

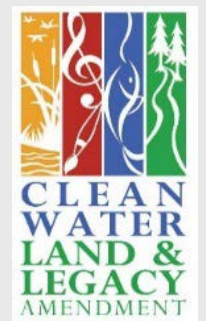


Working *Together*
to address nitrate in groundwater

Nitrate Mitigation in Drinking Water Supply Management Areas

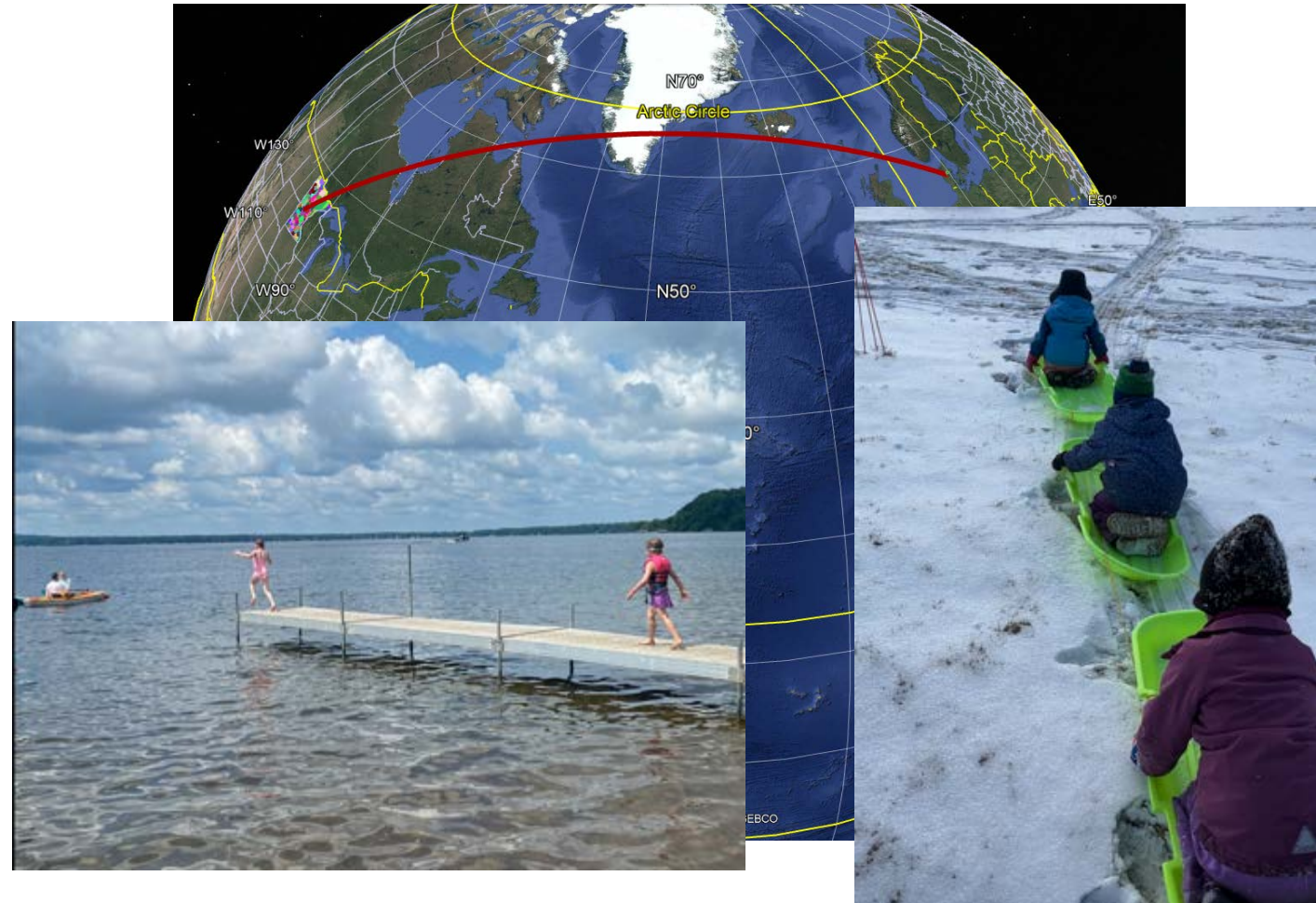
Reid Christianson and Margaret Wagner

Minnesota, United States of America







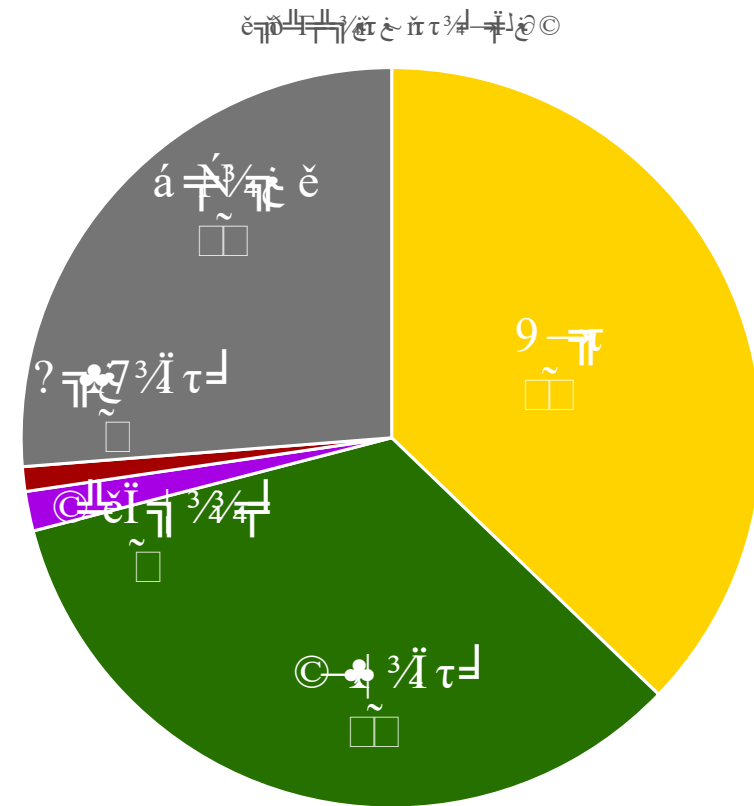
