# Mt. Simon High Capacity Aquifer System

- Western Wisconsin

Darrell Reed, PG

# Mt. Simon High Capacity Aquifer

Most important high capacity aquifer in Wisconsin

Aquifer is used extensively by municipalities, agriculture and industrial sand industries in Wisconsin, Minnesota, Illinois and Iowa

# BEDROCK GEOLOGY OF WISCONSIN

UNIVERSITY OF WISCONSIN - EXTENSION
Geological and Natural History Survey
M.E. Ostrom Director and State Geologist
APRIL 1981

## LEGEND

Extent of glaciation

**PHANEROZOIC**

DEVONIAN FORMATIONS
- D — dolomite and shale

SILURIAN FORMATIONS
- Sd — dolomite

ORDOVICIAN FORMATIONS
- Om — Maquoketa Formation—shale and dolomite
- Os — Sinnipee Group—dolomite with some limestone and shale
- Osp — St. Peter Formation—sandstone with some limestone shale and conglomerate
- Opc — Prairie du Chien Group—dolomite with some sandstone and shale

CAMBRIAN FORMATIONS
- € — sandstone with some dolomite and shale

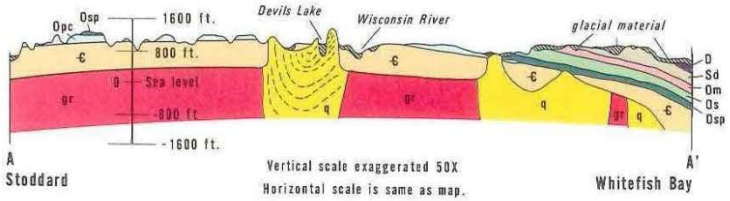
**PRECAMBRIAN**

MIDDLE PROTEROZOIC ROCKS
- ss, v — Keweenawan Rocks—
  - ss, sandstone
  - v, basaltic to rhyolitic lava flows
  - t, gabbroic, anorthositic and granitic rocks
- g, a — Wolf River Rocks—
  - g, rapakivi granite, granite and syenite
  - a, anorthosite and gabbro

LOWER PROTEROZOIC ROCKS
- q — quartzite
- gr — granite, diorite and gneiss
- s, vo, ga
  - s, argillite, siltstone, quartzite, graywacke, and iron formation
  - vo, basaltic to rhyolitic metavolcanic rocks with some metasedimentary rocks
  - ga, meta-gabbro and hornblende diorite

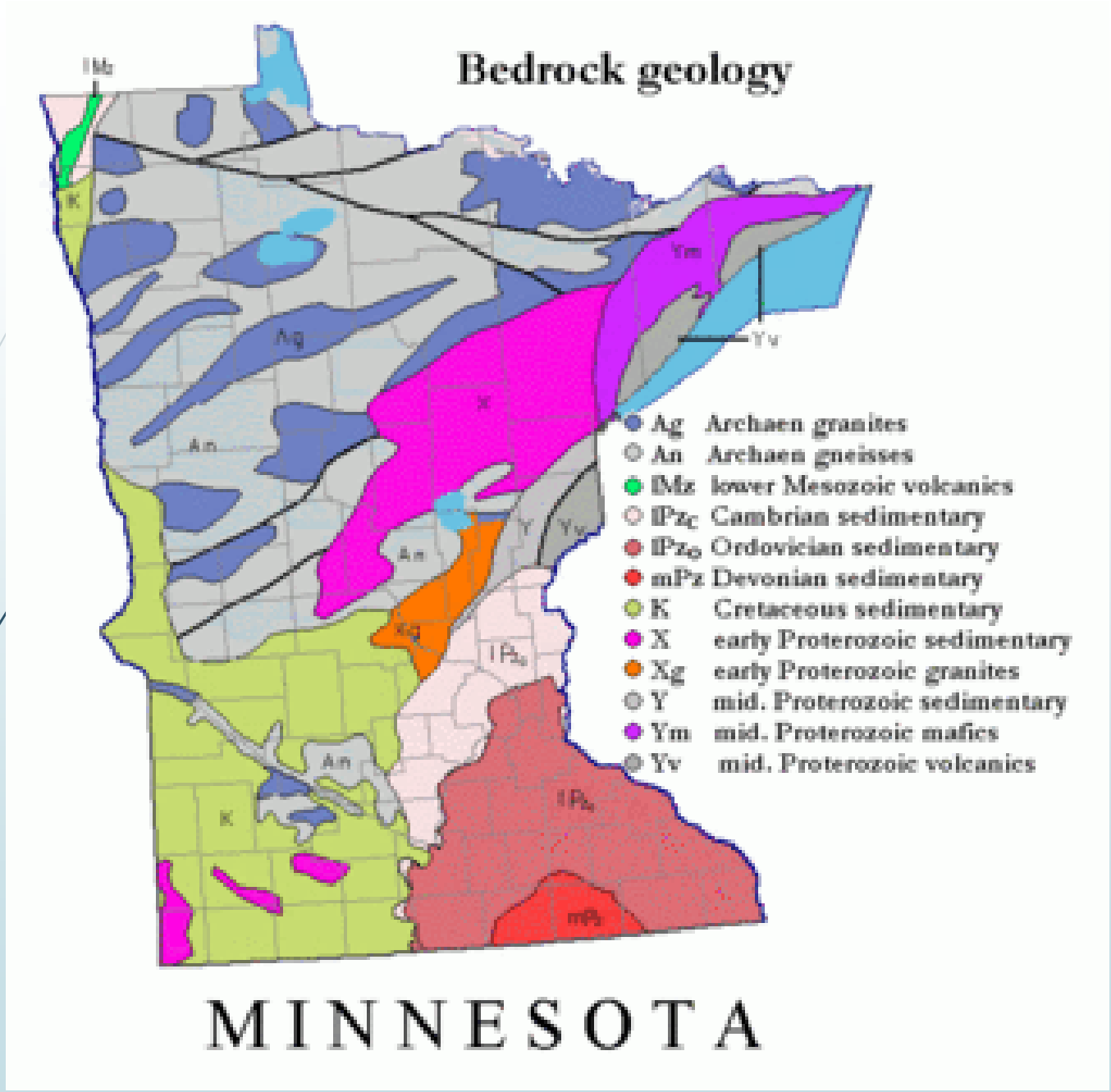
LOWER PROTEROZOIC OR UPPER ARCHEAN ROCKS
- mv, gn
  - mv, metavolcanic rocks
  - gn, granite, gneiss and amphibolite

MILES
0 30 60
0 50 100
KM.

