

Sundsruds Court DWSMA Groundwater Protection Rule Summary

Groundwater, Nitrogen Fertilizer Management, and Nitrogen Loading Analysis

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Introduction

This document summarizes the Minnesota Department of Agriculture's (MDA) current understanding of the Sundsruds Court Drinking Water Supply Management Area (DWSMA), public well nitrate-nitrogen levels, and nitrogen management information. Also included is a summary of the MDA's analysis of nitrogen loss below cropland within this DWSMA. This summary provides the detail the MDA considered to determine whether the proposed list of nitrogen fertilizer best management practices (BMPs) and Alternative Management Tools (AMTs) will be protective of groundwater.

DWSMA and Public Well Nitrate-Nitrogen Data

The DWSMA boundary defined by the Minnesota Department of Health (MDH) for the Sundsruds Court public wells includes 310 acres. The MDH defines the groundwater below this DWSMA as highly vulnerable (Figure 1). Of the 310 acres in the DWSMA, 260 acres meet the definition of cropland in the Groundwater Protection Rule (GPR). The GPR applies to the 260 acres of cropland within this DWSMA.



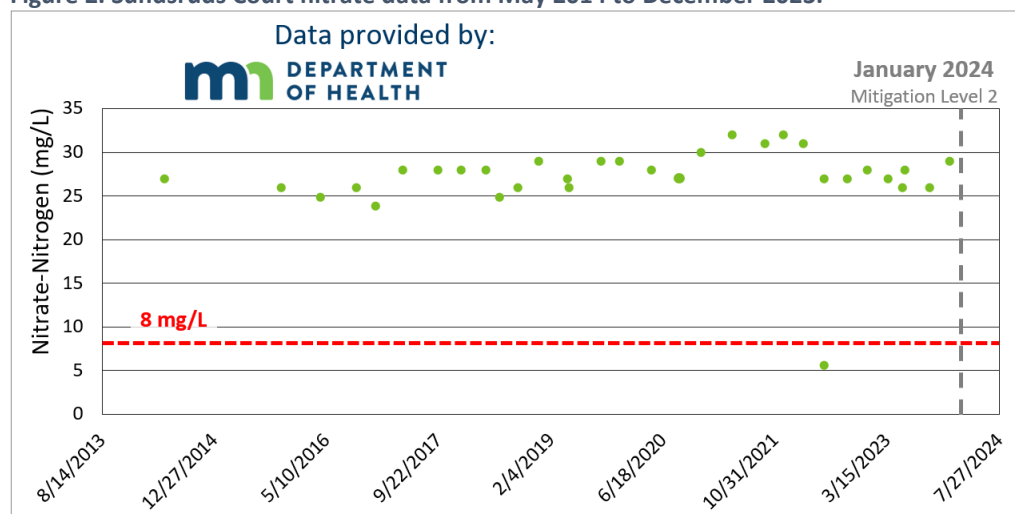
Figure 1. Sundsruds Court DWSMA Vulnerability Designated by the MDH.

The MDA relies on the water quality data provided by the MDH to evaluate nitrate-nitrogen levels in the public water supply. Nitrate-nitrogen levels have exceeded 8 mg/L in Sundsruds Court's public well within the past ten years (Figure 2). See Table 1 for specific well information.

Table 1. Sundsruds Court public well information.

Local Well ID	MDH Status	Casing Diameter (in)	Well Depth (ft)	Date Constructed
Well #1	Primary	4	60	Unknown

Figure 2. Sundsruds Court nitrate data from May 2014 to December 2023.



DWSMA Land Use and Potential Nitrate-Nitrogen Point Source Consideration

The MDA conducted a detailed review of potential contaminant sources to determine whether a point source of nitrogen could be the cause of the public well exceeding the criteria for mitigation level designation (Minnesota Statute 1573.0040, Subp. 3, C). In the Sundsruds Court DWSMA, the MDA review did not identify a point source for nitrate-nitrogen. With nitrate levels exceeding 8.0 mg/L within the past ten years and without a point source contribution, this DWSMA was designated at Mitigation Level 2 under Part 2 of the Groundwater Protection Rule in January 2024 (Minnesota Statute 1573.0040, Subp. 7, C, 2).

