



Groundwater Sustainability Challenges in the Land of 10,000 Lakes

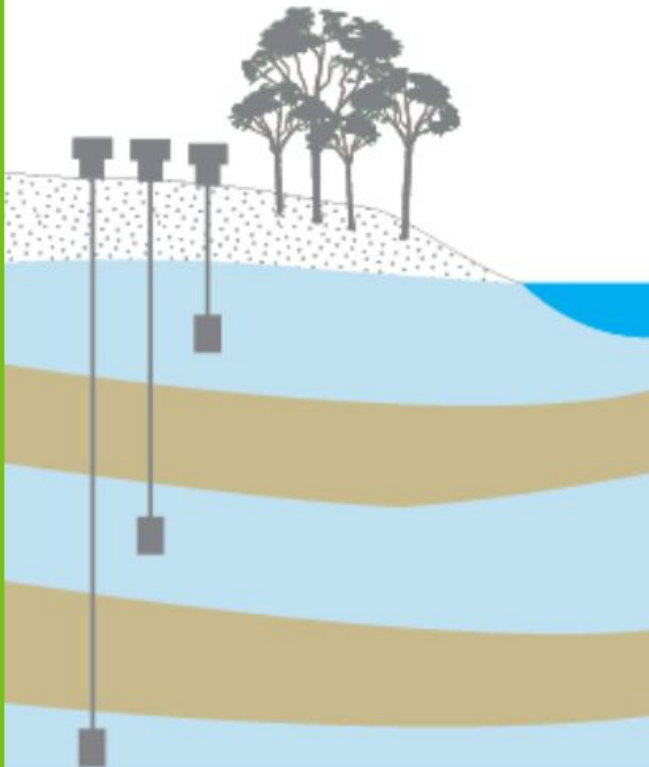
Ellen J. Considine, Jennifer L. Rose, and Amanda Yourd | November 19, 2024

Ecological and Water Resources | Groundwater Technical Analysis Unit

Groundwater Regulation in Minnesota

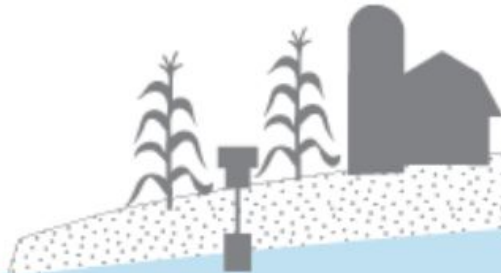
Water Quantity

Department of Natural Resources (DNR)

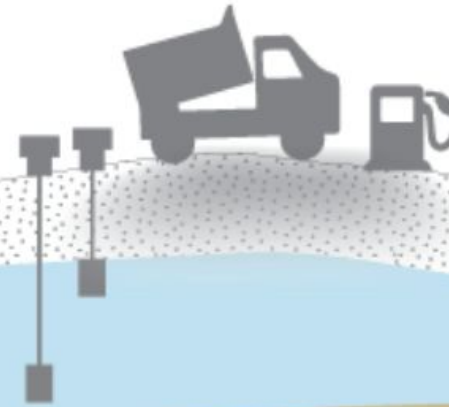


Water Quality

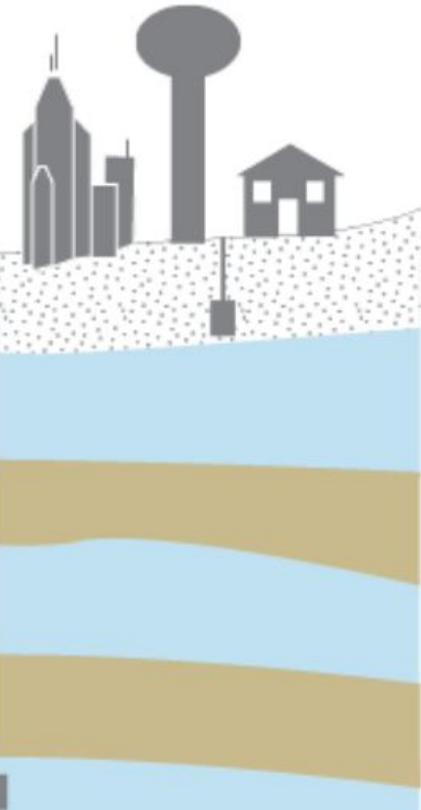
Department of Agriculture (MDA)



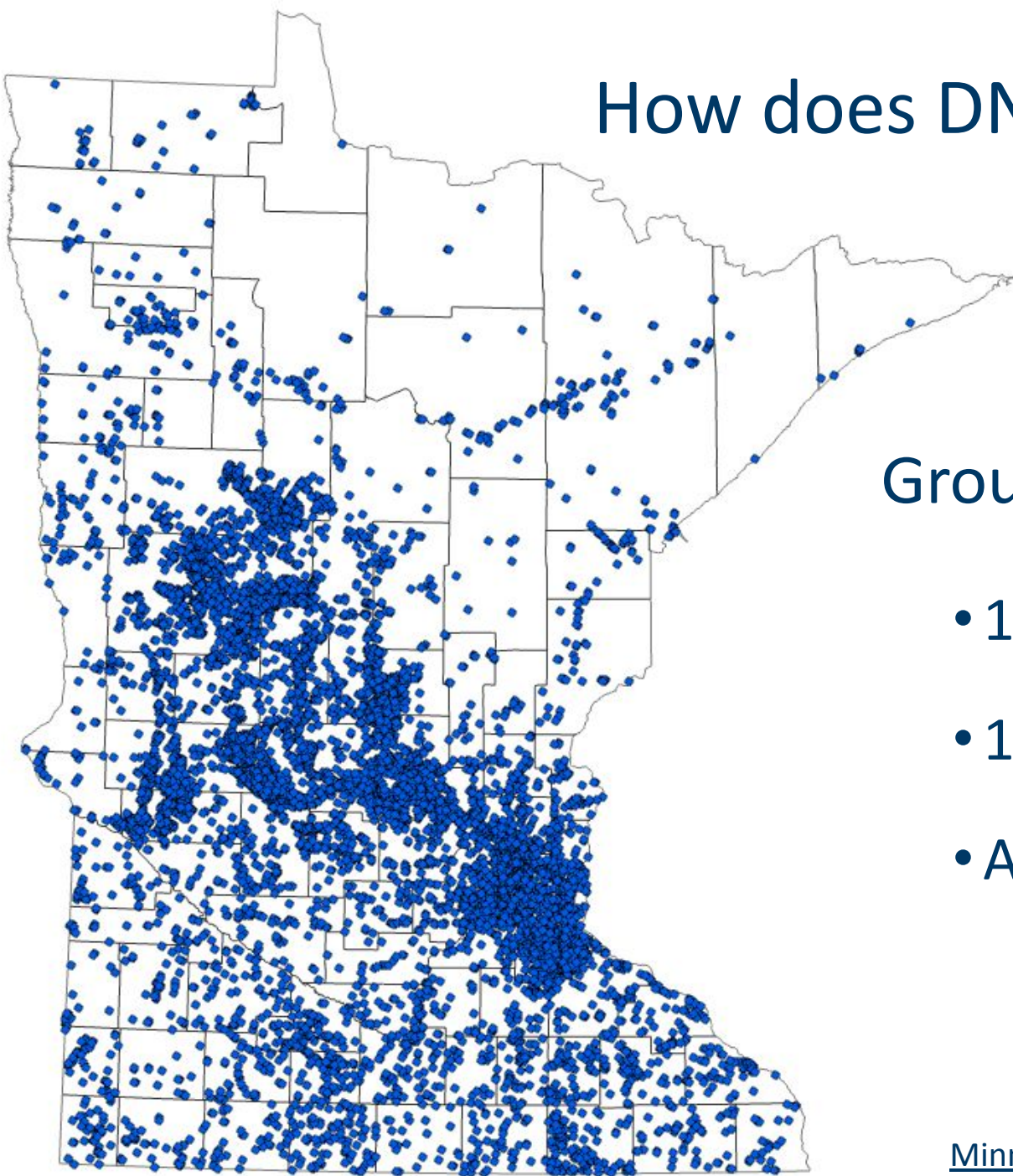
Pollution Control Agency (MPCA)



Department of Health (MDH)



How does DNR Regulate Water Quantity?



Groundwater Appropriation Permits

- 10,000 gallons per day
- 1 million gallons per year
- Annual water use reporting

Groundwater Sustainability Statute (103G.287, Subd. 5)

Groundwater use is sustainable if:

1. **Future generations** will have enough water



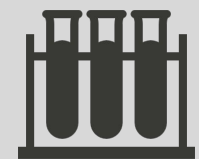
2. **Ecosystems** are protected



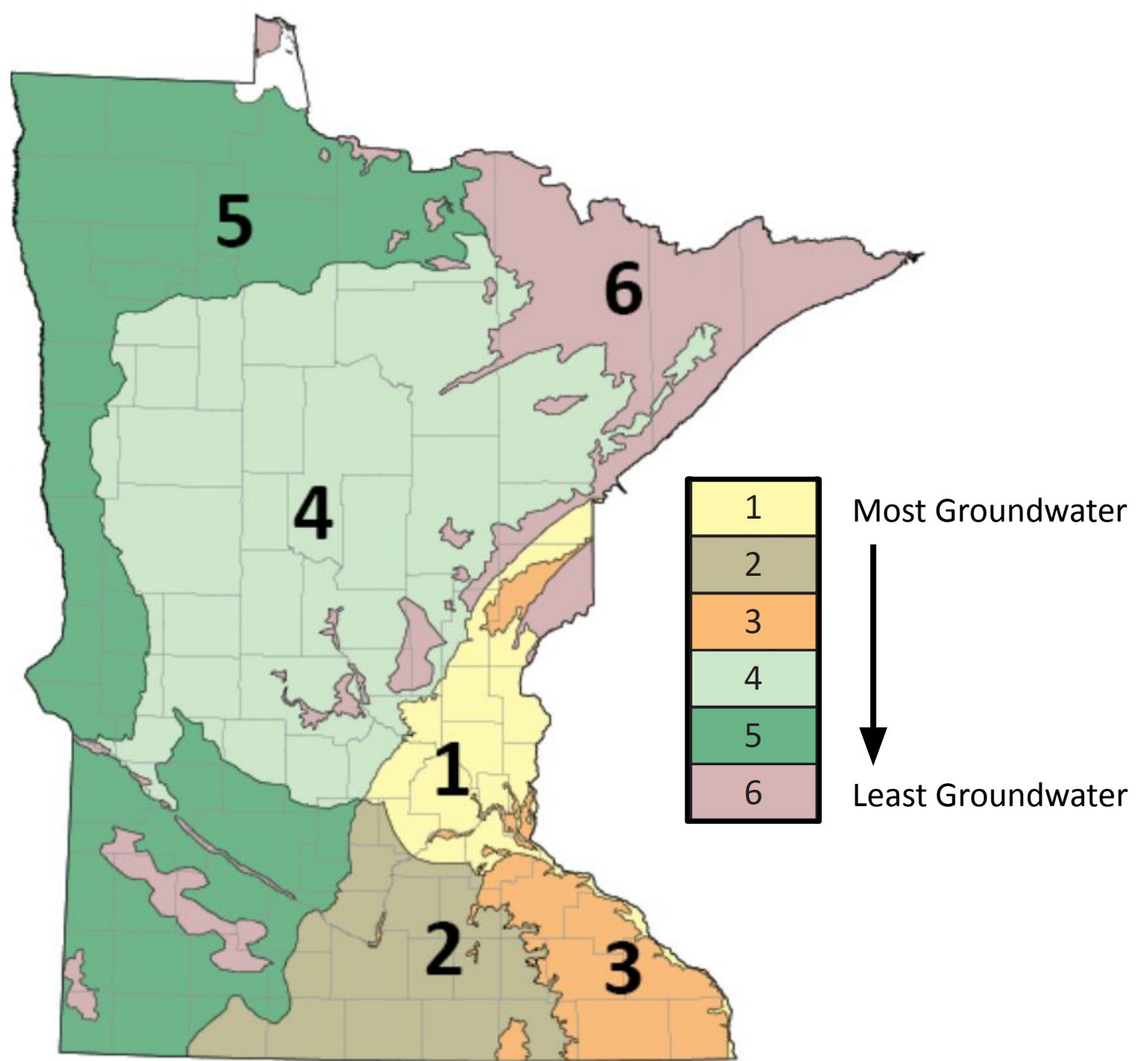
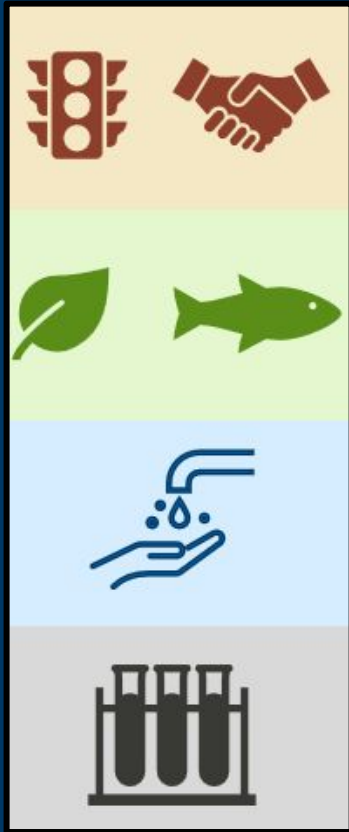
3. **Drinking water** is protected



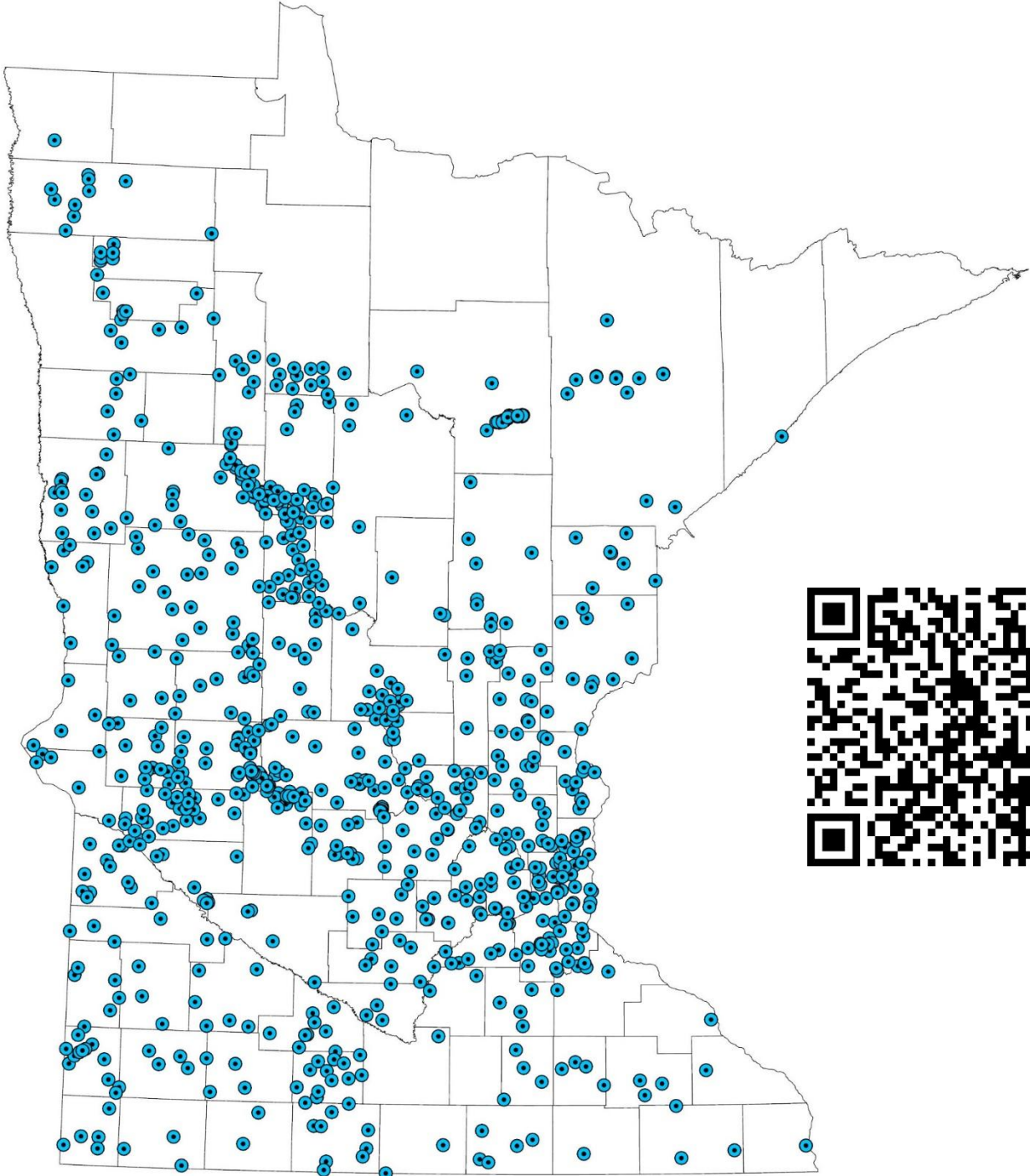
4. **Water quality** is not degraded



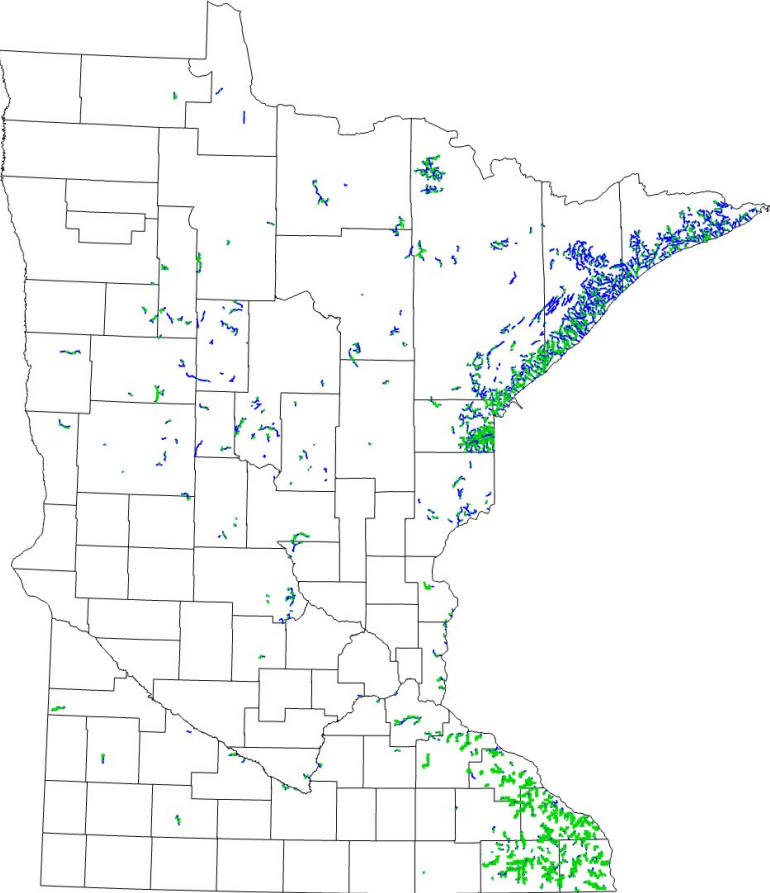
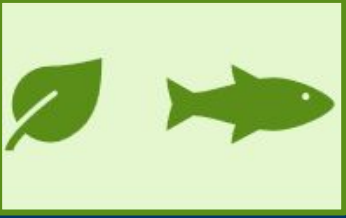
Tool #1: Groundwater Provinces



