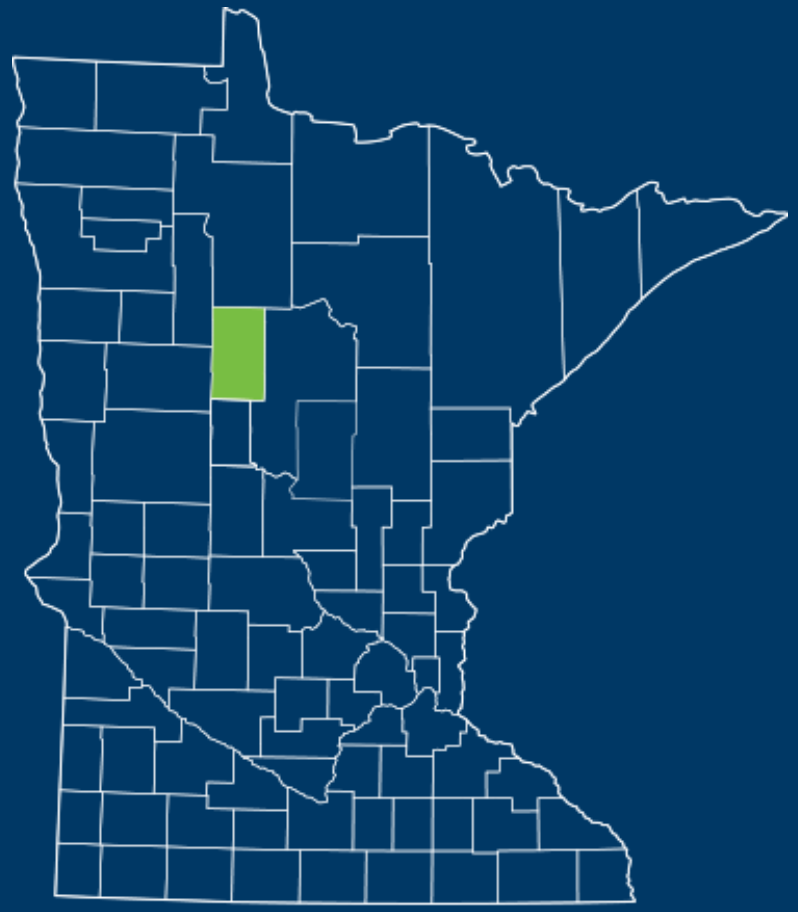


Hubbard County Geologic Atlas (Part B: Groundwater Atlas)

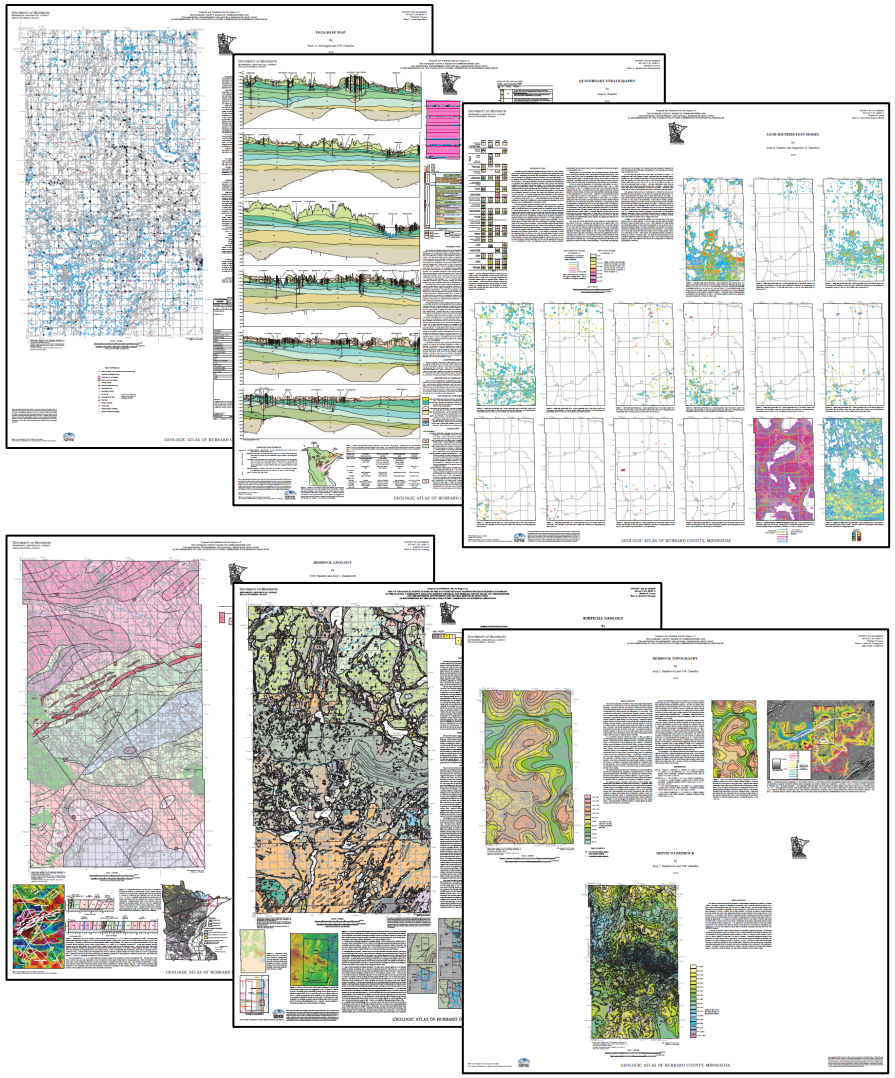
Nicholas (Nick) Budde | Minnesota Department of Natural Resources (DNR)

Hubbard County Coalition of Lake Associations Meeting | Aug. 29, 2024

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

CLEAN WATER LAND & LEGACY AMENDMENT

Part A: Minnesota Geological Survey



Plates (6)

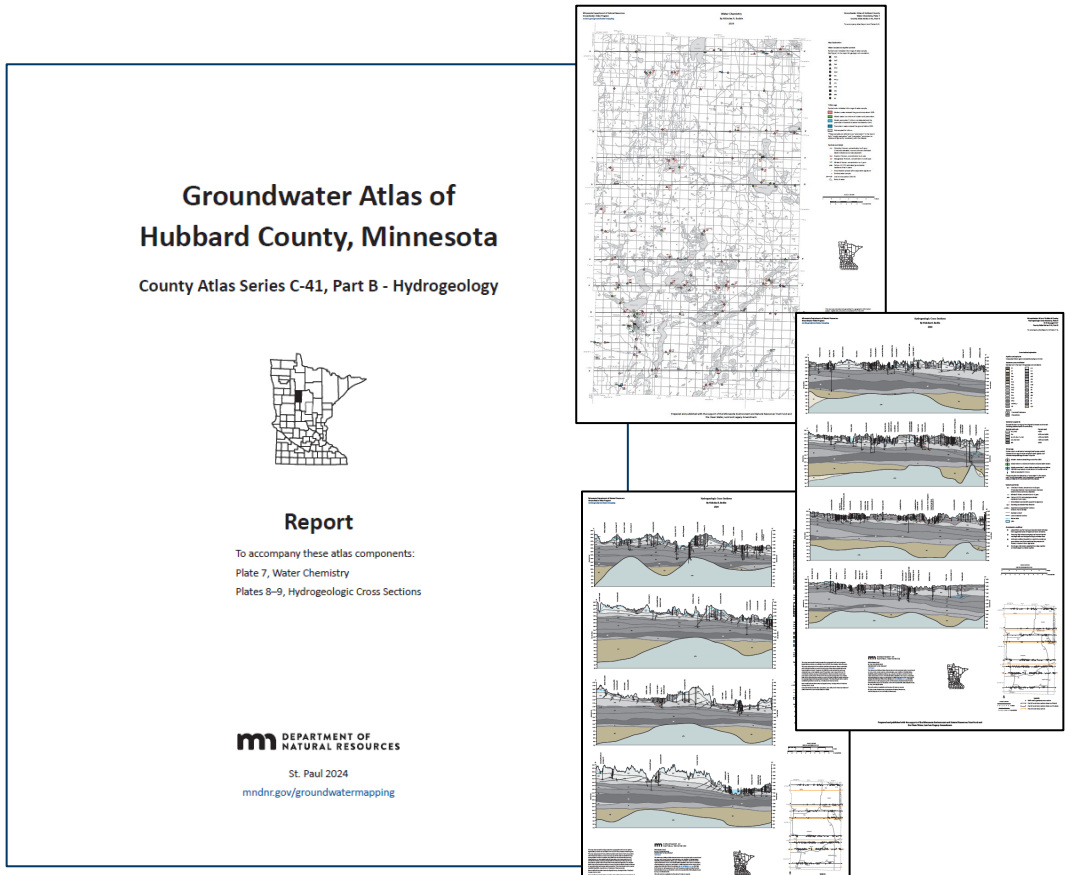
- Geology
  - Surficial
  - Glacial
  - Bedrock

