Second five-year review of the Tulare: East James and Tulare: Western Spink-Hitchcock aquifer management units

Presented before the Water Management Board

By Kim Drennon on the 3rd of December 2025

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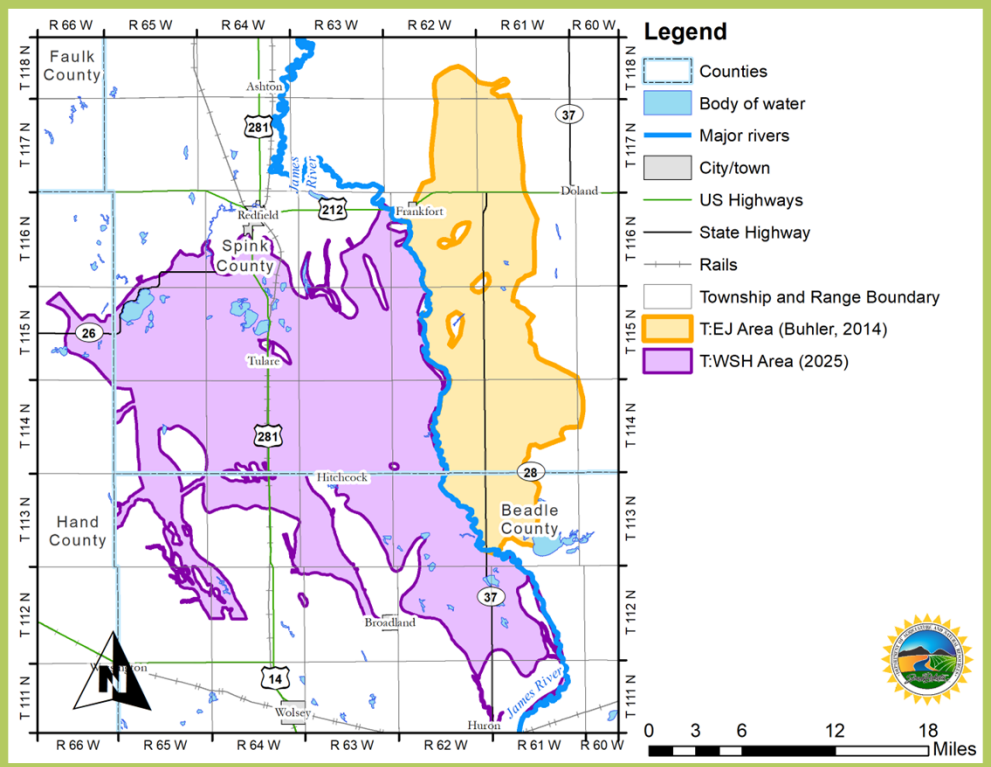
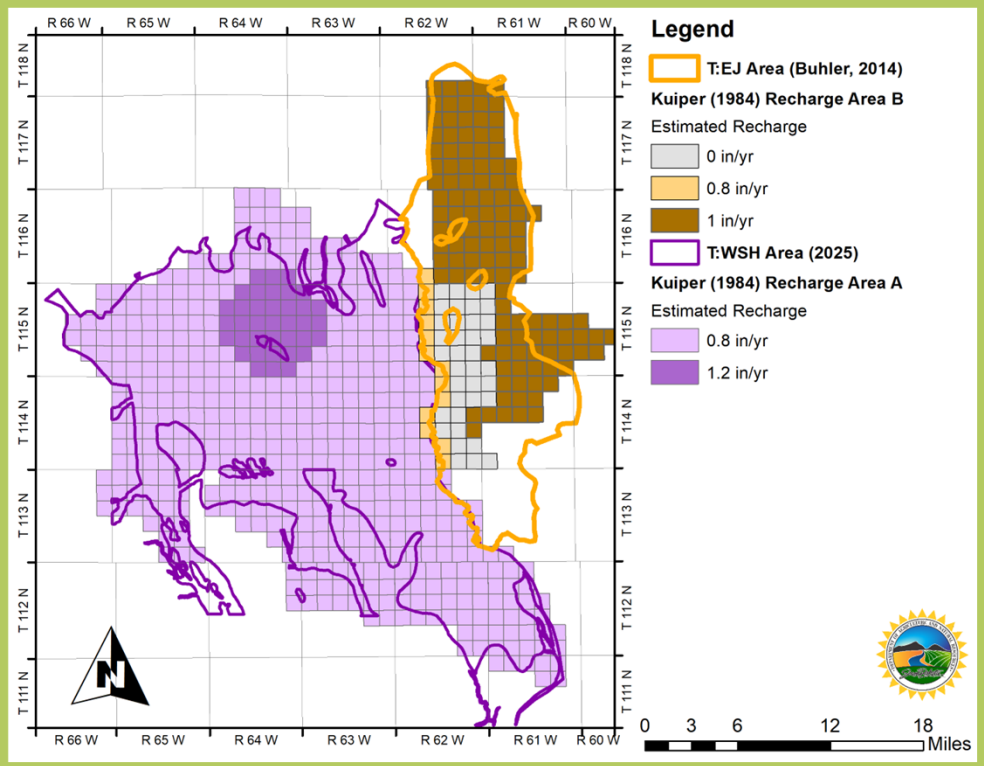
Overview



- Glacial sand, silt, and gravel outwash
- Located near the surface, but can go down to bedrock formations
- Connected to surface water bodies
- Underlain by the Pierre Shale and Niobrara Marl (Chalk)
- Niobrara Formation can be an aquifer in this area
- Niobrara aquifer has water which can create a salinity hazard for crops
- Both aquifers have portions that are confined and other portions that are unconfined

How recharge is estimated



- Computer model run by USGS Hydrologist Kuiper in 1984 with square-mile sized nodes
- Areas were re-delineated based on newer drilling data
- For T:WSH, multiply average estimated recharge (in/ac) by new areas
- For T:EJ, assume total ac-ft/yr estimated by Kuiper is best information available, due to large differences in model area vs. new delineation
- T:WSH recharge is 18,000 ac-ft/yr
- T:EJ recharge is 6,800 ac-ft/yr

How are withdrawals estimated

- Non irrigation is a small fraction of withdrawals
  - Domestic self-supply (T:WSH, 70 ac-ft/yr; T:EJ, 17 ac-ft/yr)
  - Commercial use (in T:WSH only)
- Most withdrawals are from irrigation
- 2020 estimates:
  - T:WSH withdrawal was 18,000-19,000 ac-ft/yr
  - T:EJ withdrawal was 7,900 ac-ft/yr
  - Some permits were still undeveloped
  - Used average irrigation plus estimate for undeveloped permits

