



Produced Water Recycling and Reuse

The Role in Western Water Stewardship

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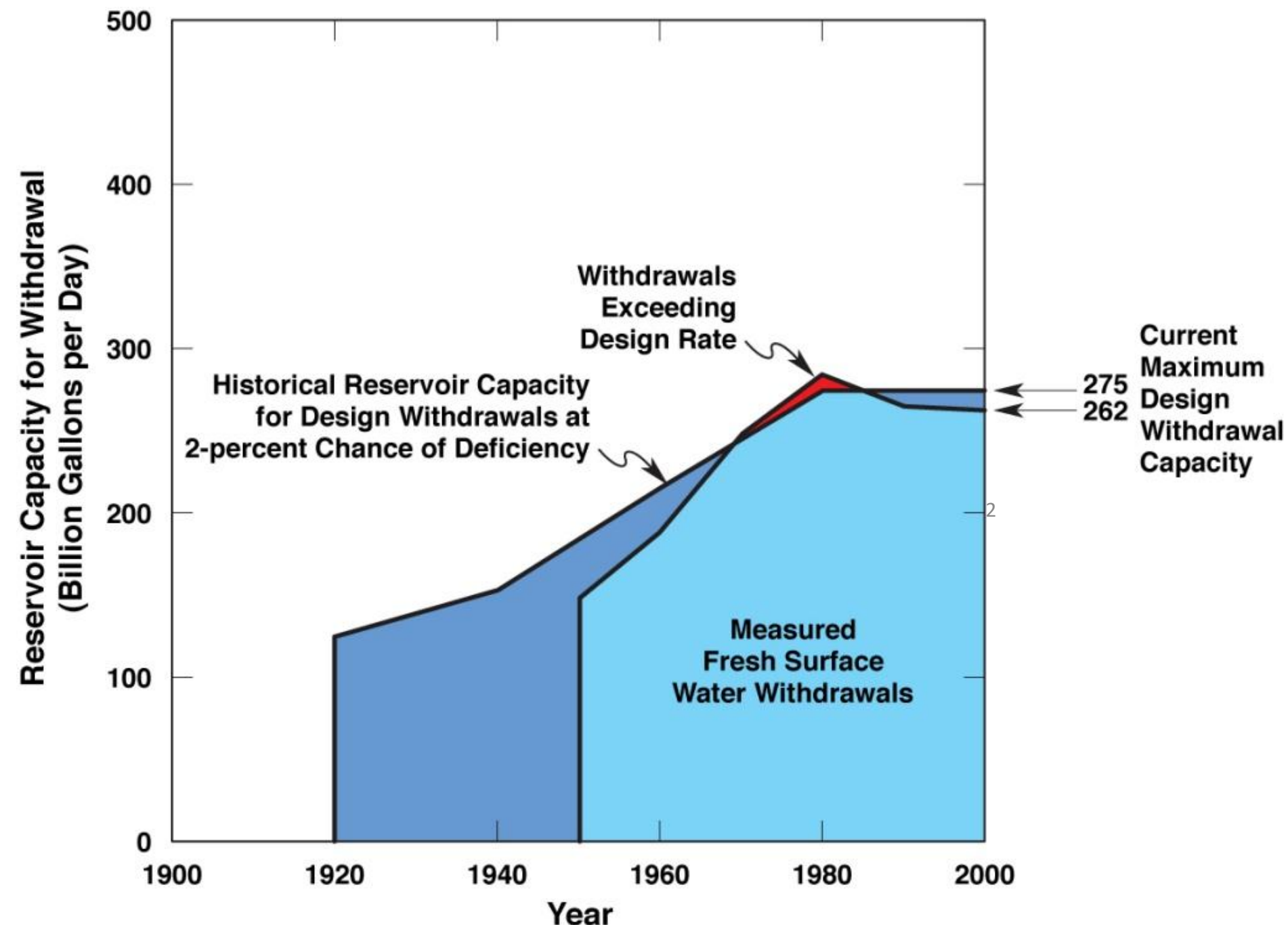
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OIL FIELD WATER MANAGEMENT SYMPOSIUM
MARCH 27-28, 2024





Current U.S. Fresh Surface Water Stewardship



USGS Fresh Surface Water Withdrawals

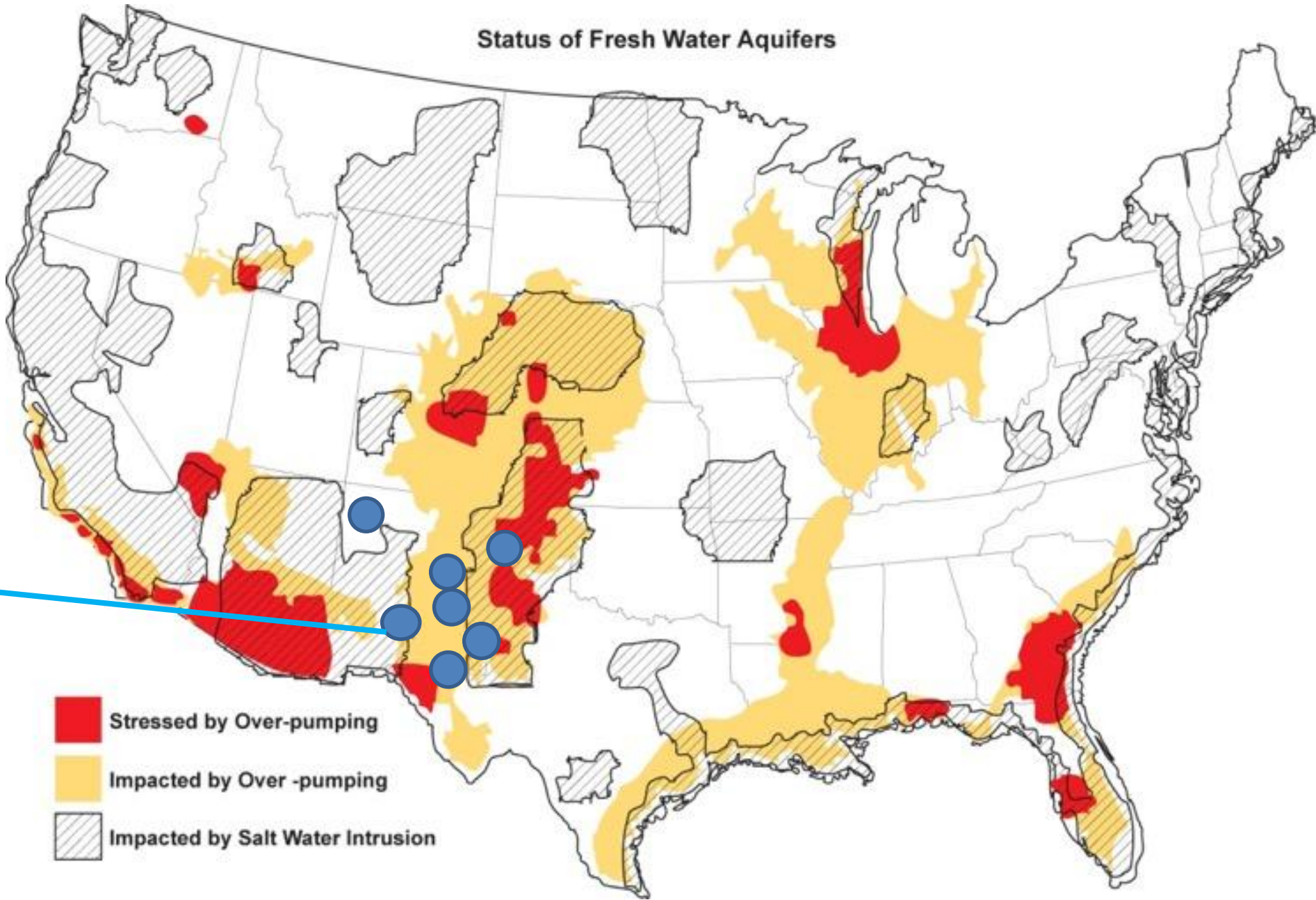
- **Water Sustainability**
 - “support as just”
 - acknowledged by society
- **Water Stewardship**
 - “actively direct and manage”
 - personal/professional/societal commitment



