Accomodating High-Volume Water Users

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Research and Policy Director

FRESHWATER

Inspiring and empowering people
to value and protect water.

freshwater.org

What does Freshwater do?

Communication, coordination, and collaboration to drive critical actions with people and partners by region.

Water Research

Water Policy

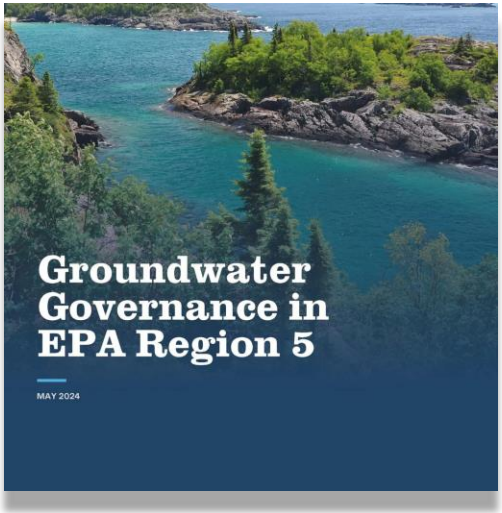
Education and Engagement

FRESHWATER

- **Groundwater governance —** how people and their institutions collaborate across various jurisdictional levels to establish laws, policies, and decisions to manage the groundwater they share.

- **Groundwater management —** the practical implementation of those laws, policies, and decisions.

Prior Work on Groundwater Governance



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WATER 365 LLC

MUSKINGUM WATERSHED CONSERVANCY DISTRICT

UNIVERSITY OF MINNESOTA Driven to Discover

The Joyce Foundation

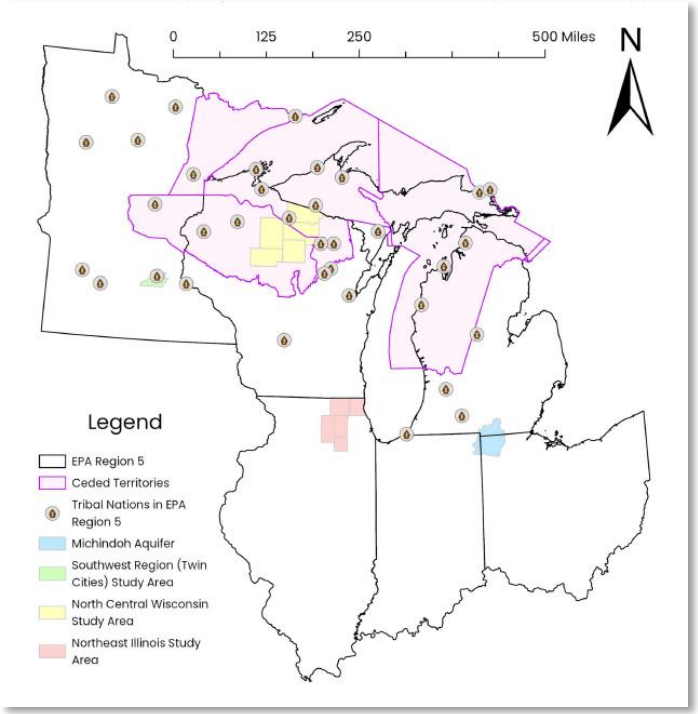
1. **Describe the system** of groundwater governance surrounding the Great Lakes.
2. **Assess its adequacy** to support sustainable use, mindful of existing and future challenges.

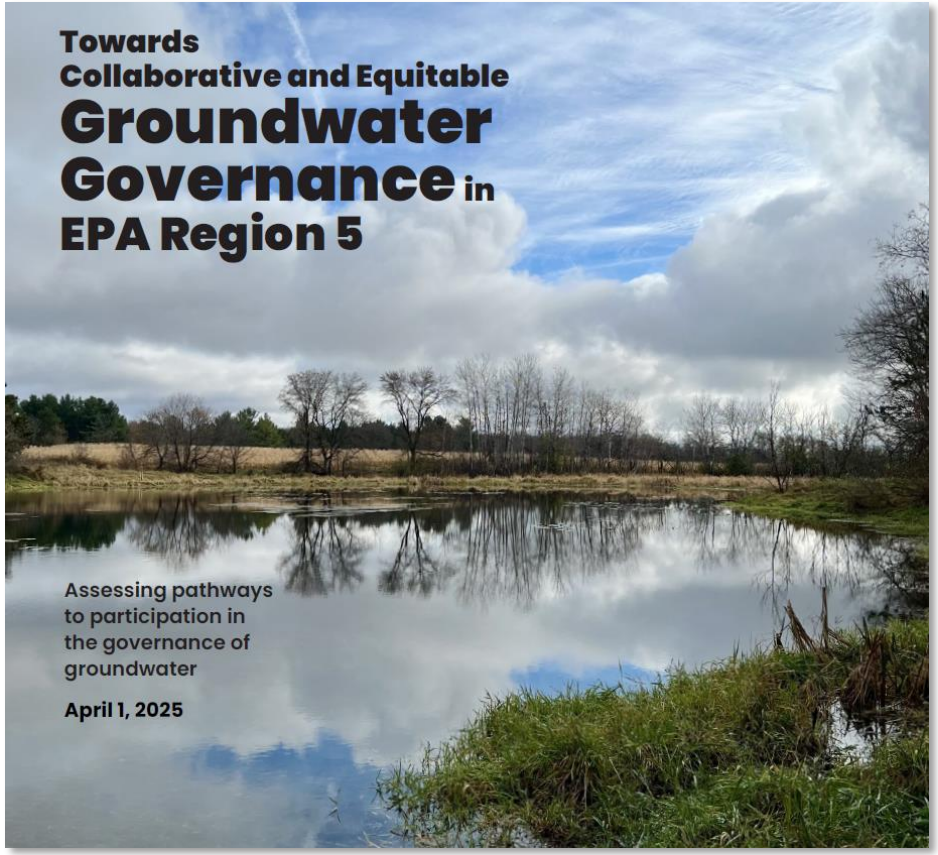
Overview of:

- hydrogeologic knowledge production
- current groundwater institutions
- governance approaches
- challenges

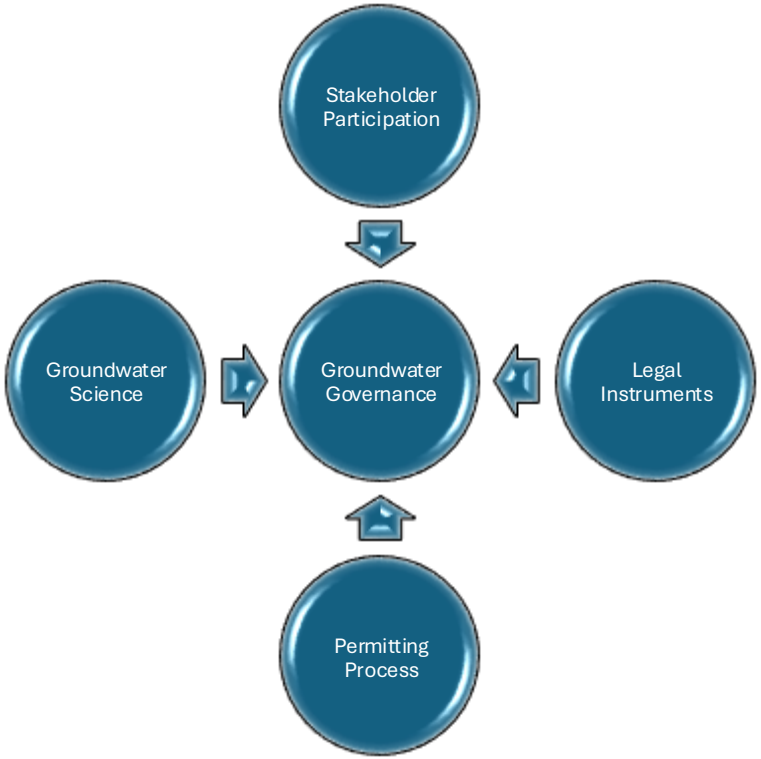
Prior Work on Groundwater Governance

Second Phase of Work: Aquifer Conversations





Governance to support inclusive prosperity and ecological health has these components:

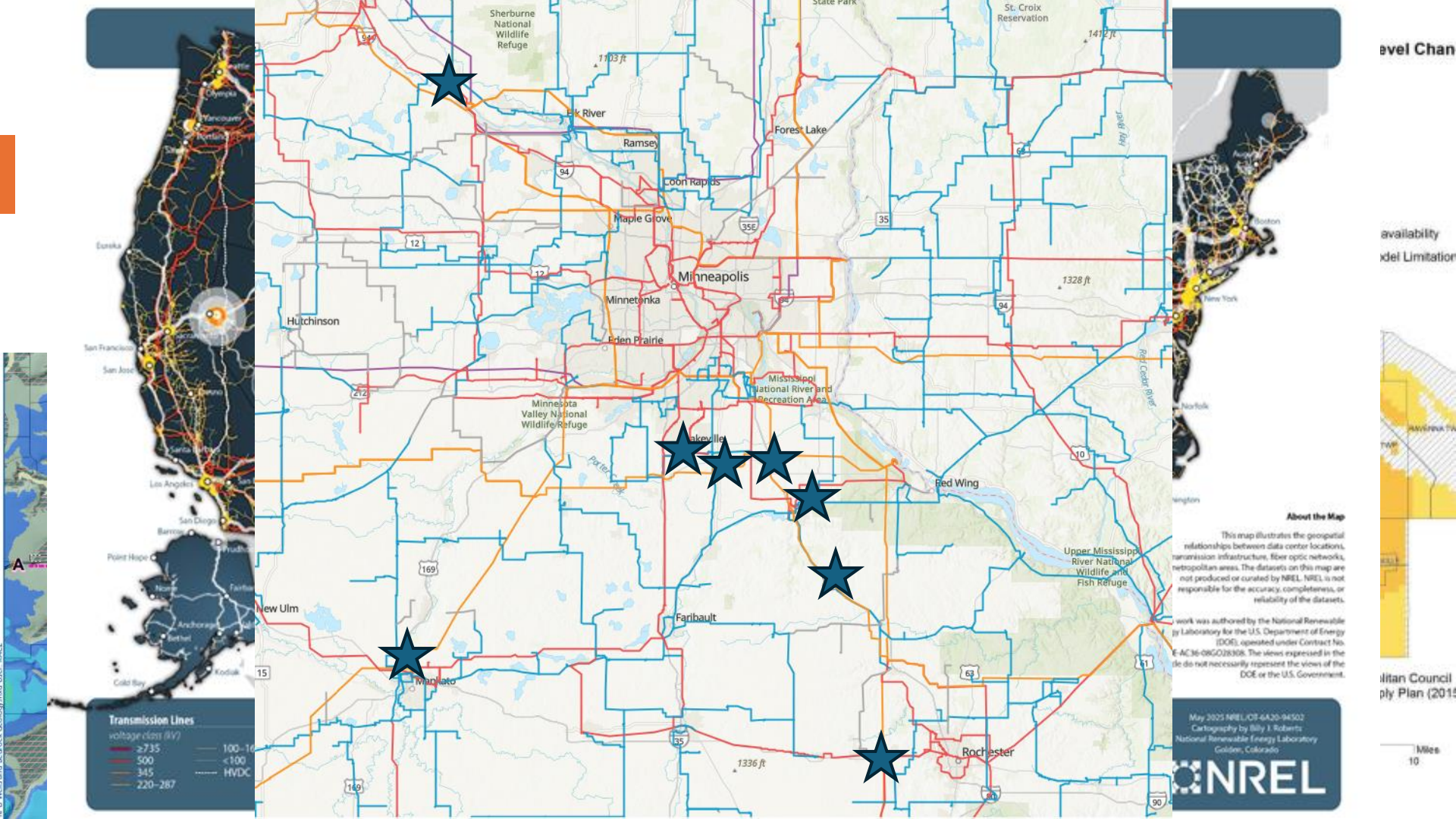


The Problem: The Speed of Business *vs.* Policy

- **Minnesota is a Target for Water-Intensive Industries**
  - Data Centers
  - Biofuels (sustainable aviation fuel)
  - Green Hydrogen
  - Beverages
- **Over 20 cities approached in the last year alone**
- **Decisions move quickly, often under NDAs**

The Challenge

ISSUES ARE
EMOTIONAL


Sherburne National Wildlife Refuge
St. Croix Reservation
Elk River
Ramsey
Forest Lake
Coon Rapids
Maple Grove
Minneapolis
Minnetonka
Hutchinson
Eden Prairie
Mississippi National River and Recreation Area
Minnesota Valley National Wildlife Refuge
Lakeville
Red Wing
Upper Mississippi River National Wildlife and Fish Refuge
New Ulm
Faribault
Mankato
Rochester
1103 ft
1328 ft
1336 ft
Transmission Lines
voltage class (kV)
≥735
500
345
220–287
100–16
<100
HVDC
About the Map
This map illustrates the geospatial relationships between data center locations, transmission infrastructure, fiber optic networks, metropolitan areas. The datasets on this map are not produced or curated by NREL. NREL is not responsible for the accuracy, completeness, or reliability of the datasets.
May 2025 NREL/OT-6A20-94502
Cartography by Billy J. Roberts
National Renewable Energy Laboratory
Golden, Colorado
NREL

A Tension

Sustainable Water Supply

How to balance economic development with the need to ensure future water for communities and ecosystems?

Decision critical information on water availability and impact lacking

DEED helps site the project

- *Water managers or regional planners may not be involved*

Municipalities approached to evaluate land use, power use, and maybe water use

- *NDAs may be used*
- *Land use and power discussed first*
- *Partners approached with a short timeline*

Agreements reached and project goes public

- *Usually municipal connection*
- *May not require environmental review*

Reactions from citizens, water managers, DNR, met council, regional planners

- *Packed city meetings*
- *Legal action may stall project*
- *Developer may pull out*

Possible adverse outcomes

- ***Private well interference***
- ***Increased water rates***
- ***Environmental impacts***
- ***City saddled with expensive infrastructure***

Legal Instruments — Priority of Use

(1) domestic water supplies and power producers which have approved contingency plans;

(2) uses of less than 10,000 gallons per day;

(3) agricultural irrigation and processing of agricultural products consuming in excess of 10,000 gallons per day;

(4) power production without approved contingency plans;

(5) other uses in excess of 10,000 gallons per day; and

(6) nonessential uses of water.

Issues we see

- **Speed.** These projects move faster than water planners can react.
- **Need for data sharing.** Cities need data and tools to evaluate regional long-term water supply sustainability.
- **Short term incentives are attractive.** Easier to consider than long-term sustainability.
- **Community engagement?** Often none.
- **Many stakeholders.** Makes being proactive a challenge.

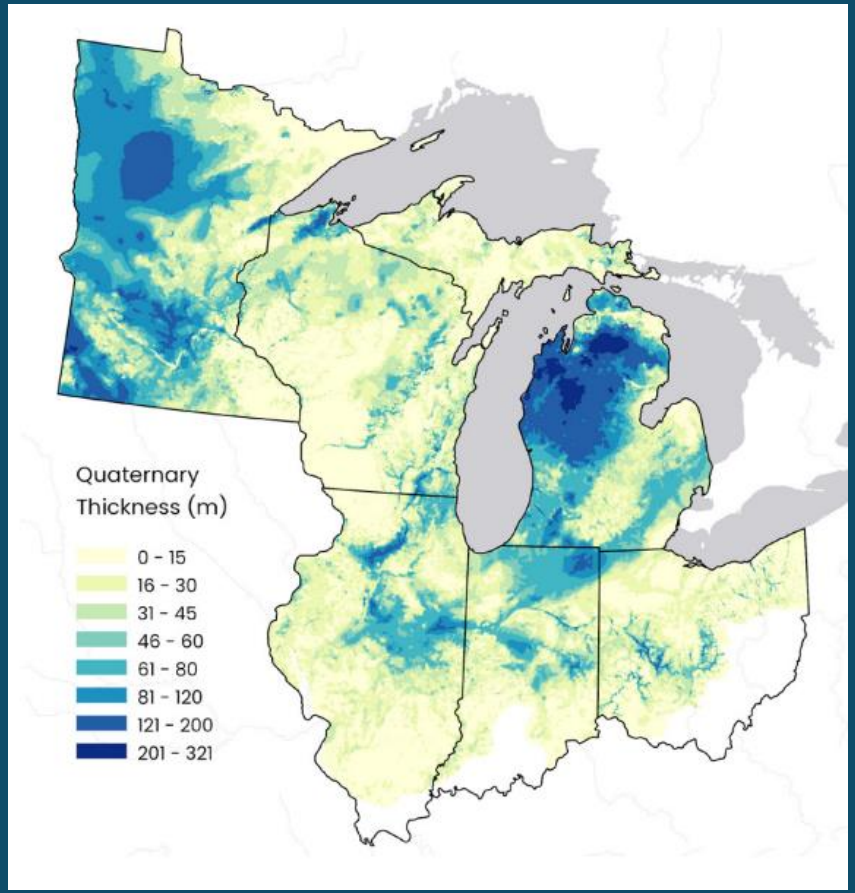
2025 Minnesota Legislature bill (SSHF16)