Electronic files

- Plates
- GIS files

cse.umn.edu/mgs/county-geologic-atlas

Part B: Minnesota DNR



Report

- Hydrogeology and groundwater flow
- Water chemistry
- Groundwater pollution sensitivity
- Groundwater use

Plates (3)

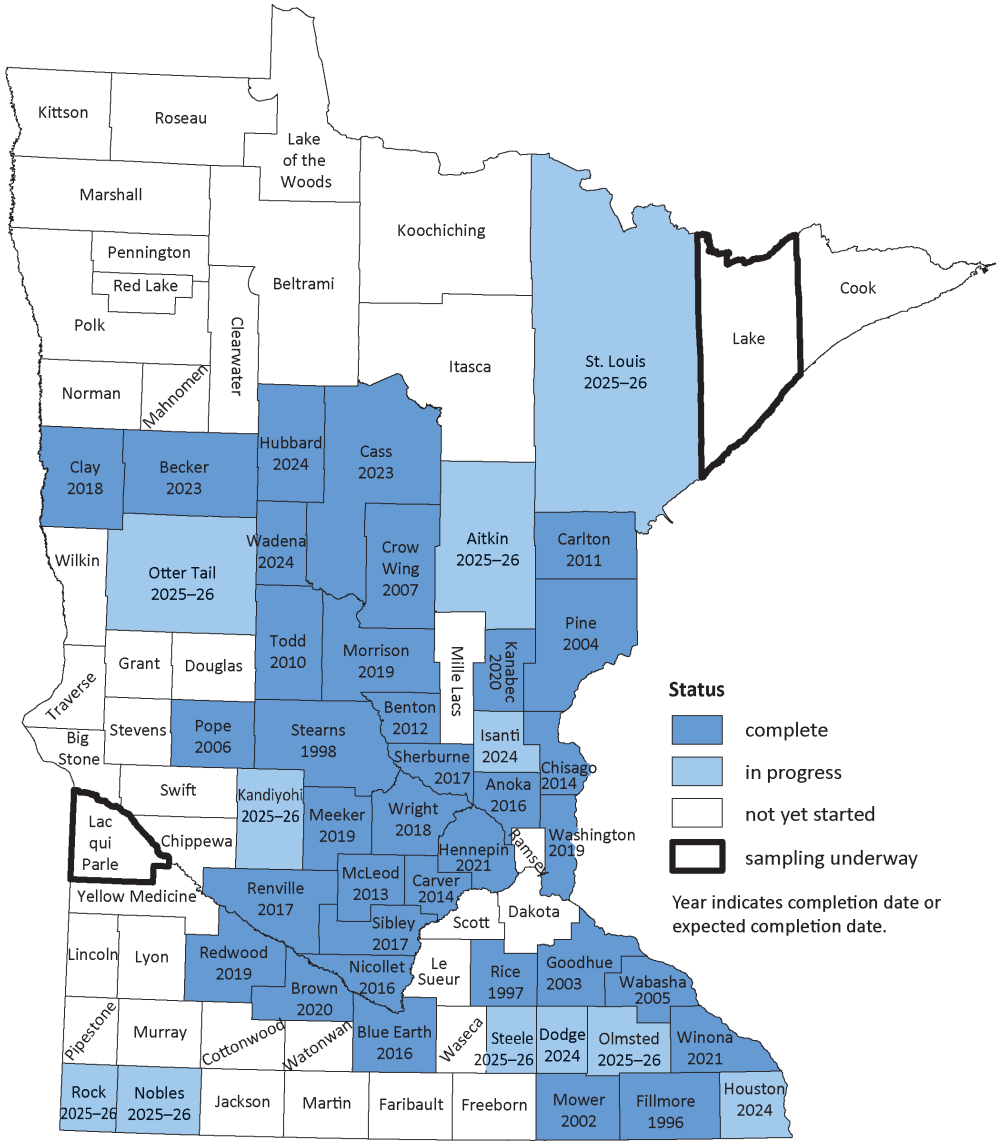
- Water chemistry (1)
- Hydrogeologic cross sections (2)

Electronic files

- Report and plates
- GIS files

mndnr.gov/groundwatermapping

Groundwater: Part B Status



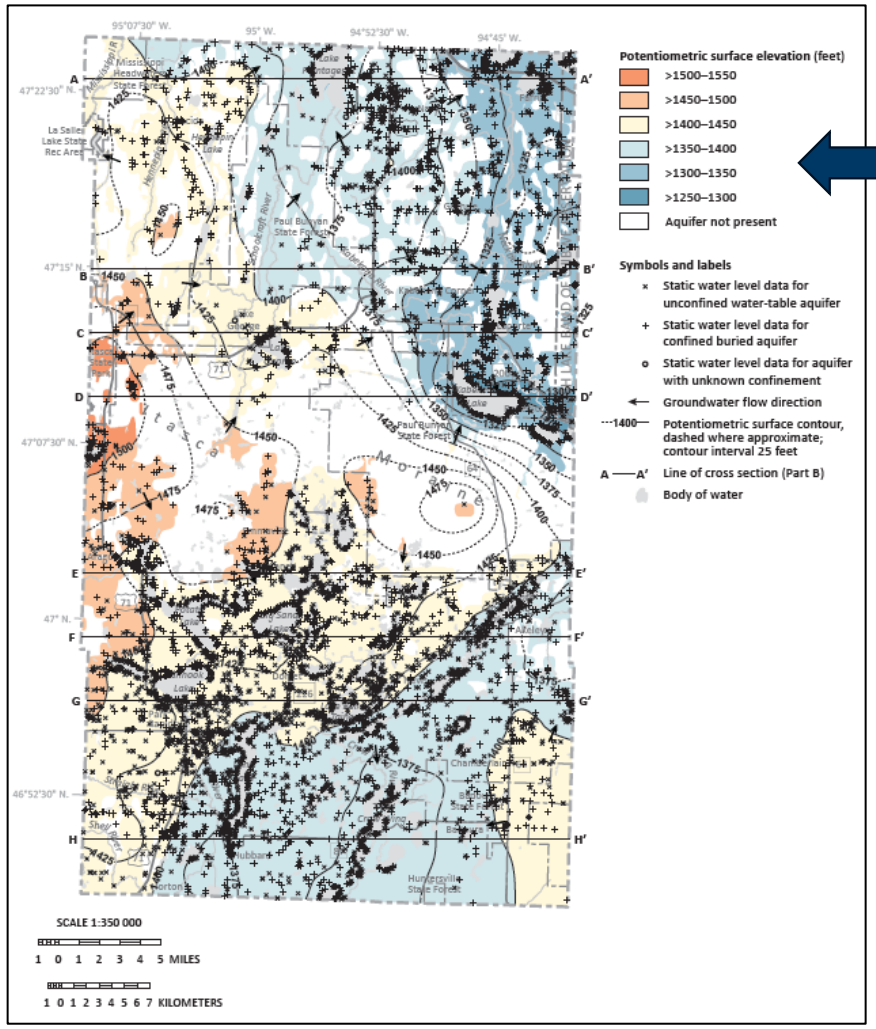
- 35 counties are complete (blue)
- 11 counties are in progress (light blue)
- 39 counties are not started (white)
- 2 counties are actively being sampled (bold black outline)

Statuses are as of August 23, 2024.

How Are Groundwater Atlases Used?

