Prescott Valley:
Groundwater, Growth, Verde River
Status and Solutions

Presented by Gary Beverly,
Citizens Water Advocacy Group

Citizens Water Advocacy Group

PROTECT OUR WATER

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Next Event

Sat Aug 09 @10:00AM - 12:00PM
Groundwater, Growth & The Verde River - Prescott Valley program! ABOUT THE PRESENTATION Thi...
Sat Sep 13 @10:00AM - 12:00PM
Arizona Department of Environmental Quality Presentation - ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY ADEQ will deliver a ...

Quick Links

Welcome to Citizens Water Advocacy Group

Founded in 2002, the **Citizens Water Advocacy Group** (CWAG) is a local science-based citizens group dedicated to working for a sustainable water future for the Prescott Active Management Area and to protecting the upper Verde River. We see two fundamental challenges to sustainable water management:

- Our water supply is dependent on groundwater; we are depleting our groundwater reserves because we are pumping too much.
- Excessive groundwater pumping and climate change are reducing the flow of the upper Verde River.

FOR FIRST TIME VISITORS. If this is your first visit to our website:

- Issues of water sustainability are discussed in the section "Our Water Supply".
- The challenges facing the upper Verde River are discussed in the section "Verde River".
- "Introductory Water Info" will connect you to some basic and important topics.

Current Issues:

Prescott Candidate Forum

Op Ed: Prescott council election — what are the water issues?

Op Ed: Our water future — time for regional solution is NOW

www.cwagaz.org

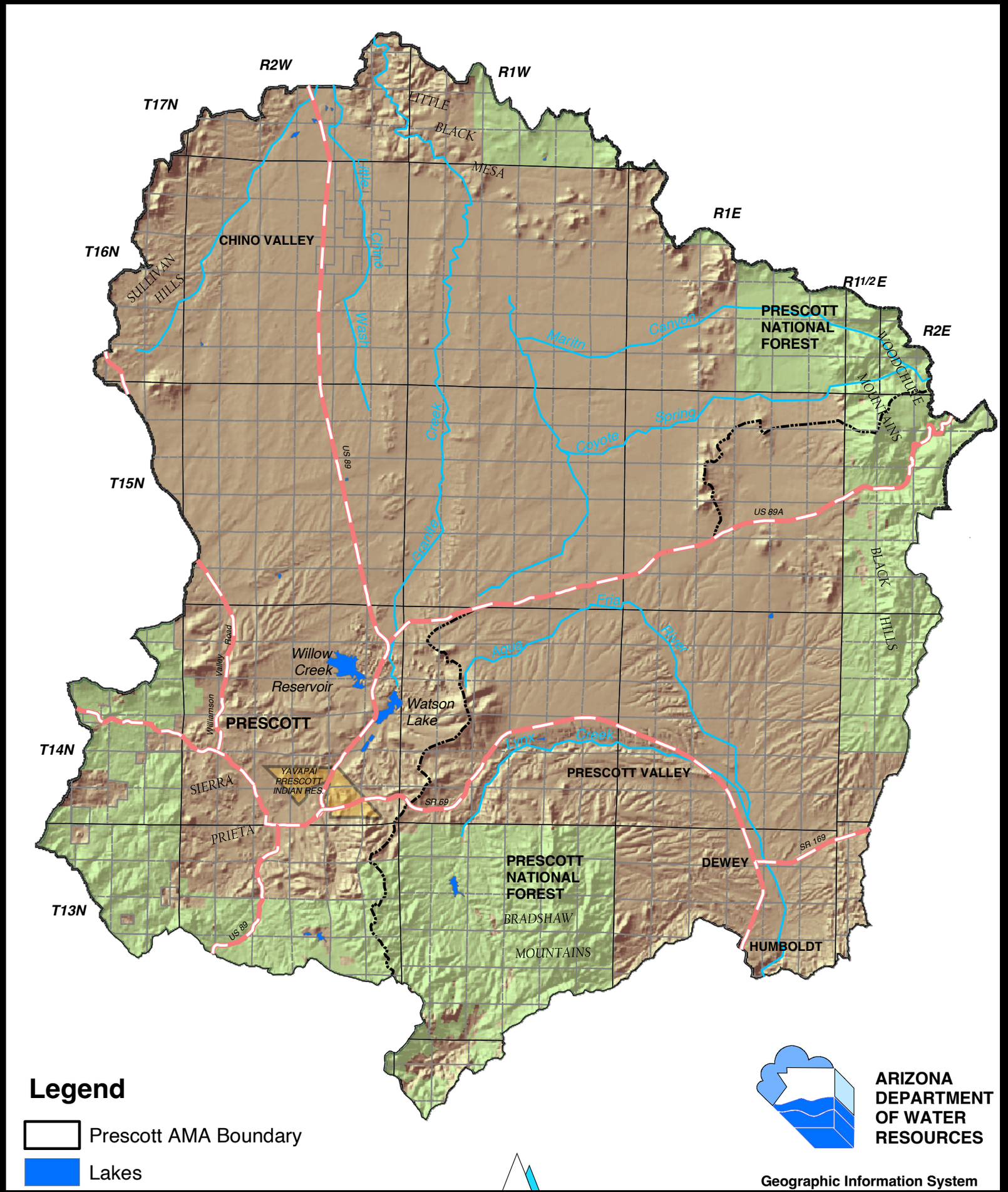
Arizona Water Law

- 1980 Arizona Groundwater Management Act
- Goal: Transition to renewable supplies and Safe Yield
- Established the AZ Department of Water Resouces
- Established Prescott Active Management Area:
  - Management goal: Safe Yield by 2025.
  - Management plans every decade.
- No control on industrial or agricultural uses outside of AMA.

AMA Management Goal by 2025:

Safe Yield

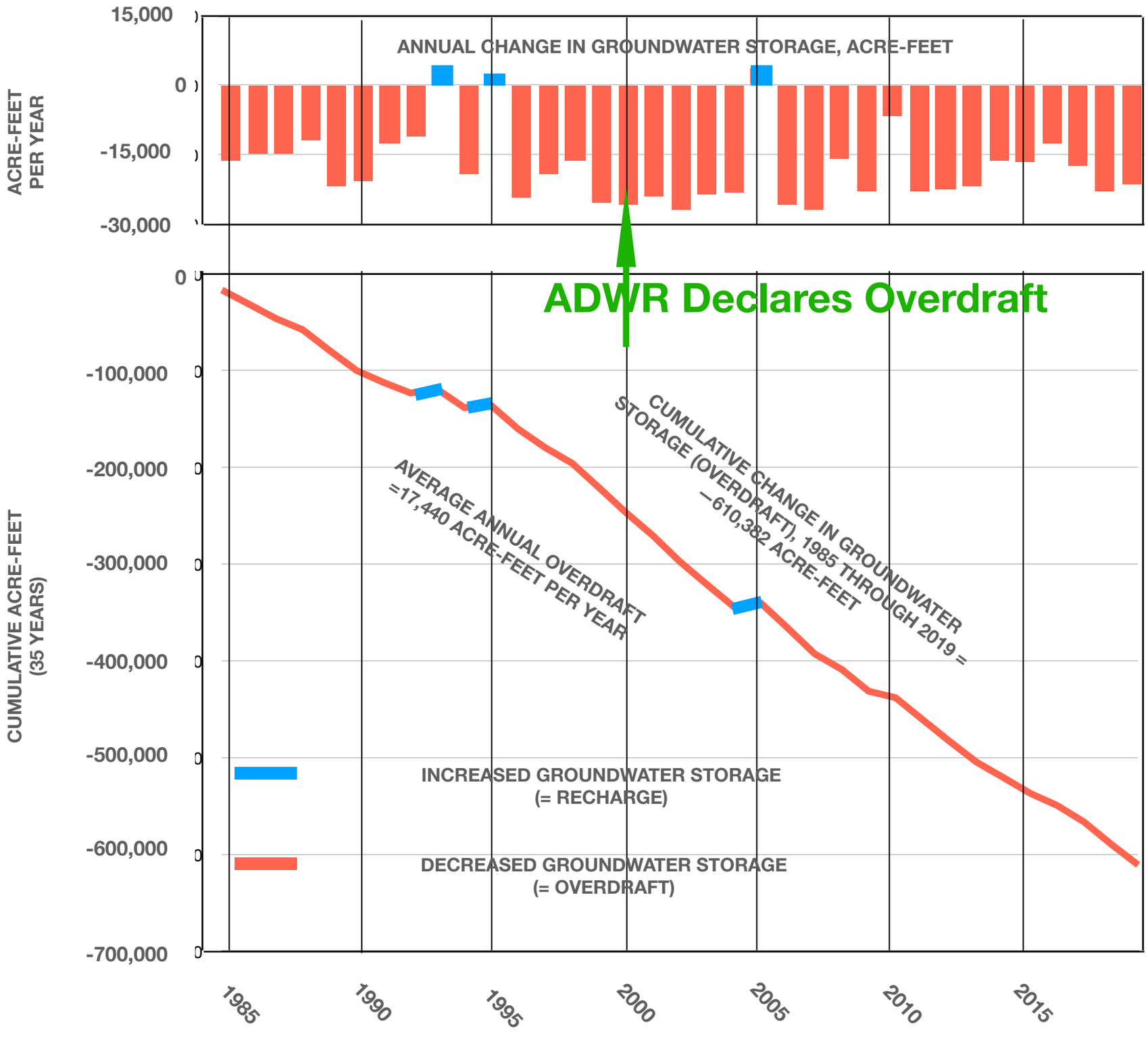
- A long-term balance between recharge and withdrawal.
- No penalty for failure.
- No incentives to succeed.
- ADWR provides data but no assistance.
- Responsibility of region, not ADWR.
- No regional plan exists.
- After 45 years, discussions are only now planned.



Safe Yield

- A political invention, not a scientific concept.
- Designed to fail.
- At safe yield, natural discharge ceases so rivers and springs will dry up.
- However, safe yield is the goal we are required to follow.
- ADWR 5MP (2022): In PrAMA, safe yield is unlikely.
- PrAMA: worst in the state

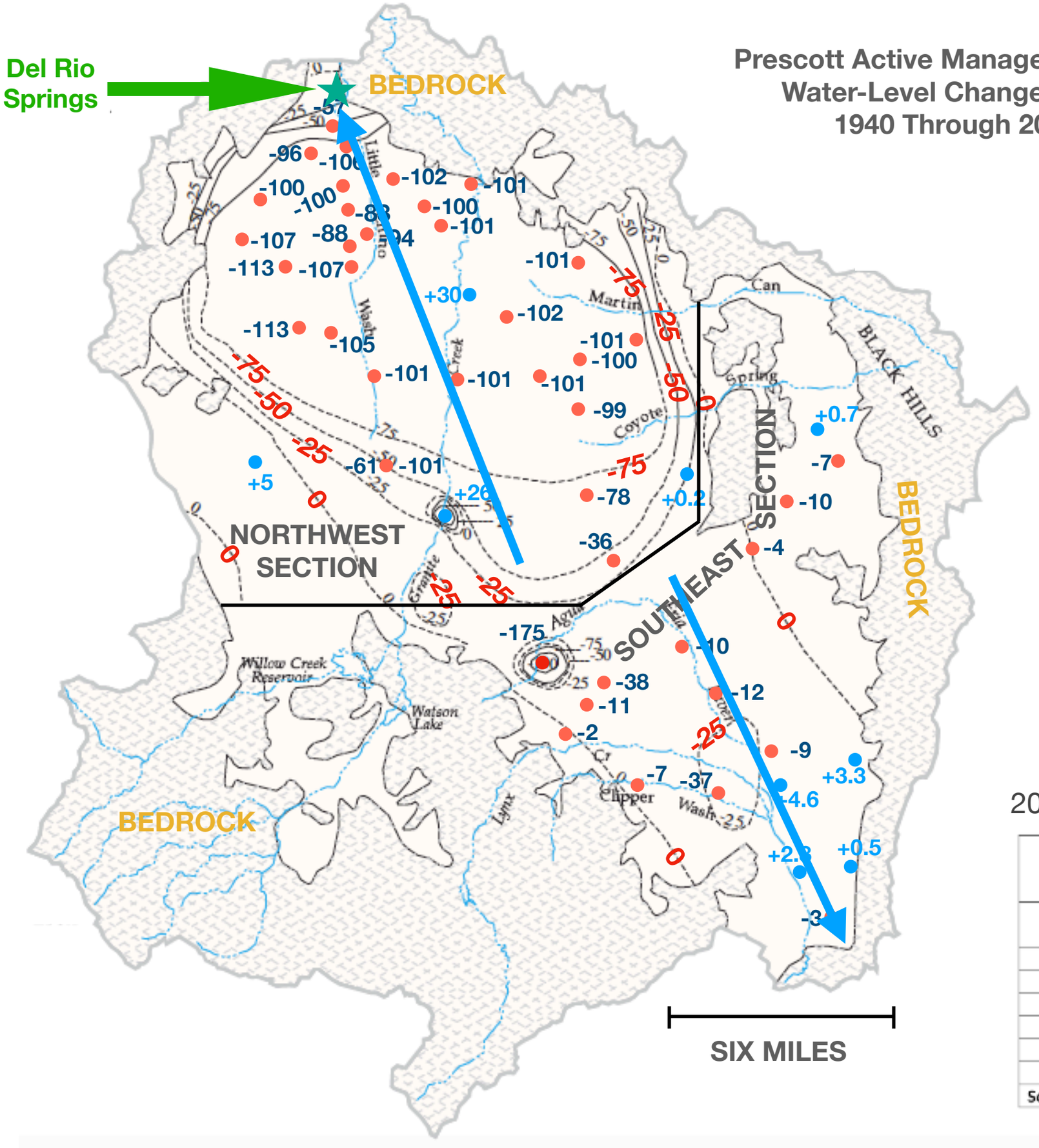
PrAMA ANNUAL AND CUMULATIVE CHANGE IN GROUNDWATER STORAGE, ACRE-FEET 1985 THROUGH 2019



