

625 Robert Street North  
Saint Paul, MN 55155-2538

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RE: Nitrate in Groundwater: MDA nitrate loss reduction efforts in Southeast Minnesota

The Minnesota Department of Agriculture (MDA) has taken significant actions to address concerns about nitrate in groundwater and drinking water. This is a challenging issue. The current elevated levels of nitrate in groundwater in some parts of Minnesota are the result of nitrate leaching losses over many decades, and it will take a substantial and concerted effort over many years to significantly improve groundwater quality. Groundwater in Southeast Minnesota is vulnerable to nitrate contamination due to its karst geology.

The MDA is executing a science-based, long-term strategy to address local groundwater problems by working directly with farmers, the agricultural community, and local partners to adopt practices that reduce nitrate leaching. **The MDA's strategy consists of the following five main activities in Southeast Minnesota:**

#### **Water Quality Monitoring**

- **Southeast Minnesota Volunteer Nitrate Monitoring Network**, a partnership between the MDA and local Soil and Water Conservation Districts (SWCDs), has been testing private wells annually for nitrate in Southeast Minnesota since 2008. The drinking water maximum contaminant level for nitrate-N is 10 mg/L. Trends for 2008-2024 at 523 private wells in Southeast Minnesota include:
  - 438 wells (84%) had no statistically significant trend (not increasing or decreasing), including 64 with nitrate-N above 10 mg/L.
  - 27 wells (5%) had a decreasing trend, including 12 with nitrate-N above 10 mg/L.
  - 58 wells (11%) had an increasing trend, including 16 with nitrate-N above 10 mg/L.
- **Nested well monitoring in the Galena and Prairie du Chien Aquifers** have been installed through an MDA–Department of Natural Resources partnership and are now collecting real-time groundwater levels and nitrate concentration data in high-risk townships. Sampling beginning in 2026 will provide long-term trend data on nitrate, pesticides, and chloride to support farmers and local water-quality partners.
- **Monitoring Technology Evaluation** current efforts also include evaluating and demonstrating new nitrate sensor technologies beneath the corn root zone, generating data that can gauge best management practice (BMP) effectiveness and support real-time, on-farm nitrogen management decisions.
- **The MDA is working directly with the Minnesota Department of Health and the Olmsted SWCD to provide reverse osmosis (RO) or other home water treatment systems to private wells in the region.** As of March 2026, 256 RO systems have been installed, and 118 households received a one-year maintenance visit and follow-up water sample.
  - To date, no post-treatment nitrate sample has exceeded 10 mg/L. The median concentration is 1.5 mg/L nitrate-N.

- Post-treatment water samples for pesticides (cyanazine+atrazine) have all shown 100% removal.
- There is not a confirmed number of wells that require treatment for nitrate. There are about 36,000 private wells in Southeast Minnesota; based on previous data, up to 12% may exceed the standard. Therefore, up to 4,500 private wells may be eligible for treatment. If every private well in the eight-county area is tested, the MDA could then anticipate that up to 1,125 homeowners would be interested in a treatment system based on a 25% return rate.

## Research and Demonstrations

- **MDA staff were lead authors on an innovative and important paper related to groundwater age.** This is resulting in additional monitoring work and development of decision support tools.
  - Kuehner, K. J., Runkel, A. C., & Barry, J. D. (2025). Informing nitrate concentration trends: estimating groundwater residence time in a karstic, multiaquifer system using anthropogenic tracers (Minnesota, USA). *Hydrogeology Journal*, 33(1), 167-192.
- **Long-term University of Minnesota (UMN) nitrogen rate and timing research** continues to provide localized, science-based guidance that improves fertilizer recommendations and reduces nitrate loss. In 2026, additional studies expanded to examine the nitrogen contained in fall- and spring-applied phosphorus fertilizers (i.e. MAP, DAP).
- **The MDA and UMN are evaluating the effectiveness of new, real-time manure-sensing technologies** designed to reduce both over- and under-application of nitrogen from manure. These tools have the potential to improve nutrient management accuracy, protect water quality, and support better on-farm decision making.
- The **Goodhue Paired Cover Crop Demonstration** is measuring long-term effects of cover crops on nitrate loss and soil health under real-world farming conditions, providing valuable data for fields draining to sensitive trout streams. This is one of two continuous cover crop monitoring sites.

