Groundwater Management in Arizona

Vivek Bedekar

S.S. Papadopulos & Associates, Inc.
Environmental and Water-Resource Consultants

CWEMF

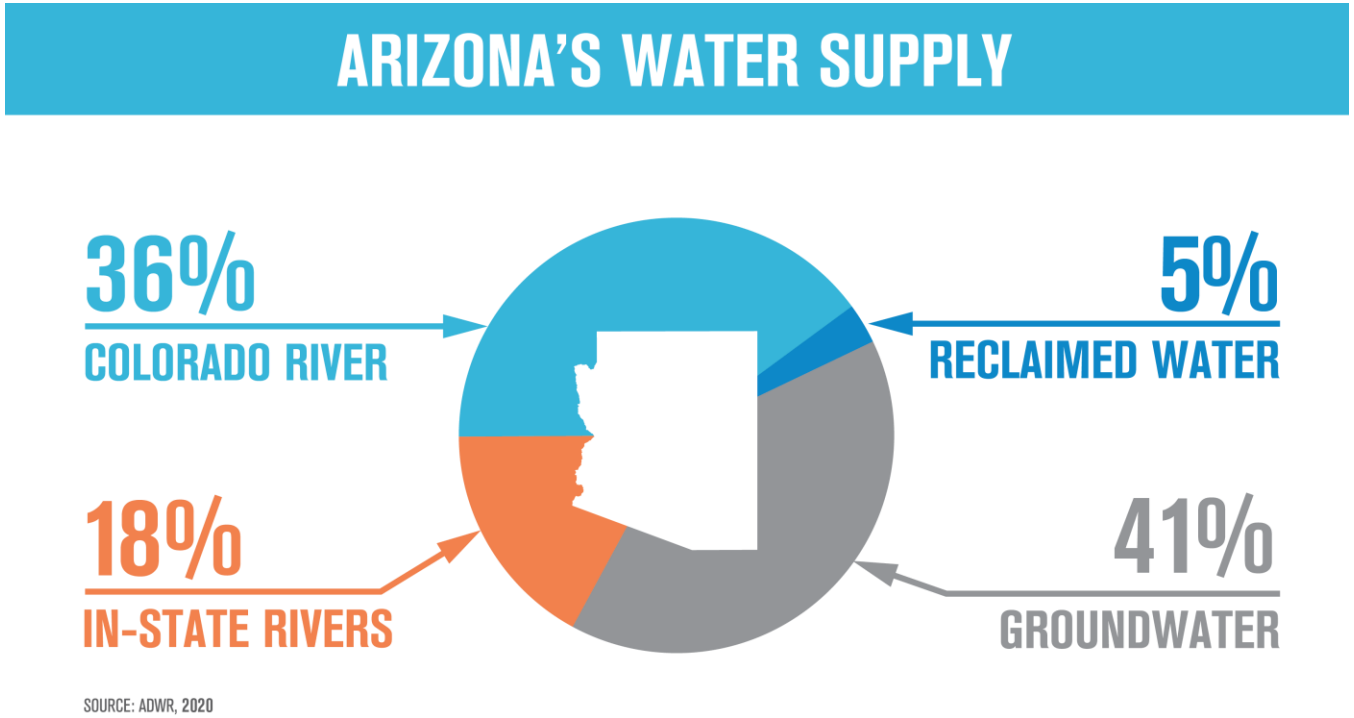
Folsom, CA

April 19, 2023

Outline

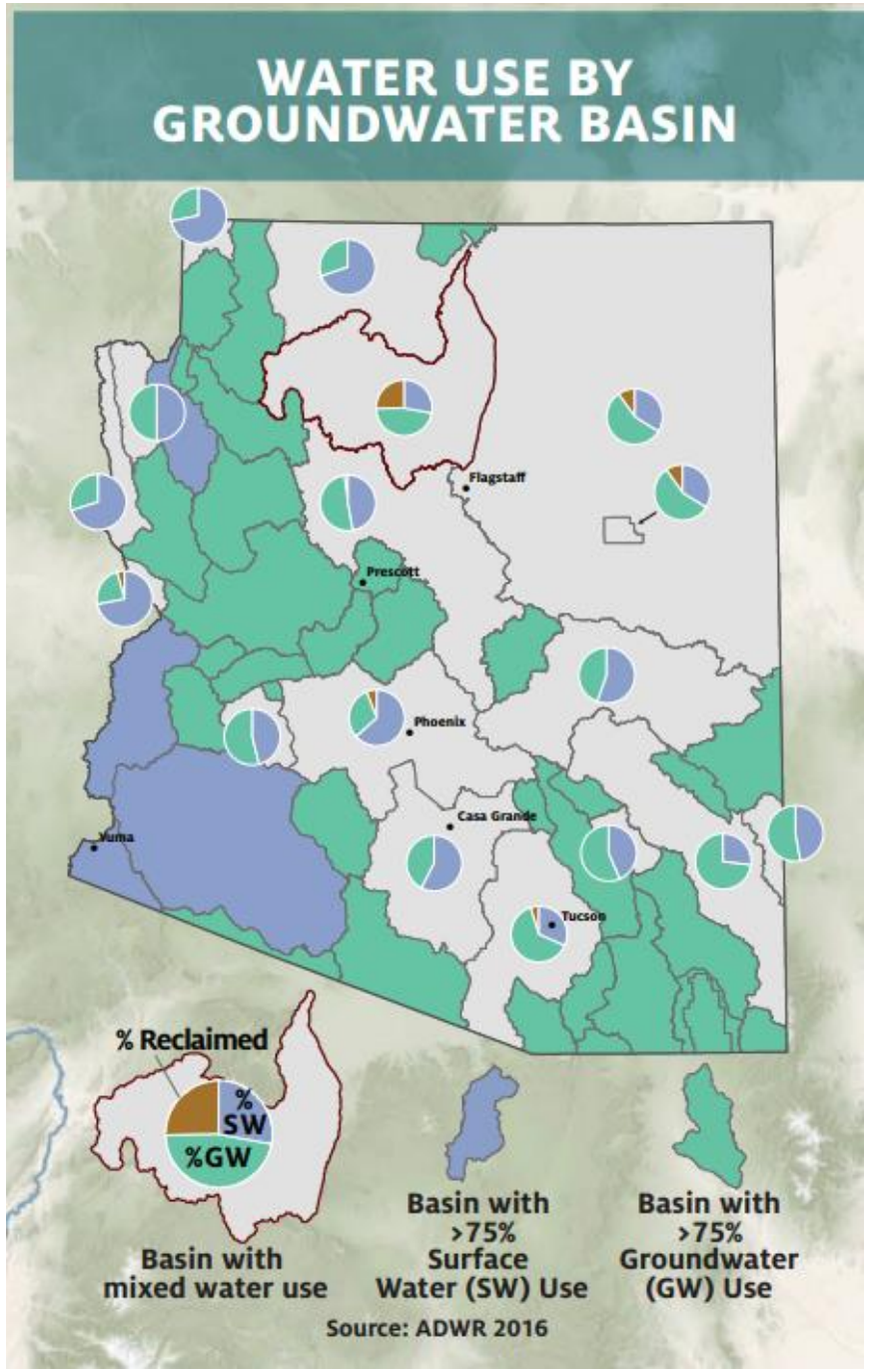
- Water in Arizona
- History
- Groundwater management
- Comparisons with California

Water in Arizona



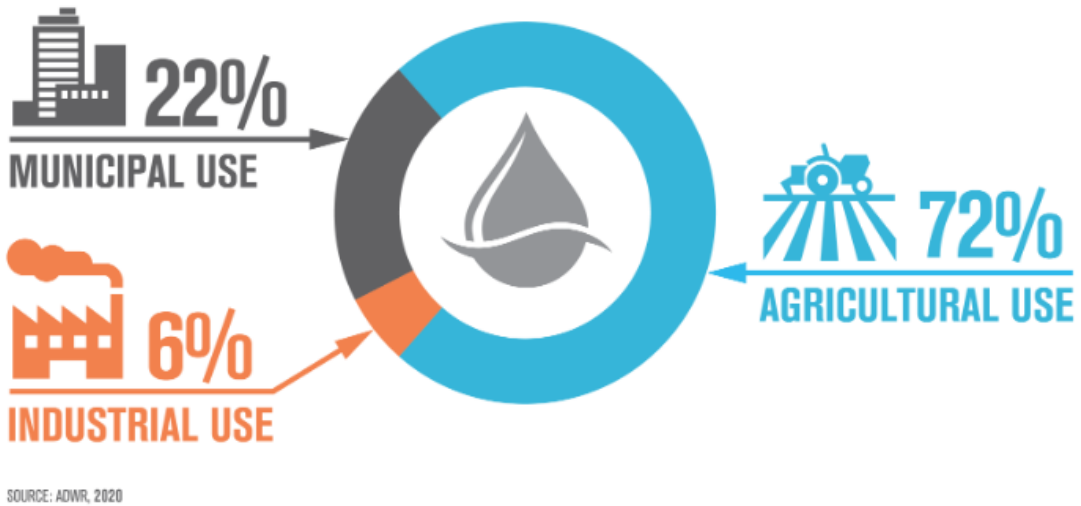
Source: https://www.arizonawaterfacts.com/ [ADWR 2020]

Water Use in Arizona



https://wrrc.arizona.edu/sites/wrrc.cals.arizona.edu/files/2022-03/Water-Map-Poster-2017.pdf

ARIZONA'S WATER USE BY SECTOR (2019)



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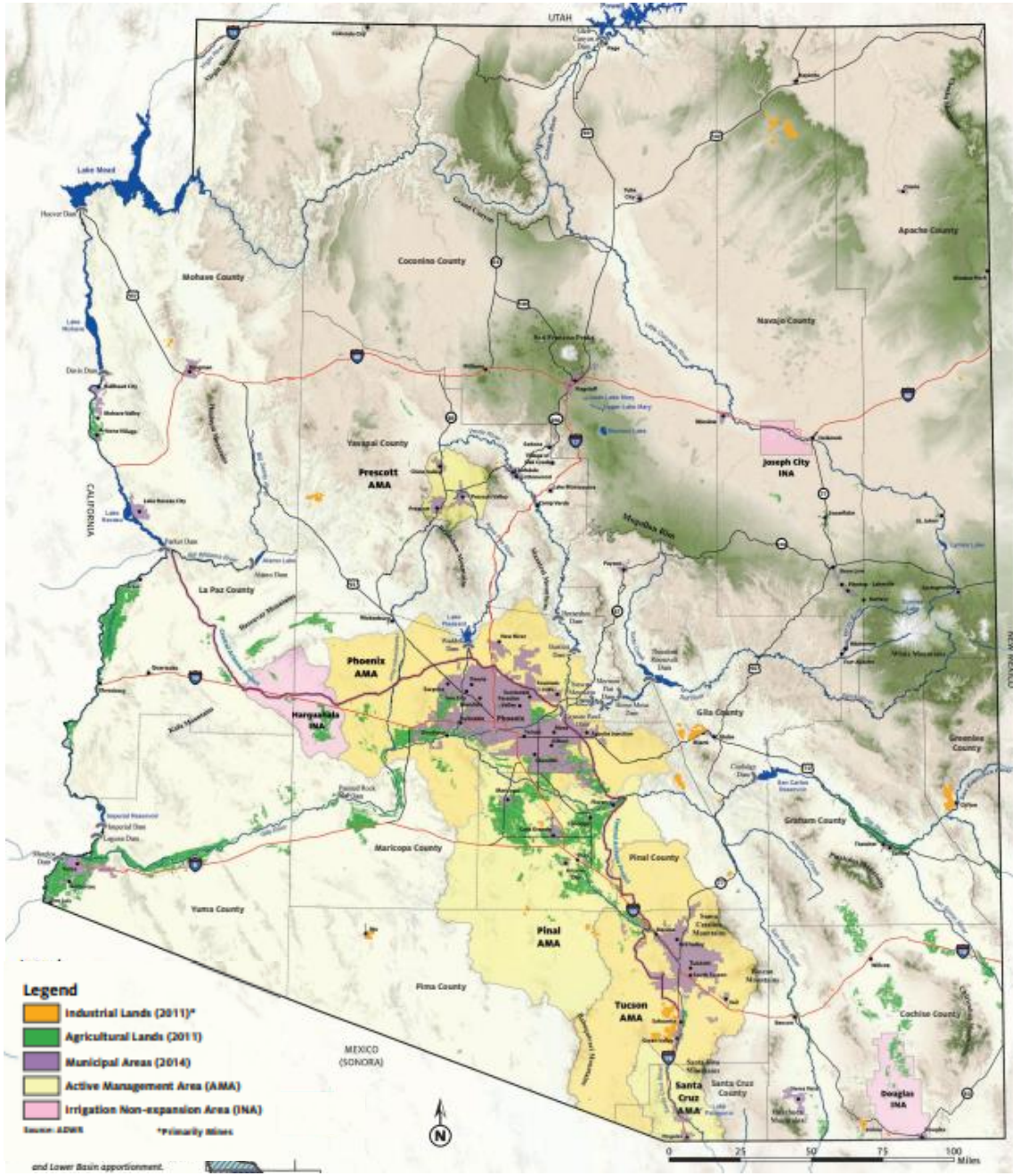

