The Mahomet Aquifer: Is the Glass Half Full, Half Empty, or Getting Bigger?

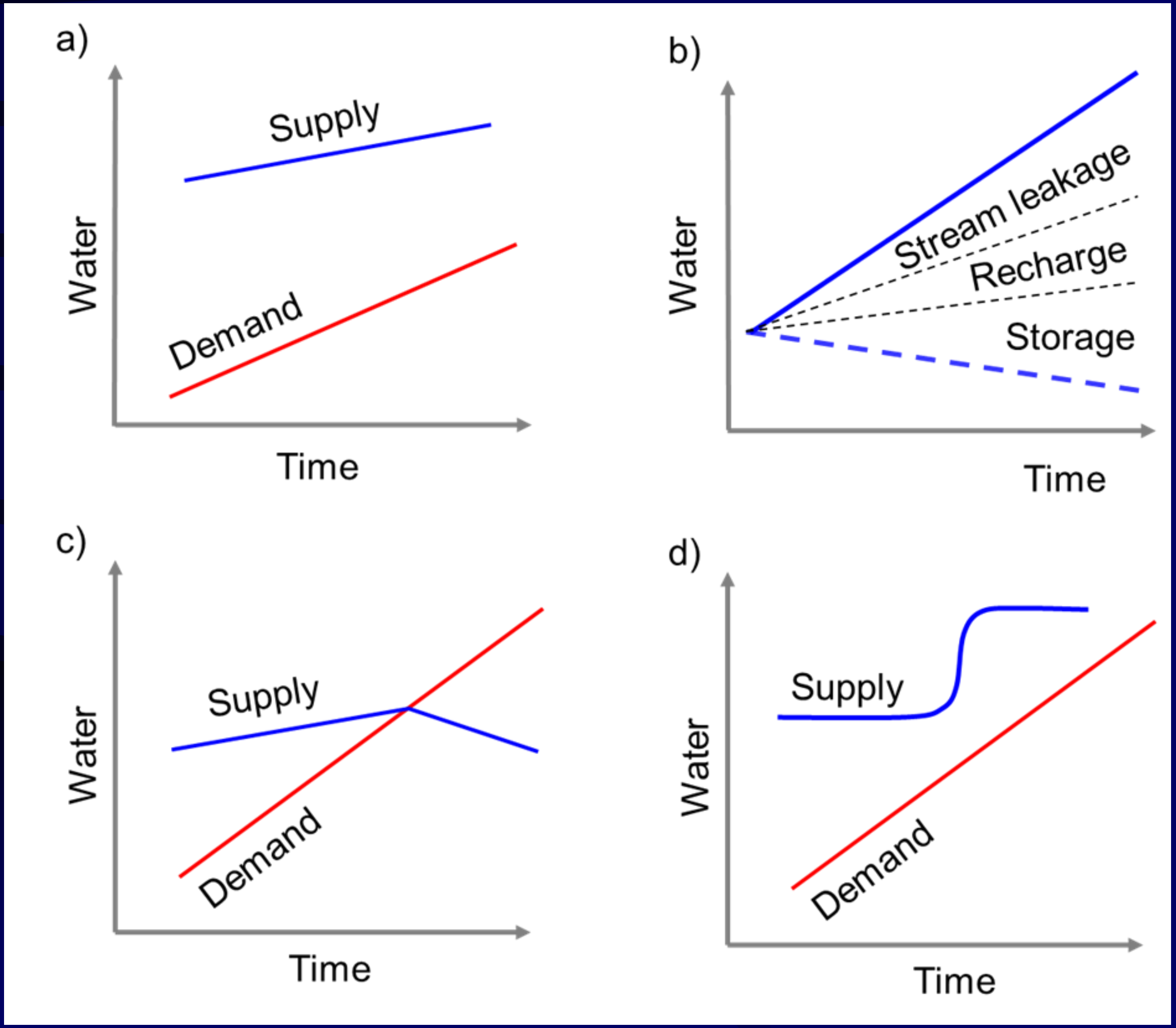
George S. Roadcap

Illinois State Water Survey
Prairie Research Institute
University of Illinois
Champaign, IL
www.sws.uiuc.edu

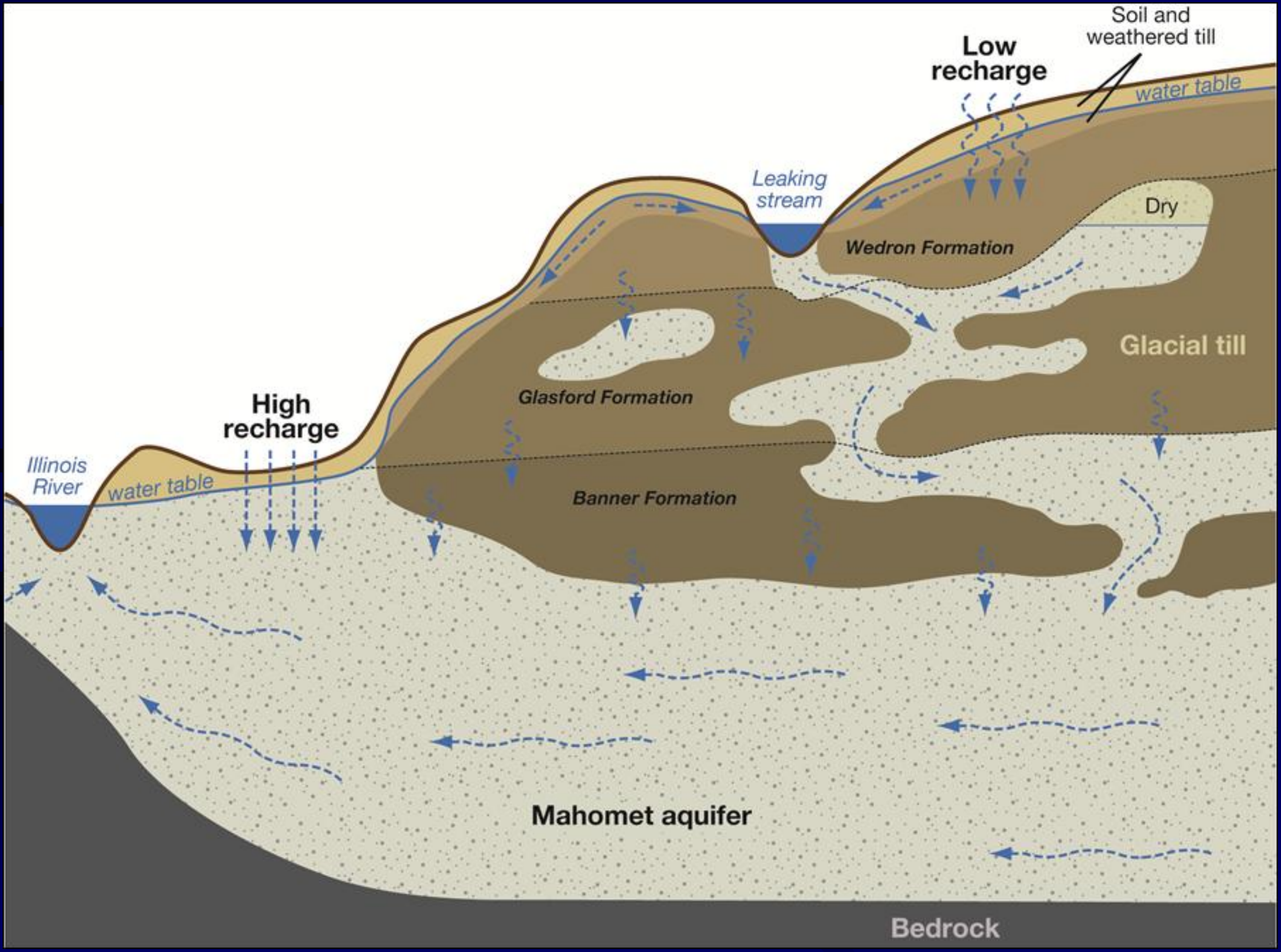
ILLINOIS

ILLINOIS STATE WATER SURVEY
PRAIRIE RESEARCH INSTITUTE

Groundwater Supply and Demand



Conceptual Model

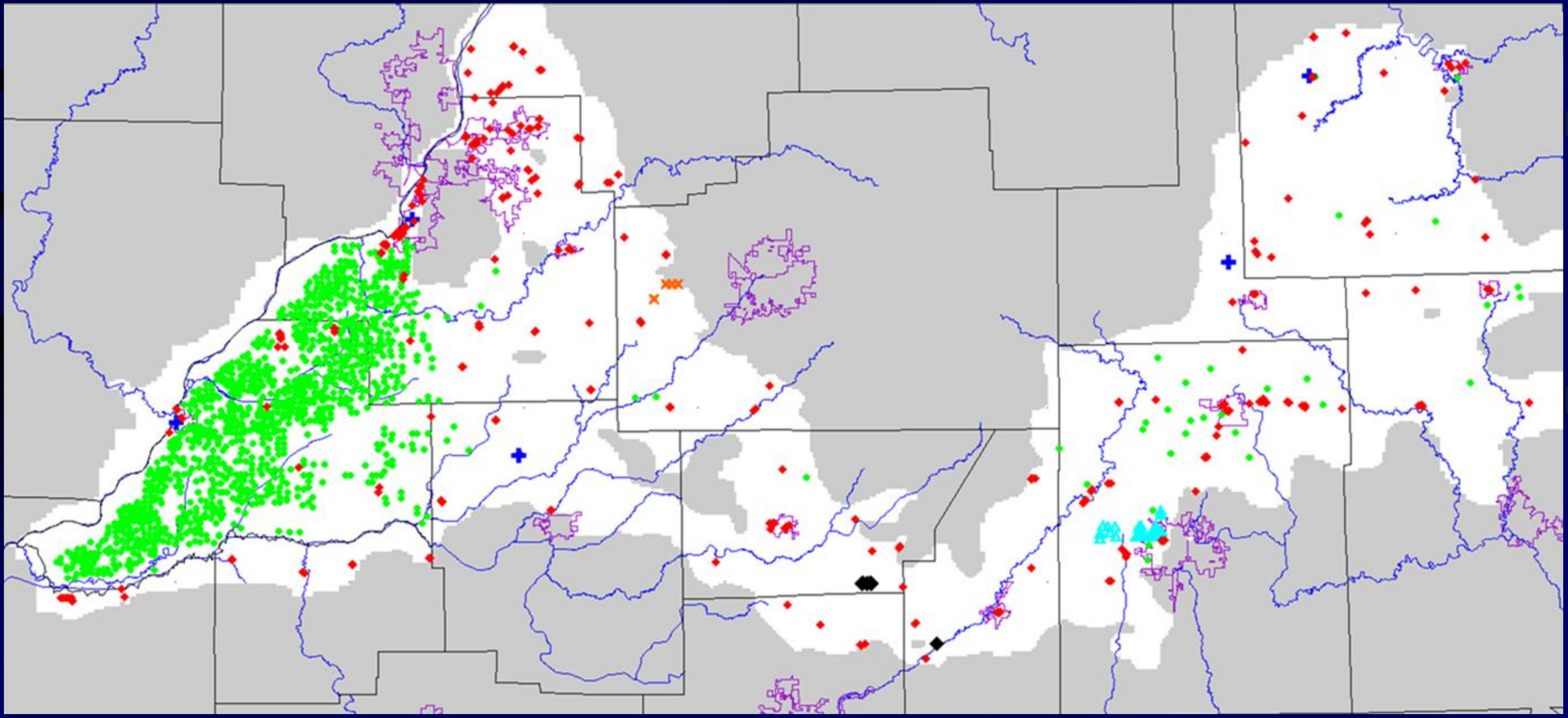


Groundwater Demand

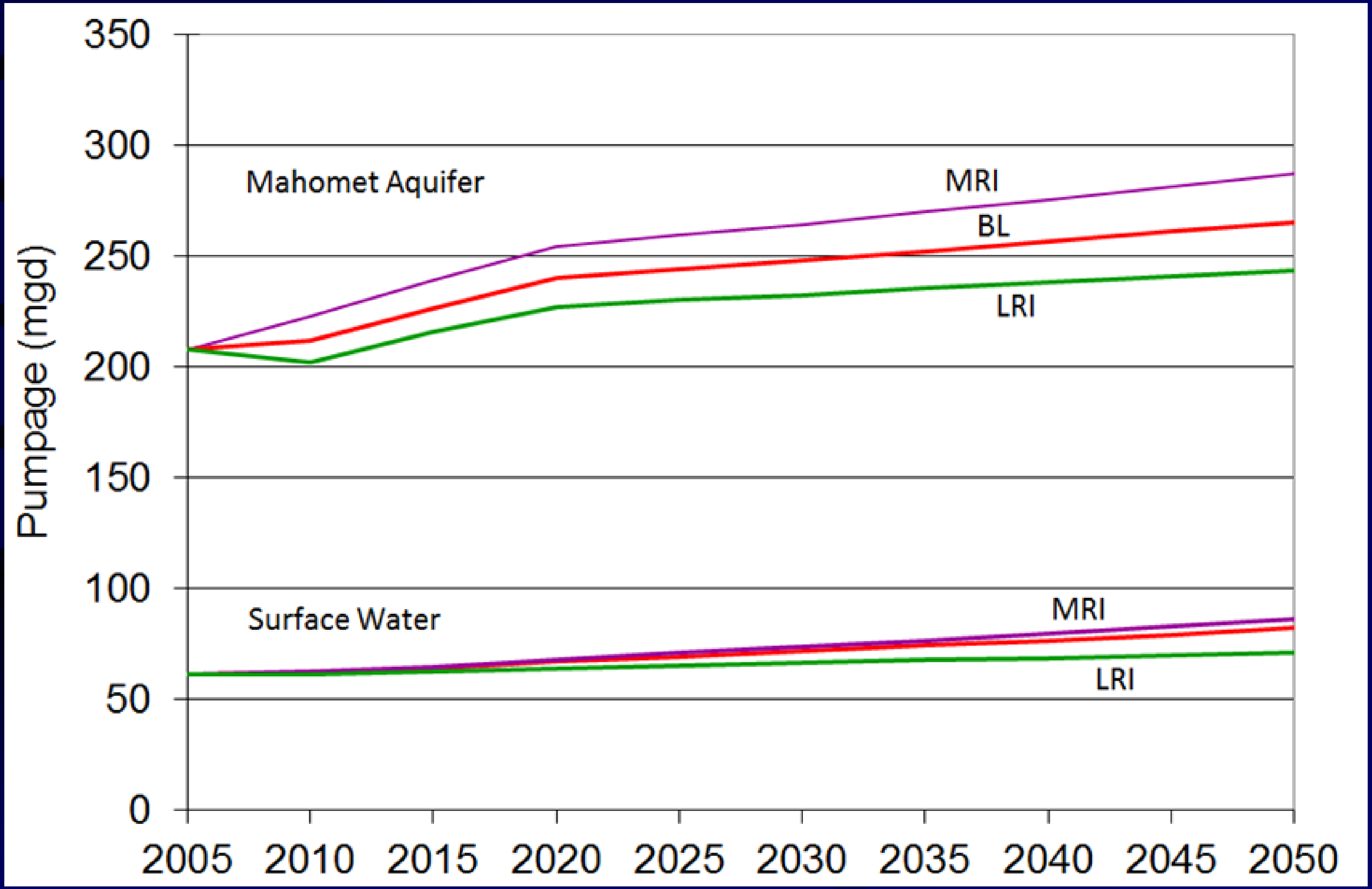
Total Pumpage in 2005:

210 million gallons per day (MGD)

