

Oak Grove Mobile Home Park 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 Oak Grove Mobile Home Park 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 Oak Grove Mobile Home Park public wells includes 134 acres. The MDH defines the groundwater below this DWSMA as highly vulnerable (Figure 1). Of the 134 acres in the DWSMA, 81 acres meet the definition of cropland in the Groundwater Protection Rule (GPR). The GPR applies to the 81 acres of cropland within this DWSMA.

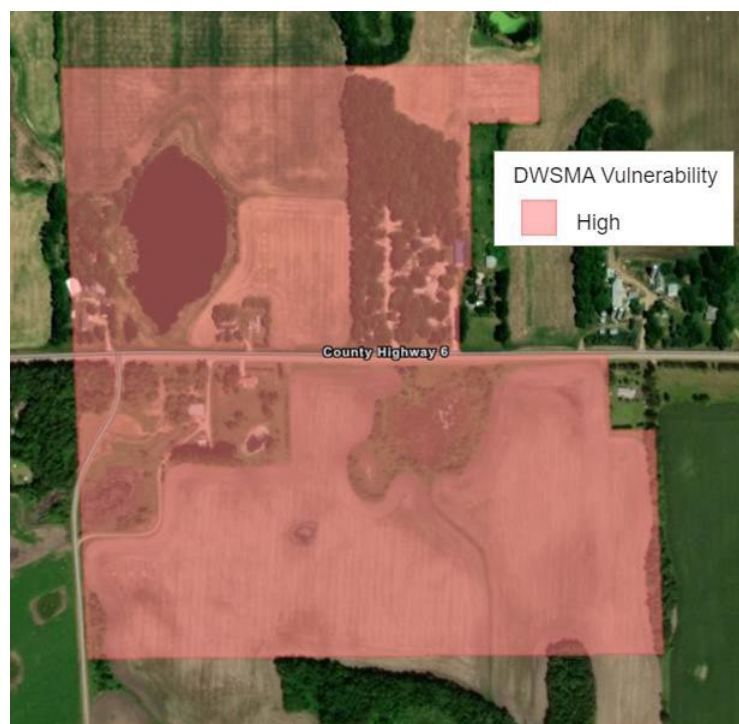


Figure 1. Oak Grove Mobile Home Park DWSMA Vulnerability Designated by the MDH.

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 the two Oak Grove Mobile Home Park public wells within the past ten years (Figure 2). See Table 1 for specific well information.

Table 1. Oak Grove Mobile Home Park public well information.

Local Well ID	MDH Status	Casing Diameter (in)	Well Depth (ft)	Date Constructed
Well #1	Primary	4	65	1972
Well #2	Primary	4	63	1970

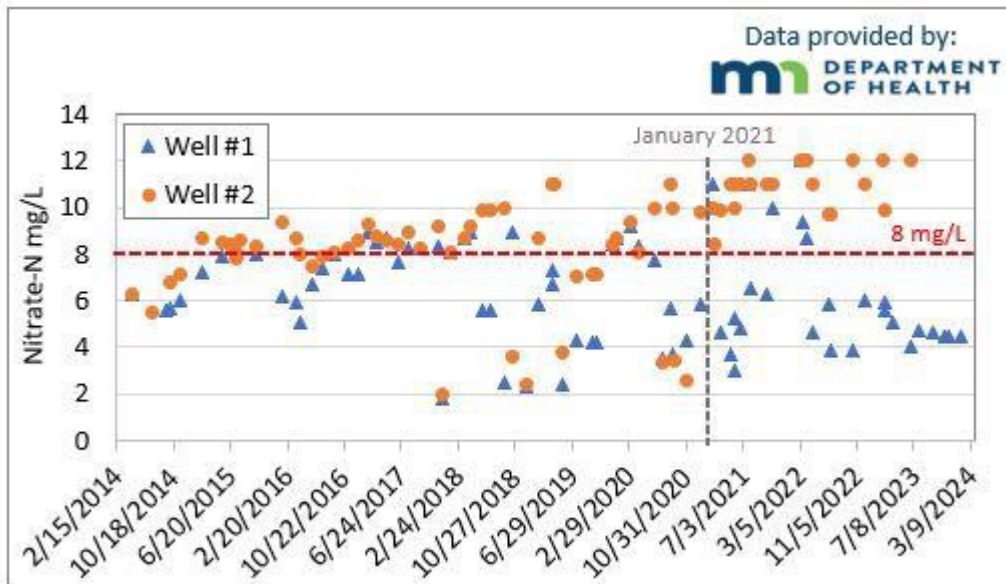


Figure 2. Oak Grove Mobile Home Park nitrate data from April 2014 to January 2024.

