significant staff time and resources to implement. It is necessary and reasonable to focus the limited staff time and resources on the highest priority DWSMA areas. Through implementation of the proposed Rule in the DWSMAs, the MDA will build the Rule infrastructure and will learn important lessons, such as what land use practices worked, what elements contribute to a successful Local Advisory Team, and if there are parts of the Rule that are more or less difficult to enforce. These learnings can then be applied to a broader geographic area in the future, if circumstances warrant.

The MDA will implement the voluntary parts of the 2015 NFMP in townships up to level 2, including forming LATs and conducting groundwater monitoring. Based on the above, it is reasonable for the MDA to focus its regulatory efforts on DWSMAs and continue with the voluntary approach for townships that was outlined in the NFMP, based on available resources.

MDH's authority governing public water suppliers?
The state's Safe Drinking Water Act (SDWA) was adopted by the legislature in 1977 (Minn. Stat. §§ 144.381-144.387). It authorizes the MDH commissioner to promulgate rules which are no less stringent than federal regulations governing public water supplies (Minn. Stat. § 144.383(e)). This authority was granted by the legislature to allow the state, under the federal Safe Drinking Water Act of 1974 (Public Law 93-523 and amendments thereto), to assume primacy for enforcement of the USEPA safe drinking water regulations.

MDH collects data on public water supply wells which includes nitrate-nitrogen analysis. At a minimum, PWSs are required to submit annual samples. If the wells have exceeded 5.4 mg/L nitrate-nitrogen in the past, then quarterly testing is required in order to more closely monitor, evaluate and identify ways to reduce nitrate-nitrogen concentrations in their water supply.

For purposes of the proposed Rule, the MDA will use the nitrate-nitrogen data collected by the MDH in order to evaluate public water supply wells and their surrounding DWMSAs for mitigation levels. These monitoring results are an 'official record' of groundwater conditions that supply the public well. PWS monitoring has been conducted for many years and hence a relationship between communities and MDH is well established. Using this data for purposes of determining mitigation levels is reasonable because the public water supply monitoring program is firmly established and the additional testing requirement at 5.4 mg/L nitrate-nitrogen is an already established 'action level.' In addition, the value of 5.4 mg/L is used in Part 1 for DWSMAs, therefore it is reasonable to be consistent between both parts of the proposed Rule.

Subp. 2. DWSMA mitigation levels. – Evaluation of nitrate-nitrogen concentrations in groundwater

Nitrate-nitrogen concentration data from public wells
Minn. Stat. § 103H.251, subd. 1(a) directs the commissioner to evaluate the detection of pollutants from agricultural chemicals and practices in groundwater of the state. The statute does

not provide details on how this is done, therefore giving the MDA the discretion on how to conduct the evaluation of pollutants. For purposes of public water protection, it is needed for the proposed Rule to use public water supply wells to initially determine the nitrate-nitrogen concentrations in groundwater. This is reasonable because the MDH has conducted annual monitoring in these PWSs over the history of the wells; therefore, in many cases, there is reliable past data available on nitrate-nitrogen concentrations. Subsequent monitoring may continue to use the public well(s) monitoring data or a groundwater monitoring network may be established within the DWSMA for mitigation levels 2, 3 and 4. This approach will yield reliable, accurate results while allowing the MDA flexibility to monitor based on local conditions and allocate its resources appropriately.

Where did the mitigation level criteria come from?
The mitigation part of the NFMP and the proposed Rule is based broadly on a multi-level approach currently in use in the State of Nebraska (Central Platte NRD, 2016). The approach was modified in consideration of the requirements in the Groundwater Protection Act, conditions and data that are Minnesota-specific, and the existing MDH program. The NFMP advisory committee was presented with Nebraska's nitrate groundwater protection activities (including an in-person presentation from University of Nebraska staff) at advisory team meetings in 2011 and 2012. The advisory committee recommended that the MDA develop a phased approach which includes both groundwater monitoring and nitrogen fertilizer BMP adoption criteria, and voluntary and regulatory phases (now called levels). See also MDA, 2014.

There are four levels, two are voluntary and two are regulatory. Each mitigation level in the proposed Rule is designed to initiate actions commensurate with the level of contamination in the source water, or threatening the source water, in the public water supply well. DWSMAs that fall under Part 2 of the proposed Rule will be monitored and will move up or down according to changes in water quality or increases in residual soil nitrate below the root zone which can leach into the groundwater. Factors used for moving within levels include: past nitrate concentrations, the length of time of past public well monitoring, projecting future nitrate concentrations, residual soil nitrate below the root zone, and the adoption of nitrogen fertilizer BMPs. (These are discussed in greater detail below). A DWSMA will always start in a voluntary level and will only progress to a regulatory level if the voluntary approach is unsuccessful either because the nitrogen fertilizer BMPs are not being adopted or groundwater monitoring or soil sampling data indicates that nitrate levels are increasing. DWSMAs may only move up one mitigation level at a time. For example, a DWSMA will never go from mitigation level 1 to mitigation level 3 in a single cycle. (see also Subp. 10)

Initial designation of mitigation levels 1 and 2
The initial designation of mitigation levels 1 and 2 is necessary and reasonable for several reasons. The NFMP, published draft rule and proposed Rule follow the overall intent of and are necessary under the Groundwater Protection Act (Minn. Stat. chap. 103H). Prevention and

implementation must be conducted within a voluntary framework until there is adequate information to provide feedback that the voluntary efforts are not effective in addressing nitrate concerns. The evaluation of monitoring results of the public water supply wells will be used by the MDA to initially designate an area as mitigation level 1 or 2. Mitigation levels 1 and 2 are voluntary levels with no immediate regulatory components. These voluntary levels are meant to encourage farmers to adopt nitrogen fertilizer BMPs and other nitrogen management practices and make changes on their own, without regulation. The MDA will always start the process at either a mitigation level 1 or 2 based on monitoring results. This approach was supported by the NFMP advisory committee, comments received during the NFMP public comment period, request for comments on the proposed rule and the summer 2017 comment period for the draft rule as well. Farmers are always given the chance to voluntarily comply with the nitrogen fertilizer BMPs and other practices (as recommended by the LAT). If they choose not to voluntarily adopt nitrogen fertilizer BMPs for level 2 sites, the MDA will proceed to a regulatory level. For these reasons, the initial designation is reasonable.

The approach is designed to prevent and minimize nitrate-nitrogen concentrations in groundwater to the extent practicable and to prevent pollution from exceeding the health risk limits as directed in Minn. Stat. § 103H.275, subd. 1(c) by working with local farmers and their agronomists to evaluate, promote, and adopt practices that are able to reduce nitrate-nitrogen concentrations in groundwater. The approach starts in a voluntary step because, based on the NFMP advisory committee discussions, the approach likely will be more effective if it is voluntary. This will be done through the formation of a local advisory team (LAT). It was noted that if local farmers and their agronomists are actively consulted and become committed partners in trying to address local nitrate concerns, they will have a much greater potential for solving the problem than any other group. Most farmers live in or near the communities that are experiencing nitrate problems and are concerned about protecting water quality. They control the land and have the ability to manage and change the use of the land in a manner that will be far more effective and efficient in reducing nitrate leaching than is the likely outcome of a purely regulatory approach. The goal of the plan and proposed Rule is, in part, to create a formal approach and structure to facilitate that engagement process. However, the proposed Rule and the specific actions outlined in the proposed Rule are necessary in the event that the voluntary approach is not successful and to outline a clear set of expectations regarding what performance-based outcomes are required before a regulatory action is justified and necessary.

The mitigation process in the proposed Rule has been designed to increase the level of response activity as the water quality gets worse in a manner commensurate with the nitrate pollution as directed in Minn. Stat. § 103H.275, subd. 1(b). It is also designed to be integrated in a practical manner with existing MDH source water protection strategies and regulations. The use of monitoring data, regulatory boundaries, and action level criteria all are based to a large extent on the existing MDH source water protection program. It is necessary for the MDA to determine regulatory boundaries and action levels in order to create an effective proposed Rule. It is

reasonable for the MDA to align our regulatory process and guidance with the existing program requirements in order to prevent the inefficient duplication of efforts and in order to take advantage of the extensive amount of effort which has already been dedicated to protecting public water supplies.

Subp. 3. Criteria for initial mitigation level designation

The initial level designation will be based on the nitrate-nitrogen concentration from public water supply wells. The initial level designations are designed to prioritize DWSMAs based on the risk to human health from elevated nitrate. The MDA will continue to work on education and implementation activities in mitigation level 1 DWSMAs and will continue to evaluate nitrate-nitrogen concentrations from the public water supply wells but will not establish monitoring networks in mitigation level 1 DWSMAs. Mitigation level 2 DWSMAs are areas where nitrate-nitrogen concentrations are at or exceed 8.0 mg/L or have been at or exceeded that concentration at any point during the previous 10 years, or are projected to exceed the 10 mg/L MDH HRL within the next ten years. Farmers and their agricultural advisors are provided the opportunity to engage in local work groups to decide and implement local solutions before regulations are necessary. This is a reasonable approach, using objective data and making progressive decisions based on that data.

Subp. 3. Criteria for initial mitigation level designation. A. (1) – Mitigation Level 1

For a mitigation level 1 designation, a threshold concentration of 5.4 mg/L nitrate-nitrogen was selected because it is the concentration under which the MDH, as the lead state agency implementing the federal Safe Water Drinking Act, (Minn. Stat. § 144.381-144.387) requires more frequent monitoring of a well because of the potential for increased health risk due to elevated nitrate-nitrogen concentrations.

Mitigation level 1 is voluntary. However, a mitigation level 1 designation provides notice to the local agricultural community and others within a DWSMA that the source water to the well and groundwater within the DWSMA have significantly elevated concentrations of nitrate-nitrogen and require immediate increased attention and care to nitrogen management practices. This is reasonable because it uses an existing and established guideline for action. For mitigation level 1 DWSMAs the MDA will seek to work with the local agricultural community to increase protective actions, including nitrogen fertilizer BMP adoption, and promotion and funding for implementation of AMTs, within the DWSMA.

Mitigation level 1 DWSMAs will continue to be monitored through the MDH’s programs. If nitrate-nitrogen concentrations increase and meet the requirements for a mitigation level 2, the MDA will reevaluate and re-designate the mitigation level of the DWSMA.

Subp. 3. Criteria for initial mitigation level designation. A. (2). – Mitigation Level 2

A DWSMA will initially be placed in mitigation level 2 if the source water has met or exceeded a concentration of 8.0 mg/L nitrate-nitrogen at any time during the previous 10 years or if the projected trend of the source water nitrate-nitrogen concentrations will exceed 10 mg/L within 10 years. These criteria are necessary because some clear benchmarks are needed to determine when the nitrate concentrations are increasing such that increased actions are required commensurate with the nitrate contamination and to prevent the water quality from exceeding the MDH HRL as directed in the Groundwater Protection Act. They are reasonable because they are appropriate indicators that there is an increasing risk that the source water for the public water supply well may exceed the MDH HRL. They were selected specifically to provide for increased response actions before the source water for a well exceeds the MDH HRL.

The concentration of nitrate in groundwater can vary significantly in a well based on a number of factors. For shallow wells or wells constructed in areas with karst geology, the nitrate concentrations in groundwater can vary rapidly over short periods of time due to rapid travel times through the aquifer (Runkel et al, 2014, Steenberg et al, 2014). For deeper wells or wells in slightly less vulnerable aquifers concentrations tend to change at slower rates. Nitrate concentrations in groundwater can also change in response to changes in land use, for example, a significant increase or decrease in the number of acres planted to a high nitrogen using crop like corn, or because of adverse weather which can affect the rate of nitrate leaching. Because of the range of possible situations considering well construction, hydrogeology, land use and weather, the MDA selected indicators for a level 2 determination which are applied over a long period of time. A single detection of nitrate-nitrogen over 8 mg/L at any time over the last 10 years or a projected increase in nitrate-nitrogen concentration to over 10 mg/L over the next 10 years should provide sufficient notice that the source water is at risk and additional actions are needed to prevent the source water from exceeding the MDH HRL of 10 mg/L.

