INFORMAL PUBLIC MEETING & INFORMATIONAL SESSION

Status of the Ranegras Plain Groundwater Basin: Hydrology & Water Management Options

October 15, 2025

Welcome and Introduction by Supervisor Holly Irwin

La Paz County Board of Supervisors, District 3

ADWR Introductions

Agenda

1. Welcome, Introductions, & Meeting Logistics
2. Overview of Hydrology in Ranegras Plain Groundwater Basin
3. Overview of Water Management Options
4. Q & A
5. Closing

Meeting Logistics

- Today's meeting is **not** a formal public hearing.
- This meeting will be recorded and will be available on ADWR's website in a few days.

- Please hold questions and comments until the public discussion portion.
  - If you would like to ask a question, please fill out a speaker card, located at the entrance, and return it to ADWR staff. Online attendees should complete the questionnaire at the link provided in the chat.
- Please be respectful to staff and fellow attendees.

Meeting Logistics

- During the public discussion portion, please speak into the microphone so those participating virtually can hear.
- Please keep your phone on mute or silenced during the meeting.
- Specific questions about individual circumstances should be addressed separately via phone/email.

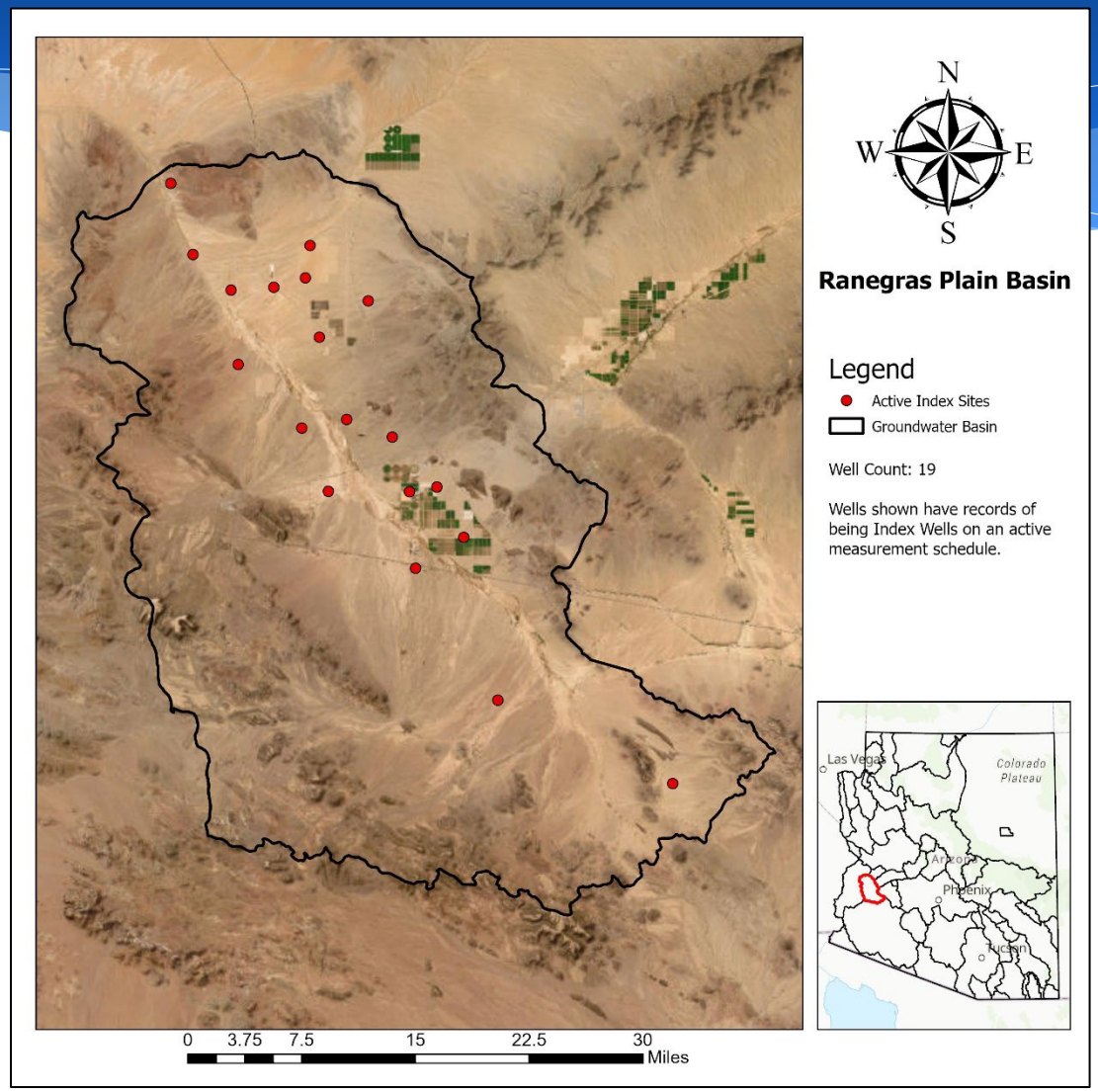
ADWR does not intend to provide comprehensive guidance and cannot give legal advice. If you have legal questions about your specific circumstances, you should consult with an attorney.

Overview of Hydrology in Ranegras Plain Groundwater Basin

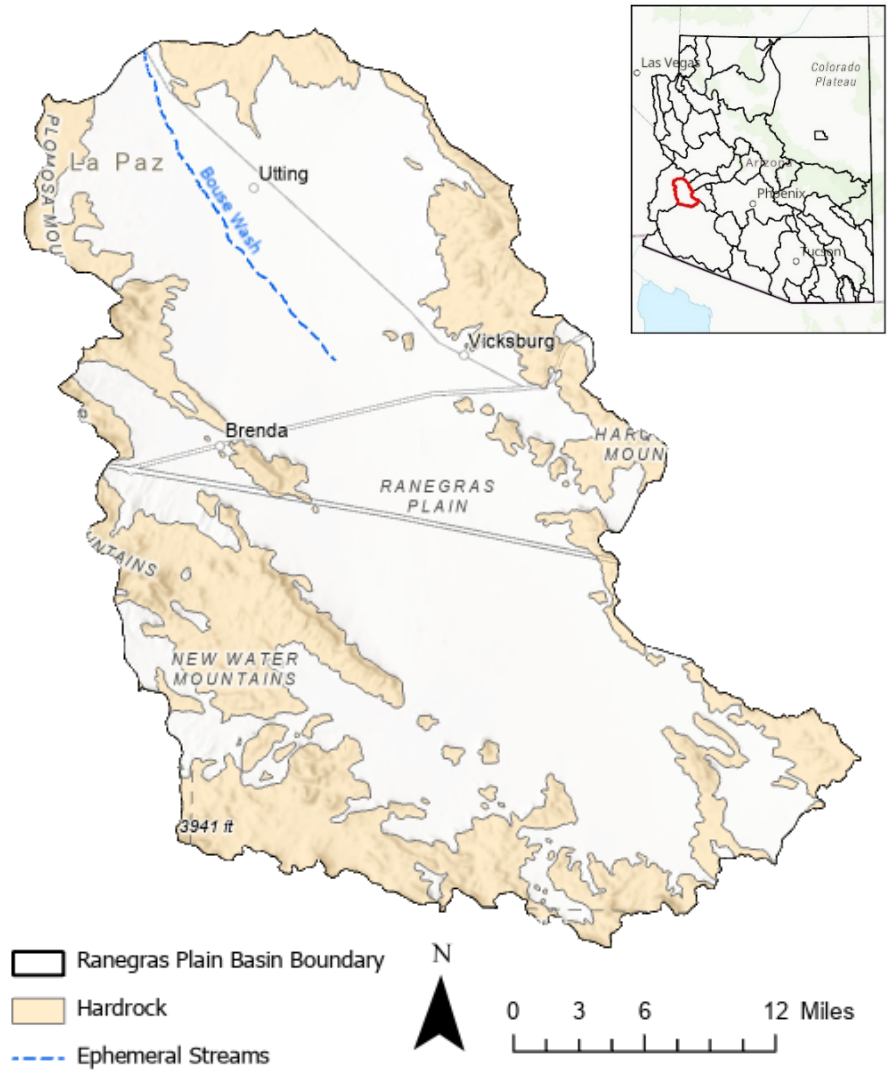
Ryan Mitchell, RG, CPG
Chief Hydrologist

Hydrology Agenda

- Regional Overview
- Existing Data
  - Geology/Lithology
  - Hydrology
- ADWR Index Wells
- Statistical Review of Water Level Data (Open File Report No. 20)
- Water Level Data Summary
  - Index Well Measurements
  - Water Level Trends
  - Water Level Difference Contours
- Land Subsidence



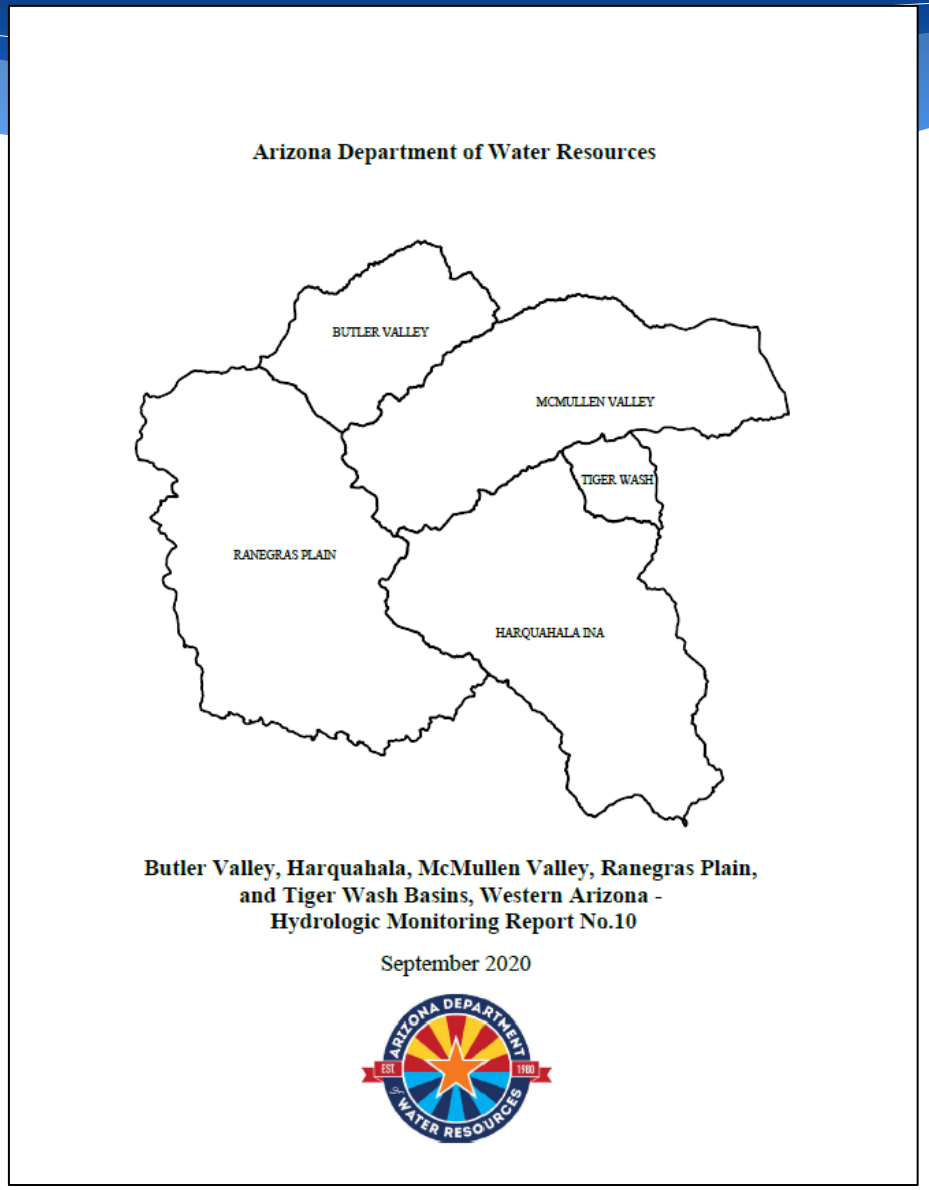
Regional Overview



- **Basin and Range Physiographic Province**
- **Approximately 912 square miles**
- **Mountains/desert basin**
  - ~3,950 feet amsl at Granite Wash Mountains
  - ~930 feet amsl at the basin floor to the north
- **Surface water**
  - Surrounded by topographical highs, drainage is internal then to the north
- **Groundwater occurrence is contained in alluvial deposits**
  - Lower basin-fill sediments composed of clay, volcanics, conglomerate, and sand & gravel
  - There are perched hydro-stratigraphic units from fine-grained alluvial sediments
- **5.5” annual precipitation on the valley floor**
- **8.5” annual precipitation in the mountains to the south**

Existing Data: Publications

- ADWR Hydrologic Monitoring Report No. 10
  https://www.azwater.gov/sites/default/files/2022-08/WPA_HMR_10_FINAL.pdf
- ADWR Open File Report No. 20
  https://www.azwater.gov/hydrology/e-library/adwr-open-file-report-number-20
- ADWR Hydrologic Map Series HMS No. 18
  https://www.azwater.gov/sites/default/files/2022-07/HMS_No_18.pdf
- Arizona Water Atlas – Section 7.7
  https://infoshare.azwater.gov/docushare/dsweb/Get/Document-10432/Volume_7_final.pdf
- ADWR Land Subsidence Map Series
  https://www.azwater.gov/hydrology/land-subsidence/ranegras-land-subsidence-feature

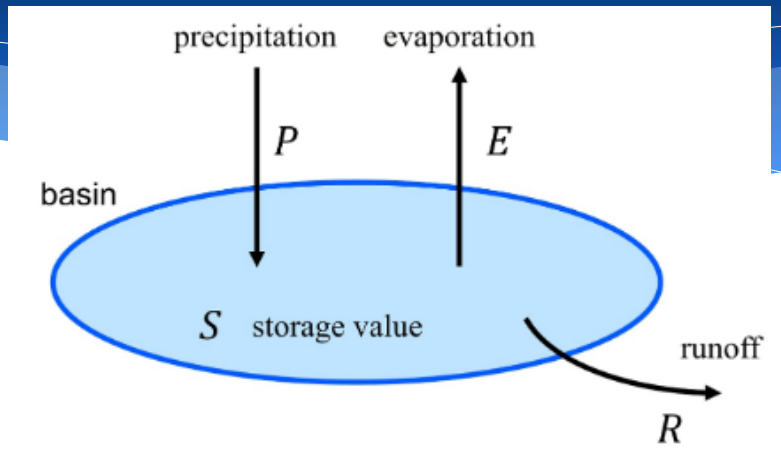

Arizona Department of Water Resources

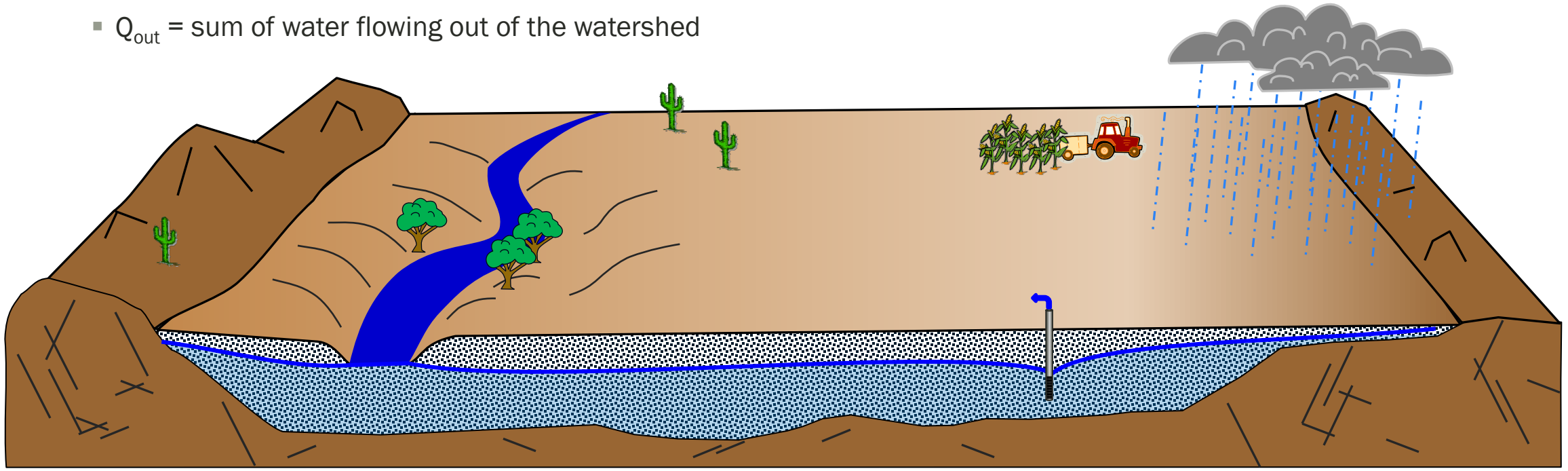
Butler Valley, Harquahala, McMullen Valley, Ranegras Plain, and Tiger Wash Basins, Western Arizona - Hydrologic Monitoring Report No.10

September 2020

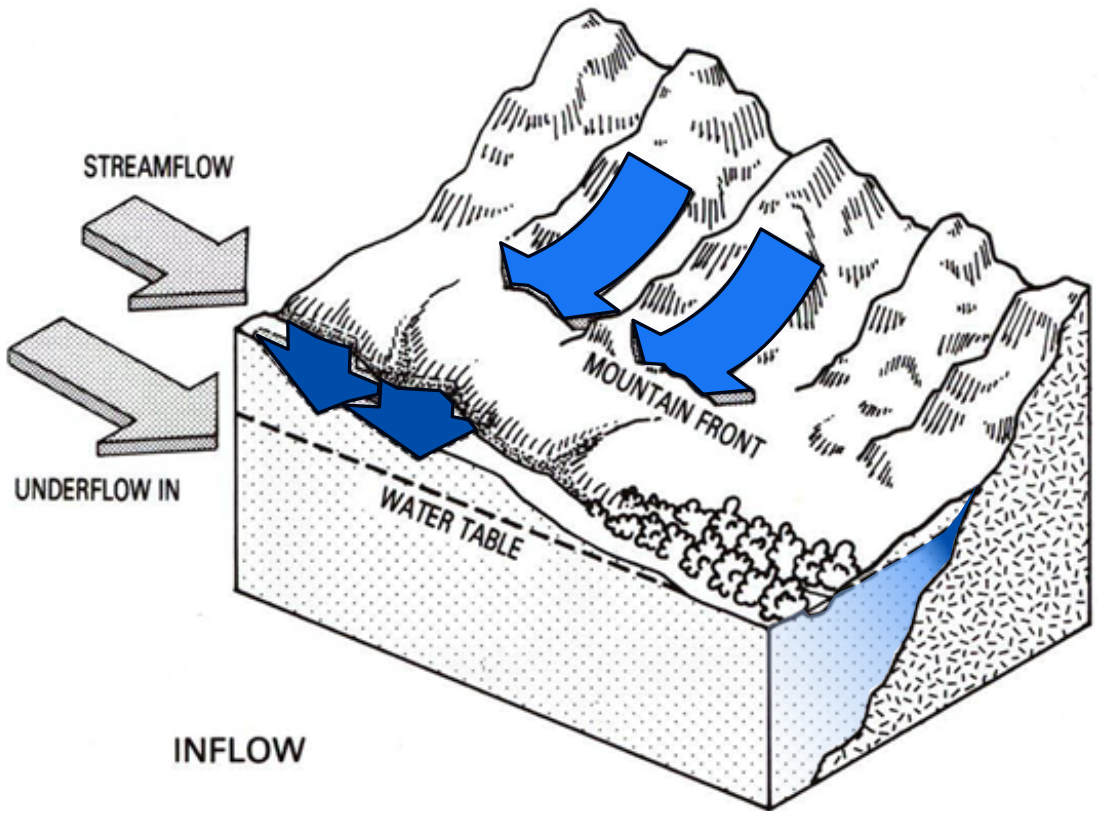
Hydrology: Water Budgets

- **Simple in concept, difficult in practice**
- $P + Qin = ET + \Delta S + Qout$
  - P = precipitation
  - Q_{in} = water flow into the watershed
  - ET = evapotranspiration (from soils, surface water, plants, etc.)
  - ΔS = Change in water storage
  - Q_{out} = sum of water flowing out of the watershed





Hydrology: Water Budgets Inflows versus Outflows



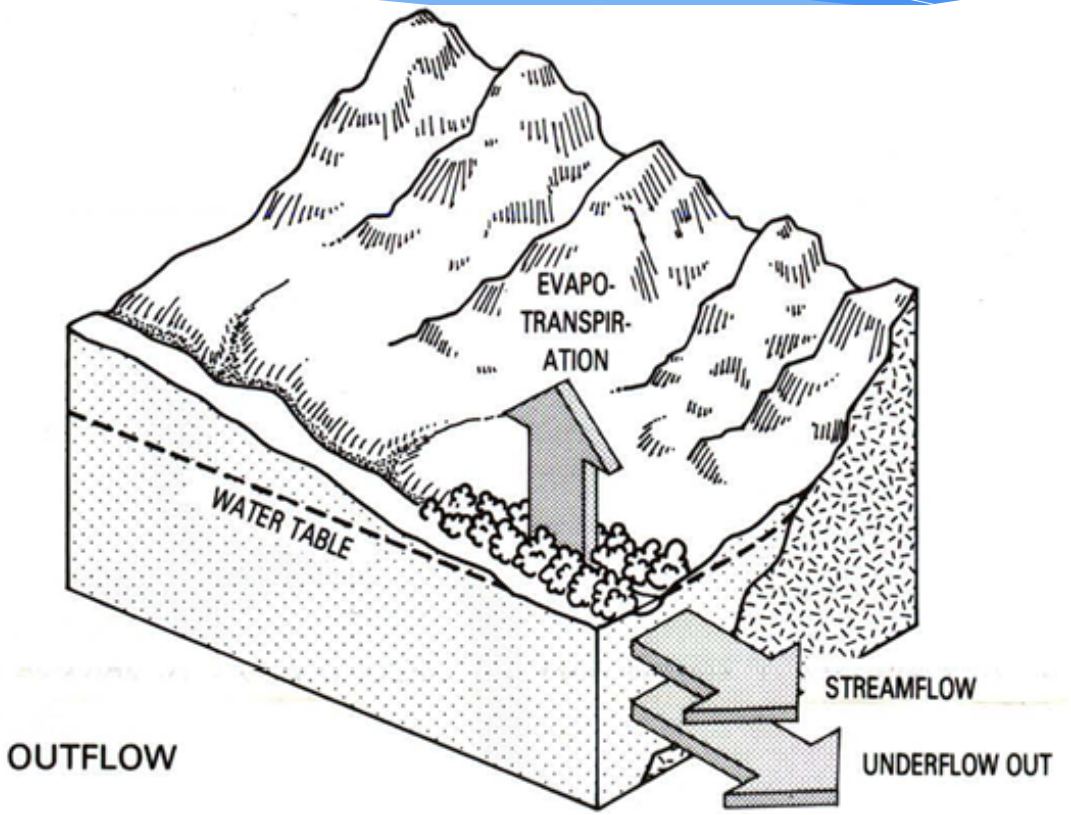


FIGURE 2. – Mechanisms of natural inflow in typical basins in the study area.
Freethey and Anderson, 1986