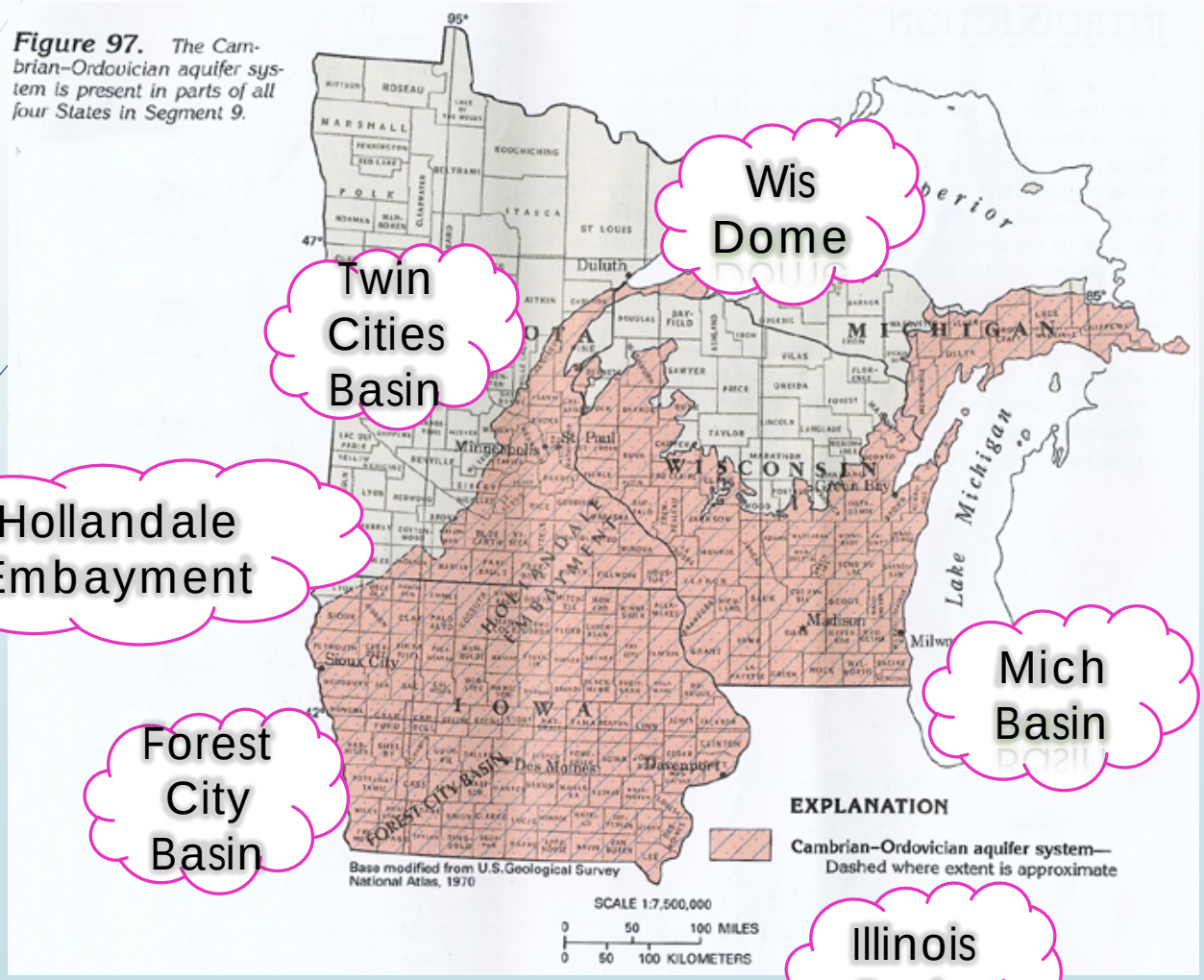



UNGLACIATED

UNGLACIATED

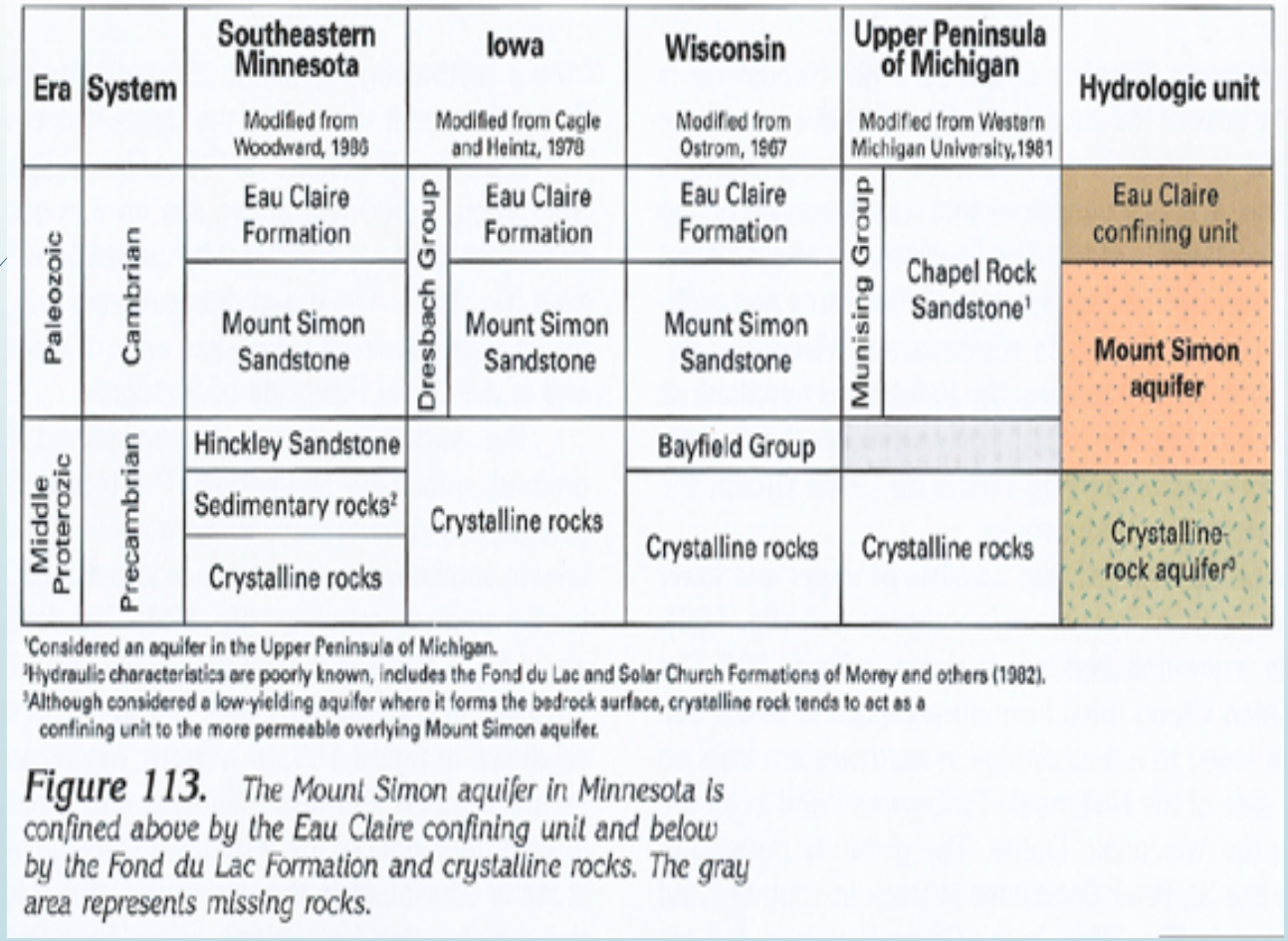

Bedrock geology
lMz
K
Ag
An
X
Ym
Yv
Y
Xg
lPz
mPz
Ag Archaen granites
An Archaen gneisses
lMz lower Mesozoic volcanics
lPzc Cambrian sedimentary
lPzo Ordovician sedimentary
mPz Devonian sedimentary
K Cretaceous sedimentary
X early Proterozoic sedimentary
Xg early Proterozoic granites
Y mid. Proterozoic sedimentary
Ym mid. Proterozoic mafics
Yv mid. Proterozoic volcanics
MINNESOTA

# Upper Midwest Structural Features




From USGS

# Mount Simon Aquifer Correlation between States



| Era | System | Southeastern Minnesota (Modified from Woodward, 1988) | Iowa (Modified from Cagle and Heintz, 1978) | | Wisconsin (Modified from Ostrom, 1967) | Upper Peninsula of Michigan (Modified from Western Michigan University, 1981) | | Hydrologic unit |
|---|---|---|---|---|---|---|---|---|
| Paleozoic | Cambrian | Eau Claire Formation | Dresbach Group | Eau Claire Formation | Eau Claire Formation | Munising Group | Chapel Rock Sandstone[1] | Eau Claire confining unit |
| | | Mount Simon Sandstone | | Mount Simon Sandstone | Mount Simon Sandstone | | | Mount Simon aquifer |
| Middle Proterozoic | Precambrian | Hinckley Sandstone | Crystalline rocks | | Bayfield Group | | | |
| | | Sedimentary rocks[2] | | | Crystalline rocks | Crystalline rocks | | Crystalline-rock aquifer[3] |
| | | Crystalline rocks | | | | | | |

[1]Considered an aquifer in the Upper Peninsula of Michigan.
[2]Hydraulic characteristics are poorly known, includes the Fond du Lac and Solar Church Formations of Morey and others (1982).
[3]Although considered a low-yielding aquifer where it forms the bedrock surface, crystalline rock tends to act as a confining unit to the more permeable overlying Mount Simon aquifer.

*Figure 113.* *The Mount Simon aquifer in Minnesota is confined above by the Eau Claire confining unit and below by the Fond du Lac Formation and crystalline rocks. The gray area represents missing rocks.*

From USGS

# Cambrian-Ordovician Regional Aquifer System

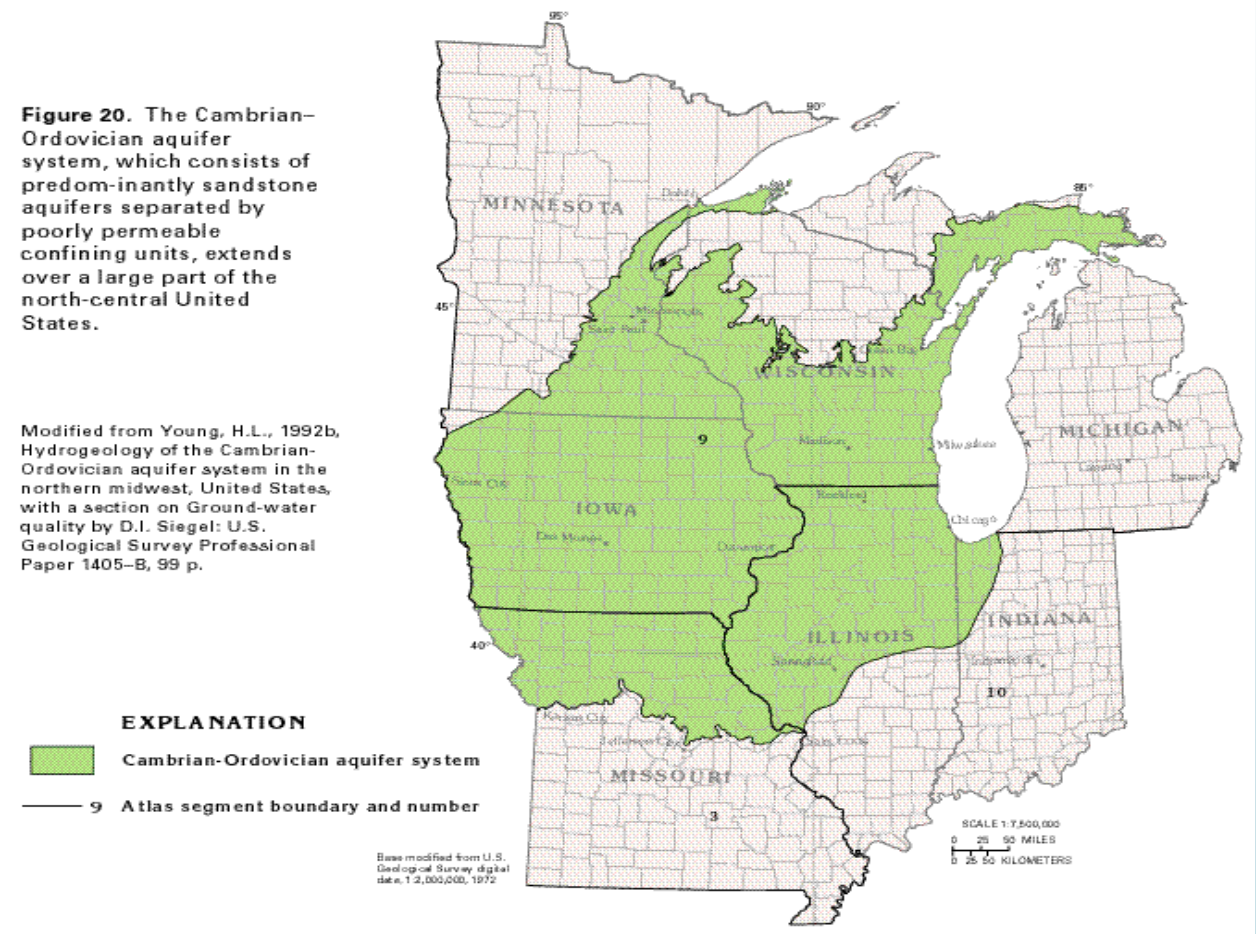



**Figure 20.** The Cambrian–Ordovician aquifer system, which consists of predom-inantly sandstone aquifers separated by poorly permeable confining units, extends over a large part of the north-central United States.

Modified from Young, H.L., 1992b, Hydrogeology of the Cambrian-Ordovician aquifer system in the northern midwest, United States, with a section on Ground-water quality by D.I. Siegel: U.S. Geological Survey Professional Paper 1405–B, 99 p.

From USGS

# Total Groundwater Withdrawals by State

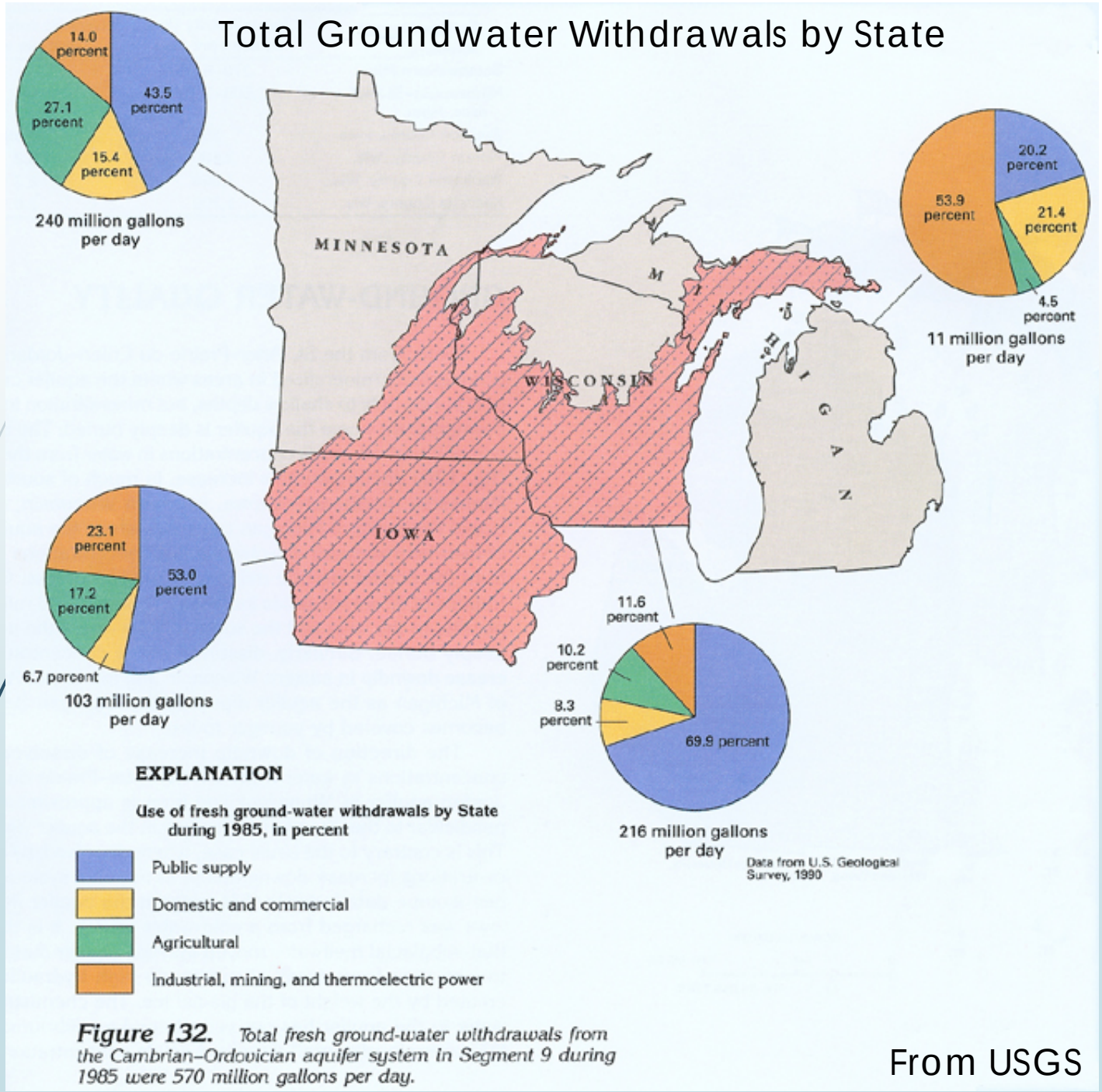



***Figure 132.*** *Total fresh ground-water withdrawals from the Cambrian–Ordovician aquifer system in Segment 9 during 1985 were 570 million gallons per day.*

