

# *Geologic salinity sources and management options for the Rio Grande*

**James Hogan**

Assistant Director – NSF STC Center for Sustainability of semi-Arid Hydrology and Riparian Areas  
Adjunct Assistant Professor, Department of Hydrology and Water Resources, University of Arizona



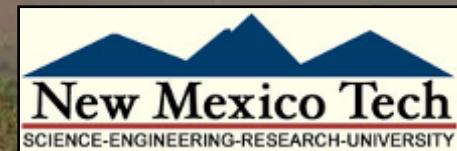
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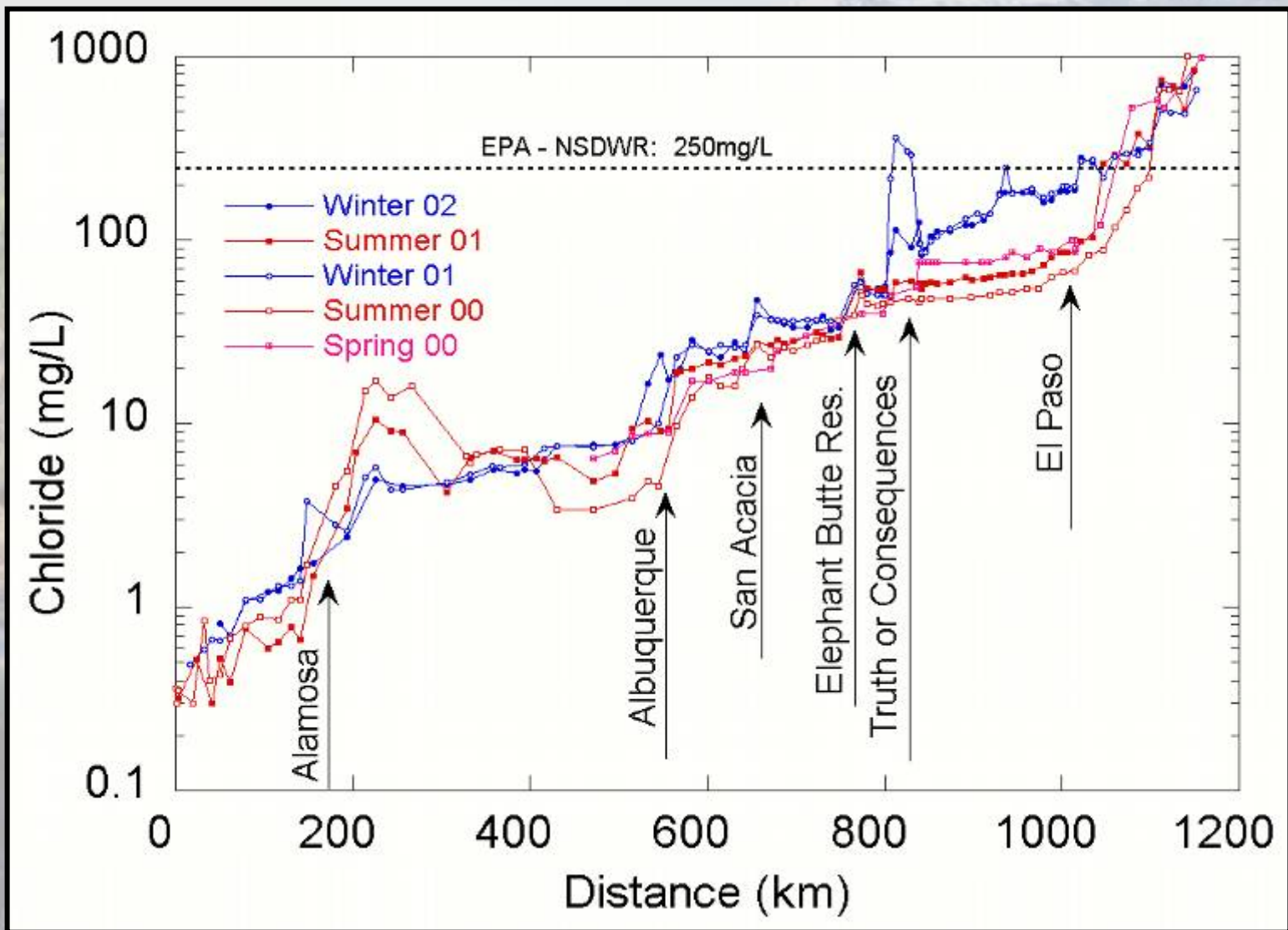
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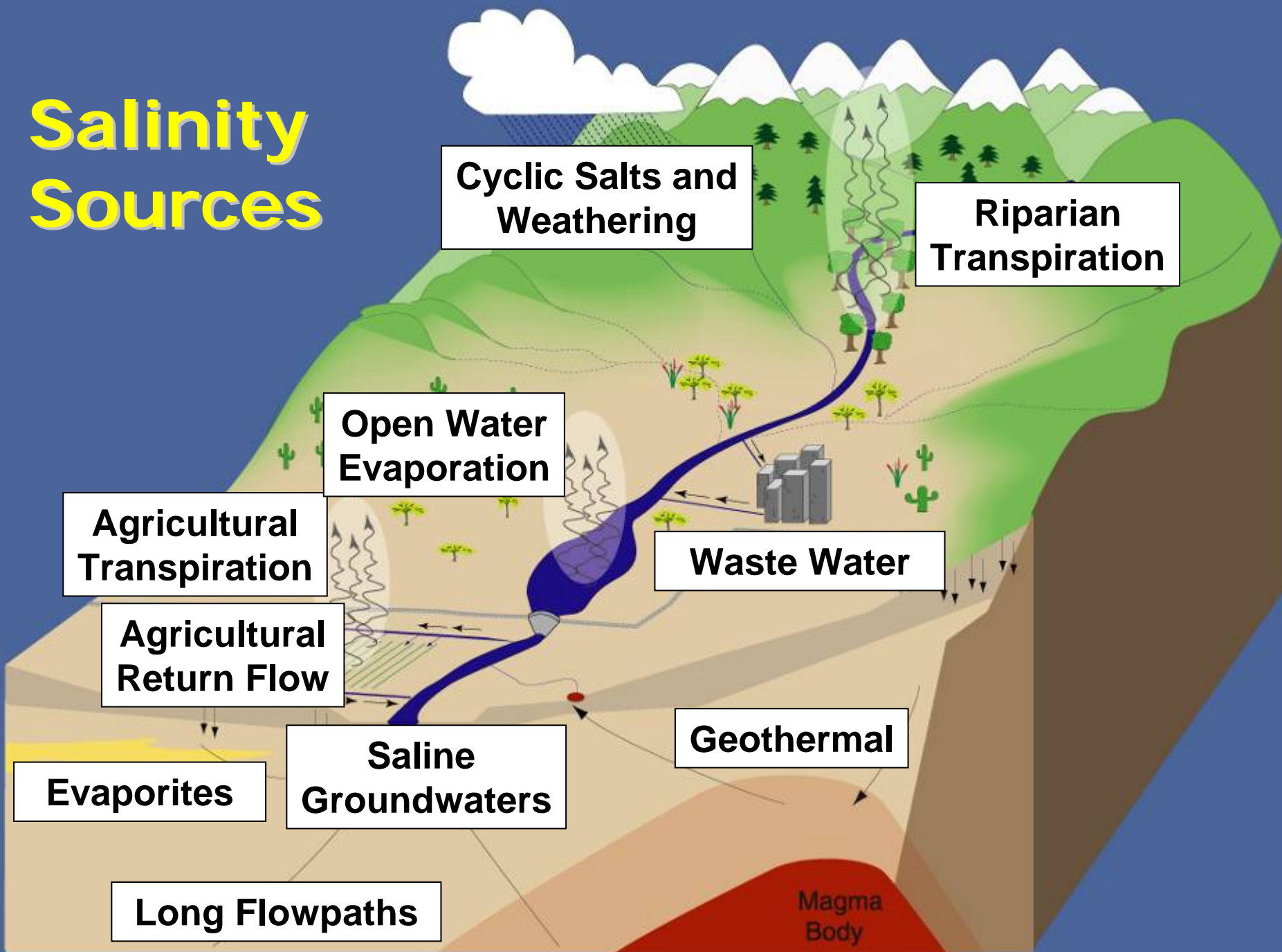
**Fred Phillips**  
New Mexico Tech