Part 2 of the Groundwater Protection Rule responds to DWSMAs which have elevated nitrate. For DWSMAs, like Sundsruds Court designated at Level 2, the MDA works with a local advisory team (LAT) including local farmers, agronomists, and others to get input on BMPs and AMTs that can reduce nitrate levels in groundwater.

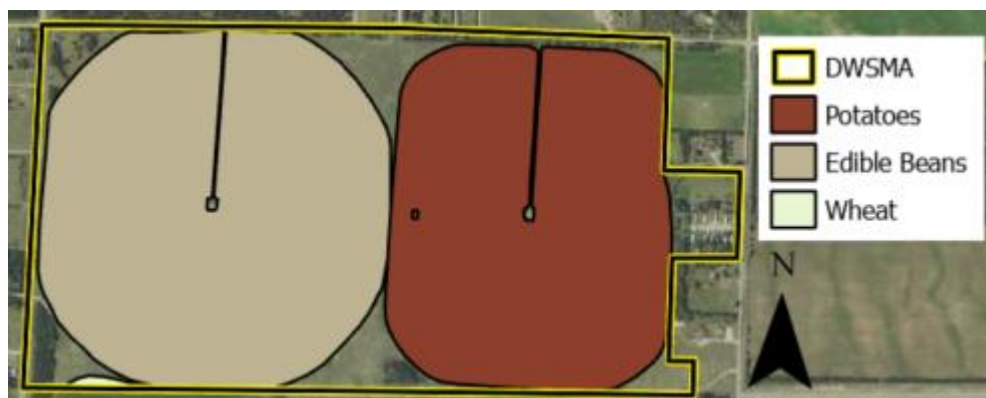


Figure 3. 2023 Cropland within the Sundsruds Court DWSMA based on the USDA Cropland Data Layer

The Groundwater Protection Rule defines cropland as land used primarily for the production or harvest of annual or perennial field, forage, food, fiber, or energy crops including pasture but excluding forestland. The evaluation of BMP adoption, to determine if a mitigation level change is needed, excludes soybean acres (Minnesota Statute 1573.0040, Subp. 7, A).

A review of the publicly available [USDA Cropland Data Layer](https://nass.usda.gov/Research_and_Science/Cropland/Release/index.php) (hosted on Crop Scape, nass.usda.gov/Research_and_Science/Cropland/Release/index.php) in the Sundsruds Court DWSMA shows that the land use here is predominately cropland. Data illustrated in Figure 3 is from the Feb 2024 data release.

The MDA has also surveyed agronomists and farmers to understand the nitrogen fertilizer management practices used in the Sundsruds Court area. The MDA was able to obtain farming information for all of the cropland acres across the DWSMA. Having current and accurate nitrogen fertilizer management data is critical to the discussion of BMPs and AMTs. With computer modeling tools, the MDA compares nitrogen leaching loss below current nitrogen fertilizer management and under management changes proposed to protect groundwater. The farming practice information collected includes crop planting, harvest, tillage, and nitrogen fertilizer use data.

Table 2. Sundsruds Court DWSMA Cropland Cover

Year	Edible Bean Acres	Edible Bean % of Cropland	Corn Acres	Corn % of Cropland	Potato Acres	Potato % of Cropland	Wheat Acres	Wheat % of Cropland
2014	260	100.0%						
2015			1	0.4%	142	54.6%	117	45.0%
2016	1	0.4%	142	54.6%	117	45.0%		
2017	142	54.6%	117	45.0%			1	0.4%
2018	117	45.0%			1	0.4%	142	54.6%
2019			118	45.4%	142	54.6%		
2020	118	45.4%	142	54.6%				
2021	142	54.6%	118	45.4%				
2022	118	45.4%	142	54.6%				
2023	142	54.6%			117	45.0%	1	0.4%

Due to the small number of operators farming within this DWSMA, the farming practice information the MDA collected is not included in this document. Minnesota’s statute on Agricultural Data (Minnesota Statute 13.643 Subd. 7) protects the identities and location of producers who are cooperating with the MDA in an assessment of farm practices. If farm practice information could identify an individual, it is considered private information and cannot be shared by the MDA.

