Desaturation of Sandstone Aquifers in Northeastern Illinois

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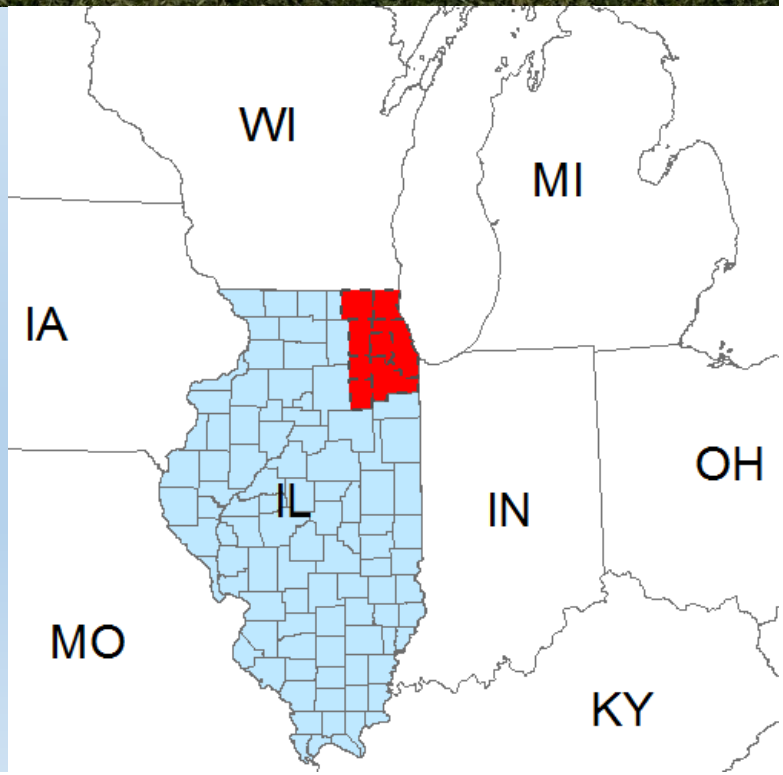
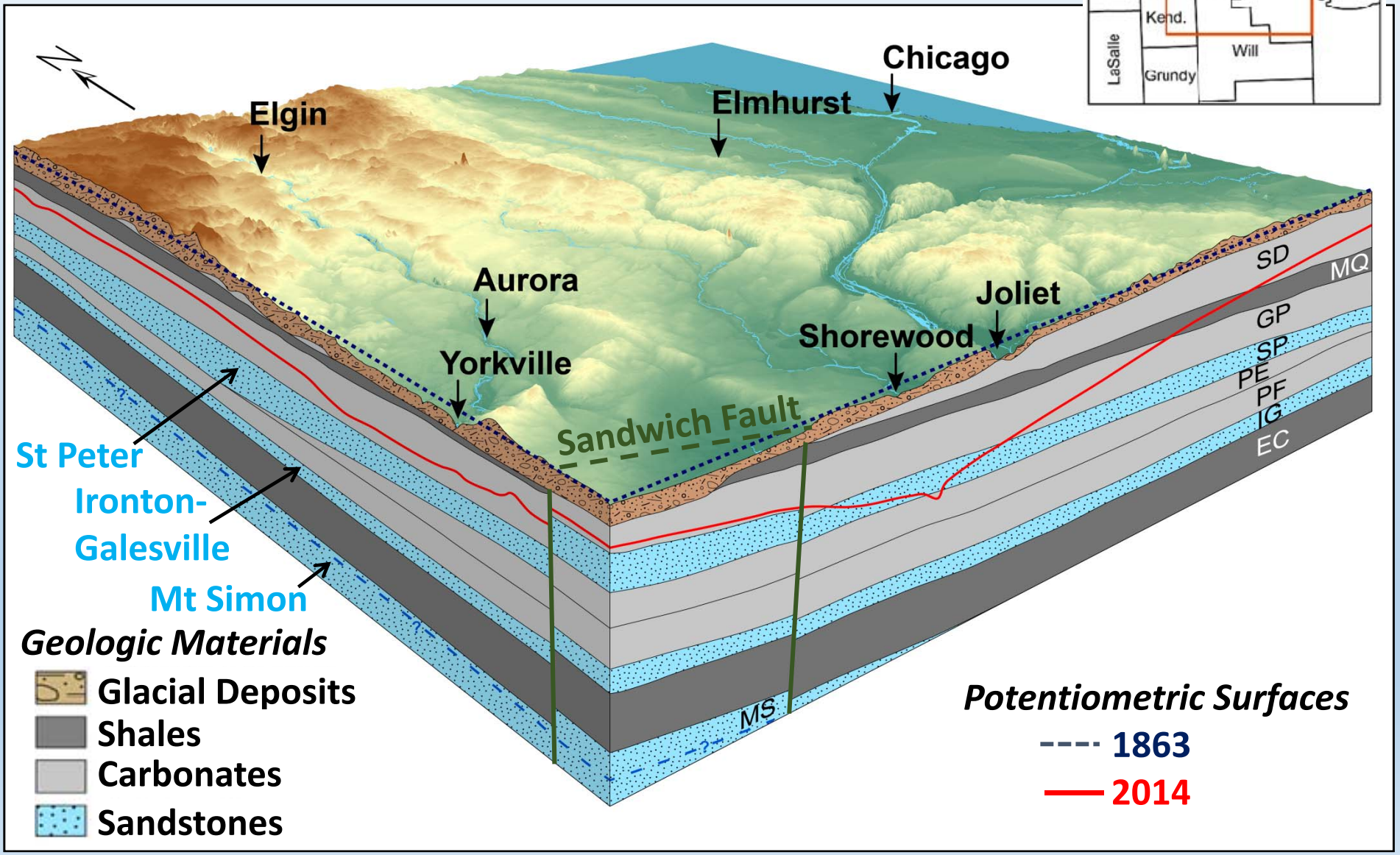
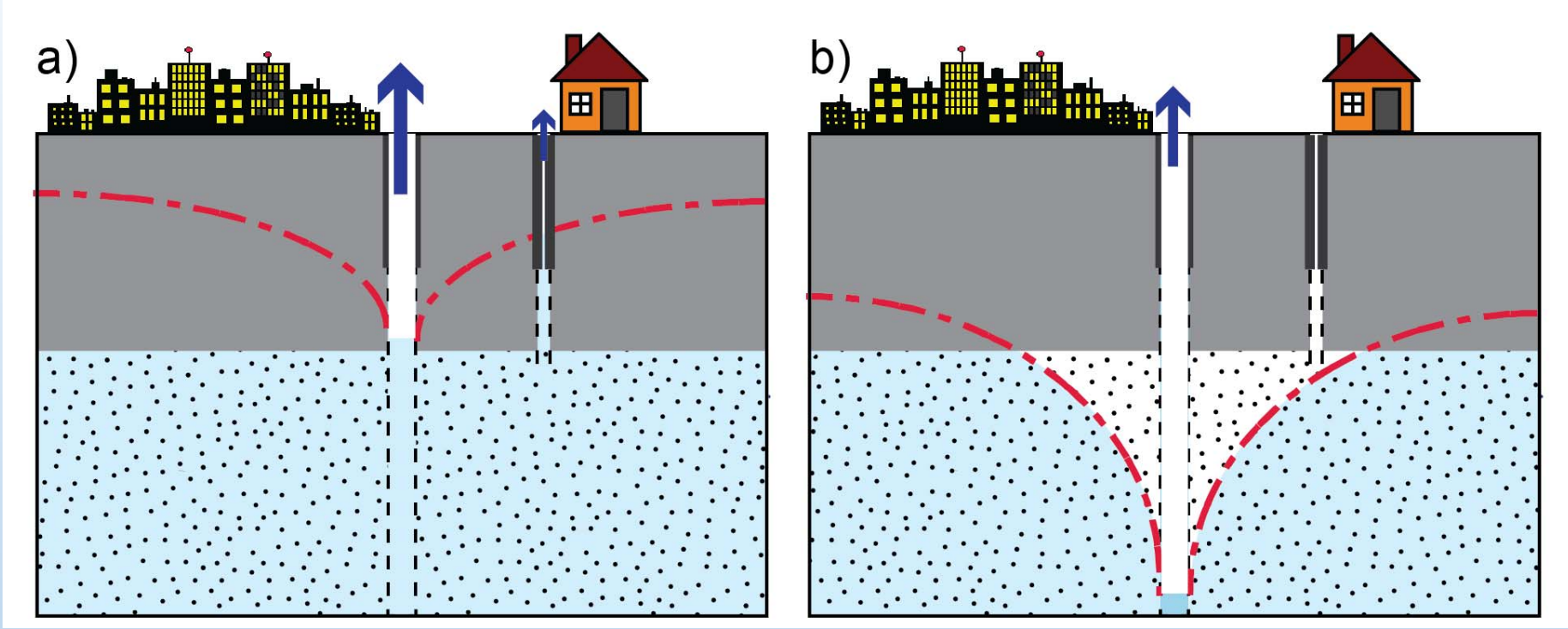


