Cold Spring Drinking Water Supply Management Area Groundwater Protection Rule Summary

DEPARTMENT OF AGRICULTURE

DWSMA

Groundwater, Nitrogen Fertilizer Management, and Nitrogen Loading Analysis

August 2026

Introduction

This document summarizes the Minnesota Department of Agriculture's (MDA) current understanding of the Cold Spring's 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 outlines the information 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 City of Cold Spring's public wells includes 890 acres. The MDH defines the groundwater below this DWSMA as high vulnerability (Figure 1). Of the 890 acres in the DWSMA, 588 acres the definition of cropland in the Groundwater Protection Rule (GPR). The GPR applies to the 588 acres of cropland within this DWSMA.

The MDA relies on water-quality data provided by the MDH to evaluate nitrate-nitrogen levels in the public water supply. Nitrate-nitrogen levels exceeded 8 mg/L in two of the Cold Spring public wells within the past 10 years (Figure 2). Cold Spring public well information is shown in Table 1.

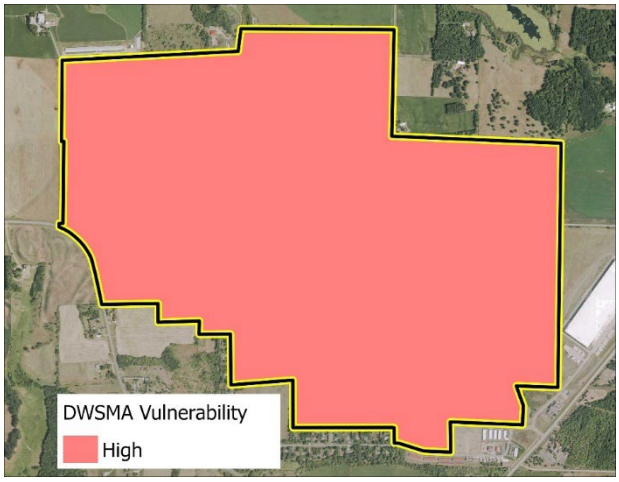

Figure 1. Cold Spring DWSMA Vulnerability Designated by the MDH

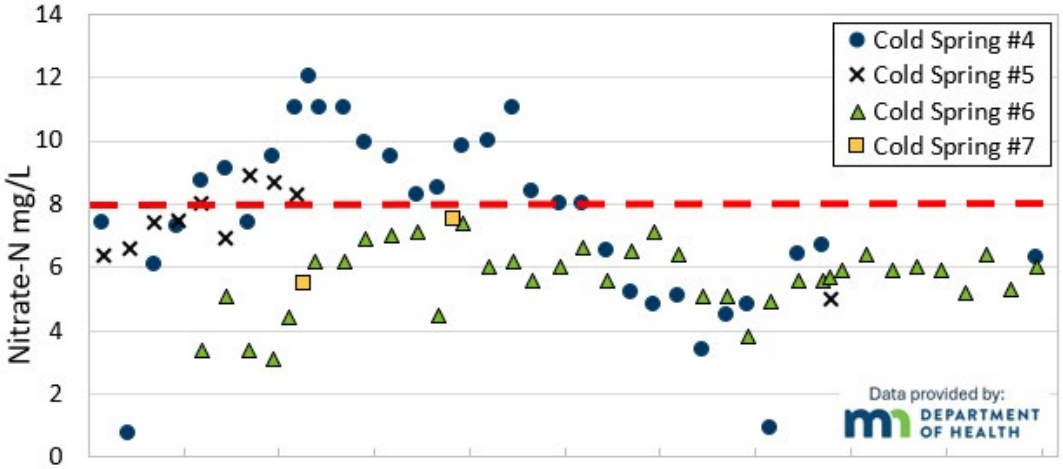

Figure 2. Cold Spring public well nitrate data through December 2025. See the supplemental data at the end of this summary for a table of the individual well nitrate data listed in this graph.

Table 1. City of Cold Spring public well information.

Local Well ID	MDH Status	Casing Diameter (in)	Casing Depth (ft)	Well Depth (ft)	Date Constructed
Well #4	Primary	14	80	98	1998
Well #5	Primary	14	74	101	1999
Well #6	Primary	16	77	101	2002
Well #7	Primary	12	85	110	2018

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 public wells exceeding the criteria for mitigation-level designation (Minnesota Statute 1573.0040, Subp. 3, C). In the Cold Spring DWSMA, the MDA review did not identify a point source for nitrate-nitrogen. With nitrate levels exceeding 8.0 mg/L within the past 10 years and without a point source contribution, this DWSMA was designated 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 GPR responds to DWSMAs with 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 Cold Spring designated at Level 2, the MDA works with a local advisory team (LAT), which includes local farmers, agronomists, and others to get input on agricultural practices that can reduce nitrate levels in groundwater.

