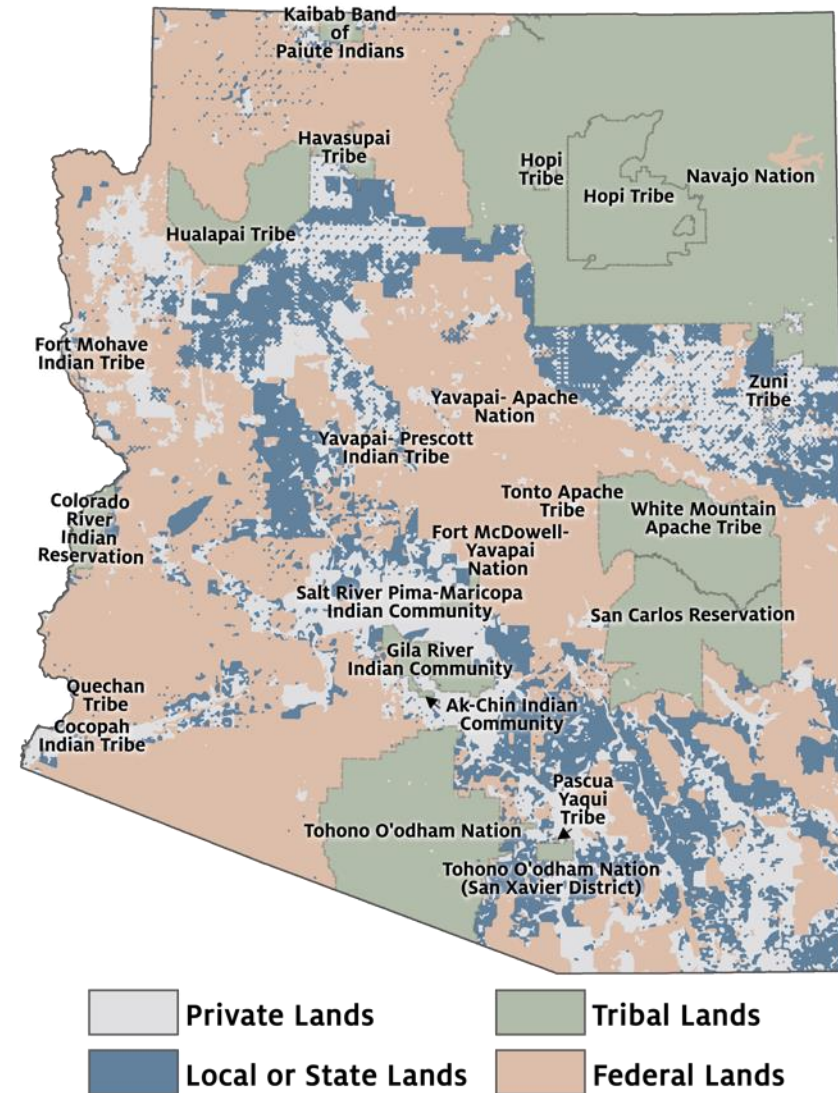
SOURCE: ADWR, 2020

WATER USE BY GROUNDWATER BASIN



Source: ADWR 2016

LAND OWNERSHIP



Source: ARLIS 2010

Wicked Water Problems Context

- Wicked Water Problems are big problems that do not have a simple pathway to resolving them.
- Some reasons
 - incomplete or contradictory knowledge
 - the number of people and opinions involved
 - the large economic burden
 - the interconnected nature of these problems with other problems [e.g., geopolitics, poverty]
- Collaboration and interdisciplinary work are necessary for addressing Wicked Water Problems.



Water supply-demand imbalances – The Colorado River Basin – An example of a wicked water problem

May 8, 2022
Guest Opinion
Arizona Republic

No exaggeration: Record lows at Lake Powell and Lake Mead call for drastic action

Lake Powell's elevation requires immediate protective actions. Everyone will be asked to conserve to delay or reduce further mandatory reductions.