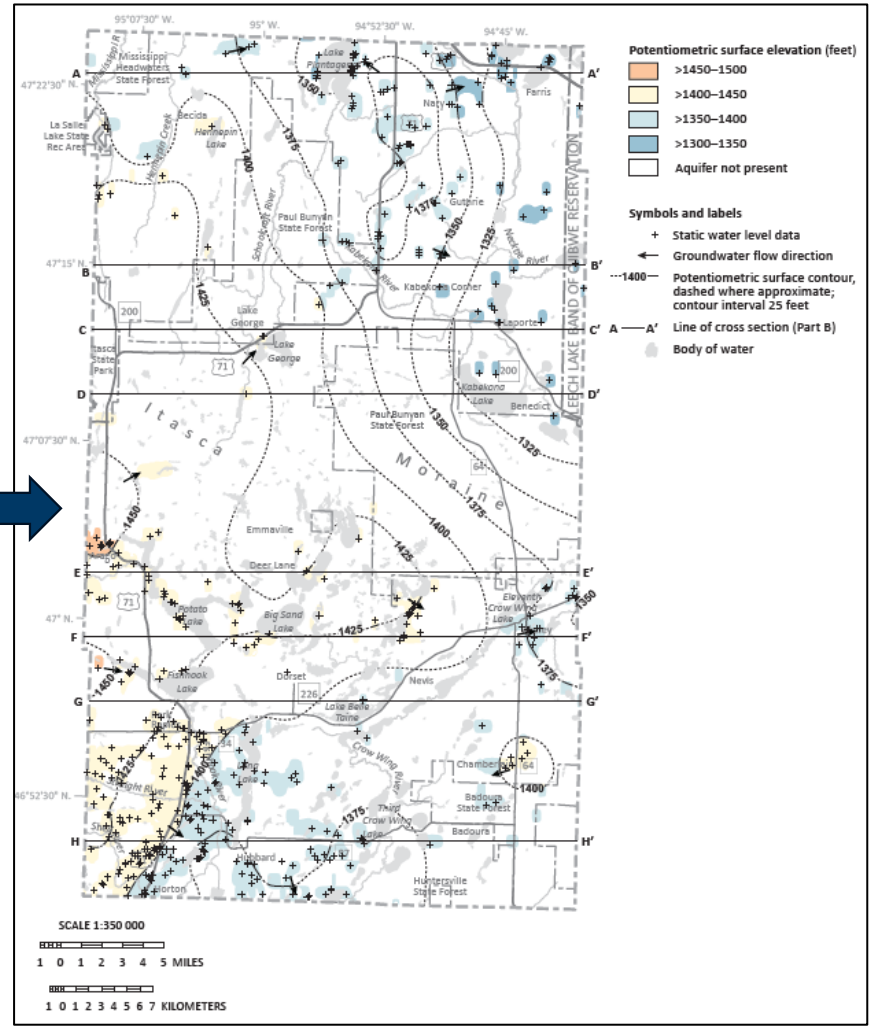
- Planning for location and drilling of water supply wells (public, private, agricultural)
- Groundwater resource protection and management
- Education about groundwater and natural resources
- Pollution sensitivity of aquifers in planning and zoning
- Community development planning (land use, zoning)
- Infrastructure planning (roads, bridges)
- GIS layers of all available information are added to county databases

Groundwater Flow

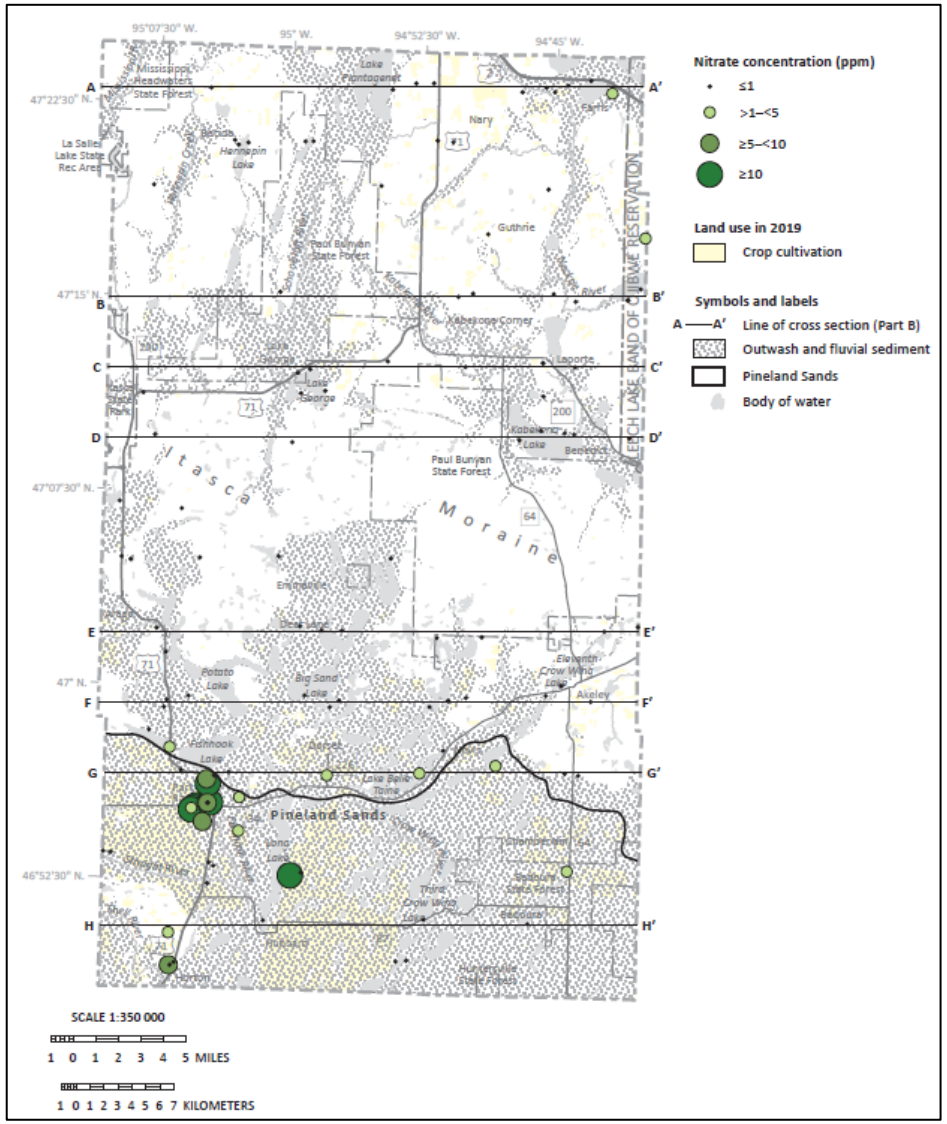


Upper sand aquifers buried by sand or sandy loam sediment

Deeper sand aquifers buried by clay-rich sediment



General Chemistry (100-125 Wells)



Nitrate (fertilizer, septic, manure)

- Drinking water standard (10 ppm) exceeded in 5% of wells
- Likely human-introduced (>1 ppm) in 18% of wells
- Wells <100’ deep in sandy south

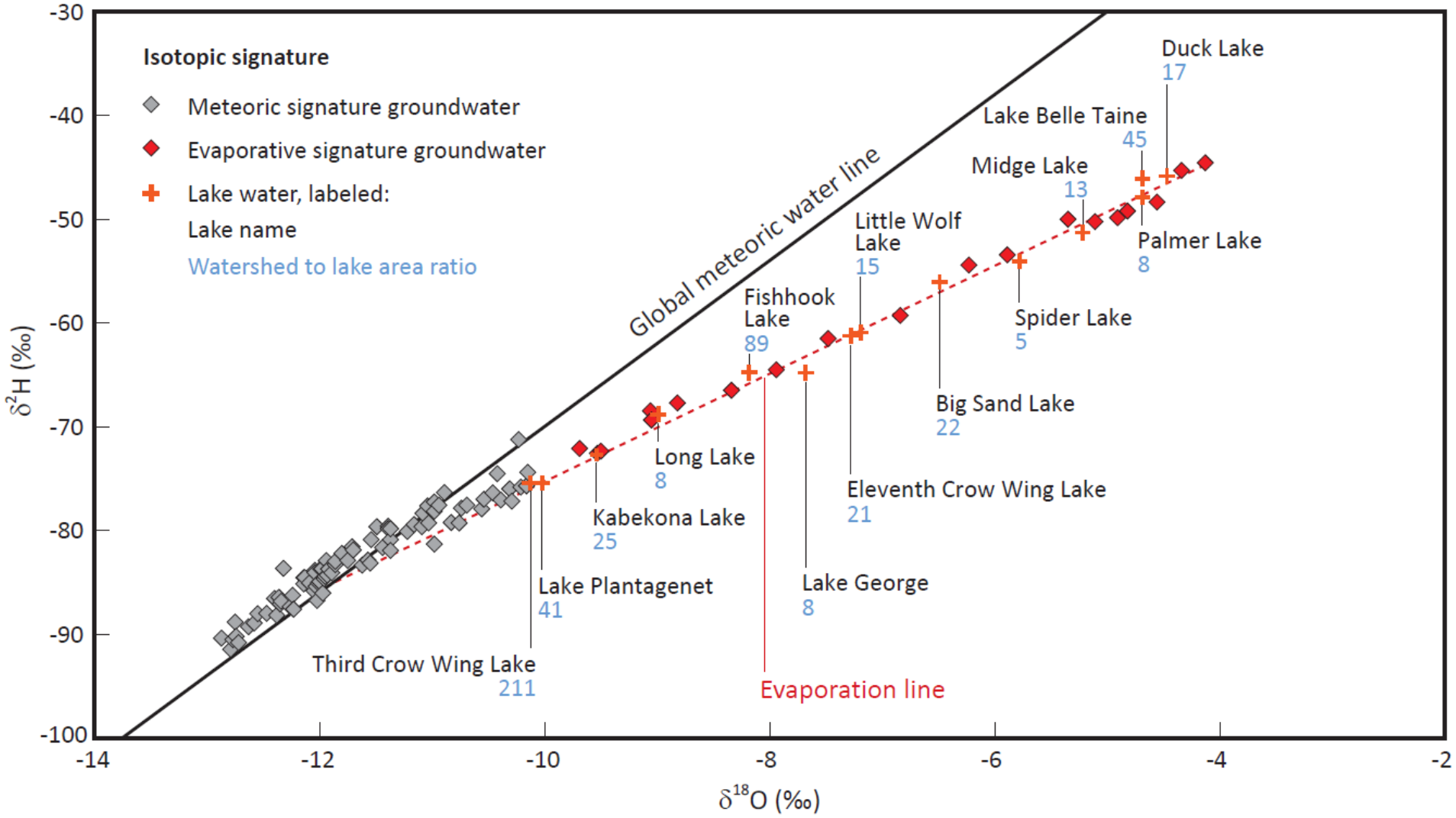
Chloride (road salt, septic, fertilizer)