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Volcanic Rocks in Arizona

- Permeable rock
- Gravel, sand, silt

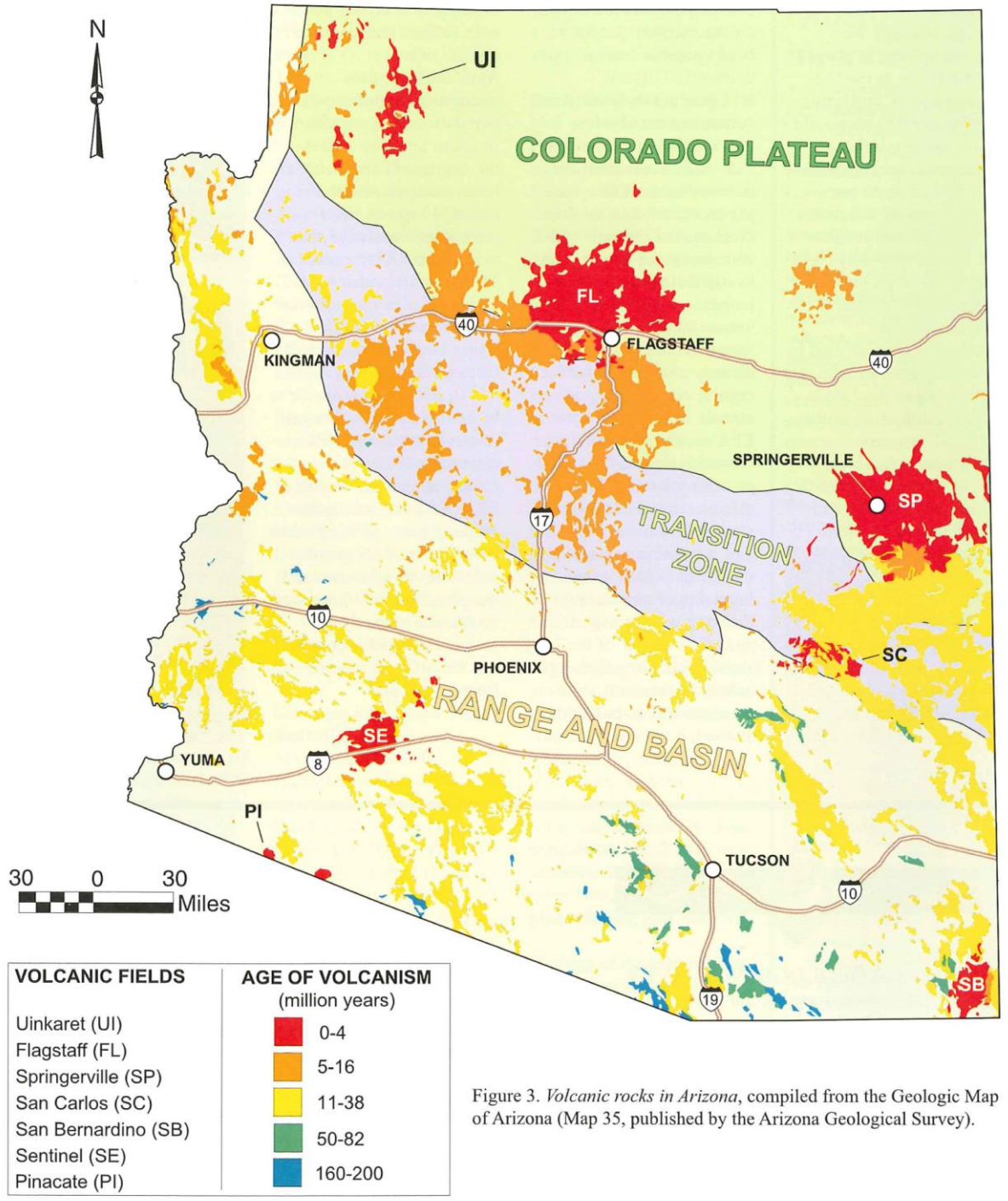
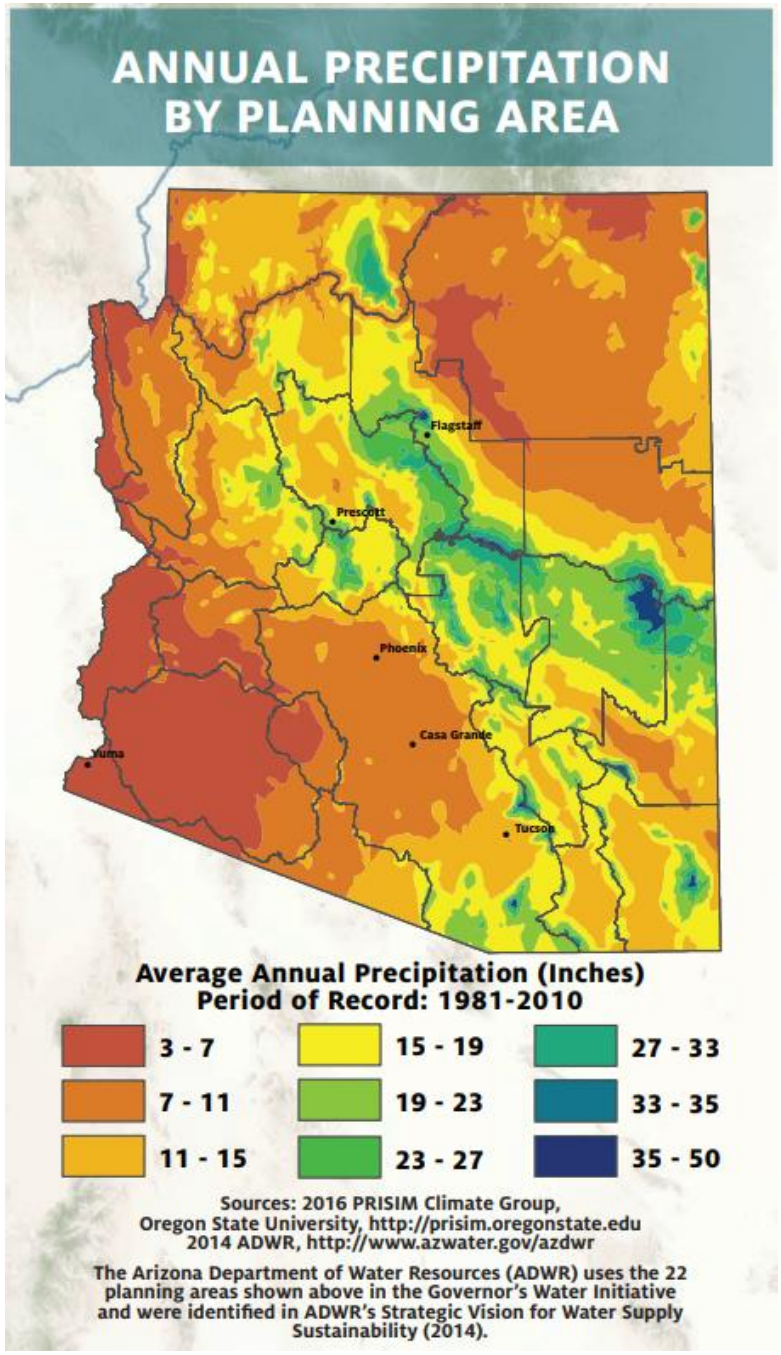


Figure 3. *Volcanic rocks in Arizona*, compiled from the Geologic Map of Arizona (Map 35, published by the Arizona Geological Survey).

Annual Precipitation



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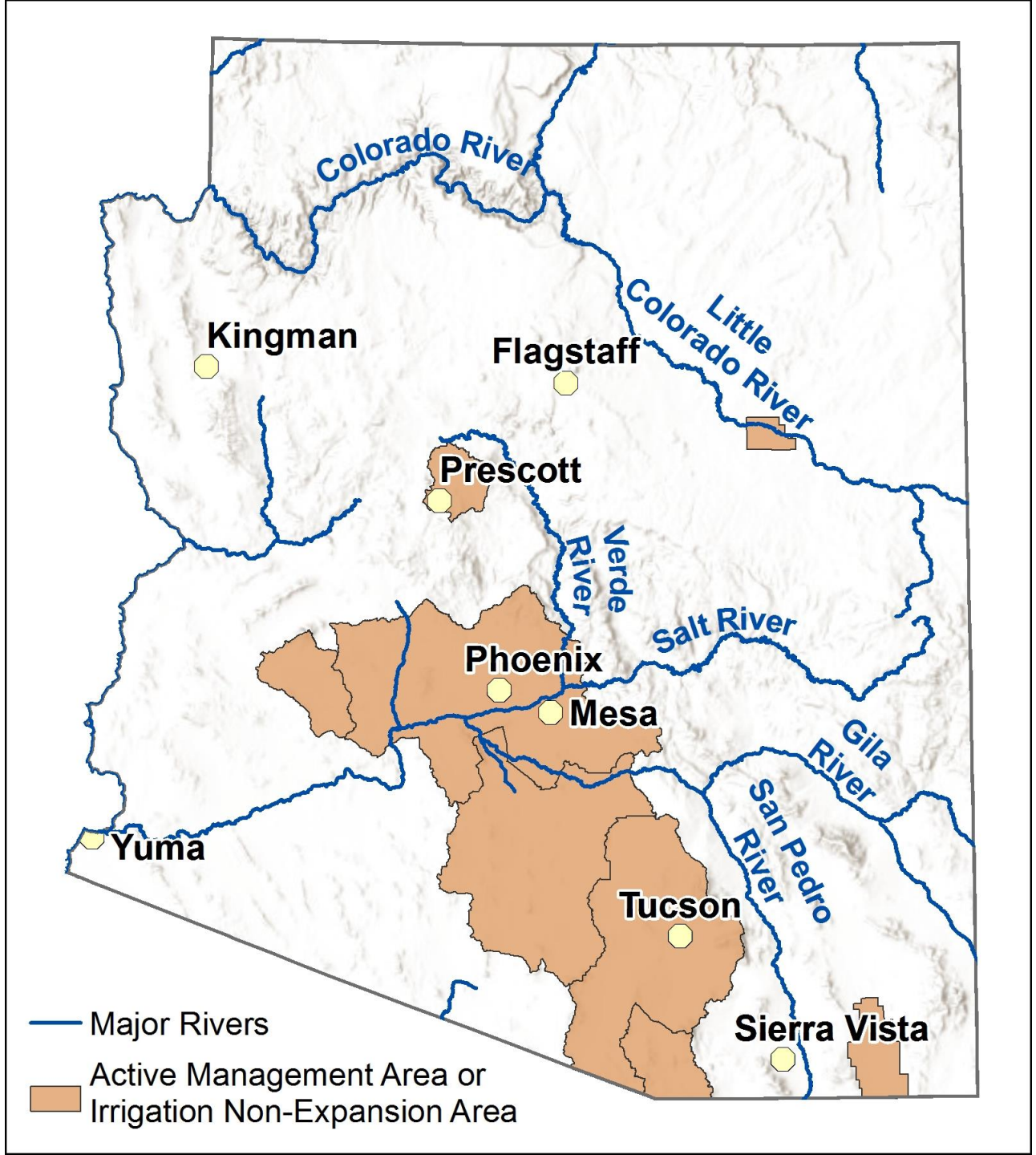
Major Rivers in Arizona

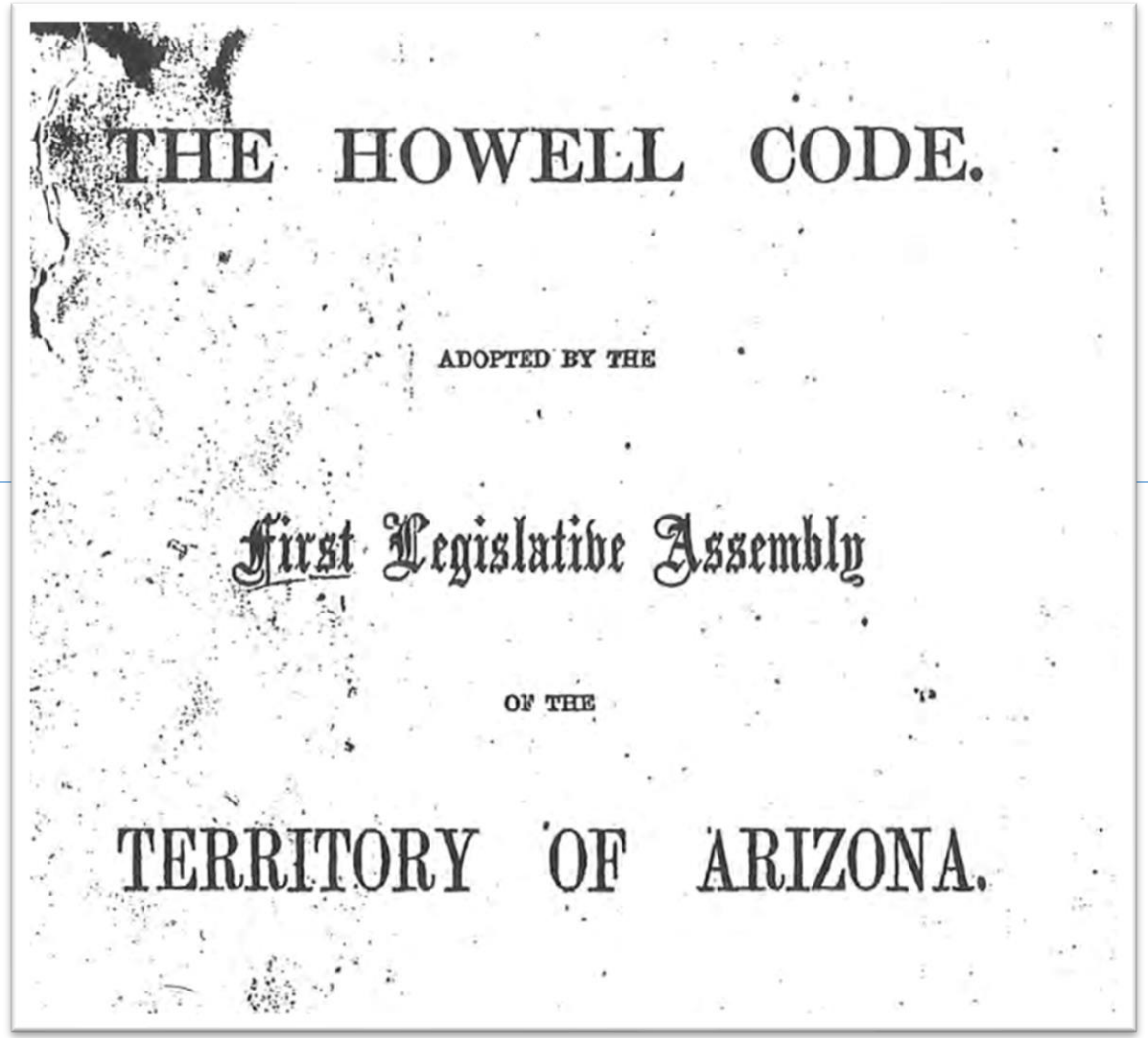


History

History

Howell Code

1864



THE HOWELL CODE.

ADOPTED BY THE

First Legislative Assembly

OF THE

TERRITORY OF ARIZONA.

History

Howell Code

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State Water Code; Office of State Water Commissioner established

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(AZ refused to ratify the compact until 1944)

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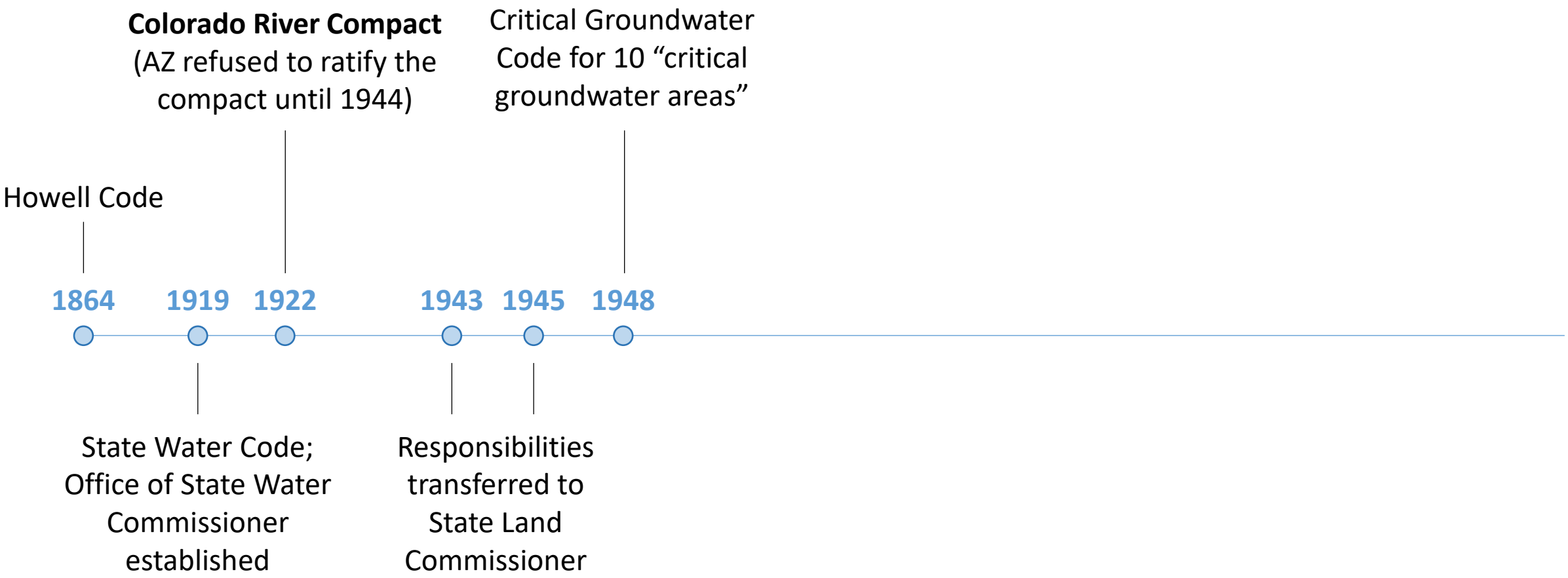
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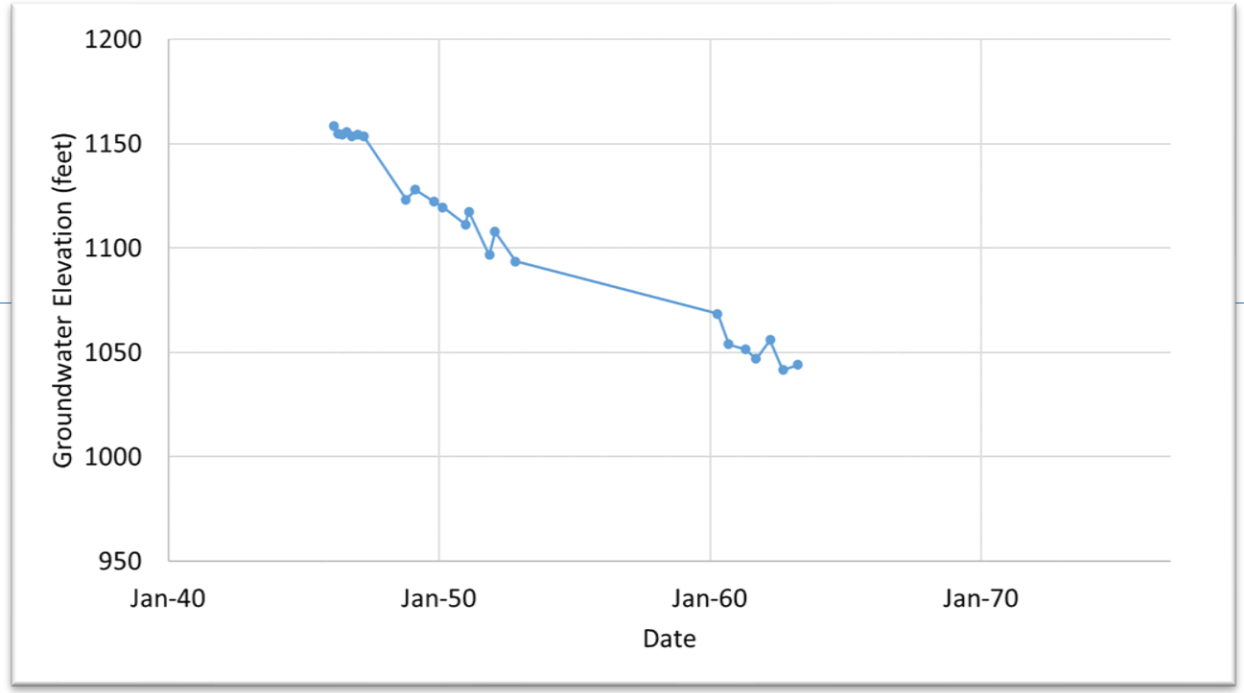

