

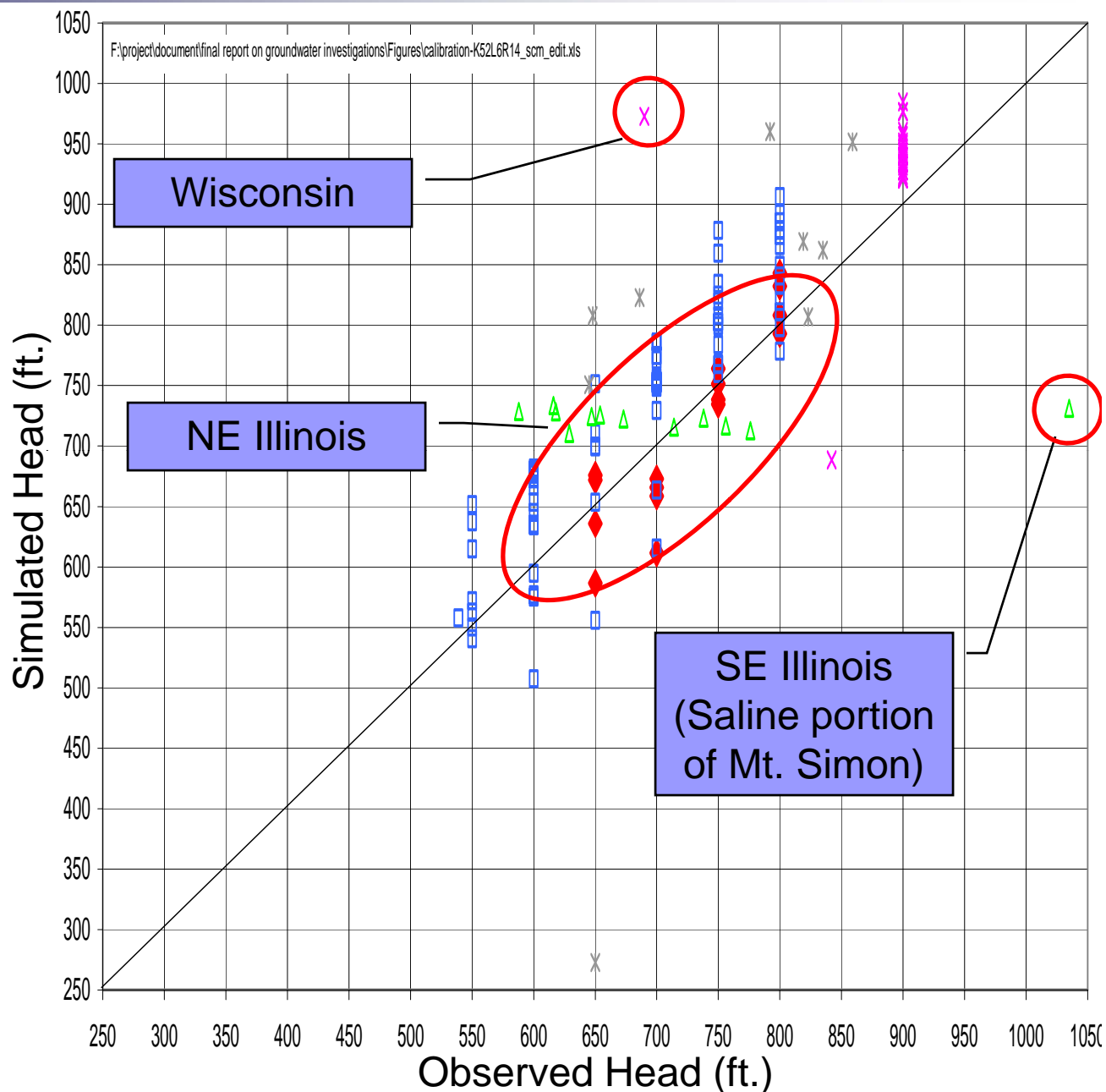
Effects of Historical Pumping on Deep Groundwater Circulation