- Likely human-introduced in 34% of wells
- Wells <100’ deep in sandy south

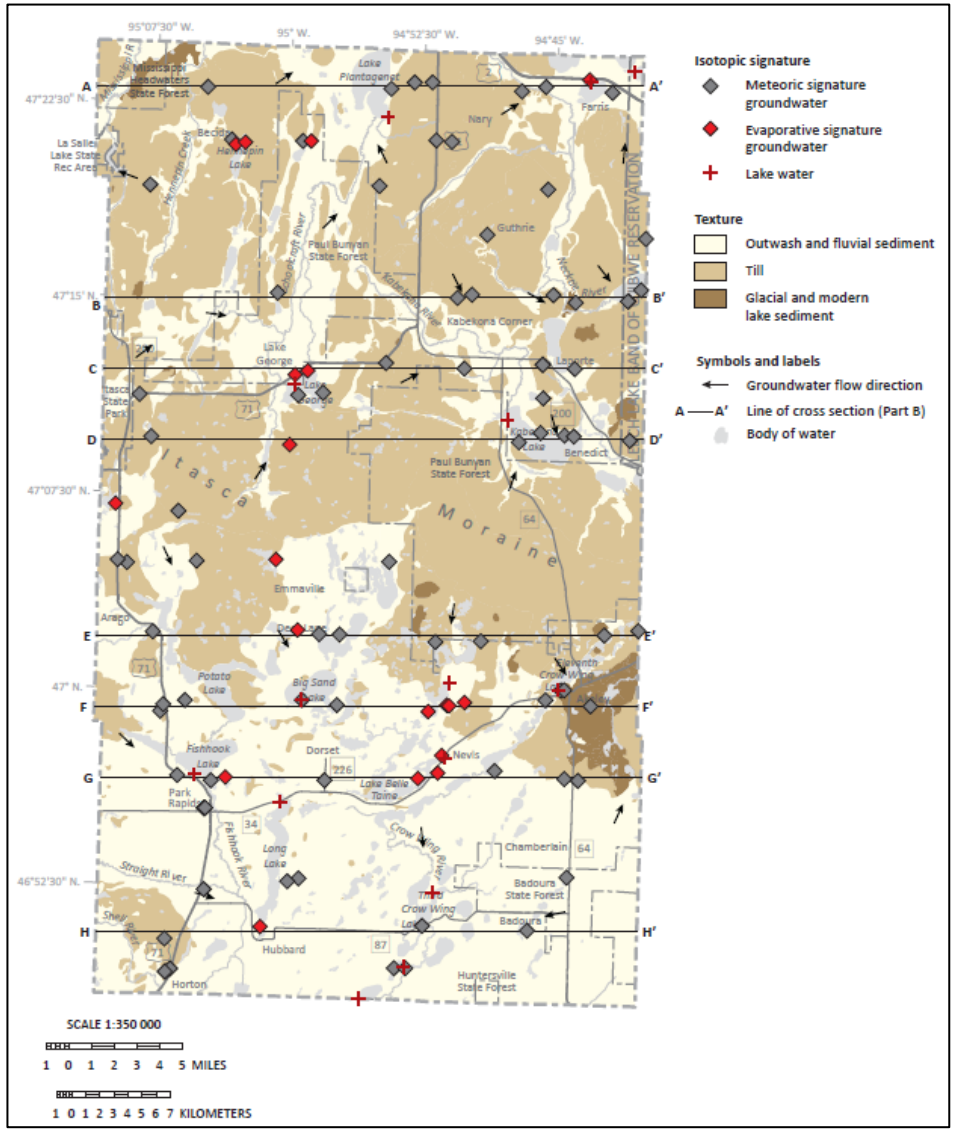
Arsenic (natural)

- Exceeded drinking water standard (10 ppb) in only 3% of wells
- Detected in 75% of wells

Lake Water Recharge Determination

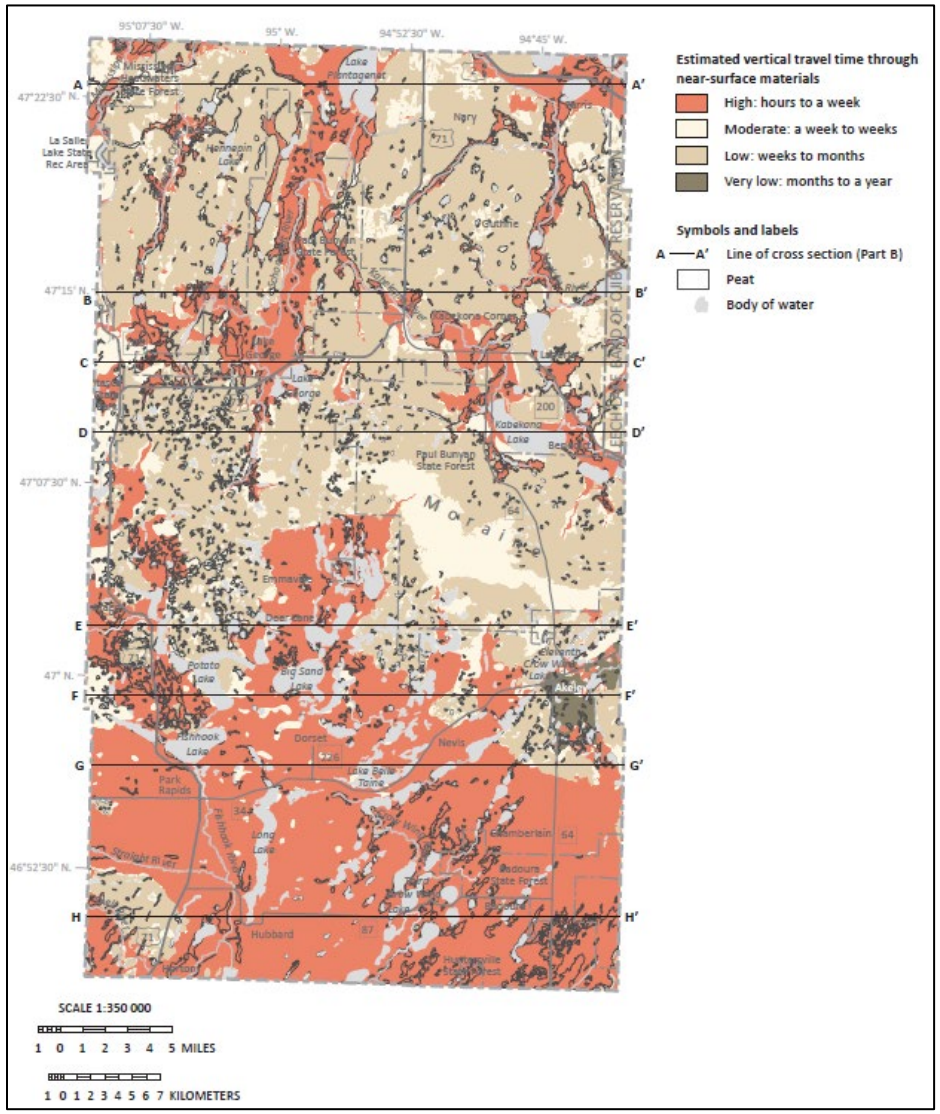


Lake Water vs. Rainwater Recharge



- Lake water recharge in 19 of 101 well samples (19%)
  - Downgradient of lakes
  - Often wells less than 100 ft. deep
  - Often where sand (as opposed to sandy-loam) is at surface
- Connection between lakes and groundwater