OP ED Tom Buschatzke and Ted Cooke 6:00 a.m. MT May 8

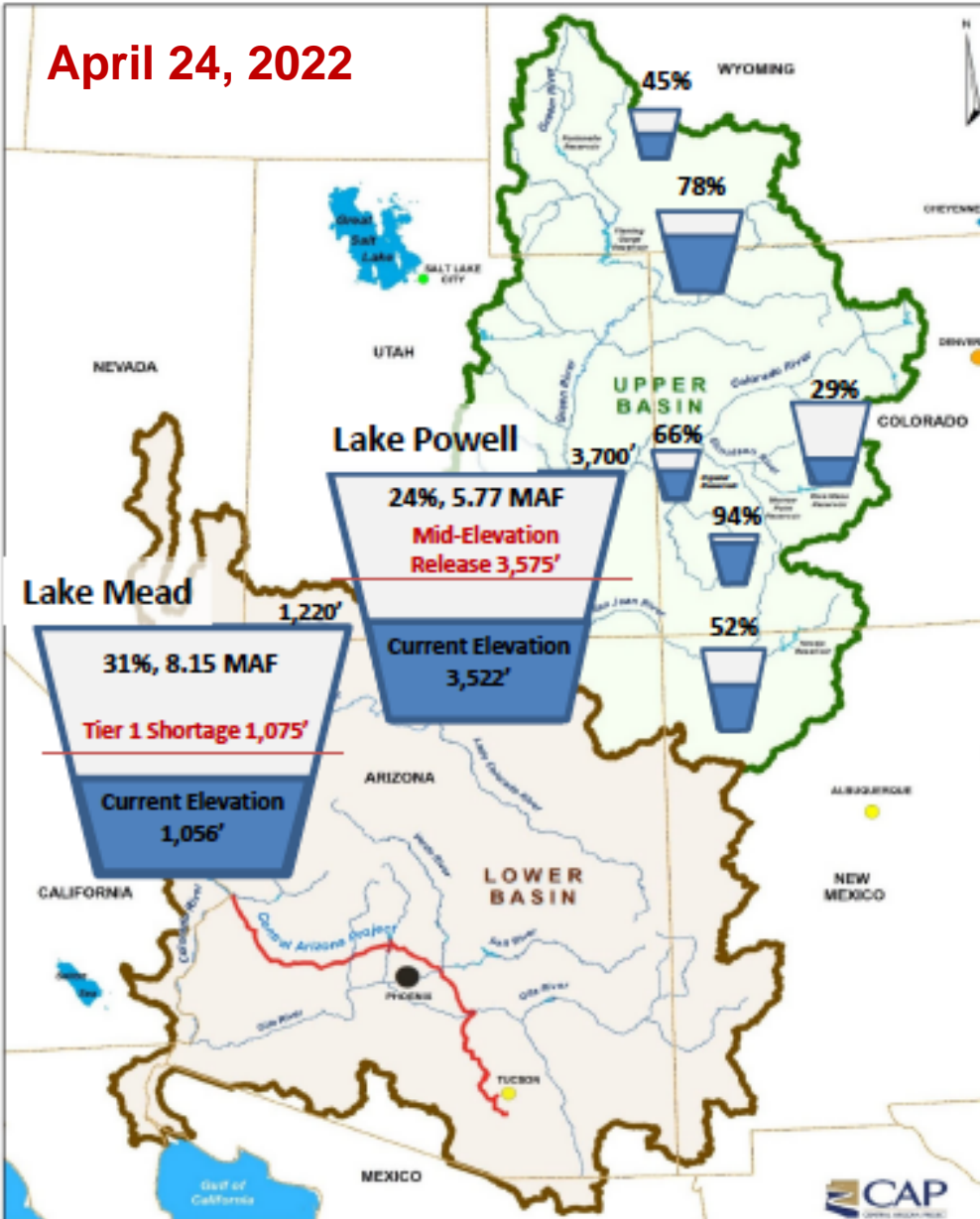


Elevations in Lake Mead over time.