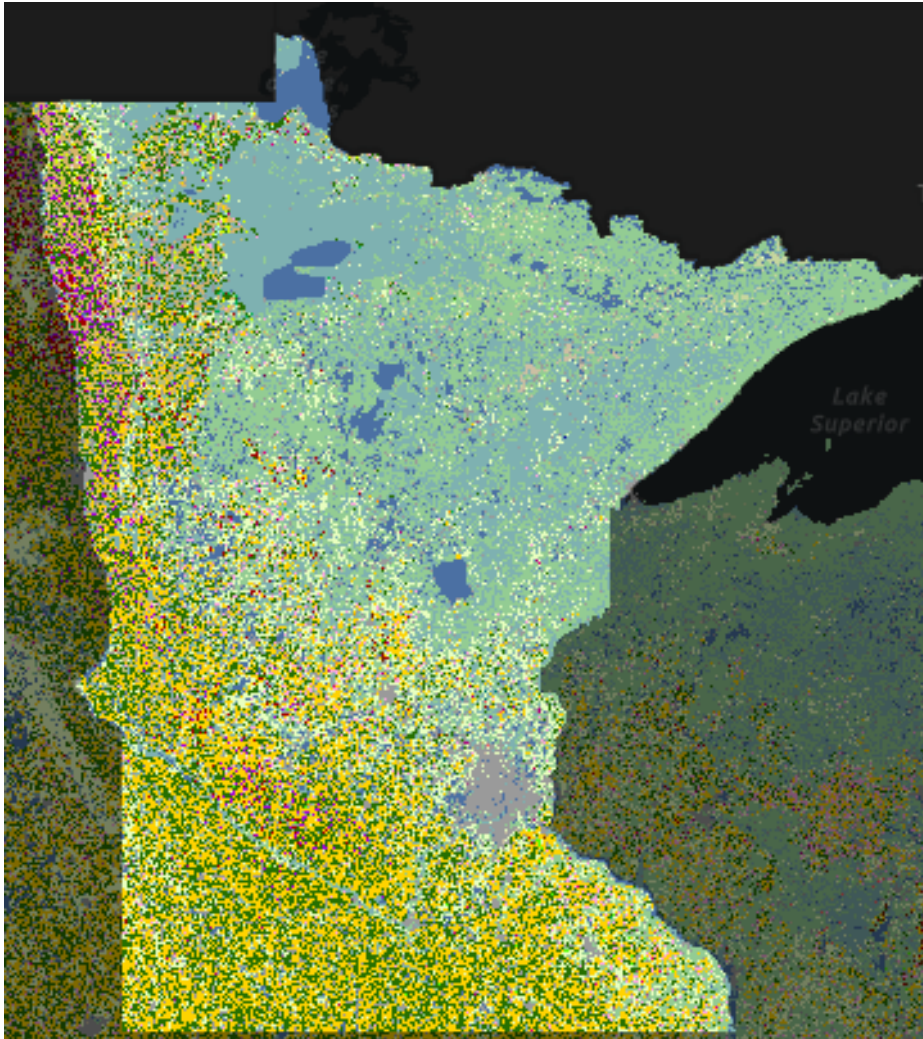
Jurisdictional Characteristics

- Total Area: $\sim 225,163 \text{ km}^2$
- Water Area: $\sim 20,960 \text{ km}^2$
 - The "Land of 10,000 Lakes"
- Forested Area: $\sim 71,450 \text{ km}^2$
 - Roughly 33% of the state
- Agricultural Area: $\sim 75,400 \text{ km}^2$