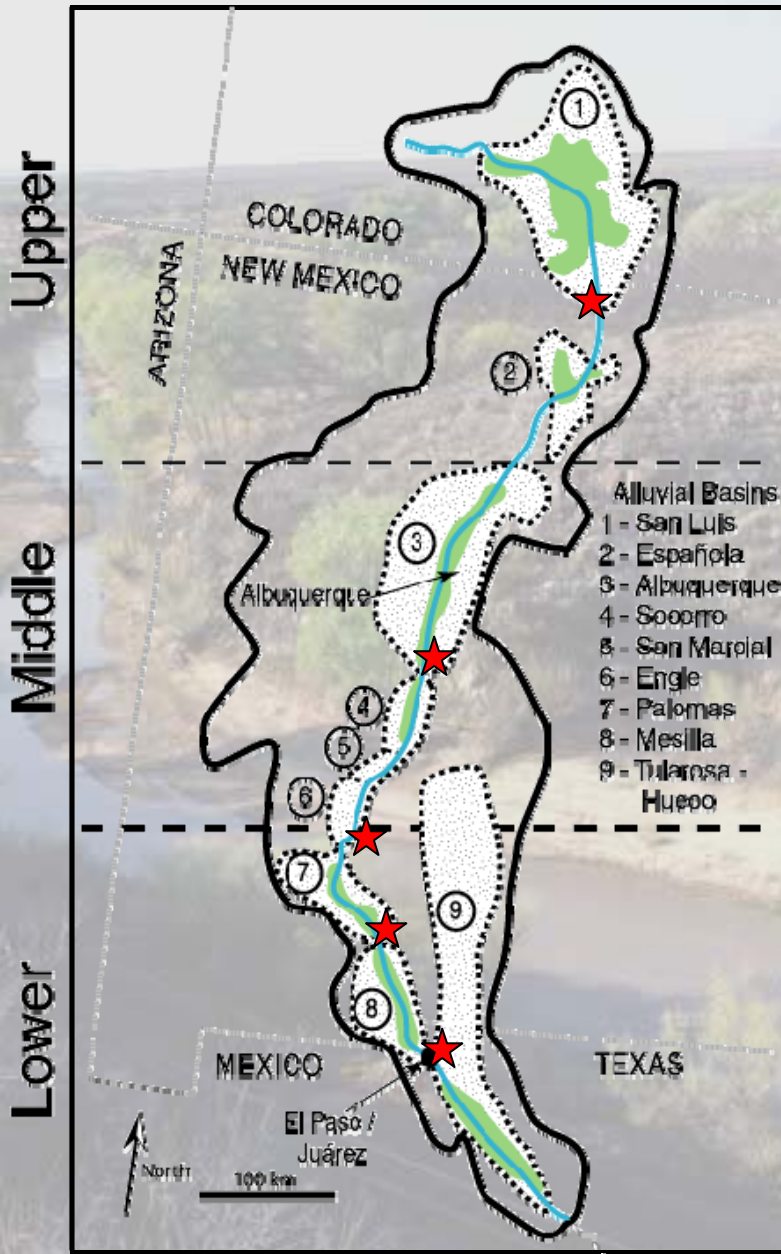




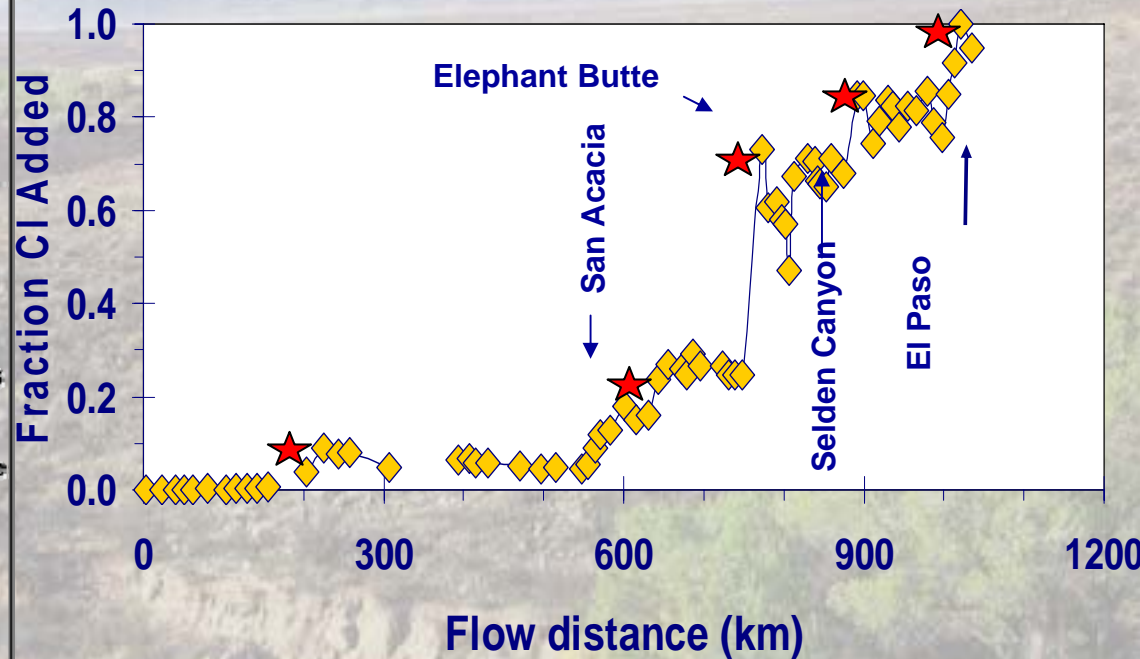
- Cl in the Rio Grande increases from  $\sim 1$  mg/L to  $\sim 100$  mg/L at El Paso
- Headwaters contain chloride mainly derived from atmospheric deposition
- ET losses remove  $\sim 75\%$
- Concentration would be  $\sim 4$  mg/L if no additional sources
- About 24 mg of chloride are added to each original liter of water