Stop gap bill passed last session

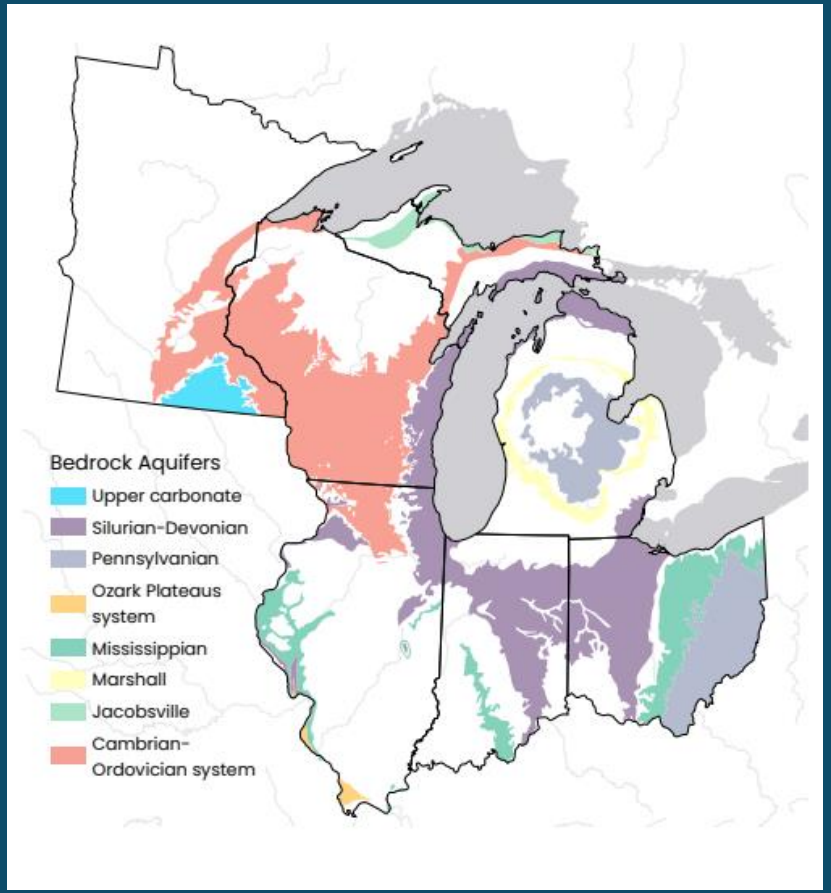
- Coordination with **MN Business First Stop.**
- **Defines a large-scale data center** as over 100 MW and 100 MGY.
- Pre-application with **MN DNR** if water use exceeds 100 MGY and requires a new permit or permit amendment.
- **More transparency** in water and energy use in the preapplication process.
- *Encourages* **water conservation**.
- Outlines **energy fees** and *encourages* renewable energy.

What questions should be asked?

- What is the distribution of usable groundwater?
- Who is already using it and how much?
- Are there other concerns with using high volumes of groundwater?
- What are the societal priorities for using groundwater?
- What are the alternatives to using groundwater?