Data downloaded August 22, 2022, from Arizona Dept. of Water Resources Overdraft Dashboard

Overdraft causes aquifer water levels to fall

Prescott Active Management Area
Water-Level Changes, Feet
1940 Through 2010



NORTHWEST SECTION

1940 -2010
● -102 Water-level decline
-1.5 ft/yr

SOUTHEAST SECTION

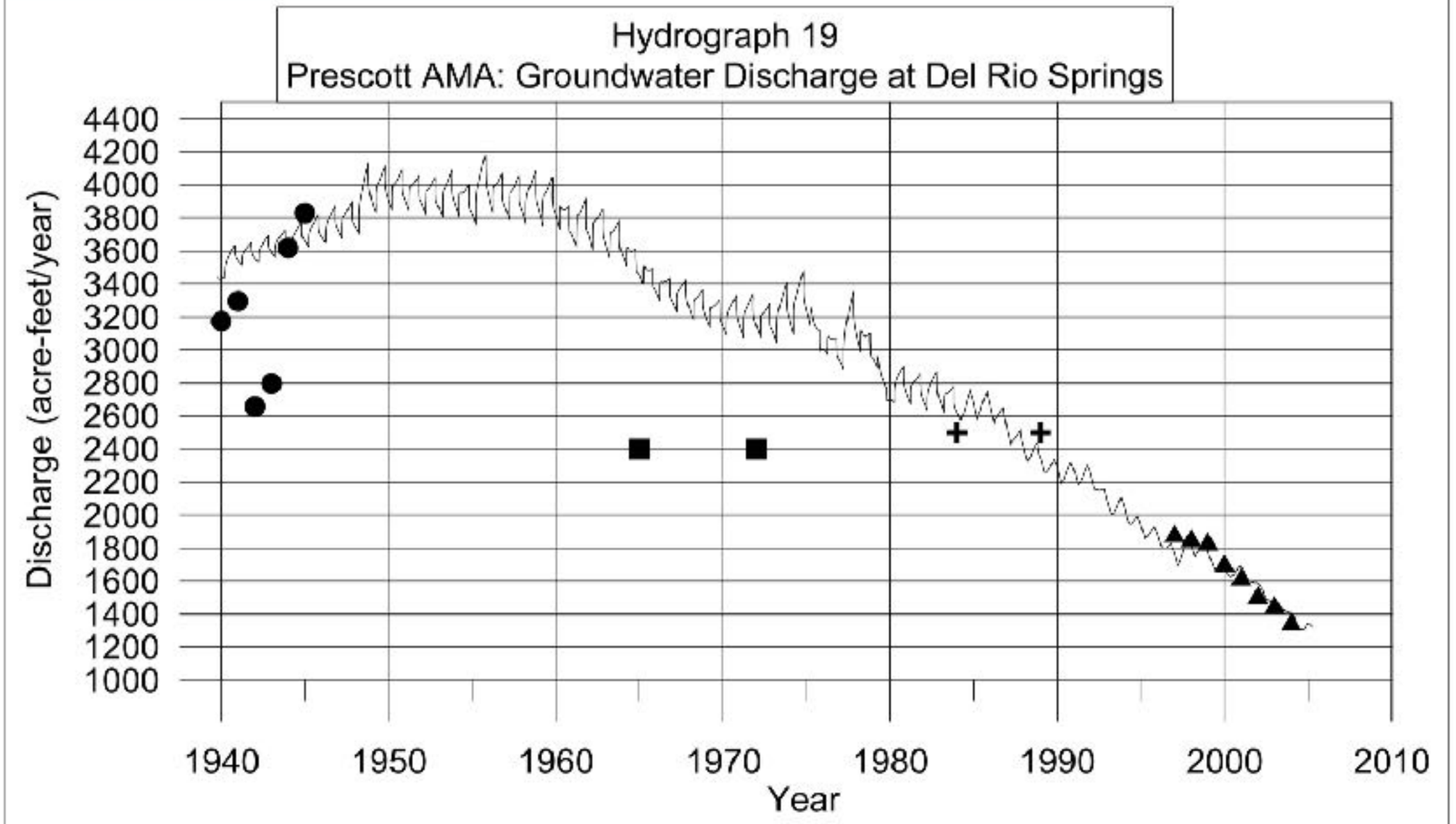
1994-2010
● -38 Measured Water-level decline, ft.
-2.4 ft/yr

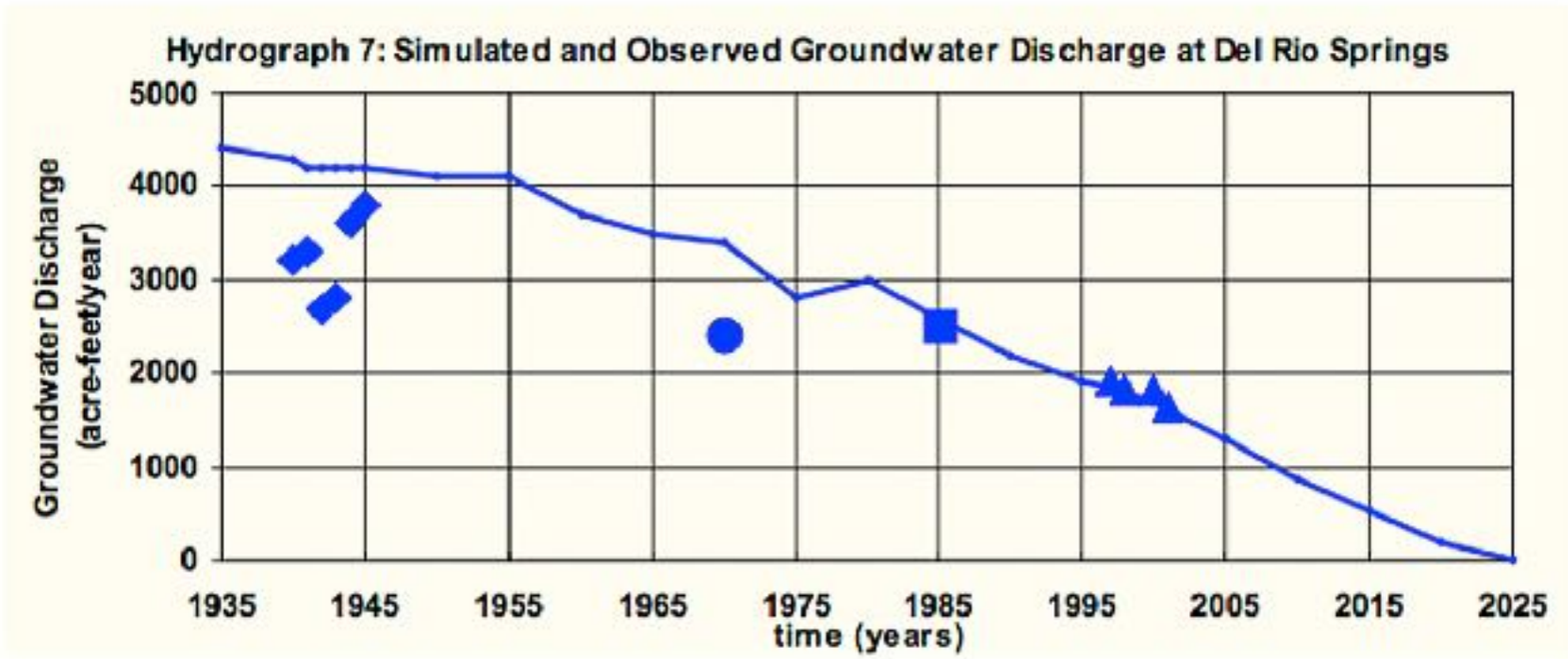
2020: 62% of PV pumping from Little Chino

PRESCOTT VALLEY POPULATION GROWTH		
CENSUS	POPULATION	PERCENTAGE INCREASE
1970	244	---
1980	2,284	836.1%
1990	8,904	289.8%
2000	23,535	164.3%
2010	38,822	65%
2020	46,785	19.8%

Source: 2020 Census

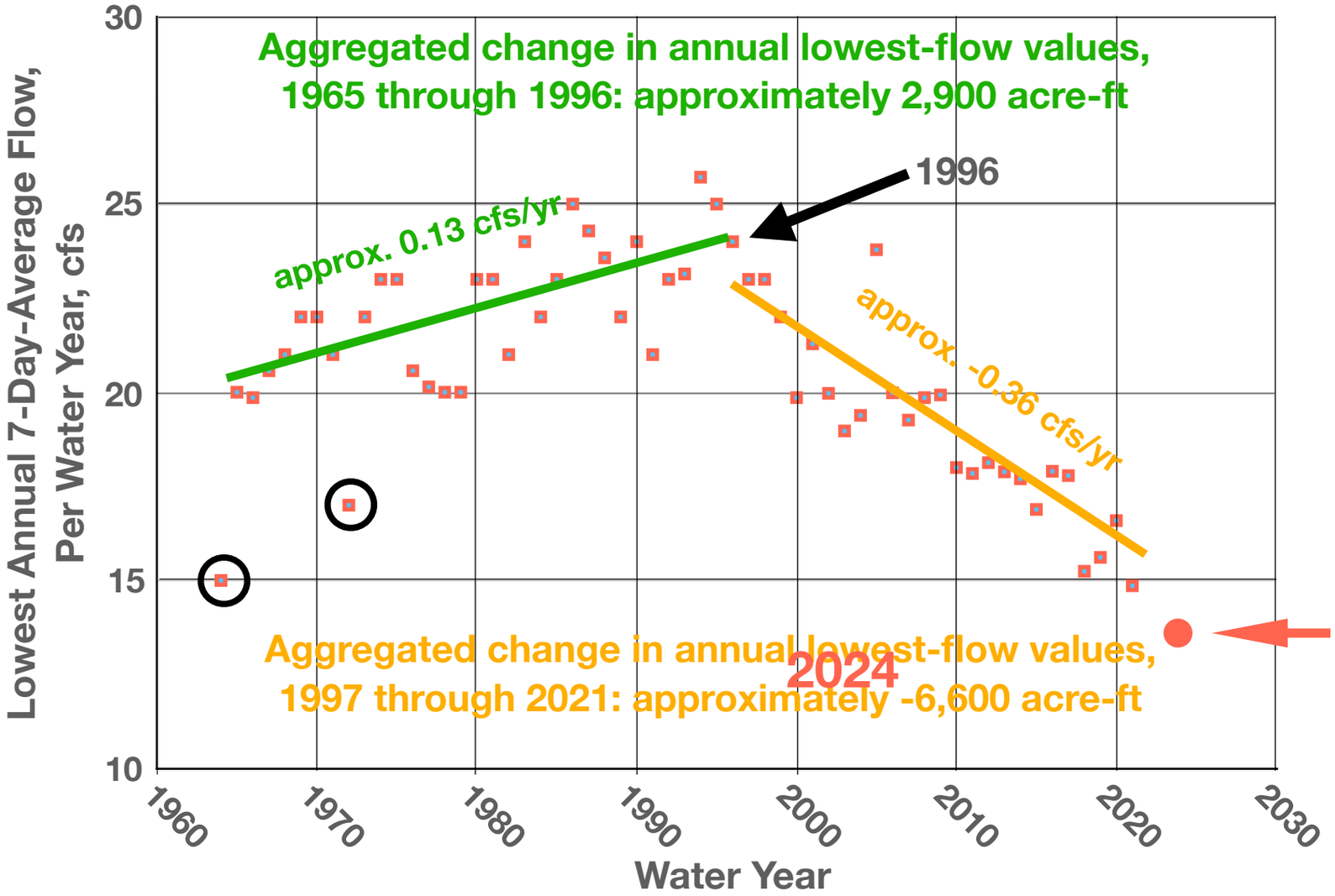
Overdraft causes Del Rio Springs to dry up


Hydrograph 19
Prescott AMA: Groundwater Discharge at Del Rio Springs
Discharge (acre-feet/year)
4400
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
1940
1950
1960
1970
1980
1990
2000
2010
Year


Hydrograph 7: Simulated and Observed Groundwater Discharge at Del Rio Springs
Groundwater Discharge (acre-feet/year)
5000
4000
3000
2000
1000
0
1935
1945
1955
1965
1975
1985
1995
2005
2015
2025
time (years)

Groundwater pumping and climate change reduce the flow of the Verde River

USGS PAULDEN STREAMGAGE, LOWEST 7-DAY ANNUAL FLOW



If declining trend at Paulden gage -0.36 cfs/y, or -260 af/y, continues unchanged, the upper Verde River will be briefly dry annually through Perkinsville, 25 river miles, beginning in 2060s