The criteria in the proposed Rule changed from the previous draft and the NFMP by reducing the benchmark from 9 mg/L nitrate-nitrogen over the previous 10 years to 8 mg/L nitrate-nitrogen over the previous 10 years. MDA concluded that this change was needed and reasonable to provide an increased margin-of-safety to take action before source water might exceed the MDH HRL. This change represents moving from an action level that was 10% below the MDH HRL to one that is 20% below the MDH HRL, for a single sampling event.

The proposed Rule requires that the projected increase in nitrate-nitrogen concentrations to greater than 10 mg/L over 10 years be based on a statistical analysis. The statistical trend analysis is reasonable because this is a standard practice already used to evaluate trends in data (generally and specifically water quality trends). Statistical analysis is a rigorous evaluation,

using scientific methodology to arrive at results that are highly reliable. The analysis of monitoring data is described in this SONAR, 1573.0040, Supb. 5. Monitoring.

Moving to mitigation level 2 will initiate several actions to address the nitrate-nitrogen concentration concern. These include, most importantly, the formation of a LAT including local farmers and their agronomists to advise on appropriate nitrogen fertilizer BMPs and AMTs to reduce nitrate levels in groundwater. These actions are described in other places in this SONAR.

Subp. 3. Criteria for initial mitigation level designation. B. – Exceptions

The proposed Rule allows the Commissioner to make exceptions for increasing the mitigation level designations for non-municipal public water supply wells. These exceptions might be for one or more of the following reasons:

1. whether there has been a significant change in the amount of land used for agricultural production within a drinking water supply management area;
2. the severity of the nitrate-nitrogen concentration found in other wells in a drinking water supply management area;
3. the population affected by the groundwater contamination of nitrate-nitrogen; and
4. other factors expected to influence nitrate-nitrogen concentration.

Non-municipal community wells serve at least 25 year-round residents or 15 service connections used by year-round residents and are privately owned. They might include nursing homes, mobile home parks, or housing developments. There are about 260 such wells in Minnesota. They typically have much lower capacity (lower pumping rate) wells compared to municipal systems. Because of the low capacity wells, the DWSMA might be very small – on the order of a few hundred acres or less. Many of these systems do not currently have DWSMAs delineated by the MDH, but MDH staff have indicated they plan to develop DWSMAs for the systems that are located in areas with vulnerable groundwater (Steve Robertson, MDH Supervisor, personal communication).

Although these systems are small in scale, they may involve a significant amount of MDA staff work to implement the proposed Rule within them. These exceptions were included in the proposed Rule to allow the MDA to prioritize work with the larger systems which are the most contaminated and serve the largest population being addressed as a higher priority than smaller systems with a smaller served population and less nitrate-nitrogen contamination. In addition, the exceptions allow the commissioner to consider changes in land use that can be especially significant for small DWSMAs. An example would be a nursing home on the edge of a town where the land in the DWSMA is being developed and converted from cropland to residential housing. The exceptions also allow the MDA to consider other factors because of the potential for unusual situations that can occur but are difficult to fully predict.

This provision in the proposed Rule is necessary because it allows the MDA to prioritize work in a practical manner if there are insufficient staff resources to address all of the community water systems with elevated concentrations of nitrate-nitrogen at one time, or if actions in the DWSMA are unlikely to improve water quality because of changes in land use or for other reasons. It is reasonable because it is anticipating situations that might realistically occur, it will ensure that staff resources are used efficiently by working on those areas that pose the greatest risk first, and because the MDA has professional staff able to exercise good judgement when allowing exceptions to the mitigation level criteria for smaller non-municipal water systems.

Subp. 3. Criteria for initial mitigation level designation. C. – Point Sources of Pollution

As stated in the SONAR for 1573.0030, Subp. 2. F., in some cases, elevated nitrate levels within DWSMAs are due to point sources of nitrogen. Examples of point sources may include but are not limited to an improperly sealed well, animal feedlot or an agricultural chemical incident. This exclusion is needed and reasonable since it is clearly inappropriate to consider any mitigation actions, especially regulations, for nitrogen fertilizer if the source of the contamination in the public well is not related to the use of nitrogen fertilizer.

Subp. 3. Criteria for initial mitigation level designations. D. - Partial Exclusions Due to Low Risk

The commissioner may exclude part of a drinking water supply management area from a level designation if the commissioner determines that the area is not contributing significantly to the contamination of the public well in the drinking water supply management area. This provision in the rule is necessary to allow the commissioner to exempt parts of a DWSMA which are not contributing significantly to the groundwater contamination in the public well from the level determination and subsequent requirements in the rule.

DWSMAs vary in size from very small, less than a hundred acres, to relatively large, on the scale of tens of thousands of acres. For most DWSMAs the soils types and vulnerability to groundwater contamination are likely to be fairly uniform across the DWSMA and this exclusion will not be needed. But for large DWSMAs it is reasonable to expect that there will be areas with significantly different soils types, land features, and groundwater vulnerability such that some parts of the DWSMA may not be contributing significantly to high nitrate-nitrogen concentrations in the public well.

This provision is necessary to ensure that the commissioner does not implement surveys, install monitoring wells, promote practices, and potentially impose regulatory requirements and related costs in areas where these activities will not significantly help reduce nitrate-nitrogen concentrations in the public well. It is reasonable because the Groundwater Protection Act directs that Water Resource Protection Requirements should be practicable and consider factors such as

economics, implementability and effectiveness, and implementing certain practices uniformly across a DWSMA including in areas where they may provide limited environmental benefits would not meet this requirement.

Subp. 4. Determination of nitrogen fertilizer best management practices and mitigation levels. A. – Determination of BMPs and LATs.

Determination of nitrogen fertilizer BMPs for each DWSMA?
The U of M nitrogen fertilizer BMPs are developed and promoted as general guidance for the majority of the soils, climate conditions and crops found in the each of the five BMP Regions. Frequently localized conditions can be considerably different requiring site specific recommendations. In many DWMSAs, the unique conditions are frequently much more conducive for nitrogen leaching. Many of the DWMSAs already identified having elevated nitrates are frequently those with significant acres comprised of coarse texture soils or thin mantles of loamy soils underlain by sands and gravels. For these reasons, the local advisory teams (LATs), in partnership with experts from the U of M and the MDA will be helpful in recommending the most appropriate practices.

A primary goal of the NFMP and the proposed rule is to create a process which encourages local farmers and their agronomists to learn about and adopt the most current and effective practices and technologies that will help reduce nitrate contamination in highly vulnerable groundwater areas. The use of LATs is intended specifically to accomplish that goal.

Local advisory team
When a DWSMA is designated as a mitigation level 2, it indicates that additional monitoring and education/promotion activities need to begin. After a DWMSA is designated in mitigation level 2 status, a very important step is the establishment of a local advisory team (LAT). The purpose of LATs will be to make recommendations to the commissioner about the appropriate nitrogen fertilizer BMPs and AMTs that should be used in the DWSMA While the formation of the LAT in a mitigation level 2 is not mandatory, it is desirable because the LAT can help develop and implement locally viable solutions to address elevated nitrate-nitrogen concentrations. The LAT will be critical to advising the MDA on designing educational aspects including field demonstrations, the Nitrogen Smart training program (U of M Extension/Minnesota Corn Growers) and other outreach approaches.

The LAT will consist of people who are from the area, including farmers, representatives of local groups/organizations, public water supply systems, and government staff and/or professionals who can provide technical or financial support. The majority of members will be local farmers

and their crop advisors/consultants. The size and composition of the team will vary depending upon the size of the area, the nature of the problem and availability of local stakeholders; however, it will likely be no more than 15 -20 people. The MDA will develop guidance that outlines the roles and responsibilities of the LAT.

Local farmers and their crop advisors/consultants are critical in helping develop and implement appropriate activities to address elevated nitrate in their groundwater because they control the land use. The mitigation strategy is constructed specifically to involve the local agricultural community in problem solving with the opportunity to avoid regulations if voluntary actions are taken.

LAT decisions will not be determined by majority vote, but rather the team will seek consensus and common ground. The team will advise the MDA in an open process. All members' comments and recommendations will be considered. The MDA will be responsible for final determinations of potential regulatory actions and will seek to provide consistency in decision making for similar situations/areas.

In addition, the MDA believes LAT members know their local area the best, and therefore are best able to determine what will work locally. The MDA acknowledges that a 'one size fits all' approach is not ideal. Instead, the LAT is a reasonable and better alternative to find local solutions to address nitrate in groundwater. During the summer 2017 comment period, there were significant comments supporting the formation and use of LAT to address local nitrate in groundwater issues.

Subp. 4. Determination of nitrogen fertilizer best management practices and mitigation levels. B. – Notice.

Legal notice of proposed and established commissioner's orders is required in Minn. Stat. § 103H.275, subd. 2. Providing legal notice is a balance between providing adequate and appropriate notice to affected parties, but not creating an undue burden (time and expense) to the regulator in providing this notice. Use of a local legal newspaper is a reasonable alternative for the larger DWMSAs. Due to the limited number of producers in many of the smaller DWMSAs, the MDA will contact the landowners, operators, and dealerships directly if they are known. If not, the MDA will publish the water resource protection requirements in two consecutive issues of the legal newspaper.

In addition, it is reasonable to provide other options to provide notices of proposed Rule actions. The agency website is a reasonable option because this is a likely location where individuals impacted by the proposed Rule will go to find more information.

Supb. 5. Monitoring. A and B – Public wells and groundwater monitoring networks

The primary monitoring point for water quality in a water supply well is the raw (untreated) water pumped from the well. This is the source of nitrate-nitrogen concentration data that will be used to evaluate if the source water has exceeded the water quality thresholds used for mitigation level determinations and for assessing if nitrate concentrations are projected to exceed 10 mg /L within a 10-year period. It is reasonable to use this data for decision making since it is the actual water being provided for use by the public water supply system and it is the point where monitoring is conducted under the direction of the MDH.

Public wells

Historical nitrate data provided by the MDH from the water supply well(s) will be evaluated to estimate future nitrate concentration in the well(s). This analysis will use the most recent 10 years of nitrate-nitrogen concentration data provided by the MDH to project future nitrate-nitrogen concentrations. Using regression techniques, the future nitrate-nitrogen concentration in the well(s) will be projected to determine if the concentration is likely to exceed the MDH HRL within ten years.

When a groundwater monitoring network is established within a DWSMA, the groundwater nitrate-nitrogen concentration data will be evaluated after a minimum of three growing seasons or the estimated lag time, whichever is longer. A statistical analysis will be performed to assess change in the nitrate-nitrogen concentration by comparing pre-and post-implementation periods for nitrogen fertilizer BMPs. Changes will be assessed using the 90^{th} percentile concentration from nitrate samples collected from the groundwater monitoring network. It is anticipated that the 90^{th} percentile concentration will generally indicate changes in the nitrate-nitrogen concentration distribution sooner. The statistical significance of change in the 90^{th} percentile concentration will be determined utilizing a 90% confidence level ($p < 0.10$).

It is necessary and reasonable to use statistical methods to evaluate changes in water quality data which sometimes includes considerable variability in the data. Statistical analysis will provide robust analysis of the groundwater nitrate-nitrogen concentration data (from public wells and the groundwater monitoring network – if applicable) to ensure confidence in the results. It is reasonable to consider and use statistical methods that have been developed for this purpose.

The MDA hired a national expert in statistical analysis of groundwater monitoring data to provide guidance on the groundwater monitoring network design and the interpretation of groundwater monitoring data. (Comments on statistics of the conceptual design, the five assumptions of network design, and the seven statistical questions in the Township Nitrate Monitoring Scope of Work, July 2017). Statistical analyses such as those suggested by Dr. Helsel provide a basis for evaluating change in nitrate-nitrogen concentration within the DWSMAs. Dr. Helsel outlines a variety of statistical analyses that can be used to evaluate

changes in concentrations over time. These methods will be evaluated to determine which would be the most appropriate for the data being assessed.