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 Oak Grove Mobile Home Park 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 2020 (Minnesota Statute 1573.0040, Subp. 7, C, 2).

Part 2 of the Groundwater Protection Rule responds to DWSMAs which have elevated nitrate. The goal is to take action to reduce nitrate in groundwater before a public well exceeds the health standard for nitrate, 10 mg/L. For DWSMAs, like Oak Grove Mobile Home Park 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.

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 Oak Grove Mobile Home Park DWSMA shows that the land use here is predominately cropland. Data illustrated in Figure 3 is from the Feb 2022 data release.

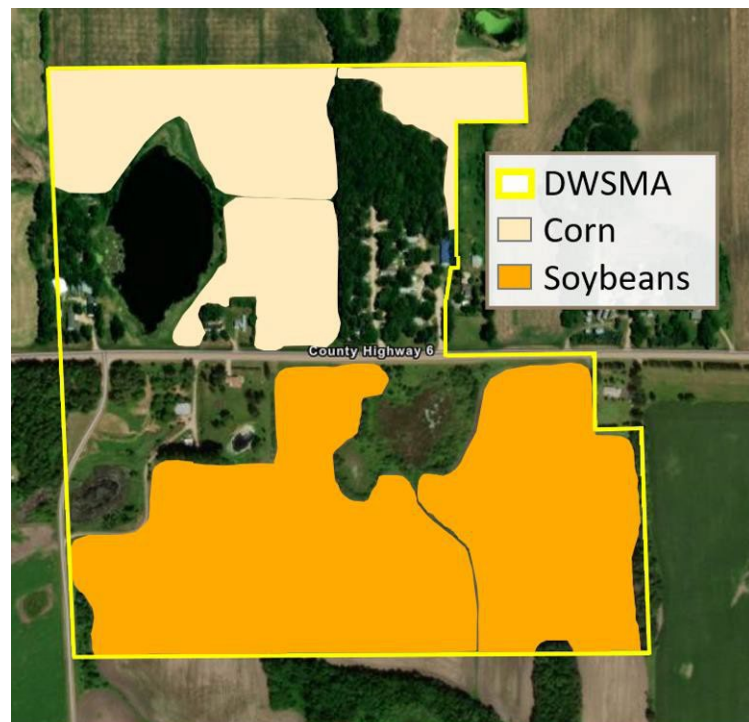


Figure 3. 2022 Cropland within the Oak Grove Mobile Home Park DWSMA based on the USDA Cropland Data Layer

The MDA has also surveyed agronomists and farmers to understand the nitrogen fertilizer management practices used in the Oak Grove Mobile Home Park area. The MDA was able to obtain farming information for most 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.

Due to the small number of operators farming within this DWSMA, the farming practice information the MDA collected is not included in this document. The state 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.

Farmers are doing a good job managing nitrogen fertilizer within the Oak Grove Mobile Home Park DWSMA. All nitrogen sources are accounted for, and nitrogen credits from previous legume crops and manure are taken. 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 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 2. 2022 Oak Grove Mobile Home Park DWSMA cropland cover

Crop Type	Acres	% of Cropland (81 acres total)
Corn	26	32%
Soybean	55	68%

Table 3. Oak Grove Mobile Home Park DWSMA cropland history excluding soybeans.

Year	Corn Acres	Corn % of Cropland	Other Acres	Other % of Cropland
2013	69	100%	-	-
2014	0	0%	-	-
2015	55	100%	-	-
2016	27	100%	-	-
2017	55	100%	-	-
2018	27	100%	-	-
2019	0	0%	55	100%
2020	14	52%	13	48%
2021	69	100%	-	-
2022	26	100%	-	-

In 2022 corn and soybeans accounted for 32 and 68% of cropland respectively (Table 2). With few exceptions, corn and soybeans have occupied the cropland within the Oak Grove Mobile Home Park DWSMA in the last 10 years. The MDA has reviewed the USDA Cropland Data Layer over the past 10 years in the DWSMA. During that time, all fields have been in corn and soybeans except for 55 acres that could not be planted in 2019 and 13 acres of spring wheat in 2020 (Table 3).