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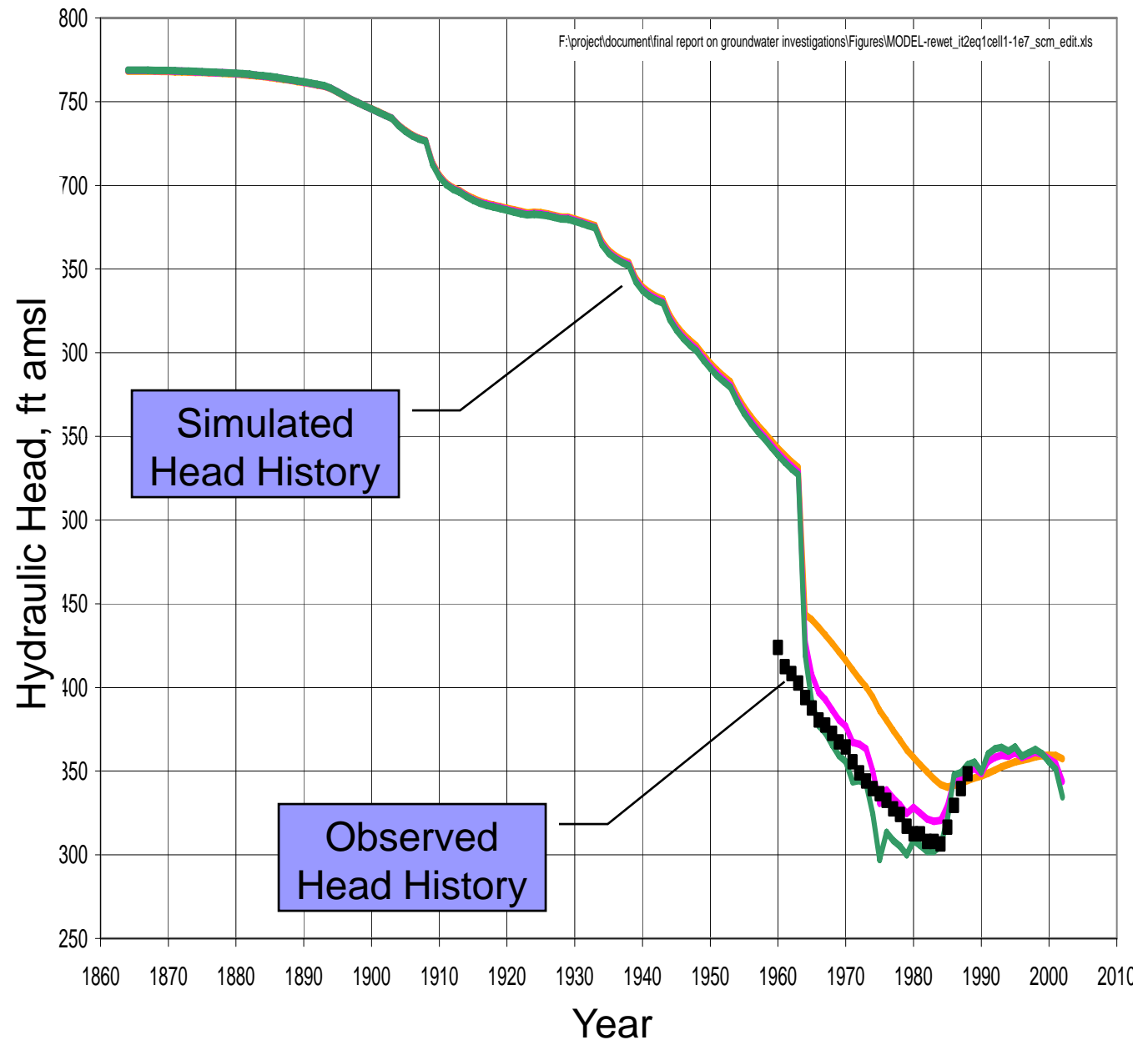
Calibration in Deep Aquifers

- Adjust model and parameters to match simulations to observations.
- Best match in NE Illinois.

