Assessment of Safe Aquifer Yields within the Salt Basin in NM and TX: Approach and Model Update

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New Mexico Bureau of Geology and Mineral Resources
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Earth Science for the 21st Century

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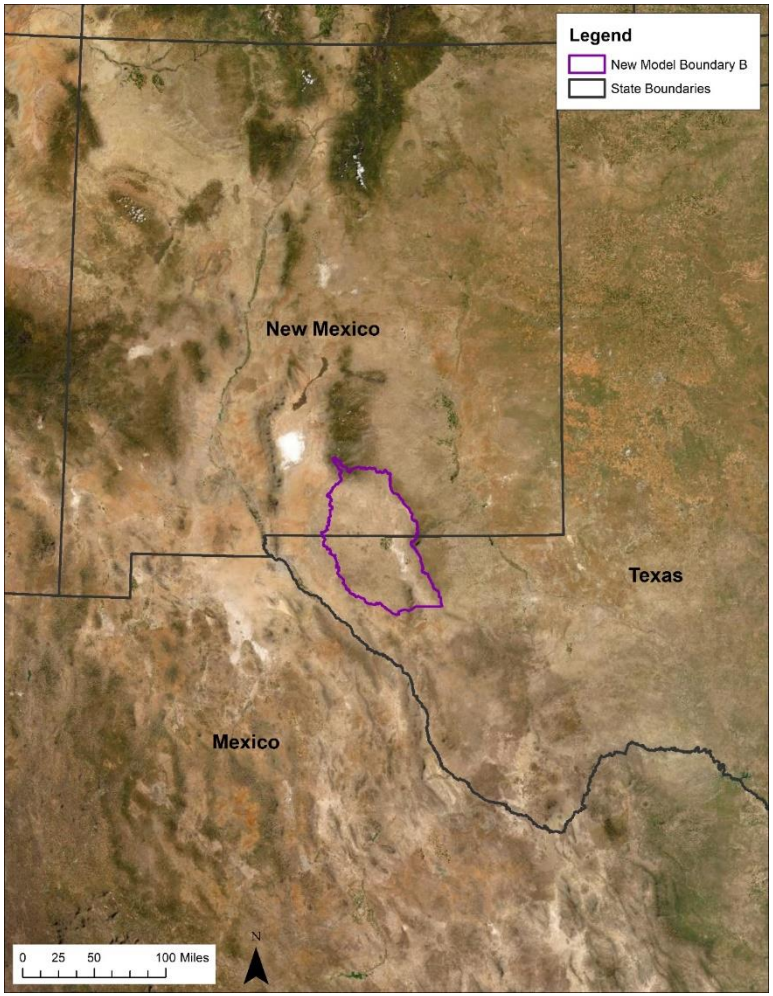
S.S. Papadopulos & Associates, Inc.

Overview

- Hydrologically closed basin with large salt flats in low elevations of TX

Goals:

- Assess the water resources in the Salt Basin region
- Refine hydrologic water budget of the Salt Basin, especially recharge
- Effects of increased pumping in NM



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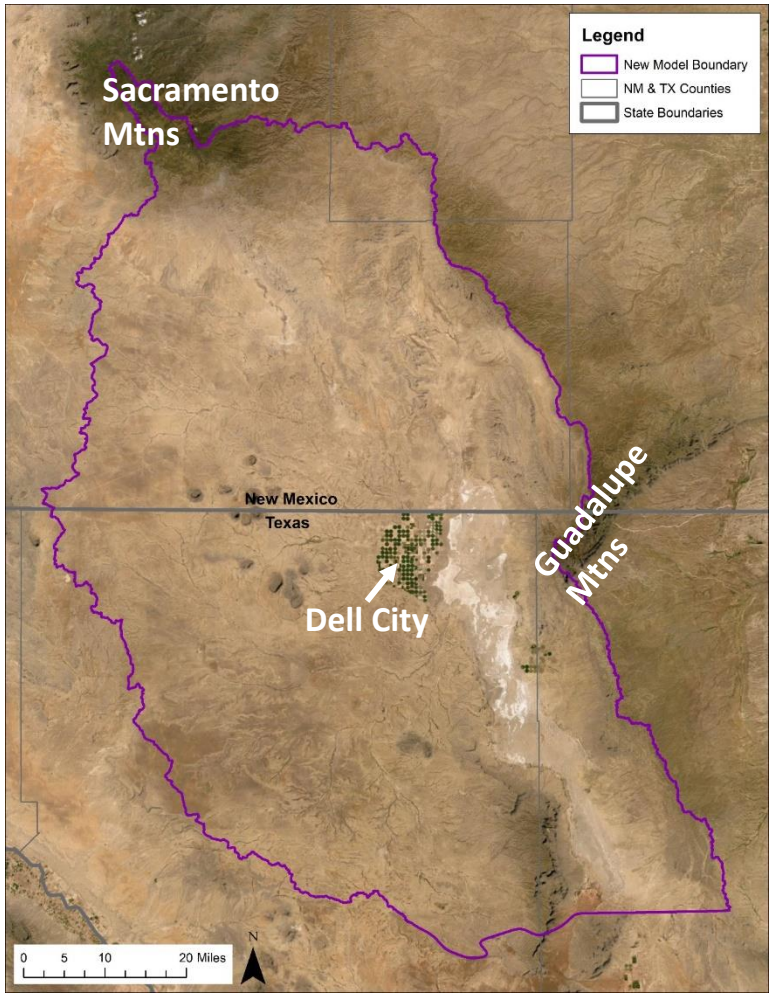
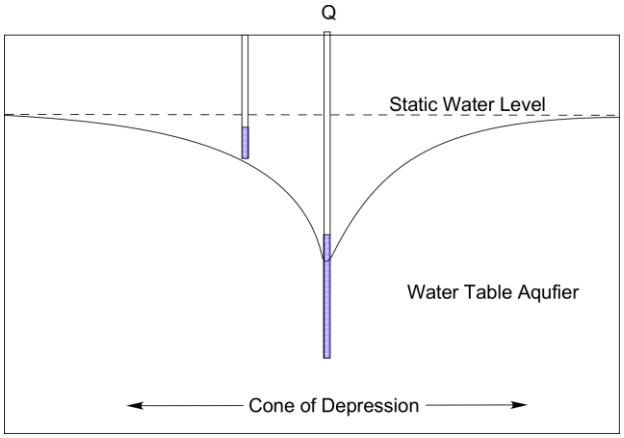


