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Title:	Reuse of Oil and Gas Produced Water in Southeast New Mexico-Resource Assessment, Treatment Processes, and Policy
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Webinar:
Sustainability in the Water–Energy–Food Nexus

Reuse of Oil and Gas Produced Water in Southeast New Mexico-Resource Assessment, Treatment Processes, and Policy

International Water Resources Association and the Sustainable Water Future Programme
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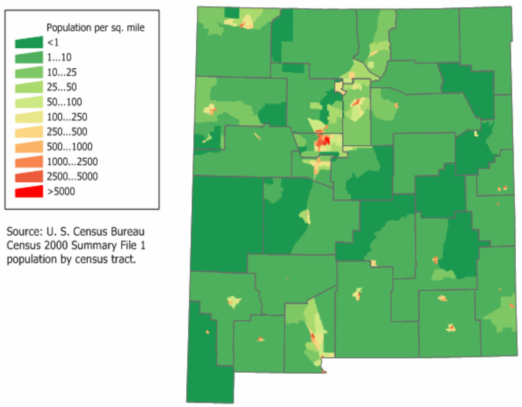
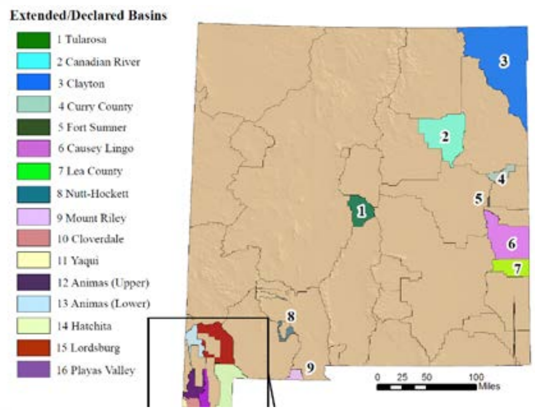
New Mexico Profile

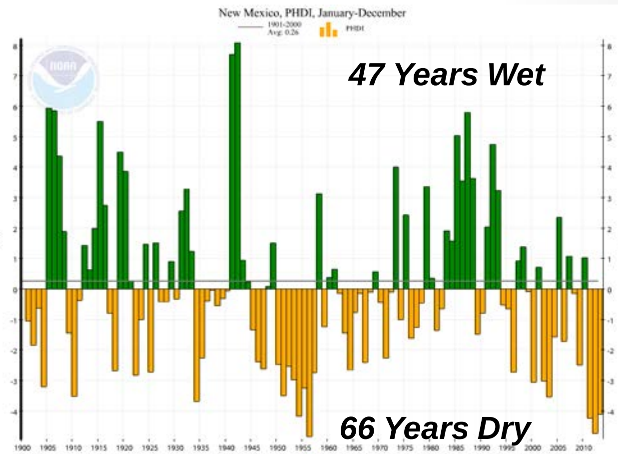


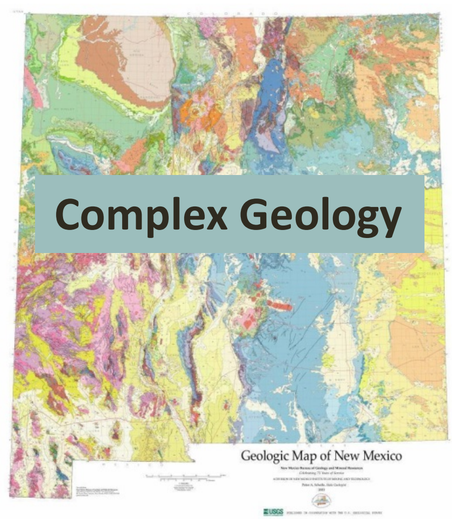
Population ~2M



16 Water Planning Regions

Palmer Hydrological Drought Index for New Mexico, 1900-2013





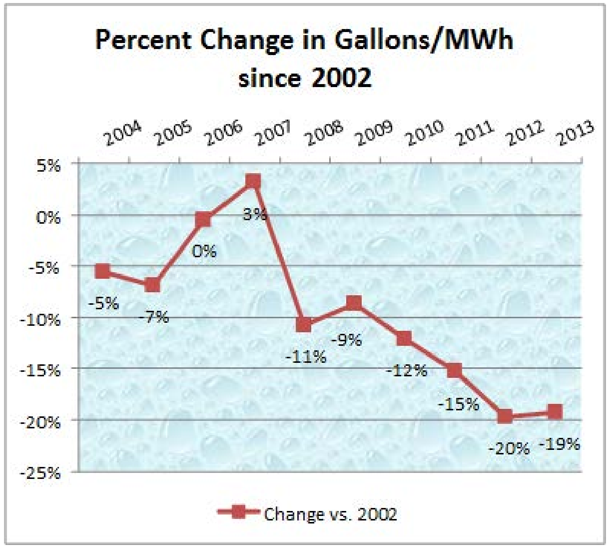


Figure 3. USDA drought designations for 2014. Southeast New Mexico Drought disaster incidents are shown in red (primary counties) and orange (contiguous counties). Source: USDA Farm Service Agency.