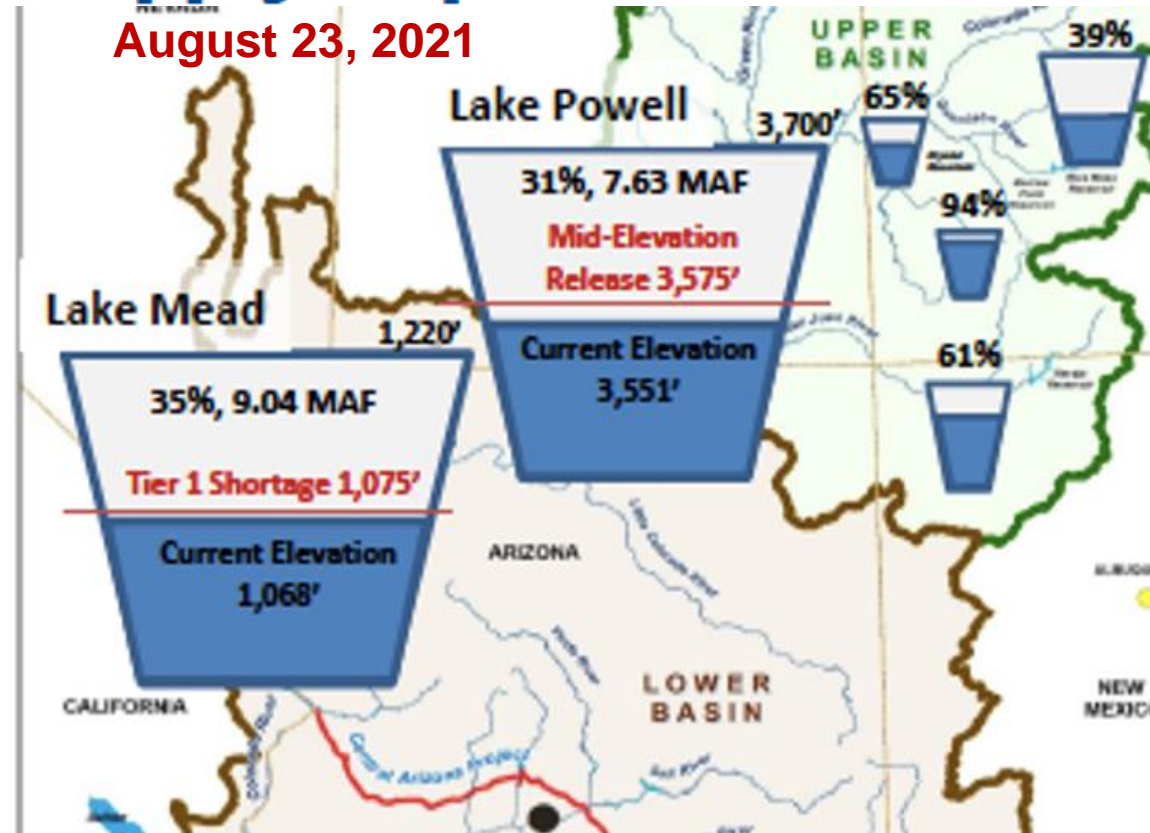
At Hoover Dam – May 2019

April 24, 2022



Colorado River Water Supply Report

August 23, 2021



With respect to previous month's report

Hot off the (digital) press!

RENEWABLE RESOURCES JOURNAL



VOLUME 37 NUMBER 3

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<https://rnrf.org/wp-content/uploads/2022/05/RRJV37N3.pdf>

Water Policy Options as Arizona Adapts to a Drier Colorado River: A Perspective

Sharon B. Megdal

The Colorado Basin Context

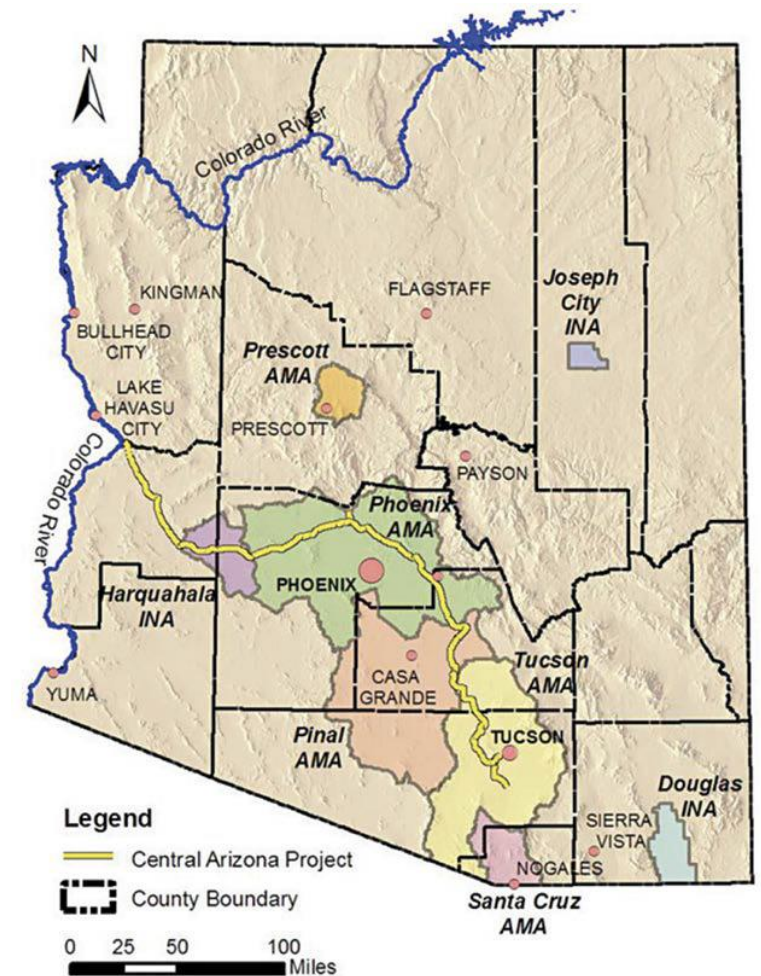
On August 16, 2021, the U.S. Bureau of Reclamation announced the first-ever Tier 1 Colorado River shortage. The water delivery cutbacks, which went into effect on January 1, 2022, per the “Colorado River Interim Guidelines for Low Basin Shortages and Coordinate Operations for Lake Powell and Lake Mead” (2007 Interim Guidelines), are most significant for the Central Arizona Project (CAP). Governed by the

is divided into an Upper Division and a Lower Division. Different formulas govern the distribution of water. Upper Basin water is distributed on a percentage basis but each of the Lower Basin states have a set amount of water that is expected to be delivered in non-shortage years. The 1944 Treaty for Utilization of Waters from the Colorado and Tijuana Rivers and of the Rio Grande between the United States and Mexico, which is implemented by the International