Safe Aquifer Yields

- **Safe Yield** is the maximum pumping rate for which the consequences are considered acceptable.
  (Alley, 1999 USGS)

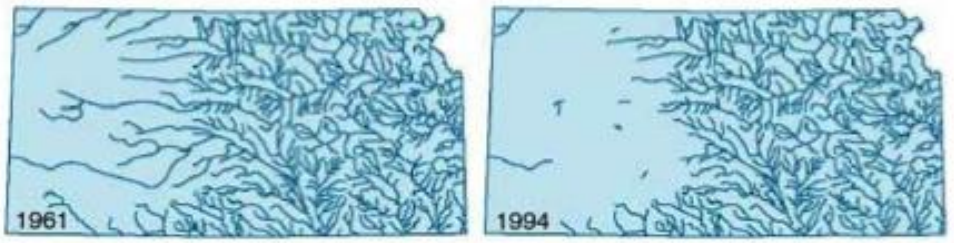
- **Sustainability** : A decision-making concept describing development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
  (NMOSE Glossary of Water Terms)

Safe Aquifer Yield. Example 1. Pumping should not negatively effect a neighbors well.



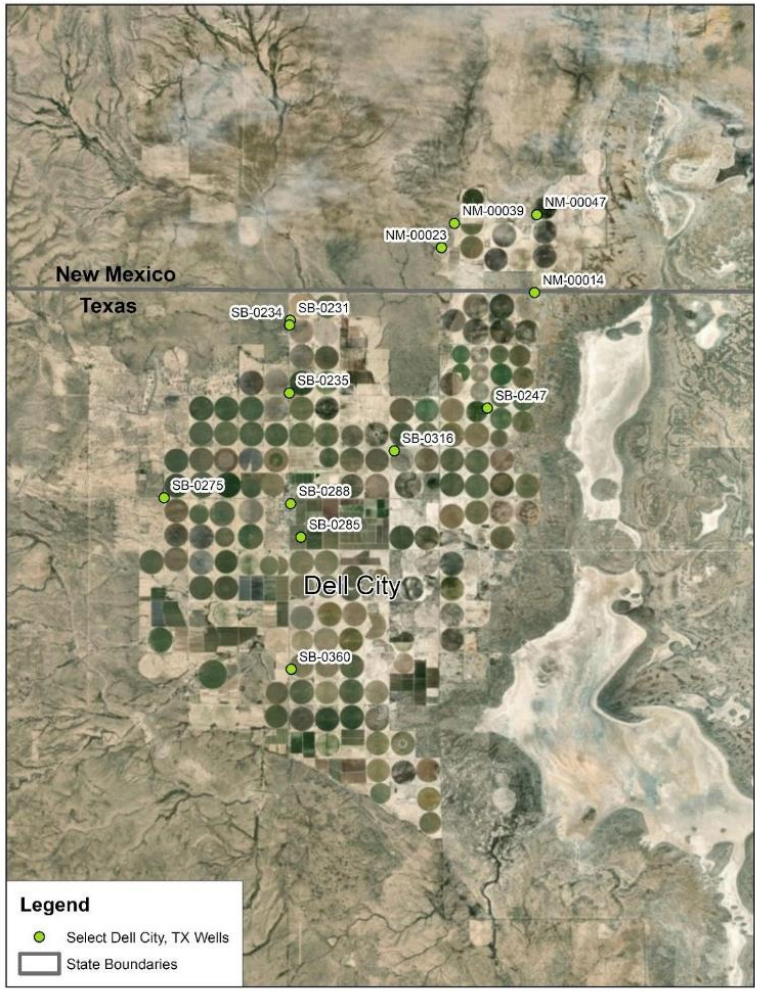
(Mark Person, 2021)

Safe Aquifer Yield. Example 2. Pumping should not negatively effect surface water bodies.