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This review – a little different

- All permits are developed and reporting
- Instead of adding up total reported, then average, average each permit's reports, then add up
  - This is done with the Madison aquifer, for example
  - Other method can underestimate withdrawals
  - Increased development over time means that old irrigation summaries are not directly comparable to new irrigation summaries

Bottom line:

T:WSH withdrawals are 12,000-13,000 ac-ft/yr

T:EJ withdrawals approximately 8,100 ac-ft/yr

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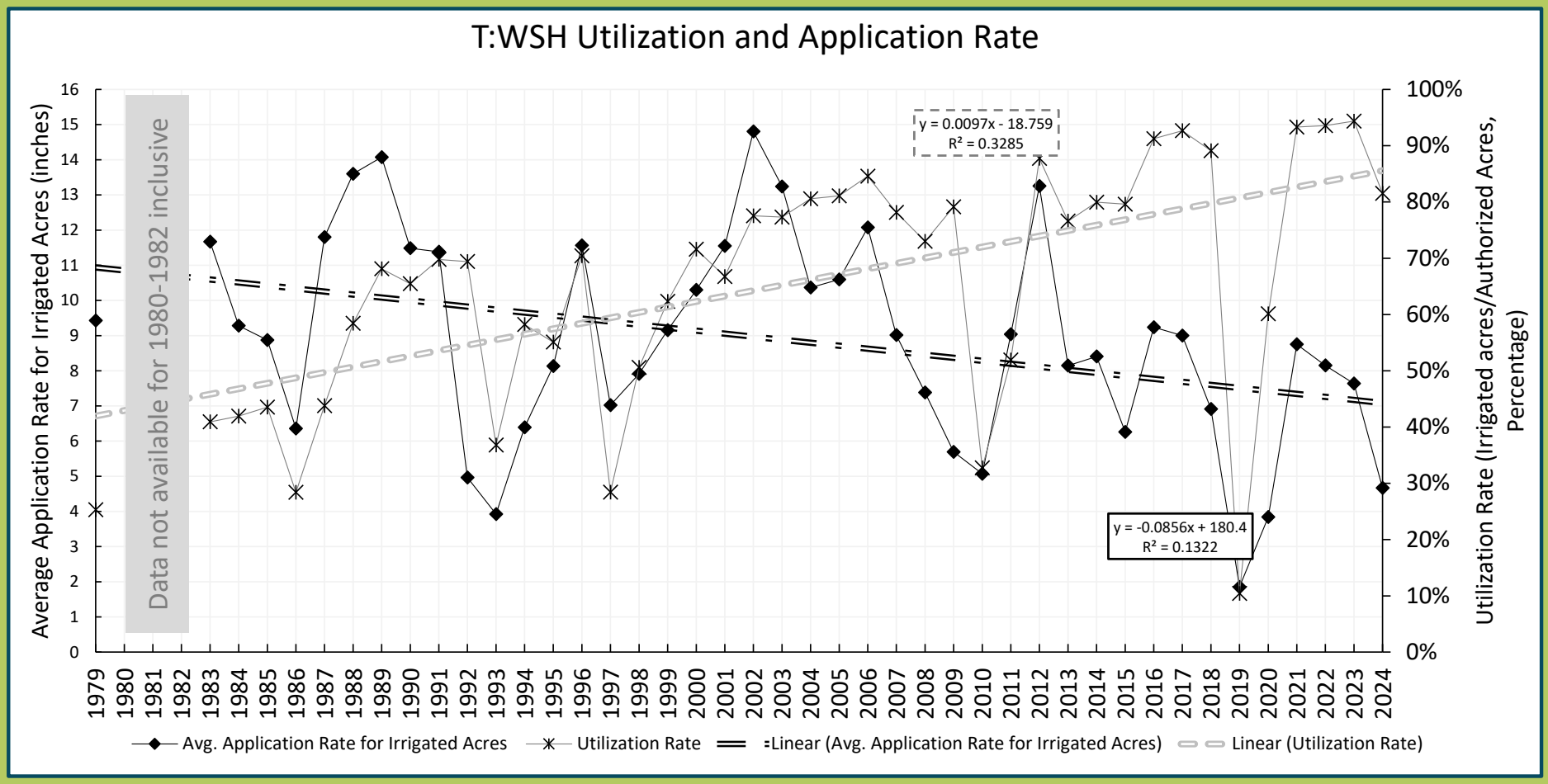
Irrigators are using more permitted acreage, but fewer inches of water per acre.