Regional Bedrock Geology



Desaturation of sandstone



Previous ISWS work has examined desaturation of the St. Peter Sandstone.

Future analysis needs to also include the Ironton-Galesville Sandstone.

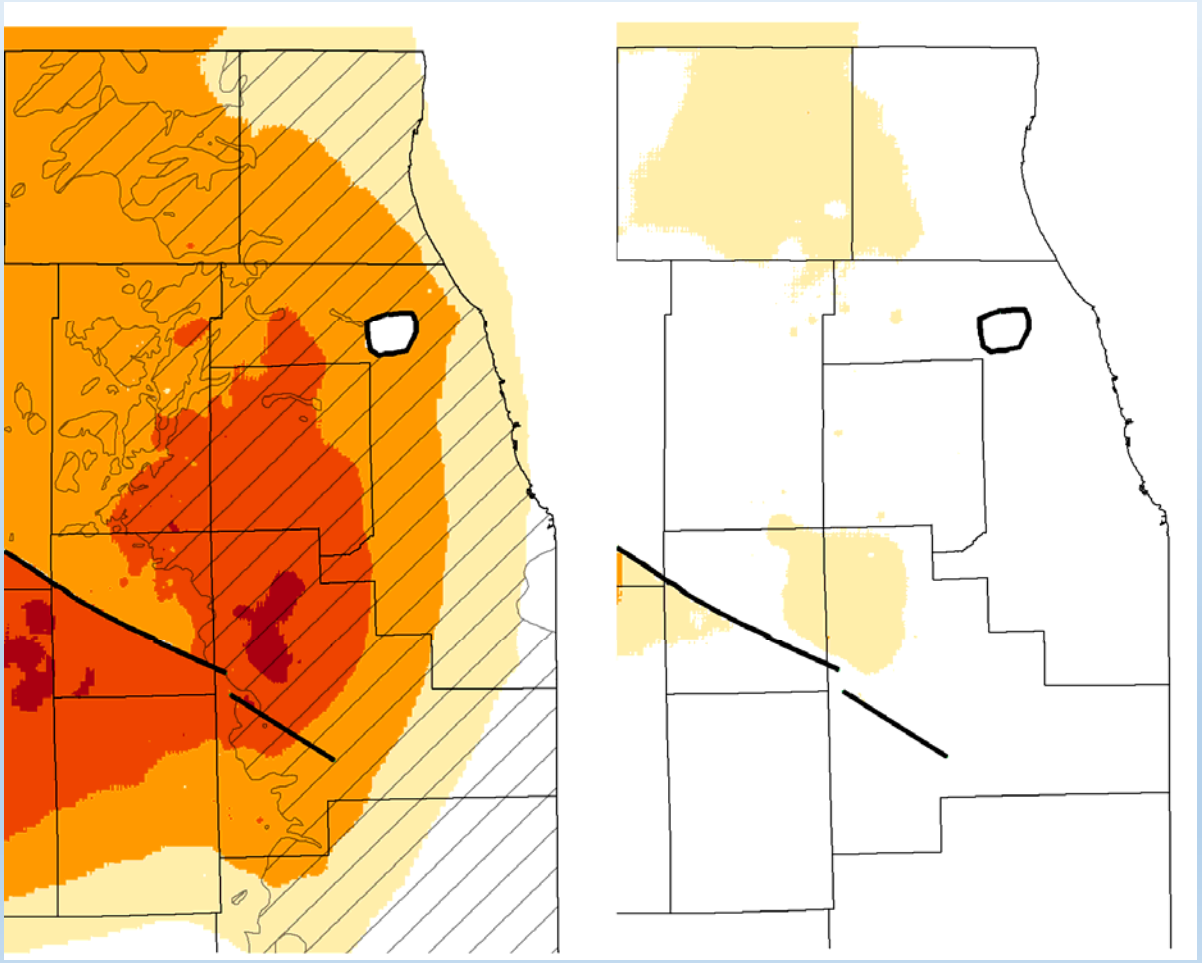
Impacts of desaturating sandstone

	St. Peter	Ironton-Galesville
Lost well capacity (including dry wells)	Residential; Some public and industrial	Most public and industrial
Water quality impacts	Arsenic (Wisconsin)	Unknown
Caving potential (well sucks sand)	Only when pumping equipment lowered into sandstone	May occur when pumping equipment is within 200 ft of the top of the sandstone