Current U.S. Ground Water Stewardship



Hope, NM - 95% Population decrease due to loss of ground water supply



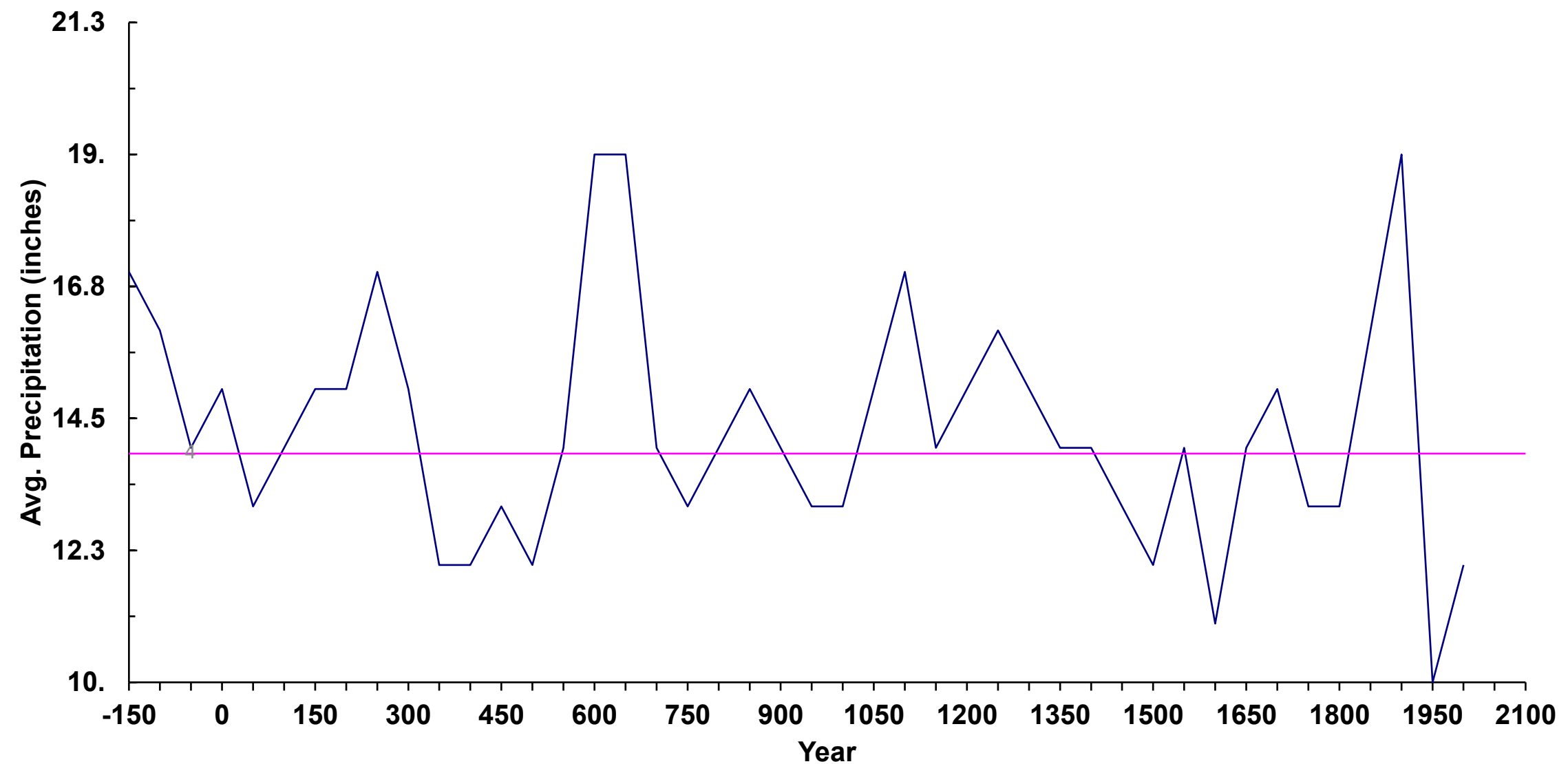
Communities are at risk of running out of water



