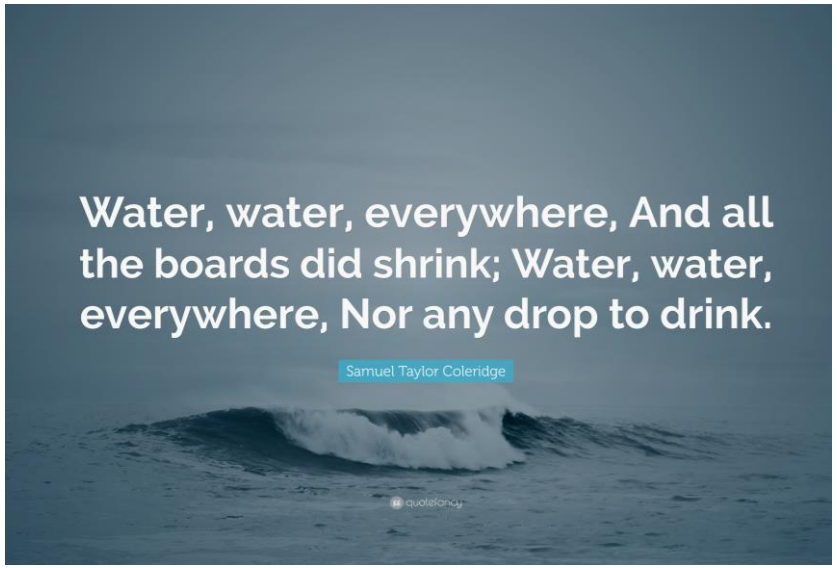
“Water, water everywhere..”

Jerri L. Pohl, Statewide Projects Supervisor Office of the State Engineer Water Resource Allocation Program

New Mexico Produced Water Consortium- Government Advisory Board year end meeting - December 7, 2022



1. OSE mission.
2. Fresh Water Supplies Nationally then locally.
3. Climate Forecast .
4. New Waters/Non-Traditional Waters.
5. Produced Water – Nationally then locally.

OSE MISSION STATEMENT

The Office of the State Engineer

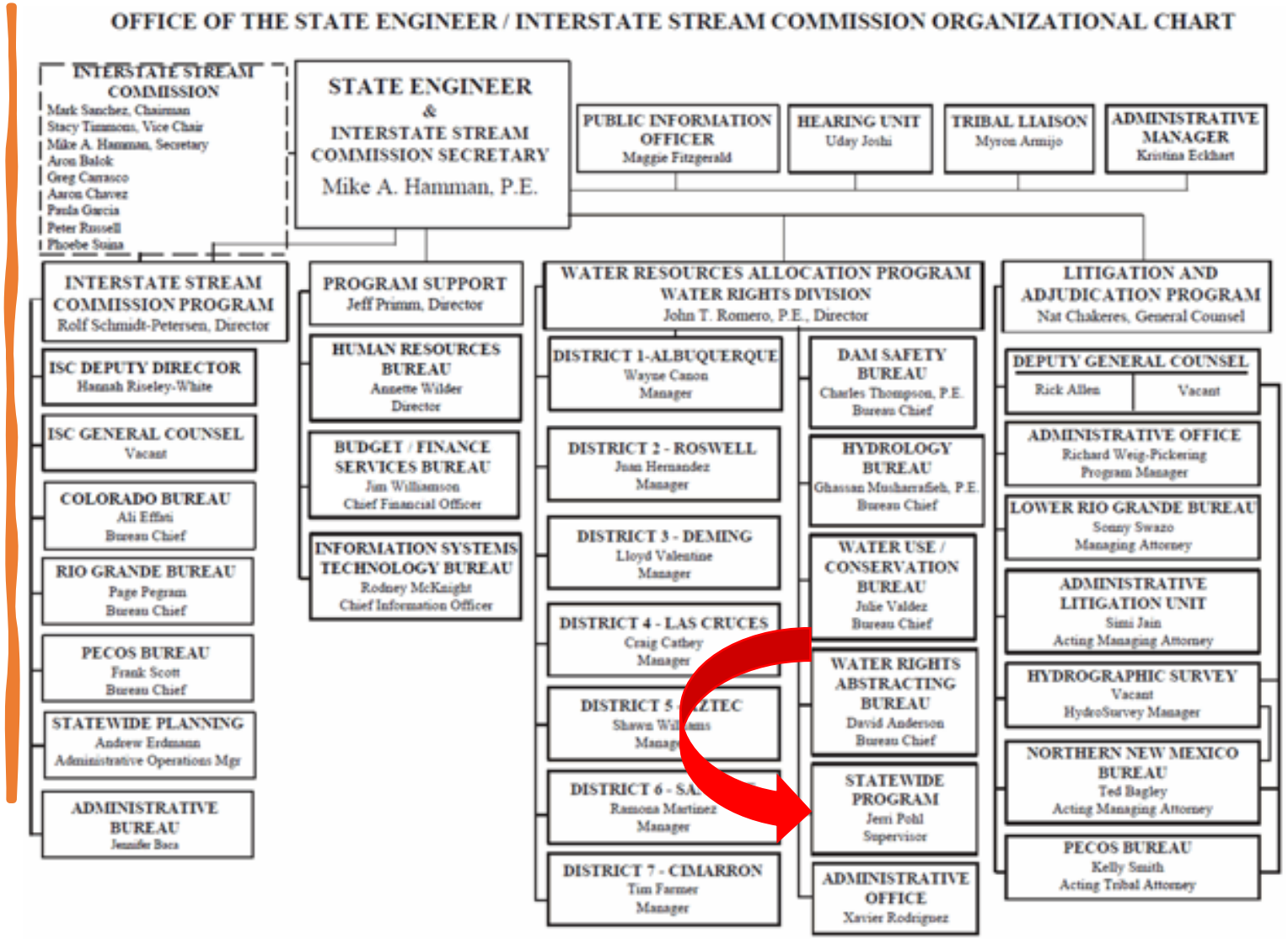
is charged with administering the state's water resources. The State Engineer has power over the **supervision, measurement, appropriation,** and **distribution**

of all surface and groundwater

in New Mexico,

including streams and rivers that cross state boundaries.

OSE
ORG CHART



STATEWIDE PROJECTS

Aquifer, Storage and Recovery Projects

Deep Well NOI well construction

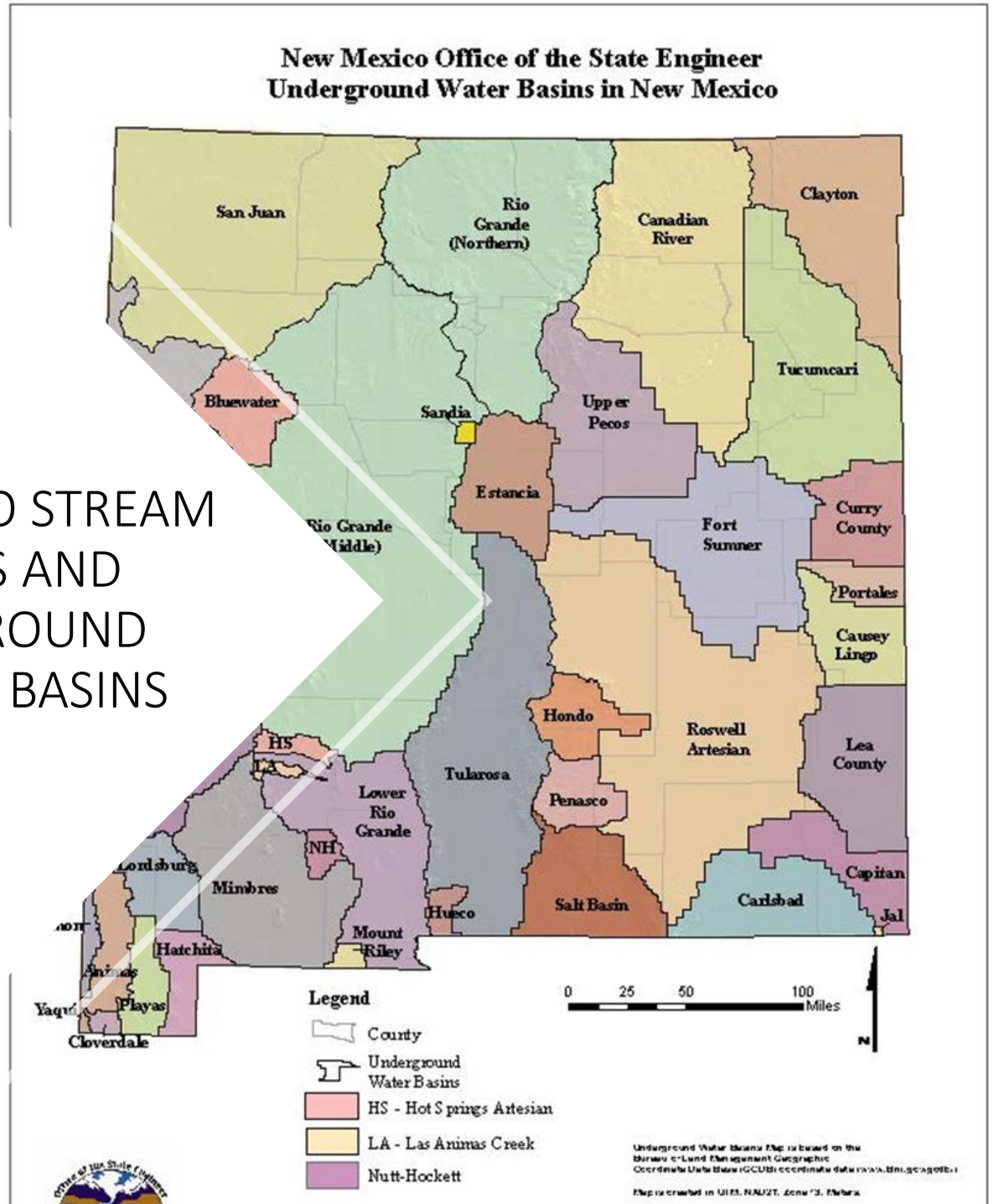
Produced Water/Desalination

Policy and Rule Writing

Well Driller Licensing and Construction Compliance

Training/Outreach

NEW MEXICO STREAM SYSTEMS AND UNDERGROUND DECLARED BASINS



Megadroughts

- …are persistent, multi-year **drought events that stand out** as especially extreme in terms of severity, duration, or spatial extent when **compared to other droughts of the last two thousand years**
- …have occurred on every continent outside of Antarctica, often causing major **disturbances to ecosystems (e.g., forests in the Southwest U.S.) and societies (e.g., the Maya in Central America, the Ming Dynasty in northern China**).
- …past megadroughts were caused by persistent shifts in tropical ocean temperatures, **climate change is likely to increase future megadrought risk through regional declines in precipitation and widespread increases in evaporative demand**.
- …ongoing megadrought in Southwestern North America (2000–present), amplified by climate change, suggest that these **events will significantly strain water resources and present major resiliency challenges in the future.**