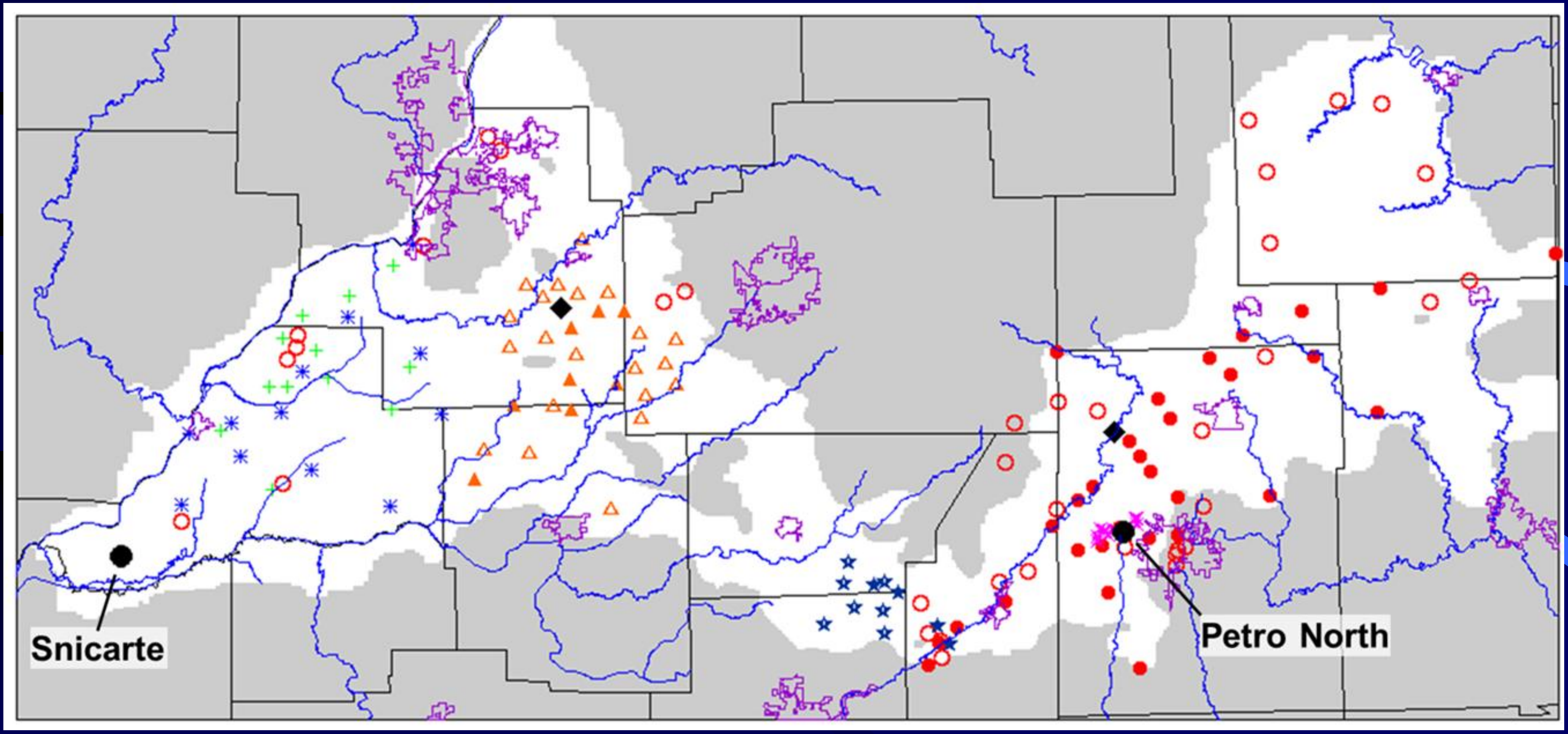
1544 large-capacity wells



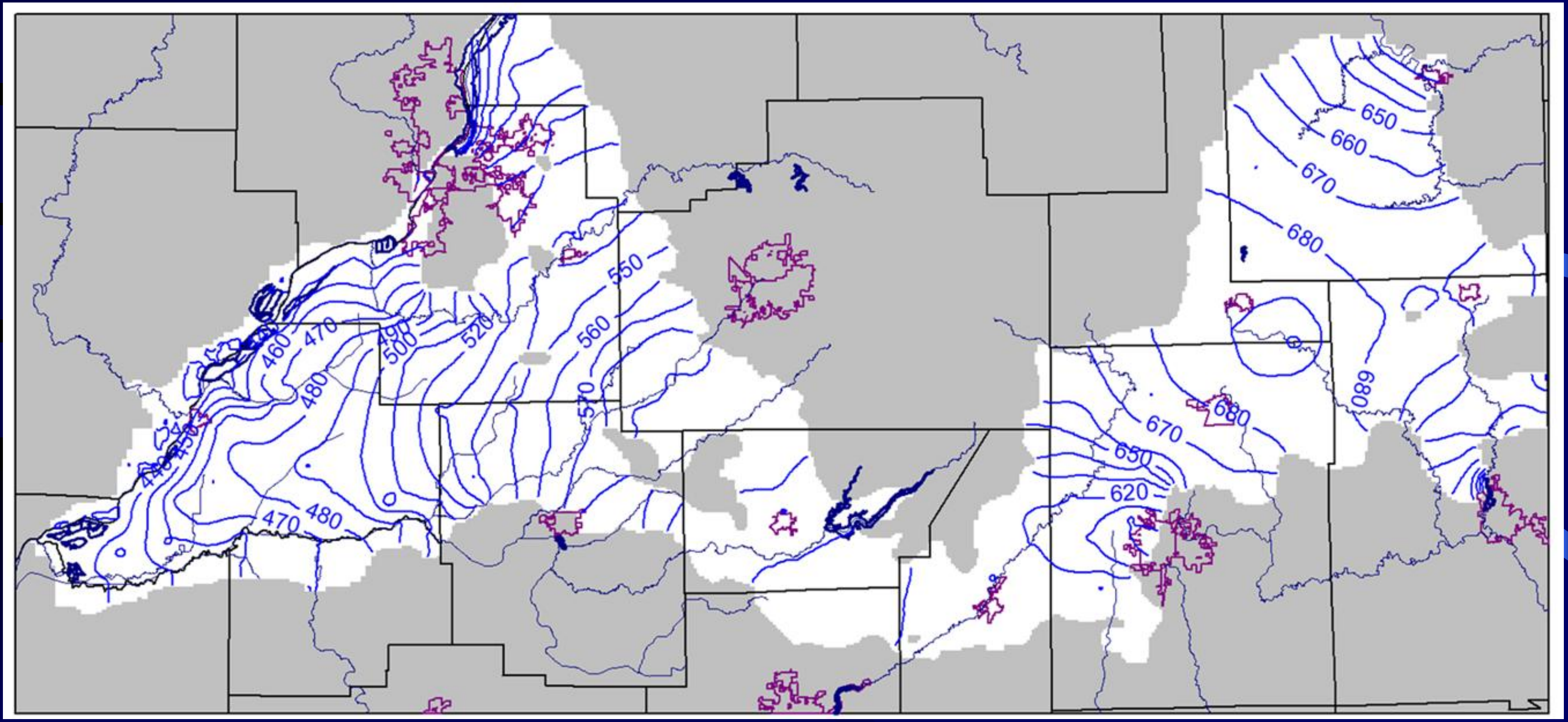
Projected Water Demands



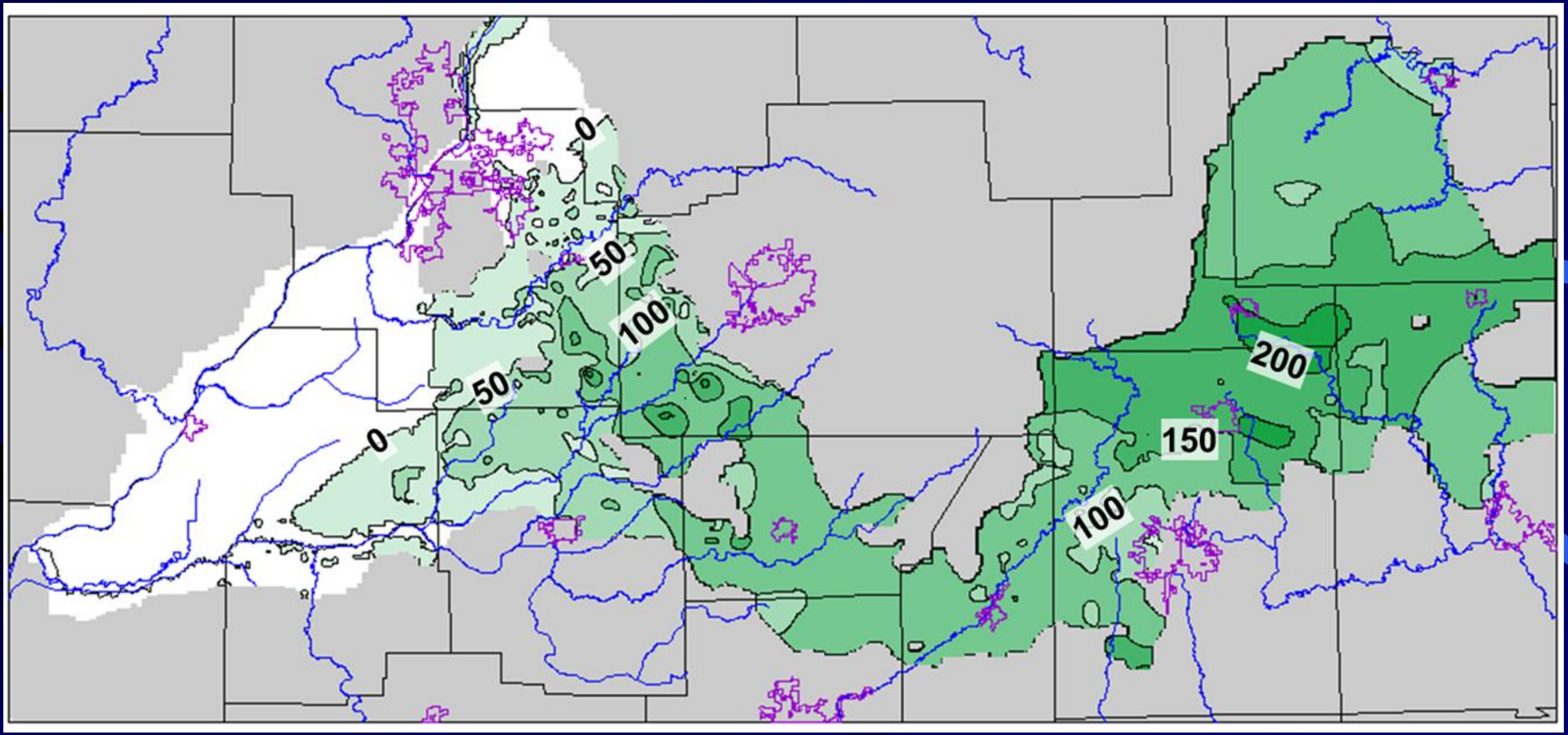
Observation Well Network



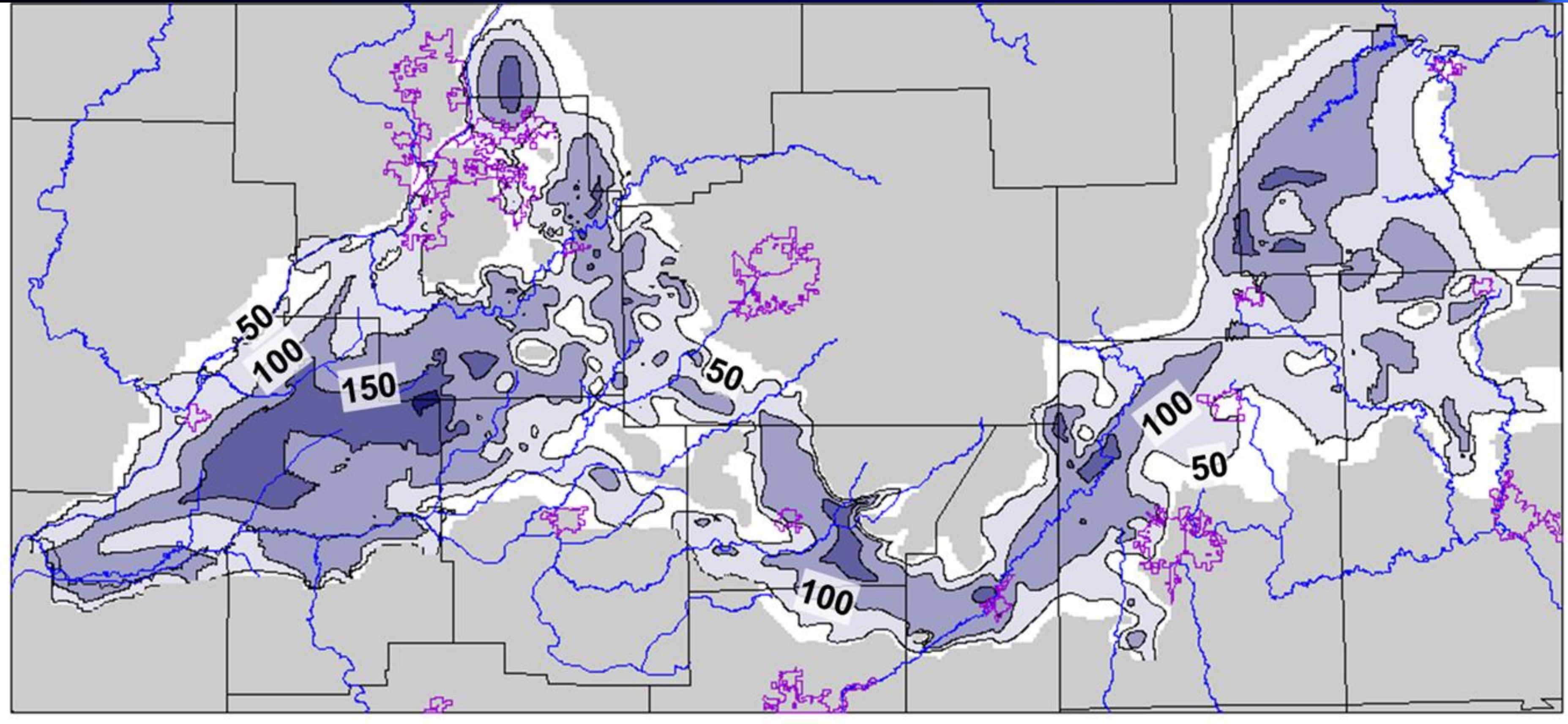
Potentiometric Surface – July 2009



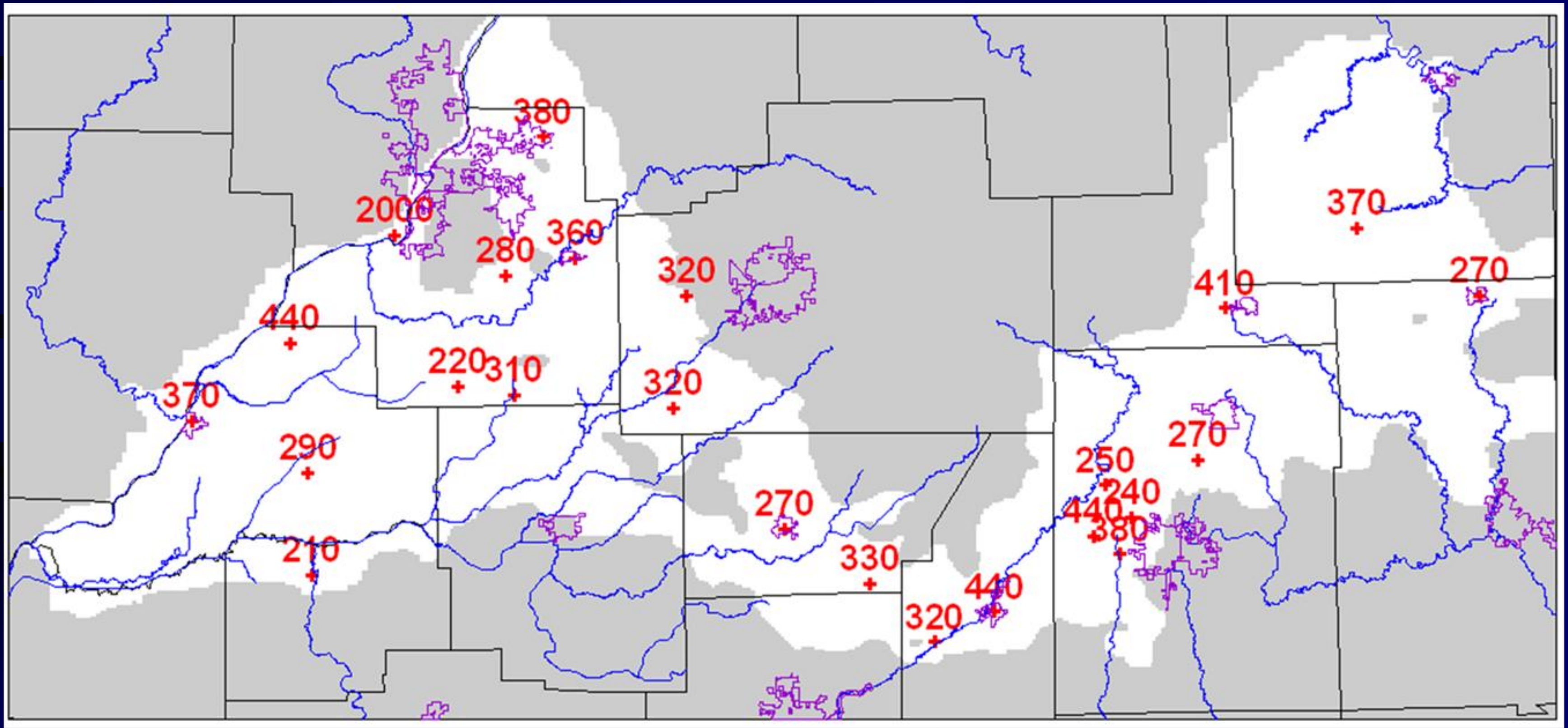
Head Above the Top of the Aquifer



Saturated Thickness



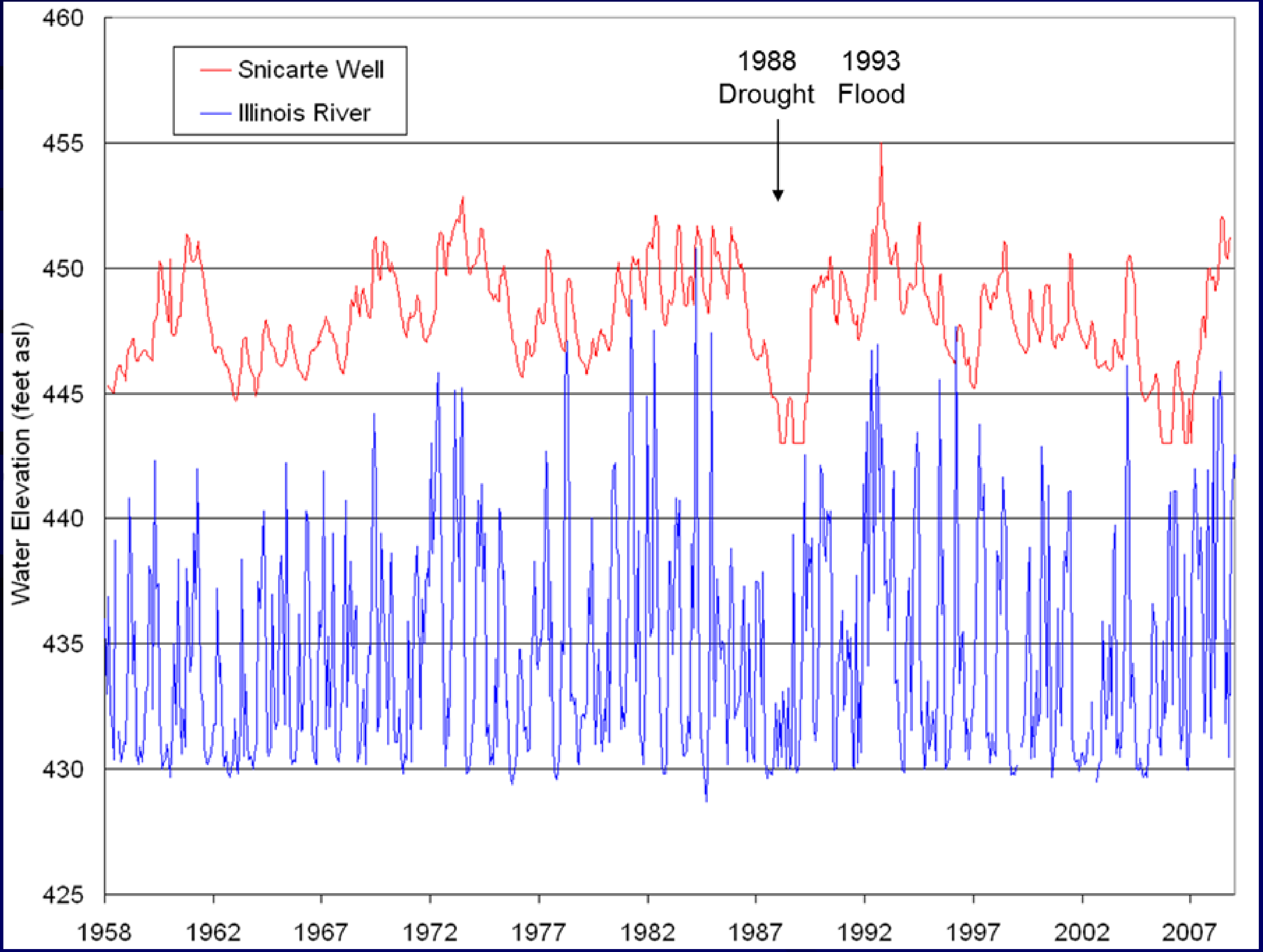
Hydraulic Conductivities from Aquifer Tests (ft/d)