Groundwater monitoring network

The MDA may also conduct monitoring to evaluate the effectiveness of nitrate reduction practices in two other ways, through the installation of a groundwater monitoring network within the DWSMA or through monitoring of residual soil nitrate below the root zone. Both of these approaches to monitoring can be used to determine if nitrate levels are increasing or decreasing in the DWSMA.

The MDA may install a groundwater monitoring network to evaluate if the nitrate-nitrogen concentrations are increasing or decreasing across the DWSMA. This is reasonable because a DWSMA is defined as the area that contributes water to a pumping well over a period of 10 years. That means it will take 10 years for groundwater to travel from the boundary of the DWSMA to the pumping well. As such, it would take a minimum of 10 years for changes in practices across the entire DWSMA to be reflected in the water quality in the pumping well. A groundwater monitoring network can be designed and installed to evaluate changes in water quality in the upper portion of the aquifer, at multiple locations within the DWSMA. This will reduce the amount of time required to measure changes in water quality associated with practices that have been implemented at the land surface. This approach is reasonable since the network will be specifically designed to provide an accurate assessment of changes in water quality across the agricultural areas of the DWSMA and will reduce the time required to evaluate those changes. The groundwater monitoring network data will not be used to determine if source water in the DWSMA meets water quality thresholds in the public water supply well, because it is not directly representative of the water supply well. The pumping well may be screened at different depths in an aquifer or in different aquifers and nitrate-nitrogen concentrations can change with increasing depth in an aquifer. Therefore the monitoring data in the public well is not directly comparable to the water quality measured in the shallowest portion of the aquifer.

The wells in the groundwater monitoring network will be constructed to evaluate the water quality in the upper portion of the shallowest aquifer. The groundwater monitoring network will specifically target row crop agricultural areas to assess changes in water quality as a result of changes in agricultural and land management practices within the DWSMA. The groundwater monitoring network will meet the minimum requirements for statistical analysis and may include a variety of well types (monitoring wells, temporary monitoring wells, domestic wells), provided each of the wells meet the specifications and requirements for the monitoring network. The requirements could include but are not limited to: well depth, construction, age, screen length, and well access.

If a groundwater monitoring network cannot be installed, changes in water quality can still be evaluated for regulatory decision making using water samples collected at the pumping well following a period of time equal to the lag time plus the groundwater travel time within the DWSMA.

Subp. 5 Monitoring C. – Residual soil nitrate tests

Residual Soil Nitrate Tests

Researchers routinely examine residual soil nitrate levels while developing and evaluating new nitrogen fertilizer management practices. If application rates exceed crop consumption or if other management changes (such as timing or source) result in reduced fertilizer recovery, the efficiency of the imposed practices can be evaluated through examining the nitrate levels remaining in the soil profile upon crop termination. Quantifying residual soil nitrate levels is an important metric because it is this fraction of the overall nitrogen inputs that has a high probability of escaping through the soil and eventually reaching groundwater supplies. Generally, soil scientists monitor the root zone or directly below the root zone using this technique.

Besides using standard groundwater monitoring approaches, the MDA also considered employing two soil sampling procedures used in Nebraska to evaluate changes in shallow "residual" soil nitrates levels: shallow residual soil nitrate monitoring and deep residual soil nitrate monitoring. In both Nebraska techniques, the idea is to determine if the potential for nitrogen loading is changing without having to wait for the groundwater to respond. Inorganic nitrogen is analyzed by depth increments providing valuable quantitative values on the nitrogen amounts in transport to the water table. Subsequent resampling provides critical information on the rate which the nitrogen is moving and if improvements over time are being achieved. The two different Nebraska approaches are described below.

Shallow Residual Soil Nitrate Monitoring

In a number of nitrate-impacted areas of Nebraska, farmers are required to provide three-foot soil samples annually from each field which grew either corn, potatoes or sorghum. Ferguson (2015) examined forty years of soil testing (0 to 3') results from the Central Platte Natural Resource District and determined that a strong correlation existed between the residual soil nitrate levels and nitrate-nitrogen concentrations of the underlying shallow groundwater in areas of coarse-textured soils. This is important because it provides strong evidence that Nebraska's approach for addressing elevated nitrate-nitrogen concentrations in groundwater is working and the timeframe for seeing measurable improvements is better understood.

Canadian researchers have also used nationwide residual soil nitrate information from shallow sampling over time to make policy decisions related to fertilizer use efficiencies and groundwater implications (Yang et al., 2007; Drury et al., 2007).

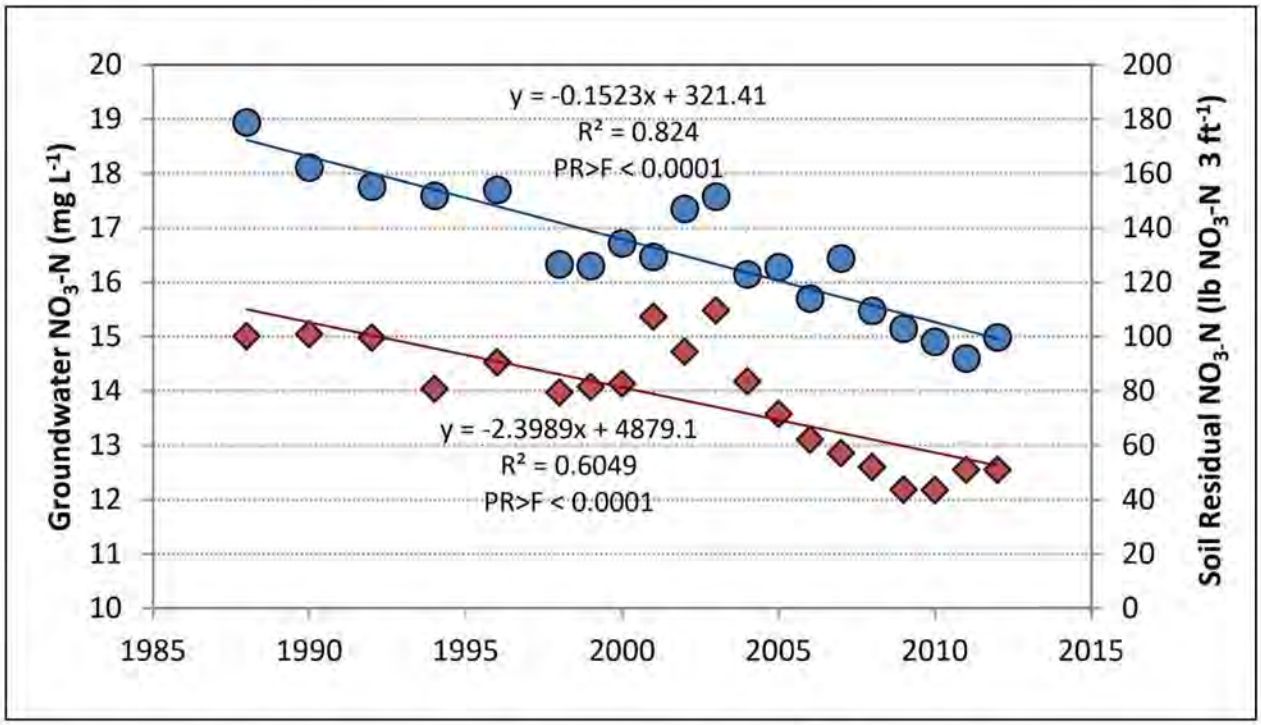

Figure VI-4. Relationship between nitrate-nitrogen in soil and shallow groundwater.

Deep Residual Soil Nitrate Monitoring

Some regions of Nebraska have very deep soils ranging from loams to clay loams. The estimated lag time (the travel time for nitrogen applied to the soil surface to the time it enters the groundwater) is frequently measured in decades. University of Nebraska scientists have experimented with the concept of using deep soil coring information (60 to 100 feet) in order to better understand the nitrogen inventory and the travel speed to groundwater. Routine groundwater monitoring in these types of environments can be greatly enhanced with the associated time lags.

Shields et al. (2017) summarized a number of previous related research projects which established a small number of study sites in the 1990s. The original researchers found that there were very high amounts of inorganic nitrogen (frequently over 1,000 lb. /acre) between the crop zone and the water table. Much of this excess nitrogen is believed to be from poor fertilizer and water management practices used in the 1970s. In the recent re-sampling, Shields determined that nitrogen was traveling at a rate of approximately 29 inches/year. **Error! Reference source**

not found. (Shields and Snow, 2017). Figure IX-5 illustrates a soil coring down to 80 feet at two different time intervals. After twenty years of nitrogen and water management outreach and regulations, this data suggests some drastic reductions in nitrate leaching losses.

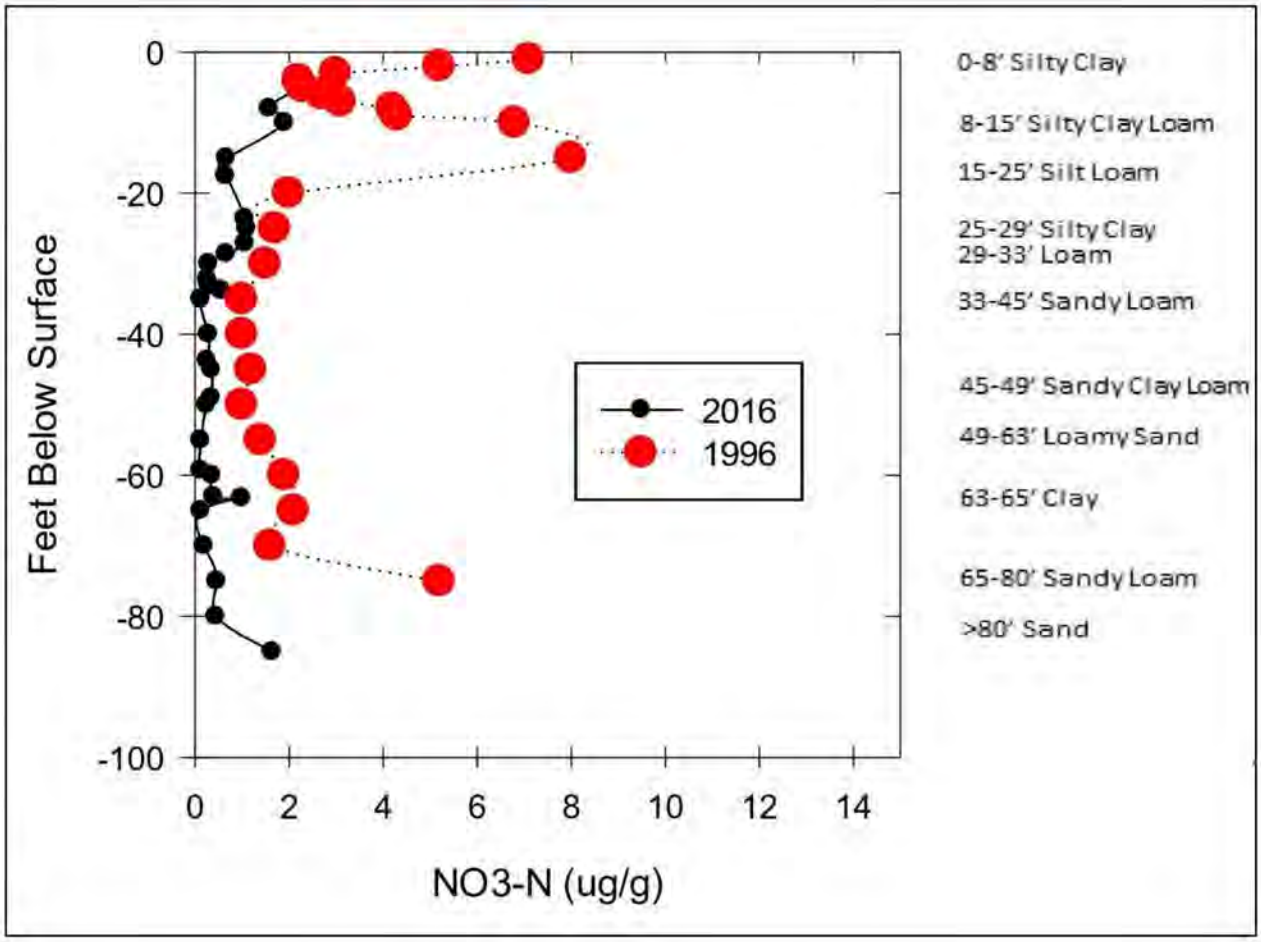

Figure VI-5. Deep soil nitrate coring and lag time to assess nitrogen and water management outreach and regulations.