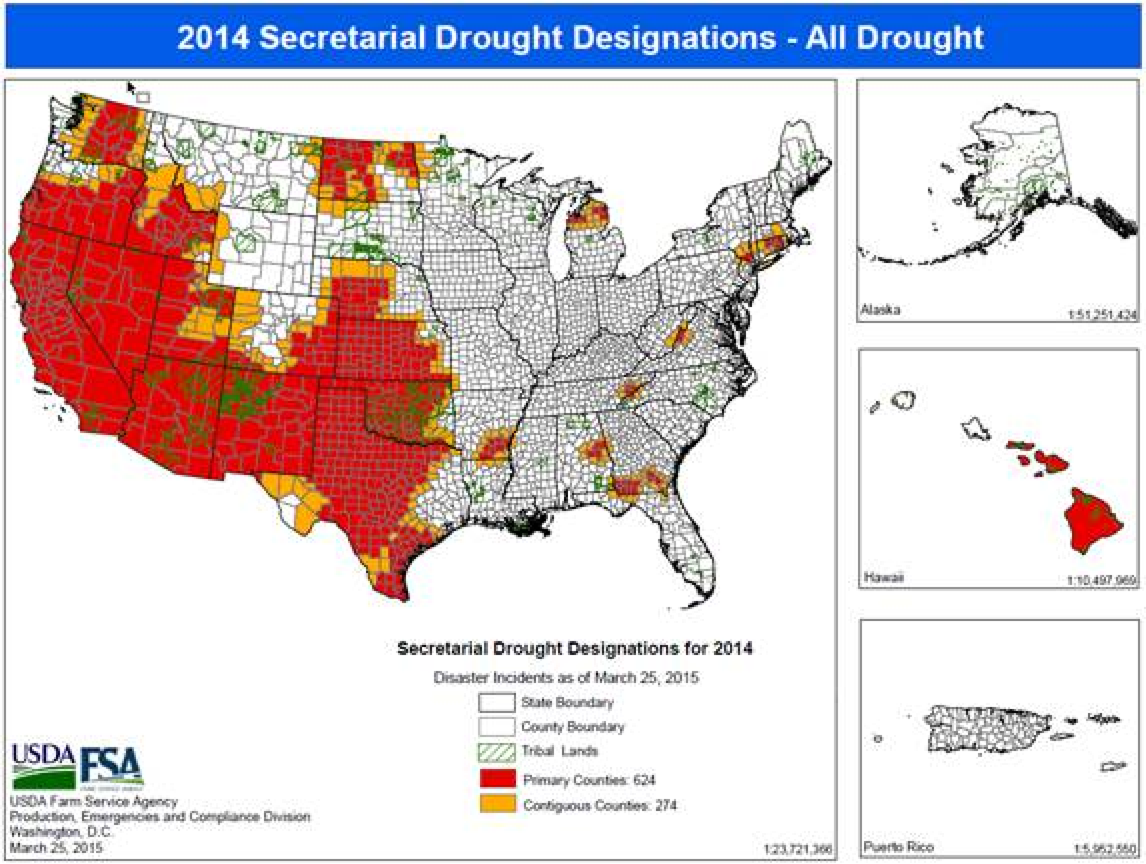
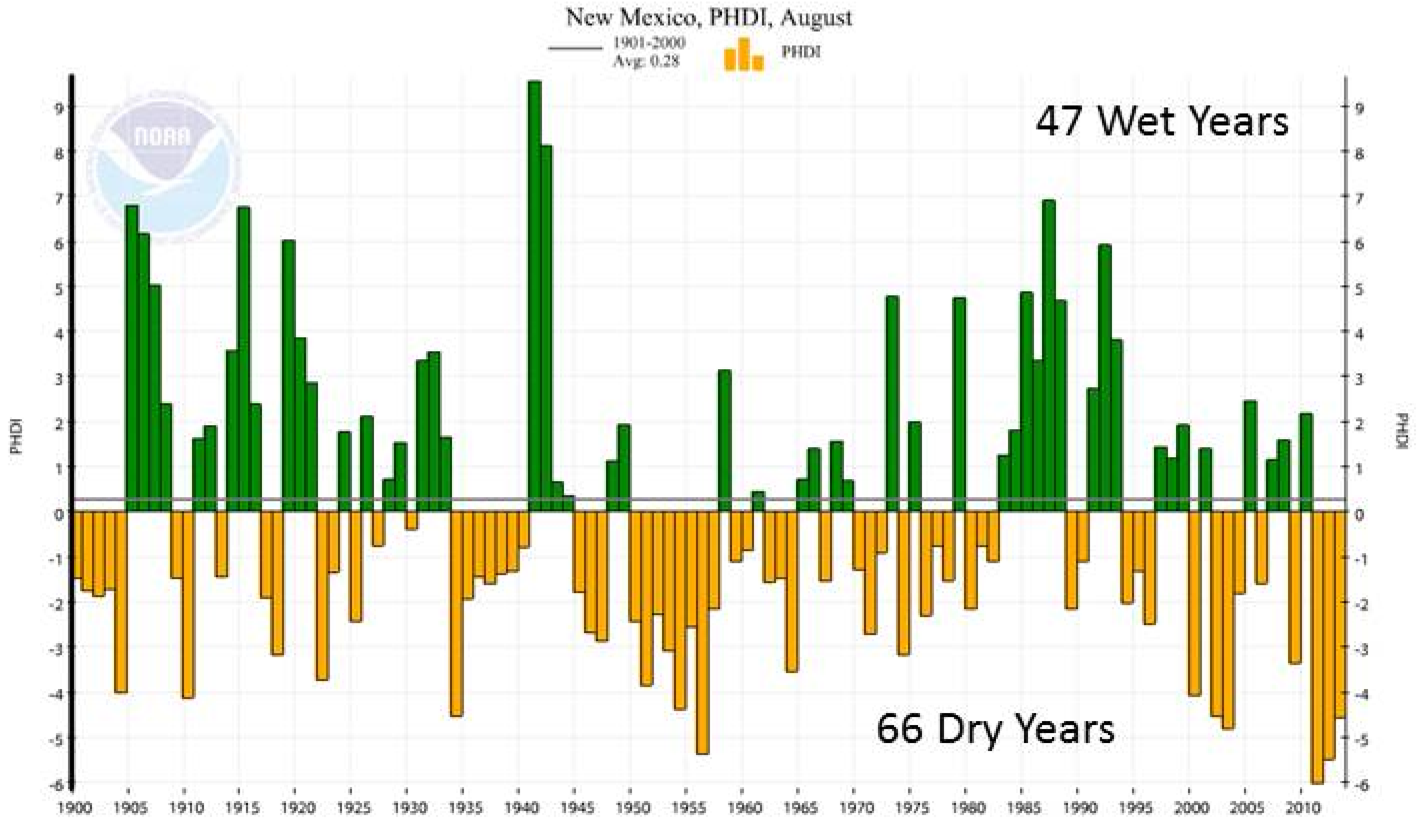