2024: 13 cfs

Lowest flow, cfs, 7 consecutive days, per water year

Least squares trendline, lowest 7-day annual flow, 1965 through 1996

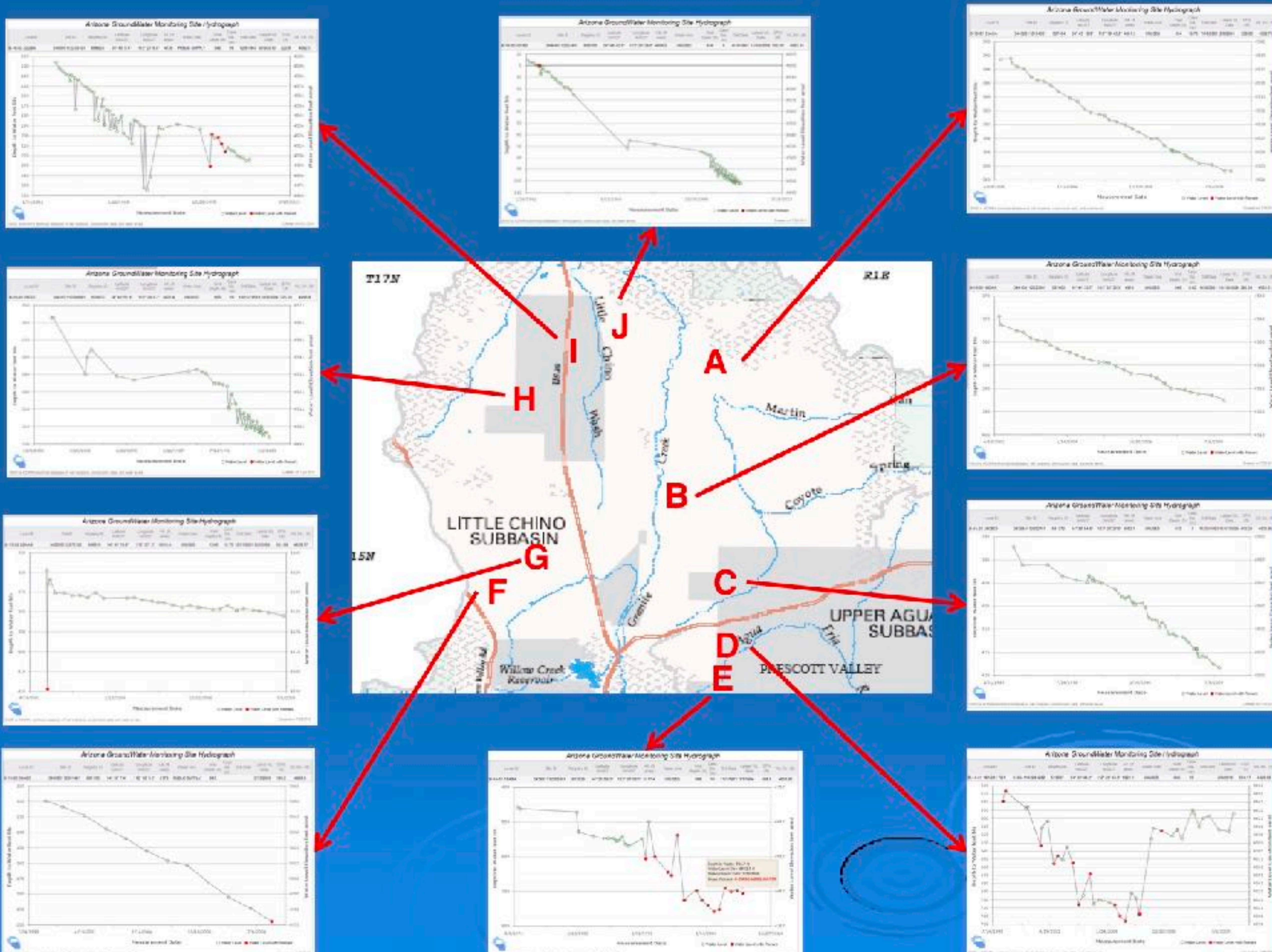
Least squares trendline, lowest 7-day annual flow, 1997 through 2021

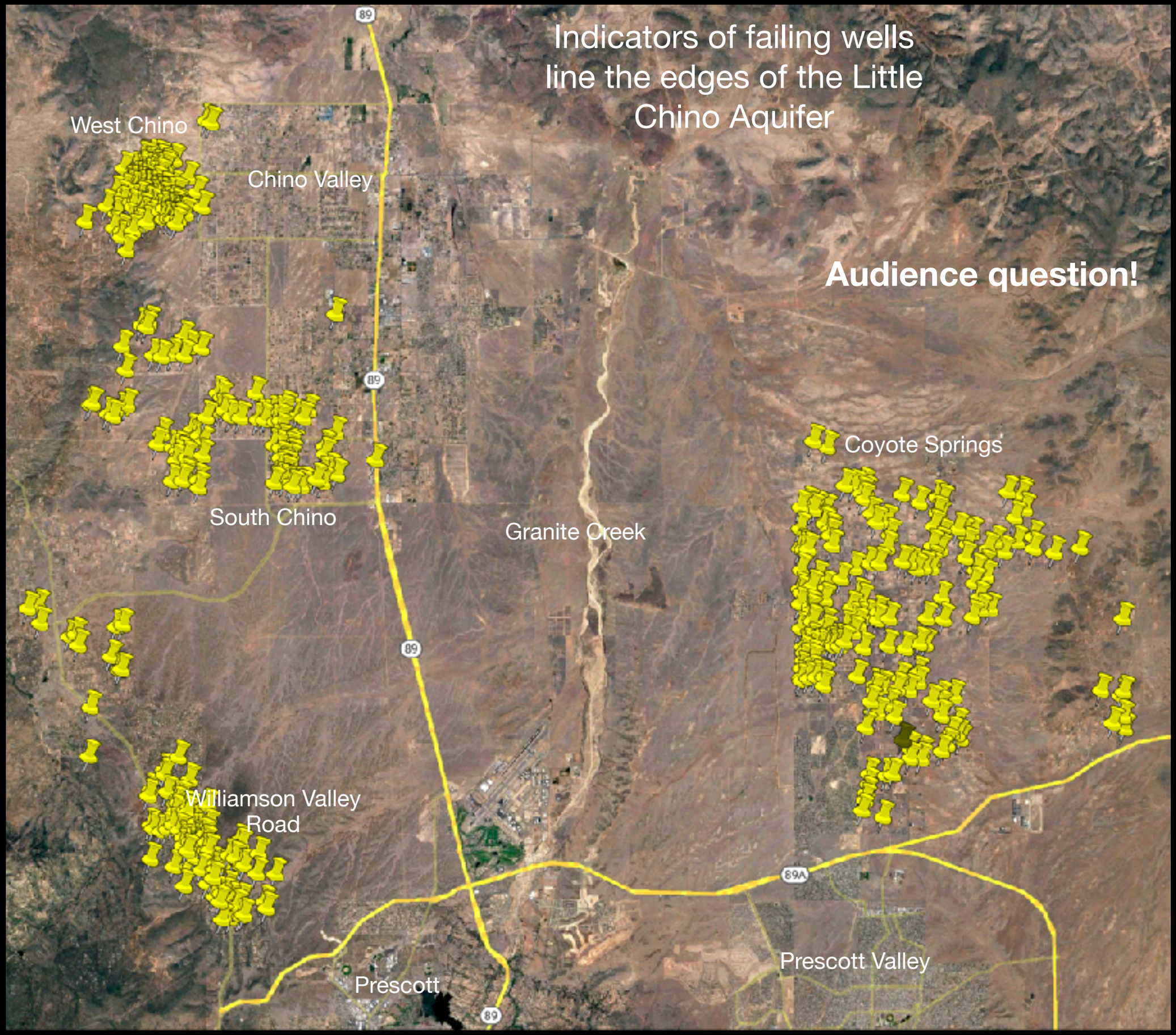
Documented excessive pumping in Paulden area; (excluded from linear regressions)

Importation of thousands of afy of groundwater to the Prescott Active Management Area from the Big Chino Valley will accelerate drying of the upper Verde River.

Overdraft reduces water levels in wells throughout the AMA.

Prescott AMA Groundwater Hydrographs




Indicators of failing wells line the edges of the Little Chino Aquifer
Audience question!
West Chino
Chino Valley
South Chino
Granite Creek
Coyote Springs
Williamson Valley Road
Prescott
Prescott Valley
89
89A

Audience question

How Long Will Our Water Last?

- No reliable scientific estimate of available groundwater resources.
  - ADWR no longer publishes estimates.
- Domestic wells and small water companies on the edges of the aquifer are impacted now spreading into the center.
- Misinformation is common!
- Later: Does Water Limit Growth?

Myth vs Reality

Click on the question to see CWAG's answer.

If you have a question that is not answered here, please ask us by using the Contact button above.

Myth: Arizona's laws and regulations will protect our region's water supply.

Myth: Safe Yield will protect our water supply.

Myth: Because COP/PV follow current laws and regulations, we will achieve safe yield.

Myth: There is plenty of water is in the aquifer to last a long time.

Myth: We do not need to be concerned about whether we will have enough water for the future.

Myth: Exempt wells are the main cause of water levels going down across the Prescott Active Management Area.

Myth: The Big Chino pipeline will assure that we have a sustainable water future for the Quad Cities region.

Myth: Prescott and PV officials claim that our water supplies are OK because they recharge 65-95%.

Not a Crisis!

- CWAG has NEVER yelled “CRISIS”
- Municipal water supplies are secure for the indefinite future.
- BUT: the overdraft cannot go on forever.
- The current situation is **UNSUSTAINABLE**

Overdraft Triggers the Assured Water Supply Rules:

- Grandfathers all existing uses, rights assigned.
- Caps agricultural pumping.
- Requires a 100-yr water supply for new subdivisions.
- Provides special exemptions & loopholes
- Creates costs, complexity, and litigation.

AWS Regulation: Lot Splits: < 6 parcels

- Must comply with local zoning; Yavapai County default zoning is 2 acre minimum.

- No regulation of roads, utilities, public safety, or water supply.

- Domestic wells are permitted and regulated (< 35 gpm, irrigate < 2 acres) but are exempt from reporting pumping volume.

  - >14,000 exempt wells in PrAMA

  - 14% of pumping serving 19% of population.

AWS Regulation: Subdivisions >= 6 parcels

- County/City zoning and development codes regulate land use, roads, utilities, public safety, open space.
- New subdivisions must prove 100-year water supply.
  - a) financial capability,
  - b) water quality,
  - c) continuous availability,
  - d) compliance with management plan.
  - f) Legal rights (abundant by design - more later)
  - e) Physical availability:
    - Cannot impact other rights
    - Water level must be >1000’ bgs in 100 yrs

To prove 100-year water supply:

- Prescott, a Designated AWS (DAWS) provider, can guarantee a 100-yr supply using a water portfolio allocated by ADWR.
    - Developer applies to city.
    - Conserved water can be reallocated.
- In Prescott Valley & County, each subdivision developer must obtain a Certificate of Assured Water Supply (CAWS) - expensive & detailed.
    - Developer applies to ADWR
    - Conserved water cannot be reallocated to serve additional homes.

AWS Loopholes Permitted PV Development

Grandfathered Water
Great Plat Rush

- 1998: ADWR declares PrAMA in overdraft, activates AWS rules.
- 1998: Shamrock Water (Fain Family) objected, causing a 1-year delay.
- 1999: ADWR rejects Shamrock's objection.
- 1998-99: 32,000 preliminary plats created primarily in PV.
- **32,000 lots are grandfathered: AWS rules do not apply.**

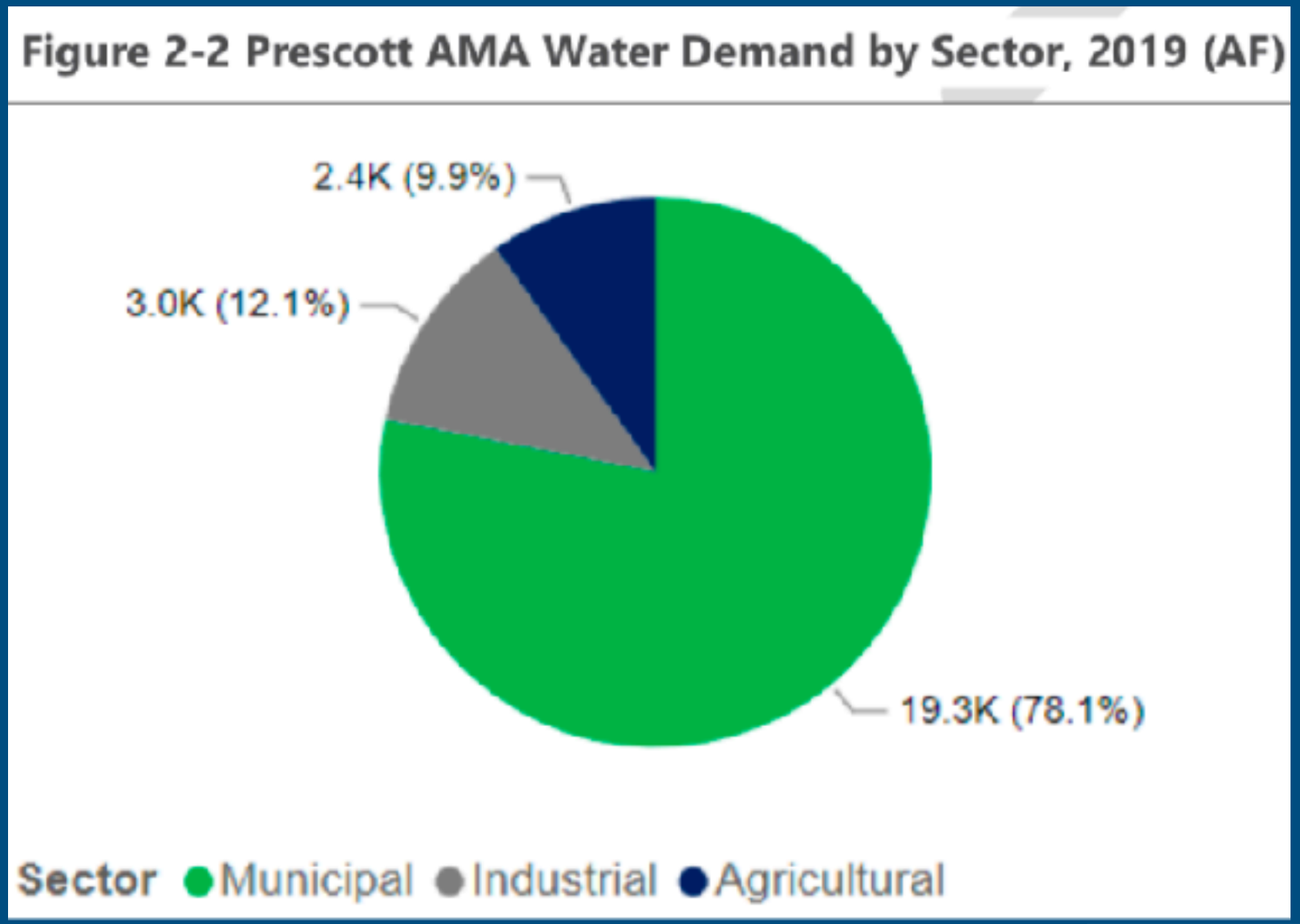
Grandfathered Water
Great Plat Rush

- Committed >10,000 afy for 100 years = 1,000,000 af groundwater, a large fraction of total groundwater storage and about half of the PrAMA overdraft.
- Safe Yield for PrAMA becomes impossible!
- ADWR: “We lacked authority to control the plat rush”

Great Plat Rush: Impacts on PV

- Great Plat Rush development since 1999: Mingus West, Pronghorn Ranch, Granville, Stoneridge, Viewpoint, Quailwood Meadows, Town Center, and an expansion of Quailwood Meadows, approximately 8,100 lots.
- Approximately 2,800 grandfathered vacant lots remain (2021).
- Other new subdivisions require a CAWS.
- Conserved water in a CAWS cannot be used to support additional growth.