Implications of the Residual Soil Nitrate Test for the proposed Rule

Use of the shallow residual soil nitrate test provided very good feedback for the Nebraska regulatory process. As previously mentioned, it worked in areas where the soils were coarse textured and the lag times where short because of shallow depth to groundwater. However, this method imposes some burdens: all Nebraska farmers in certain areas with elevated nitrates are required to provide shallow soil test results annually on fields receiving nitrogen fertilizer, and they are required to bear that additional cost. In addition, this testing requires access to a large number of acres. For this reason, the agency chose not to include this method in the rule, but it may be useful in some voluntary responses under the NFMP such as for townships with elevated nitrate.

The deep soil sampling method, the second approach used by the University of Nebraska, provides an accurate and useful approach and is included in the proposed Rule. In regions of the state where groundwater is located at much greater depths, it may be cost prohibitive to install monitoring wells. Similar to the Nebraska approach, deep soil samples would be obtained to establish a baseline inventory of the amount of inorganic nitrogen which has accumulated between the root zone and close proximity to the water table. Borings would be collected early in the Mitigation Level 2 process and then resampled on a predetermined sampling cycle. The number of sampling sites could be limited within the DWMSAs where this approach is used depending on available resources. MDA and the LATs would need to designate a small number of representative fields where the technique would be used.

This technique will provide useful metrics in terms of the initial levels of nitrogen currently in transport to the water table. The nitrogen levels should be reduced over time with improvements in nitrogen management practices. Once the resampling is conducted, the travel time of the nitrogen to groundwater can be quantified. The advantage of this approach is it is possible to determine if the implementation of BMPs and AMTs are effective by reducing the amount of nitrogen in the unsaturated profile without having to wait for extended lag times to actual reach (and ultimately impact) groundwater resources.

Subp. 6. Nitrogen fertilizer best management practices evaluation A.

BMP evaluation in mitigation level 2

According to Minn. Stat. § 103H.275, the MDA shall evaluate the nitrogen fertilizer BMPs based upon two components: 1) the evaluation of BMP implementation; and 2) the evaluation of BMP effectiveness. Each component must be evaluated individually, and their combined effect must be evaluated as well. Evaluation of either component will be a complex process. This section will discuss the tools used for assessing the implementation of nitrogen fertilizer BMPs.

The results of BMP implementation may not be discernible for a long period of time, as measured by the change in nitrate-nitrogen concentration of groundwater. Furthermore, changes in nitrate-nitrogen concentration observed over the course of a single year may or may not be related to BMP adoption. In view of these challenges, it is recognized that BMP adoption must be evaluated as well as BMP effectiveness in preventing or reversing the degradation of water quality.

On-Farm Nutrient Assessments: The ability of the MDA to document farmer adoption rates of voluntary nitrogen fertilizer BMPs is a critical component of the 1989 Minnesota Groundwater Protection Act (Minn. State. chap. 103H). The MDA has developed a diagnostic tool called FArm Nutrient Management Assessment Process (FANMAP) to get a clear understanding of existing farm practices regarding agricultural inputs such as fertilizers, manures and pesticides.

Although it is labor intensive, it provides a useful and accurate method of compiling data on BMP adoption. This approach was developed for DSWMAs and other small-scale water quality projects.

Results have been used to design focused water quality educational programs. Data collected in the program's infancy can be used as a baseline to assist in determining if the nitrogen fertilizer BMPs are being adopted. Over the past twenty years, hundreds of farmers have volunteered two to four hours of their time to share information about their farming operations. The complete compendium of FANMAP surveys is available on the MDA's FANMAP website (n.d. (b)).

Phone Surveys: The MDA has partnered with the NASS and U of M researchers to collect information about fertilizer use and farm management on regional or statewide scales. Partners have pioneered a survey tool for characterizing fertilizer use and associated management. Surveys are conducted over the phone.

Enumerators from NASS are highly skilled at obtaining critical information over the phone with minimal time and burden on the farmer. The first attempt using this technique was in 2010. NASS enumerators surveyed approximately 1,500 corn farmers from across the state to gather information about commercial fertilizer use on corn (Bierman et al. 2011). Statewide nitrogen use surveys for grain corn production are now conducted every other year in partnership with NASS. During the alternate year, surveys on other crops and practices are conducted.

Evaluation for purposes of the proposed Rule will be conducted after a minimum of three growing seasons after the publication of the nitrogen fertilizer BMPs. Since the proposed Rule is focused on DWSMAs, the FANMAP approach previously described will be the likely tool. To determine if proper nitrogen rates are used, it will be necessary to look back at past years practices for the purposes of crediting all sources of nitrogen that are applied. The survey will take into consideration all cropland except soybean (i.e. corn, alfalfa, wheat, etc.)

Time period for BMP adoption

The MDA will inform farmers of the selected nitrogen fertilizer BMPs (and AMTs if funded in mitigation level 3, or for mitigation level 4) prior to the beginning of a growing season and give them adequate time before implementation is required and evaluated by the MDA. The MDA determined that three growing seasons should be used because this is the length of the most common corn-soybean crop rotation. The corn-soybean rotation for the past several years has covered approximately 16 million acres which represents over ¾ of Minnesota's cropland acres.

It is reasonable that the MDA gives farmers time for implementing the nitrogen fertilizer BMPs (and AMTs if required) because after the selection and promotion of the nitrogen fertilizer BMPs, it may take some time for adoption. The MDA routinely finds that growers tend to use rates higher than the U of M recommendations in some parts of the rotations. Farmers will need time to experiment with these more conservative rates. In addition to farm management changes,

there may be supplies (e.g., nitrogen fertilizer product availability), equipment (e.g., 'specialized' fertilizer application equipment), or other issues beyond the control of the farmer that may take time to resolve.

Exclude soybean acres

The MDA will not include soybean acres when evaluating compliance whether 80% of the cropland is following nitrogen fertilizer BMPs. Being a legume, soybeans fix their own nitrogen and therefore do not have a nitrogen recommendation except under unique circumstances. The proposed Rule is intended to apply to crops that apply nitrogen fertilizer; therefore it is reasonable that soybeans not be included. If soybeans were included, those acres would artificially increase the number of acres that followed the (non-existent for soybeans) nitrogen fertilizer BMPs. In addition (as noted above), soybeans are most often in rotation with corn, therefore those acres could be evaluated for compliance with required nitrogen fertilizer BMPs during the year corn is grown.

U of M research has shown that soybean loses appreciable amounts of nitrogen in comparison to other legume crops such as alfalfa. Beans frequently lose about 75% of the rate losses typically found under corn even though nitrogen fertilizer is seldom directly applied. Losses, in part, are due to the contributions from mineralized nitrogen along with lower crop water use (resulting in greater nitrogen flux). Alfalfa and other perennials are extremely effective in reducing nitrate losses through the root zone and when these crops are managed correctly, they can have extremely positive water quality benefits. For this reason, the introduction of these crops is considered an AMT and highly encouraged.

The MDA received some comments that suggested that it should not include soybeans in the 80% cropland calculation. Considering all of these factors, it is reasonable that the MDA does not include soybeans in the '80% cropland compliance'.

Justification for using 80% of cropland

Within any geographical region, it is reasonable to expect that some percentage of the agricultural landscape will experience climatic conditions or other conditions which will impede the producer's ability to manage nitrogen inputs in accordance to the nitrogen fertilizer BMPs and corresponding Fertilizer Guidelines (MDA, n.d. (g) Kaiser et al., 2011, 2016, Lamb 2015). For example, one of the consequences of climate change is more localized thunderstorms resulting in wide variations of rainfall within small distances. Large differences are frequently observed within the boundaries of an individual farm. Localized saturated conditions, as well as drought conditions, can have a profound impact on time management and the producer's ability to implement nitrogen management on these minor acres.

Additionally, making alterations to fertilizer management practices can also impact time management, labor costs, labor availability, and many associated equipment issues. For a variety

of reasons, it is not realistic to assume that nitrogen fertilizer BMPs can be implemented across all acres for any particular growing season.

There was considerable discussion and eventual consensus across the NFMP Advisory Committee that this threshold level should not be 100%. A range of percentages were discussed and eventually the committee agreed that 80% would represent a balance between challenging producers to continue adopting the best available science yet reflecting that the forces of nature must always be considered.

Why is it needed and reasonable to allow periodic evaluations to monitor progress?
Periodic evaluations of nitrogen fertilizer BMP adoption will allow the agency to check on progress and compliance, and to make adjustments as needed. Over time, cropping systems and nitrogen fertilizer BMPs may change and the MDA will need to track these changes. In addition, evaluations indicate whether the practices needed to improve groundwater quality are in place. These periodic evaluations will allow the MDA to make sure that the desired nitrogen fertilizer BMPs/AMTs in mitigation levels 3 and 4 are being implemented. This type of feedback will also be informative for the LATs and other partners to evaluate the effectiveness of mitigation level 2 promotional activities. For these reasons, it is reasonable that the MDA conduct evaluations of nitrogen fertilizer BMP adoption.

The timeframes of these evaluations may be variable due to the mitigation level and DWSMA area as further discussed below.

Subp. 6. Nitrogen fertilizer best management practices evaluation. B – Evaluation criteria.
The proposed Rule has established several additional considerations when determining whether the nitrogen fertilizer BMPs (and AMTs) are being adopted. The MDA has determined that it is necessary for the rule to include additional circumstances that are relevant in determining compliance with the BMPs. These include:

> *Approved Alternative Management Tools (AMTs):* The AMTs are a replacement or improvement to the nitrogen fertilizer BMPs; therefore, it is reasonable that they be deemed in compliance with the nitrogen fertilizer BMPs. In the NFMP and in subsequent proposed Rule outreach activities, the MDA has repeatedly stated the goal of going beyond the nitrogen fertilizer BMPs and implementing AMTs. Therefore, in an effort to facilitate their use within the proposed Rule, the MDA will maintain a list of agency-approved AMTs so they are readily accessible for the MDA to promote and for farmers to implement. Therefore, it is needed to understand if farmers adopted approved AMTs in order to assess whether they are in compliance with the BMPs.
>
> *Minnesota Agricultural Water Quality Certification Program (MAWQCP):* A compliance determination for MAWQCP is needed because Minn. Stat. § 17.9891 states that enrollment in MAWQCP is deemed in compliance with any state regulation. This

includes the proposed Rule. In addition, in order to get certified under the MAWQCP, the nitrogen fertilizer BMPs as well as other fertilizer management practices will have been adopted on the certified acres.

Lack of Information: If a regulated party does not provide the MDA any information, or provides inadequate information, that party will be determined to not be in compliance with the proposed Rule. The MDA expects regulated parties to be forthcoming during compliance checks, and noncooperation by providing inadequate information will result in an assumption that nitrogen fertilizer BMPs have not been adopted. This is reasonable because the proposed Rule begins in a voluntary level, providing farmers adequate opportunity to comply before regulation. In the regulatory levels, it is reasonable to expect continued cooperation in compliance with regulatory requirements. In addition, determination of noncompliance is reasonable because it is equitable to all regulated parties in an area to require all to comply with the same regulatory requirements.

Waiver from non-compliance due to an agricultural emergency – In some cases, events will occur that are beyond the control of a farmer (e.g., weather events). The proposed Rule needs to account for agricultural emergency events, so that farmers are not deemed noncompliant due to an event that is unpreventable. It would not be uncommon for agricultural emergencies to impact more than one farmer in an area as well. Therefore, an exception for agricultural emergencies is needed and reasonable.