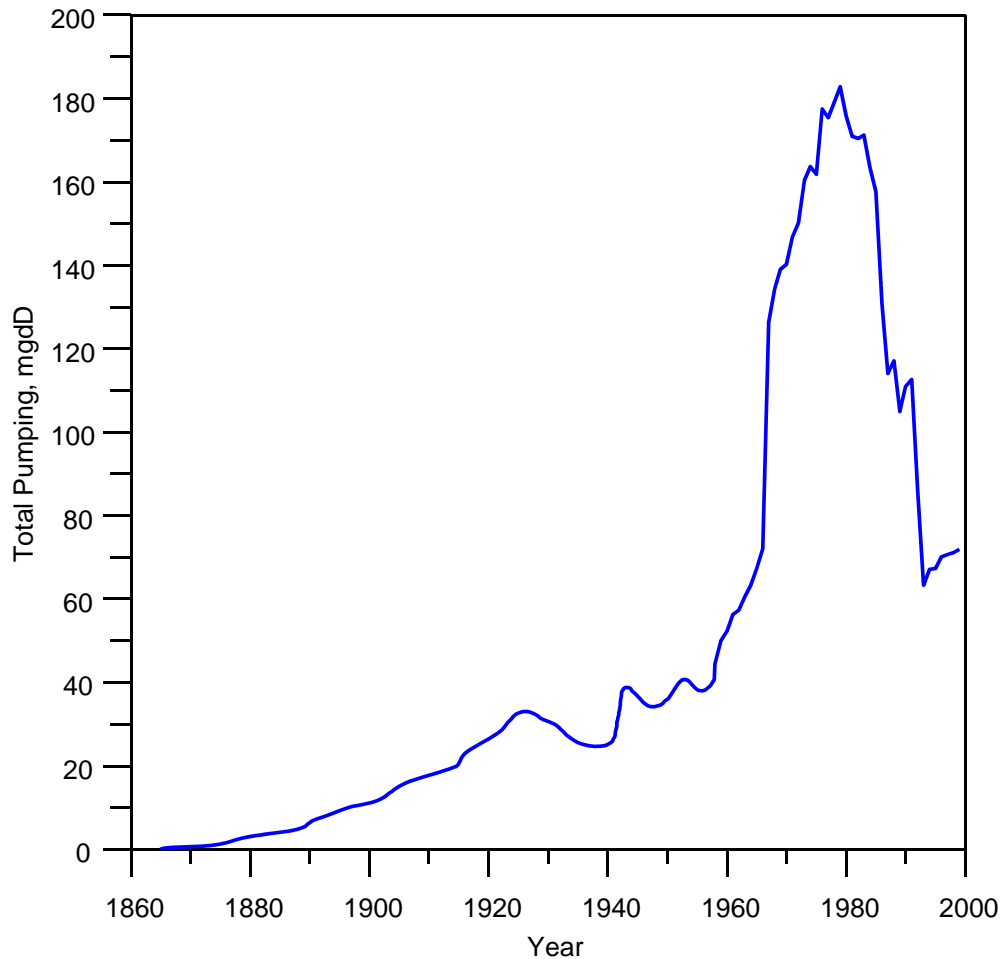


Verification in Deep Aquifer

- Confirm calibration by simulating historical response to pumping.
- Best match in Kane Co. (Elgin)