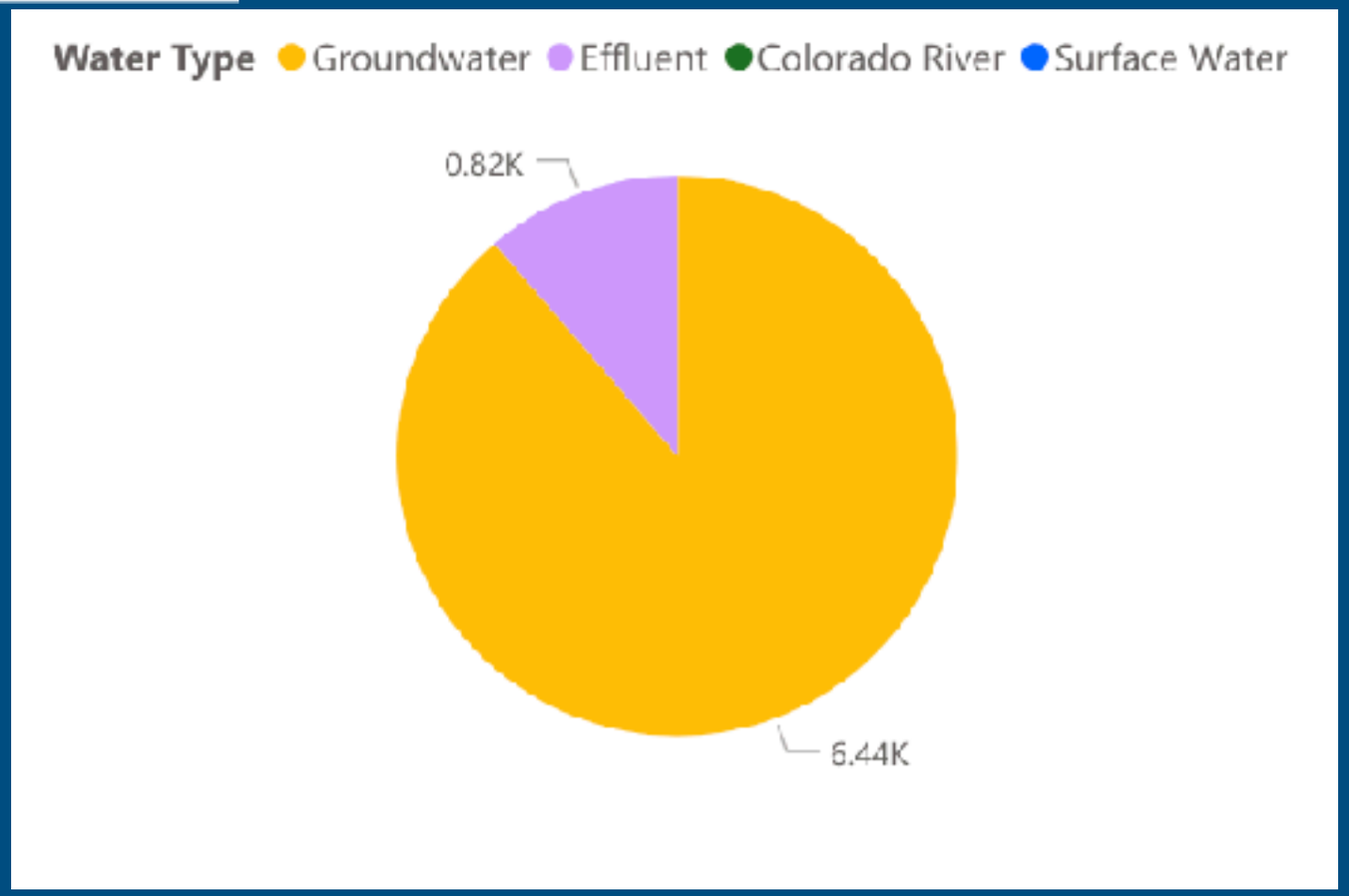
Water Use



Audience Question

PrAMA Primary User:
78% Municipal

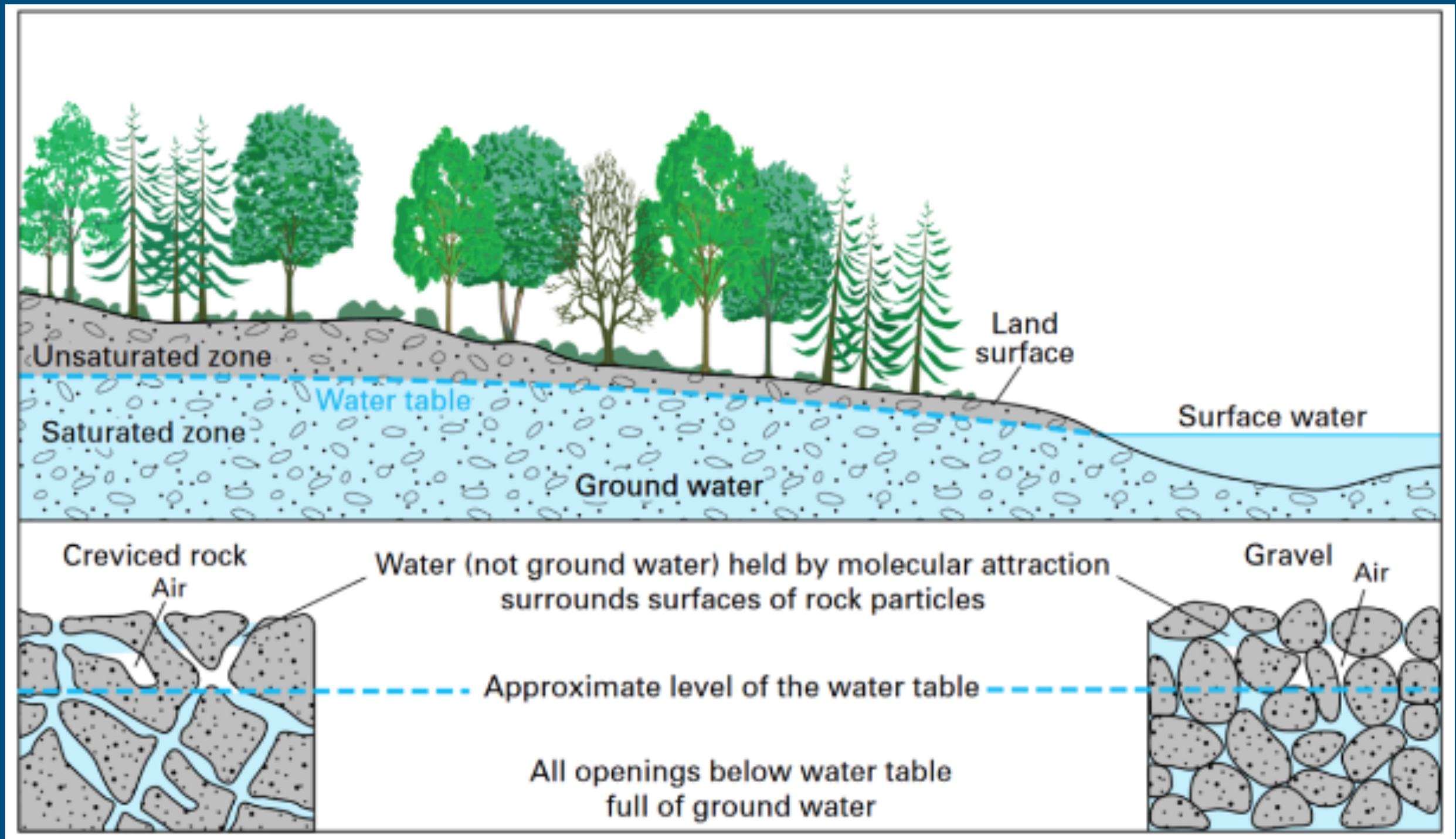
PV Primary Sources:
88% groundwater
12% effluent



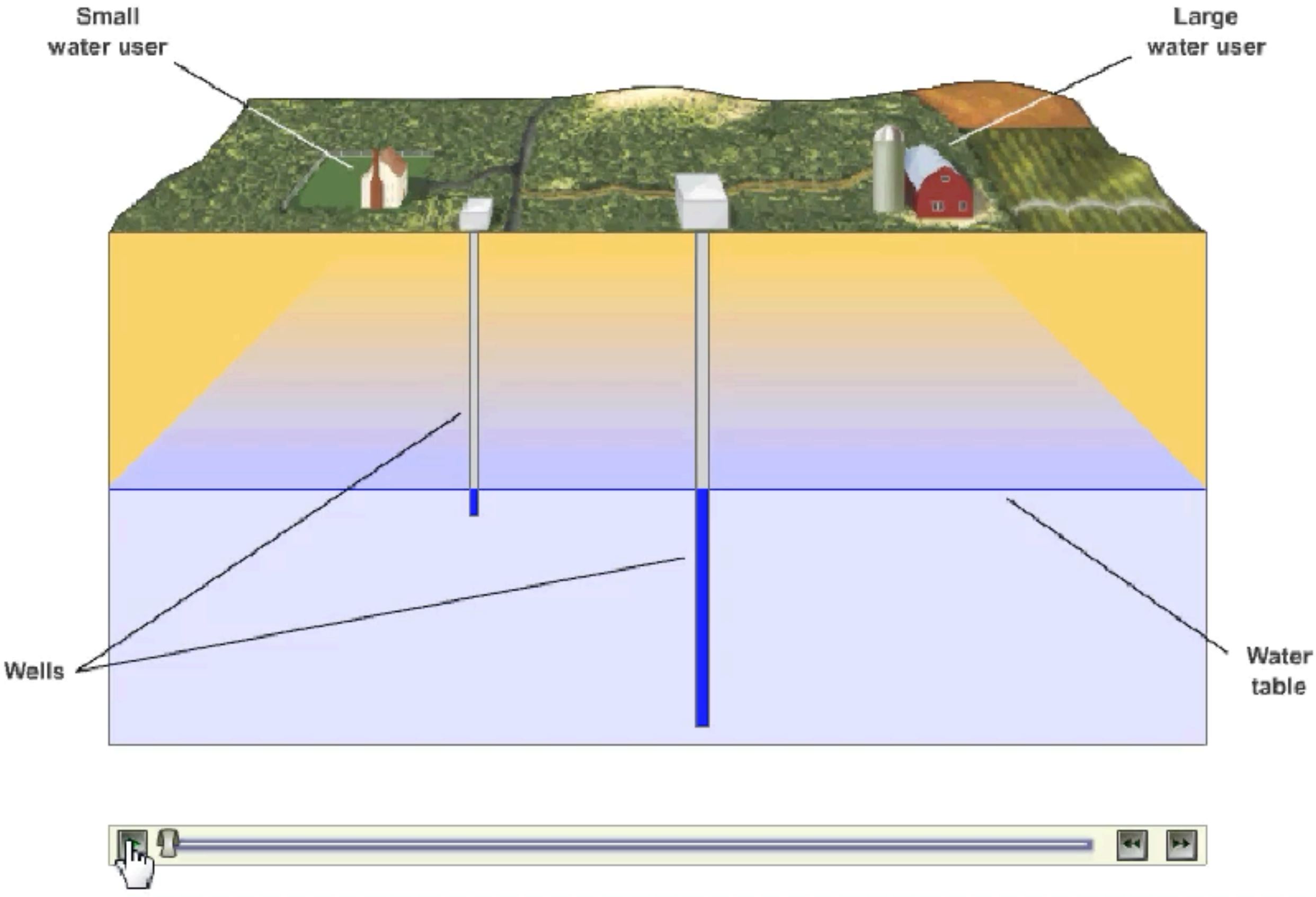
2024 Prescott Valley Groundwater Pumping

- Pumping: 6,354 acre-feet (af)
  - Loss & unaccounted: 552 af (9%)
  - Delivered: 5,680 af
- 28 municipal wells, production rotates to “rest” wells

What is an Aquifer?



