Effects of Future Pumping on Deep Groundwater Quality

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Illinois State Water Survey

Potential Problems

- Dewatering of base of Galena-Platteville unit: higher arsenic
- Dewatering of Ancell unit: higher radium and barium
- Northward and upward migration of salty water into the Ancell and Ironton-Galesville units in northeastern Illinois: higher chlorides and dissolved solids.

Dewatering of Base of Galena-Platteville

Consequences in Wisconsin

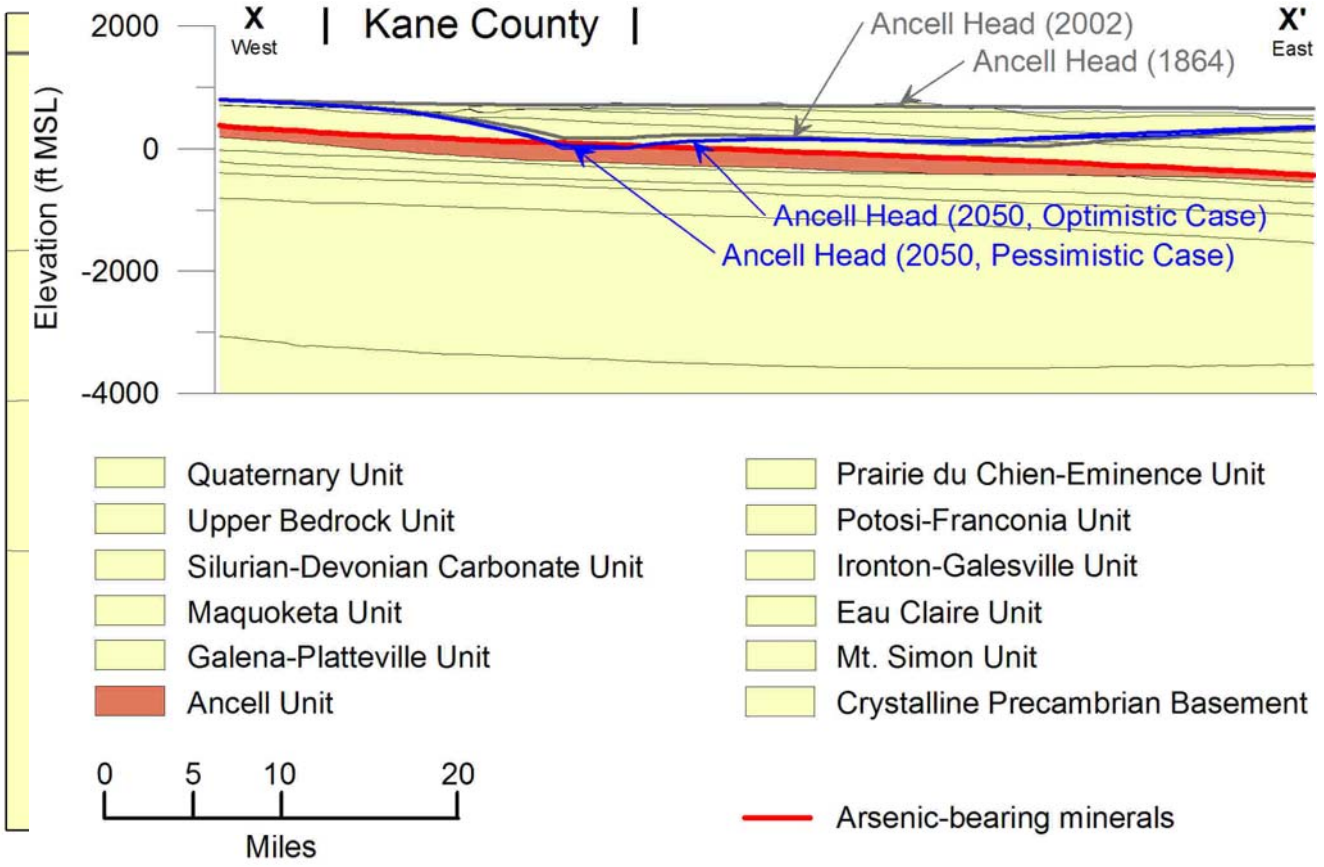
- Naturally-occurring arsenic impurity in common minerals (pyrite, marcasite) in base of Galena-Platteville
- Arsenic released when exposed to oxygen
- Oxygen introduced through lowered water levels caused by pumping
- Arsenic concentrations as high as 12,000 micrograms/liter (µg/L) (Drinking water standard is 10 µg/L)

Dewatering of Base of Galena-Platteville

Arsenic Source in NE Illinois?