From USGS

# Top of Mt. Simon Aquifer

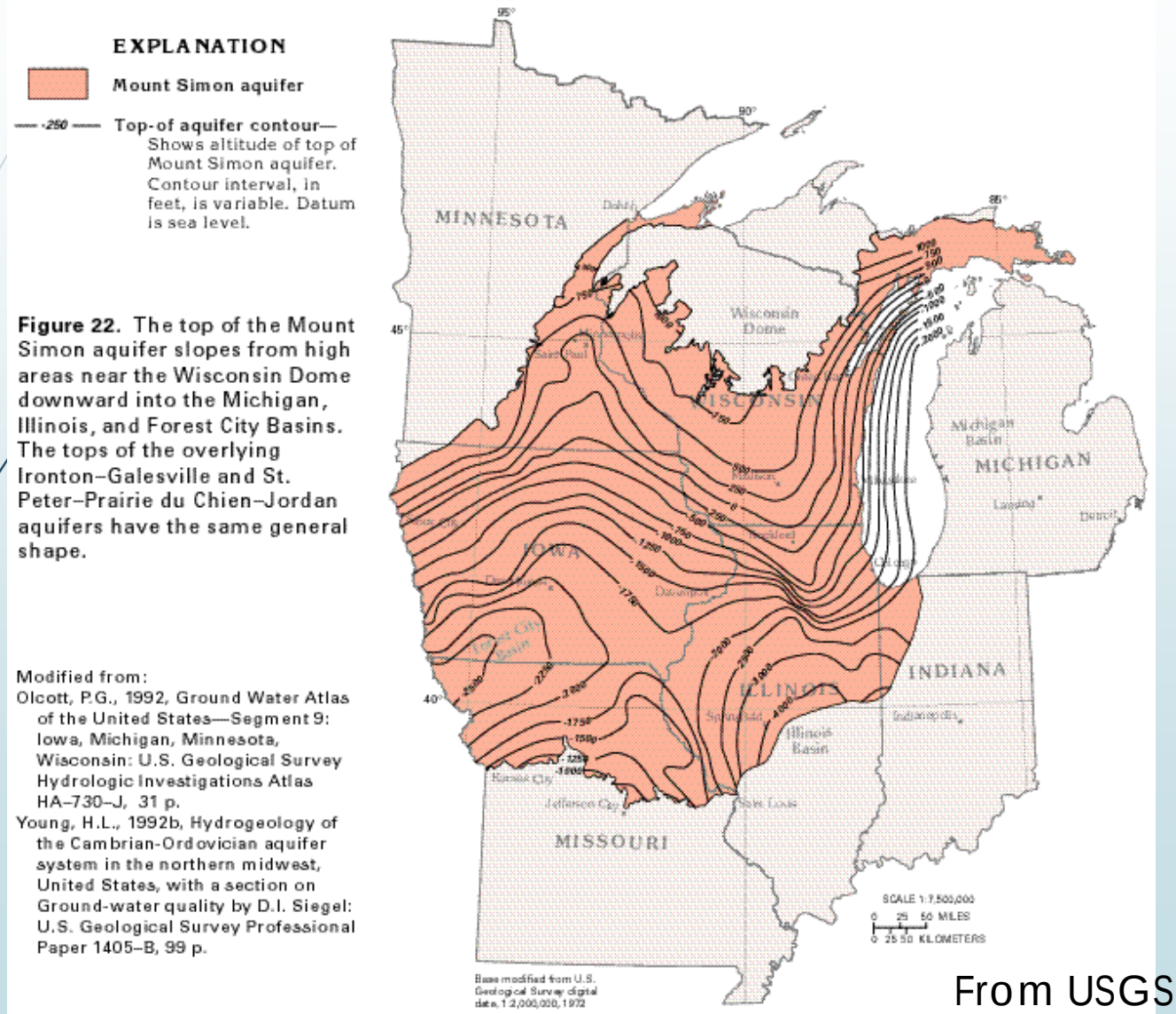



**Figure 22.** The top of the Mount Simon aquifer slopes from high areas near the Wisconsin Dome downward into the Michigan, Illinois, and Forest City Basins. The tops of the overlying Ironton–Galesville and St. Peter–Prairie du Chien–Jordan aquifers have the same general shape.

Modified from:

Olcott, P.G., 1992, Ground Water Atlas of the United States—Segment 9: Iowa, Michigan, Minnesota, Wisconsin: U.S. Geological Survey Hydrologic Investigations Atlas HA–730–J, 31 p.

Young, H.L., 1992b, Hydrogeology of the Cambrian-Ordovician aquifer system in the northern midwest, United States, with a section on Ground-water quality by D.I. Siegel: U.S. Geological Survey Professional Paper 1405–B, 99 p.

From USGS

# Mt. Simon Aquifer Thickness

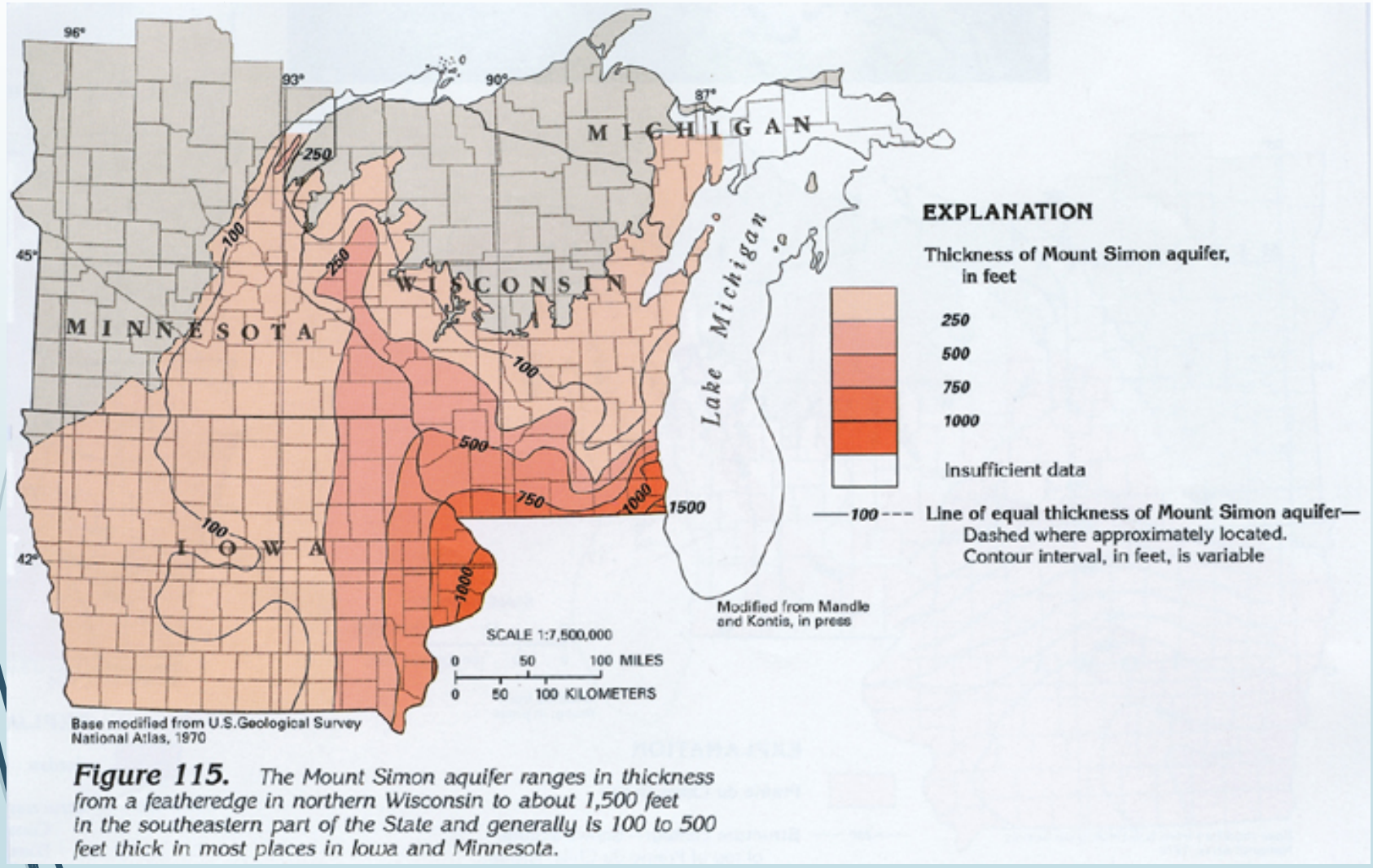



***Figure 115.*** *The Mount Simon aquifer ranges in thickness from a featheredge in northern Wisconsin to about 1,500 feet in the southeastern part of the State and generally is 100 to 500 feet thick in most places in Iowa and Minnesota.*