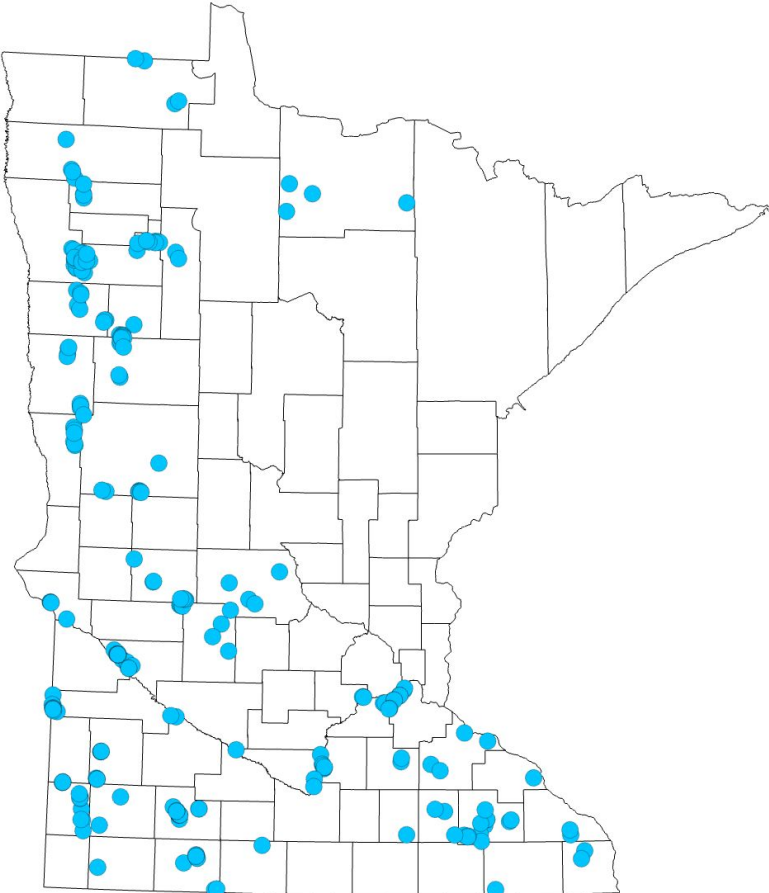
Tool #2: Observation Wells



Tool #3: Groundwater Dependent Ecosystems Mapping



Trout Streams



Calcareous Fens



Tool #4: Water Use Priorities



Domestic water supply



Consumptive less than 10,000 gallons/day



Agricultural irrigation & processing



Power production

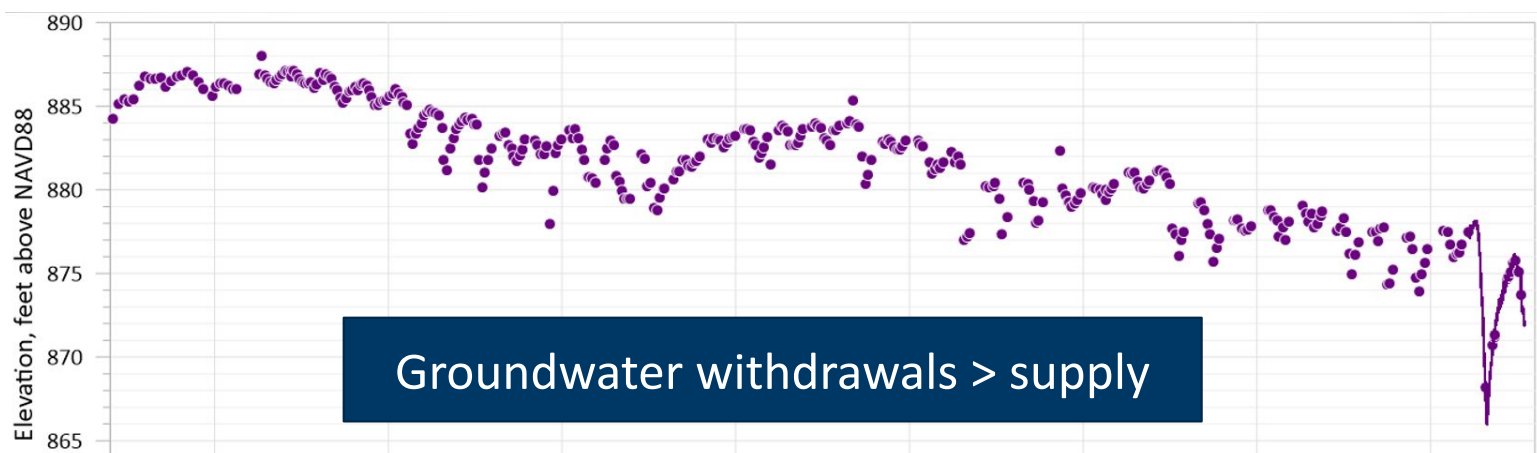
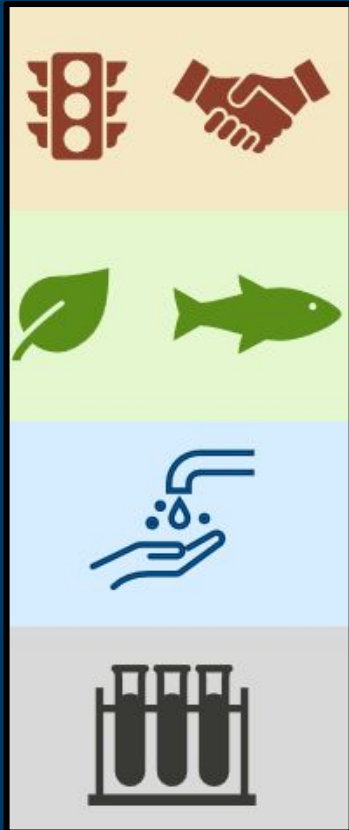


Consumptive use more than 10,000 gallons/day



Non-essential uses




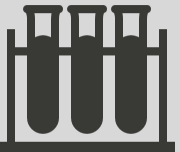
Tool #5: Water Use Conflict

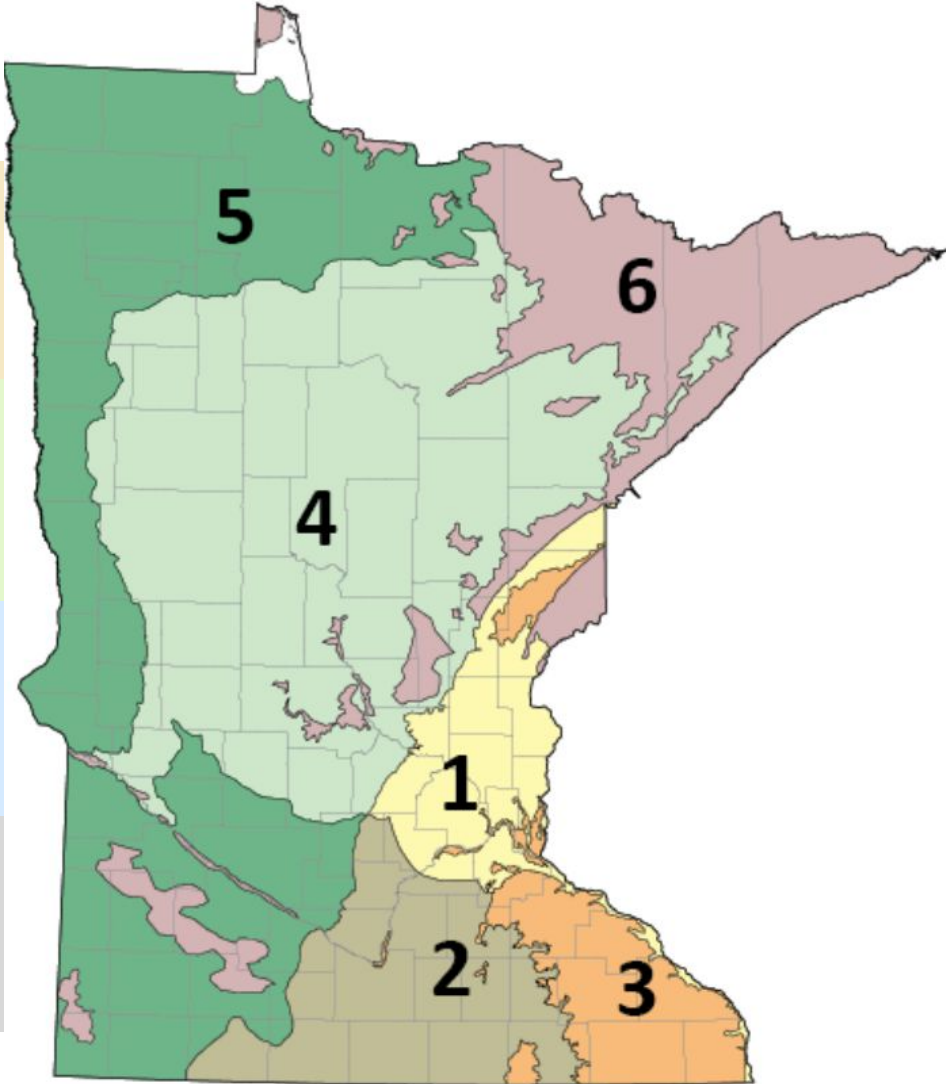


[MN Rules 6115.0740](#)

Groundwater Sustainability Statute (103G.287, Subd. 5)

Groundwater use is sustainable if:

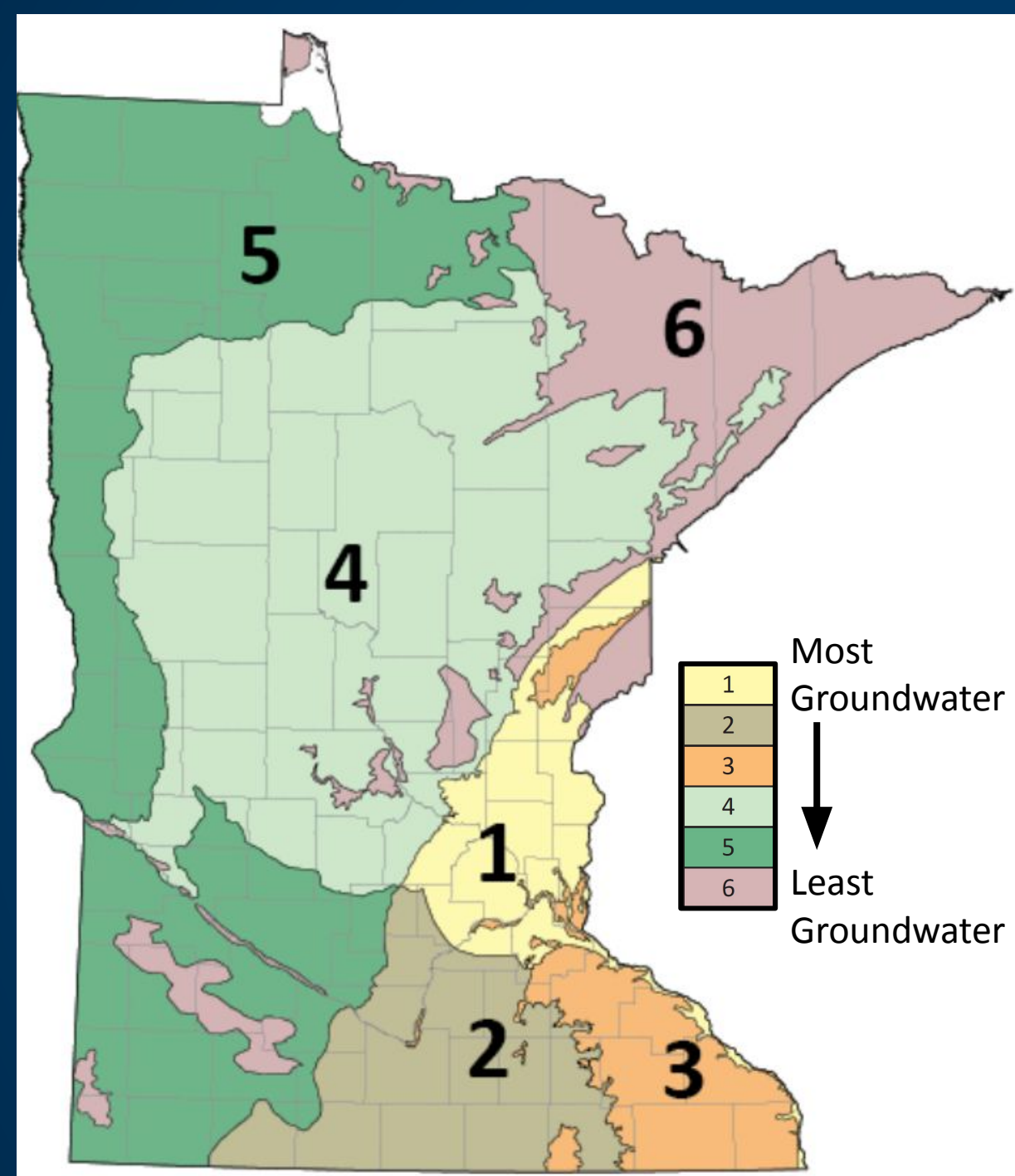
-  1. Future generations will have enough water
-  2. Ecosystems are protected
-  3. Drinking water is protected
-  4. Water quality is not degraded