- The pyrite and marcasite are present at the base of the Galena-Platteville in NE Illinois, but …
  - Not known whether arsenic impurity is present
  - Base of Galena-Platteville has not been dewatered
  - High levels of arsenic not reported in NE Illinois.

Potential for Dewatering of Base of Galena-Platteville Unit in Northeastern Illinois



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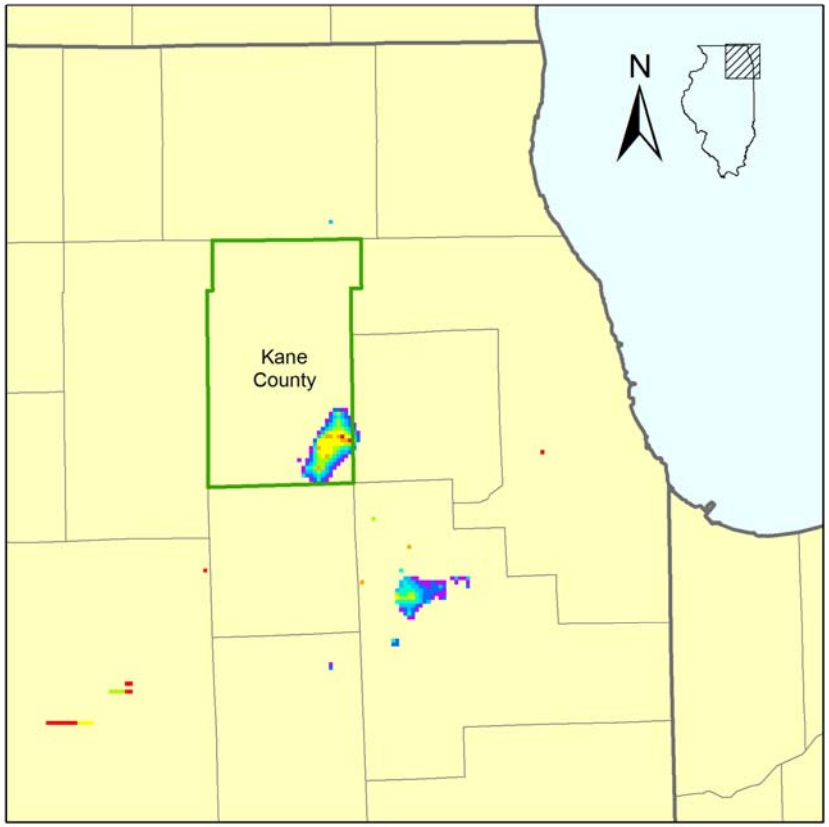
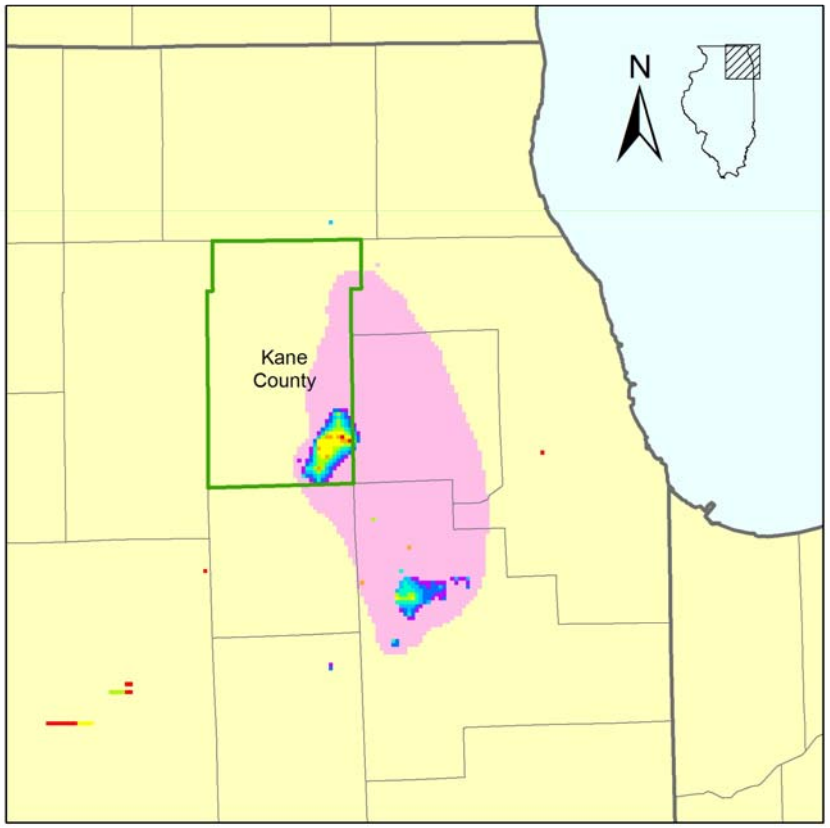