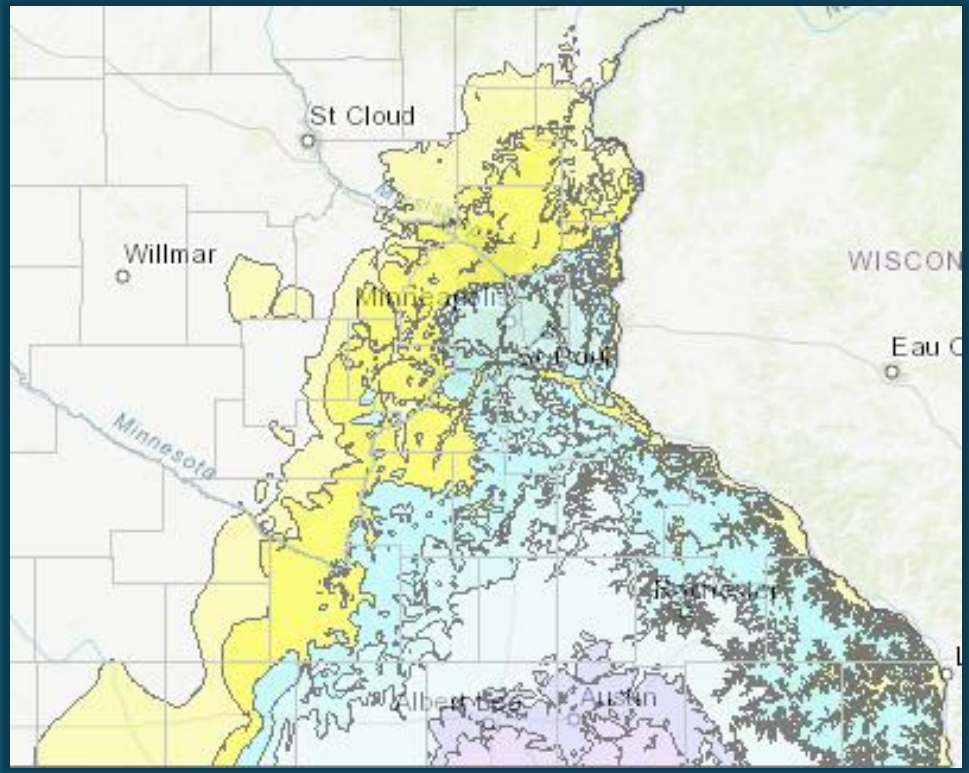
Glacial Sediment Thickness

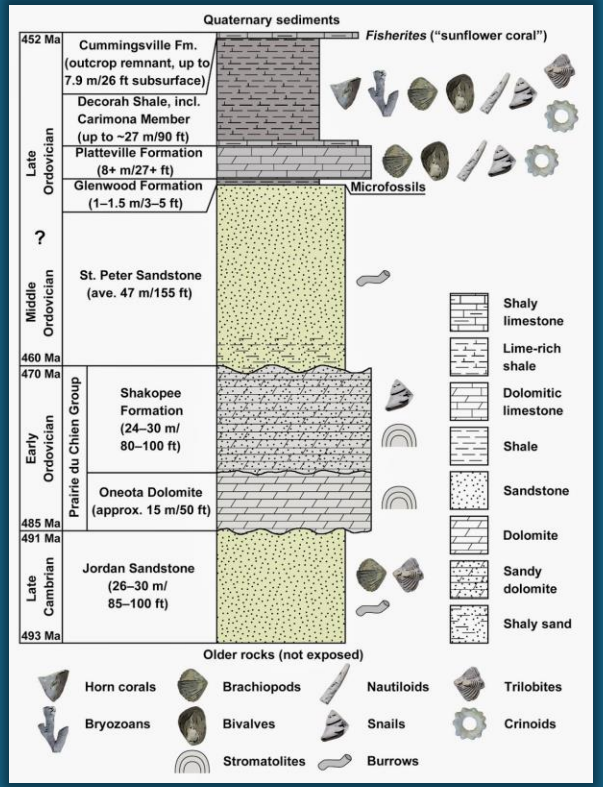


Available Bedrock Aquifers

Glacial Sediment Covering Bedrock, NW Ohio

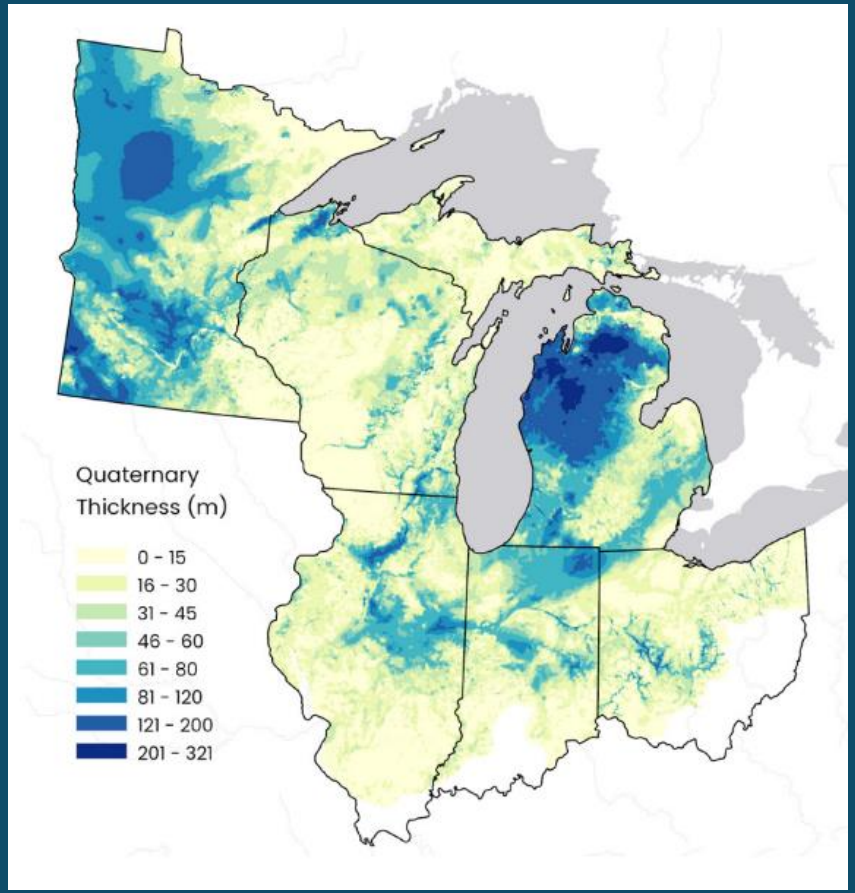
Cambrian-Ordovician Aquifer System





http://equatorialminnesota.blogspot.com/2014/05/reference-diagrams.html

Glacial Stream Sediment = Aquifers



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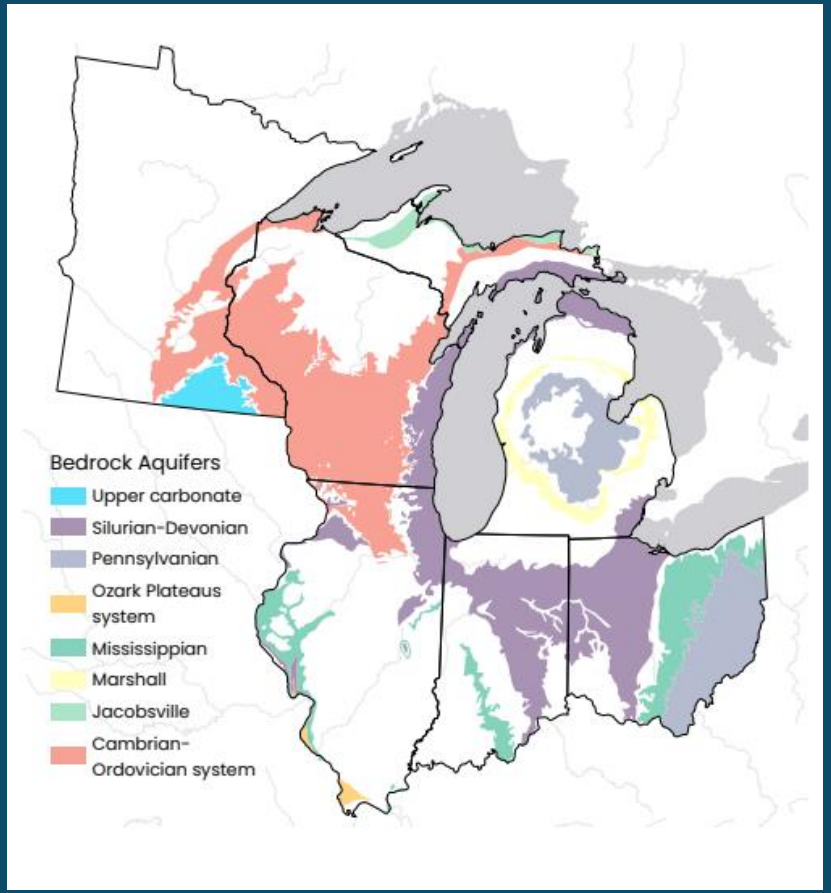


Available Bedrock Aquifers

Glacial Sediment Covering Stream Sediment, N. Minnesota

How much is there and who is using it?

DNR monitors groundwater in Minnesota *and* issues appropriation permits

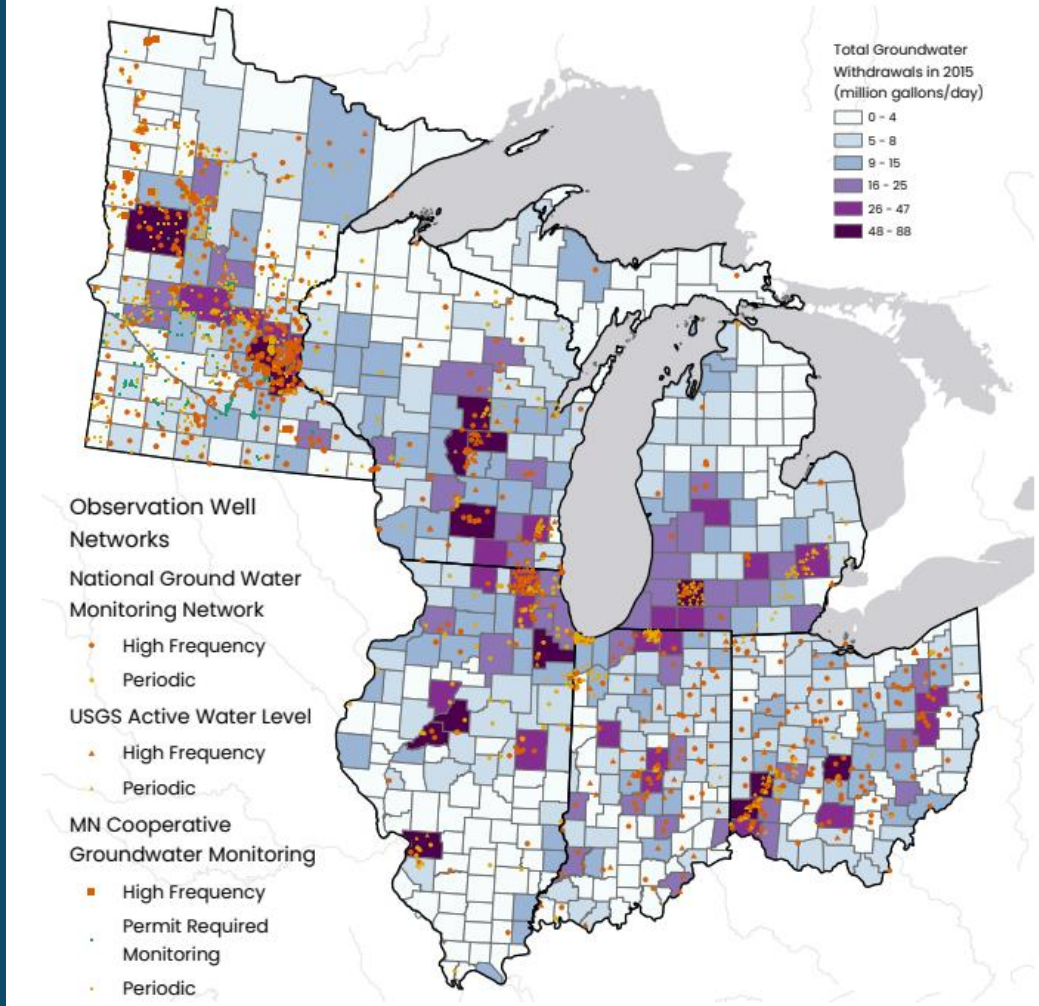


Figure 8: Density and type of observation wells vary by state.

How is Groundwater Replenished?

An aquifer is like a bank account.

Income is important.