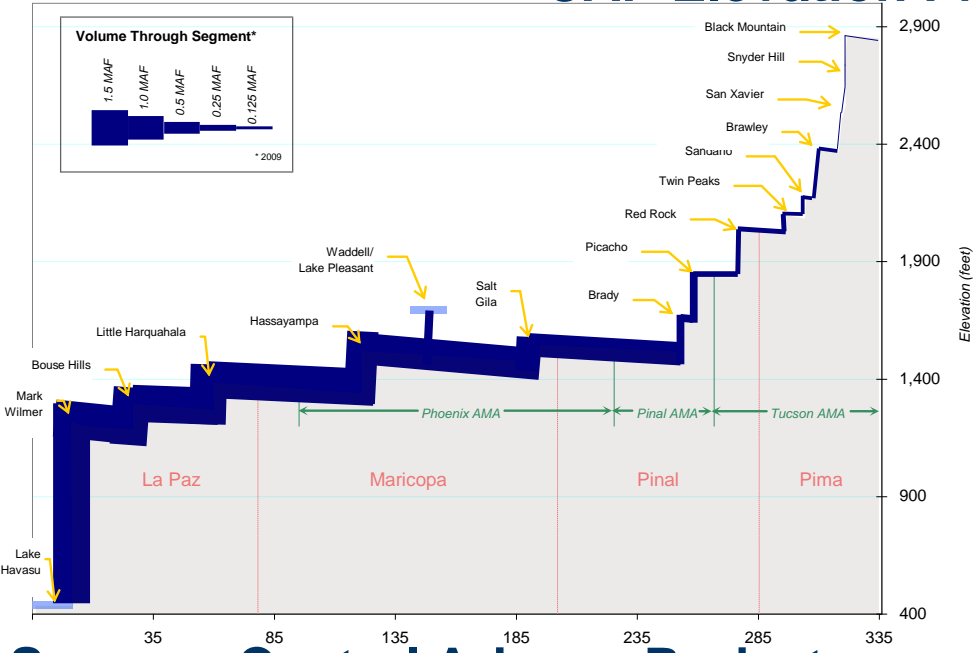
Arizona is highly impacted by cutbacks in deliveries of Colorado River Water

Review: 1980 Groundwater Management Act

- Created Active Management Areas (AMAs) with statutory management goals and Irrigation Non-Expansion Areas
- Quantified rights for existing groundwater users
- Some rights transferable
- Management Plans with Conservation Programs
- Restricted new groundwater uses but grandfathered in most uses.
- Footprint of agriculture could not expand.
- Placed burden of using renewable supplies on new residential uses through requiring an assured water supply program (AWS)
- Its adoption was connected funding for the Central Arizona Project (CAP)
- <https://www.youtube.com/watch?v=sNJbqCE9sXU>
Groundwater: To enact a law for the common good (27 minutes)
- Later legislation authorized recharge and recovery program



CAP Elevation Profile



Source: Central Arizona Project

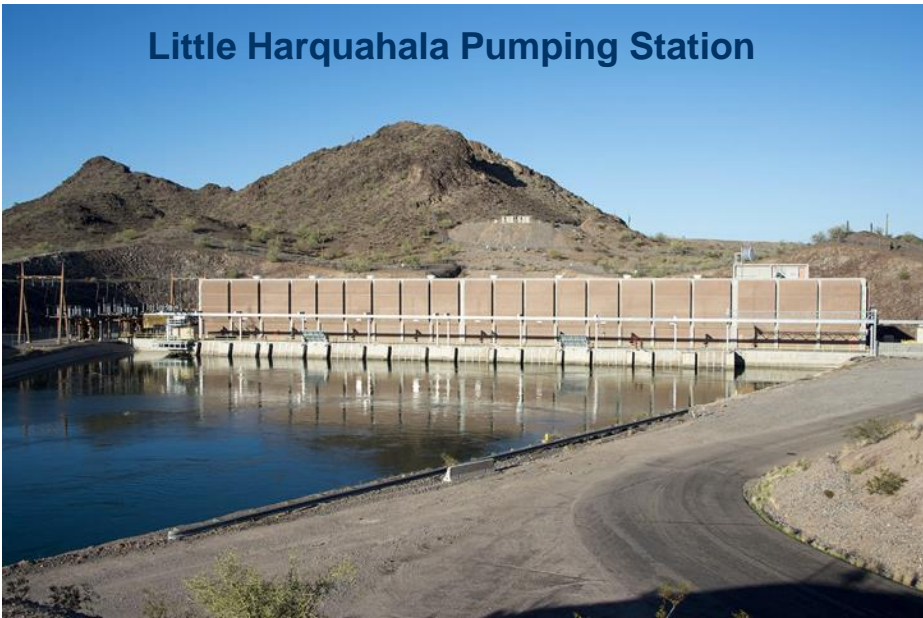


Central Arizona Project



Central Arizona Project canal is 336 miles long, pumps water to 2800 ft, and was designed to deliver ~1.5 MAF annually. CAP is the largest consumer of electricity in Arizona.