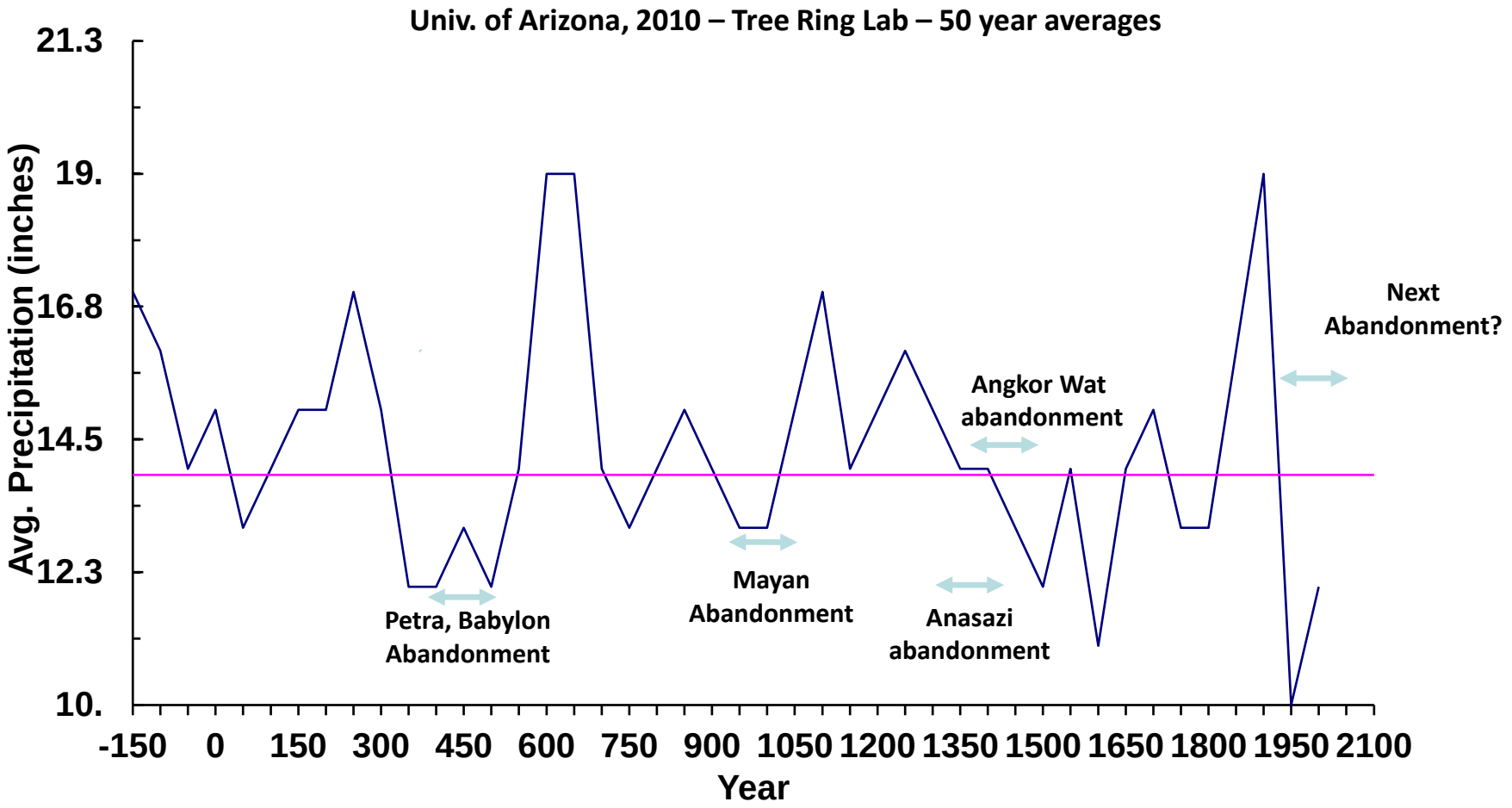
Megadroughts in the Common Era and the Anthropocene