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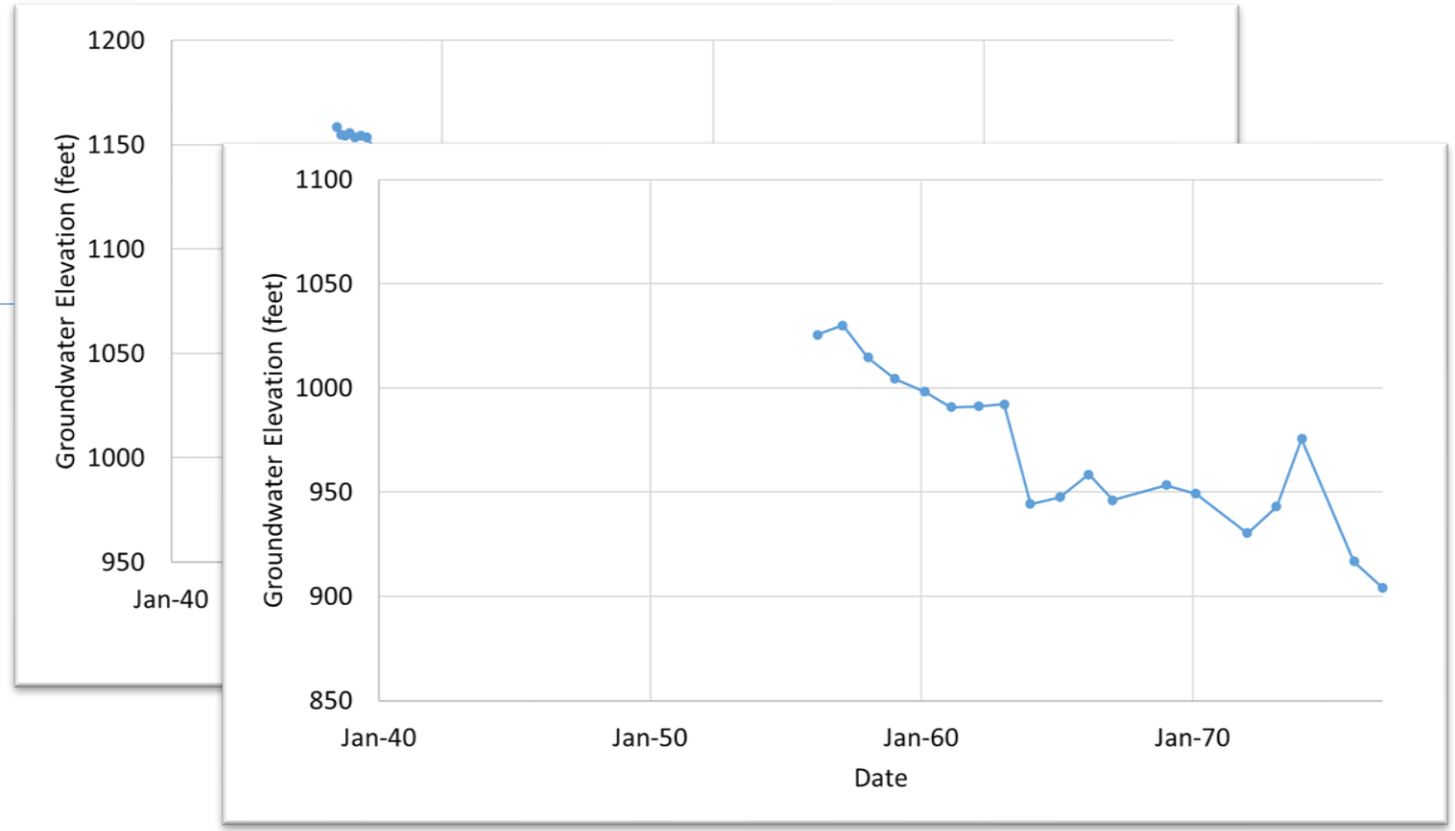