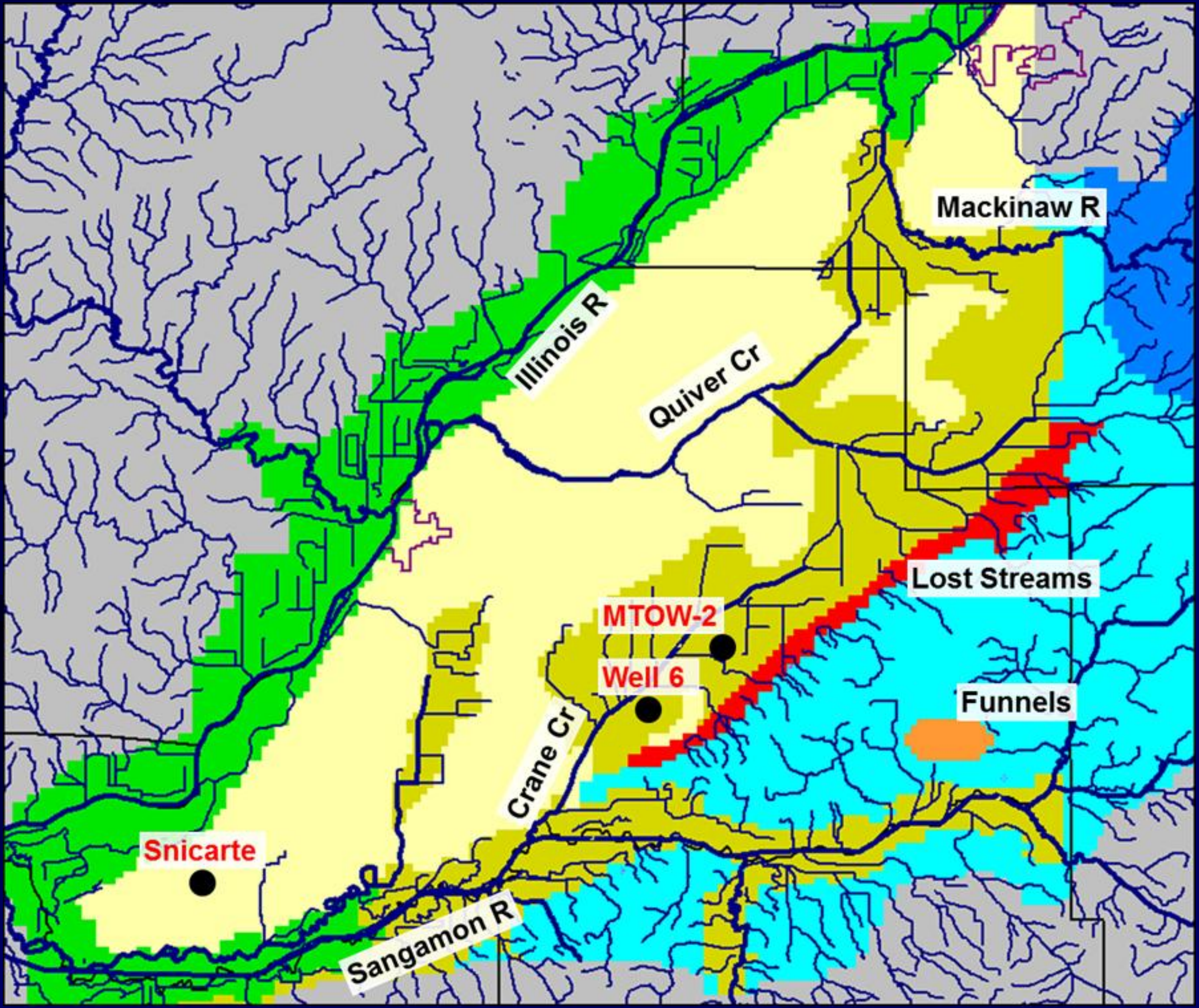
Geometric mean: 304 ft/d

Havana Lowlands

Groundwater Elevation at Snicarte



Recharge Zones

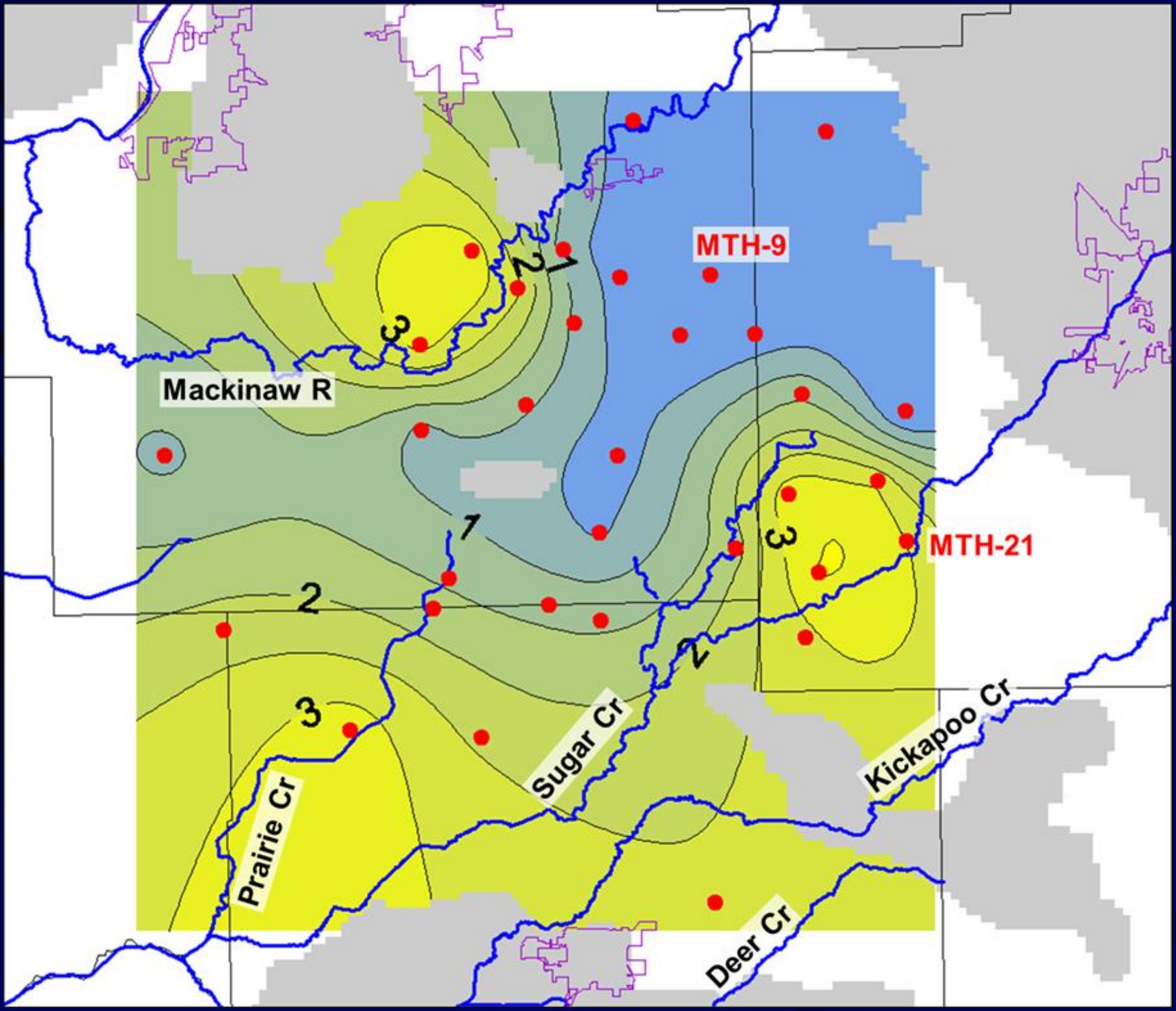


Havana Lowlands Irrigation

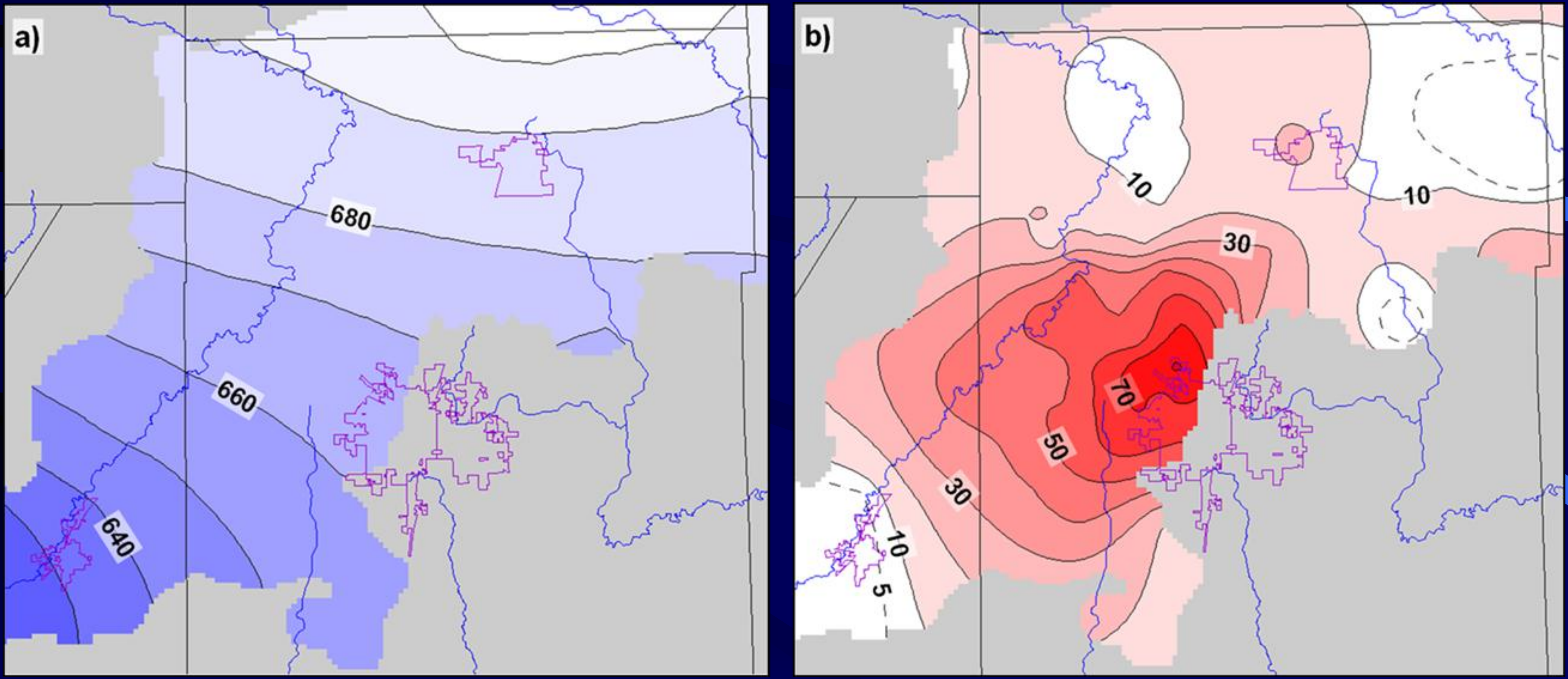
- No observable long-term impacts of irrigation on groundwater water levels
- Additional recharge is entering the aquifer
  - Localized flooding
  - A rise in the stage of the Illinois River
  - Induced infiltration
  - Decreased Evaporation
  - Return of irrigation water
- Need to increase recharge with pumpage in the groundwater flow model to keep water levels constant