Hydrology: Water Budgets

Inflows

- Precipitation
- Surface Water Inflows
- Groundwater Inflows
- Imported Water
- Runoff
- Artificial Recharge

IF:

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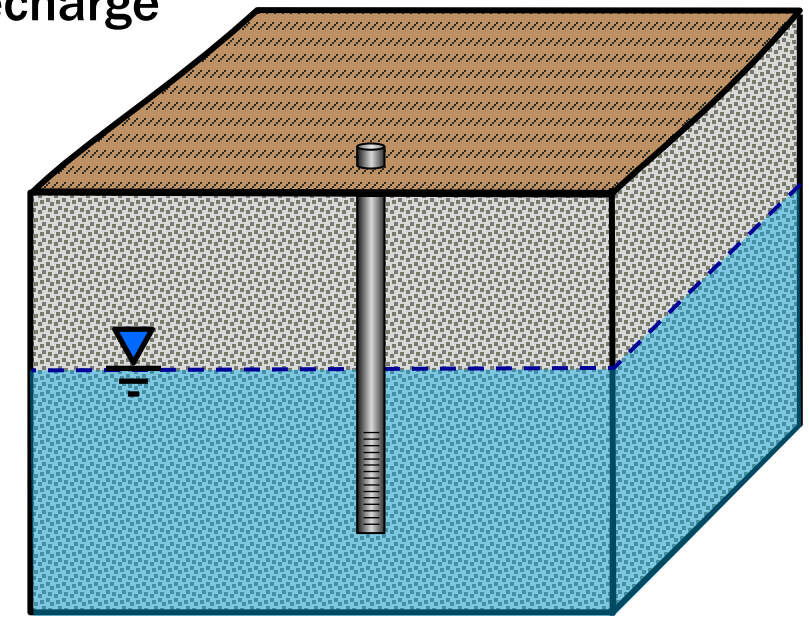
Outflows

- Groundwater Pumping
- Evapotranspiration
- Surface Water Outflows
- Groundwater Outflows



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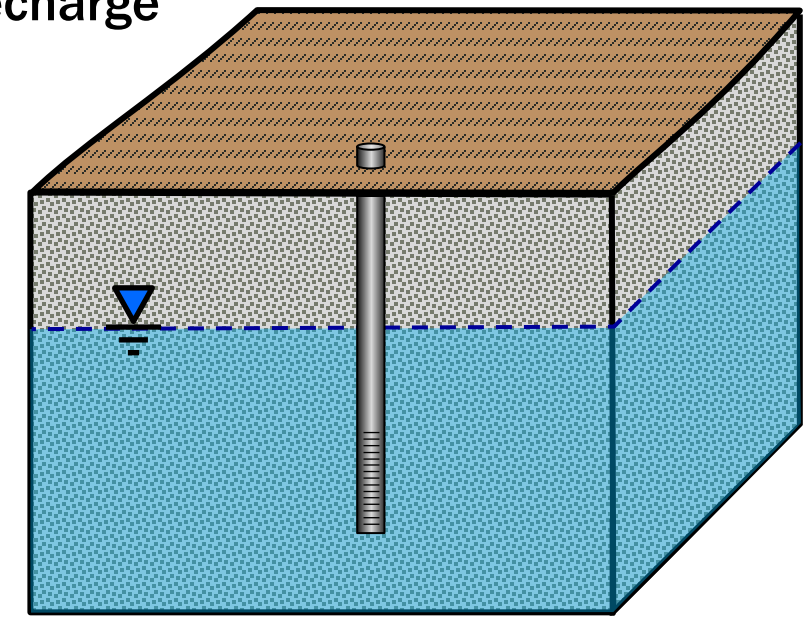


Inflow: 30-Year (1991 – 2020) Average Precipitation (annual)

Annual Precipitation:

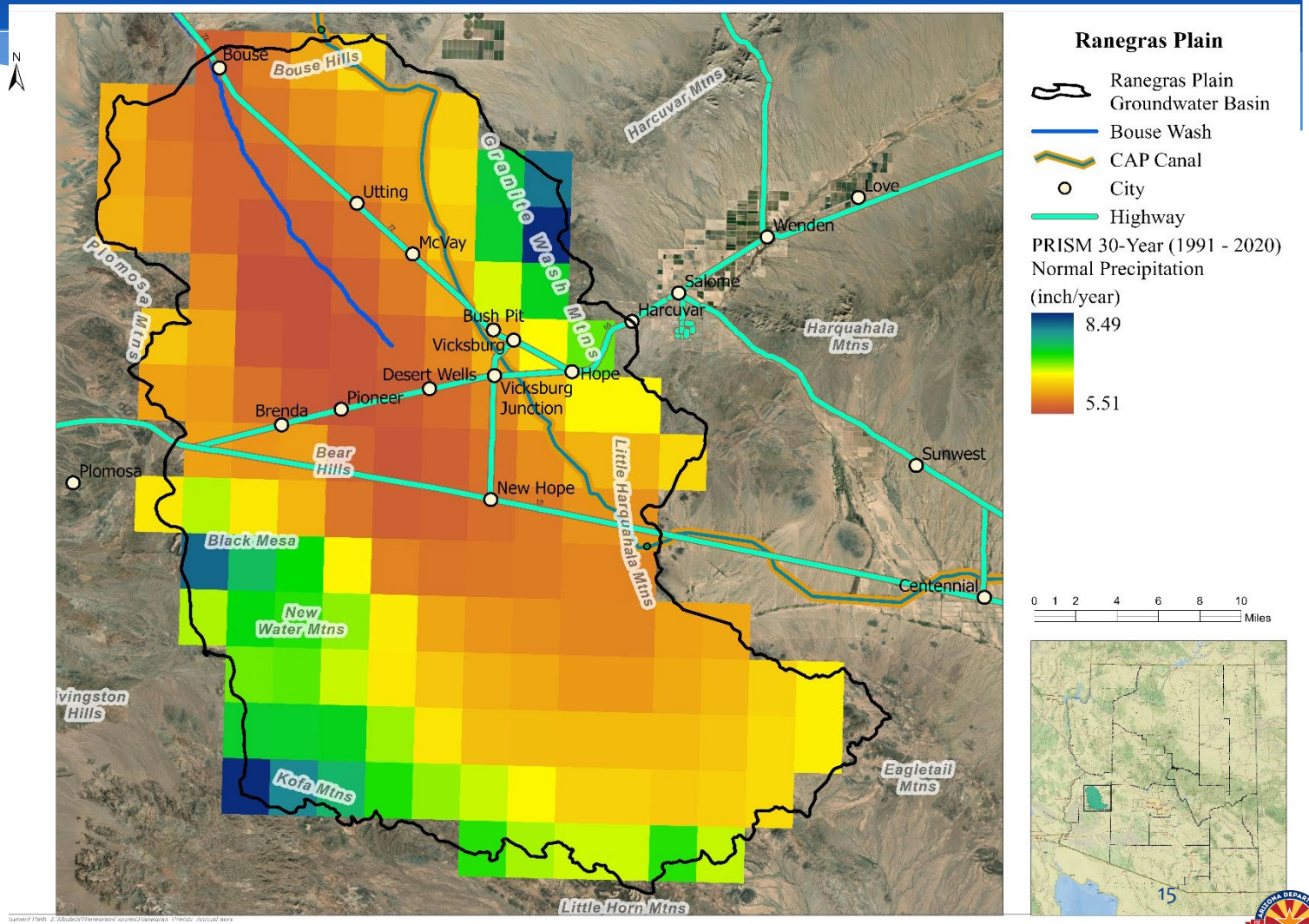
5.5 in/year at the valley to

8.5 in/year at the Kofa Mountains to the southwest

Based on Parameter-elevation Regressions on Independent Slopes Model (PRISM) Weather Stations

Reference:

https://prism.oregonstate.edu/normals/



Inflow: Mountain Front Recharge

USGS Scientific Investigation Report 2011-5071

Water Availability and Use Pilot: Methods Development for a Regional Assessment of Groundwater Availability, Southwest Alluvial Basins, Arizona

Table 12: Average annual mountain-front recharge estimated by the Southwest Alluvial Basins-Regional Aquifer System-Analysis (SWAB-RASA) regression equation and Parameter-elevation Regressions on Independent Slopes Model (PRISM) precipitation data for time periods indicated.

https://pubs.usgs.gov/sir/2011/5071/

Average Annual Volume of Mountain Front Recharge:

2,000 AF

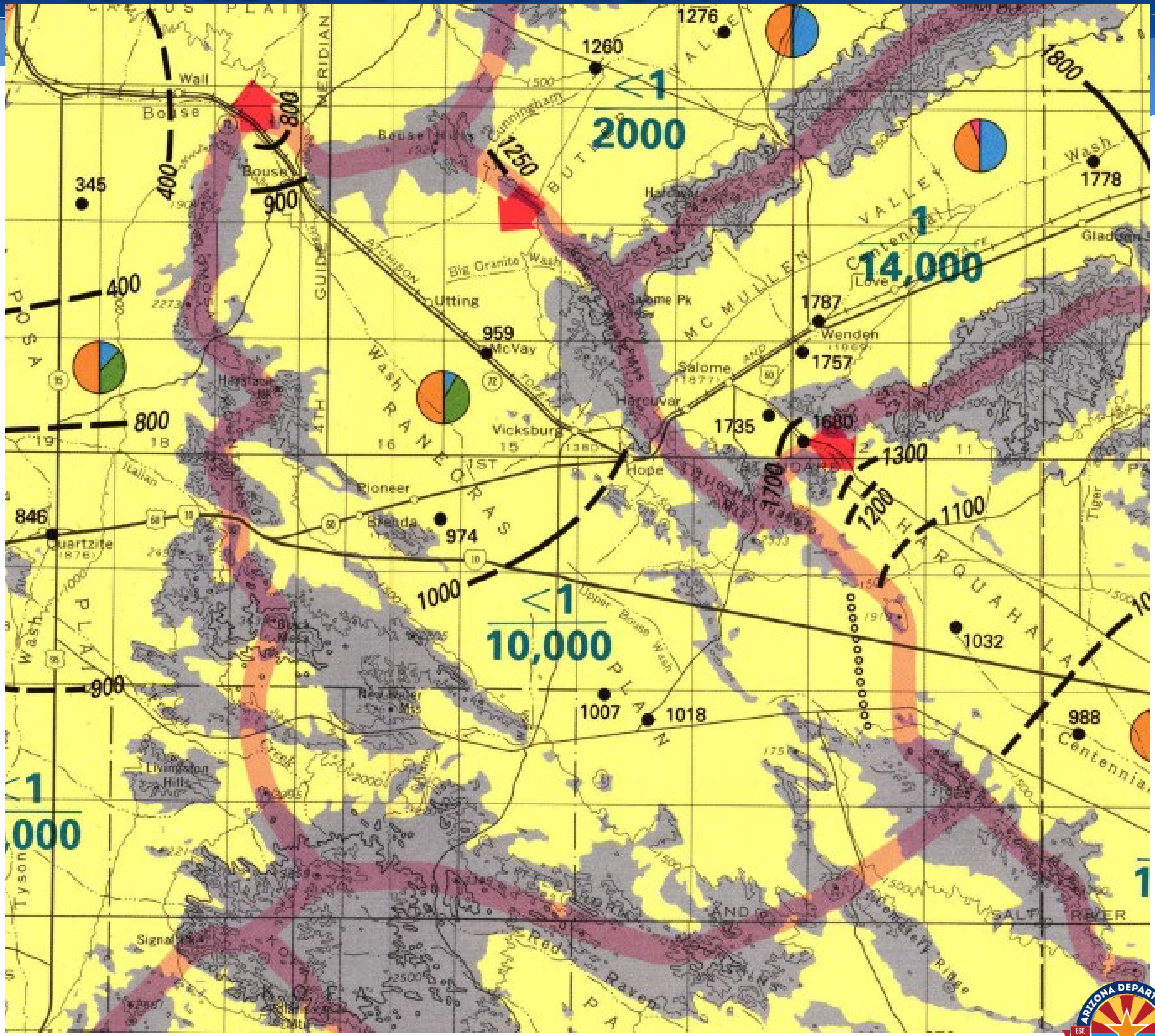
Table 12. Average annual mountain-front recharge estimated by the Southwest Alluvial Basins-Regional Aquifer System-Analysis (SWAB-RASA) regression equation and Parameter-elevation Regressions on Independent Slopes Model (PRISM) precipitation data for time periods indicated.—Continued

	2000–2006			1940–2006		
Basin name	Average annual recharge (in)	Average annual volume of recharge (acre-ft)	Percent of PRISM precipitation	Average annual recharge (in)	Average annual volume of recharge (acre-ft)	Percent of PRISM precipitation
AGUA FRIA	0.22	15,000	1.5	0.29	19,000	1.7
ARAVAIPA CANYON	0.21	6,000	1.4	0.29	8,000	1.7
BIG SANDY	0.12	13,000	1.1	0.18	19,000	1.4
BILL WILLIAMS	0.13	24,000	1.2	0.16	28,000	1.2
BONITA CREEK	0.22	5,000	1.4	0.25	6,000	1.5
BUTLER VALLEY	0.06	1,000	0.7	0.05	1,000	0.6
CIENEGA CREEK	0.28	9,000	1.7	0.35	12,000	1.9
DETRITAL VALLEY	0.04	2,000	0.6	0.04	2,000	0.5
DONNELLY WASH	0.14	2,000	1.1	0.23	4,000	1.5
DOUGLAS	0.14	3,000	1.2	0.18	4,000	1.4
DOUGLAS INA	0.10	3,000	0.9	0.14	4,000	1.1
DRIPPING SPRINGS WASH	0.17	4,000	1.3	0.29	6,000	1.8
DUNCAN VALLEY	0.13	4,000	1.1	0.15	4,000	1.2
GILA BEND	0.02	1,000	0.3	0.03	2,000	0.4
HARQUAHALA INA	0.04	1,000	0.5	0.03	1,000	0.4
HUALAPAI VALLEY	0.06	4,000	0.7	0.07	4,000	0.7
LAKE HAVASU	0.03	0	0.5	0.02	0	0.3
LAKE MOHAVE	0.04	2,000	0.6	0.02	1,000	0.3
LOWER GILA	0.02	6,000	0.3	0.02	6,000	0.3
LOWER SAN PEDRO	0.18	15,000	1.3	0.26	23,000	1.6
MCMULLEN VALLEY	0.08	3,000	0.8	0.07	2,000	0.7
MEADVIEW	0.07	1,000	0.8	0.07	1,000	0.7
MORENCI	0.30	24,000	1.6	0.32	26,000	1.6
PARKER	0.02	2,000	0.4	0.01	1,000	0.2
PEACH SPRINGS	0.10	8,000	1.0	0.13	10,000	1.1
PHOENIX AMA	0.06	18,000	0.7	0.08	23,000	0.8
PINAL AMA	0.05	11,000	0.6	0.07	16,000	0.8
PRESCOTT AMA	0.20	5,000	1.4	0.26	7,000	1.6
RANEGRAS PLAIN	0.03	2,000	0.5	0.02	1,000	0.3
SACRAMENTO VALLEY	0.06	5,000	0.7	0.07	6,000	0.7
SAFFORD	0.14	35,000	1.1	0.18	46,000	1.3
SALT RIVER	0.32	88,000	1.7	0.39	109,000	1.8
SAN BERNARDINO VALLEY	0.12	2,000	1.0	0.19	4,000	1.3
SAN RAFAEL	0.34	4,000	2.0	0.39	5,000	2.1
SAN SIMON WASH	0.09	11,000	0.9	0.10	12,000	0.9
SANTA CRUZ AMA	0.25	10,000	1.6	0.31	12,000	1.7
TIGER WASH	0.08	0	0.8	0.05	0	0.6
TONTO CREEK	0.31	16,000	1.7	0.42	22,000	1.9
TUCSON AMA	0.15	32,000	1.2	0.20	41,000	1.4
UPPER HASSAYAMPA	0.18	8,000	1.3	0.24	10,000	1.5
UPPER SAN PEDRO	0.17	16,000	1.2	0.21	20,000	1.4
VERDE RIVER	0.25	76,000	1.5	0.31	93,000	1.7
WESTERN MEXICAN DRAINAGE	0.02	1,000	0.3	0.03	1,000	0.4
WILLCOX	0.17	17,000	1.2	0.21	21,000	1.4
YUMA	0.00	0	0.1	0.00	0	0.0

Inflows: Basin to Basin Underflow

<1,000 AF from Butler Valley

<1,000 AF exiting to the north

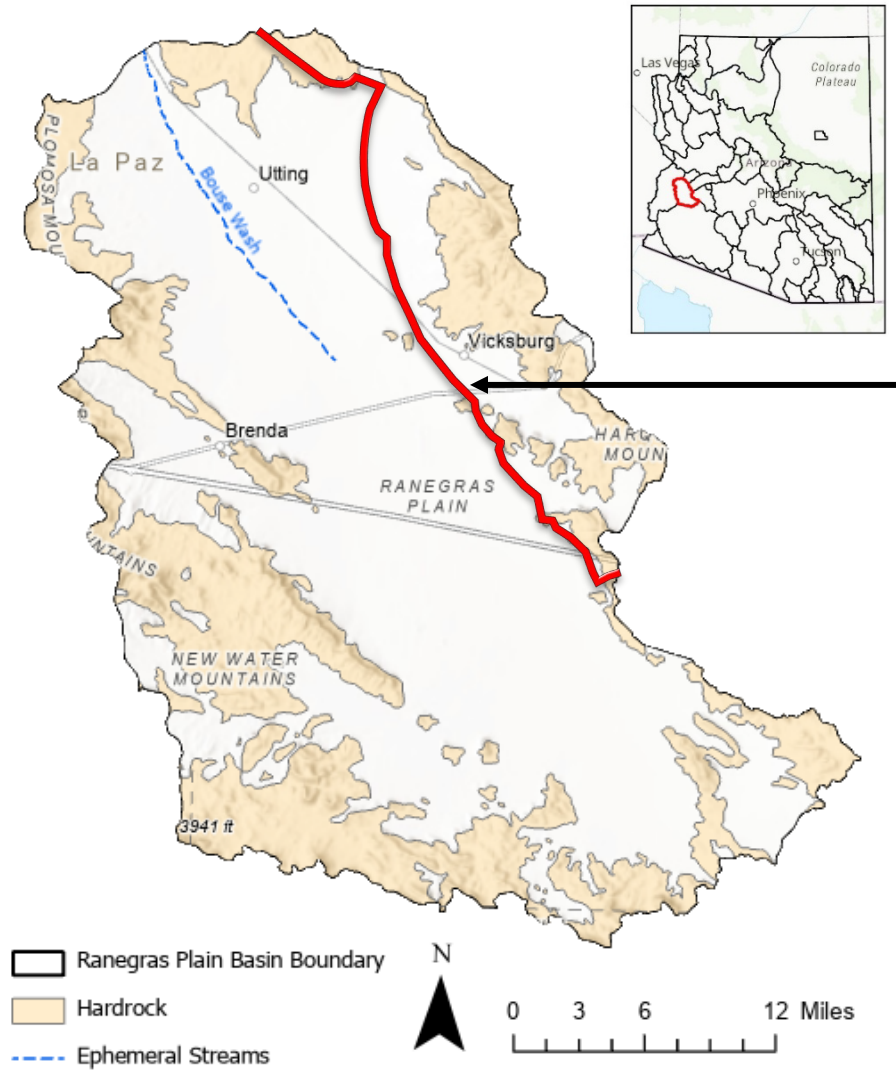


Freethey and Anderson, 1986

Predevelopment hydrologic conditions of alluvial basins in Arizona and adjacent parts of California and New Mexico

https://pubs.usgs.gov/publication/ha664

Inflows: CAP Canal Leakage



CAP Canal Leakage of ~2,500 AFY

Quinn et al., A Groundwater Model to Assess Water Resources at the Brenda Solar Energy Zone, Argonne National Laboratory, 2013 (https://blmsolar.anl.gov/solar-peis/sez/az/brenda/downloads/Brenda-Groundwater-Report.pdf)