Published on November 15, 2022

Author Benjamin Cook, NASA, Columbia University

https://www.nature.com/articles/s43017-022-00329-1

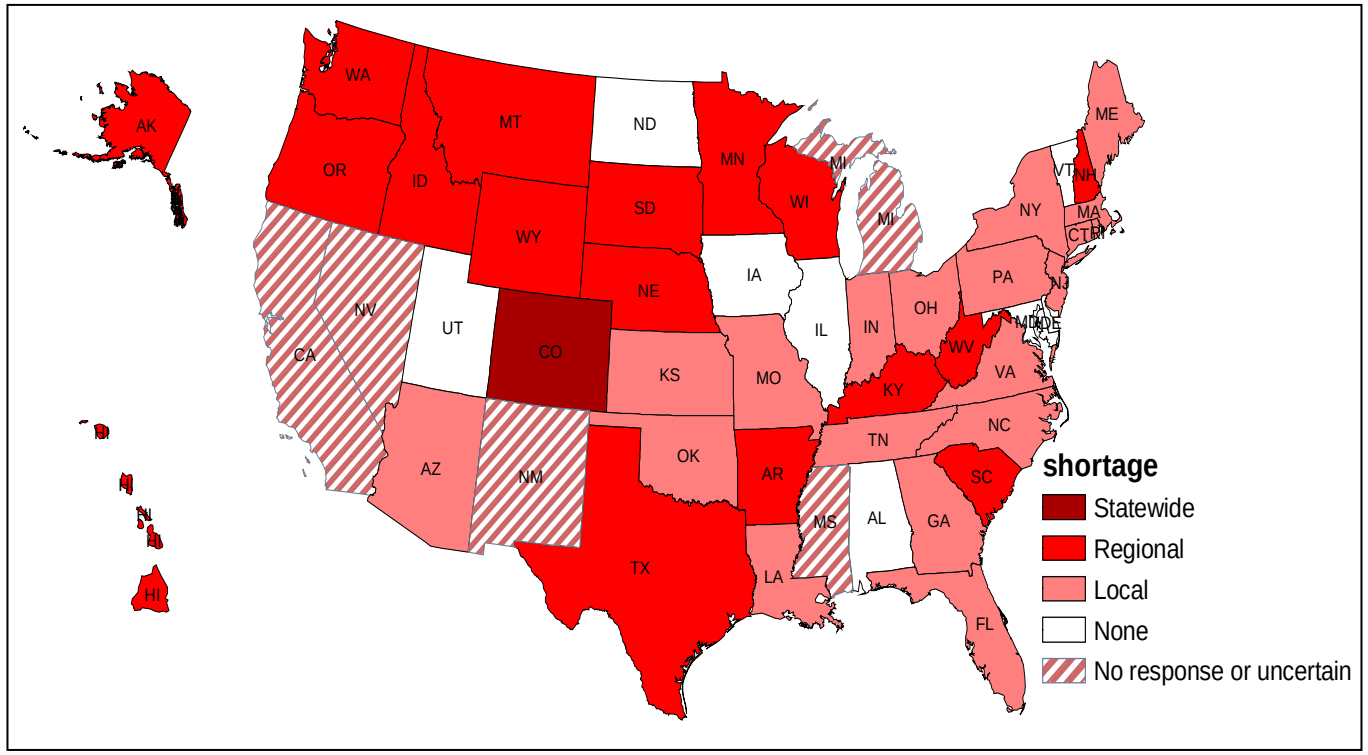
AVERAGE PRECIPITATION



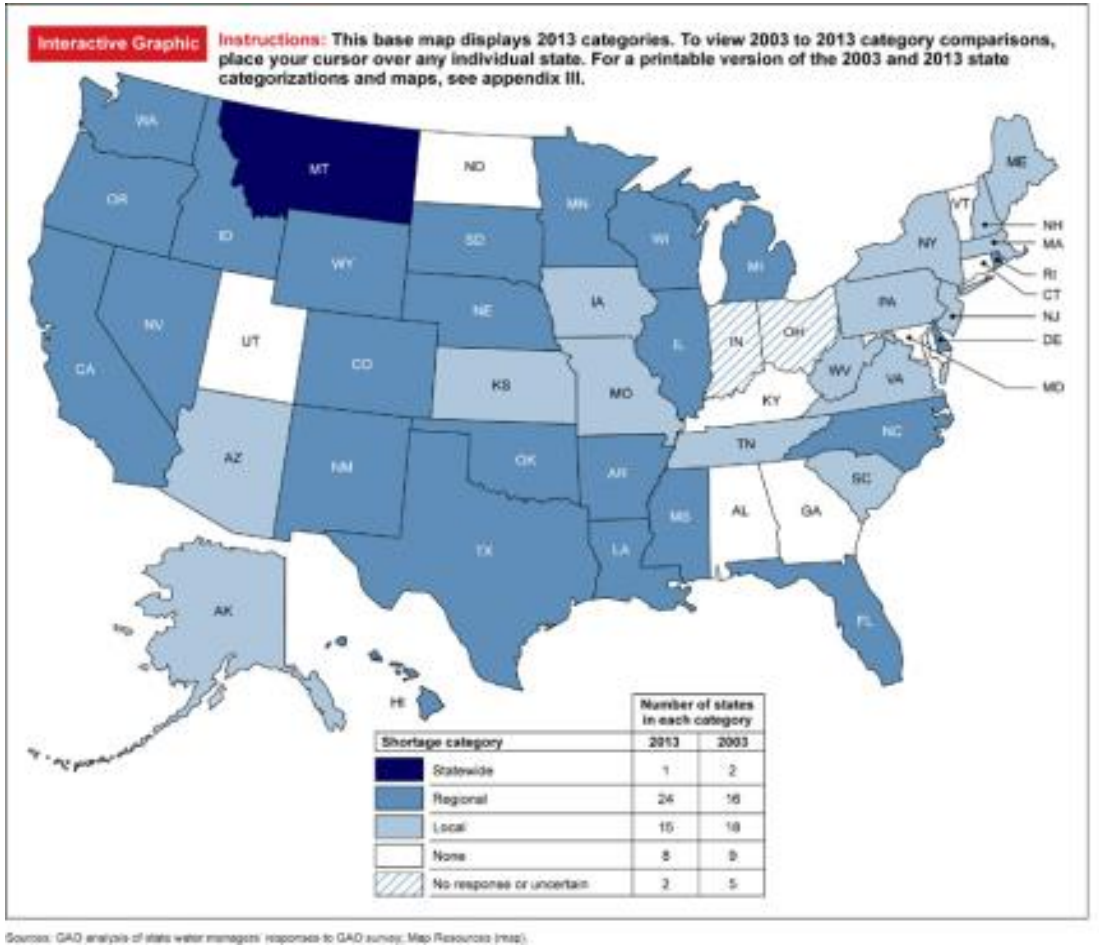
The mid-latitudes are in the 150th year of a 300 yr arid cycle

https://www.researchgate.net/publication/259466472_Fundamentals_of_Tree_Ring_Research

National Water Stress
Water Manager expected shortages within the next Decade



General Accountability Office – 2003-2013

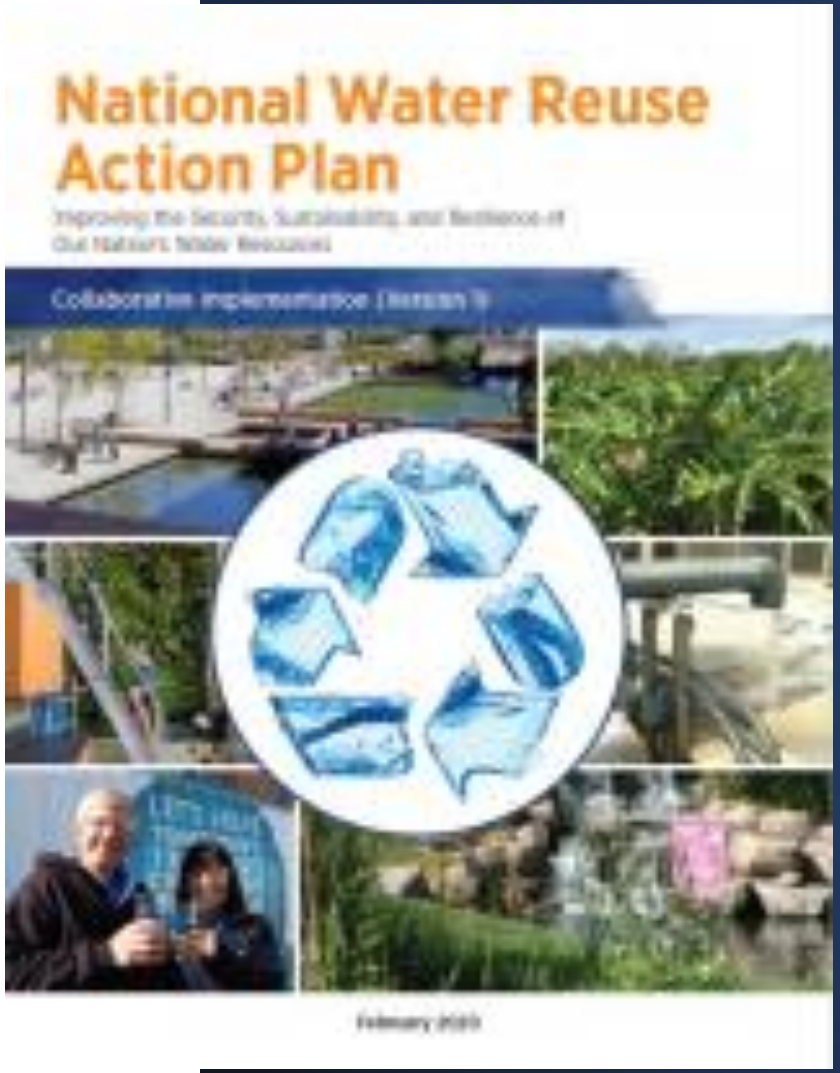


General Accountability Office – 2014 - 2024

https://www.gao.gov/products/gao-14-430

EPA RESPONSE TO NATIONAL WATER STRESS – WATER REUSE ACTION PLAN

- Fit-for-purpose treatment and reuse of waste water in five major categories:
  - Thermo-electric cooling water
  - Agricultural waste water
  - Municipal waste water
  - Produced water
  - Storm water
- New Mexico is implementing these along with brackish and saline water treatment
- Most **new water resources** above will require desalination and concentrate management



https://www.epa.gov/waterreuse/national-water-reuse-action-plan-online-platform

EPA – 2021 –1st year WRAP update

- New Mexico stands alone as a national example of accomplishments toward:
  - Water **Security**
  - Water **Sustainability**
  - Water **Resilience**

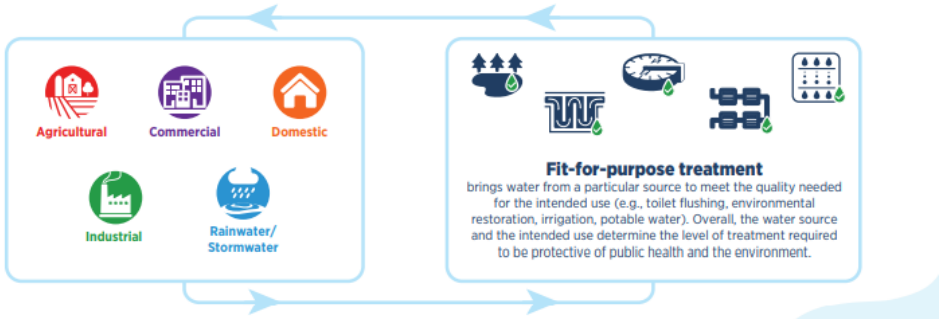
TECHNICAL ACCOMPLISHMENTS

- **Enabling water reuse research.** Federal agencies provided critical support to advance research on priority reuse topics. For example, as part of its Small Business Innovation Research (SBIR) program, the U.S. Environmental Protection Agency (EPA) announced Phase I awards of $800,000 for water reuse technology research in April 2021 (Action 7.5), and the U.S. Department of Energy (DOE) is awarding $27.5 million for research and development for advanced water resource recovery systems, which include water reuse (Action 4.3).
- **Creating technical guidance and tools for onsite non-potable reuse.** In partnership with the Water Research Foundation (WRF), the National Blue Ribbon Commission published a guidance manual and training materials on onsite non-potable water systems (ONWS). The materials synthesize public health guidelines and regulations to offer clear details on how to design and implement an ONWS. As part of the effort, EPA launched its complementary Non-Potable Environmental and Economic Water Reuse (NEWR) Calculator, a web-based decision support tool to quantify the availability of alternative water sources for building-scale reuse (Action 3.4).
- **Examining stormwater capture and use challenges and opportunities.** In February 2021, more than 650 water professionals from across the country gathered for two live webinars on stormwater capture and use: one on drivers and barriers and one on developing treatment standards. Twenty-five action leaders and partner organizations, researchers, and expert local practitioners worked together to produce the webinars (Action 3.3).
- **Compiling existing fit-for-purpose specifications.** EPA, in collaboration with eight other organizations, is developing a compendium of state and international water reuse regulation and guidance documents and summarizing their scientific underpinnings. This will be a valuable resource for water reuse practitioners who want to know more about existing regulations and should help inform best practices (Action 3.1).
- **Advancing research on the treatment of produced water for uses outside the oil and gas sector.** In January 2021, the New Mexico Produced Water Research Consortium issued a request for proposals for research and development projects evaluating treatment technologies; produced water availability; quantitative risk assessments; and socio-economic, environmental, and ecological cost-benefit analyses. The Consortium's proposal review team chose six treatment and three modeling and analysis proposals to move forward in the research process (Action 4.2).