Figure 2. Palmer drought severity index for New Mexico, 1900-2013. Wet years shown in green above baseline, dry years shown in yellow below baseline. Adapted from: *NCDC-NOAA, accessed 06/30/2014.*



A collision of Drought and Energy development in an arid region....

- The Permian Basin is located in an arid region in southeastern New Mexico and West Texas
- Hydraulic fracturing drove a boom in oil and gas development from 2005-2014
- Concurrent water use by the oil and gas industry rose dramatically
- At the same time, drought year incidence and severity increased, leading to surface water supply stress, increased ground water use, and reduced ground water recharge.

Leading to Questions:

How large were the fresh water withdrawals by the oil and gas industry in this region during this time?
How do they compare with other withdrawals, and how impactful are they?
Can reuse of produced water reduce impacts and be economically feasible?
What policy changes will be needed to improve outcomes?

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Figure 1. New Mexico natural gas and oil basins and uplifts including Eddy, Lea, and Chaves counties and the Permian Basin region in the southeast, and the San Juan Basin region in the northwest.

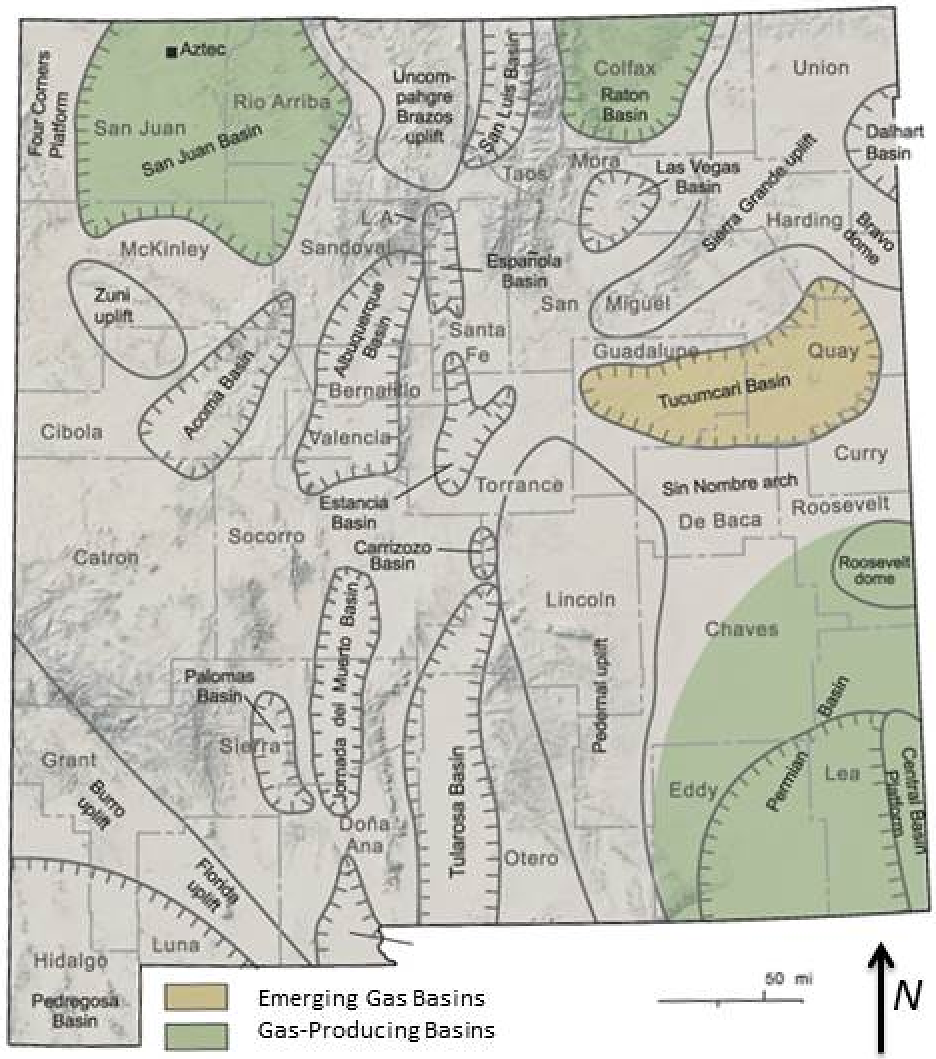


Figure 4. (Left) Water levels in shallow ground water aquifer well, Lea County, NM, from 1970 through 2013. Well completed in Alluvium, Bolson Deposits, and other Surface Deposits, TD= 604 feet below land surface. (Right) Water levels in a shallow ground-water aquifer, Eddy County, NM, from 1946 through 2013. Well completed in Alluvium, Bolson Deposits, and other Surface Deposits, TD= 186 feet below land surface. Source: USGS NWIS.