Desaturation (static water levels)

St. Peter

Ironton-Galesville



Head above sandstone (ft)

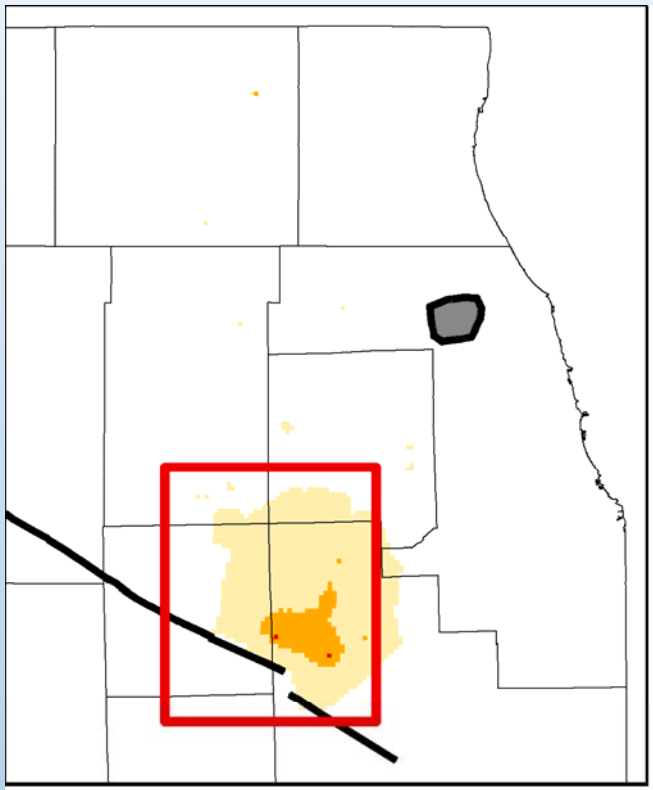
- < 0
- 0 – 200
- 200 – 400
- 400 - 600

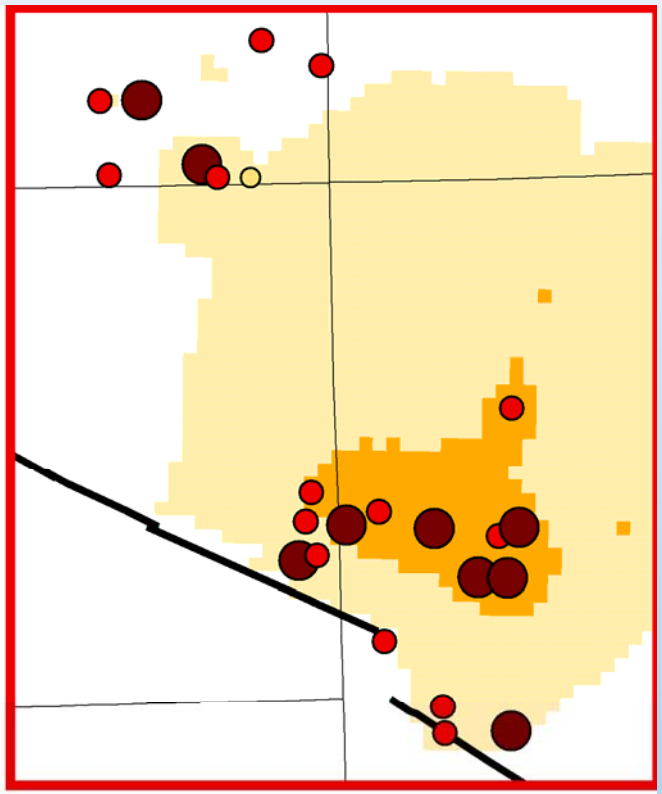
Bedrock Fault

Unweathered Shale

0 15 30 60 km

How close is the Ironton-Galesville to being partially desaturated?





Percent available head remaining (static)

20 - 30
30 - 40
40 - 50
> 50

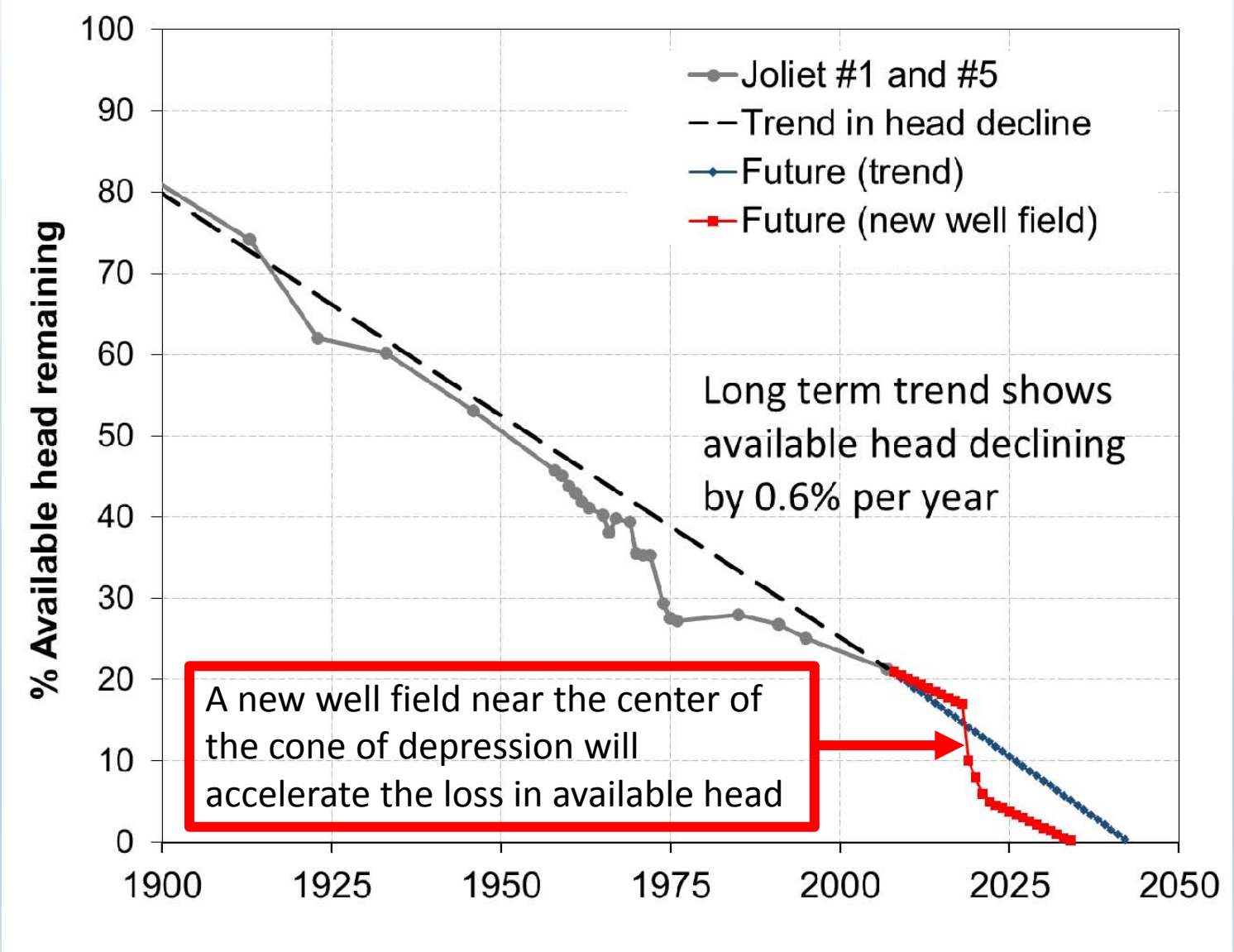
Percent available head remaining (pumping)