Primary Water Reuse Objectives

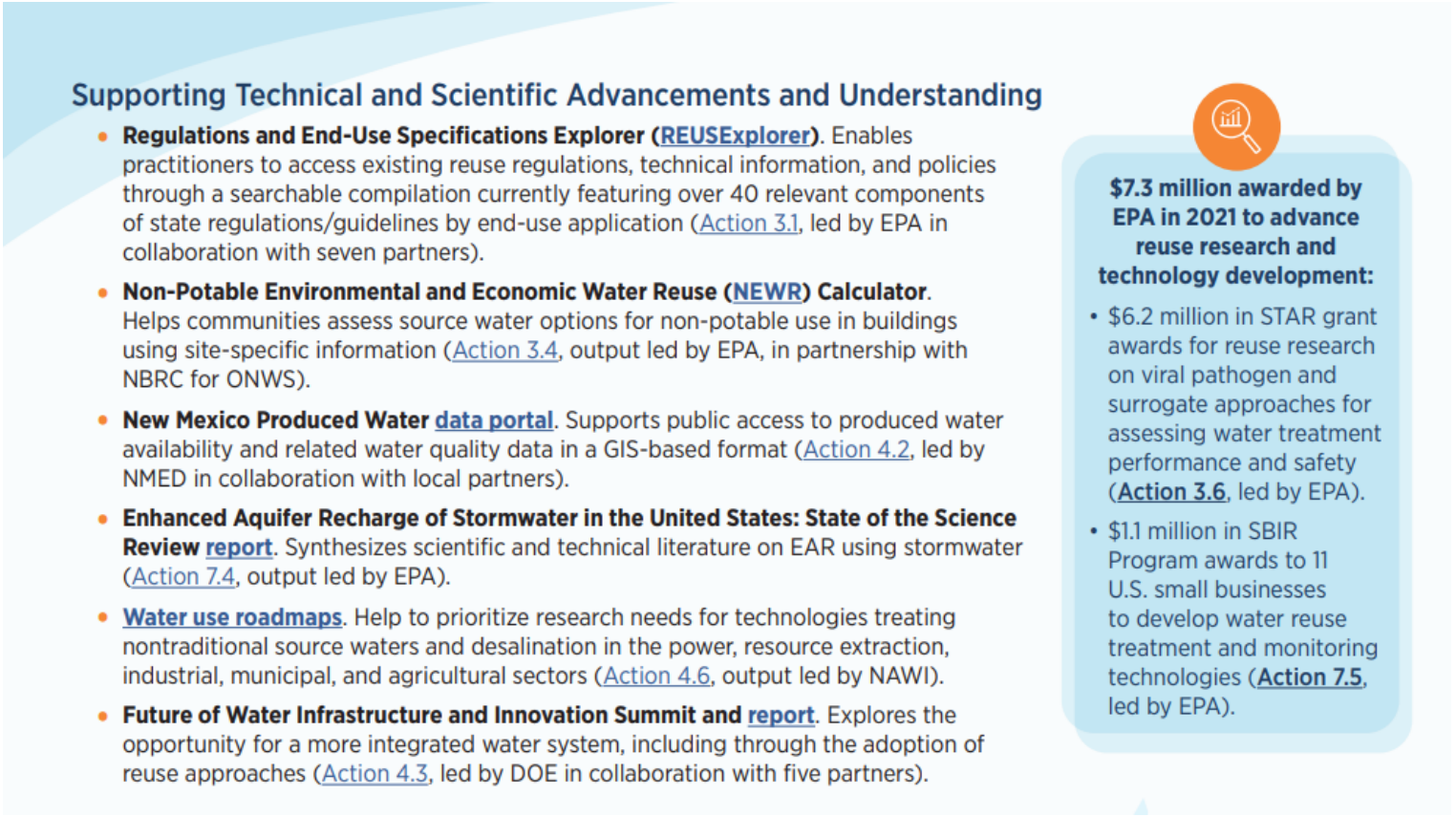
- **Water security:** The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socioeconomic development.
- **Water sustainability:** Ensuring an adequate, reliable, and continual supply of clean water for human uses and ecosystems.
- **Water resilience:** The ability of a water supply (e.g., a water system or an asset of a water system) to adapt to or withstand the effects of rapid hydrologic change or a natural disaster.

Examples of Reuse Sources and Uses



EPA – 2022 –2nd year WRAP update

New Mexico again stands out as successfully rolling out the New Mexico Produced Water Data Portal – giving the public access to information on wells, water quality and produced water volumes

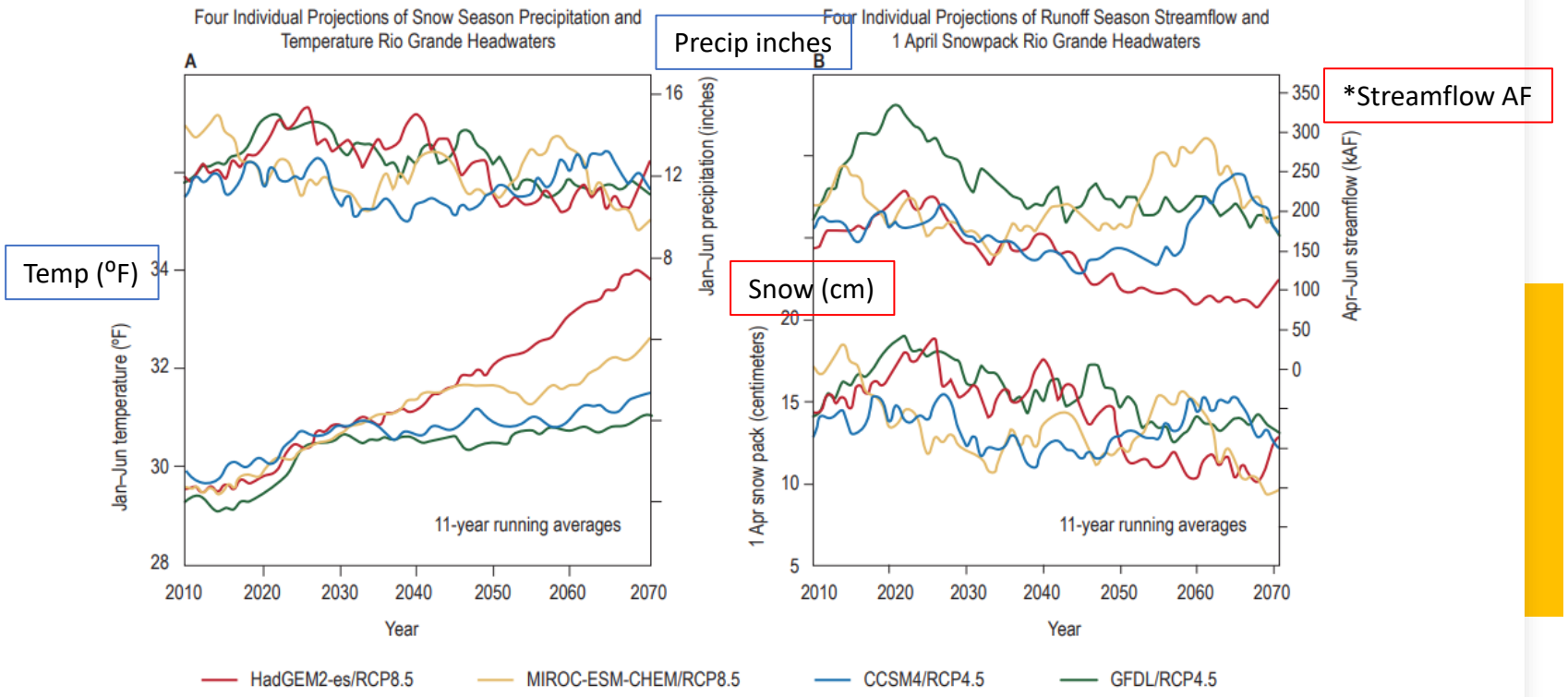


Supporting Technical and Scientific Advancements and Understanding

- **Regulations and End-Use Specifications Explorer (REUSExplorer)**. Enables practitioners to access existing reuse regulations, technical information, and policies through a searchable compilation currently featuring over 40 relevant components of state regulations/guidelines by end-use application (Action 3.1, led by EPA in collaboration with seven partners).
- **Non-Potable Environmental and Economic Water Reuse (NEWR) Calculator**. Helps communities assess source water options for non-potable use in buildings using site-specific information (Action 3.4, output led by EPA, in partnership with NBRC for ONWS).
- **New Mexico Produced Water data portal**. Supports public access to produced water availability and related water quality data in a GIS-based format (Action 4.2, led by NMED in collaboration with local partners).
- **Enhanced Aquifer Recharge of Stormwater in the United States: State of the Science Review report**. Synthesizes scientific and technical literature on EAR using stormwater (Action 7.4, output led by EPA).
- **Water use roadmaps**. Help to prioritize research needs for technologies treating nontraditional source waters and desalination in the power, resource extraction, industrial, municipal, and agricultural sectors (Action 4.6, output led by NAWI).
- **Future of Water Infrastructure and Innovation Summit and report**. Explores the opportunity for a more integrated water system, including through the adoption of reuse approaches (Action 4.3, led by DOE in collaboration with five partners).

$7.3 million awarded by EPA in 2021 to advance reuse research and technology development:

- $6.2 million in STAR grant awards for reuse research on viral pathogen and surrogate approaches for assessing water treatment performance and safety (**Action 3.6**, led by EPA).
- $1.1 million in SBIR Program awards to 11 U.S. small businesses to develop water reuse treatment and monitoring technologies (**Action 7.5**, led by EPA).



Precip inches

*Streamflow AF

Temp (°F)

Snow (cm)

Figure 2.7. (a) Projected Jan–Jun temperature (bottom set of curves) and precipitation (top set of curves) in the Rio Grande headwaters basin in southern Colorado, derived from the same four downscaled projections used for Fig. 2.4 with the same color coding. (b) Projected 1 April snowpack (bottom set of curves) and Apr–Jun streamflow, in thousand-acre-feet (KAF), at a point on the river corresponding to the Del Norte stream gage (top set of curves), corresponding to the precipitation and temperature projections shown in (a). An 11-year running average, centered on each year, has been applied to all time series to emphasize variability on decadal and longer time scales.