Estimated Areas of Dewatering of Base of Galena-Platteville

Pessimistic Scenario
(High Pumping, Low Recharge)

- 2015
- 2020
- 2025
- 2030
- 2035
- 2040
- 2045
- 2050

Potential for Dewatering of Base of Galena-Platteville Unit in Northeastern Illinois



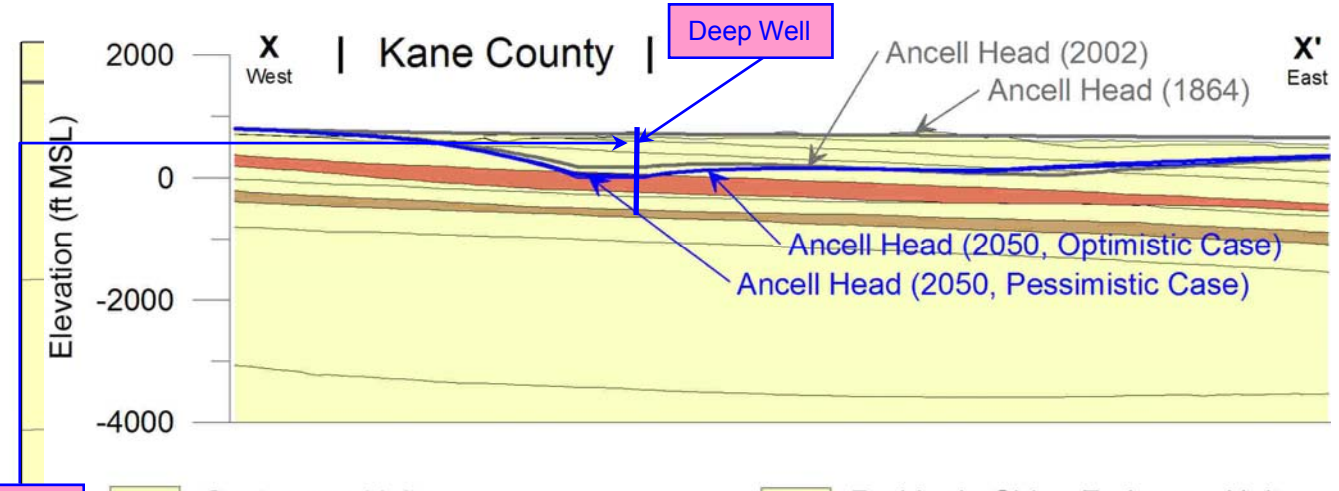
Pessimistic (with dewatered area resulting from extended pumping of 2002 network)

