



Agricultural Chemical Reduction Effort (ACRE)

Final Plan

October 2022



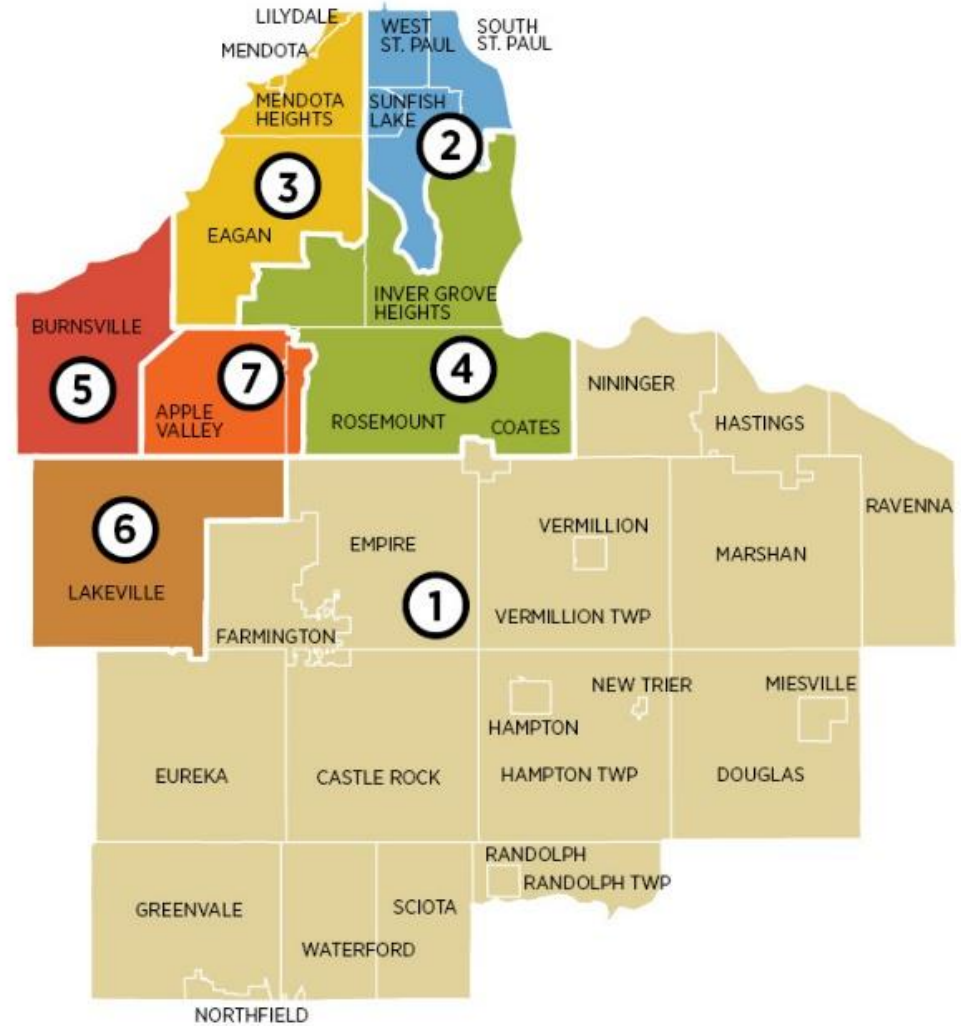
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Abbreviations and Acronyms

AAG	Agricultural Advisory Group
ACRE	Agricultural Chemical Reduction Effort
AMT	Alternative Management Tool
BMP	Best Management Practice
BWSR	Minnesota Board of Water and Soil Resources
DC	Dakota County
DWSMA	Drinking Water Supply Management Area
EORN	Economic Optimum Return to Nitrogen
ESA	Ethanesulfonic acid (herbicide breakdown product)
GPR	MDA Groundwater Protection Rule
GW Plan	2020-2030 Dakota County Groundwater Plan
µg/L	Micrograms per liter, equivalent to parts per billion
mg/L	Milligrams per liter, equivalent to parts per million
MAWQC	Minnesota Agricultural Water Quality Certification
MDA	Minnesota Department of Agriculture
MDH	Minnesota Department of Health
MPCA	Minnesota Pollution Control Agency
MRTN	Maximum Return To Nitrogen
N	Nitrogen (or pounds of active nitrogen available in fertilizer)
NFMP	MDA Nitrogen Fertilizer Management Plan
NO ₃ -N	Nitrate or Nitrate-nitrogen
NRCS	United States Department of Agriculture, Natural Resources Conservation Service
PLSS	Public Land Survey System (township, range, section)
PMP	MDA Pesticide Management Plan
SWCD	Dakota County Soil and Water Conservation District
SWL	Static water level
TAG	Technical Advisory Group
UMN	University of Minnesota
US EPA	United States Environmental Protection Agency
WHPP	Wellhead Protection Plan
WMO	Watershed management organization
WSP	Water Supply Plan
WWTP	Wastewater treatment plant

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Executive Summary

Sufficient high-quality groundwater is critical for Dakota County's future and the health and wellbeing of its residents, businesses, and ecosystems. The 2020-2030 Dakota County Groundwater Plan (Groundwater Plan), adopted in January 2021, identified a wide range of issues related to groundwater quality in both rural and urban areas of the county, from a variety of sources, and described the county's strategies and tactics for addressing those issues.

One of the topics of the Groundwater Plan is agricultural chemicals -- especially nitrate, crop herbicides, and chloride -- which are significant, persistent drinking water issues for much of rural Dakota County. The Groundwater Plan identified reduction of agricultural chemicals (Strategy 1B1) and development of an Agricultural Chemical Reduction Effort (ACRE) Plan (Tactic 1B1B) as a priority.

The goal of the Dakota County Agricultural Chemical Reduction Effort (ACRE) is to reduce agricultural chemicals in groundwater to levels that no longer pose threats to human health or the environment.

A. Plan Purpose

The focus of ACRE is to reduce agricultural related nitrate contamination in groundwater, and address other agricultural contaminants (e.g., pesticides and chlorides) where practical to protect human health and the environment. At the same time, the Minnesota Department of Agriculture (MDA) is working on addressing nitrate in the Hastings Drinking Water Supply Management Area (DWSMA). Dakota County and MDA are working together to coordinate efforts, use resources efficiently, and learn from each other's experiences. ACRE builds on the MDA's implementation of the Nitrogen Fertilizer Management Plan (NFMP) and Groundwater Protection Rule (GPR), but there are several differences to include 1) ACRE Plan's outcome measures are results-based (contaminant reduction) rather than performance-based (practice adoption, the standard for the MDA Groundwater Protection Rule); 2) ACRE includes all of rural Dakota County, not just the Hastings DWSMA; and 3) ACRE considers the health of private drinking water wells, not just public water supply wells. More details are provided in Chapter 2: Planning Overview.

Although the primary focus of ACRE is nitrate, the ACRE strategies will also reduce pesticides and chloride in groundwater, in many cases. In particular, the agricultural practices discussed under Chapter 1, Strategy 4 -- those changes that modify or expand cropping systems, or switch land from annual row crop production to some form of perennial vegetation -- are expected to reduce pesticide and chloride levels in groundwater, in addition to reducing nitrate.

B. Agricultural Chemicals of Concern

Nitrate

In the ACRE Plan, "nitrate" refers to "nitrate nitrogen" or nitrate-N, nitrogen present (in water, for example) in the form of the nitrate ion (NO_3^-). Nitrate-contamination is a well-documented problem in Dakota County drinking water and is the most common contaminant to exceed health guidelines in groundwater in the county. Although low levels of nitrate (zero to 3 milligrams per liter [mg/L]) may occur naturally in water, high levels of nitrate in groundwater usually come from human activities. In the Upper Midwest, the major source is nitrogen fertilizer used on agricultural crops, although septic systems and feedlots are lesser sources.

Although a necessary nutrient for plants, high nitrate levels in people can harm the respiratory and reproductive system, kidney, spleen, and thyroid in children and adults. In particular, consumption of drinking water exceeding the Minnesota Department of Health (MDH) guideline of 10 mg/L nitrate can lead to a health problem called methemoglobinemia or “blue baby syndrome” in infants younger than 6 months. The condition is characterized by a reduced ability of the infant’s blood to deliver oxygen and can lead to death if untreated. Numerous studies suggest that the guideline of 10 mg/L may not be protective of health for people of all ages and it fails to address the chronic, low level exposure of nitrate’s effect on health (Ward et al, 2018).

The City of Hastings had to take multiple actions to maintain safe nitrate levels in their water supply, including a \$3 million nitrate removal system. In addition, 20 to 30 percent of the households in Dakota County that rely on private drinking water wells have well water that exceeds the nitrate health guideline of 10 mg/L. For them, an effective drinking water treatment system may cost \$1,500 to \$4,000 for a professionally installed system, plus ongoing maintenance costs.

The map to the right shows the estimated nitrate levels (NO₃-N) in shallow groundwater throughout the Dakota County, based on private drinking water well sampling results. The darker the red, the higher the estimated concentration of nitrate. As shown, many areas of the county have shallow groundwater nitrate levels that are above the MDH drinking water guideline of 10 mg/L, especially in the south/ southeastern part of the County. ACRE intends to address nitrate contamination to achieve concentrations below 10 mg/L throughout the county.

Although Dakota County has extensive data showing that agricultural fertilizer is the source of the excessive nitrate in its rural areas, septic systems and lawn fertilizer are potential sources as well. The Dakota County 2020-2030 Groundwater Plan, adopted in January 2021, contains tactics to address those sources. The ACRE Plan is specific to agricultural chemicals.

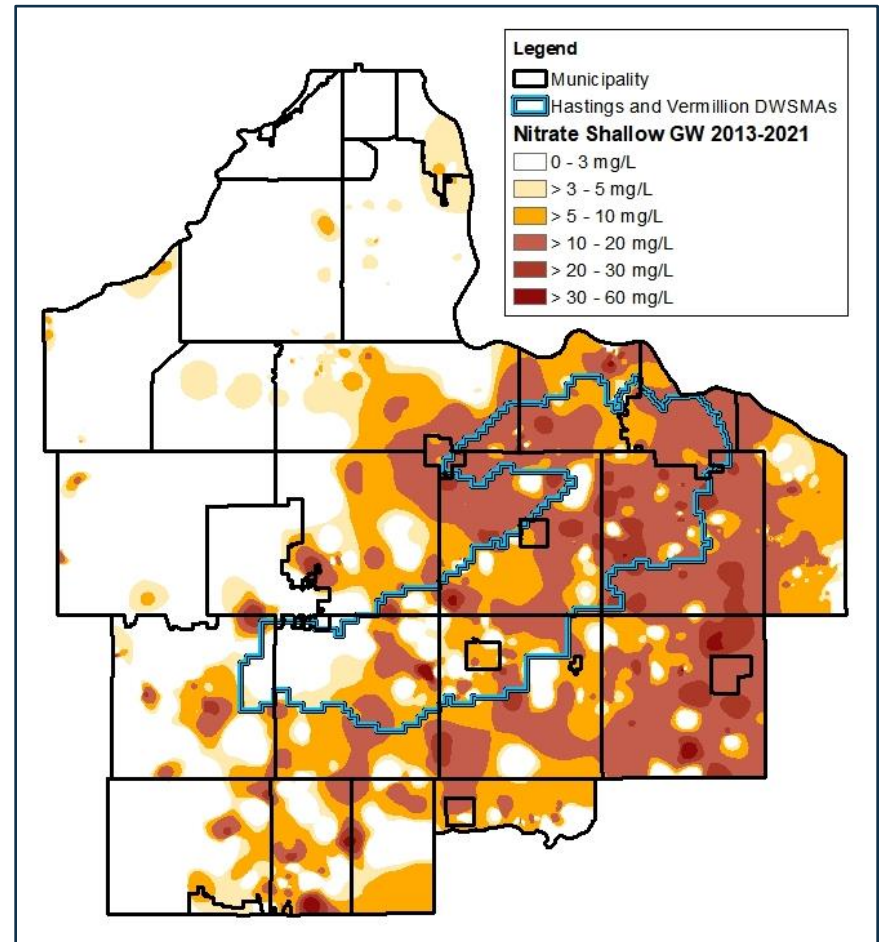


Figure 1. Interpolation of Shallow Groundwater Nitrate Concentrations

Crop Pesticides

Pesticides are a group of chemicals developed and used to kill or control pest species. In addition to the county's nitrate problem, numerous pesticides – specifically, crop herbicides and their breakdown products -- are widely detected in the groundwater in rural parts of the County. Most of the herbicides that have been detected have been at concentrations below health risk standards, but cyanazine and its breakdown products exceeded the MDH drinking water guideline of 1.0 micrograms per liter ($\mu\text{g}/\text{L}$) in 22 percent of the wells sampled in Dakota County.

In drinking water, different pesticides and their breakdown products can be health risks to different endpoints in the human body, at different concentrations. Dakota County's monitoring of pesticides in private wells has focused on herbicides used on crops, for two reasons: 1) the County has monitored for the pesticides that MDA has most commonly detected in its statewide monitoring program, which are crop herbicides, and 2) the County's monitoring program has found the sum total of breakdown products of cyanazine, a crop herbicide no longer in use, persistently above cyanazine's health risk guidance values. The United States Environmental Protection Agency (US EPA) lists cyanazine as "a probable human carcinogen." Because of health concerns, they prohibited its sale after 1999 and prohibited its use after 2002.

Herbicide breakdown products are generally less toxic than their parent compound; however, the health effects of mixtures of pesticides and their breakdown products, such as the County's monitoring has found, have not been evaluated. Some of the most common breakdown products, such as acetochlor ethanesulfonic acid (ESA), alachlor ESA, or metolachlor ESA, have their own health guidance values. When these chemicals are found, they are compared to the breakdown product guideline. For many herbicide breakdown products, such as those of cyanazine, no separate health risk standards have been established. In those cases, based on MDH guidance, the health risk is evaluated by comparing the concentration of the breakdown product(s) to the drinking water standard for the parent compound.

Chloride

Chloride levels in groundwater in the county are increasing (as they are in most metropolitan areas). Potassium chloride (potash) fertilizer contributes about one-fourth of the chloride that makes its way to Minnesota waters. (Winter pavement maintenance and water softeners are the largest sources.) The county will encourage farmers to follow best management practices for potassium fertilizer use, although chloride reduction will be a secondary concern in the ACRE Plan.

At high levels, chloride is a pollutant for both drinking and surface waters. The drinking water guideline for chloride is 250 mg/L; the US EPA does not consider chloride a threat to health, and this a secondary, not health-based guideline for aesthetics. The water will start to taste salty at a level of 250 mg/L. Chloride in surface water can be toxic to fish, aquatic bugs, amphibians, and plants at 230 mg/L. Chloride corrodes road surfaces and bridges and damages reinforcing rods, increasing maintenance and repair costs. Since nearly all surface water features in the county interact with groundwater; pollution of groundwater can degrade surface water quality and pollution of surface water can degrade groundwater quality.

C. Plan Goals, Strategies, and Proposed New Activities

As stated above, the goal of the Dakota County Agricultural Chemical Reduction Effort (ACRE) is to reduce agricultural chemicals in groundwater to levels that no longer pose threats to human health or the environment.

County staff and their consultant, Environmental Initiative, used a variety of approaches to engage with the agricultural community and other stakeholders to develop, consider, and refine the ACRE Plan's strategies and tactics. This included consulting with farmers, farm advisors, other rural residents, state and

regional agencies, municipal water suppliers, township representatives, watershed management organizations, and non-governmental organizations. County staff used this process to 1) listen, 2) add and test ideas, and 3) refine plan actions.

Utilizing stakeholder engagement feedback (Appendix G) and technical research findings (Appendix E), the County developed four strategies focused on enhanced information-gathering, education and outreach, technical assistance, and financial incentives. Many of the tactics are continuations or expansions of existing county or SWCD activities. The strategies and proposed new activities are listed below.

Table 1. ACRE Plan Strategies and Proposed New County Activities

Strategy	Proposed New Activities
Strategy 1: Collect Information for Decision Making	<ul style="list-style-type: none"> • Develop and update a Dakota County groundwater nitrate model to evaluate scenarios for different patterns of agricultural practice adoption.
Strategy 2: Communicate and Educate	<ul style="list-style-type: none"> • Create a permanent Agricultural Advisory Group. • Advocate for agricultural water quality practices with service providers such as agronomists, co-ops, retailers, irrigation installers and associations, other ag advisors, and lenders. • Advocate for improved internet access throughout rural Dakota County. • Provide in-person updates, news items, and helpful information to townships and cities on a regular basis.
Strategy 3: Provide Technical Assistance	<ul style="list-style-type: none"> • Partner with UMN Extension to conduct large-scale plant tissue nitrogen testing projects. • Explore ways to assist landlords and renters implement water quality practices on rented farmland. • Assist beginning and “emerging” farmers to access resources. • Educate farmers about potassium fertilizer Best Management Practices.
Strategy 4: Provide Financial Incentives	<ul style="list-style-type: none"> • Provide ongoing incentives to farmers for <u>maintaining</u> water quality practices. • Provide one-time or ongoing incentives to farmers for completing the MN Agricultural Water Quality Certification. • Partner with the State of Minnesota, UMN Forever Green Initiative, or other organizations to explore price support or other guaranteed-financial-return programs.

Chapter 1. Goal, Strategies, and Outcome Measures

A. Plan Terminology

The Dakota County ACRE Plan follows the same terminology and outline as the 2020-2030 Groundwater Plan. “Goals” refer to the County’s aspirations for its desired future condition. “Outcome measures” are measurable benchmarks toward achieving the goals. “Strategies” are an organized framework of activities to achieve those benchmarks. “Tactics” are the intended activities to implement the strategies.