Little Harquahala Pumping Station



REFLECTIONS



WRRC Director Sharon B. Megdal published nine *Reflections* essays in the Weekly/Summer Wave.

wrrc.arizona.edu/reflections

<https://wrrc.arizona.edu/director>

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<https://wrrc.arizona.edu/public-policy-review>

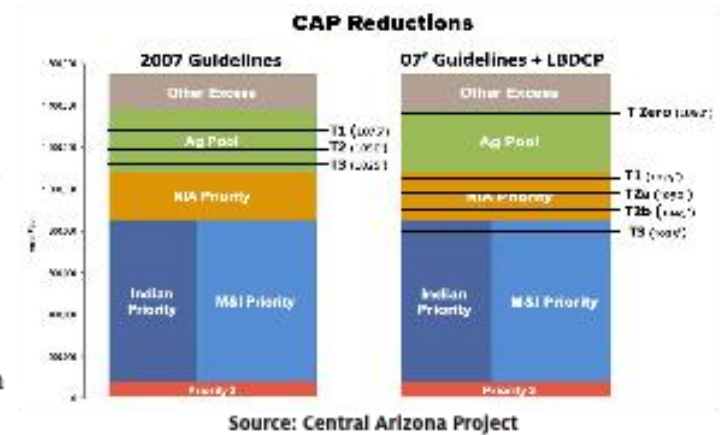
Reflections: Adapting to a Drier Future

by Sharon B. Megdal
08/20/2021



Photo: Sharon B. Megdal, Hoover Dam.

On August 16, 2021, the United States Bureau of Reclamation announced a Tier 1 Shortage to go into effect on January 1, 2022. This declaration of cutbacks in water deliveries was in accordance with established Colorado River operating criteria. Local, national, and international media have been covering the poor health of the Colorado River system for some time, with the shortage declaration bringing media interest to a crescendo. Like many, I've spoken with reporters, who ask about who will be most impacted by the cutbacks in water deliveries. The answer to this question is Central Arizona irrigators who have been utilizing "Ag Pool" water. Central Arizona Project (CAP) has lower priority than many other suppliers and users of Colorado River water, and Ag Pool deliveries are lowest priority within the CAP. Tier 1 curtailments do not affect Municipal & Industrial (M&I) Priority or Indian Priority water. For the most part, Non-Indian Agricultural (NIA) Priority water deliveries are not impacted until a declaration of a Tier 2 Shortage. As the block graphic shows, were we to experience a Tier 3 Shortage, all NIA water deliveries would be eliminated and even some M&I and Indian Priority deliveries would be reduced. While it is true that water stored by the Arizona Water Banking Authority can be drawn upon to offset some cutbacks to high priority users within the CAP system, reduced water availability is always a concern, especially when the duration and severity of the poor Colorado River conditions are unknown. It is this uncertainty that makes planning particularly difficult. Whereas the sophisticated modeling of the Colorado River system supports projections of future river conditions, we just do not know when there might be a wet cycle – or if, as most expect, runoff conditions will continue to worsen. No one has that crystal ball for precisely predicting the future.



Recharge

- The process of adding water to an aquifer
 - Natural Recharge results from natural process such as precipitation and streamflow
 - Incidental recharge is water entering the aquifer after various human uses, such as irrigation uses or leaks in water lines
 - Artificial recharge facilities or projects that are developed for the purpose of adding water to an aquifer
 - Artificial recharge used over the years to:
 - Manage groundwater supply
 - Assure full use of Colorado River water allocation
 - Protect against shortages during drought
 - Enable affordable use of Central Arizona Project water
 - Important for the Central Arizona Groundwater Replenishment District (CAGRD)



CAGRD and the Assured Water Supply Rules

- Central Arizona Groundwater Replenishment District (CAGRD) established in 1993
- Assured Water Supply (AWS) Rules approved in 1995
- CAGRD responsibilities were assigned to the Central Arizona Water Conservation District, which operates the Central Arizona Project
- CAGRD has responsibility for replenishing "excess groundwater" for its members
- Two kinds of members
 - Member service areas
 - Member lands
- Meeting replenishment obligation may involve the purchase of long-term storage credits (LTSCs) from others
- Artificial recharge activities are regulated by the Arizona Department of Water Resources