DWSMA Nitrate-Nitrogen Loss Below Cropland

Using a crop and soil computer simulation model called the [Environmental Policy Integrated Climate model \(EPIC\)](https://epicapex.tamu.edu/epic/) (<https://epicapex.tamu.edu/epic/>), the MDA has estimated the nitrogen loss below the root zone in the Oak Grove Mobile Home Park DWSMA comparing the nitrogen management practices used in the recent past with the nitrogen loss below alternative nitrogen management practices within this DWSMA. The table below shows the modeled nitrogen loss below current nitrogen management practices. The model estimates an area weighted average of 8.4 lbs. N/acre are lost below the rootzone of all cropland within the DWSMA (Table 4).

Table 4. Oak Grove Mobile Home Park DWSMA nitrate-nitrogen loss estimates below cropland. Modeled nitrogen loss below cropland following current nitrogen management practices.

Crop Rotation	2022 Acres within the DWSMA	Fraction of the DWSMA Cropland	Nitrogen Leaching Range (lbs. N/ac)	Area Weighted Average Nitrogen Leaching (lbs. N/ac)
Corn-Soybean	81	100%	5.3 – 32.0	8.4

Setting the total nitrogen rate at the high end of the 0.10 price ratio on corn would require a small management change on a portion of cropland acres. Model output estimates this rate change would result in a 17% reduction in

nitrogen loss on an annual basis (Table 5). To consider additional opportunities the MDA modeled Alternative Management Tools (AMTs) that go above and beyond BMPs to further reduce nitrogen loss below the root zone (Table 6). If these AMTs were adopted, the model estimates that nitrogen leaching below the cropland rootzone could be reduced by the percentages shown in the table. These are voluntary practices. Working with local farmers this list will be promoted widely and funding will be identified to support adoption of these practices.

Table 5. Oak Grove Mobile Home Park DWSMA modeled nitrate-nitrogen loss below nitrogen best management practices (BMPs). The nitrogen loss reductions are based on the adoption of the listed BMP where nitrogen rates on corn currently exceed the listed rates.

Nitrogen Best Management Practice	Acres Within the DWSMA	Nitrogen Loss Reduction	Notes
Apply nitrogen at or below the high end of the 0.10 price ratio for corn crops (currently 190 for C-C and 150 for C-SB)	81	17%	A reduction in nitrate leaching can be realized if all corn acres in the DWMSA receive nitrogen at current rates or reduce rates to the high end of the 0.10 price ratio

Table 6. Oak Grove Mobile Home Park DWSMA modeled nitrate-nitrogen loss below Alternative Management Tools considered by the Oak Grove Mobile Home Park LAT.

Alternative Management Tools	Acres Within the DWSMA	Nitrogen Loss Reduction	Notes
CRP in place of C-SB	8	10%	8 acres of new CRP planted in place of existing C-SB acres
Grass hay in place of C-SB	8	10%	8 acres of grass hay in place of existing C-SB acres
Cover crop after SB on 37 acres of C-SB rotation	37	10%	The cropland acres with cover crop would vary depending on the soybean acreage planted each year. Currently there are no cover crops grown within the DWSMA.

MDA Recommended Nitrogen Fertilizer Best Management Practices for the Oak Grove Mobile Home Park 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 [Oak Grove Mobile Home Park DWSMA](http://www.mda.state.mn.us/oakgrovemhp-dwsma) webpage (www.mda.state.mn.us/oakgrovemhp-dwsma).

- Apply nitrogen to dryland corn in a corn-corn rotation at or below the high end of the 0.10 nitrogen rate range in the University of Minnesota's nitrogen fertilizer application guidelines.
- Apply nitrogen to dryland corn in a corn-soybean rotation at or below the high end of the 0.10 nitrogen rate 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.
- For all other crops grown within the DWSMA, follow the current University of Minnesota guidance applicable to that crop.