Cropping Systems

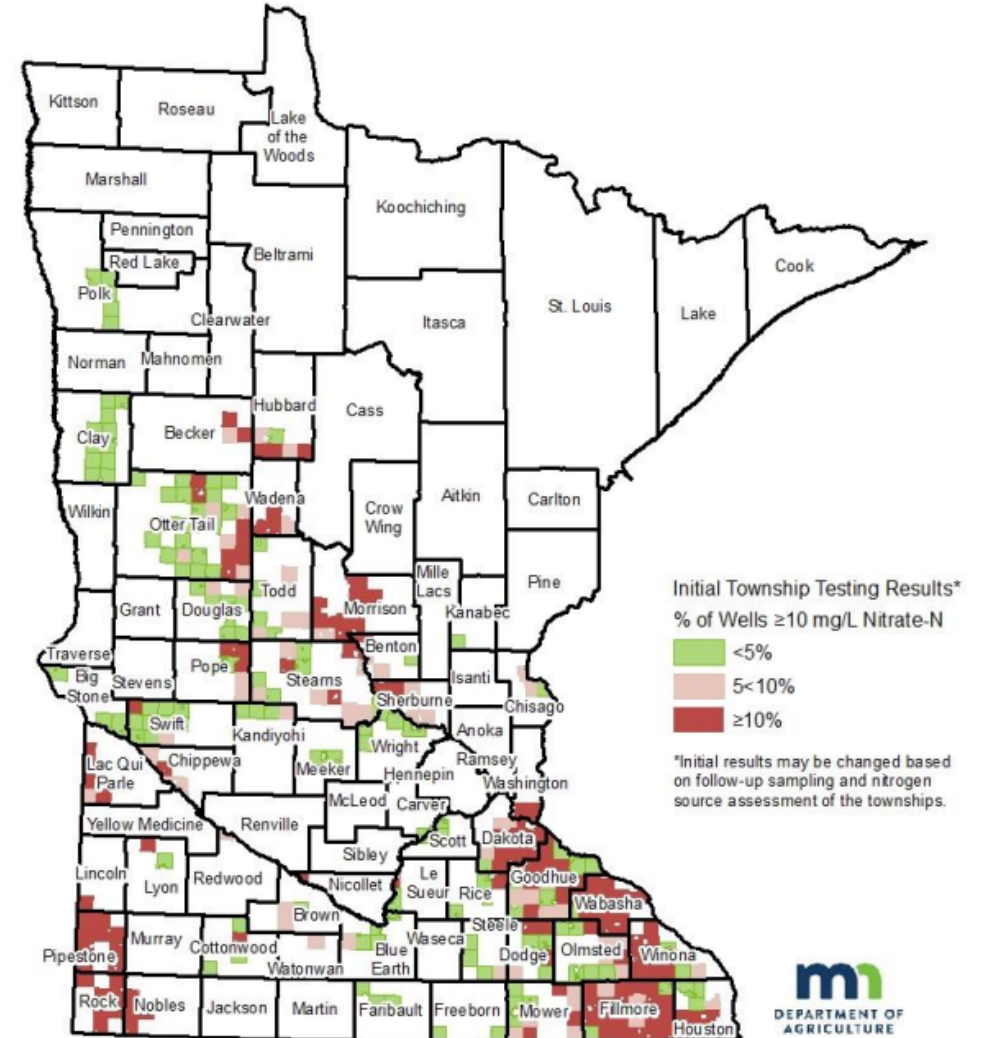
-  Corn
-  Soybeans
-  Sugarbeets
-  Dry Beans



