Rising Water Levels in the Sandstone Aquifer of Eastern Wisconsin:

A conservation Success Story and a lesson in the Law of Unintended Consequences

John Jansen, Ph.D., P.G., P.Gp.

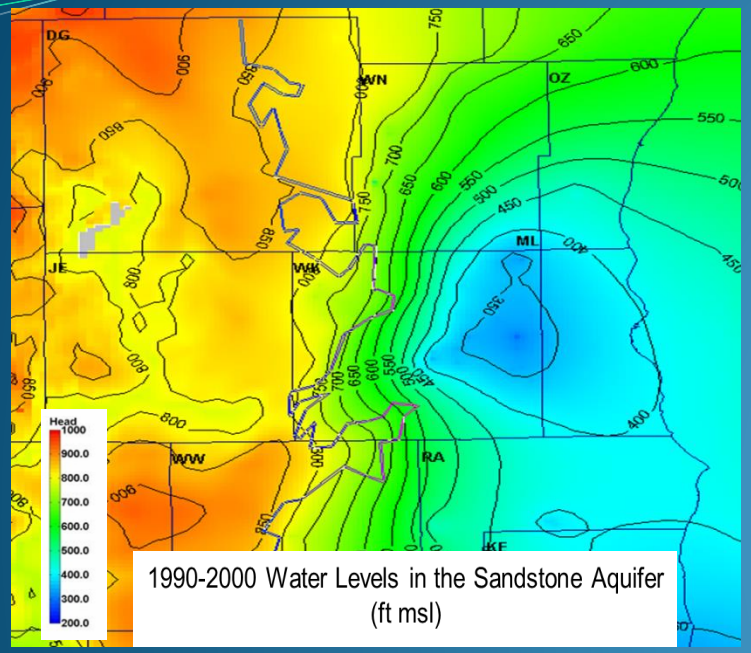
Collier Geophysics

john@collierconsulting.com

(239)896-0576

The Sky is Falling!

(or at least the water levels in the sandstone aquifer)



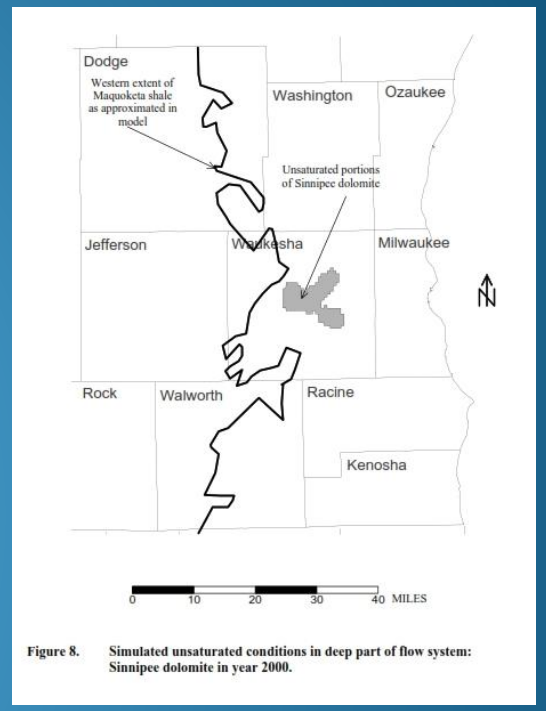
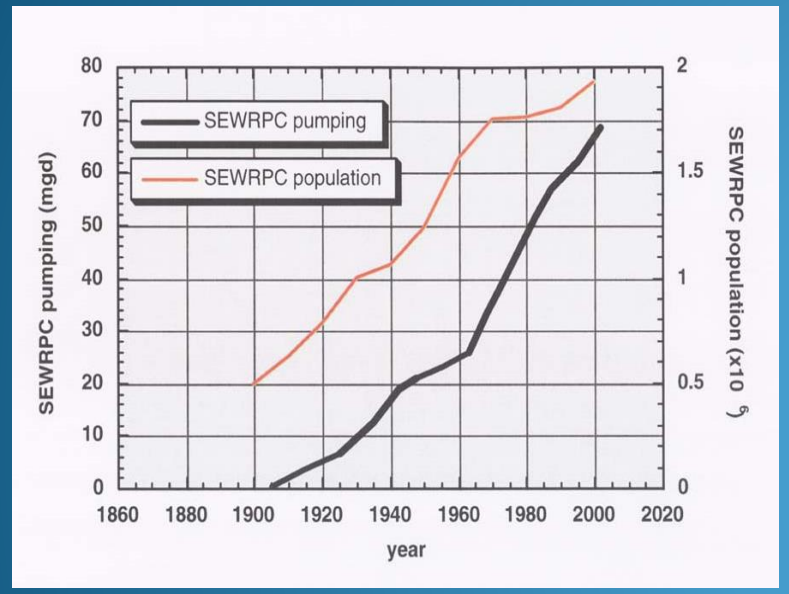
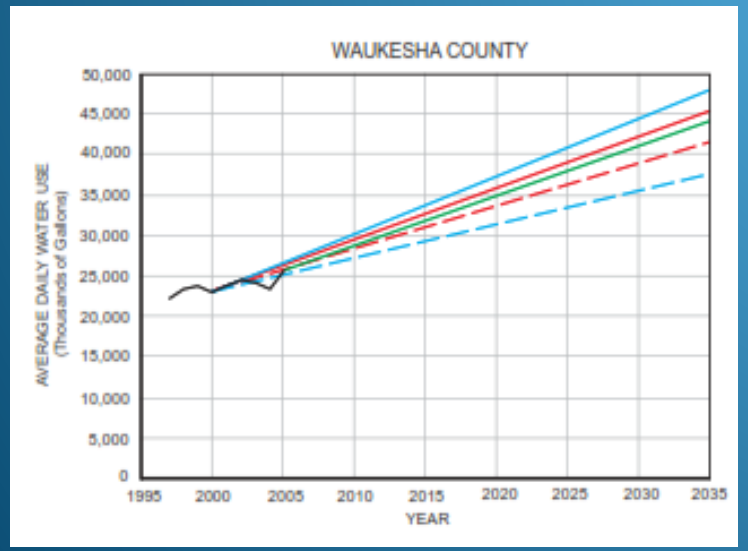