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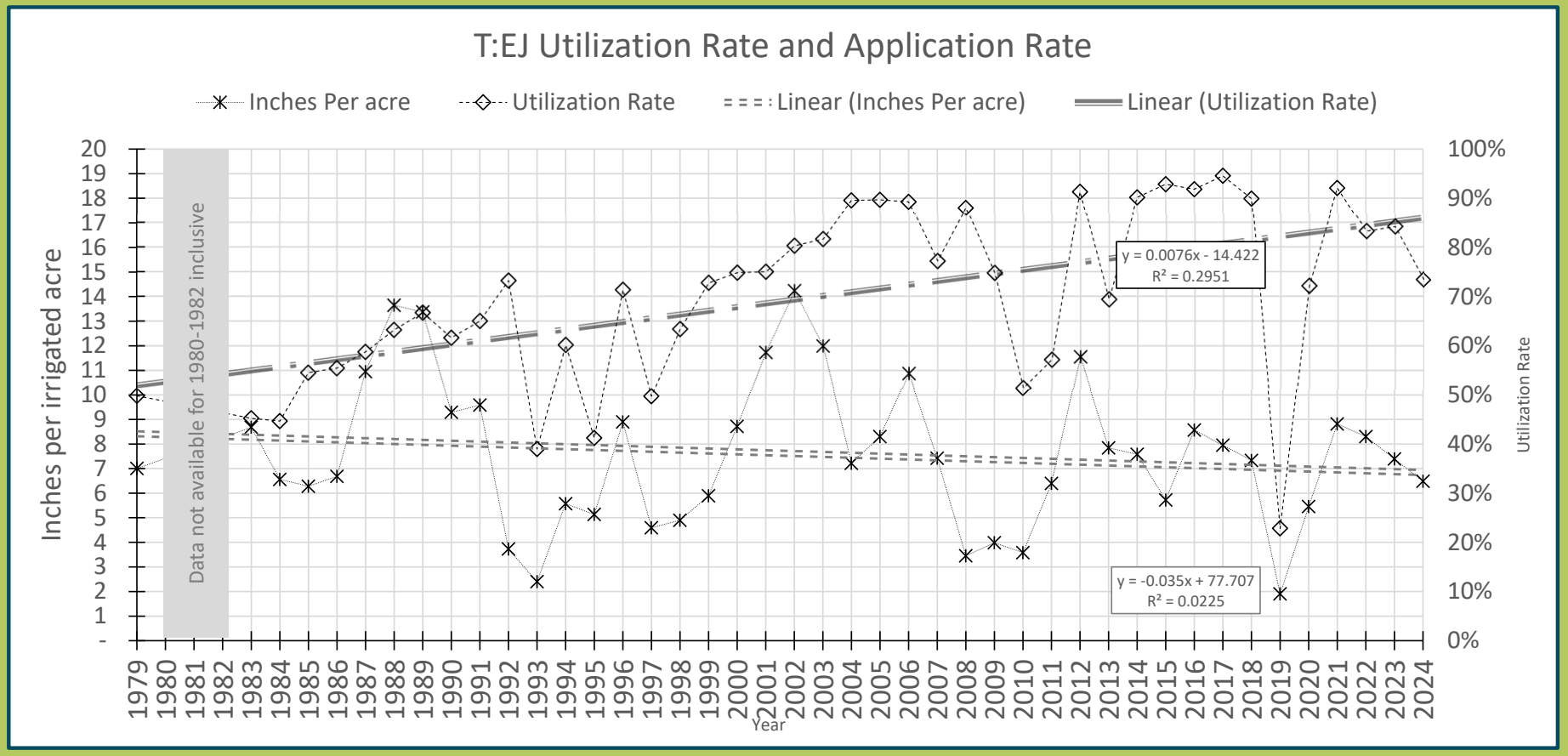
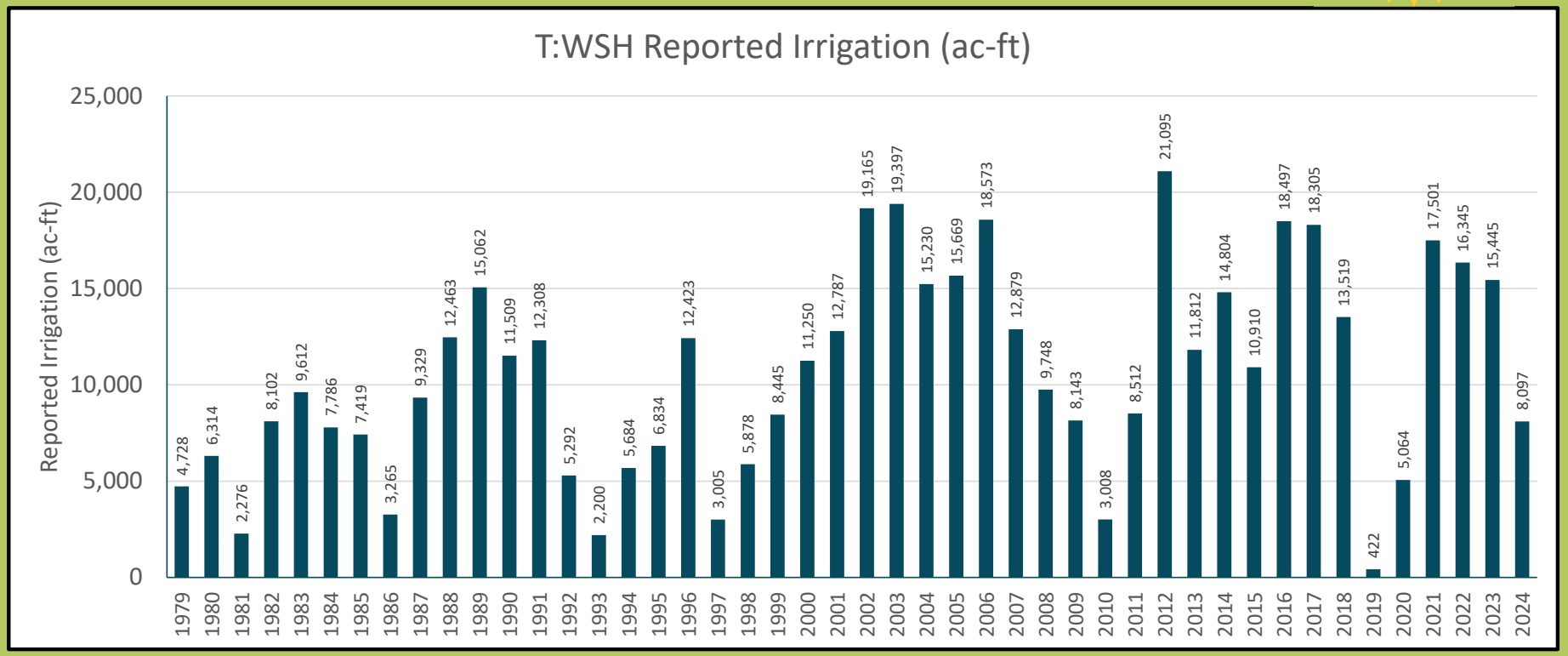
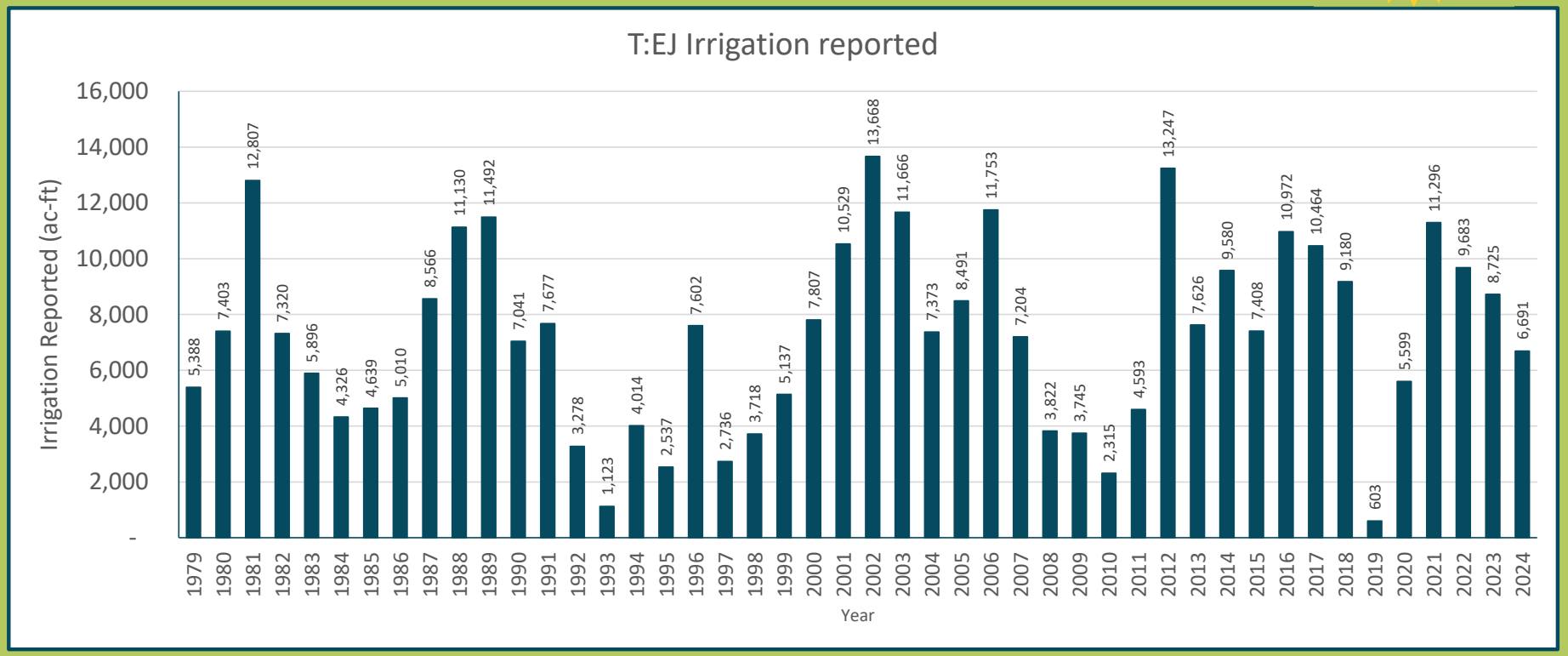