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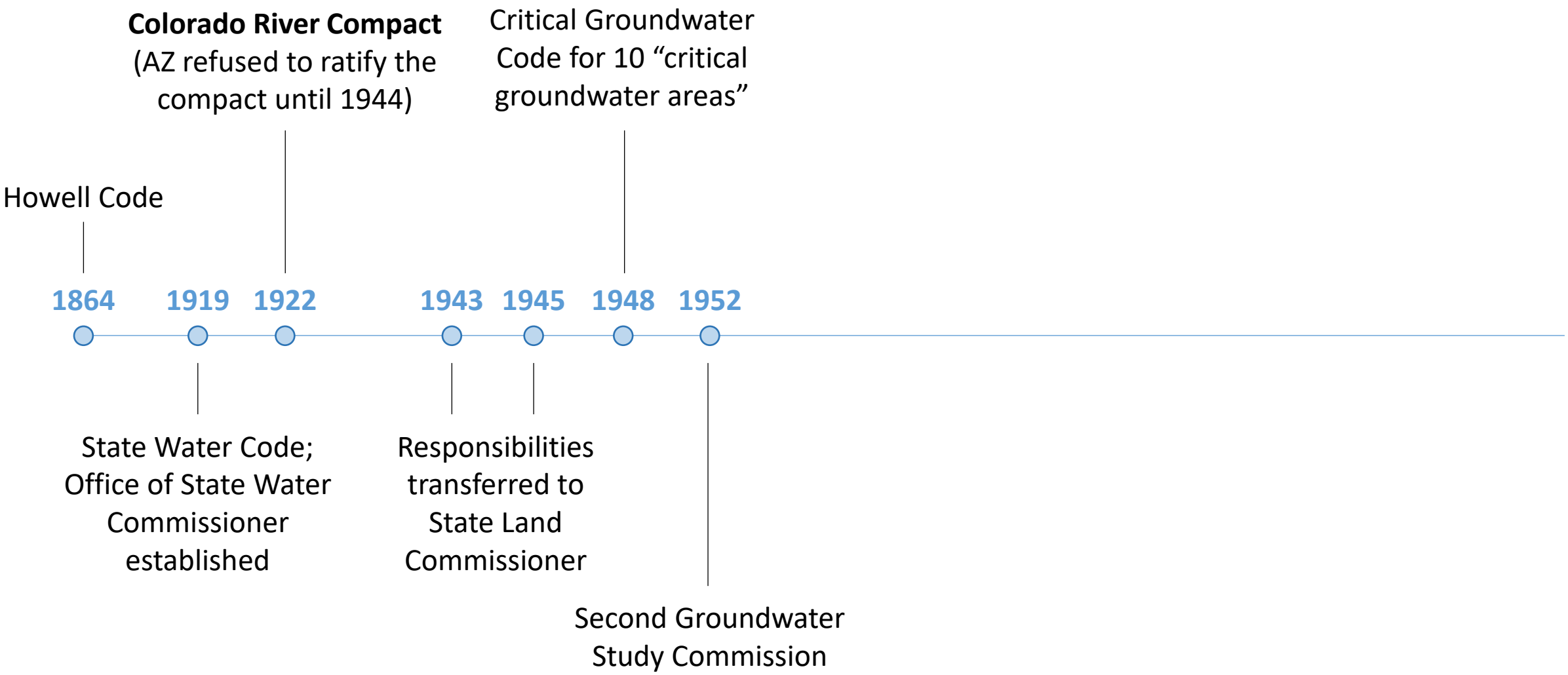
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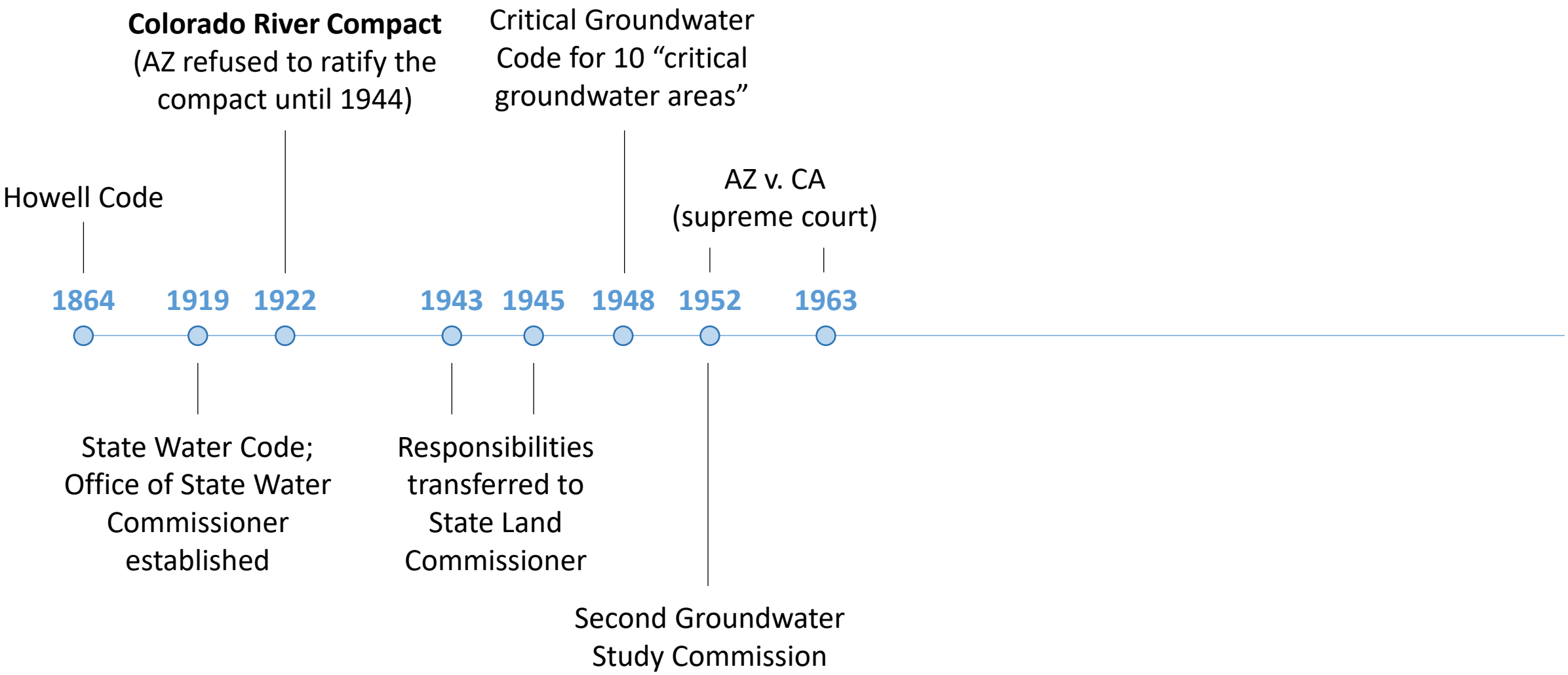
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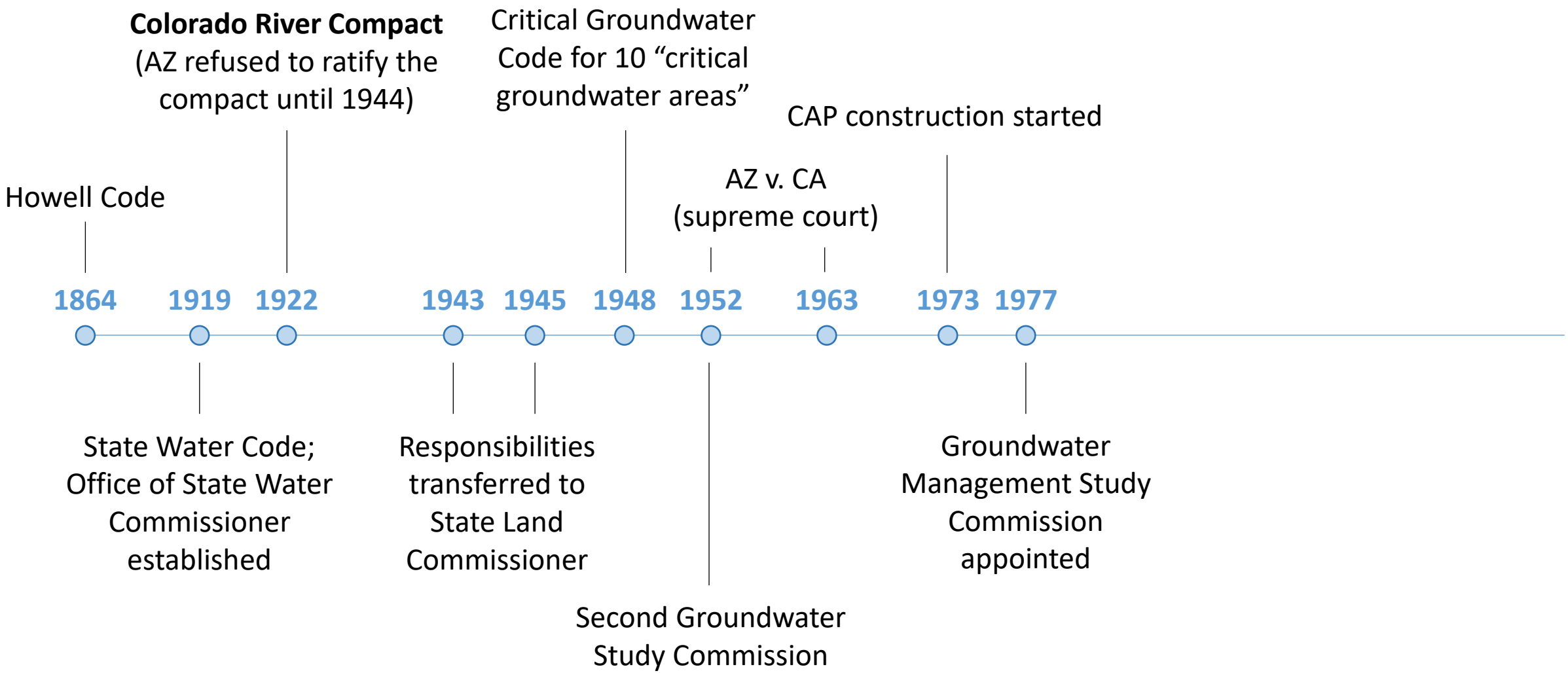
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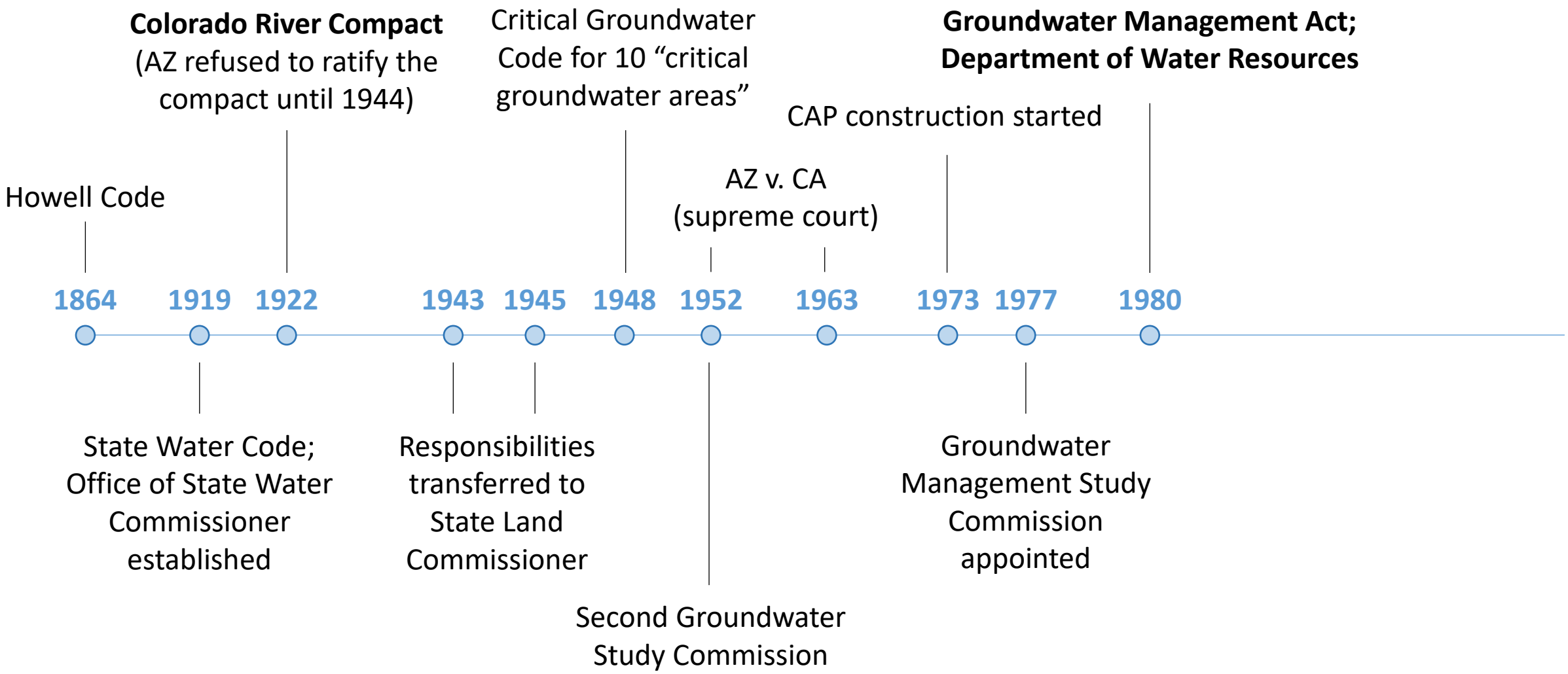
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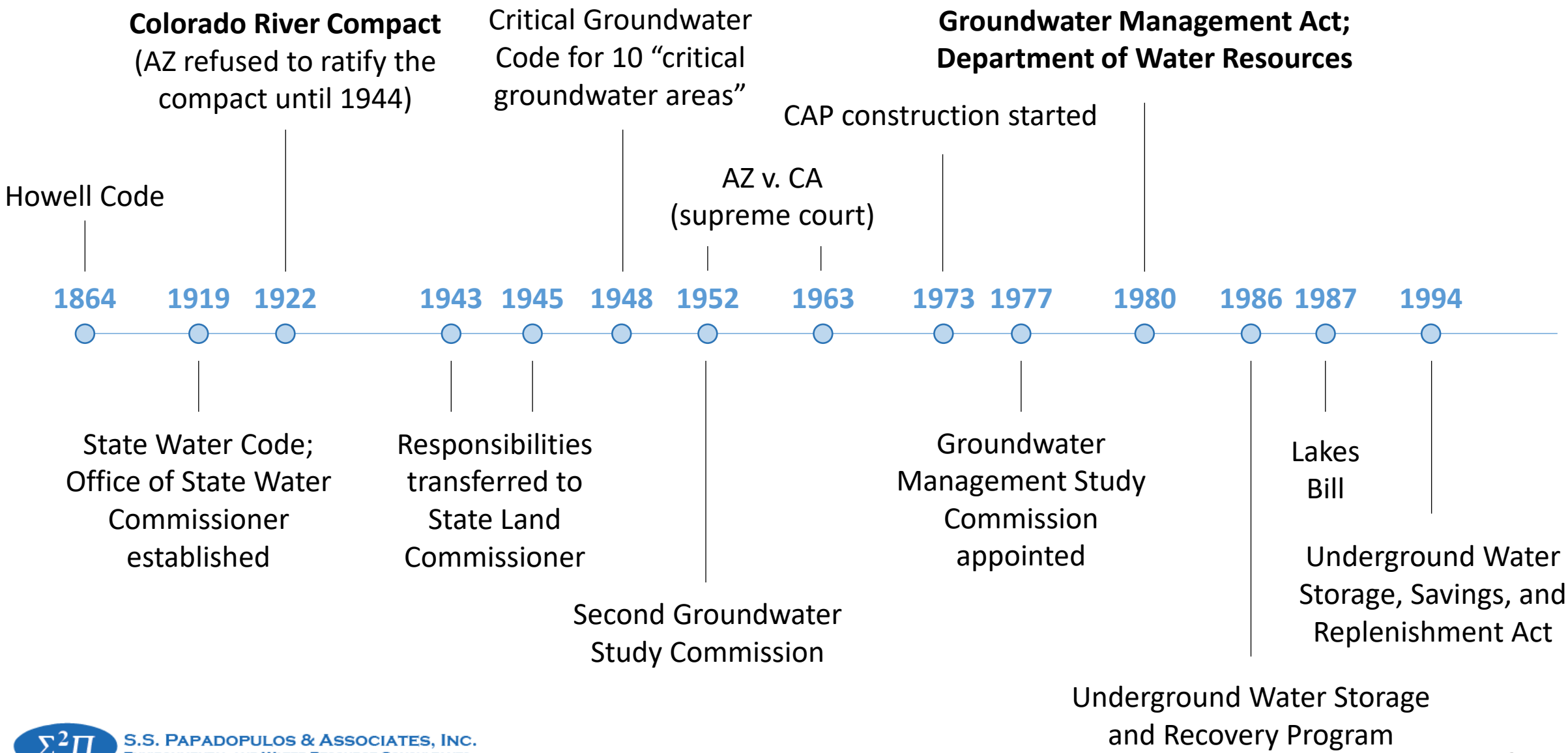
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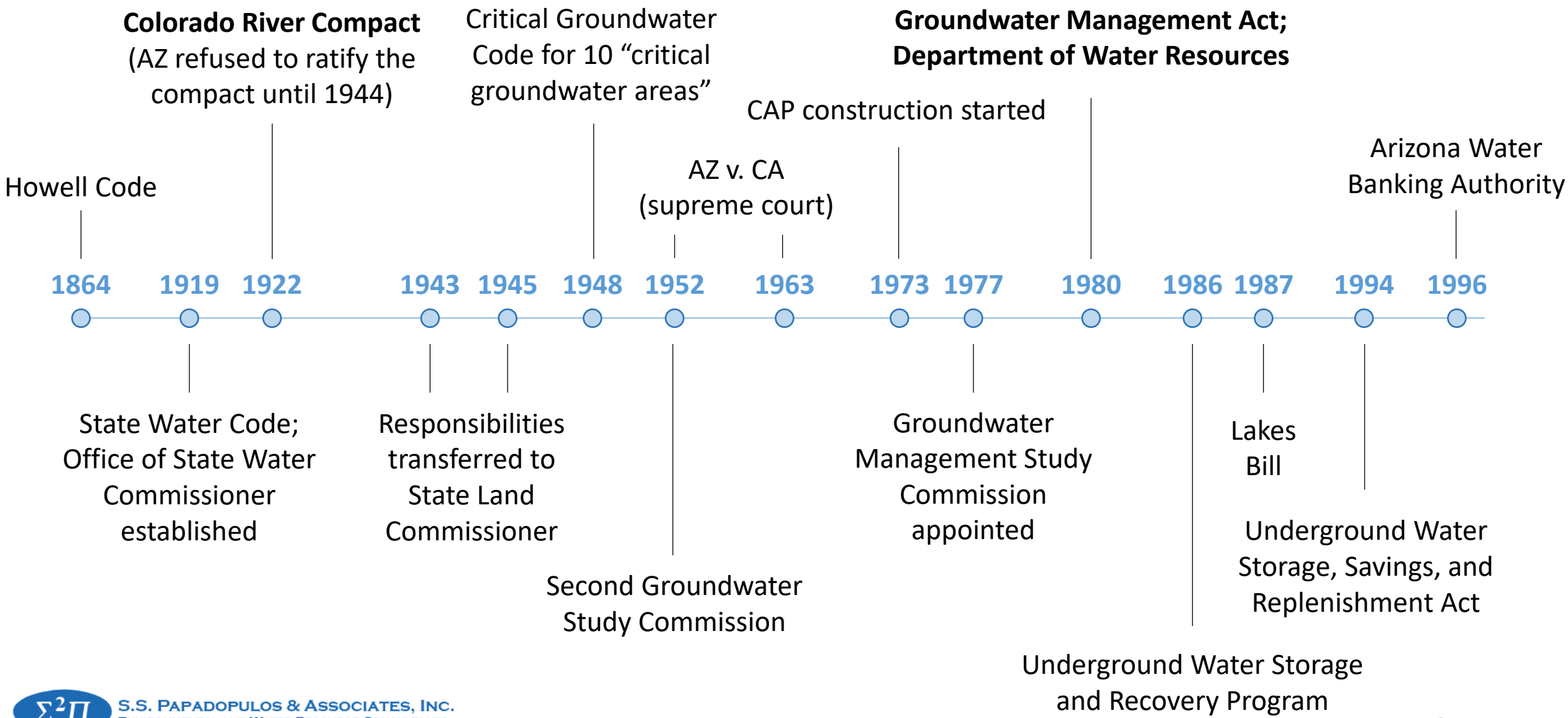
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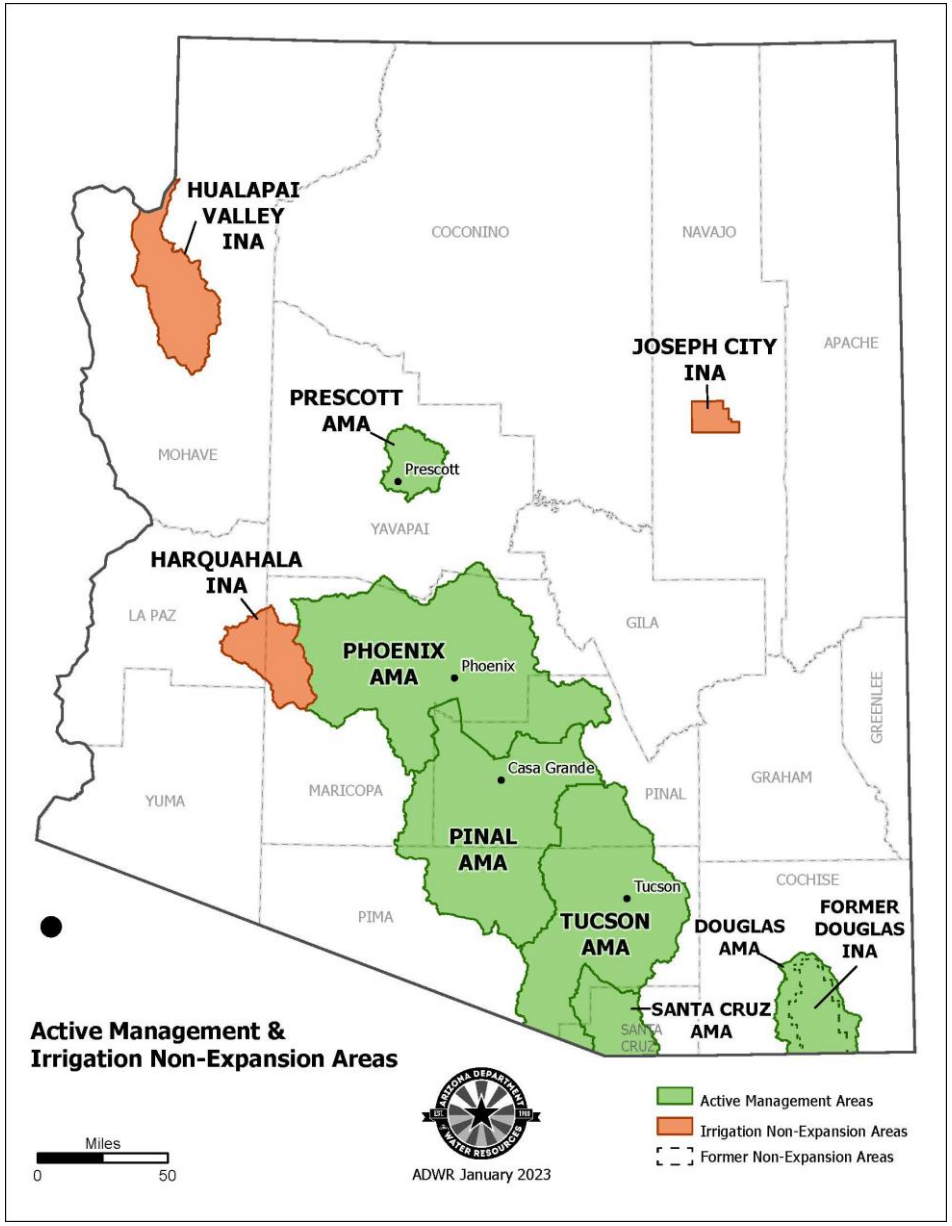
Arizona Water Banking Authority

Groundwater Management

Groundwater Management Act, 1980

- Active Management Areas (AMAs)
  - less than a quarter of the state's land mass
  - but over 75 percent of its population
- Irrigated Non-expansion Areas (INAs)
- Greater "Rural" Arizona