From USGS

# Regional Water Quality

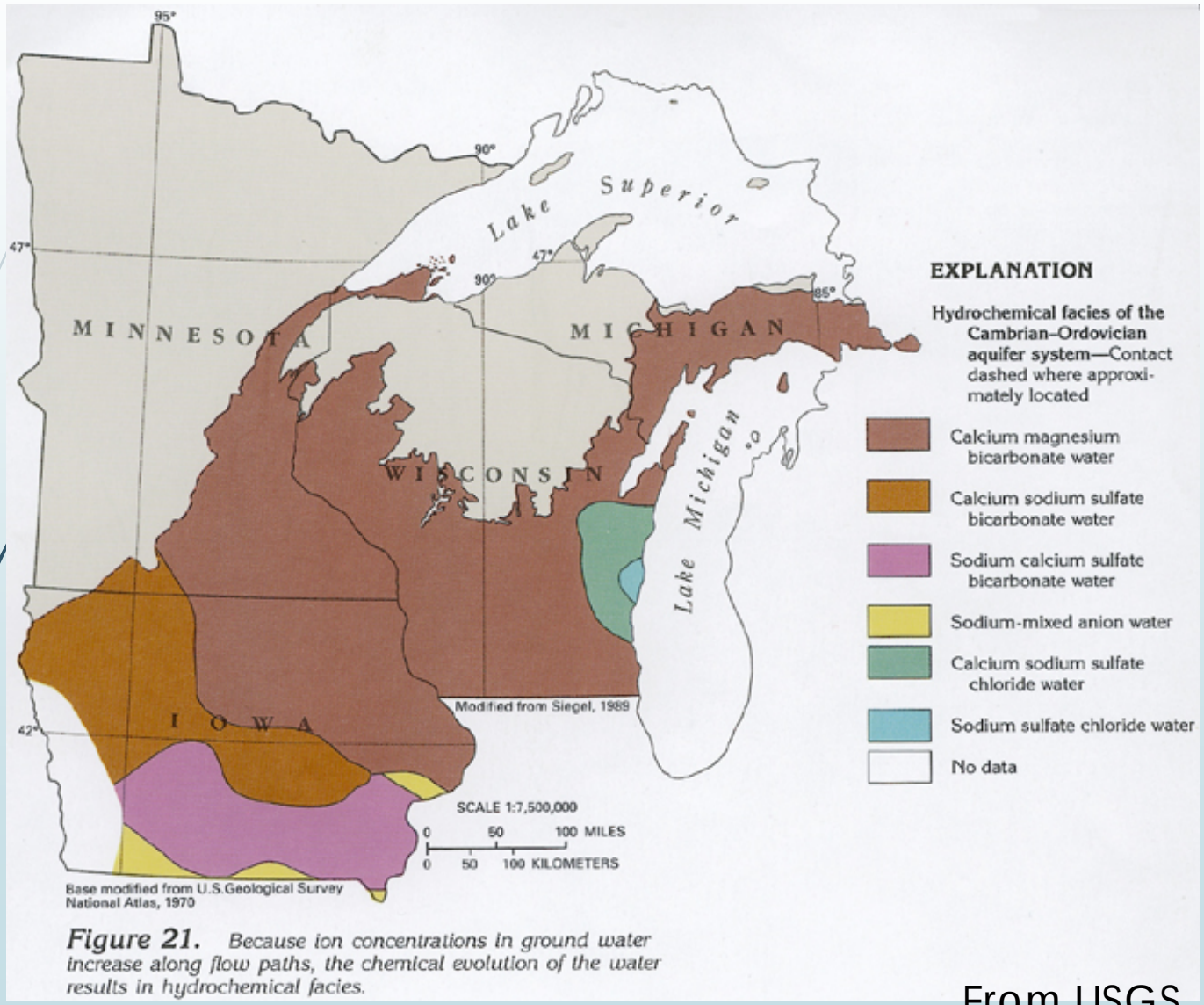
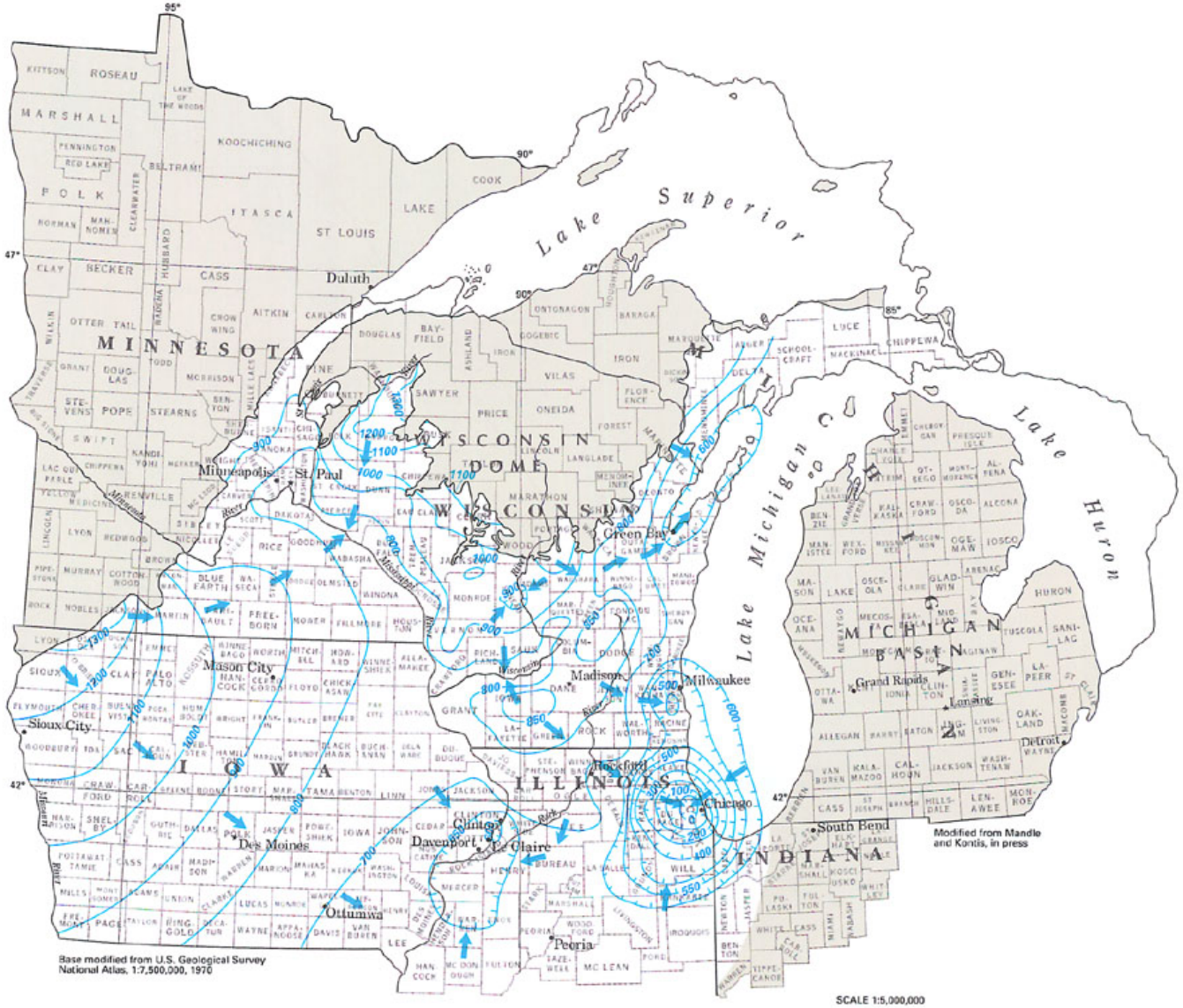



***Figure 21.*** *Because ion concentrations in ground water increase along flow paths, the chemical evolution of the water results in hydrochemical facies.*

From USGS

# Mount Simon Aquifer Pumping Centers

***Figure 127.*** *A computer-generated potentiometric surface of the Mount Simon aquifer for 1980 indicates groundwater movement was to the Mississippi and Wisconsin Rivers in Minnesota and western Wisconsin and to pumping centers in eastern Wisconsin, eastern Iowa, and northern Illinois.*




From USGS

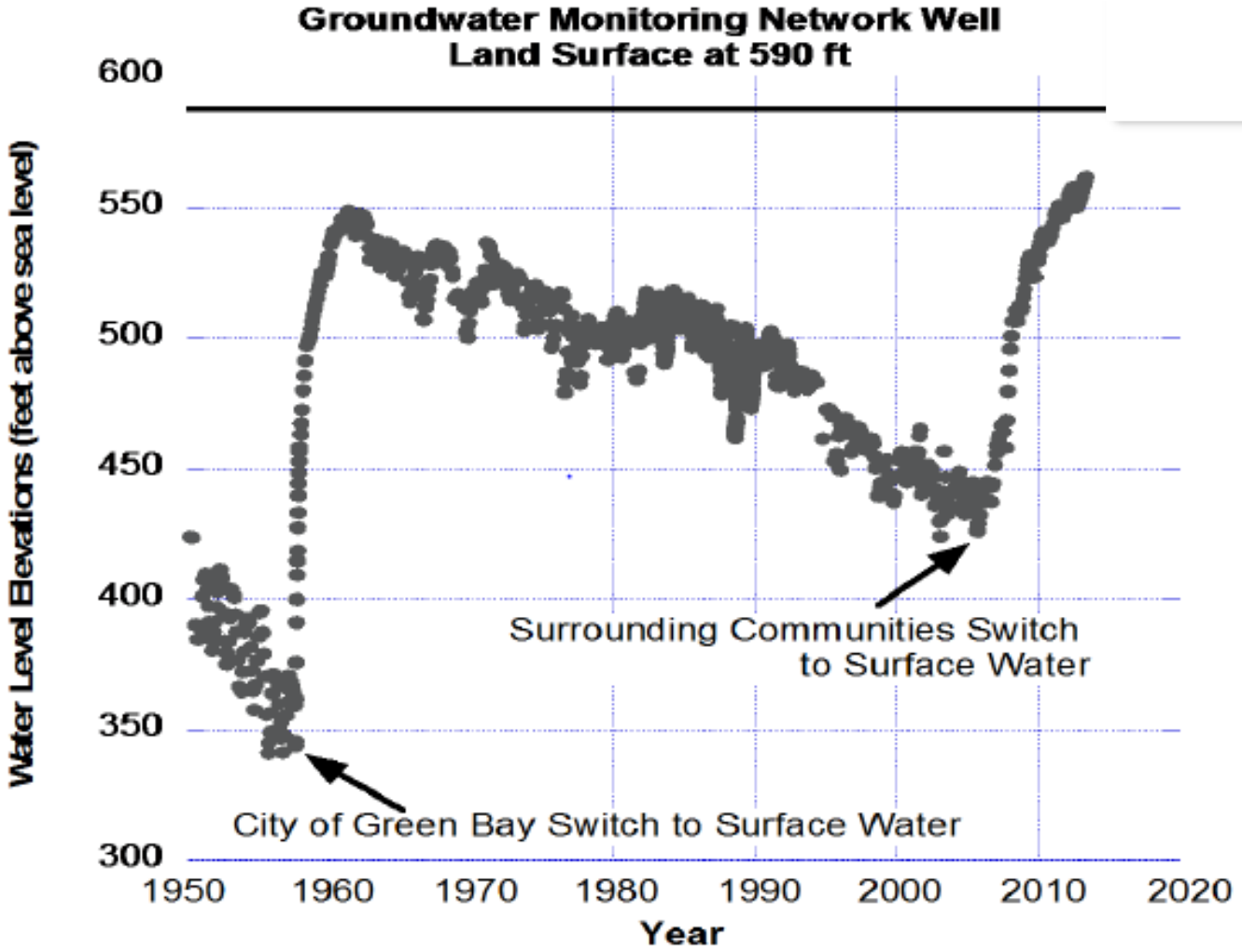
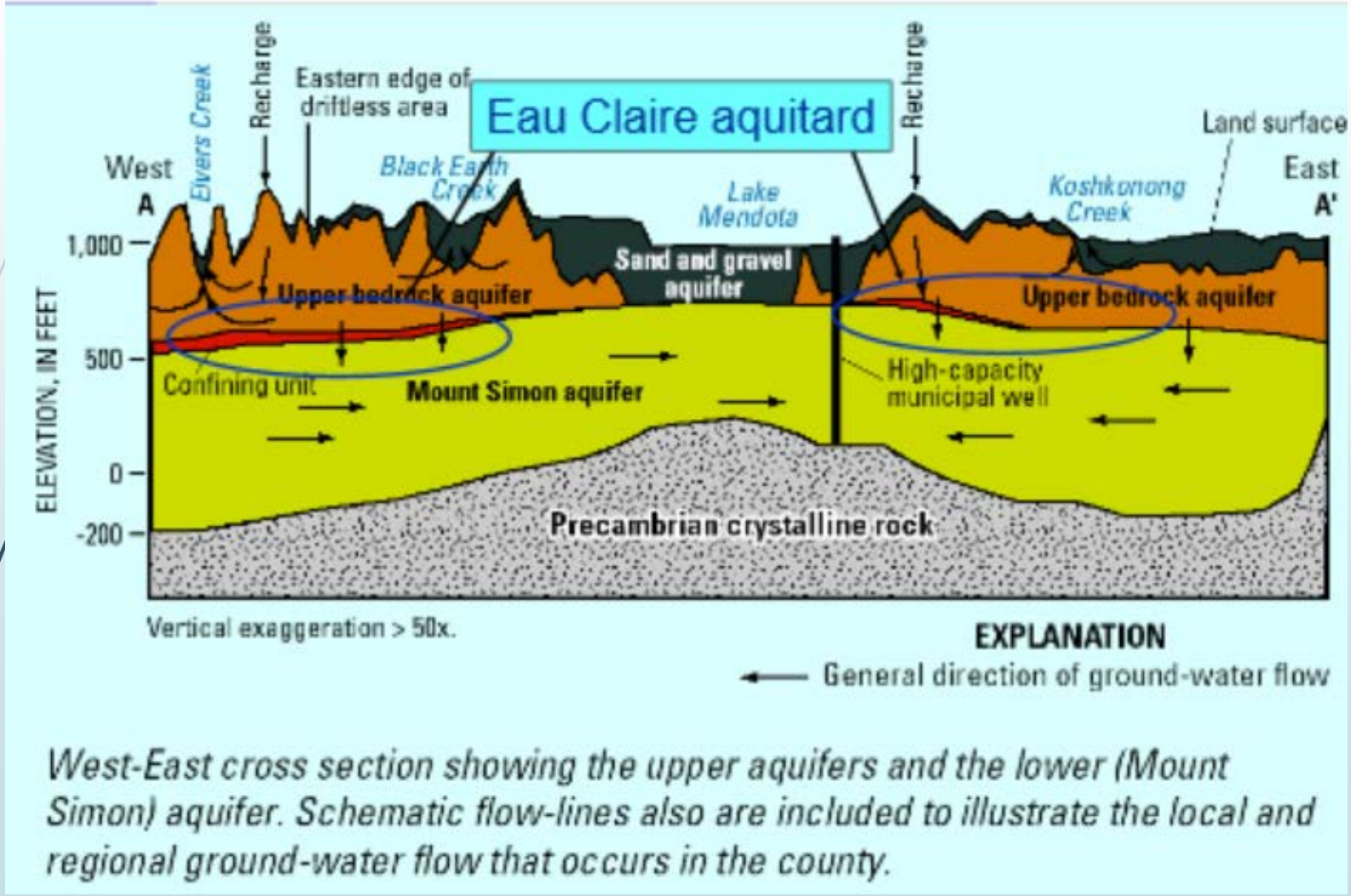