Figure 8. Simulated unsaturated conditions in deep part of flow system: Sinnipee dolomite in year 2000.

- **In 1990s and 2000s chronic declines in the sandstone aquifer received a lot of attention**
- **Water levels dropping up to 5 ft/yr from 1985-1995**
- **SE WI named GMA Under Act 310**
- **Media becomes fixated on Waukesha County running out of water**
- **Portions od sandstone aquifer become unsaturated and exposed to air**

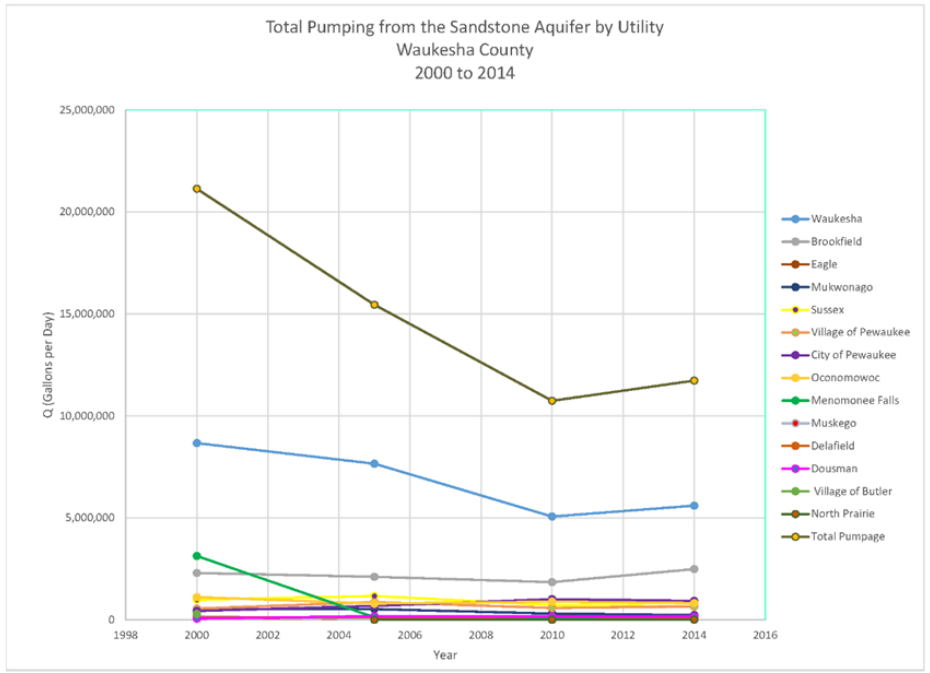
Water demand was rising rising faster than population growth