McLean, Tazewell, and Logan Counties

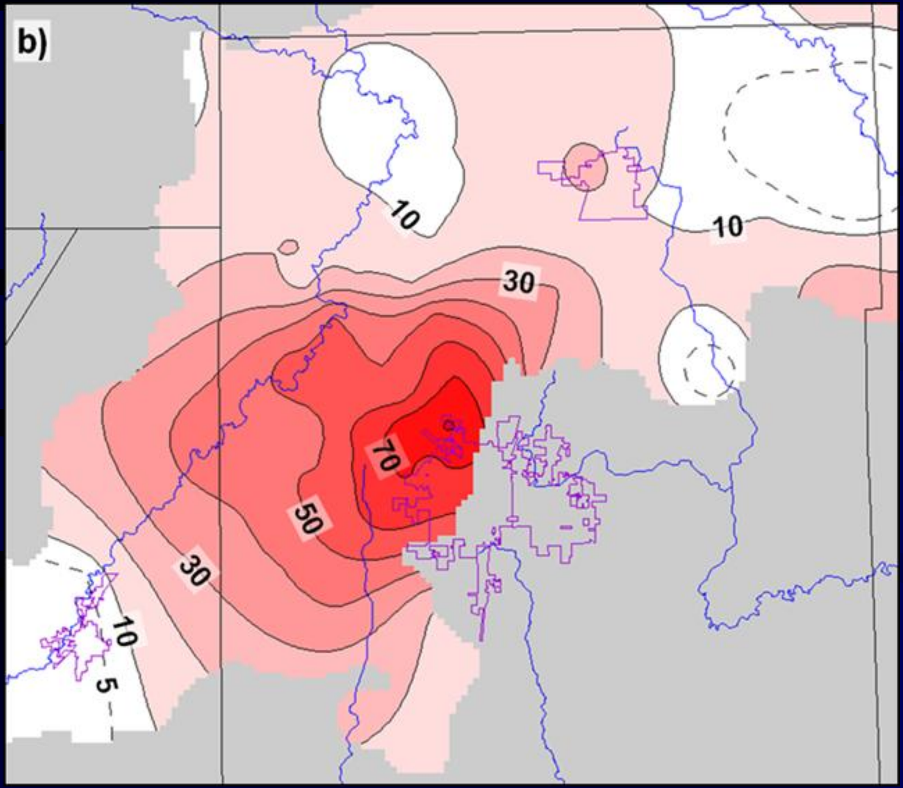
Water Level Rise 11/1/2006 to 3/8/2007



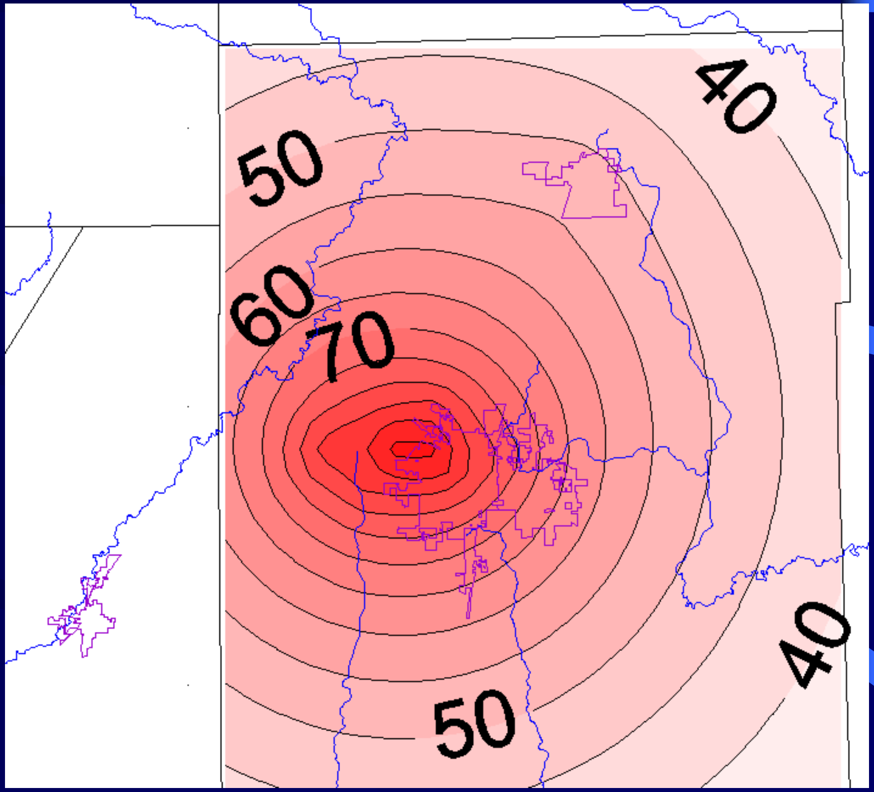
Drawdown near Champaign: 1920s - 2005



Drawdown near Champaign

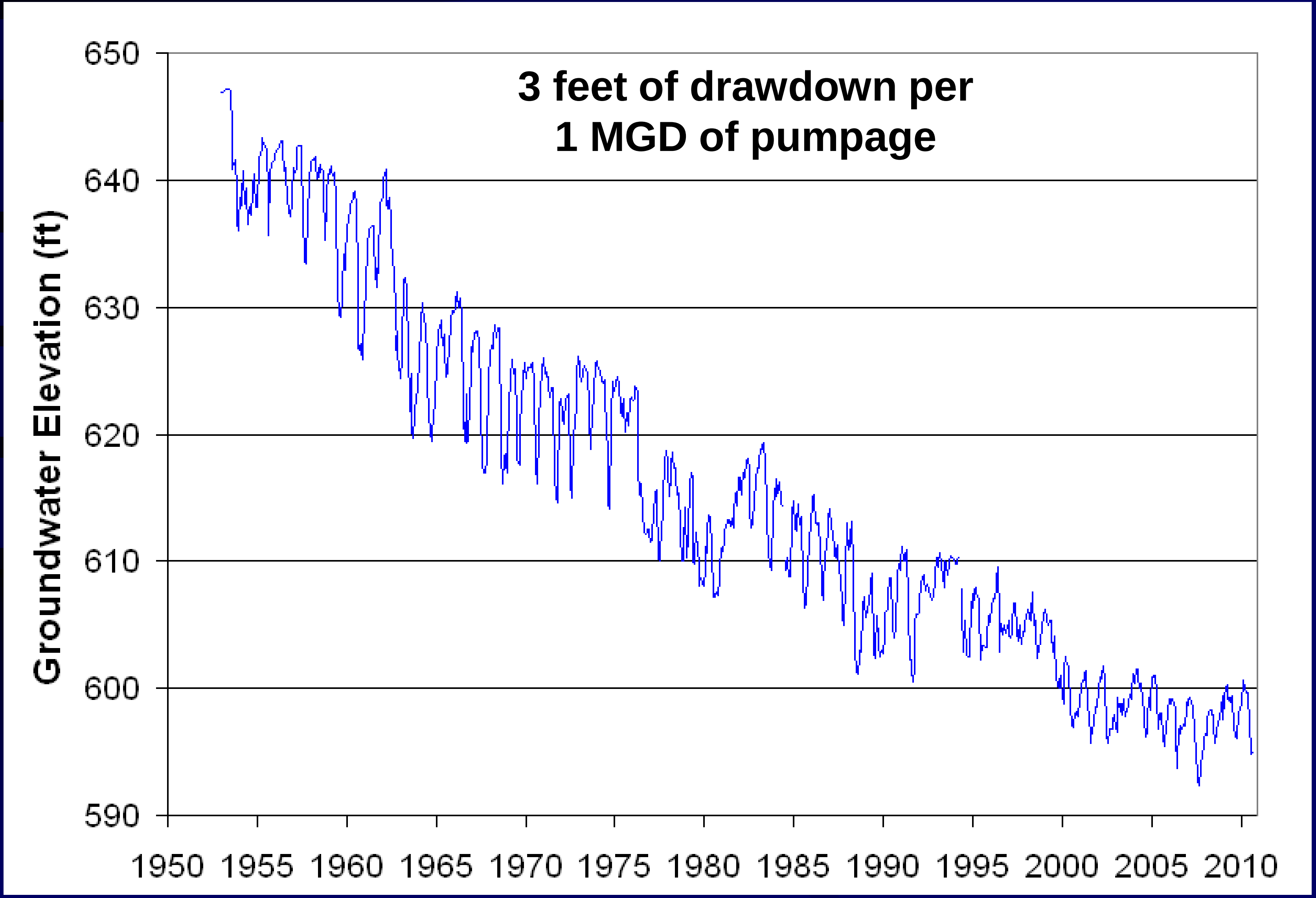


Measured

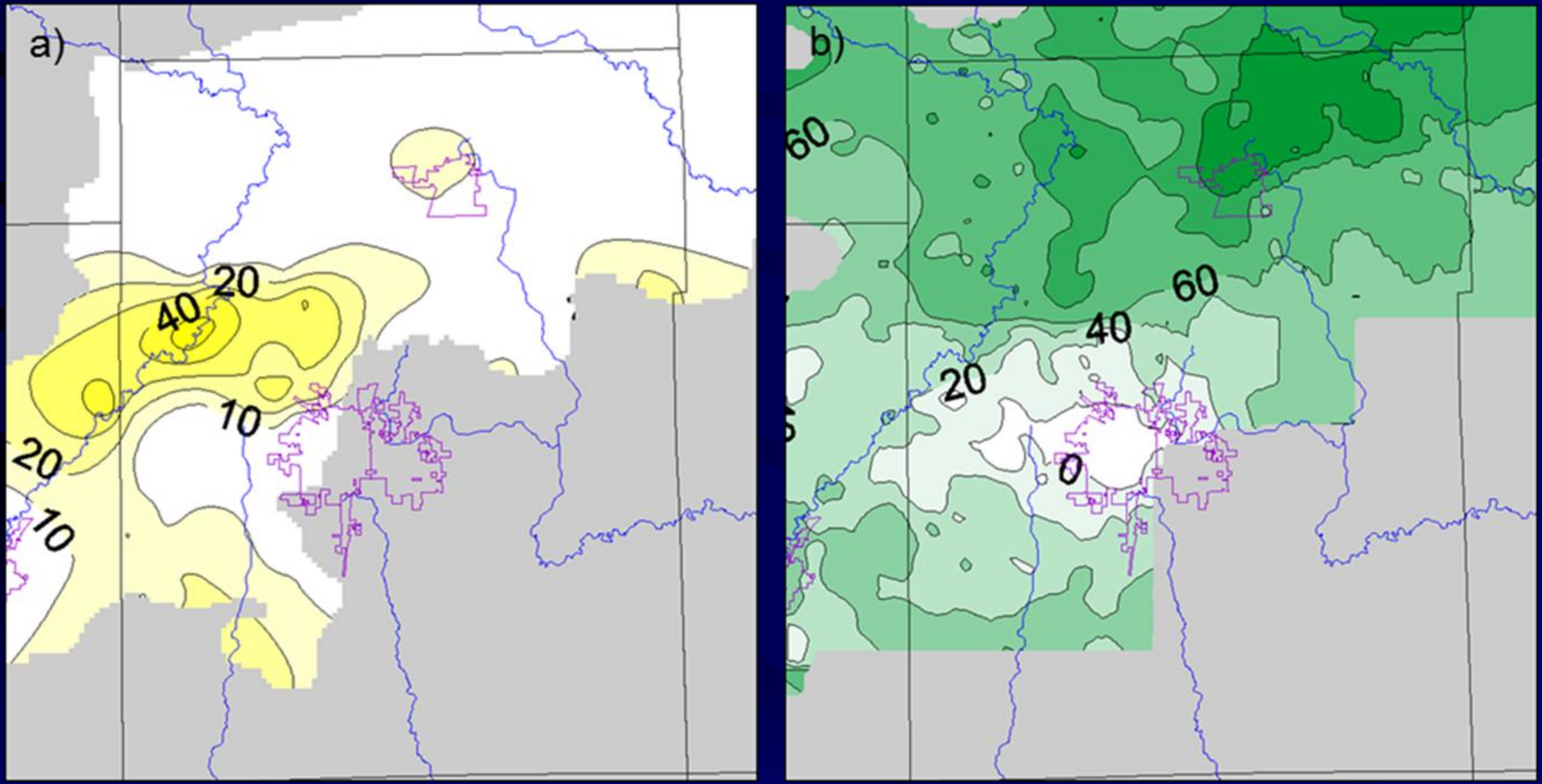


Analytical calculation with no boundaries

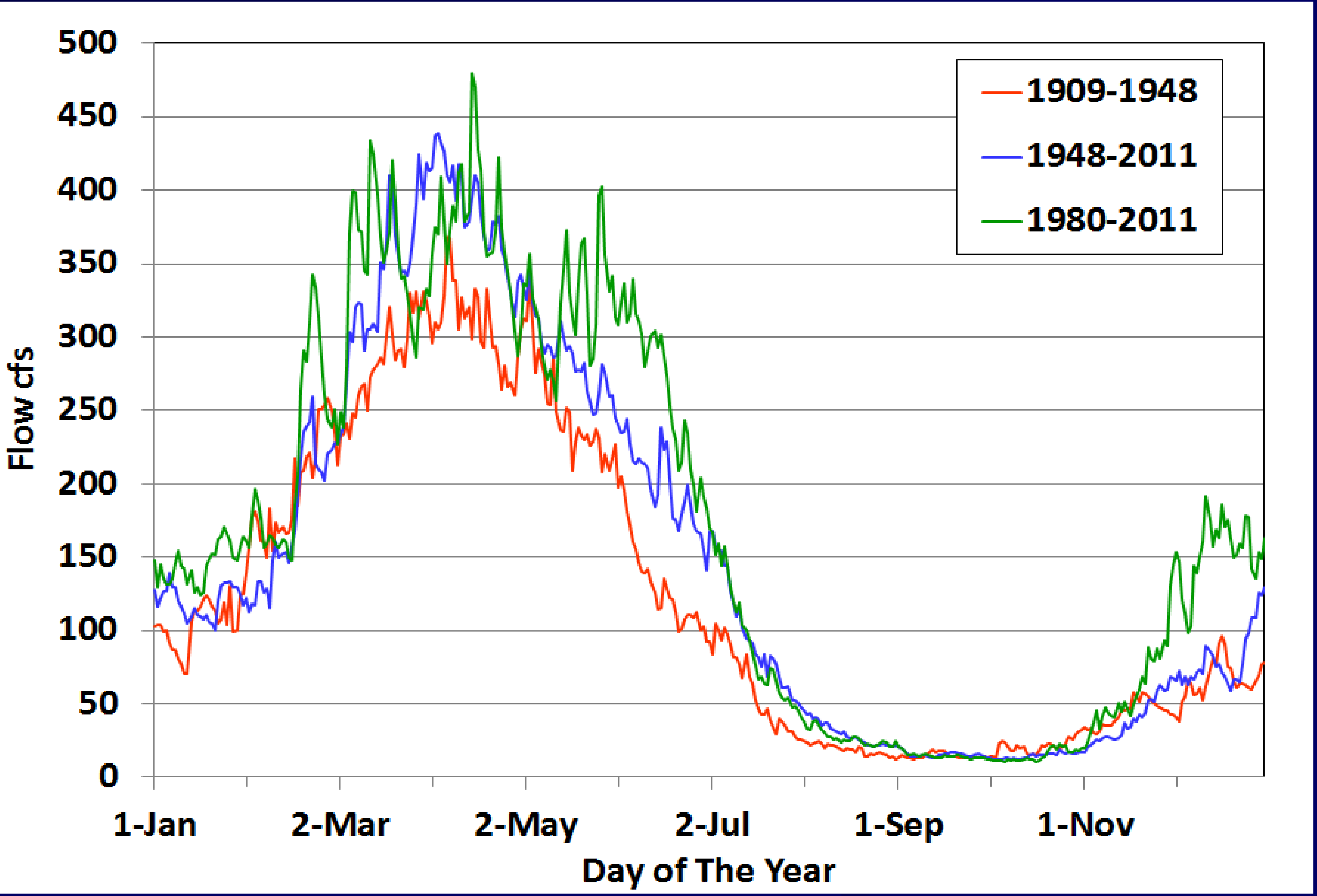
Groundwater Elevation at Petro North



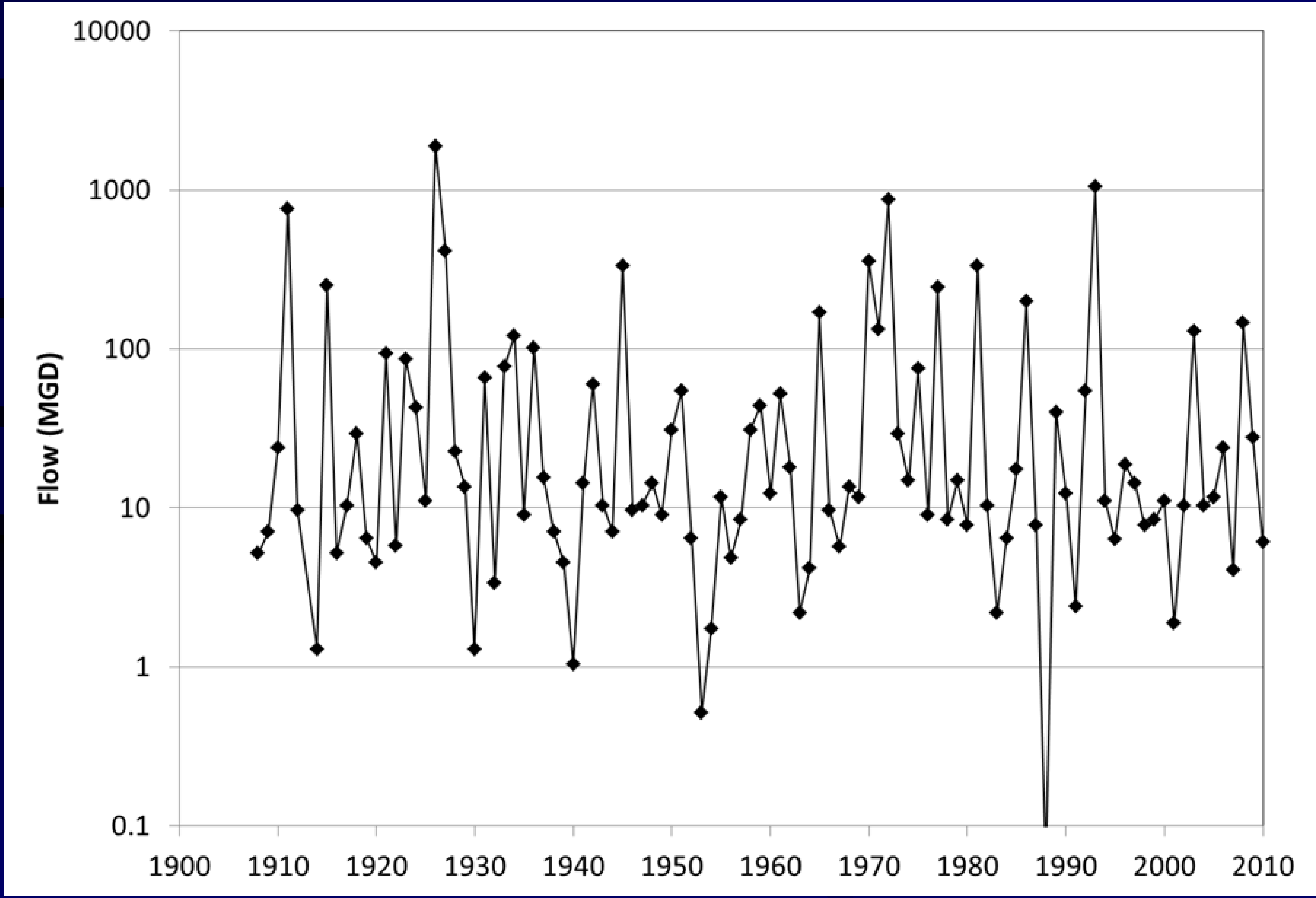
Unconfined Portion of the Glasford Aquifer



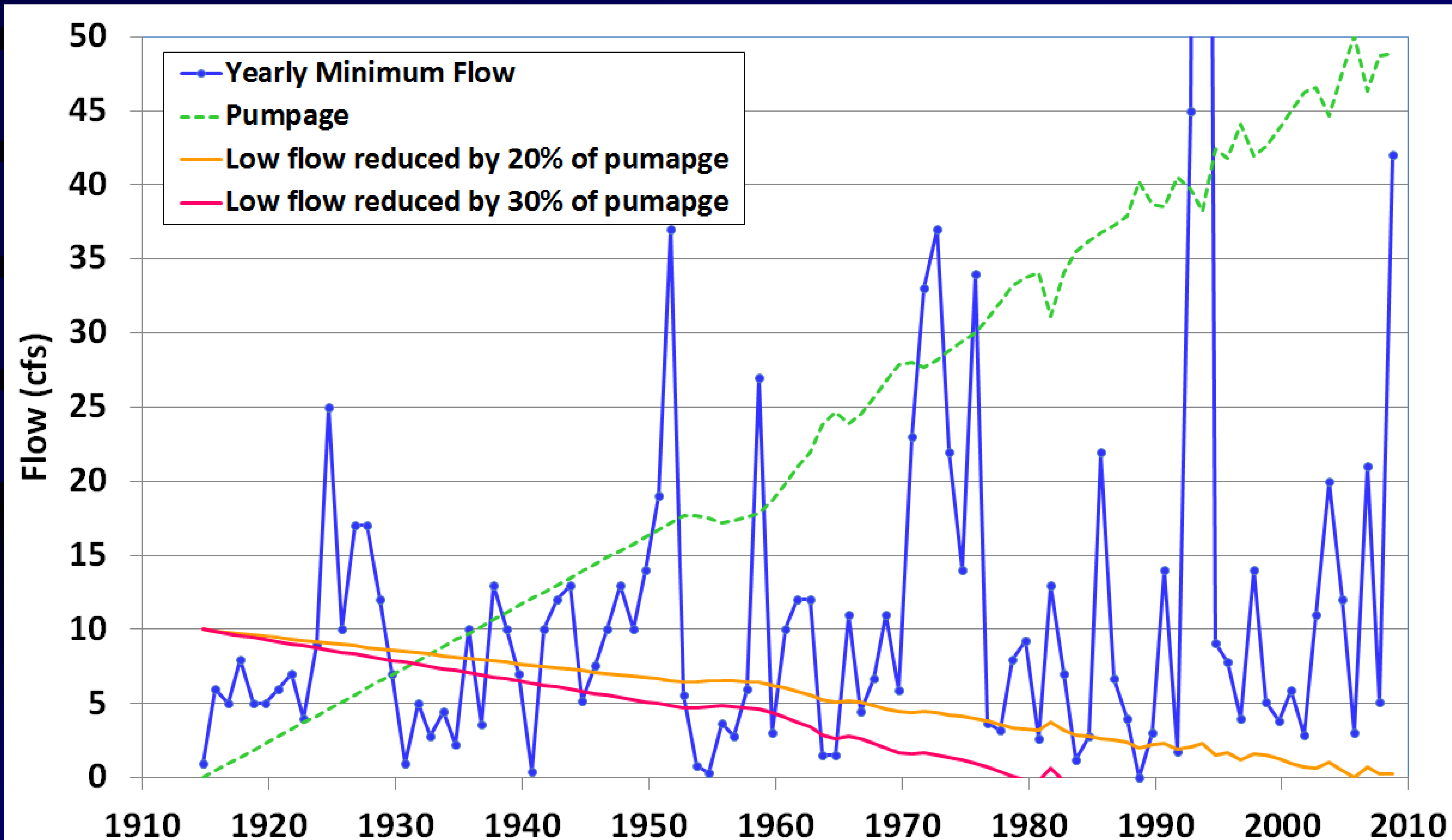
Baseflow in the Sangamon River (Average Q80 and Q50)