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 Oak Grove Mobile Home Park DWSMA the MDA has reviewed the cropping history, surveyed nitrogen management practices, modeled nitrogen loading estimates below existing nitrogen fertilizer management practices and alternative practices.

The current University of Minnesota nitrogen fertilizer BMPs are already being followed on most cropland acres within the DWSMA. All nitrogen sources are considered, and nitrogen credits from legumes and manure are counted. Nitrogen rate is the only remaining University of Minnesota BMP that could further reduce nitrogen leaching.

If all nitrogen rates applied to corn were at or below the high end of the 0.10 nitrogen rate range in the University of Minnesota's nitrogen fertilizer application guidelines modeling indicates at least a 17% reduction in nitrate leaching below cropland in the DWSMA.

Modeling of nitrogen loss below Alternative Management Tools within this DWSMA illustrate options for cropland that can further reduce nitrogen loss. Specific cropland acres have not been identified for the establishment of these Alternative Management Tools, but the LAT acknowledges the additional groundwater protection that AMTs could provide if adopted. The next steps within this DWSMA are to review these practices with individual landowners and explore possible funding opportunities to establish these practices.

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 practices within the Oak Grove Mobile Home Park DWSMA are appropriate and that the continued use of these practices over the long-term will prevent nitrate-nitrogen loss below cropland from increasing. Additionally, modeling of nitrogen loss indicates that further reductions are possible with the establishment of Alternative Management Tools. Promotion and funding to support the establishment of these practices within the Oak Grove Mobile Home Park DWSMA will be a priority.

Supplemental Data

The following table is supplemental information for the “Oak Grove Mobile Home Park 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 Oak Grove Mobile Home Park public wells that exceeded 8 mg/L within the past ten years.

Well Number	Collection Date	Nitrogen Test Levels in mg/L
1	4/22/2014	6.3
1	9/18/2014	5.6
1	9/30/2014	5.7
1	11/19/2014	6
1	2/18/2015	7.2
1	5/17/2015	7.9
1	7/14/2015	8.1
1	10/6/2015	8
1	2/1/2016	6.2
1	3/27/2016	5.9
1	4/12/2016	5.1
1	6/7/2016	6.7
1	7/17/2016	7.4
1	9/13/2016	8
1	11/7/2016	7.1
1	12/20/2016	7.1
1	2/3/2017	8.9
1	3/5/2017	8.5
1	4/19/2017	8.7
1	6/14/2017	7.6
1	7/24/2017	8.2
1	9/18/2017	8.2
1	11/27/2017	8.3
1	12/16/2017	1.8
1	1/22/2018	8.1
1	3/19/2018	8.7
1	4/18/2018	8.9
1	6/12/2018	5.6
1	7/17/2018	5.6
1	9/10/2018	2.5
1	10/16/2018	8.9
1	12/11/2018	2.3
1	2/4/2019	5.8
1	4/6/2019	6.7

Well Number	Collection Date	Nitrogen Test Levels in mg/L
1	4/6/2019	7.3
1	5/23/2019	2.4
1	7/21/2019	4.3
1	9/24/2019	4.2
1	10/9/2019	4.2
1	12/16/2019	8.4
1	1/7/2020	8.7
1	3/4/2020	9.2
1	4/14/2020	8.3
1	6/15/2020	7.7
1	7/20/2020	3.5
1	8/22/2020	5.7
1	9/1/2020	3.7
1	11/3/2020	4.3
1	12/29/2020	5.8
1	2/21/2021	11
1	3/3/2021	10
1	3/29/2021	4.6
1	5/10/2021	3.7
1	5/26/2021	5.2
1	6/1/2021	3
1	6/19/2021	4.8
1	7/25/2021	11
1	8/4/2021	6.5
1	10/11/2021	6.3
1	11/7/2021	10
1	3/6/2022	12
1	3/20/2022	9.4
1	4/4/2022	8.7
1	5/2/2022	4.6
1	7/5/2022	5.8
1	7/19/2022	3.9
1	10/19/2022	3.9
1	12/8/2022	6
1	3/9/2023	5.6
1	3/9/2023	5.9
1	4/11/2023	5.1