T:WSH Irrigation Reported over time



T:EJ Irrigation Reported over time



Summary of hydrologic budget

Aquifer	Appropriated Acres	2015 - 2024	
		Avg. Irr. /Rept. Acre (in/yr)	Avg. Utilization (acres used/acres authorized)
T:WSH	25,542	6.63	79%
T:EJ	16,735	6.79	80%

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Summary of hydrologic budget

Aquifer	Area (thousand acres)	Storage (thousand ac-ft)	Recharge (thousand ac-ft/yr)	Withdrawal (thousand ac-ft/yr)
T:WSH	260	1,400	18.0	12.2
T:EJ	124	608	6.8	8.1

Difference between Withdrawal and Recharge for T:EJ is within uncertainty of model and estimated withdrawals

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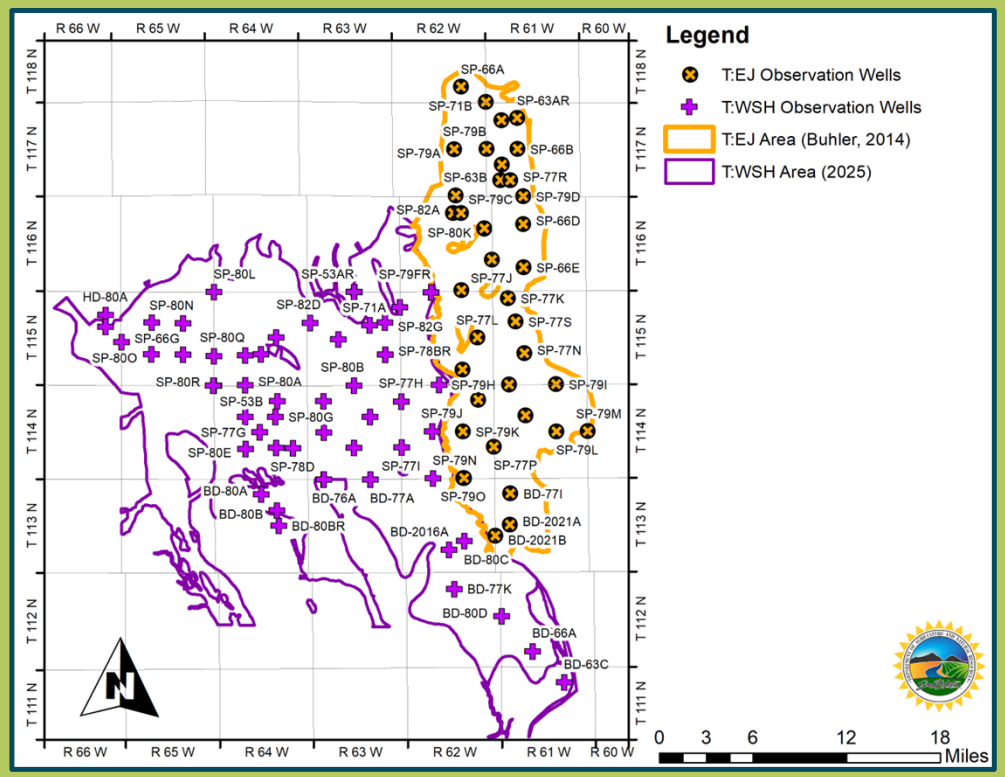
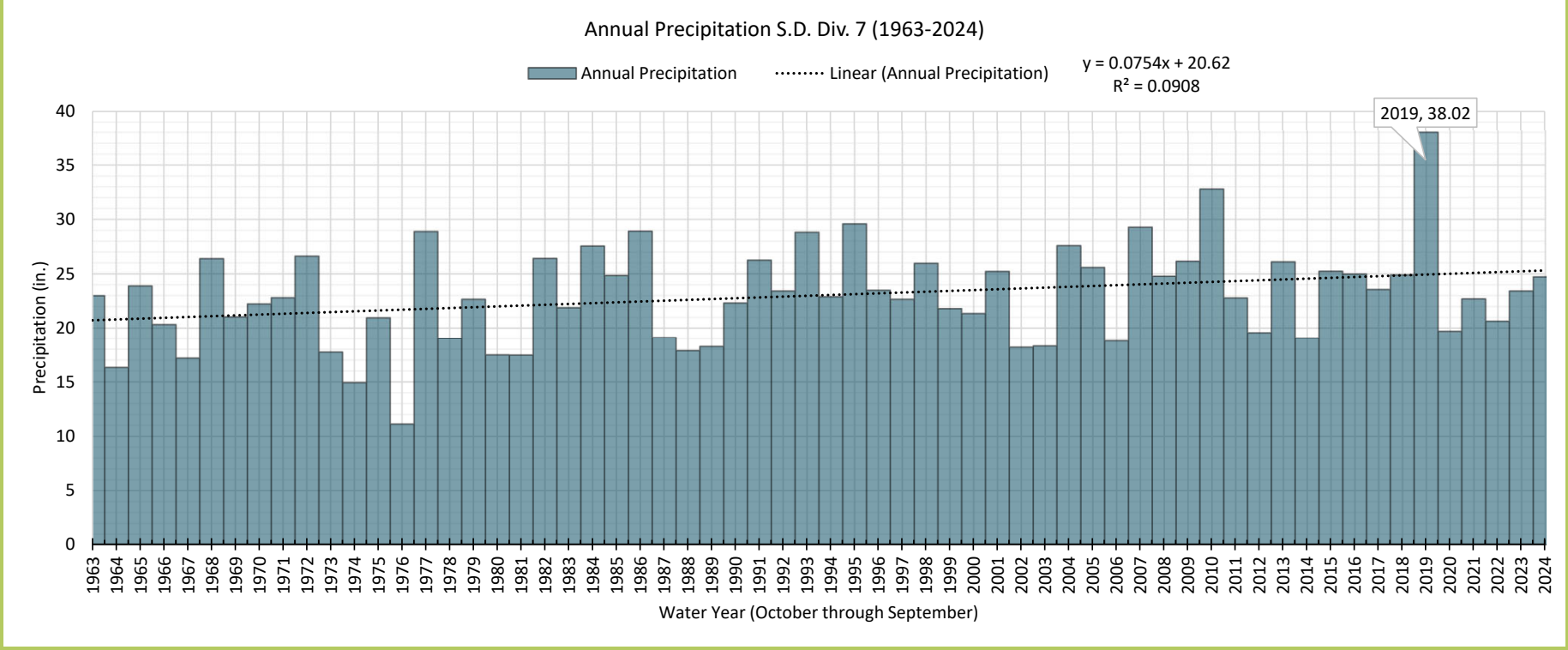
Observation Wells