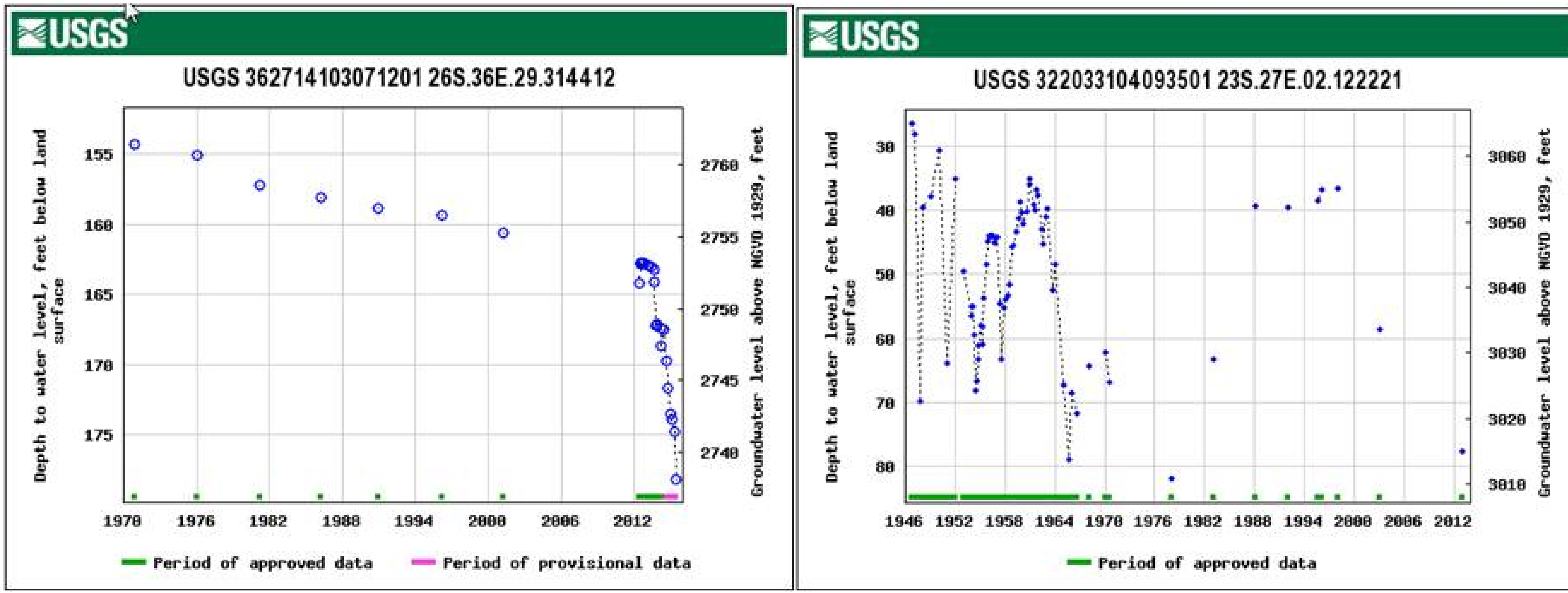
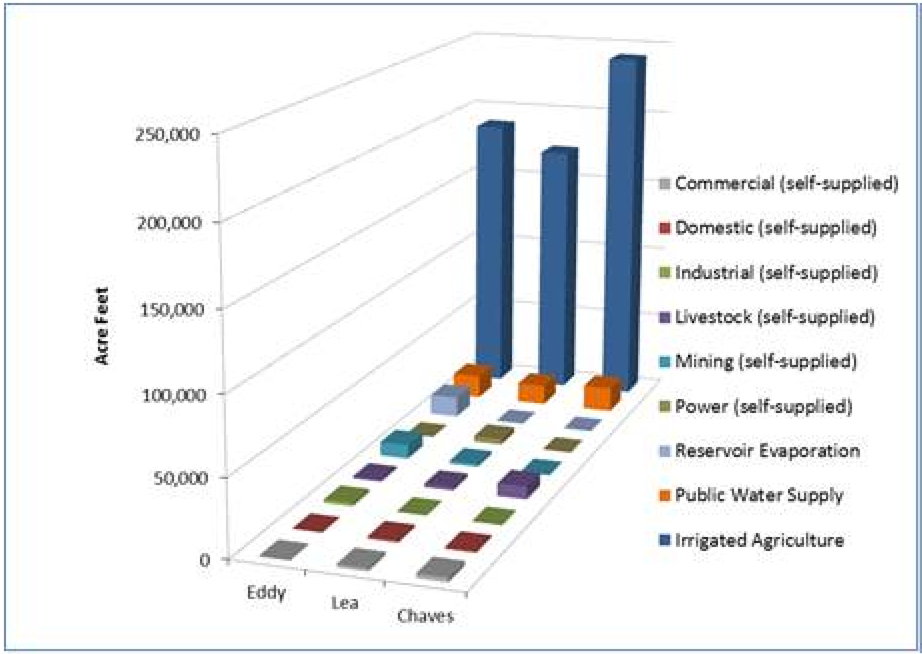
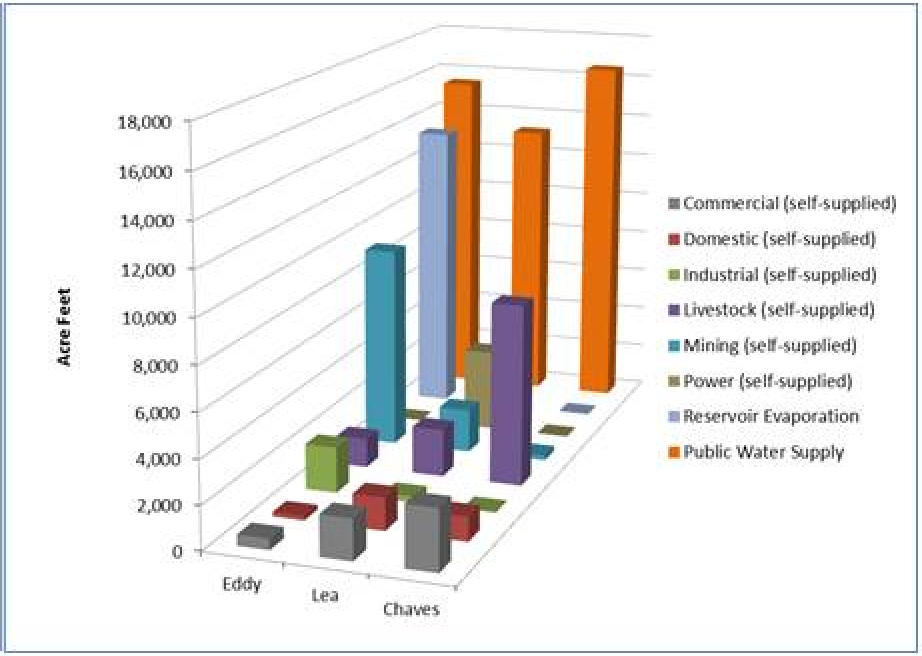


Figure 5. Fresh water withdrawal category comparison for Chaves, Lea, and Eddy Counties. On left, all categories reported (acre-feet). On right, all categories except irrigated agriculture (acre-feet). Mining category includes oil and gas withdrawals. Source: NMOSE.