## Implementation

- **Groundwater Protection Rule initiatives with Altura and Elgin (mitigation Level 2) Drinking Water Supply Management Areas (DWSMAs).** Farmers in the area participate in the Nutrient Management Initiative and have adopted other practices such as cover crops. More than half of the 1,200-plus acres in the Altura DWSMA are now growing cover crops
- **The MDA is prioritizing work in townships with high nitrate levels in private wells,** conducting on-farm visits to assess current practices and identify improvement opportunities under the Nitrogen Fertilizer Management Plan. In Preble Township (Fillmore County), conservation practice inventories are underway, and contracted staff with the Fillmore SWCD have worked directly with 15 farmers. The MDA completed field walkovers in Spring Grove Township (Houston County) last summer, resulting in 23 potential conservation projects on 14 farms. Projects include grassed waterways, prairie strips, terraces, and feedlot projects. Over the fall/winter 2025-2026, the MDA focused on livestock operations of Caledonia, Mayville, and Wilmington townships (Houston County), resulting in 22 potential feedlot projects on 20 farms. Projects include roof structures, solids settling areas with grassed buffers, and manure storage.
- **The Minnesota Ag Water Quality Certification Program (MAWQCP)** is producing measurable results across Minnesota. As of March, 1,810 producers have certified more than 1.27 million acres. These acres: Keep an estimated 59,900 tons of sediment out of Minnesota waters each year; retain more than 166,600 tons of soil per year; prevent more than 1.2 million pounds of nitrogen from entering state waters every year; and prevent more than 77,000 pounds of phosphorus from entering lakes

and streams per year. Program guidance has led to the implementation of more than 8,100 conservation improvements.

- **The Environmental and Economic Clusters of Opportunity (EECO) Program** is being implemented in nine counties in Southeast Minnesota to support the early commercial success and environmental benefits of continuous living cover crops and cropping system being developed by the UMN Forever Green Initiative. Since 2021, 1,035 acres have been enrolled in the program.
- **Nitrogen management and efficiency programs**, including the Biofertilizer Innovation and Efficiency Program, Soil Health Equipment Grant Program, and the Fertilizer Inhibitor Program, are benefiting Minnesota's water and natural resources by keeping nitrogen where farmers need it—on their fields.

### Tools and technology

- The MDA is developing three decision-support tools to help farmers and homeowners:
  - Find My Aquifer app for private well owners
  - Smartphone-based Cover Crop Performance tool
  - Nitrogen Rate Planner application to simplify BMP-aligned fertilizer decisions

### Farmer and Stakeholder Engagement

- MDA staff, including the MAWQCP, are working directly with crop retailers to expand technical assistance and help more farmers adopt nitrogen BMPs and achieve Ag Water Quality Certification.
- The MDA has convened two local advisory teams in high-nitrate DWSMAs and is working with farmer groups in five high-nitrate townships.
- The MDA has seven Joint Powers Agreements with SWCDs in Southeast Minnesota, including support for a position dedicated to outreach to livestock operators and adoption of manure management BMPs.
- The MDA provided financial support for the UMN Extension's first Grain Gathering meeting to discuss how high-quality oats fit in with Southeast Minnesota crop rotations. Additional support for oat growers includes on-farm trials. The MDA is requesting funding from the Clean Water Fund to provide more technical and agronomic support.

Overall, MDA's work in Southeast Minnesota continues to advance both immediate public-health protections and long-term water-quality improvements.



The Clean Water Land and Legacy Amendment (Clean Water Fund) has provided funding allowing the MDA to accelerate work and implement a strategy to address nitrate in vulnerable areas of the state.