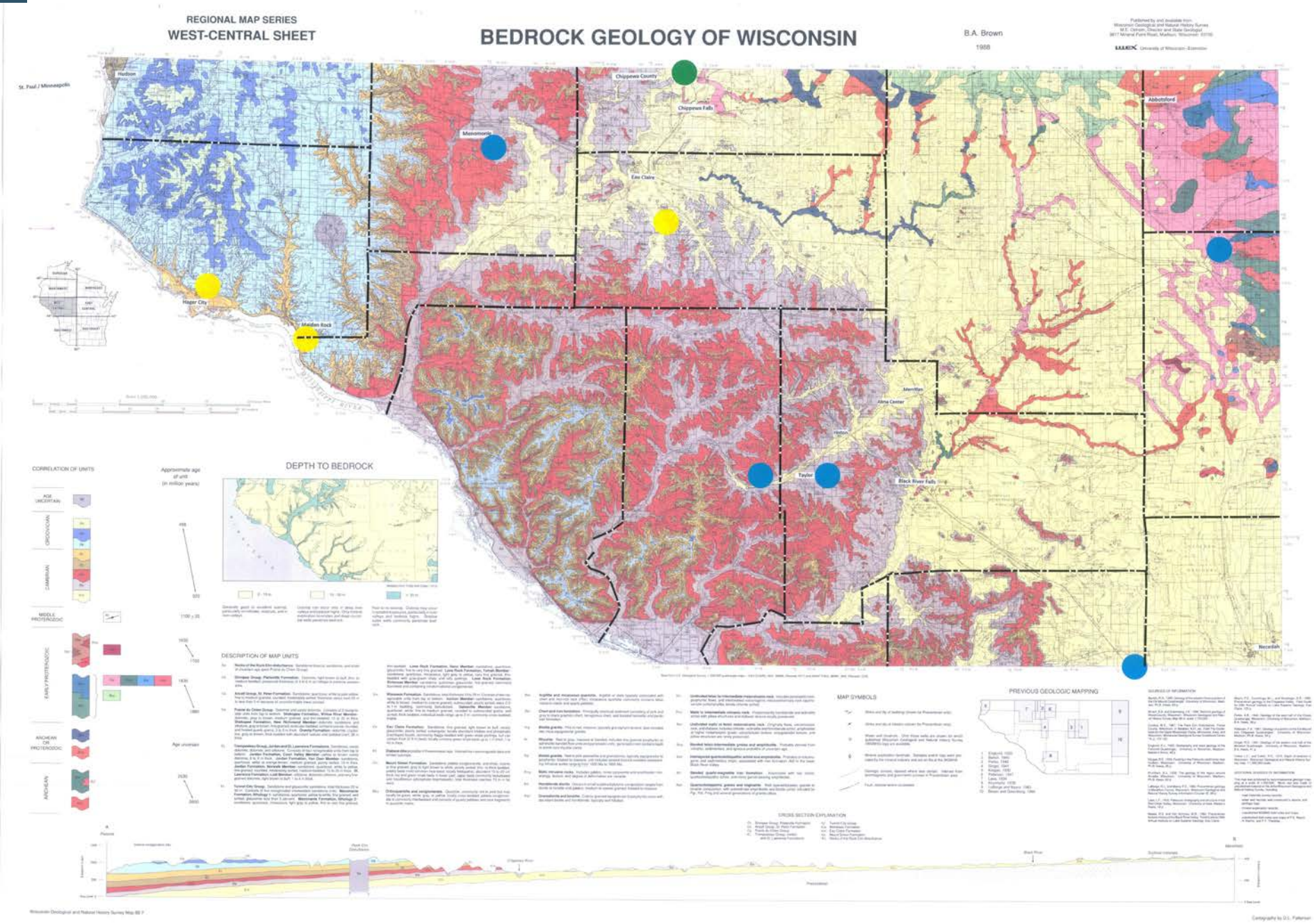

*Figure 1: Changes in groundwater levels in a groundwater level monitoring well in Green Bay, Wisconsin (WGNHS)*

# Dane County, WI Cross-Section



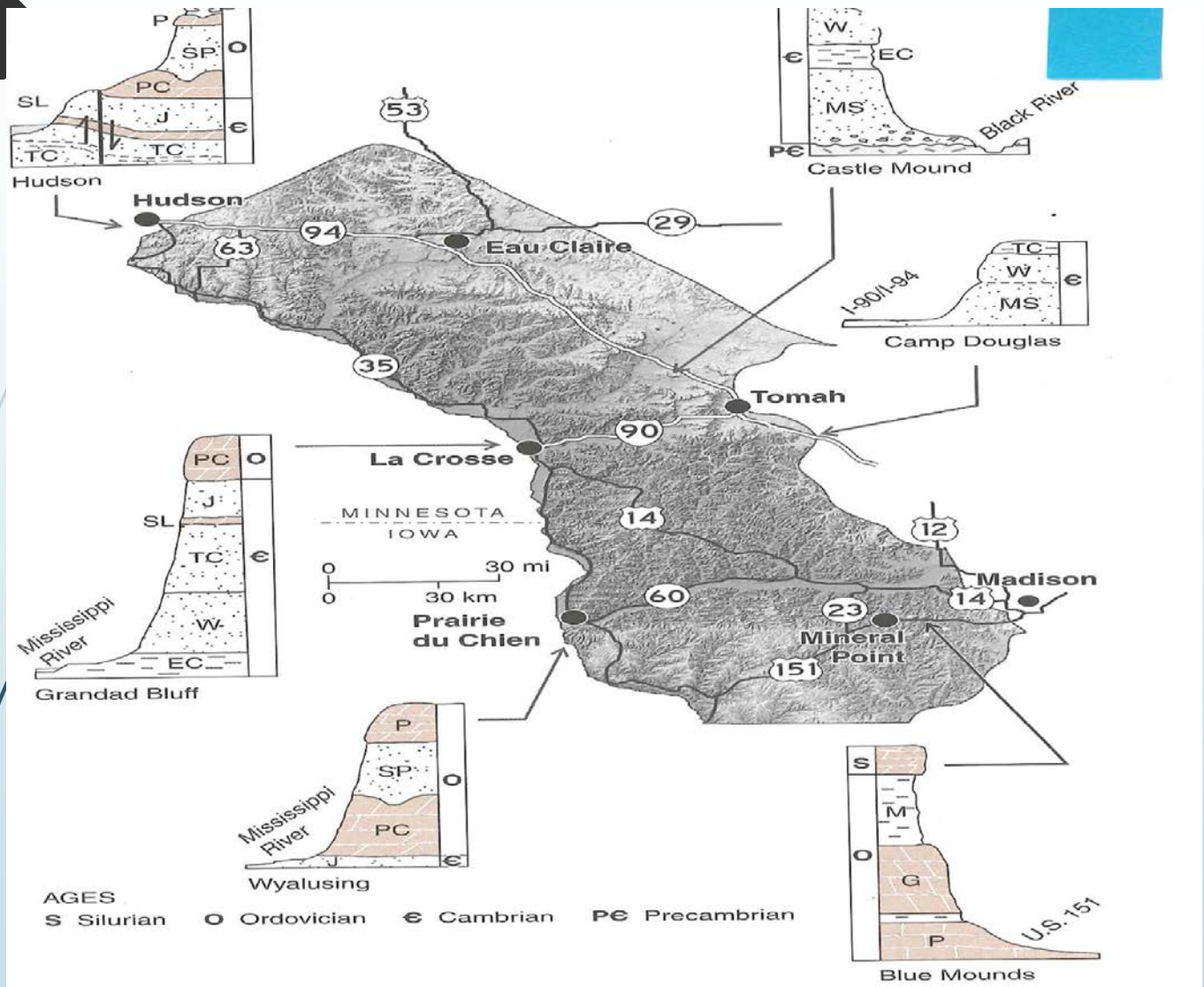

*West-East cross section showing the upper aquifers and the lower (Mount Simon) aquifer. Schematic flow-lines also are included to illustrate the local and regional ground-water flow that occurs in the county.*

From WGNHS




From Brown, WGNHS

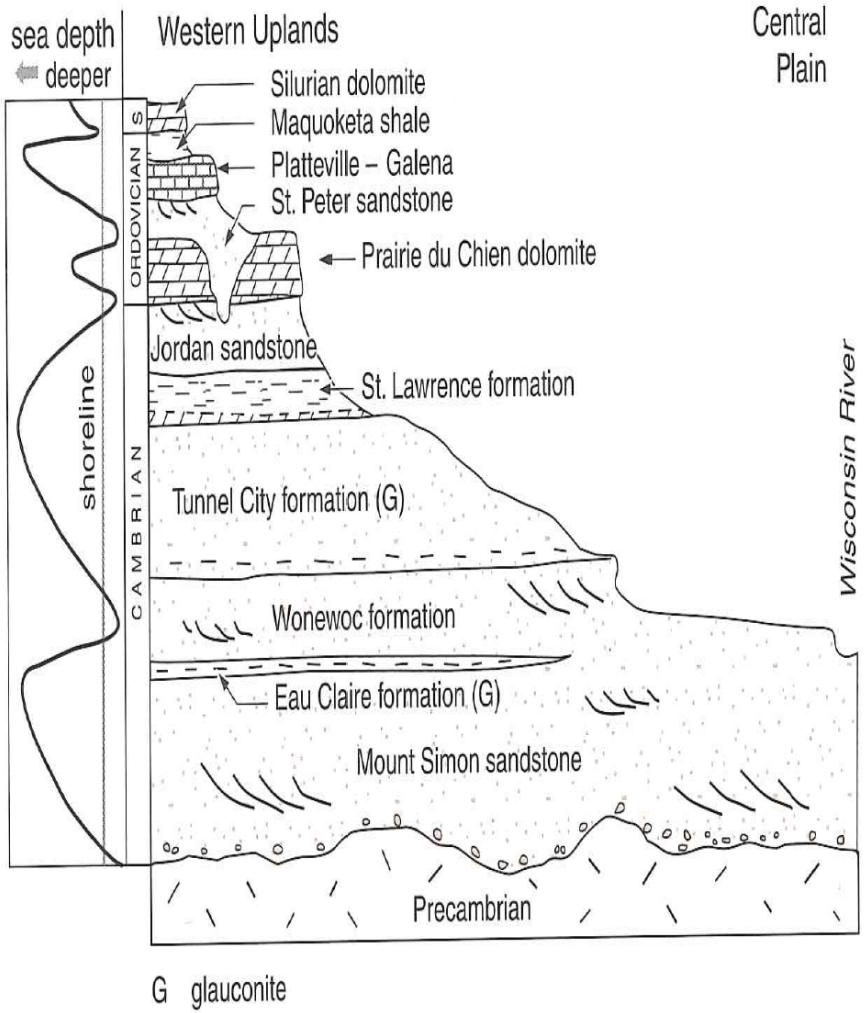
# Stratigraphic Features




*Cambrian and Ordovician strata in different parts of the Western Uplands. MS, Mt. Simon sandstone; EC, Eau Claire formation; W, Wonewoc formation; TC, Tunnel City formation; SL, St. Lawrence formation; J, Jordan sandstone; PC, Prairie du Chien dolomite; SP, St. Peter sandstone; P, Platteville dolomite; G, Galena dolomite; M, Maquoketa shale.*