County Roles in Implementation: Levels of Control and Commitment

For each strategy and tactic described in this Plan, the County has indicated its intended role in the implementation. From left to right/bottom to top, these roles reflect increasing levels of control and commitment on the County’s part:

- **Studying, researching** – monitoring and collecting and analyzing data for informed decision-making
- **Advocating** – encouraging other levels of government to make changes
- **Educating** – encouraging behavioral changes through education and outreach
- **Partnering, facilitating, or demonstrating** – working with other agencies, local governments, non-governmental organizations, land owners, and other residents
- **Funding or operating** – creating changes by directly funding or operating activities, where authority to regulate does not exist or is not desired
- **Regulating** – requiring or forbidding certain activities, where legal authority exists and regulation is desired

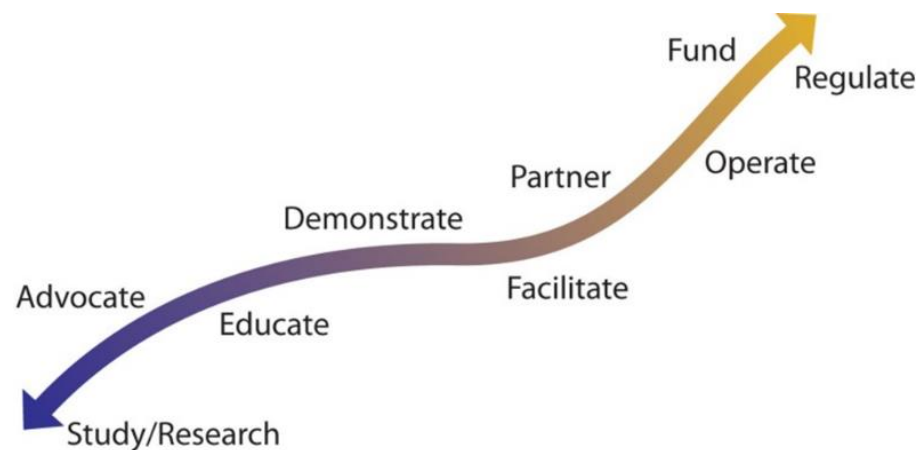


Figure 2. Levels of County Roles in Implementation

Plan Principles

The ACRE Plan builds upon the 2020-2030 Dakota County Groundwater Plan, which reflects the following principles.

1. Use financial and human resources prudently; leverage non-County funding to the extent possible.
2. Ensure services and events are accessible, equitable, inclusive, convenient, and practical.
3. Provide people who live or work in the county with opportunities to create and implement solutions.
4. Promote behavior change, such as water conservation and pollution prevention, through policies, programs, regulations, and incentives.
5. Lead by example.
6. Use science to support policy and action: support decisions with appropriate, representative groundwater data that are accessible to stakeholders.
7. Communicate information about issues, services, and events using plain language and multiple channels and formats.

In addition to these, the ACRE Plan principles include:

8. Be efficient: ensure policies, services, and programs are complementary to MDA and other state or federal programs, where practical.
9. Facilitate, demonstrate, and fund voluntary practices first.
10. Consider regulatory requirements only if voluntary approaches produce insufficient improvements in groundwater conditions after a reasonable amount of time.

B. Goal

The Groundwater Plan identifies:

Goal 1: Water Quality – Groundwater and drinking water are free from unhealthy levels of contamination

Strategy 1B1: Reduce agricultural chemical contamination

Tactic 1B1B: In consultation with farmers, the SWCD, UMN, State agencies, and nongovernmental organizations, develop, adopt, and implement a Dakota County Groundwater Agricultural Chemical Reduction Effort (ACRE) with prioritized, targeted, and measurable strategies that are more protective of the health of private drinking water wells than the objectives of the MDA Nitrogen Fertilizer Management Plan and Groundwater Protection Rule.

ACRE GOAL: The goal of the Dakota County Agricultural Chemical Reduction Effort (ACRE) is to reduce agricultural chemicals in groundwater to levels that no longer pose threats to human health or the environment.

Outcome Measures

Quantitative Measures

Implementation of the Plan will be successful when the following quantitative outcome measures are achieved:

1. In every Dakota County city and township, **five percent or fewer of the households that use private drinking water wells exceed the drinking water guideline for nitrate-N (10 mg/L)**. (A community with fewer than five percent of its private drinking water wells exceeding the drinking water guideline is considered in “Prevention” status in the MDA NFMP. See Appendix C.)
2. No public water supply well will exceed the nitrate drinking water guideline (10 mg/L) or be projected to exceed it in the next 10 years.
3. In every township or city (or smallest practical geographic area, down to the Public Land Survey System (PLSS) quarter section), the median nitrate levels in shallow groundwater (less than 20 feet below the static water level) will be lower than be 10 mg/L.
4. No household with private drinking water wells will have **pesticide (or pesticide breakdown product)** concentrations that exceed 50 percent of applicable drinking water guidelines. The target level is set at 50 percent because of the uncertainties associated with the toxicity of herbicide mixtures.
5. Contributions of **chloride** to groundwater from crop fertilizer will decrease in comparison to current baseline conditions (see Chapter 3).

County staff do not expect these outcome measures to be achieved within a 10 year timeframe, but do expect that measurable progress can be made towards these outcomes. Current baseline conditions for the above quantitative measures are provided in Chapter 3: Background Information.

Qualitative Measures

In addition to the quantitative objectives outlined above, the ACRE Plan includes the following desired future conditions.

1. **Human Health Perspective:** Private well owners are knowledgeable about their well and water quality, have their wells tested at appropriate intervals, and understand and implement drinking water treatment systems as needed.
2. **Social and Economic Perspective:**
 - Local farmers cooperate with the county, SWCD, and state and federal agencies to implement practices that can be expected to reduce or eliminate agricultural chemicals reaching the groundwater.
 - Farmers who live or work in Dakota County have opportunities to thrive and enjoy a high lifelong quality of life while protecting the environment for future generations.
 - People who live or work in Dakota County are knowledgeable about agricultural practices as they relate to water issues and knowledgeable about household practices to conserve water and prevent pollution.
3. **Environmental Perspective:**
 - Agricultural chemicals and irrigation are used efficiently, reduce the risk of groundwater contamination, and maintain sustainable groundwater quantities.
 - Soils are preserved and sustain plant and animal productivity; enhance biodiversity; maintain and enhance water quality and quantity; support human health; and sequester carbon. (Based on Wikipedia definition of “soil health.”)

C. ACRE Strategies, Tactics, and Implementation

Proposed new activities are highlighted in green.

As described in the Executive Summary, the ACRE program will work primarily to reduce agricultural related nitrate contamination in groundwater, and address other agricultural contaminants (e.g., pesticides and chlorides) where practical, to protect human health and the environment.

The purpose of ACRE's strategies, tactics, and implementation framework is to guide Dakota County and its partners for the next 10 years. The framework identifies **prioritized, targeted, and measurable** activities necessary to achieve the identified the ACRE Plan Goal.

Priorities indicate the relative importance and precedence of a proposed activity – the timeframe in which the county or SWCD will carry out a tactic. Initial priorities (High, Medium, Low) were established for each tactic based on stakeholder engagement feedback and Agricultural Advisory Group guidance. This will help guide Dakota County on which strategies and tactics should be given resource prioritization.

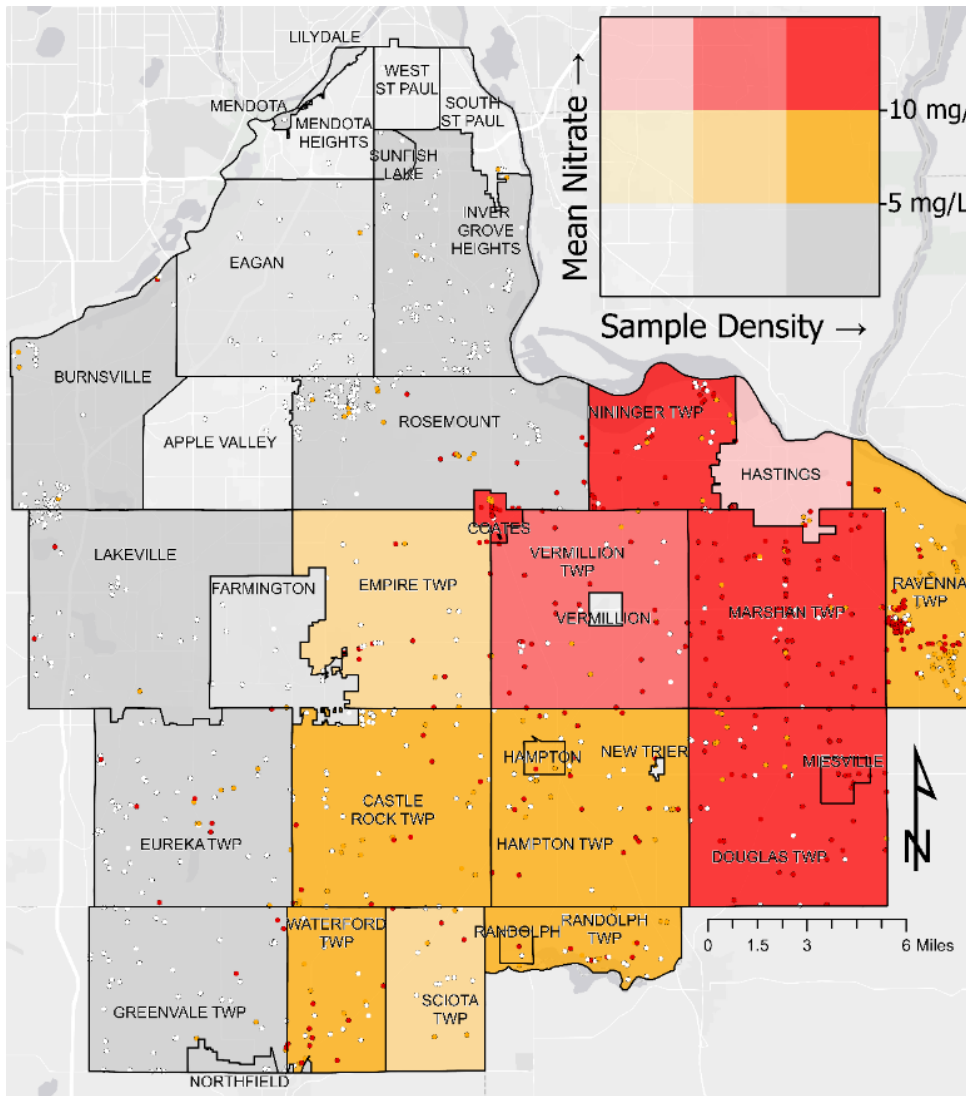
The target is identified as the area, audience, or activity the tactic will address. The geographic target areas for nearly all the tactics will be the same: activities will be prioritized in the order of highest to lowest shallow groundwater nitrate concentration areas. Figure 3 below, showing the geographic target areas on a township basis, represents current mean shallow groundwater nitrate area conditions. Geographic target areas may shift over time.

The current groundwater quality differences between these areas largely reflect the underlying soils and geology, which make much of eastern Dakota County highly vulnerable to groundwater contamination. The top 10 inches of soil have a major influence on the quality and quantity of water leaving a field, through surface runoff, interflow (subsurface horizontal movement), and deep percolation below the root zone. Soil type (texture) influences infiltration, water holding capacity, water flow, biological activity, organic matter (humus), tillage, and compaction. Sandier soils such as those in eastern Dakota County allow for increased water and chemical movement into groundwater, while clayey soils such as those in the western county have less infiltration of both water and agricultural chemicals.

The target audiences are described in the Tables below. Annual measures are identified for each tactic to help quantify success. In addition, implementation timeframes and partners were identified for each tactic. Implementation timeframes estimate the start and end date of each tactic. Several tactics identified as “*Ongoing*” are activities that are expected to last throughout the duration of the Plan; in most cases, these are activities the County or its partners are already doing. Those tactics identified as “*Opportunity-based*” are activities that are not necessarily dependent upon other activities, and don't have a required start or end date; instead they will be implemented based on funding or availability of resources. There are also several tactics identified as “*Optional*” under Strategy 4, these activities are to be considered in limited, high priority areas if current financial incentives and cost-share programs appear to be insufficient to achieve adoption rate goals after a couple of years of implementation.

The Dakota County SWCD is not listed as a separate partner in the following Implementation Tables. The ACRE Plan was developed in close collaboration with the SWCD. Tactics identified in the Tables below may be led by either Dakota County Staff or SWCD Staff. In general, Dakota County will lead tactics related to groundwater and private well monitoring, nitrate modeling, and evaluation and communication of results; development of new policy and programs; and assistance with funding for local programs. Dakota County SWCD is a trusted resource for the agricultural community, therefore, SWCD will lead tactics that involve interactions with local farmers and the agricultural community and industry; providing technical assistance; and managing financial incentives through existing programs, or newly created programs with assistance from the County.

The framework and timelines below provide an overall direction and expectation; however, **individual implementation and prioritization of strategies and tactics are subject to County Board approval during the annual budgeting and the Department work planning processes.**



The Shallow Groundwater Nitrate Concentration Map shown here, was created using an interpolation of 1,071 nitrate samples collected from 2013 through early 2021. All sample results are from private wells with static water levels of 0 to 20 feet below the water table, or for which there were no well records and were presumed to be shallow. For assessment and monitoring purposes, “shallow groundwater” is defined as 20 feet deeper than the water table or less. The focus on “shallow groundwater” is because that is the groundwater where changes in practices on the land surface will become evident in the shortest amount of time, if the changes are effective.

The interpolation (shown in Figure 1 in the Executive Summary.) was then converted to mean nitrate concentration estimates for each township and city in its entirety. The color-coded municipalities are symbolized depending on their mean nitrate value:

- Shades of grey: mean nitrate below 5 mg/L
- Shades of orange: mean nitrate between 5 and 10 mg/L
- Shades of red: mean nitrate above drinking water standard; above 10 mg/L

The darker the color, the more sample results were available for that community and therefore the higher the confidence in the estimate.

Figure 3. Shallow Groundwater Nitrate-N Concentrations/Sample Density

Strategy 1: Collect Information for Decision Making

Strategy: Conduct monitoring, modeling, and information collection

Summary

Develop, implement, and continuously improve the ACRE program by monitoring and modeling groundwater quality to inform private well owners of the health of their drinking water; inform farmers and other stakeholders about groundwater conditions; and inform County decision-makers about program effectiveness.

On an ongoing basis, collect and evaluate information about program participation, practice adoption, practices being implemented, nitrogen and pesticide usage information, costs and effectiveness of practices, programs being implemented in other locations, etc.

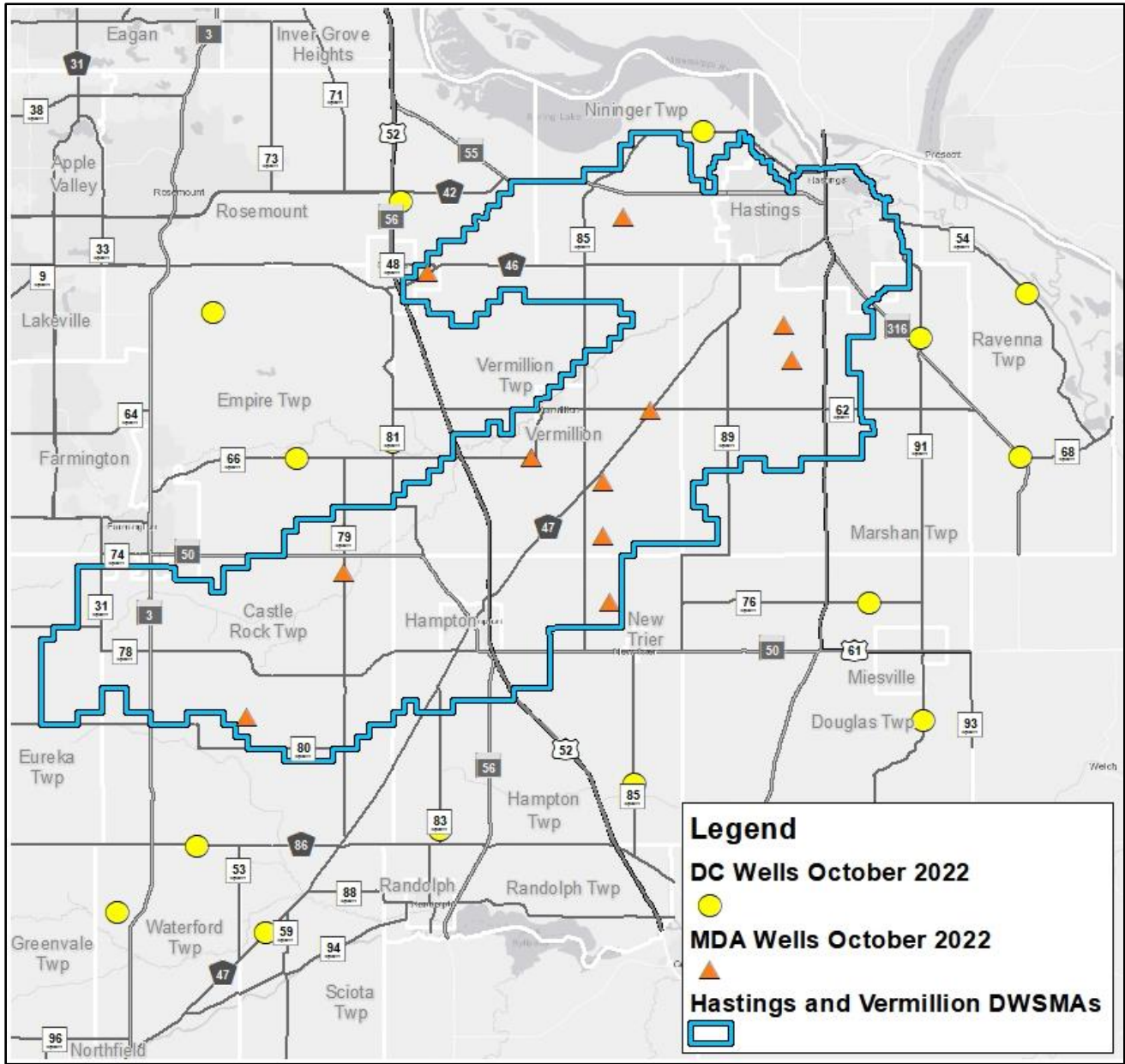
Notable Components

MDA/Dakota County Environmental Well Network

The County will use the results from an environmental well network and its private well sampling programs to evaluate trends in nitrate, chloride, and when practical, pesticides in groundwater and drinking water to evaluate progress in the ACRE program. As of 2022, MDA and the County are in the process of installing and sampling a network of environmental wells in high nitrate areas. The purpose of the environmental well network is to quantify the baseline nitrate conditions at the water table in the vulnerable areas of the County, interpret the results in terms of nitrogen losses per acre, then monitor changes in those conditions over time. Changes in farming practices and water quality trends should be detectable in the shallow groundwater first. MDA's wells are within the Hastings DWSMA and Dakota County's wells are outside of the Hastings DWSMA.