ARSD 74:02:05:07. Observation well measurements to be used to determine the need for regulation.

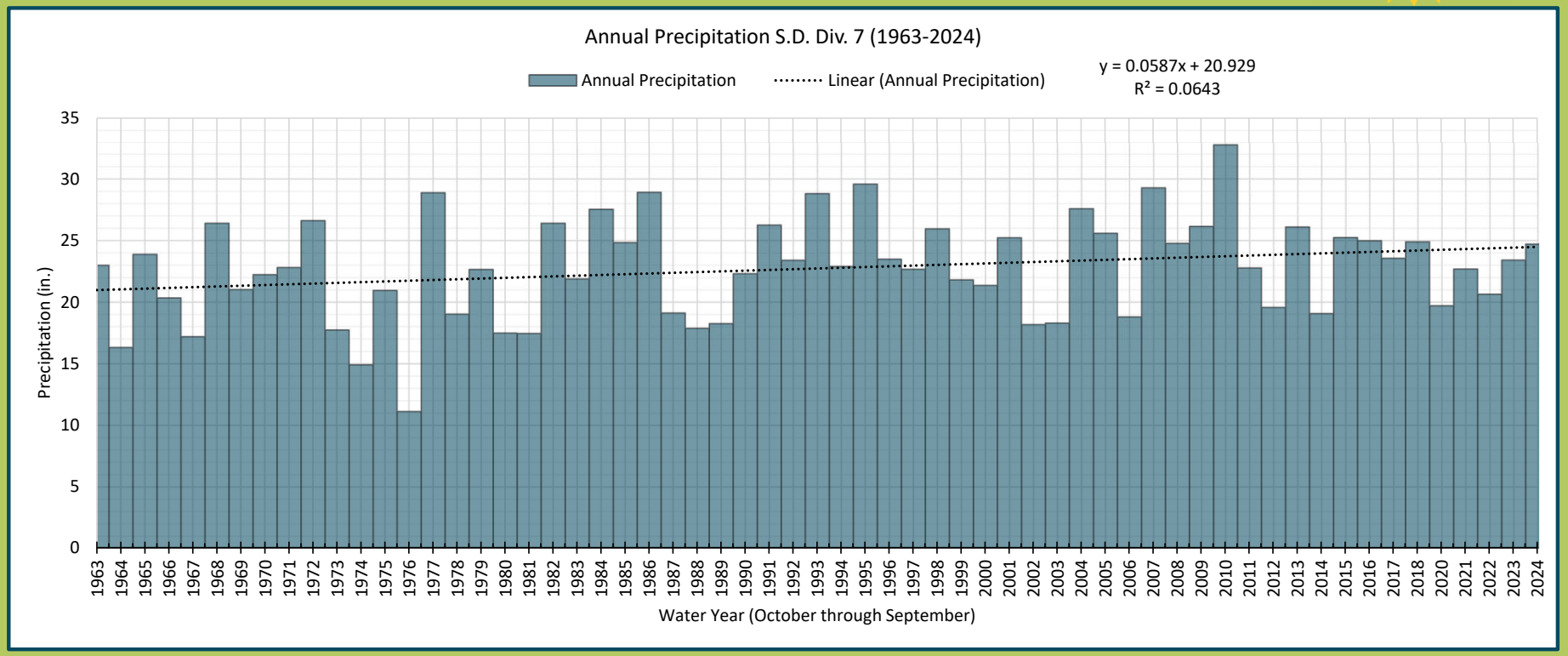
"When regulating water withdrawals by large-capacity wells and in determining the availability of unappropriated water for an application for a permit to appropriate water, the board shall rely upon the record of observation well measurements in addition to other data to determine that the quantity of water withdrawn annually from the aquifer does not exceed the estimated average annual recharge to the aquifer."