Outflows: Pumping

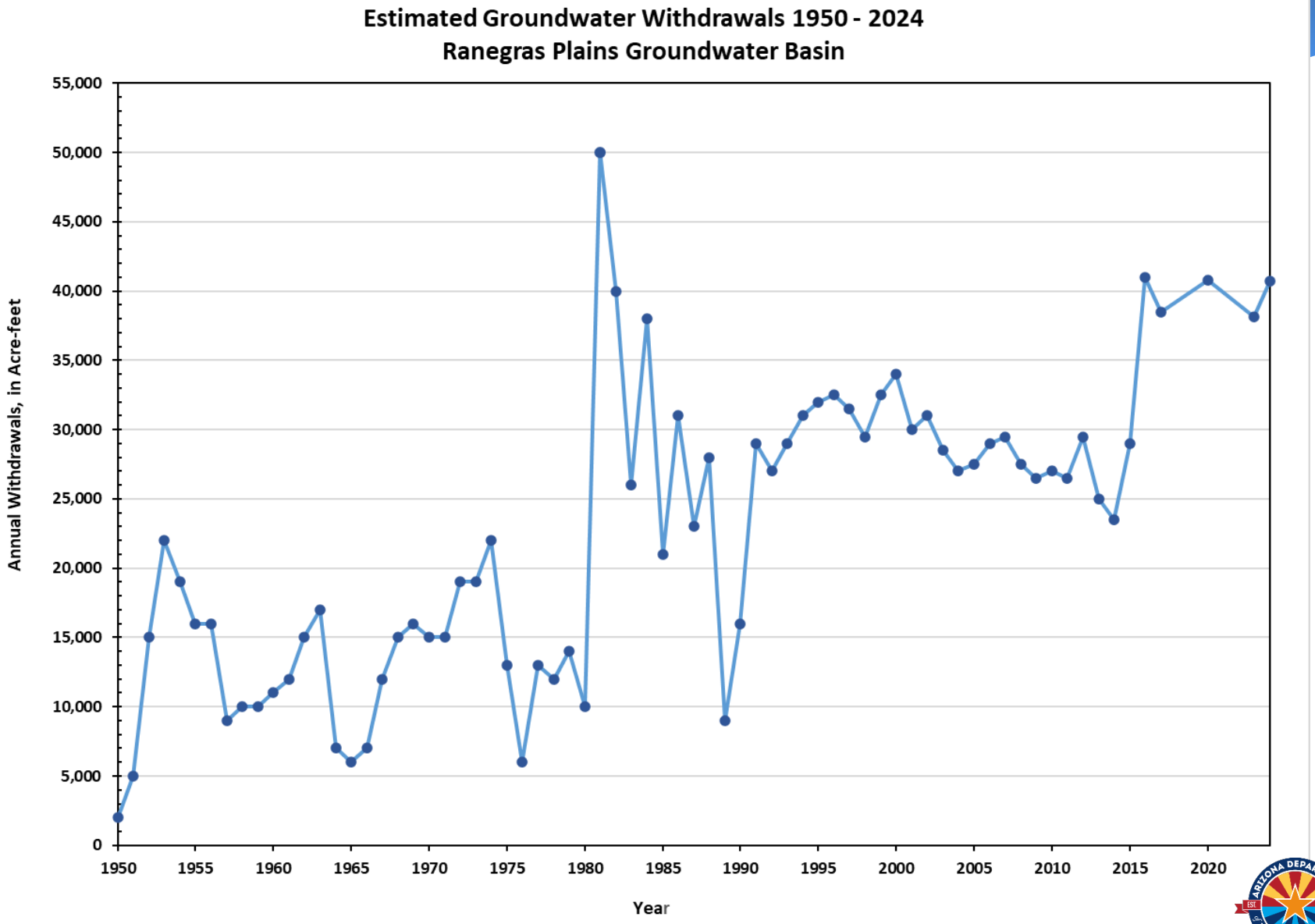
USGS Field Crop Verification Surveys

Ag pumping of 40,000 AF per year since 2016

Some Agricultural Flow

Additional Industrial Pumping ~1,600 AFY

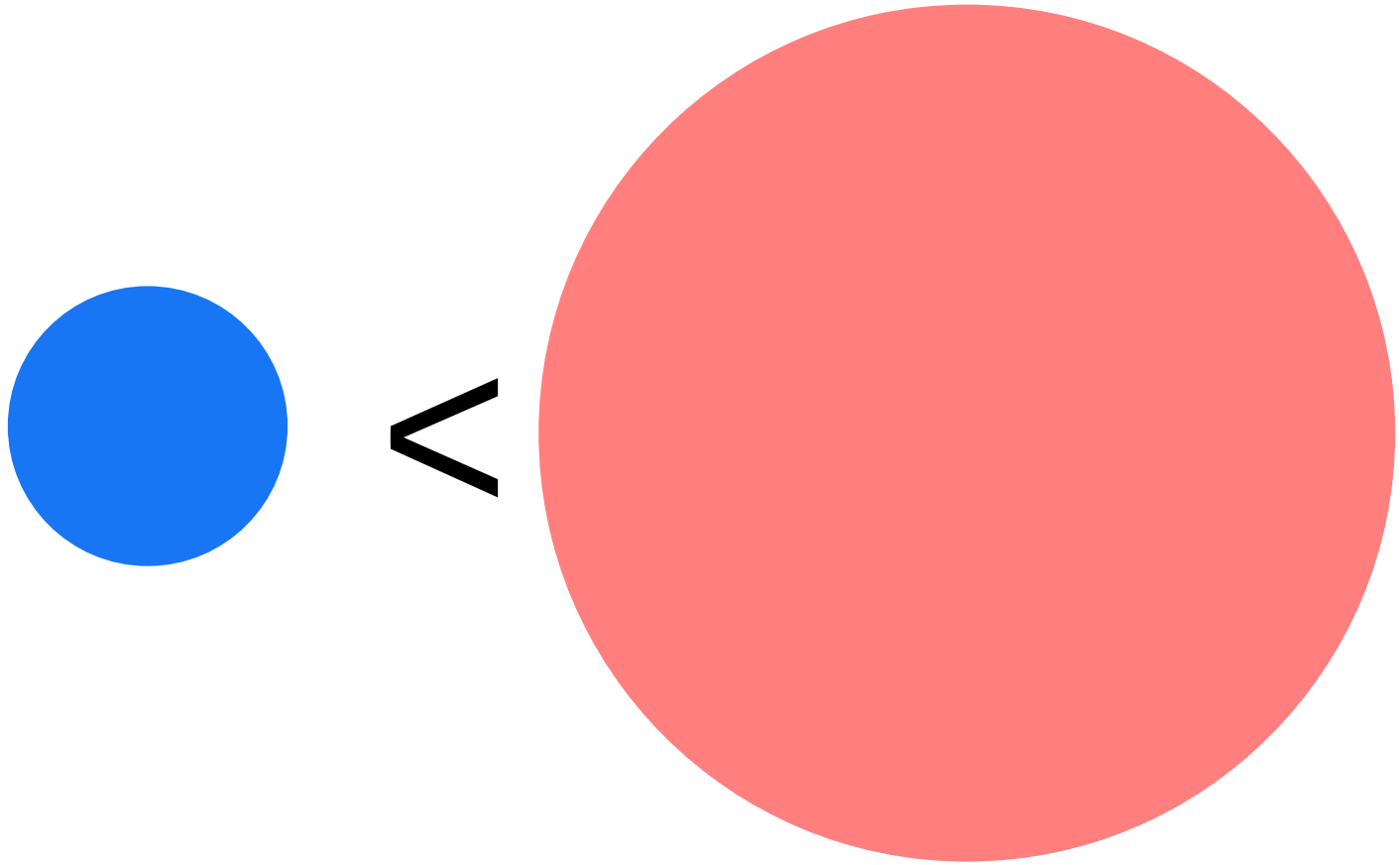
Domestic Pumping



Water Budget Imbalance

Inflows:
~4,500 AFY

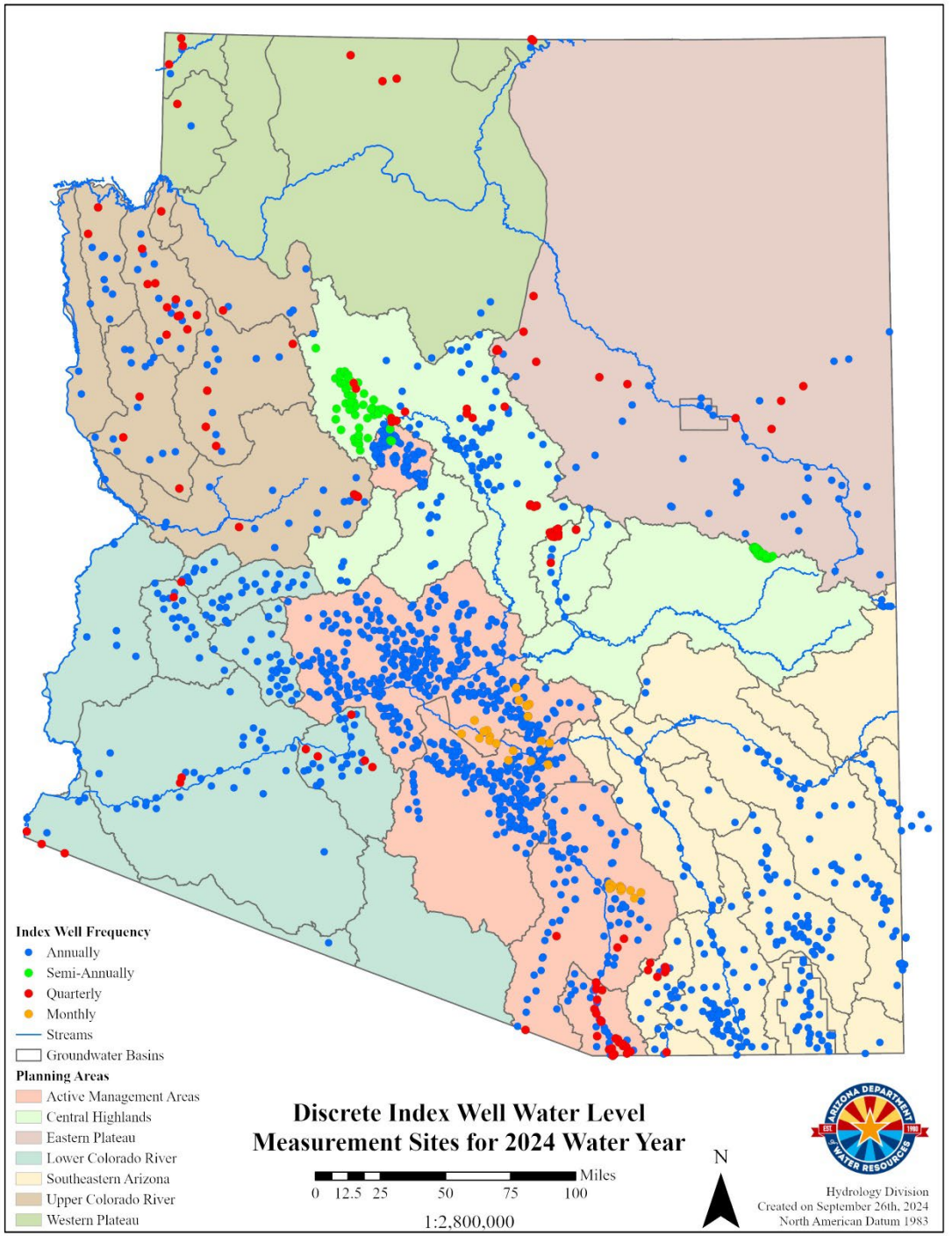
Outflows:
~42,000+ AFY



ADWR Index Wells

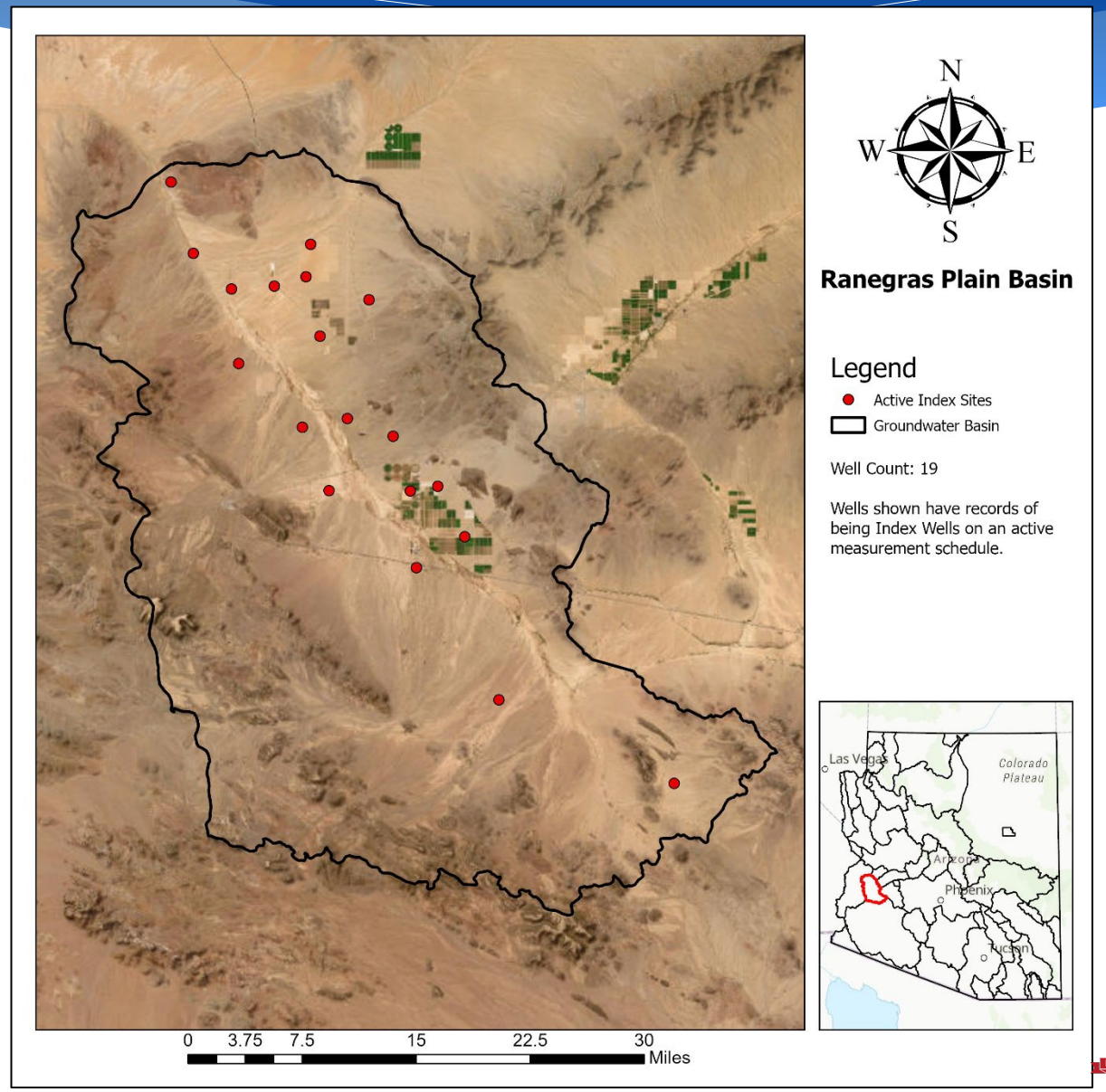
- Over 1,700 wells across the state.
- Water levels are collected annually, semi-annually, and quarterly.
- All water level measurements are updated on the Groundwater Site Inventory (GWSI) Interactive web map.

https://azwatermaps.azwater.gov/gwsiweb/



Existing Data of the Ranegras Plain Basin

- **19 active index wells**
  - 1 measured automatically (transducer)
  - 18 measured annually
- **Basin sweeps**
  - 1988, 1993, 1998, 2004, 2016
  - 2,362 water level measurements
- **Discharge data**
  - 39 pumping discharge rate measurements
  - 23 specific capacity values (gpm/ft)
- **Land subsidence measurements**
- **No active USGS streamflow gages**

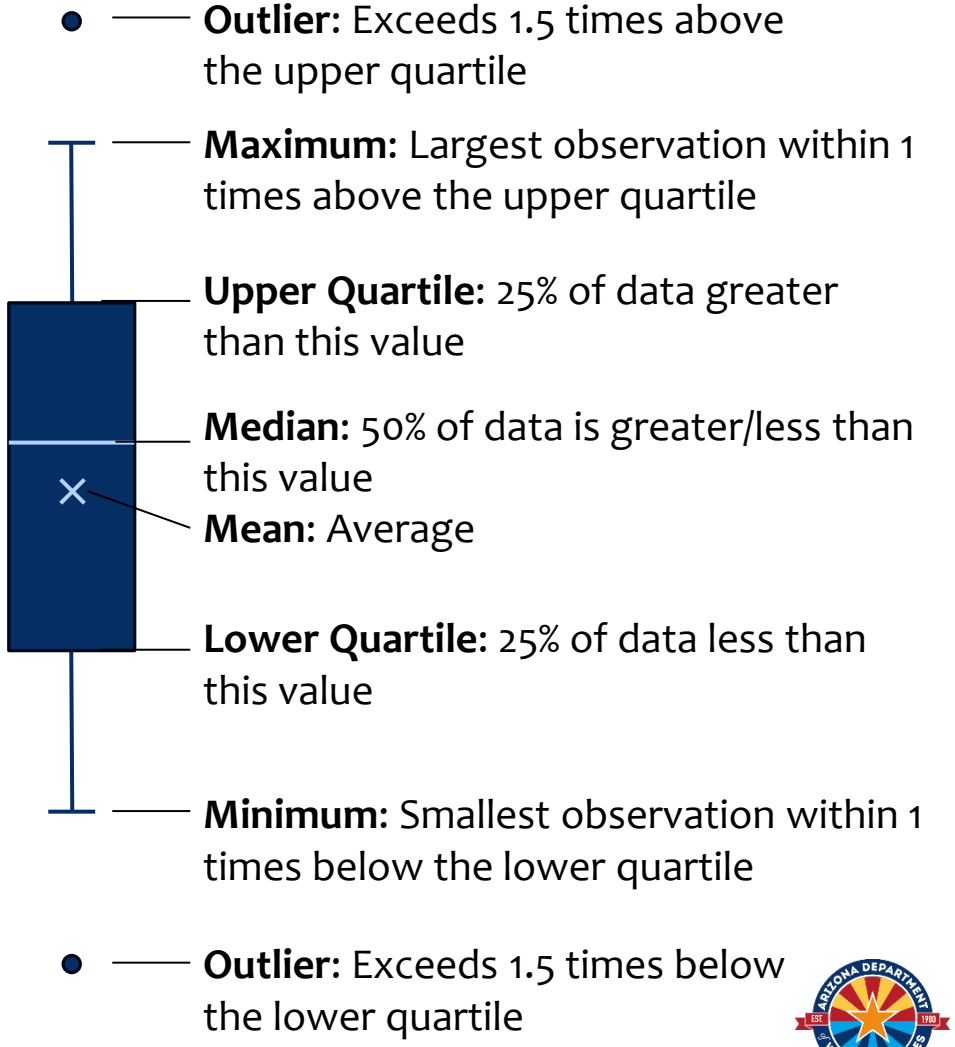


Box and Whisker Plot Explanation

- Open File Report No. 20

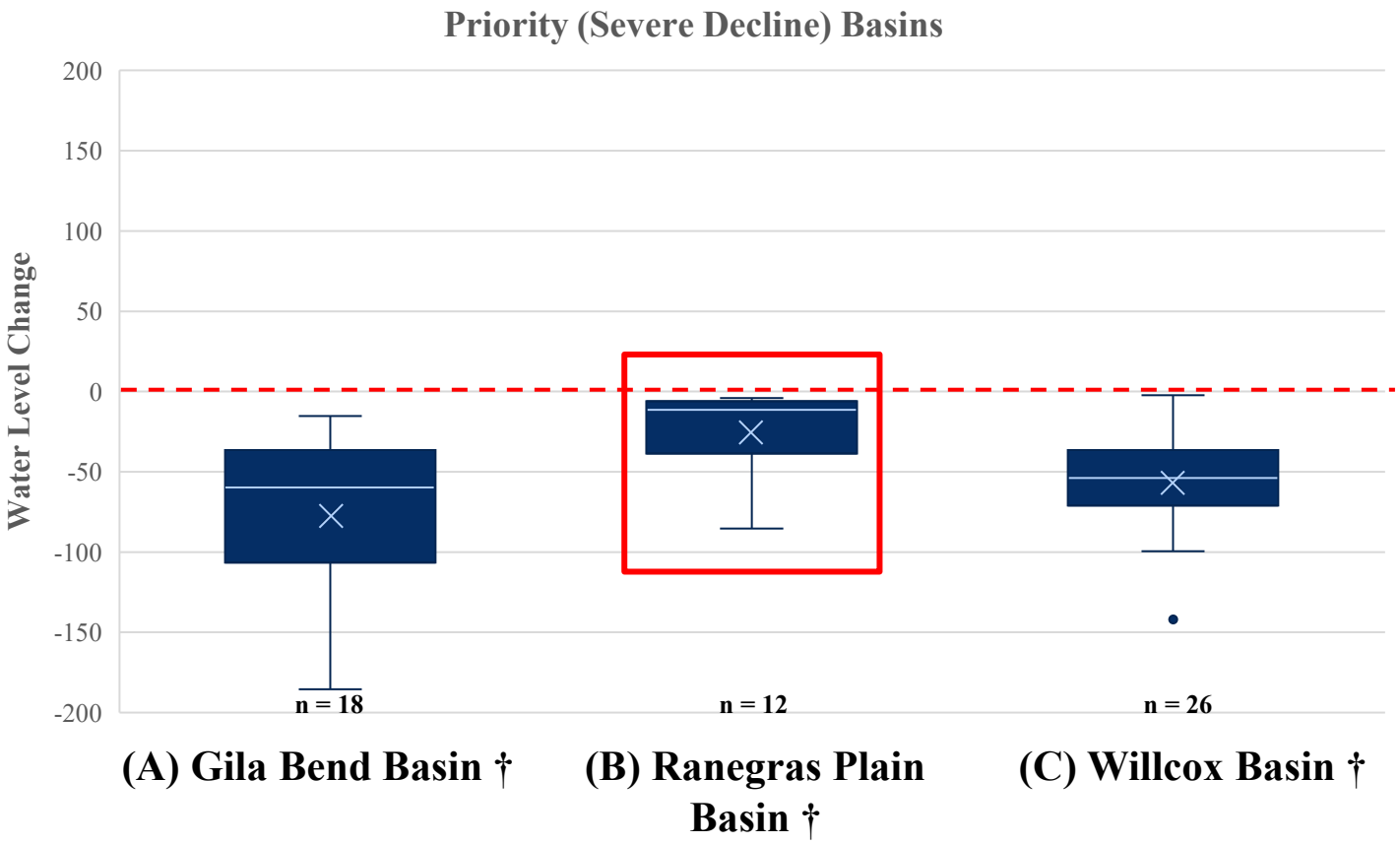
(https://www.azwater.gov/hydrology/e-library/adwr-open-file-report-number-20)

  - Statewide Groundwater Level Changes
  - Published in April 2023
  - ***Table 6:*** *Groundwater level change statistics and counts of wells with declines, rises, or no water level change in Arizona by sub-basin – Water Years 2000 and 2020*
- Box and Whisker Plots
  - 1 per basin
  - All plotted on the same scale for comparison
  - Mapped subsidence features

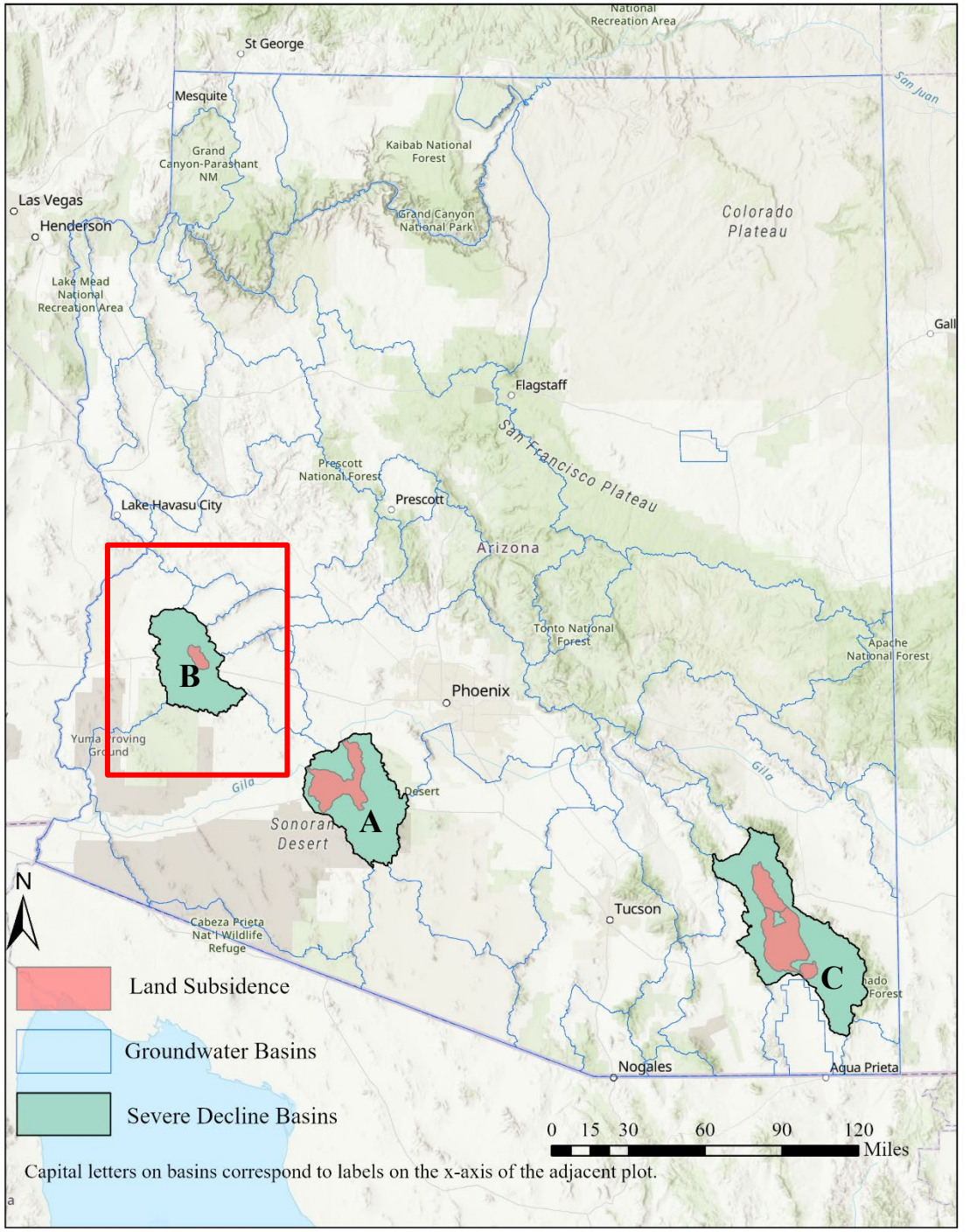


*Presented in the Governor's Water Policy Council Rural Groundwater Committee meeting on August 17, 2023