Within the Sundsruds Court DWSMA all nitrogen sources are accounted for, and nitrogen fertilizer applications are split throughout the growing season. The timing, placement, and product BMPs recommended by the University of Minnesota for the cropping rotation and soil types present within this DWSMA are currently being used. A reduction in nitrogen fertilizer rates applied to some crops in the rotation is the primary BMP change that could reduce nitrogen leaching below the crop rootzone. Hydrologic and geologic conditions in this area make groundwater vulnerable.

Table 3. 2023 Sundsruds Court DWSMA cropland.

Crop Type	Acres	% of Cropland (260 acres total)
Edible Beans	142	54.6%
Potatoes	117	45.0%
Wheat	1	0.4%

In 2023 edible beans, potatoes, and wheat accounted for 54.6, 45.0 and 0.4% of cropland respectively (Table 3). The MDA has reviewed the USDA Cropland Data Layer over the past 10 years in the DWSMA (Table 2). During that time, edible beans, corn, potatoes, and wheat have occupied the cropland within the Sundsruds Court DWSMA.

DWSMA Nitrate-Nitrogen Loss Below Cropland

Using a crop and soil computer simulation model called the Decision Support System Agrotechnology Transfer (DSSAT) (www.dssat.net), the University of Minnesota worked with the MDA to estimate the nitrogen loss below the root zone in the Sundsruds Court DWSMA comparing the nitrogen management practices used in the recent past with the nitrogen loss below alternative practices within this DWSMA. The table below shows the crop rotations modeled within the Sundsruds Court DWSMA (Table 4). Computer modeling estimates a 5.9% reduction in annual nitrogen loss with corn nitrogen rates applied at the high end of the 0.10 price ratio for irrigated corn (Table 5).

Table 4. Sundsruds Court DWSMA cropland rotation that MDA modeling estimated nitrate-nitrogen loss below following current nitrogen management practices.

Crop Rotation	Acres within the DWSMA
Corn-Edible Beans-Corn-Edible Beans-Potato	260

Table 5. Sundsruds Court DWSMA modeled nitrate-nitrogen loss reductions below listed nitrogen fertilizer BMPs.

Nitrogen Fertilizer Best Management Practice	Acres Within the DWSMA	Nitrogen Loss Reduction
Apply nitrogen at or below the high end of the 0.10 price ratio range for irrigated corn (Currently 195 lb. N/ac for C-SB, 205 lb. N/ac for C-EB, 225 lb. N/ac for C-C)	260	5.9%

In addition to modeling the benefit of BMPs, the MDA used modeling to estimate the nitrogen loss reductions below additional practices that go above and beyond BMPs to further reduce nitrogen loss below the root zone. These additional practices have been voluntarily adopted by producers within the DWSMA to protect the Sundsruds Court community drinking water supply. The model estimates that nitrogen leaching below the cropland rootzone is reduced by 13.9% with this additional practice implemented (Table 6).

Table 6. MDA modeled nitrogen loss reductions below additional practices adopted in the Sundsruds Court DWSMA.

Additional Practices	Acres Within the DWSMA	Nitrogen Loss Reduction
New crop variety with lower nitrogen demand	260	13.9%

MDA Recommended Nitrogen Fertilizer Best Management Practices for the Sundsruds Court DWSMA

In consultation with the local advisory team that includes farmers and agronomists managing cropland within the DWSMA, the MDA has developed the following list of BMPs to protect groundwater. A more detailed list of these BMPs is available on the MDA's [Sundsruds Court DWSMA webpage](http://www.mda.state.mn.us/sundsrudscourtmdhp-dwsma) (www.mda.state.mn.us/sundsrudscourtmdhp-dwsma).