Long-term Western Water Stewardship Challenges

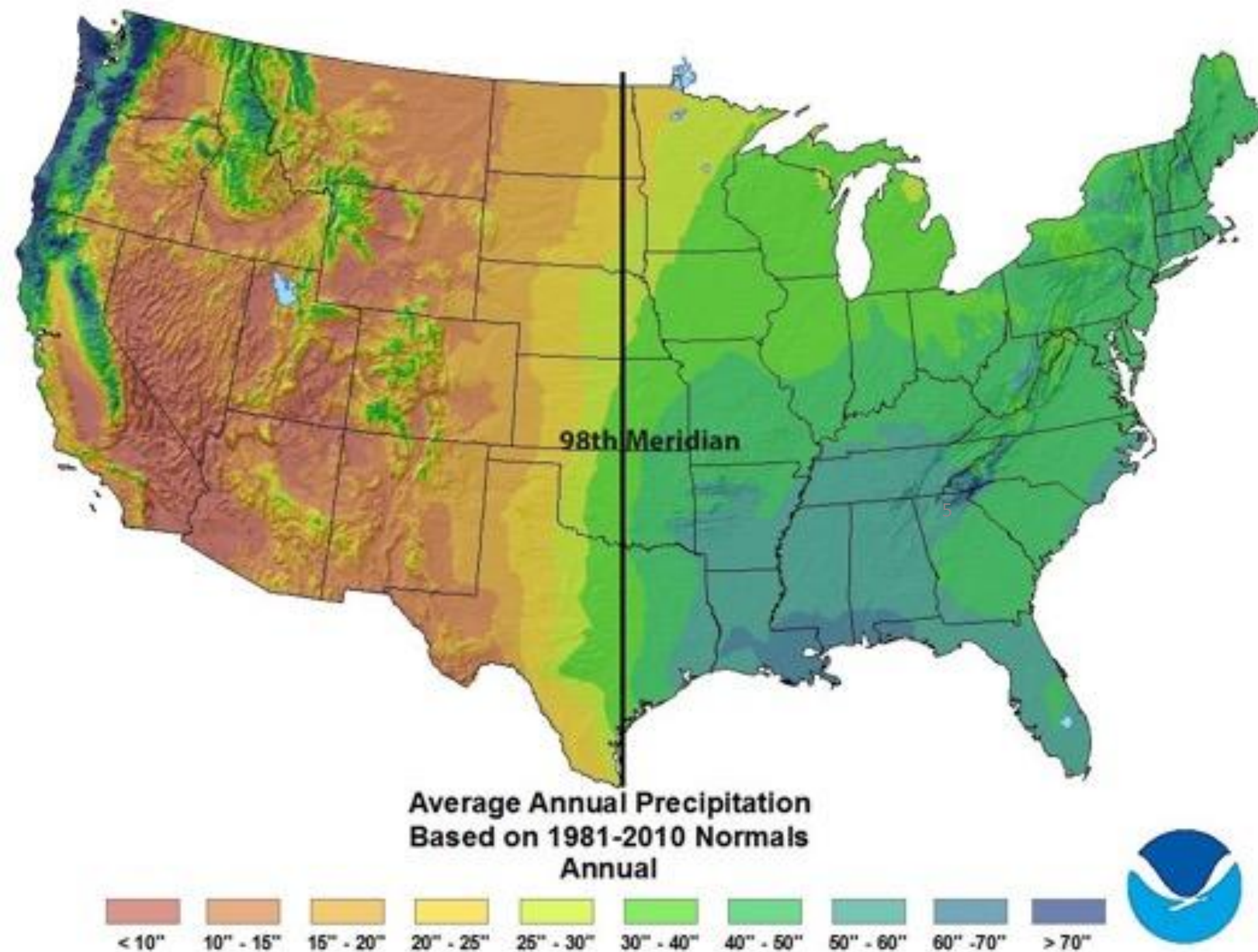
- **Climate Impact on Rainfall**
 - Enhanced evapotranspiration
 - 50% less surface water runoff
 - More reliance on groundwater
- **Ecological/Environmental Impact**
 - Aridification in the west
 - Less environmental flows
 - Reduction in agriculture
- **Economic/Social Impact**
 - Community abandonment, population migration

Univ. of Arizona – Tree Ring Lab – SW 50 year averages





Changing Climate Impacts on Water and Associated Ecological and Agricultural Impacts



USDA announces in 2024 the the 98th Meridian has moved 145 miles east

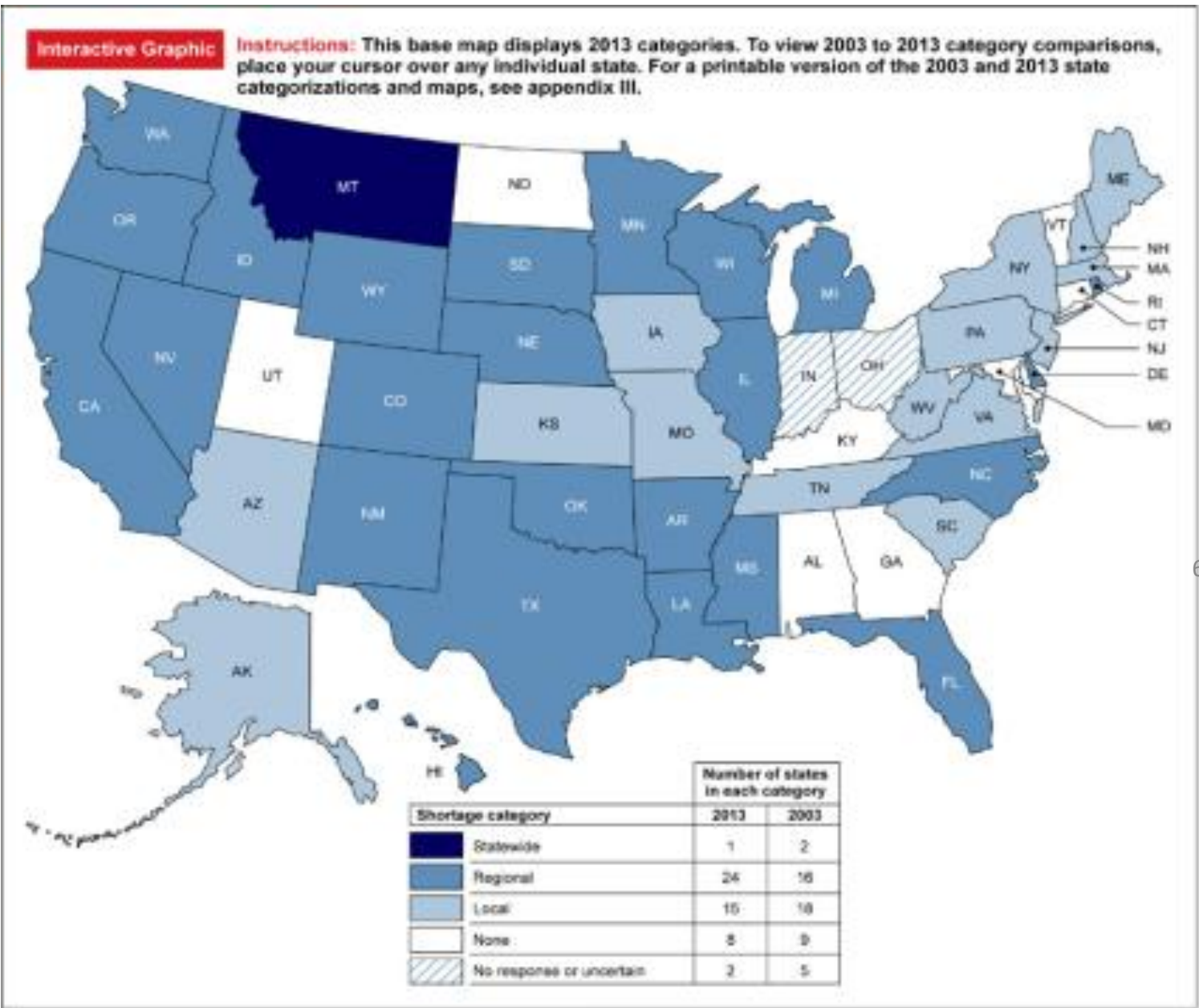
- Really means dry-land farming has moved east 145 miles