Western Minnesota Province 5

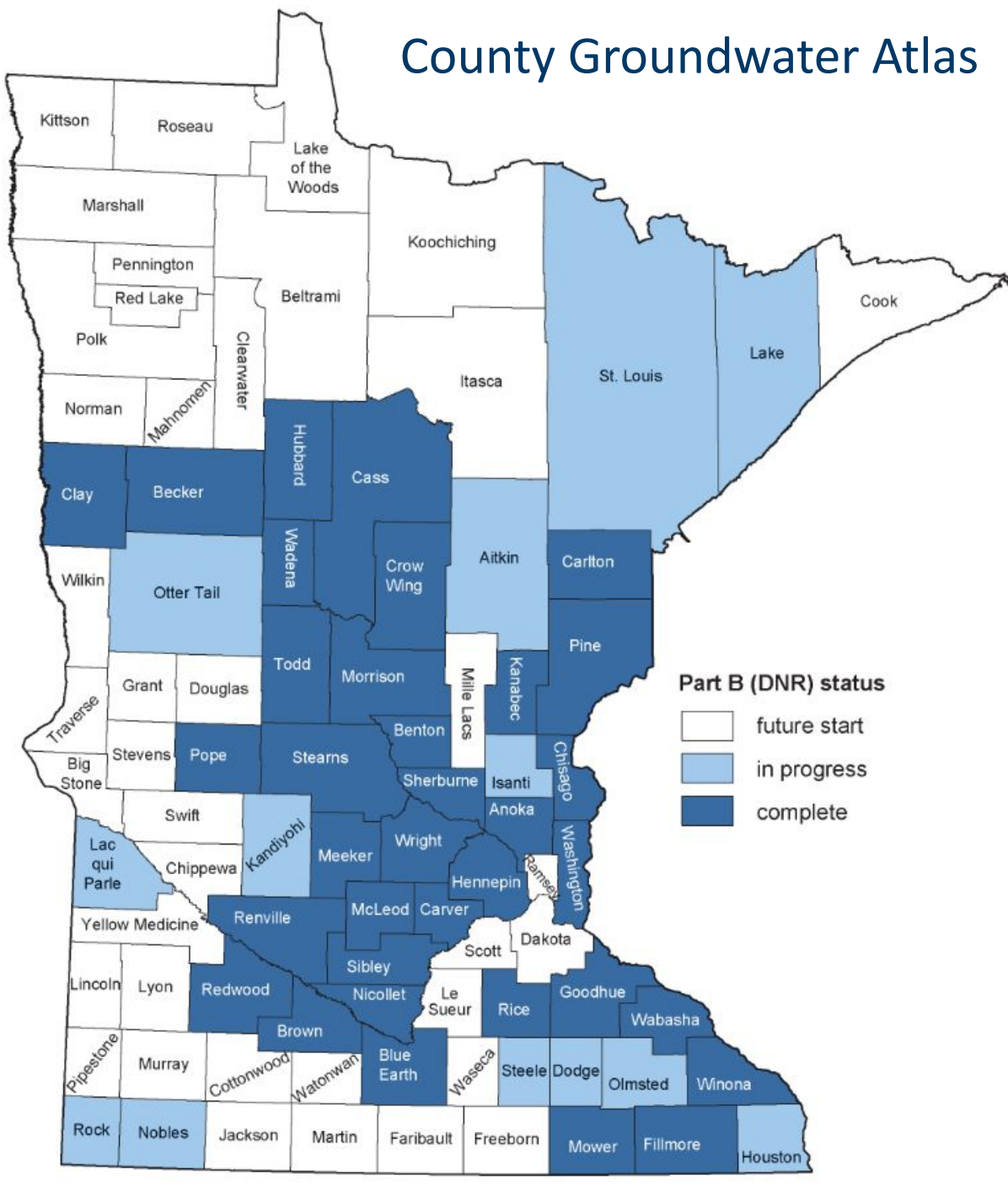
Jennifer L. Rose | Hydrogeologist

- Limited groundwater



County Groundwater Atlas

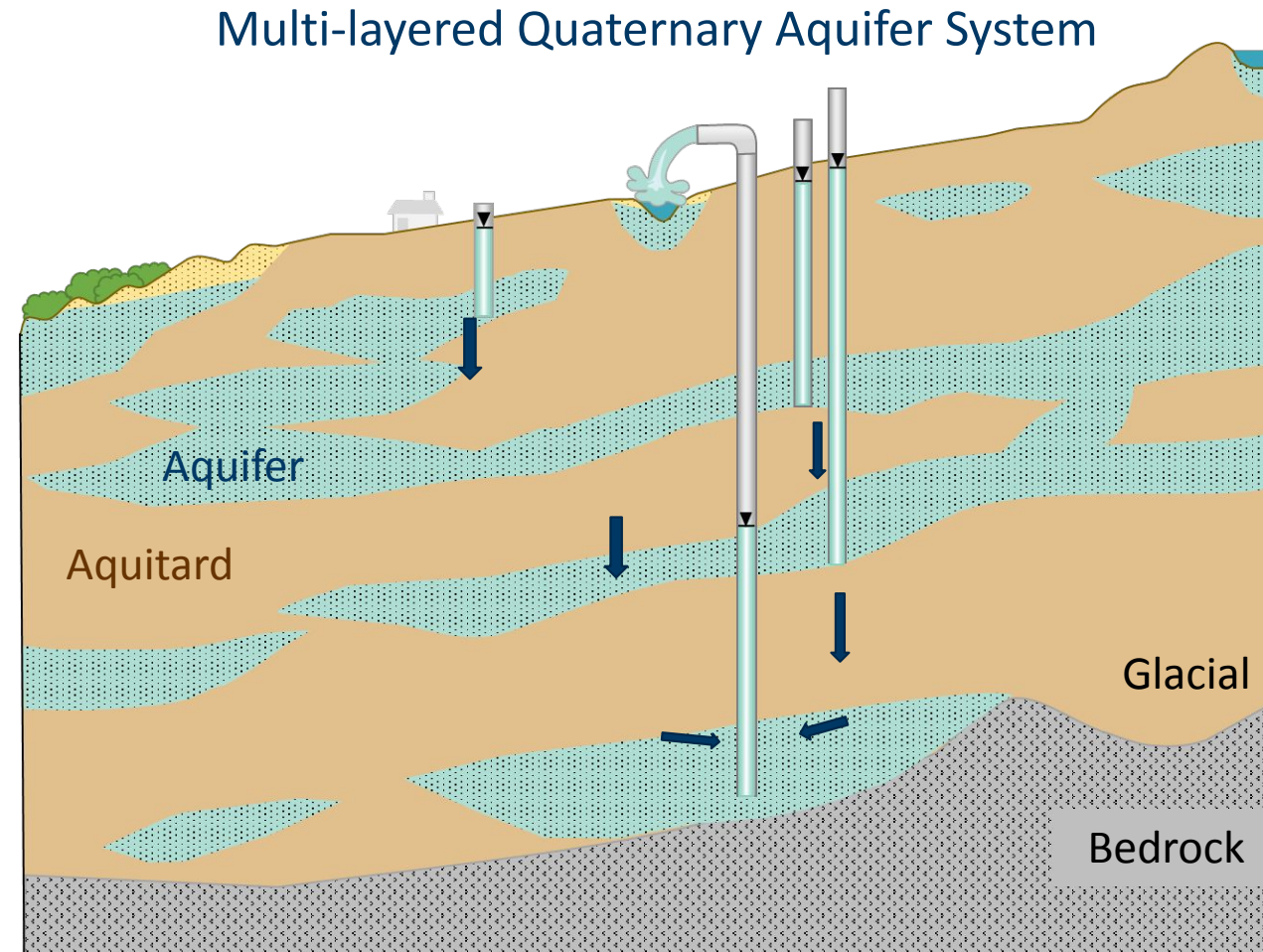
Western Minnesota Province 5



- Limited groundwater
- Limited aquifer information

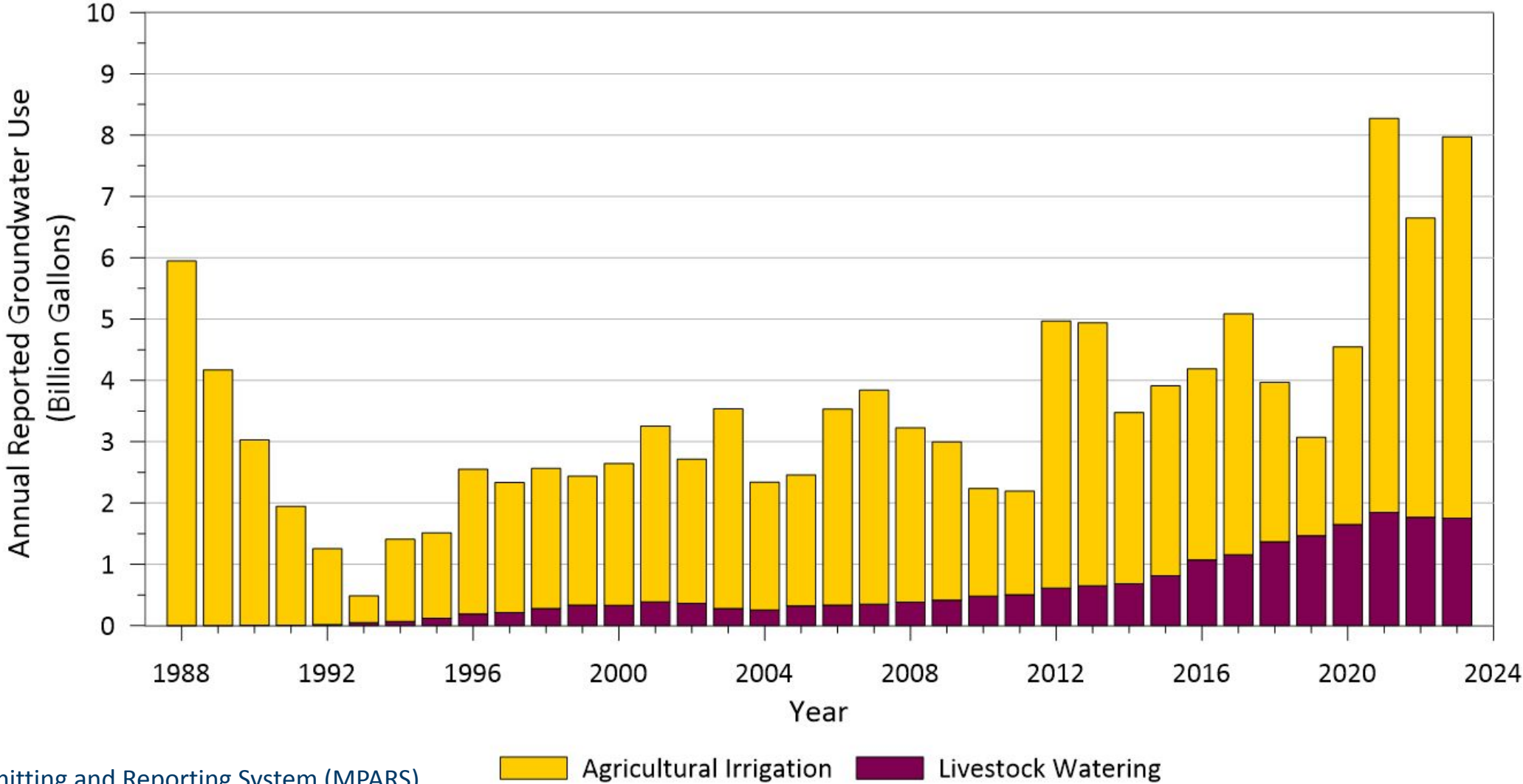
Aquifer Testing

- Aquifers are connected systems
- Drawdown extends 2 to 3 miles away
- Aquifer systems are small



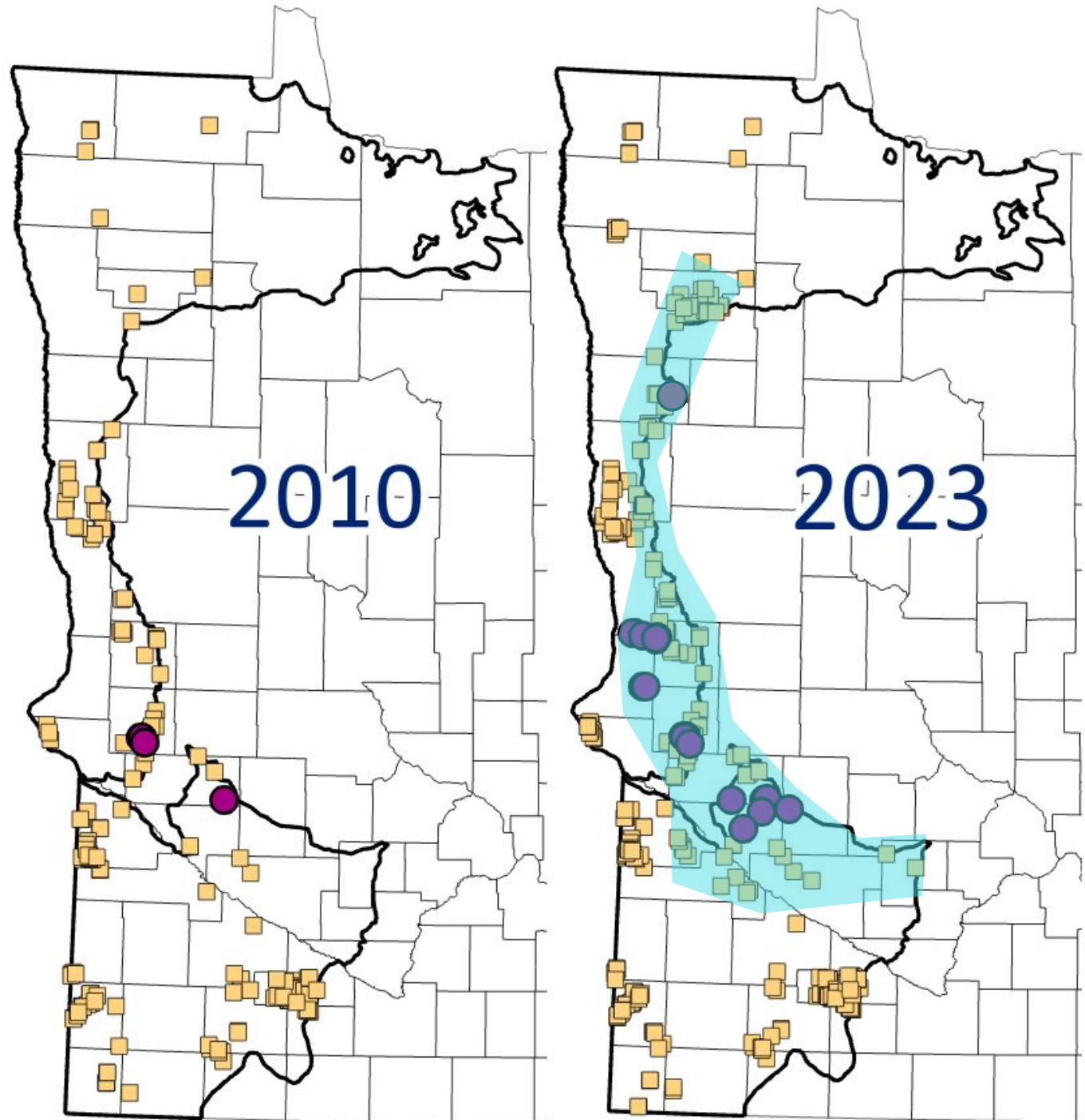
Agricultural Water Use Increasing

Annual Reported Groundwater Use

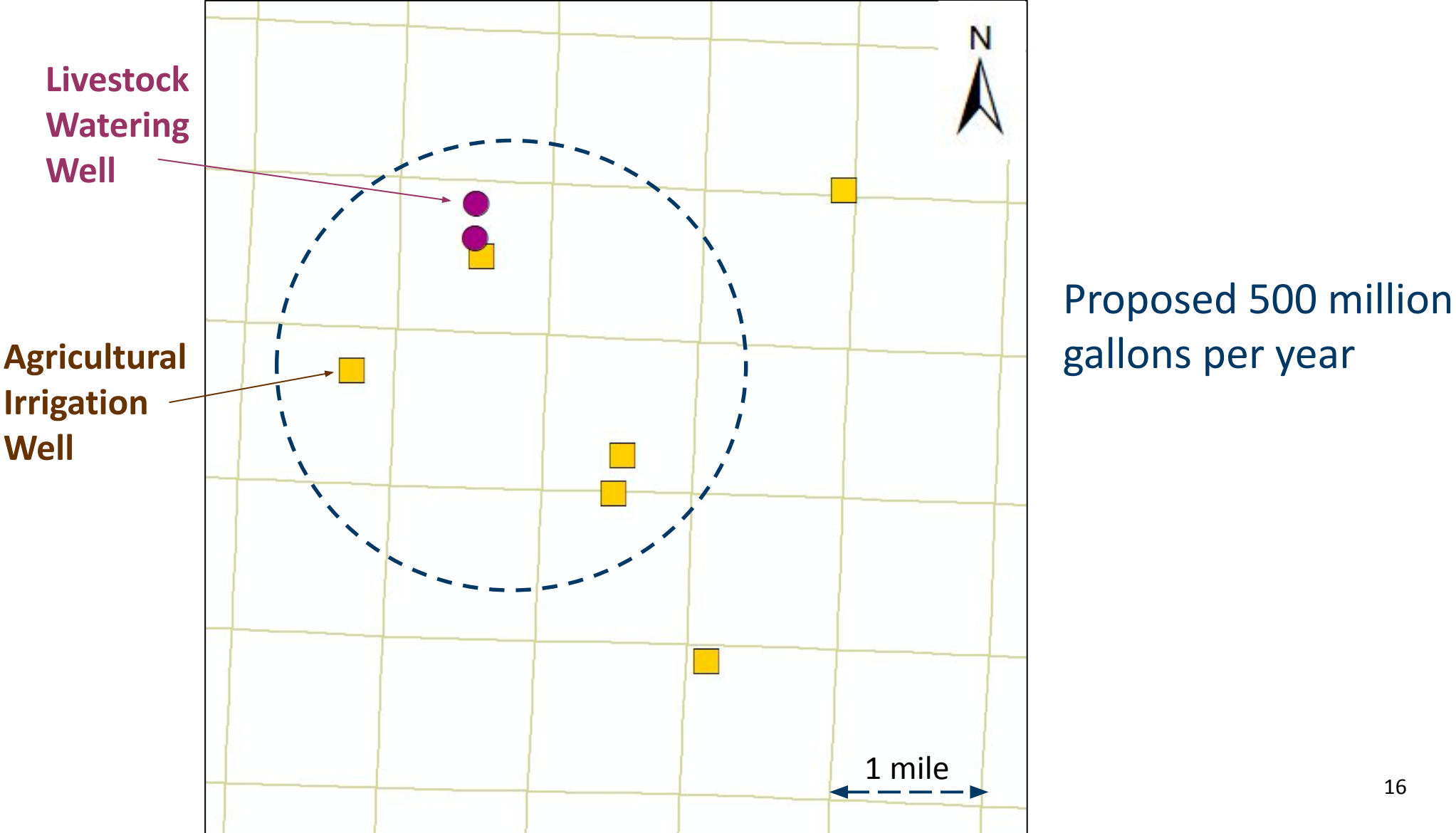


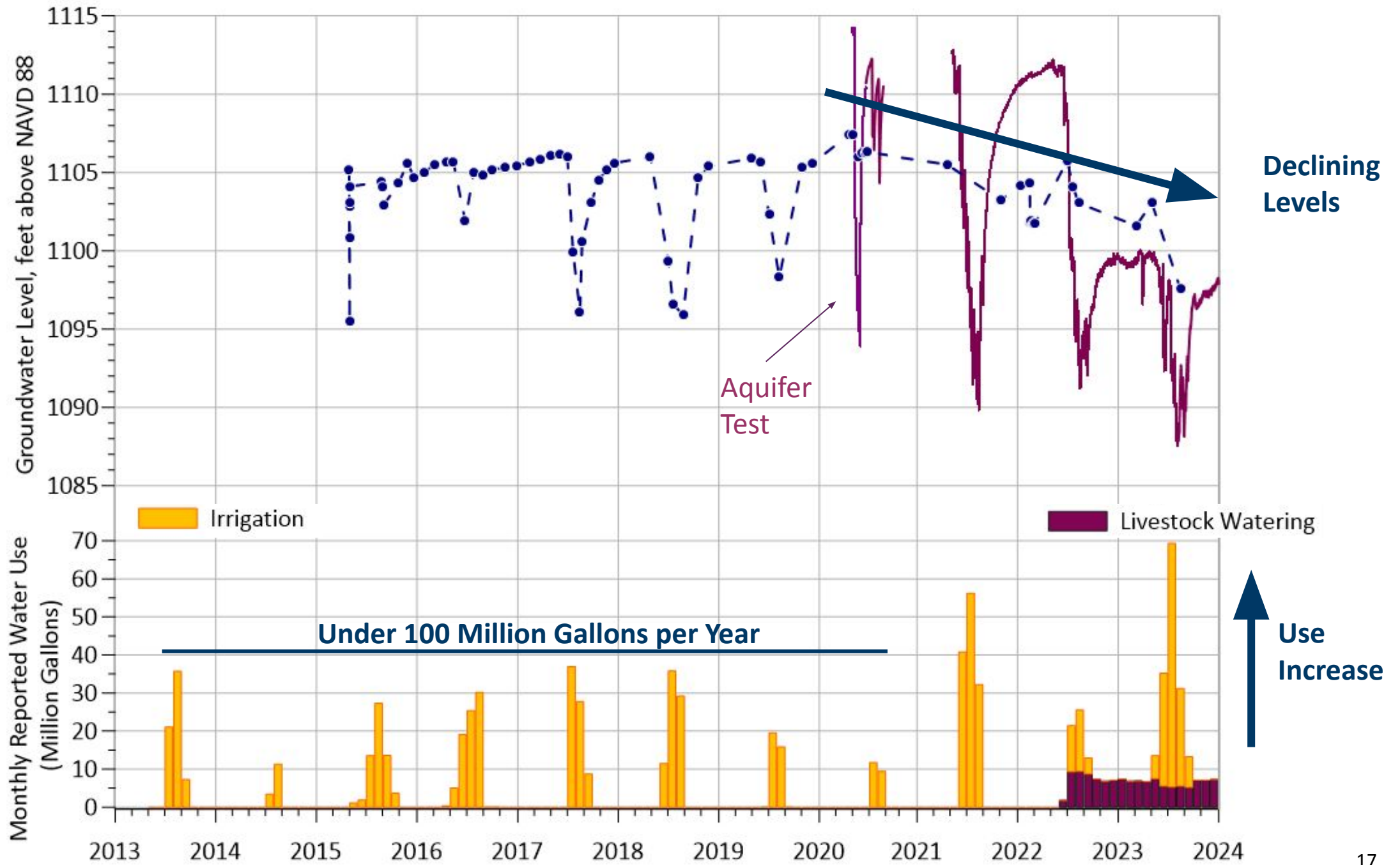
Appropriation Permits

- Agricultural Irrigation
- Livestock Watering (80 – 140 MGY)
- Western Groundwater Province