A Concern in Vulnerable Areas

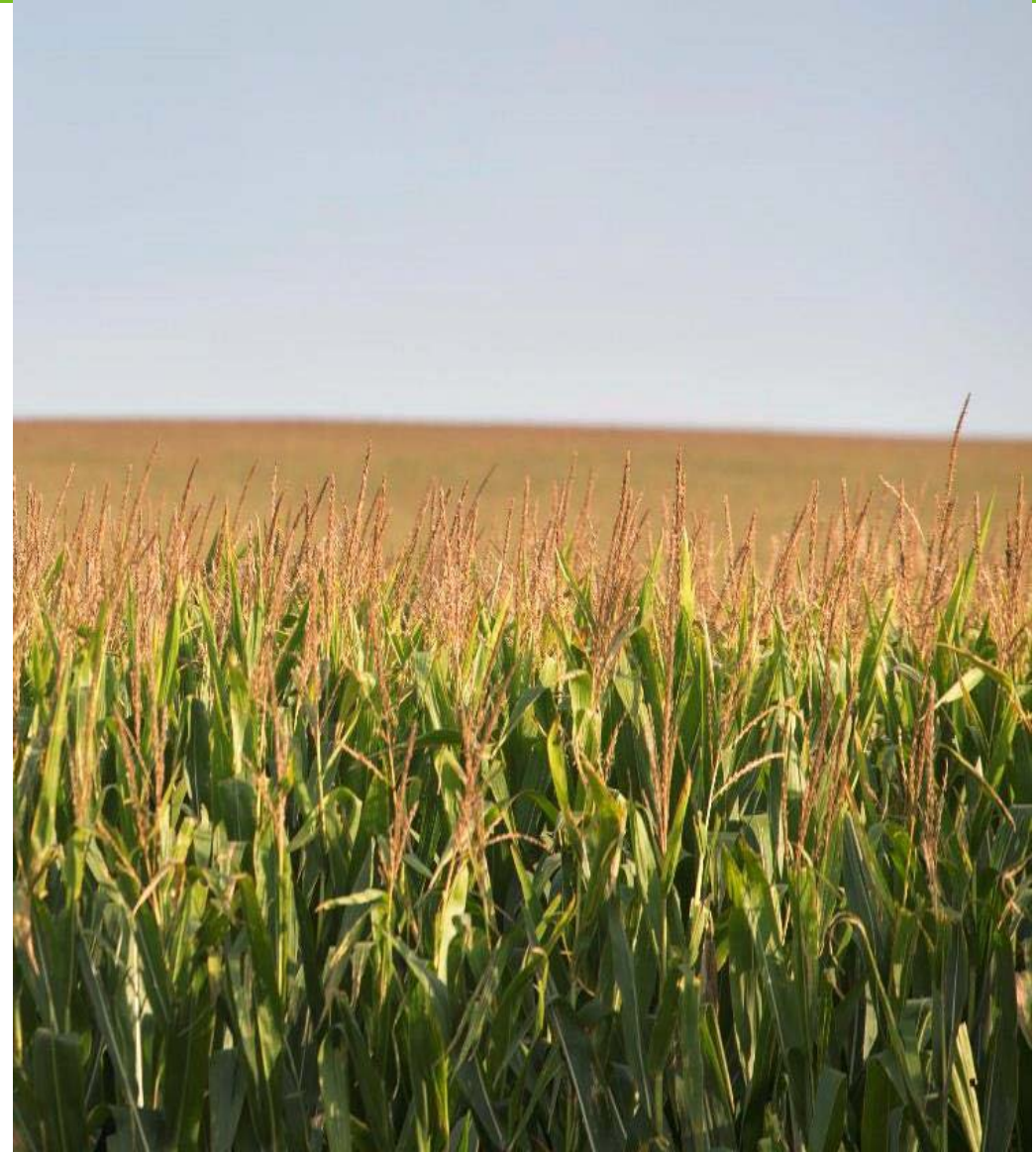
- Nitrate in groundwater is a concern in certain areas of Minnesota
- Nitrate in groundwater is a challenge that starts with geology and soil texture
 - Karst geology
 - Coarse textured (sandy) soils
 - Shallow depth to bedrock

Initial Township Testing Private Well Nitrate Results



Minnesota's Groundwater Protection Rule

- The Groundwater Protection Rule applies to the use of nitrogen fertilizer
- It focuses on protecting groundwater in areas vulnerable to groundwater contamination
- It went into effect in 2019
- The Rule contains two parts