Precipitation

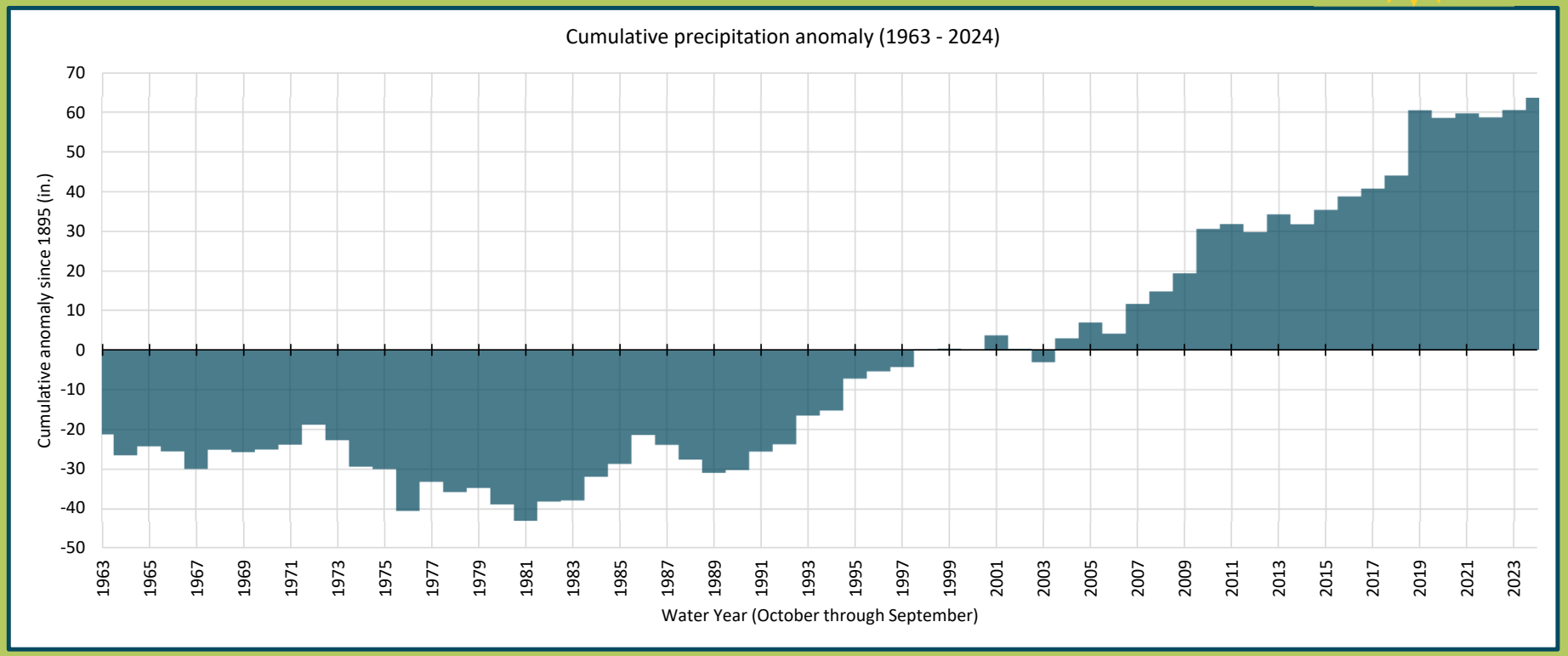


Precipitation – without 2019

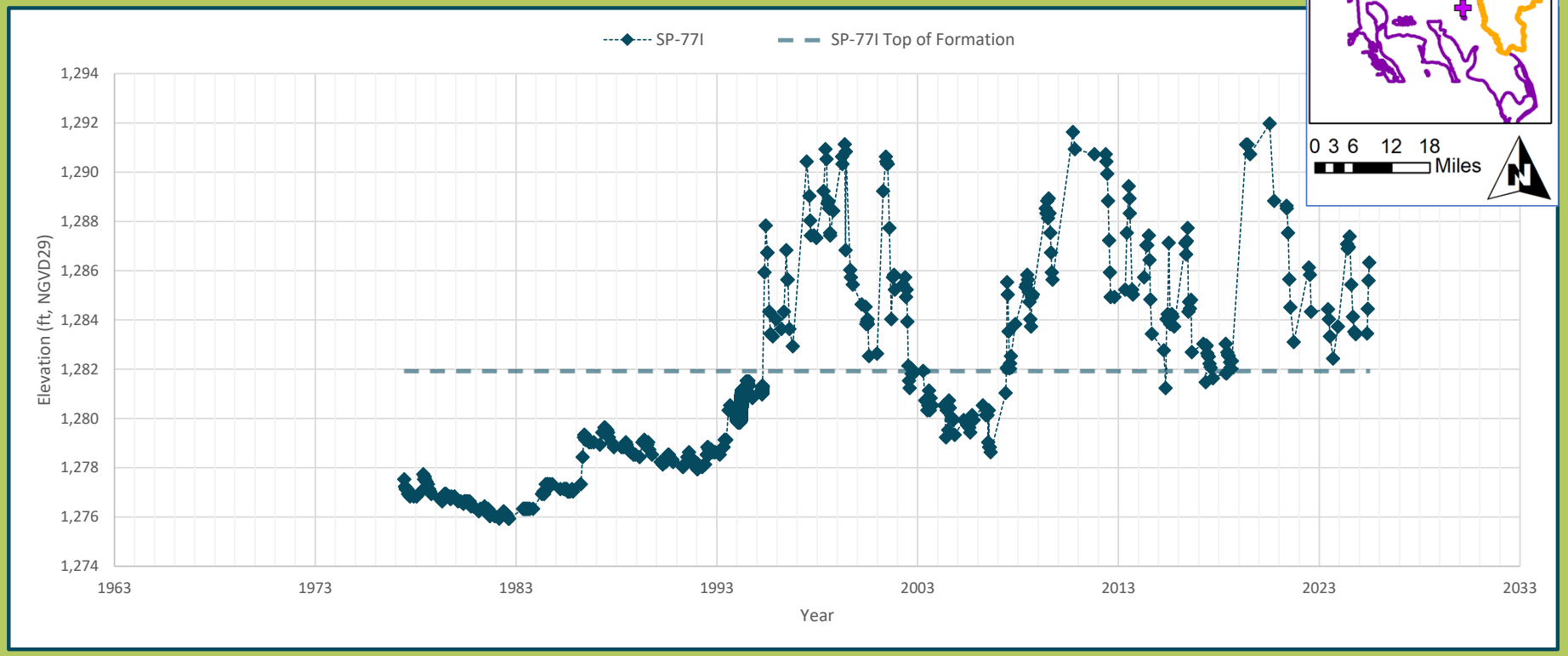
Still has an increasing trend



Precipitation cumulative anomaly



Example well – T:WSH