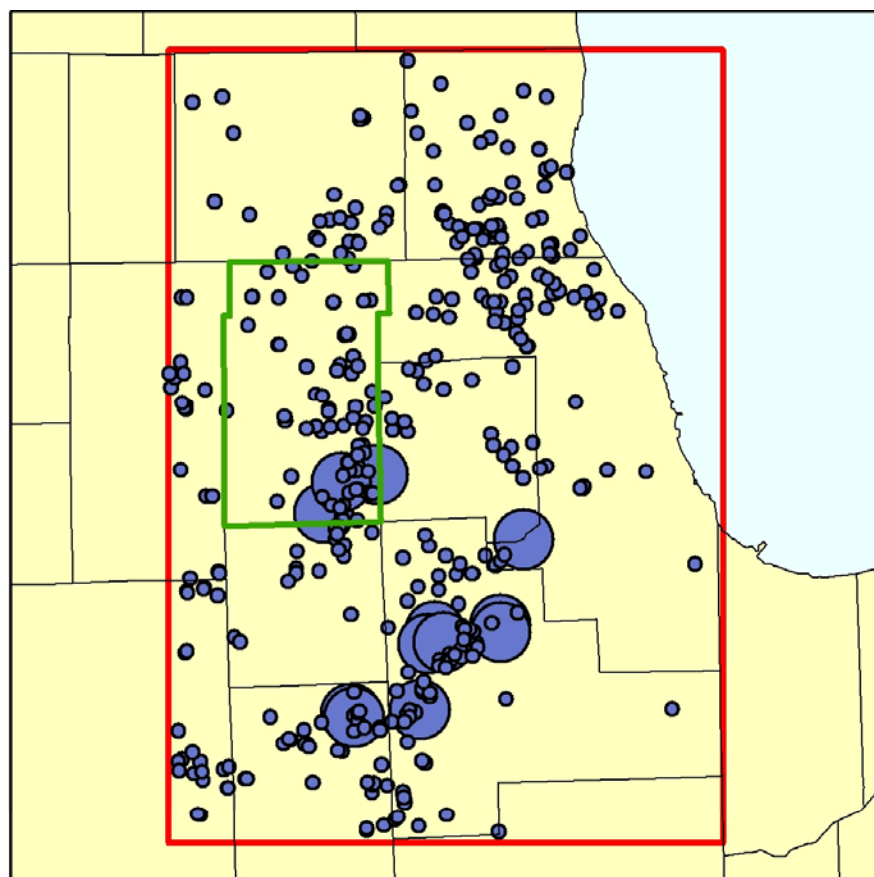
Historical Pumping of Deep Aquifer



- Large-scale pumping of deep aquifer begins in 1864
- Model is used to simulate effects of pumping to 2002