MDA installed seven environmental wells in 2021 and six additional wells in 2022. MDA created initial well locations using a randomized grid, then adjusted the locations based on practical site accessibility for the drill rigs. The wells are located within public rights-of-way to avoid potential issues with private landowners.

Dakota County installed 15 environmental wells in 2021 and 2022. County staff used MDA's method for selecting well locations. Additional wells may be installed in future years, depending on the availability of funding. The map below shows the wells installed as of October, 2022. The wells will be sampled at least three times per year (spring, summer, and fall) for nitrate (NO₃-N), chloride, and other parameters as considered useful; static water levels will be measured each time samples are collected. Digital nitrate sensors may be used in some or all of the wells in the future if funding is available. Precipitation data for eastern Dakota County will be measured at the MDA weather station in Marshan Township.



Environmental Well Installation, Hampton Township, January 2022

Figure 4. Dakota County/MDA Environmental Wells Installed as of October 2022

Community Focused Sampling Program

In addition to the shallow environmental well network, the County is implementing a Community Focused Sampling Program. On a five-year rotation, the County is offering every household that uses a private drinking water well the opportunity to have their well tested, at no cost to the household, for contaminants such as nitrate, arsenic, manganese, lead, and chloride. Shallow groundwater monitoring and private well testing results will help evaluate progress towards achieving the desired Outcome Measures.

Nitrogen Loss Modeling

As part of development of the ACRE Plan, Dakota County hired Barr Engineering to develop a groundwater nitrate model to evaluate nitrogen loss from cropland to groundwater throughout rural Dakota County. The intent of the model is to identify the nitrogen-load reductions necessary at the local level to achieve groundwater nitrate concentrations below 10 mg/L. Additional information regarding the model is included in Appendix F. A **new High-Priority tactic** is to update the nitrate model periodically using the data from the environmental well network and private well monitoring results, as well as other available information, and run model scenarios to identify priority areas and types of agricultural practices that will maximize nitrate reduction.

Data collection methods, results, and modeling will be coordinated and shared with MDA, other interested agencies, and the general public. Additional implementation information for Strategy 1 tactics are provided in the table below.

Tactics that are new activities are highlighted in green.

Tactics

Table 2. Strategy 1 Tactics

ACRE Plan ID (Priority) Related GW Plan Tactic	Tactic (Role)	Target Audience	Timeframe	Partners	Annual Measures
ACRE 1A (High) GW Plan Principle 6	Collect and evaluate information on what practices are being implemented and maintained in Dakota County, crops, fertilizer and pesticide usage, livestock, yields, etc. Develop estimates (on a township/city basis) of existing acreages of specific farming practices and wetlands, estimates of potential for improvement, and 10-year objectives for improvement. (Research)	Agricultural community and other stakeholders.	2023-24 with periodic updates	Ag industry/ organizations MDA UMN	<ul style="list-style-type: none">• Type and quantity of information collected• # of participants

ACRE Plan ID (Priority) Related GW Plan Tactic	Tactic (Role)	Target Audience	Timeframe	Partners	Annual Measures
ACRE 1B (High) 1B1D	Expand environmental well network, the installation of which began in 2021. Conduct environmental well nitrate and chloride sampling three times per year and evaluate results. As funding allows, expand to 3-5 wells per high-nitrate township/city and add automated samplers. (Research)	Agricultural community and other stakeholders.	2021- Ongoing (Annually)	MDA MDH DNR Cities/ Townships	<ul style="list-style-type: none"> • # of environmental wells established • # of wells actively monitored • Observed nitrate reduction through sampling
ACRE 1C (High) 1A3E	Conduct annual Community Focused Sampling Program and evaluate and communicate results to well owners and other ACRE stakeholders. (Operate)	All Dakota County private well owners	Ongoing (Annually)	MDA MDH Cities/ Townships	<ul style="list-style-type: none"> • # of private wells tests provided • # of residents that participated (response rate # of chemicals tested)
ACRE 1D (High) 1D1A	Periodically conduct and update nitrate modeling (nitrogen losses from fields to groundwater). Coordinate modeling efforts with MDA to avoid duplication of effort and maximize usefulness of county nitrate model. (Research/Partner)	Agricultural community and other stakeholders.	2022 -Ongoing (Every 2-3 years)	MDA MDH	Nitrate model updated
ACRE 1E (High) 1D1A	Based on nitrate modeling outputs and other available information, develop scenarios for different patterns of practice adoption across the county and use the scenarios to prioritize cost-share funding. (Operate)	Agricultural community and other stakeholders.	2022 – Ongoing (Every 2-3 years)	MDA	<ul style="list-style-type: none"> • # of scenarios developed • Identification of practice adoption needs
ACRE 1F (High) 1A3H (verbatim)	To the extent appropriate and possible, collect demographic data to evaluate if water quality problems disproportionately impact specific populations and to address those inequities. (Research)	Underrepresented populations	Ongoing (Annually)	Public Health	<ul style="list-style-type: none"> • # data collected and analyzed • # of trends identified • Actions taken to address inequities

ACRE Plan ID (Priority) Related GW Plan Tactic	Tactic (Role)	Target Audience	Timeframe	Partners	Annual Measures
ACRE 1G (Medium) 1A3E	Periodically conduct pesticide (and pesticide breakdown product) sampling of private drinking water wells and environmental well network; evaluate results for trends and potential health risks. (Operate)	Private well owners in high nitrate area, with additional targeting based on pesticide results; rural community	Opportunity-based	MDA MDH	<ul style="list-style-type: none"> • # of private wells tested • # chemicals tested • Observed trends
ACRE 1H (Medium) GW Plan Principle 6	Collect and evaluate information on an ongoing basis on advances in agricultural water quality programs and practices from Minnesota and other states, such as cover crops; soil health initiatives; forages and small grains; new crops and markets; precision agriculture; nutrient and irrigation management; and costs, effectiveness, and adoption rates of practices. (Research)	Agricultural community and other stakeholders.	Ongoing (Periodically)	Ag industry/ organizations MDA UMN	<ul style="list-style-type: none"> • # programs evaluated • Updates to water quality programs

Strategy 2: Communicate and Educate

Strategy: Raise public awareness, promote practices to improve water quality, and raise awareness of educational and cost-share opportunities

Summary

Provide farmers and other rural residents with useful and timely information regarding groundwater conditions, practices to improve water quality, and funding opportunities.

Notable Components

Dakota County and SWCD will increase efforts to ensure rural residents, farmers, and the agricultural community receive sufficient information regarding County and SWCD programs, as well as federal, state, and other local programs. This includes providing updates on the ACRE Plan and progress towards achieving the Outcome Measures identified in Chapter 1; ensuring broad dissemination of program opportunities through multiple different formats - in-person, mail, and email were identified as preferred communication methods; developing an Agricultural Advisory Group to continue to advise County and SWCD staff on Plan implementation; and partnering with organizations to host field days and other educational opportunities. The County will continue to test different communication methods and resources such as township newsletters, expos, and other events, and use trusted advisors such as co-ops to share messages to determine what methods are the most successful.

To ensure the rural community has equal access to information, a **new High-Priority tactic** is the County will advocate for improved internet access throughout rural Dakota County. Figure 5 below shows that much of rural Dakota County is an underserved area for Broadband, making it difficult to receive fast and reliable internet access. Additional implementation information for Strategy 2 tactics are provided in the table below.

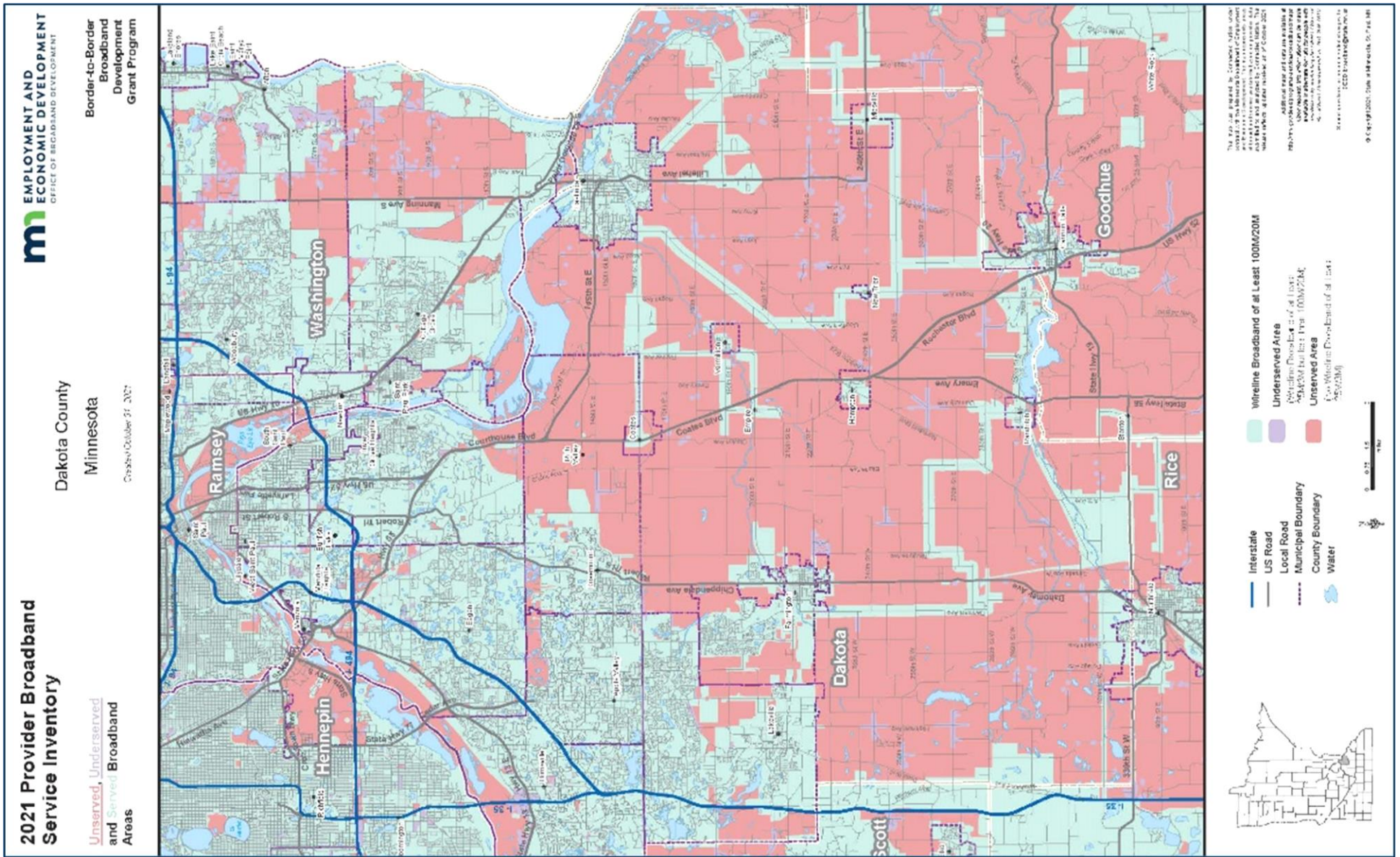


Figure 5. Dakota County Broad Band Service Inventory

Tactics

Table 3. Strategy 2 Tactics

ACRE Plan ID (Priority) Related GW Plan Tactic	Tactic (Role)	Target Audience	Timeframe	Partners	Annual Measures
ACRE 2A (High) 3B1A	Create and distribute annual ACRE update (or updates) to farmers and rural residents with prior year’s activities; latest nitrate, chloride, and other groundwater conditions; public and household health implications; desired outcomes; and opportunities for education, technical assistance, or financial incentives. (Educate)	All Dakota County farmers and rural resident	Expand: 2023 Ongoing (Annually)	MDA UMN	<ul style="list-style-type: none"> • # of residents reached • # of outreach efforts or events
ACRE 2B (High) 1B1A	Promote participation in USDA-NRCS Conservation Stewardship Program (CSP), Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), Reinvest in Minnesota (RIM) and other federal and state incentive programs. (Educate)	Agricultural community	Ongoing	MDA NRCS UMN	<ul style="list-style-type: none"> • # of residents reached • # of outreach efforts or events
ACRE 2C (High) GW Plan Principle 7	Distribute information and training through a variety of channels, including in-person and virtual meetings and programs, printed materials, the county and SWCD websites, YouTube, and social media. (Educate)	All Dakota County Agricultural Community and private well owners.	Ongoing (Annually)	MDA UMN Cities/ Townships	<ul style="list-style-type: none"> • # of training provided • # of types of training provided • # of different media avenues utilized
ACRE 2D (High) GW Plan Principle 2	Advocate for improved internet access throughout rural Dakota County to facilitate outreach. (Advocate)	Residents in underserved Broadband area per Figure 5.	2023 – Ongoing (Annually)	Cities/ Townships	<ul style="list-style-type: none"> • On legislative platform • Miles of broadband added

ACRE Plan ID (Priority) Related GW Plan Tactic	Tactic (Role)	Target Audience	Timeframe	Partners	Annual Measures
ACRE 2E (Medium) 1B1B	Create a permanent Agricultural Advisory Group to help maintain transparency and communication in the ACRE Plan implementation; meet with them at least once a year to evaluate what's working, what's not, new opportunities. (Facilitate)	Agricultural community and other stakeholders.	2023 – Ongoing (Annually)	Farmers Ag industry/ organizations	<ul style="list-style-type: none"> • # of advisory members • Diversity of advisory member
ACRE 2F (Medium) 3B1E	Provide in-person updates, news items, and helpful information to townships and cities on a regular basis. Encourage them to include ACRE information and links on their websites and in their newsletters. (Educate)	Dakota County rural cities and townships	2023 – Ongoing (Annually)	Cities/ Townships	<ul style="list-style-type: none"> • # of cities/ townships engaged • # of information pieces shared by cities/townships
ACRE 2G (Medium) 3B1A	Advocate for agricultural water quality practices with service providers such as agronomists, co-ops, retailers, irrigation installers and associations, other ag advisors, and lenders to gain their support and assistance for farmers implementing the practices. (Advocate)	Dakota County ag. service providers (agronomist, co-ops, retailers, and advisors)	2023 – Ongoing (Annually)	MDA Ag. industry/ organizations	<ul style="list-style-type: none"> • # of service providers contacted • # of service providers who agree to promote water quality practices
ACRE 2H (Low) 1A3G	Conduct outreach to private well owners by holding free nitrate testing clinics, in cooperation with MDA. (Educate)	Private well owners in high nitrate area	Ongoing (Periodically)	MDA	<ul style="list-style-type: none"> • # of clinics held • # of participants
ACRE 2I (Low) 1B1A	Work with MDA, UMN Extension, USDA-NRCS, Mn Agricultural Water Resources Center, and others to host field days and demonstration projects. (Partner)	Agricultural community	Ongoing (Periodically)	MDA NRCS UMN	<ul style="list-style-type: none"> • # of outreach/ demo projects • # of attendees/ participants • # of types of projects
ACRE 2J (Low) 3A1A	If cooperators give permission, post signage next to roads to identify water quality demonstration projects, research sites, and test plots. (Partner)	Agricultural community	Opportunity-based	MDA NRCS UMN	<ul style="list-style-type: none"> • # of signage • # of participants • # of types of projects

ACRE Plan ID (Priority) Related GW Plan Tactic	Tactic (Role)	Target Audience	Timeframe	Partners	Annual Measures
ACRE 2K (Low) 4A	Evaluate opportunities to leverage the programs, policies, and regulations of other agencies and organizations to improve water quality. (Partner)	Agricultural community	Ongoing	State agencies and NGOs	<ul style="list-style-type: none"> • # opportunities identified • # of partnerships

Strategy 3: Provide Technical Assistance

Strategy: Provide hands-on assistance with implementing practices.

Summary

Provide farmers with hands-on technical assistance regarding practices to improve water quality, related funding opportunities, and implementation advice.

Notable Components

The County and SWCD will increase efforts to provide one-on-one technical assistance, this includes partnering with other organizations such as UMN Extension, MDA, and USDA-NRCS to bring different program assistance directly to the farmer. The technical assistance tactics focus on helping farmers understand their farm’s current conditions (i.e., nutrient and irrigation needs); identifying conservation practices that are economically viable for each individual farm and operation; and helping the farmer adopt and implement conservation practices which may include cost-share incentives (further discussed in Strategy 4).

Concern was raised during stakeholder engagement meetings that “absentee landlords” are more focused on short-term financial gains rather than long term viability of the land. Based on survey results and national averages, 30 to 40 percent of farmland in Dakota County may be rented from non-operator landlords or landlords who are not involved in farming, of which about 15 percent of landowners do not live in Dakota County. The amount of farmland owned by absentee landlords may be increasing. Therefore, a **new High-Priority tactic** is focused on exploring ways to encourage landlords and renters to implement water quality conservation practices.