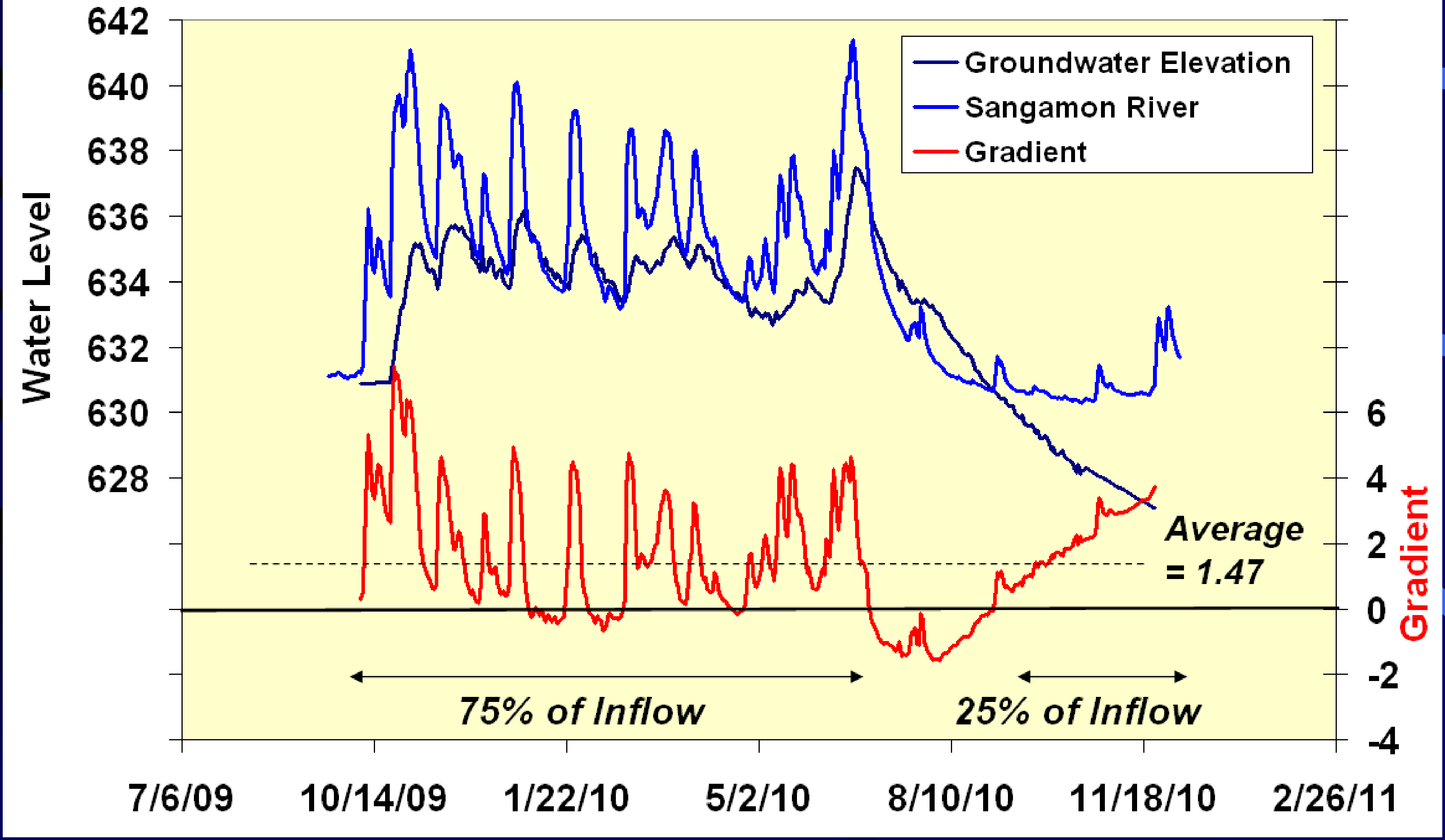
Flow on the Sangamon River at Monticello on September 30 of each year



What Might Happen If River Low Flows Where Impacted by Pumpage



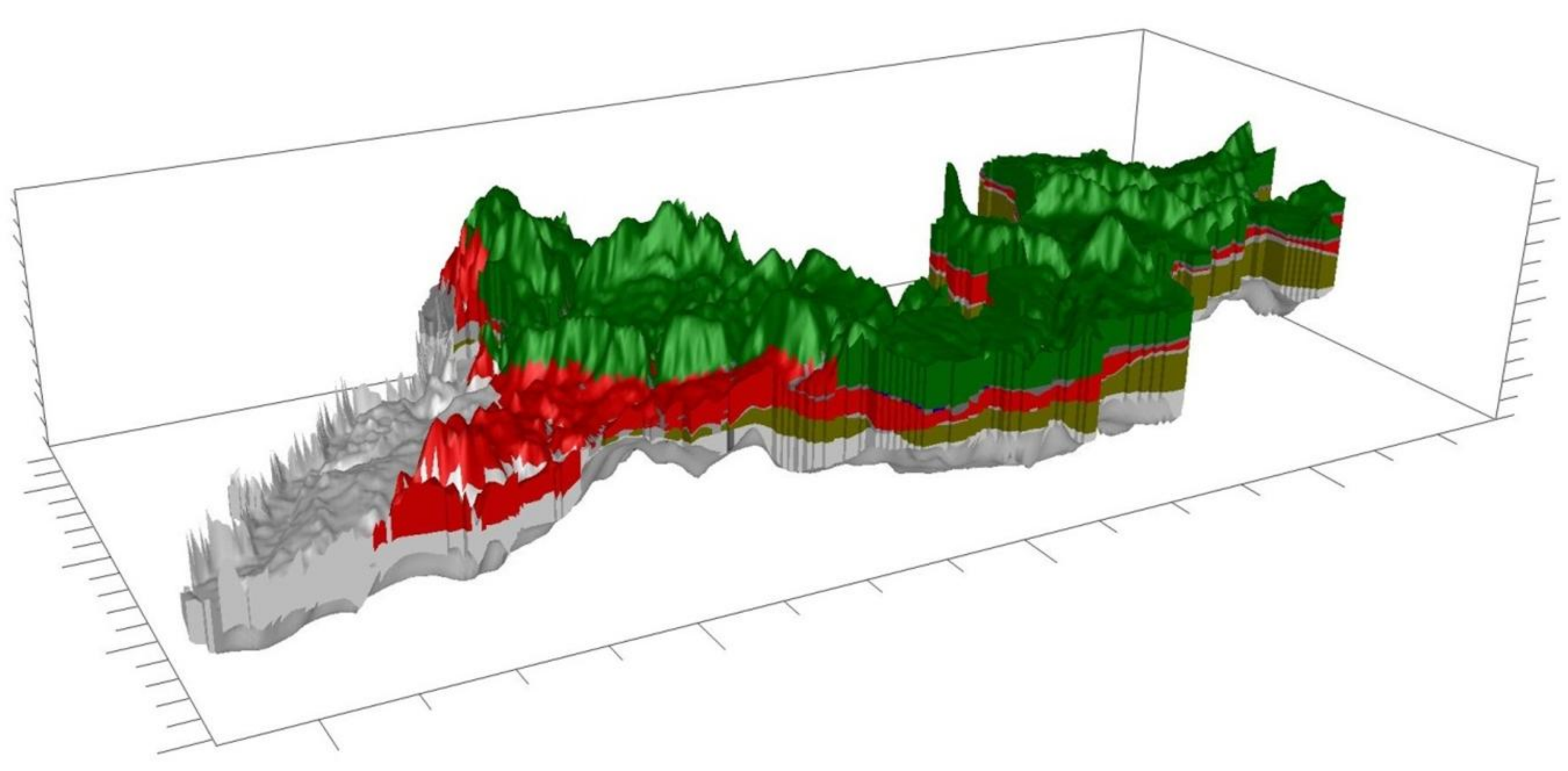
Sangamon River and Well PIAT 09-01



Champaign Pumping Center

- No observable impact of pumpage on baseflow
- Water level fluctuations decrease with increasing pumpage
  - Dewatering of overlying sands
  - Possible sensitivity to drought
- Increased discharge from bedrock
- Poor model calibration to historic heads using constant recharge