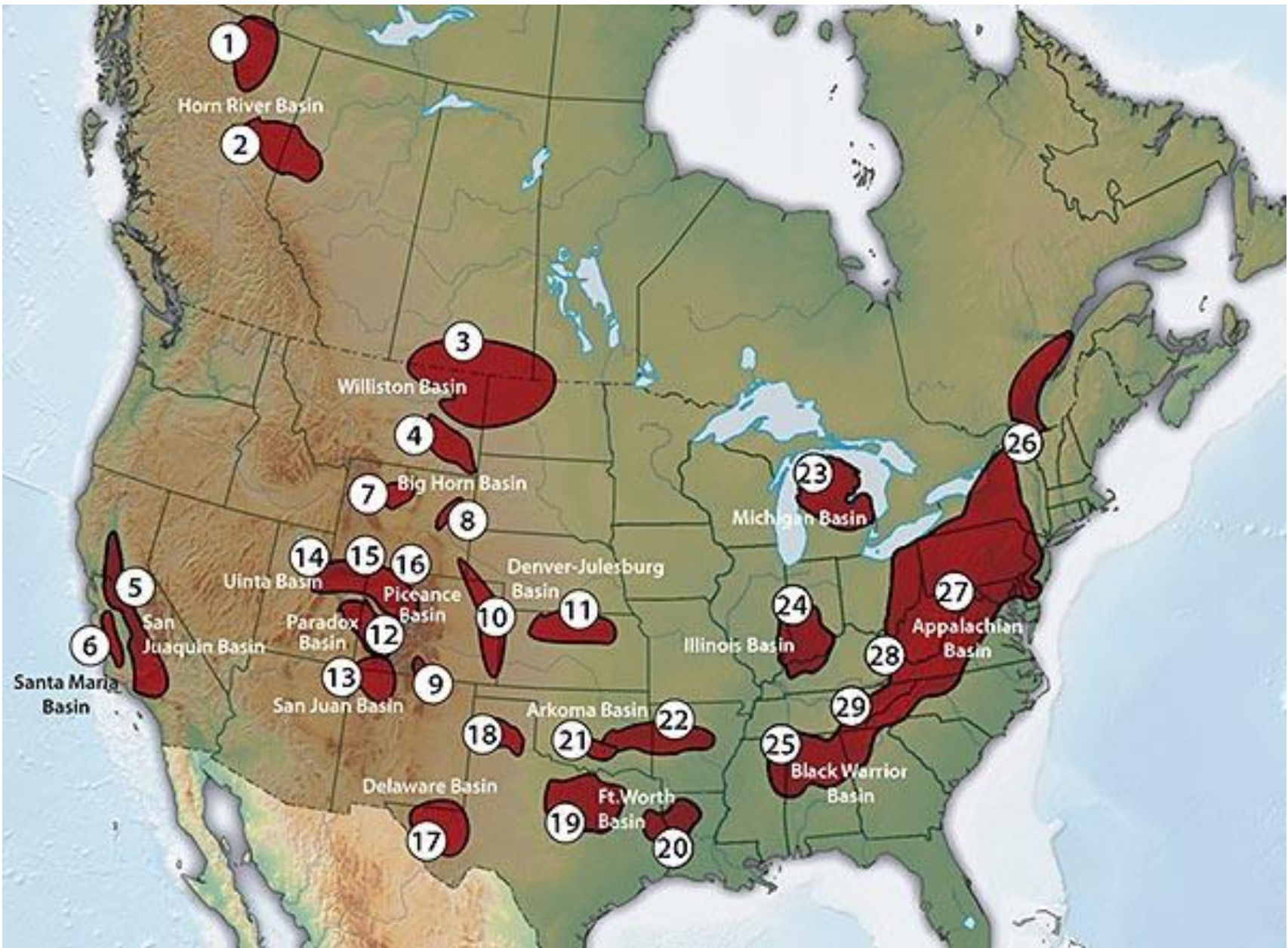
Why Consider Treating and Using Produced Water