Near-surface Pollution Sensitivity



- The upper 10 feet of subsurface

Buried Sand Aquifer Pollution Sensitivity

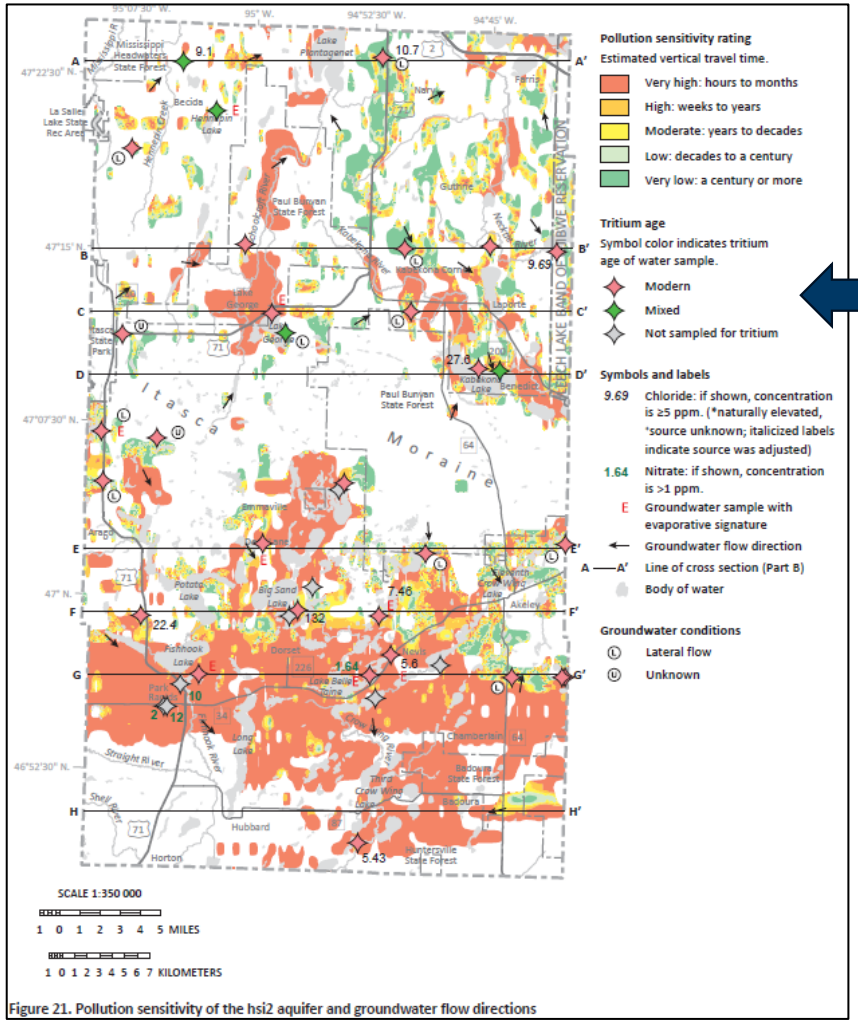


Figure 21. Pollution sensitivity of the hsi2 aquifer and groundwater flow directions

Shallowly buried

More deeply buried

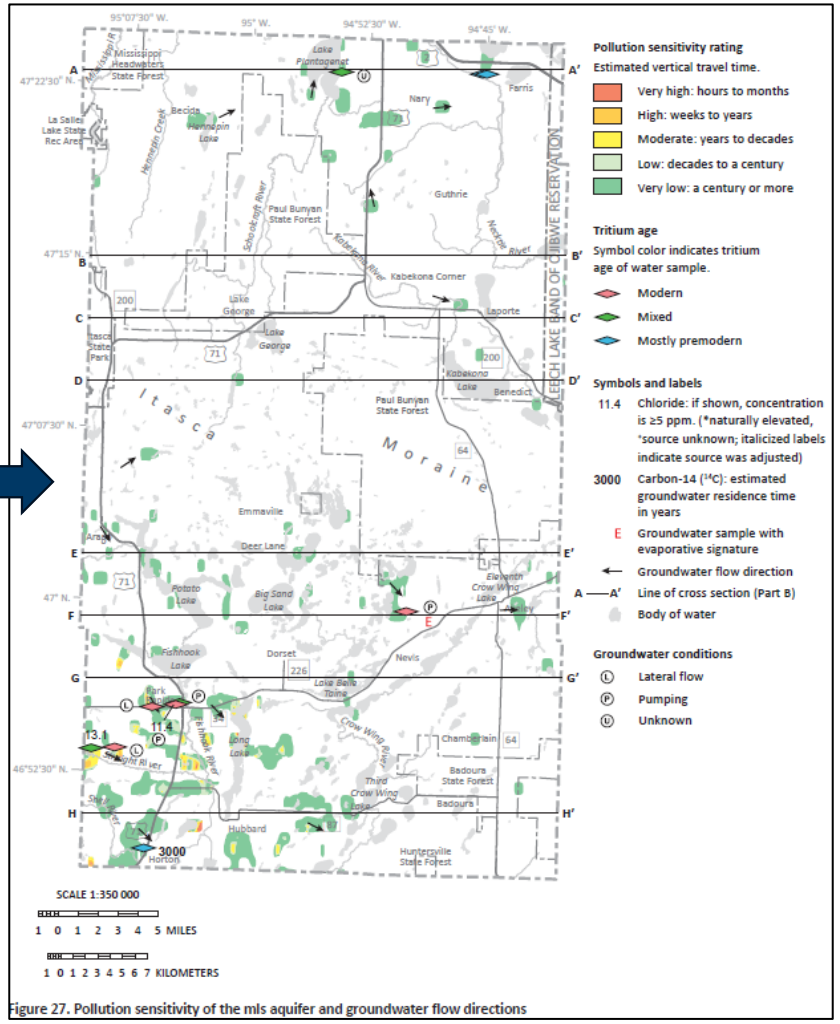
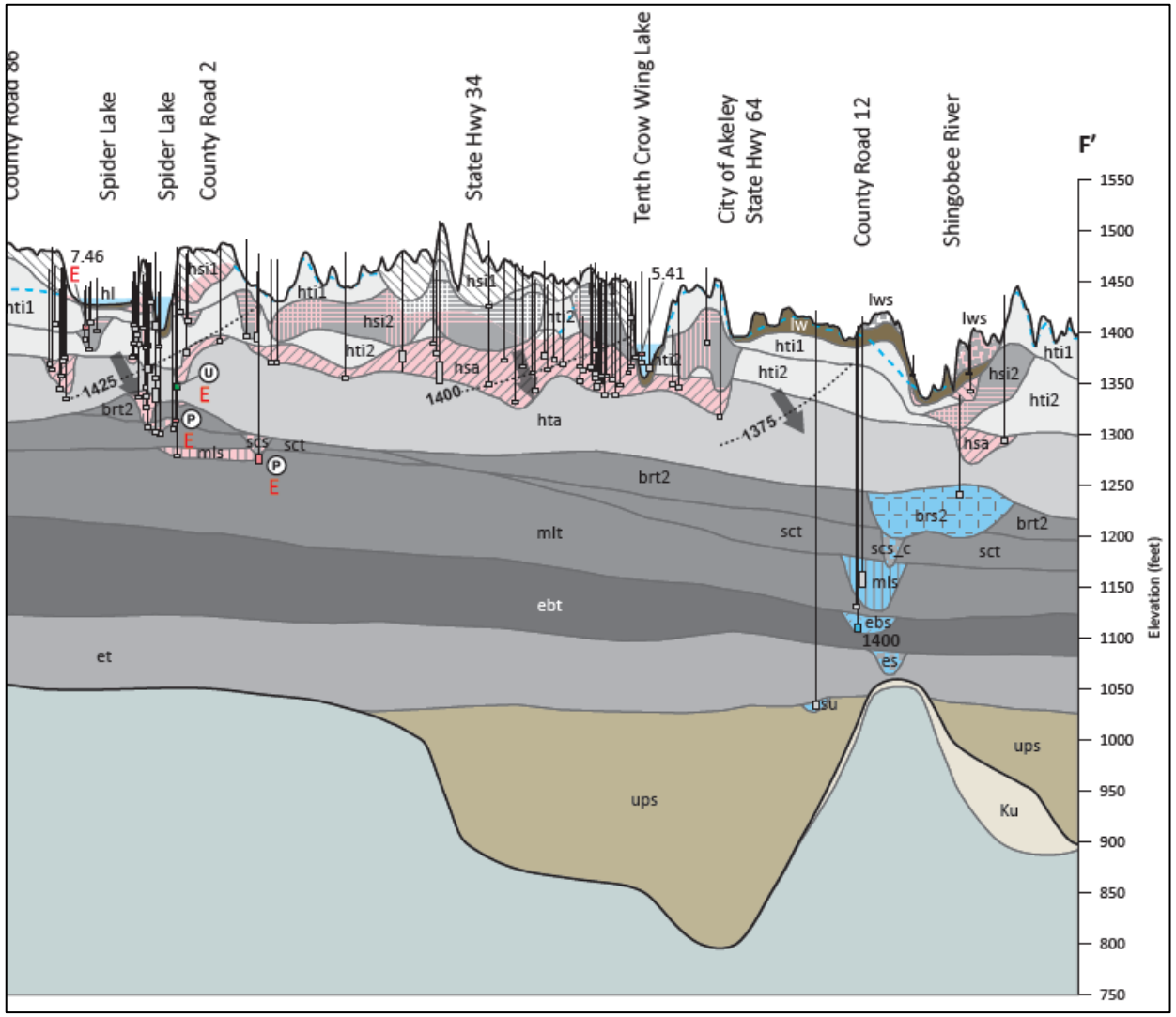