Estimated Areas of Dewatering of Base of Galena-Platteville

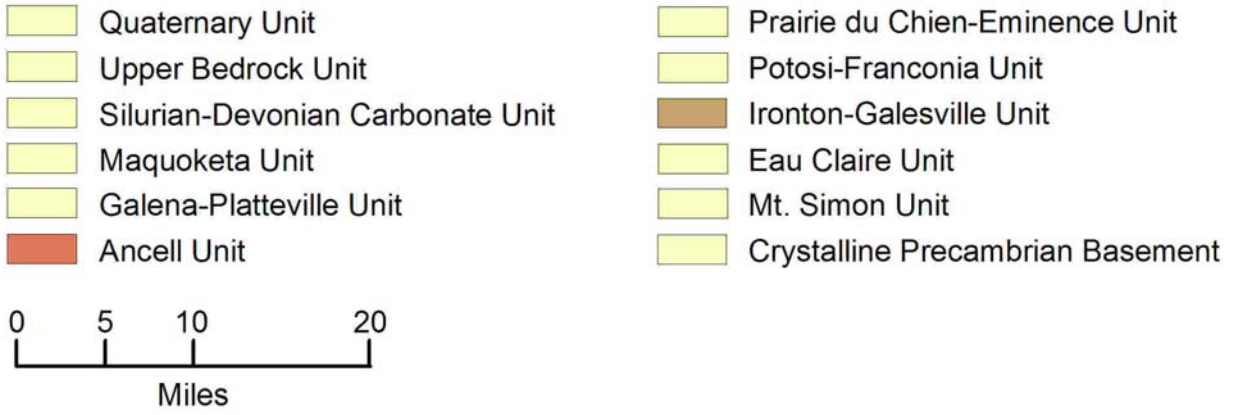
- 2015
- 2020
- 2025
- 2030
- 2035
- 2040
- 2045
- 2050
- After extended pumping of 2002 network

Dewatering of the Ancell Unit

Less Dilution of Poorer-Quality Ironton-Galesville Water



Typical Deep Well
- Pumped water is blend of Ancell and Ironton-Galesville water
- Ancell dewatering will reduce dilution of Ironton-Galesville water; pumped water quality will deteriorate



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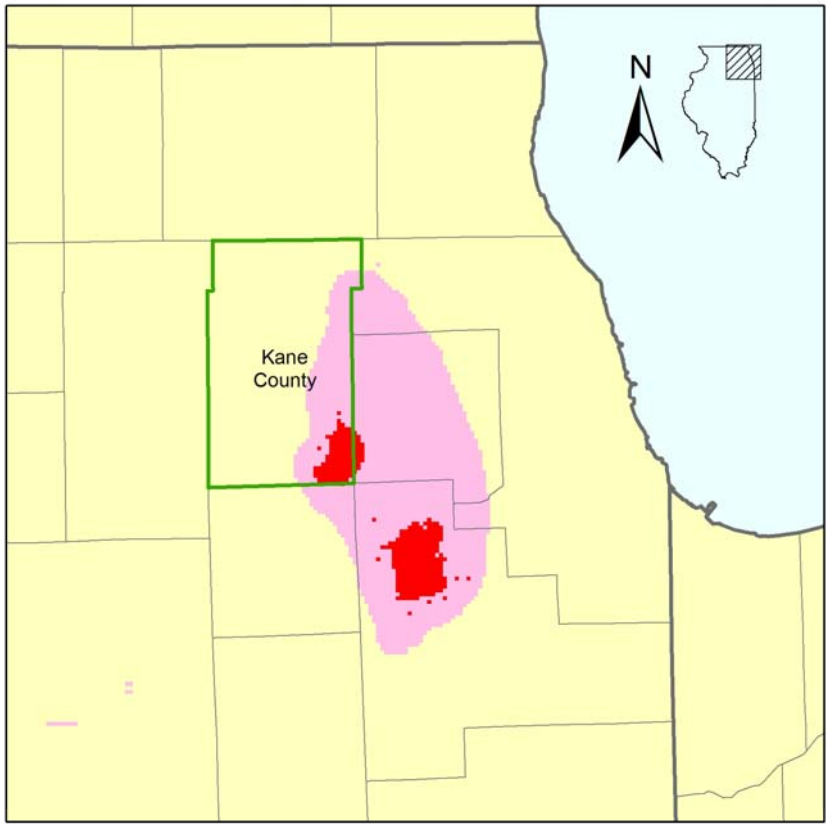

Estimated Areas of Dewatering of the Ancell Unit

Extended Pumping of 2002 Network
(High Pumping, Low Recharge)