The County and SWCD’s technical assistance is available county-wide, but groundwater improvement efforts may be prioritized based on the location’s estimated nitrate levels per Figure 3, or updated results from the County and MDA environmental well network and the County’s Community Focused Sampling Program. Additional implementation information for Strategy 3 tactics are provided in the table below.

Tactics

Table 4. Strategy 3 Tactics

ACRE Plan ID (Priority) Related GW Plan Tactic	Tactic (Role)	Target Audience	Timeframe	Partners	Annual Measures
ACRE 3A (High) 1B1A	Partner with UMN Extension, MDA, USDA-NRCS, Minnesota Rural Water Association, Mn Agricultural Water Resources Center, or others to provide nutrient management education or certification for farmers. Provide technical assistance to farmers for completing nutrient management or irrigation management plans. (Partner/ Educate)	Agricultural community	Ongoing (Annually)	MDA NRCS MRWA MAWRC UMN	<ul style="list-style-type: none"> • # of farmers reached • #, acres covered, and types of plans completed • Lbs. of nitrogen input reduced
ACRE 3B (High) 1B1A	Expand availability and awareness of one-on-one technical assistance from SWCD, UMN Extension, consultants, or others for water quality improvement practices. (Educate)	Agricultural community	Expand: 2023 Ongoing (Annually)	MDA NRCS UMN	<ul style="list-style-type: none"> • # of farmers engaged • #, acres, and type of BMP/AMT implemented
ACRE 3C (High) 3B1H	Customize technical information for different farm operations and demographics. (Educate)	Agricultural community	Ongoing (Annually)	MDA NRCS UMN	<ul style="list-style-type: none"> • # of education information pieces developed • # of languages, formats, demographics reached
ACRE 3D (High) 1B1C	Explore ways to assist landlords and renters in implementing water quality practices on rented farmland. (Educate)	Agricultural and rural community	2024 – Ongoing (Periodically)	MDA UMN Cities/ Townships	<ul style="list-style-type: none"> • # and type of programs developed • # of landlords and renters engaged
ACRE 3E (Medium) 1B1A	Host UMN Extension Nitrogen Smart and other training programs. (Partner)	All Dakota County Agricultural Community	Ongoing (Periodically)	MDA UMN	<ul style="list-style-type: none"> • # and type of training provided • # of participants
ACRE 3F (Medium) 1B1F	Partner with UMN Extension to conduct large-scale plant tissue nitrogen testing projects to improve usefulness of tissue testing to inform fertilizer use. (Partner)	All Dakota County Agricultural Community	2024 – Ongoing (Periodically)	MDA UMN	<ul style="list-style-type: none"> • # of projects supported • # of participants at events

ACRE Plan ID (Priority) Related GW Plan Tactic	Tactic (Role)	Target Audience	Timeframe	Partners	Annual Measures
ACRE 3G (Low) 1B4B	Educate farmers about potassium fertilizer BMPs. (Educate)	All Dakota County Agricultural Community	2023 – Ongoing (Periodically)	MDA UMN	<ul style="list-style-type: none"> • # of education events • # of participants
ACRE 3H (Low) GW Plan Principle 2	Assist beginning and “emerging” farmers who live or farm in Dakota County in accessing resources to implement agricultural water quality practices. (Educate)	All Dakota County Agricultural Community	Ongoing; expansion would be opportunity- based	MDA UMN	<ul style="list-style-type: none"> • # and type of programs developed • # of languages, formats, demographics reached

Strategy 4: Provide Financial Incentives

Strategy: Provide funding and other incentives to farmers and other rural residents for practices or equipment to improve groundwater quality or provide safe drinking water.

Summary

The County and SWCD will partner with state funding agencies, such as MDA or the Minnesota Board of Water and Source Resources (BWSR), and with watershed and other organizations to promote and fund voluntary best management practices (BMPs) and alternative management tools (AMTs), based on the geographic target areas discussed in above. Activities required under the Groundwater Protection Rule may be ineligible for Clean Water Fund grants.

Notable Components

Agricultural Practices

The County will work with SWCD, MDA, and UMN staff to identify appropriate and cost-effective BMPs and AMTs for local conditions. Practices on agricultural lands that protect groundwater quality can be divided into practices that are part of conventional (annual row-crop) cropping systems, practices that modify or expand cropping systems, and practices that take land out of agricultural production. The Minnesota Board of Water and Soil Resources describes these as Tier I, Tier II, and Tier III practices, respectively. (http://bwsr.state.mn.us/sites/default/files/2021-03/GW%20Protection%20Guide_accessible.pdf, BWSR Groundwater/Drinking Water Protection Practices for Agricultural Lands, April 2021)

Tier I – Cropping Practices with Known Groundwater Benefits. These include management practices that provide measurable benefits within conventional cropping systems that have high potential for nutrient and pesticide leaching, such as continuous corn and/or irrigation.

Tier I Examples

- Follow recommended “4Rs” of nutrient management – right nutrient source, right rate, right time, right place
- Use nitrogen fertilizer inhibitors or stabilizers
- Take soil tests for nutrients
- Test irrigation water for nitrate (NO₃-N) and take N credits
- Take plant tissue tests for N
- Make variable rate fertilizer applications
- Use Integrated Pest Management
- Use irrigation water management (follow an irrigation water management plan, use moisture sensors to schedule irrigation, use variable rate irrigation, other)

Tier II – Cropping System Changes. These practices modify or change management of conventional summer annual crops to include longer crop rotations with small grains or perennials, forage and biomass planting, cover crops, and grazing practices that utilize forage crops. Because the return on these practices is more uncertain, higher incentives – and longer contracts with farmers – may be necessary.

In the ACRE Plan, the term “perennials” refer to the following:

- land enrolled in the Conservation Reserve Program or Conservation Reserve Enhancement Program;
- prairie restorations;
- grass hay, alfalfa, or pasture;
- Kernza™ or other perennial crops;
- other vegetation where the root structure is left in place all year round.

Cover crops are plants seeded into agricultural fields, either within or outside of the regular cash crop growing season. Cover crops are used to slow erosion, prevent nutrient losses, improve soil health, enhance water availability, smother weeds, help control pests and diseases, increase biodiversity, and bring other benefits to cropland (Sustainable Agriculture Research and Education). In regard to nitrate, cover crops can help retain nitrogen in fields, rather than allowing the nitrogen to be converted to nitrate and leach into the groundwater. The cover crop will use whatever nitrogen is still available from the fertilizer applied for the current growing season, plus the nitrogen that continues to mineralize via soil organic matter. That nitrogen will be protected from leaching and denitrification losses.

Farmers have many choices among cover crops, depending on their priorities for the planting, the cash crop that preceded the cover crop, and the crop to be planted after the cover crop. The most common cover crops in Dakota County are Winter Cereal Rye, oats, or an oat and radish mix (Dakota SWCD staff). Dakota County SWCD staff or UMN Extension Educators can assist farmers with selecting an appropriate cover crop for their farm.

Tier II Examples

- Plant cover crops for seasonal vegetative cover, including harvestable cover crops
- Use conservation crop rotation (planned succession of crops on the same field, including at least one low nitrogen input crop or two or more years of hay in a five-year rotation).

- Grow specialty crops/ market gardening/ high tunnel systems
- Plant perennial crops
- Use prescribed grazing
- Grow fruit or nut trees or nursery stock (agroforestry), including silvopasture (combining tree crops with grazing)

Tier III – Land Use Changes. These practices take land out of agricultural production, transitioning to land retirement or non-agricultural land uses. Land may be converted to wildlife habitat, wetlands, protected open space, or other land uses, under several federal, state, or county easement programs; or to energy development or to limited urban development combined with open space.

Tier III Examples

- Convert land permanently from an intensive cropping system to perennial native or non-native vegetation. (For example, Dakota County Natural Areas Land Conservation Program)
- Convert land temporarily (multiple years) from an intensive cropping system to perennial native or non-native vegetation. (For example, Reinvest in Minnesota, Conservation Reserve Program, etc.)
- Preserve or restore wetlands in agricultural areas
- Install solar farm with pollinator habitat/ perennials/ grazing

For some practices, the Minnesota Pollution Control Agency (MPCA) and UMN have estimated how much the practice improves nitrogen losses to surface water adjacent to the acres where the practice is being implemented (MPCA, 2013). To some extent, these surface water estimates can also be used to estimate how much the practice will benefit groundwater and the cost-effectiveness of different practices. Practices will be updated as new information is available, and practices will be prioritized according to their estimated benefit to groundwater.

Table 5. Agricultural Practices Estimated Nitrogen Loss and Interim Adoption Rates

Practice Tier (BWSR)	Agricultural Practice	Estimated Nitrogen Loss Improvement*	Current Estimated Adoption Rates**	Interim Adoption Rate Goals	NRCS Practice Number, if applicable
Tier I	Nutrient Plan Development and Implementation (e.g., follow recommended “4Rs” of nutrient management – right nutrient source, right rate, right time, right place)	15%	< 1%	25%	157 & 590
Tier I	Use nitrogen fertilizer inhibitors or stabilizers	9%	51%	75%	-
Tier I	Irrigation Water Management Plan and Implementation	60%	2%	20% of farmers with irrigation	590 & 163
Tier II	Plant cover crops for seasonal vegetative cover, including harvestable cover crops	50%	4-5%	10-40% See detail by city/township in below table	340
Tier II	Plant perennial crops	72%-95%	1%	1-8% See detail by city/township in below table	512
Tier III	Convert land permanently from an intensive cropping system to perennial native or non-native vegetation. (For example, Dakota County Natural Areas Land Conservation Program)	95%	Combined with temporary retirement, below	Combined with temporary retirement, below	327 or 342
Tier III	Convert land temporarily (multiple years) from an intensive cropping system to perennial native or non-native vegetation. (For example, Reinvest in Minnesota, Conservation Reserve Program, etc.)	95%	< 0.1%	1%	327
Tier III	Preserve or restore wetlands in agricultural areas	50%	< 0.2%	-	-

*Estimates are based on surface water adjacent to acres where practice is implemented, MPCA

**Rates are calculated based on 227,081 acres of farmland in Dakota County

The groundwater nitrate model developed in conjunction with the ACRE Plan evaluated nitrate loss to the shallow groundwater based on current groundwater concentrations, agricultural practices, and soil and land-use conditions. Nitrate leaching rates were based on MDA’s modeling for areas of the Hastings’ DWSMA. The nitrate model simulated three modeling scenarios to evaluate the net effect of nitrate leaching rates, and associated changes in groundwater nitrate concentrations, from increased adoption of cover crops and conversion of cultivated cropland to perennials. The scenarios included cropping systems with continuous corn or a corn-soybean rotation in both irrigated and non-irrigated settings, then modeled changes to nitrate losses based on increased cover crops

and increased perennial plantings. In the model, alfalfa is used as the example for perennials, so it is a stand-in for alfalfa, switch grass, other hay, perennial crops such as Kernza™, or native vegetation. The models are much-simplified versions of farming in the county, where there are many other cropping combinations and, as described above, many options for improving groundwater quality. Nitrate model results are further discussed on Appendix F.

Interim adoption rate goals for each city and township are listed below based on initial scenario results and other metrics, including the percentage of households with nitrate in their well water above 10 mg/L, median nitrate concentrations, and estimated acres of farmland with shallow nitrate above 10 mg/L. Initial results indicate that the maximum adoption rate scenarios may not be sufficient to achieve median nitrate levels below 10 mg/L in some townships or cities; and there were several data gaps identified that are needed to develop a more accurate model. The nitrate model will be updated periodically as part of Strategy 1 (Tactic 1D), and interim adoption rate goals will be evaluated and updated as necessary to achieve the outcome measures.

Table 6. Interim Cover Crop and Perennial Adoption Rate Goals by Township or City

**The term “perennial” is used broadly here to include alfalfa, switch grass, other hay, Kernza™, native vegetation, or other perennial vegetation.*

Township/City	Cover Crop Adoption Rate Goal	Perennial Adoption Rate Goal*
CASTLE ROCK TWP	20%	5%
COATES	40%	8%
DOUGLAS TWP, MIESVILLE	40%	8%
EMPIRE TWP	40%	5%
EUREKA TWP	10%	1%
FARMINGTON	10%	1%
GREENVALE TWP	10%	1%
HAMPTON, HAMPTON TWP, NEW TRIER	40%	5%
HASTINGS	40%	8%
MARSHAN TWP	40%	8%
NININGER TWP	40%	5%
RANDOLPH, RANDOLPH TWP	20%	5%
RAVENNA TWP	40%	5%
ROSEMOUNT	20%	5%
SCIOTA TWP	20%	5%
VERMILLION, VERMILLION TWP	40%	8%
WATERFORD TWP	20%	5%

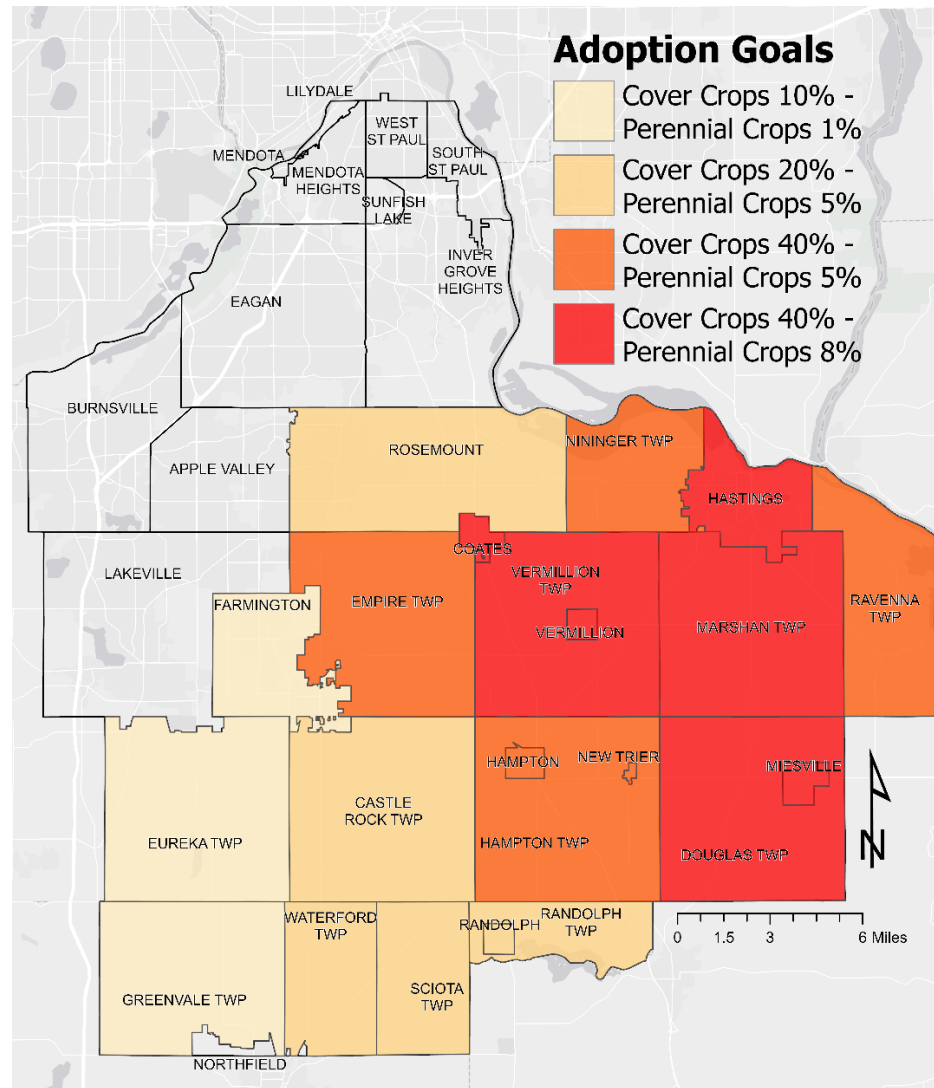


Figure 6: Interim Cover Crop and Perennial Adoption Rate Goals

Currently, both state and local policies are to provide cost-share funding for no more than three years for the adoption of water quality improvement practices that are new for a particular piece of land. The three year period is often sufficient to defray the cost of installing and implementing the new practice and to enable the operator to gain experience with the practice and see its benefits on their land. However, some practices, such as cover crops, may benefit from longer financial incentive periods to get past a trial-and-error period and get buy-in from farmers.

New “optional” tactics in the ACRE Plan are to provide incentives for maintaining water quality practices. This is to recognize and reward ongoing good practices and address the perception that “a farmer has to be doing the wrong thing to get paid to do the right thing.” The intent is to allow for a broad range of possibilities dependent upon identified need and County and/or SWCD Board approval. Incentives could range from providing payments to all farmers implementing practices to extending cost-share projects for additional time to allow for risk reduction. Other new activities include potentially removing the limits on the number of acres for cost-share incentives for new or maintained water quality practices and linking incentives to either completing the Minnesota Agricultural Water Quality Certification (MAWQC) process or to achieving and maintaining a minimum MAWQC score for their operations that are in Dakota County. However, these tactics will only be implemented if current cost-share programs are unsuccessful, since the end goal is for farmers to realize benefits of the practices and buy-in to long-term implementation without incentives.

Agriculture in Dakota County is some of the most irrigation-dependent farming in Minnesota, and crop irrigation coincides with the high nitrate areas of the county, as shown in Figure 7. Good irrigation management can help reduce nitrogen losses while using water efficiently. In addition to the BMPs and AMTs identified by MDA, the County and SWCD will advocate and facilitate farmers’ testing irrigation well water samples for nitrate and taking appropriate nitrogen credits; maintaining records of nitrogen use, including rates, credits, sources, timing, and placement; implementing irrigation and nutrient management plans; and attending annual continuing education programs. The County may subsidize nitrate testing of irrigation well water by farmers.