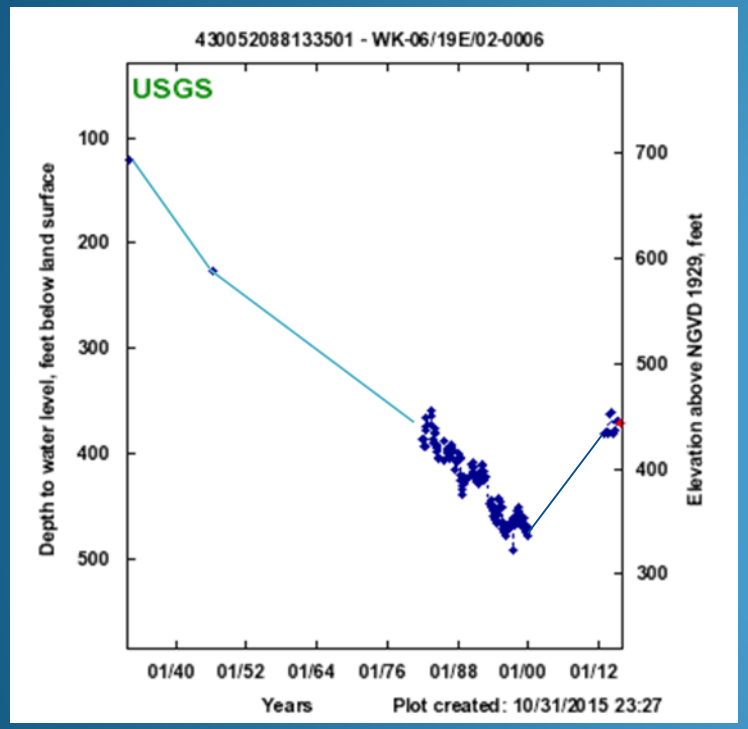
- SE Wisconsin water usage up 42% from 1980 to 2000 while population up about 8%
- Slightly more than half of pumping from sandstone aquifer
- Biggest user in SE Wisconsin is Waukesha County
- 2010 SEWRPC and PSC predictions of 1.5 to 5% per yr for Waukesha County

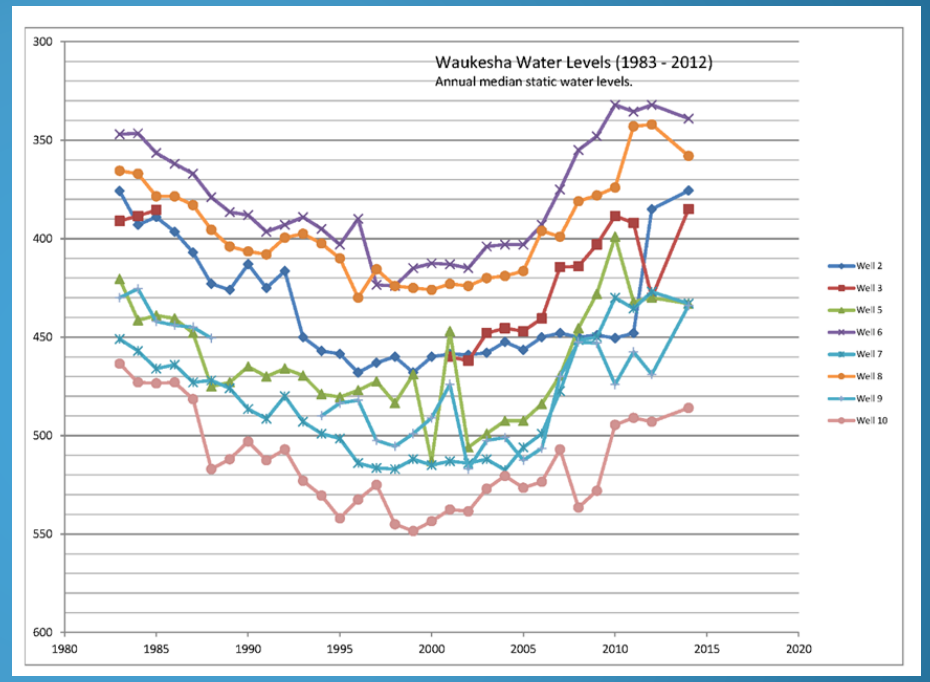
But.....Pumping From Sandstone in Waukesha County Actually Dropped by 50% from 2000 to 2010