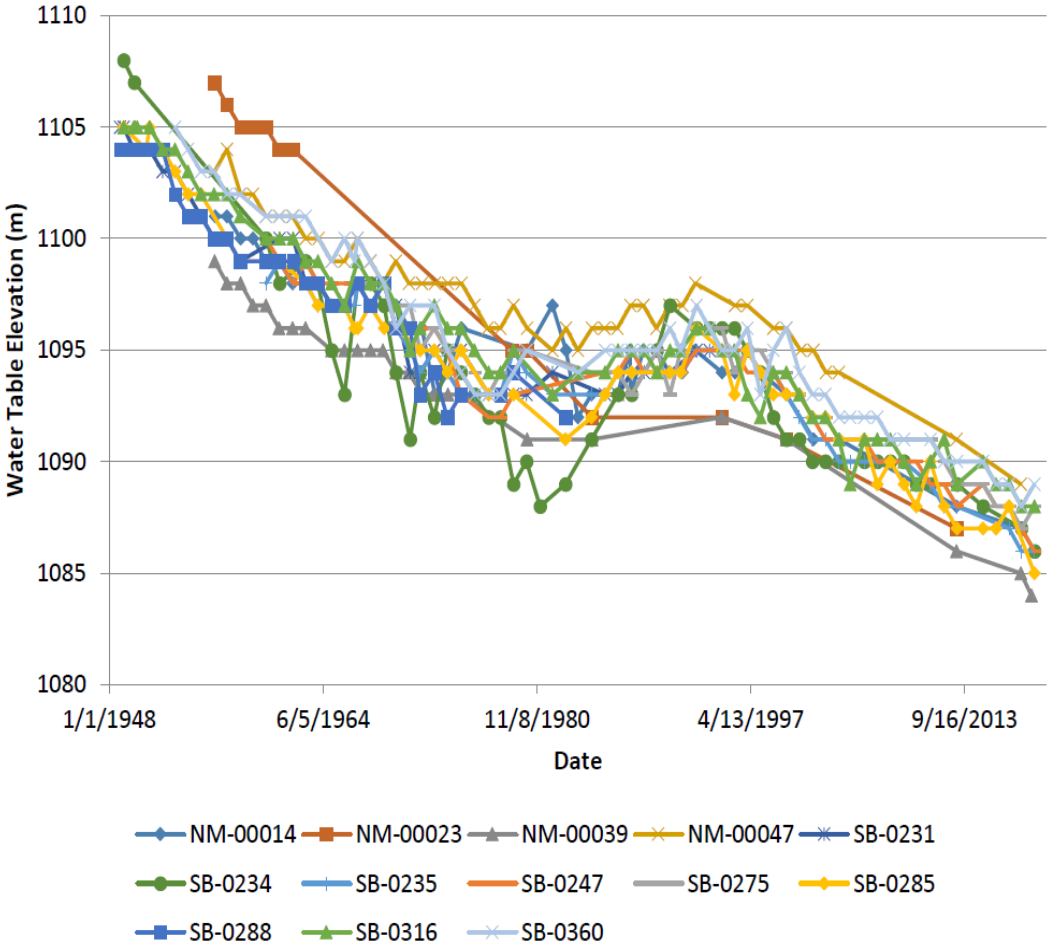


(Sophocleous, 2000)