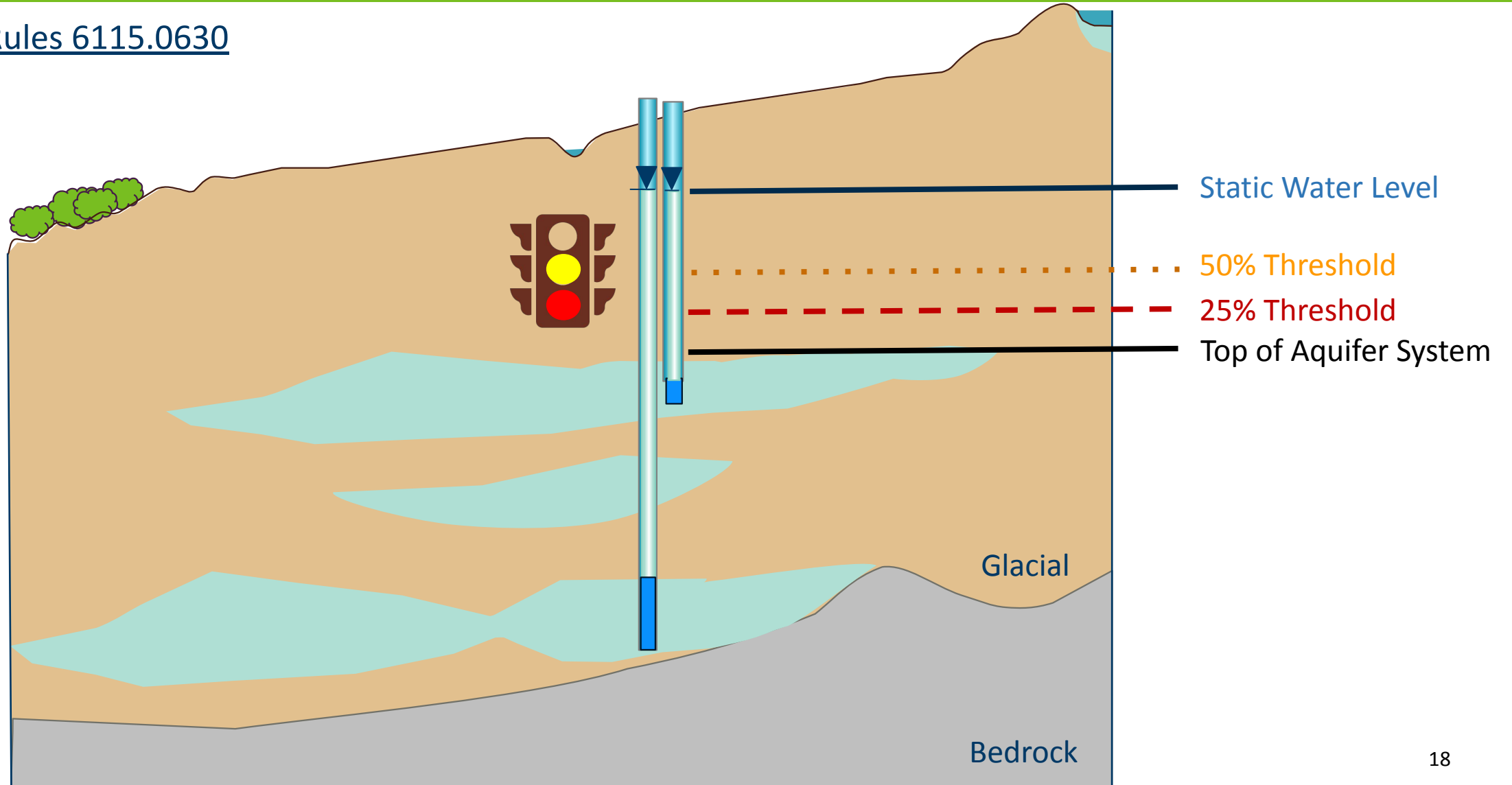
Small Aquifer System and Clustered Use



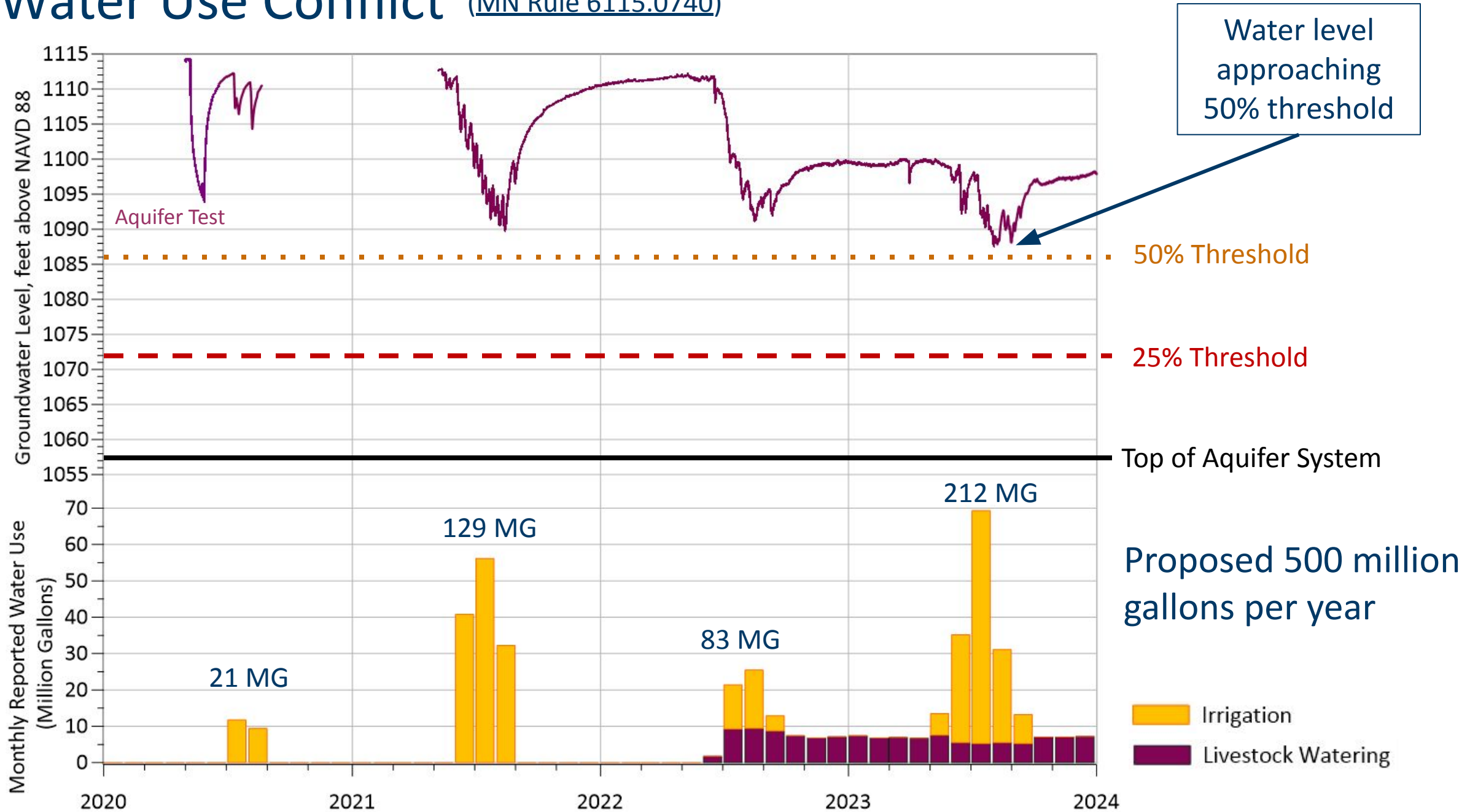


Aquifer Safe Yield

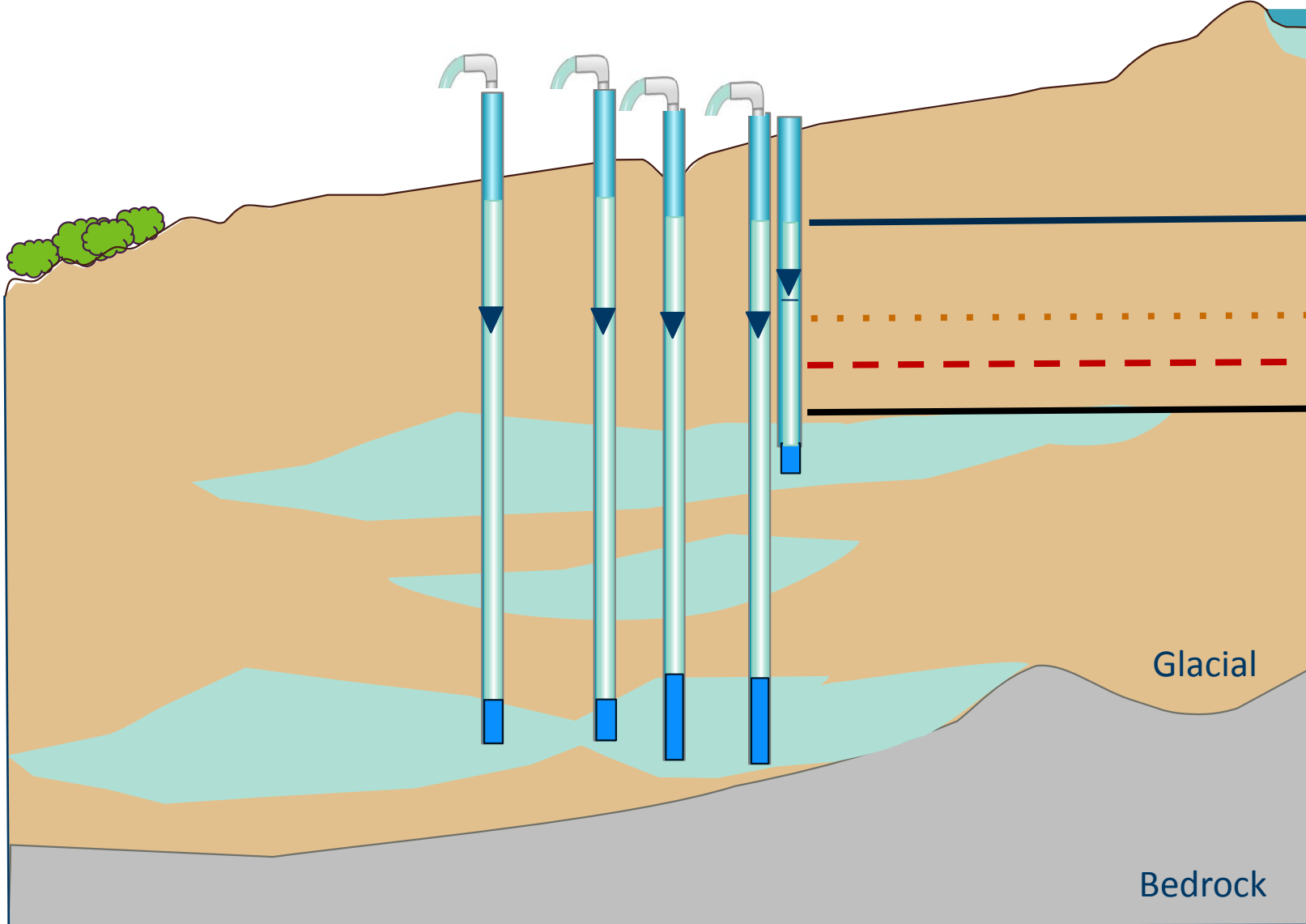
MN Rules 6115.0630



Water Use Conflict (MN Rule 6115.0740)