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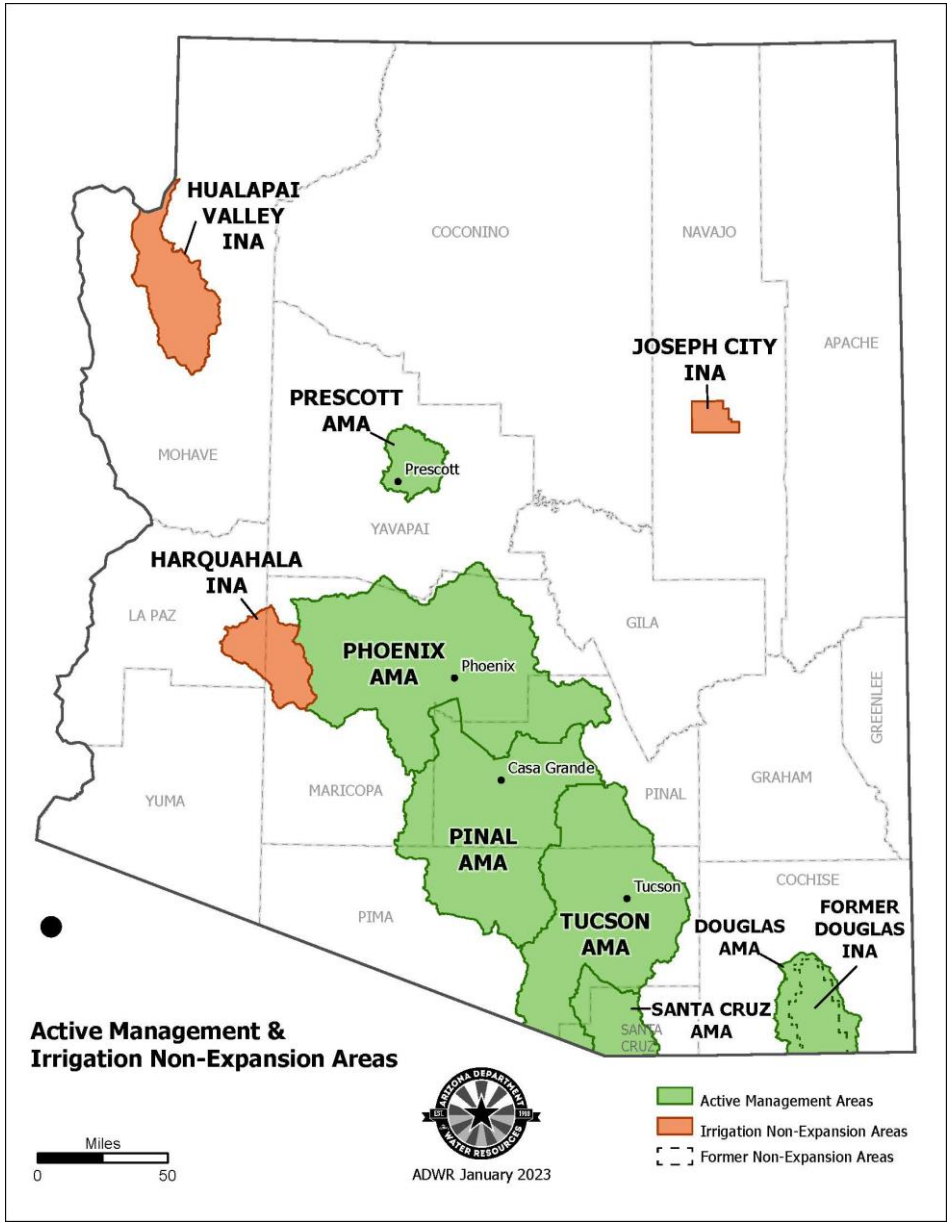

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http://www.cap-az.com/water/cap-system/water-operations/recharge/

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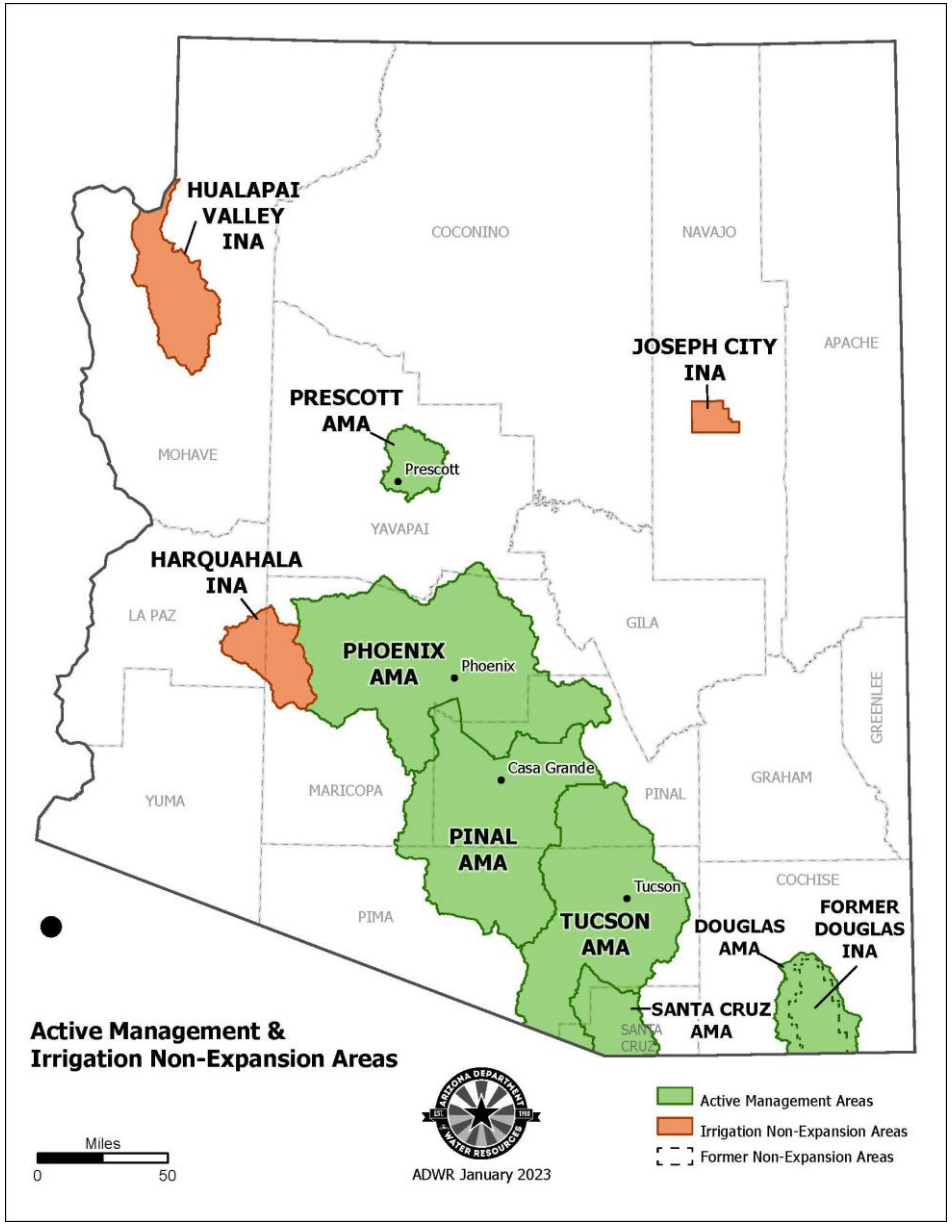
Developers are trying to build hundreds of thousands of homes in Arizona. New report warns there isn't enough water.

Brandon Loomis
USA TODAY NETWORK

Published 1:56 a.m. ET Jan. 12, 2023 | Updated 9:25 a.m. ET Jan. 12, 2023

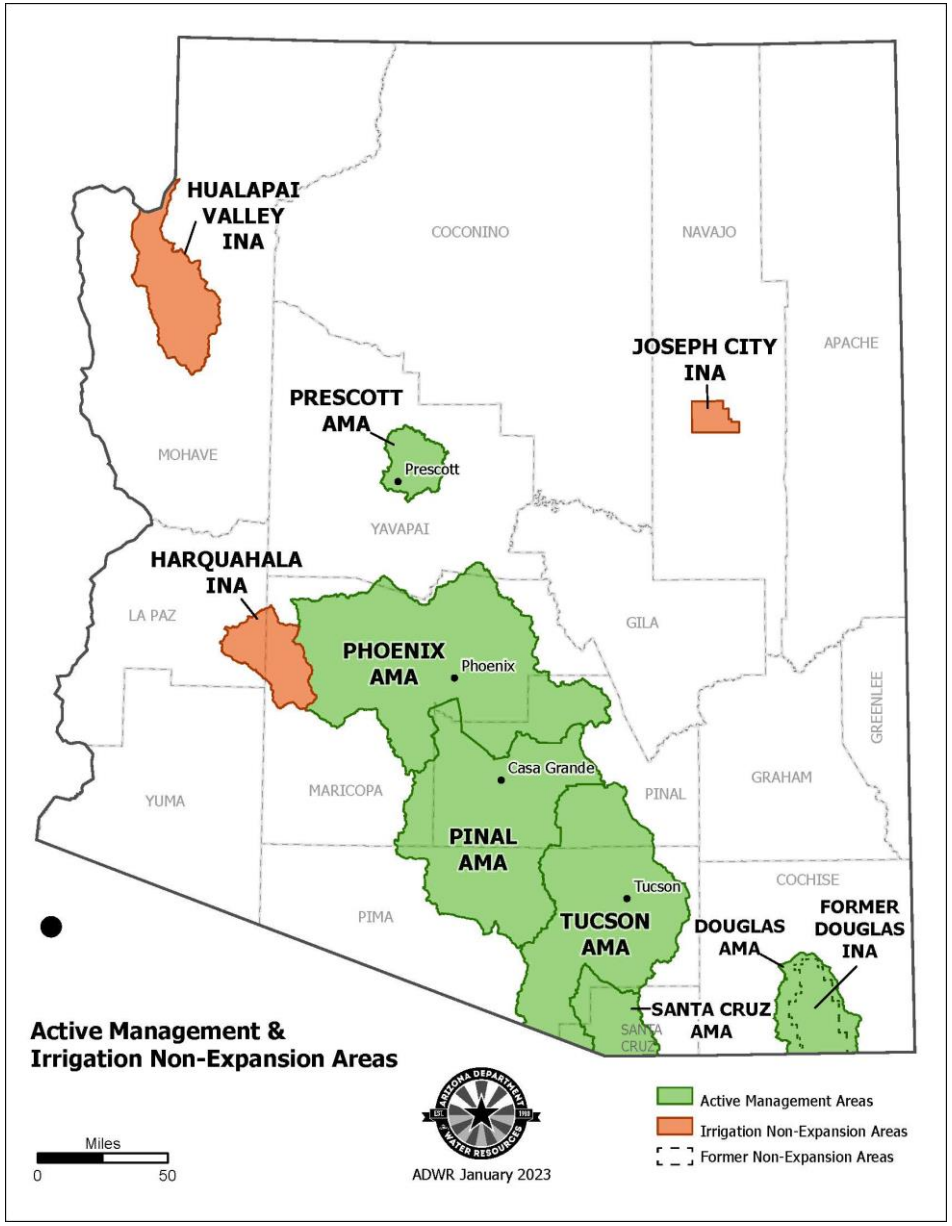
Irrigated Non-expansion Areas (INAs)

- Fewer restrictions than AMAs
- Irrigation cannot be expanded



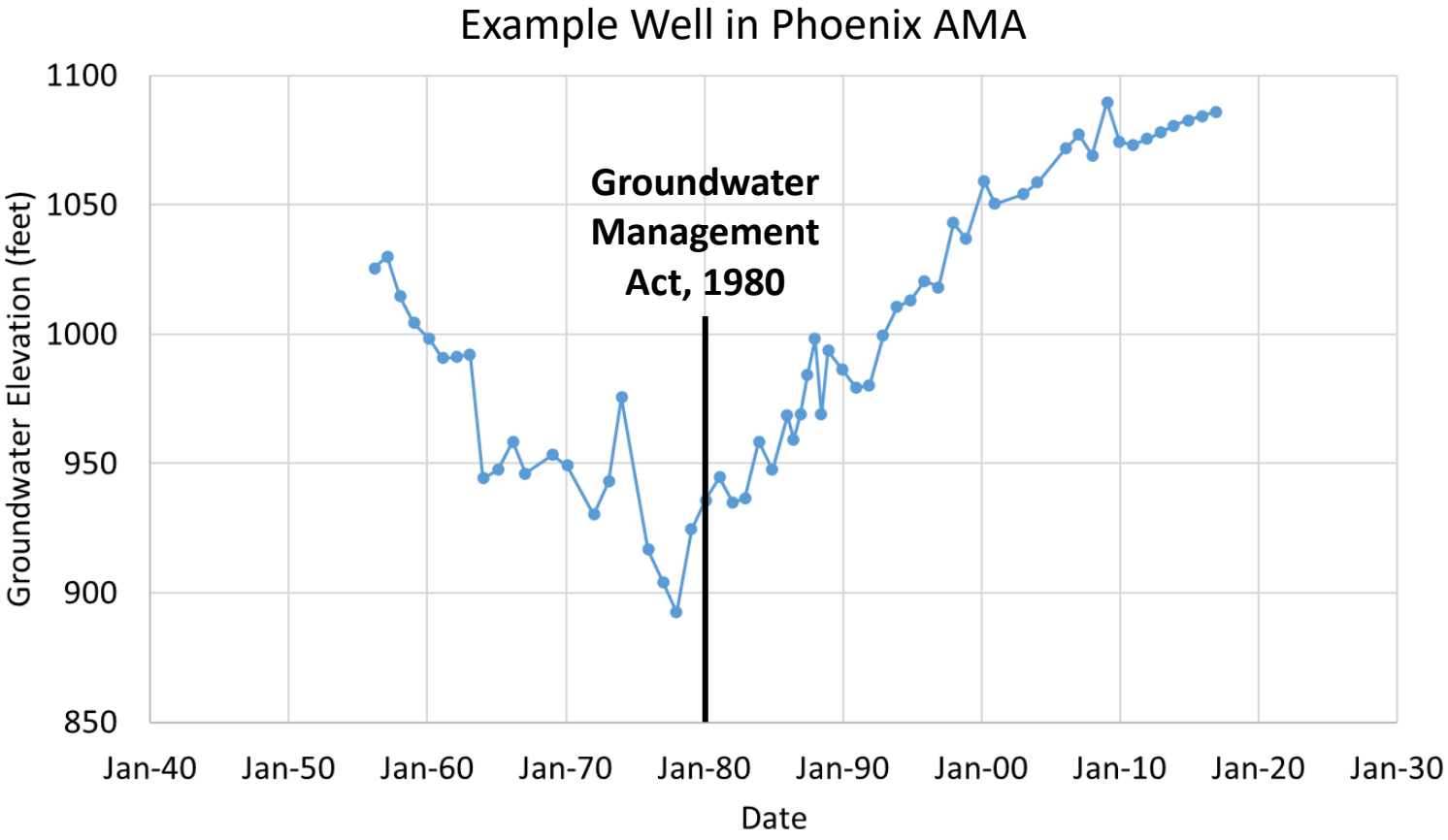
Greater “Rural” Arizona

- Outside of AMAs and INAs groundwater use in Arizona remains essentially unregulated
  - Doctrine of “reasonable use”
  - Groundwater transportation restrictions
- Adequate water supply

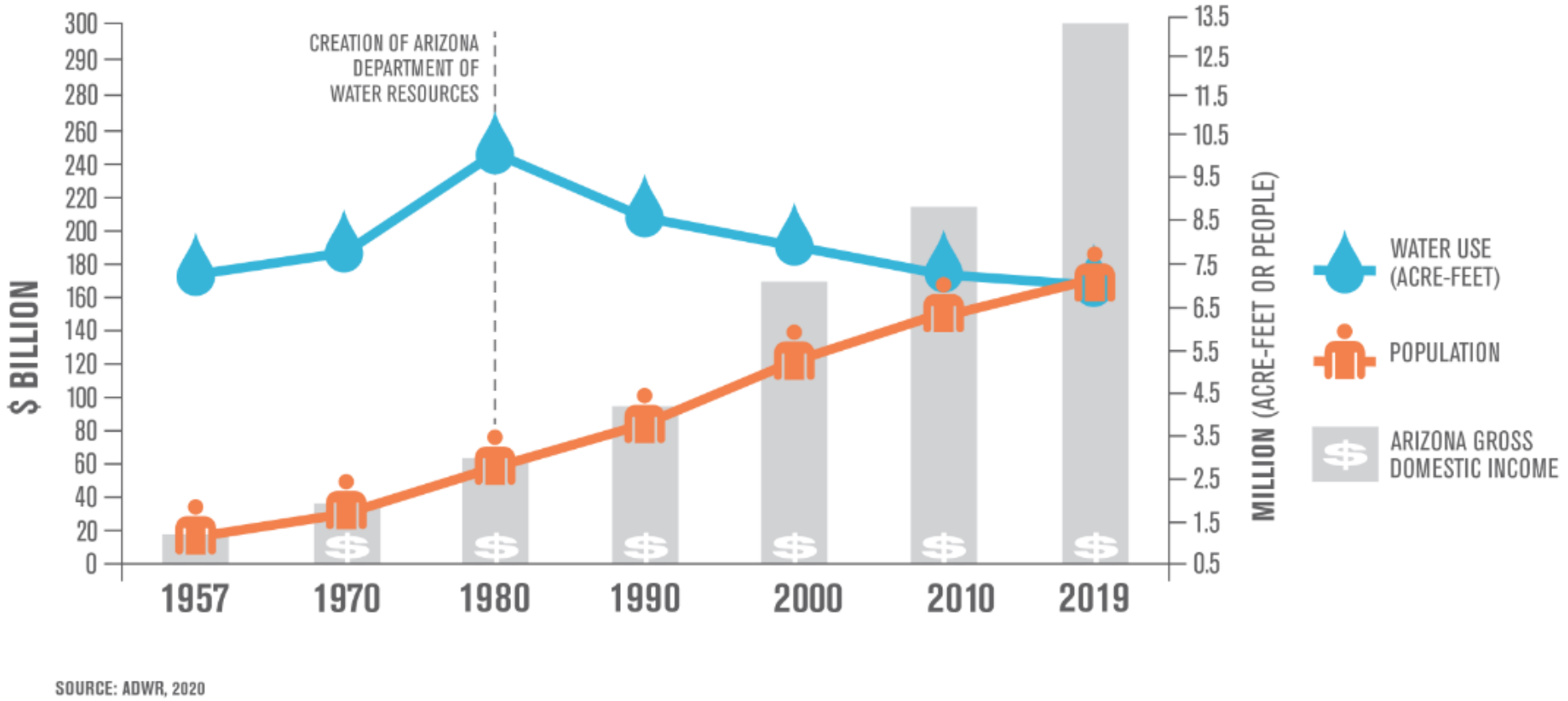


Groundwater Management – Successes

- Water management programs have stored trillions of gallons of water underground