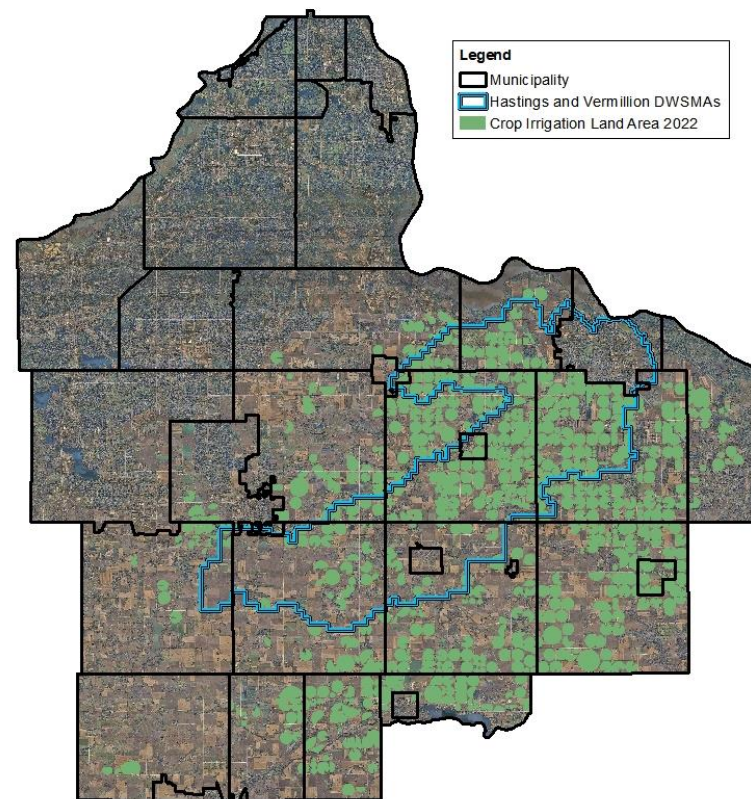


Figure 7. Area of Irrigated Cropland

Tactics

Table 7. Strategy 4 Tactics

ACRE Plan ID (Priority) Related GW Plan Tactic	Tactic (Role)	Target Audience	Timeframe	Partners	Annual Measures
ACRE 4A (High) GW Plan Principle 1	Seek State or other sources of funding for agricultural water quality cost-share programs. (Advocate)	State, regional, and federal granting agencies	Ongoing (Annually)	WMOs Cities/ Townships	<ul style="list-style-type: none"> • # of grants applied • #, \$, and types of grants received
ACRE 4B (High) 1B1C	Provide cost-share payments through SWCD for <u>new</u> adoptions of water quality practices (for 3 years or less), including but not limited to practices that improve soil health, prioritized on location, cost-effectiveness, and other factors. (Fund)	Agricultural community	Ongoing (Annually)	WMOs MDA	<ul style="list-style-type: none"> • #, \$, type of cost-share funding provided • # of programs • # of participants • # of acres • lbs. of nitrogen input reduced
ACRE 4C (High) 1B1C	Provide incentives to farmers for completing nutrient management or irrigation management plans. (Fund)	Agricultural community	Ongoing (Annually)	WMOs	<ul style="list-style-type: none"> • # and \$ of funding provided • #, acres covered, and types of plans completed • lbs. of nitrogen reduced
ACRE 4D (High*) 2B2C (verbatim)	Develop, monitor, protect, restore, and manage wetlands for water retention and habitat. (Includes wetland restoration initiatives like Wetland Banking) (Fund)	Landowners with wetlands or hydric soils/potential wetlands	Opportunity-based	WMOs Cities/ Townships	<ul style="list-style-type: none"> • Acres of wetland restored • Gallons of water stored on-land • Lbs. of sediments, nutrients, or chemicals (e.g., nitrate) reduced

ACRE Plan ID (Priority) Related GW Plan Tactic	Tactic (Role)	Target Audience	Timeframe	Partners	Annual Measures
ACRE 4E Medium 1B1E (verbatim)	Partner with SWCD to facilitate, promote, and potentially provide cost-share funding for irrigation practices and technologies that reduce groundwater contamination and conserve water. (Fund)	Agricultural community	Ongoing (Annually)	MDA UMN WMO Ag industry/ organizations NRCS	<ul style="list-style-type: none"> • # of projects implemented • Gallons of water saved • Reduction in nitrogen fertilizer or pesticide loading
ACRE 4F (Medium) 1B1C	Provide one-time incentives to farmers for completing the MN Agricultural Water Quality Certification process for their Dakota County operations. (Fund)	Agricultural community located in high nitrate areas per Figure 3	Optional - For consideration if current cost-share programs (ACRE 4B) are not sufficient to meet adoption rate goals	WMOs MDA	<ul style="list-style-type: none"> • # and \$ funding provided • # of certifications completed
ACRE 4G (Medium) 1B1C	Provide incentives to farmers for <u>maintaining</u> water quality practices (e.g., beyond 3-year limited terms), including but not limited to practices that improve soil health prioritized on location, cost-effectiveness, and other factors. (Fund)	Agricultural community located in high nitrate areas per Figure 3	Optional - For consideration if current cost-share programs (ACRE 4B) are not sufficient to meet adoption rate goals	WMOs Cities/ Townships	<ul style="list-style-type: none"> • #, \$, type of funding provided • # of programs • # of participants • # of acres • lbs. of nitrogen input reduced
ACRE 4H (Medium) 1B1C	Provide ongoing incentives (longer than 3 years) to farmers for completing the MN Agricultural Water Quality Certification process and achieving and maintaining a score of 8.5 or higher for their Dakota County operations. (Fund)	Agricultural community located in high nitrate areas per Figure 3	Optional - For consideration if current cost-share programs (ACRE 4B) are not sufficient to meet adoption rate goals	WMOs MDA	<ul style="list-style-type: none"> • # and \$ funding provided • # of certification process completed with qualifying score

ACRE Plan ID (Priority) Related GW Plan Tactic	Tactic (Role)	Target Audience	Timeframe	Partners	Annual Measures
ACRE 4I (Medium) 1B1G (verbatim)	Leverage County Land Conservation, State, and federal funds and County and SWCD staff expertise to acquire easements on private lands that promote practices that improve water quality. (Fund)	Landowners in rural Dakota County	Opportunity-based	WMOs Cities/ Townships	<ul style="list-style-type: none"> • # of easements • Acres converted to easements • Lbs. of chemicals (e.g. nitrate) reduced
ACRE 4J Low 1B1C	Partner with the State of Minnesota, UMN “Forever Green” initiative, or other organizations to explore price support or other guaranteed-financial-return programs for growing oats, wheat, barley, alfalfa, and other low-chemical-input or perennial crops. (Advocate/ Partner/ Fund)	Agricultural community	Opportunity-based	WMOs MDA UMN	<ul style="list-style-type: none"> • # of initiatives explored • # of programs developed

*The county, SWCD, and other partners are implementing wetland conservation and banking outside the scope of the ACRE Plan, due to the multiple water quality and habitat benefits associated with wetland restoration and management.

Potential Future Strategies

The information gathered through Strategy 1 will be evaluated yearly. Tactics and priorities will be refined and adjusted as conditions and opportunities change.

Explore Regulatory Options If Needed

The ACRE Plan is designed to support and reward voluntary activities to improve groundwater quality and only consider regulatory measures if groundwater fails to improve in a reasonable number of years. MDA and the County will continue to measure changes in water quality through the MDA/Dakota County environmental well network monitoring results, Community Focused Sampling Program results, and MDH public water supply monitoring results. If, after at least five years (five complete growing seasons, or sufficient time to identify statistically significant trends, whichever is longer), groundwater nitrate conditions show a stable or upward trend (by township or city), County staff may recommend to the County Board ordinance amendments that require agricultural practices to reduce nitrate contamination.

In this context, "stable" means that no statistically significant upward or downward change over time beyond the normal range of variation can be determined. Also, it should be understood that this refers to groundwater that is not improving toward the ACRE Plan's quantitative outcome measures (p. 7), not groundwater that already meets those criteria.

In addition to the various sources of groundwater monitoring information described above, ACRE Tactic 1A calls for collecting and evaluating information on what agricultural practices are being implemented and maintained in the county. Staff will use the preponderance of the evidence before recommending any regulation.

Examples of practices that might be required in specific areas of the County are described below:

- Require periodic testing and reporting of soil nutrients
- Require periodic testing and reporting of nutrients in irrigation water (where applicable).
- Require development and implementation of nutrient management plans.
- Require maintaining and reporting annually on nitrogen fertilizer use, including rates, credits, sources, timing, and placement.
- Require periodic education and certification on fertilizer practices.
- Require development and implementation of irrigation management plans (where applicable).
- Require planting of cover crops following short season crops.
- other requirements to be considered.

Evidence is growing that farms that adopt practices to improve water quality (such as participating in the Minnesota Agricultural Water Quality Certification program) are more profitable than farms that do not (Minnesota State, 2022). That said, any requirements imposed by the county would respect that farming requires economic sustainability to support and maintain environmental sustainability.

In addition, it is likely that such requirements would be imposed by the county on a township by township basis, as needed based on groundwater-based criteria, rather than county-wide. Also, any proposed ordinance language implementing potential restrictions described above would also include steps for lifting restrictions.

D. Funding and Resources

In accordance with Plan Principle No. 1, the County will leverage non-county funding to the extent possible for implementation of the ACRE Plan. The implementation framework was developed with the purpose to allow flexibility in executing the different tactics, and to provide options based on success of the programs and budget availability. Those tactics identified as *Opportunity-based* would only be implemented if funding and staff were available.

There are several grant opportunities through state, federal, and local agencies, plus non-profit organizations, focused on environmental protection and water quality improvement, as discussed in the Groundwater Plan (Chapter 2(G), page 58). There are also state and federal financial incentive programs specifically geared towards reduction of agricultural contaminants and are already administered under current SWCD cost-share incentive programs (examples provided in Table 8). It is estimated that upwards of \$730,000 a year may be available through these programs to implement agricultural practice cost-share, education, and outreach activities. Additional information on current cost-share programs are provided in Appendix B.

Several tactics developed based on feedback from stakeholder engagement meetings and discussions with the Ag Advisory Group, are currently not eligible for external grant dollars. These tactics under Strategy 4 are identified as *Optional*, and could be implemented in limited, high-priority areas if current financial incentive programs are determined to be insufficient to meet adoption rate goals. Financial incentives not currently covered by federal or state programs would

need to be funded by the County, SWCD, or other partners contingent upon funding availability and local Board approval. Annual costs will be dependent on the specific tactics implemented, ***new programs will be subject to County Board approval, budgets will be amended through the annual budgeting and Department work planning process as needed.***

Table 8. Federal and State Grant and Loan Programs

Program	Agency
Environmental Quality Incentives Program (EQIP)	USDA – Natural Resources Conservation Service
Conservation Stewardship Program (CSP)	USDA – Natural Resources Conservation Service
Conservation Reserve Program (CRP)	USDA – Natural Resources Conservation Service
AgBMP Loan Program	Minnesota Department of Agriculture
Minnesota Agricultural Water Quality Certification Program (MAWQCP)	Minnesota Department of Agriculture
Conservation Reserve Enhancement Program (CREP)	Minnesota Board of Water and Soil Resources
Reinvest in Minnesota (RIM)	Minnesota Board of Water and Soil Resources
Clean Water Fund (CWF) - Competitive Grants or Watershed Based Implementation Funding	Minnesota Board of Water and Soil Resources
Source Water Protection Grants	Minnesota Department of Health
Wellhead Protection Partner Grants	Minnesota Board of Water and Soil Resources
Groundwater Protection Initiative	Minnesota Department of Health
Outdoor Heritage Fund	Lessard-Sams Outdoor Heritage Council (Minnesota Legislature)

Chapter 2. Planning Overview

A. Plan Period

The ACRE Plan was developed using the 2020-2030 Dakota County Groundwater Plan as the foundation. The ACRE Plan is designed to complement the Groundwater Plan, and for activities to occur simultaneously. The County intends to review the ACRE Plan every five years and will revise the Plan as necessary to achieve the Outcome Measures identified in Chapter 1. Staff do not expect the Quantitative Outcome Measures of the Plan to be achieved within a 10-year period but do anticipate measurable improvements in groundwater quality trends during that time. The County may propose amendments to the Plan at any time to ensure alignment with the Groundwater Plan, address changed groundwater conditions, respond to evaluation results (e.g., success or failure) of proposed strategies and tactics, or other possible circumstances.

B. Planning Process

The ACRE Plan was developed with local, regional, and state stakeholder feedback. Before final adoption by the County Board, the County submitted the draft Plan for a 45-day public review period from July 20 to September 6, 2022. The draft ACRE Plan was posted online during the review period and submitted to the Metropolitan Council, the state review agencies (MDH, MDA, DNR, BWSR), the Dakota County Soil and Water Conservation District, cities, townships, and watershed organizations. Extensive electronic communications through social media, news releases, and emails to partners; stakeholders; state; regional; and local agencies and officials; and others to include agricultural and farm service agencies were undertaken for ACRE Plan distribution. During the public review period, there was a display at the Dakota County Fair encouraging comments (August 8-14, 2022); staff offered a Lunch & Learn opportunity with co-ops, agronomist, and other agricultural industries (July 26, 2022); conducted a Zoom Information Webinar for the general public (August 4, 2022); and presented information at 13 Dakota County Township Board Meetings from July to September 2022. A summary of all public review period comments and responses are provided in Appendix H.

Plan Comparison to the MDA Groundwater Protection Rule

To a great extent, the ACRE Plan is based on pertinent elements of [MDA 2015 NFMP](#) and [2019 Groundwater Protection Rule \(GPR\)](#), such as using results from Township Testing-style private well testing plus public water supplier well testing results to establish nitrate mitigation levels at the township/city level; promoting BMPs and AMTs; and using environmental well networks and private well results to monitor water quality over time. However, the outcome measures for the ACRE Plan will be results-based (contaminant reduction) rather than performance-based (BMP adoption, the standard for the MDA Groundwater Protection Rule).

The Groundwater Protection Rule does have gaps that make it likely it will be insufficient to achieve Dakota County's nitrate goals and the ACRE Plan is intended to address those gaps.

Table 9: Differences between ACRE Plan and MDA Nitrogen Fertilizer Management Plan and Groundwater Protection Rule

MDA Nitrogen Fertilizer Management Plan and Groundwater Protection Rule Implementation	Dakota County ACRE Plan
MDA program in Dakota County only addresses the Hastings Drinking Water Supply Management Area (DWSMA).	ACRE Plan applies to all high nitrate areas of the county.
MDA Groundwater Protection Rule only addresses nitrate levels in public water supply wells.	ACRE Plan addresses private and public water supply wells.
High nitrate areas outside of the Hastings DWSMA will not have MDA groundwater monitoring.	Dakota County environmental wells are installed in high nitrate areas of the county outside of the Hastings DWSMA to complement MDA’s monitoring network.
Nitrate levels are not required to improve, just not to get worse.	ACRE Plan outcome measures are based on improving nitrate levels in private water supply wells and environmental well network to specific levels that protect human health.
The MDA Groundwater Protection Rule bans fall application of commercial nitrogen fertilizer in most of Dakota County, but enforcement would only be done on a complaint basis.	ACRE Plan does not include enforcement of any specific farming practice. The ACRE Plan is outcome-based; in other words, any future regulation would be based on groundwater quality results, not on the adoption of particular practices.
<p>MDA program is essentially practice-based. In other words, MDA will specify cropping practices (Best Management Practices, or BMPs) within the Hastings DWSMA, then, after at least three growing seasons, determine if those practices have been implemented on at least 80% of the crop acres in the DWSMA. If not, MDA may impose regulations on farmers in the DWSMA. This approach locks the MDA and farmers within the DWSMA into practices where the water quality benefits at field scale may be currently unquantified. In addition, the criteria by which MDA will evaluate BMP adoption are not yet identified.</p> <p>The Groundwater Protection Rule does contain results-based elements by 1) moving a DWSMA from mitigation level 2 to a mitigation level 3 if the statistical analysis of the nitrate-nitrogen concentration is increasing for the public well or groundwater monitoring network; OR 2) moving a mitigation level 2 DWSMA to mitigation level 1 if the statistical analysis of the nitrate-nitrogen concentration in the public well is not projected to exceed the health risk limit of 10 mg/L in ten years and the groundwater nitrate-nitrogen concentration has been below 8.0 mg/L for ten years. These two results-based factors are evaluated separately from BMP adoption, although the two evaluations can occur in tandem.</p>	<p>As mentioned above, ACRE Plan does not include enforcement of any specific farming practice.</p>

The ACRE Plan focuses on nitrate reduction in groundwater but addresses other contaminants where practical, as described below.

- Nitrate is the focus of the MDA’s Groundwater Protection Rule and NMFP, ACRE builds on the activities of MDA and MDH to address nitrate in groundwater.
- Many practices discussed under Strategy 4 in Chapter 1 that will reduce nitrate contamination of groundwater will also reduce other agricultural contaminants. In Dakota County, the presence and concentrations of pesticides in groundwater are highly correlated to the presence and concentrations of nitrate in groundwater; however, nitrate water testing (monitoring) is inexpensive and uncomplicated compared to pesticide monitoring.
- The County currently has the authority to regulate nitrogen fertilizer practices if needed, but is precluded from regulating phosphorus fertilizer or pesticides.

Stakeholder Engagement

Stakeholder support and participation in recommended actions will ultimately determine this Plan’s success in remediating groundwater contamination. Broad engagement of the agricultural community was essential, while recognizing the diversity of farm types, farm operators, and farm-related businesses in Dakota County. A thorough and thoughtful stakeholder engagement approach was used to 1) listen, 2) test ideas, and 3) refine plan actions.