- Apply nitrogen to irrigated corn at or below the high end of the 0.10 price ratio range in the University of Minnesota's nitrogen fertilizer application guidelines.
- Account for all nitrogen sources when calculating nitrogen rate.
- Take appropriate credits for previous legume crops and manure used in the crop rotation.
- Split applications of nitrogen fertilizer.
- Use a nitrogen rate for potatoes based on variety, harvest date, and realistic yield goals.
- For all other crops grown within the DWSMA, follow the current University of Minnesota guidance applicable to that crop.
- Limit the rate of starter nitrogen applied to potatoes.
- Plant a fall cover following potatoes whenever possible.

The MDA will conduct an evaluation in this Level 2 DWSMA to determine whether these nitrogen fertilizer BMPs have been implemented on 80% of the cropland, excluding soybeans. The evaluation will occur no sooner than three growing seasons after the BMP list is published.

Conclusion

In the Sundsruds Court DWSMA the MDA has reviewed the cropping history, surveyed nitrogen management practices, modeled nitrogen loading estimates below previous nitrogen fertilizer management practices and below BMPs and additional practices adopted to protect the community drinking water supply.

The current University of Minnesota nitrogen fertilizer BMPs are being followed during most years in the crop rotation. All nitrogen sources are considered, and nitrogen applications are split during the growing season. Additional crediting of nitrogen following previous legume crops and changes to nitrogen rate are University of Minnesota BMPs that can further reduce nitrogen leaching.

With nitrogen rates applied to irrigated corn at or below the high end of the 0.10 price ratio range in the University of Minnesota's nitrogen fertilizer application guidelines combined with the primary crop changes made within the DWSMA, modeling estimates a 19.8% reduction in nitrate leaching below cropland.

If cropland management changes occur within the DWSMA, additional review of the appropriate nitrogen fertilizer BMPs for this DWSMA may be needed and a new list of nitrogen fertilizer BMPs approved. Examples that could cause such a change include, but are not limited to, changes in the cropping rotation, changes to the MDH groundwater vulnerability designations, and changes to the MDH approved DWSMA boundary.

Based on the understanding and information provided above, the MDA believes that the recommended nitrogen management BMPs within the Sundsruds Court DWSMA are appropriate and that the continued use of these practices along with the primary crop changes made over the long-term will reduce nitrate-nitrogen loss below cropland. Promotion and outreach to support the continued implementation of these practices within the Sundsruds Court DWSMA will be a priority.

Supplemental Data

The following table is supplemental information for the “Sundsruds Court DWSMA Groundwater Protection Rule Summary”. The data included below is presented as a graph (Figure 2) in the summary document.

Table 7. Nitrate-nitrogen levels within the Sundsruds Court public wells that exceeded 8 mg/L within the past ten years.

Well Number	Collection Date	Nitrogen Test Levels in mg/L
1	5/19/2014	27.0
1	10/19/2015	26.0
1	4/13/2016	25.0
1	9/20/2016	26.0
1	12/15/2016	24.0
1	4/17/2017	28.0
1	9/18/2017	28.0
1	12/29/2017	28.0
1	4/24/2018	28.0
1	6/20/2018	25.0
1	9/10/2018	26.0
1	12/11/2018	29.0
1	4/19/2019	27.0
1	4/30/2019	26.0
1	9/17/2019	29.0
1	12/9/2019	29.0
1	4/28/2020	28.0
1	9/1/2020	27.0
1	12/7/2020	30.0
1	4/22/2021	32.0
1	9/15/2021	31.0
1	12/7/2021	32.0
1	3/8/2022	31.0
1	6/7/2022	27.0
1	9/19/2022	27.0
1	12/16/2022	28.0
1	3/20/2023	27.0
1	5/22/2023	26.0
1	6/5/2023	28.0
1	9/21/2023	26.0
1	12/20/2023	29.0