- Pumping From Sandstone in Waukesha County Dropped by 50% from 2000 to 2010
- Compliance with Radium standard caused many utilities to blend or replace sandstone wells with shallow aquifer wells
- Overall pumping by utilities has been dropping since about 2000
- The 2010 SEWRPC pumping projections now look way too high
- **Conservation Works!!!**

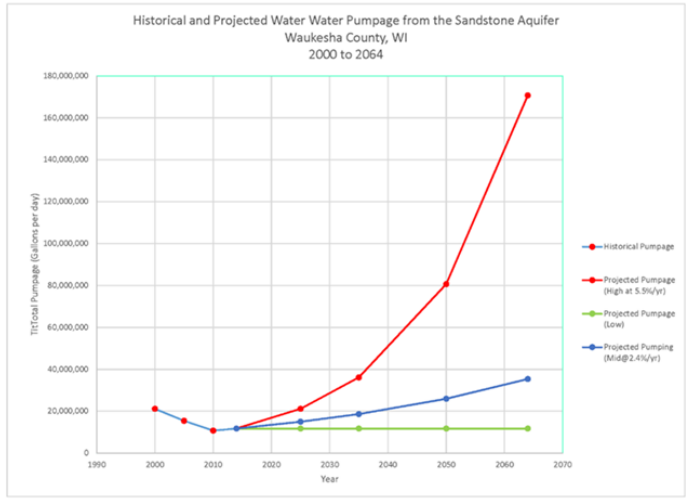
Water Levels Rising In Sandstone Aquifer in Southeastern Wisconsin

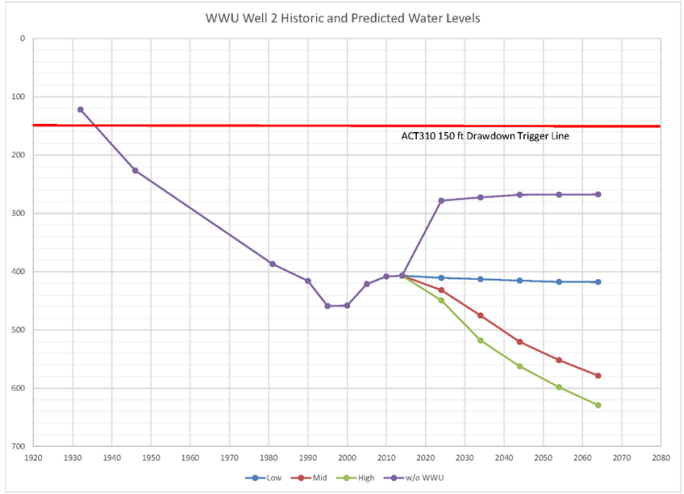




- Water levels declined up to 500 feet from the 1880s to 2000
- Water levels recovered over 100 feet from 2000 to 2015
- Portions of the aquifer that have been exposed to air for decades are resaturated
- May cause changes in Quality