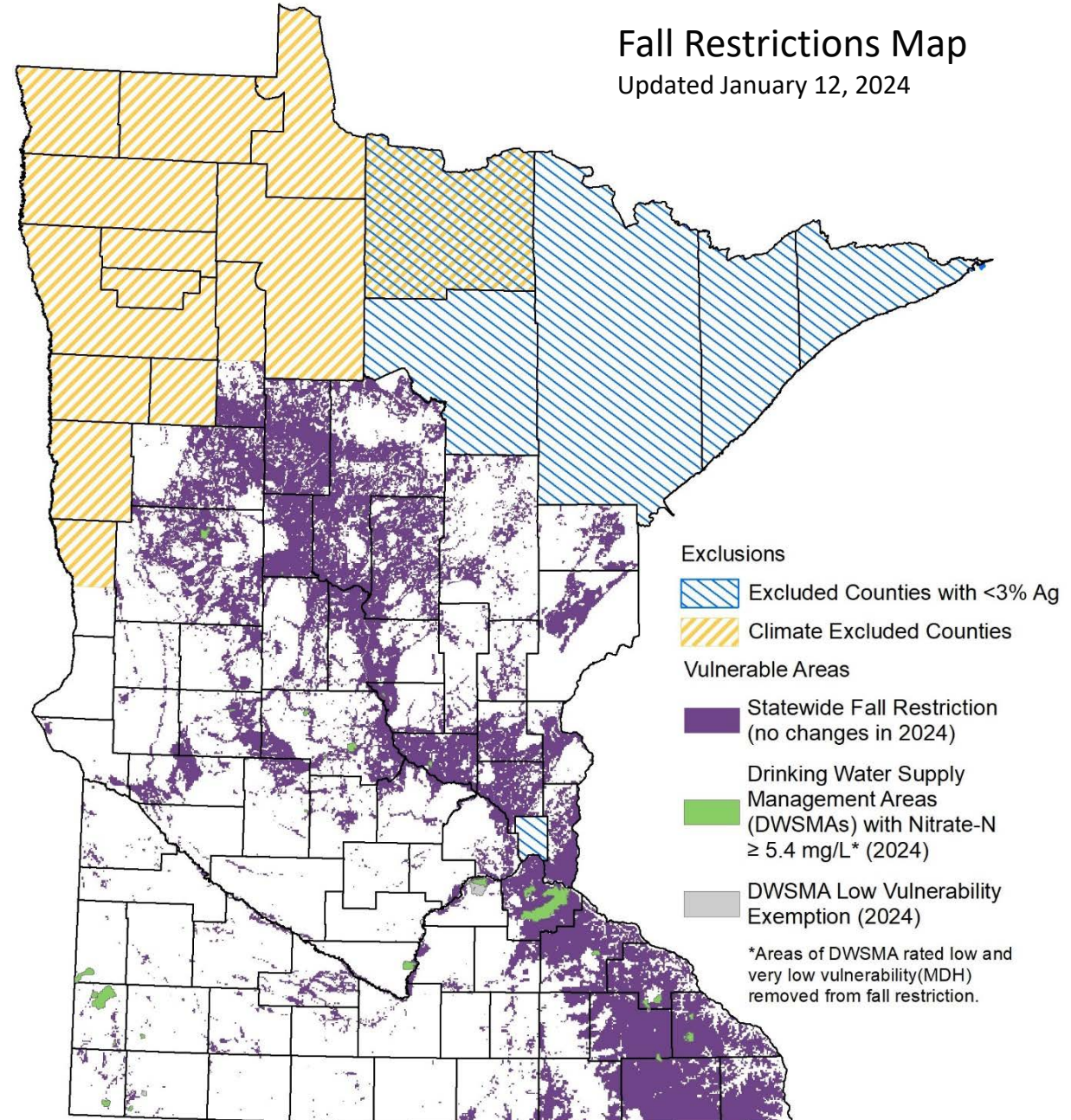
Minnesota's Groundwater Protection Rule

Restricts nitrogen fertilizer application in fall

- Areas with vulnerable groundwater - roughly 38,446 km²
- Protection areas around community wells with high nitrate

Fall Restrictions Map

Updated January 12, 2024



- **Interactive Online Map:**
www.mda.state.mn.us/vulnerableareamap

Minnesota's Groundwater Protection Rule

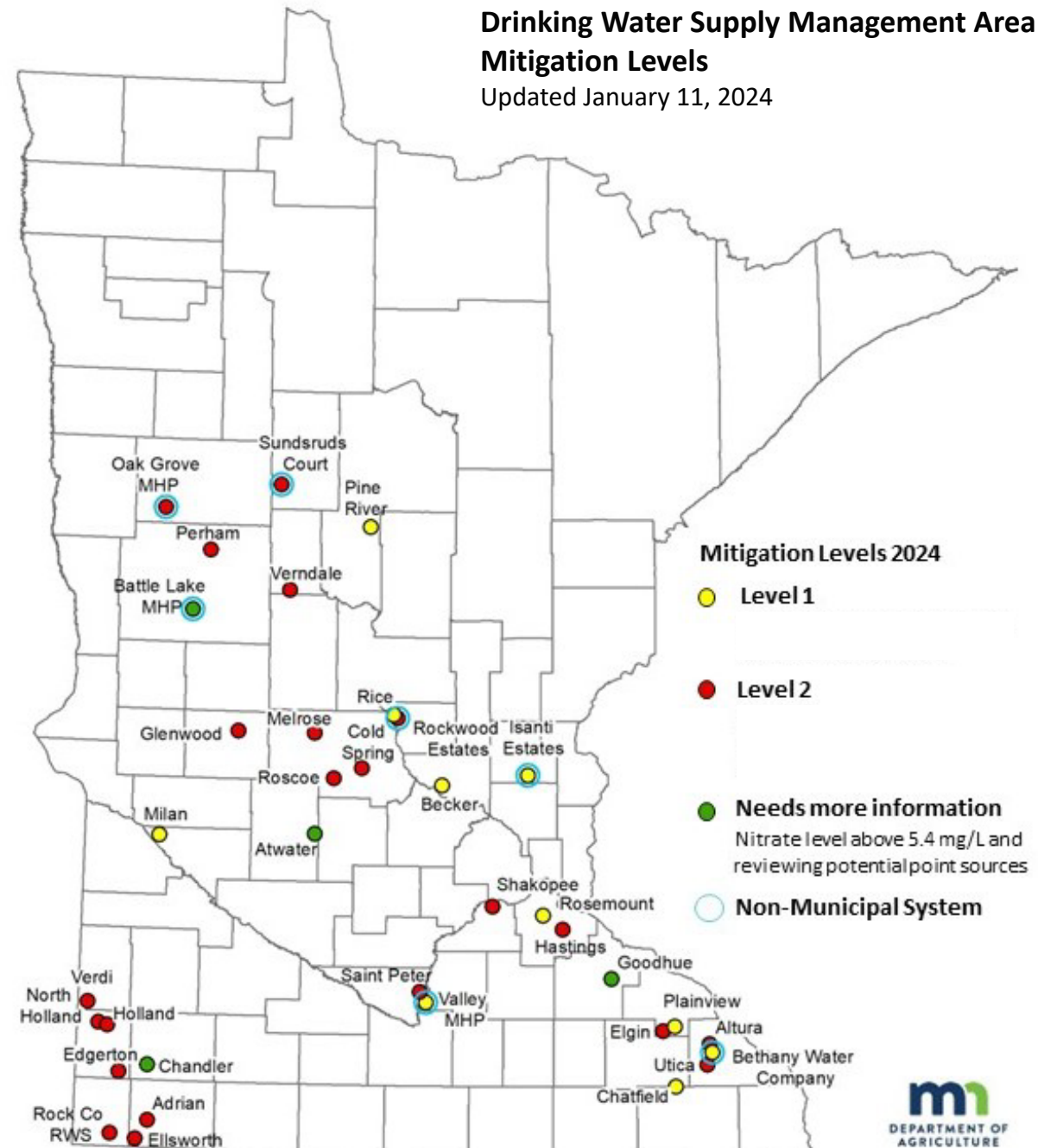
Drinking Water Supply Management Areas (DWSMAs) where community wells have high nitrate levels:

Level 1: Nitrate-N level is 5.4 to less than 8 mg/L in past ten years (n=10)

Level 2: Nitrate-N level is 8 mg/L or greater; or is projected to exceed 10 mg/L in the next ten years (n=23)

Drinking Water Supply Management Area Mitigation Levels

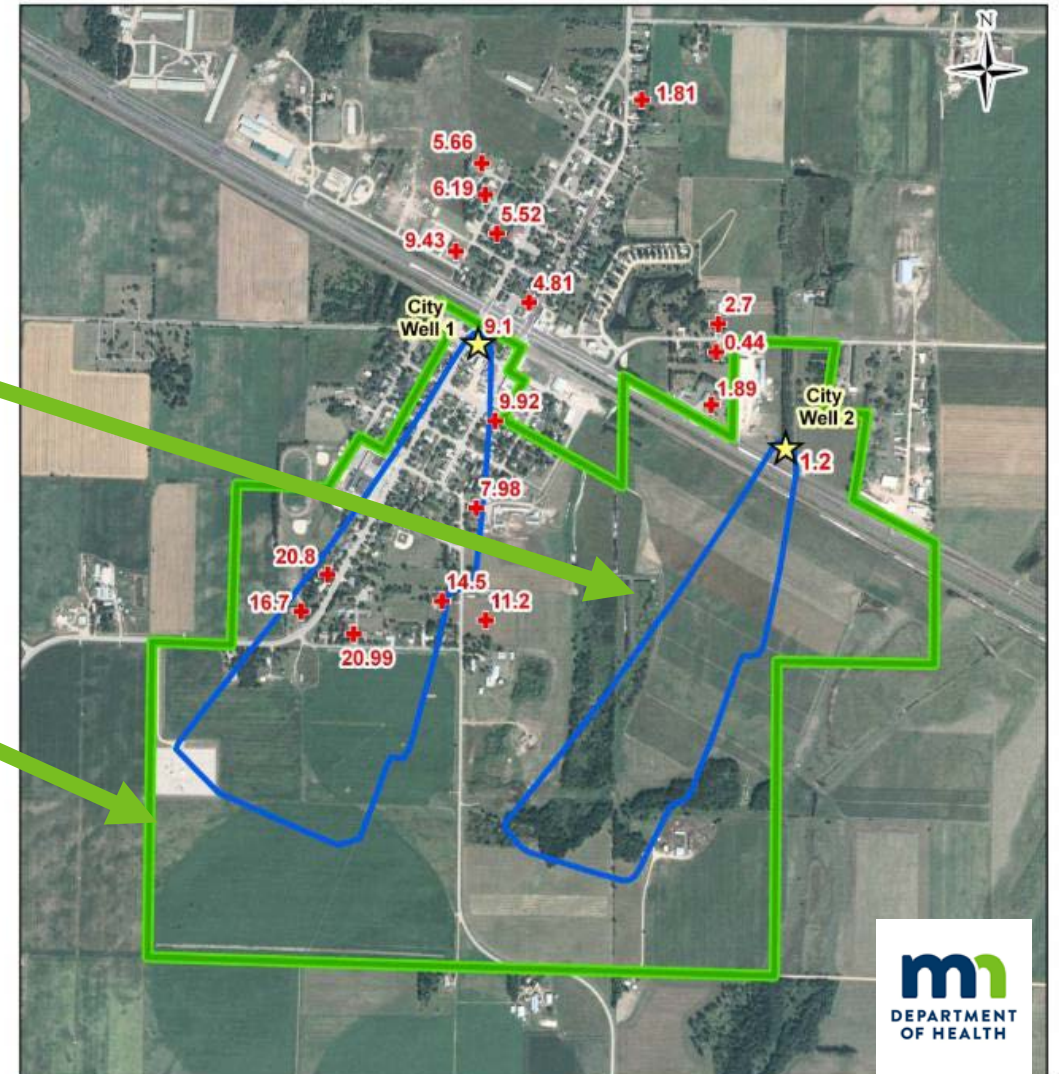
Updated January 11, 2024



What is a Drinking Water Supply Management Area (DWSMA)?