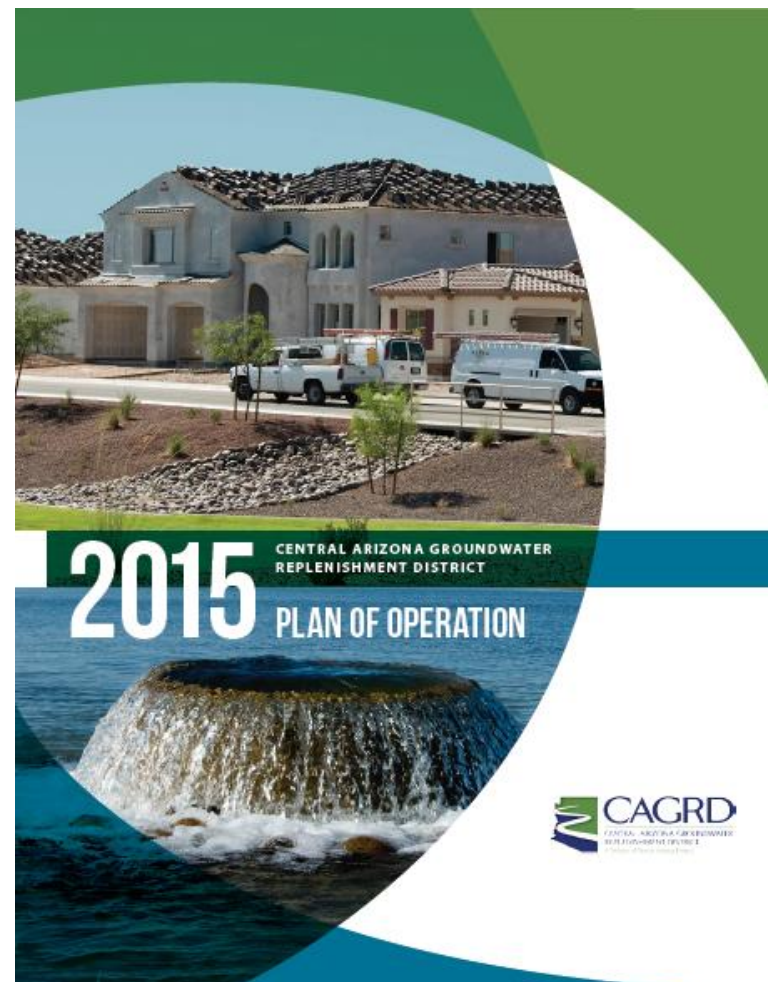
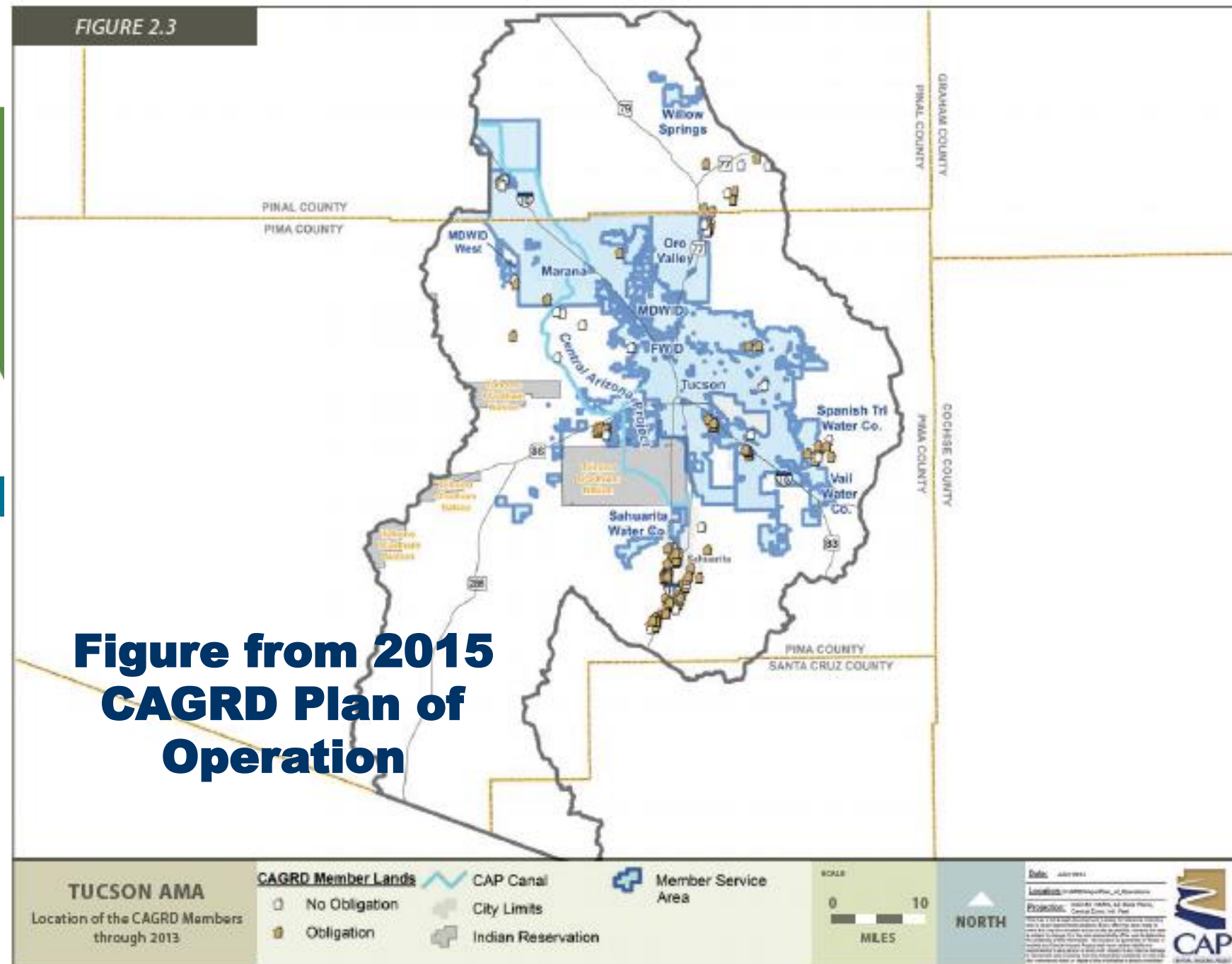
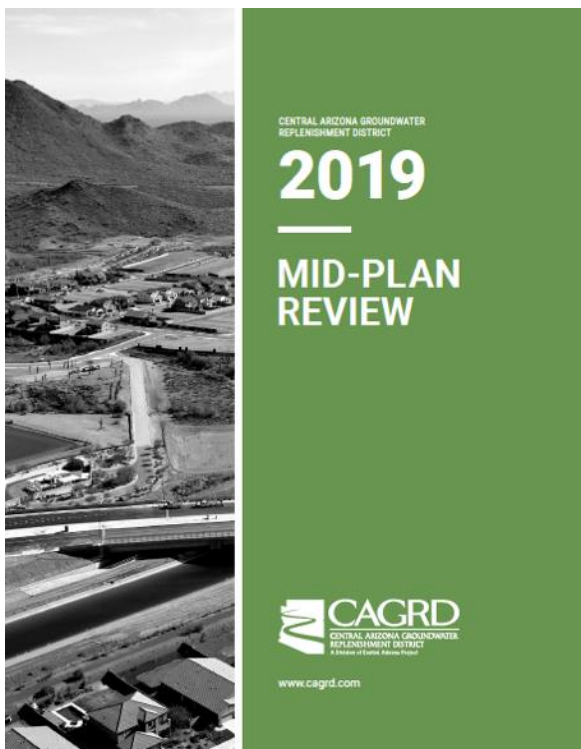