Water Use Conflict: Sharing the Pie



MN Rules 6115.0740

Static Water Level

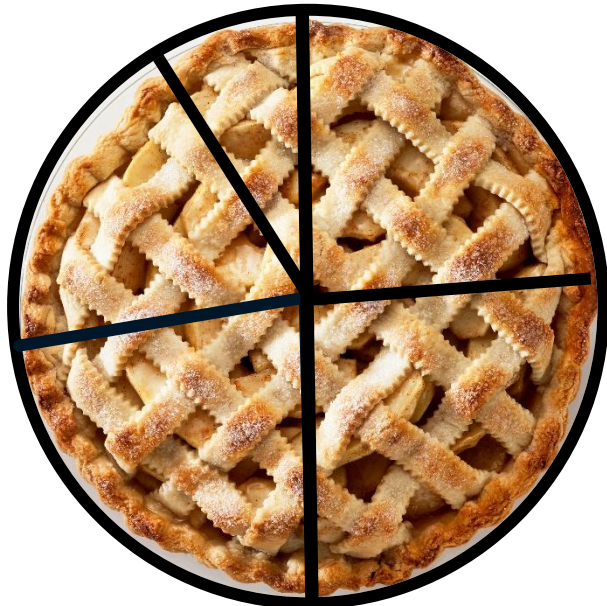
50% Threshold

25% Threshold

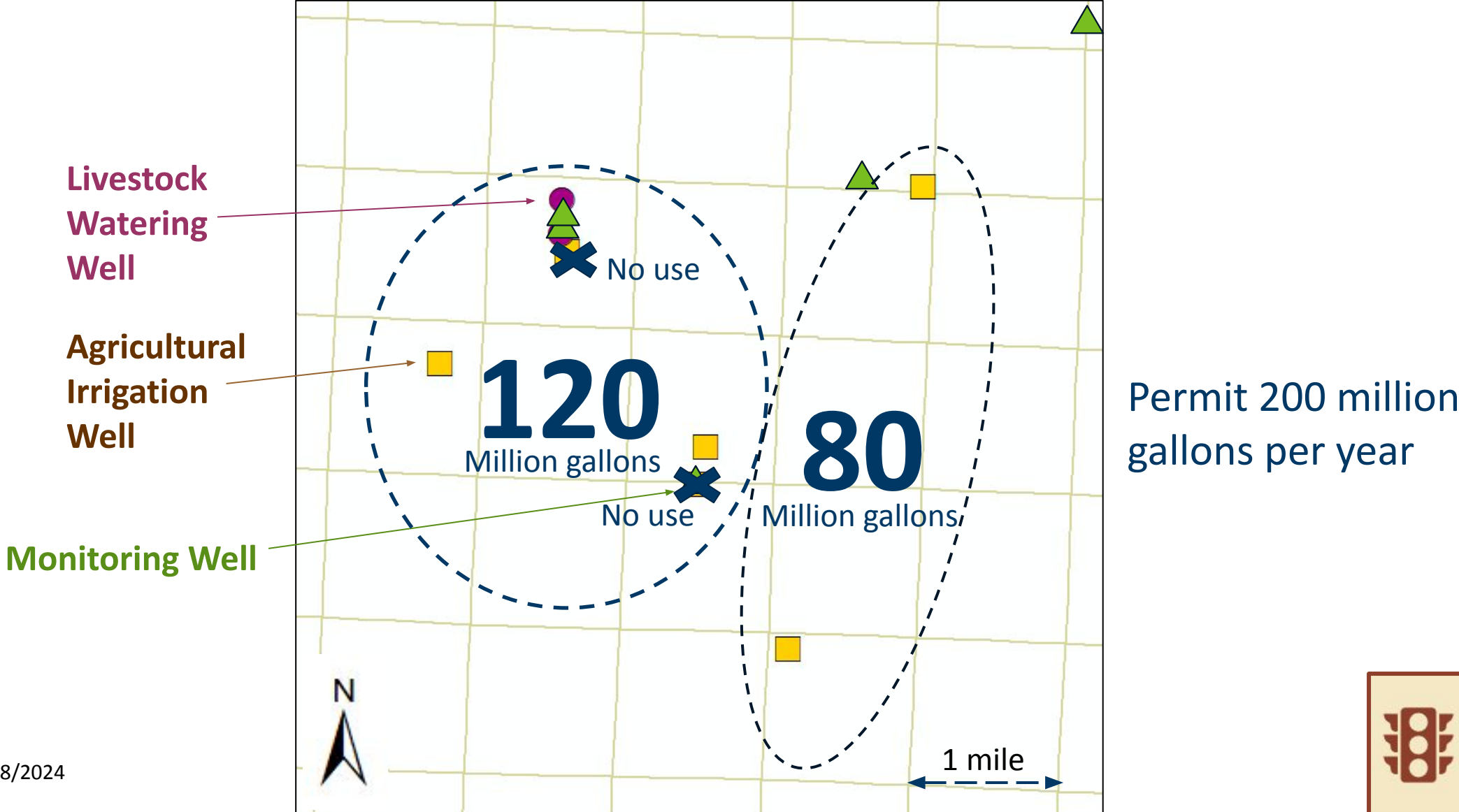
Top of Aquifer System

Glacial

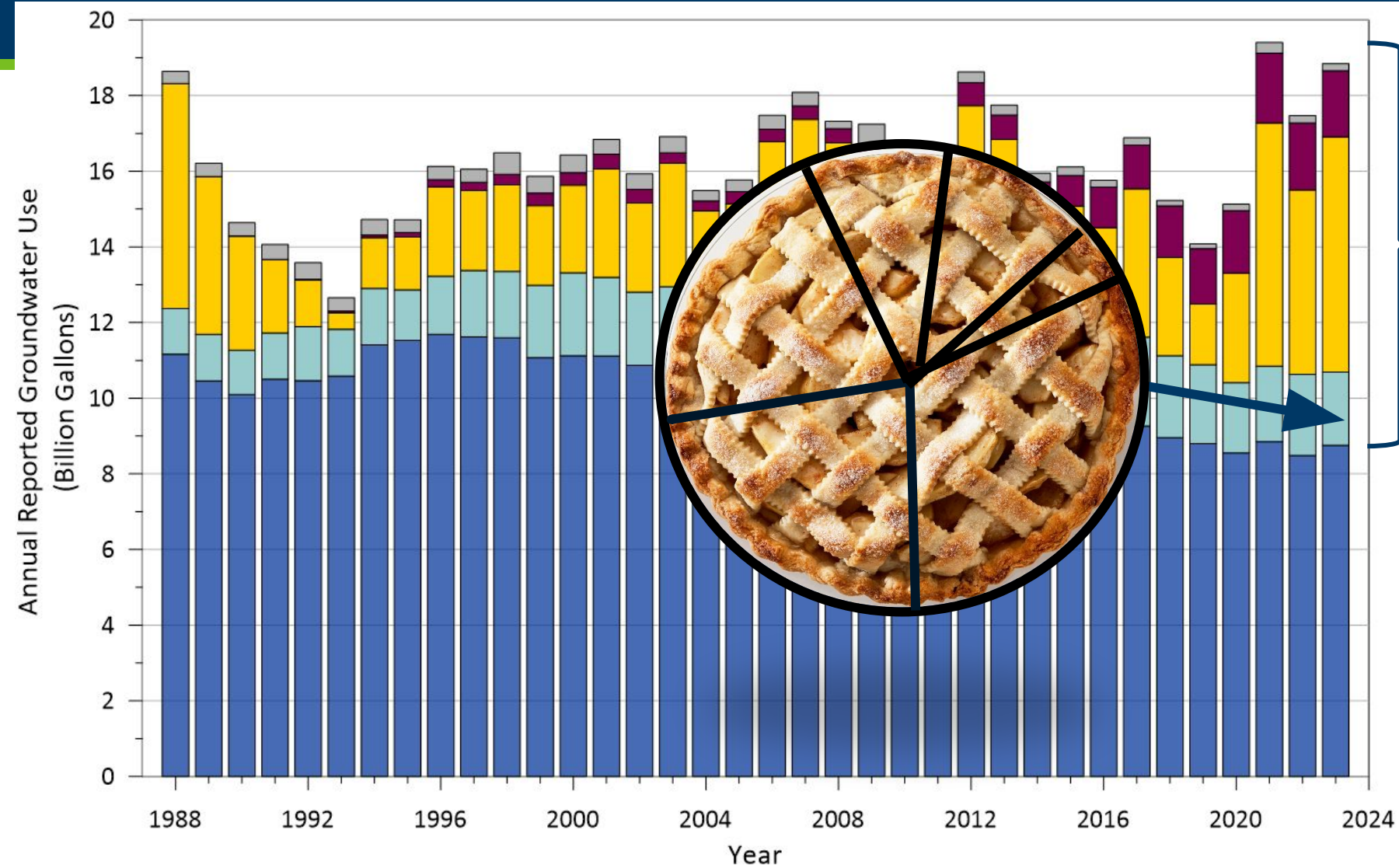
Bedrock



Water Allocation Plan

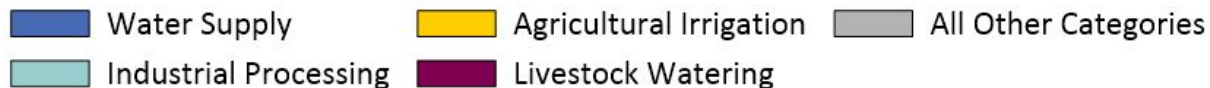


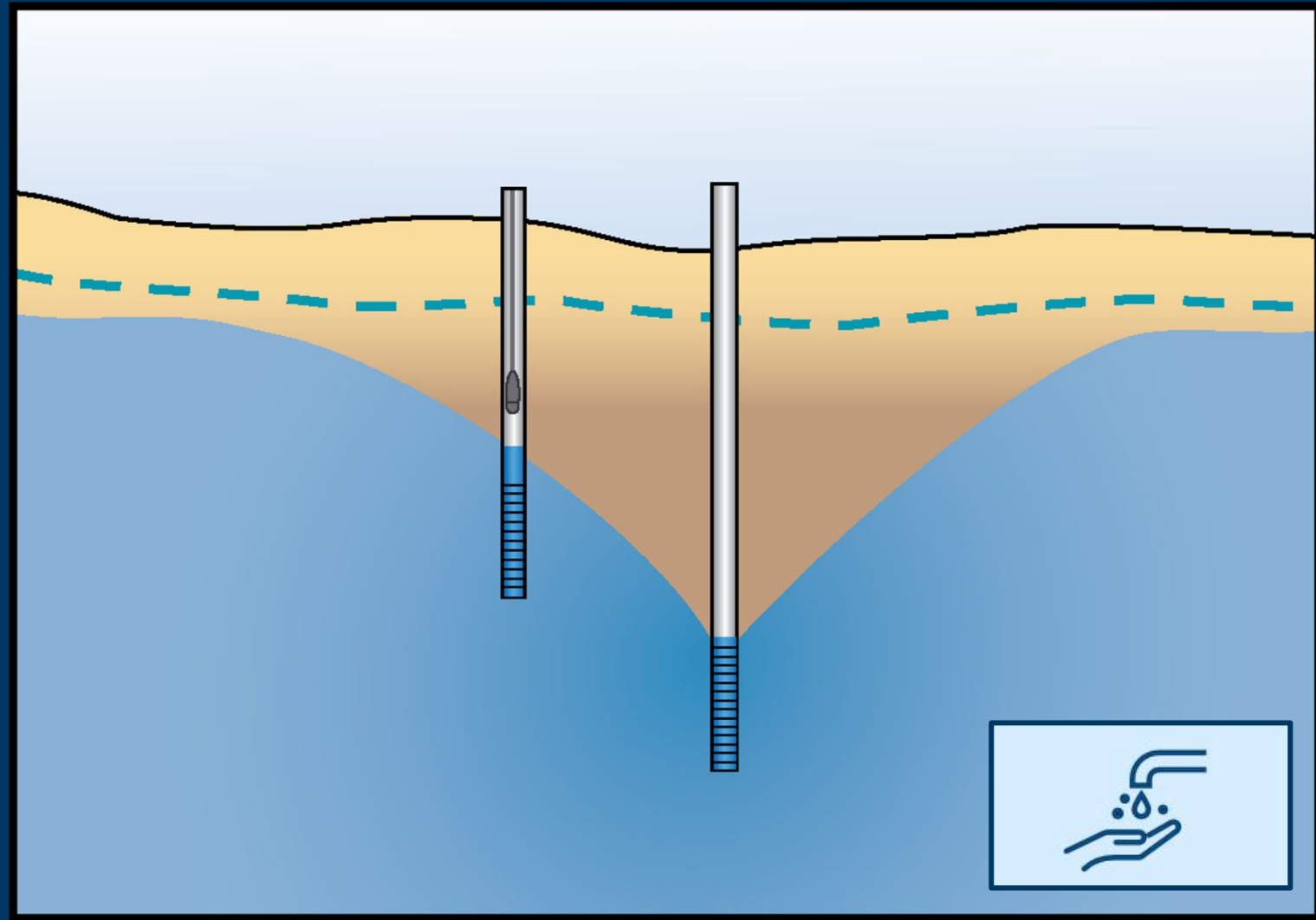
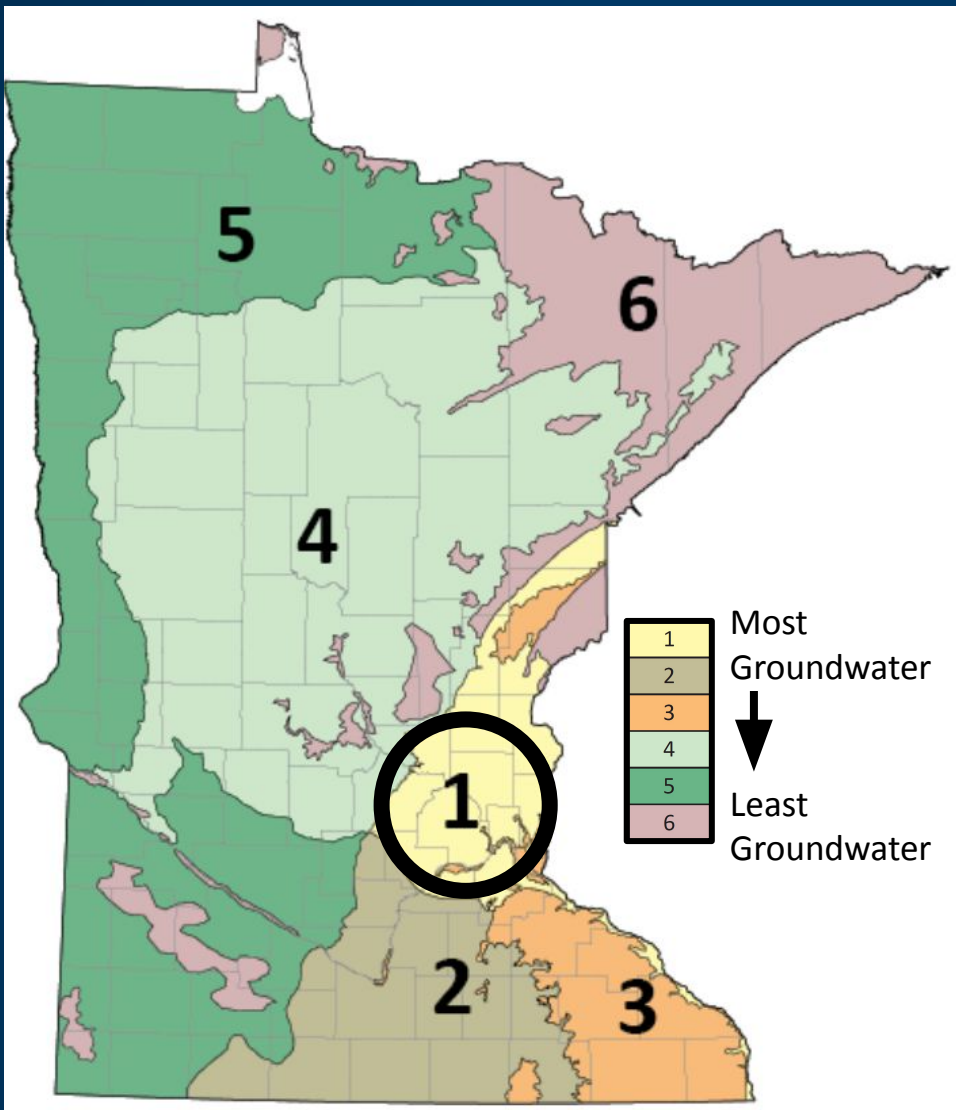
Change in Groundwater Use



2021 to 2023:
Other uses exceed
public water
supply

Decline in
public water supply

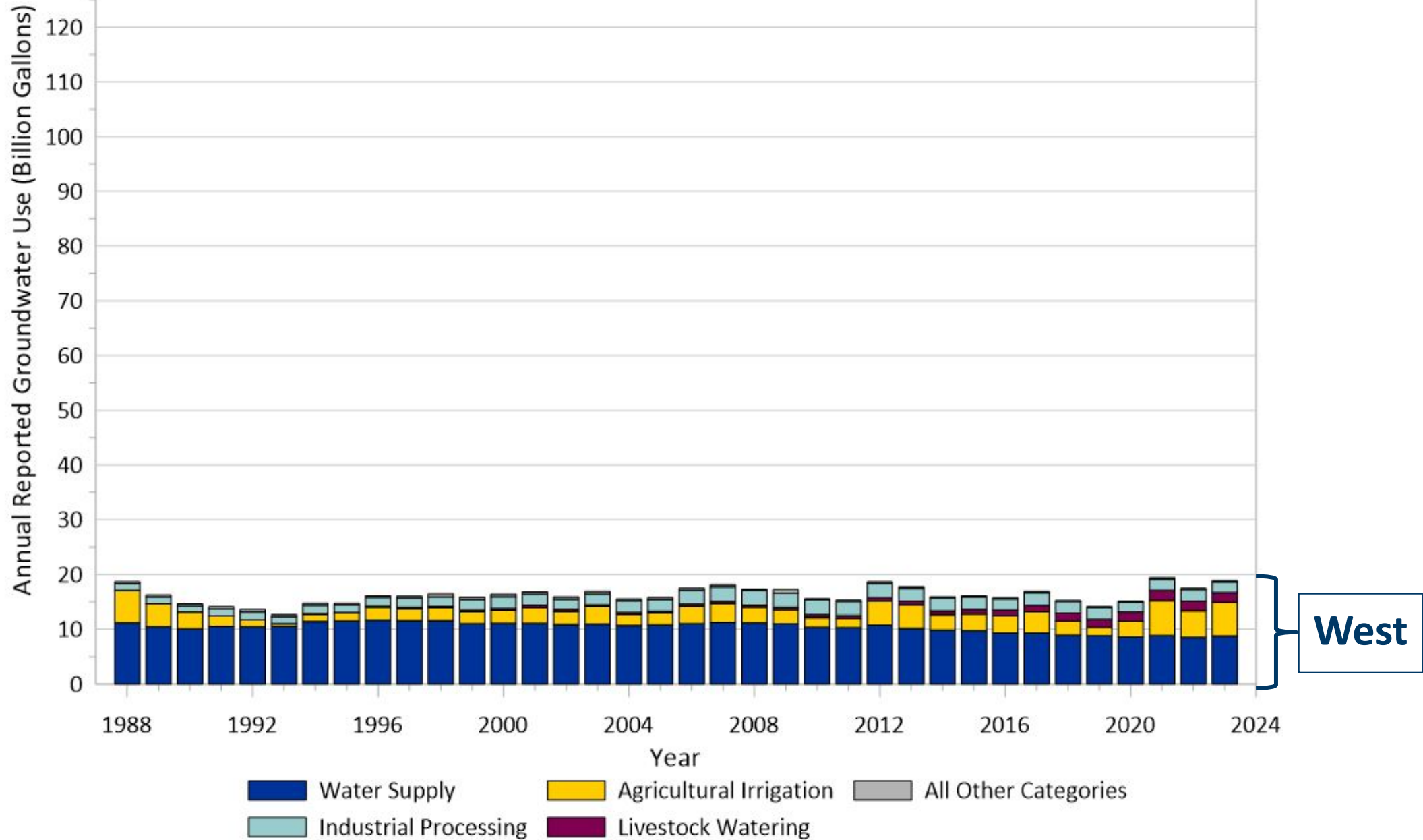


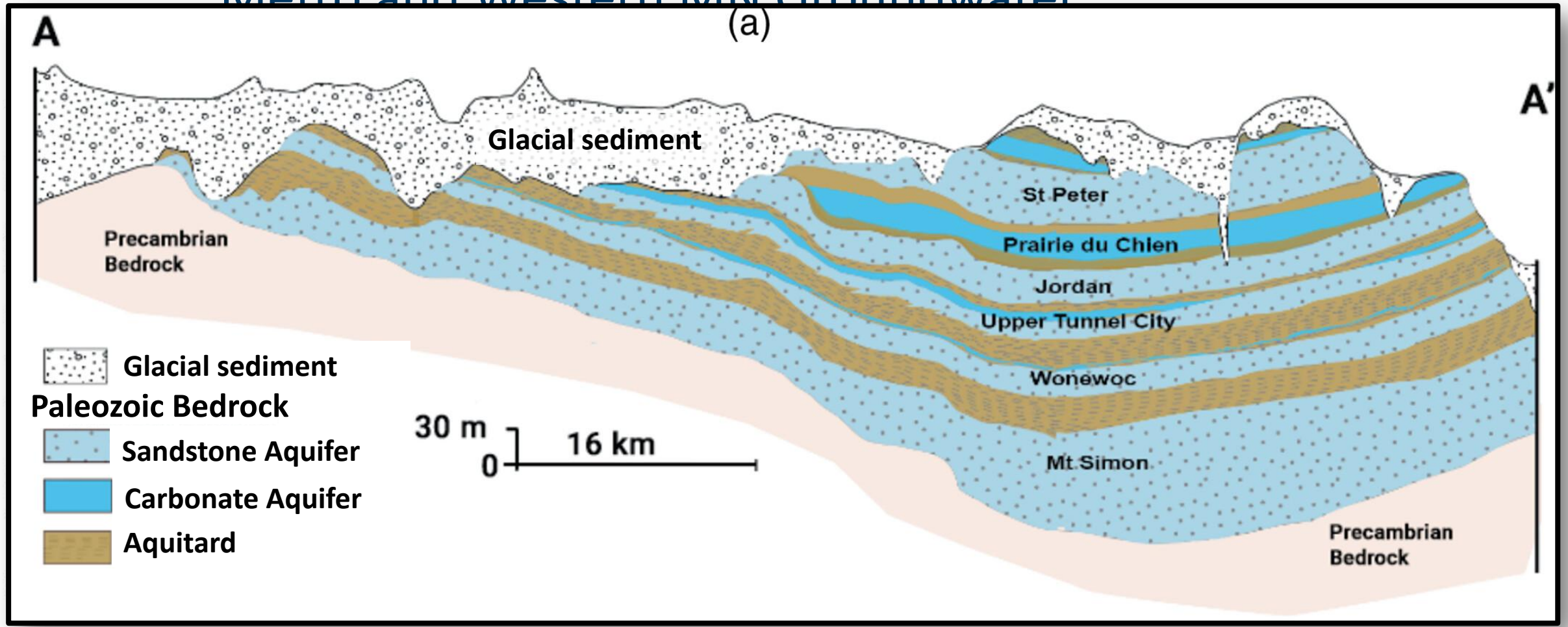


Protecting Drinking Water in Groundwater Province 1

Amanda Yourd | Hydrogeologist

Metro and Western MN Groundwater Use



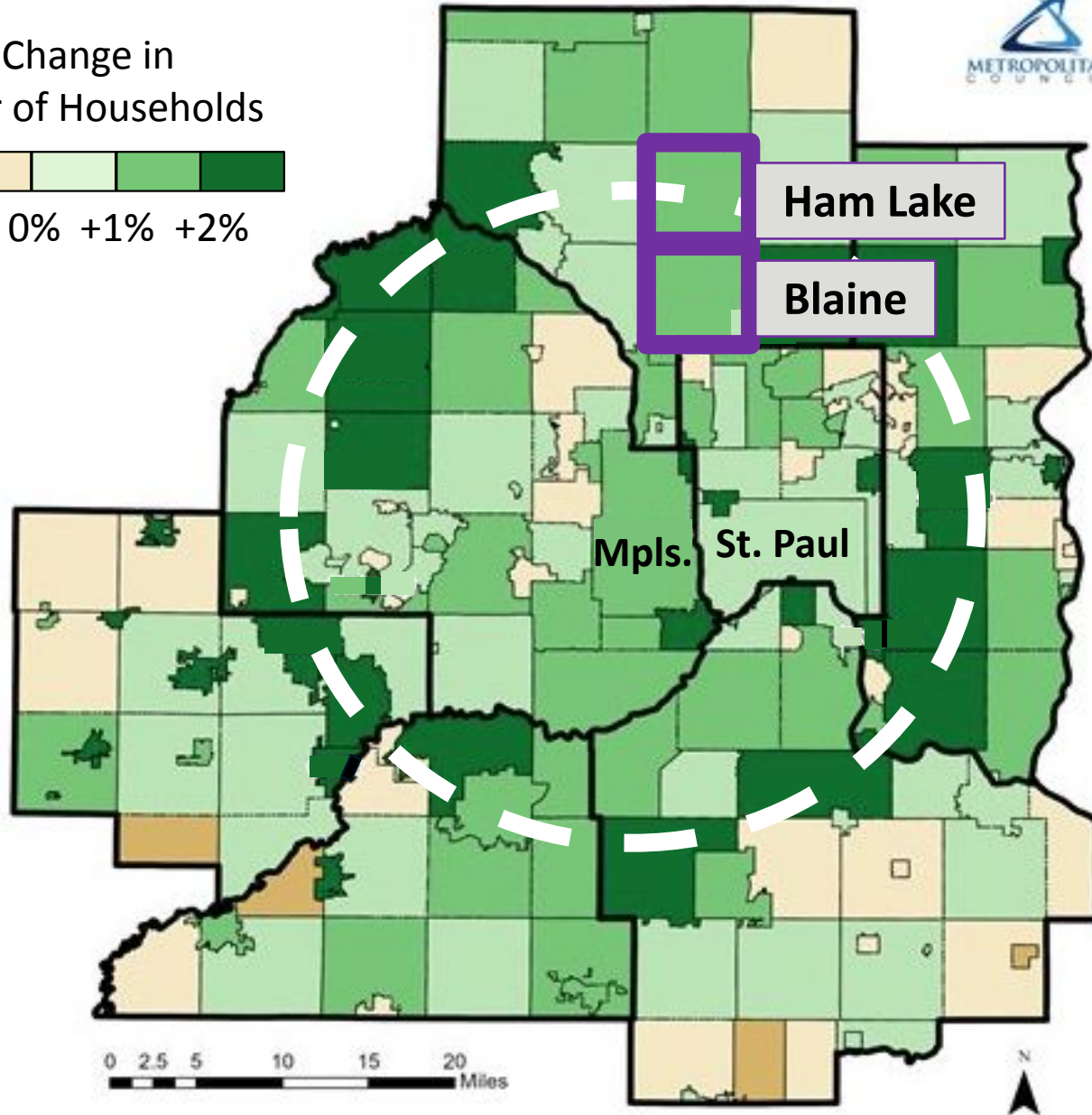
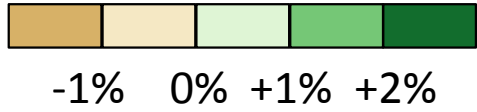


Modified after:

McDaris, J. R., Feinberg, J. M., Runkel, A. C., Levine, J., Alexander, E. C., and Kasahara, S. (2022). Documentation and Prediction of Increasing Groundwater Chloride in the Twin Cities, Minnesota. *Groundwater* 60 (6), 837–850. [doi:10.1111/gwat.13227](https://doi.org/10.1111/gwat.13227)

Runkel, A.C., J.H. Mossler, R.G. Tipping, and E.J. Bauer. (2006). *A Hydrogeologic and Mapping Investigation of the St. Lawrence Formation in the Twin Cities Metropolitan Area*. University of Minnesota, Minnesota; Retrieved from the University of Minnesota Digital Conservancy <http://hdl.handle.net/11299/108892>

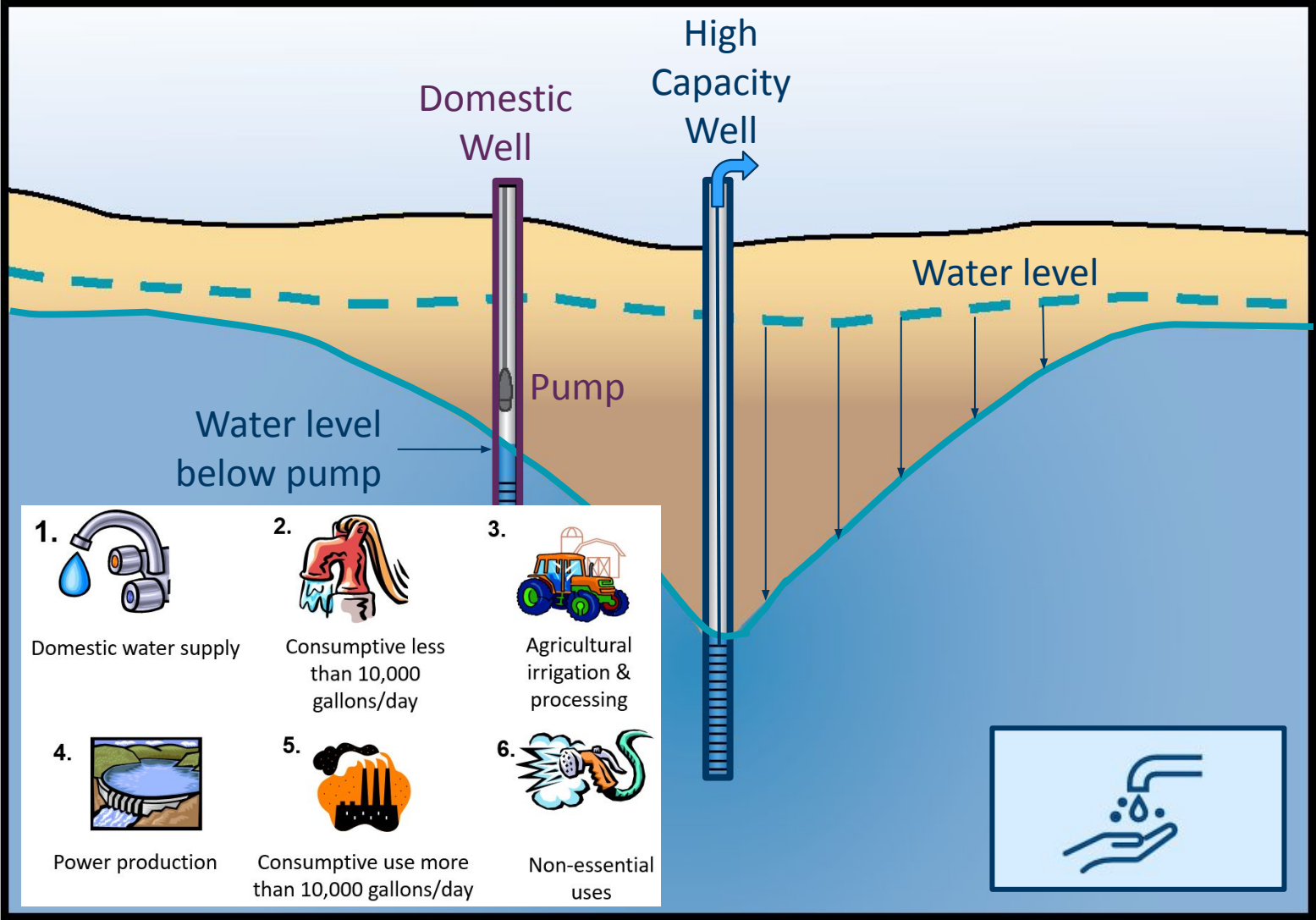
Percent Change in
Number of Households



Growth Concentrated at Edge of Metro Area

- Edge of Metro
- Supported by groundwater
- Different sizes and needs
- Municipal *and* domestic wells

Municipal Pumping in Blaine caused Well Interference in Ham Lake



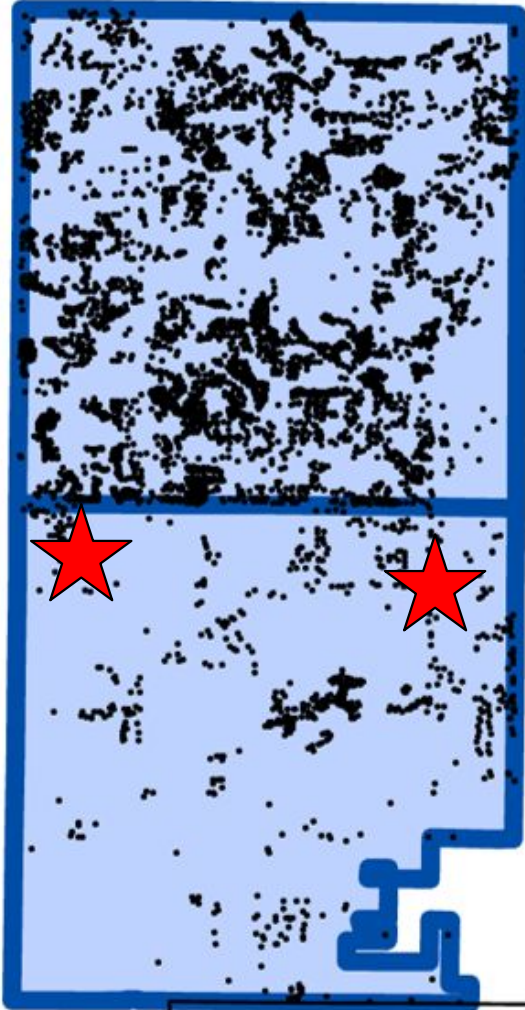
Blaine-Ham Lake Investigation

- 57 complaints over two years
- 53 well interferences
- City of Blaine responsible
- Homeowners reimbursed

What Caused Well Interference in Blaine and Ham Lake?