ARIZONA'S WATER MANAGEMENT SUCCESS



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Groundwater Management – Shortcomings

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  - Number of wells have substantially increased

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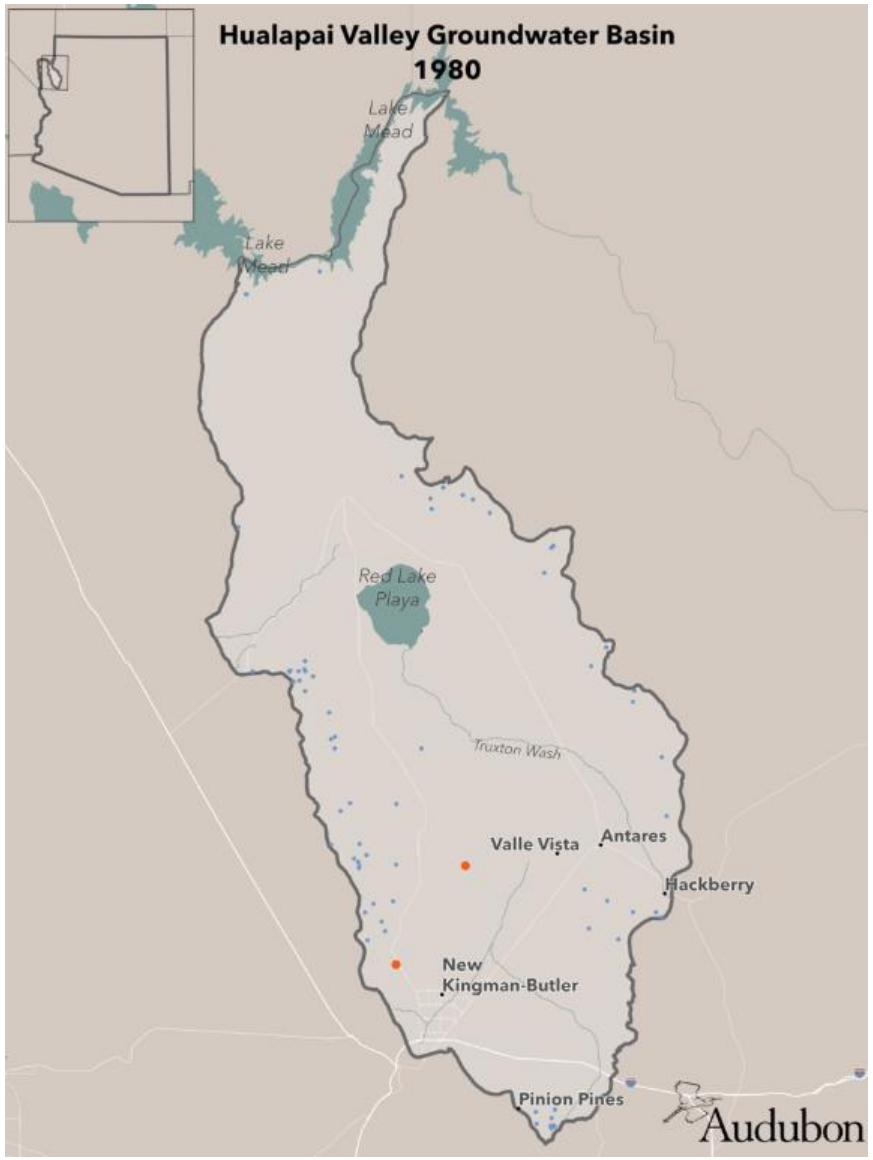

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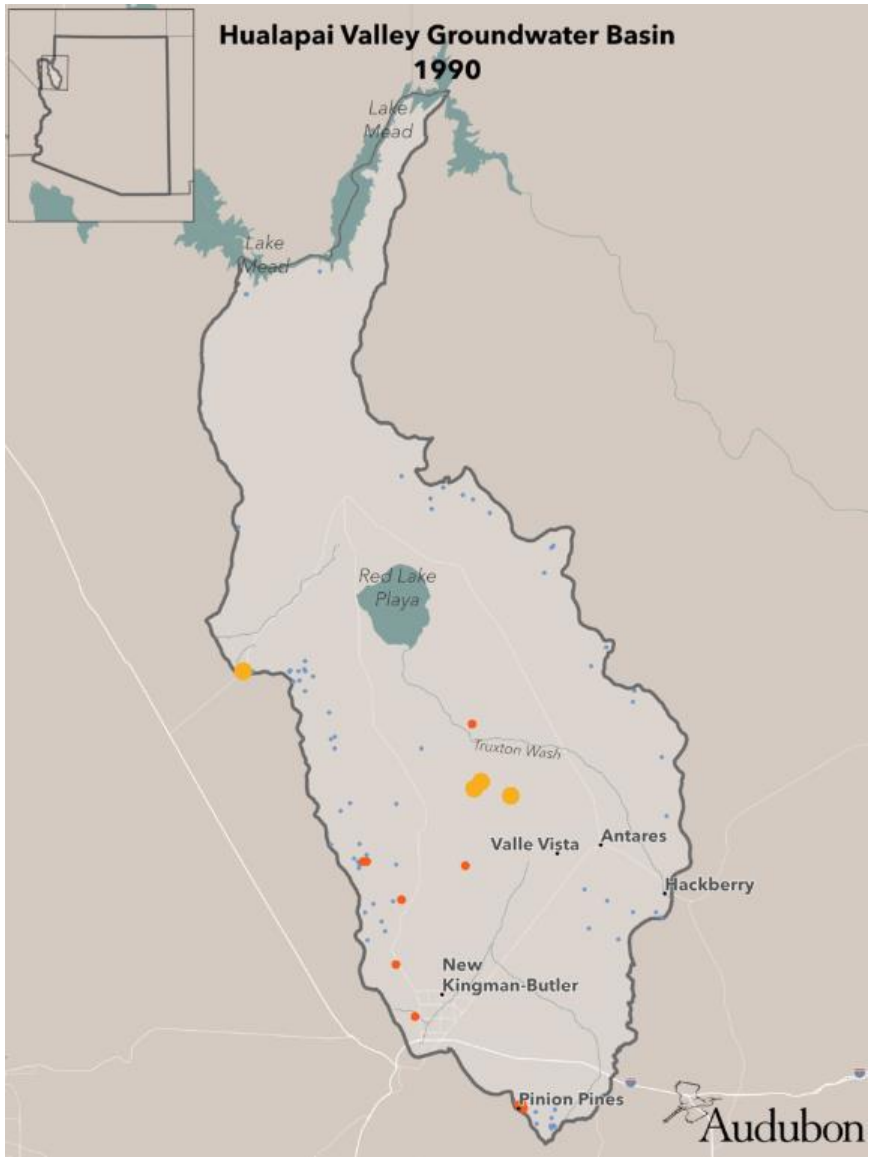

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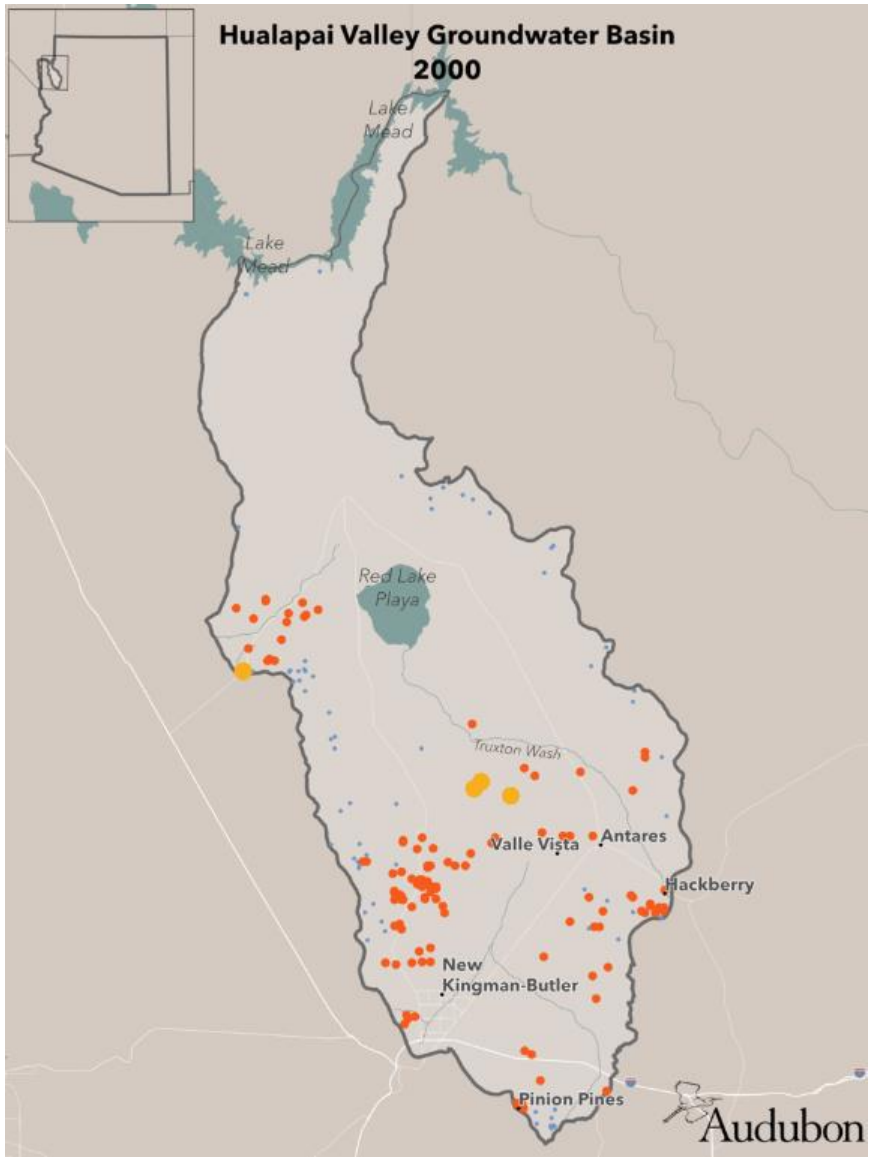

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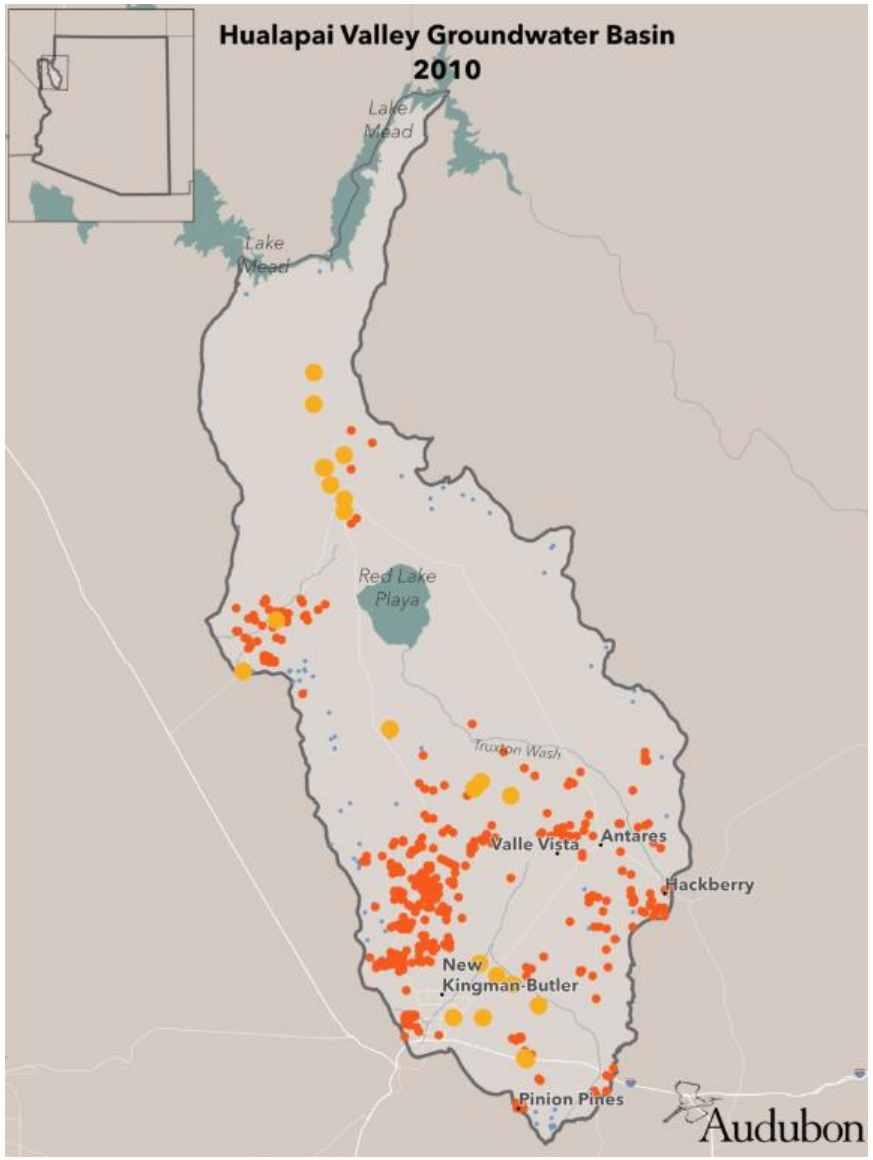