Figure 27. Pollution sensitivity of the mls aquifer and groundwater flow directions

Hydrogeologic Cross-Sections



- What do they show?

Upcoming Hubbard County Workshop

- 12:30 to 3:30 p.m., **Wednesday, Sept. 11** in Park Rapids, Minnesota
- For more information or to register, contact nicholas.budde@state.mn.us by **Friday, Sept. 6**.
- Wadena County workshop likely in November

DEPARTMENT OF NATURAL RESOURCES

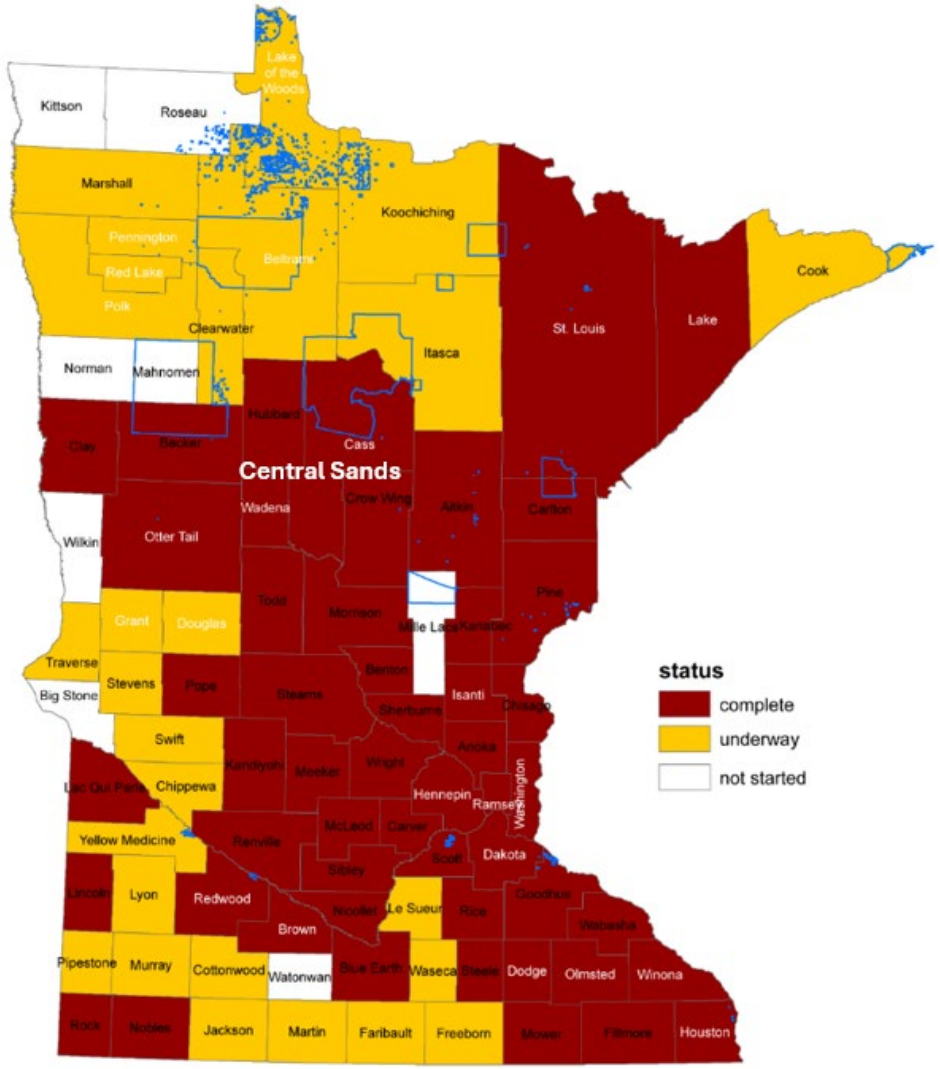
Thank You!

Nick Budde

nicholas.budde@state.mn.us
651-259-5072

mndnr.gov/groundwatermapping

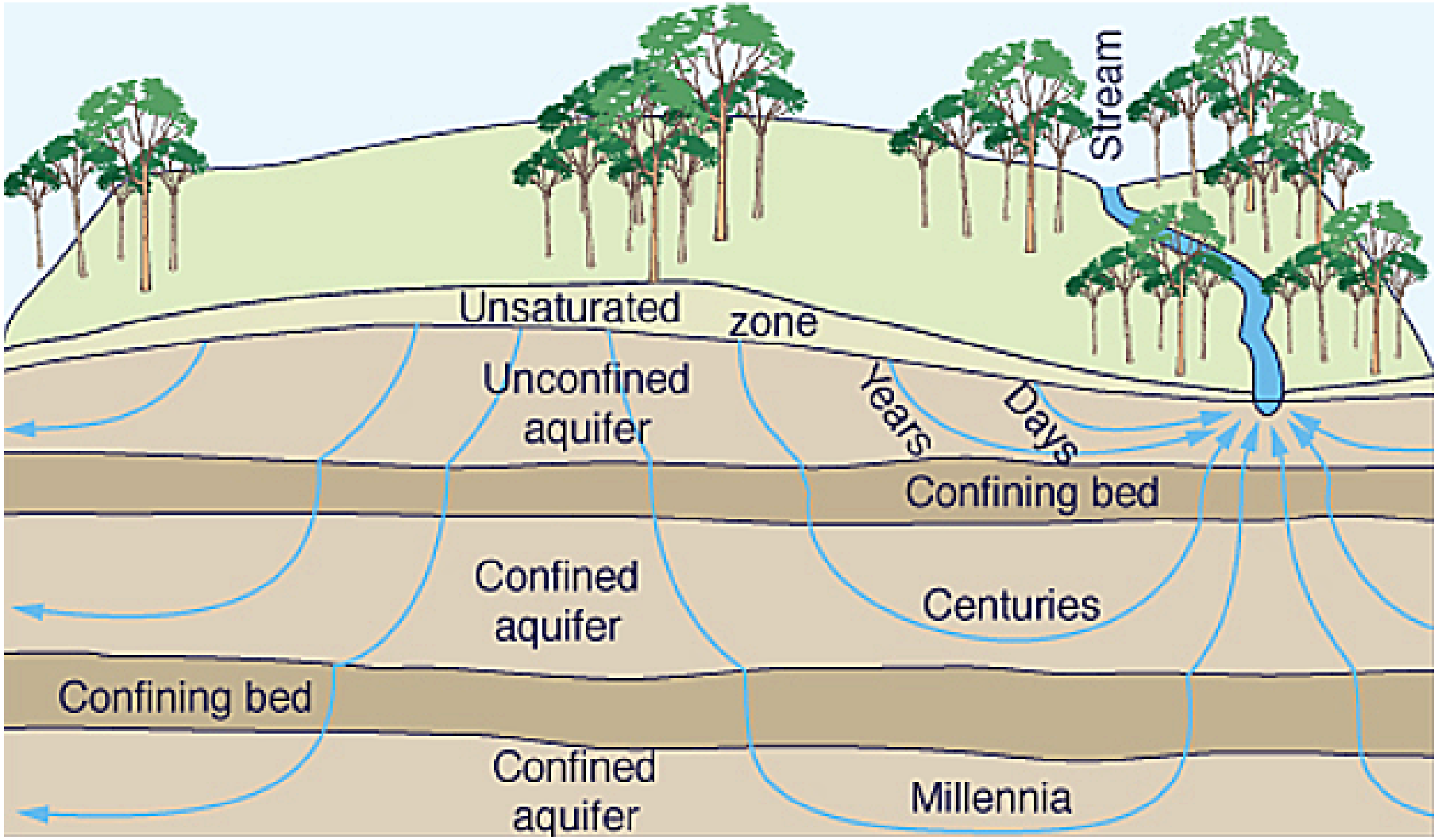
Geology: Part A Status



- 52 counties are complete (maroon)
- 27 counties are in progress (gold)
- 8 counties are not started (white)
- 23 counties are supported all or in part by Clean Water Funds (county names in white)