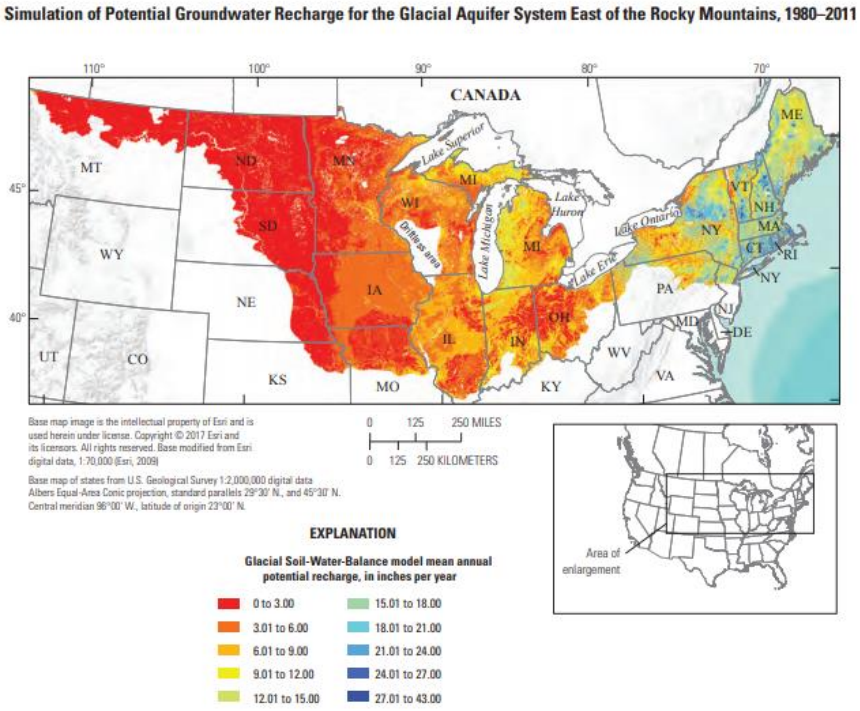


Figure 14. Mean annual potential recharge from 1980 to 2011 simulated with the glacial Soil-Water-Balance model.

Residence time

Water in the Mankato area has a >60,000-year residence time

- Water entered the ground in the previous interglacial period
- Before there was a Minnesota River Valley

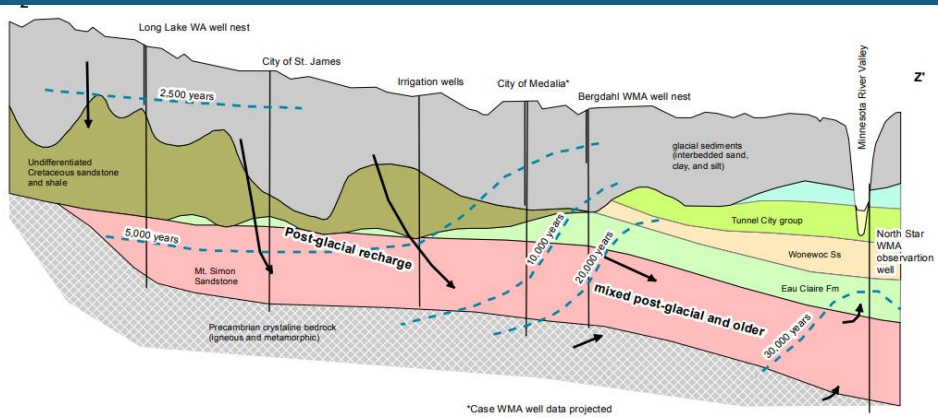


Figure 29 Cross section Z-Z'
Mt. Simon recharge and discharge

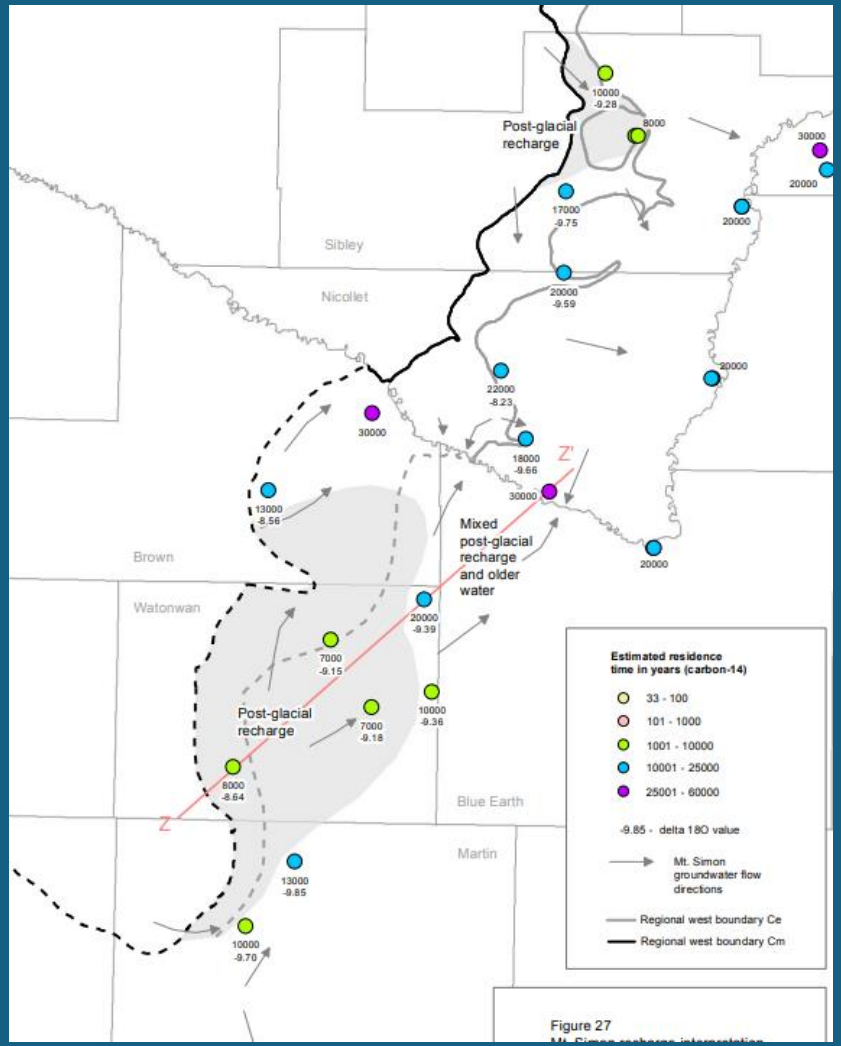


Figure 27

Where is scarcity a concern?

“Thirstwaves” Are Growing More Common Across the United States

Like heat waves, these periods of high atmospheric demand for water can damage crops and ecosystems and increc resources. New research shows they’re becoming more severe.

By **Rebecca Owen** 7 April 2025

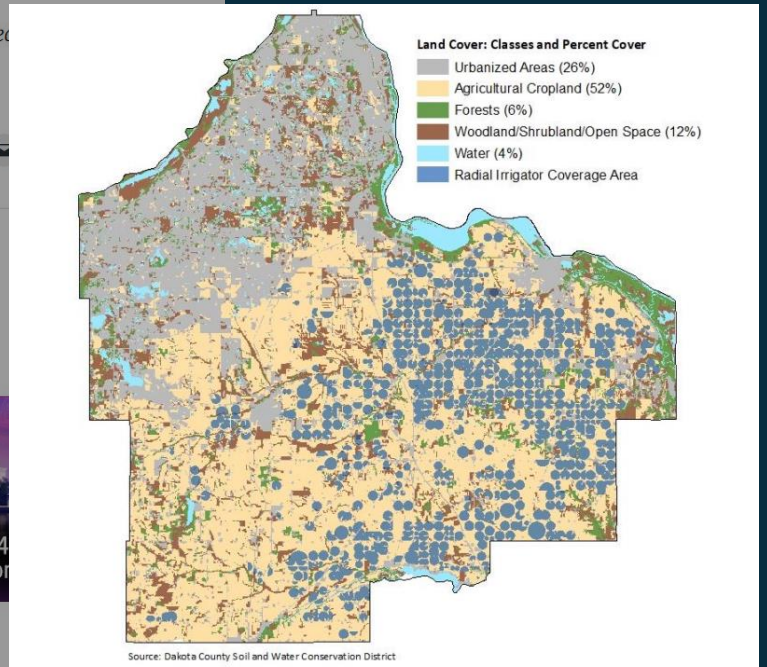
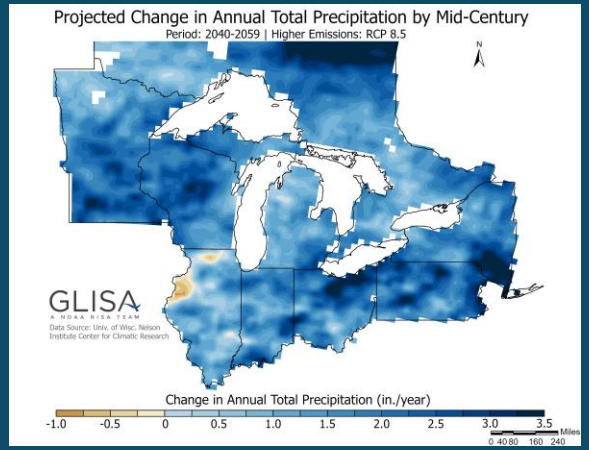
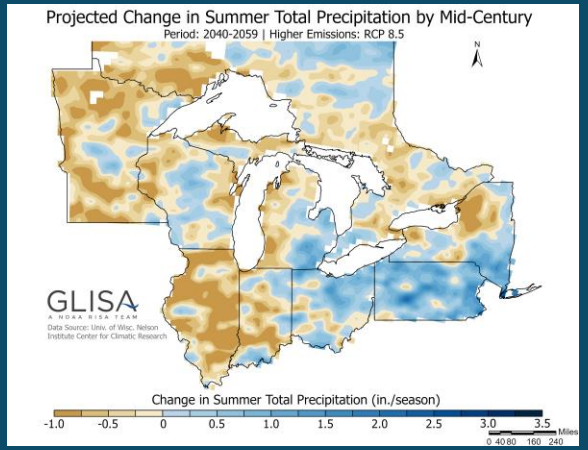