Groundwater Flow Modeling



Model Calibration

Head Targets

Wells: 133

Mean Error: 0.26 ft

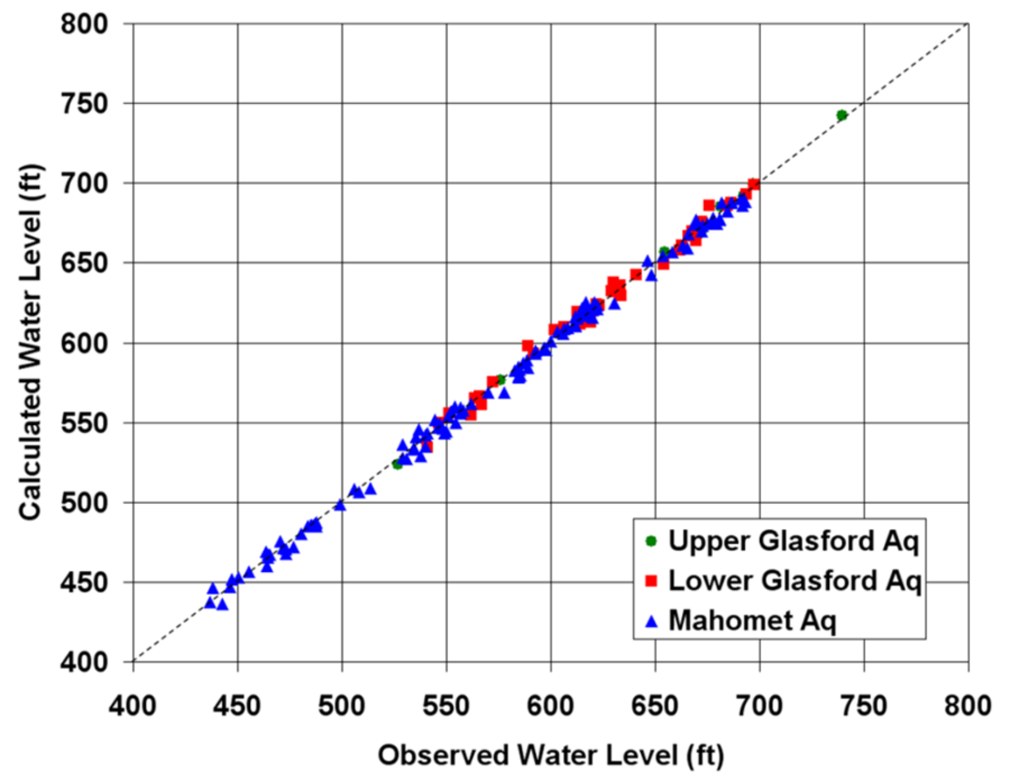
Absolute mean error: 2.95 ft

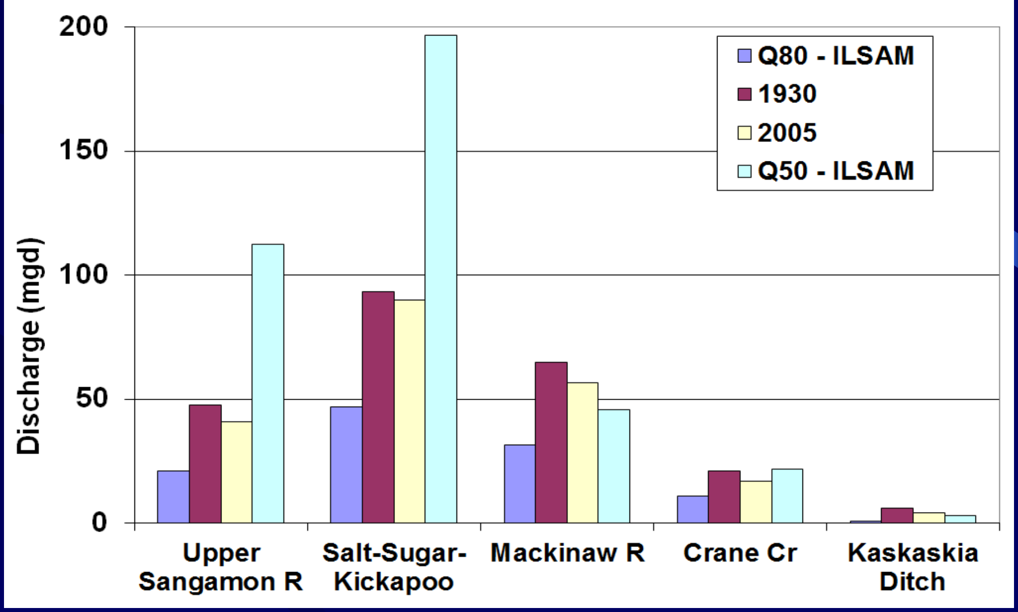
Error range: -10 to 8.6 ft

Head range: 303 ft

Flux Targets

Major watersheds between Q80 and Q50

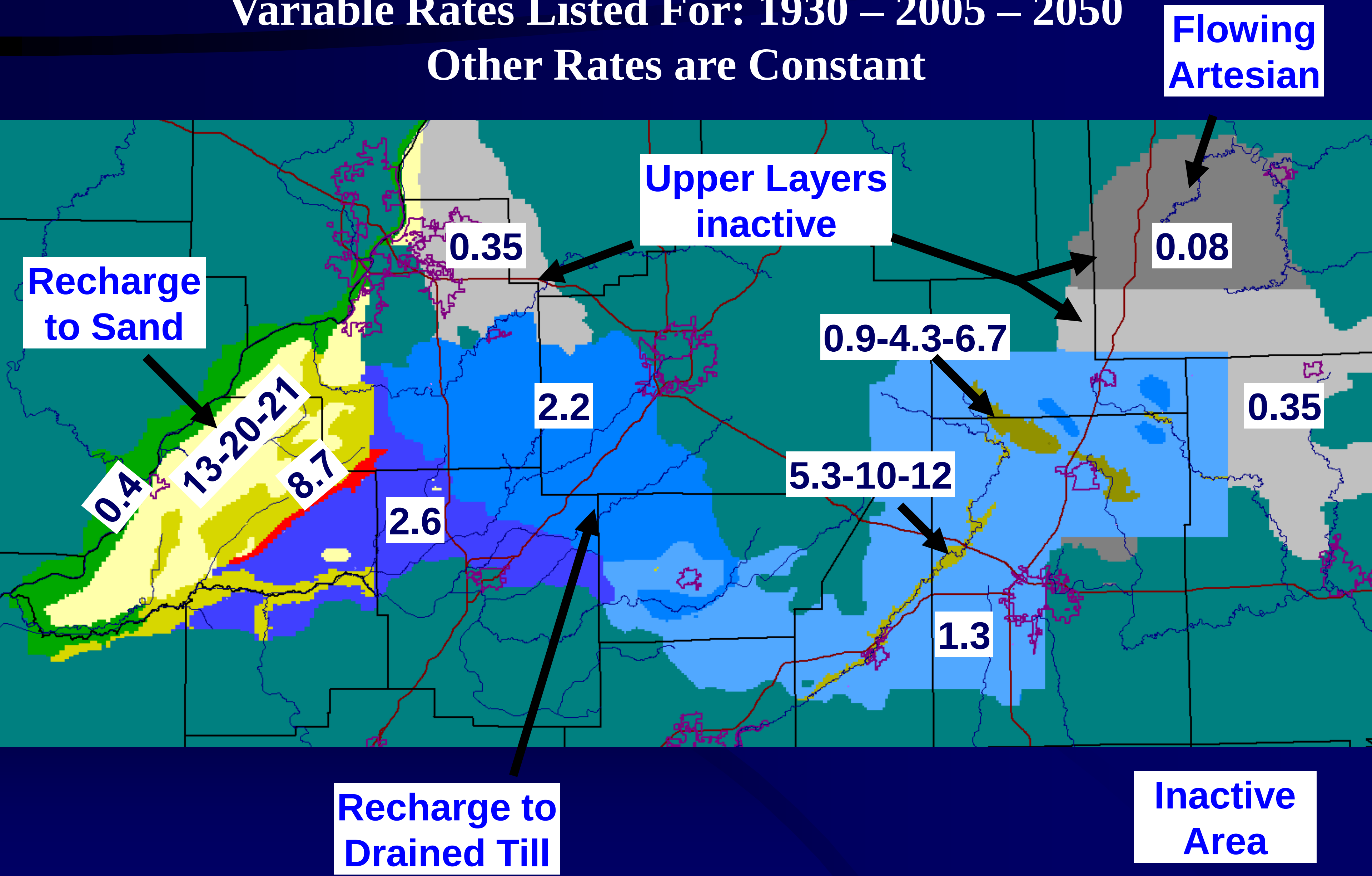




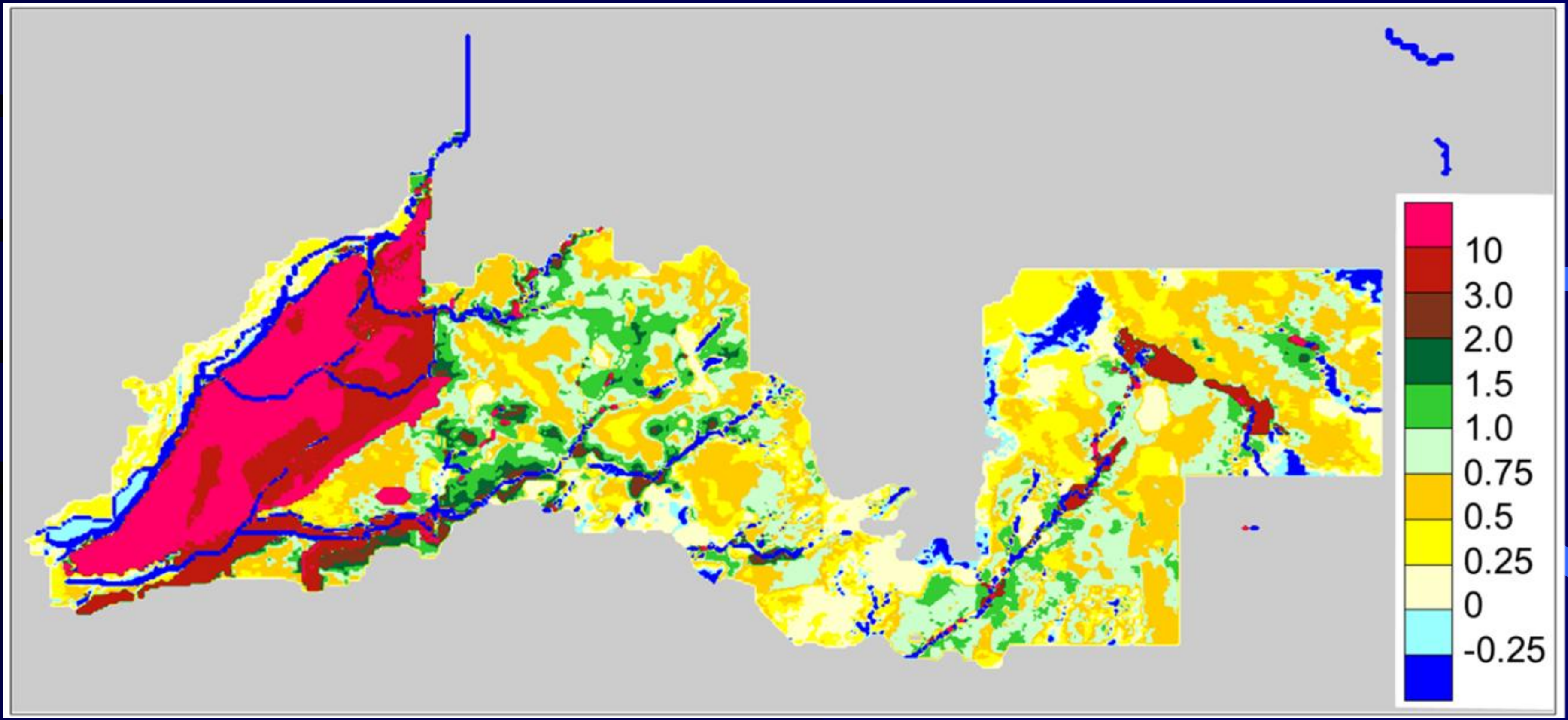
Recharge Rates (in/yr)

Variable Rates Listed For: 1930 – 2005 – 2050

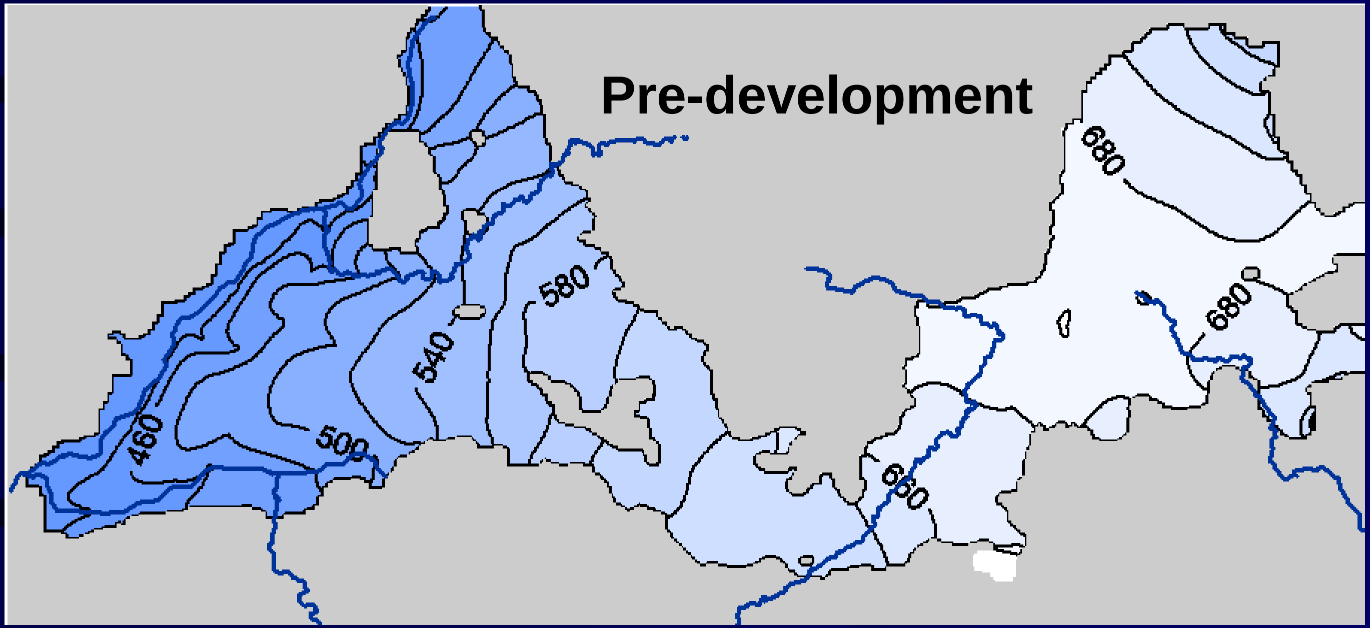
Other Rates are Constant

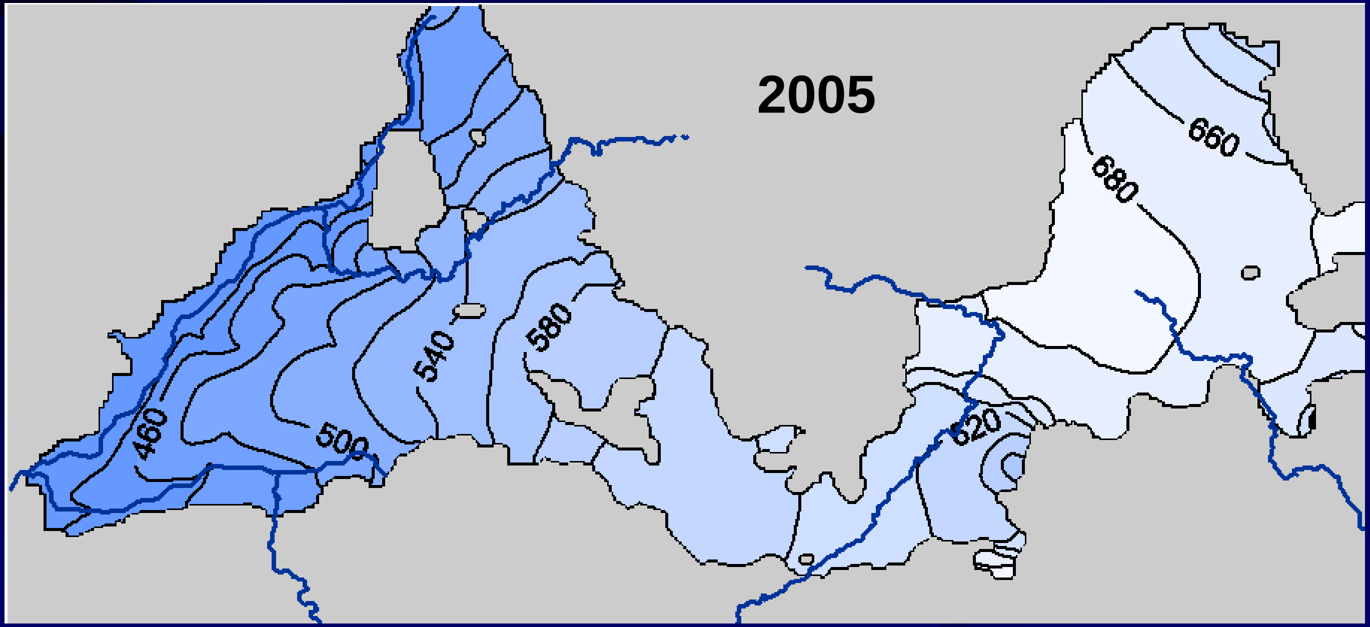


Effective Recharge Rates (in/yr)