State Water Stress



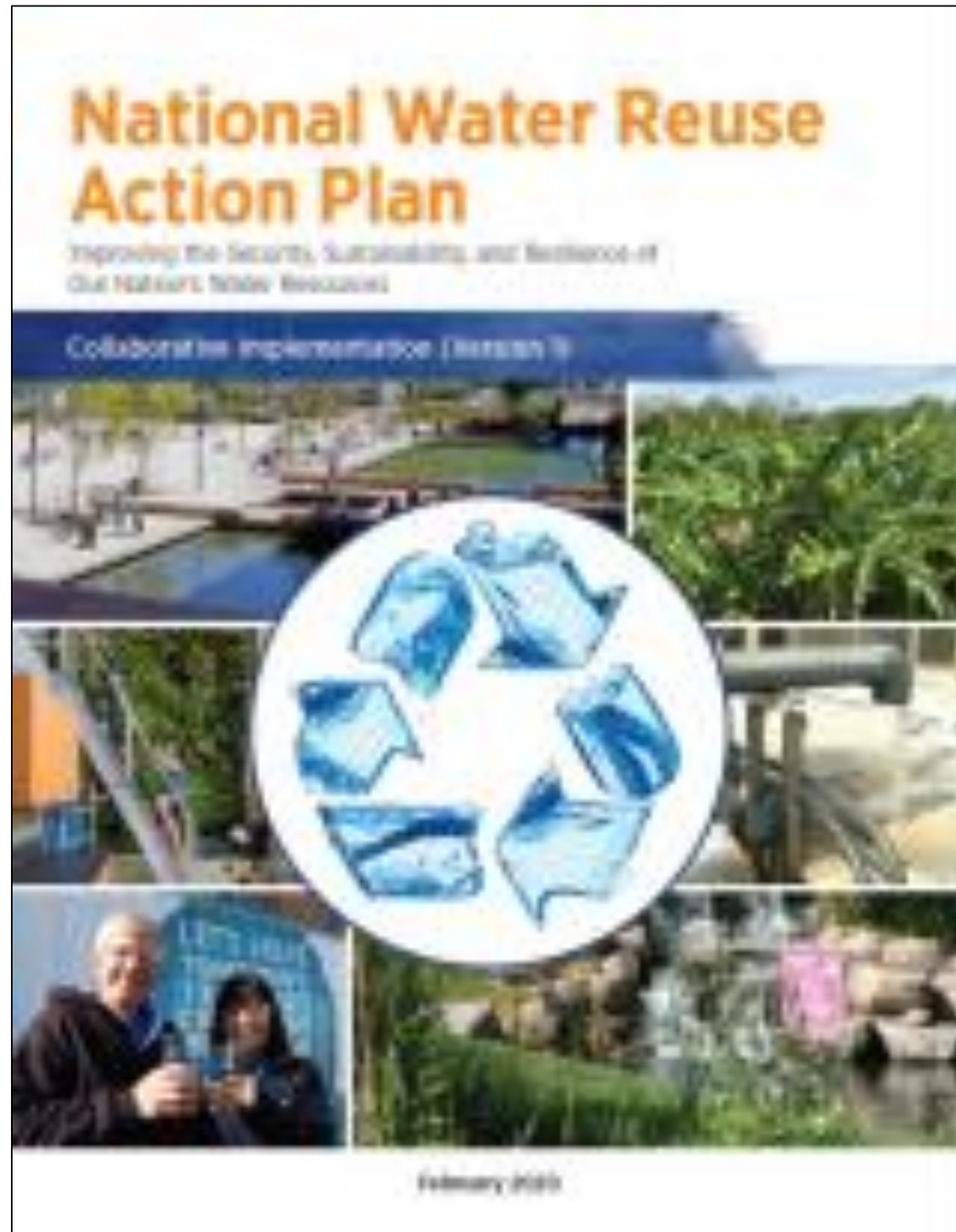
Sources: GAO analysis of state water managers' responses to GAO survey; Map Resources (map).

Unconventional Oil and Gas Basins





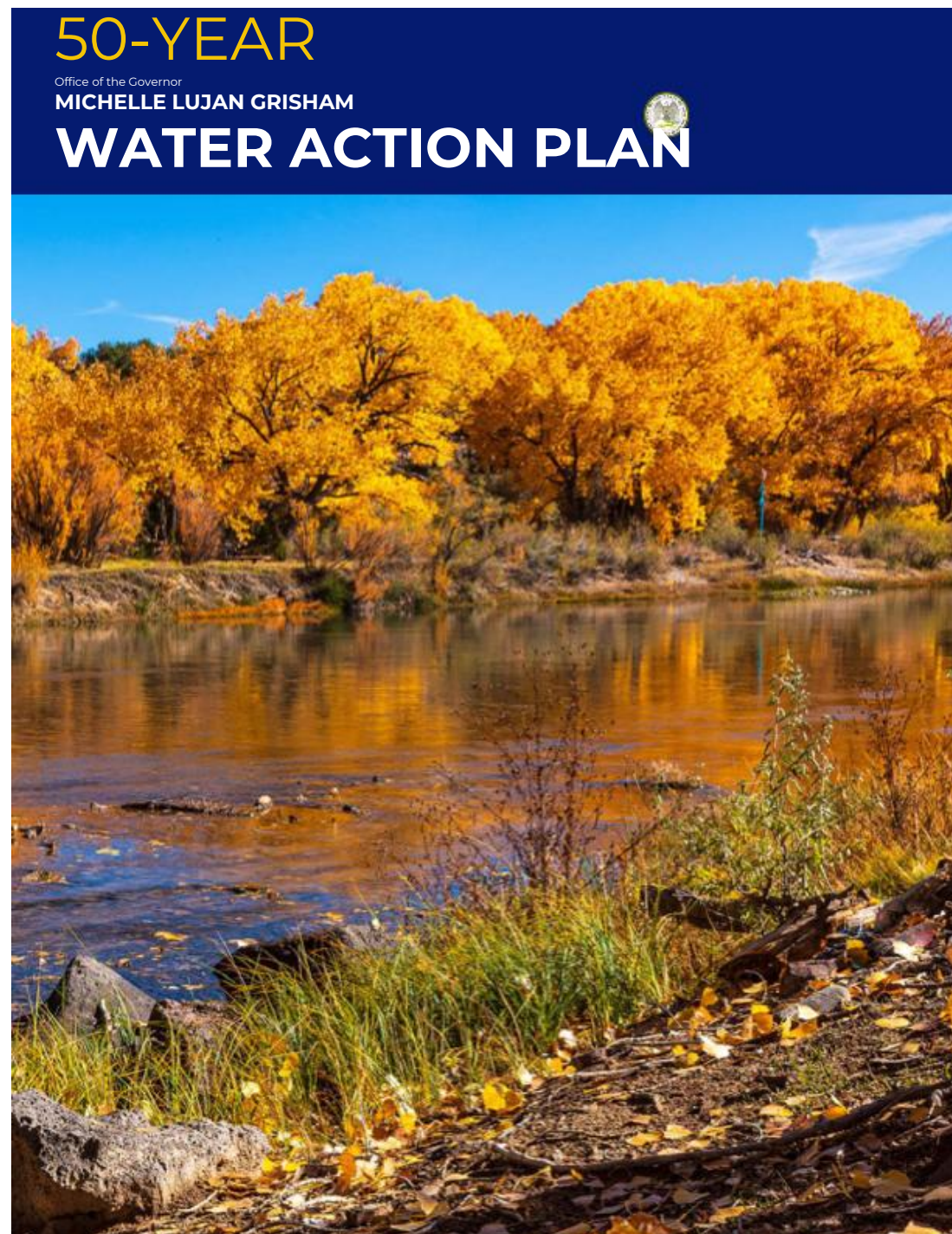
National Produced Water Reuse Program



- Focus is on the fit-for-purpose treatment and reuse of waste water – including produced water
- ..“examples of reuse applications include; agriculture and irrigation, potable and non-potable water supplies, groundwater storage and recharge, industrial processes, on-site non-potable use, salt water intrusion barriers, and environmental restoration.”