Formation of a cone of depression



2024 Prescott Valley Recharge

- Wastewater recovery: 3,058 af (48% of pumping)
- Treated wastewater available for reuse: 2,891 af (46% of pumping)
    - Direct reuse-turf: 314 af
    - Discharged, not reused: 691 af (“permanent recharge”)
    - Recovered: 129 af
    - Long-term recharge (recoverable): 1,781 af (28% of pumping)
    - Short-term recharge (recoverable): 0 af
- Aquifer storage loss: ~3900 af (61% of pumping) ***if no recovery!***

Recharge/Reuse
Renewable Water Credits

- Treated effluent is recharged then recovered as groundwater. All water deliveries are pumped groundwater.
- Sources:
  - Treated wastewater (COP, PV, CV)
  - Granite Creek surface water (COP only)
- Recharge credits are created, can be recovered and used to support development.

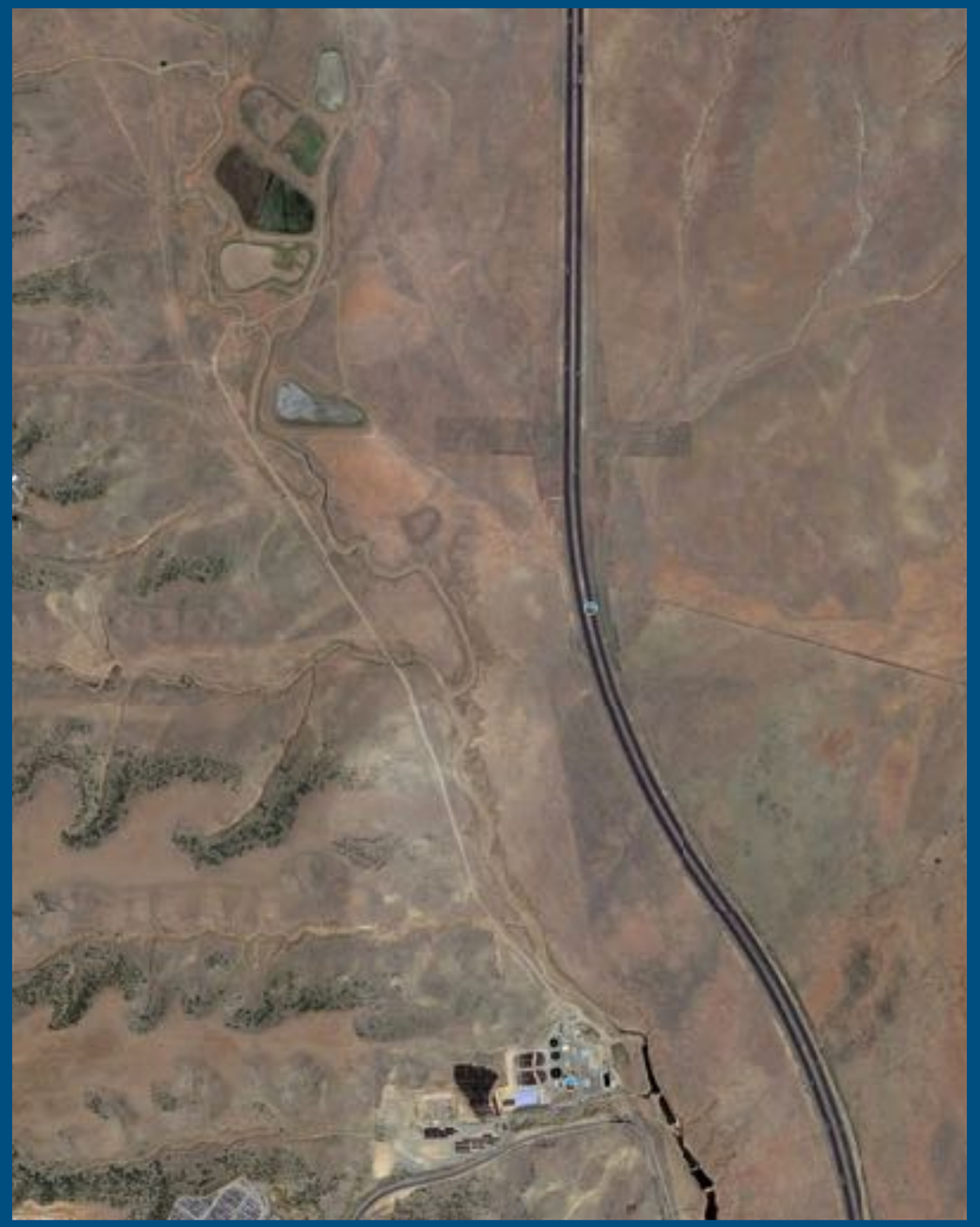
PV Recharge Locations

Treated wastewater returned to aquifer generates recovery credits.

Water quality is controlled.

Streambed:
50% credit

Ponds or injection wells:
95% credit



Recharge Credits

Audience question

- 2008: PV sold 2,700 afy of recharge credits to an east coast investment group for $67,000,000.

- ADWR credits PV with long-term recharge credits that are actually owned by the investor.

- Investor sells recharge credits to builders to prove a 100-year water supply, ~$20,000 - $40,000/af.

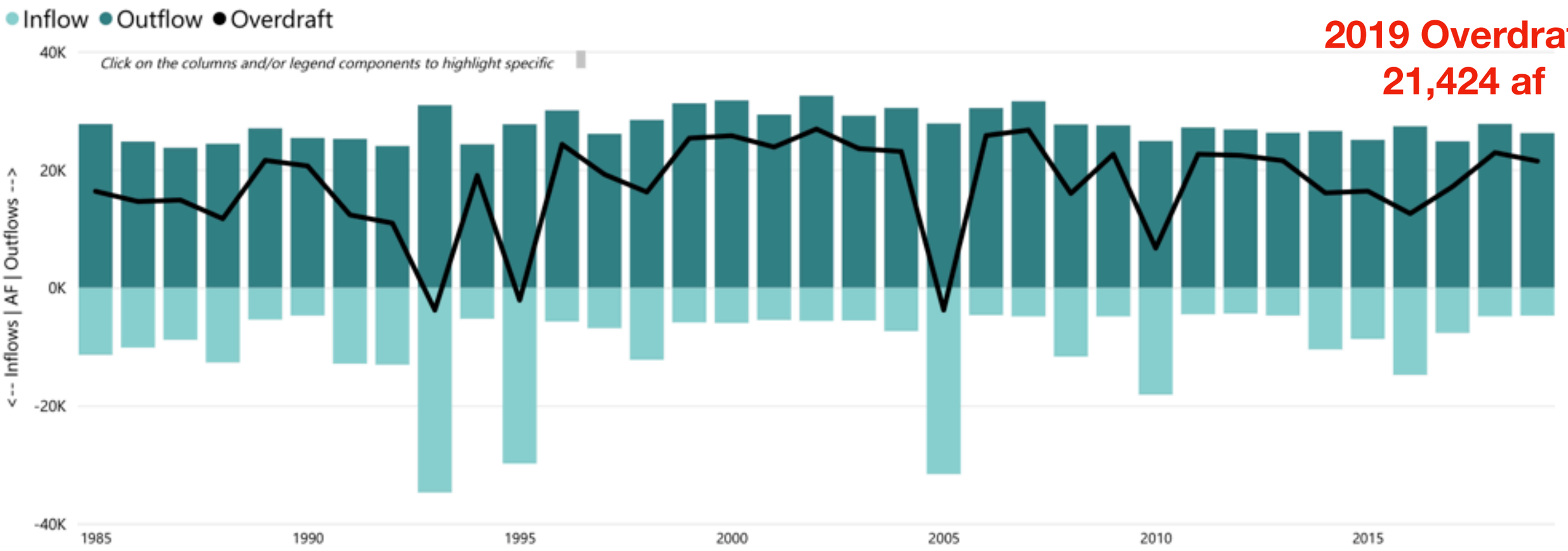
- Credits must be used in PV, ~ $4-8,000 per home

- Water quality concerns: eg PFAS

Aquifer Storage Loss

OVERDRAFT DATA DASHBOARD: Annual Overdraft

For more information, click here for the Safe-Yield Report



2019 Overdraft: 21,424 af

Show Components

Hide Components

YEAR

1985 2019

AMA

- [ ] Phoenix
- [ ] Pinal
- [x] Prescott
- [ ] Santa Cruz
- [ ] Tucson

Hold down "Ctrl" to select multiple AMAs

SAFE-YIELD INFLOWS:

Groundwater Inflow (Natural)*
Streambed Recharge (Natural)*
Mountain-front Recharge (Natural)*
Agricultural Incidental Recharge (Artificial)
Municipal Incidental Recharge (Artificial)
Industrial Incidental Recharge (Artificial)
Canal Seepage (Artificial)
Cut to the Aquifer (Artificial)
CAGRD Replenishment (Artificial)

SAFE-YIELD OUTFLOWS:

Groundwater Outflow (Natural)*
Riparian Demand (Natural)*
Agricultural Demand (Artificial)
Municipal Demand (Artificial)
Industrial Demand (Artificial)
Indian Demand (Artificial)

Solutions

It's up to us.
The AZ Legislature and ADWR will not help.

Conservation:

- Increase block rates
- Increase Recharge/Reuse
  - Connect septic to Sewer
  - Control Landscape water use
  - Direct Potable Reuse
  - Stormwater capture

Import Water:

- Desalination
- Big Chino

All require regional cooperation!

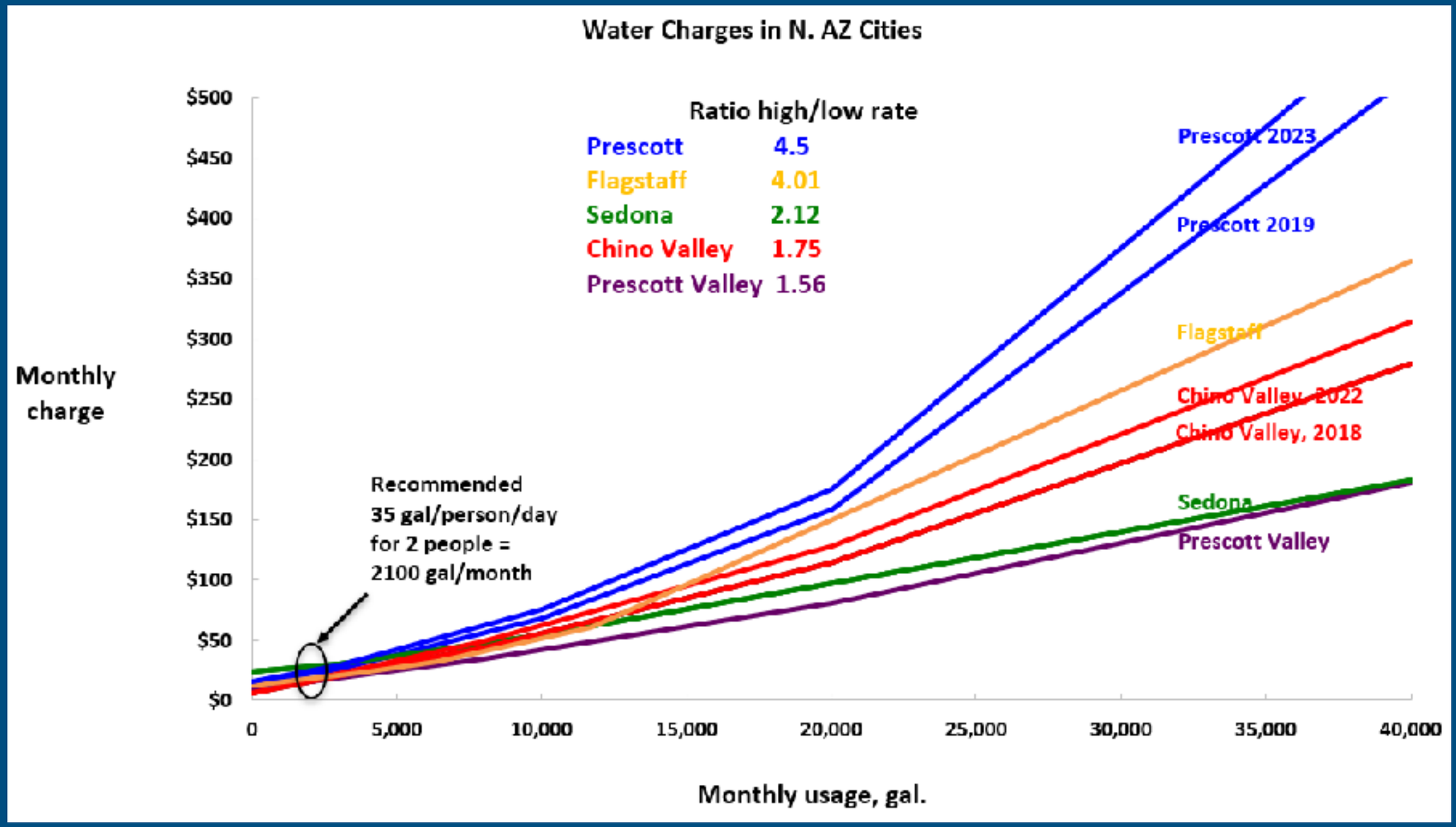
Will Conservation fix?

Estimates for comparison only

	Service Population	GPCD	Pumping, afy	Aquifer storage loss, afy
Service area 2024	55,850	102	6,354	3,900
Service area 2045 (assume conservation benefits aquifer)	71,100	*50	4,000	<2,000

- Conservation is the fastest and least expensive, but is not a complete solution.
- A combination of solutions is necessary.

Increase Block Rates



Prescott 2010: 13% improved gpcd

PV adjustments in progress

Connect septic to sewer?

- 19% of PV 2019 pumping was for out of town customers on septic tanks.
- Potentially 480 afy could be recovered for treatment and recharge.
- Prescott & Chino Valley estimates: VERY expensive.
- Substantial cost to homeowners and town.