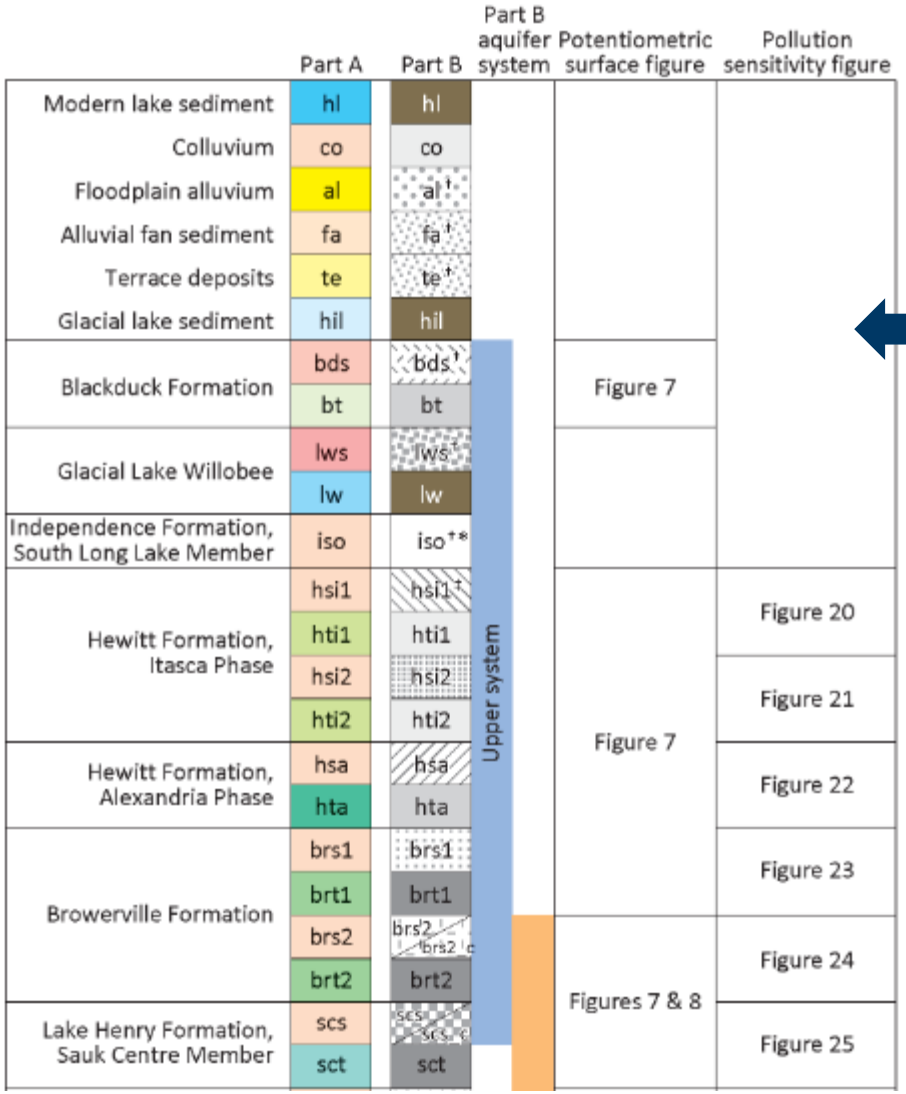
Statuses are as of May 17, 2024.
Minnesota counties are labeled
Tribal government boundaries (blue outlines)

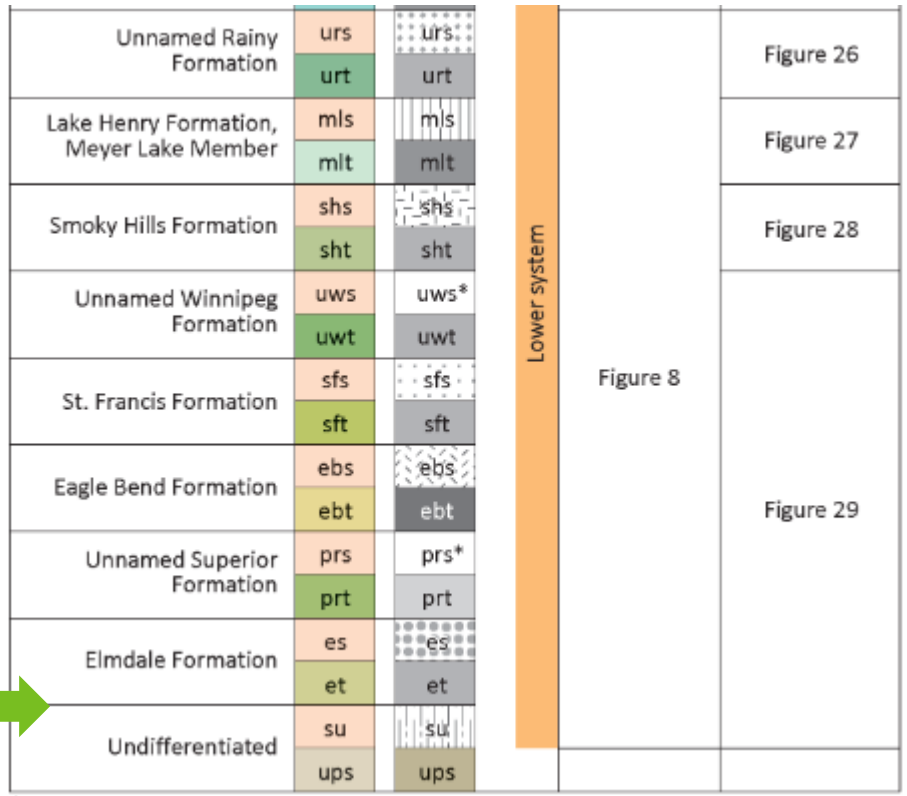
Flow Pathways and Residence Time



Source: United States Geological Survey; Winters, 1998, Figure 3.