- 2015
- 2020
- 2025
- 2030
- 2035
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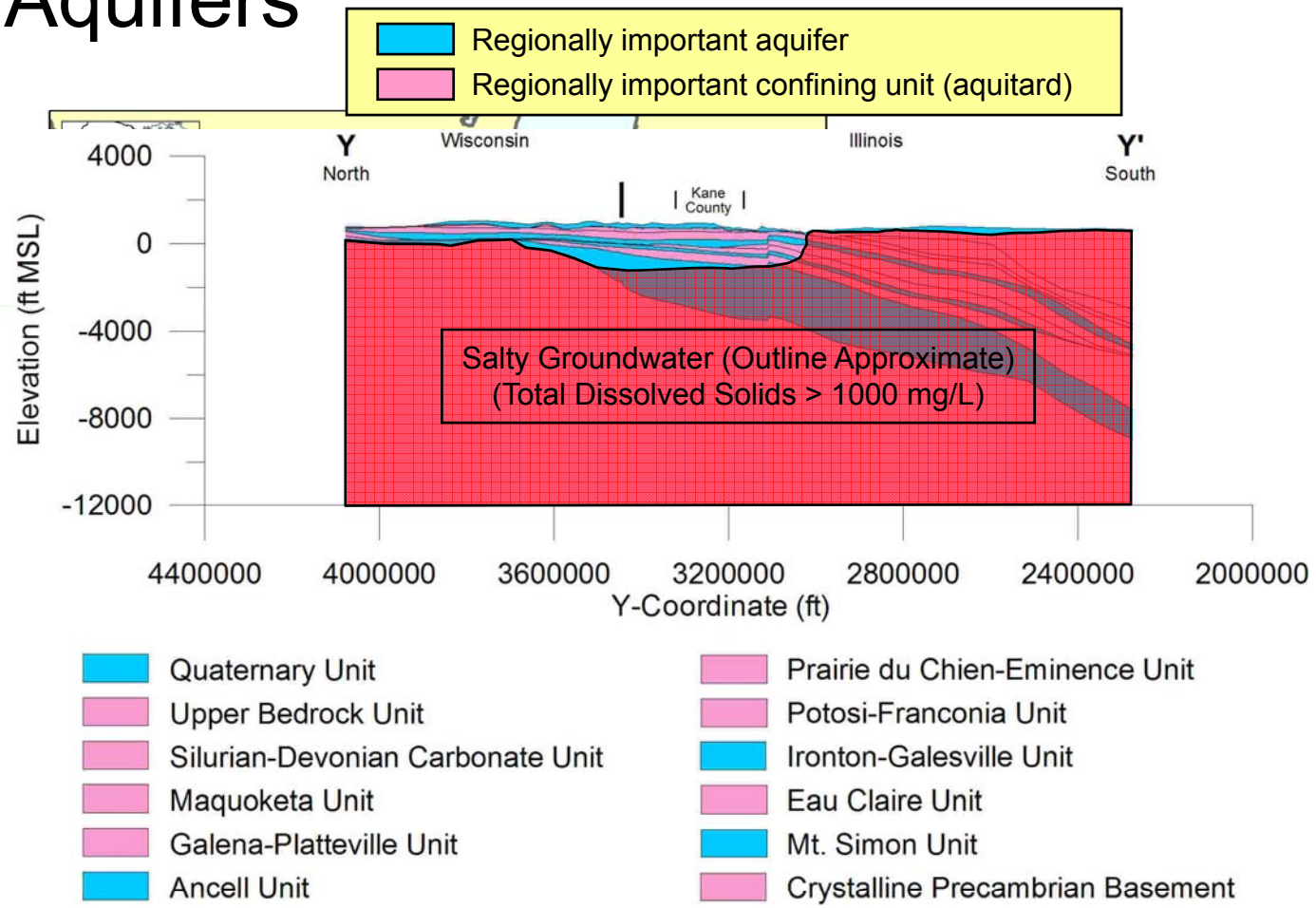
- 2050