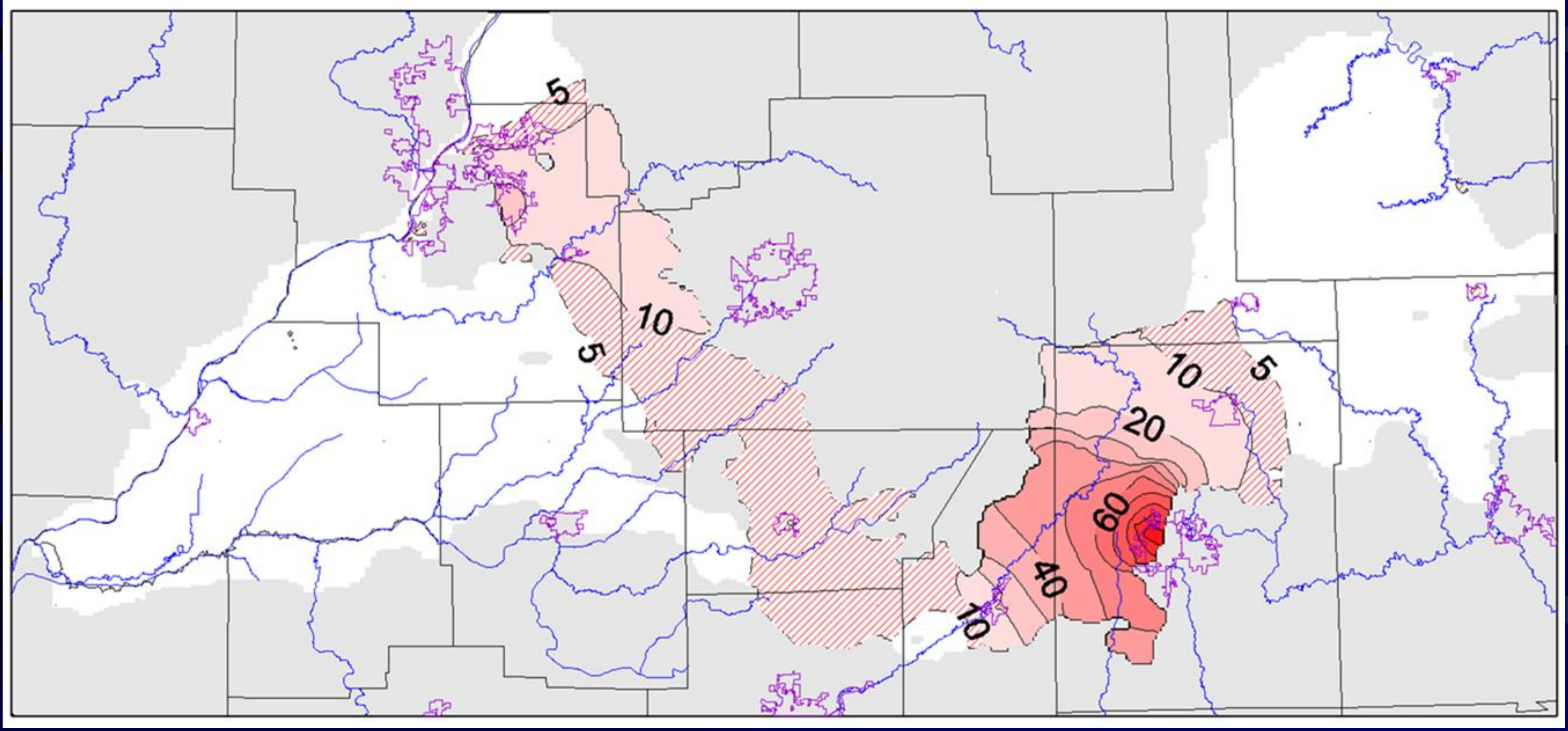


Modeled Potentiometric Surfaces



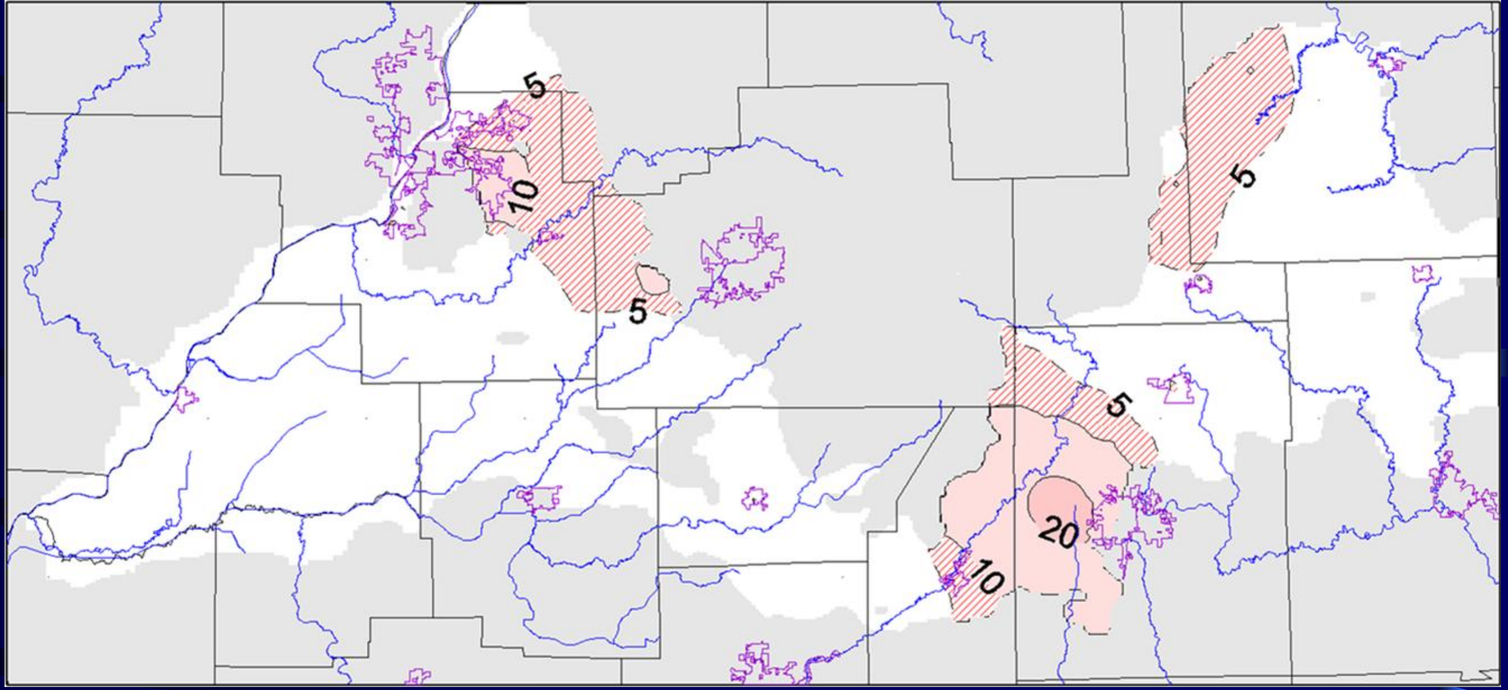


Drawdown 1930-2005

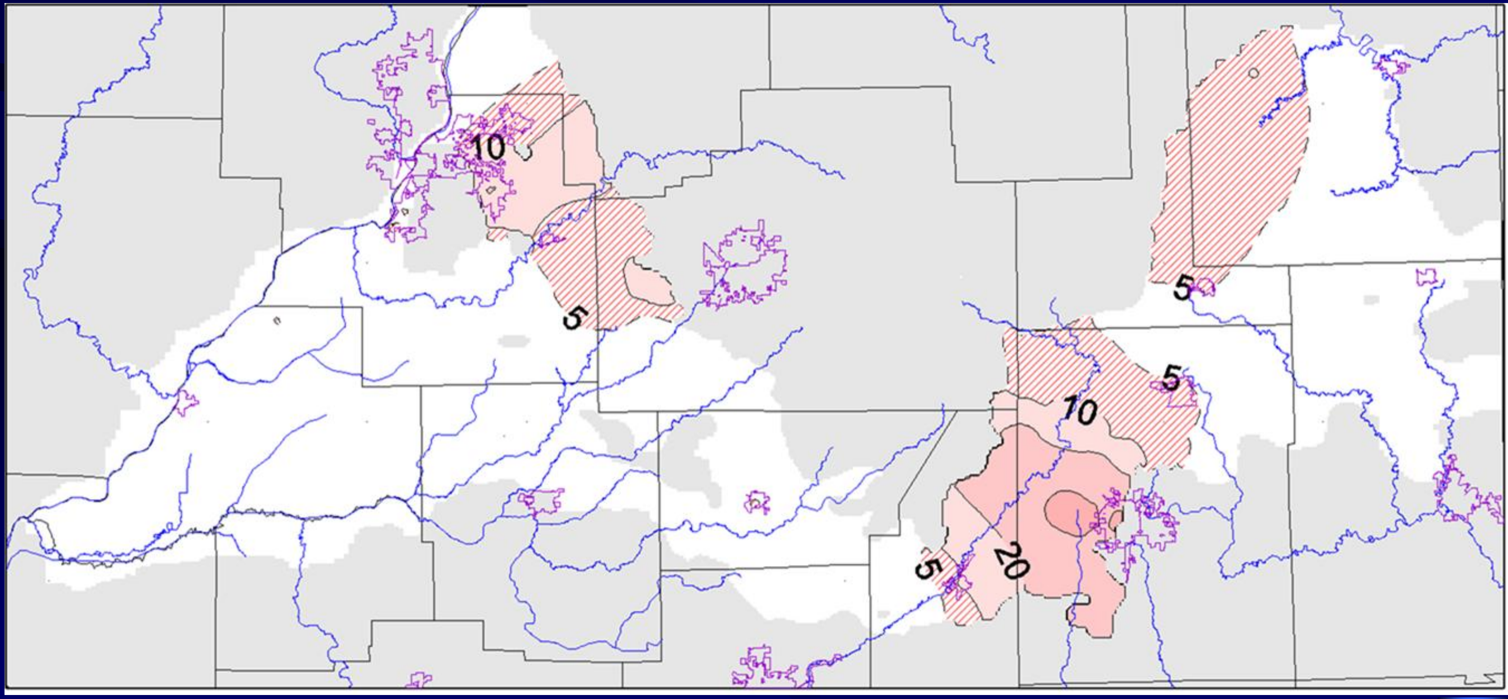


Drawdown 2005-2050

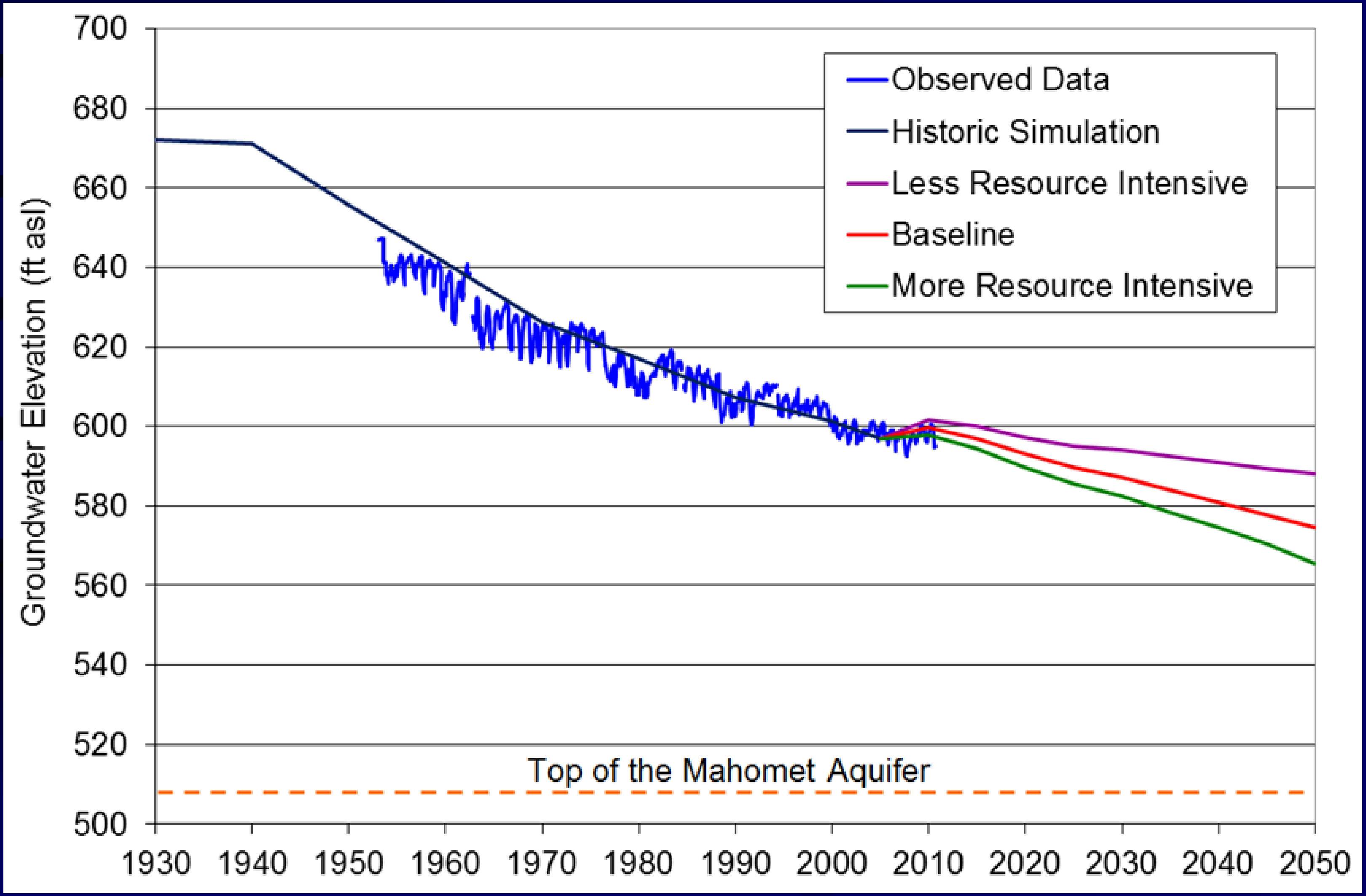
Baseline Case



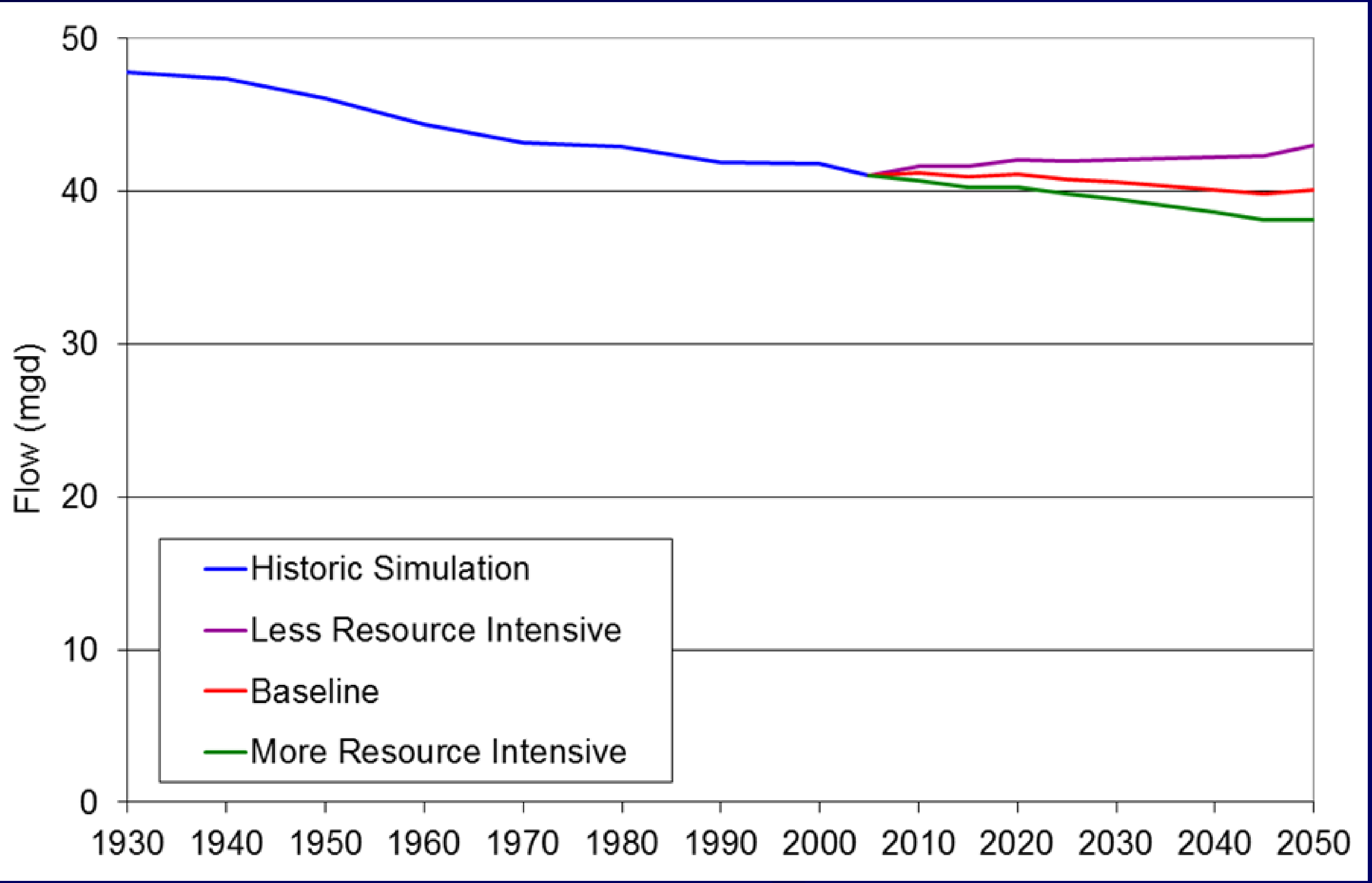
More Resource Intensive Case



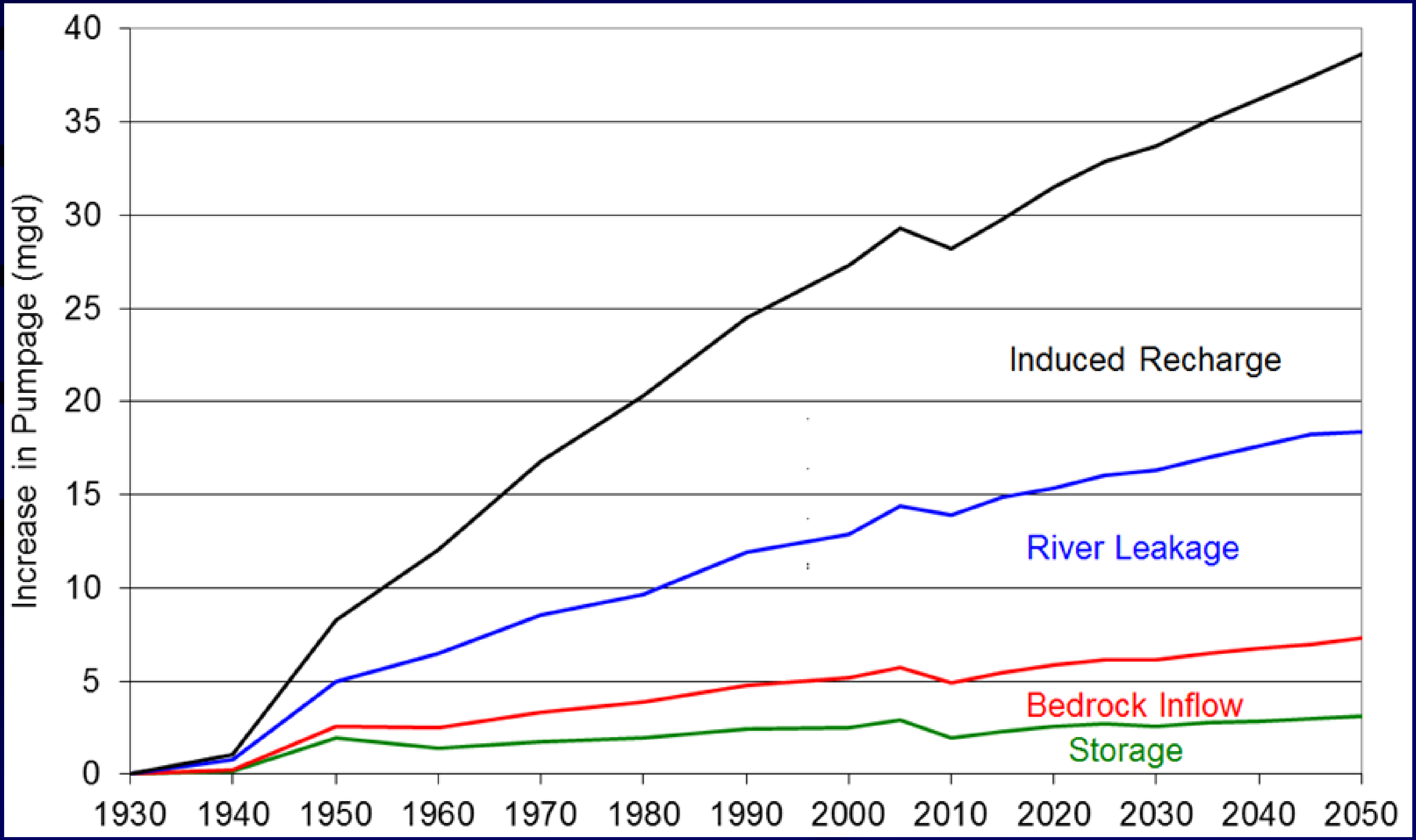
Petro North Observation Well



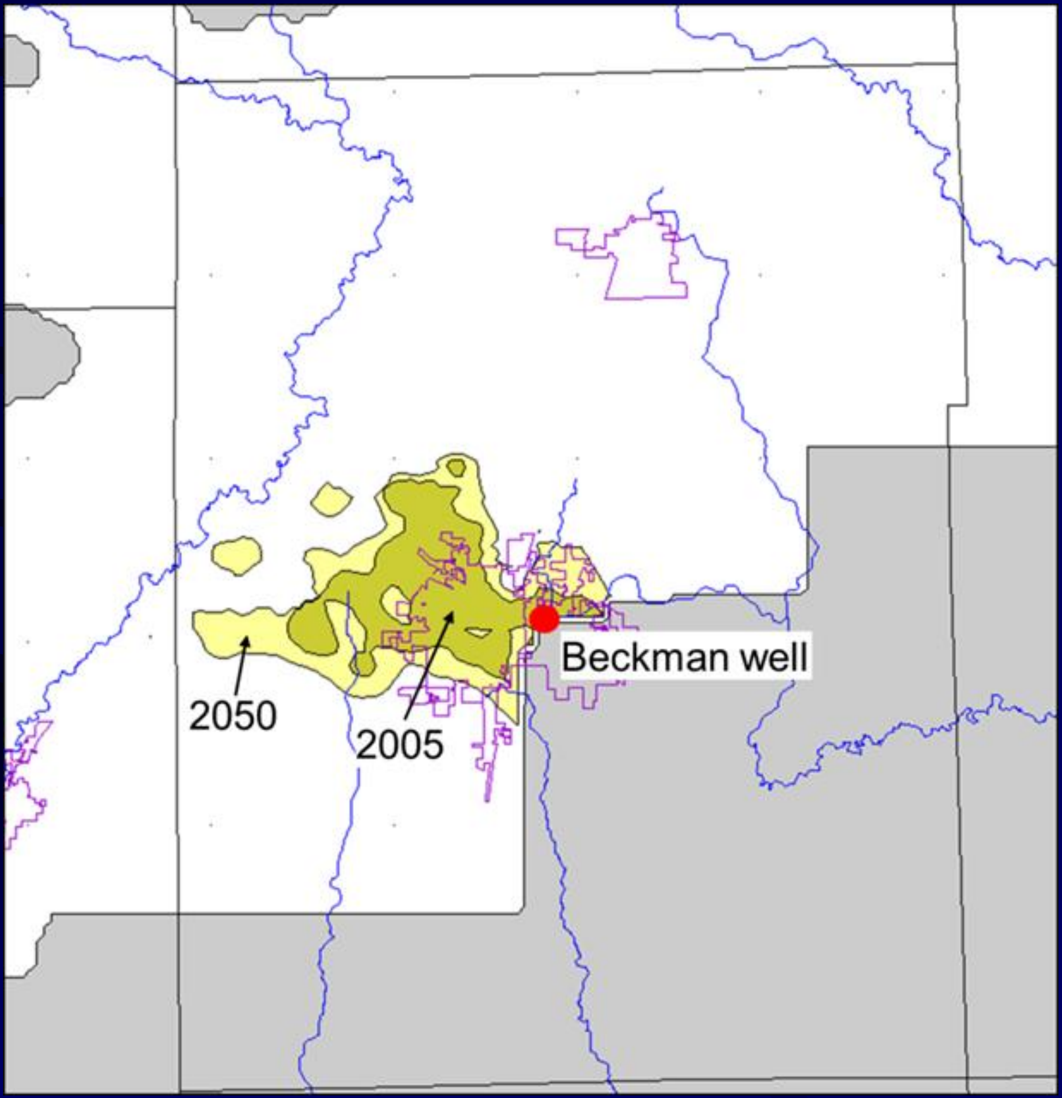
Sangamon River at Monticello



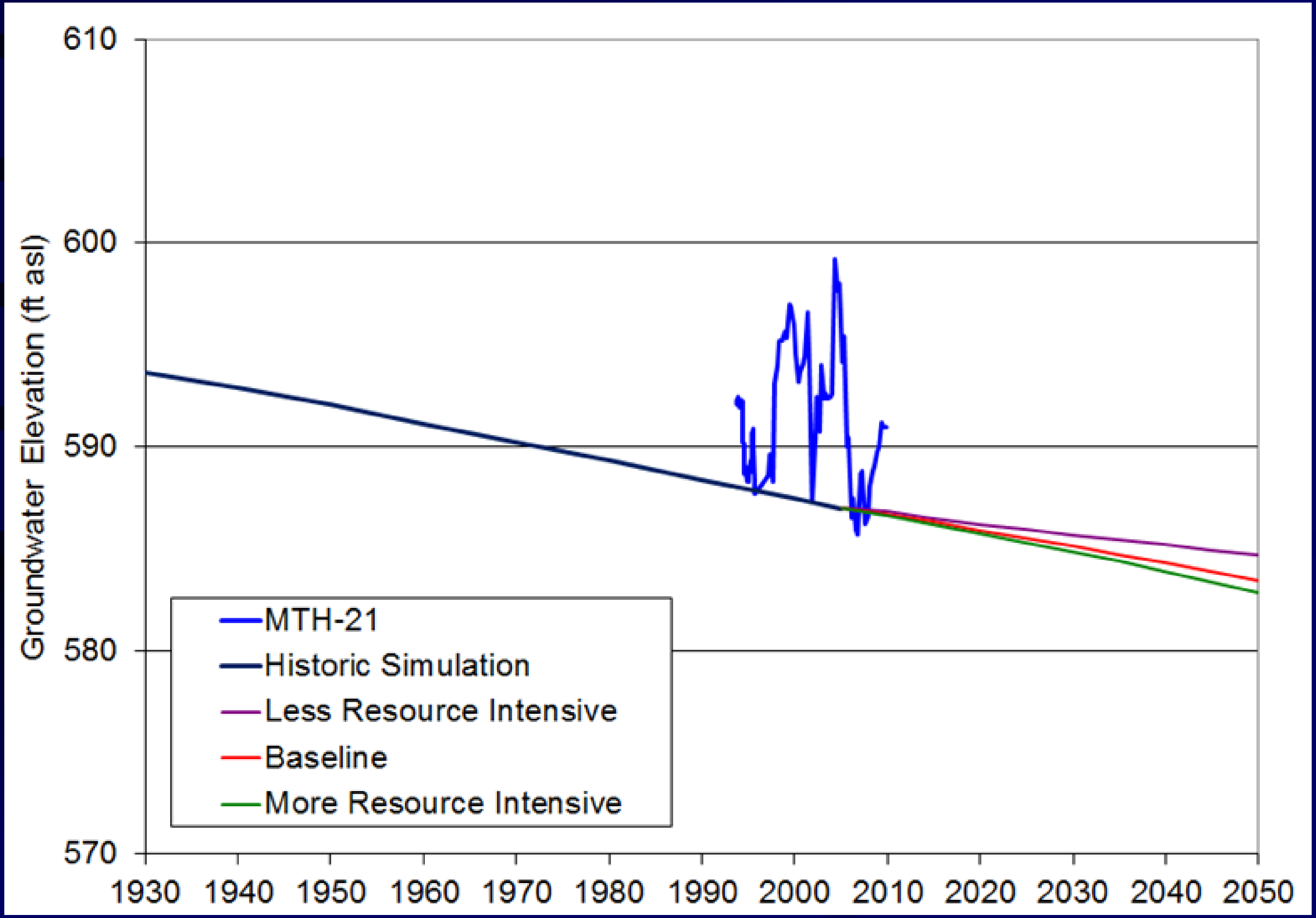