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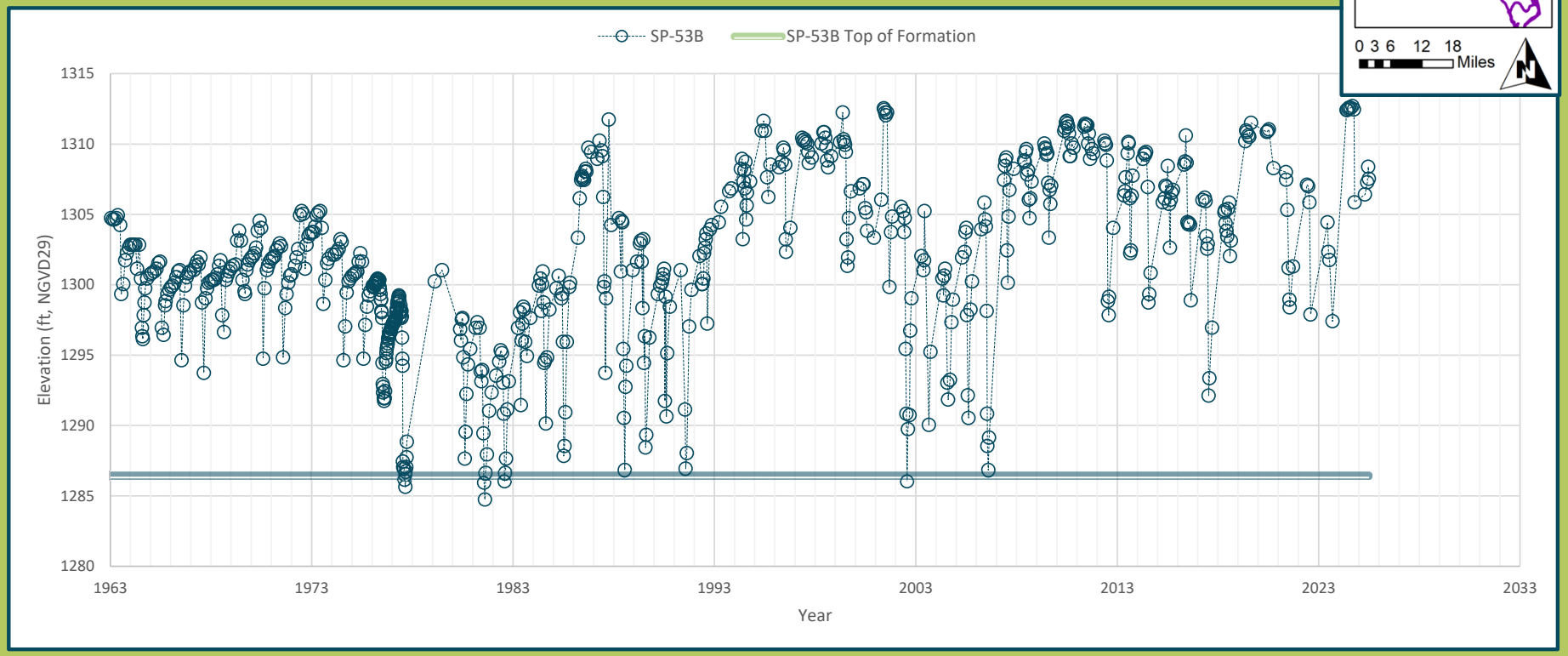
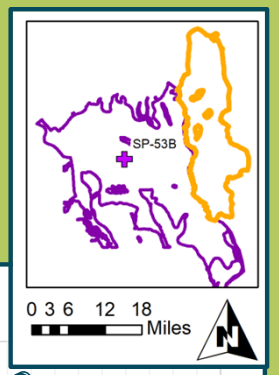
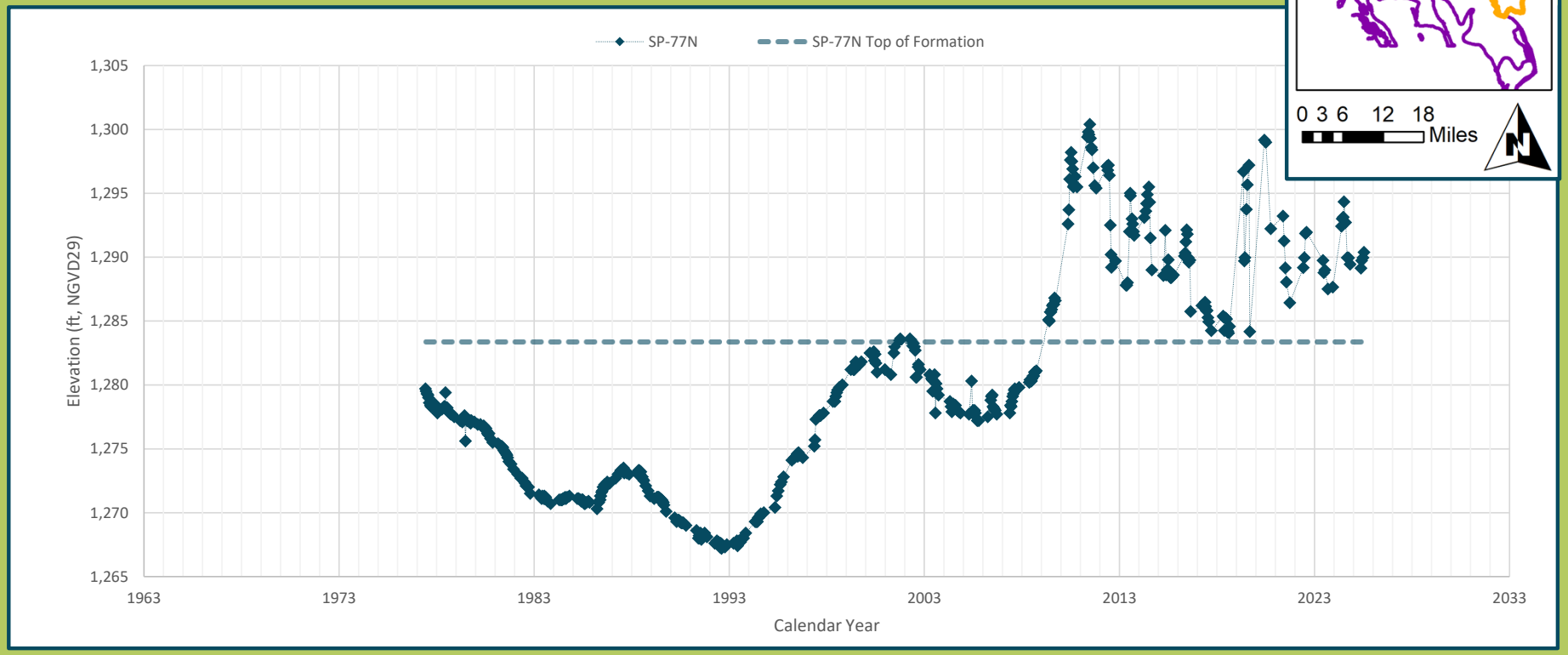
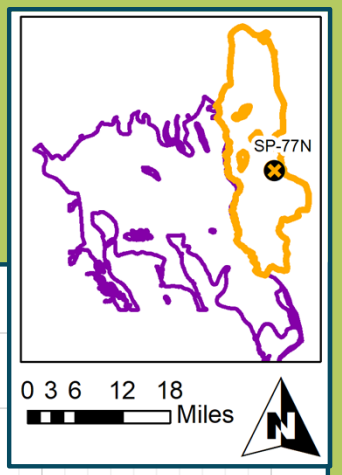