MPCA-approved and implemented manure management plan that include the required BMPs: Manure management plans are in place for feedlots of a defined size throughout Minnesota. These plans require proper management of manure based on the nutrient content including nitrogen. The plans provide a formal process for reviewing and approving the proper management of nutrients. In the comment process, the MDA received several recommendations that MDA use this existing process for approval of any required BMPs and practices so that farmers do not need two reviews of their practices. This provision has been included in the rule in response to those recommendations. A manure management plan that includes any required practices for the land in the DWSMA and has been approved by the MPCA or their designee will be considered to be implementing the required practices under the rule. This is reasonable, because a manure management plan requires that land application of manure be done in a manner that protects surface and groundwater. Therefore, including MPCA approve management plans is reasonable because feedlot rules (Minn. R. chap. 7020) require that nutrient applications be based on crop needs. This includes nitrogen from all sources including manure, fertilizer, crop credits and other sources; however, in addition the proposed Rule requires that the manure management plan is determined to be implemented (by MPCA staff or designee) as well. This is needed and reasonable

because the plan must be implemented to reflect that actual manure (and associated nitrogen) management activities protective of water quality are being done.

Subps. 7-9. DWSMA mitigation levels. – Mitigation level 2, 3 and 4 designation review

The proposed Rule provides for a systematic process to determine the appropriate mitigation level. This process considers a review of water quality monitoring data and residual soil nitrate data below the root zone (if available) for all mitigation levels. In addition, for a mitigation level 2 site, it considers a survey on the adoption of designated nitrogen fertilizer BMPs.

The criteria for determining a site to be at a specific mitigation level are clearly defined. A site will move up a mitigation level if the criteria for a specific mitigation level are met. If the criteria for a mitigation level are no longer met because water quality is improving, then the site will be moved down.

The criteria for initial mitigation level 1 and mitigation level 2 determinations were previously discussed in Subp. 3. The criteria for moving a mitigation level 2 site to mitigation level 3 are if the recommended set of nitrogen fertilizer BMPs are not being adopted on 80% of the crop land acres (excluding soybean) or if water monitoring data or residual soil nitrate testing data indicates that nitrate-nitrogen concentrations are increasing.

The development of mitigation level criteria is needed to provide for a consistent approach and for ensuring that the goals of the regulation (reductions of nitrate-nitrogen concentrations in groundwater) are met. These mitigation level criteria are reasonable for two reasons. First, one of the primary goals of the Groundwater Protection Act is to ensure the adoption of nitrogen fertilizer BMPs. The criteria of 80% adoption of the recommended nitrogen fertilizer BMPs was selected because it means that most of the agricultural land with high nitrogen using crops in the DWSMA will be adopting the most important nitrogen fertilizer BMPs to ensure that nitrogen fertilizer is used appropriately and in a manner that will minimize nitrate leaching to groundwater. As is discussed elsewhere in the SONAR, the required percent of BMP adoption is not 100% because there are frequently practical limitations to 100% adoption of some practices and the Groundwater Protection Act clearly directs that any regulatory requirements must be practicable.

The 80% of cropland acres surveyed does not apply to soybean acres. This is reasonable because they do not generally receive significant applications of nitrogen fertilizer. In the case of soybean, it is generally grown in rotation with corn and proper crediting for nitrogen for soybean will be considered during other parts of the crop rotation. Other crops such as alfalfa and perennial crops are included in the assessment of cropland. This is reasonable because growing certain other crops such as perennials can have a significant beneficial effect on reducing nitrate

losses. If these crops were not included in the assessment of cropland it might cause an unintended consequence of discouraging their adoption.

The other criteria for moving to mitigation level 3, and also for moving to mitigation level 4 for sites in mitigation level 3, is if nitrate-nitrogen concentrations in groundwater or in residual soil nitrate below the root zone are increasing. These criteria are intended to ensure that, at a minimum, the agricultural practices within the DWSMA are sufficiently protective to prevent water quality from getting worse and from eventually exceeding the HRL for nitrate-nitrogen of 10 mg/L. If nitrate-nitrogen concentrations are continuing to increase that indicates additional implementation actions beyond the widespread voluntary adoption of nitrogen fertilizer BMPs are necessary. In mitigation level 3 the commissioner – in consultation with a local advisory team – would require landowners to implement best management practices and may require other practices such as testing, educational programs and AMTs if they are funded. These actions would represent a significant increase in implementation activities to address the issue.

The timeline for review and possible redetermination of a mitigation level may vary depending upon the lag time for each DWSMA. The approach is to reevaluate the appropriate mitigation level after not less than three growing seasons or the estimated lag time, whichever is longer, following when the recommended practices are first published for mitigation level 2 or when the order is finalized and published for mitigation levels 3 and 4. The monitoring data and mitigation level will then be reviewed not less than every three years thereafter. The exception to this approach is if residual soil nitrate testing below the root zone is conducted in which case the timeline for evaluating these tests will be highly dependent upon the characteristics of the site and the procedures employed in the testing. Soil residual nitrate tests would be conducted in cases where the lag time is measured in decades. In such instances it is not feasible to wait until after the lag time and soil residual nitrate tests offer an alternative method to tracking the amount of nitrate moving to groundwater. However, these procedures will require an initial and one or more follow-up series of soil tests. In most cases the timeframe for evaluating these tests will be several years between tests at a minimum. For purposes of the rule it states that the time interval for review of residual soil nitrate tests will be not less than three years. Use of this test to assess changes in nitrate-nitrogen concentration is reasonable because it provides a more rapid alternative to groundwater monitoring in areas where there are very long lag times (which can be decades) or where it is very expensive to install monitoring wells. However, residual soil nitrate testing is highly resource intensive and still relatively new therefore it is anticipated that its application will be very limited. (see SONAR Supb. 5. Monitoring, Residual Soil Nitrate Monitoring).

Lag Time

Lag time is the period of time for nitrate to travel from the point of application on or near the land surface, through the unsaturated zone and reach the aquifer being monitored. This lag time can vary significantly in different locations across Minnesota from periods of less than a year in

extremely vulnerable aquifers to decades or longer in some deeper aquifers. It is necessary to account for the lag time when evaluating if changes in land management practices are having an effect on water quality in an aquifer. The lag time can be estimated in several ways, including through models or calculations that estimate these travel times and/or through the use of a variety of tracers. Tracers are chemicals which are used in the environment at a known point in time so that when they are first detected in an aquifer they provide an estimate of the travel time to that aquifer. There are a number of commonly used tracers including the first use of a specific pesticide, pharmaceutical or compound linked to atmospheric deposition. The Minnesota Geologic Survey (MGS), the United States Geologic Survey (USGS) and the MN DNR have all provided technical advice, research publications, and conduct or support ongoing research to estimate travel times to different aquifers in Minnesota (Runkel et al, 2014, Steenberg et al, 2014, Puckett and Cowdery, 2002). The following references provide information on tracers. https://water.usgs.gov/lab/references/group/

These timelines provide clear guidance on expectations to the public regarding the MDA's process for review of water quality data, and expectations on when changes in water quality can reasonably be anticipated based on changes in practices. It is necessary to have some guidance in the proposed Rule on the evaluation process including timelines for moving to regulation or, if water quality improves, when regulatory requirements may be dropped. The timelines proposed in the proposed Rule are reasonable for several reasons. Three growing seasons is based on the three-year timeline that is frequently used for a crop rotation. This will provide a reasonable timeframe for all of the farmers in the DWSMA to learn about, evaluate and adopt any changes in practices that are necessary. During this time the MDA and partners in the agricultural community and local government will actively promote the nitrogen fertilizer BMPs, and at the same time discuss and encourage the adoption of AMTs. It is important to note that one of the primary goals of the NFMP is to educate on and promote the most effective and current agricultural practices that can minimize nitrate losses. The AMTs, which are described elsewhere in the SONAR, are intended to provide a highly flexible approach to engaging and sharing information across the entire agricultural community in Minnesota on new or proven strategies and technologies the can help reduce nitrate losses in vulnerable groundwater areas. Anyone can suggest AMTs and if they are suitable, they will be listed on the MDA website and may be considered for use in DWSMAs. The MDA is currently funding agricultural educator positions with U of M Extension specifically to promote nitrogen fertilizer BMPs and AMTs in targeted high-risk areas including DWSMAs. The three-year adoption period, especially in mitigation level 2, will be an important time for working with the local advisory committee, local farmers and agronomists to promote both the nitrogen fertilizer BMPs and AMTs in the DWSMA. This is reasonable and supports the goal of promoting practices that can improve water quality in the DWSMA.

As previously discussed, consideration of the lag time from when a change in practices will have an effect on groundwater quality is necessary and reasonable because we cannot know if changes

in practices are having the desired effect until after the lag time (see 1573.0040, Supb. 5. Monitoring).

The timeline for mitigation review states that it will be “not fewer than” three cropping seasons or the lag time for water sampling, whichever is longer, or “not fewer than” three years for residual soil nitrate tests. The phrase “not fewer than” has been used because it is necessary and reasonable to use a longer timeline in some situations. For example, it is necessary to align the survey of BMP adoption in the DWSMA with the monitoring data, so they are assessed together. If the BMP adoption survey takes longer than anticipated, then it will be necessary to delay the review of the mitigation level until it is completed. In addition, there might be other factors which require a delay in the survey of BMP adoption. There could be extreme weather events such as a drought or extremely late planting due to heavy rainfall or late spring planting under which the Commissioner may allow wide spread exceptions to BMP adoption. In those years the MDA would postpone surveys until following a normal cropping year. The timelines for use of residual soil nitrate tests will vary by the test and may also be modified during periods of extreme weather. When working with agricultural systems, it is necessary to have some flexibility to adjust to weather conditions. An approach that provides this flexibility is reasonable and necessary to efficiently align different testing and survey methods into a single review cycle and to adjust or correct for extreme weather events.

The proposed Rule allows the commissioner to grant a one-time delay moving a mitigation level 2 or mitigation level 3 site up a mitigation level for a period equal to three growing seasons or the lag time, whichever is longer, or for a time period equal to the time used for the reviewing the level determination for residual soil nitrate tests, if the responsible parties have demonstrated progress in addressing nitrate in groundwater within the DWSMA. This provision has been included in the proposed Rule to recognize situations in which actions in the DWSMA have already been implemented that are comparable to, or go beyond, the actions that would likely be required in a mitigation level 3 or mitigation level 4 order. In this case the order would be unnecessary and even counter-productive. This provision might be applied in a situation where it took several years to implement practices that are much more extensive than mitigation level 2 nitrogen fertilizer BMPs or mitigation level 3 water resource protection requirements, such as a change in the cropping system to a perennial crop. This delay in implementation might be because it took a long time to obtain funding to implement the new practice, which is quite common when implementation funds are limited as they generally are. But since the new practices will have been implemented, it is appropriate to provide additional time to evaluate how effective they are. This provision in the proposed Rule is necessary because if the increased actions taken are effective the order would be unnecessary. Further, it might actually be counter-productive to issue the order because any regulatory action tends to provoke a defensive response from some members of a regulated community and an order that might reasonably be viewed as clearly unnecessary might offend and discourage further voluntary cooperative efforts. It is important to note that a goal of the Groundwater Protection Act and the NFMP is to address

nitrate concerns through a voluntary approach and only move to a regulatory approach if the voluntary approach is not successful. This provision allows the commissioner to encourage and reward a strong voluntary response to elevated nitrate in the DWSMA.

The proposed Rule also allows the commissioner to make exceptions to increasing a mitigation level due to changes in land use. Some DWSMAs are very small and changes in land use might have a dramatic effect on water quality. In some cases there may be limited cropland left in a DWSMA. An example might be a DWSMA on the edge of an area where land is being converted from agriculture to suburban development.

The commissioner could not use the exceptions to increase the mitigation level faster than the other parts of the proposed Rule allow. However, the commissioner may make exceptions to the criteria and not increase a mitigation level based on a reduced risk of nitrate contamination to groundwater.