Dell City, TX Water Levels

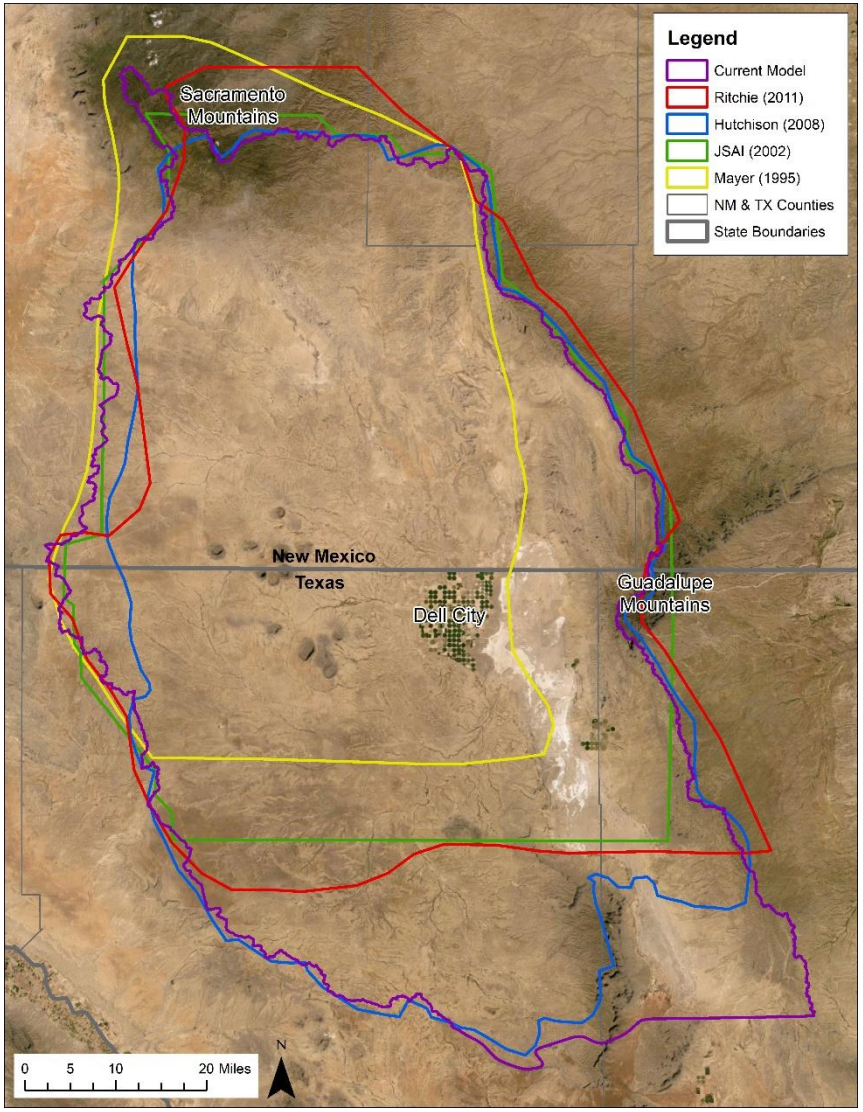


Dell City, TX Hydrograph

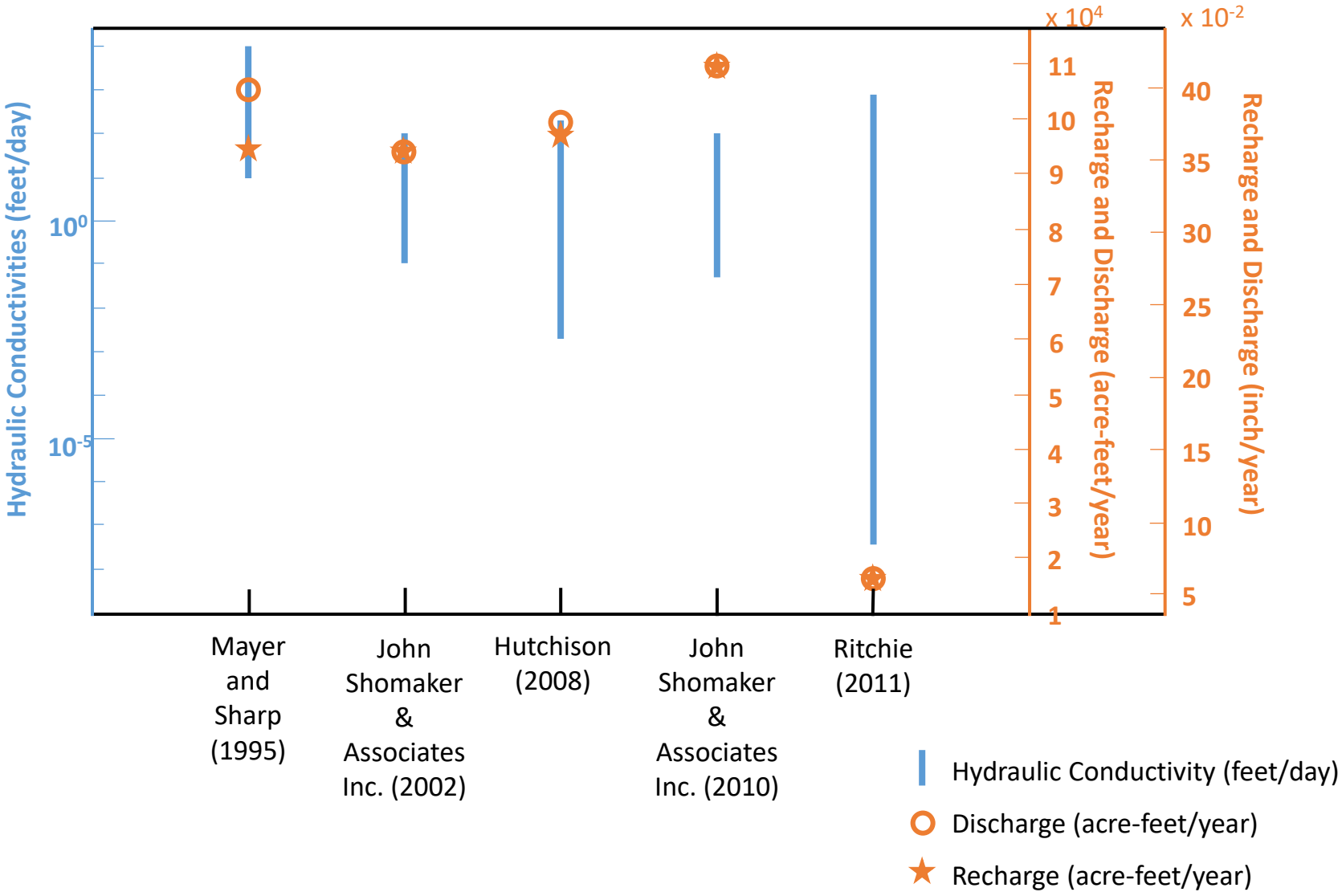


Five Past Models

- Mayer and Sharp (1995)
- John Shomaker & Associates, Inc. (2002)
- Hutchison (2008)
- John Shomaker & Associates, Inc. (2010)
- Ritchie (2011)

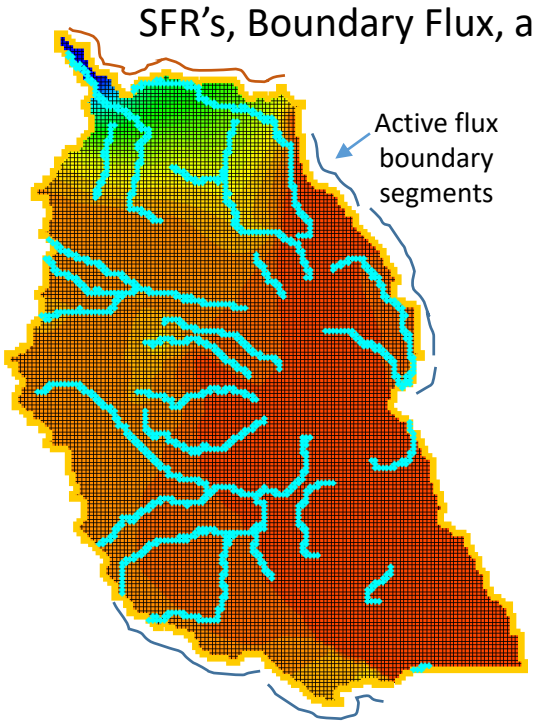