Percentages of mining water withdrawn for oil and gas were: 2% (Eddy), 91% (Lea) and 45% (Chaves). Lea supported more oil and gas activity, while Eddy supports potash mining. Chaves has more agriculture.

Figure 6. Fresh water irrigation withdrawals, number of irrigated farms, and number of irrigated acres in Chaves, Lea, and Eddy Counties from 2000-2012.

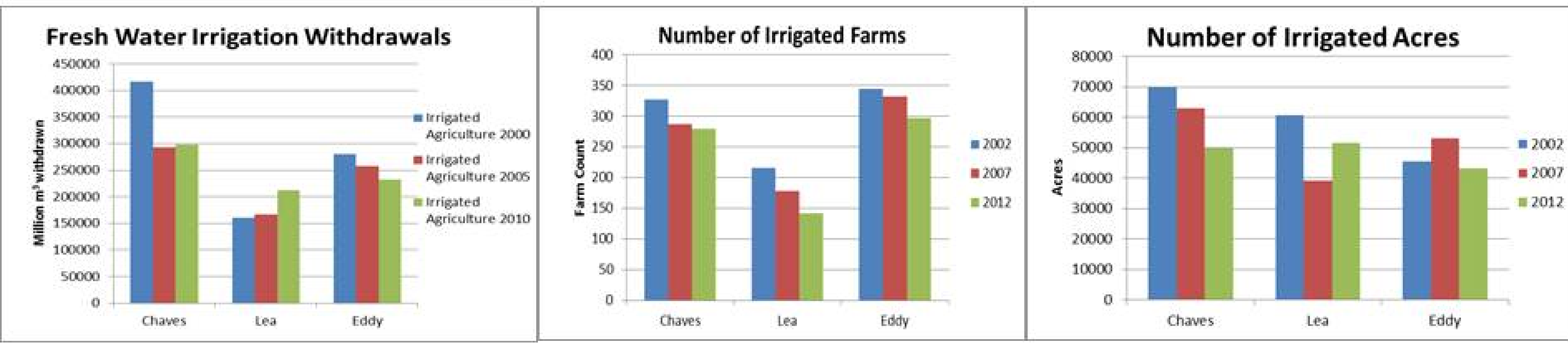


Figure 8. Comparison of oil and gas well development "starts", oil and gas production, and fresh water withdrawals for oil and gas use from 2000-2010 for Chaves, Eddy, and Lea Counties. Note difference in scales left and right.