FIGURE 2.3

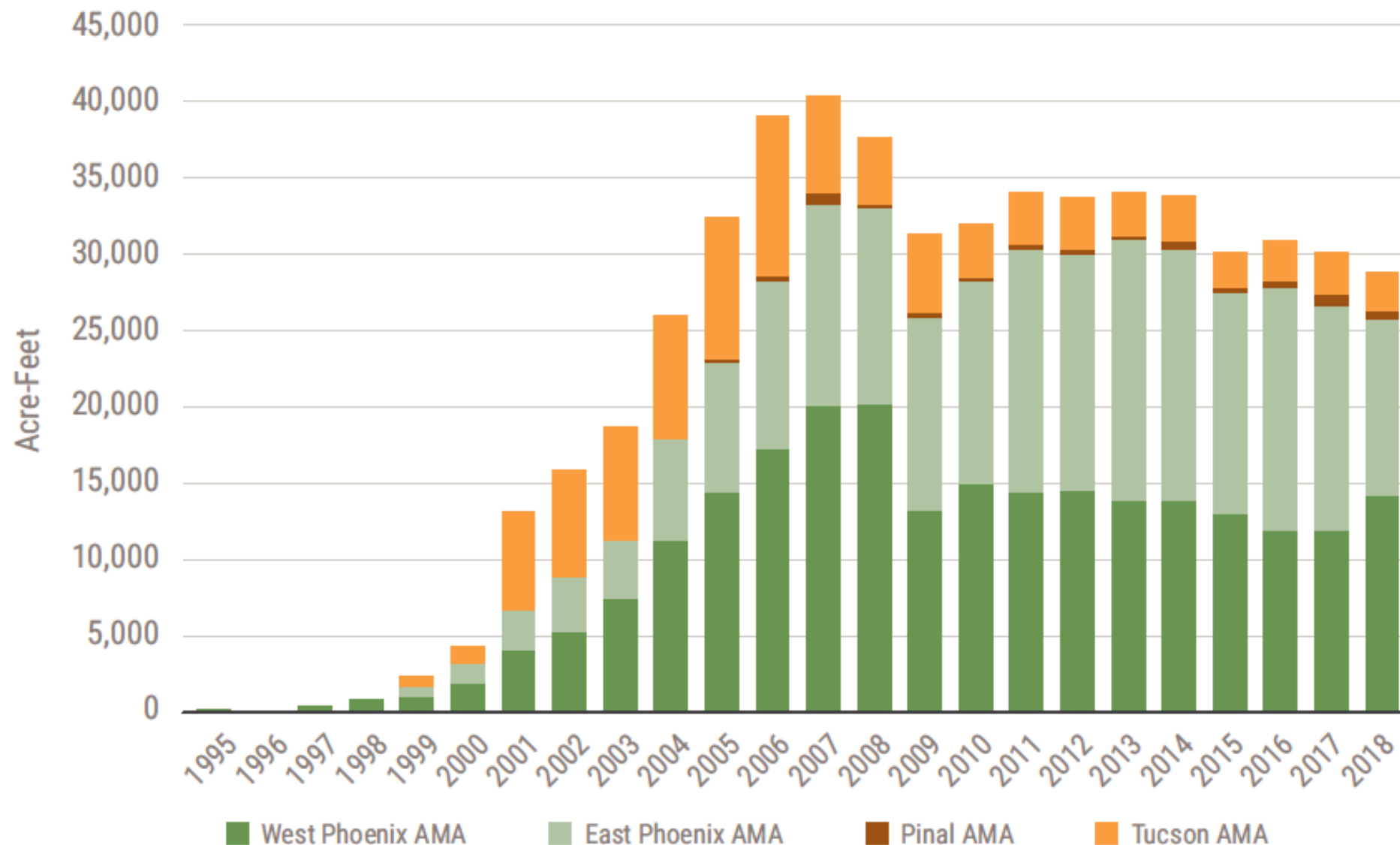




The 2015 Plan of Operation and the 2019 Mid-Plan Review are available at CAGRD.com