The first engagement round (summer-fall, 2021) sought input on:

- Preferences for a range of best practices and incentive programs
- General approaches the county could take to reduce the agricultural contaminants
- Priorities
- Trusted information sources and preferred communication methods
- New ideas for addressing contaminants

A set of draft strategies emerged from a combination of the first-round engagement findings and research on practices and programs.

The second engagement round (winter-spring, 2022) tested support for the draft strategies and refined them based on the comments that were received. Further refinement of strategies will occur with review of the draft plan.

Engagement Methods:

- **Public webpage** with project and contact information.
- **Public surveys** mailed to County residents with at least two acres of non-urban land.
Round One and two: Survey sent to 3,200 landowners.
- **Technical Advisory Group**, representing state and regional agencies with expertise in groundwater issues. The group met once during each engagement round.
- **Agricultural Advisory Group**, including large and small farm and nursery operators, agribusiness, and agricultural researchers. The group met three times during the first engagement round and once during the second engagement round.

- **Town Hall Meetings** for members of the public. Held once during each round of engagement.
- **Public Sector Meetings** for elected officials. Held once during each round of engagement.
- **Township Board Presentations** at regularly scheduled meetings, upon request. Presentations were made at four townships during the first round of engagement.
- **Watershed Management Organization** presentation during the first round of engagement
- **Dakota County Planning Commission** presentations during the beginning of the planning process and after the initial round of stakeholder engagement.
- **Dakota County Fair Intercepts, 2021.** An interactive board was on display in the Natural Resources Building over the course of the Fair during the first engagement round.
- **Interviews** with the Hmong American Farmers Association, Southeast Minnesota Irrigators Association, and the University of Minnesota Extension Service took place during the second engagement round.

General promotion of public events and the survey occurred through the County webpage, social media, and targeted mailings. Detailed findings from engagement efforts are provided in Appendix G, Stakeholder Engagement Findings.

Chapter 3. Background Information

For additional information about contaminants in Dakota County groundwater, from agriculture and other sources, refer to the [2020-2030 Dakota County Groundwater Plan, Ambient Groundwater Quality Study Final Report](#) (Ambient Study), [Groundwater Quality Research Summaries](#), and [Community Focused Sampling](#) annual reports, on the Dakota County website. These documents include the sources, frequency and level of detection in private and public wells, and trends for a variety of contaminants.

A. Nitrate

The Ambient Study identified that nitrate is the most commonly detected anthropogenic contaminant exceeding the drinking water guideline in the county, and upwards of 30 percent of wells exceeded the drinking water guideline of 10 mg/L at least once over the 20-year study. Results from the MDA Township Testing Program (2013-2015) and Dakota County Community Focused Sampling Program (2019-2021) indicate that 17 cities/townships have 10 percent or more of the wells exceeding the guideline of 10 mg/L, one township was between 5 percent and 9.9 percent of wells exceeding the guideline, and four cities/townships had less than 5 percent of wells exceeding the guideline (Table 13).

Sources of Nitrogen in Minnesota Water Resources

As part of Minnesota’s Nutrient Reduction Strategy, the MPCA and University of Minnesota have calculated the relative contributions of various sources of nitrogen to surface waters in the state. This incorporates the sources to groundwater (which ultimately discharges to surface water). (MPCA, Nutrient Reduction Strategy, 2014). As of 2021, a comparable “nitrogen budget” is not available for groundwater itself. The table below describes each nutrient source and its average contribution to surface waters in Minnesota.

Table 10: Sources of Nitrogen in the Mississippi River basin in Minnesota (Minnesota Pollution Control Agency, Minnesota Nutrient Reduction Strategy, 2014)

Nutrient Source Average Contribution to Surface Waters*	Percentage from Source
Agricultural tile drainage	43%
Cropland leaching into groundwater	31%
NPDES permitted wastewater discharges (Wastewater Treatment Plant, WWTP)	9%
Atmospheric deposition	6%
Cropland surface runoff	5%
Forest runoff	4%
Individual sewage treatment (septic) systems	2%
Urban runoff and leaching	1%

*Total is greater than 100% due to rounding.

Fertilizer Practices as of 2017

The most recent information about fertilizer usage in the county is from 2017, when the MDA conducted in-person, on-site interviews with all of the fertilizer dealerships and a fertilizer distributor that serve Castle Rock, Douglas, Empire, Hampton, Marshan, Nininger, Ravenna, and Vermillion Townships in Dakota County. The total sample population (number of farmers) in all eight townships was 279. A total of 129,000 acres of crops were reported for those farmers. (Because of duplicates, the interview acres could be greater than the actual crop acres.) (Complete results are in the MDA Report, “2017 Dakota County Fertilizer Dealership Interview Results, January 2018.”)

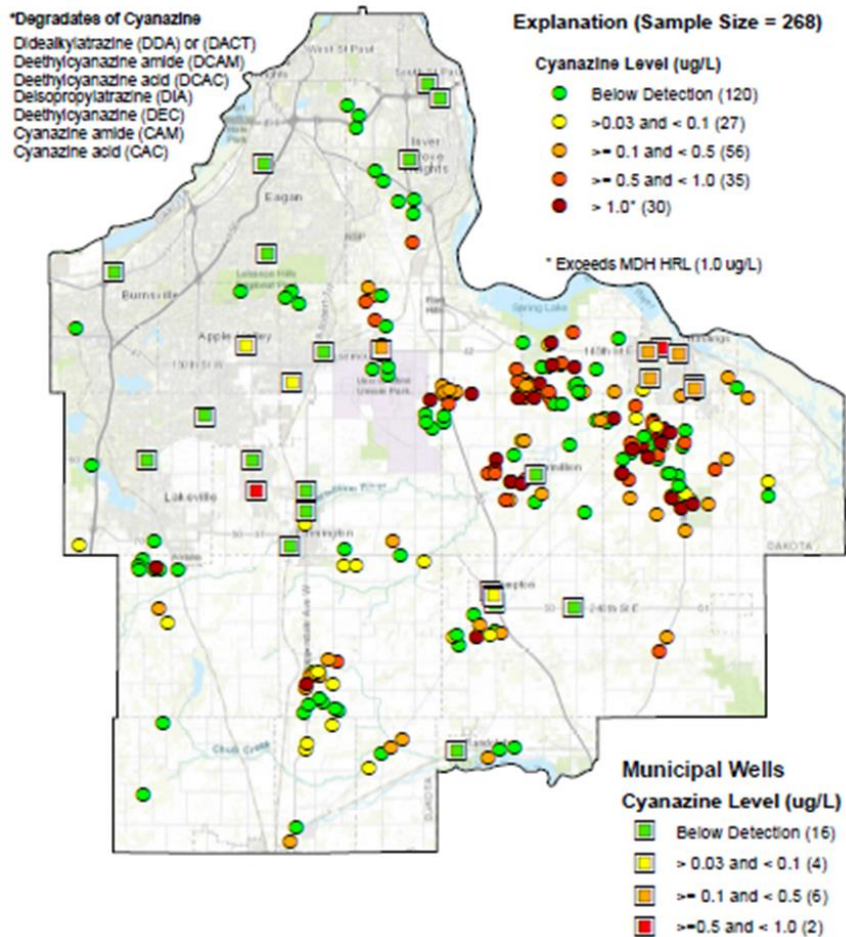
The six dealerships provided nitrogen fertilizer rates typically applied to a variety of crops; the combined results are shown in the table below.

Table 11. 2017 Dakota County Fertilizer Rates (Minnesota Department of Agriculture Report, “2017 Dakota County Fertilizer Dealership Interview Results, January 2018.”)

Cropping Scenario	Minimum N Rate (lbs/ac)	Maximum N Rate (lbs/ac)	Average N Rate (lbs/ac)
Dryland corn following soybeans	80-125	140-175	130-140
Irrigated corn following soybeans	100-150	150-220	145-220
Dryland corn following corn	140-170	180-220	160-180
Irrigated corn following corn	150-180	200-244	180-190
Dryland corn following alfalfa	40-110	100-150	80-120
Irrigated corn following alfalfa	60-110	100-150	80-120
Irrigated potatoes	240	250	245

Fifty-five percent of the nitrogen was applied in the spring, preplanting; five percent was applied in the fall; five percent at planting, and 35 percent post emergence. Spring preplant application (91 percent of farmers) and incorporation (90 percent) were common practices. Fifty-one percent of farmers reported using a nitrogen inhibitor or stabilizer.

B. Pesticides (Total Cyanazine)



From 2001 through 2019, as part of the county's Ambient Study, the county had 77 private wells, selected to be representative of drinking water conditions county-wide, sampled and analyzed for pesticides repeatedly, in addition to other potential drinking water contaminants. The pesticide results from the Ambient Study were:

- Most of the herbicides were detected at low levels, with the exception of cyanazine breakdown products
- Herbicides compounds were detected in 57 of the 77 wells sampled (73 percent).
- 51 different herbicides or herbicide breakdown products were detected out of the 72 analytes.
- As many as 25 different pesticide compounds were detected in a single well.
- The number of herbicide compounds, the frequency of occurrence and concentrations of herbicides detected is correlated with nitrate levels and the percent of row crop agriculture adjacent to sampled wells.
- Based on the frequency of detection, the most commonly detected herbicides were:
 - alachlor and alachlor breakdown products (71 percent);
 - metolachlor and metolachlor breakdown products (65 percent);
 - atrazine and atrazine breakdown products (64 percent);
 - cyanazine breakdown products (64 percent);
 - acetochlor breakdown products (56 percent).
- Of the 16 most frequently detected herbicide compounds in the study, atrazine, introduced in 1957, is the only parent compound.
- The most commonly detected herbicide compound was alachlor ESA (73 percent) followed by metolachlor ESA (66 percent).

Dakota County’s extensive sampling for crop herbicides and herbicide breakdown products through its Ambient Study has documented the environmental fate of common herbicides in groundwater in the county over **time**, but is not necessarily **geographically** representative. In particular, the extent and concentrations of cyanazine breakdown products in private well water are not yet comprehensively understood. To date, cyanazine has been found above the drinking water guideline of 1 µg/L in 11 townships (Table 13). In late summer 2022, the MDA will be sampling private wells in Dakota County for the herbicides cyanazine, and atrazine, and related chemicals. When the results of the 2022 sampling are available, the information about cyanazine in private wells may be quite different from what is currently shown in Table 13 below.

In addition, if feasible, the County’s rotating private well sampling program will be expanded to include cyanazine breakdown products and other frequently detected pesticides and pesticide breakdown products, in accordance with the Groundwater Plan.

C. Chloride

Chloride levels in groundwater in the county are increasing (as they are in most metropolitan areas) (Ambient Study Report 2020). Although the major sources of chloride in Minnesota waters are salt from road and other winter pavement maintenance and from water softeners (by way of septic systems or municipal wastewater treatment plants), potassium chloride (potash) fertilizer is also a significant source (23 percent, according to Overbo et al, 2019). The data available are for surface water, but the assumption is that contributions to groundwater and surface water are very similar.

Although chloride levels are increasing throughout the county, they are higher in developed areas -- especially near major highways and concentrations of roadways -- than in rural parts of the County. As a result, the County will encourage farmers to follow best management practices for potassium fertilizer use, but chloride reduction is a secondary concern in the ACRE Plan.

Table 12. Statewide annual chloride contributions to surface waters from major point and nonpoint sources (Overbo et al, 2019)

Source	Chloride mass (tons)	Percent of total
Road salt (winter paved surface maintenance)	403,600	42%
Fertilizer (potassium chloride)	221,300	23%
WWTPs (residential and commercial water softening)	209,900	22%
Livestock manure	62,600	6%
Residential septic systems (residential water softening)	33,100	3%
Permitted industries	14,200	1%
Atmospheric deposition	14,200	1%
Dust suppressant use	9,400	1%
<i>Total</i>	<i>968,300</i>	<i>100%</i>

D. Baseline Conditions by Community (Township or City)

Table 13 below shows the current (baseline) conditions for nitrate, total cyanazine, and chloride, by township or city. Additional details can be found on the Dakota County [Drinking Water Studies Webpage \(https://www.co.dakota.mn.us/Environment/WaterResources/WellsDrinkingWater/Pages/drinking-water-studies.aspx\)](https://www.co.dakota.mn.us/Environment/WaterResources/WellsDrinkingWater/Pages/drinking-water-studies.aspx).

Nitrate: Communities with cells in red fail the proposed ACRE Outcome Measure that five percent or fewer of the households that use private drinking water wells exceed the drinking water guideline for nitrate (10 mg/L).

Nitrate: Communities with cells in green meet the proposed ACRE Outcome Measure of five percent or fewer households exceed the drinking water guideline.

Pesticides: Communities with cells in red fail the proposed ACRE Outcome Measure and have households that exceed 50 percent of the Drinking Water Health Guideline for total cyanazine of 1.0 ug/L.

Pesticides: Communities with cells in green meet the proposed ACRE Outcome Measure and have no households that exceed 50 percent of the Drinking Water Health Guideline.

Table 13: Baseline Conditions by Community (2022)

All baseline data estimates are from private drinking water well sampling results.

Township or City	Year of Nitrate/Chloride Sampling (next sampling)	Estimated Percent of Households w/ Nitrate > 10 mg/L	Median Nitrate (mg/L)	Estimated Percent of Ag Acres where shallow groundwater nitrate > 10 mg/L	Maximum Total Cyanazine (Year of Maximum) Health Guideline is 1.0 ug/L	Maximum Chloride (Year of Maximum) Secondary MCL is 250.0 mg/L	Median Chloride (mg/L)
CASTLE ROCK TWP	2013-14 (2022)	15%	1.8	24%	1.7 (2019)	31.4 (2018)	7.8
COATES	2019	75%	12.3	93%	13.3 (2019)	178.0 (2020)	43.9
DOUGLAS TWP	2020	29%	12.7	77%	0.9 (2009)	278.0 (2020)	8.5
EMPIRE	2021	18%	6.2	19%	1.2 (2009)	175.0 (2021)	8.7
EUREKA TWP	2013-14 (2023)	6%	Non-detect	9%	1.9 (2013)	9.1 (2017)	3.7
FARMINGTON	2013-14 (2023)	0%	0.4	4%	1.0 (2019)	No samples	No samples
GREENVALE TWP	2019	4%	Non-detect	4%	Non-detect (2019)	110.0 (2019)	3.3
HAMPTON	2020	25%	8.9	8%	Non-detect (2005)	118.0 (2020)	47.6
HAMPTON TWP	2021	30%	7.1	42%	1.9 (2019)	282.0 (2021)	9.5

Township or City	Year of Nitrate/Chloride Sampling (next sampling)	Estimated Percent of Households w/ Nitrate > 10 mg/L	Median Nitrate (mg/L)	Estimated Percent of Ag Acres where shallow groundwater nitrate > 10 mg/L	Maximum Total Cyanazine (Year of Maximum) Health Guideline is 1.0 ug/L	Maximum Chloride (Year of Maximum) Secondary MCL is 250.0 mg/L	Median Chloride (mg/L)
HASTINGS	2020	44%	10.6	89%	1.3 (2019)	227.0 (2020)	32.3
MARSHAN TWP	2020	37%	16.9	89%	11.6 (2019)	80.5 (2020)	14.6
MIESVILLE	2020	32%	15.6	100%	No samples	167.0 (2020)	17.1
NEW TRIER	2020	0%	Non-detect	31%	Non-detect (2005)	Non-detect (2020)	Non-detect
NININGER TWP	2021	36%	11.1	54%	5.6 (2019)	112.0 (2021)	9.8
RANDOLPH	2020	50%	8.6	53%	Non-detect (2005)	15.4	8.4
RANDOLPH TWP	2013-14 (2022)	11%	5.9	18%	0.6 (2005)	No samples	No samples
RAVENNA TWP	2013-14 (2022)	38%	9.7	43%	0.7 (2013)	No samples	No samples
ROSEMOUNT	2019	5%	2.5	44%	1.3 (2011)	222.0 (2020)	34.7
SCIOTA TWP	2013-14 (2022)	14%	1.9	14%	0.5 (2004)	No samples	No Samples
VERMILLION	2020	33%	Non-detect	68%	0.8 (2017)	20.3 (2020)	10.5
VERMILLION TWP	2021	44%	10.1	61%	3.8 (2004)	235.0 (2021)	8.9
WATERFORD TWP	2021	10%	6.5	23%	0.7 (2005)	623.0 (2021)	4.7

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Appendix B. Summary Water Quality Cost-Share Programs

Practice	Local (SWCD or County)	State	Federal	Estimated Annual Funding Available	Current Estimated Coverage	Cost-Share Ranges	Quantitative Benefits (Pollutant Load Reduction Estimate)	Qualitative Benefits
Cover Crops <i>NRCS Code 340</i>	Utilize BWSR grants and Dakota County CIP. Maximum length of contract is 3 years.	Some small direct grants through MDA.	Incentives available through EQIP and CSP; FSA offers crop insurance	\$265,000	8833 acres	\$20-\$50 per acre	<ul style="list-style-type: none"> • \$38.24 lb/N removed in Corn/Soybean • \$17.87 lb/N removed in Short Season Crop • 50% N loss reduction 	Healthy soils, more organic matter, increased water holding capacity
Nutrient Management Plan Development <i>NRCS Code 157</i>	Not typically funded; possibility of funding through County CIP or grants.	Some small direct grants through MDA.	Funding available but not utilized much	\$20,000	4 plans	\$5,000 per plan	<i>See Implementation</i>	Education, work with certified professionals, document to reference
Nutrient Management Plan Implementation <i>NRCS Code 590</i>	Not typically funded; possibility of funding through County CIP or grants.	Some small direct grants through MDA	Funded through EQIP in conjunction with another practice.	\$15,000	600 acres	\$5-\$45 per acre	<ul style="list-style-type: none"> • Savings of \$0.62 to \$2.65 lb/N removed • Cost of \$2.13 to \$3.59 lb/N removed • 9% to 15% N loss reduction 	Economic savings, build trust in recommendations
Irrigation Water Management Plan <i>NRCS Code 163</i>	Not typically funded; possibility of funding through County CIP or grants.	Some small direct grants through MDA.	Lack of certified Technical Service Providers to write plans.	\$10,000	1 plan	\$6,000-\$12,000 per Plan	<i>See Implementation</i>	Education, work with certified professionals, document to reference
Irrigation Water Management Implementation	Not typically funded; possibility of funding	Some small direct grants through MDA.	Funded through EQIP, but	\$110,000	4400 acres	\$10-\$40 per acre	57-60% less N leaching using new scheduling methods	Economic savings, build trust in