Rural Home: Septic

Typical use: 0.20 - 0.35 afy/home

Potable water from Aquifer 100%

aquifer recharge: ~0-10%

Recharge: 10-35%

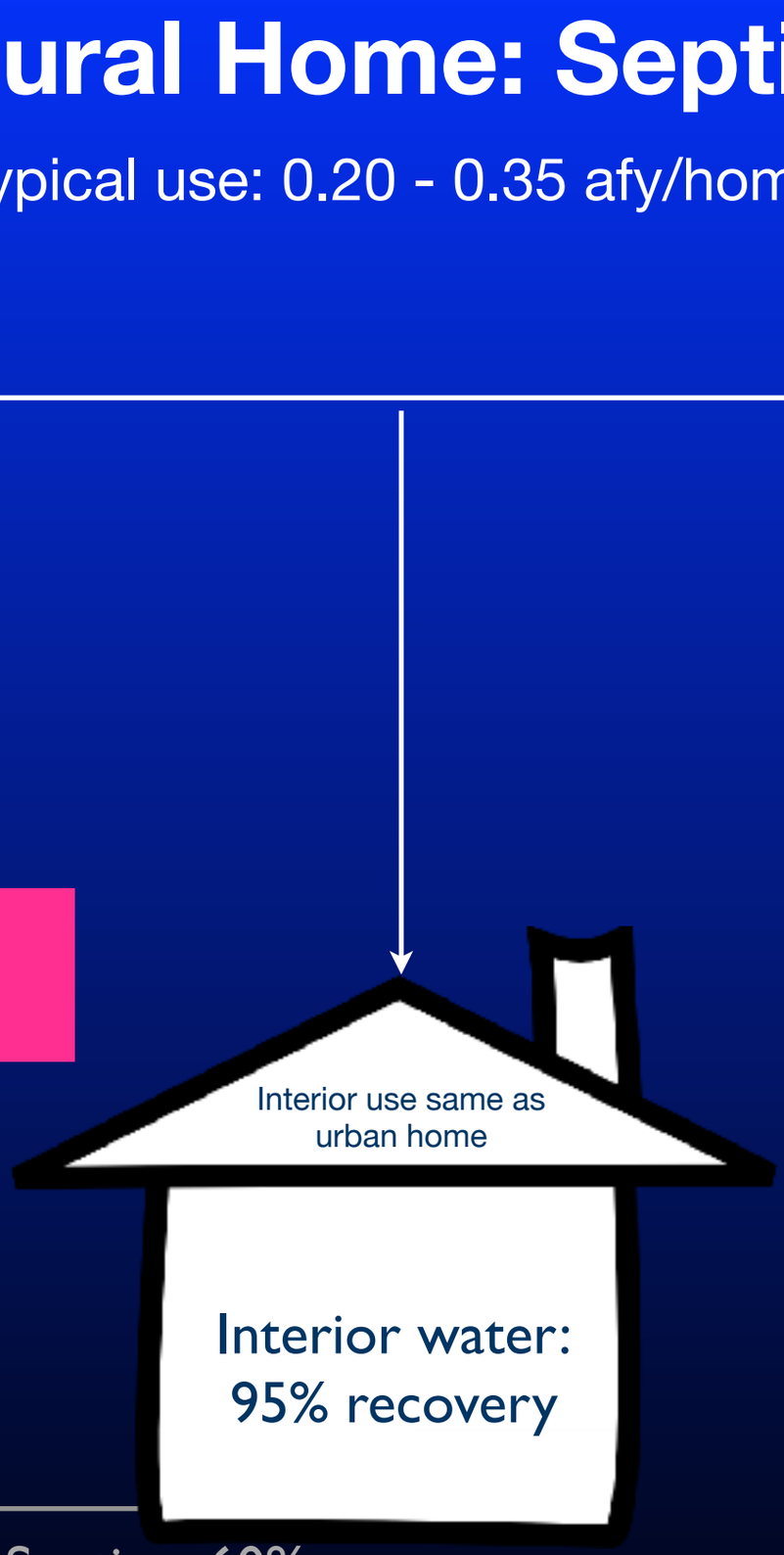
Loss

Leach Field

ET Field

Septic System

Septic: ~60%



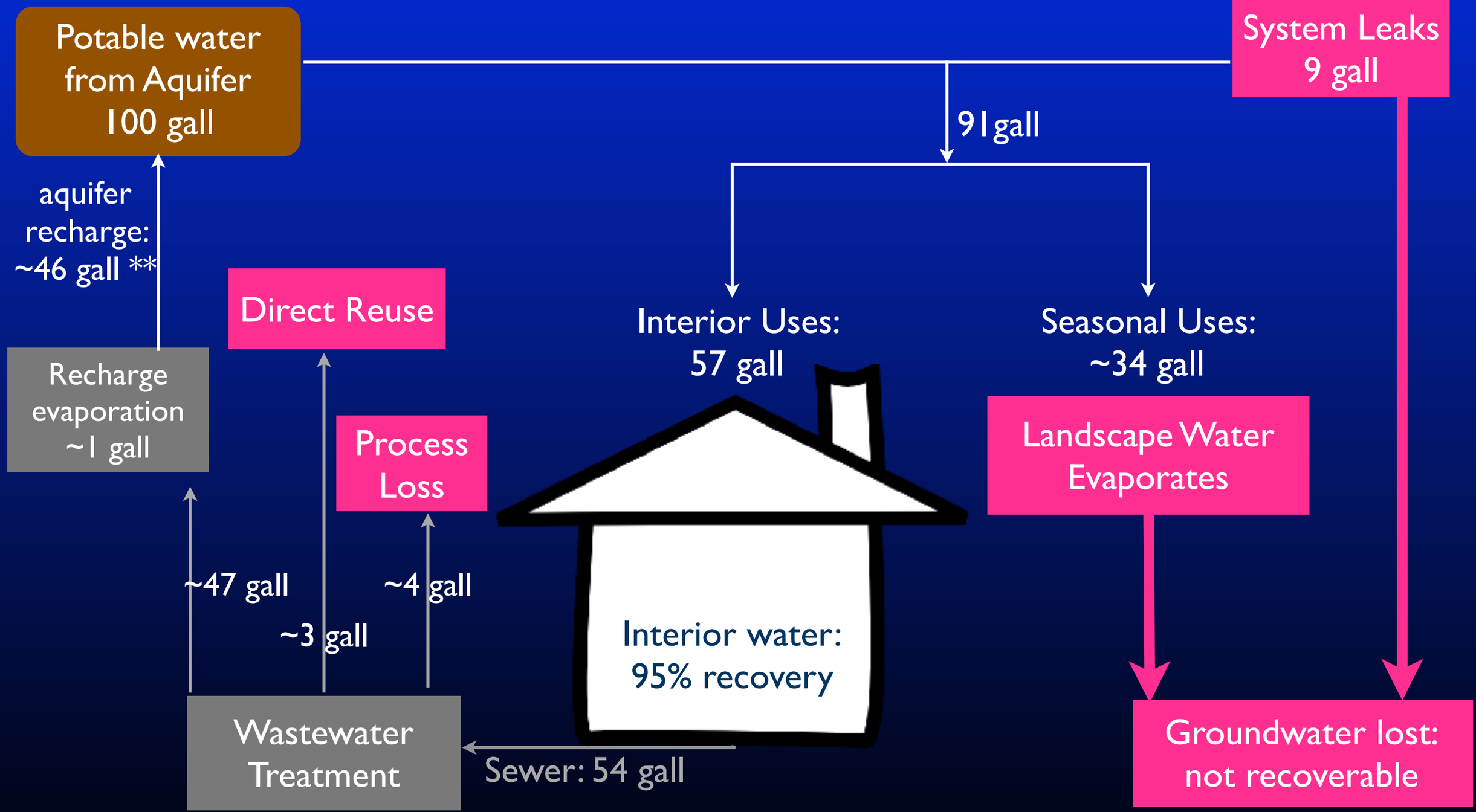
System Leaks ?%

Seasonal Uses ~30-50%

Landscape Water Evaporates

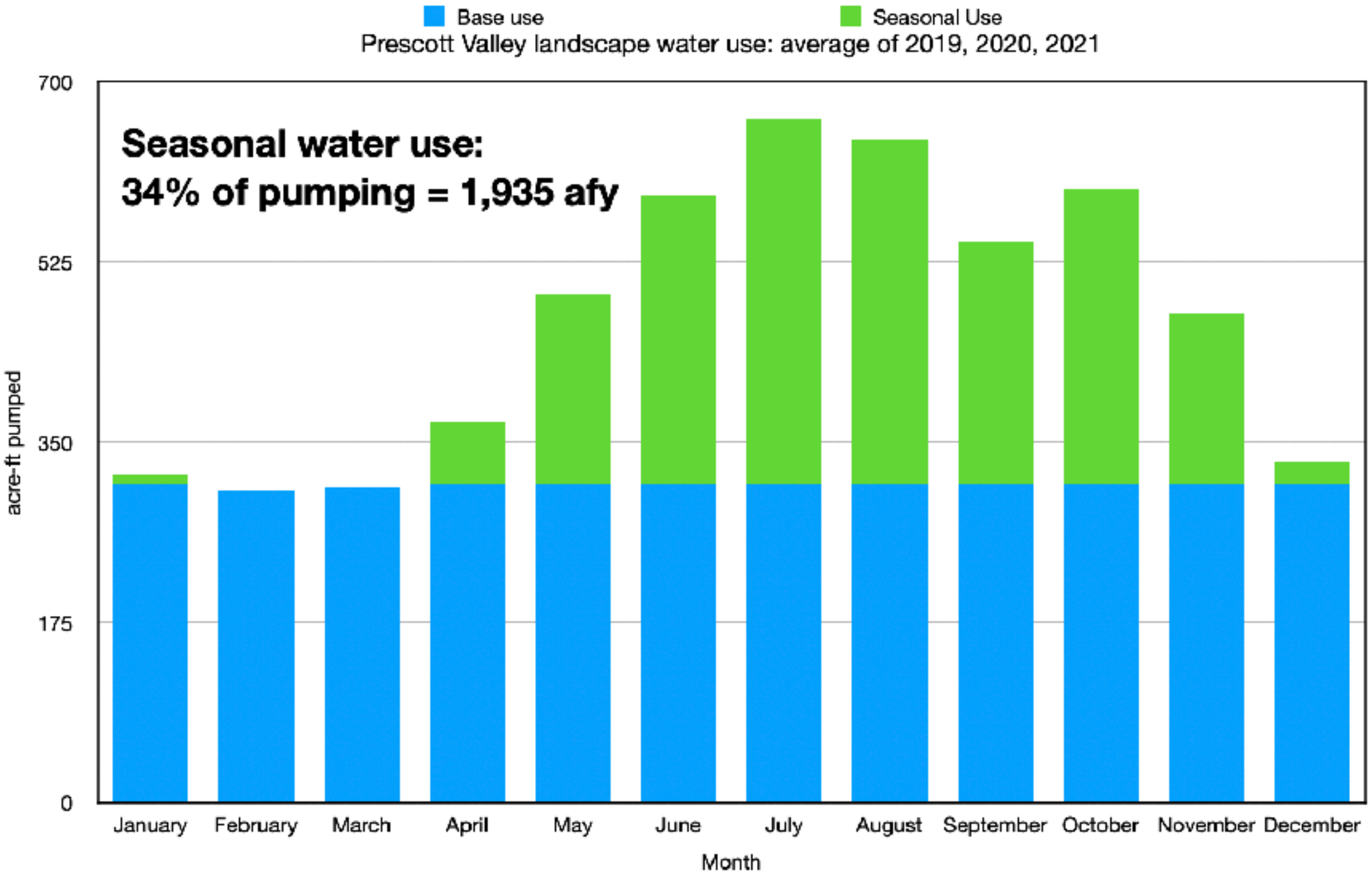
Groundwater lost: not recoverable

Average Prescott Valley Home: Municipal Water & Sewer



** *~28 gall average for town, including septic systems*

Landscape Water Use



Landscape Water Management

- Public education and assistance.
- Municipal demonstration sites.
- Incentives for turf removal, active & passive rainwater harvesting.

Landscape Water Management

Codes & Ordinances

- Modify & reduce landscaping requirements.
- Require drought-tolerant (native) plants.
- Prohibit graywater use unless on septic system.
- Prohibit groundwater use for landscapes for new building. Use rainwater harvesting instead.
- Prohibit additional direct reuse.

Municipal Water & Sewer

No direct reuse. No groundwater on landscapes.

Potable water from Aquifer 100%

Indirect Reuse

System Leaks 8%

aquifer recharge: ~ 81%

Recharge ~2% evap

Direct Reuse

~0%

Process Loss

~4%

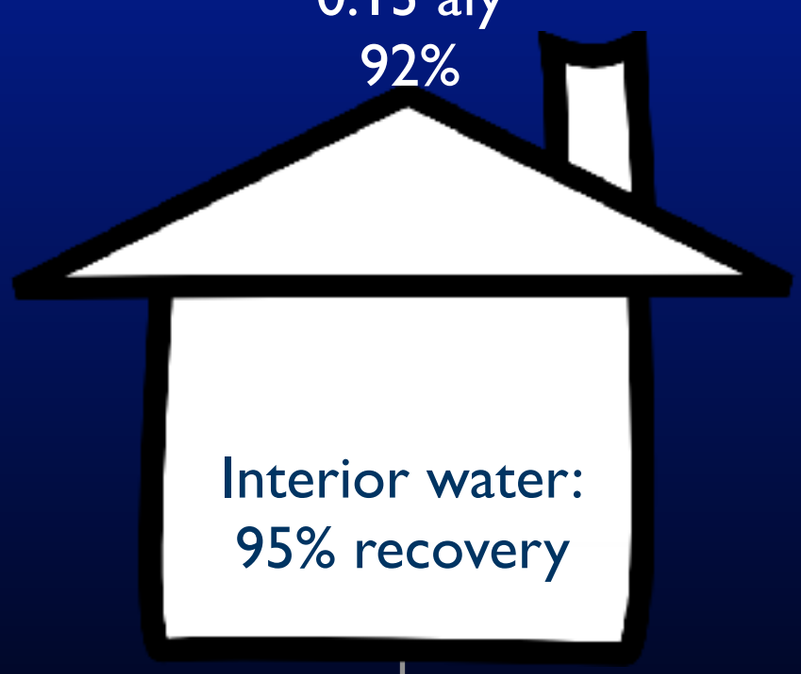
~83%

Percent of Groundwater Pumped

Interior Use: 0.13 afy 92%

Seasonal Uses: ~0%

No Landscape Water Use



Wastewater Treatment

Sewer: 87%

Water Neutral Development
(WND)

- No septic tanks or graywater - all waste water is collected.
- No groundwater is applied to landscapes.
- Stormwater runoff is captured for recharge before it evaporates or flows into a natural channel, so it is not appropriable.
- All treated wastewater and stormwater is recharged to benefit aquifer - permanent recharge.