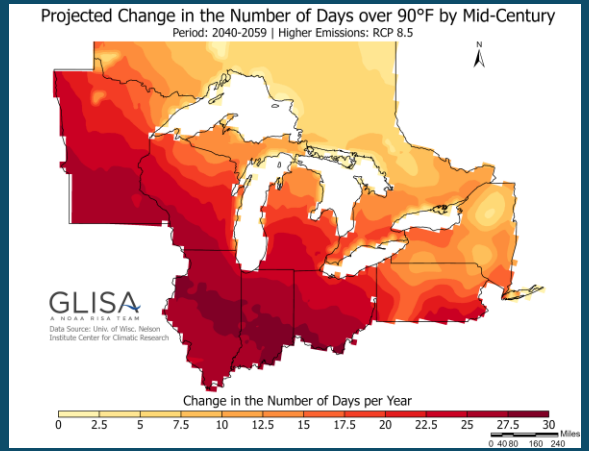
Figure 7. Land Use Classes in Dakota County.

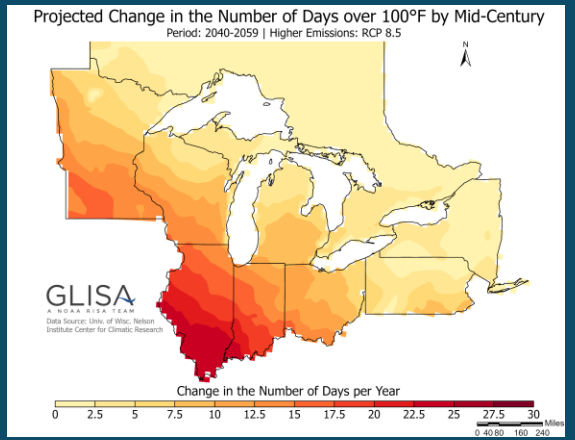
Change in Precipitation and Hot Days

https://glisa.umich.edu/great-lakes-regional-climate-change-maps/

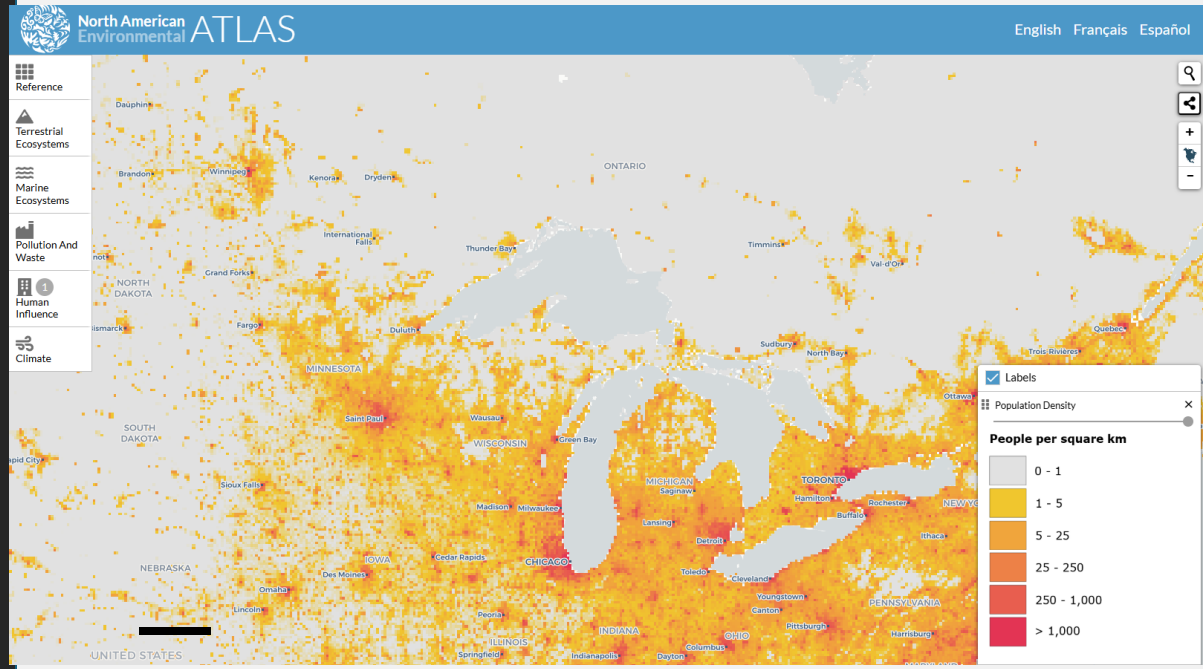








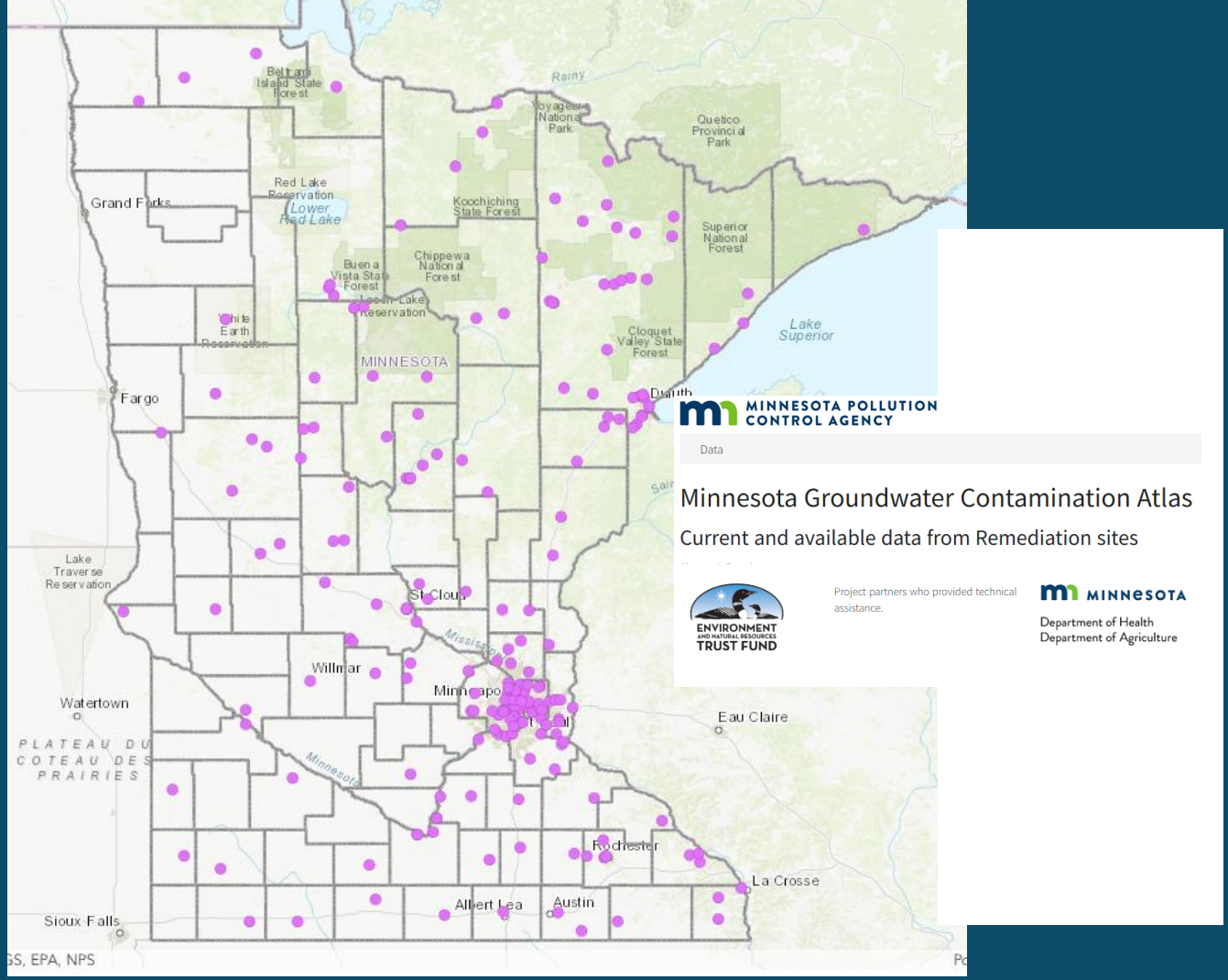
Where can we safely add the water demands of a medium city?