Well Number	Collection Date	Nitrogen Test Levels in mg/L
1	6/26/2023	4
1	8/1/2023	4.7
1	9/26/2023	4.6
1	11/15/2023	4.5
1	11/20/2023	4.5
1	12/2/2023	4.5
1	1/30/2024	4.5
2	4/22/2014	6.3
2	7/15/2014	5.5
2	9/30/2014	6.8
2	11/19/2014	7.1
2	2/18/2015	8.7
2	5/17/2015	8.5
2	6/18/2015	8.4
2	7/14/2015	7.8
2	7/14/2015	8.1
2	8/4/2015	8.6
2	10/6/2015	8.3
2	2/1/2016	9.4
2	3/27/2016	8.7
2	4/12/2016	8
2	6/7/2016	7.5
2	7/17/2016	7.9
2	9/13/2016	8.1
2	11/7/2016	8.2
2	12/20/2016	8.6
2	2/3/2017	9.3
2	3/5/2017	8.8
2	4/19/2017	8.6
2	6/14/2017	8.4
2	7/24/2017	8.9
2	9/18/2017	8.2
2	11/27/2017	9.2
2	12/16/2017	2
2	1/22/2018	8.1
2	3/19/2018	8.7
2	4/18/2018	9.2
2	6/12/2018	9.9
2	7/17/2018	9.9
2	9/10/2018	10
2	10/16/2018	3.6
2	12/11/2018	2.4

Well Number	Collection Date	Nitrogen Test Levels in mg/L
2	2/4/2019	8.7
2	4/6/2019	11
2	4/6/2019	11
2	4/18/2019	11
2	5/23/2019	3.8
2	7/21/2019	7
2	9/24/2019	7.1
2	10/9/2019	7.1
2	12/16/2019	8.4
2	1/7/2020	8.7
2	3/4/2020	9.4
2	4/14/2020	8.1
2	6/15/2020	10
2	7/20/2020	3.3
2	8/22/2020	11
2	9/1/2020	10
2	9/9/2020	3.4
2	11/3/2020	2.6
2	12/29/2020	9.8
2	2/21/2021	10
2	3/3/2021	8.4
2	3/29/2021	9.9
2	5/10/2021	11
2	5/26/2021	10
2	6/1/2021	11
2	6/19/2021	11
2	7/25/2021	12
2	8/4/2021	11
2	10/11/2021	11
2	11/7/2021	11
2	3/6/2022	12
2	3/20/2022	12
2	4/4/2022	12
2	5/2/2022	11
2	7/5/2022	9.7
2	7/19/2022	9.7
2	10/19/2022	12
2	12/8/2022	11
2	2/27/2023	12
2	3/9/2023	9.9
2	6/26/2023	12

Addendum: Updated Corn Nitrogen Fertilizer Rate Guidance

Added 5/15/25

This addendum explains changes to University of Minnesota nitrogen fertilizer rates for corn. Other text in the document has not been edited and reflects the University of Minnesota guidance available at the time this summary was published in October 2024.

In April 2025 the University of Minnesota (UMN) nitrogen rate recommendations for dryland corn were updated. The updated UMN corn nitrogen rate guidance is based on the latest research available in Minnesota. To align with the current guidance, the corn nitrogen rates included in the BMP list published for this DWSMA were updated. The tables below are adapted from the UMN rate guidance released in April 2025 and reflect the new rate guidance to which the BMPs published in this DWSMA will refer.

Guidelines for use of nitrogen fertilizer for corn grown following soybeans when supplemental irrigation is not used.

N Price/Crop Value Ratio	Maximum Return to Nitrogen	Acceptable Range
0.075	155	145-170
0.100	150	135-160
0.125	140	130-155
0.150	135	125-145

Guidelines for use of nitrogen fertilizer for corn grown following corn when supplemental irrigation is not used.

N Price/Crop Value Ratio	Maximum Return to Nitrogen	Acceptable Range
0.075	200	180-220
0.100	185	170-200
0.125	175	160-190
0.150	165	150-175

Adoption of the BMPs can be evaluated no sooner than three growing seasons after the DWSMA BMP list is published. For the Oak Grove Mobile Home Park DWSMA the evaluation could occur as soon as 2027. Following that evaluation, the BMP list for the Oak Grove Mobile Home Park DWSMA may be adjusted considering water quality information, input from the LAT and any new Nitrogen Fertilizer BMP updates from the University of Minnesota.