OSE Leap Ahead Analysis

https://engagenmwater.org/new-mexico-50-year-water-plan

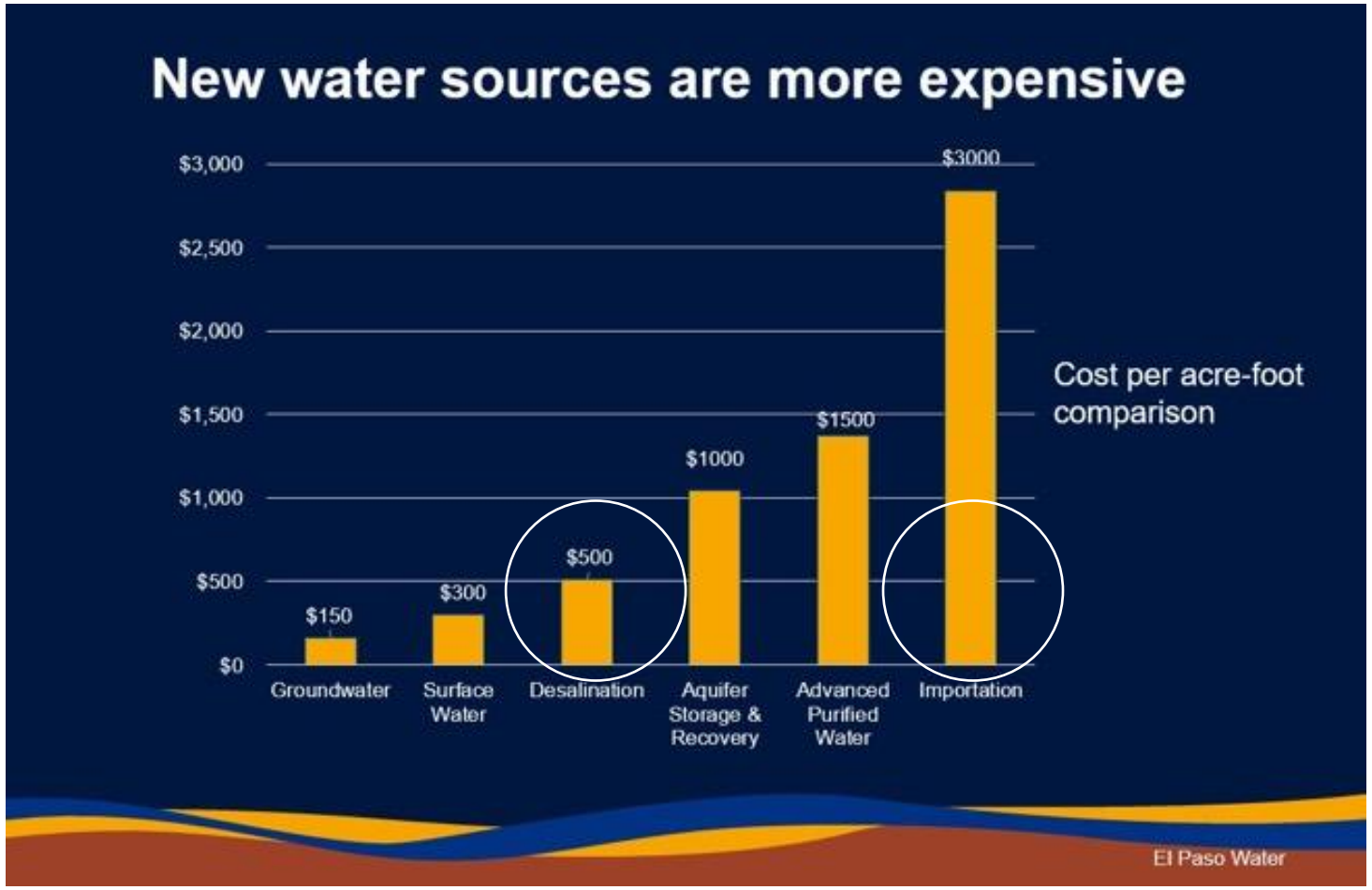
TAKE AWAYS:

Likely Changes Based on Peer-Reviewed Studies:

- Average **temperature rise** of 5°- 7°F
- **Lower streamflow & aquifer recharge**
- Greater year-to-year **variability** in precipitation
- **Hotter**, more **severe** droughts
- **Decreasing snowpack**, earlier & **diminishing runoff**
- Greater **demands on groundwater** due to surface water shortfall
- Stress on natural vegetation caused by **increasing temperature** & **decreased water** availability
- **Increasing forest fire** frequency resulting from heat & dryness
- **Increasing flooding & sediment transport** due to more intense storm events & fires
- Irreversible **damage to soils** through loss of vegetation & erosion
- **Degraded quality** of surface waters

NM STATE ENGINEER FOCUS – NEW WATER FOR NEW MEXICO
ONE WATER CONCEPT

- **One Water Concept** – "all water has value"
  - Brackish and saline waters
  - Fit-for-purpose treatment and reuse of waste waters (Santa Fe, Albuquerque, Las Cruces, Rio Rancho, Cloudcroft, etc.)
- Trend – the unit cost of '**new water**' is changing, import of new fresh water is often more costly than treatment and reuse of other waters



El Paso Example – Desalination is cheaper than fresh water import from New Mexico

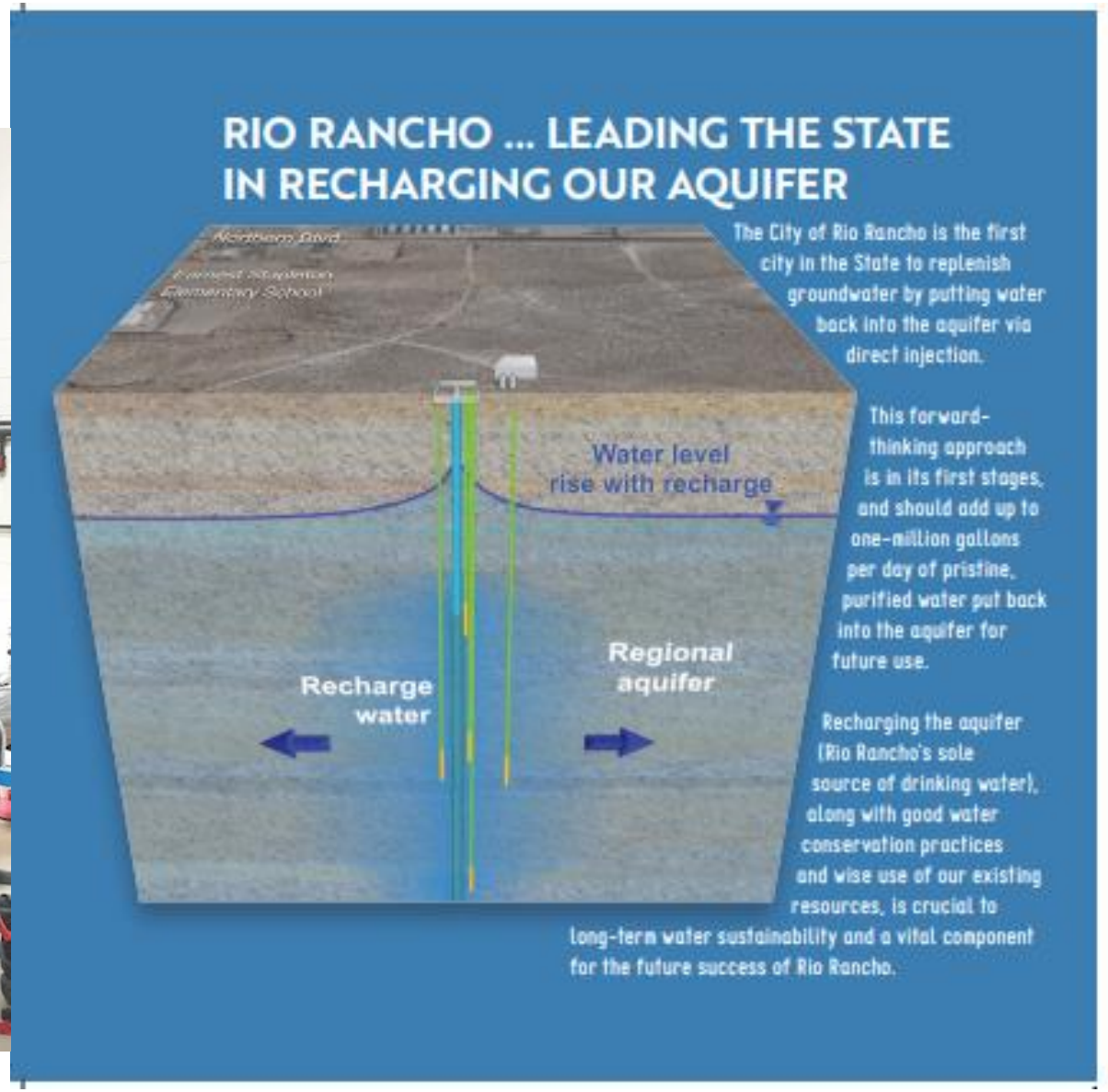
HISTORY OF DESALINATION:

1958 - United States authorized **Saline Water Conversion Act** funding the **Office of Saline Water**