New Mexico Produced Water Reuse and Stewardship Goals and Requirements



2019 Produced Water Act – Section 9D

...(the WQCC). shall adopt water quality standards for surface and ground waters of the state based on credible scientific data and other evidence appropriate under the Water Quality Act. The standards shall include narrative standards and, as appropriate, the designated uses of the waters and the water quality criteria necessary to protect such uses. The standards shall at a minimum protect the public health or welfare, enhance the quality of water and serve the purposes of the Water Quality Act. In making standards, the commission shall give weight it deems appropriate to all facts and circumstances, including the use and value of the water for water supplies, propagation of fish and wildlife, recreational purposes and agricultural, industrial and other purposes;



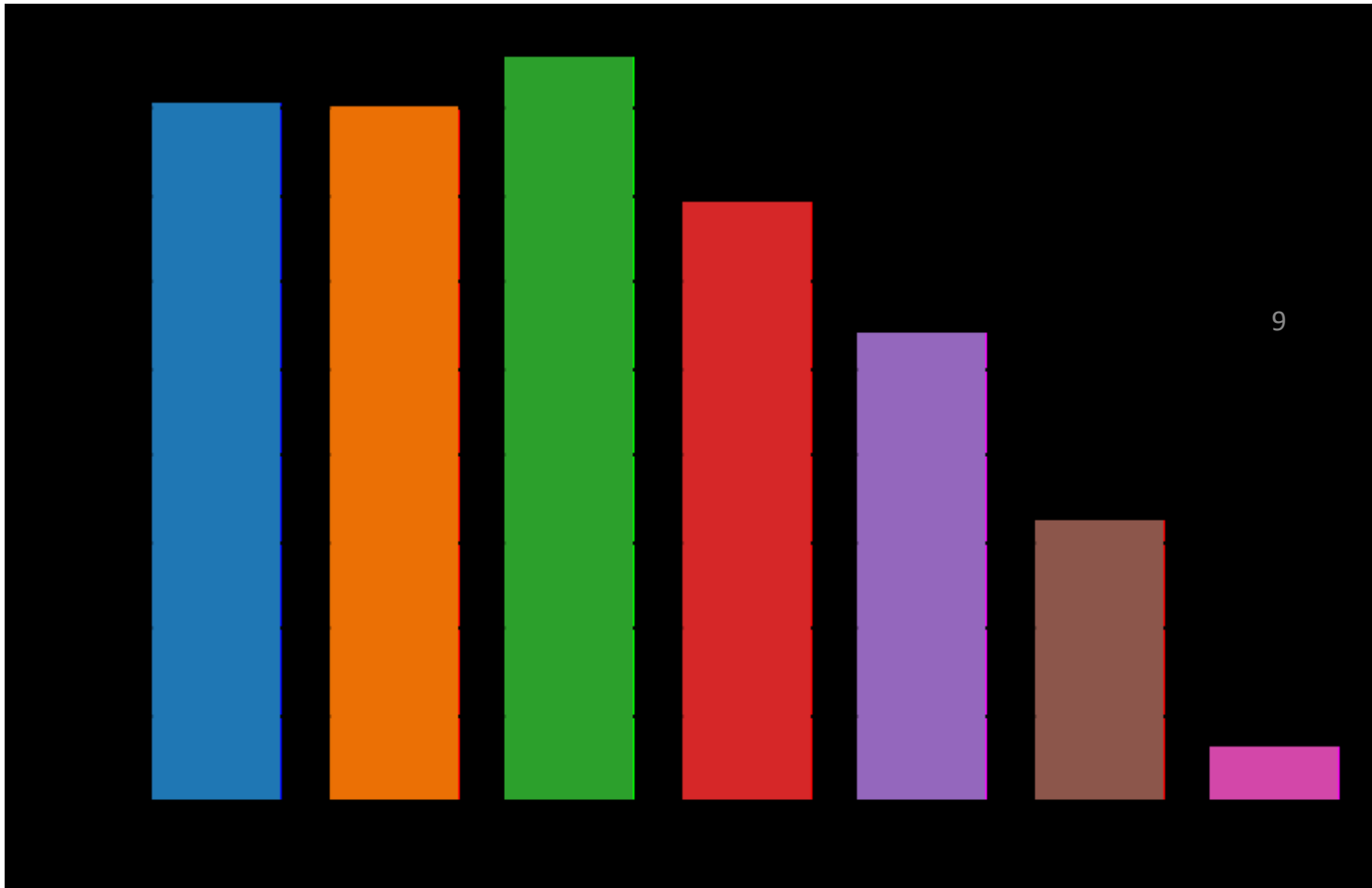
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Public Acceptance of Produced Water Treatment to Conserve Fresh Water