Example well – T:EJ





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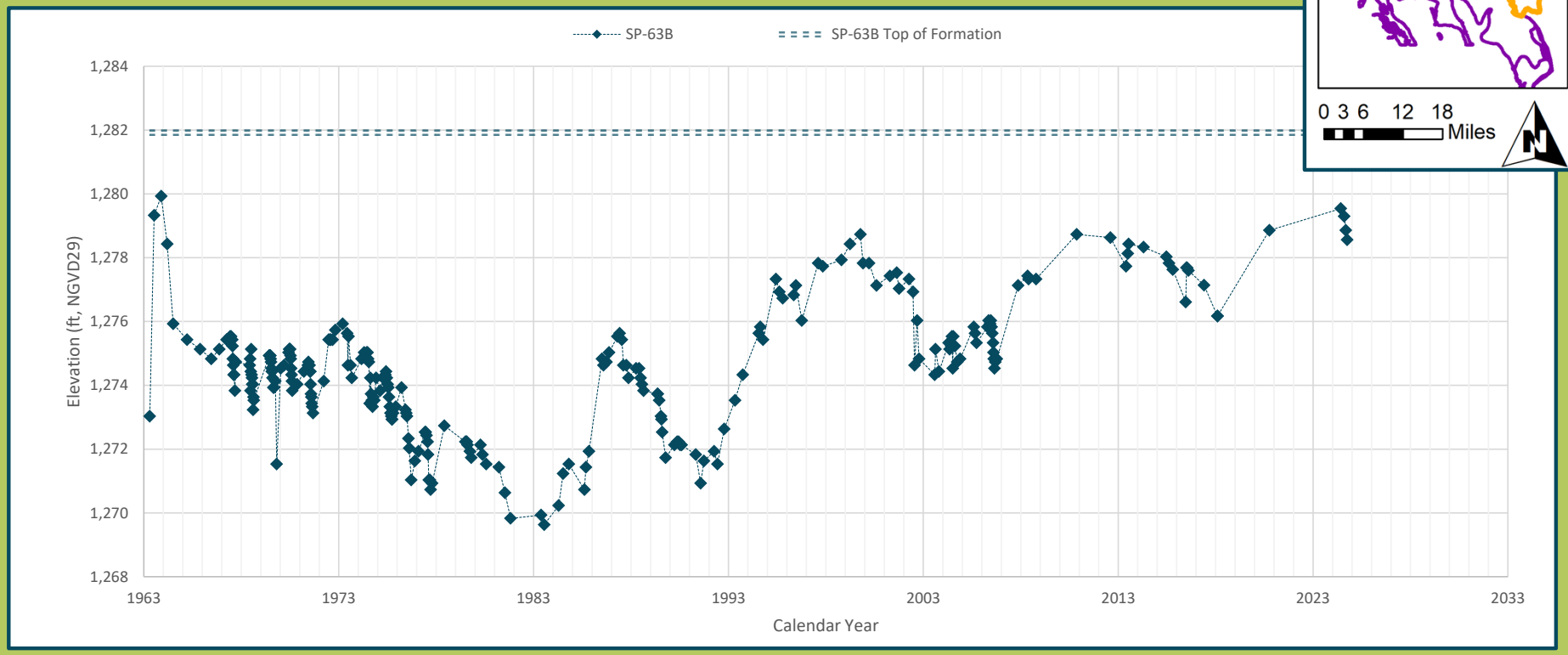

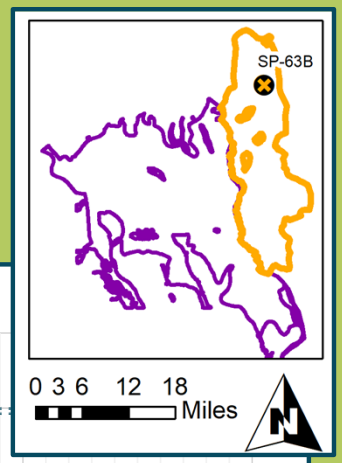

Held Permits

Aquifer	No. Held Permits	Total Acreage Held	Est. App. Rate in/yr	Est. Utilization (percent)	Est. Withdrawal if approved (ac-ft/yr)
T:WSH	27	5,214	6.63	79%	2,300
T:EJ	14	1,893	6.79	80%	860

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Conclusions

- According to the hydrologic budget, unappropriated water is available
- Observation wells indicate recharge exceeds withdrawals
- A new model of the aquifer system is necessary to know how much more water is available, especially for Tulare: East James

Aquifer	Storage (thousand ac-ft)	Recharge (thousand ac-ft/yr)	Withdrawal (thousand ac-ft/yr)
T:WSH	1,400	18.0	12.2
T:EJ	608	6.8	8.1

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