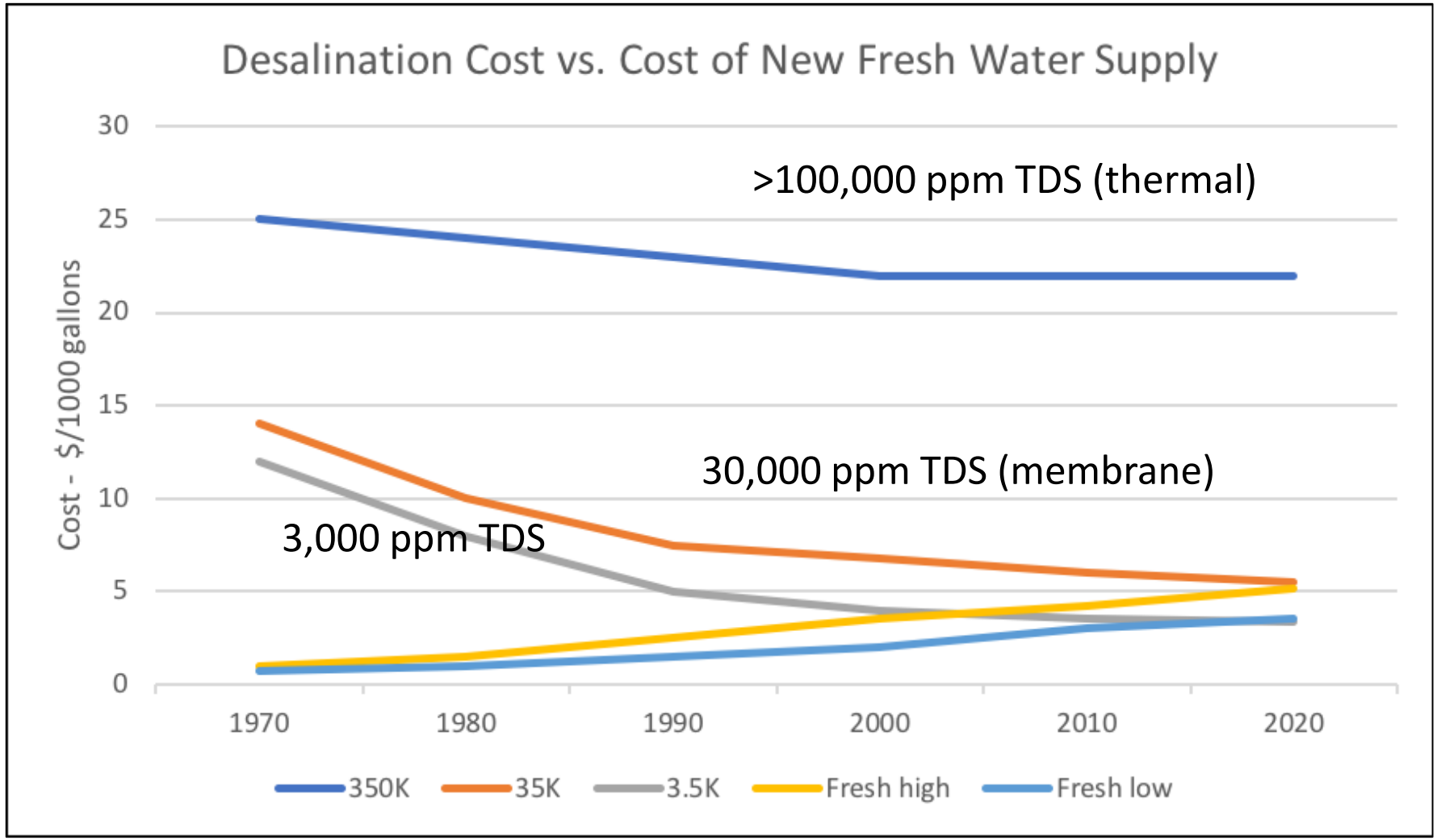
REMARKS OF S. E. REYNOLDS AT THE
GROUNDBREAKING CEREMONY FOR THE
ROSWELL BRACKISH WATER DISTILLATION
PLANT - JULY 10, 1962

This ceremony inaugurating a plant for demonstrating the feasibility of converting brackish water to fresh water marks another event in the pioneering tradition of our state. It is particularly in keeping with tradition that this plant is being constructed in New Mexico where the tremendous energy of the atom was demonstrated and in Roswell, where, by Professor Goddard's rockets, the feasibility of the exploration of space was demonstrated.

New Mexico reportedly has about 15-billion acre-feet of saline ground waters of a quality ranging from brackish water to concentrated brine. If only one-third of these saline waters could be mined, desalinized, and conveyed to places where water will be needed, we could double our present uses and supply the new demand for a thousand years. These salt-laden waters, which in the past have usually been considered a curse in this arid land, may yet become one of our greatest blessings.


RIO RANCHO ... LEADING THE STATE IN RECHARGING OUR AQUIFER
Water level rise with recharge
Recharge water
Regional aquifer
The City of Rio Rancho is the first city in the State to replenish groundwater by putting water back into the aquifer via direct injection.
This forward-thinking approach is in its first stages, and should add up to one-million gallons per day of pristine, purified water put back into the aquifer for future use.
Recharging the aquifer (Rio Rancho's sole source of drinking water), along with good water conservation practices and wise use of our existing resources, is crucial to long-term water sustainability and a vital component for the future success of Rio Rancho.

NON-TRADITIONAL WATER TREATMENT VS NEW FRESH WATER DEVELOPMENT



Common produced water disposal $25-100/1000 gal

Common brackish, waste water, and sea water TDS concentrations

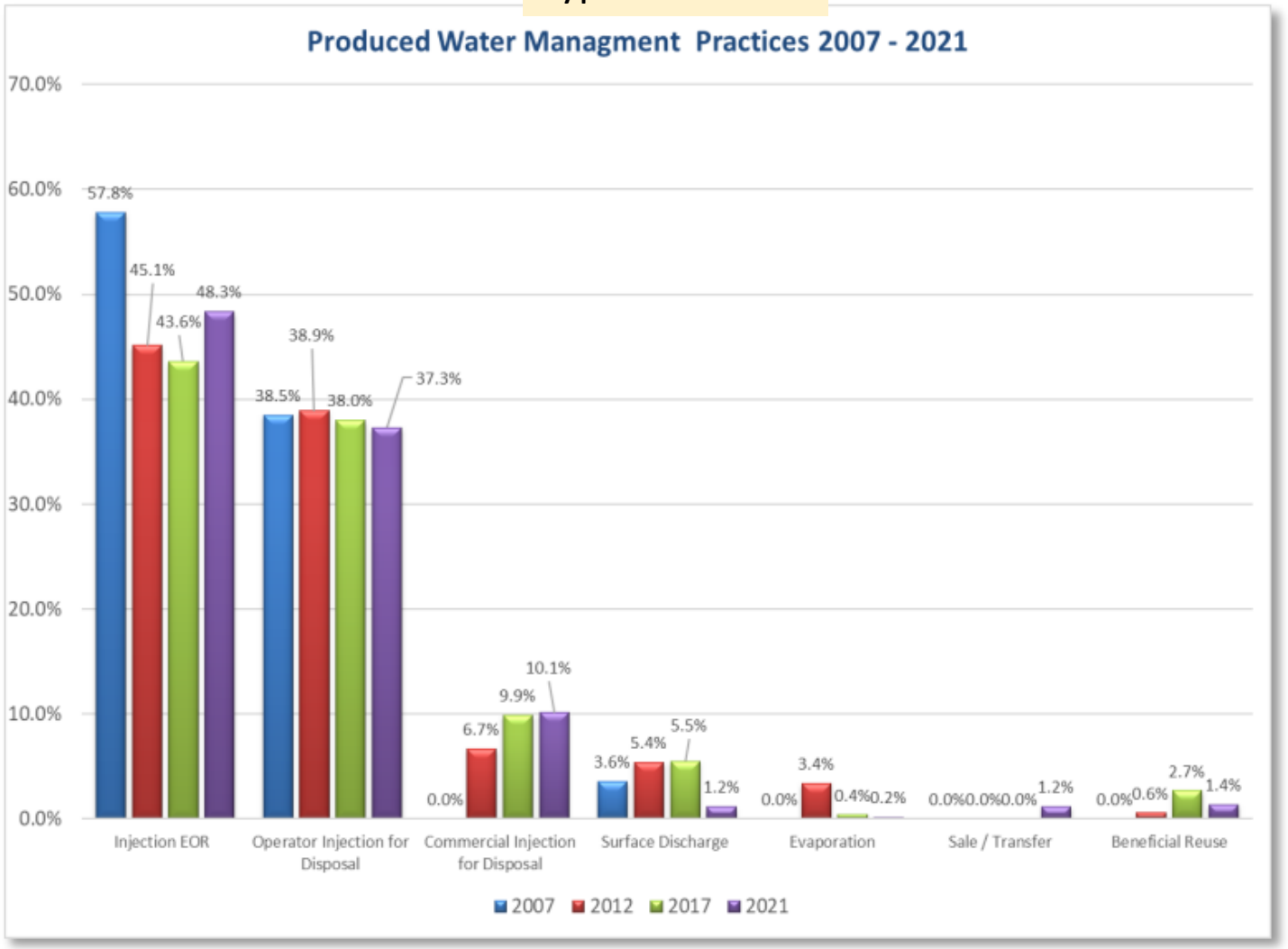
PRODUCED WATER NATIONALLY / LOCALLY

CHANGES THROUGH TIME

- National Produced Water Management data from 2007-2021.

GWPC
https://www.gwpc.org/sites/gwpc/uploads/documents/Research/Produced_Water_Full_Report___Digital_Use.pdf