<i>NRCS Code 449</i>	through County CIP or grants.		only half of applications funded annually.					recommendations/scheduling tools
Perennial Crops (Forage & Biomass Planting) <i>NRCS Code 512</i>	Same funding source as cover crops.	MDA has funding in cooperation with UMN Forever Green in targeted areas.	Possibly EQIP, but practice may rank low.	\$220,000	2000 acres	\$20-\$200 per acre	<ul style="list-style-type: none"> • \$4.34 lb/N removed • 72% to 95% N loss reduction 	Emerging markets and local economies, Multi-use crops, knowledge to expand cropping rotations
Conservation Cover <i>NRCS Code 327, 342</i>	Same funding source as cover crops; or Land Conservation Grants	Some small direct grants through MDA	CRP funding	\$90,000	225 acres	\$100-\$700 per acre	<ul style="list-style-type: none"> • \$15.28 lb/N removed • 95% N loss reduction 	Longer term vegetative changes, habitat, filtering

Appendix C. Definitions from Statute or Rule

Word or Phrase	Definition	Statute or Rule
Agricultural chemical	A pesticide, fertilizer, plant amendment, or soil amendment	MN Statute 103H.005
Fertilizer	A substance containing one or more recognized plant nutrients that is used for its plant nutrient content and designed for use or claimed to have value in promoting plant growth. Fertilizer does not include animal and vegetable manures that are not manipulated, marl, lime, limestone, and other products exempted by rule by the commissioner [of Agriculture]	MN Statute 18C.005
Pesticide	A substance or mixture of substances intended to prevent, destroy, repel, or mitigate a pest, and a substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant	MN Statute 18B.01
Plant amendment	A substance applied to plants or seeds that is intended to improve germination, growth, yield, product quality, reproduction, flavor, or other desirable characteristics of plants except fertilizers, soil amendments, agricultural liming materials, pesticides, and other materials that are exempted by rule	MN Statute 18C.005
Soil amendment	A substance intended to improve the structural, physical, or biological characteristics of the soil or modify organic matter at or near the soil surface, except fertilizers, agricultural liming materials, pesticides, and other materials exempted by the [Agriculture] commissioner's rules	MN Statute 18C.005
Static water level	The distance measured from the established ground surface to the water surface in a well or boring neither being pumped, nor under the influence of pumping nor flowing under artesian pressure	MN Rules 4725.0100

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Appendix D. Summary of Minnesota Department of Agriculture (MDA) Existing Rules and Plans

MDA Mitigation Levels and Regulatory Status

(p. 73, MDA Nitrogen Fertilizer Management Plan, 2015)

Revised NFMP: Clear Definition of Prevention & Mitigation Levels for Localized Responses

	Prevention	Level One	Level Two	Level Three	Level Four
Nitrate Levels	<i>Increasing</i>				
BMP Adoption	<i>Acceptable or Undetermined</i>			<i>Not Acceptable</i>	
Regulatory Status	<i>Voluntary</i>			<i>Regulatory</i>	

MDA Mitigation Process for Private Wells

(p. 73, MDA Nitrogen Fertilizer Management Plan, 2015)

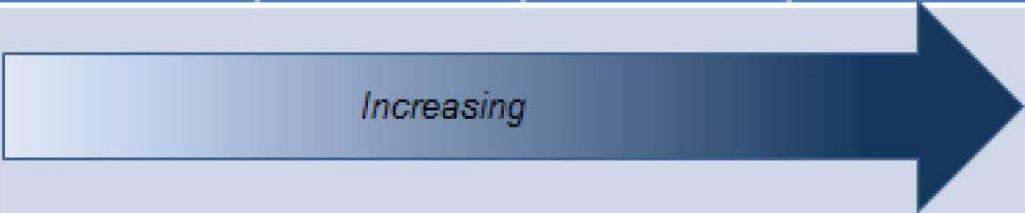
Criteria within the “Mitigation” Process for Private Wells (Township Scale)

	Level One	Level Two	Level Three	Level Four
Nitrate Levels				
% Number of Private Wells	5% or More Above 10 mg/L NO ₃ -N OR 10% or More Above 7 mg/L NO ₃ -N	10% or More Above 10 mg/L NO ₃ -N		15% or More Above 10 mg/L NO ₃ -N

MDA Mitigation Process for Public Wells

(p. 74, MDA Nitrogen Fertilizer Management Plan, 2015)

Criteria within the “Mitigation” Process for Public Water Supplies

	Level One	Level Two	Level Three	Level Four
Nitrate Levels				
Nitrate Conc. mg/L	5.4 mg/L NO ₃ -N	Nitrate Levels Expected to Exceed 10 mg/L NO ₃ -N in 10 Years or Less		9.0 mg/L NO ₃ -N

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Appendix E. Summary of Nutrient Reduction Programs Beyond Minnesota

The below table provides a very brief summary of “State Legal Approaches to Reducing Water Quality Impacts from the Use of Agricultural Nutrients on Farmland,” P. K. Hall and E. Essman, National Agricultural Law Center, May 2019 (Hall and Essman). For the purpose of developing Dakota County’s groundwater Agricultural Chemical Reduction Effort (ACRE) Plan, this summary focuses on approaches excluding those intended for animal feeding operations (AFOs and CAFOs) and emphasizing those that should benefit groundwater.

The programs described in the summary below are categorized by BWSR practice Tier (as best as possible), and type of practice.

Practice	Applicable BWSR Tier	States (Regulatory)	States (Voluntary)	Brief Description of Programs (details vary by state)
Nutrient Application limitations	Tier I	All states except AK, CA, HI, ID, KY, LA, MS, NV, NH, NJ, NY, RI, TX, UT, VA, WA, WV, and WY	MI, OH, WI	<p><u>Regulatory:</u> Limitations to nutrient application based upon depth to water table, distance to surface waterbodies, rainfall events, or frozen ground.</p> <p><u>Voluntary:</u> Following runoff risk or application forecast service recommendations (weather-based recommendations).</p> <p><u>Minnesota: Regulatory</u> – Fall application of chemical nitrogen fertilizers not allowed in designated Vulnerable Groundwater Areas.</p>
Nutrient Management Plans	Tier I	All states except NV and NH, usually related to manure mgmt, at minimum.	PA, OH	<p><u>Regulatory:</u> Nutrient Management Plan (NMP) development and nutrient management application, reporting, and training and certification requirements based upon criteria of gross income, pounds of live animal weight, number of acres where nutrients are applied, or proximity to specified sensitive waters (state dependent).</p> <p><u>Voluntary:</u> Reimbursement/ incentives for completion of NMP.</p> <p><u>Minnesota: Regulatory</u> – NMPs required for Animal Feeding Operations of 300 animal units or more. NMP must include non-manure fertilizer in addition to manure.</p>
Nutrient Management Plans, beyond manure mgmt.	Tier I	AR, DE, CT, MD, NC	N/A	<p><u>Regulatory:</u> NMP development and nutrient management application, reporting, and training and certification requirements based upon criteria of gross income, number of</p>

Practice	Applicable BWSR Tier	States (Regulatory)	States (Voluntary)	Brief Description of Programs (details vary by state)
				acres where nutrients are applied, or proximity to specified sensitive waters (state dependent).
Fertilizer use records	Tier I	DE, KS, MD, OH	N/A	<u>Regulatory</u> : Maintaining and/or providing copies of all fertilizer records (nitrogen, chemigation, etc.)
Nutrient application education and certification	Tier I	AL, AR, DE, GA, IL, IN, IA, KS, MA, MN, ME, MD, NE, NC, OH, OK, PA, SC, VT, WI	N/A	<u>Regulatory</u> : Agricultural nutrients can only be applied by someone who has completed training or applicable certification course or program (state dependent). <u>Minnesota: Regulatory</u> – Pesticide applicators must be trained and certified.
Conservation Crop Rotation	Tier II	N/A	OH	<u>Voluntary</u> : Incentives for establishing and harvesting wheat, barley, oat, cereal rye, spelt or triticale, making manure applications, and establishing a post-harvest cover crop.
Conservation Buffers	Tier III	VT, MN, PA, NC, NH	OH, WI	<u>Regulatory</u> : Year-round vegetative cover adjacent to surface waters and ditches. <u>Voluntary</u> : Incentives for maintaining buffers in excess of state law requirements (buffer width, duration, etc.). <u>Minnesota: Regulatory</u> – Vegetative buffer up to 50 ft. required next to lakes, rivers, and streams and 16.5 feet along ditches.
Water Quality Trading Programs	Tier I - III	N/A	MD, NC, OH	<u>Voluntary</u> : Allows farmers and industrial facilities to trade pollution credits through establishment of wetlands, implementation of practices (ranging from Tier I – Tier III) that reduce nutrient loads.
Tax Credits or Incentives for Best Management Practice (BMP) Installation	Tier I - III	N/A	KS, OH, VA, WI	<u>Voluntary</u> : Tax credit or incentives for purchase of precision agriculture equipment, installation of voluntary BMPs, improvement to technology or equipment, and other voluntary programs that reduce nutrient loss.

Appendix F. Nitrate Model Summary

Dakota County hired Barr Engineering (Barr) to develop and calibrate a groundwater nitrate model for rural parts of the county. The objective was to develop a tool that will estimate current nitrate loading to groundwater and identify the nitrate-load reduction necessary to achieve concentrations below 10 mg/L in the shallow groundwater. Barr utilized the previously developed sub-regional MODFLOW model for Dakota County (based on Metro Model 3) and combined it with MT3D-USGS groundwater transport code to simulate nitrate fate and transport throughout the county. Nitrate leaching loss rates for current crop practices were obtained from MDA’s modeling for areas within the Hastings DWSMA and applied county-wide. In general, nitrate concentrations are greatest in the southeastern part of the county. Areas in the southwestern part of the county have less nitrate in the groundwater even though loading rates are not different. The difference in groundwater concentrations is primarily driven by differences in geology, with the southwestern part of the county having less permeable sediments.

After consulting with MDA, Dakota County requested Barr run three modeling scenarios to estimate the net effect on nitrate leaching rates and the resulting groundwater nitrate concentrations. All three scenarios were based on increased adoption of cover crops and conversion of cultivated cropland to perennials only; no reductions in nitrate fertilizer application were assumed. Table F.1 below shows the three scenarios and the estimate nitrate reduction.

Table F.1. Nitrate model scenarios and estimated nitrate leaching reduction (Barr, 2022)

Scenario	Percent Non-Irrigation Cropland with Cover Crops	Percent Irrigated Cropland with Cover Crops	Percent Cropland converted to Perennials	Estimated Reduction in Weighted Nitrate Leaching Rate from Cropland
Baseline (current conditions)	4%	3%	0%	-
Scenario 1	20%	20%	5%	6%
Scenario 2	40%	40%	5%	13%
Scenario 3	20%	20%	8%	14%

Table F.2. shows the model run results for each of the scenarios on the city and township level. Median nitrate levels reduced from 3-6 percent for Scenario 1, 7-13 percent for Scenario 2, and 8-14 percent for Scenario 3. There were discrepancies for several townships between the simulated model nitrate values and the measured nitrate values, likely as a result of having an insufficient number of sample points for the model. As a result, some simulated city and township median nitrate concentrations are artificially high or low compared to median nitrate values shown in Chapter 3, Table 13. Significant discrepancies will help inform data needs; additional sampling conducted as part of Strategy 1 will help with development of the updated model over time, and new scenarios will be evaluated periodically. The percent reduction in the median nitrate values compared to baseline helped inform the adoption rate goals presented in Chapter 1, Table 6.

The full Dakota County Nitrate Model Report can be viewed on the [ACRE Project Page](https://www.co.dakota.mn.us/Environment/WaterResources/Agriculture/Pages/agricultural-chemical-reduction-effort.aspx)

(<https://www.co.dakota.mn.us/Environment/WaterResources/Agriculture/Pages/agricultural-chemical-reduction-effort.aspx>).

Table F.2. Nitrate model run results (Barr, 2022)

City/Township	Baseline Median Nitrate (mg/L)	Scenario 1 Median Nitrate (mg/L)	Scenario 1 Percent Nitrate Reduction	Scenario 2 Median Nitrate (mg/L)	Scenario 2 Percent Nitrate Reduction	Scenario 3 Median Nitrate (mg/L)	Scenario 3 Percent Nitrate Reduction
CASTLE ROCK TWP	6.6	6.3	5%	5.9	11%	5.8	12%
COATES	6.4	6.1	5%	5.7	11%	5.6	12%
EMPIRE TWP	11.9	11.2	6%	10.5	12%	10.4	13%
EUREKA TWP	6.4	6.1	5%	5.7	10%	5.7	11%
FARMINGTON	2.6	2.5	4%	2.4	9%	2.3	9%
GREENVALE TWP	4.6	4.5	3%	4.3	7%	4.3	8%
HAMPTON	1.1	1	5%	1	11%	1	12%
HAMPTON TWP	6.7	6.4	4%	6.1	9%	6	10%
HASTINGS	7.8	7.4	5%	6.9	11%	6.8	12%
MARSHAN TWP	4.6	4.4	3%	4.3	7%	4.2	8%
MIESVILLE	7.2	6.8	5%	6.3	11%	6.3	12%
NEW TRIER	14.3	13.5	6%	12.5	13%	12.3	14%
NININGER TWP	11	10.3	6%	9.7	12%	9.6	13%
RANDOLPH	7.1	6.7	5%	6.3	11%	6.3	12%
RANDOPH TWP	9.3	8.9	5%	8.4	10%	8.3	11%
RAVENNA TWP	8.3	7.9	5%	7.4	11%	7.3	12%
ROSEMOUNT	6.1	5.8	5%	5.4	11%	5.4	12%
SCIOTA TWP	4.7	4.6	4%	4.4	7%	4.3	8%
VERMILLION	10.3	9.8	6%	9.1	12%	9	13%
VERMILLION TWP	5.2	5	5%	4.6	12%	4.6	13%
WATERFORD TWP	7.7	7.3	5%	6.8	12%	6.7	13%

Appendix G. Stakeholder Engagement Findings and Direction

Two rounds of stakeholder engagement helped inform this plan. Summary reports are available online.

Phase One (August-December, 2021): [Report on Phase One Engagement Findings](#)

Phase Two (January-March, 2022): [Report on Phase Two Engagement Findings](#)

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Appendix H. Public Comments and County Responses

Source	Page, Chapter & Section	Comment	County Response
<p>J. Clark and M. Hoffman, Met Council 8/31/22</p>	<p>General Comment</p>	<p>Thank you for providing the Met Council the opportunity. Neither of us have any specific comments or concerns. The plan is considered, has valuable and useful goals, and reasonable strategies for meeting those goals informed by residents and technical experts. We appreciate that the plan acknowledges and has strategies to build relationships with farmers, landowners, and rural communities. We too recognize the need to build trust within and help support these communities through our regional planning work and hope that the Council can learn and benefit from your efforts. We also want to recognize your identification of agency partnerships as a part of achieving the plan's outcomes. We look forward to supporting your efforts and collaborating as you proceed with plan implementation. As the 2050 regional development guide and regional policy plans are developed in the coming years, we hope that you will help them to align with local needs and Dakota County's plans and goals.</p>	<p>Thank you for your kind and supportive remarks! We look forward to continuing to work together toward our common goals.</p>
<p>S. Christopher, Board of Water and Soil Resources 9/1/22</p>	<p>General Comment</p>	<p>Thank you for the opportunity to comment on the Dakota County Draft Agricultural Chemical Reduction Effort (ACRE) Plan. I would like to acknowledge the hard work that the County has done. The ACRE Plan is well-informed through data and the strategies & outcomes for implementation are defined and include quantifiable measures which will assist the County in evaluating its effort and progress. The approach to addressing an issue that may impact many stakeholders of the County is forward-thinking and will be an example for other areas around our state and region.</p>	<p>Thank you!</p>

Source	Page, Chapter & Section	Comment	County Response
<p>K. Cervantes, Conservation Minnesota 9/6/22</p>	<p>General Comment</p>	<p>We applaud Dakota County for attempting to further build on the MN Department of Agriculture’s Groundwater Protection Rule (GPR) and implementation of the Nitrogen Fertilizer Management Plan (NFMP) to address the very serious issue of nonpoint pollution in agriculture and its impacts on water quality throughout the county. We especially support the plan’s measurement of results-based contaminant reduction to protect the integrity of groundwater, and to consider private drinking water wells when measuring the plan’s outcomes.</p> <p>Much of the success of the county’s goals will depend on education and implementation, and we support the urgency of helping incentivize and provide assistance to farmers to reduce or eliminate the use of agricultural chemicals that ultimately contaminate the groundwater. Nitrogen-based fertilizers that are used to increase crop yields are important to farming operations but drinking water high in nitrates has been linked to different types of cancer, potentially fatal children’s health issues, and elevated heart rates. Rather than continuing to invest money in denitrification systems to clean up water contamination, we support the county’s effort to begin to eliminate the causes, such as over-application and nitrogen leaching into soil, which leads to these costly impacts on human health and groundwater.</p> <p>As water quality is an essential human right, Conservation Minnesota aims to ensure clean, safe drinking water in communities throughout the state of Minnesota. We support the ACRE plan as a solutions-based approach, especially creating models for cover and perennial crop adoption rate goals and the evaluation of agricultural practices. It will be vital to implement the “exploring ways” section of the plan and to secure funding to implement water quality practices on rented farmland and provide financial incentives to farmers for adopting healthy soil and groundwater practices. Conservation farming practices are proven to impact higher profits and we support the ultimate impact this new program will have on Minnesota’s farm economy, water quality, and natural resources.</p>	<p>Thank you! Please let us know if there are ways that Conservation Minnesota would like to be more involved with this effort.</p>