# Salinity Sources





## Fraction Cl Added vs. flow distance

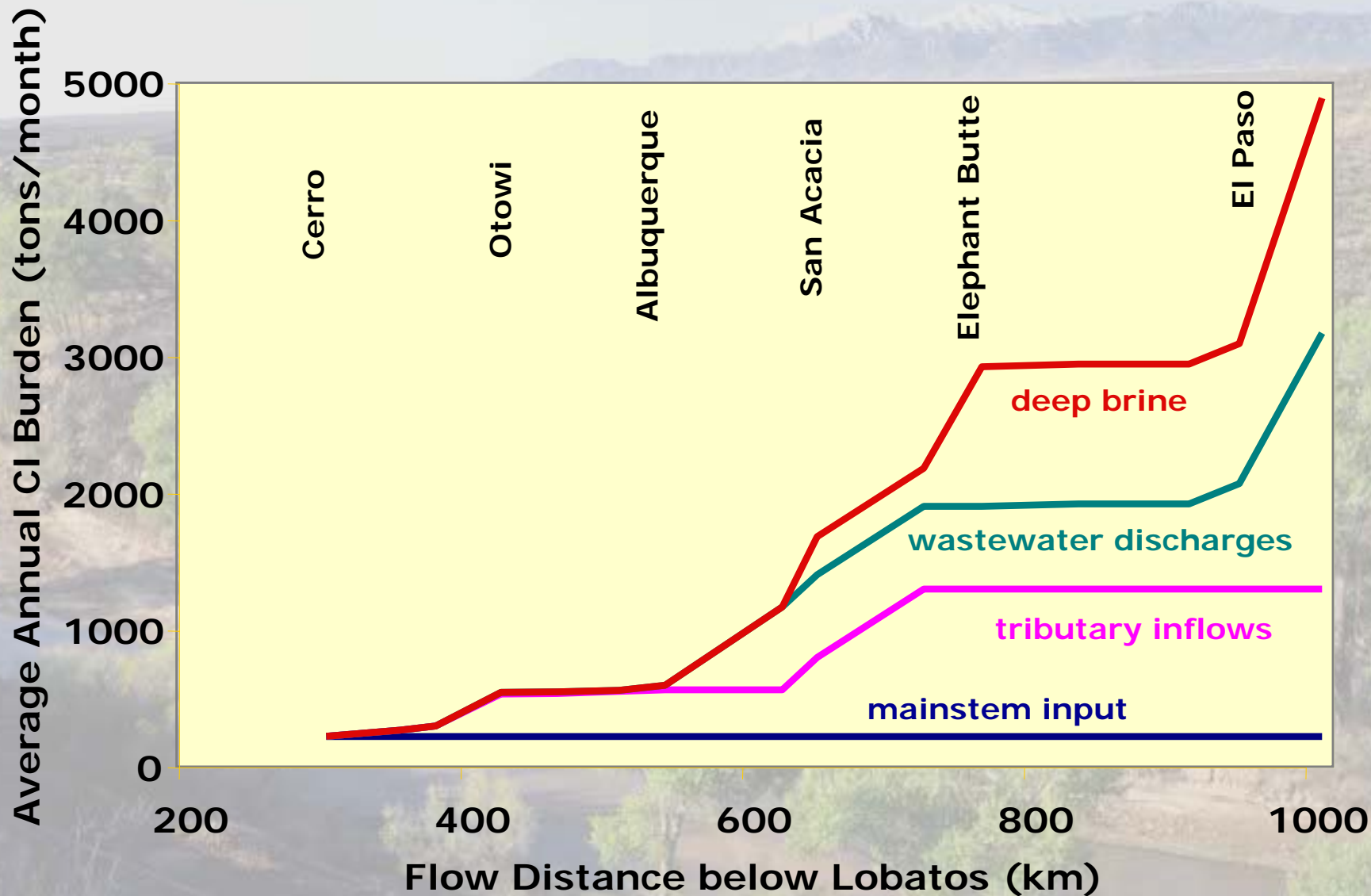


- Simple Mass Balance of Cl and Br
- Account for Evaporation

 = basin terminus

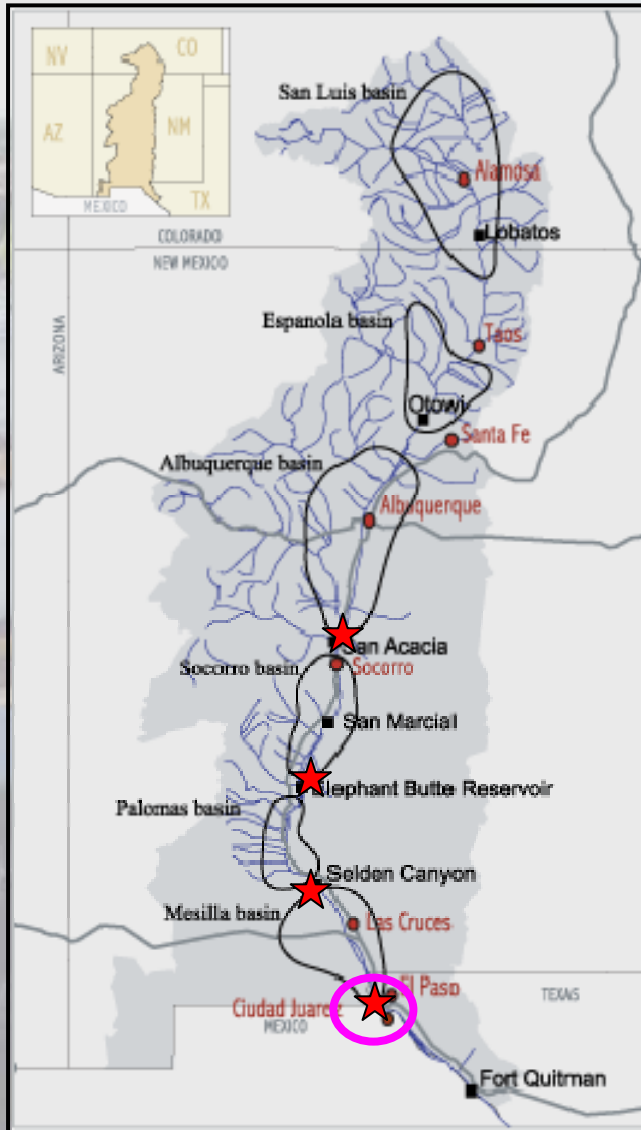


salt-encrusted tree stumps