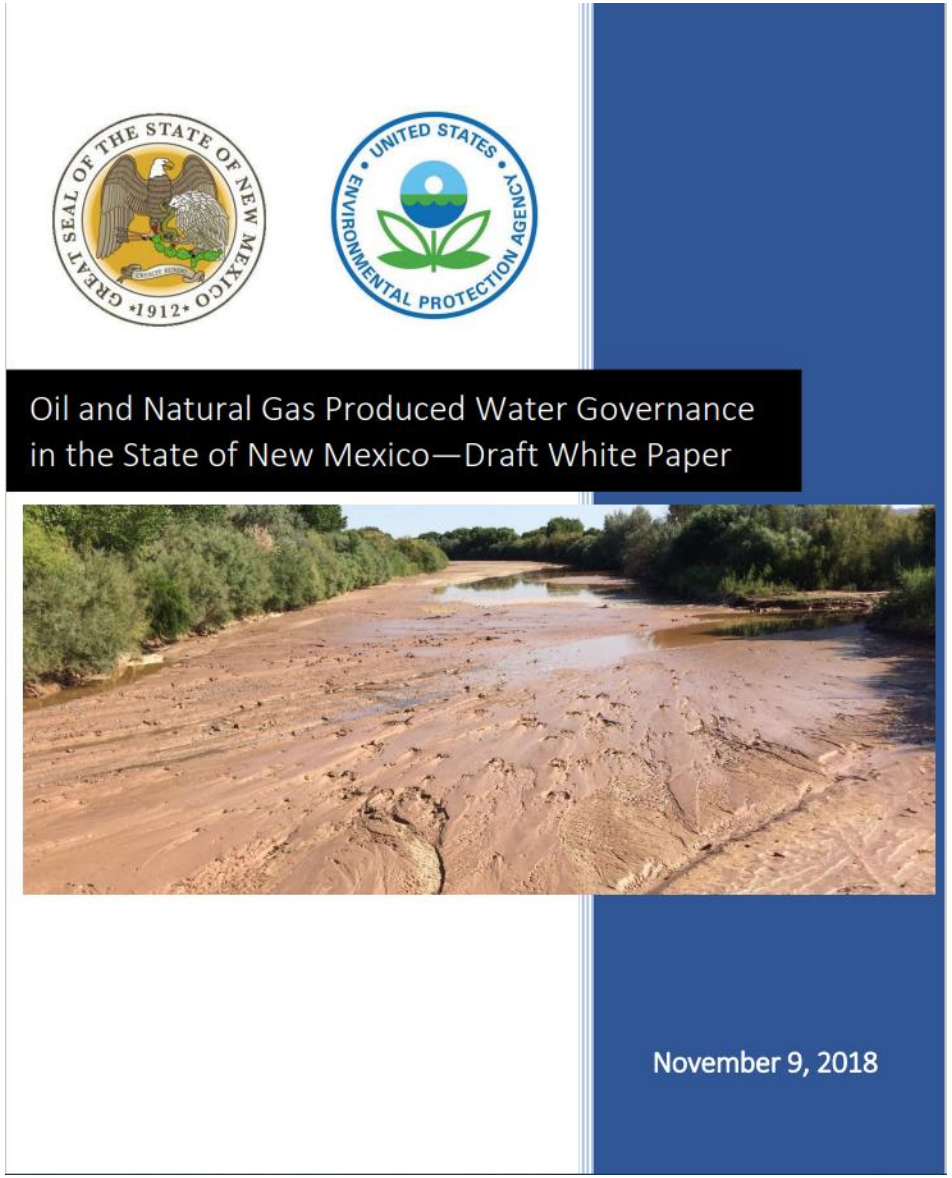
Typo not mine!



2018 – NM & EPA DRAFTED WHITE PAPER

While conservation plays an important role in managing the state's limited water resources, it is not enough.

Managing water scarcity has always been important in New Mexico, but never more important than now.

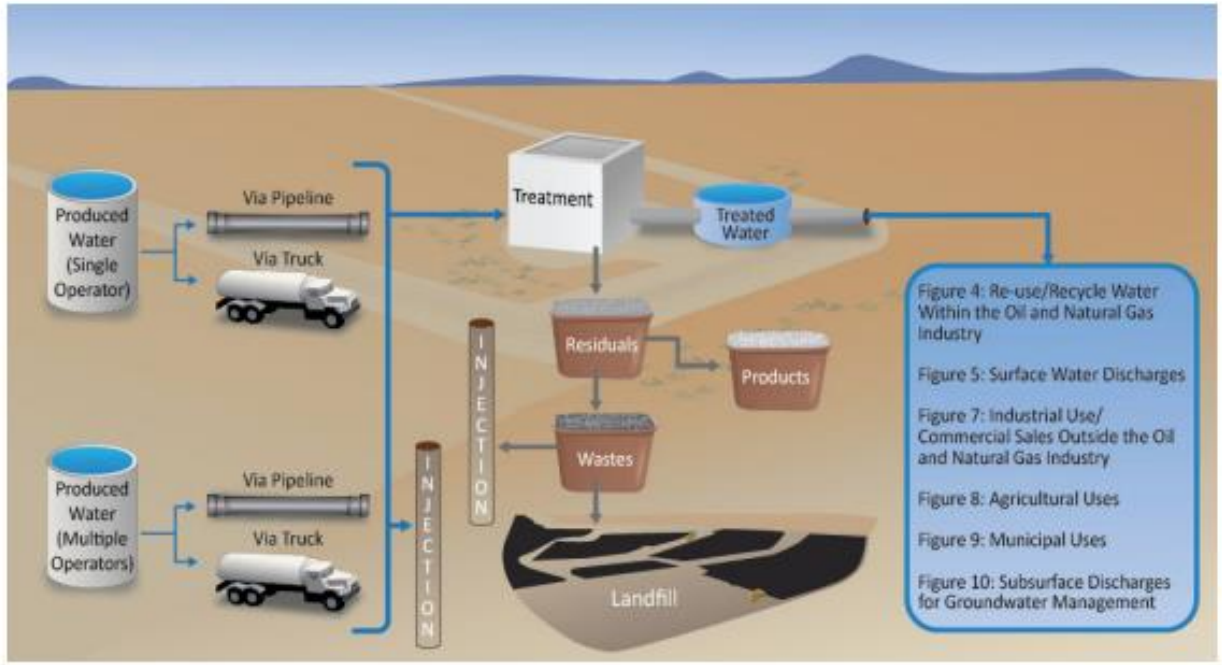


WHITE PAPER SCOPE

- **Highlighted for state, local and federal decisionmakers how the use of treated produced water could help alleviate water scarcity issues in New Mexico;**
- Provide a roadmap for stakeholders navigating the existing federal and state regulatory landscapes; and
- Identify policy gaps and opportunities to streamline existing frameworks.

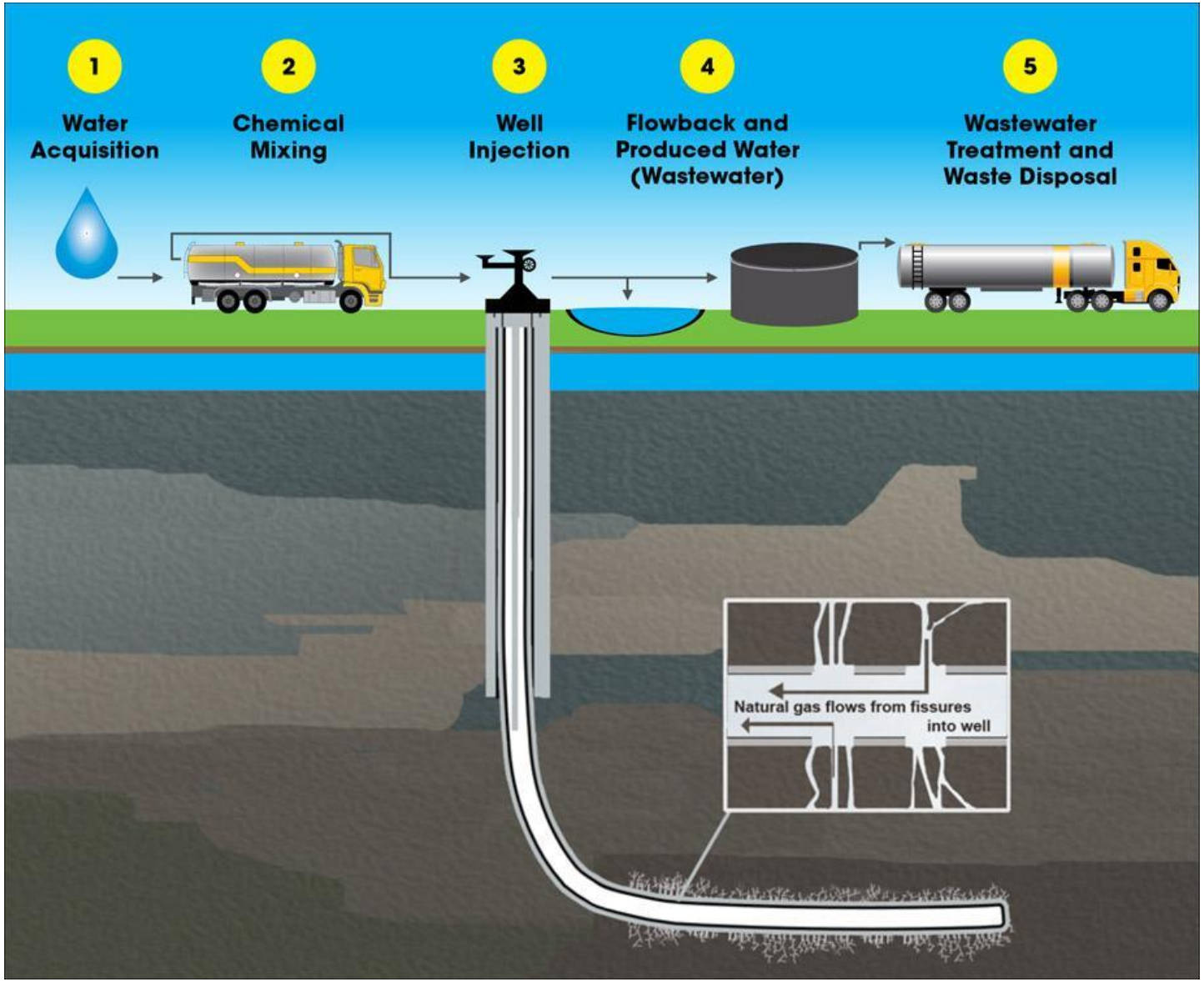
- *Re-use water* is any fluid that is generated from an oil and natural gas well, undergoes minimal treatment, and is used again in an oil or natural gas well before disposal in an underground injection well.
- *Recycled water* is any water that is generated from an oil or natural gas well, undergoes significant treatment, and is used again in an oil or natural gas well before disposal in an underground injection well.
- *Renewable water* is fluid that is generated from an oil or natural gas well that undergoes significant treatment and is used outside the oil and natural gas industry and is added to the hydrologic cycle, as opposed to disposed of in an underground injection well.