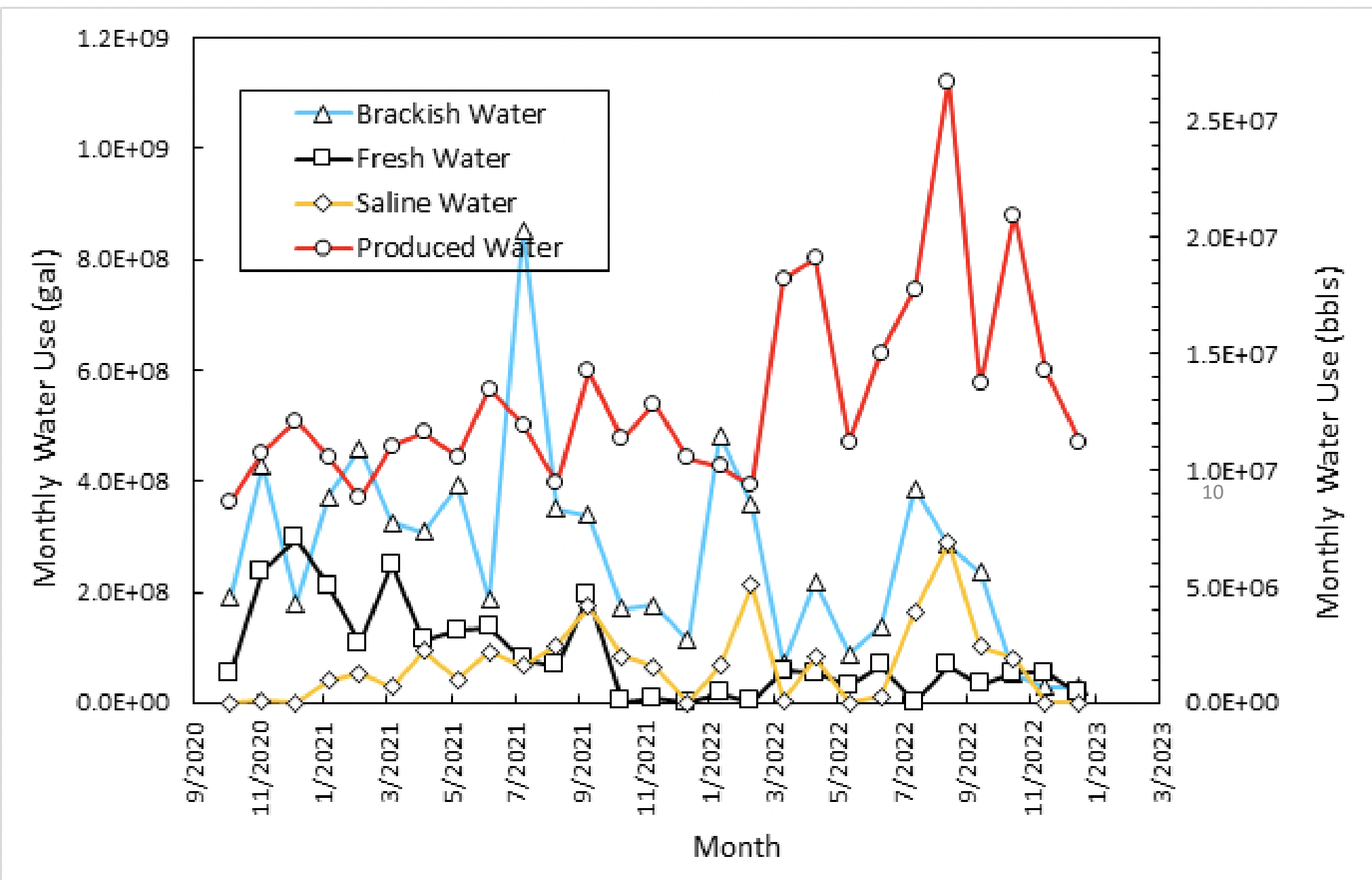
Identify all potential reuse applications that you would support for the use of treated produced water to conserve the use of New Mexico’s freshwater supplies, if the water is treated and regulated to standards that prove it to be safe to use and protect human health and the environment?



- Uses inside the oil field - such as construction, drilling and fracking, concrete mixing, and dust suppression **(61%)**
- Industrial uses outside the oil field - such as construction, power generation, manufacturing, etc. **(61%)**
- Agricultural uses, such as irrigation for non-edible crops (e.g., cotton) **(65%)**
- Multiple agricultural uses, e.g., irrigation, rangeland restoration, livestock watering, etc. **(53%)**
- Supplemental drinking water supplies **(41%)**
- I need more information to support the reuse of treated produced water **(25%)**
- No, I would not support the reuse of treated produced water for any use outside of the oil field **(5%)**



Produced Water Recycling Saves Fresh Water in Oil and Gas Operations



Clean Brines via zwitter ionic, ceramic, composite membranes, or ozone

2020- 50% avg. NM fresh water use in fracking
2023 – 5% avg. NM fresh water use in fracking



Produced Water Treatment Saves Fresh Water in Oil and Gas Operations



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NM OCD – Reuse of treated produced water in plugging and abandoning orphan wells

- \$2/bbl for fresh water for cementing
- \$3/bbl for 10# brine
- Roswell and Artesia, \$25 M+ in federal funding
- 100-200 bbls/day of treated produced water needed
- 700 abandoned wells to address
- Creates hundreds of data points on treatment quality data