1. Urban Edge

Ham Lake



Blaine



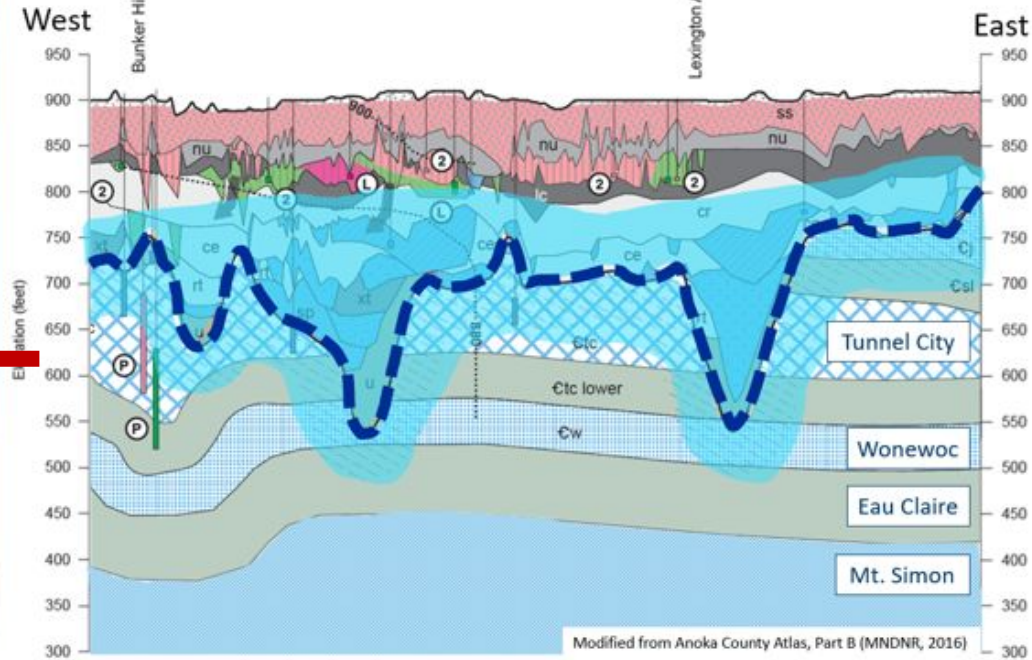
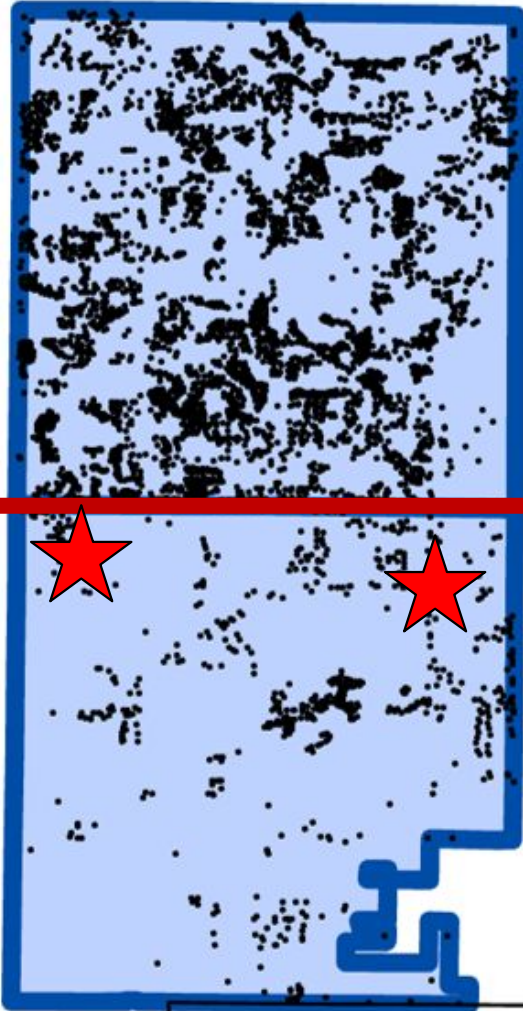
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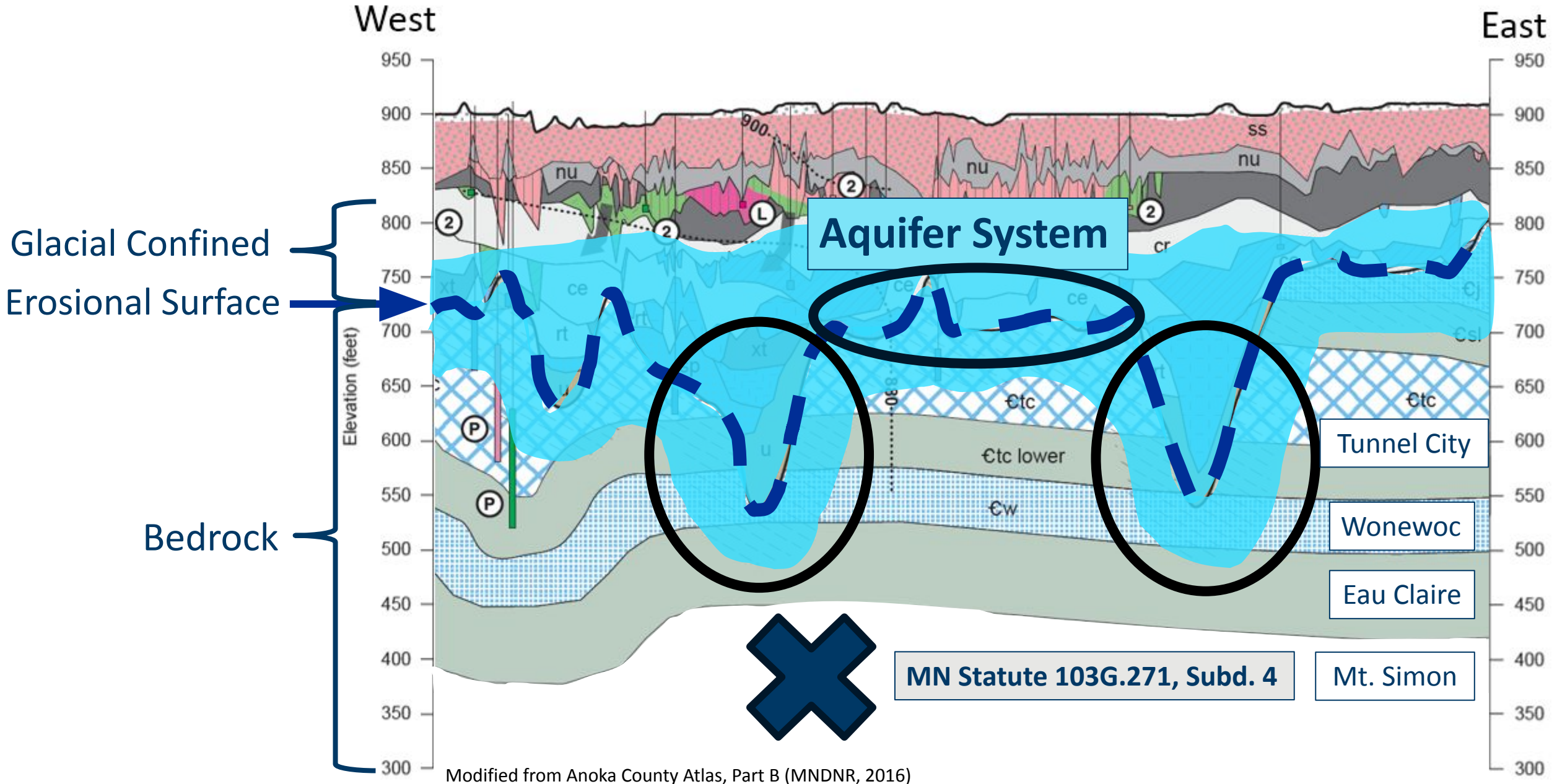
2. Hydrogeology

Ham Lake

Blaine

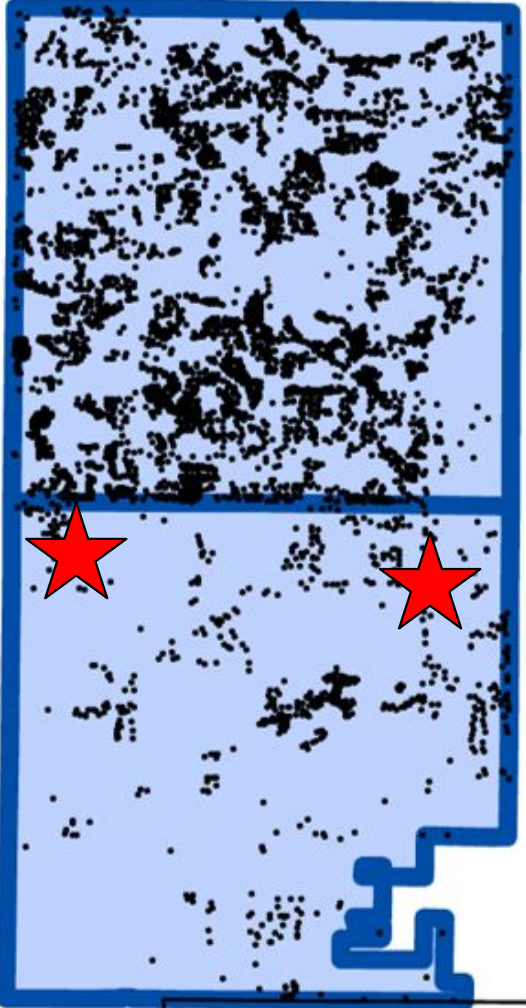


Hydrogeologic Cross Section

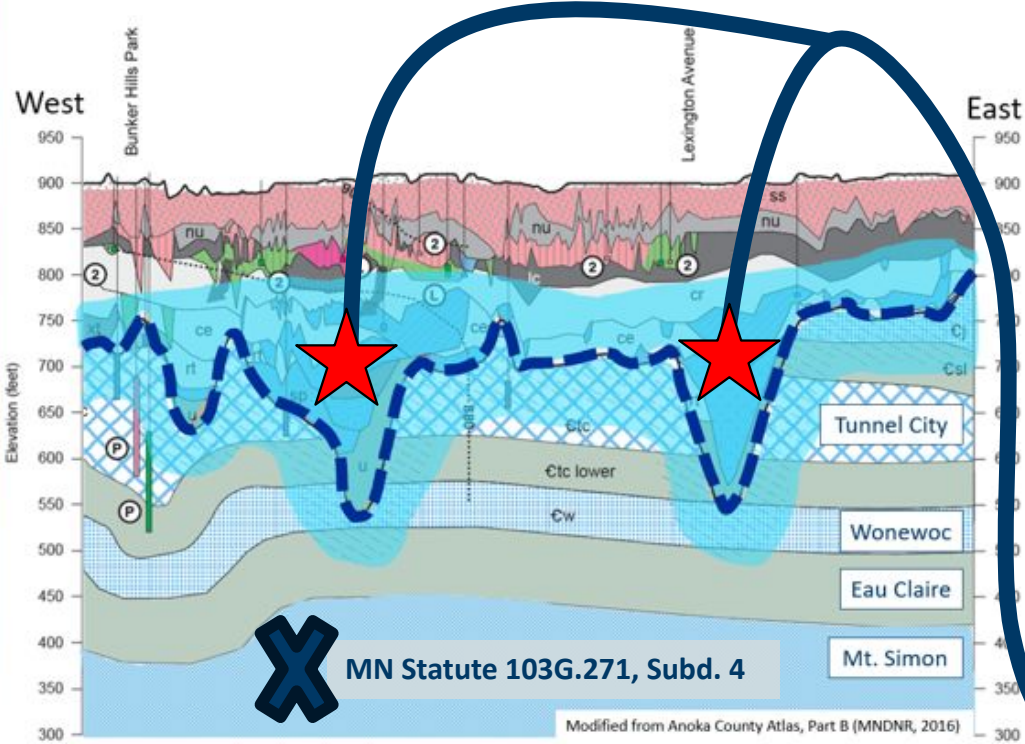


What Caused Well Interference in Blaine and Ham Lake?

1. Urban Edge



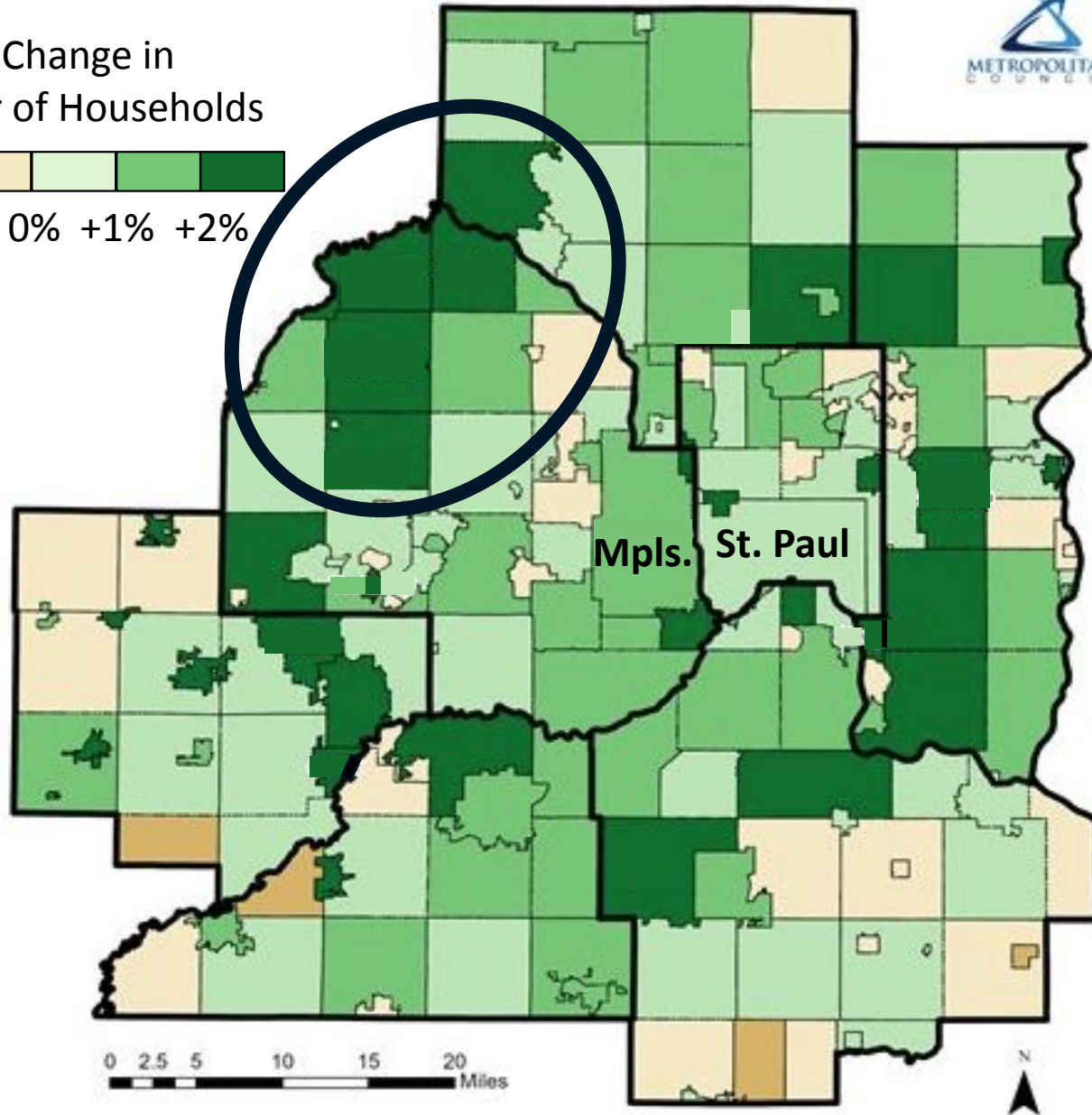
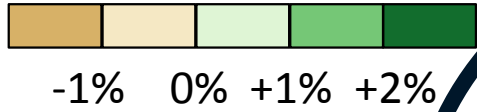
2. Hydrogeology



3. Drought →
high water use →
low water levels →
well interference



Percent Change in
Number of Households



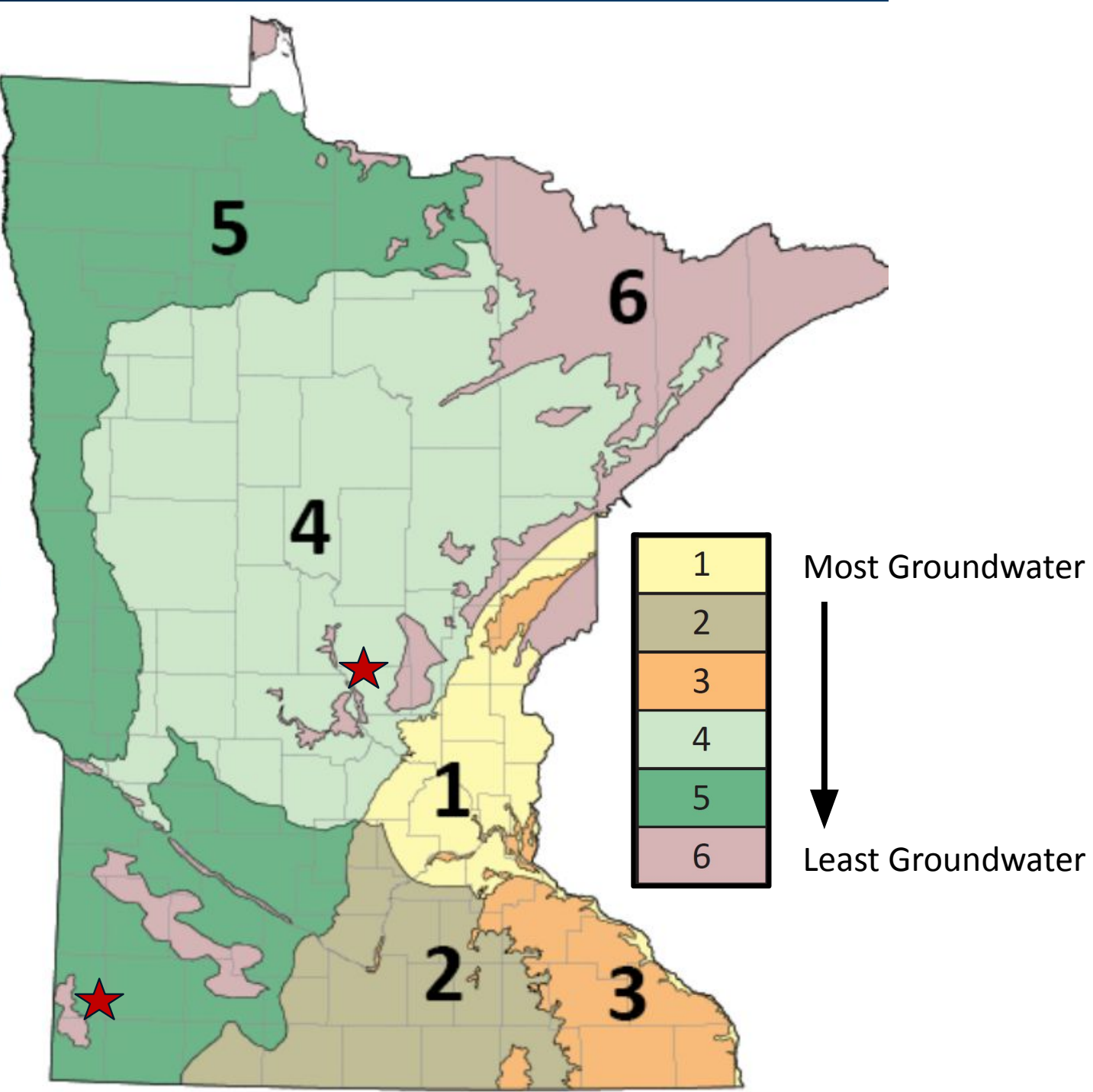
Northwest Metro is Growing the Fastest

- Collecting domestic well information
- Expanding monitoring in highly used aquifer systems