- **Caution:** the urban fringe
  - mix of private and municipal wells has the potential for well interference
  - far from surface water sources like the Great Lakes or major rivers
- **Caution:** areas with only glacial sediment aquifers
- **Caution:** areas with seasonal water scarcity
  - irrigated
  - drought-prone

Are there other concerns with increased pumping?

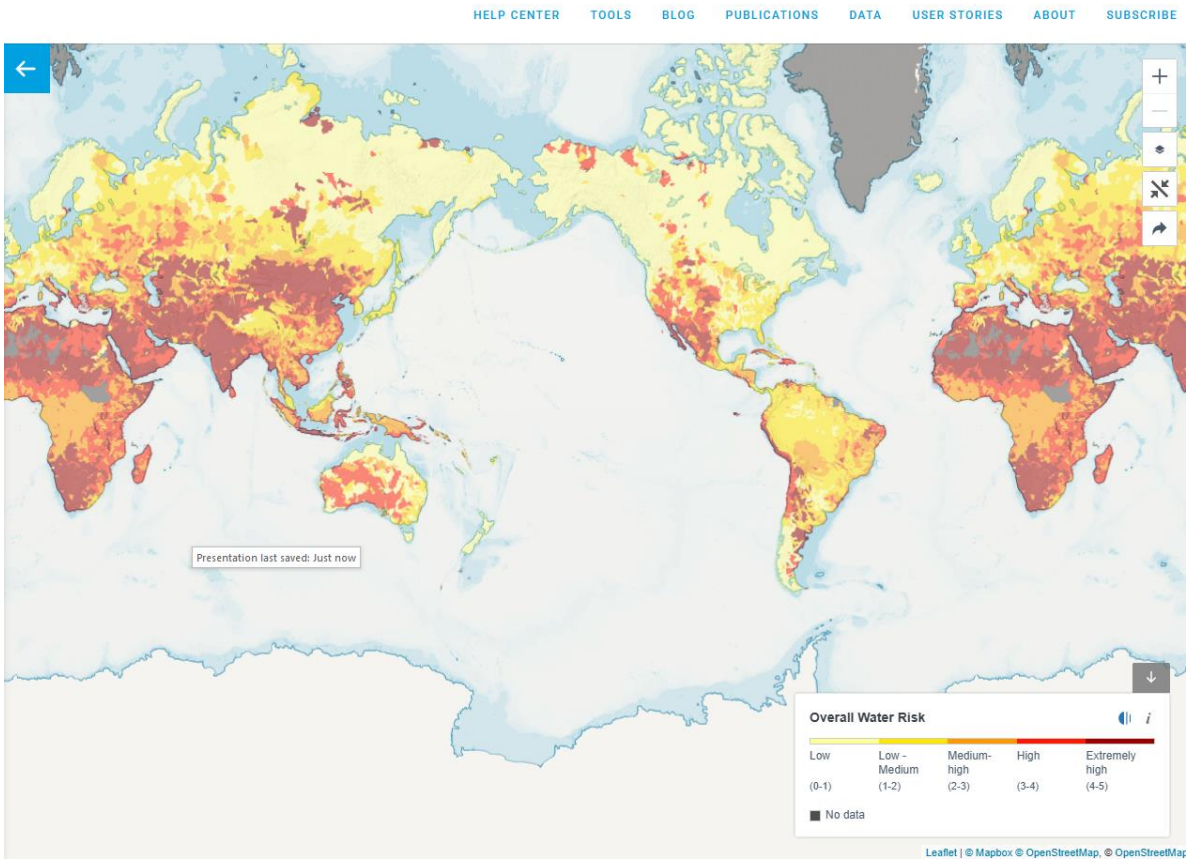
- Migrating existing contamination
- Mobilizing harmful geogenic constituents



The Tool Gap

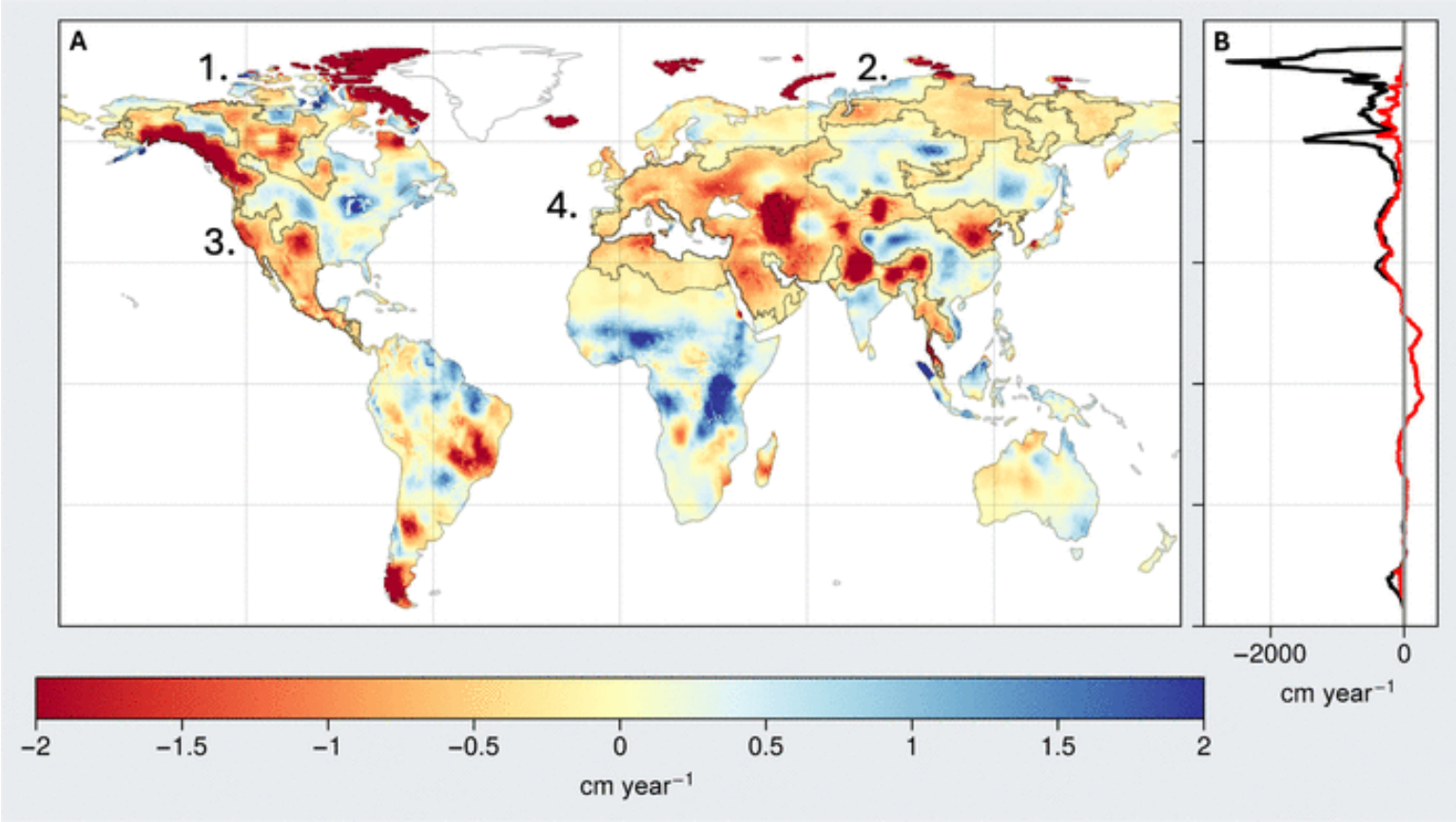
Industry uses WRI's Aqueduct Global Model.