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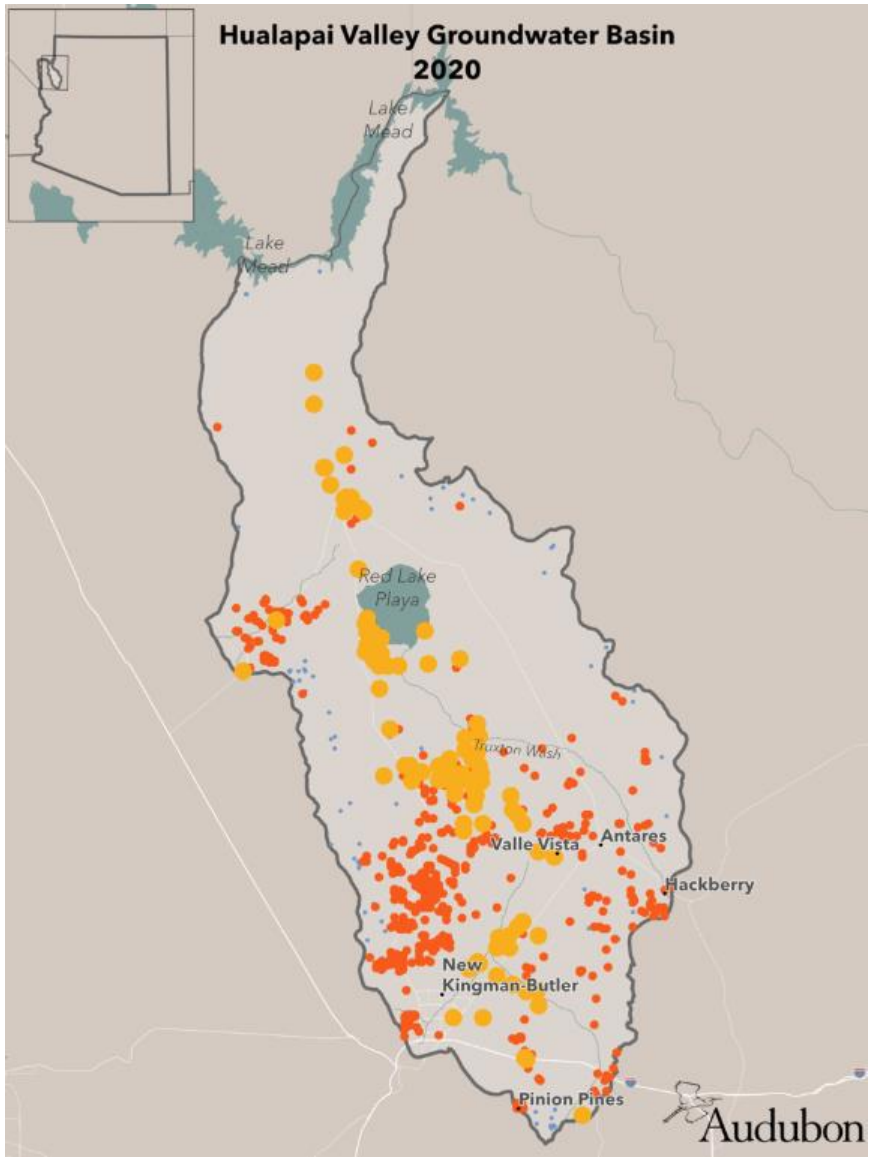

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Groundwater Management – Challenges

- Diminishing flows
- Rapid water level declines in groundwater-dependent rural communities
- Environmental water needs (riparian ecosystems)
- Tribal water rights
- Increasing demands and competition for water from the Colorado River

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US considers imposing Colorado River water cuts to western states

Depending on the plan, either California would be the most affected, or Arizona and Nevada would be parched

Guardian staff and agencies

Tue 11 Apr 2023 19.20 EDT

Comparisons with California

Groundwater Law

AZ's Groundwater Management Act 1980

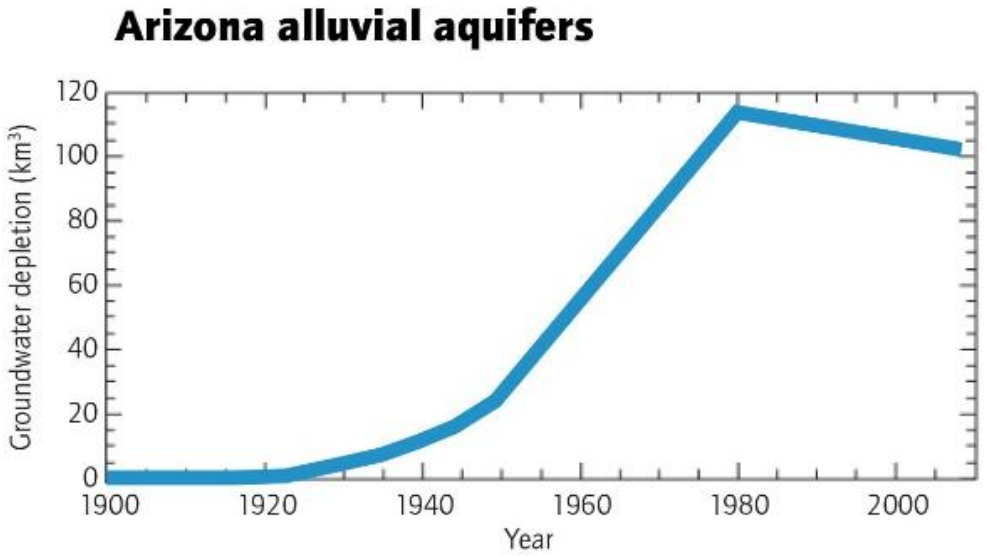
AZ's Groundwater Management Act of 1980 | Arizona Department of Water Resources (azwater.gov)

CA's Sustainable Groundwater Management Act 2014

Governor Brown Signs Historic Groundwater Legislation | Governor Edmund G. Brown Jr. (ca.gov)

1980 versus 2014

Source: USGS



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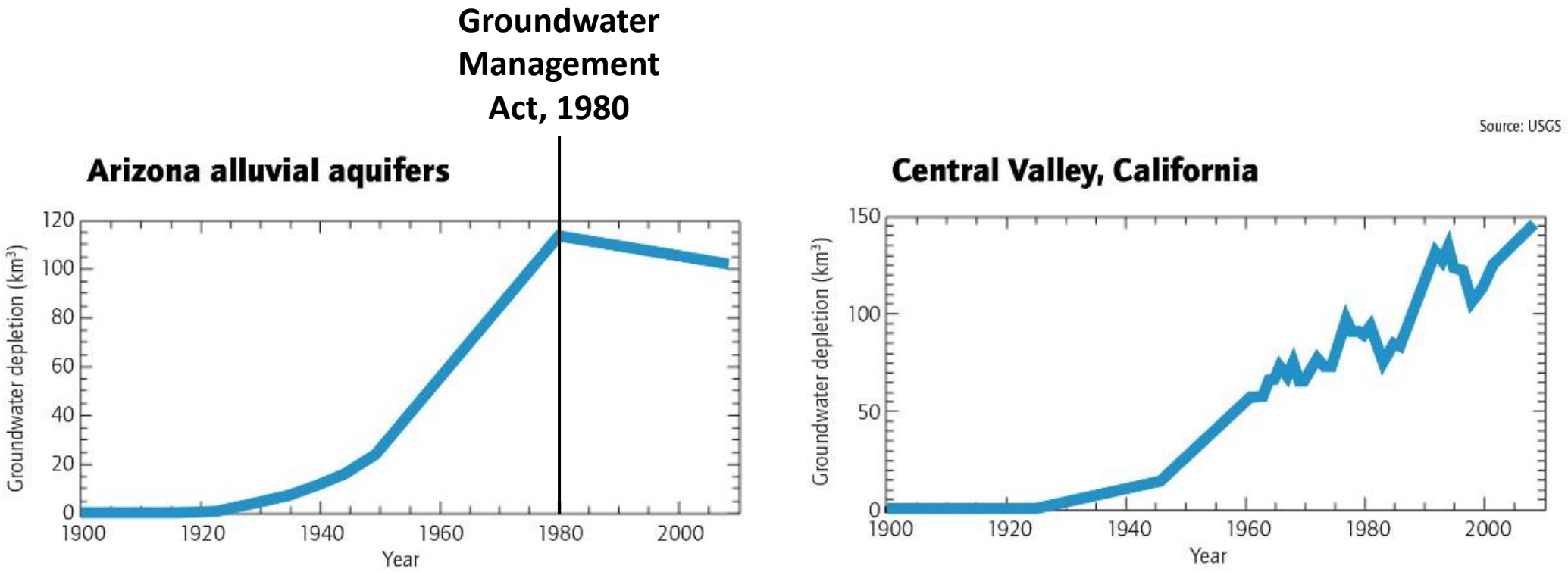

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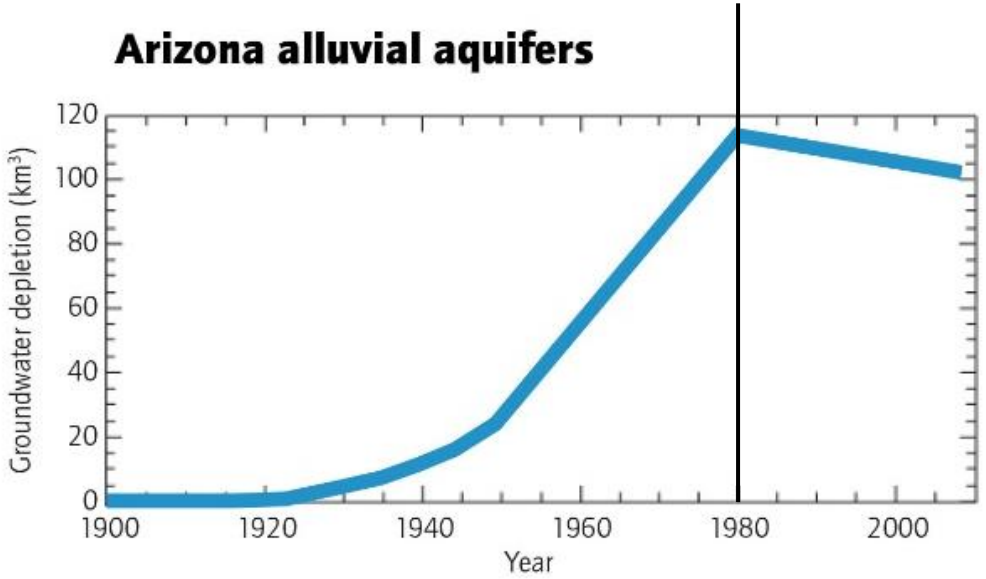
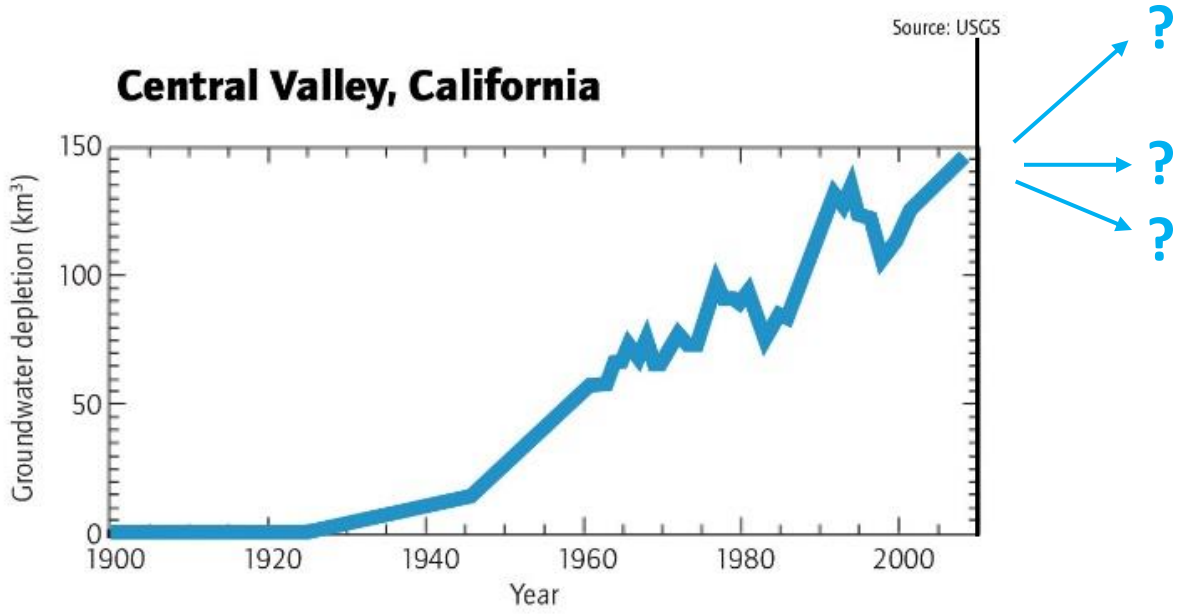
1980 versus 2014

Groundwater Management Act, 1980

SGMA, 2014





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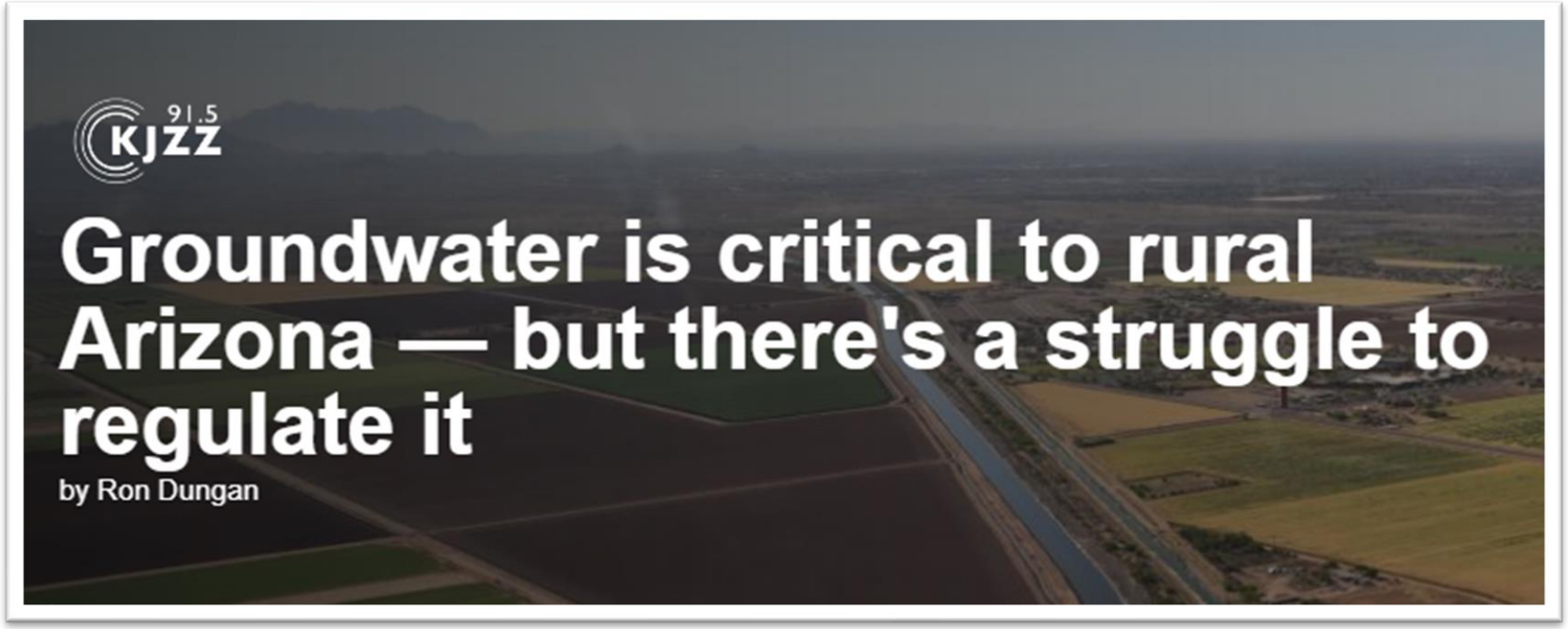

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Groundwater mostly unregulated, impacts rural areas

By: Shane Brennan, Arizona Capitol Times February 24, 2023

A researcher measures the dimensions of a well. Groundwater is one of the main water resources for most of the state, but it is finite and mostly unregulated, especially in rural communities that solely depend on it. (Photo courtesy of Scott Stuk/Arizona Department of Water Resources)