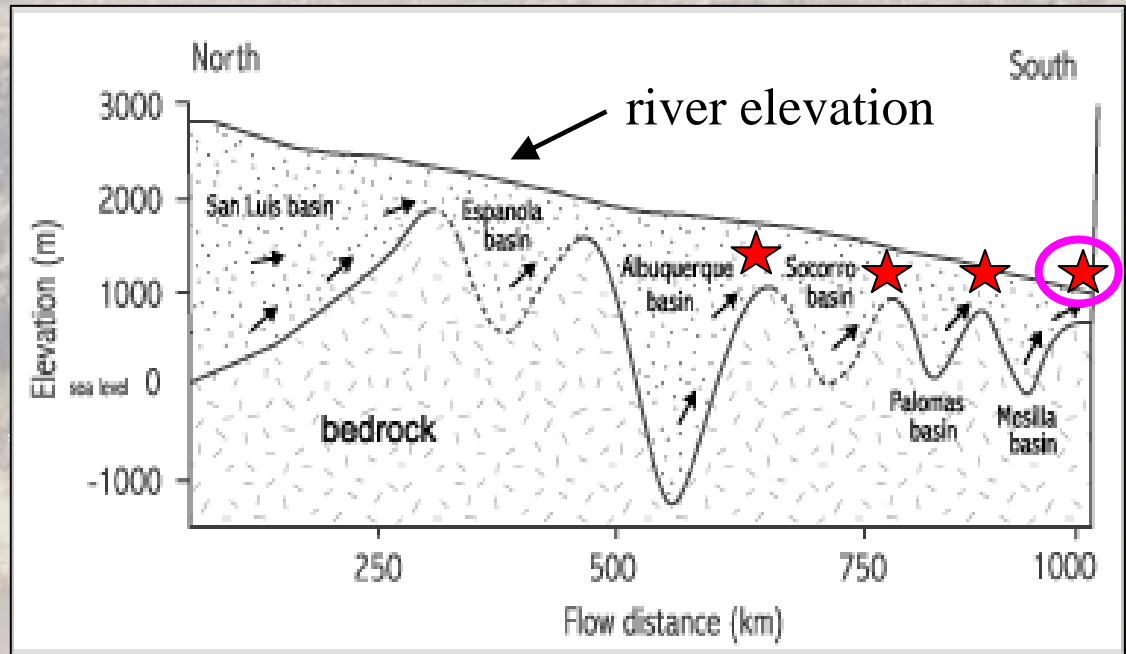


- Concentrated saline subsurface discharges account for at least one-third of solute additions to the Rio Grande
- Approximately one-half of such discharges occur between Bernardo and Elephant Butte Dam