From Dott & Attig

# W. Wisconsin Strat. Section

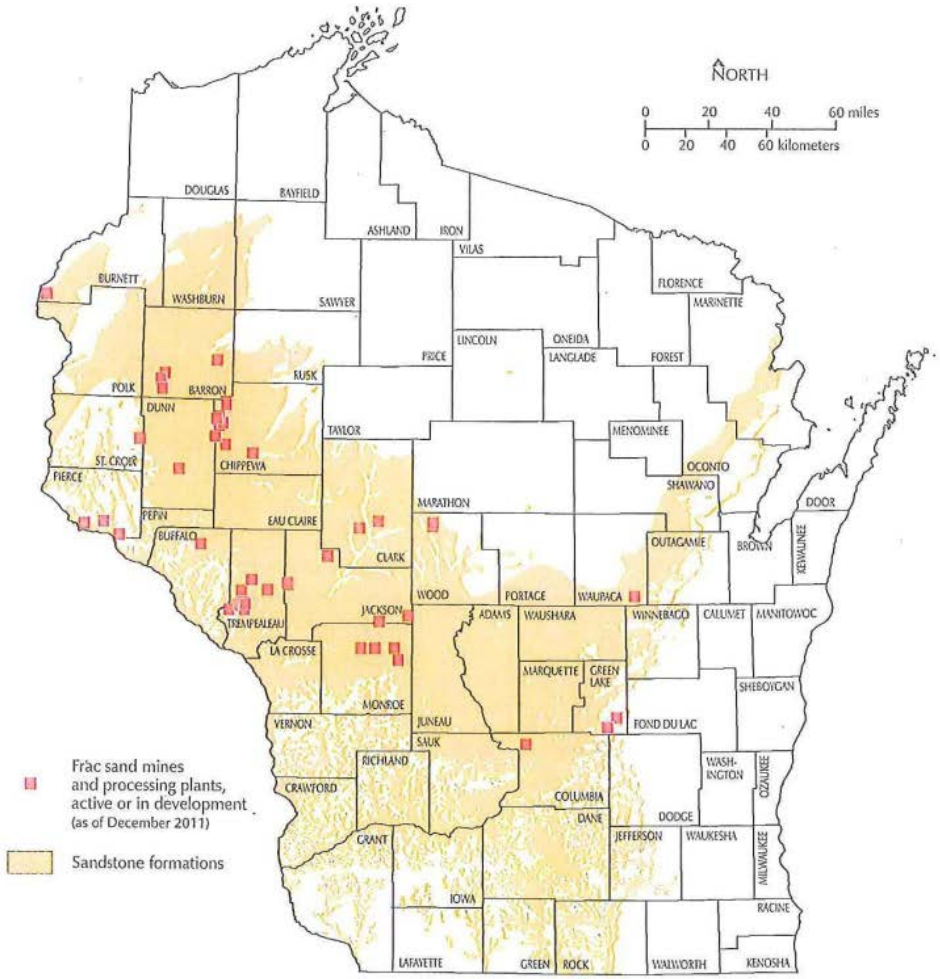



*Paleozoic formations exposed widely in the Western Uplands. Curve at left shows relative position of sea level when the different formations were deposited.*

From Dott & Attig

# Frac sand in Wisconsin

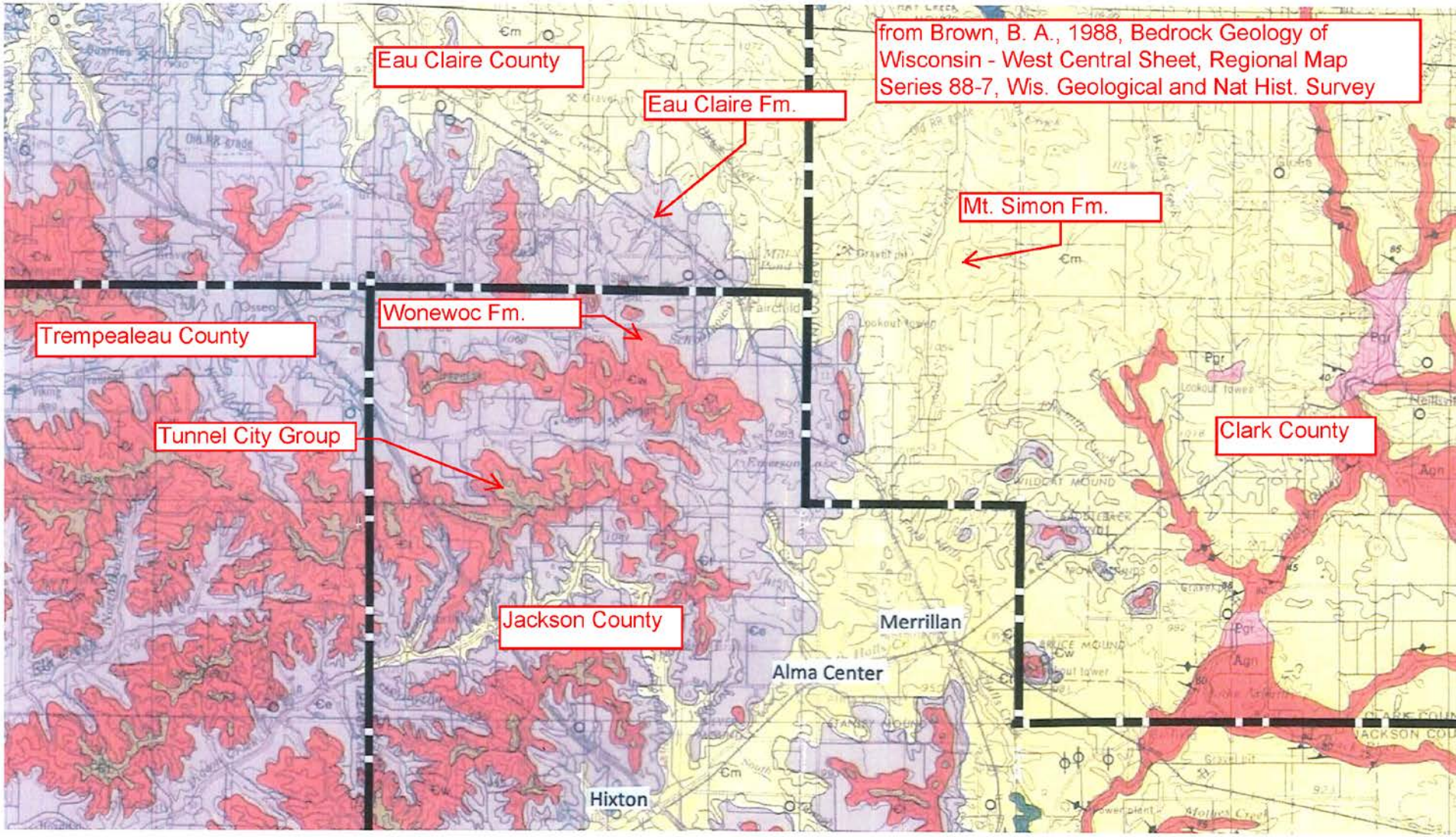
**Wisconsin Geological and Natural History Survey**
Factsheet 05 | 2012



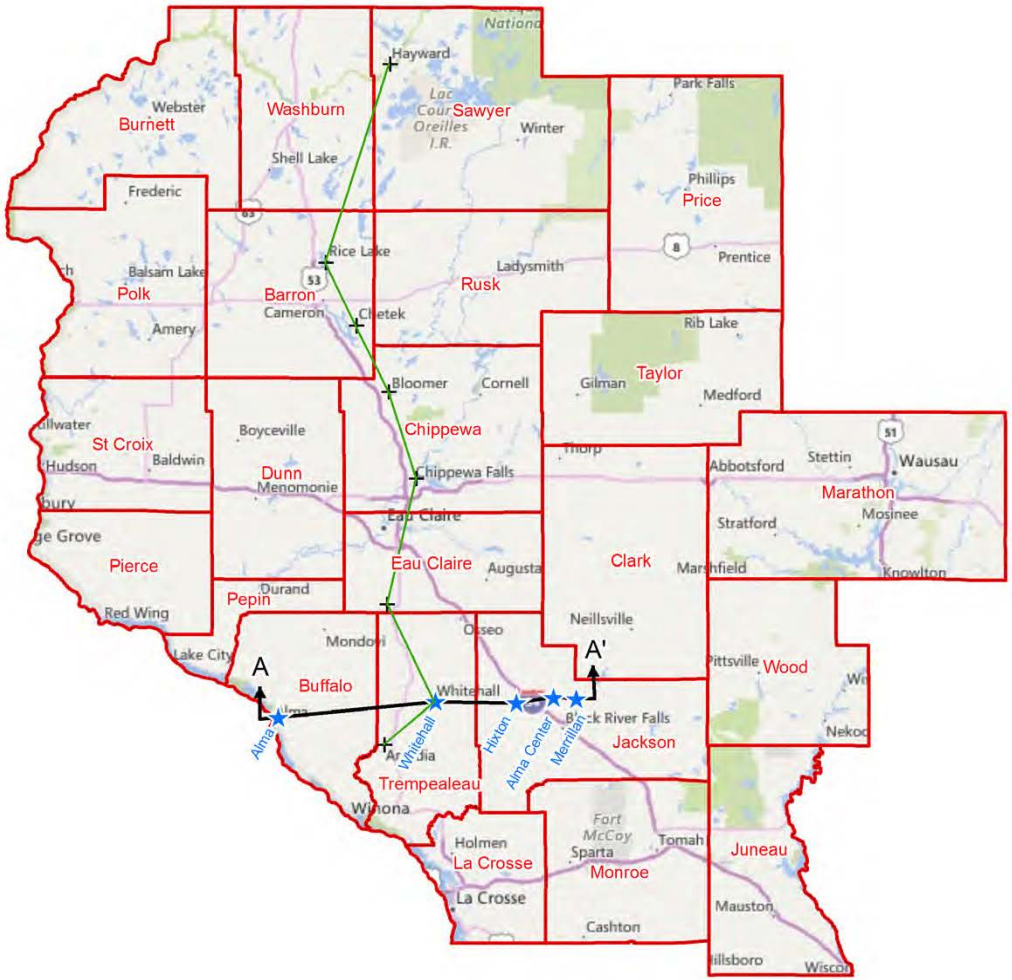

UW Extension Cooperative Extension

**Wisconsin Geological and Natural History Survey** 3817 Mineral Point Road • Madison, Wisconsin 53705-5100
Tel 608.263.7389 • Fax 608.262.8086 • www.WisconsinGeologicalSurvey.org
**Director and State Geologist:** James M. Robertson