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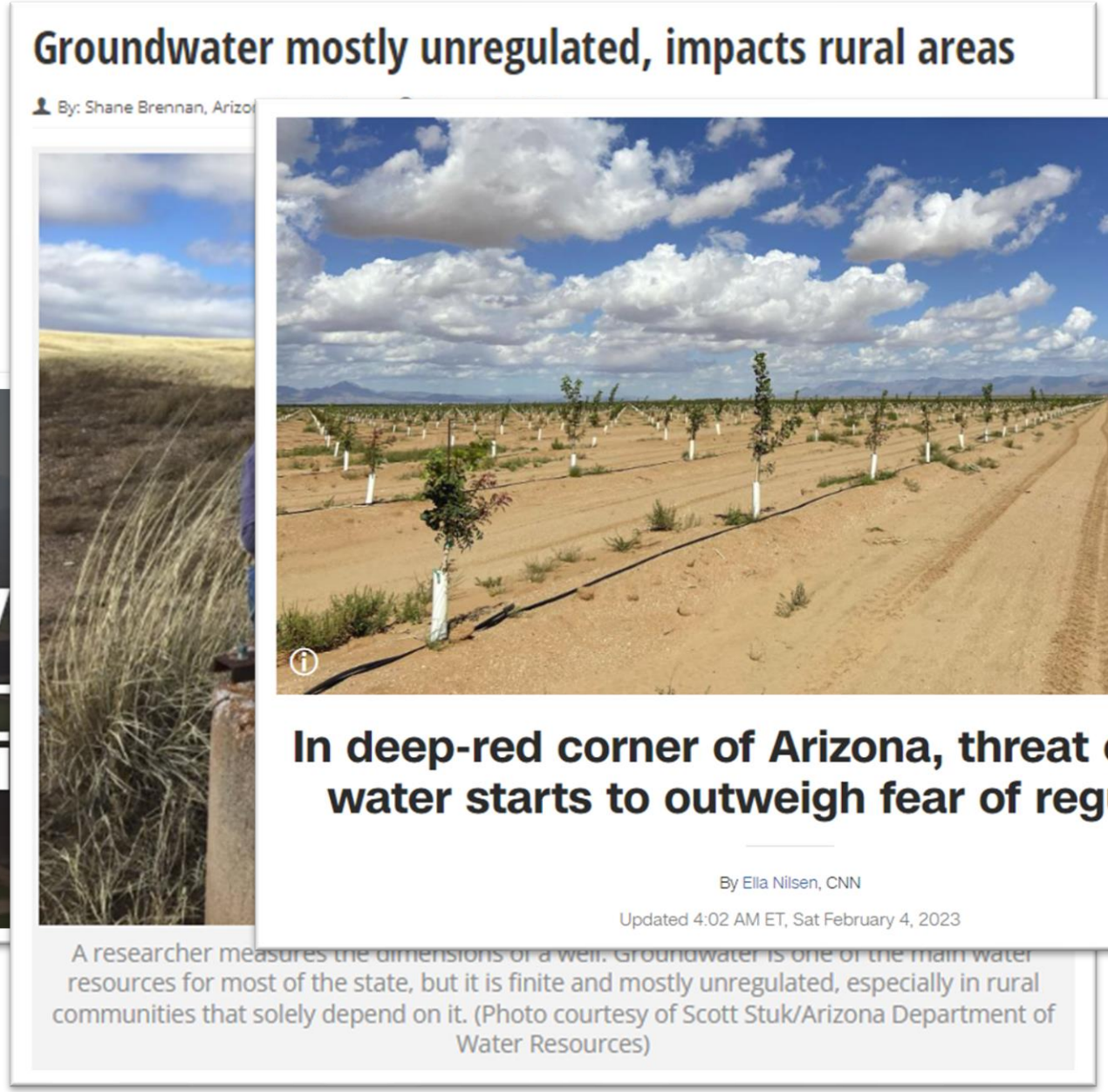

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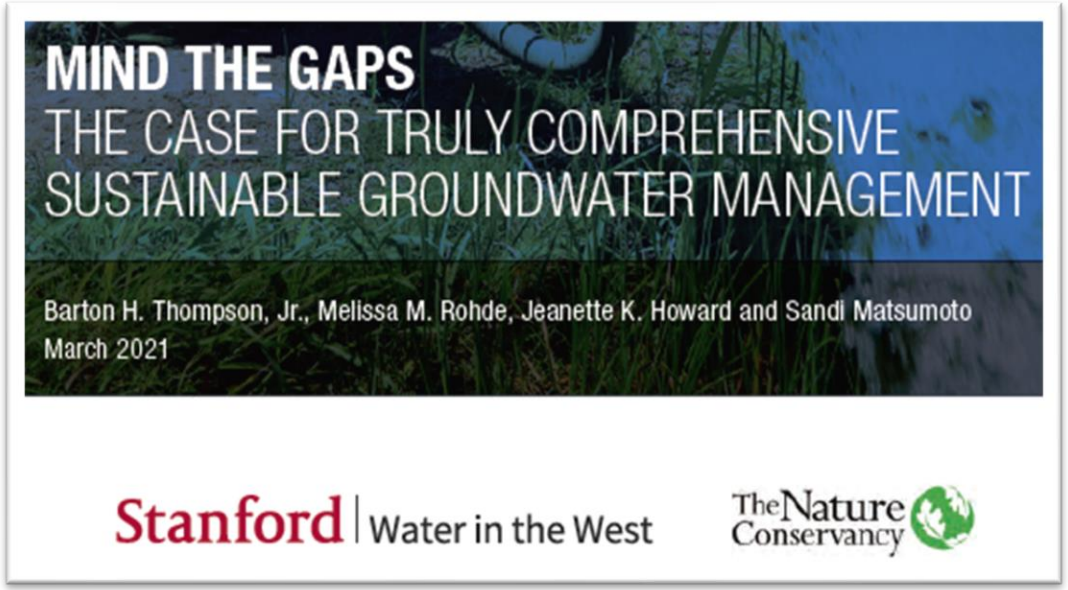
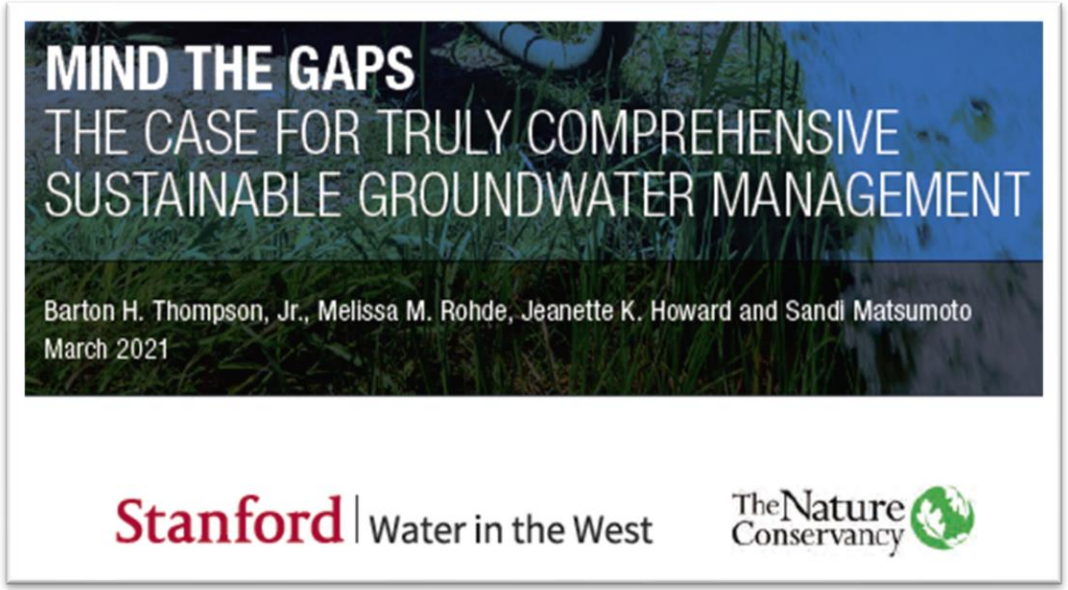
- In Arizona, rural areas are largely unregulated
- In California, are there similar gaps in SGMA?



Groundwater Management – Shortcomings

- In Arizona, rural areas are largely unregulated

- In California, are there similar gaps in SGMA?
  - Brackish groundwater
  - Fractured hard rocks
  - Low and very-low priority basins



Surface Water – Groundwater

Arizona

- Bifurcated water laws in which surface water is treated separately from groundwater
- “Subflow” is defined as saturated floodplain alluvium

California

- Interconnected Surface-water depletion is included as a sustainability indicator

Recharge Programs

Arizona

- Central Arizona Project (CAP)

https://www.cap-az.com/water/cap-system/water-operations/system-map/

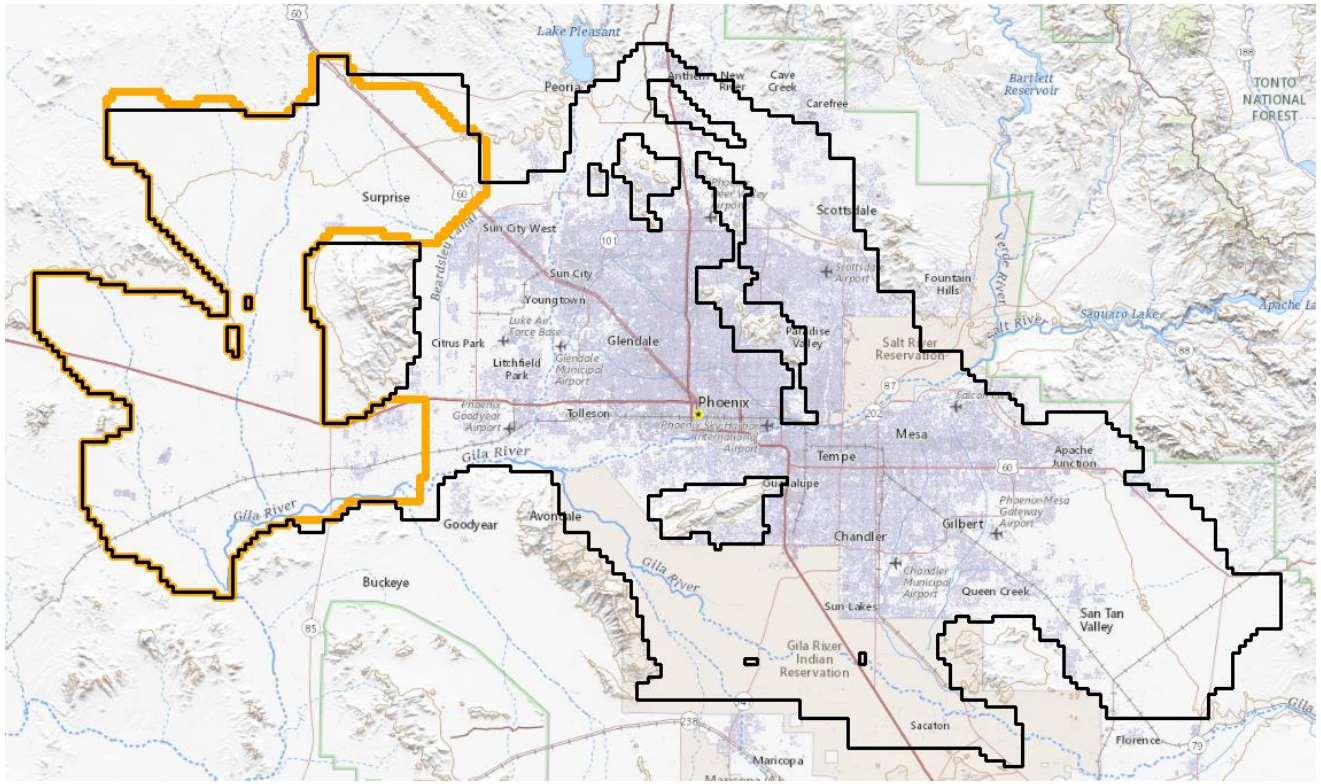
California

- Water Replenishment District (WRD) was formed in 1959

Rio Hondo Spreading Grounds https://www.wrd.org/mission-and-history

Multiple Overlapping Models

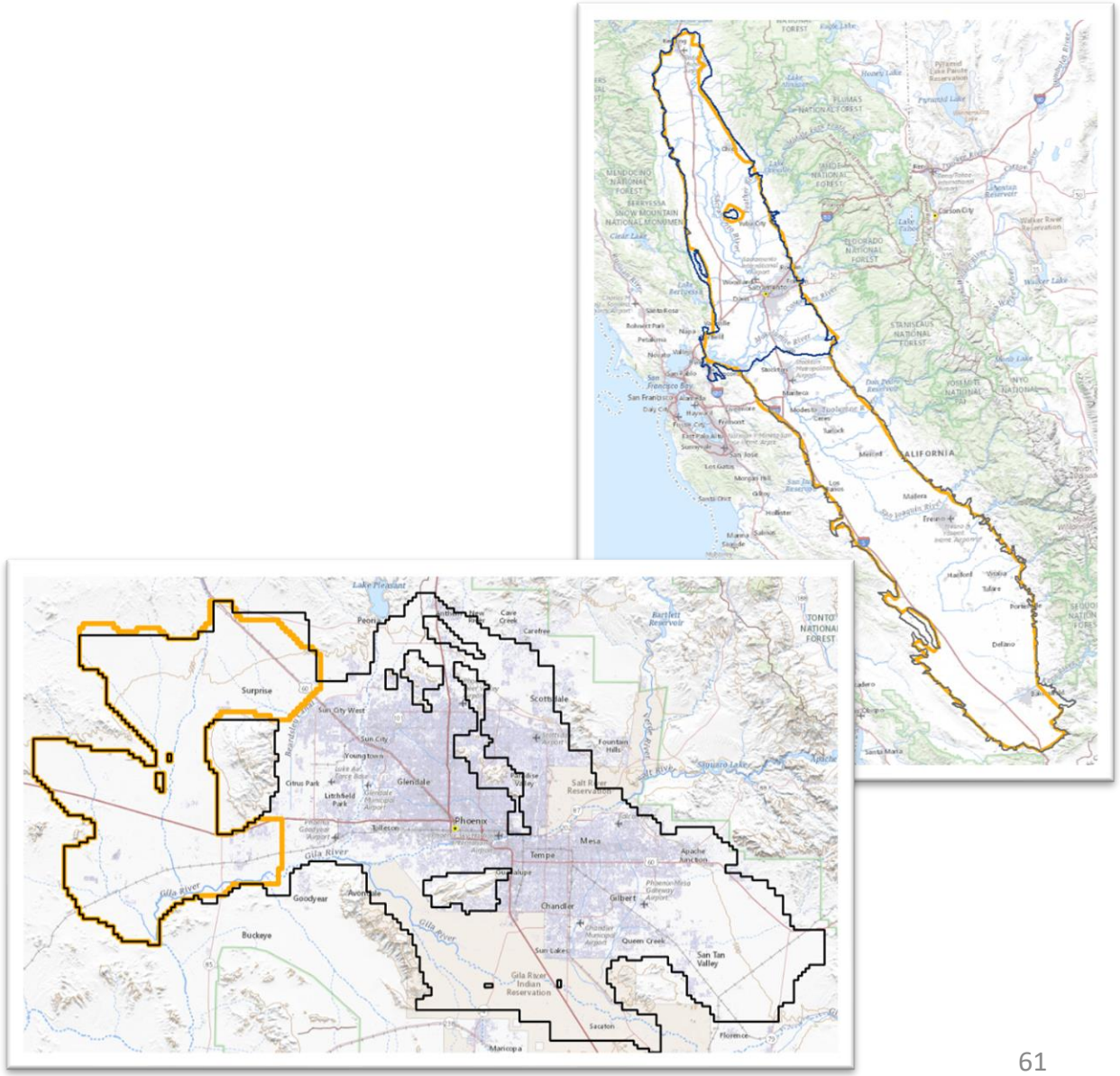
Phoenix AMA Model
Hassayampa Model



Central Valley Models, California
(SVSim, C2VSim-CG, C2VSim-FG; CVHM)

Case for Multi-model Calibration

- Multiple overlapping models can be concurrently calibrated
- Ensures consistency
  - Aquifer parameters
  - Boundary conditions
  - Water budgets
- Efficient and cost-effective
- Timelines for each model may be a constraint



Key Takeaways

- Status-quo is unsustainable
- Groundwater management is essential
- Sustainability is achievable
- Coordination, education, time, and effort will be needed

Thank you for your time!

Questions?

vivekb@sspa.com