10 - 20
20 - 30

How long before the Ironton-Galesville is partially desaturated?

- As little as 15% of the original (1863) available head above the Ironton-Galesville remains.
- 0.6% of the original available head is lost each year.
- At this rate, the Ironton-Galesville will become desaturated in **25 years** at the center of the cone of depression

Example (Approximate pumping head)

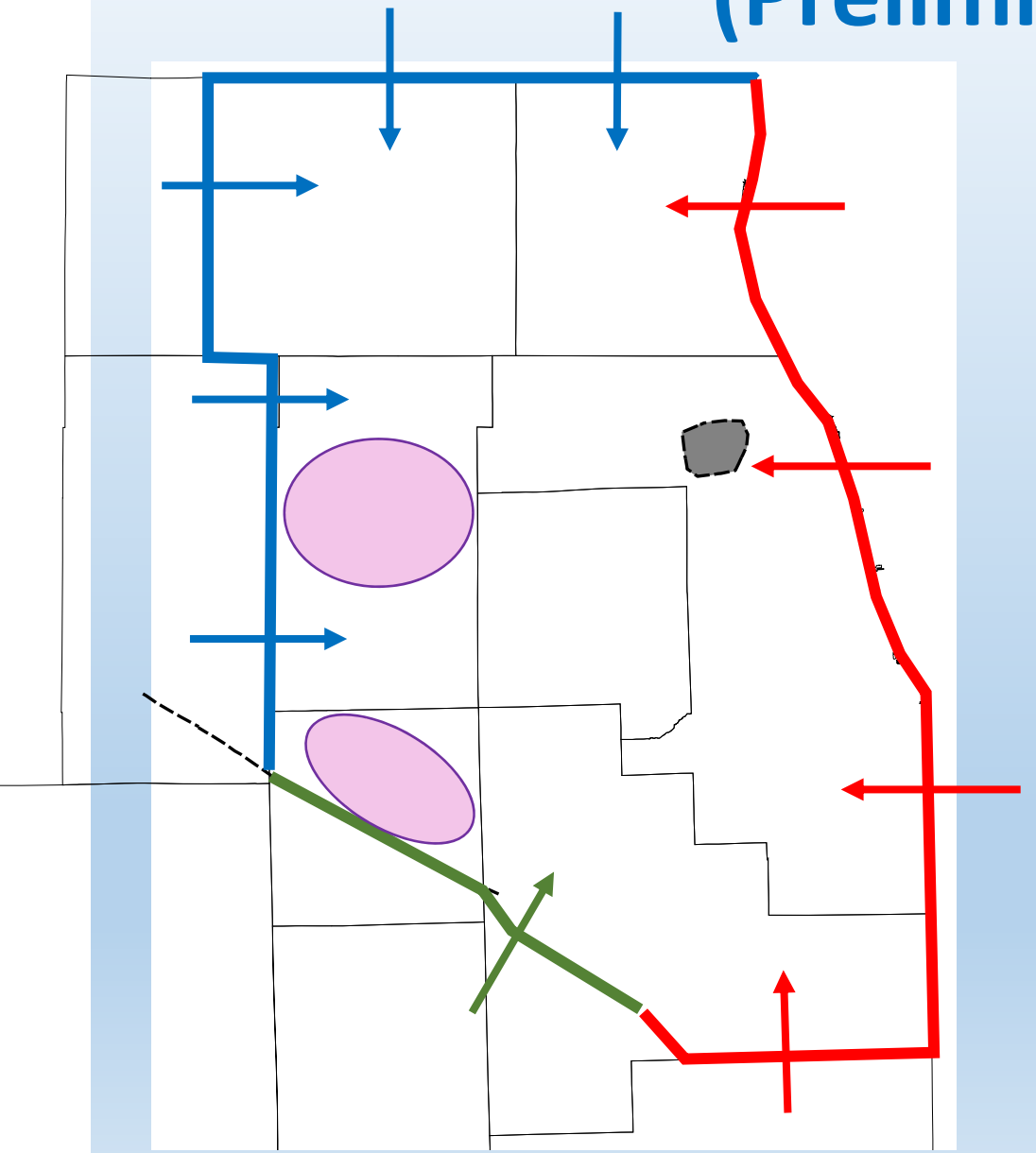