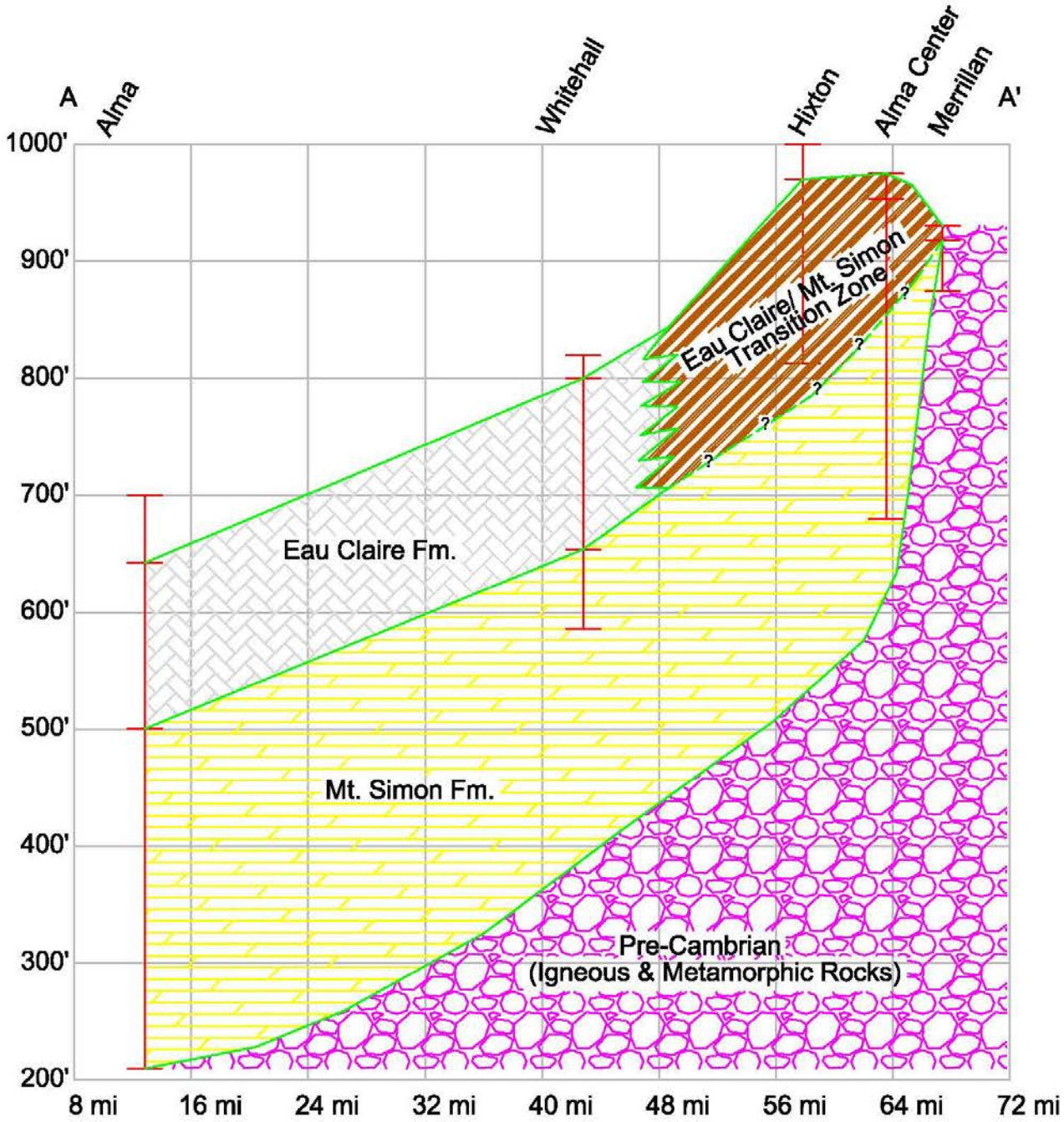
# Jackson / Trempealeau/ Eau Claire County Area Map



# Mt. Simon Aquifer Usage



# W. Wisconsin Regional Cross Section



# Transmissivity/Hydraulic Conductivity and SC. Values

**Table 9.** *Transmissivity values for the Mount Simon aquifer at 6 sites in Segment 9 ranged from 270 to 9,400 feet squared per day*

[Modified from Young, in press. —, no data available]

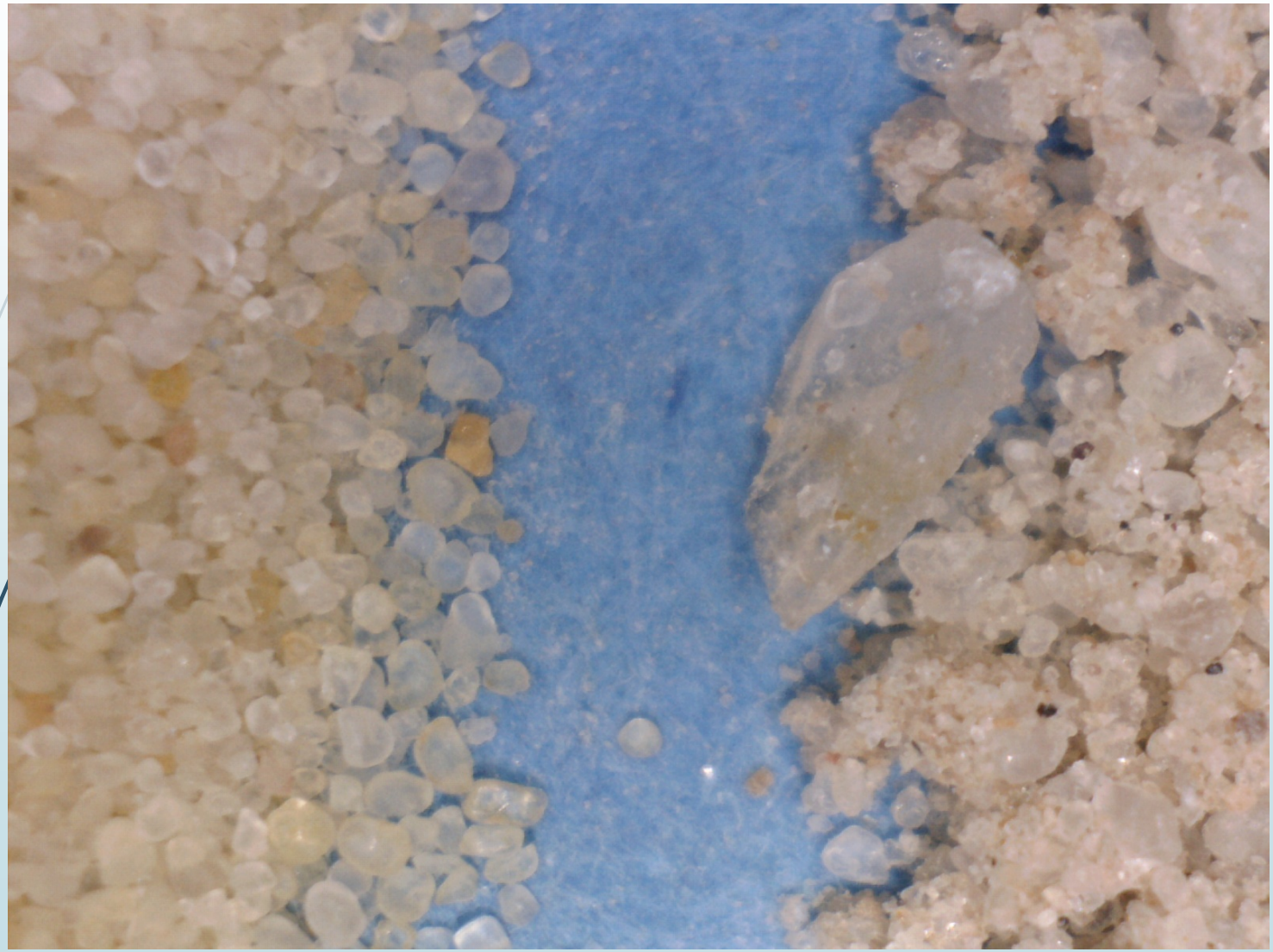
| Site location | Transmissivity (feet squared per day) | Hydraulic conductivity (feet per day) |
|---|---|---|
| Southwestern Minn. | 270–9,400 | — |
| Minneapolis–St Paul area, Minn. | 1,600–3,100 | — |
| Jackson County, Iowa | 350 | 0.38 |
| Vernon County, Wis. | 3,600 | 9.2 |
| Waukesha County, Wis. | 1,000 | 2.2 |
| Kenosha County, Wis. | 1,700 | 2.0 |

| **Hi Cap Well** | **Specific Cap** | **Test GPM** |
|---|---|---|
| Jackson County #1 | 6.7 | 700 |
| Trempealeau County #1 | 6.9 | 450 |
| Barron County #1 | 8.2 | 830 |
| Chippewa County #1 | 17.1 | 800 |
| Chippewa County #2 | 5.8 | 550 |

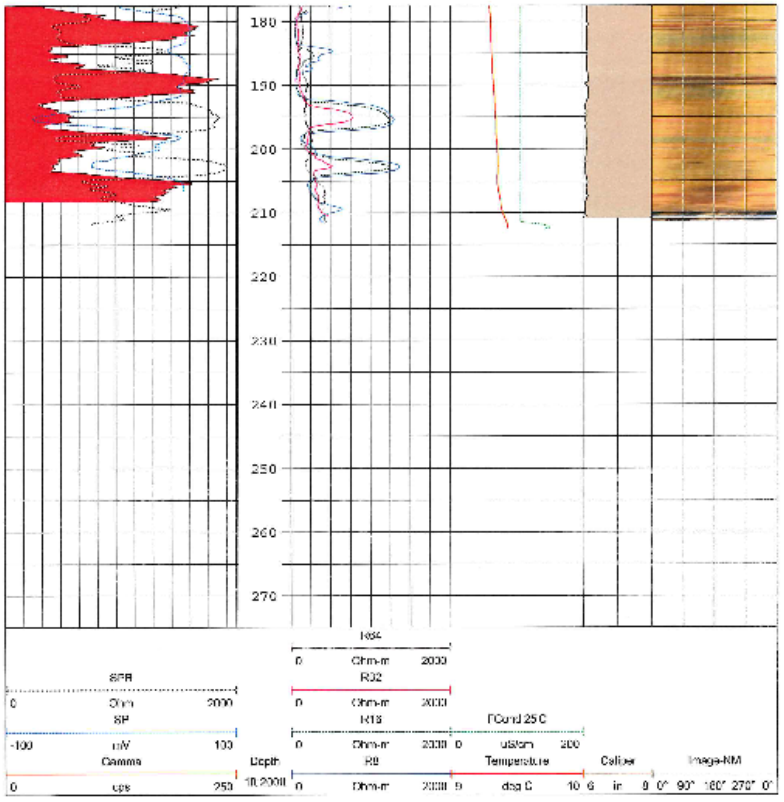
# Jackson County #2
# Cutting Samples
# Mount Simon