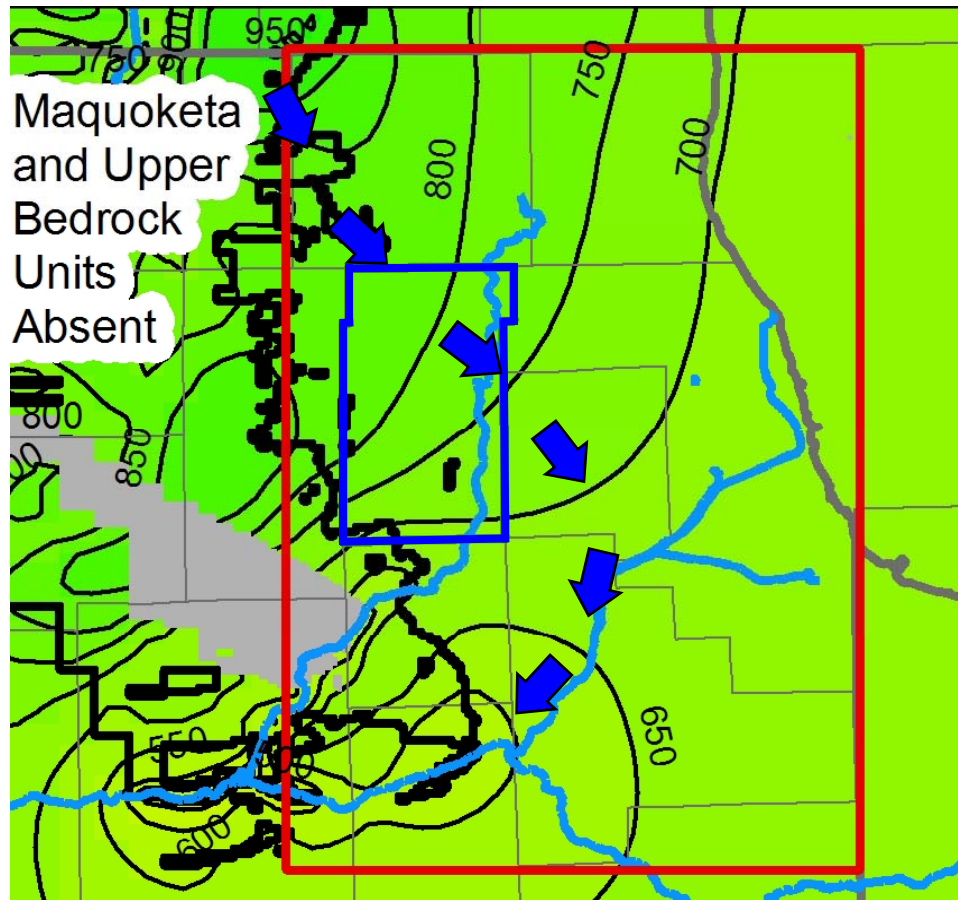
Historical Pumping of Deep Aquifer

Pumping Locations, 2002



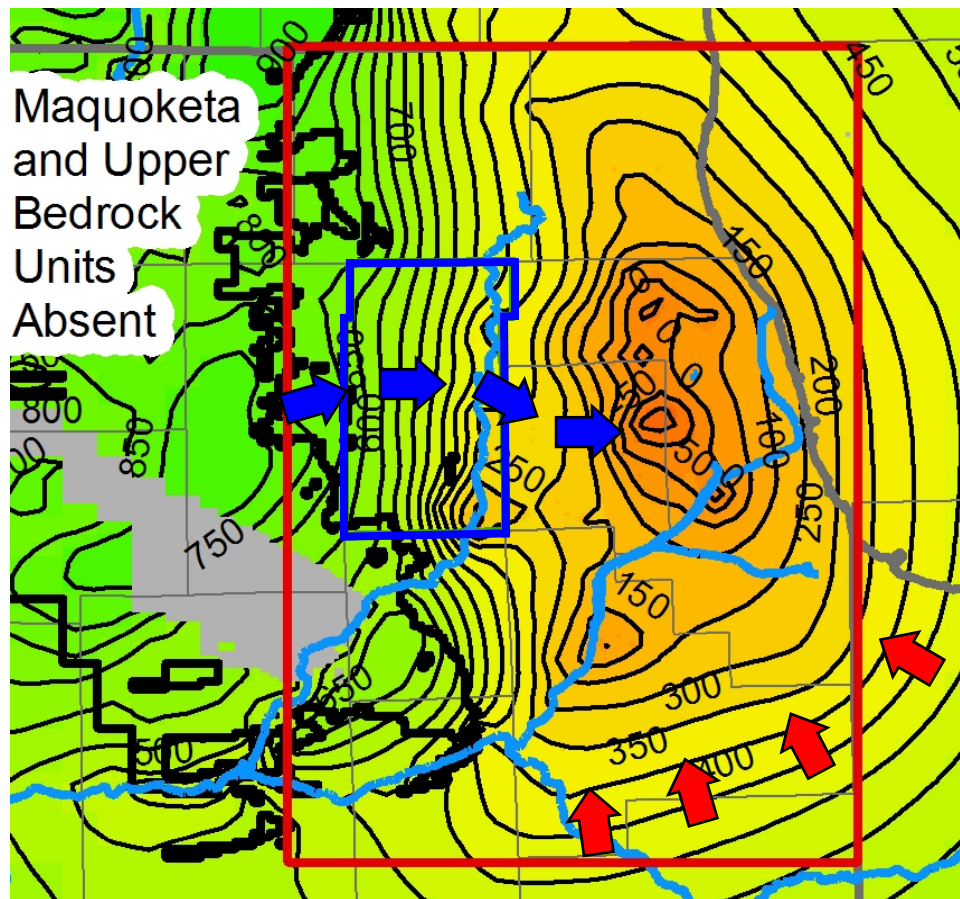
- In 1985, centered in Cook and DuPage Counties
- Pumping in Cook and DuPage Counties decreases, shifting center southwestward