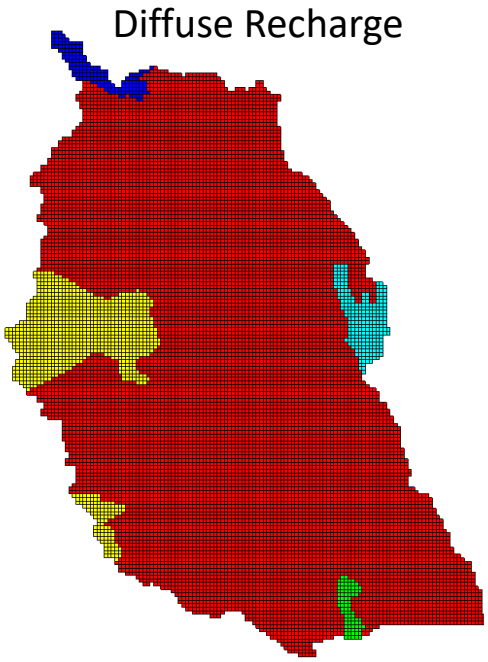
Past Model Parameter Summary

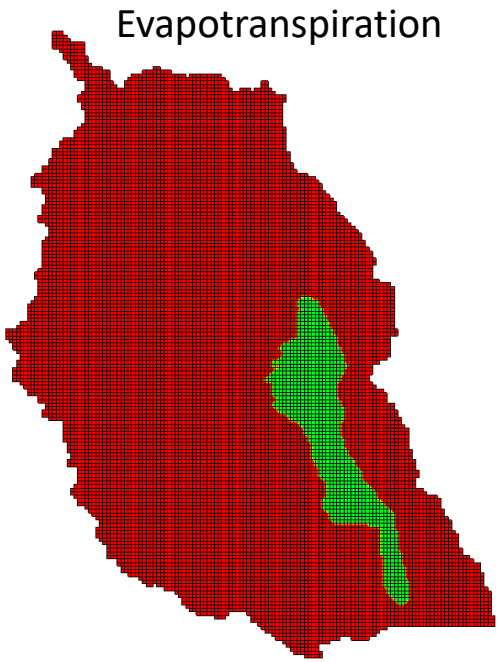


Current Model

- Updated the Geology
- Updated the Model Boundary
- Dynamic ET, water table depth dependent
- Stream Flow Routing (SFRs), focused recharge
- PyRANA based recharge
- Parameter ESTimation (PEST)