This provision in the proposed Rule is necessary because it allows the MDA to use resources efficiently and to be able to respond to situations where the source for elevated nitrate in a public well has been removed or greatly diminished even though, because of lag times and travel times within the DWSMA, it may take many years for high nitrate-nitrogen concentrations in the well to fall. It is reasonable for MDA to include provisions in the proposed Rule which allow flexibility for quickly adjusting to changes in nitrogen sources so that limited resources are not wasted.

A mitigation level 3 site will be moved to mitigation level 4 if nitrate water monitoring data or residual soil nitrate testing data shows nitrate-nitrogen concentrations are increasing as described above, or if the nitrate-nitrogen concentration in the sampling data from the public well exceeds 9 mg/L three times over the previous 10 years. The criteria indicate that the source water to the public well is at great risk of exceeding the nitrate-nitrogen MDH HRL of 10 mg/L and additional implementation activities than are required for mitigation level 3 are needed to prevent this from occurring. For mitigation level 4, the proposed Rule allows the commissioner, in consultation with the LAT, to order the implementation of any actions that are allowed under the Groundwater Protection Act. For a mitigation level 4 order the commissioner, in consultation with the LAT, would conduct a detailed site-specific assessment of the site, and then select practices that are likely to reduce nitrate-nitrogen concentrations in the source water to below the MDH HRL in consideration of the requirements in the Groundwater Protection Act. It is important to note the commissioner must consider economic and other practical factors for any requirements in the order. The specific statutory language (Minn. Stat. § 103H.275, subd. 2) regarding what the commissioner could require in the order is the following:

> *"The water resource protection requirements must be based on the use and effectiveness of best management practices, the product use and practices contributing to the pollution*

detected, economic factors, availability, technical feasibility, implementability, and effectiveness."

It is necessary to have clear criteria of when the concern for high nitrate-nitrogen concentration in groundwater or threatening groundwater justify moving to the highest regulatory requirements allowed by the Groundwater Protection Act and the proposed Rule. It is reasonable for the proposed Rule to adopt these specific criteria for moving to a mitigation level 4 because the criteria are reasonable indicators that there is a significant risk that the source water will exceed the MDH HRL if additional actions are not implemented than are currently being conducted under mitigation level 3.

If the criteria for a given mitigation level are no longer met, then a site will be moved to a lower mitigation level. The criteria for a specific mitigation level do not change. For a mitigation level 4 site it would be moved down one mitigation level to a mitigation level 3 site, and a mitigation level 3 order would be prepared in accordance with the mitigation level 3 requirements in the proposed Rule. For a mitigation level 3 site it would be moved down to mitigation level 1. This is because the water quality goal of not exceeding 8 mg/L nitrate-nitrogen over 10 years is the same for mitigation level 2 and 3. In addition, the site cannot have increasing nitrate-nitrogen concentrations as previously discussed.

It is necessary to have clear guidance in the proposed Rule for when a site will be removed from regulatory requirements. It is reasonable to use the same set of criteria for moving a site up or down since the criteria are based an increasing concern that nitrate-nitrogen concentrations are threatening to exceed the MDH HRL for source water in a public well, and if this concern no longer true, then regulatory requirements should be reduced. It is important to recognize that the water quality criteria are based on the nitrate-nitrogen concentrations observed over period of 10 years. It is felt that this is a sufficiently long period to provide confidence that the changes are likely to continue to be sustained over the long term

Subp. 10. DWSMA mitigation levels. - Limitation on change in designation

It is needed and reasonable for a DWSMA to only increase one mitigation level at a time in order to give regulated parties certainty about regulation. No less than every three growing seasons or the lag time, whichever is longer, DWSMAs with a mitigation level of 2 or higher will be reevaluated. If nitrate-nitrogen concentrations are increasing, the regulated party knows that they will only move up one mitigation level until the next re-evaluation cycle. This proposed Rule provides certainty for the responsible party and allows some certainty for the regulated party regarding the process of increasing mitigation levels.

E. 1573.0050 Water Resource Protection Requirements Order

Subp. 1. Commissioner's water resource protection requirements order

The MDA is required to lay out the procedures for notice to be given to persons affected by the water resource protection requirements order under Minn. Stat. § 103H.275, subd. 2(d). This provision of the proposed Rule is reasonable to identify who is subject to the water resource protection requirements order when it is issued for a DWSMA. Minnesota farms can be operated by an owner, a tenant, or other arrangements. Where neighboring DWSMAs are the same mitigation level and the cropping systems are similar, meaning that the implemented nitrogen fertilizer BMPs would be the same or similar, it is necessary and reasonable to use the MDA's limited resources to address these areas with one LAT and one mitigation level. This can reduce complications for those farmers that operate on land in more than one DWSMA and will not provide any additional regulations for those farmers that only operate in one DWSMA.

Subp. 1. Commissioner's water resource protection requirements order. A. – Mitigation level 3 and 4 DWSMAs

To address the most serious groundwater concerns, it is necessary and reasonable for the commissioner to issue a water resource protection requirements order, as described in Minn. Stat. § 103H.275, subd. 2(c), for DWSMAs that meet the requirements of mitigation levels 3 and 4 as described in this SONAR 1573.0040 Drinking Water Supply Management Areas; Mitigation Level Designations.

The water resource protection requirements in the proposed Rule are necessary to achieve the purpose of the Groundwater Protection Act, which is to ensure that groundwater is "maintained in its natural condition." Minn. Stat. § 103H.001.

Under the Groundwater Protection Act, the commissioner of agriculture is charged with, among other things, promoting the implementation of BMPs to prevent or minimize pollution from agricultural chemicals "to the extent practicable." Minn. Stat. § 103H.275, subd. 1. The commissioner of agriculture may issue water resource protection requirements if "the implementation of best management practices has proven to be ineffective." Minn. Stat. § 103H.275, subd. 1(b). Thus, if BMPs have not been implemented or if they have been implemented and found to be ineffective, the commissioner may issue water resource protection requirements. The proposed Rule addresses both the "implementation" factor and the "ineffectiveness" factor.

Implementation: Under the proposed Rule, the commissioner will issue water resource protection requirements if nitrogen fertilizer BMPs have been implemented on less than 80% of the cropland in the affected DWSMA. If nitrogen fertilizer BMPs are implemented on less than 80% of the cropland in the affected DWSMA, it is expected that nitrate-nitrogen concentrations

in groundwater will continue to rise, making it necessary for the commissioner to issue a water resource protection requirements order. The use of 80% is a reasonable measurement to determine if nitrogen fertilizer BMPs have been implemented.

Ineffective: Under the proposed Rule, the commissioner also will issue a water resource protection requirements order if the nitrogen fertilizer BMPs have been proven ineffective. This will be assessed by measuring whether nitrate-nitrogen concentrations are increasing.

This is reasonable because, before moving to any water resource protection requirement, the MDA intends to use voluntary mitigation levels 1 and 2 to alert farmers to groundwater conditions, encourage farmers to voluntarily adopt the nitrogen fertilizer BMPs, and employ farmer-led strategies to protect groundwater. Farmers will have adequate time to implement the measures voluntarily, and adequate time will be allowed to take into account the travel time of the affected groundwater. It is also reasonable because the commissioner will assess whether the criteria have been met through scientifically accepted methods for testing for nitrate in groundwater (see 1573.0040 Drinking Water Supply Management Areas; Mitigation Level Designations). If the nitrate-nitrogen concentrations meet those objective criteria, it will be necessary for the commissioner to adopt water resource protection requirements in order to prevent the nitrate-nitrogen concentrations from becoming a broader public health issue by exceeding the MDH HRLs. It is also reasonable and satisfies the provisions of Minn. Stat. § 103H.275, subd. 2(c) because the water resource protection requirements order will be site-specific for each affected DWSMA.

Subp. 1. Commissioner's water resource protection requirements order. B. – Presence of groundwater monitoring networks or residual soil nitrate testing

It is necessary for the rule, as part of the mitigation level decision, to account for the time it takes for changes in agricultural or land management practices on the land surface to have an effect on water quality in the aquifer or in the public well. As noted in 1573.0060, subp. 5, the Commissioner may construction a groundwater monitoring network or conduct residual soil nitrate testing to evaluate if the water quality within a DWSMA is getting worse for purposes of designating a mitigation level. The groundwater monitoring network will be designed to evaluate water quality for groundwater considering the unique hydrogeology in each DWSMA. The installation of a monitoring network and use for mitigation level decisions is reasonable because it will provide a rapid and technically defensible assessment of changes in groundwater quality. The monitoring data from the monitoring network will be a direct reflection of the effectiveness of changes in agricultural or land management practices in reducing nitrate-nitrogen contamination in the aquifer. Residual soil nitrate testing below the root zone provides similar information on the increase or decrease of nitrate levels in soils below the root zone. Nitrate in

soil below the root zone will not be taken up by the crop and is available for migration to the groundwater, and provides a useful indicator of future nitrate leaching into the aquifer.

For all aquifers there is a lag time before changes in agricultural or land management practices have a beneficial or harmful effect on water quality in the underlying aquifer. This is because it takes time for nitrate to migrate below the root zone of the crop where nitrate may be taken up by the plant, and through an unsaturated zone below the ground surface before it reaches an aquifer. An aquifer is a geologic formation that yields usable quantities of groundwater. This lag time can vary substantially from less than a year to decades or longer depending upon the depth to groundwater and ability of the soil or bedrock to rapidly conduct water (the hydraulic conductivity) (Adams, 2016, Struffert et al, 2016).

The DWSMA is a two-dimensional estimate of the area within an aquifer that would provide groundwater to a pumping well within a period of 10 years. The DWSMA is based on horizontal travel times within an aquifer (i.e. movement of nitrate once it has reached groundwater) and does not generally consider the lag time for nitrate or another contaminant to travel downward to reach the aquifer. The installation of a groundwater monitoring network or conducting residual soil nitrate testing will assess the changes in water quality across the entire DWSMA at once, without waiting 10 years for groundwater from the most distant part of the DWSMA to reach the public water supply well. Therefore it is reasonable, in areas where a groundwater monitoring network is installed or residual soil nitrate testing is conducted, for the order to apply to the entire DWSMA.

Subp. 1. Commissioner's water resource protection requirements order. C. – for areas where a groundwater monitoring network is not installed or residual soil testing is not conducted

It is necessary for the rule, as part of the mitigation level decision, to account for the time it takes for changes in agricultural or land management practices to have an effect on water quality in the public well. As described in subpart 1 (B), a DWSMA is calculated based on the two dimensional area in an aquifer that will provide water to a pumping well over a period of 10 years without consideration of lag time. In contrast to the situation described in subpart 1 (B), if a groundwater monitoring network is not installed, or residual soil nitrate testing is not conducted, then the monitoring information will not be available to assess the entire DWSMA at one time until a period equal to the lag time plus 10 years to account for the horizontal travel time across the entire DWSMA. However, the effectiveness of practices on water quality can be evaluated for those parts of the DWSMA that are having an impact on water quality in the public well based on estimated lag and horizontal travel times.

This provision in the rule provides that an order in a DWSMA may only apply to that part of the DWSMA for which practices on the land surface would impact water quality in the public well, considering both the lag time for nitrate to reach the aquifer and the horizontal travel time for

water in the aquifer to reach the well. This is reasonable, because it ensures that the order will only apply to those fields where practices are impacting water quality in the public well based on a detailed assessment of the estimated travel time for nitrate-nitrogen to travel from the place of application to the well.

Subp. 1. Commissioner's water resource protection requirements order. D. – Prioritizing issuance

Minnesota's agricultural economy and its geology are very diverse and using a water resource protection requirements order is necessary as they allow the MDA to tailor groundwater improvement solutions to fit an affected area. The MDA has limited staff and resources, and the criteria described in part 1573.0040, Subp. 3 (A) of the proposed Rule allows the commissioner to prioritize the areas of greatest concern in order to use these resources most efficiently. Using the criteria described in the proposed Rule to prioritize water resource protection requirements orders are reasonable as it allows for areas with high groundwater nitrate concentrations that affect the largest populations to be prioritized over areas where nitrate-nitrogen concentrations are low and/or where there are higher levels of nitrogen fertilizer BMPs are adopted.