Two methods for estimating when the Ironton-Galesville will start to desaturate

Trends in water levels	Groundwater flow model
25 years	15-25 years

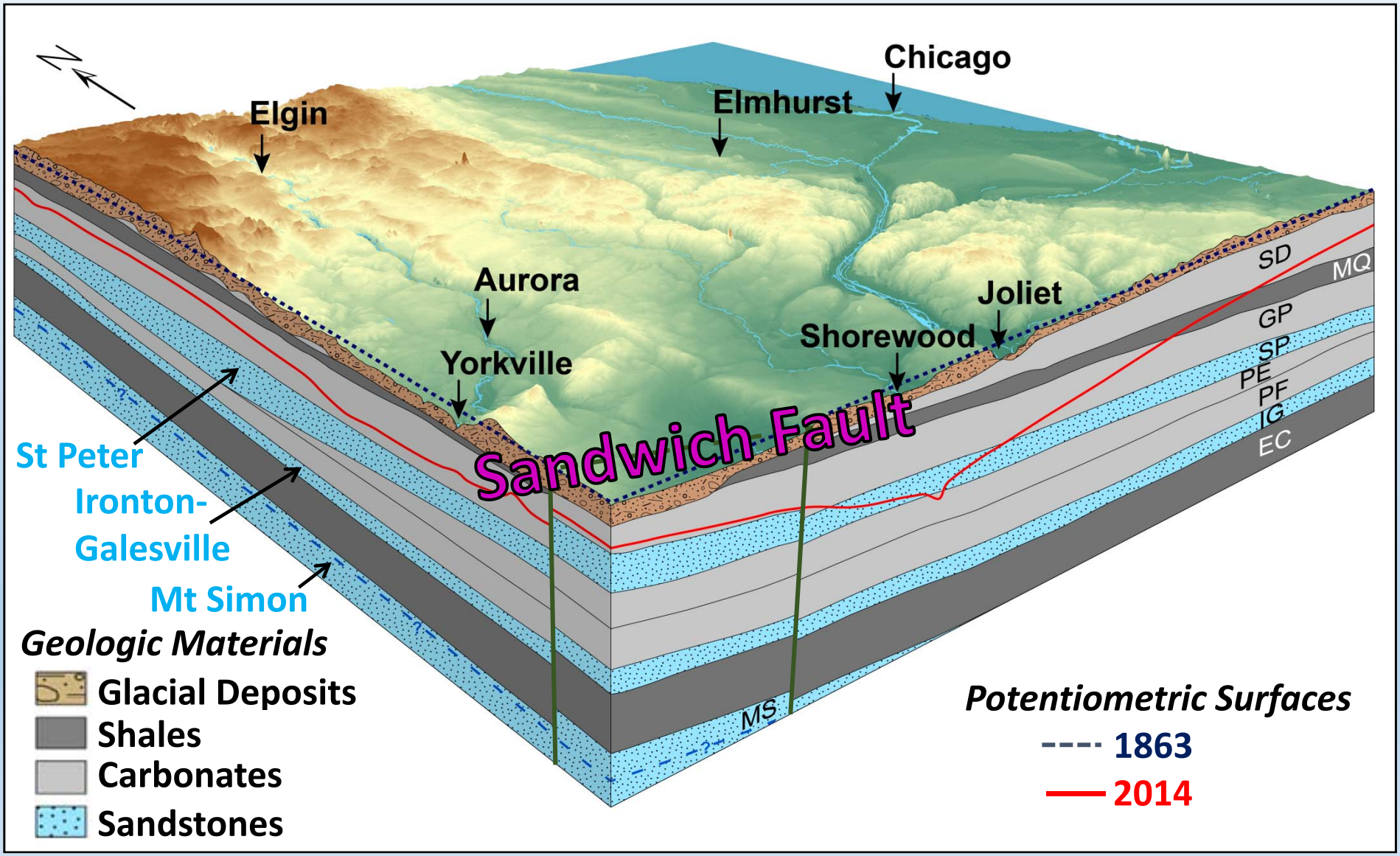
Actual time-frame will be shortened with the construction of new well fields

Source of water in NE Illinois (Preliminary)



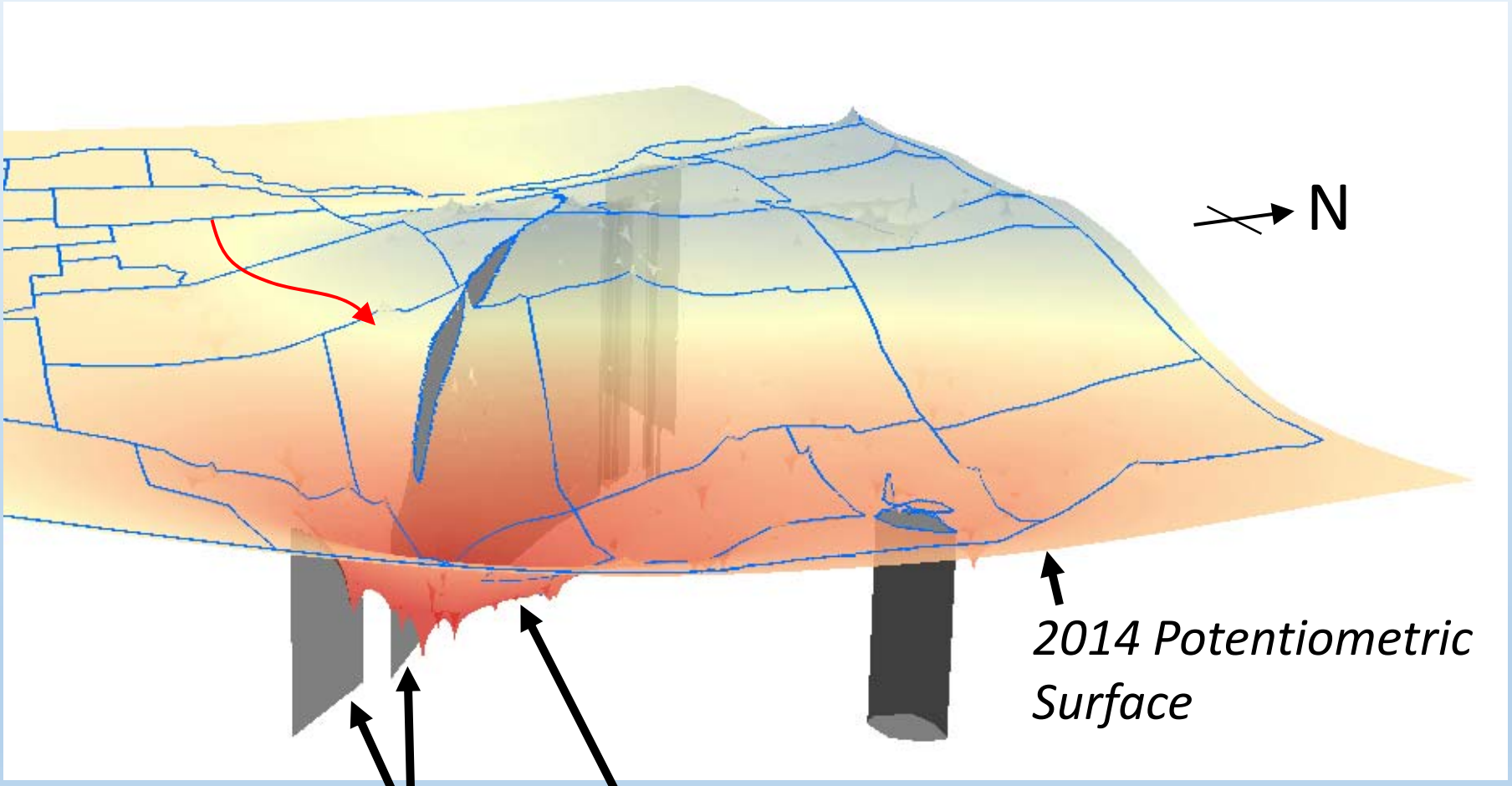
Source	MGD
Total Pumpage	69
Recharge Zone	14.7
Deep Basin	12.6
Fault Zone	14.3
Other Aquifers	16.7
Storage	10.7