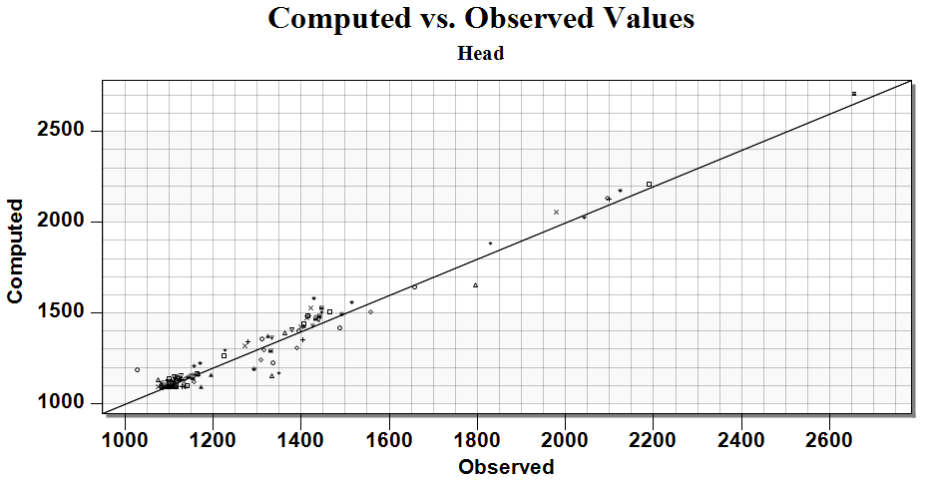




Recharge Evaluation

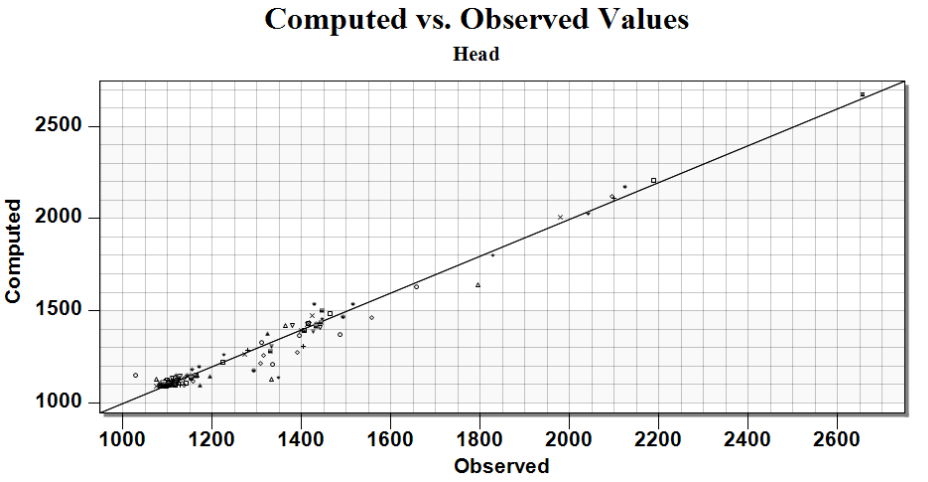
~40,000 acre-feet/year of recharge

Root Mean Squared Error = 0.023



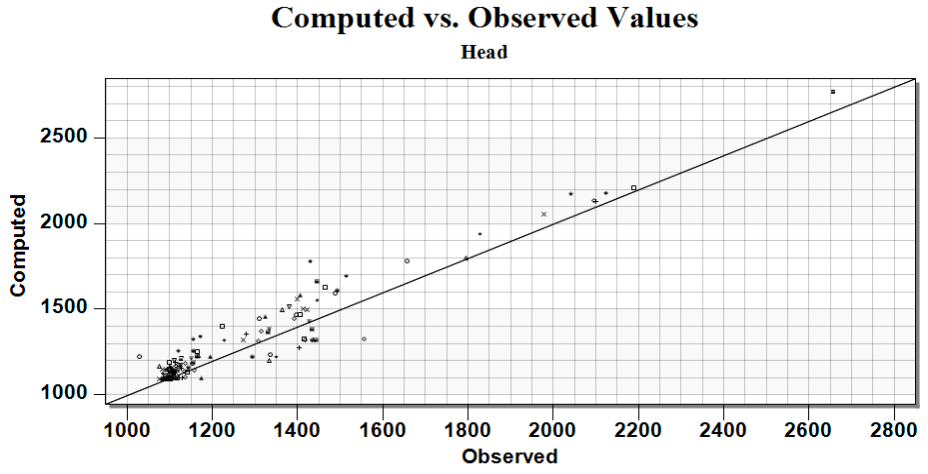
~60,000 acre-feet/year of recharge

Root Mean Squared Error = 0.021

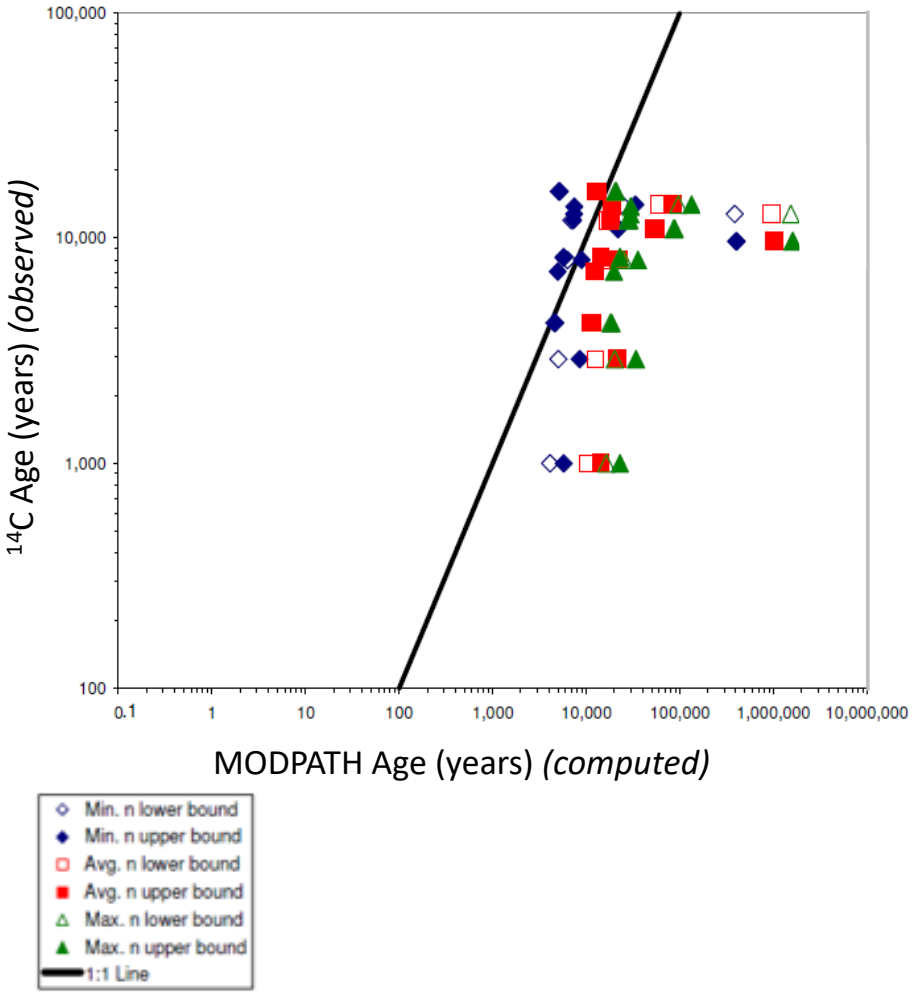


~80,000 acre-feet/year of recharge

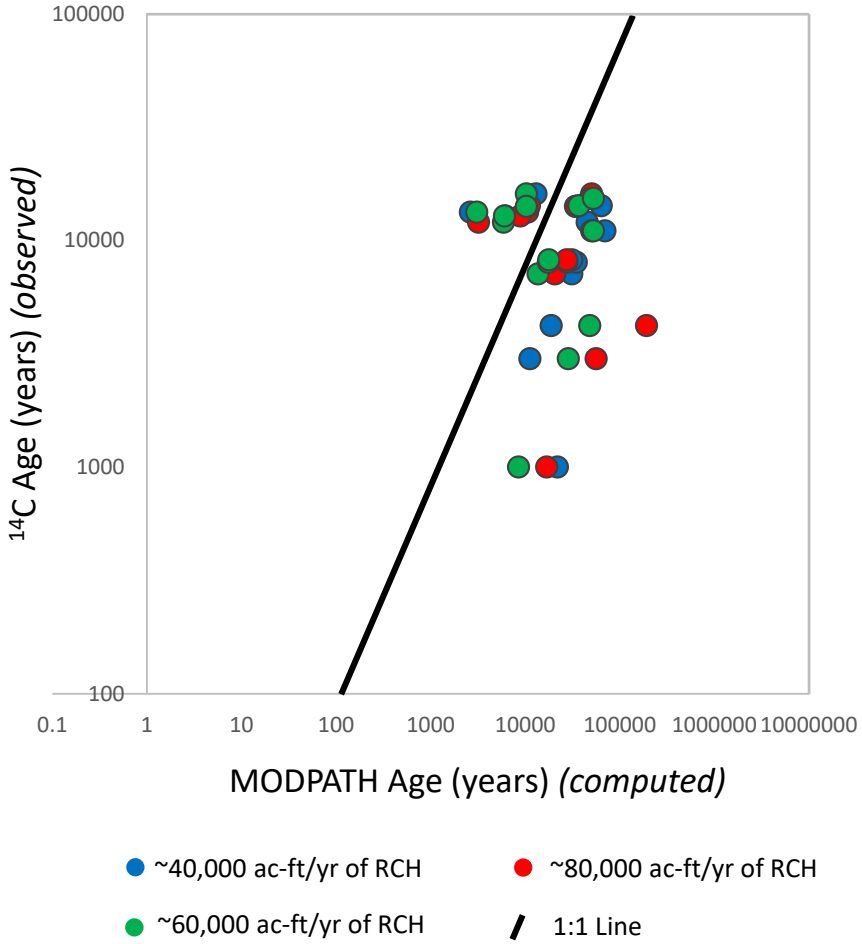
Root Mean Squared Error = 0.015



^{14}C Groundwater Ages



(Ritchie (2011) and Sigstedt (2010))

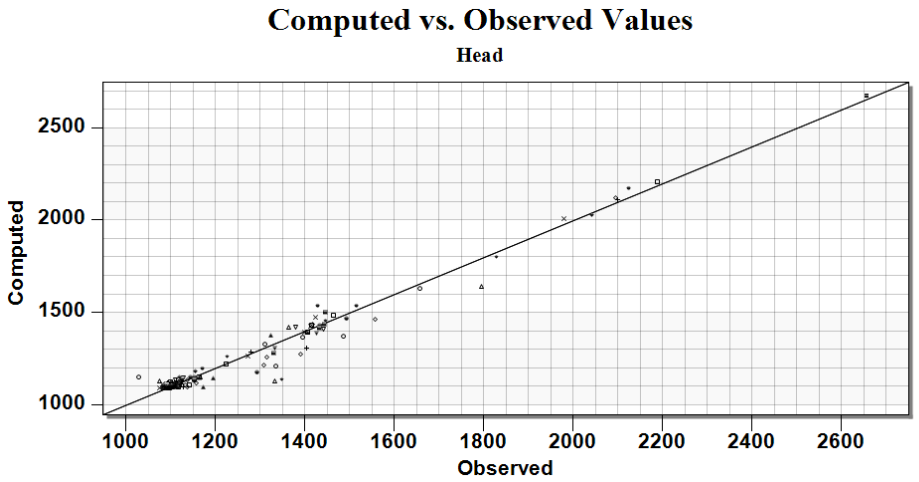