Subp. 1. Commissioner's water resource protection requirements order. E. – Contents and application

Due process requires notice of a government action that may affect a private interest and provides a meaningful opportunity to be heard. The content of the water resource protection requirements order are needed and reasonable in order to inform the responsible parties in the DWSMA of the basis for its designation of a mitigation level 3 or 4. Including the information described in the proposed Rule is reasonable to sufficiently inform a responsible party why the DWSMA had been designated a mitigation level 3 or 4. This information includes letting responsible parties know of their mitigation level; providing responsible parties with the evidence as to why the mitigation level has been designated for their area;, informing regulated parties about the boundaries of the DWSMA that the order applies to, when the water resource protection requirements order will be effective, and their rights to contest the case. It is needed for the MDA to provide the responsible parties with the data that lead to the mitigation level designation. This data can help farmers understand that there is a groundwater problem in their DWSMA. It is reasonable and will help the regulated parties in that DWSMA understand the steps the MDA will take to work with the local area to reduce the concentration of nitrate-nitrogen in groundwater.

Subp. 1. Commissioner's water resource protection requirements order. F. – DWSMA partial exclusions

This provision in the rule is necessary to allow the commissioner to exempt parts of a DWSMA which are not contributing significantly to the groundwater contamination in the public well

from certain requirements in the rule, and to allow MDA to consider other factors that may make implementation of a specific practice impracticable because of the unsuitability of the location for the specific practice.

An important consideration when working with agricultural systems is that one size or set of practices does not fit all landscapes and cropping systems. DWSMAs vary in size from very small, less than a hundred acres, to relatively large, on the scale of tens of thousands of acres. For most DWSMAs, the soils types and vulnerability to groundwater contamination are likely to be fairly uniform across the DWSMA and this exclusion will not be needed. But for large DWSMAs, it is reasonable to expect that there will be areas with significantly different soils types and groundwater vulnerability such that some parts of the DWSMA may not be contributing significantly to high nitrate-nitrogen concentrations in the public well.

In addition for large DWSMAs there may be differences in soils types, land features, or groundwater vulnerability such that the practices that are highly desirable for one area may not be as beneficial or even practicable to implement across the entire DWSMA. This is especially important for level three orders that may require more complex AMTs (if fully funded) and for level four orders that can require any practices allowed under the Groundwater Protection Act. These practices could be much more difficult to implement then standard fertilizer BMPs and may not be suitable for all of the land area in a large DWSMA or their implementation in some parts of the DWSMA may provide little or no improvement in nitrate-nitrogen concentrations in the public well.

This provision is necessary to ensure that the commissioner does not impose requirements and related costs on individuals in areas where they will not significantly help reduce nitrate-nitrogen concentrations in the public well. It is reasonable because the Groundwater Protection Act directs that Water Resource Protection Requirements should be practicable and consider factors such as economics, implementability, and effectiveness; implementing certain practices uniformly across a DWSMA including in areas where they may provide limited environmental benefits would not meet this requirement. It is necessary to be able to exclude parts of a DWSMA from a water resource protection requirements order so that they are not overly broad and do not include persons whose practices are not contributing significantly to the contamination. It is also reasonable to include only those responsible persons whose actions can affect the groundwater in the DWSMA.

Subp. 1. Commissioner's water resource protection requirements order. G. – Exclusion.

This requirement is addressed under in the SONAR under 1573.0040, **Error! Reference source not found.**

Subps. 2-4 and 6. Commissioner's water resource protection requirements order – Notice, contested case hearings, final order effective date and judicial review

These provisions are necessary and reasonable because they provide due process and follow the requirements set forth at Minn. Stat. § 103H.275, subd. 2

Minn. Stat. § 103H.275, subd. 2(d) requires the MDA to provide procedural due process to persons affected by a commissioner's order. Procedural due process requires notice of a government action that may affect a private interest, and a meaningful opportunity to be heard. The MDA considered the question of how much process is due in issuing a water resource protection requirements order. *"[T]he requirements of due process must be measured according to the nature of the government function involved and whether or not interests are directly affected by the government action." Barton Contracting Company, Inc., v. City of Afton*, 268 N.W.2d 712, 715 (Minn. 1978). The MDA believes it is reasonable and necessary to provide sufficient notice of its proposed action and ample, meaningful opportunity for affected farmers to be heard. The process for issuing a water resource protection requirements order was drafted to follow the process outlined in the Public Waters Inventory because it involved similar due process challenges that are shared by the MDA (Minn. Stat. § 105.391). The procedural due process described in the public waters inventory has been upheld by the Supreme Court of Minnesota in *Application of Christenson*, 417 N.W.2d 607 (Minn. 1987).

Minn. Stat. 103H.275, subd. 2(d) authorizes the MDA to provide notice by personal service, publication, or other appropriate methods. While personal service will be the first priority, in large DWSMAs, the MDA may encounter significant difficulty and administrative burden in identifying potentially affected operators. In many cases, the landowner and the operator are different entities. Landowners may be living out of state and, while it might be possible to identify all landowners through tax records, not all landowners and operators are the same entity. It is possible that the task of comparing maps with land records to determine owners and addresses would only provide the MDA with partial information. The MDA would still not be aware of the operator on the land. Under these circumstances, providing published notice is the most efficient and effective way to provide notice to the actual operator of affected farmland. As the rule on the public waters inventory states, *"To provide personal notice to all interested persons in the public water inventory process throughout the state would be a nearly impossible administrative task."* For large DWSMAs, notifying each individual landowner and operator of that land could similarly be a nearly impossible administrative task.

The USDA Farm Service Agency (USDA-FSA) collects data about operators on agricultural land for federal grants and funding purposes. However, this information is federal and not available to the MDA.

The proposed Rule incorporates many procedural safeguards to prevent erroneous designation or mandatory practices that may a farmer may object to: there are required informational meetings, multiple publications in legal newspapers, public hearings, and notice to other governmental agencies, cities, counties and the township board. Judicial review pursuant to Minn. Stat. §§ 14.63-14.69, is also available to any person or entity subject to a final order. All of these measures are reasonable and necessary to provide meaningful opportunities to be heard about proposed action to interested parties.

Subp. 5. Commissioner's water resource protection requirements order. – Amended orders

A water resource protection requirements order may need to be amended for a variety of reasons. Research and agricultural practices are always changing and the LAT may recommend that new or additional nitrogen fertilizer BMPs or other practices are needed. An amendment process for the water resource protection requirements order is needed to order to update water resource protection requirements orders. The proposed Rule is reasonable as it outlines the amendment process, which requires due notice similar to the original issuance of a water resource protection requirements order, and will allow affected parties to seek beneficial changes.

Subp. 7. Commissioner's water resource protection requirements order. – Recording

This provision is needed and reasonable so that all affected persons will have notice of specific water resource protection requirement orders and amendments.

F. 1573.0060 Requirements for Water Resource Protection Requirements Orders

All water resource protection requirements orders will be site-specific for each DWSMA, and will be designed with input from a LAT and technical support from the MDA. This is needed so that the water resource protection requirements require a set of activities that are appropriate for the specific cropping systems, soils, hydrogeology, and the climate of the area. The one exception is a record keeping requirement applied to all orders for fertilizer-related records, which is reasonable and necessary in order determine if the required practices in the order have been adopted. This is also necessary to determine proper crediting for the nitrogen contribution or estimated losses due to agricultural practices that may include nitrogen or result in increased or decreased leaching losses of nitrate to groundwater. Many agricultural practices can have an influence on nitrate leaching and losses through runoff or atmospheric loss.

All responsible parties must comply with the requirements described in the proposed Rule and the final water resource protection requirements order. Minn. Stat. § 103H.275, subd. 2(f) states that a person who violates a water resource protection requirements order is subject to the orders

under Minn. Stat. chap. 18D, which gives the MDA authority to enforce rules. This section of the proposed Rule is needed and reasonable because it gives the regulated party and the public knowledge and notice of the MDA's statutory authority.

G. 1573.0070 Water Resource Protection Requirements Order Contents

Subp. 1. Mitigation level 3.

This subpart outlines the categories of what might be included in the water resource protection requirements order. The order under mitigation level 3 may include nitrogen fertilizer BMPs formally approved by the MDA under Minn. Stat. § 103H.151 and any of the specific related practices that are listed under 1573.0070. Setting forth the practices that can be included in a mitigation level 3 order is necessary and reasonable to provide a transparent, consistent, and structured process for selecting technically defensible practices for a mitigation level 3 order. The general list of practices listed under 1573.0070 is reasonable and necessary because it is the result of a lengthy development process starting with the development of the NFMP and continuing into the development of the proposed Rule. It includes suggestions from a stakeholder advisory committee and input from three public comment periods - one on the NFMP and two discretionary comments periods on the draft rule. It includes activities that are widely accepted as being important to properly manage nitrogen fertilizer under different cropping systems and in different settings. It also includes an option for an education requirement which was an option strongly recommended by the advisory committee and has been generally supported as an important option by many commenters.

The nitrogen fertilizer BMPs that can be considered by the MDA for the order have been approved by the MDA under Minn. Stat. § 103H.151. This requirement is reasonable because it is based on the process for developing and approving nitrogen fertilizer BMPs, which is science-based and formal, with a public comment period. Nitrogen fertilizer BMPs are developed based on guidance in Minn. Stat. § 103H.005, subd. 4. They are developed with direct input from U of M scientists and consider economics and other practical considerations. In most cases, adopting the nitrogen fertilizer BMPs will increase a farmer's profitability. They are also flexible and can be amended through the above-stated process to address new studies, new practices, and other considerations such as climate change. Many of the practices are specific to the different regions across Minnesota. Because of the differences in nitrogen fertilizer BMPs for different soils and different regions, not all nitrogen fertilizer BMPs may be suitable for all locations. Therefore, some judgement in the selection of appropriate nitrogen fertilizer BMPs is needed and is an important part of the order development process. The nitrogen fertilizer BMPs are the foundation of good nitrogen management, which in turn is the most important step in minimizing nitrate losses. There is extensive research and many publications on their environmental and economic

benefits. For all these reasons considering a requirement for appropriate nitrogen fertilizer BMPs in a mitigation level 3 order is both necessary and reasonable.

The MDA considered other options when drafting the list of water resource protection requirements for mitigation level 3. One of these options includes a fixed list of all possible options that could be considered a nitrogen fertilizer BMP now or in the future. The MDA concluded that this would not be a feasible requirement, as there is continuing research and advancement that may lead to updates of the nitrogen fertilizer BMPs. Practices that may be included on the list now may be outdated in a few years. In addition, new developments should be expected in the future that will likely be included on the recommended nitrogen fertilizer BMP list. Including these in the proposed Rule would make them static and would not allow the proposed Rule to follow future nitrogen fertilizer BMPs. It is necessary and reasonable for the list to be broad enough to cover practices that may be developed in the future, but specific enough so that LATs and responsible parties know what regulations could potentially become eligible nitrogen fertilizer BMPs included in the water resource protection requirements order. The water resource protection requirements order will be developed based on the recommendations of the LATs using the options included under 1573.0100 as the basis for the recommendations. All interested parties will have the opportunity to review the water resource protection requirements order before it goes into effect under the process described in 1573.0080.