Stratigraphic Column



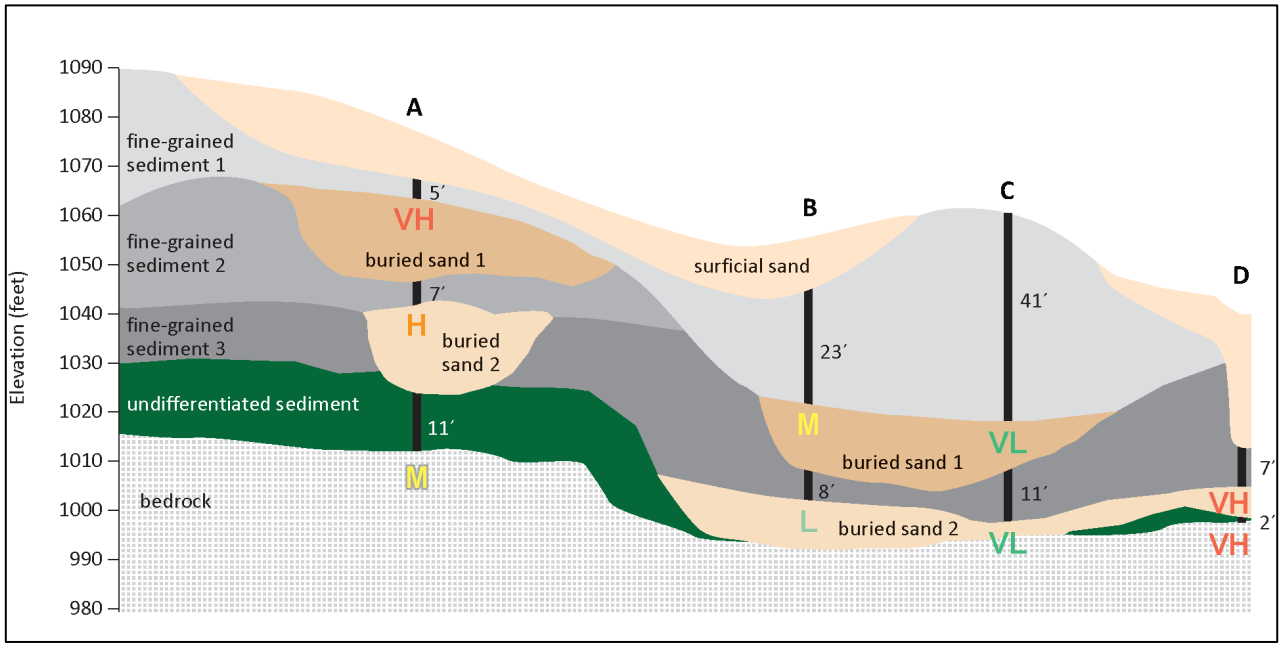


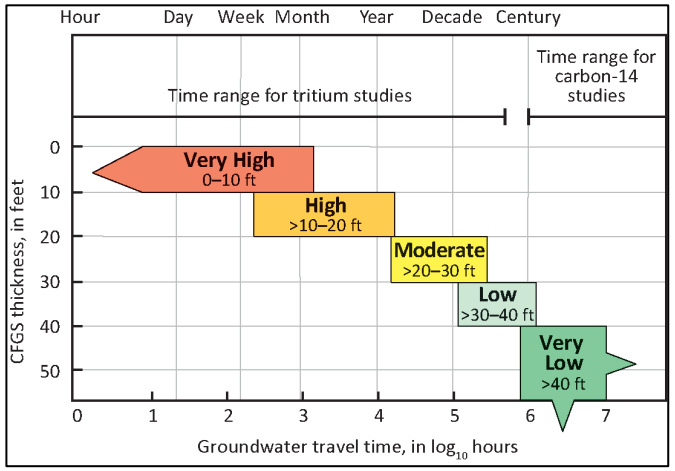
†Surficial sand

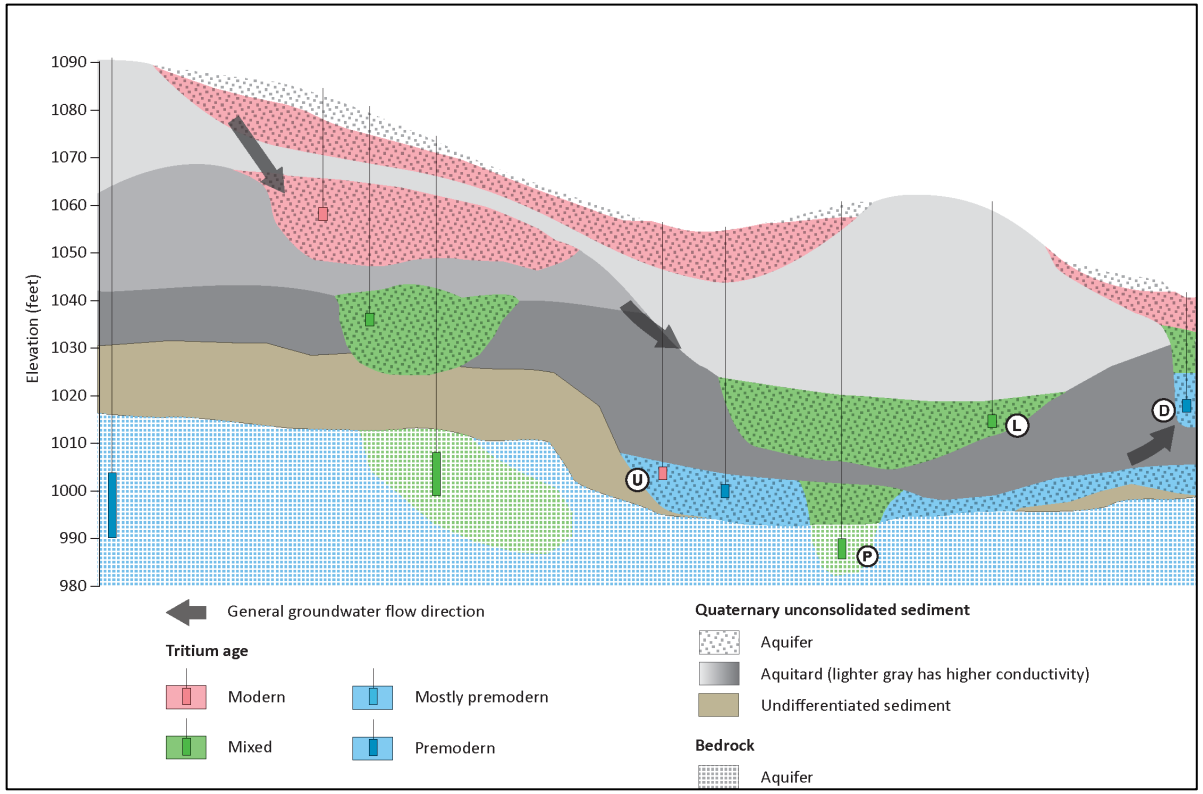
‡Unit is a surficial aquifer except where buried in the northeast, near Akeley, or overlain by modern alluvial sediment.

*Unit is not shown on cross sections.

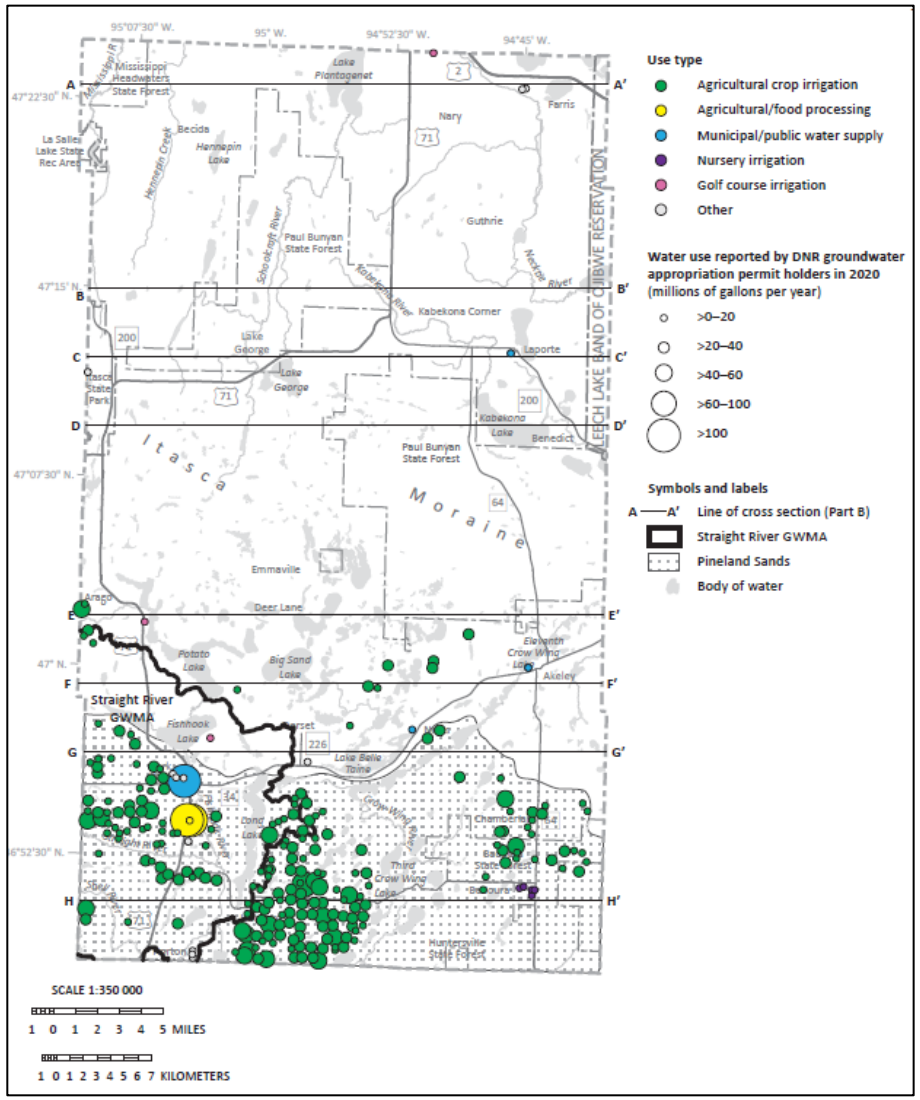
Buried Aquifer Sensitivity Model







DNR-permitted Groundwater Use



- >10,000 gallons/day or 1 million gallons per year