Sources of Water for the Champaign Pumping Center



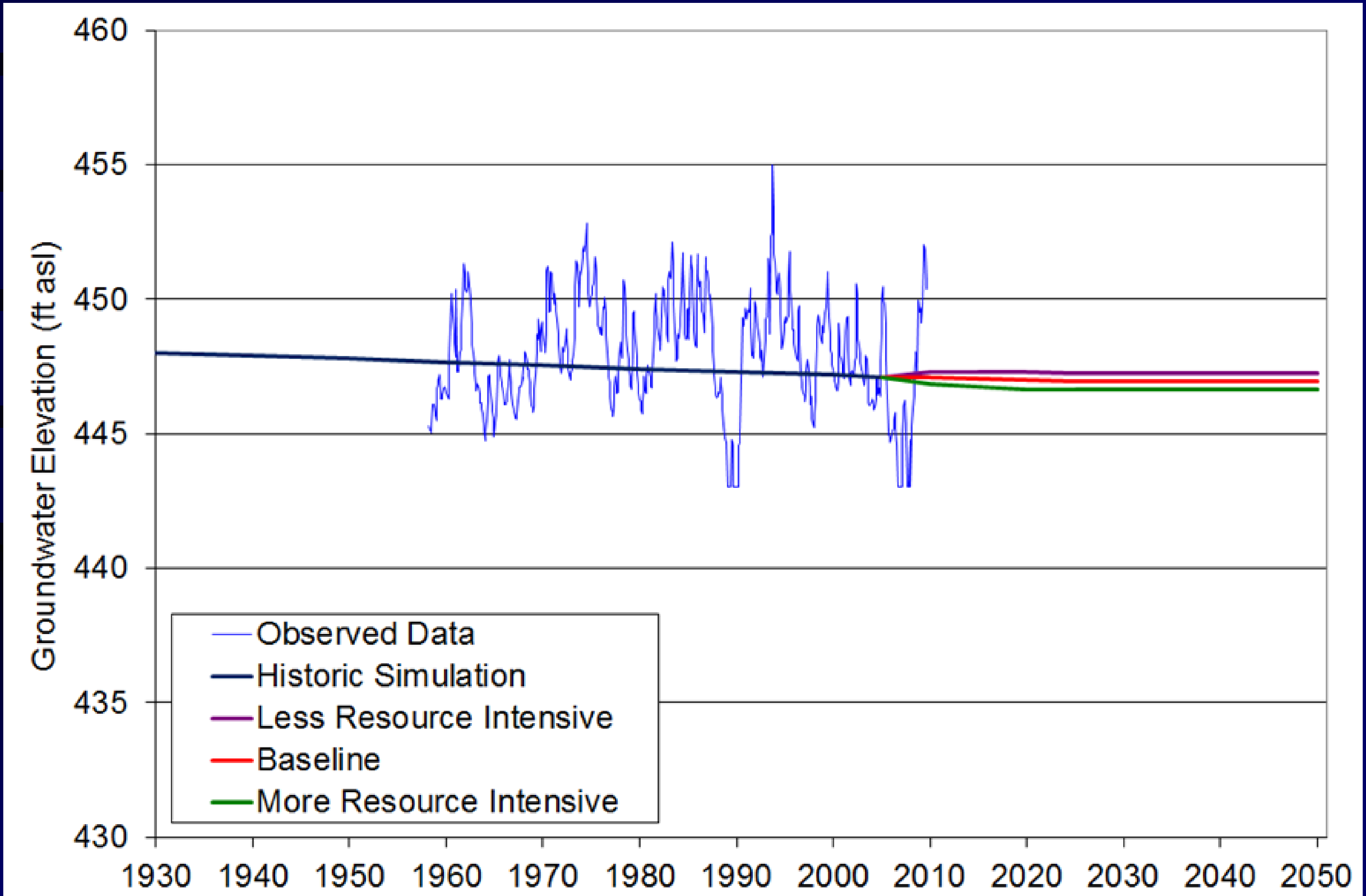
Unconfined Portion of the Glasford Aquifer



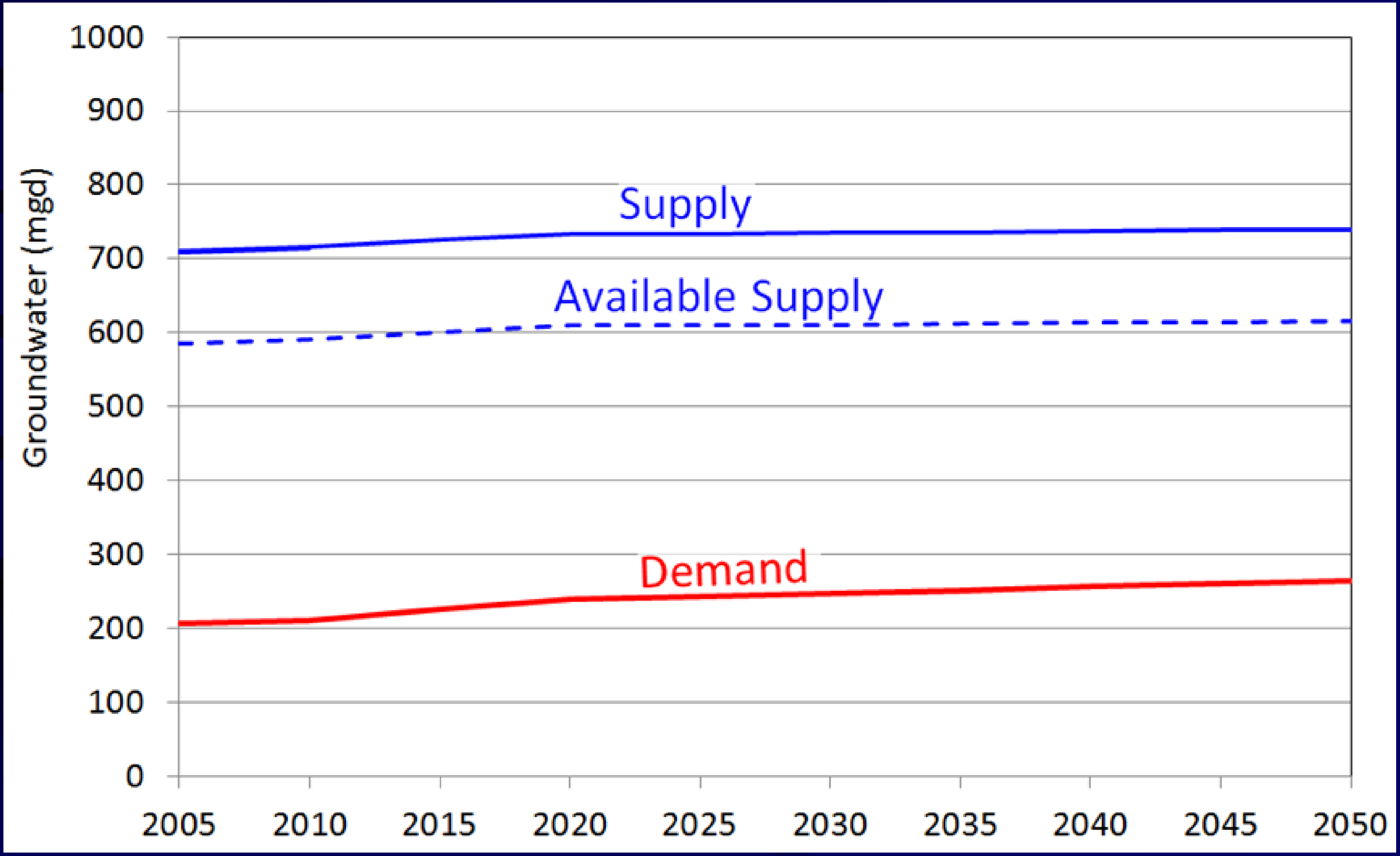
Southwest McLean County MTH-21



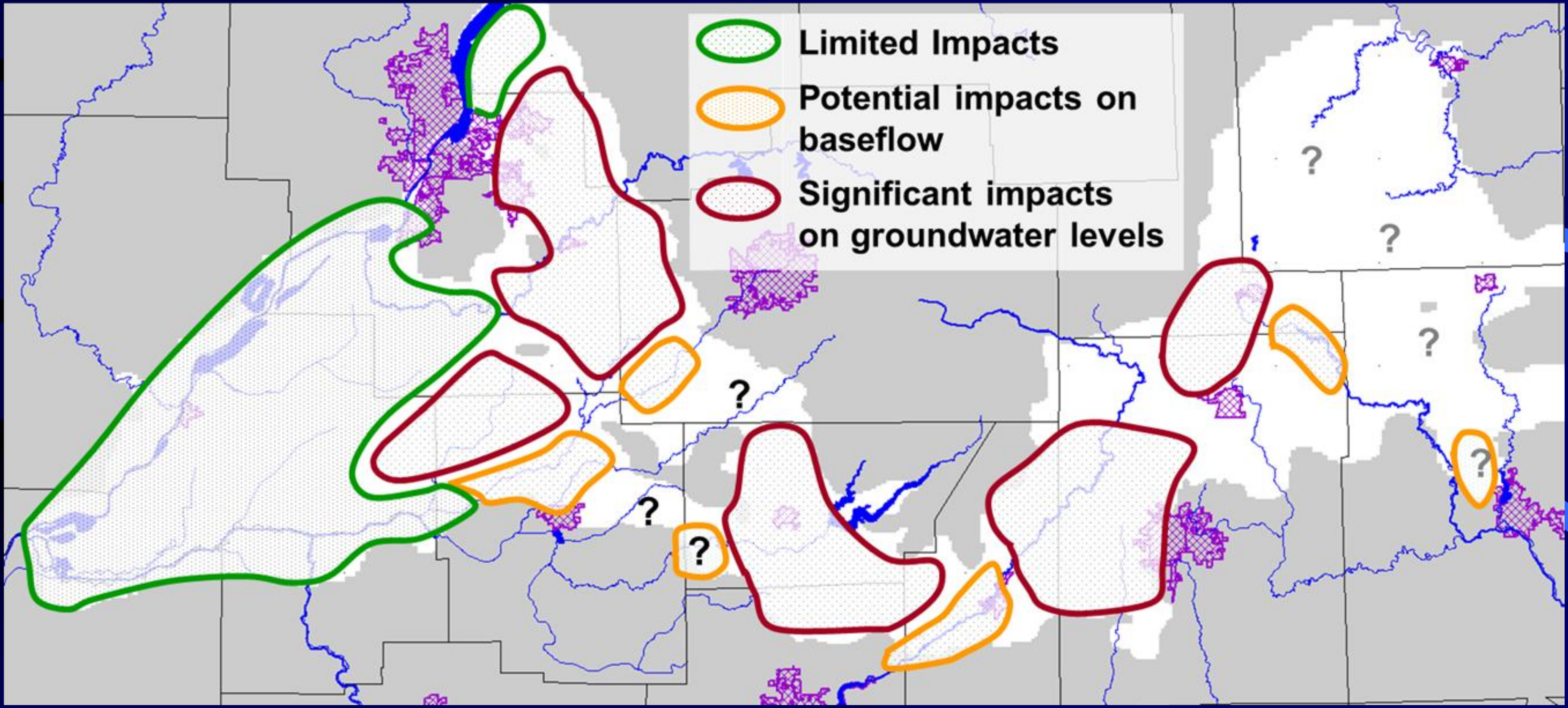
Mason County – Snicarte Well



Aquifer Budget

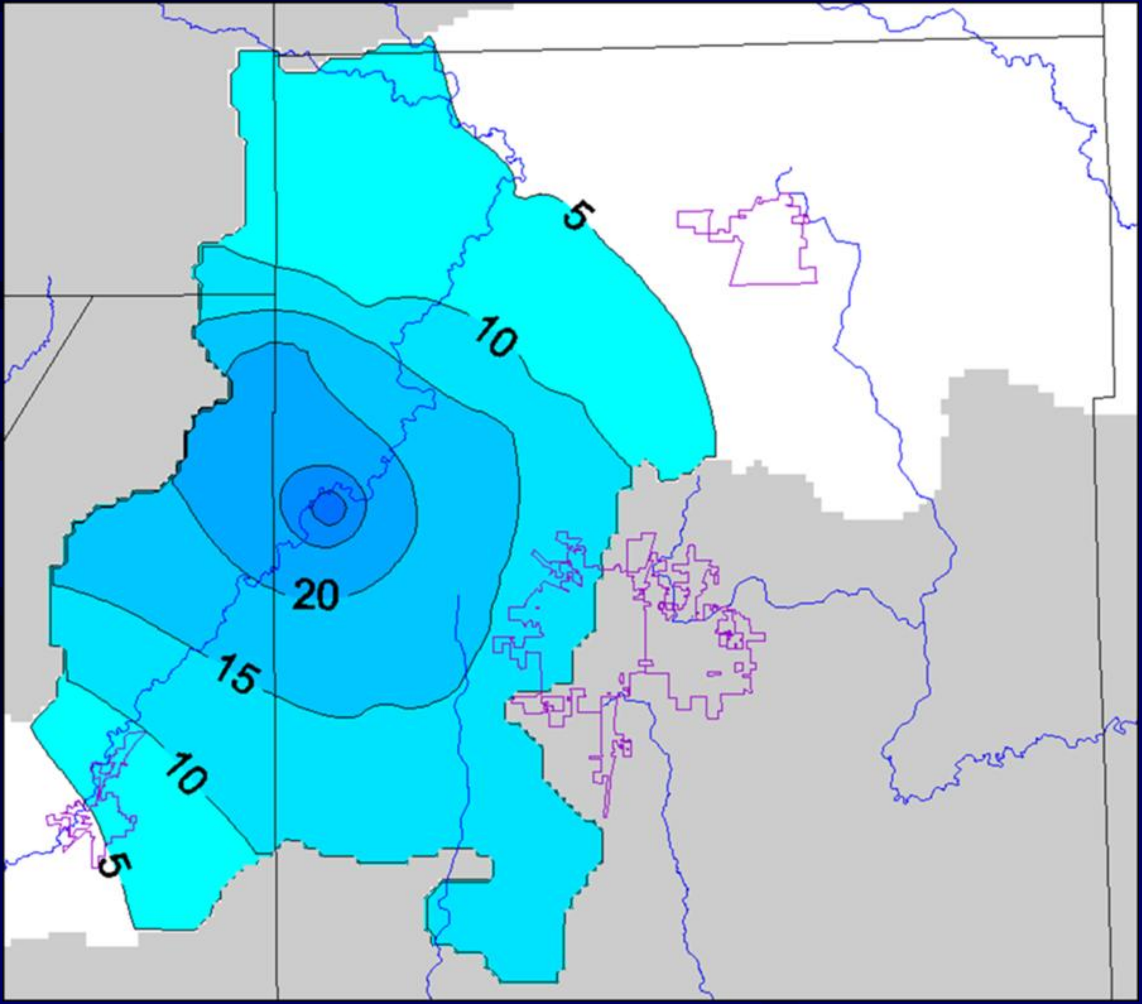


Potential For Development of High-Capacity Wellfields



Rise in Water Level with Recharge Pit

Recharge Rate – 10 MGD



Conclusion

The water supply glass is getting bigger