Alternative management practices may be required for mitigation level 3 DWSMAs if there is a source of funding available to help offset the costs of implementing the practice. In mitigation level 4, alternative management practices that meet the requirements listed under Minn. Stat. § 103H. 275, subd. 2(a) shall be considered for inclusion in a water resource protection requirements order regardless of whether or not funding is available. As described in this SONAR Section I, 1573.0090 Alternative Management Tools; Alternative Protection Requirements, these practices will go above and beyond the nitrogen fertilizer BMPs and are locally optimized practices that will have been shown to reduce nitrate-nitrogen concentrations in groundwater. In the proposed Rule, AMTs are defined as “specific practices and solutions approved by the commissioner to address groundwater nitrate problems.” In areas with highly vulnerable groundwater, the use of nitrogen fertilizer at the recommended rate, timing, source and placement of the nitrogen fertilizer BMPs may not be enough to decrease the amount of nitrate leaching into groundwater to meet water quality goals. In these areas, the MDA will work with the LAT on locally developed solutions for addressing groundwater nitrate problems that are implemented on a site-specific basis. AMTs are needed because they are practices and activities designed to reduce nitrate leaching. AMTs represents an advanced level of groundwater protection that go beyond traditional nitrogen fertilizer BMPs.

Mitigation level 3 DWSMAs are areas where nitrates have exceeded or are projected to exceed the MDH HRLs within the next 10 years. These areas will affect large populations around the

state and regulatory action is being taken to ensure the nitrogen fertilizer BMPs are being adopted. It is necessary for the MDA to be able to require the stronger practices of AMTs to reduce nitrate at this level. However, the MDA acknowledges that there may be additional costs associated with implementing AMTs and given that economic factors are one of the considerations the MDA must consider under Minn. Stat. § 103H.275, subd. 2(a), it is reasonable that these factors will only be required if there is additional funding available.

Mitigation level 3 DWSMA may include requirements for AMTs if funded. This is reasonable because farmers may need incentives to implement AMTs. AMTs may not be profitable, and funding could bridge this gap. Use of funding is reasonable, to ensure that farmers can implement these practices even during periods of very low crop prices. Sources of funding exist from Federal, state, and often also local sources (Lenhart et al., 2017). Funding would currently be available for some of the AMTs being considered, subject to funding levels and priorities within the local area.

Rules that include funding requirements to implement conservation practices to improve water quality are being applied in Wisconsin (Wisc. Stat. § 281.16; Wisc. R. NR 151.09(4)).

Subp. 2. Mitigation level 4.

A commissioner's order for a mitigation level 4 may contain any of the requirements for mitigation level 3, requirements for rate for nitrogen fertilizer, and any practices that meet the definition of water resource protection requirements in Minn. Stat. § 103H.005, subd. 15 (with two exceptions, see below, Subp. 3. Exceptions.) that meet the criteria set forth in Minn. Stat. § 103H.275, subd. 2(a). This is the highest mitigation level and it is reasonable that it would contain the most stringent requirements. It is necessary and reasonable to include these more stringent water resource protections requirements because DWSMAs will have had a minimum of six growing seasons to implement nitrogen fertilizer BMPs and will have had a minimum of three growing seasons under a mitigation level 3 water resource protection requirements order, yet specific indicators show that nitrate levels are not improving.

It is necessary and reasonable for the commissioner to implement more stringent water resource protection requirements in mitigation level 4, because the criteria set forth in the proposed Rule for moving to mitigation level 4 will be the indicators that nitrogen fertilizer BMPs have proven to be ineffective, which is the trigger for implementing more stringent water resource protection requirements under Minn. Stat. § 103H.275, subd. 1(b).

It is necessary and reasonable to include in a mitigation level 4 order any practice that meets Minn. Stat. § 103H.275, subd. 2(a) factors, rather than limiting the commissioner's authority (except as described below in Subp. 3. Exceptions.) to specific, enumerated practices at this time, because agricultural methods, scientific knowledge, treatment methods, and technology will have advanced significantly by the time a DWSMA gets to mitigation level 4, and it would be

unreasonable to limit the commissioner's authority to what technology exists at the time a proposed Rule is passed. The commissioner will need to meet the statutory requirements set forth in Minn. Stat. § 103H.275, subd. 2(a) that require that any water resource protection requirements must be *"based on the use and effectiveness of best management practices, the product use and practices contributing to the pollution detected, economic factors, availability, technical feasibility, implementability, and effectiveness."* The MDA must consider these conditions in order to require a practice under mitigation level 4. In considering economic factors in mitigation level 4, it is reasonable and necessary to consider economic impacts both to affected farmers as well as to area residents who must bear the costs of treatment of public water supplies that have been contaminated with nitrate.

The proposed Rule states that the commissioner shall not restrict the selection of the primary crop in mitigation level 4. This part of the proposed Rule is needed and reasonable to clarify for farmers that the water resource protection requirements order will not dictate the main crop they should grow. Requiring farmers to grow the primary crop could put a huge burden on a farmer and have a significant effect on their livelihood. It is probable other crops that could be grown would not be as profitable as the primary crop. Also, other crop options may need other management than the primary crop; therefore farmers would need to alter their management. It would be unreasonable for the commissioner to prevent farmers from selecting which crop to raise in order to earn their livelihoods. The proposed Rule also states that the commissioner cannot require a nitrogen fertilizer application rate lower than the bottom of the rate range in U of M recommended nitrogen fertilizer BMPs. This is reasonable and necessary because requiring a rate that is lower than the bottom of the range would have the effect of restricting the primary crop raised by a farmer.

Subp. 3. Exceptions.

It is needed and reasonable for exceptions to the water resource protection requirements order to be allowed on a site-specific basis as there can be factors that can affect whether nitrogen fertilizer BMPs can be implemented. Weather plays an important role in agriculture, more so than many other industries. In the case of a severe weather event, where there has been damage to large amounts of a crop or a damaging storm that requires crops to be put in late, or other situations where the BMPs can't be followed, it is needed and reasonable for the MDA to grant an exception from a requirement of the water resource protection requirements order to a targeted area or even individual farmer.

H. 1573.0080 Minnesota Agricultural Water Quality Certification Program Exemption

Minn. Stat. § 17.9897 (a)(1) states that once a producer is certified, the producer *"retains certification for up to ten years from the date of certification if the producer complies with the certification agreement, even if the producer does not comply with new state water protection*

laws or rules that take effect during the certification period." Proposed Rule language was added in order to provide certainty for those producers that are certified that they are deemed to be in compliance with the proposed Rule, for the length of their certification.

Agricultural producers certified in the Minnesota Agricultural Water Certification Program (MAWCP) shall be deemed to be in compliance with the proposed Rule so long as they are consistent with the Certification Agreement signed by the commissioner. As stated in Minn. Stat. § 17.9891 *"whereby a producer who demonstrates practices and management sufficient to protect water quality is certified for up to ten years and presumed to be contributing the producer's share of any targeted reduction of water pollutants during the certification period."* In order to be certified and meet the intent of the statute, producers need to be addressing the groundwater resource concern in areas subject to the proposed Rule. This means that they will be not only implementing the nitrogen fertilizer BMPs but exceeding them with conservation practices and management appropriate to their operation that reduces the risk of nitrate loss to both groundwater and surface water. It is necessary to include this exemption because it is required by Minn. Stat. § 17.9897.

I. 1573.0090 Alternative Management Tools; Alternative Protection Requirements

Alternative management tools (AMTs) are practices and activities designed to reduce nitrate leaching. AMTs represent an advanced level of groundwater protection that go beyond traditional nitrogen fertilizer BMPs. The MDA recognizes that implementation of nitrogen fertilizer BMPs may not be adequate to decrease the amount of nitrate leaching into groundwater to meet water quality goals in some areas or situations. In areas where groundwater is vulnerable, the MDA encourages farmers to consider AMTs to meet water quality goals.

In many cases AMT practices are developed and used by farmers and implemented in ways that are optimized for local conditions and opportunities. The tools are designed to be flexible and can be adjusted or tailored to local conditions to a greater extent than BMPs. The MDA will continue to work toward providing technical and financial resources regarding the effectiveness of these alternatives. The MDA will work with the local agricultural community to encourage and incentivize their use. The general benefits of AMTs have been documented in scientific studies.

At the present time, the AMTs fall into the following categories:

- Alternative cropping systems, including low nitrogen input crops or continuous cover,
- Advanced nitrogen fertilizer management, including variable rate application and use of advanced nitrogen requirement prescription tools,
- New technologies that can increase nitrogen use efficiency, including the use of advanced crop sensor technology,

- Enrollment in the Minnesota Agricultural Water Quality Certification Program (MAWQCP).

The AMTs are needed for the following reasons:

- Because the nitrogen fertilizer BMPs are relatively static and require a long process to change, the MDA needs AMTs to recognize new practices and technology that are developed to reduce nitrogen leaching as they evolve.
- The nitrogen fertilizer BMPs may not have sufficient flexibility to work under all conditions or situations. The AMTs provide this additional flexibility.
- Nitrogen fertilizer BMPs may not be sufficient to meet water quality goals in all areas or in all situations. The AMTs represent an advanced level of groundwater protection and are designed to go above and beyond the BMPs and improve water quality faster.
- AMTs allow the MDA to support and recognize a regulated party who wishes to implement practices that exceeds the nitrogen fertilizer BMPs.
- Including AMTs as an option in the proposed Rule will allow farmers to be recognized for practices and activities they have adopted that go beyond the nitrogen fertilizer BMPs.
- Including AMTs as an option in the proposed Rule will engage the agricultural community in problem solving and will provide an effective approach for the agricultural community to propose workable solutions and new technologies that can improve water quality on both the local and state level.
- Maintaining a list of approved AMTs will provide a rapid and effective means for sharing information on new and effective methods to address nitrate concerns.

Thus, it is needed and reasonable for the MDA to include AMTs in the proposed Rule.

Subp. 1. Alternative Management Tools. A and B.

The MDA will maintain a list of approved AMTs and make this list available on the website. This list will be updated on a regular basis as AMTs are evaluated and approved. The list of alternative management practices is needed to inform responsible parties of the recognized AMTs available to them. Publishing this list on the MDA's website and updating it annually is reasonable as it informs regulated parties of options available to them to reduce the risk of nitrate leaching into groundwater. If the regulated party is subject to a water resource protection requirements order this list will inform them of other practices that could be implemented and allow them to still meet the requirements of the water resource protection requirements order.

Subp. 1. Alternative Management Tools. C.

The list of AMTs on the MDA's website will state whether these practices can be used in addition to nitrogen fertilizer BMPs or if they can be substituted for a nitrogen fertilizer BMP. Substitutions are necessary as in some cases, an AMT might go above and beyond a particular

BMP and implementation of that BMP is no longer necessary, or the tool may be incompatible with the BMP. In some cases the AMT might be most effective when used in combination with a nitrogen fertilizer BMP. Keeping records of the practices used where an AMT was substituted for another required practice will allow for the AMTs to be counted during the evaluation of nitrogen fertilizer BMPs.

Subp. 1. Alternative Management Tools. D.

This proposed Rule is needed and reasonable because if a producer wants to go above and beyond the nitrogen fertilizer BMPs, the MDA supports this. In many cases, AMTs can be tailored to the local conditions to a greater extent than the nitrogen fertilizer BMPs.

Subp. 2. Alternative protection requirements.

Minn. Stat. § 103H.275, subd. 2(e) requires the MDA to allow persons subject to water resource protection requirements to be able to suggest alternative protection requirements. Therefore, it is needed and reasonable for the proposed Rule to lay out the process by which a responsible party could apply to the MDA for an alternative protection requirement.

J. Effective Date.

The effective date is necessary to give affected parties time to implement the necessary changes in their organizations before the restrictions go into place. January 1, 2020 is a reasonable start date as the MDA heard from several comments during the summer 2017 comment period that some of the larger affected parties can purchase fertilizer as much as a year ahead of time,. With the proposed Rule expected to be adopted in early 2019, giving that additional year to use the existing stock seemed reasonable. The proposed effective date is also reasonable because the MDA plans to use the fall of 2019 to conduct education and outreach to affected parties.

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VIII. Appendixes

1. Fertilizing Corn Grown on Irrigated Sandy Soils
2. Best Management Practices for Nitrogen Use in Minnesota
3. Best Management Practices for Nitrogen on Coarse Textured Soils
4. Best Management Practices for Nitrogen Use: Irrigated Potatoes
5. Best Management Practices for Nitrogen in Southeastern Minnesota
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9. Nitrogen Fertilizer Management Plan
10. Potential Nitrogen Sale Reduction