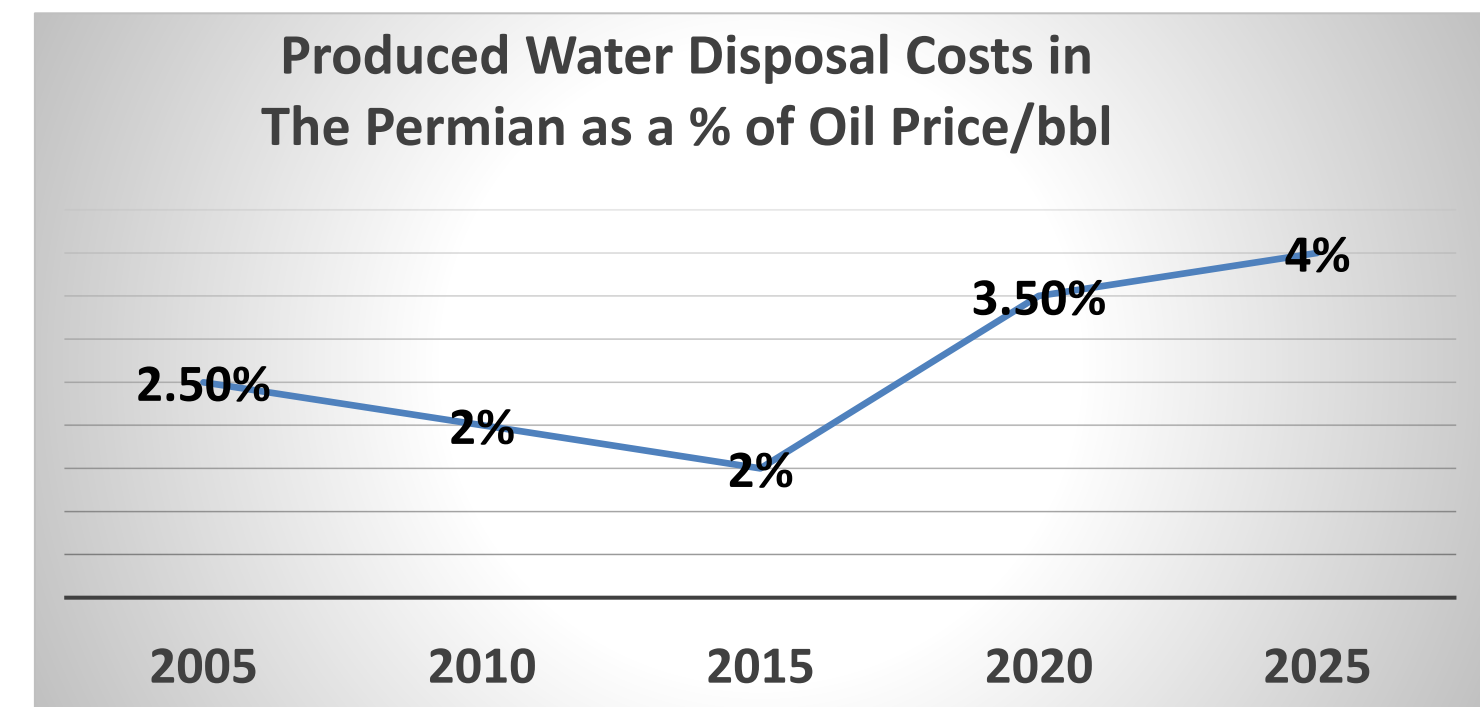
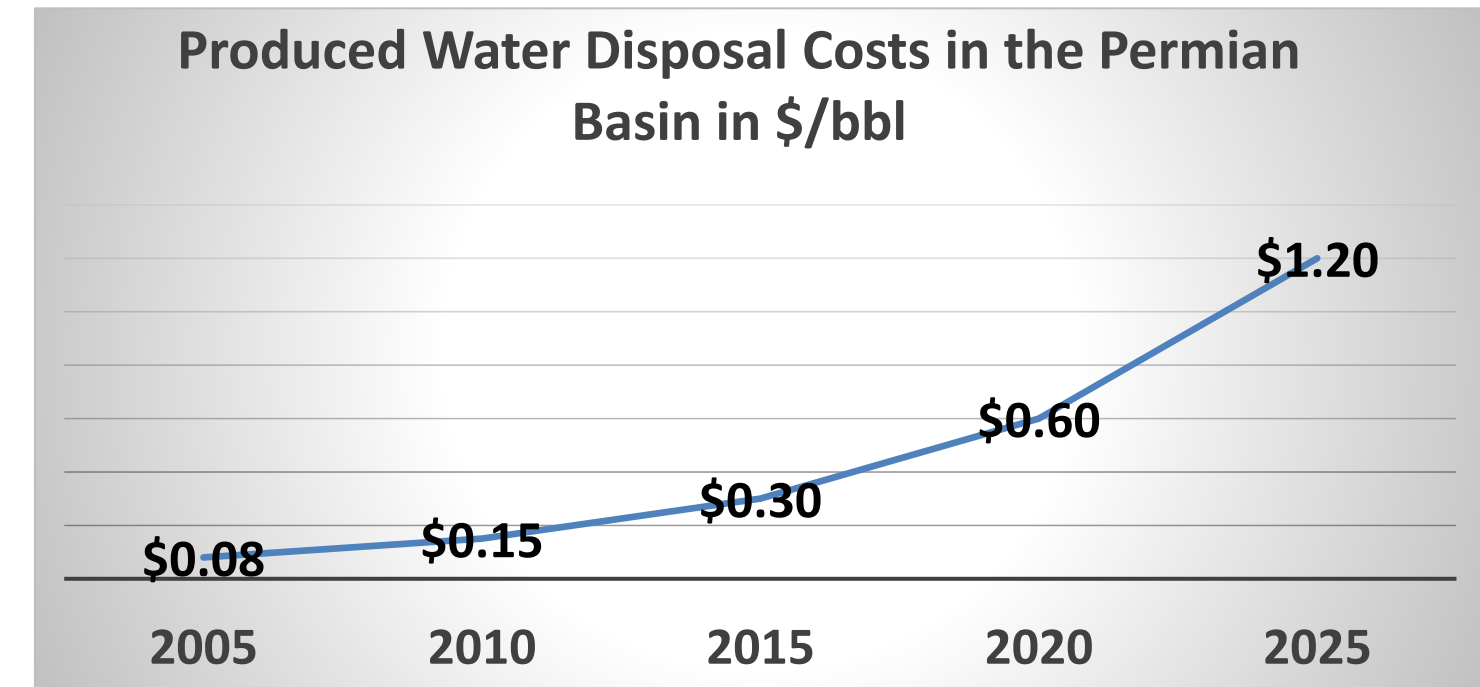
Also creates fresh water for drilling



Produced Water Treatment Can Create Clean ‘New Water’ at a Reasonable Cost

Constituent	Feed	Distillate
TDS	126,000	350+/-150
TPH	75+/-70	11+/-3
Ammonia	~400	46
Fe	1	0
Mn	0.36	0.004
Na	38162	102
Ca	4554	7
Pb	0	0.006
HCO3	120	200
SO4	270	10
Mg	751	1.5
K	647	0.9
Ba	6.6	0.9

Permian
Thermal
Treatment



SPL

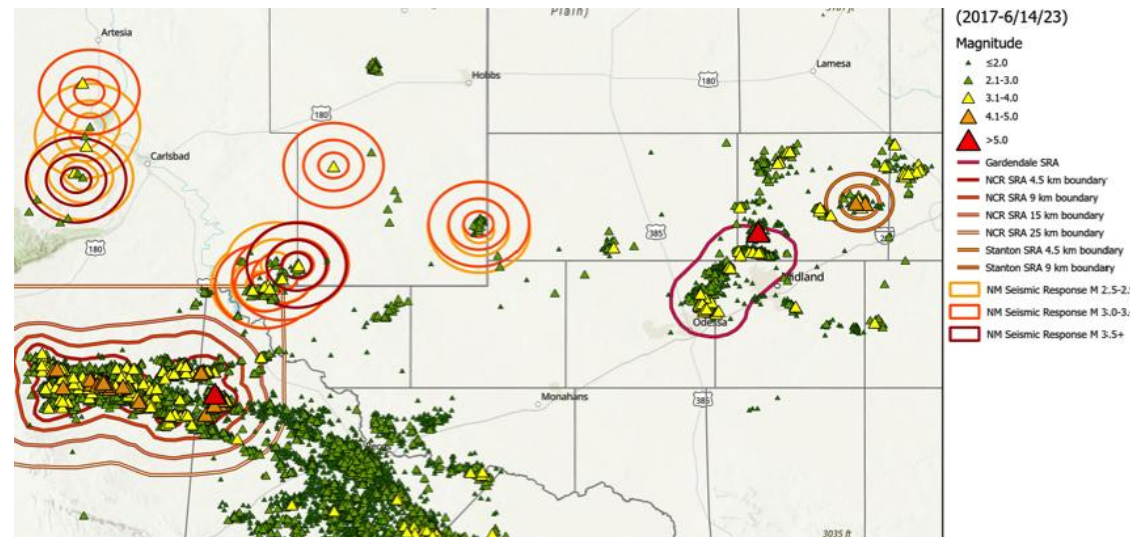




Treatment and Innovation Can Address Other Produced Water Stewardship Challenges



Wink Sink #1 and #2



Seismic areas driven by over injection of produced water



65-acre Lake Boehmer

Possible options:

- EPA brownfields – with recycling and reuse
- Research test sites for technology evaluation for recycling and reuse
- Requires industry interest and support



San Juan Basin