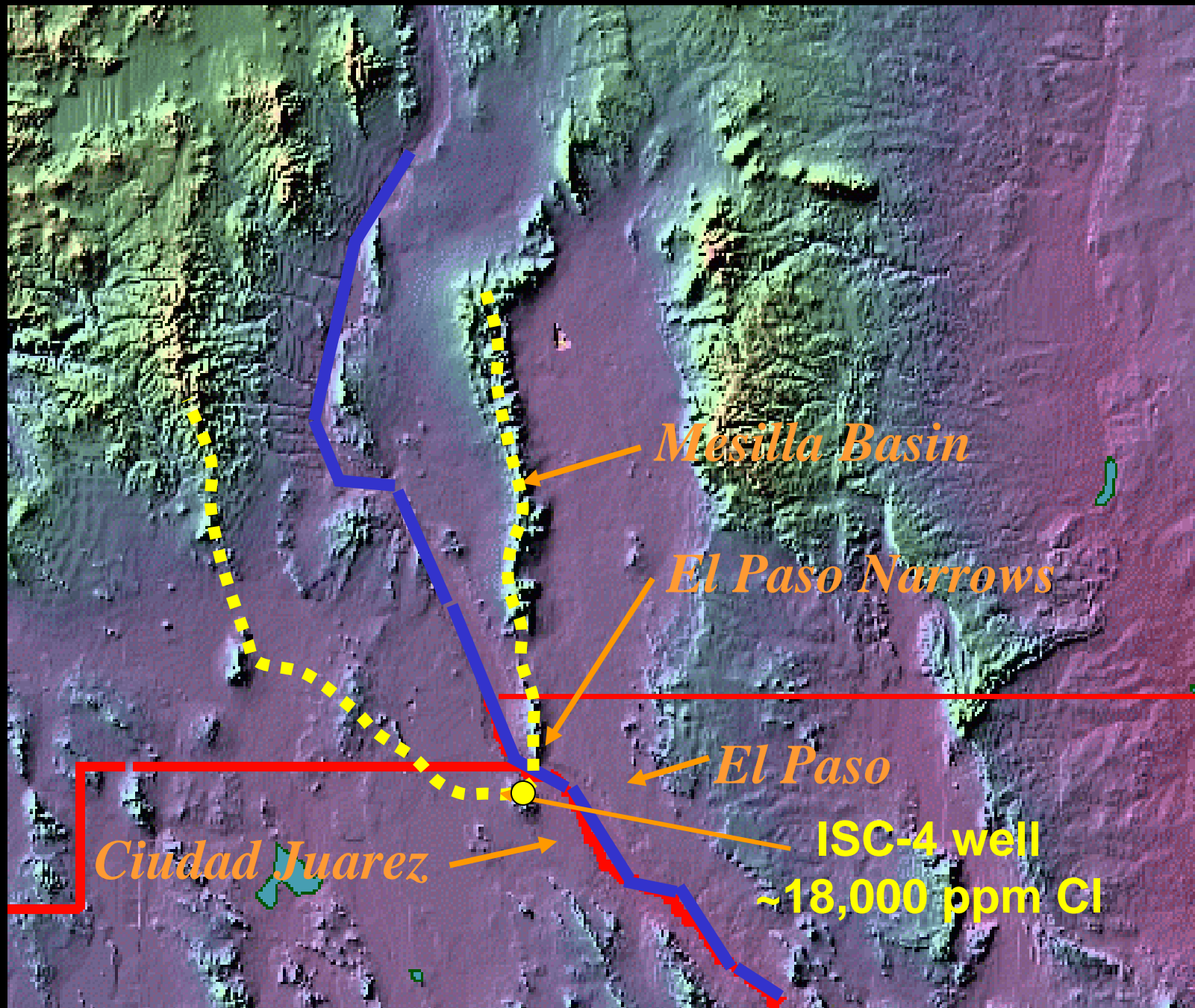
- We would like to get out as much salt as possible
- We want to remove as little water as possible
- Implication: for any salt mitigation effort to be successful, we must be able to locate and pump out concentrated brine



## Schematic Hydrogeologic Cross-Section, Parallel to River Path



 = basin terminus





- The likelihood of success in pumping out and sequestering subsurface brines is far from being a “slam dunk”
- Focused geochemical studies above, above, and below suspected discharge localities are needed
- Additional methods of investigation are needed:
  - Structural geology, Basin analysis, Aeromagnetic surveys, Well-to-well electromagnetic tomography

- **Salinity of Rio Grande**

- ~15 mg/L to ~1500 mg/L in 1200 km
- Increases occur in a stepwise fashion

- **Solutes are added to the system**

- At least 1/3 of salts originate from points of sedimentary basin discharge
- ~50% of inputs are from Abq. to El. Butte.

- **Points of focused salinity addition**

- Potential for brine interception
- Feasibility studies are needed