The GPR 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** (hosted on Crop Scape, nass.usda.gov/Research_and_Science/Cropland/Release/index.php) in the Cold Spring DWSMA shows that 66% of landcover is cropland (Figure 3). In addition to a review of cropping history, the MDA also surveyed agronomists and farmers to understand the nitrogen fertilizer management practices used in the Cold Spring 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 protective agricultural management practices (i.e. BMPs and AMTs) appropriate for this DWSMA. Computer modeling tools allow the MDA to estimate nitrogen leaching under current fertilizer management and to assess how proposed management changes could reduce those losses. The farming practice information collected includes crop planting, harvest, tillage, and nitrogen fertilizer use data. Farmers within this DWSMA use both commercial nitrogen and manure to fertilize corn. Table 2 shows the cropland rotations present within the DWSMA.

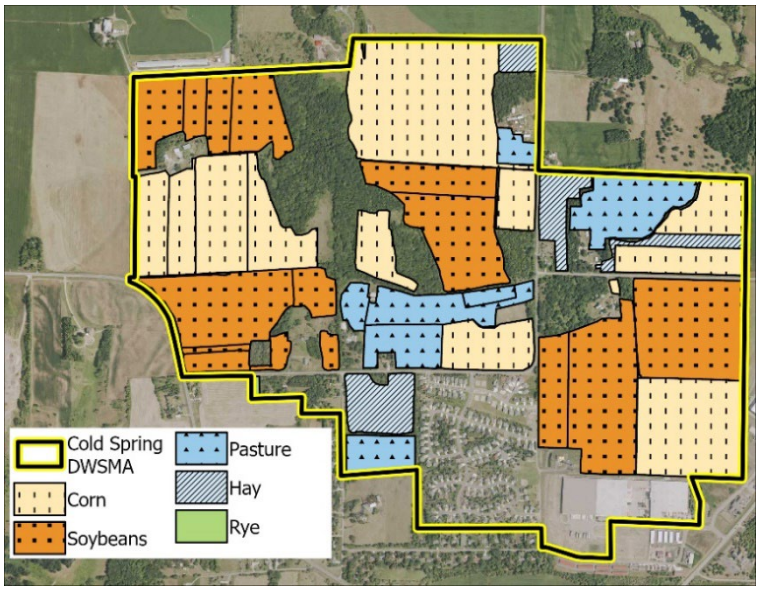

Figure 3. 2025 cropland cover in the Cold Spring DWSMA based on the USDA Cropland Data Layer. See Table 3 for specific 2025 cropland cover information

Table 2. Cold Spring DWSMA Cropland Rotations

Crop Rotation (2016-2025)	Acres	% Cropland (588 acres)
Corn-Soybeans	295	50%
Corn-Corn-Soybeans	155	26%
Pasture	74	13%
Hay	37	6%
Corn-Small Grains	28	5%

Table 3. 2025 Cold Spring DWSMA Cropland Cover

Crop Type	Acres	% of Cropland (588 acres)
Corn	242	41%
Soybean	235	40%
Pasture	74	13%
Hay	37	6%
Rye	1	0%

Due to the small number of cropland operators within this DWSMA, more detailed farming practice information cannot be 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.

Based on detailed nitrogen fertilizer use information the MDA collected within the DWSMA, nitrogen rates are within University of Minnesota guidelines, nitrogen applications are split, all nitrogen sources are accounted for, and nitrogen credits from previous legume crops and manure are taken. The BMPs recommended by the University of Minnesota for the cropping rotations and soil types present within this DWSMA are currently being used.

Within the Cold Spring DWSMA crops grown in 2025 included corn, soybeans, rye, pasture, and hay (Table 3). The MDA also reviewed the USDA Cropland Data Layer over the past 10 years in Cold Spring's DWSMA. During this time, corn and soybeans were the primary crops grown. Pasture and hay made up 16-19% of cropland over the past 10 years (Table 4).

Table 4. Cold Spring DWSMA cropland crop history 2016-2025.