Protecting Ecosystems

Ellen J. Considine, PG | Hydrogeologist
Supervisor



Calcareous fens



Hydrology: Constant upwelling groundwater

Chemistry: Low oxygen, calcium-rich

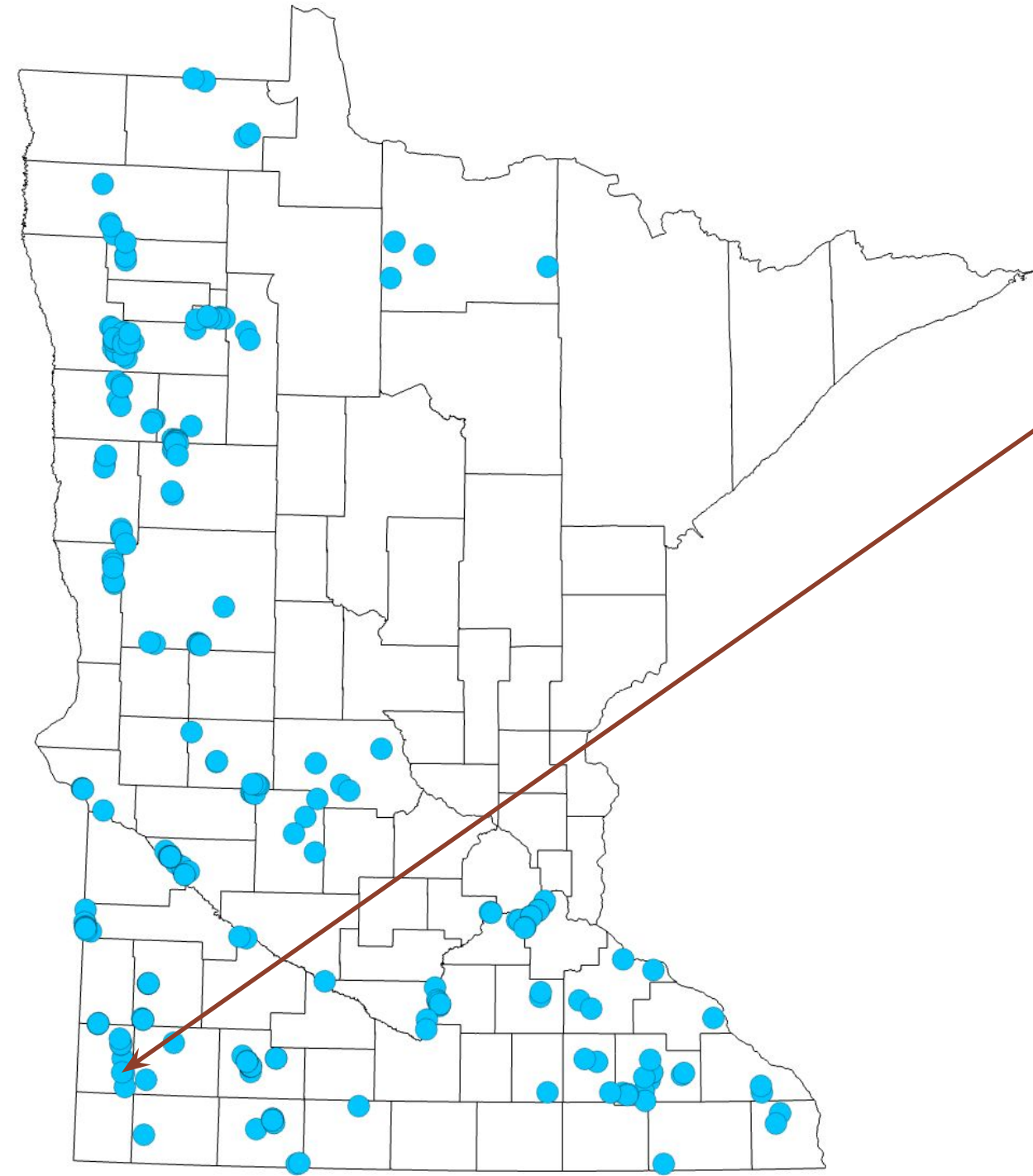
Plants: Calciphiles, rare species

Soils: Peat-forming, low acidity to alkaline

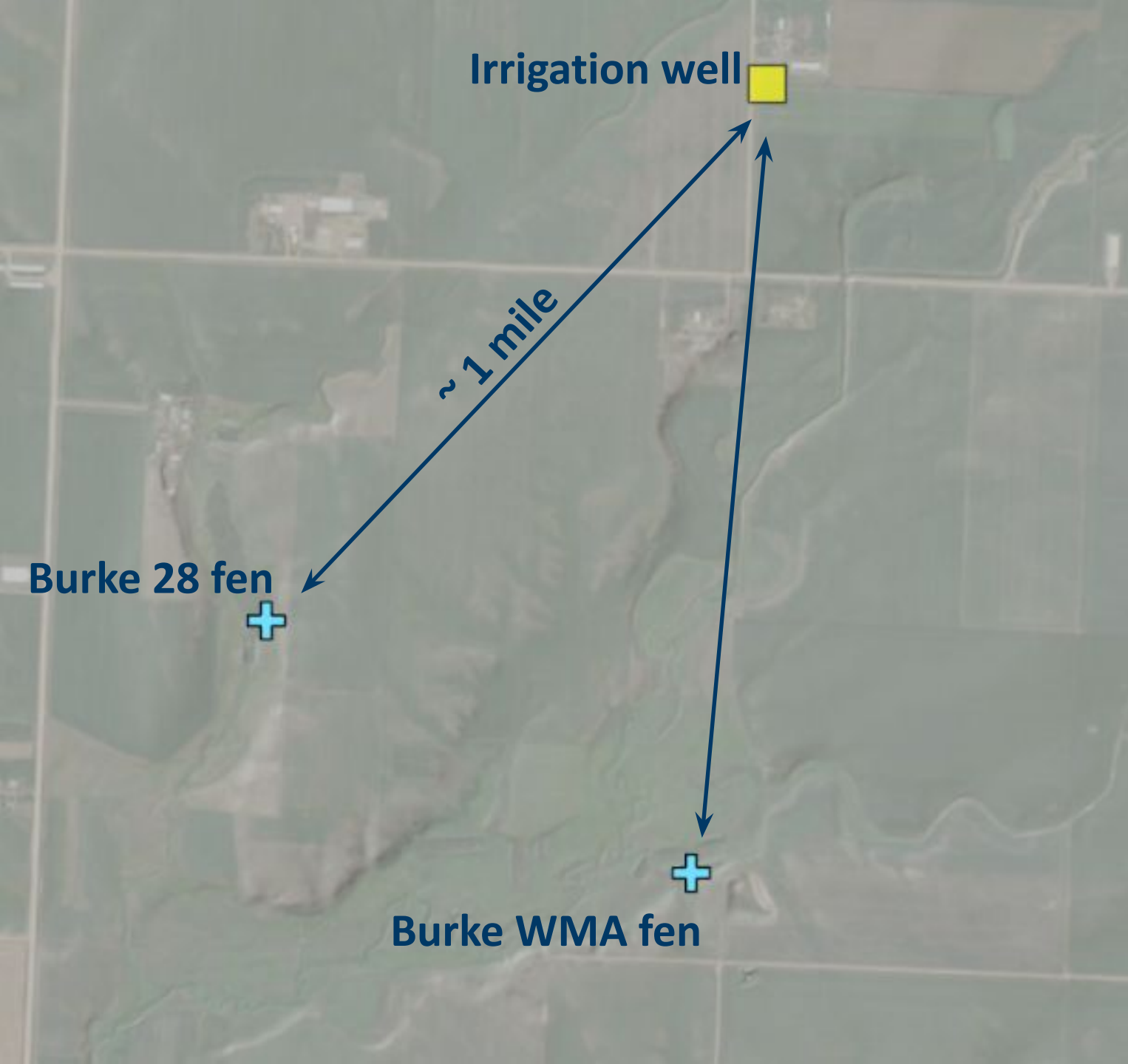
[MN Statute 103G.223](#)



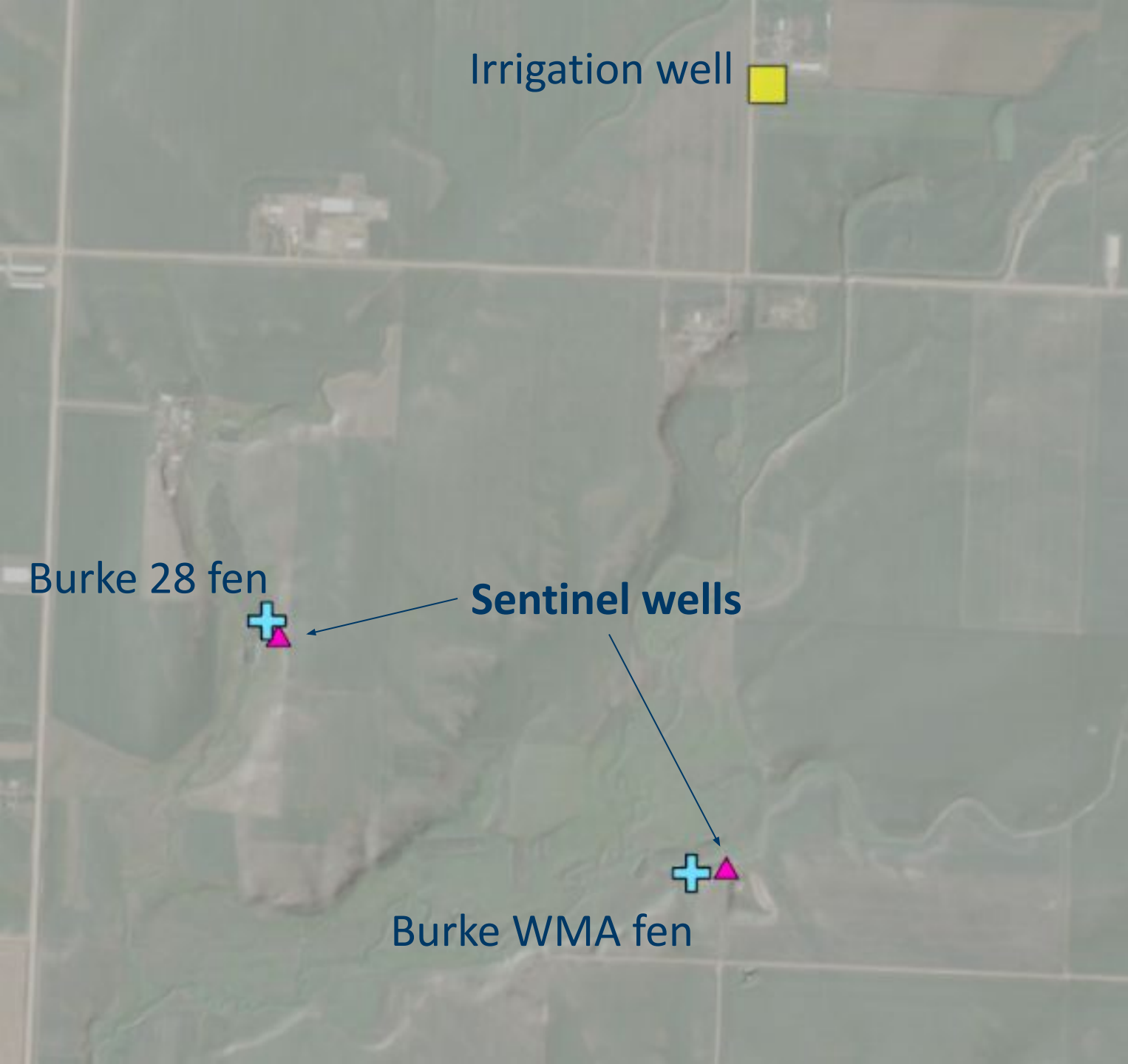
Burke calcareous fens



Permit application



Aquifer test



Contested case hearing

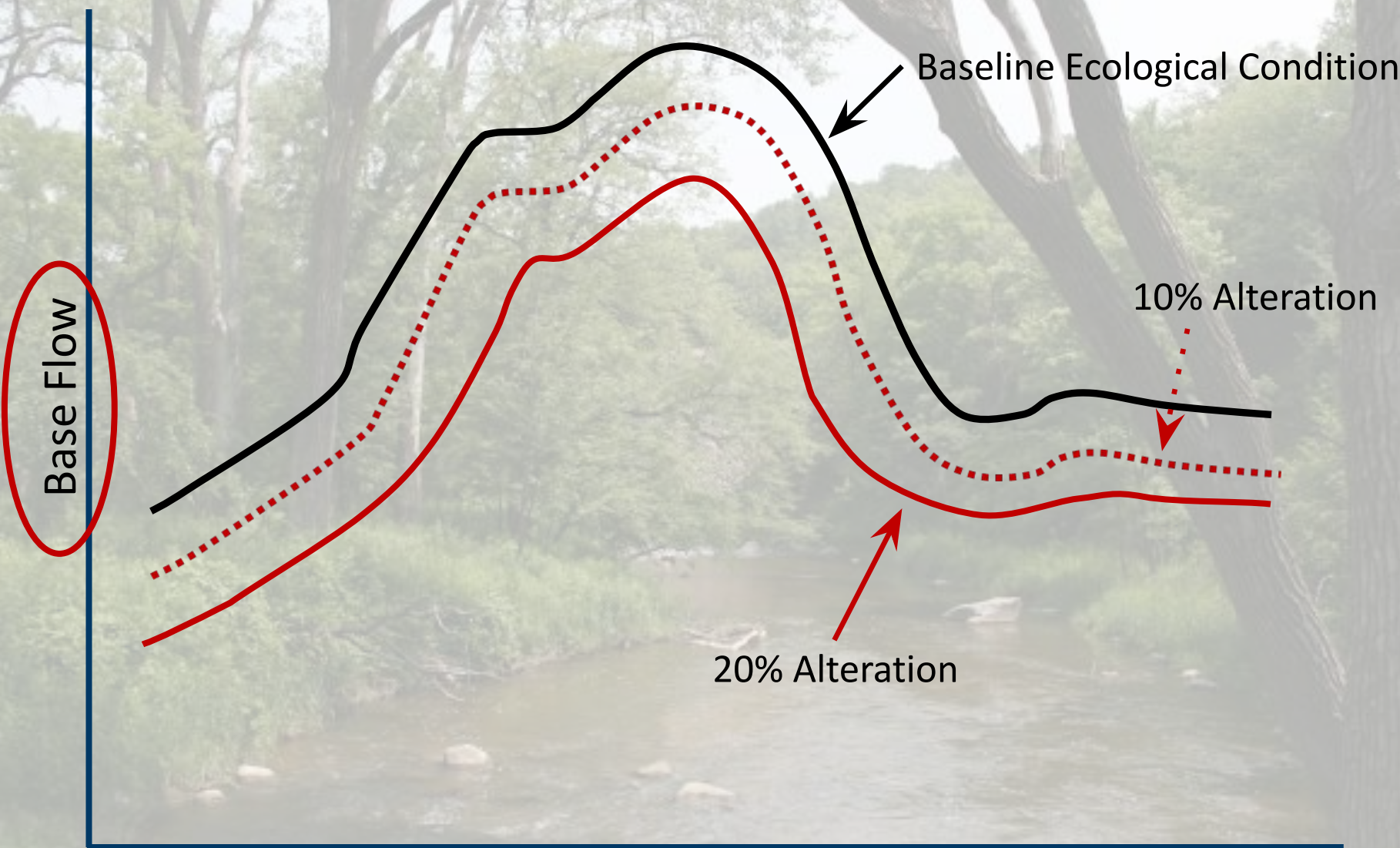
- *May not be degraded, wholly or partially*
- 0.2 feet drawdown
- 2015 – 2023: **8 years**