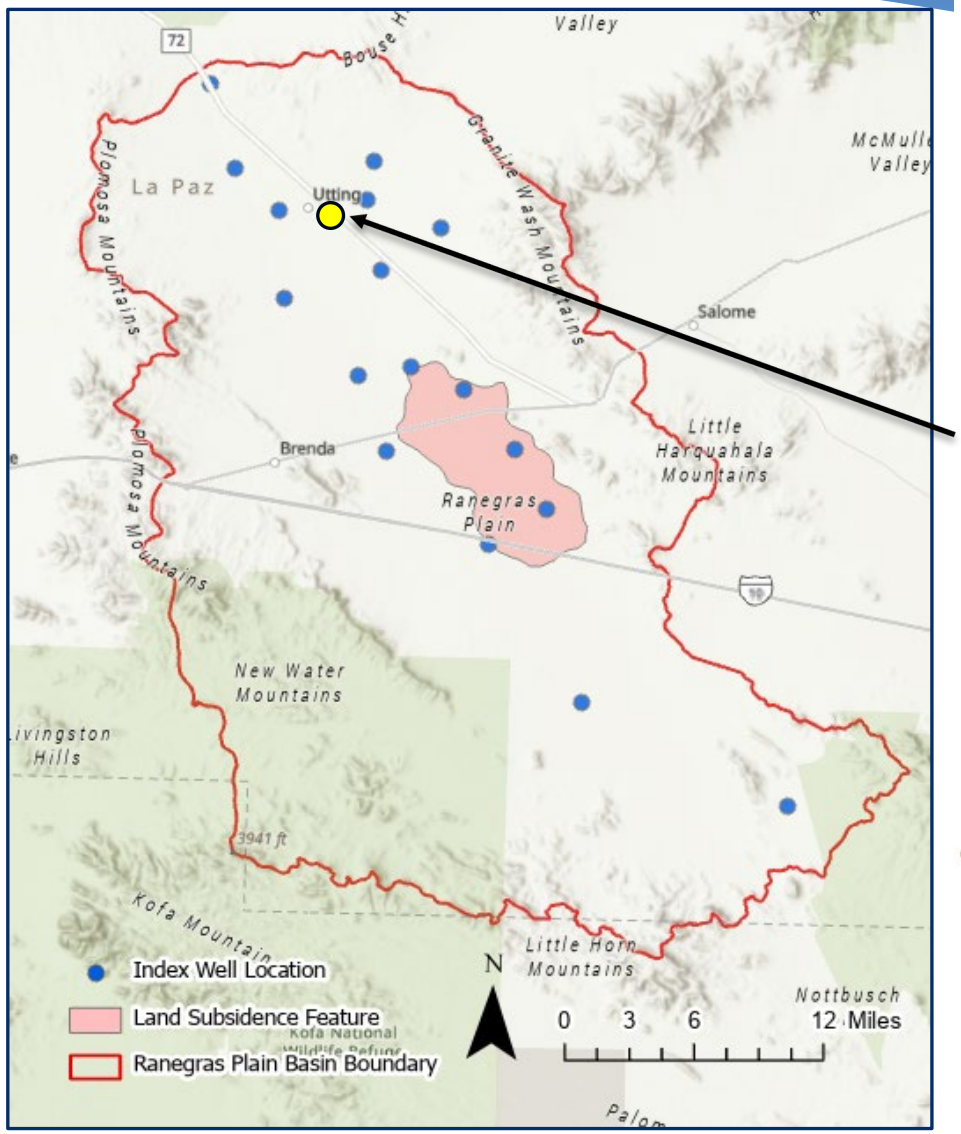
Priority (Severe Decline) Basins

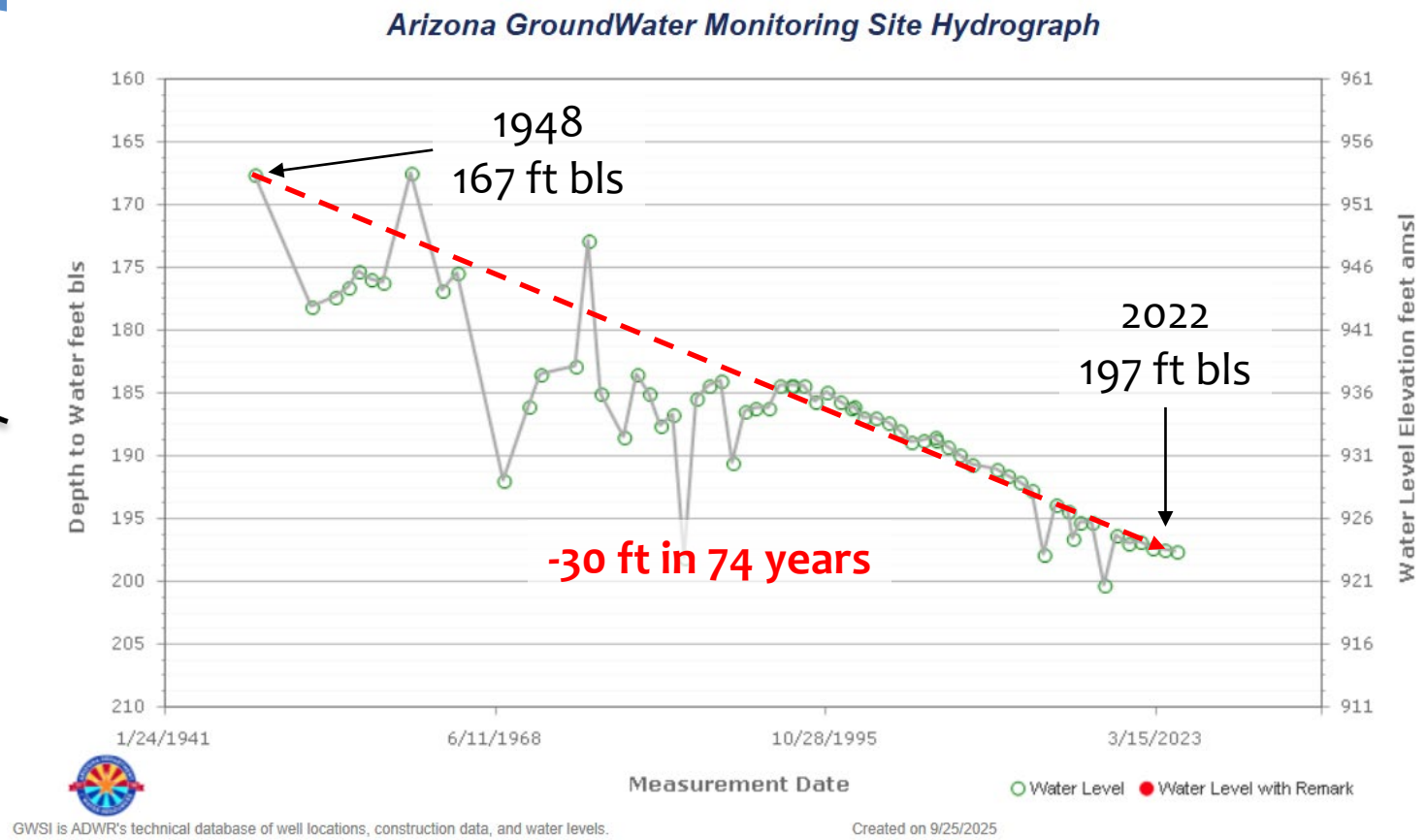


† Basin with subsidence



GWSI Well Hydrograph

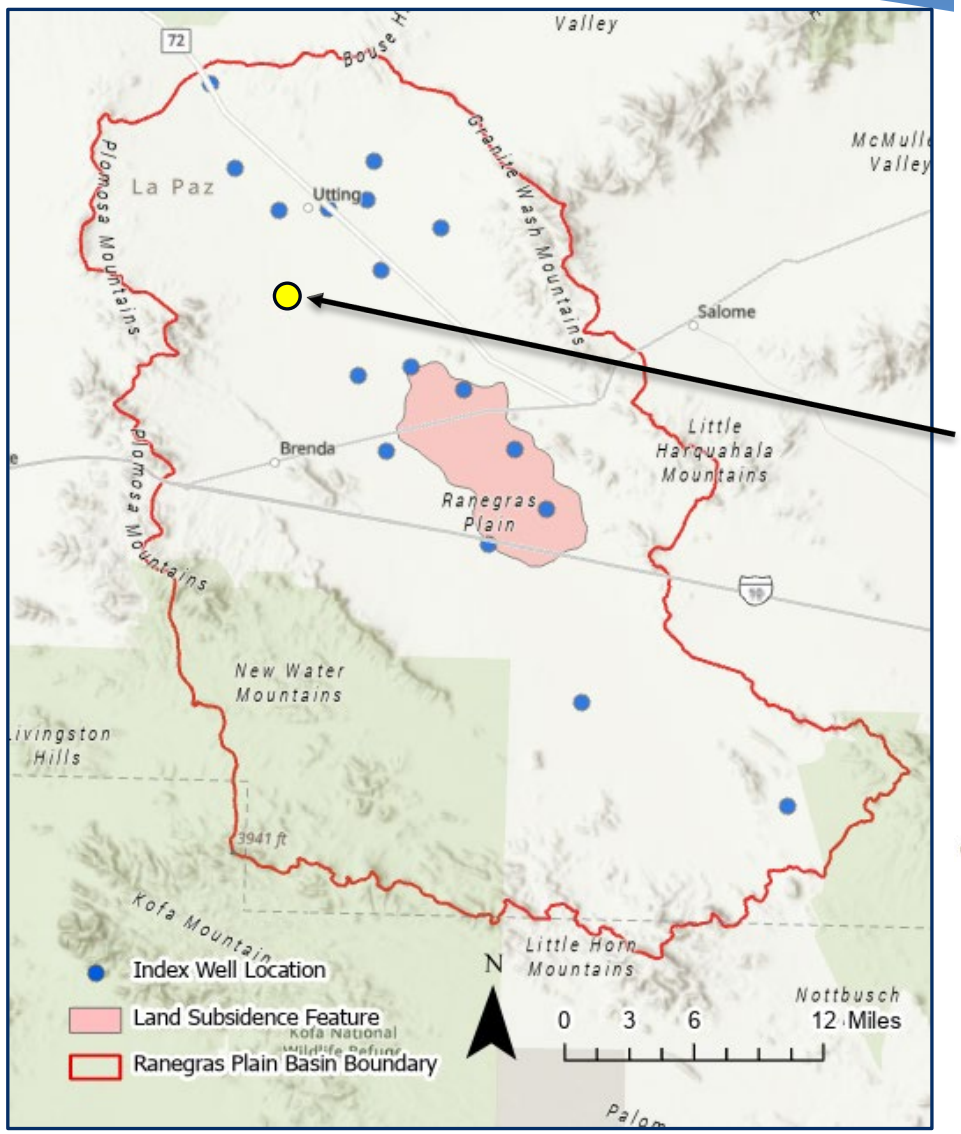


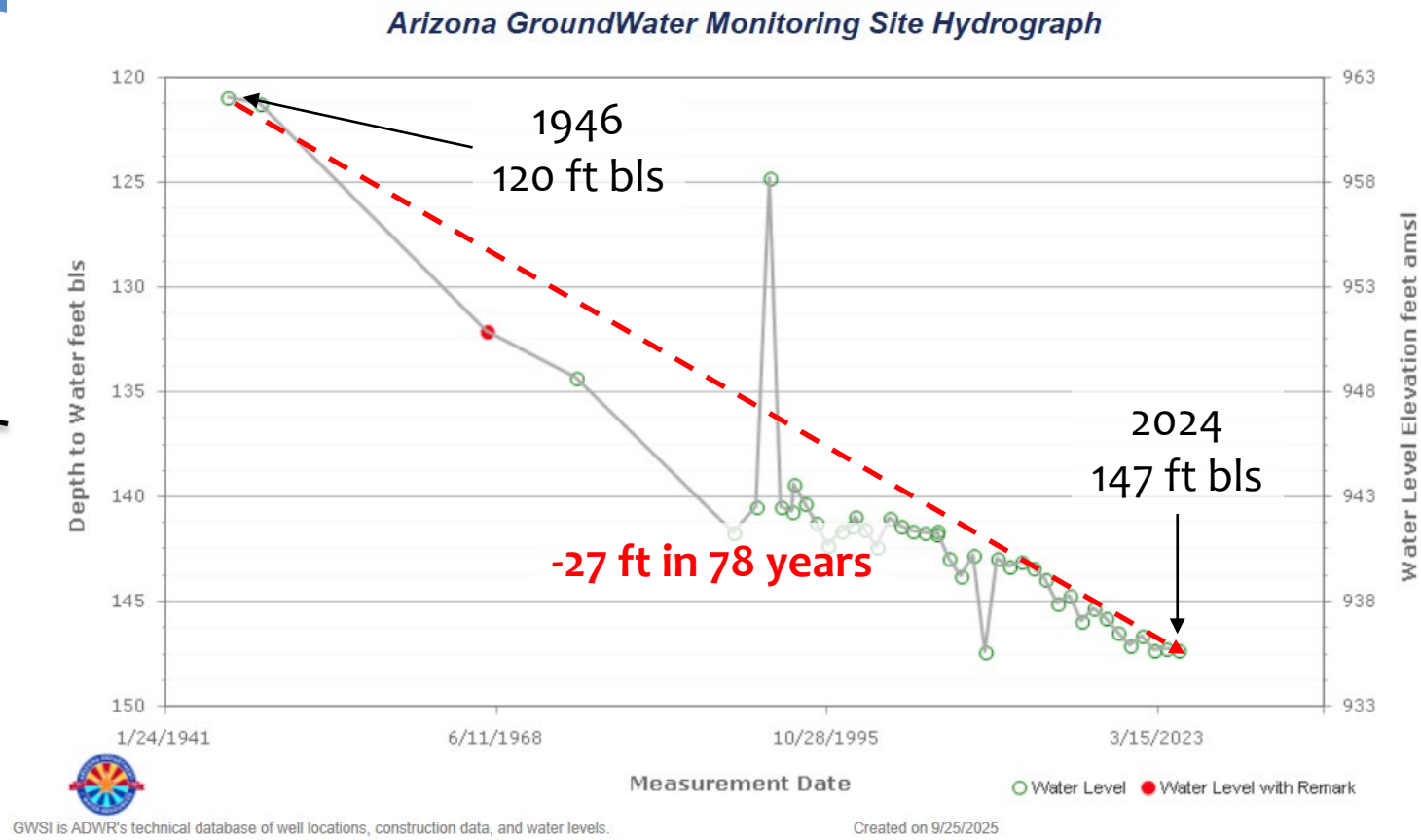


GWSI Site ID: 335102113541301

https://azwatermaps.azwater.gov/gwsiweb/?data_id=dataSource_12-GWSI_Layers_2453%3A945678

GWSI Well Hydrograph





GWSI Site ID: 334722113562001

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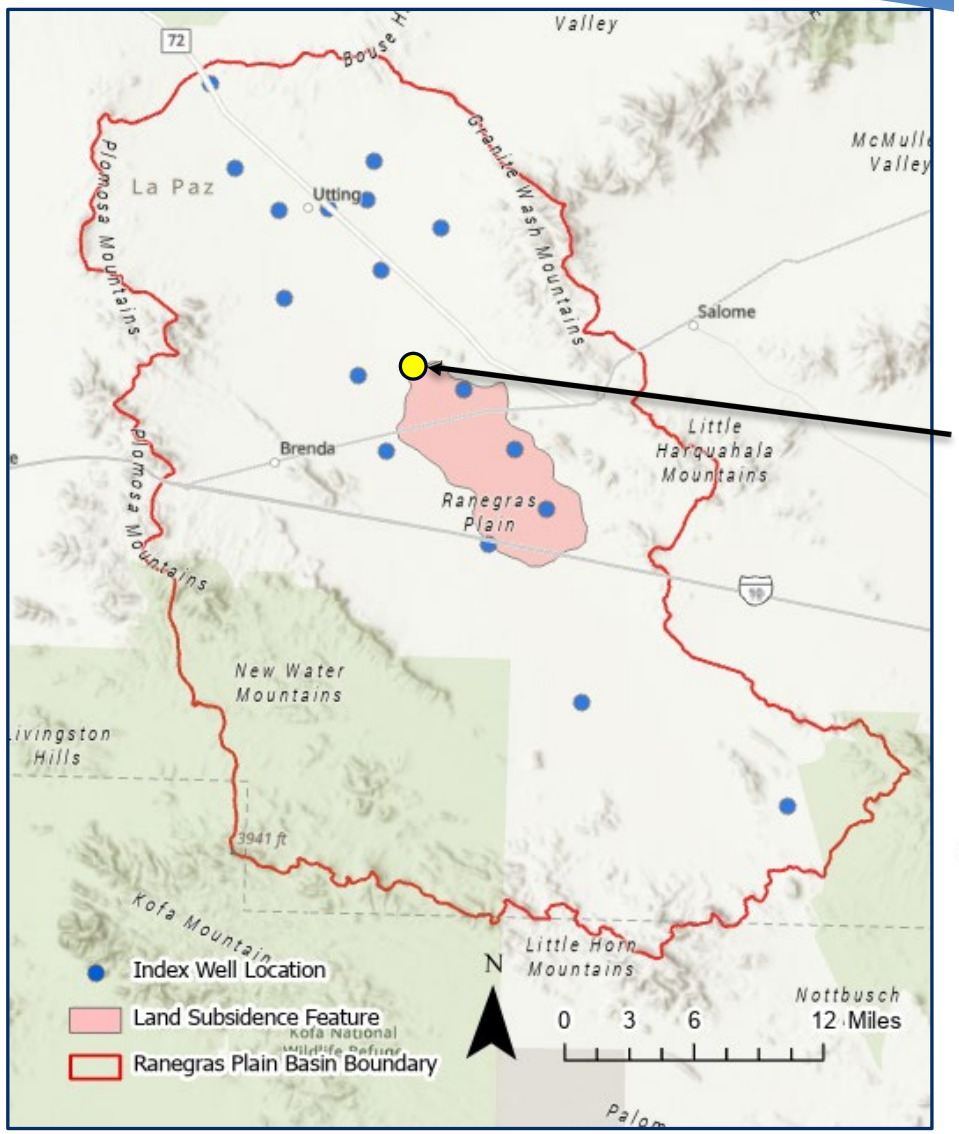
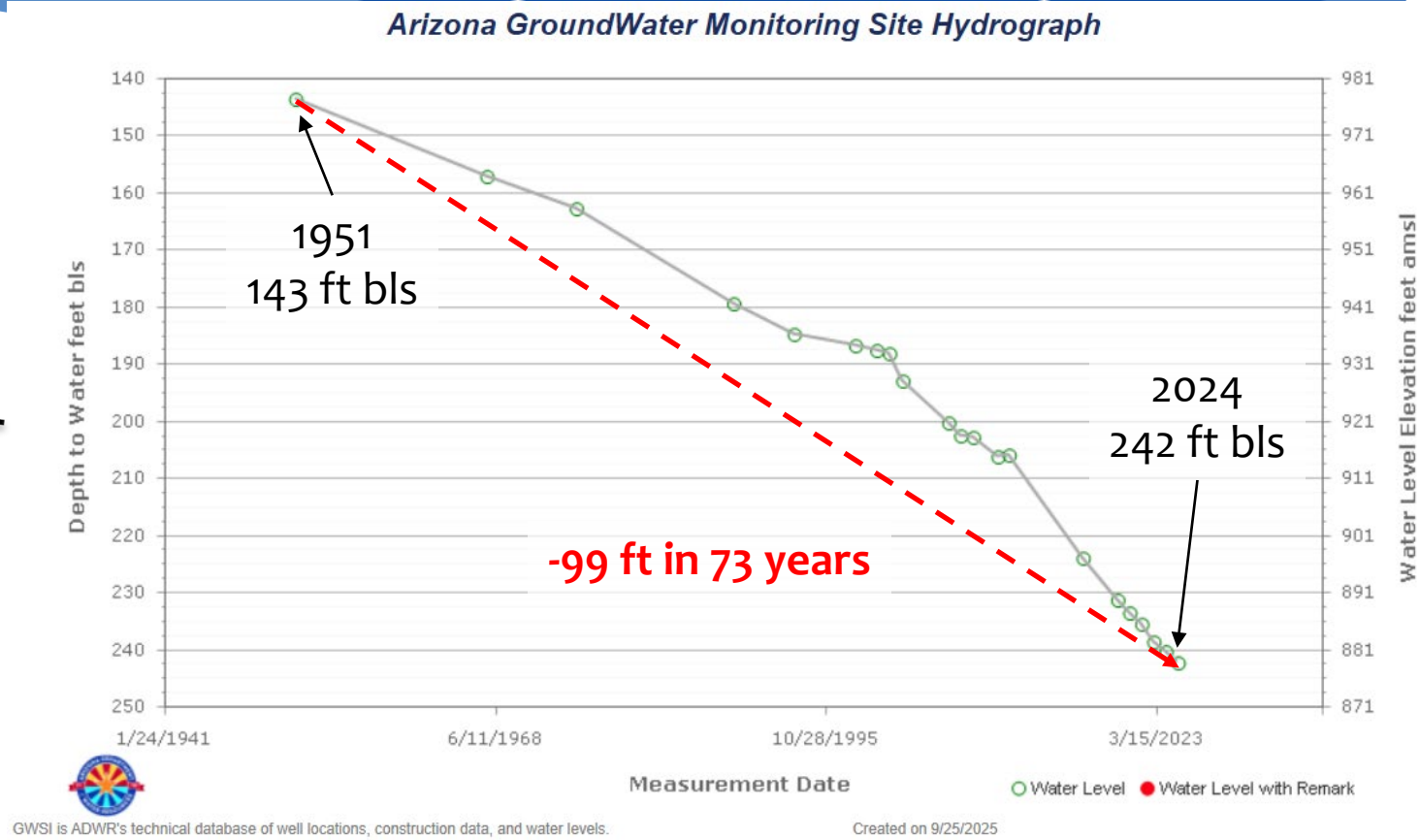
GWSI Well Hydrograph