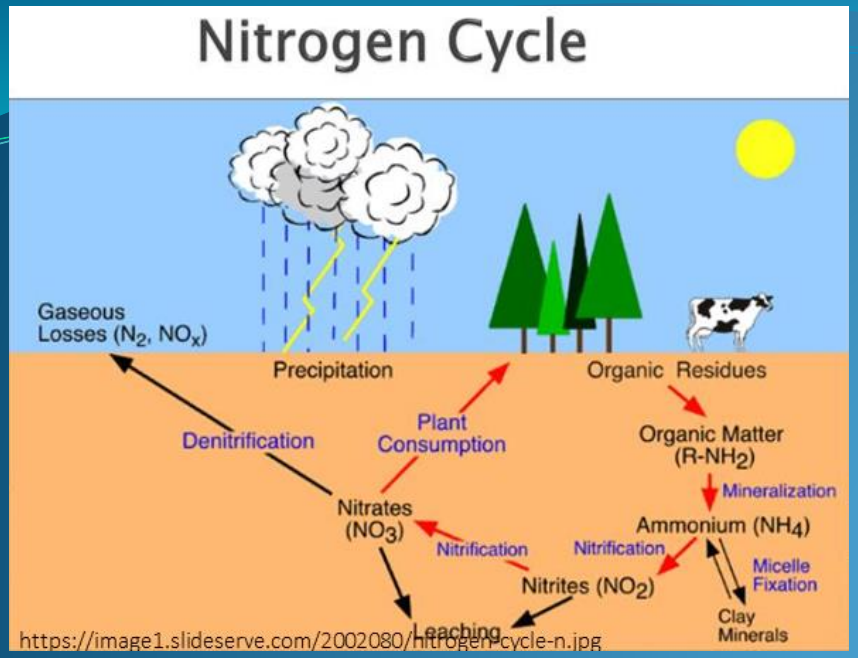
Predicting Future Water Levels



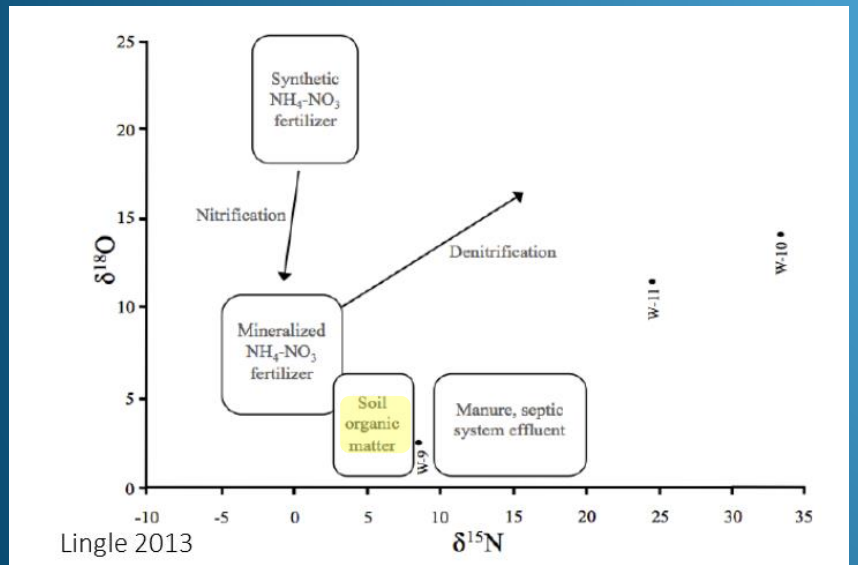


- 2015 modeling using USGS/SEWRPC SE Wisconsin Groundwater model
- Future water levels depend on future water use
- Former high level demand projections would cause 200 to 300 feet more drawdown over 50 years
- Former Mid-level demand projections cause 100 to 200 feet more drawdown
- If current pumping rates are maintained water levels will recover about 10 to 20 feet more
- Removing the WWU wells from the aquifer would cause about 90 feet of additional recovery from current levels
- Will not reach 150 foot total drawdown trigger that would remove area from ACT 310 GMA status

Ammonia in Sandstone Wells



https://image1.slideserve.com/2002080/nitrogen-cycle-n.jpg



Lingle 2013

Figure 10. Relationship between $\delta^{15}N$ and $\delta^{18}O$ from NO_3^- (Modified from Clark and Fritz, 1997). Data from this study (sampling locations W-9 through W-11) are included.

- Ammonia is normally very low in groundwater
- Normally indicates reduction of nitrate in low oxygen environment
- Ammonia is turning up in wells not associate with nitrate contamination including deep sandstone aquifer wells Source can be fingerprinted by isotopic analysis
- The source in three wells in Waukesha County was found to be organic material in the formations of the aquifer (over 200M years old)
- Question is why it is mobilizing now – Possibly related to resaturation of aquifer?
- Will other metals mobilize? As, Fe, Ra, Co, Ni, Sr??

Summary

- Water levels in SS aquifer in SE is a victory for GW management , partially intentional, partially incidental
- Water quality impacts have yet to be determined
- We are running a once in a lifetime geochemical experiment
- Potentially some human health concerns
- Could this be a good research project?
- Possible a few MS theses and maybe a Dissertation or Two??
- Brown County has a smaller scale event for comparison

- **Just another demonstration that a strong water research community is just good public policy**