NO: Evaporation Ponds

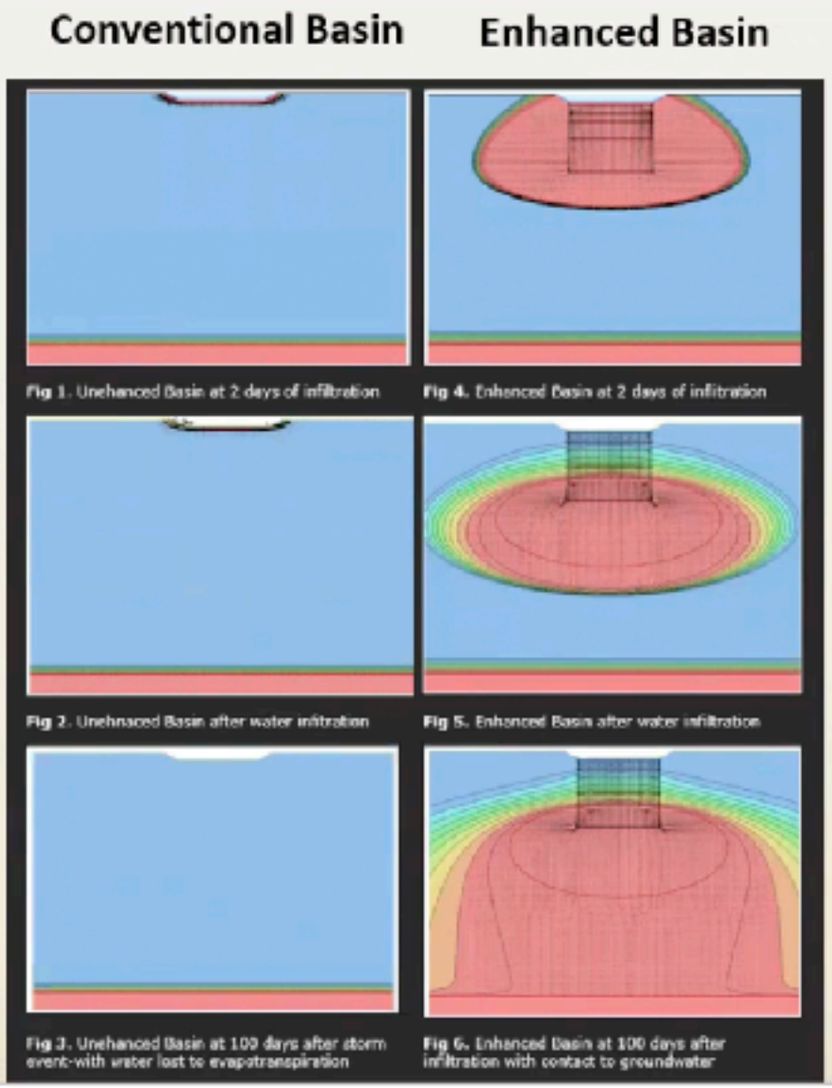
WND Conclusions:

- Not effective for septic systems.
- New subdivisions with zero landscape water use consume less groundwater than the amount of stormwater that can be collected and actually contribute a surplus to the aquifer.
- Even if WND programs cannot supply 100% of a subdivision's groundwater consumption, a partial offset is helpful and successful.
- The preliminary estimates are promising enough to warrant further investigation.

Storm Water Collection & Recharge

- Enormous potential, needs engineering study
- Issues:
  - Recharge Efficiency
  - Water Quality

Recharge Efficiency



- Conventional Basin
  - Surface water infiltrates 10 ft
  - Infiltrated water volume ~108,000 gallons
  - **All water is lost to evaporation**
- Enhanced Basin
  - Continuously infiltrates surface water
  - Infiltrated water volume > 1,000,000 gallons
  - **Virtually no losses to evaporation**
  - **Reaches 150 GW table in 30 days**

Enhanced basin field trials planned in Pronghorn

Recharge Quality: PFAS

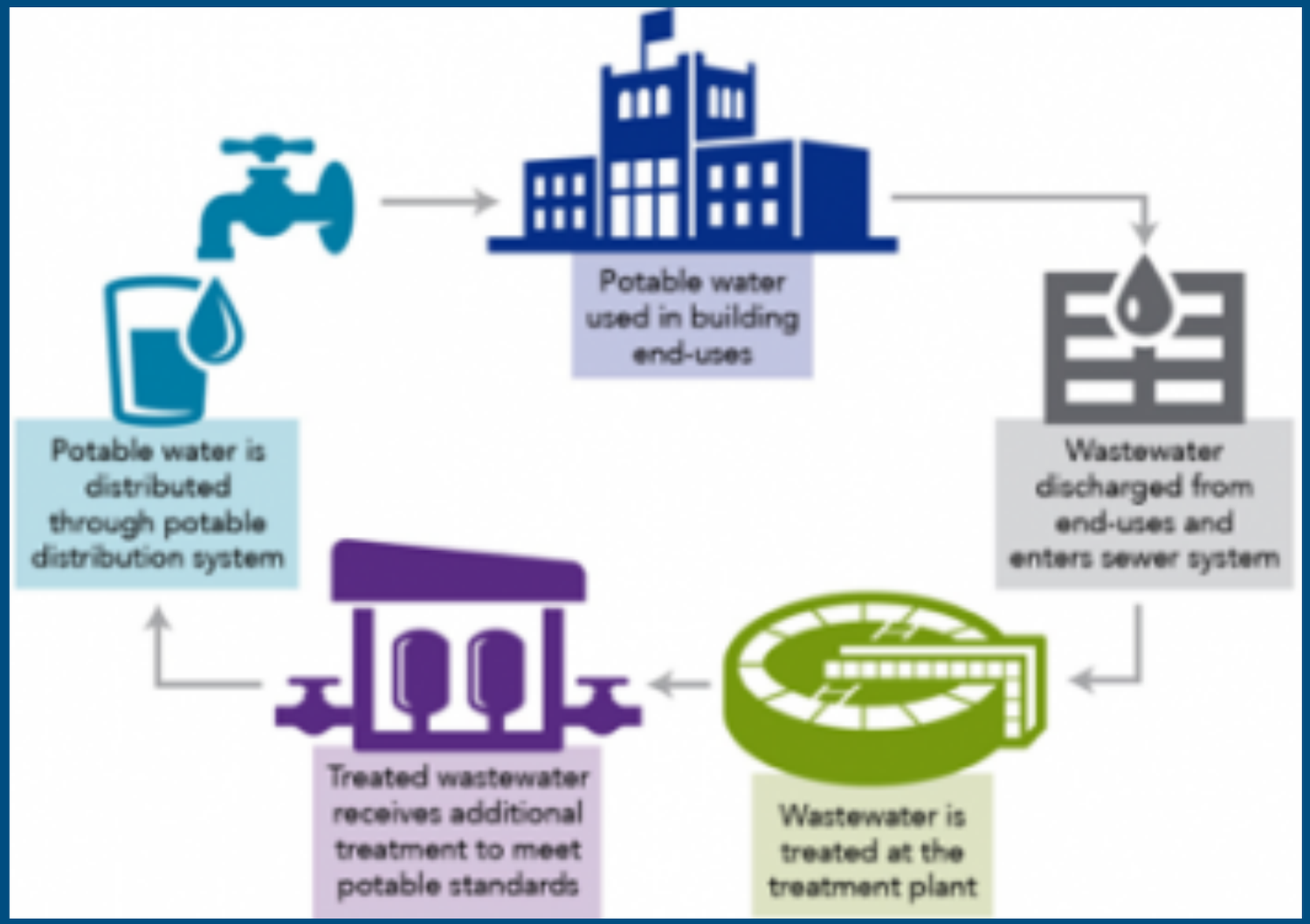
Wastewater Results

		Perfluorobutanoic acid PFBA	Perfluorobutane sulfonic acid PFBS	Perfluoropentanoic acid PFPeA	Perfluoropentane sulfonic acid PFPeS	Perfluorohexanoic acid PFHxA	Perfluorohexane sulfonic acid PFHxS	Perfluoroheptanoic acid PFHpA	Perfluorooctanoic acid PFOA	Perfluorooctane sulfonic acid PFOS	Perfluorononanoic acid PFNA	Perfluorodecanoic acid PFDA
Influent	7/19/2022	ND	ND	6.6		5.0		ND	5.2	ND	ND	3.4
Effluent	7/19/2022	1.9	1.4	28		11		1.2	9.1	ND	ND	ND

PRESCOTT VALLEY

Direct Potable Reuse

- Legal in AZ: ADEQ rulemaking in progress.
- Obstacle: Arizona Water Law creates economic disincentive.
- Opportunity: improve quality
- CWAG Video Archive: 2015-05-09 - *“Can Local Communities Make Better Use of Wastewater?”*



Examples: Scottsdale demo system, Texas, Colorado, California, Florida

Augmentation Schemes

- Should be the lowest priority - last resort after conservation.
- History: many proposals that are improbable, unacceptable, unworkable, grandiose, or unreliable: cloud seeding, icebergs, pipelines from Great Lakes/Mississippi River, replumbing North America.
- Vegetation management
- Desalination
- Big Chino groundwater

Augmentation:
Vegetation Management

No Benefit to PrAMA

- CYHWRMS: 4FRI thinning of Ponderosa Pine (>7000') yields ~2,000 af @ average cost $2,200/af ; 7 year renewal cycle. Benefits Verde Valley & SRP.

- Upper Verde River Watershed Protection Coalition (now defunct) proposed Piñon-Juniper clearing in Big Chino Valley

  - USFS Research: Does not benefit aquifer.

  - Benefit: subsidy to ranchers for forage production.

Augmentation: Desalination

- $5.5 Billion desalination plant in Puerto Peñasco.
- 1,000,000 afy piped to Lake Pleasant for CAP distribution to central/southern AZ.
    - Enough to serve 3 million homes, more than double current AZ housing.
    - Cost estimate: $3,000/af; adds ~$5-600/yr to home water bill.
    - No benefit to N. AZ.
- World’s largest desalination plant: Saudi Arabia, 414,564 afy.

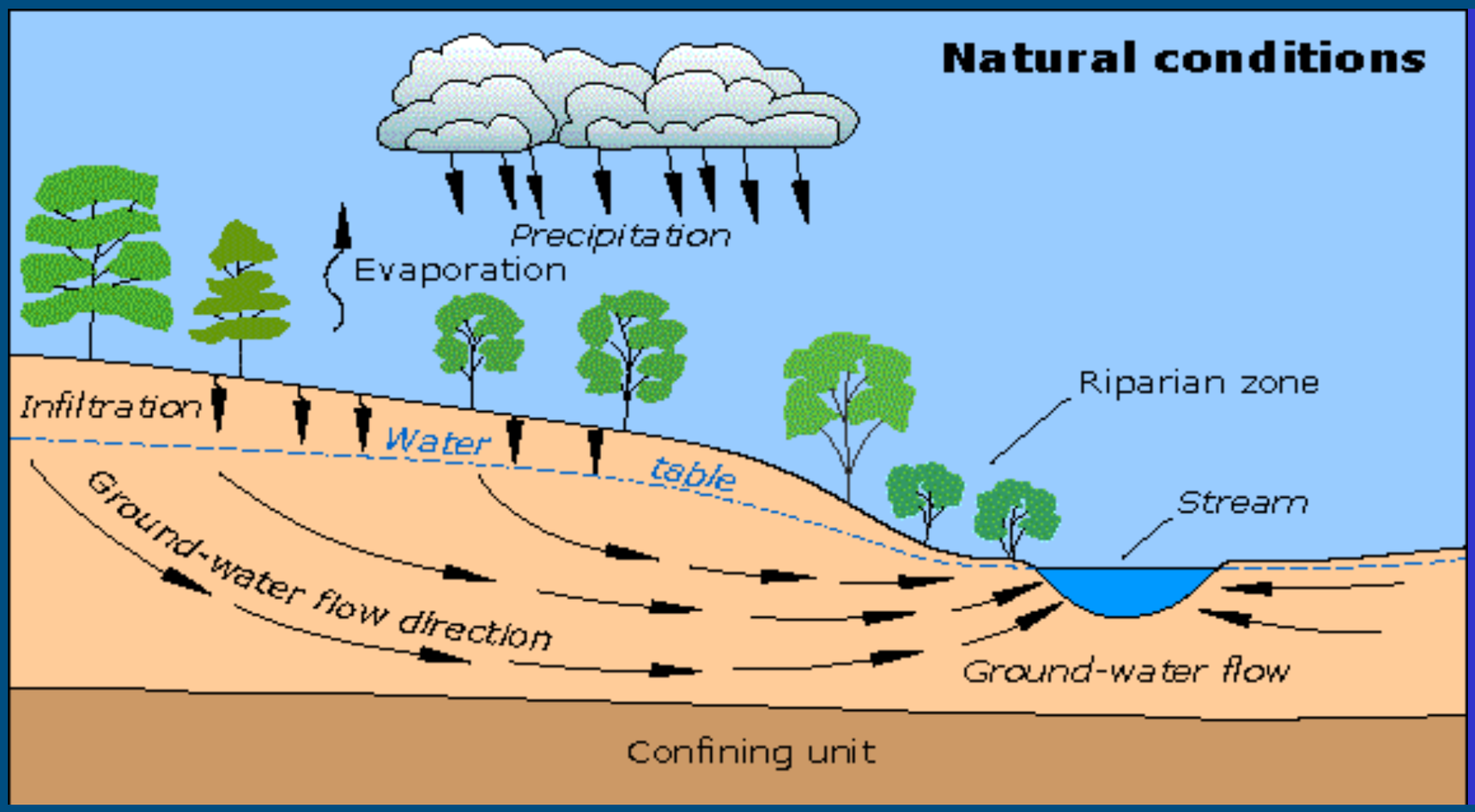
Augmentation: Big Chino Groundwater

- 1993 Groundwater Transportation Act grants Prescott legal rights to import Big Chino groundwater into the PrAMA and share with Prescott Valley.
    - Prescott: 54%; Prescott Valley 46%
- COP/PV/SRP legal settlement 2010: COP/PV agreed to mitigate BC pumping impacts to protect Verde River.