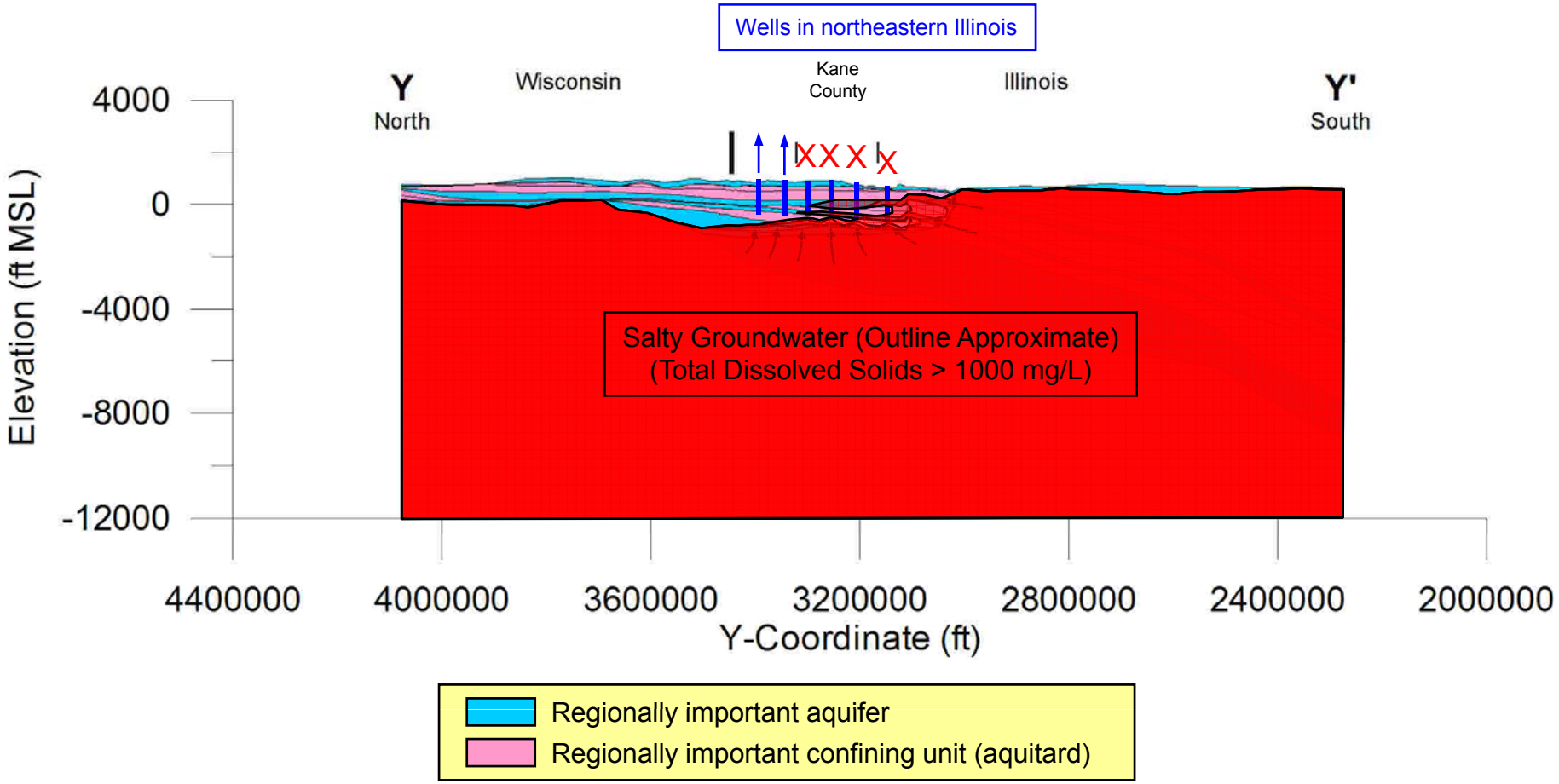
Partial dewatering

Complete dewatering

Migration of Salty Groundwater into Deep Aquifers



Migration of Salty Groundwater into Deep Aquifers



Migration of Salty Groundwater into Deep Aquifers

- Saltwater encroachment well known in coastal areas.
- Not recognized in NE Illinois, yet pieces in place:
  - Ancell and Ironton-Galesville contain salty water to south.
  - Mt. Simon contains salty water here.
  - Appropriate head gradients exist.
- Data show a slight upward trend in total dissolved solids (TDS) at Aurora and Joliet.

Summary

- Pumping could cause deep groundwater quality to deteriorate in NE Illinois.
  - Dewatering of base of the Galena-Platteville unit (higher arsenic).
  - Dewatering of the Ancell unit (higher radium and barium).
  - Northward and upward migration of salty water into the Ancell and Ironton-Galesville units in northeastern Illinois (higher chlorides and dissolved solids).
- Additional study is required.