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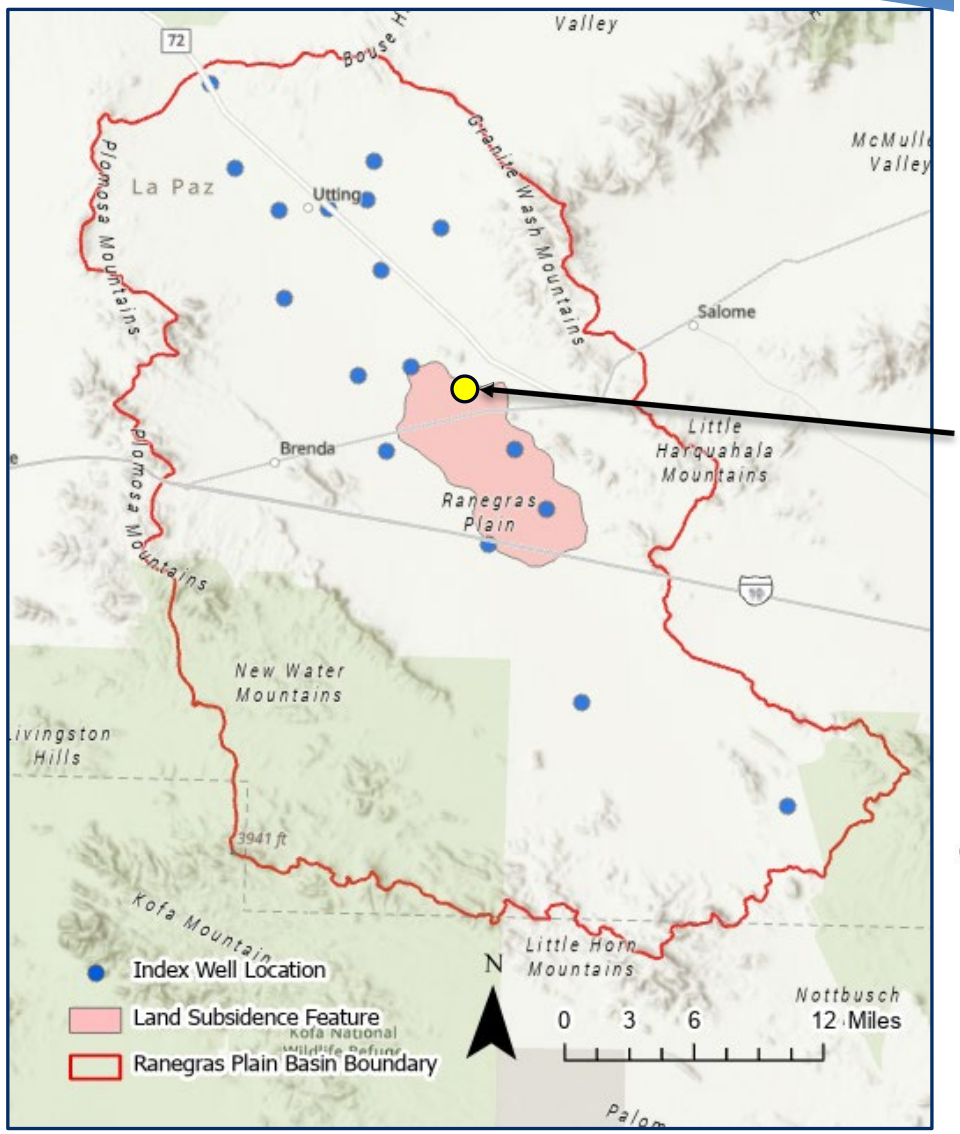
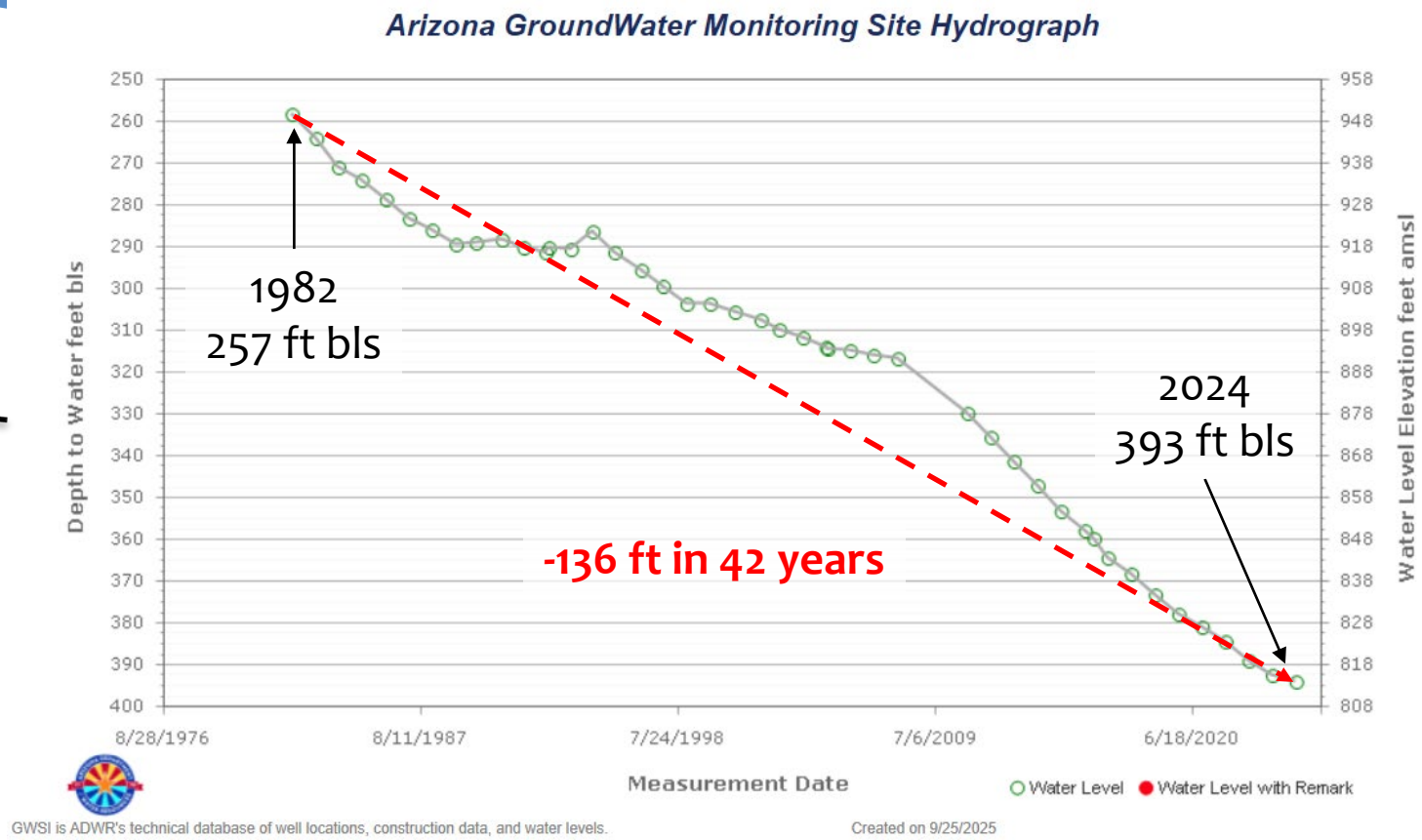
GWSI Well Hydrograph





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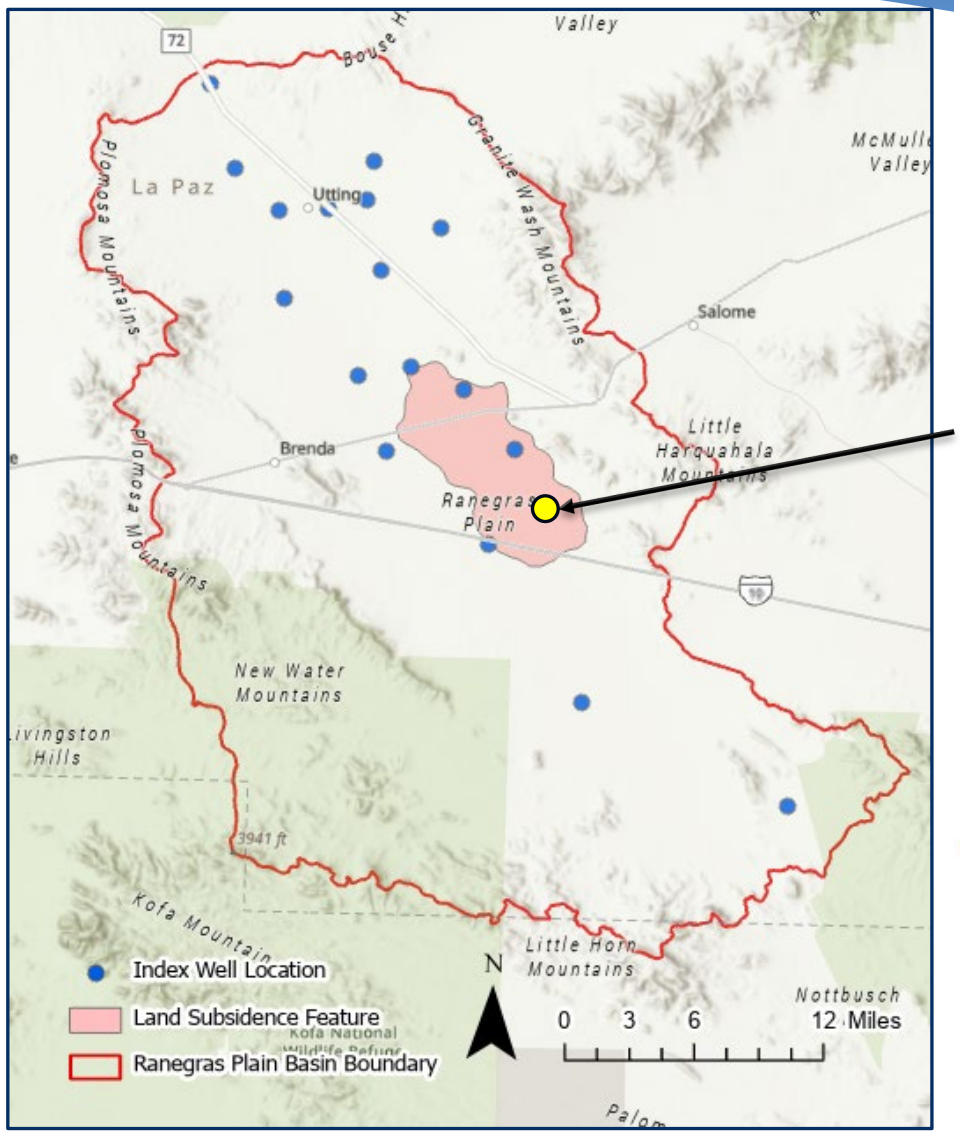
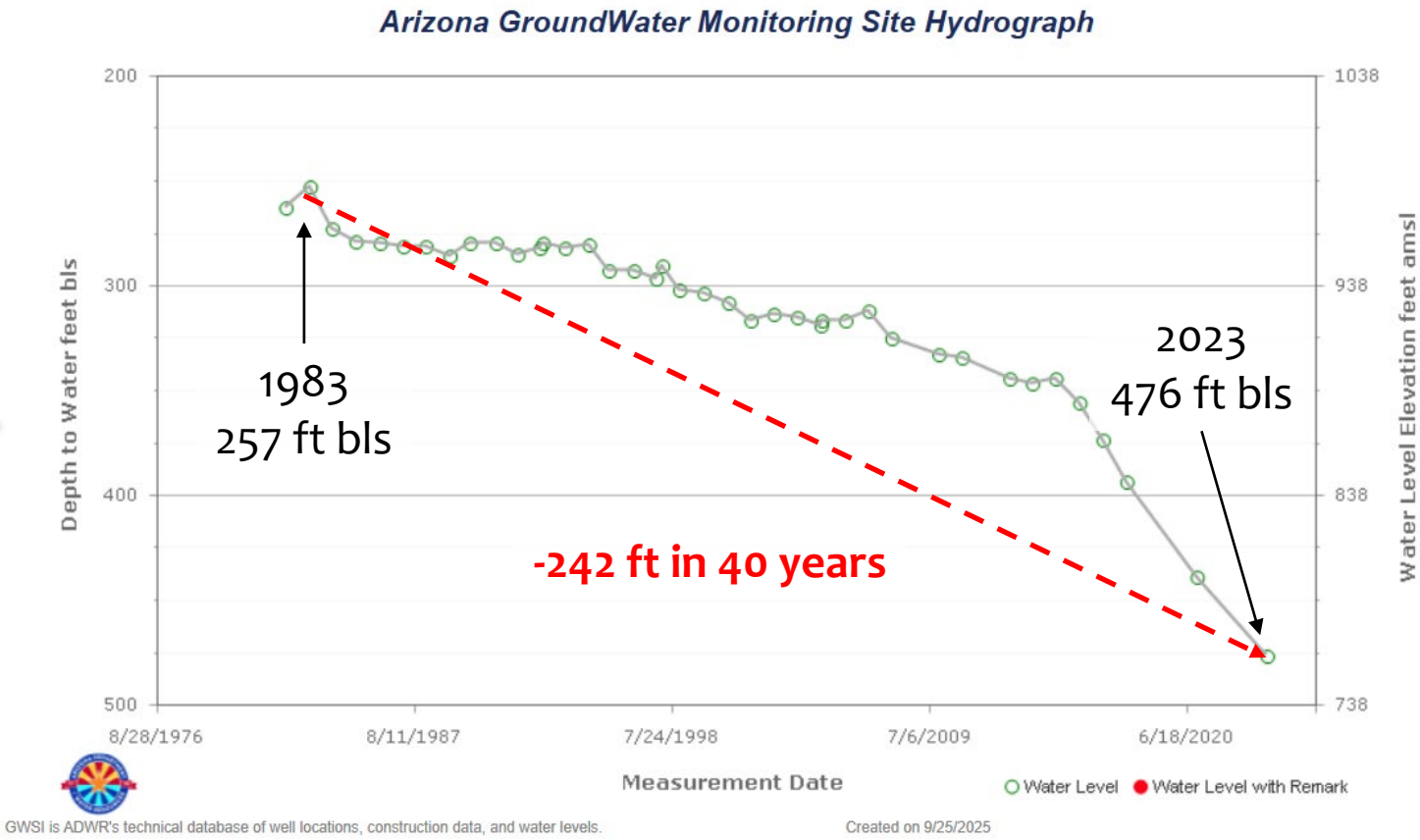
GWSI Well Hydrograph





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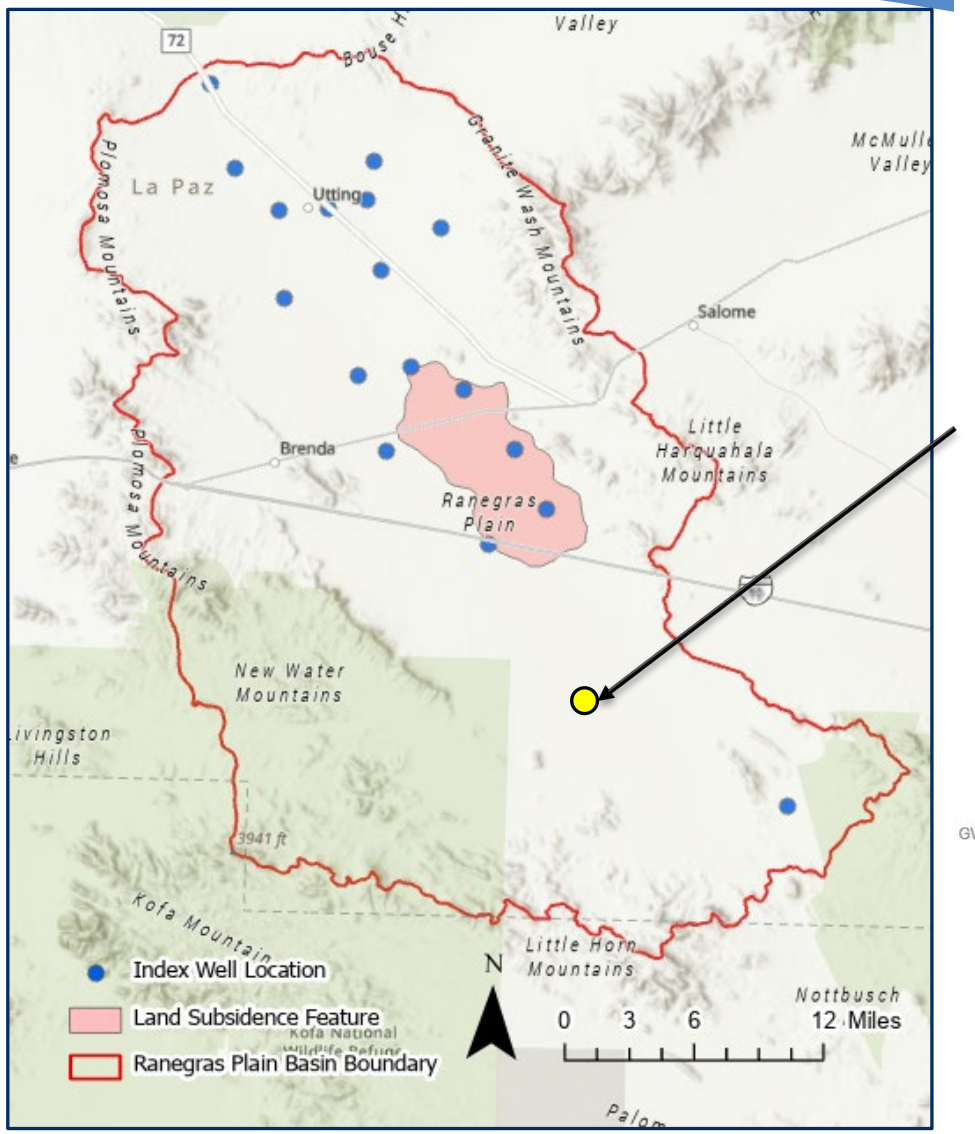
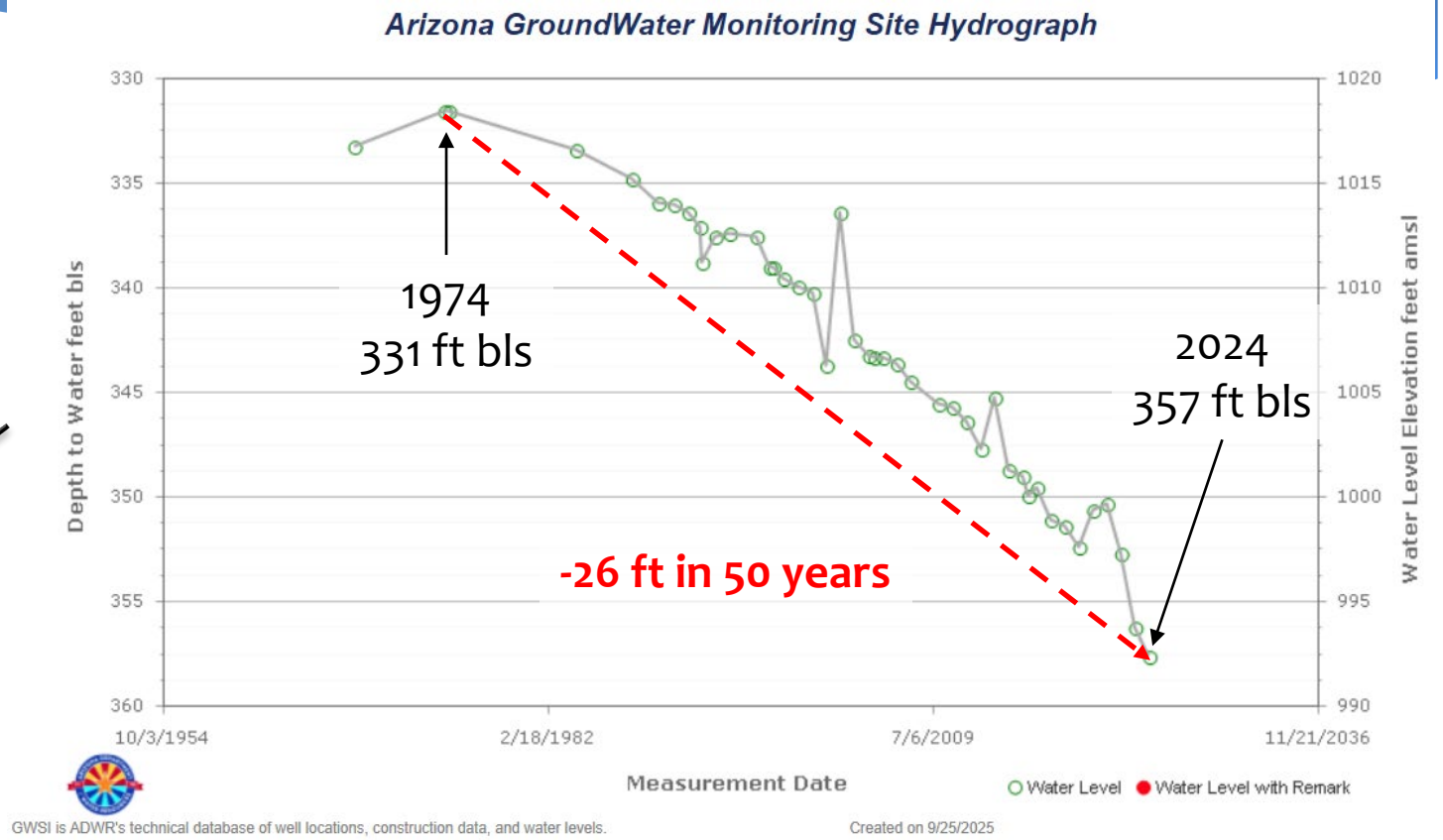
GWSI Well Hydrograph