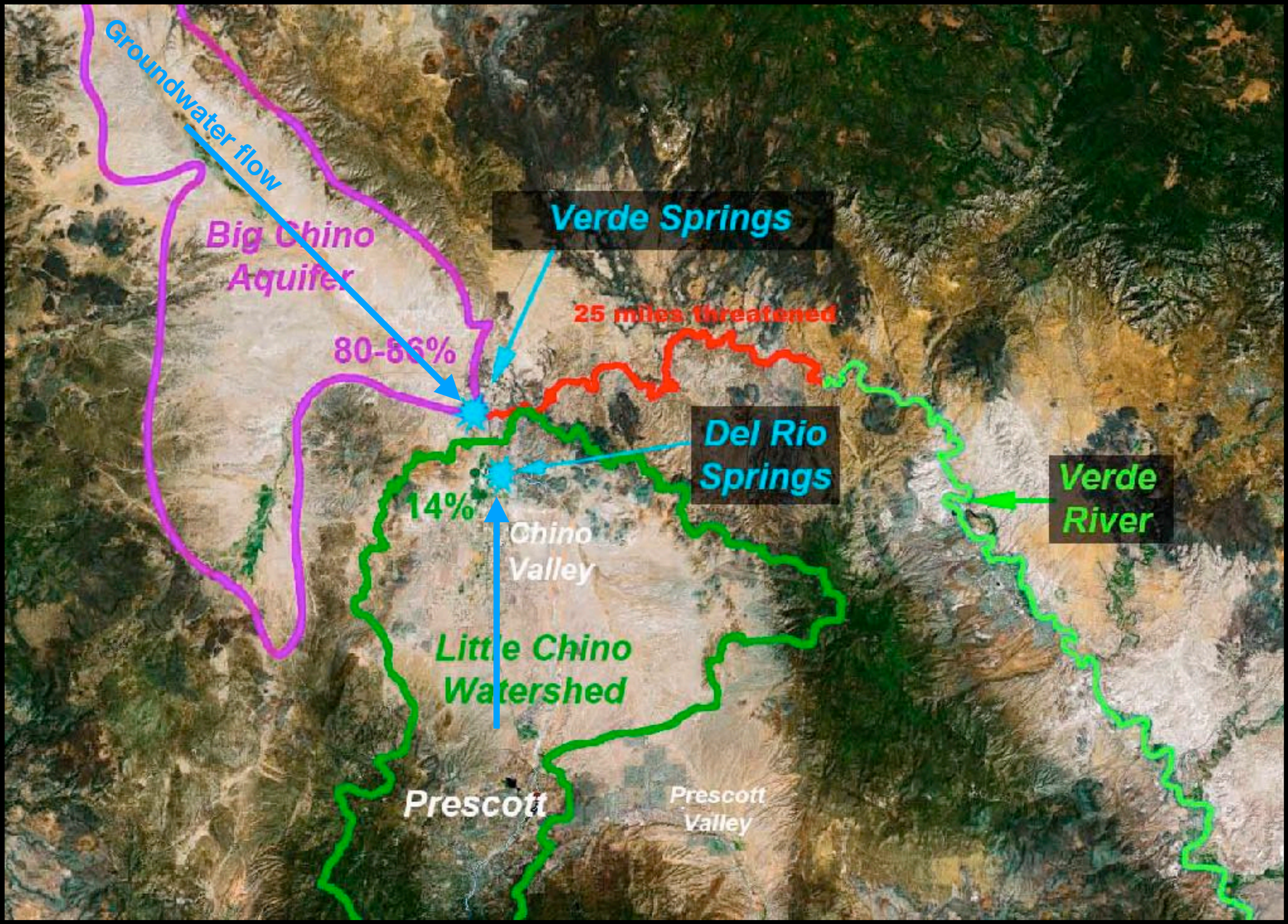
Big Chino Water Ranch

- Pipeline designed for 12 Kafy (> 1 river flow)
- Monitoring & Modeling project underway, shared cost >$5M, complete in ~~2021 2022 2023 2024 2025~~ 2026??
- Construction date unknown - decades in the future if ever.
- Prescott Charter requires Prescott citizen approval for financing.
- Cost in 2024: ~$360 M without mitigation, plus PV funds pipeline from Chino Valley to PV.

Groundwater Moves

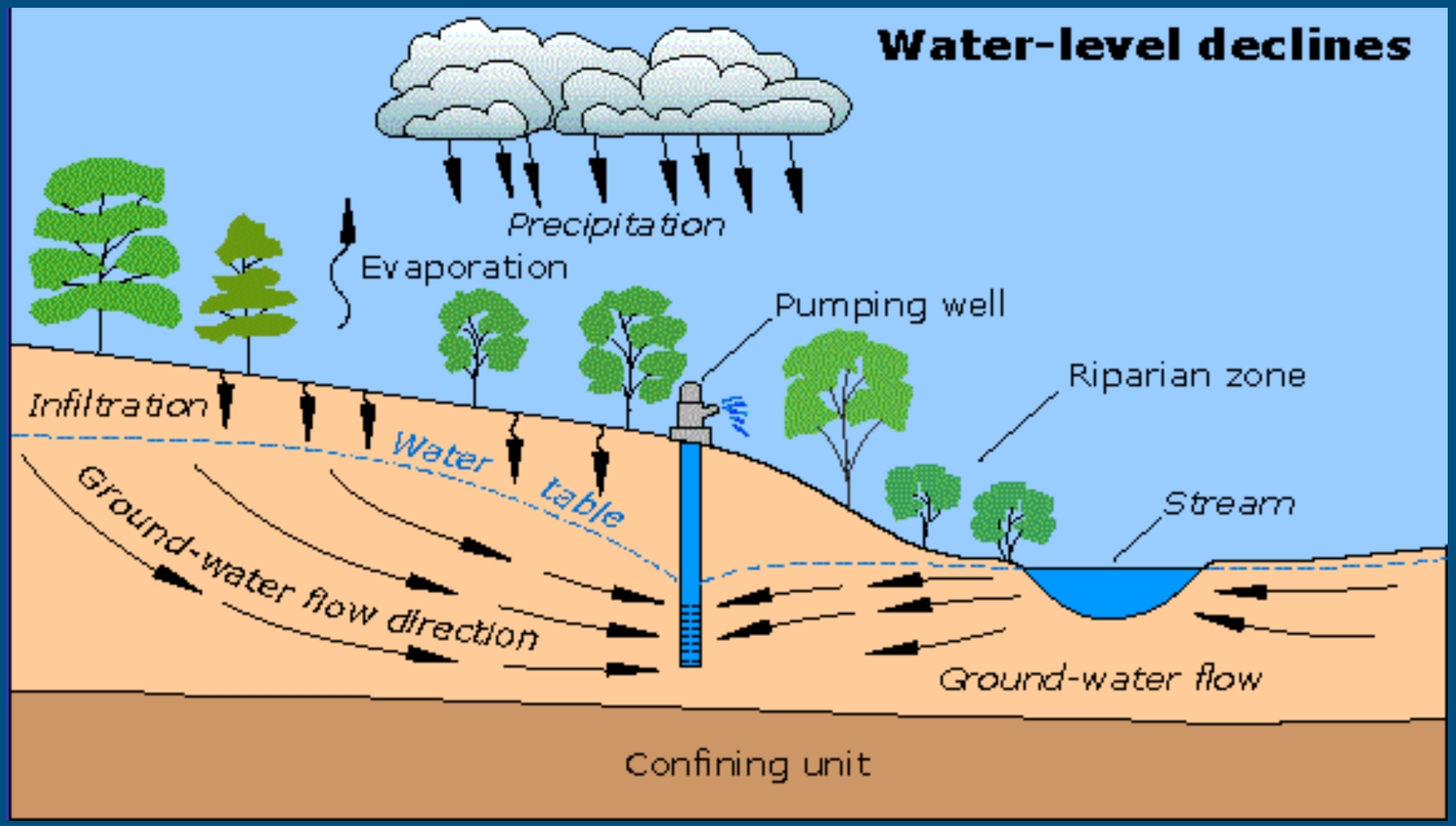


Ground-water flow Natural conditions: Recharge flows to the stream through the ground-water system


Groundwater flow
Big Chino Aquifer
80-86%
Verde Springs
25 miles threatened
Del Rio Springs
14%
Verde River
Chino Valley
Little Chino Watershed
Prescott
Prescott Valley

Groundwater Pumping Captures Streamflow

- Lowers aquifer levels, diminishes base flow
- Due to geology, Verde Springs is especially sensitive



Threat : Groundwater Exports

Current base flow: ~ 11,000 afy

Potential legal export: ~18,000 afy

Pipeline design: ~12,000 afy

Responsibility: Prescott, Prescott Valley, AZ Legislature

Big Chino Aquifer

Paulden

Williamson Valley

Chino Valley

Verde River

54%

46%

Prescott

Prescott Valley

BCWR Mitigation

- Prescott/PV promised to mitigate any harm to Verde river flow.
- Paulden wells are not considered.
- If mitigation is possible, it will be expensive and difficult.
- Mitigation discussions by PV, Prescott, and SRP are closed doors - no public transparency.

Big Chino ≠ Safe Yield

- PV plans to use Big Chino water for **growth, not safe yield.**
- The Big Chino Water Ranch is legally authorized to import 8-12,000 afy, **which exceeds the current flow of the Verde River.**
- The 2019 annual overdraft is >21,000 afy, **75% more than the pipeline capacity.**
- **Unmitigated BC water imports will dry the upper Verde River. Mitigation strategies unknown.**

What Limits Growth?

Audience Questions (many)

- Not demand, which is apparently limitless…
- Does water limit growth?

Legally Authorized "Paper" Water Facilitates Population Growth

	Population 2020	Estimated 2020 Legal "Paper" Water afy	Legal Potential Population no Big Chino	Big Chino Water, afy	Max. Legal Population w. Big Chino
Prescott	44,439	DAWS	81,307	4,356	124,867
Prescott Valley	46,785	867	55,455	3,711	92,565
Chino Valley	13,020	1,128	24,300	648	30,780
Available HIA + E.C.		7,600	76,000		76,000
Total	**104,244**		**237,062**	**8,715**	**324,212** 100 yrs @ 2%

Estimated ***minimum*** population for legally authorized water @ 0.20 afy/home, 2 occupants/home.
Does not count recycling of recharged treated effluent or homes in unincorporated areas.

What Limits Growth?

- Legal “paper” water rights will not constrain growth.
- State Cannot Mandate Growth Management Restrictions:
    - ARS 9-461.13 prohibits the state from requiring cities and counties to develop a growth management plan or establish urban growth boundaries…
    - However, growth is practically limited—not by growth ordinances, but by the reality of water scarcity and regulatory power tied to water supply. If developers cannot secure a 100-year water supply, new projects face a standstill.
- The Physical Adequacy Determination is the most likely water barrier to continued growth.

What Limits Growth?

Audience Question

- VOTERS!
- Eternal vigilance is necessary
- CWAG: focus on gallons used, not heads…

PV Current Actions

- Revised web site to eliminate misleading information.
- Prepared 2035 General Plan with correct water information.
- Now beginning to consider conservation incentives and rate structures (long overdue!).
- Improving public education on water.
- Studying stormwater management to reduce flooding and increase recharge.
- First steps to regional water planning discussions.
- Pursuing the importation of Big Chino water (endangers the upper Verde River).

Takeaways

- Prescott Valley is a major contributor to our region's current problem of rapid aquifer depletion.
- Growth exacerbates the problem. PV does not now have adequate water to achieve growth goals.
- Importation of Big Chino water without mitigation will dry up the only surviving living river in Arizona.
- Current PV investigations of greatly increased conservation and recharge measures are necessary and welcome.
- Regional cooperation is essential to find a way forward.

Regional Actions Needed

Because we all share the same aquifer!

- **Regional water planning, including a comprehensive evaluation of alternatives is essential.**
    - Eliminate competition. Improve conservation. Use environmentally responsible augmentation.
    - Modernize water law *(change the Legislature!)*
    - Obtain state assistance with augmentation.
- **Make water an electoral issue.**
- **Citizen's voices are influential and essential.**
- ***Protect the upper Verde River.***

Support the Upper Verde Wild and Scenic River!

UPPER VERDE
WILD & SCENIC RIVER

www.wildverderiver.org

A refuge for wildlife and a sanctuary for people.

Questions and Discussion