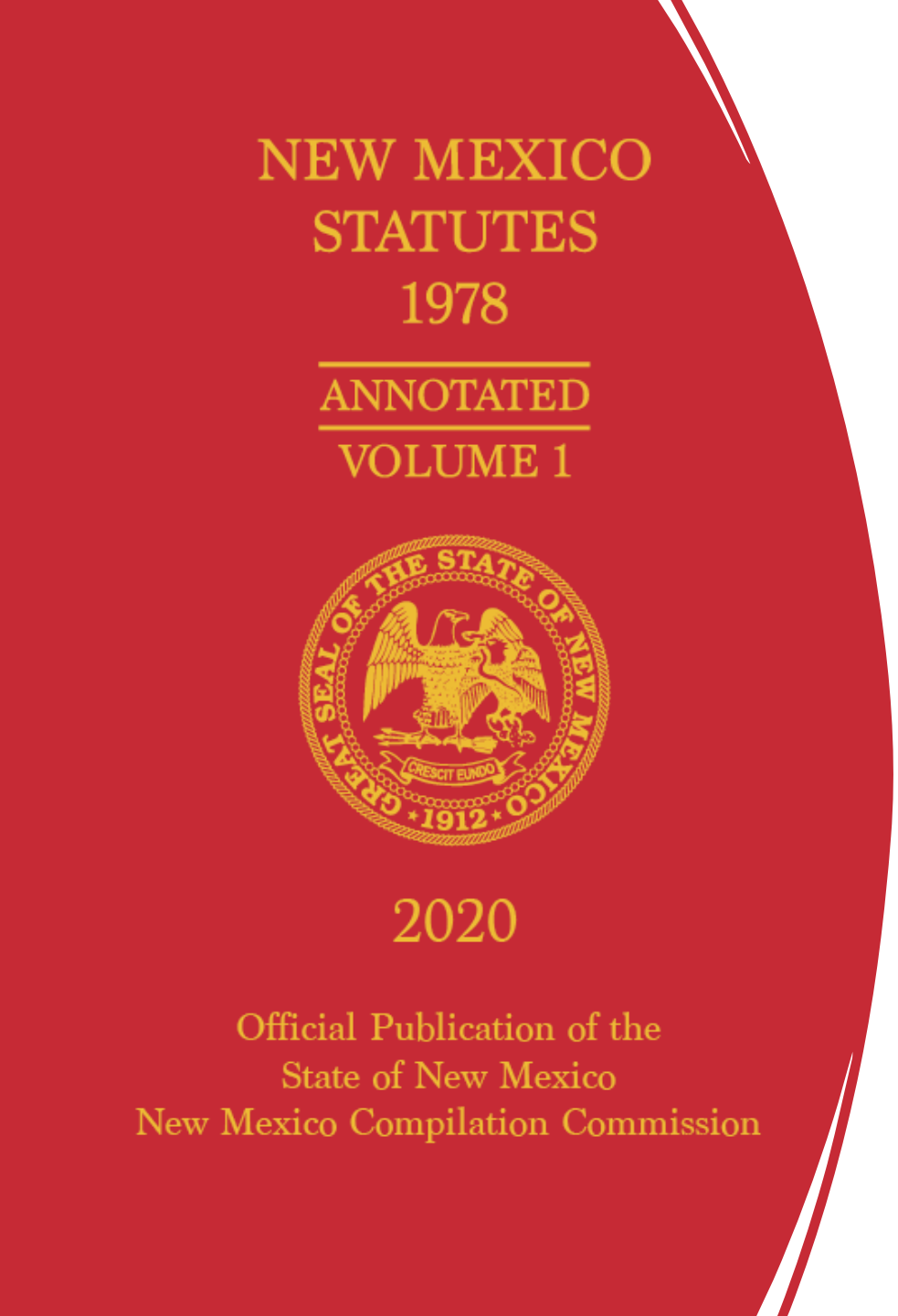
Figure 3: Re-use, Recycling and Renewable Water Scenarios



PRODUCED WATER ACT

- This resulted in the **HB 546**, passing the **Produced Water Act in 2019, amending the Water Quality Act, giving NMED** jurisdiction over treatment and use of produced water for purposes **outside** the oil and gas sector.
- The OSE accompanied sister agencies on a Public Information tour in 2019.
- In 2020, Oklahoma passed a Produced Water Act similar to NM, and additionally included the quantity of produced water into their State Water Plan.





NMSA 1978, § 72-14-3

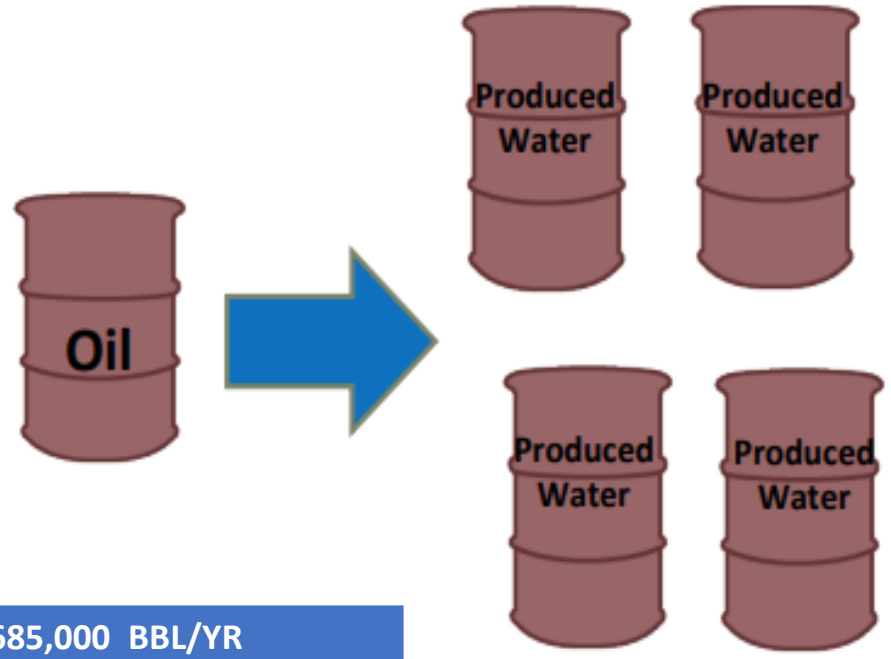
The Interstate Stream Commission, of which the State Engineer is the Secretary, has the statutory duty …

"to investigate water supply, to develop, to conserve, to protect and to do any and all other things necessary to protect, conserve and develop the waters." NMSA 1978, § 72-14-3.

HOW MUCH ARE WE TALKING ABOUT?

- In 2018, according to NMPWC:
  - 42 billion gallons in SE corner of the state.
  - 946 million gallons in the NW corner of the state.
- In 2021, NM surpassed 67 billion gallons of produced water, which equates to over 184 million gallons per day — far exceeding the total daily municipal water consumption in the state.
- NM volumes from GWPC:

(Barrels per year = 42 gallons):



2007	665,685,000 BBL/YR
2012	775,930,000 "
2017	879,740,841 "
2021	1,600,878,600 "

STATE ENGINEER'S POLICY STATEMENT

"New Mexico is at the forefront of addressing the challenges presented by climate change and increasing aridity of the Southwest. The Office of the State Engineer fully supports the reuse of treated Produced Water to replace the use of freshwater wherever reasonably practicable; thus fulfilling our statutory obligation to do all things necessary to protect, conserve and develop the water of the state.***"***

Mike Hamman PE- 2022

PREVIOUS STATE ENGINEER'S

- 2018 “Revolutionary ideas are needed to ensure [water] demand can be balanced in the future,” Tom Blaine, Past New Mexico State Engineer.
- 2011- “Conservation is the low-hanging fruit. Once we get past that, we’ll have to start looking at new technologies to provide more water. Emerging technology is the wave of the future.”
  John D’Antonio, Past New Mexico State Engineer

Year	Produced Water	TDS < 1K mg/L	TDS 1-10K mg/L	TDS > 10K mg/L	Total Water
2022	2,271,942,561 61%	122,965,572 3.3%	980,271,907 26.7%	296,880,946 8.1%	3,672,060,986
2021	7,245,217,615 49.6%	1,622,424,826 11.1%	4,898,172,712 33.5%	848,488,666 5.8%	14,614,303,819
2020	1,326,257,946 48.1%	625,872,706 22.7%	799,614,290 29.0%	3,374,868 0.1%	2,755,119,810

(Volumes reported in gallons of water) (Percentage of use per reporting year)

2022 JOINT LETTER TO LAWMAKERS

"The availability of surface water flows are unreliable and those flows are decreasing in quantity. New Mexico has tapped the underground sources as the surface supplies wane. This water becomes increasingly saline and this comes at a cost for pumping and treatment. The need for alternative sources of water is one core policy objective that led the legislature to enact the Produced Water Act in 2019."

2022 JOINT LETTER TO LAWMAKERS

- Other western states have worked to overcome these obstacles to allow treated produced water to be permitted for use in irrigation, agriculture, and aquifer storage and recovery.
- Research shows that the produced water chemistry varies greatly across the country.
- New Mexico now must navigate the science and work with private sector to find the appropriate treatment and use of this potential resource within our great state.

The State Engineer's role is to ensure that the use of produced water is not considered the exercise of a water right as defined by our laws; that the quantity of water that has been placed into reuse is metered and reported; and that commingling of uses of recycled produced water with fresh water is clearly metered separately from fresh water used beneficially toward a water right.

PRODUCED WATER AND WATER RIGHTS NEXUS

Beneficial Use of water in New Mexico is the limit, measure and extent of a water right.

Produced Water **does not** establish a water right.

Recycling or reclaiming produced water for any other use is considered "**use by disposal**".

Produced water belongs to the **entity that is responsible for the disposal** of that water.

Commingling of produced water with fresh or saline water permitted by or under jurisdiction of the State Engineer must be **metered and accounted for to the OSE**.

QUESTIONS??

Contact me at:
505.827.6120

Jerri.Pohl@ose.nm.gov