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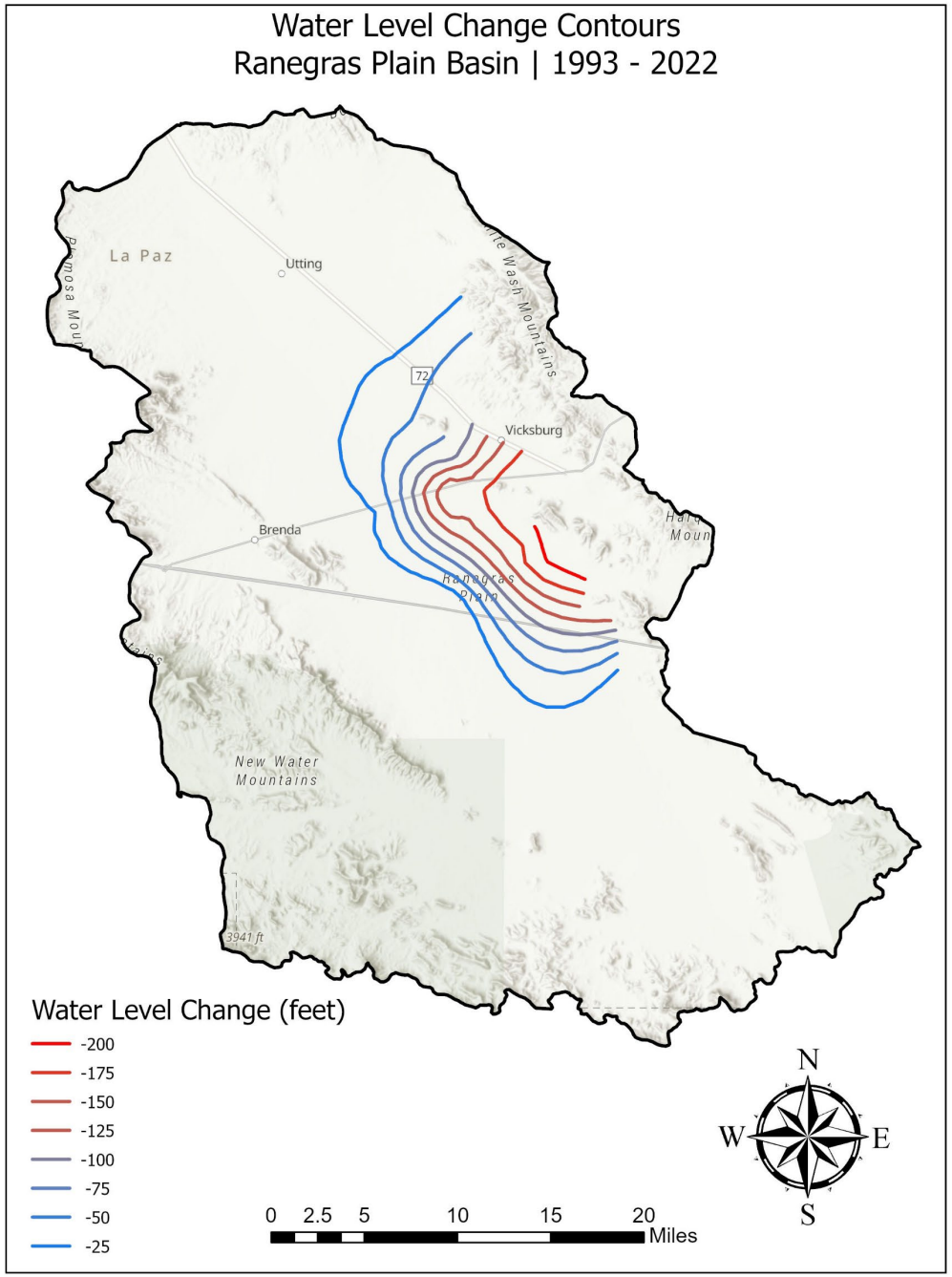
https://azwatermaps.azwater.gov/gwsiweb/?data_id=dataSource_12-GWSI_Layers_2453%3A945678

Water Level Change Contour Map

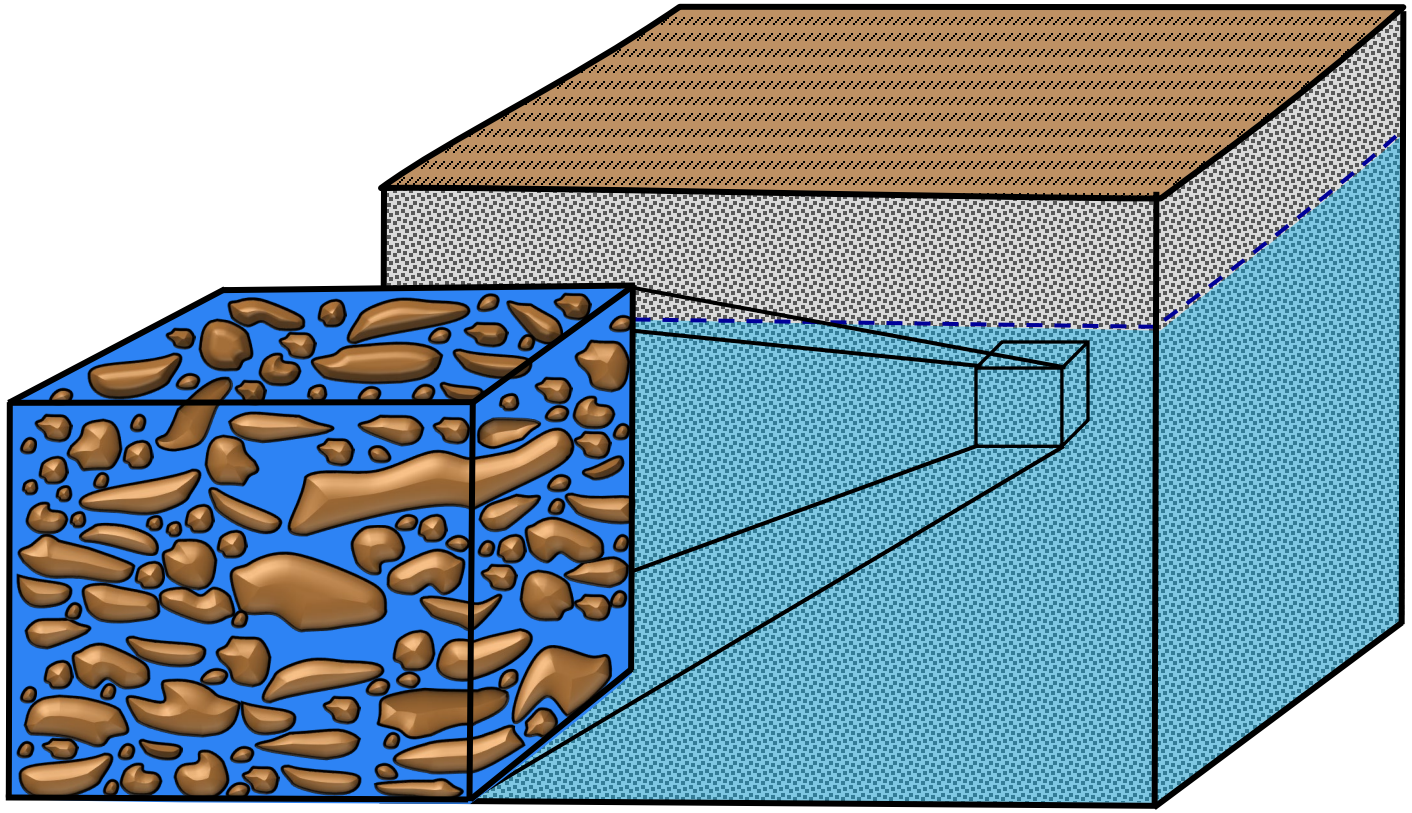


- Contour lines represent the change in water level from 1993 to 2022
- Data used to contour are from Basin Sweeps
- Water level changes greater than 175 feet in areas

Land Subsidence

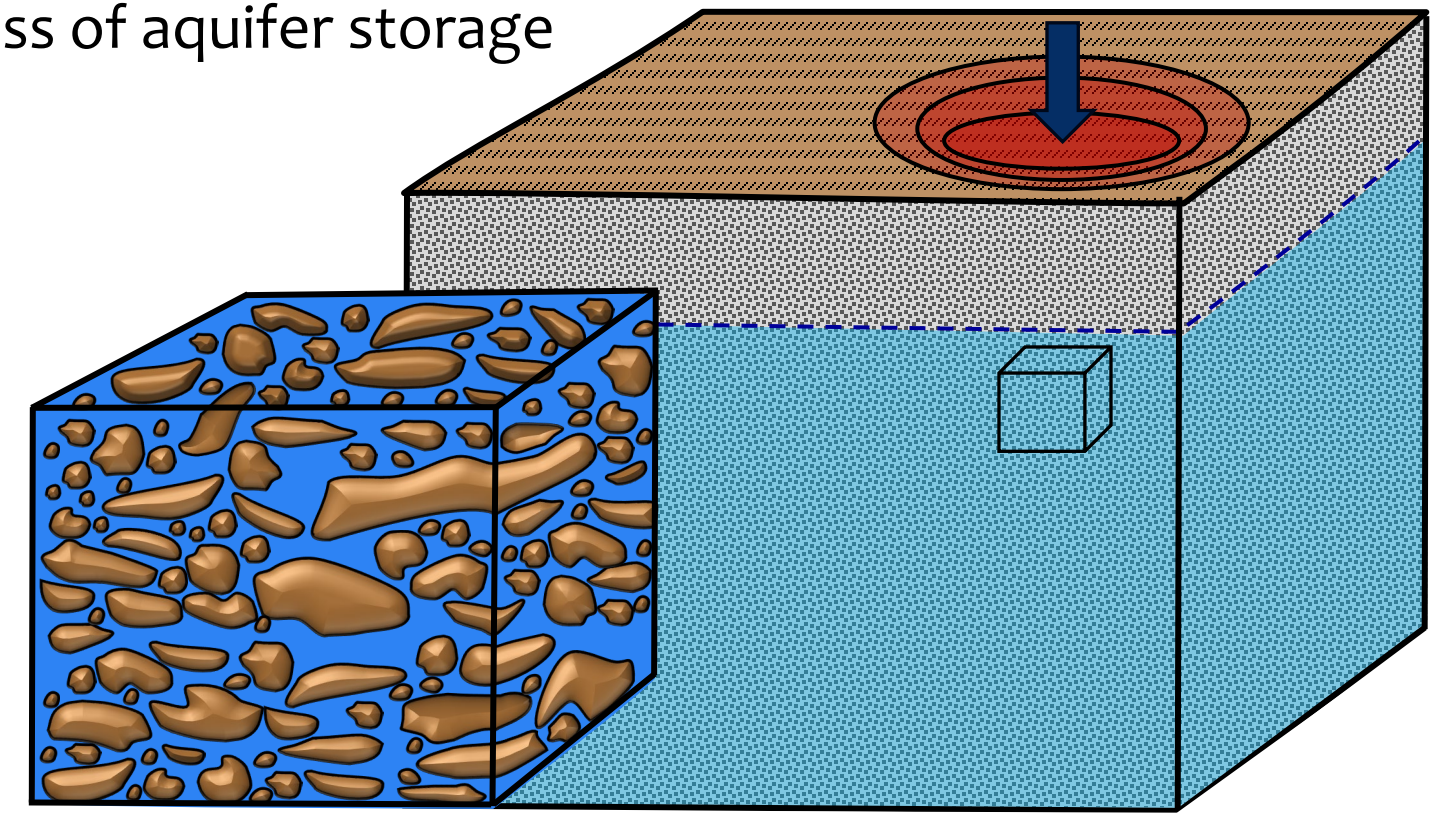
Land Subsidence

- Lowering of the land surface elevation due to aquifer depletion



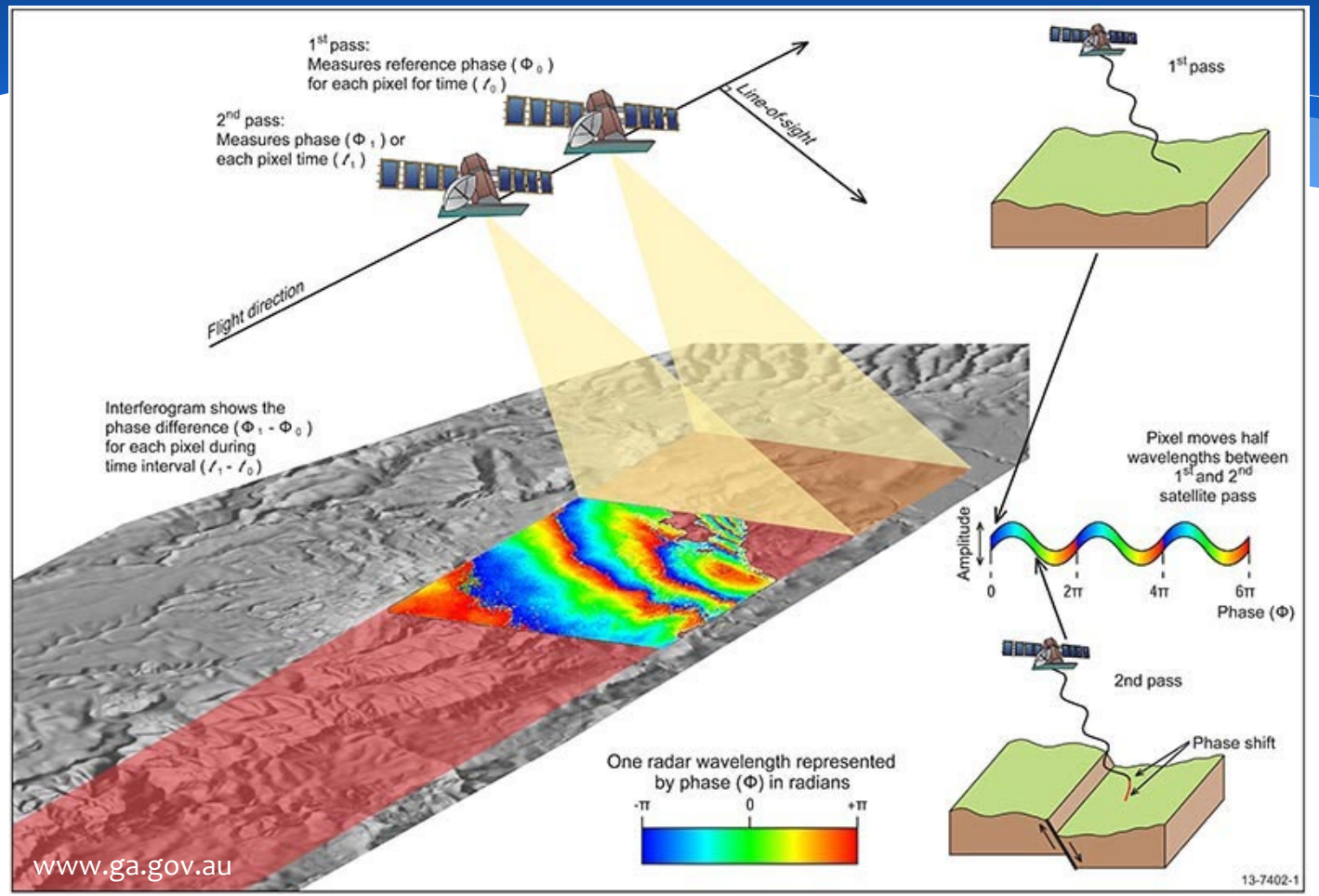
Land Subsidence

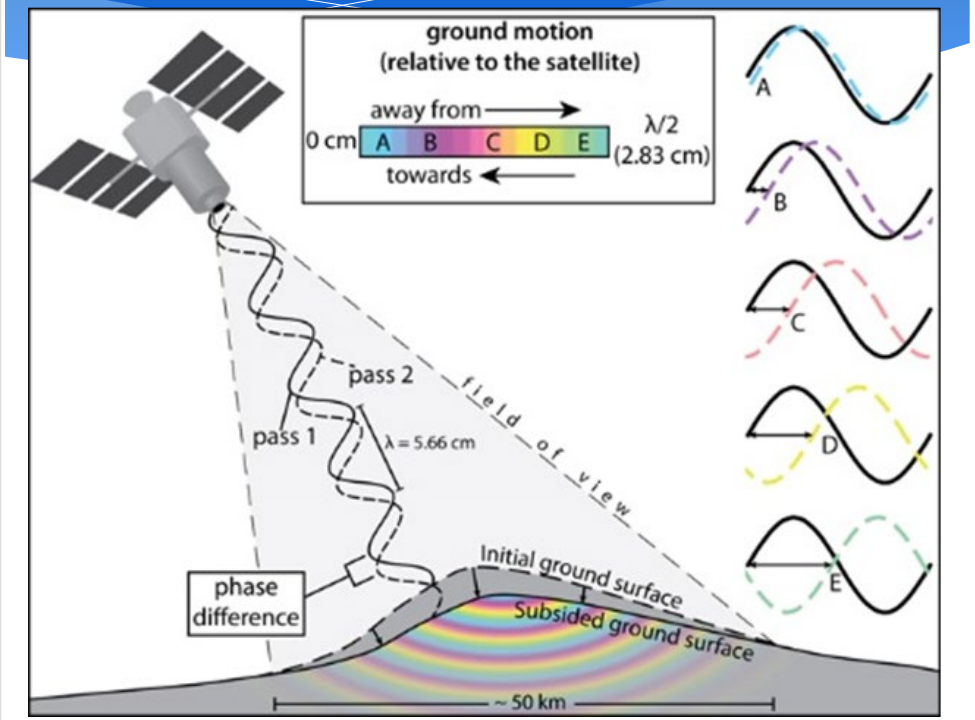
- Inelastic compression of aquifer materials
- Recharging the aquifer **will not** reverse the compression
- Permanent loss of aquifer storage



InSAR Data Used to Measure Subsidence

InSAR – Interferometric Synthetic Aperture Radar

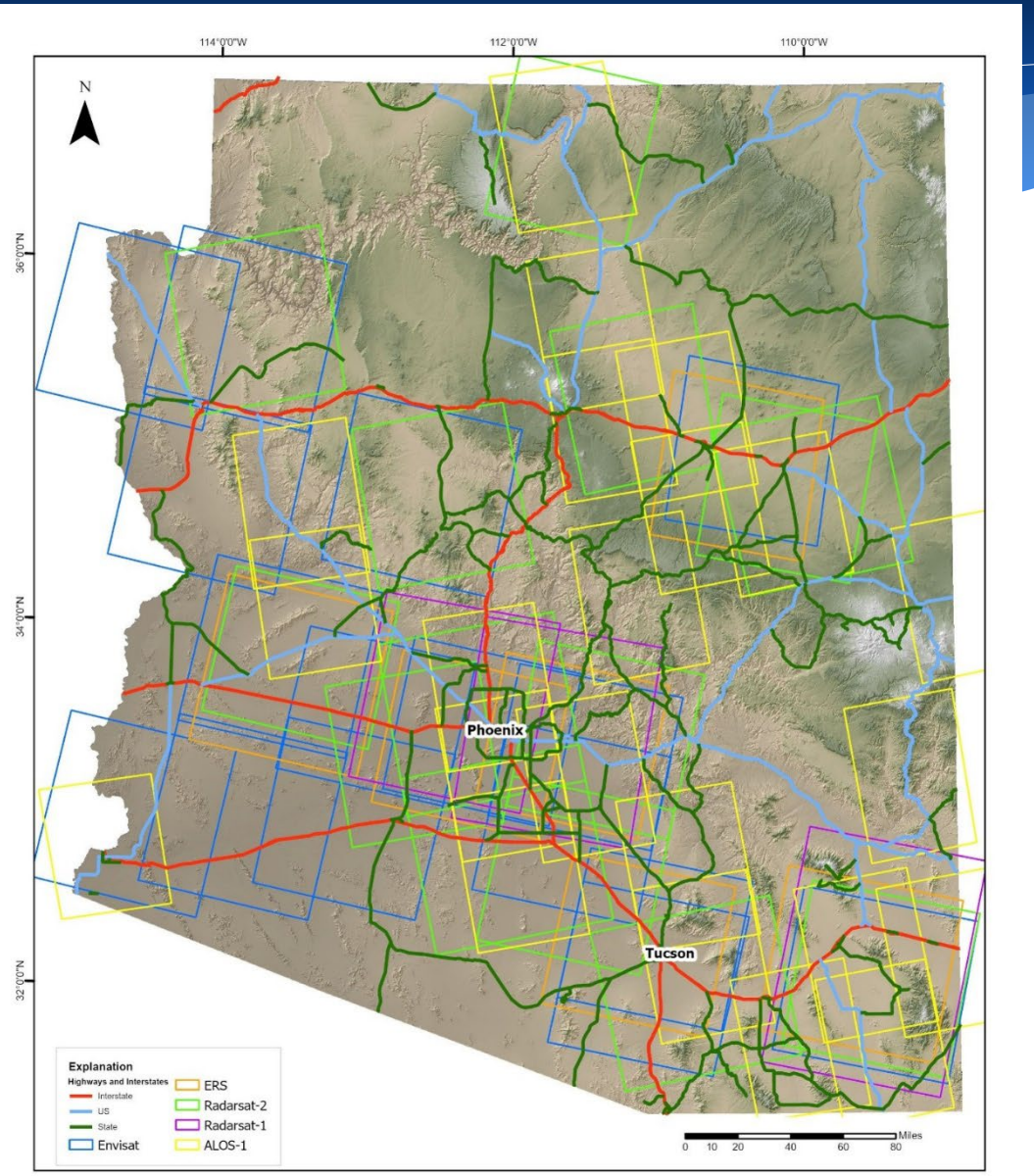




Two SAR images of the same area are acquired at different times. If the surface moves between the two acquisitions a phase shift is recorded. An interferogram maps this phase shift spatially.