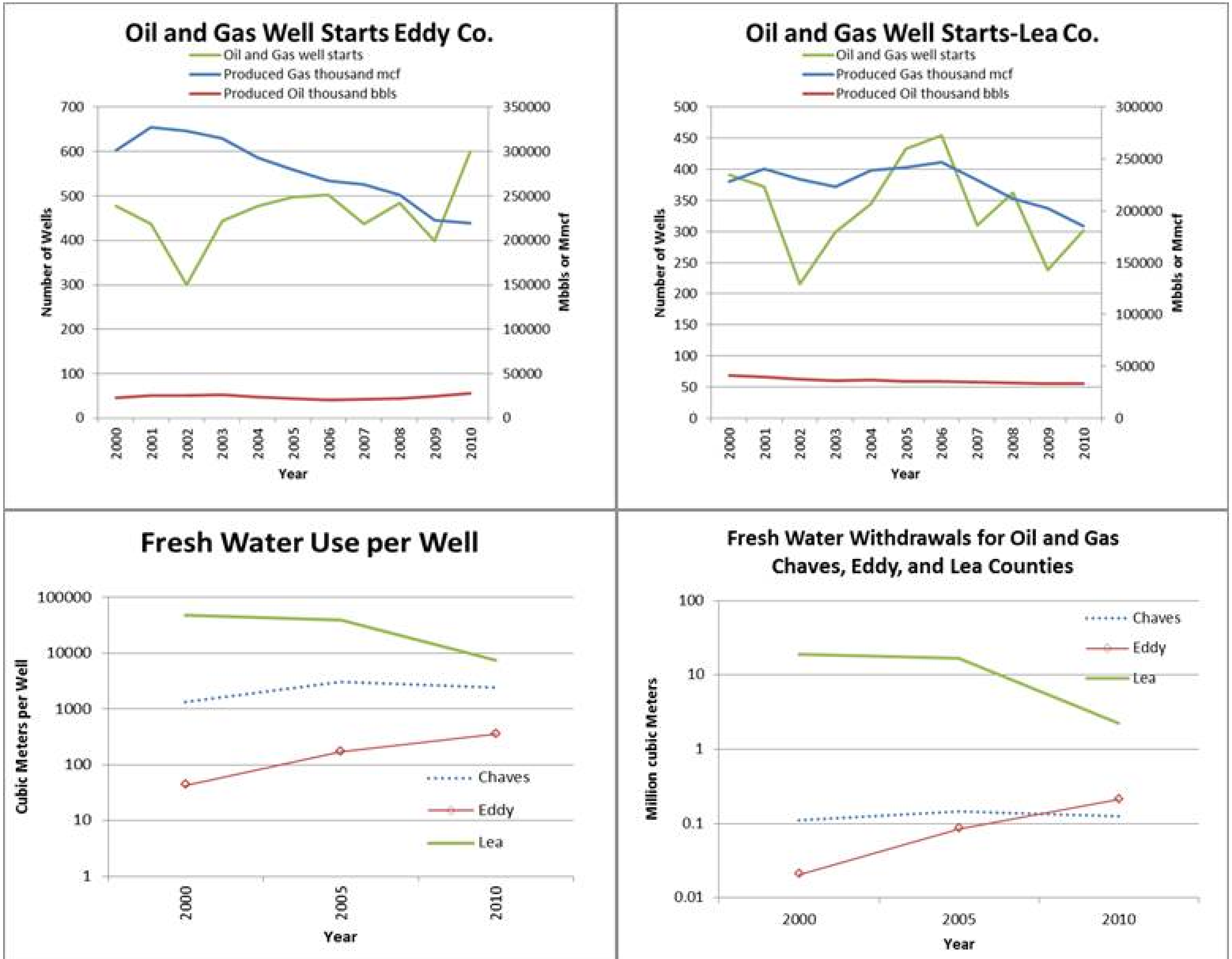


Figure 9. Increase in directional well percentage in all New Mexico counties, 2008-2013.