Flow Across the Sandwich Fault Zone



Sandwich Fault Zone in 3D

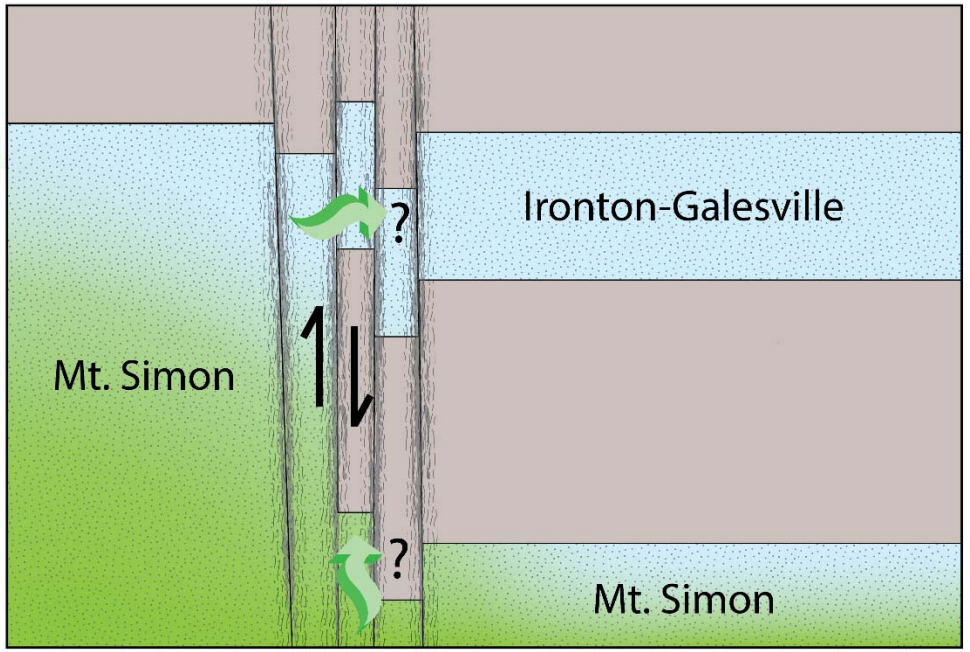
- Distinct jump in heads across the fault, with lowest heads on the north side



Conceptualization of fault

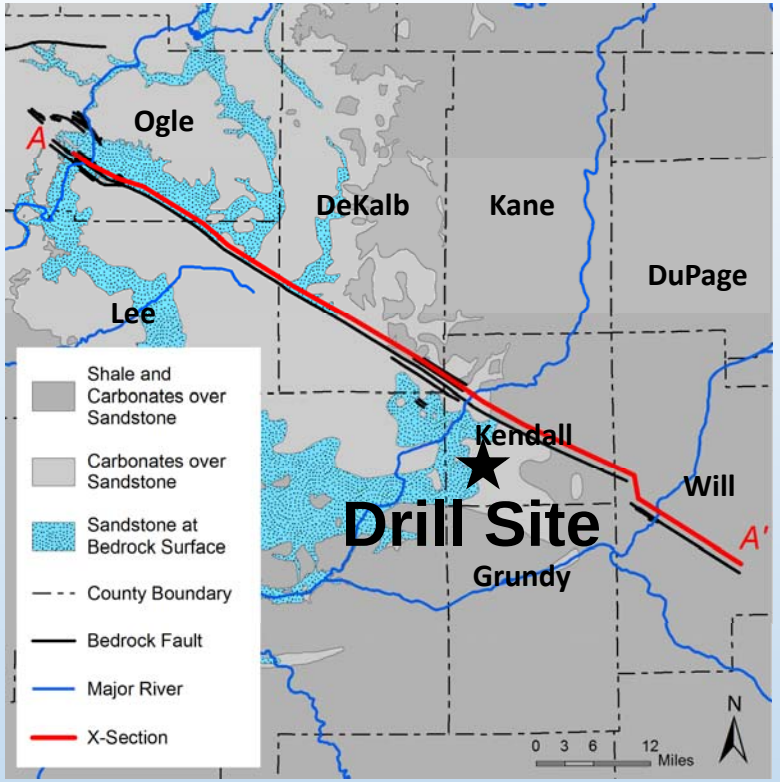
Sandwich Fault is a series of up and down thrown blocks

Flow may be impeded even when units are not completely offset, but to what degree?