(this study)

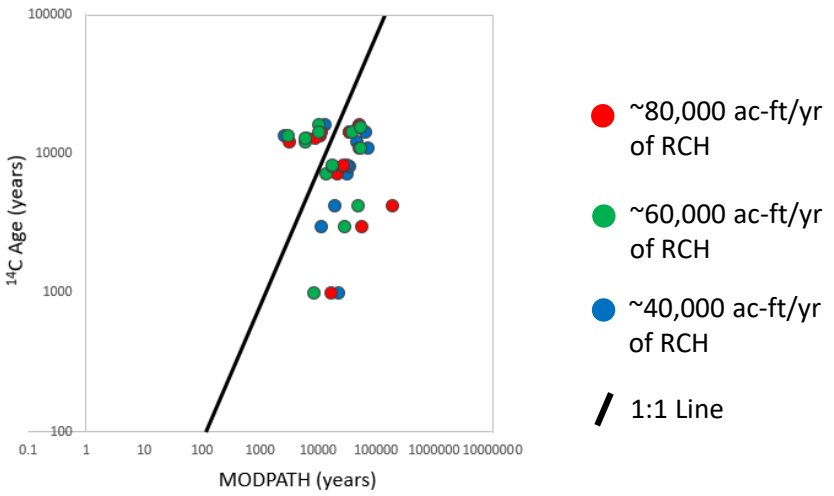
Recharge Evaluation

- Hutchison (2008)'s steady state models used 63,000 acre-feet/year
- DBS&A (2010) found that minimum evapotranspiration from the playas is 28,300 acre-feet/year
- DBS&A (2010) modeled recharge as 63,000 acre-feet/year with a range of (37,000 to 82,000 acre-feet/year)
- Shomaker (2010) calibrated model to 62,000 acre-feet/year
- Water level and age data does not contradict 60,000 acre-feet/year recharge model

~60,000 acre-feet/year of recharge



Current Model Ages



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- **60,000 acre-feet/year of recharge selected**
- **Additional age data, as well as transient calibration, may guide adjustment**

Future Model Plans

- Move to transient model
- Test hypothetical well fields in NM

Acknowledgments/References

- **Working with S.S. Papadopulos, NM Bureau of Geology, U.S. Geological Survey, NM Interstate Stream Commission, and U.S. Bureau of Reclamation.**

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Thank you