ADWR InSAR Program

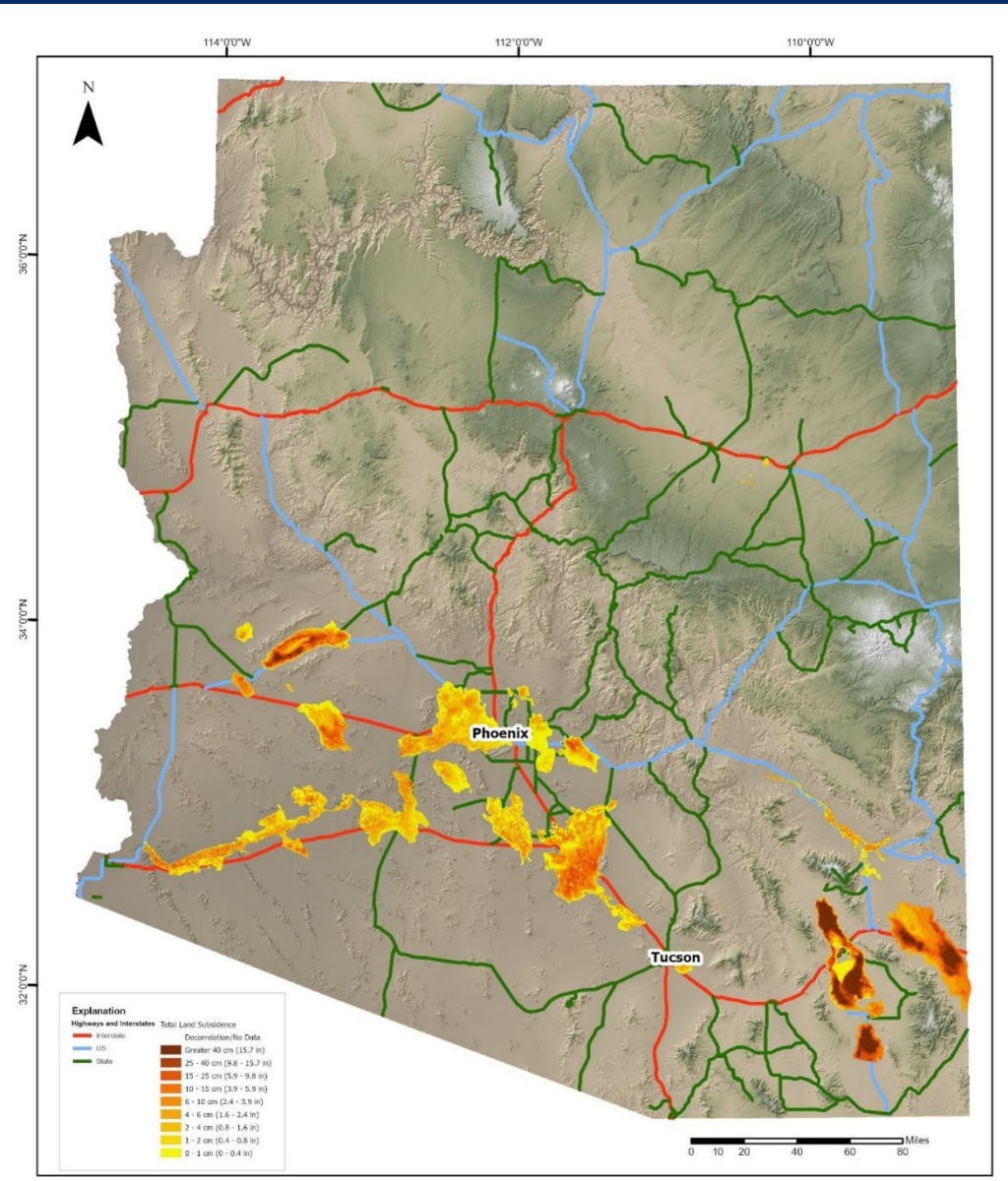
- Processed InSAR data from multiple satellites
- ERS-1 & 2, Envisat
- Radarsat-1 & 2
- ALOS-1 & 2
- TerraSAR-X
- Sentinel-1



https://www.azwater.gov/hydrology/field-services/land-subsidence-arizona

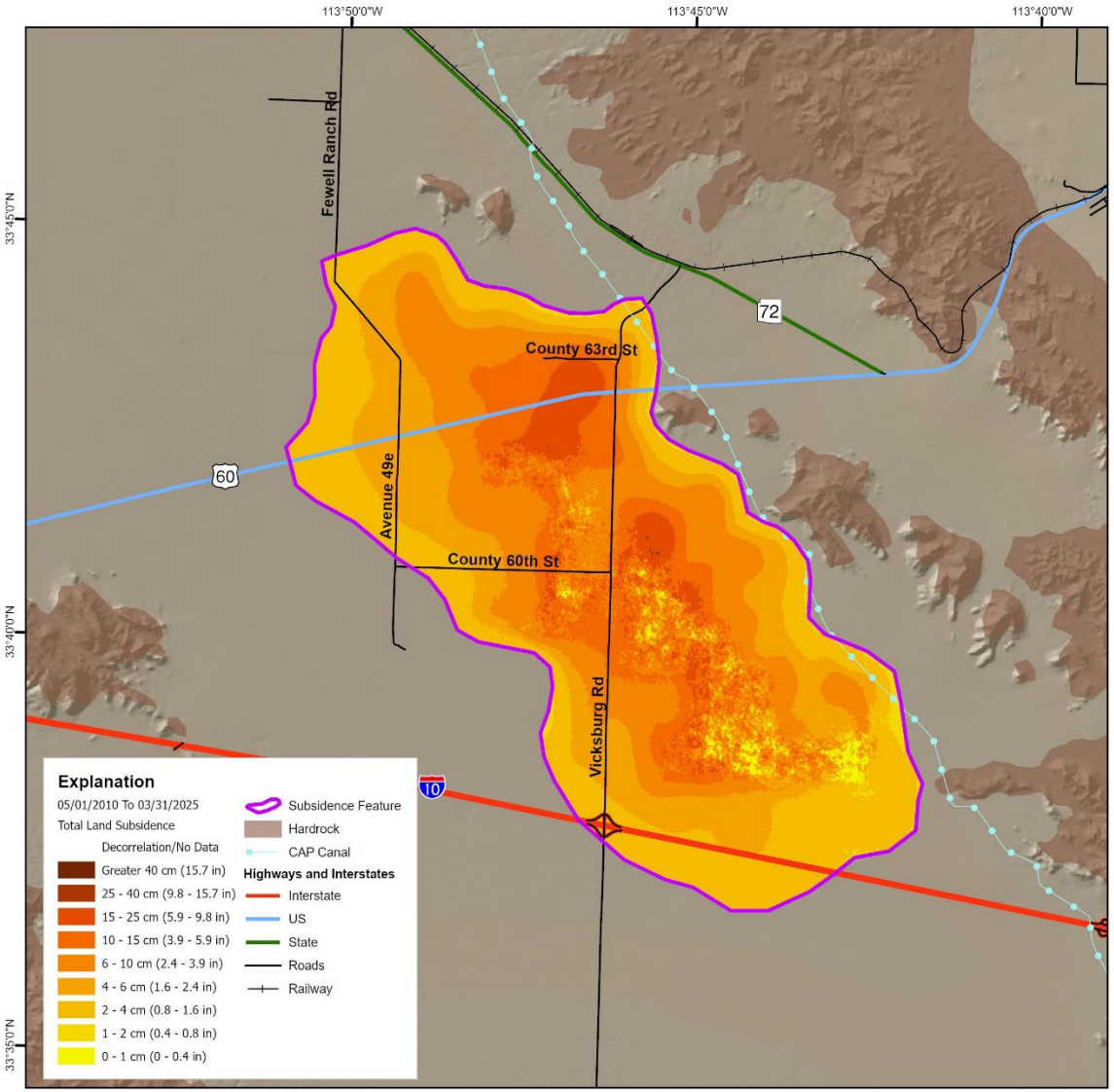
ADWR InSAR Program

- Cooperate with federal, state, county, and local agencies and private water companies to help fund the InSAR program



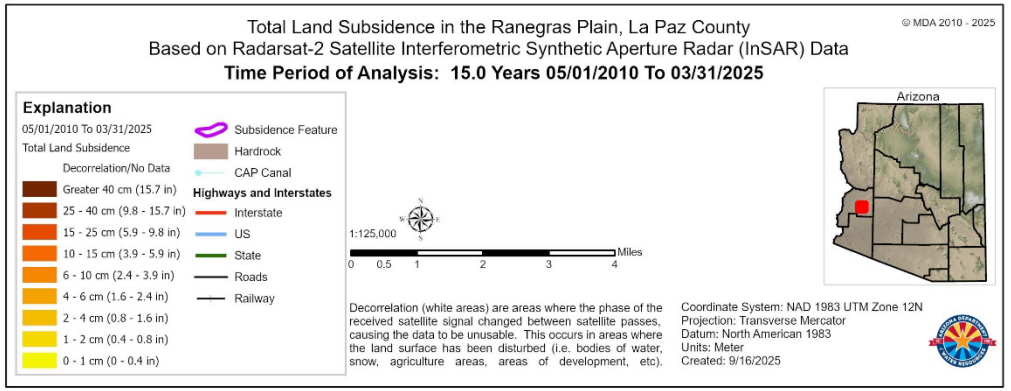
https://www.azwater.gov/hydrology/field-services/land-subsidence-arizona

Land Subsidence (15-year period)

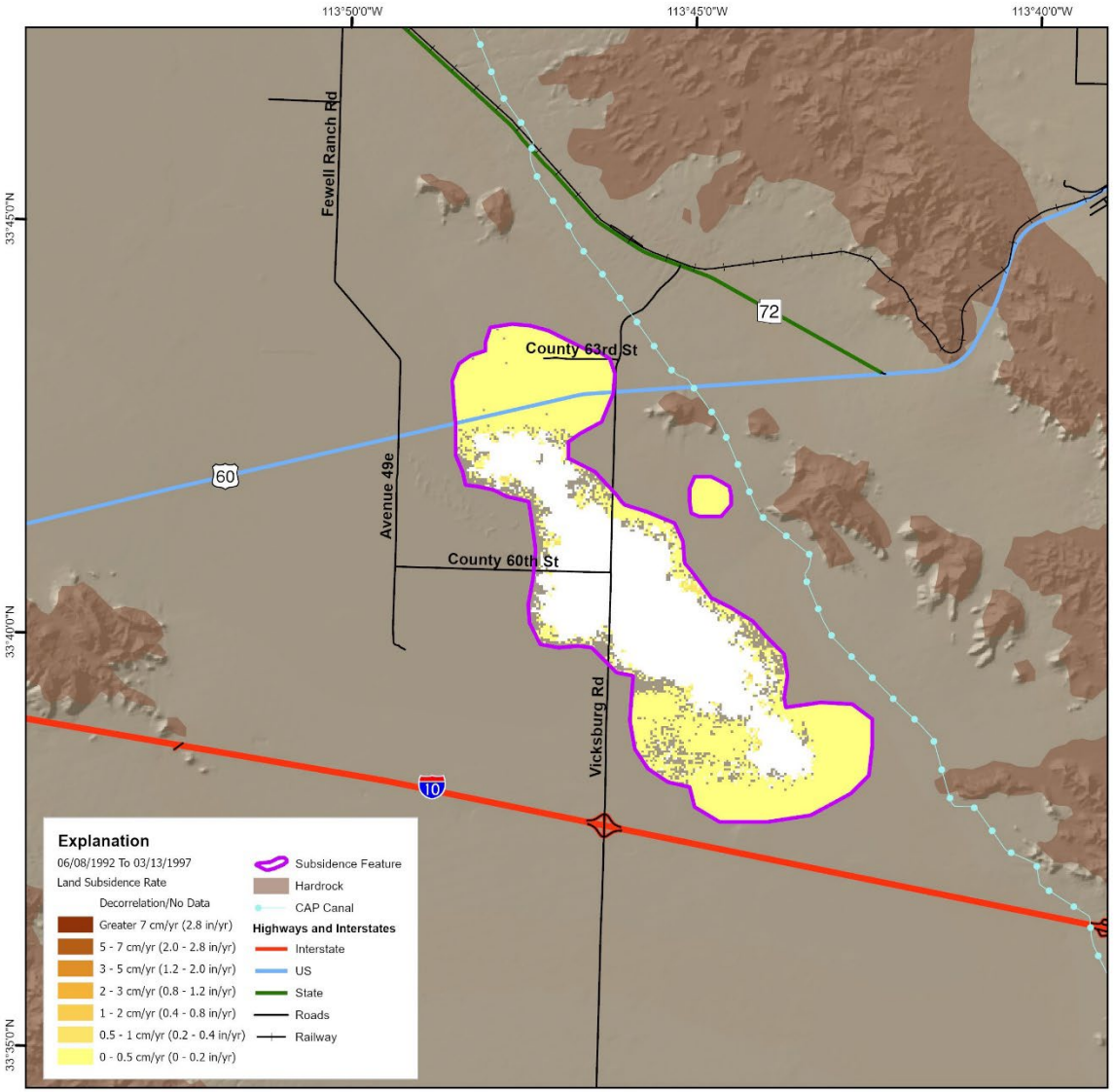


- Land Subsidence 2010-2025
  - 25 - 40 cm (9.8 – 15.7 in)
- Due to compaction of alluvium caused by dewatering the aquifer

https://new.azwater.gov/hydrology/field-services/land-subsidence-arizona

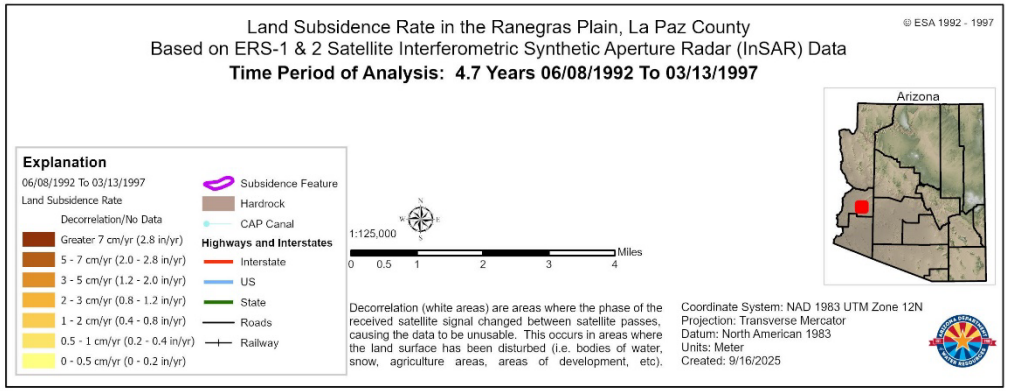


Land Subsidence Rate 1996

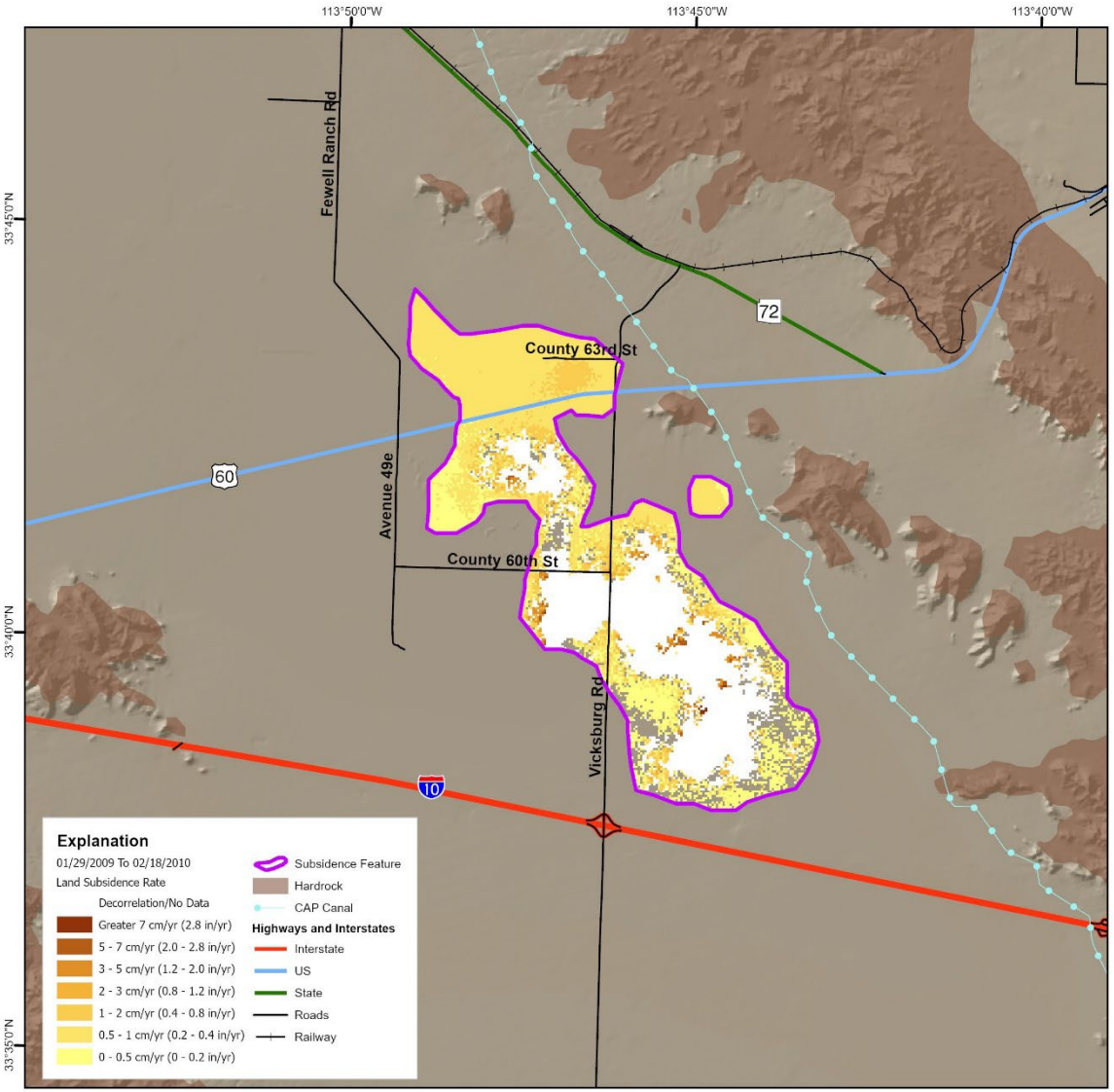


- Land Subsidence Rate 1992 - 1997
  - 0 - 1 cm/yr (0.0 – 0.4 in/yr)
- Due to compaction of alluvium caused by dewatering the aquifer

https://new.azwater.gov/hydrology/field-services/land-subsidence-arizona

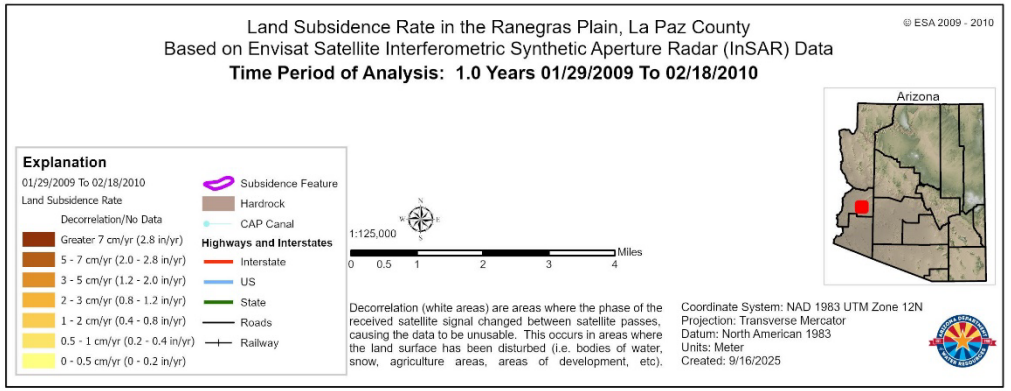


Land Subsidence Rate 2009-10

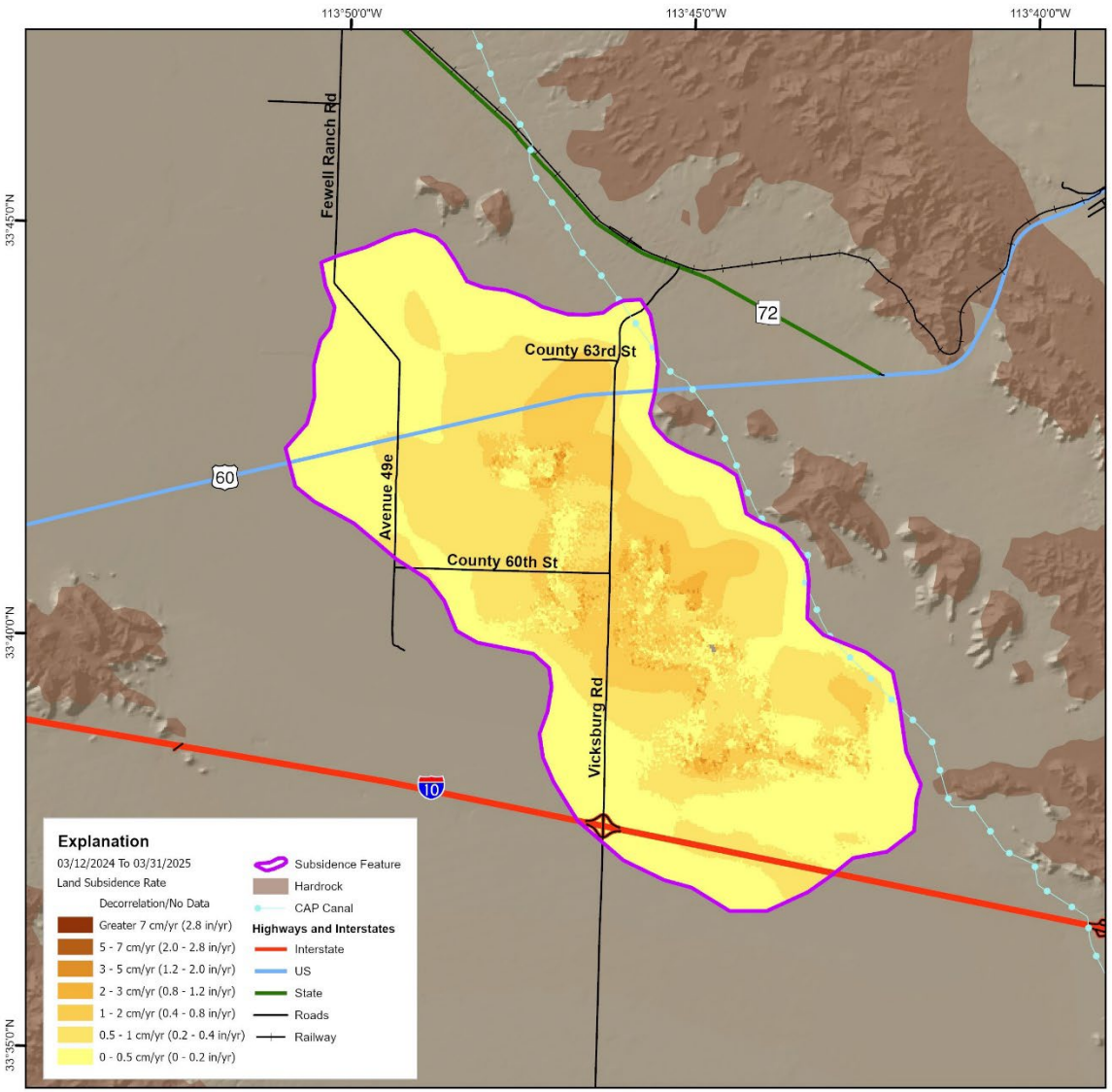


- Land Subsidence Rate 2009 - 2010
  - 1 - 3 cm/yr (0.4 – 1.2 in/yr)
- Due to compaction of alluvium caused by dewatering the aquifer