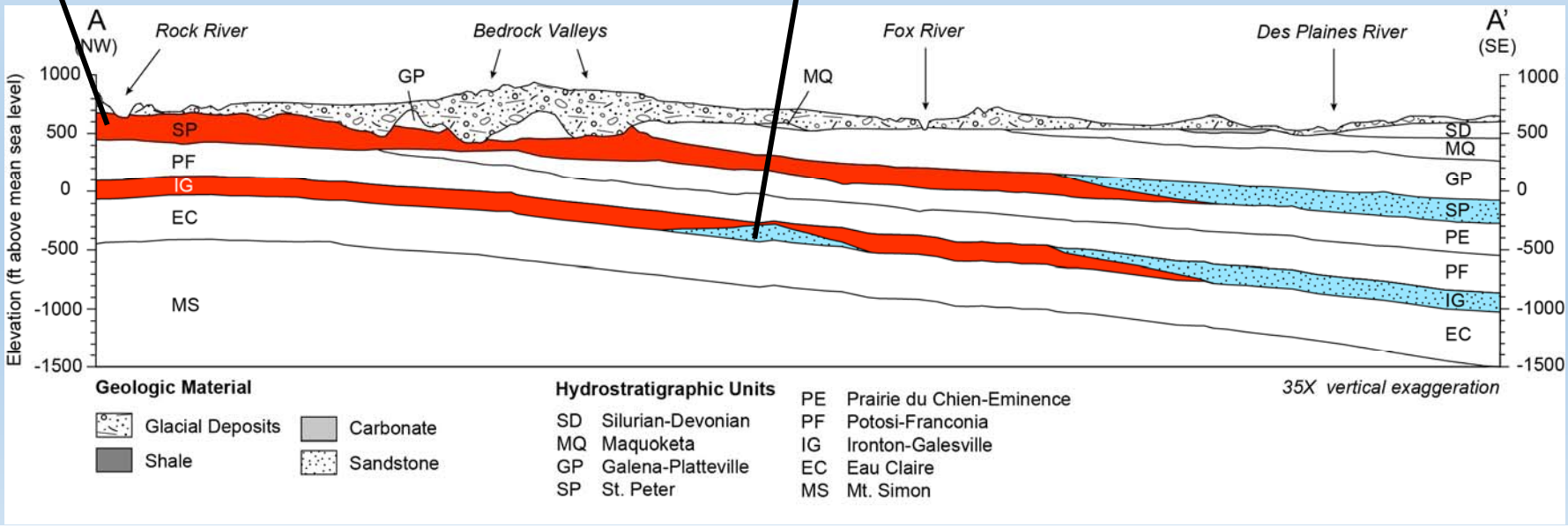
Limited Contacts Along the Fault

Cross-sectional image indicates where sandstone layers are not in contact on the north and south sides of the fault (red zones)