**Wellhead Protection Area
10-year time of travel
(blue outline)**

**Drinking Water Supply
Management Area
(green outline)**



Minnesota's Nitrate Reduction Framework



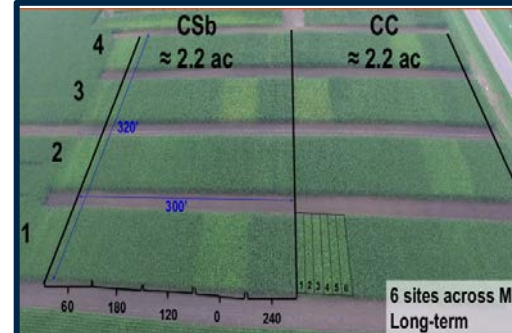
Farmer Surveys



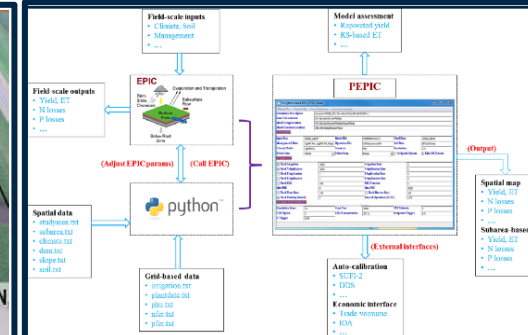
Water Monitoring and Technical Tools



On-Farm Demo Sites



Applied Research



Computer Modeling



Outreach and Education



Support farmer adoption of practices to protect groundwater



Working with Local Advisory Teams

- Farmers, agronomists, local government, water suppliers, residents.
- Sharing data, building trust, ensuring local ownership of solutions.
- Help develop and implement solutions.



Best Management Practices (BMPs)

University of Minnesota N BMPs



Best Management Practices for the Adrian Drinking Water Supply Management Area (DWSMA)



Updated: 5-26-2023

This document is a list of the University of Minnesota nitrogen (N) fertilizer best management practices (BMPs) that apply within the Adrian Drinking Water Supply Management Area (DWSMA). The BMPs are from the following University of Minnesota resources:

- Best Management Practices for Nitrogen Use in Southwestern Minnesota,
- Best Management Practices for Nitrogen on Coarse Textured Soils,
- Fertilizing Corn in Minnesota, and
- University of Minnesota Extension webpage Crop-Specific Nutrient Needs at <https://extension.umn.edu/nutrient-management/crop-specific-needs>

Considerations when reading the tables

- The BMPs listed below are applicable to all soils or specific to coarse or fine textured soils. There are both coarse and fine textured soils across the cropland within the Adrian DWSMA.
- A map of the Adrian DWSMA identifying where coarse soils exist can be found at <https://tinyurl.com/DWSMAAdrian>
- In situations where a field includes both coarse and fine textured soils, the operator can either manage each area of the field separately or follow the BMPs for the majority soil texture within the field.
- The BMPs on the final list must be implemented on 80% of the cropland (excluding soybean acres) in the DWSMA.
- Nitrogen management records need to be provided to show that a responsible party does not provide or provides insufficient documentation implemented, it counts as non-implemented during MDA's evaluation implementation.
- Some BMPs may not apply to all cropping systems, such as, incorporate systems. If a BMP is agronomically or technically unsuitable for a specific topography, crop or management system, a suitable BMP or Alternative BMPs for definitions of terms related to the BMPs. This document is www.mda.state.mn.us/adrian-dwsma.

Best Management Practices (BMPs)

The BMPs numbered 1 – 3 apply to all soil types and are the most important BMPs to reduce nitrate losses.