Year	Corn Acres	Corn % of Cropland	Soybean Acres	Soybean % of Cropland	Hay/ Pasture Acres	Hay/ Pasture % of Cropland	Small Grains Acres	Small Grains % of Cropland	Peas Acres	Peas % of Cropland	Alfalfa Acres	Alfalfa % of Cropland
2016	366	62%	97	17%	91	15%	8	1%		0%	27	5%
2017	282	48%	122	21%	91	15%	1	0%	72	12%	21	4%
2018	340	58%	100	17%	91	15%	1	0%		0%	57	10%
2019	334	57%	102	17%	91	15%	1	0%		0%	44	8%
2020	353	60%	77	13%	91	15%	15	3%		0%	53	9%
2021	172	29%	169	29%	91	15%	1	0%	106	18%	51	9%
2022	342	58%	94	16%	91	15%	28	5%		0%	34	6%
2023	271	46%	206	35%	91	15%	1	0%		0%	20	3%
2024	308	52%	142	24%	95	16%	28	5%		0%	15	3%
2025	242	41%	235	40%	111	19%	1	0%		0%		0%

DWSMA Nitrate-Nitrogen Loss Below Cropland

Using a crop and soil computer simulation called the **Environmental Policy Integrated Climate (EPIC) model** (epicapex.tamu.edu/epic/), the MDA estimated nitrogen loss below the root zone in the Cold Spring DWSMA, comparing nitrogen management practices used in the recent past with the nitrogen loss below alternative practices. Table 5 shows the crop rotations modeled within the Cold Spring DWSMA.

Table 5. Cold Spring DWSMA cropland rotations that MDA modeling estimated nitrate-nitrogen loss below following current nitrogen management practices.

Crop Rotation	Acres
Corn-Soybean (dryland)	166
Corn-Corn-Soybean (irrigated)	155
Corn-Soybean (irrigated)	129
Pasture	74
Hay	37
Corn-Small Grains (dryland)	28
Small Grains	1

Because producers in the DWSMA are using all BMPs suited to local crops and soils, the MDA turned to modeling AMTs (Table 6) to explore practices that could provide additional reductions in nitrogen loss below the root zone. If AMTs were adopted, modeling shows potential reductions in nitrogen leaching below the root zone, as shown in Table 6. Working with local farmers, the MDA will promote this list and, when possible, identify funding to support adoption of these practices. Table 7 illustrates additional practices voluntarily adopted in the DWSMA to protect the Cold Spring drinking water supply. The model estimates that nitrogen leaching below the cropland rootzone is reduced by 7% with this additional practice implementation.

Table 6. Cold Spring DWSMA modeled nitrogen loss below AMTs considered by the Cold Spring LAT.

Management Change	Additional Acres within DWSMA	Nitrogen Loss Reduction	Notes
Cover crop after Sb on dryland acres in a C-Sb rotation	166	1%	This would cover all dryland corn-soybean acres within the DWSMA.
Cover crop after SB on irrigated acres in a C-Sb and C-C-Sb rotation	284	2%	This would cover all irrigated corn-soybean and corn-corn-soybean acres within the DWSMA.
Convert C-Sb (dryland) rotation to corn-alfalfa	234	22%	Convert all 234 acres of dryland corn-soybean to a corn-corn-alfalfa rotation (C-C-A-A-A).

Table 7. Cold Spring DWSMA modeled nitrogen loss below additional practices adopted in the Cold Spring DWSMA.

Management Change	Additional Acres within DWSMA	Nitrogen Loss Reduction	Notes
Convert corn-corn rotation to corn-soybean	110	7%	This crop rotation change affected 22% of the row crop acres within the DWSMA.

MDA Recommended Nitrogen Fertilizer Best Management Practices for the Cold Spring DWSMA

In consultation with the local advisory team that includes farmers and agronomists managing cropland within the DWSMA, the MDA developed the following list of BMPs to protect groundwater. View a more detailed list of these BMPs at **Cold Spring DWSMA** (mda.state.mn.us/coldspring-dwsma).

- Apply nitrogen to dryland corn in a corn-corn rotation at or below the 0.15 Maximum Return to Nitrogen (MRTN) in the University of Minnesota's nitrogen fertilizer application guidelines.
- Apply nitrogen to dryland corn in a corn-soybean rotation at or below the 0.15 MRTN in the University of Minnesota's nitrogen fertilizer application guidelines.
- Apply nitrogen to irrigated corn in a corn-soybean rotation at or below the 0.10 MRTN in the University of Minnesota's nitrogen fertilizer application guidelines.
- Apply nitrogen to irrigated corn in a corn-corn rotation at or below the 0.10 MRTN in the University of Minnesota's nitrogen fertilizer application guidelines.
- For all other crops grown within the DWSMA nitrogen rates must follow the current University of Minnesota guidance applicable to that crop.
- 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 on coarse-textured soils.
- On coarse-textured soils use nitrogen stabilizer on labeled crops when applying at early sidedress.

The MDA will conduct an evaluation in this Level 2 DWSMA to determine whether these nitrogen fertilizer BMPs were 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 Cold Spring DWSMA, the MDA reviewed the cropping history, surveyed nitrogen management practices, and modeled nitrogen loading estimates below existing nitrogen fertilizer management practices and alternative practices.