Ancell Aquifer: Predevelopment



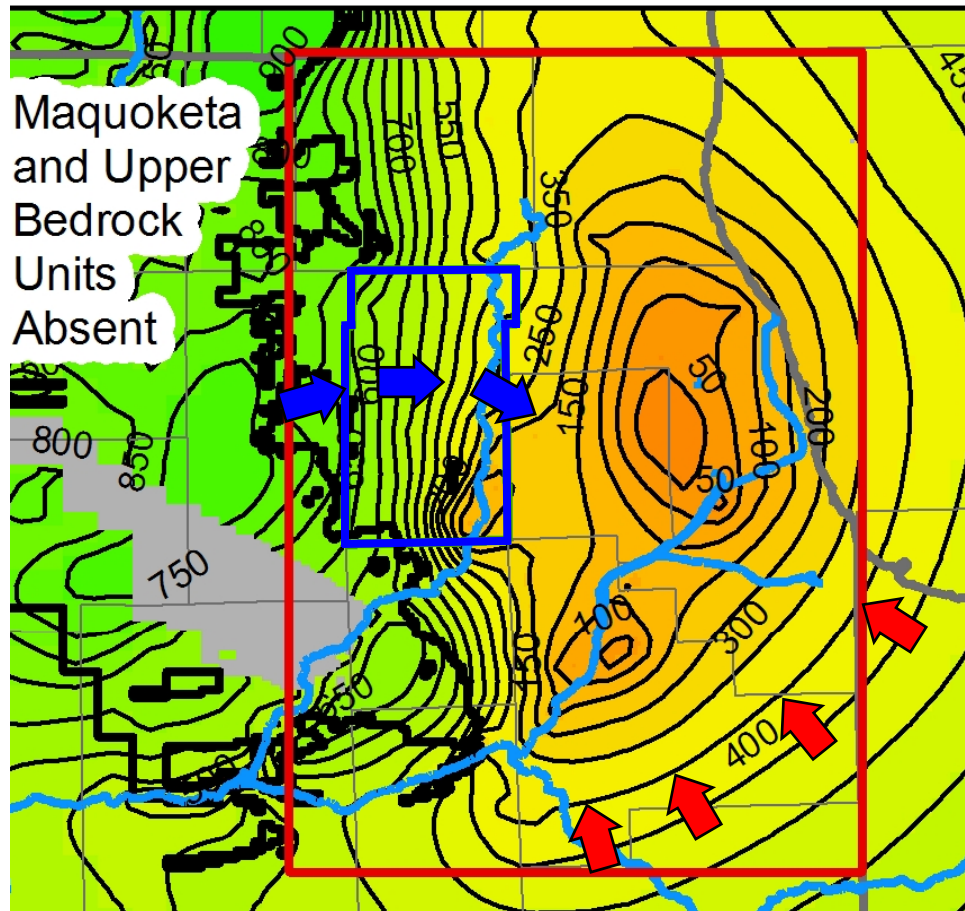
- Recharge where Maquoketa is absent
- Flow from central Wisconsin and Dekalb Co. to Illinois River
- Artesian conditions in Chicago

Ancell Aquifer: 1985



- Steep cone of depression
- Flow eastward to Cook and DuPage Counties
- Northward flow from saltwater regions
- Similar cone of depression surrounding Milwaukee

Ancell Aquifer: 2002



- Cone of depression flattens, shifts west with pumping
- Flow eastward to Cook and DuPage Counties
- Northward flow from saltwater regions
- Upper layers dewatering (Galena-Platteville)



Other Notes

- Discharge formerly went to streams or Lake Michigan; now virtually all goes to wells (except west of Maquoketa cover)
- Salt in groundwater can influence flow, but not formally addressed here
- Water Quality effects discussed later