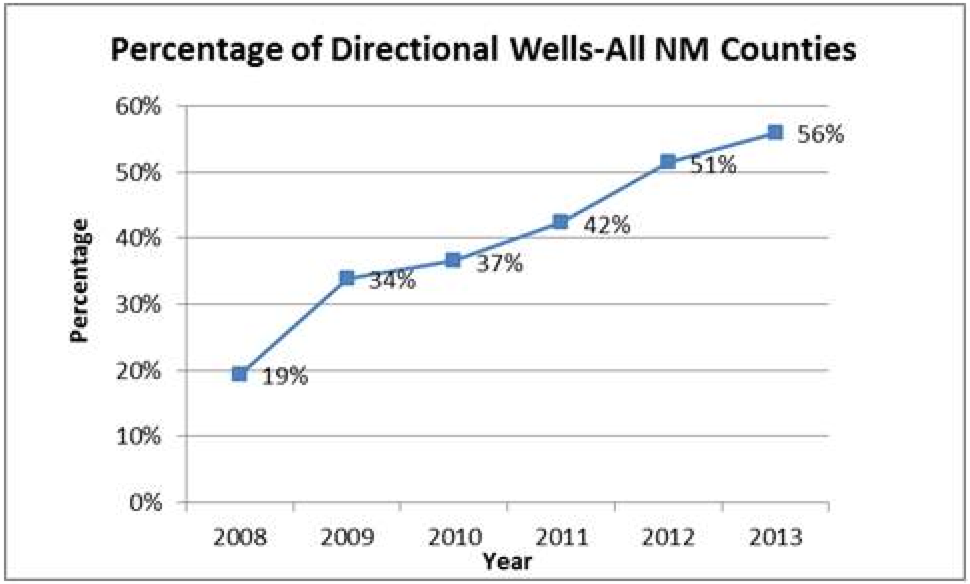
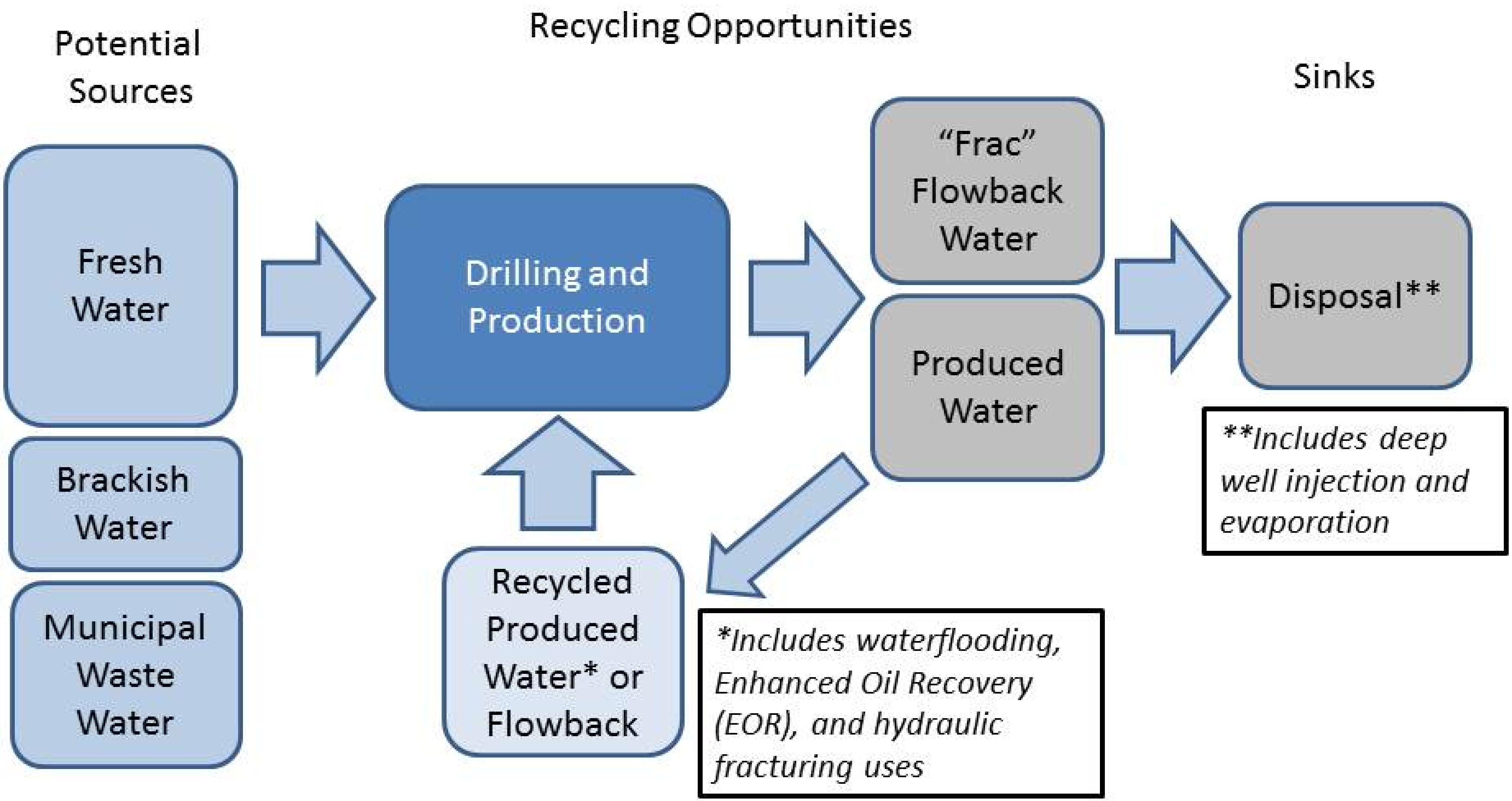


Figure 7. Generalized process flow for handling of source, produced, and flowback waters, including disposal. Both "frac" and produced water are products and can be recycled. Ultimately, all waters are disposed, mostly via deep well injection.



Policy Changes

- The primary motivation was to reduce the use of fresh water in oil and gas operations.
- Updates to Rule 17 to encourage recycling
  - Allowance of multi-well fluid pits
  - No permit needed for recycling within oil and gas industry
  - Time frames established for specific pit uses
  - Liability and insurance rules in place
- Updates to Rules 34 (produced water) and 36 (surface waste management)
- Includes “permit by rule” provisions that ease regulatory burden-reduces # of individual permits
- Result is a recycling-friendly regulatory framework

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Gaps and Path Forward

- Significant gaps exist between reporting frameworks for fresh water and potential "non-traditional" water resources like PW
- Identifying <u>who</u> uses <u>what</u> water <u>where</u>….is not transparent
- Understanding the interconnection between agricultural withdrawals of fresh water and sales to industry would help develop market-friendly ways to conserve fresh ground water during droughts.
- Regulations or guidance that smooth the way to treat and use produced water *outside* of the oil and gas industry are needed.
- Future data need to be analyzed to determine if the regulations are affecting fresh water use. A downturn in oil and gas development will likely complicate this analysis.

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