ANNUAL REPLENISHMENT OBLIGATION BY AMA

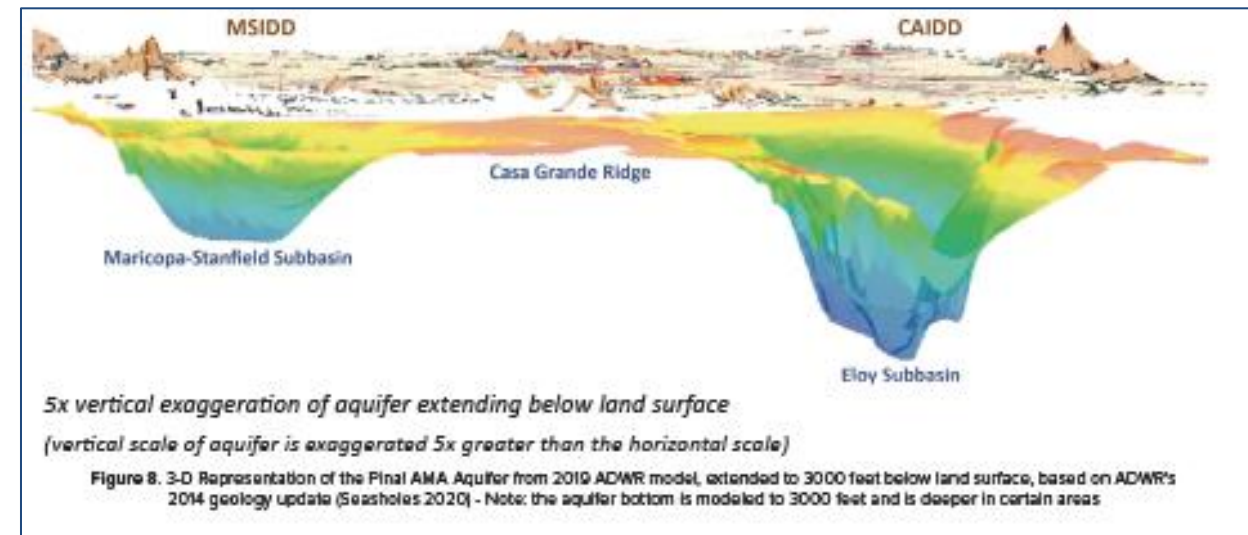
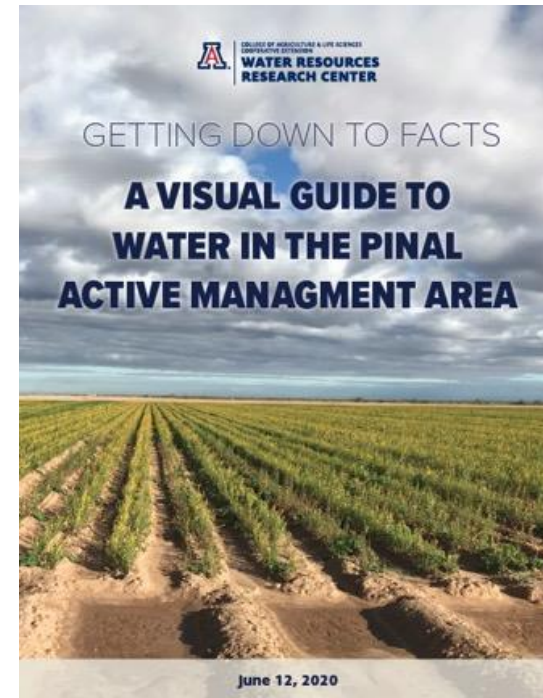
FIGURE 2.2.1



From CAGRD's 2019 Mid-Plan Review

Many outstanding issues

- Some AMA issues
 - Meeting Statutory Management Goals
 - Exempt wells
 - Disconnect between pumping and recharge
 - Assured Water Supply program
 - Central Arizona Groundwater Replenishment District
- Outside AMAs
 - What types of regulations?
 - Metering
 - Groundwater regulations
 - Conservation programs
 - Water transfers



Searching for Pathways to Solutions

- Developing information collaboratively
- Developing partnerships
 - Within states and regions
 - Interstate
 - International
 - Tribal Nations
- Considering and implementing options
 - Desalination
 - Reuse
 - Conservation
 - Water banking
 - Voluntary transactions, marketing
 - Rainwater harvesting; grey water systems
 - New ways of designing the built environment

Process is important

- Functioning cooperative mechanism(s)
- Trust and mutual respect
- Involvement of key stakeholders
- Good communication
- Persistence
- Patience
- Sharing experiences and lessons learned
- Eating with your partners



Key to charting our pathways forward...

- An informed public!
- Everyone is a water stakeholder.
- Everyone is a decision-maker influencer.
- To connect with WRRRC programming: <https://wrrc.arizona.edu/subscribe>
- smegdal@arizona.edu

Merci!
Thank you!!

The poster features a square graphic with a stylized landscape: a blue sky with a yellow sun, white clouds, and green hills with small green plants. The text "WRRC 2022 ANNUAL CONFERENCE" is at the top of the graphic.

Arizona's Agricultural Outlook: Water, Climate, and Sustainability

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