# Lower Mount Simon Sandstone – Jackson County EB-1

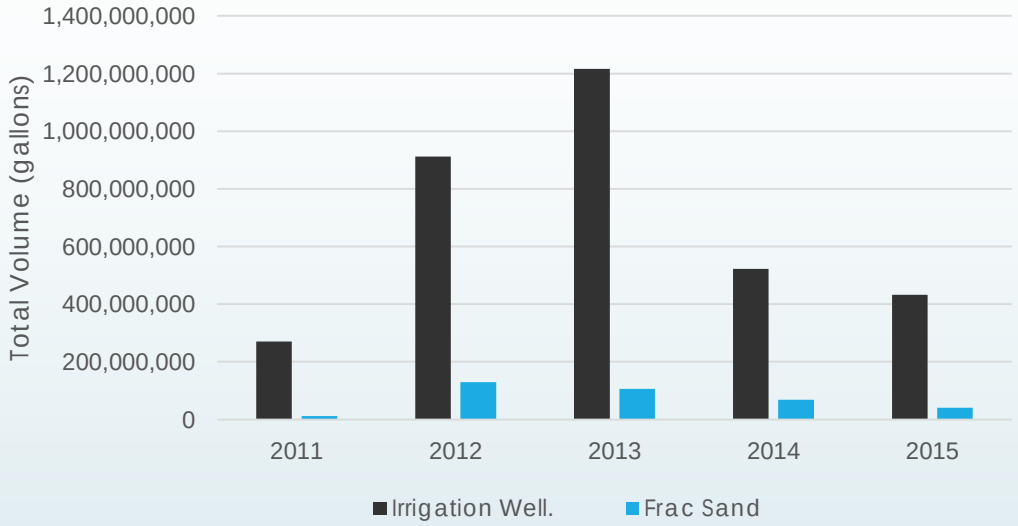
185’-190’

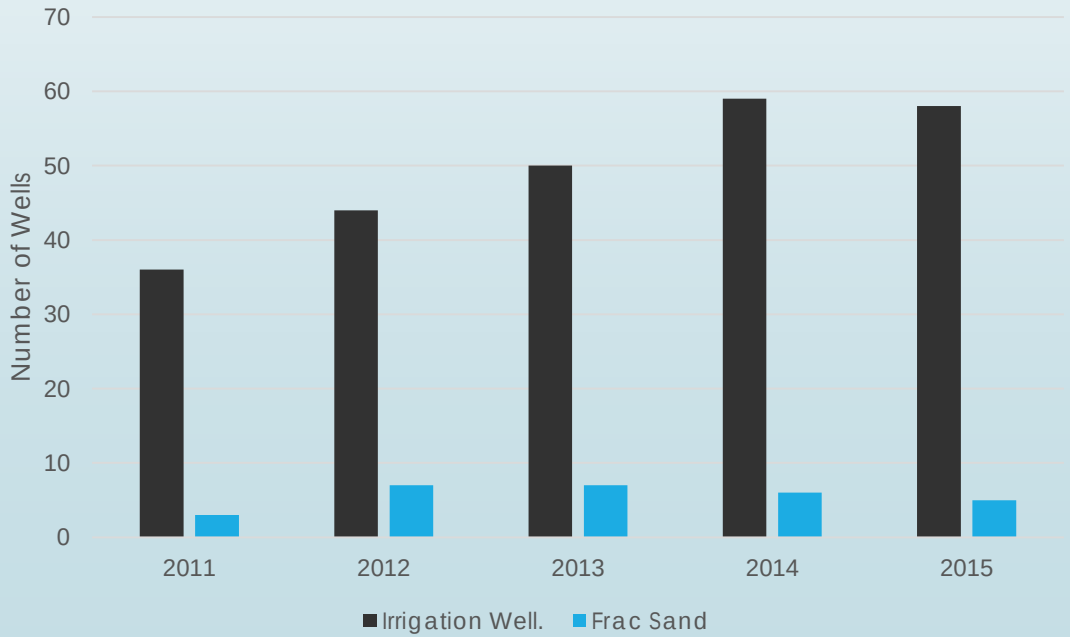


# Jackson County Geophysical Log – Deep Exploration Boring

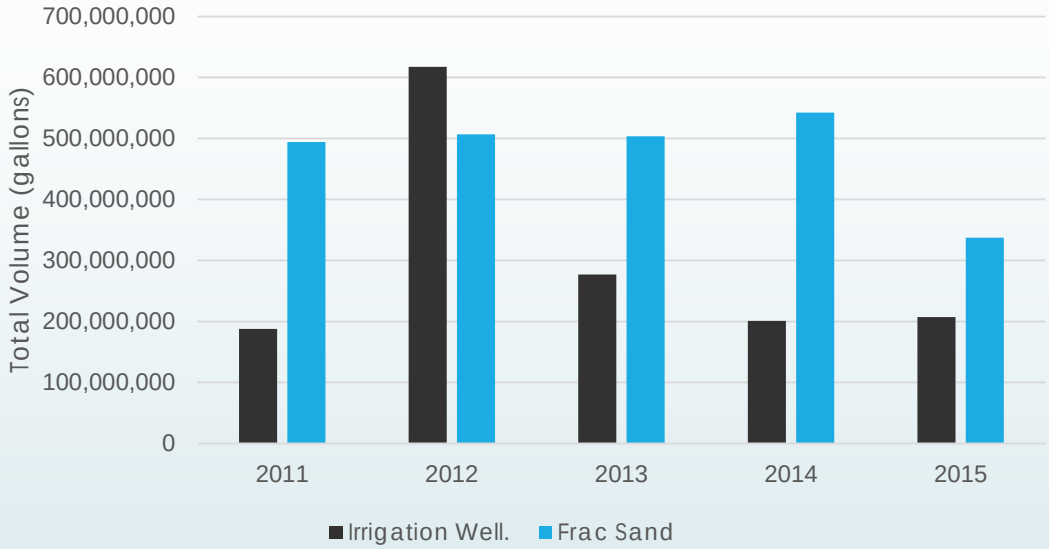


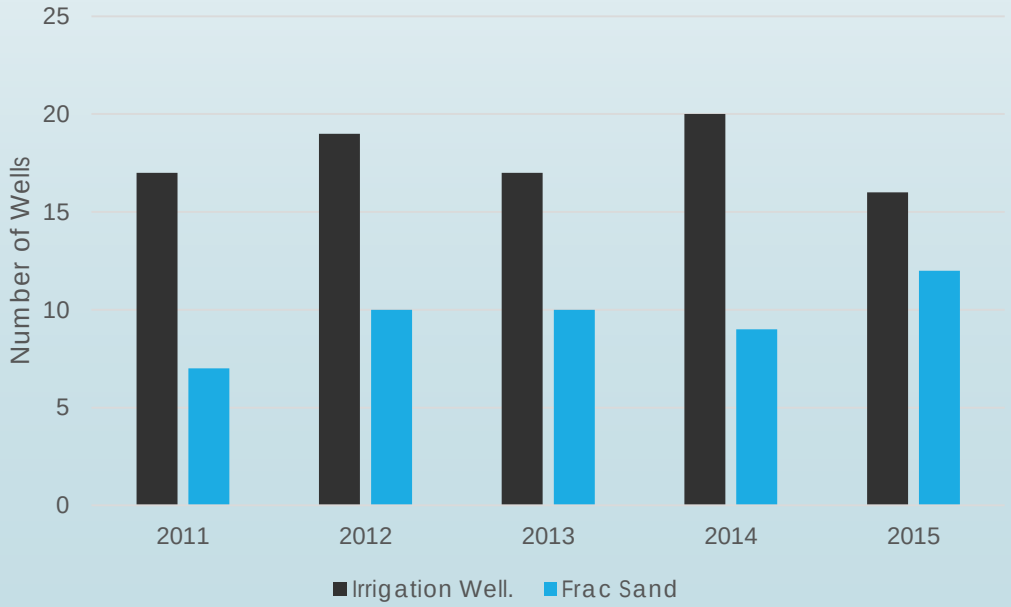
# Chippewa County Hi-Cap Water Consumption



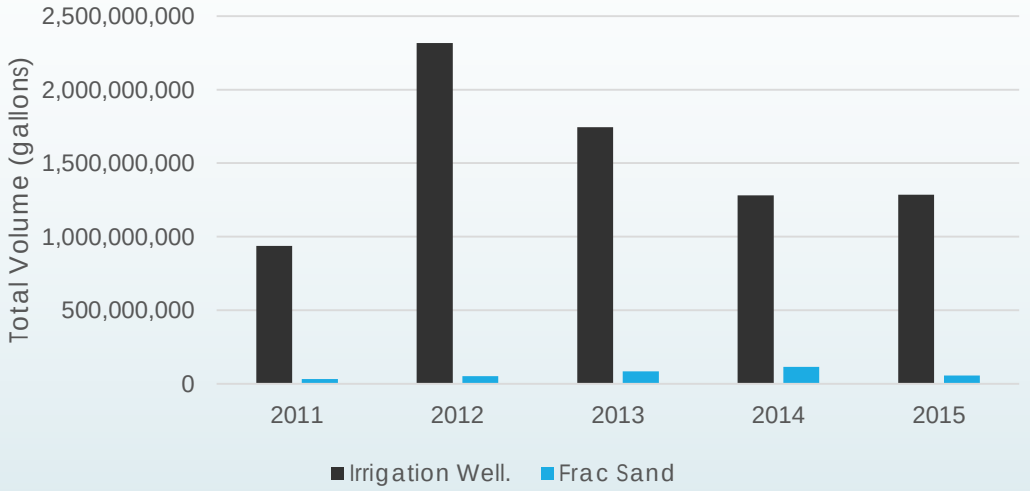



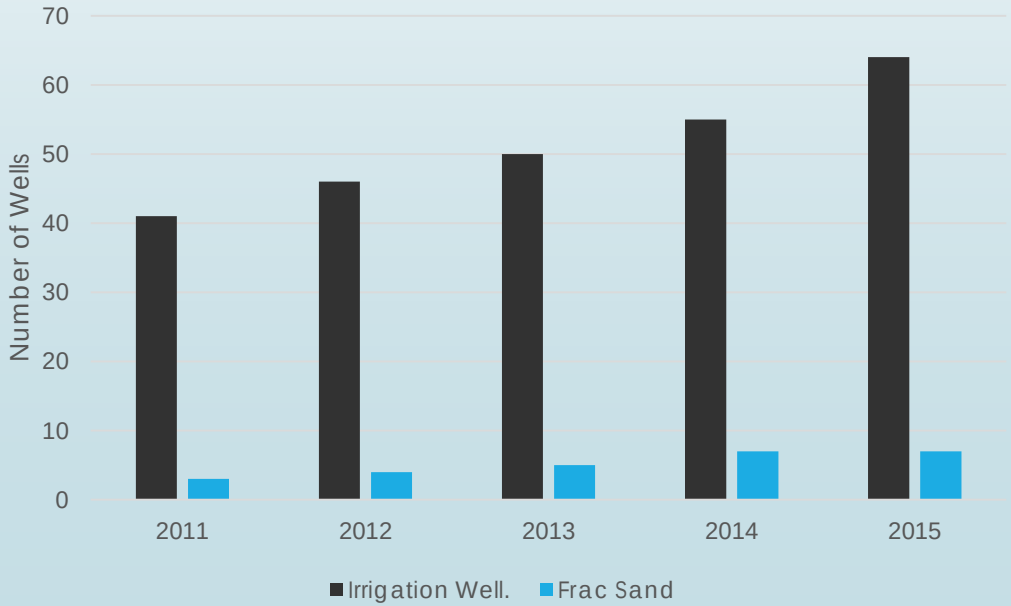
# Jackson County Hi-Cap Water Consumption



# Trempealeau County Hi-Cap Water Consumption



# Summary

- Mt. Simon is an important potable water, agricultural and industrial use regional aquifer
- High water quality in most areas
- Aquifer issues related to high historical production (drawdown) rates in large metro areas, high well densities in select agricultural areas, and water rights (Great Lakes usage)

# Final Thoughts

- Legislative budgeting needed for additional / continuation of regional and local aquifer studies
- Science based decision making in government
- Continued cooperation between State Geological Surveys – spread the education
- Support research in the State University System – UWEC, UW-Madison, UW-River Falls