ISSUE: Global model is too coarse (~10km resolution) and misses Minnesota-specific geology and water data.



ScienceAdvances | AAAS
SIGNIFICANT RESEARCH, GLOBAL IMPACT

Groundwater discharge is now the leading contributor to sea level rise, exceeding the volume of water added by melting ice.

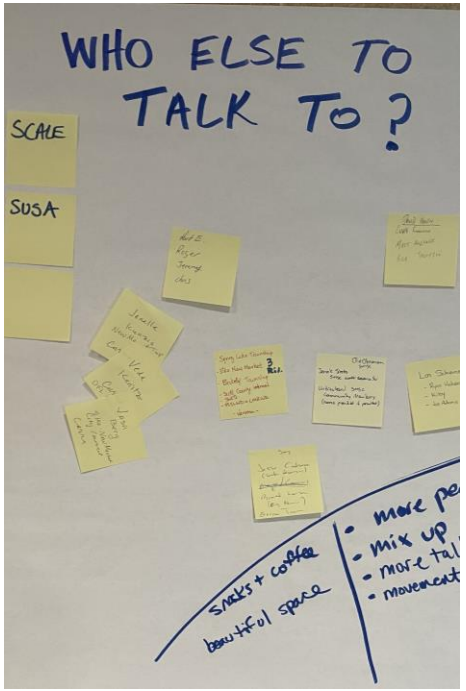


Unprecedented continental drying, shrinking freshwater availability, and increasing land contributions to sea level rise, Volume: 11, Issue: 30, DOI: (10.1126/sciadv.adx0298)

What are the societal priorities for groundwater?

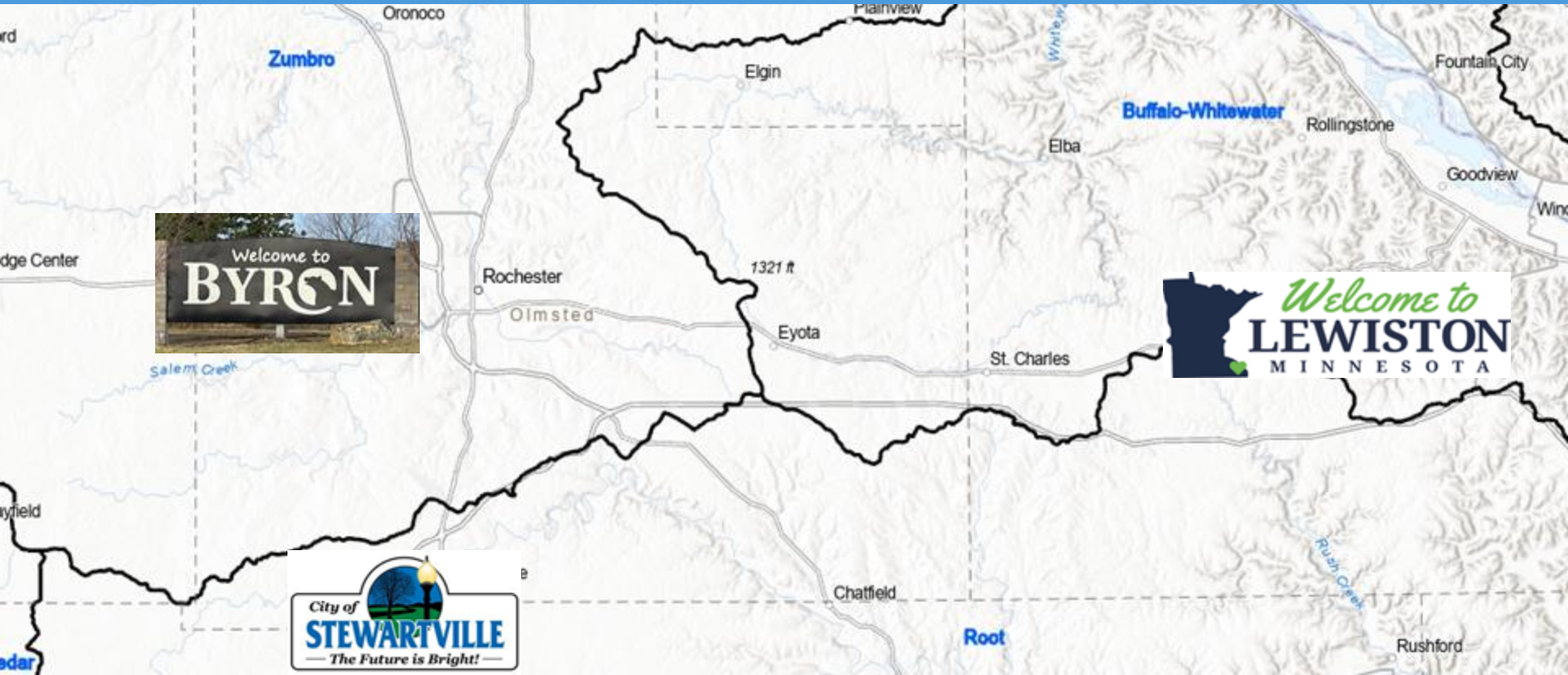
Members of hyperlocal organizations are often the first to see impacts but commonly not included in decisions.

- If process is not transparent and inclusive
  - Leads to fear and distrust in government
  - Perpetuates environmental injustices
- When a governance pathway is not established, groups take varying routes to voice their feedback:
  - legal system
  - media attention
  - formal environmental review process
  - public protest



When you start with inclusive, bottom-up practices there is less need to revise or amend plans later.

Community Partnerships & Engagement in Zumbro & Root River Watersheds



Increasing Circles of Engagement

The Planned Outcome

- Research-backed information
- Community-informed priorities
- Proactive negotiating position for city
- Support for regional economic development
- Secure water and energy future

What are alternatives to groundwater where water is essential?

- **Surface Water**
  - **Rivers**
  - **Lakes**
  - **Artificial impoundments including mine pit l**
- **Reclaimed water**
  - **Wastewater**
  - **Dewatering from quarries and structures**
  - **Discharge from industry**

Different agencies are responsible for different parts of the water cycle. As rain falls it may become stormwater (MPCA) and directed to a pond (DNR, waters of the state); if this water is to irrigate a ballfield, it may come in contact with humans (MDH); if it is used to flush toilets in a building it must be plumbed according to code and safe for human contact (MDH and DLI).

Government Roles for Large Water Users

Regional & Local	
Met Council	Approve connections to sewer systems. Assist with regional water planning. Approve updates to city comprehensive plans.
US Army Corps	Approve development that alters the course, current, or cross-section of navigable waters.
Cities & Counties	Evaluate developments Negotiate with developer. Approve connections to water and sewer. Amend city planning documents. Submit AUAR or EIS. May be asked to sign an NDA by the developer. May have delegated well authority.
Watershed District	Adopt rules with the power of law to regulate, conserve, and control water within the district. Implements local permits.
Community	Right to access public information, participate in public meetings, or advocate for their interests.
Power Utility	Statutory obligation to serve businesses when asked.

Federal	
US EPA	Class V Injection wells.
State	
Legislature	Laws
DEED	Facilitate siting. Local and regional outreach.
DNR	Appropriation permits for over 10,000 gpd or 1 MGY. Data center water use over 100 MGY (new).
MPCA	Discharge permits. Brownfield redevelopment. Clean up projects
MDH	Drinking water and source water protection.
EQB	Coordinates environmental review processes
Tribal	
Authority conferred by treaty with Fed. Govt., not subject to state law.	

https://en.wiktionary.org/wiki/divining_rod

- **State Agencies**: Make groundwater data available to **guide businesses to areas with sustainable water**.
- **Planners**: Engage across political jurisdictions, **develop shared tools**, and use results to guide regional development.
- **Cities:** Consult **stakeholders and front-line communities** to identify trade-offs and prioritize choices.
- **State:** Require **and incentivize** circular design for water and heat; require **transparency** in water reporting.
- **Attorney General:** ensure even enforcement of existing law; address agency fear of lawsuits; attend to environmental injustices for communities lacking resources.

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Thank you for inviting Freshwater