BMP Number	Nitrogen Rate BMPs	Applies to
1	Nitrogen rates are based on nitrogen fertilizer application guidelines from the University of Minnesota. Rates were last updated July 2022 ¹ . Dryland corn following corn: up to the 0.075 MRTN (currently at 190 lbs N/ac) ^{1,2} Dryland corn following soybean: up to the high end of the 0.075 rate range (currently at 165 lbs N/ac) ^{1,2} For other crops grown in the DWSMA, nitrogen rates must follow the current University of Minnesota guidance applicable to that crop ³	All agronomic crops on all soils
2	Include N supplied in a starter, weed and feed program, and contributions from phosphorus fertilizers such as MAP and DAP when calculating total N rate	All agronomic crops on all soils
3	Take appropriate N credit for previous legume crops and manure used in the crop rotation	All agronomic crops on all soils

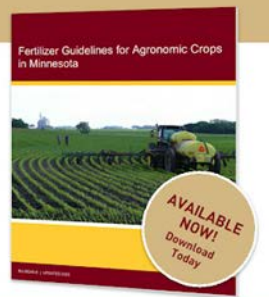
¹ Corn nitrogen rate guidelines from the University of Minnesota <https://extension.umn.edu/crop-specific-needs/fertilizing-corn-minnesota> or its successor.
² The implementation of approved alternative management tools may allow a higher nitrogen rate provided that the field specific data indicates this is appropriate.
³ All crops listed at the University of Minnesota Extension webpage Crop-Specific Nutrient Needs at <https://extension.umn.edu/nutrient-management/crop-specific-needs> or its successor.

BMP Number	Nitrogen Placement, Timing and Source BMPs	Applies to
4	Use split applications of nitrogen fertilizer	Corn on coarse textured soils

Additional Practices	Applies to
Keep records of nitrogen use, including rates, crediting of nitrogen sources, timing, placement, and source. The MDA will provide guidance on record keeping requirements.	All agronomic crops on all soils

Fertilizer Guidelines for Agronomic Crops in Minnesota

- Updated in 2023 (first time since 2011)
- Recommendations for 21 cropping systems
- How to understand your soil test report



Implementation

- Farmers in each DWSMA have very different management practices.
- Nitrogen rate is typically the most important practice to consider.
- Computer modeling provides valuable information in discussing options.



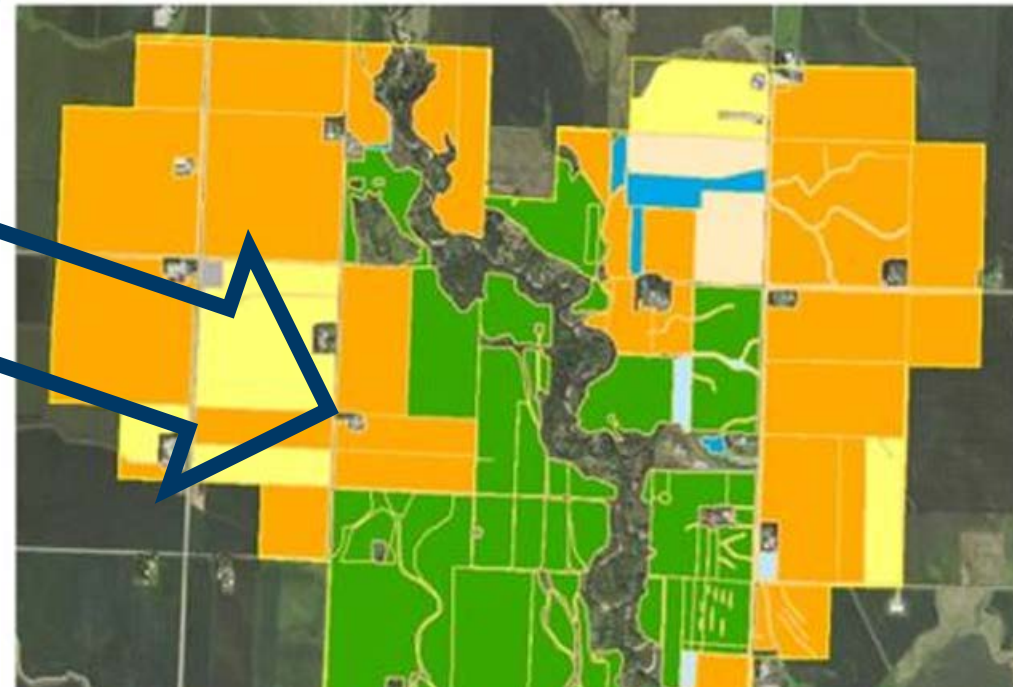
Results and Reflections

Rock Rural Water



This map is based on information from the USDA cropland data layer hosted on CropScape along with the professional judgement of local resource conservation professionals. It is not based on individual farm survey data.

- = Corn/Soybean
- = Corn/Corn/Soybean
- = Corn/Corn
- = Land Conservation
- = Hay
- = Pasture
- = Alfalfa



This map is based on information from the USDA cropland data layer hosted on CropScape along with the professional judgement of local resource conservation professionals. It is not based on individual farm survey data.

- = Corn/Soybean
- = Corn/Corn/Soybean
- = Corn/Corn
- = Land Conservation
- = Hay
- = Pasture
- = Developed

Year	Corn in Landscape
2019	77%
2020	63%
2021	59%
2022	53%

Going Forward

- Next step: working in priority townships with high nitrate in private wells on a voluntary basis.
- Build onto the >4,000 km² of cropland in the Ag Water Quality Certification Program



Thank You!

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