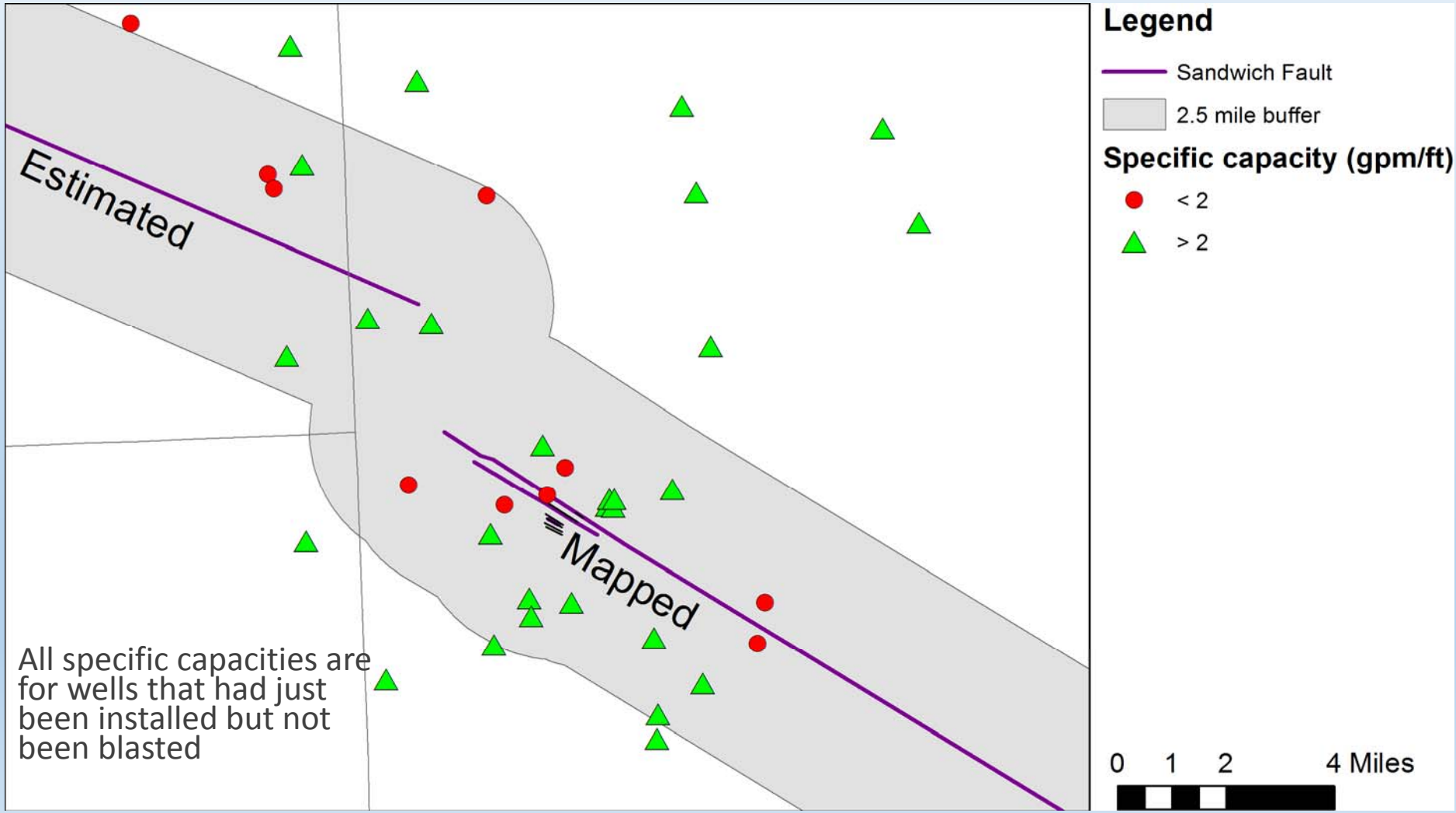
Red: Flow limited across fault

Blue: Flow uncertain across fault



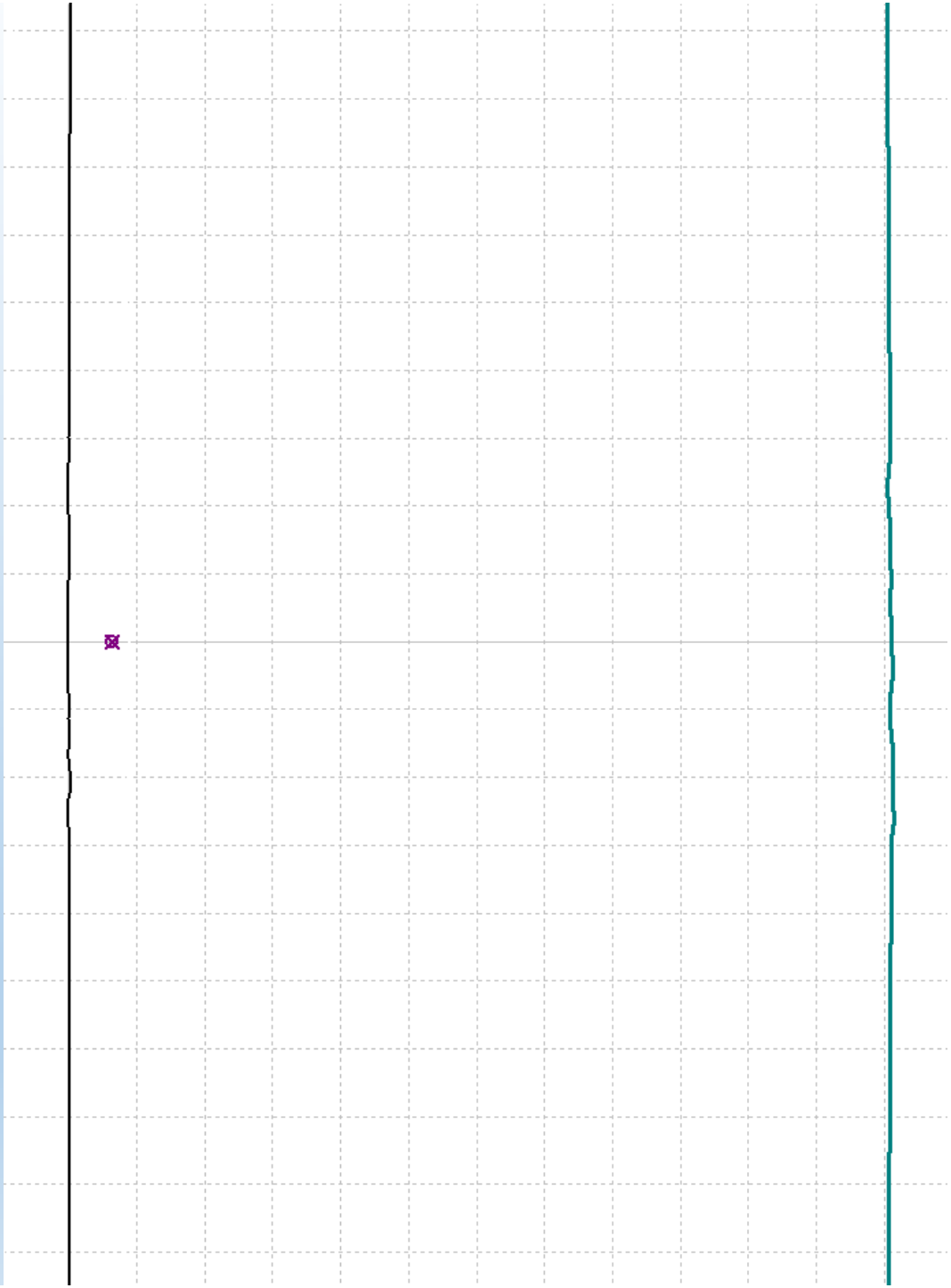
Specific Capacity in Sandwich Fault zone

Specific capacity = Q/drawdown



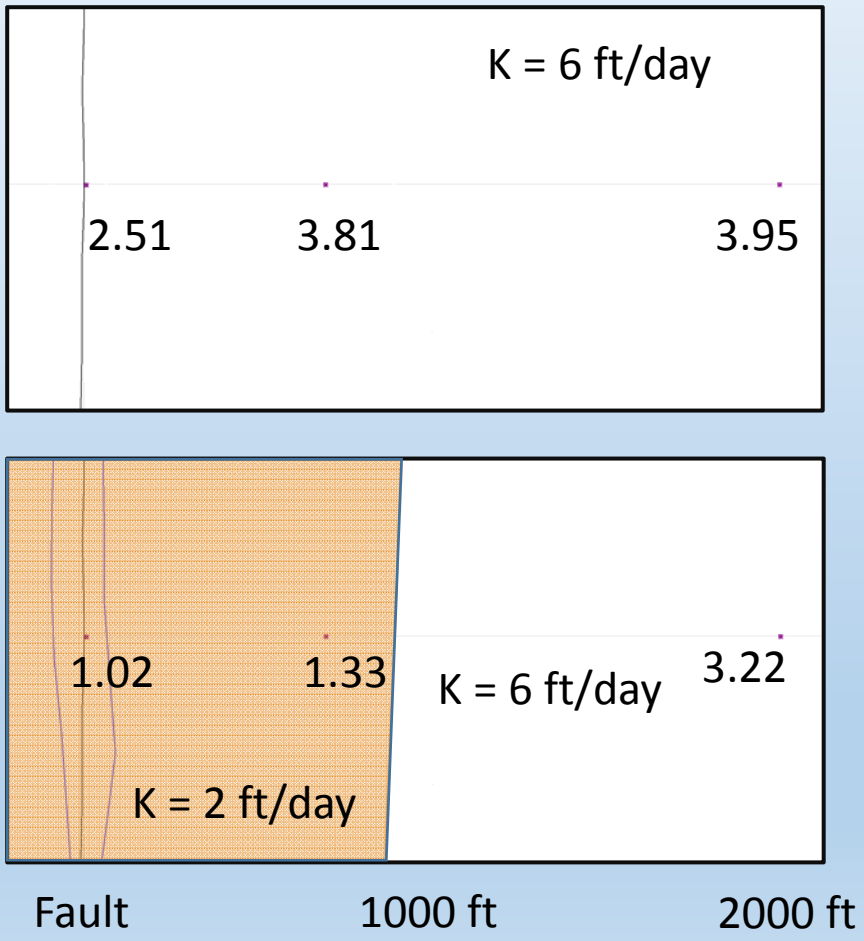
Small specific capacity

- Can we simulate specific capacity less than 1?
- MODFLOW model can't answer this without refining the grid
- Test with the analytic element model GFLOW
  - Thickness and k equivalent to the Ironton-Galesville
  - Well moved incrementally close to the no flow boundary



Sandwich Fault (local)

- Proximity to low flow boundary alone does not explain the low specific capacity
- Lowering permeability near fault zone was necessary
  - Smaller normal faults that impede flow
  - Precipitate of materials within the fractures adjacent to the fault



How communities and industries can help

Please contact the ISWS if you have plans to:

1. change water sources or add a new well field. The ISWS has the capability to model different scenarios to assist with water supply planning.
2. seal a sandstone well. The ISWS often converts production wells into monitoring wells.
3. rehabilitate a well or lower a pump. This may provide an opportunity for a detailed geophysical analysis.