https://new.azwater.gov/hydrology/field-services/land-subsidence-arizona

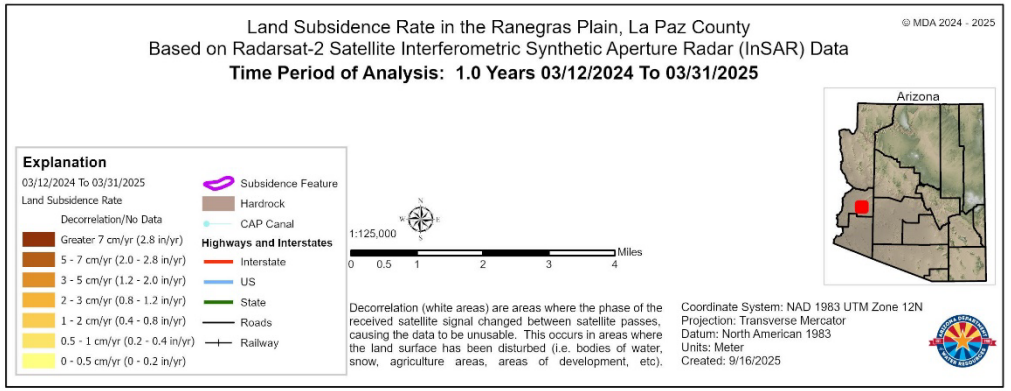


Land Subsidence Rate 2024-25



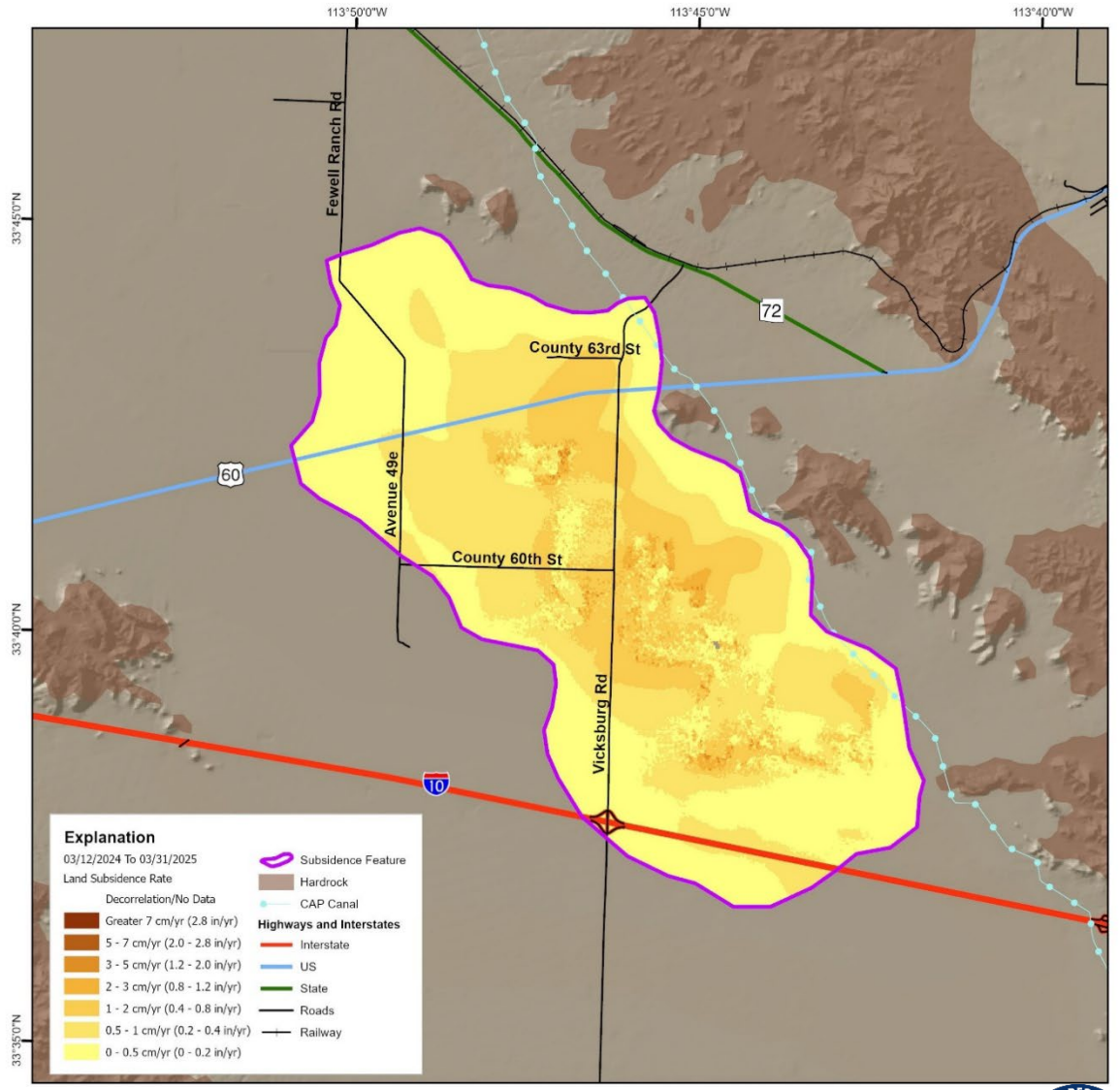
- Land Subsidence Rate 2024 - 2025
  - 3 - 5 cm/yr (1.2 – 2.0 in/yr)
- Due to compaction of alluvium caused by dewatering the aquifer

https://new.azwater.gov/hydrology/field-services/land-subsidence-arizona



Summary of Hydrology

- The water budget is out of balance
- Groundwater declines of over 200 feet have been observed since the 1980s
- Significant land subsidence has been measured/observed
- Land subsidence rates are increasing year over year



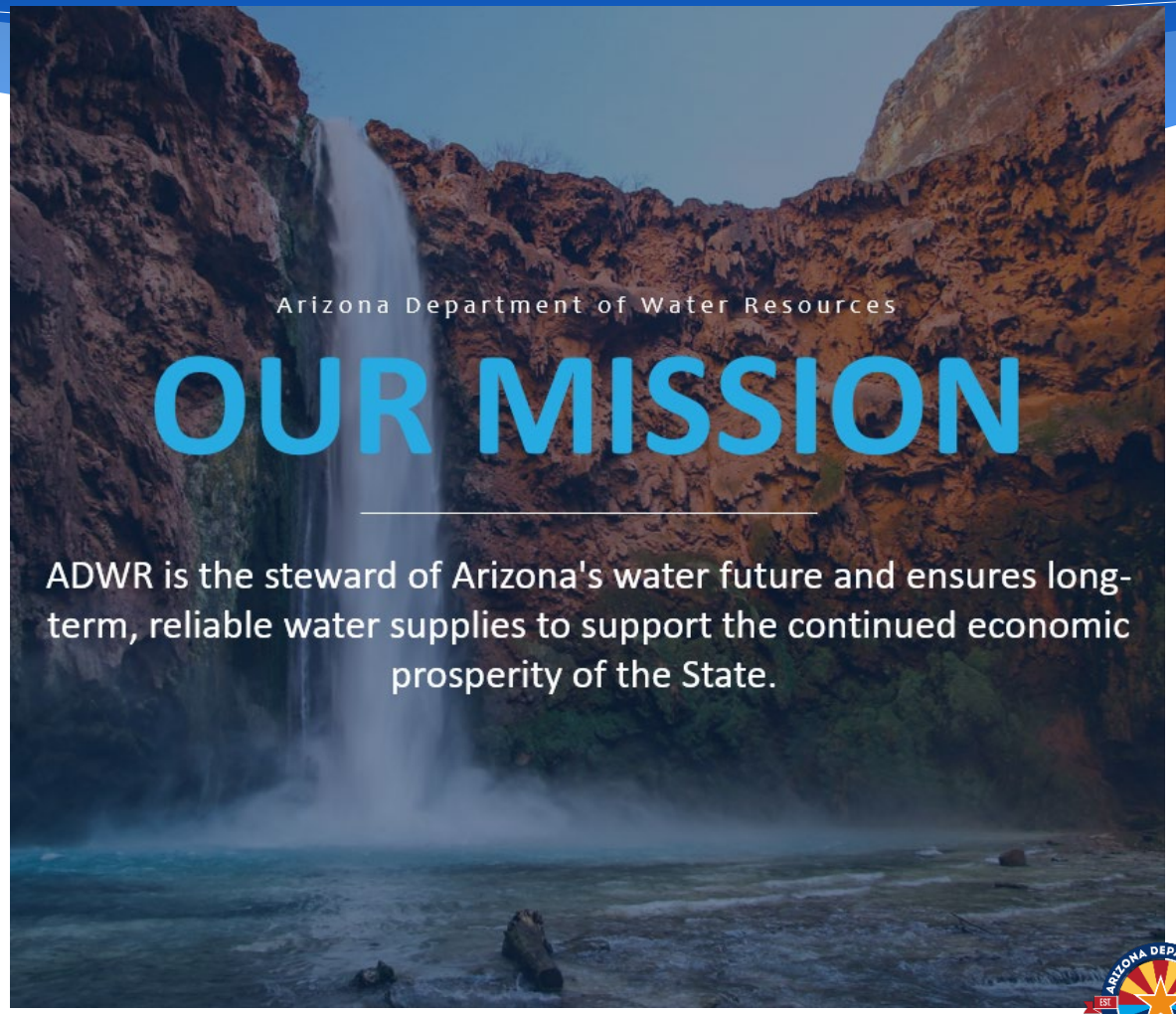
Overview of Water Management Options

Olga Hart, Director AMA Establishments

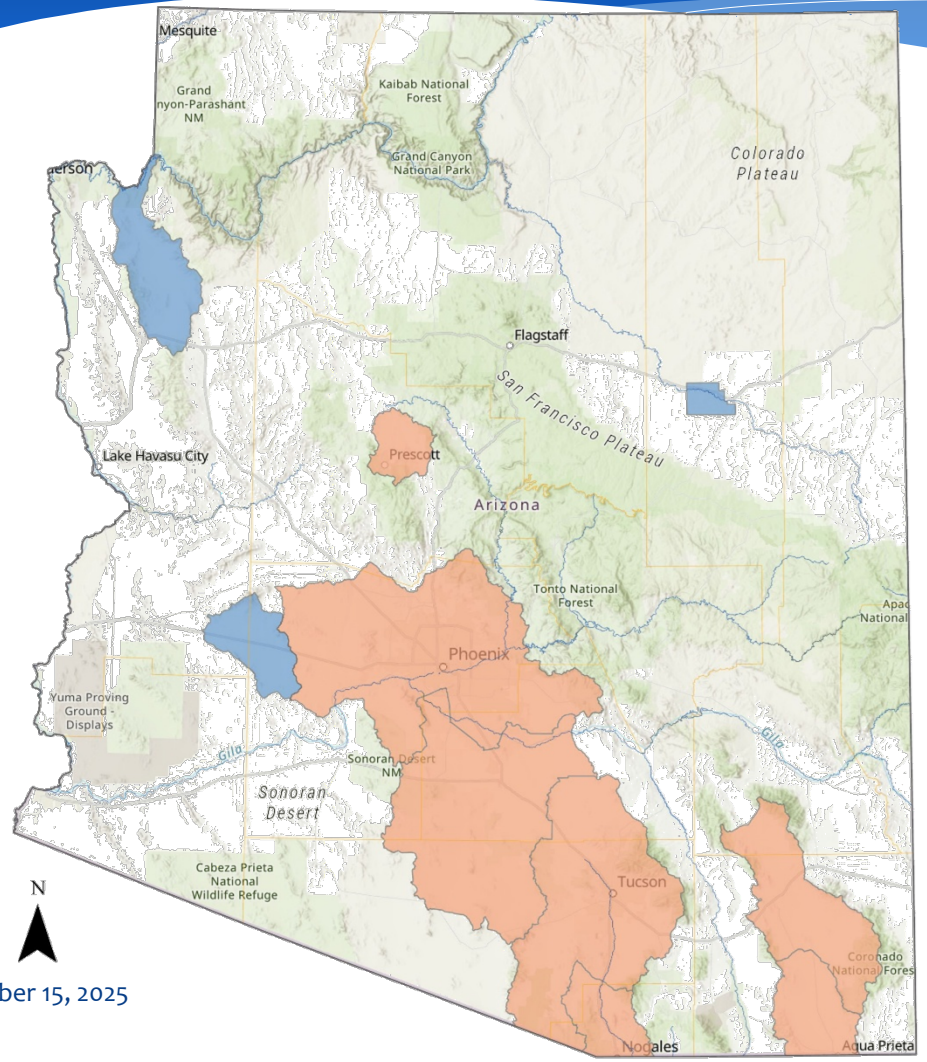
October 15, 2025

Groundwater Management Act of 1980

- Created the Arizona Department of Water Resources
- Establishes certain regulations statewide, but most protections are limited to areas designated as “irrigation non-expansion areas” and “active management areas”
- Authorizes establishment of new INAs and AMAs by either local initiation or by designation of the ADWR Director



Existing Active Management Areas (AMAs) & Irrigation Non-Expansion Areas (INAs)



Seven AMAs

- Prescott AMA
- Phoenix AMA
- Pinal AMA
- Tucson AMA
- Santa Cruz AMA (*est. 1994, considered "initial"*)
- Douglas AMA (*est. December 1, 2022*)
- Willcox AMA (*est. January 8, 2025*)

Three INAs

- Joseph City INA
- Harquahala INA (*est. 1981*)
- Hualapai Valley INA (*est. December 19, 2022*)

Water Management Framework

Statewide	INA	AMA
✓ Registration of all wells ✓ Reporting requirements for Public Water Systems ✓ Adequate Water Supply	✓ Registration of all wells ✓ Adequate Water Supply ✓ **Expansion of irrigation acres is prohibited** ✓ **Withdrawal Authorities for irrigation use** ✓ **Metering & Reporting**	✓ Registration of all wells ✓ Expansion of irrigation acres is prohibited ✓ Metering & Reporting ✓ **Grandfathered Water Rights & Withdrawal Permits** ✓ **Well Impact Analysis** ✓ **Management Goals, Plans, & Conservation Programs** ✓ **Assured Water Supply**

Water Management & Protections in an AMA

Measuring & Reporting	• Wells > 35 gpm required to measure and submit annual reports
Well Impact Analysis	• Required for new non-exempt wells • Limits the impact of new wells on nearby existing wells
Conservation Programs	• Agricultural, Municipal, and Industrial Requirements • Developed with local input and adopted in management plans • Designed to reduce withdrawals of groundwater
Assured Water Supply	• 100-year water supply requirement for new subdivisions • Consumer protection for homeowners

Exempt Wells in an AMA

An exempt well…

- ✓ Has a pump capacity of 35 gallons per minute or less, AND…
- ✓ Uses less than 10 acre-feet per year for non-irrigation use, AND…
- ✓ Is not used to irrigate 2 or more acres of land.

…is exempt from :

- ✓ Requirement to obtain a grandfathered right or withdrawal authority
- ✓ Requirement to measure and report withdrawals
- ✓ Conservation requirements in the management plan
- × Still must register well and document any well modifications/changes to well ownership

Measuring & Reporting

- Within an AMA, wells that pump over 35 gallons per minute (gpm) are required to meter their wells and report to the Department their annual water use.
- Non-exempt well users are required to obtain a grandfathered right or withdrawal authority.
- Most domestic and stock watering wells will qualify as exempt wells and will not be required to meter and report their water use to the Department.
  - For more information about how AMAs will impact metering & reporting for exempt and non-exempt wells, please refer to FAQs on ADWR's website:

    https://www.azwater.gov/proposed-ranegras-plain-groundwater-basin-ama

Well Impact Analysis

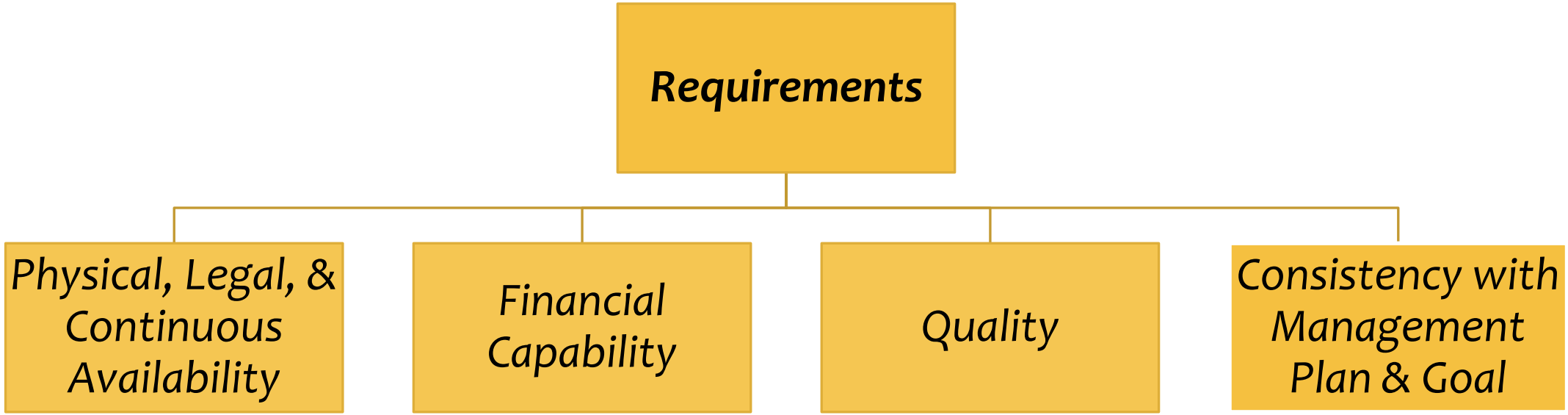
- All new, non-exempt wells within AMAs are required to file a hydrologic study demonstrating that withdrawals from the proposed well will not cause unreasonably increasing damage to surrounding land or water users from the concentration of wells in the area.
- The proposed well must show there will not be an impact of over 10 feet of additional drawdown in the first five years of operation to the surrounding area.

Conservation Programs

- Conservation programs are for Agricultural, Municipal, and Industrial water users.
- Through local input and collaboration, a management goal, management plan, and conservation programs are developed, tailored to the needs of the basin.
- The development of the policies and conservation programs within a subsequent AMA is flexible, enabling solutions that work for the basin.

Assured Water Supply

- Requires the demonstration of 100-year water supply for new subdivisions to provide consumer protection for homeowners.



Director Designation to Create a New…

Irrigation Non-Expansion Area

Hearing

Consideration of Comments & Criteria

1. Insufficient groundwater for irrigation at the current rates of withdrawal

AND

2. Establishment of an AMA is not necessary according to AMA criteria

Decision by ADWR Director

Active Management Area

Hearing

Consideration of Comments & Criteria

1. Active management practices are necessary to preserve groundwater supplies

OR

2. Land subsidence or fissuring is endangering property or groundwater storage capacity

OR

3. Use of groundwater is resulting in or threatening water quality degradation

Decision by ADWR Director

Local Initiation to Create a New…

Irrigation Non-Expansion Area

Petition

Hearing

Consideration of Comments & Criteria

1. Insufficient groundwater for irrigation at the current rates of withdrawal

AND

2. Establishment of an AMA is not necessary according to AMA criteria

Decision by ADWR Director

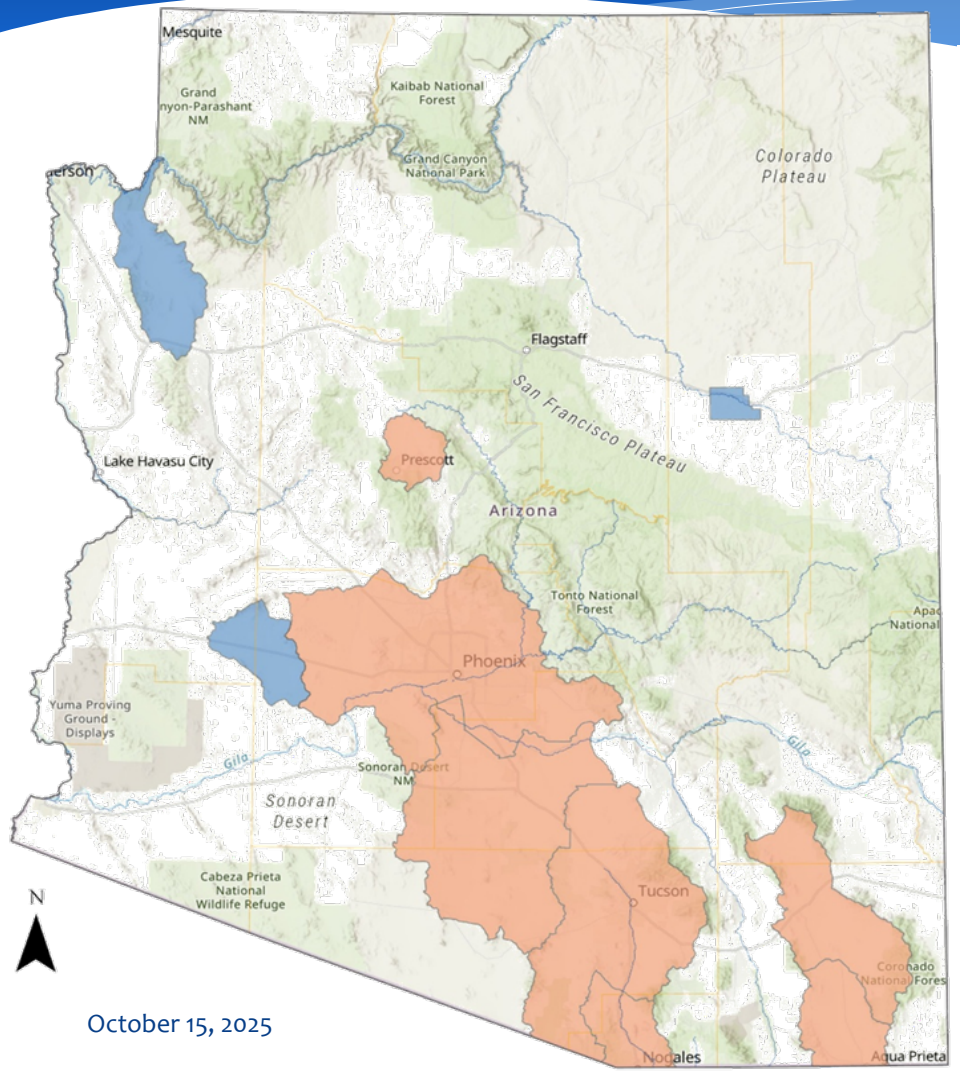
Active Management Area

Petition

Local Election

Certification of Election: Majority Vote

Water Management Summary



- Two existing structures for groundwater management, with different levels of conservation requirements and protections:
  - Irrigation Non-expansion Areas (INAs)
  - Active Management Areas (AMAs)
- New INAs and AMAs can be created through formal processes that can be initiated either locally or by the ADWR Director.
- State law specifies certain criteria that must be met as a part of those formal processes.

Q&A

Guidelines on Questions

- To ensure that everyone who wishes to speak has the opportunity, ADWR may limit time for each speaker.
- If you have not already done so and wish to speak, please fill out a speaker card (virtually or physically) and return it to ADWR staff.
- Please speak clearly into the microphone so those on the webinar can hear and participate fully.
- We will call people in the order that we receive cards, alternating those in-person with those online.
- Additional questions not presented today can be sent to our AMA Management Plans Team by **5:00pm on October 24, 2025.**

Closing

Information related to today's meeting will be posted on ADWR's website here:
https://www.azwater.gov/proposed-ranegras-plain-groundwater-basin-ama

As a reminder, additional questions not presented today should be submitted by **5:00pm on October 24, 2025**, and should be mailed to:

The Arizona Department of Water Resources
Attn: Active Management Areas
1802 W. Jackson St., Box 79
Phoenix, Arizona 85007

Or emailed to:

ManagementPlans@azwater.gov

Fax: 602-771-8686

Thank you

Additional information, including tonight's presentation and meeting recording will be available at:

https://www.azwater.gov/proposed-ranegras-plain-groundwater-basin-ama

PROTECTING
ARIZONA'S WATER SUPPLIES
for ITS NEXT CENTURY