Based on our farmer and fertilizer dealer survey, the current University of Minnesota nitrogen fertilizer BMPs are being followed on all cropland acres within the DWSMA. University of Minnesota nitrogen rate guidance is being followed for all crops, corn nitrogen rates are below the 0.15 MRTN for dryland corn and 0.10 MRTN for irrigated corn, all nitrogen sources are considered, nitrogen applications to corn are split, and nitrogen credits from legumes and manure are counted.

Modeling of nitrogen loss below additional practices and AMTs within the DWSMA offer options that can further reduce nitrogen loss below the crop root zone. These options were developed in consultation with the LAT. A total of 110 acres of corn-corn were converted to a corn-soybean rotation, resulting in an estimated 7% reduction in nitrogen loss. Specific acres have not been identified for other additional practices, but the LAT acknowledges the groundwater protection these practices could provide if adopted. The next steps in this DWSMA are to review these practices with individual landowners and explore funding opportunities to support their adoption.

Based on the information above, the MDA believes the recommended nitrogen management practices for the Cold Spring DWSMA are appropriate, and that continued use of these practices—along with the adoption of AMTs and additional practices—will reduce nitratenitrogen loss below cropland over the long term. Promotion and funding to support the establishment of alternative practices within the Cold Spring DWSMA will be a priority.

Supplemental Data

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

Well Number	Collection Date	Nitrogen Test Levels in mg/L
4	2016-03-01	7.4
4	2016-06-09	0.72
4	2016-09-13	6.1
4	2016-12-14	7.3
4	2017-03-14	8.7
4	2017-06-13	9.1
4	2017-09-13	7.4
4	2017-12-13	9.5
4	2018-03-12	11
4	2018-04-30	12
4	2018-06-13	11
4	2018-09-11	11
4	2018-12-03	9.9
4	2019-03-13	9.5
4	2019-06-19	8.3
4	2019-09-09	8.5
4	2019-12-11	9.8
4	2020-03-16	10
4	2020-06-16	11
4	2020-09-02	8.4
4	2020-12-14	8
4	2021-03-10	8
4	2021-06-14	6.5
4	2021-09-15	5.2
4	2021-12-13	4.8
4	2022-03-14	5.1
4	2022-06-14	3.4
4	2022-09-19	4.5
4	2022-12-06	4.8
4	2023-03-02	0.9
4	2023-06-14	6.4
4	2023-09-19	6.7
4	2025-12-15	6.3
5	2016-03-01	6.4

Well Number	Collection Date	Nitrogen Test Levels in mg/L
5	2016-06-09	6.6
5	2016-09-13	7.4
5	2016-12-14	7.5
5	2017-03-14	8
5	2017-06-13	6.9
5	2017-09-13	8.9
5	2017-12-13	8.7
5	2018-03-12	8.3
5	2023-10-17	5
6	2017-03-14	3.4
6	2017-06-13	5.1
6	2017-09-13	3.4
6	2017-12-13	3.1
6	2018-02-13	4.4
6	2018-05-24	6.2
6	2018-09-11	6.2
6	2018-12-03	6.9
6	2019-03-13	7
6	2019-06-19	7.1
6	2019-09-09	4.5
6	2019-12-11	7.4
6	2020-03-16	6
6	2020-06-16	6.2
6	2020-09-02	5.6
6	2020-12-14	6
6	2021-03-10	6.6
6	2021-06-14	5.6
6	2021-09-15	6.5
6	2021-12-13	7.1
6	2022-03-14	6.4
6	2022-06-14	5.1
6	2022-09-19	5.1
6	2022-12-06	3.8
6	2023-03-02	4.9

Well Number	Collection Date	Nitrogen Test Levels in mg/L
6	2023-06-14	5.6
6	2023-09-19	5.6
6	2023-10-17	5.7
6	2023-12-04	5.9
6	2024-03-06	6.4
6	2024-06-11	5.9
6	2024-09-10	6
6	2024-12-17	5.9
6	2025-03-18	5.2
6	2025-06-03	6.4
6	2025-09-08	5.3
6	2025-12-15	6
7	2018-04-09	5.48
7	2019-11-04	7.5
6	2025-09-08	5.3
6	2025-12-15	6
7	2018-04-09	5.48
7	2019-11-04	7.5
6	2025-09-08	5.3
6	2025-12-15	6
7	2018-04-09	5.48
7	2019-11-04	7.5
6	2025-09-08	5.3
6	2025-12-15	6
7	2018-04-09	5.48
7	2019-11-04	7.5
6	2025-09-08	5.3
6	2025-12-15	6
7	2018-04-09	5.48
7	2019-11-04	7.5