Streams and rivers

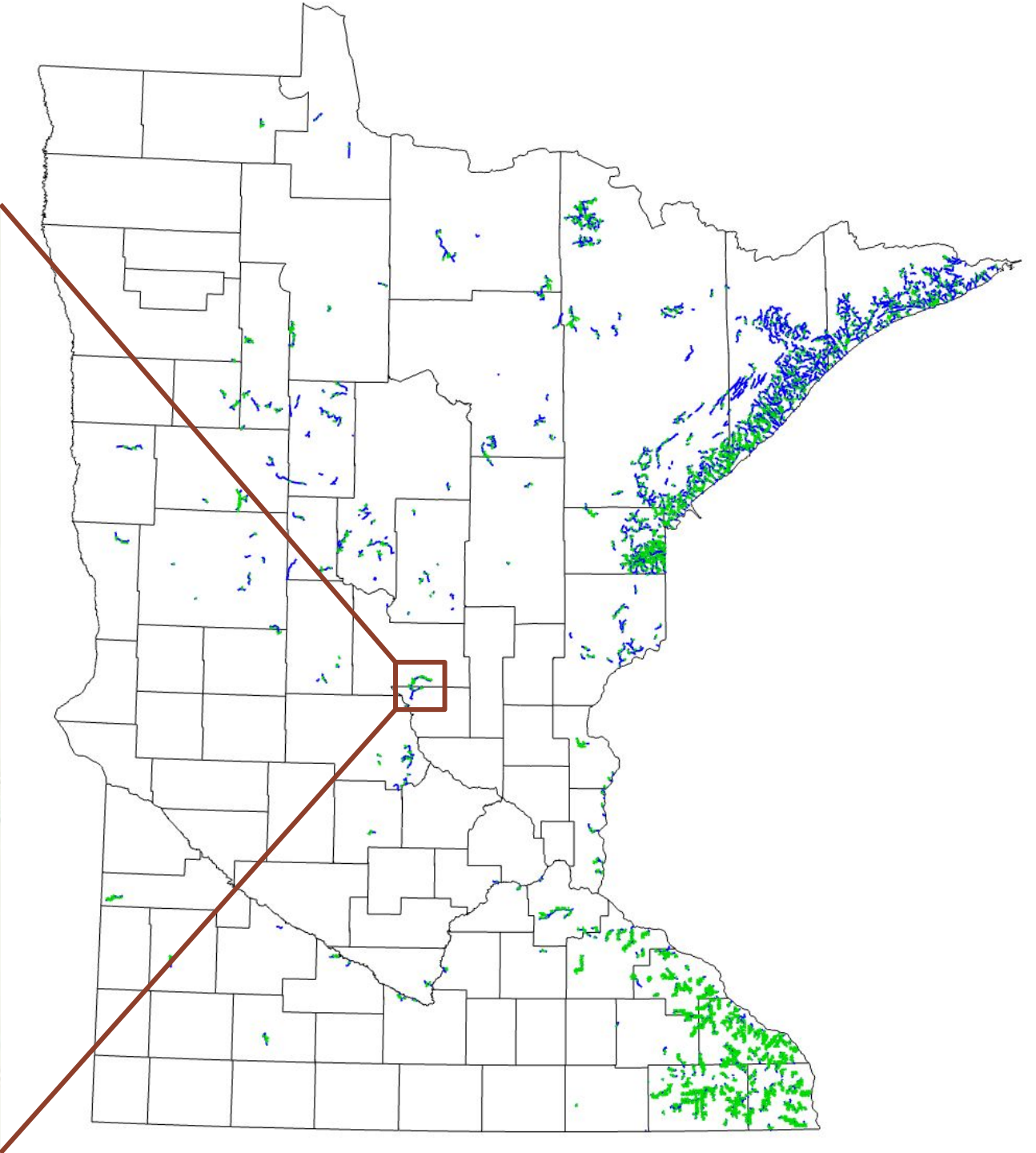
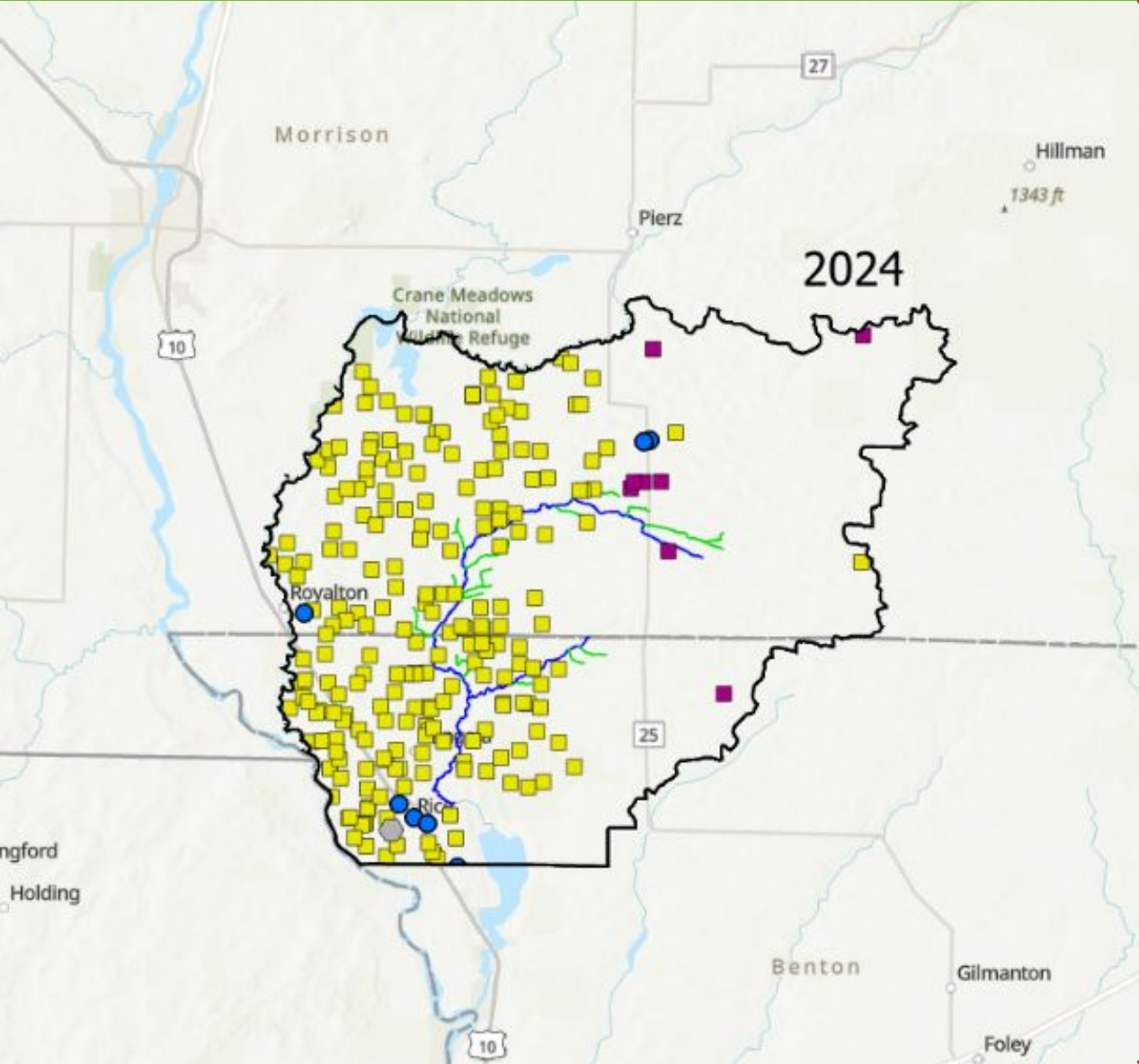


Streams and rivers



Day of Year

Little Rock Creek

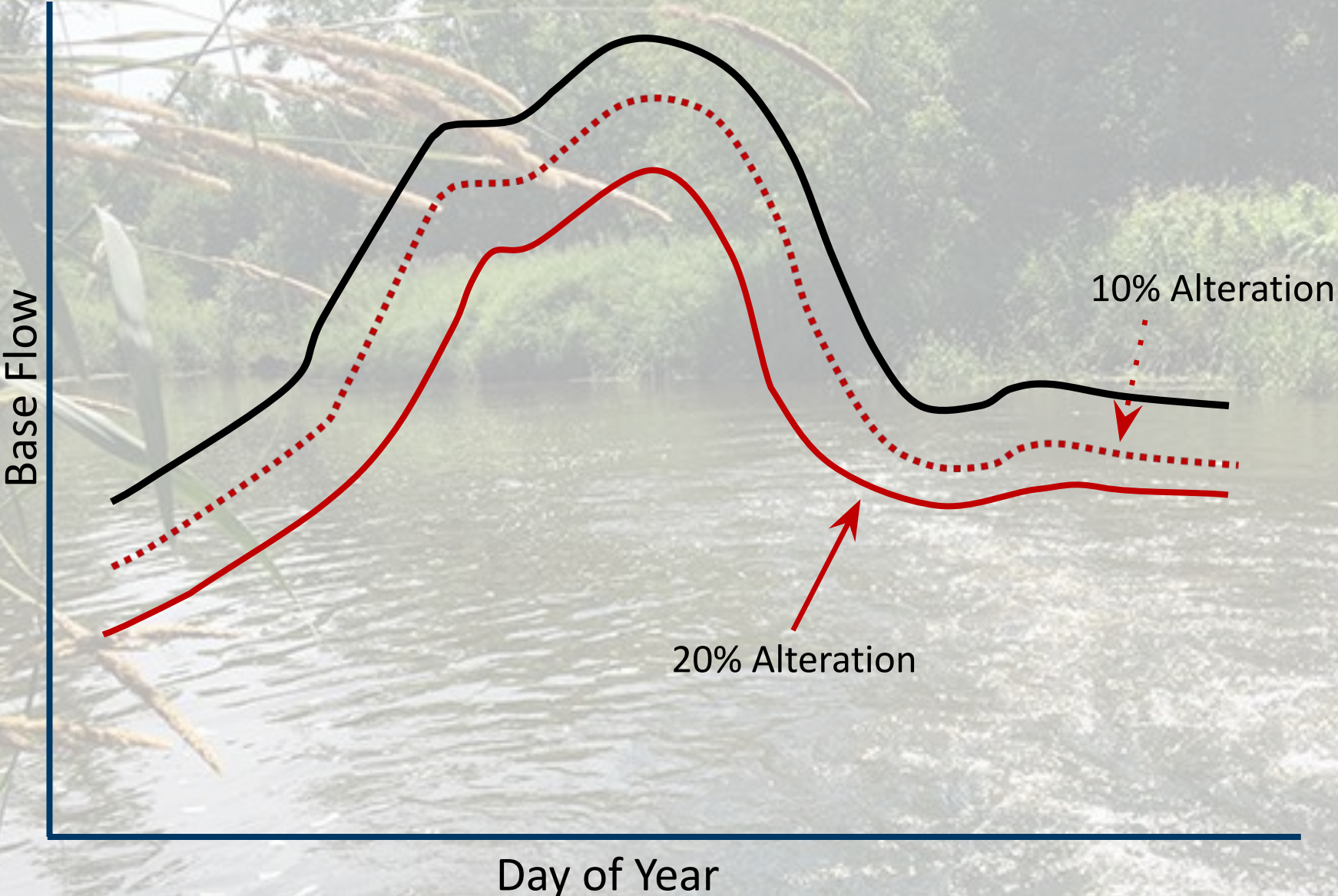


Increasing groundwater use → DNR study

- In-stream monitoring
- Groundwater monitoring
- Groundwater modeling
- Habitat analysis

Sustainable use of groundwater in the Little Rock Creek area

What we learned



April 2024: Commissioner's Order

1. Groundwater use negatively impacts the ecosystem

□ [MN Statute 103G.287](#)

2. Water Use Conflict → Water allocation plan

□ [MN Statute 103G.261](#) & [MN Rules 6115.0740](#)

3. Sustainable diversion limit =15%

April 2024: Commissioner's Order

1. Groundwater use negatively impacts the ecosystem

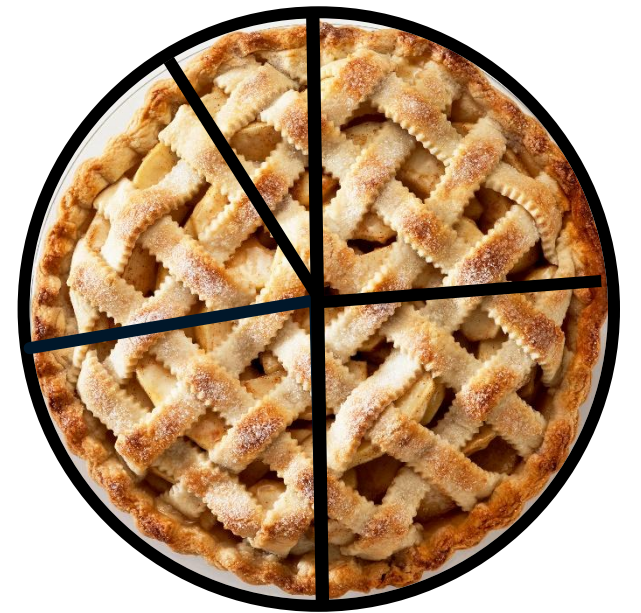
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[Sustainable use of groundwater in the Little Rock Creek area](#)



Groundwater Sustainability Statute (103G.287)

1. **Future generations** will have enough water



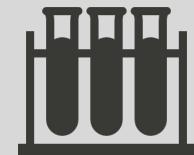
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3. **Drinking water** is protected



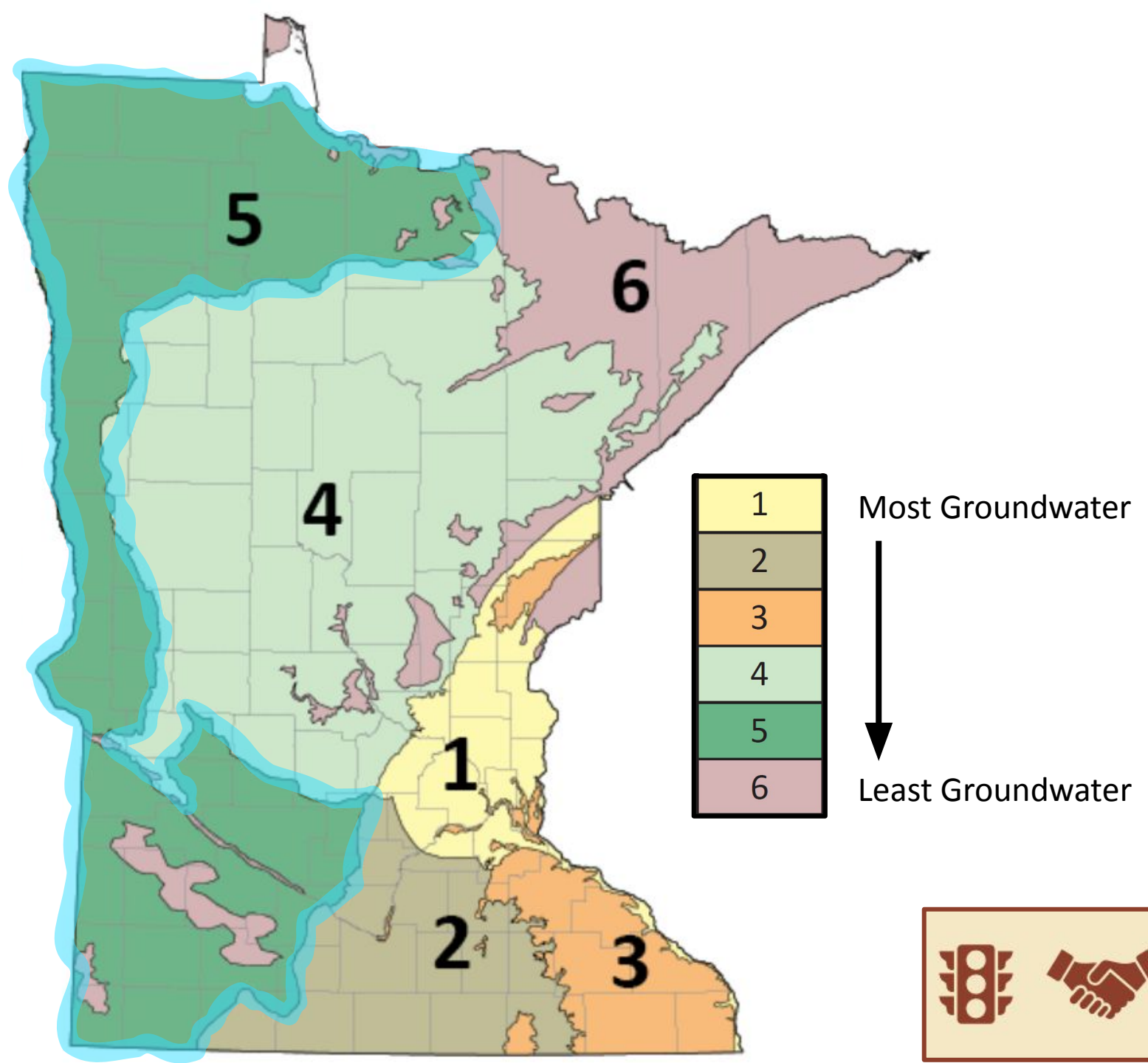
4. **Water quality** is not degraded



Tip #1:

Pay attention to groundwater provinces.

- Work in the west will take longer.
- Avoid clustered use in limited aquifers.

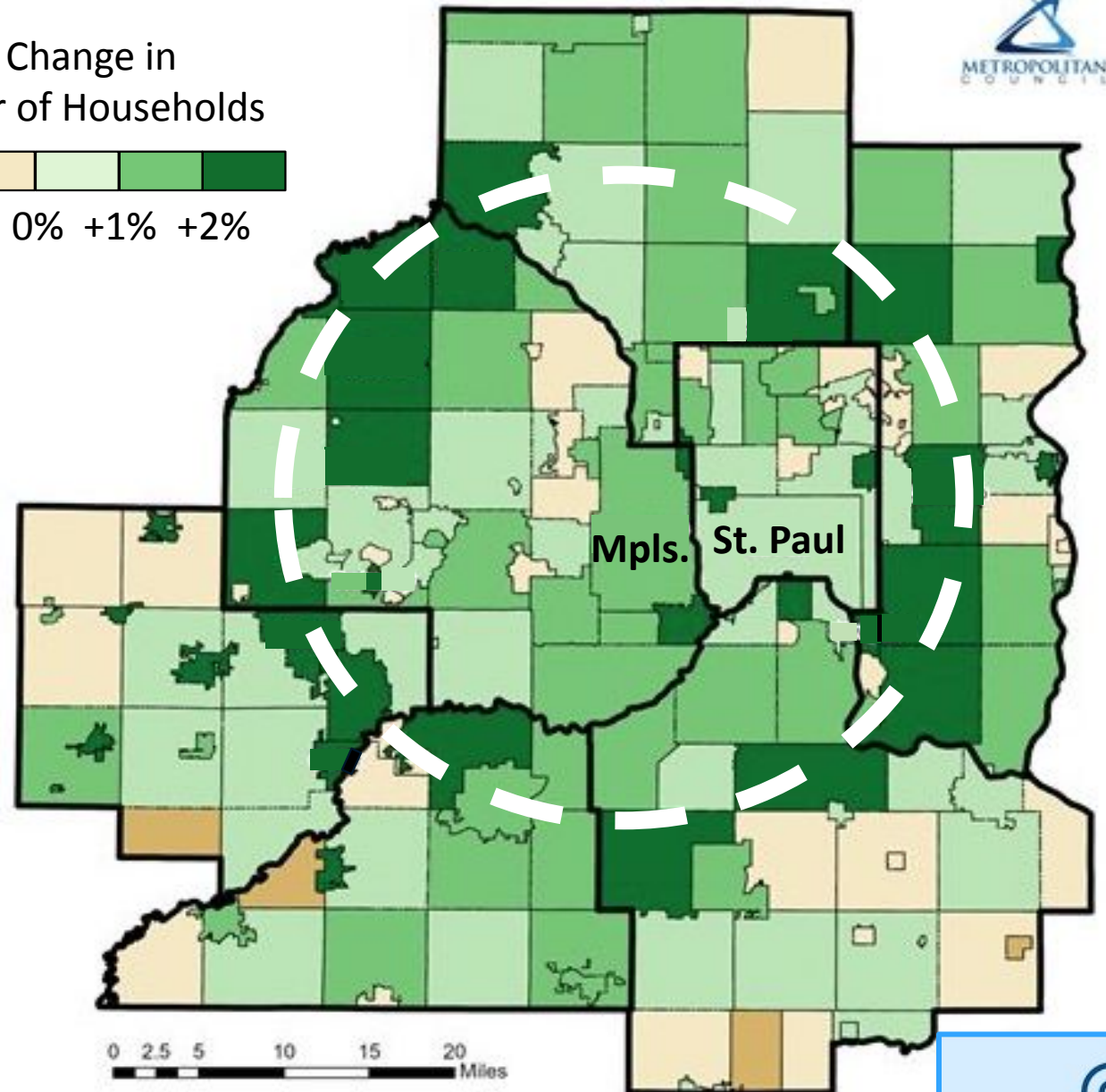
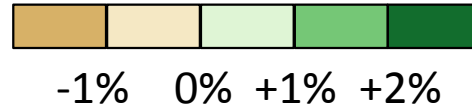


Tip #2:

If you are working in the metro:

- Domestic well information will be needed.
- Urban fringe has many domestic wells.

Percent Change in
Number of Households



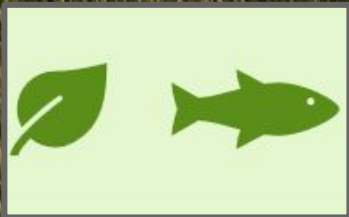
Modified after: Metropolitan Council. (2024, July). *Metro population growth slows, construction strong*. Retrieved November 4, 2024, from <https://metrocouncil.org/News-Events/Council-News/Newsletters/Metro-population-gr>









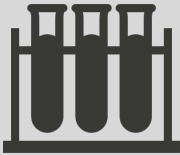
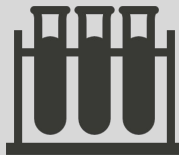
Tip #3:

If you are near a protected ecosystem:

- DNR review will take longer.
- The project may not be possible.



Groundwater Sustainability Statute (103G.287)

-  1. **Future generations** will have enough water 
-  2. **Ecosystems** are protected 
-  3. **Drinking water** is protected 
-  4. **Water quality** is not degraded 

Thank You!

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Ecological and Water Resources | Groundwater Technical Analysis Unit