Source	Page, Chapter & Section	Comment	County Response
C. Congdon, County Resident 7/20/22	General Comment	<p>Good Morning,</p> <p>While I agree that the agricultural reduction of nitrates is important to help save wells and health, I would also urge the county to mandate similar or same requirements of homeowners who are dumping these same chemicals and types on their lawns and gardens multiple times per season. This is also washing into our lakes and groundwater, continuing to add to the issue. This is not a farmer's issue alone. Commercial residences (apartment, townhomes, etc) use sprays and chemicals. A large number of my neighbors use chemicals on their lawns and we live right next to a lake. I've even seen our county parks and rec areas with signs to warn people to stay off the grass until chemicals are dry. So, it would seem farmers are only a PART of the problem and should not be held accountable to limitations and new rules, without also having the rest of the community in the same boat.</p> <p>Thank you for your time.</p>	<p>Thank you for your interest in the Dakota County Agricultural Chemical Reduction Effort (ACRE) Plan. The ACRE Plan stems from the Dakota County 2020-2030 Groundwater Plan, which addresses a wide range of potential sources of groundwater contamination, including lawn and landscape maintenance chemicals. The ACRE Plan is specific to agricultural chemicals. The Groundwater Plan is available online. It was developed with input from interested residents and other stakeholders, the Dakota County Planning Commission, and a technical advisory group. The Groundwater Plan was approved by the Minnesota Board of Soil and Water Resources (BWSR) in December 2020 and was adopted by the Dakota County Board of Commissioners in January 2021.</p>
S. Peterson, County Resident 7/23/22	General Comment	<p>Dakota County looks like it wants to replicate what the Netherlands is doing--which is killing farming! Stop this "green" nonsense!</p>	<p>Your concern is noted. The strategies proposed in the ACRE Plan are all voluntary and provide farmers with flexibility in what practices to adopt to improve groundwater quality, technical assistance, and financial incentives.</p>

Source	Page, Chapter & Section	Comment	County Response
Various, Township Board Meetings	General Comment	Private wells with high nitrate in some cases may be a result of failing septic systems, especially in areas where there is a large cluster of septic systems.	<p>Septic systems can be a source of elevated nitrate on a highly localized basis. However, septic systems are more often a health concern for infectious agents such as bacteria or viruses than as sources of nitrate contamination. For example, Inver Grove Heights is the community in the county that has the most households that use septic systems and private wells and it has very little row crop agriculture. Extensive testing of private wells there has found few wells with nitrate over the drinking water guideline.</p> <p>The county Groundwater Plan includes tactics for minimizing septic system impacts on groundwater quality. The County is responsible for directly regulating septic systems for the cities of Randolph and New Trier, Randolph and Waterford townships, and the shoreland/floodplain areas in unincorporated portions of the county, a total of approximately 980 households. Cities and townships regulate septic systems in most of the county; their ordinances are required to be consistent with the County's septic system ordinance (County Ordinance 113) and with State law. To address failing septic systems, the County administers a septic system low income grant program and a tax assessment program.</p> <p>In coming years, data collected from the county's new network of monitoring wells will help county staff to differentiate between elevated nitrate due to row-crop agriculture and that due to other sources. The monitoring wells are being located adjacent to cropland to evaluate the shallow groundwater that is being most impacted by cropping practices.</p>
Various, Township Board Meetings	General Comment	What is Dakota County doing to address contaminants as a result of lawn fertilizer and landscape chemicals?	See answer to #4, above.

Source	Page, Chapter & Section	Comment	County Response
M. Ryan/T. Thiel, VRWJPO 8/29/22	References P. 26, Chapter 1, Strategy 4, Financial Incentives	In general, there is a lack of information on how agricultural pesticides and chlorides will be reduced in the identified strategies. One can assume that activities that retire farmland/convert farmland to non-agricultural uses will reduce the use of these chemicals, but there are no other activities identified that reduce the use of or mitigate the impact of these chemicals.	Please note the Plan Purpose (page 1) and Chapter 2 (page 35) states the focus of ACRE is on reducing nitrate contamination in groundwater and addressing other agricultural contaminants where practical. Practices discussed under Strategy 4, Chapter 1 that reduce nitrate contamination will also reduce other agricultural contaminants such as pesticides and chloride. More explanation was added to page 1. Regarding chloride specifically, Tactic 3G calls for educating farmers about potassium fertilizer BMPs. At this time, farmers do not have a practical alternative source of potassium besides potassium chloride.
M. Ryan/T. Thiel, VRWJPO 8/29/22	P. 26, Chapter 1, Strategy 4, Financial Incentives	All the other quantitative measures listed have some means of quantification. This measure does not quantify anything and simply states it "will decrease." Can you specify how this will be quantified? Will decrease based on the existing groundwater concentrations in wells? We suggest being more specific about how these contributions will decrease, how that decrease will be measured, and establish the baseline for which it will be measured against. In addition, will a selection of wells/groundwater data be used to analyze this measure due to the potential for road salt use to impact some agricultural areas near larger and/or paved roads?	Chloride levels will be evaluated in comparison to baseline. Clarification was added to Quantitative Measure 5. As of August 2022, County staff have limited baseline information about chloride levels in groundwater. In the next few years, the environmental well network and Community Focused Sampling program will provide a much more complete understanding of "where we're starting from." In the longer term, these two ongoing sources of information will show the seasonal and annual trends in chloride levels. For practical reasons, both the county and the Minnesota Department of Agriculture are installing their collaborative environmental well network in public rights-of-way, for the most part. As a result, the chloride levels in these wells may be higher than what would be found in shallow groundwater wells further away from roads, especially in the spring sampling event. Staff will keep this in mind when evaluating the chloride results and will be looking for relative decreases over time rather than hitting specific targets.

Source	Page, Chapter & Section	Comment	County Response
M. Ryan/T. Thiel, VRWJPO 8/29/22	P. 12-13, Chapter 1, Section C, Strategy 1	Related to the comments later in this letter on pesticide reduction, there is not much in the way of sampling for pesticide breakdown products in the monitoring well network. While sampling drinking water sources gets at the high-risk locations for exposure, analyzing monitoring network samples from the shallow groundwater might indicate whether any pesticide application reduction efforts (or land conversion programs) are having an impact.	Amended Tactic 1G to include environmental well network. This is also addressed on p. 44, Chapter 3, Background Information: "Dakota County's extensive sampling for crop herbicides and herbicide breakdown products through its Ambient Study has documented the environmental fate of common herbicides in groundwater in the county over time, but is not necessarily geographically representative. In particular, the extent and concentrations of cyanazine breakdown products in private well water are not yet comprehensively understood. To date, cyanazine has been found above the drinking water guideline of 1 µg/L in 11 townships (Table 13). In late summer 2022, the MDA will be sampling private wells in Dakota County for the herbicides cyanazine, and atrazine, and related chemicals. When the results of the 2022 sampling are available, the information about cyanazine in private wells may be quite different from what is currently shown in Table 13 below. In addition, if feasible, the County's rotating private well sampling program will be expanded to include cyanazine breakdown products and other frequently detected pesticides and pesticide breakdown products, in accordance with the Groundwater Plan."
M. Ryan/T. Thiel, VRWJPO 8/29/22	P. 21, Chapter 1, Strategy 4, Financial Incentives	The summary indicates the County and SWCD will partner with state funding agencies and others to promote and fund BMPs and AMTs. BMPs and AMTs are terms used in MDA's Groundwater Protection Rule and are the means identified to comply with the Rule. The VRWJPO and other agencies often do not provide technical or financial assistance for practices meant to comply with or meet regulatory requirements. Funding for BMPs and AMTs may be in conflict with the policies of partner organizations and this strategy should be considered further given this potential conflict. It will be critical to identify when a practice is being implemented to meet minimum requirements of the Groundwater Protection Rule versus voluntary implementation.	The ACRE Plan itself comprises voluntary practices. Clarification was added to the ACRE Plan (page 21). However, to implement the Groundwater Protection Rule, the MDA is in the process of developing BMP requirements for the Hastings Drinking Water Supply Management Area (DWSMA) that will effectively be regulatory. (The Hastings DWSMA covers a large portion of the Vermillion River watershed but is only in the Vermillion River watershed.) BMPs proposed for nitrogen fertilizer usage per se (for example, using less fertilizer or splitting fertilizer applications during the growing season) would not depend on cost-share funding in any case. Nevertheless, Environmental Resources, SWCD, VRWJPO, and MDA staff should meet to clarify the BMPs and AMTs that will be promulgated for the Hastings DWSMA and how financial incentives might be impacted.

Source	Page, Chapter & Section	Comment	County Response
M. Ryan/T. Thiel, VRWJPO 8/29/22	P. 26, Chapter 1, Strategy 4, Financial Incentives	It is unclear whether the “optional high priority tactic” of longer funding of initiatives will be made available to those who previously enrolled or even to those farmers who implemented cover crops on their own (without assistance) but may now be interested in cost-share programs (i.e., will people who have been doing the right thing be paid to keep doing the right thing). The table makes it seem as though the optional tactic would be for maintaining existing projects for additional time after having been provided assistance through the first three years.	Edited tactic and added clarification (see page 27). The intent of the tactic is to allow for a broad range of possibilities. Any future incentive programs would be dependent upon the identified need to increase BMP/AMT adoption rates, and County and/or SWCD Board approval. This may include incentives as extensive as providing payments to all farmers implementing cover crops, or only extending projects for additional time after having been provided assistance through the first three years in order to reduce risk of initial adoption.
M. Ryan/T. Thiel, VRWJPO 8/29/22	P. 6, Chapter 1, Section B, Goal	This goal text appears incomplete and we assume it needs something written after “unhealthy levels.”	Corrected.
M. Ryan/T. Thiel, VRWJPO 8/29/22	P.8, Chapter 1, Section C, Introduction	in the second to last paragraph, it is noted that the County and SWCD are the same on the table and that the SWCD “was identified as a trusted resource to the agricultural community.” It is recommended that this be changed to “is a trusted resource...” to get rid of confusion about the working relationship (and check for similar identity references elsewhere in the document).	Text edited.
M. Ryan/T. Thiel, VRWJPO 8/29/22	P.11, Figure 4	Recommend changing one of the colors of the County or MDA wells on the map for those that are visually impaired (i.e. colorblindness).	Map updated.
Various	P. 22, Chapter 1, Strategy 4, Financial Incentives	Please clarify what is meant by "perennials."	Clarification has been added to the ACRE Plan (page 22). The term “perennials” refer to the following: <ul style="list-style-type: none"> • land enrolled in the Conservation Reserve Program or Conservation Reserve Enhancement Program; • prairie restorations; • grass hay, alfalfa, or pasture; • Kernza™ or other perennial crops; • other vegetation where the root structure is left in place all year round.

Source	Page, Chapter & Section	Comment	County Response
Various	P. 22, Chapter 1, Strategy 4, Financial Incentives	Please clarify what is meant by "cover crops."	Clarification has been added to the ACRE Plan (page 22). Cover crops are plants seeded into agricultural fields, either within or outside of the regular cash crop growing season. Cover crops are used to slow erosion, prevent nutrient losses, improve soil health, enhance water availability, smother weeds, help control pests and diseases, increase biodiversity, and bring other benefits to cropland (Sustainable Agriculture Research and Education). In regard to nitrate, cover crops can help retain nitrogen in fields, rather than allowing the nitrogen to be converted to nitrate and leach into the groundwater. The cover crop will use whatever nitrogen is still available from the fertilizer applied for the current growing season, plus the nitrogen that continues to mineralize via soil organic matter. That nitrogen will be protected from leaching and denitrification losses. Farmers have many choices among cover crops, depending on their priorities for the planting, the cash crop that preceded the cover crop, and the crop to be planted after the cover crop. The most common cover crops in Dakota County are Winter Cereal Rye, oats, or an oat and radish mix (Dakota SWCD staff). Dakota County SWCD staff or UMN Extension Educators can assist farmers with selecting an appropriate cover crop for their farm.
L. Gunderson, MDA 9/9/2022	P. 4, Executive Summary	The ACRE Plan proposes four strategies including: 1) collect information for decision making; 2) communicate and educate; 3) provide technical assistance; and 4) provide financial incentives. In general MDA agrees with these overall concepts and supports working with the local agricultural community to address water quality concerns and help provide funding where needed to implement BMPs and other recommended practices. MDA considers these strategies to be extremely important when working with farmers to reduce nitrate in groundwater. They are key strategies in the MDA's Nitrogen Fertilizer Management Plan and Groundwater Protection Rule.	Thank you.

Source	Page, Chapter & Section	Comment	County Response
L. Gunderson, MDA 9/9/2022	P. 31, Potential Future Strategies.	MDA notes that there is limited discussion on how agricultural practices might be evaluated. The MDA supports University of Minnesota recommended BMPs and other practices which have sufficient documentation to be proven to be economically viable, implementable and can improve water quality. MDA suggests that the plan emphasize that recommended or required practices will be economically viable or subsidized so they are profitable, with adequate consideration of some of the practical challenges for their implementation such as adverse weather.	Text edited on p. 31, Potential Future Strategies: "Evidence is growing that farms that adopt practices to improve water quality (such as participating in the Minnesota Agricultural Water Quality Certification program) are more profitable than farms that do not (Minnesota State, 2022). That said, any requirements imposed by the county would respect that farming requires economic sustainability to support and maintain environmental sustainability."
L. Gunderson, MDA 9/9/2022	P. 29 (30), Chapter 1, Potential Future Strategies	Text on page 29 of the plan states that Dakota County may explore regulatory options "If, after five years (five complete growing seasons), groundwater nitrate conditions show a stable or upward trend (by township or city), County staff may recommend to the County Board ordinance amendments that require agricultural practices to reduce nitrate contamination." There is limited detail provided on how the water quality trends will be evaluated or if 5 years is an appropriate period of time to ensure that changes in nitrogen management at the land surface could improve water quality in the aquifer being monitored. Since private wells are included, it is unclear if the analysis might include wells which are constructed in different aquifers which may contain water which is potentially older than 5 years. There can be significant variability in water quality monitoring data from year to year especially when comparing wet years to dry years. The plan does not appear to consider that. In addition, it is unclear what the term "stable" means for the purposes of potential regulation. If stable means that there is not a significant downward trend in water quality, then it appears there could be a move towards regulation even if recommended practices are being implemented. These issues are complex but significant. MDA recommends that the plan consider these factors and that the plan should support and reward farmers who adopt recommended practices and not move to regulation unless other efforts are not successful.	As MDA indicates, more than 5 years of data may be needed to determine the normal range of variation, especially due to weather conditions. Text amended to "If, after at least five years (five complete growing seasons, or sufficient time to identify statistically significant trends, whichever is longer), groundwater nitrate conditions show a stable or upward trend (by township or city), County staff may recommend to the County Board ordinance amendments that require agricultural practices to reduce nitrate contamination. In this context, "stable" means that no statistically significant upward or downward change over time beyond the normal range of variation can be determined. Also, it should be understood that this refers to groundwater that is not improving toward the ACRE Plan's quantitative outcome measures (p. 7), not groundwater that already meets those criteria." The text indicates "... staff may recommend to the County Board ordinance amendments that require agriculture practices to reduce nitrate contamination." Text has been edited to reflect that the Plan does call for using both private and public drinking water and shallow groundwater monitoring well results. In addition, ACRE Tactic 1A calls for collecting and evaluating information on what agricultural practices are being implemented and maintained in the county. Staff will use the preponderance of the evidence before recommending any regulation. The ACRE Plan is designed to do as MDA recommends, to support and reward voluntary activities to improve groundwater quality and only adopt regulatory measures if groundwater fails to improve in a reasonable number of years.

Source	Page, Chapter & Section	Comment	County Response
L. Gunderson, MDA 9/9/2022	P. 33 (35) Chapter 2, Planning Process (Table 9)	Text on page 33 of the plan states that the outcome measures for the ACRE Plan are results-based since Dakota County is relying on contaminant reduction and the MDA’s Groundwater Protection Rule is performance-based by evaluating BMP adoption. The Groundwater Protection Rule also includes results based elements by 1) moving a DWSMA from mitigation level 2 to a mitigation level 3 if the statistical analysis of the nitrate-nitrogen concentration is increasing for the public well or groundwater monitoring network; OR moving a mitigation level 2 DWSMA to mitigation level 1 if the statistical analysis of the nitrate-nitrogen concentration in the public well is not projected to exceed the health risk limit of 10 mg/L in ten years and the groundwater nitrate-nitrogen concentration has been below 8.0 mg/L for ten years. These two results based factors are evaluated separately from BMP adoption, although the two evaluations can occur in tandem.	MDA comment has been added to the text.
L. Gunderson, MDA 9/9/2022	P. 8, Chapter 1	Page 8 fifth paragraph – the last sentence includes an extra “a” and “rates” should be “rate”.	Text edited.
L. Gunderson, MDA 9/9/2022	P. 21	Page 21 under Summary – “alternate management tools” should be “alternative management tools”.	Text edited.

**BOARD OF COUNTY COMMISSIONERS
DAKOTA COUNTY, MINNESOTA**

October 18, 2022
Motion by Commissioner Slavik

Resolution No. 22-442
Second by Commissioner Hammann-Roland

Authorization To Adopt Dakota County Agricultural Chemical Reduction Effort Plan

WHEREAS, developing the Agricultural Chemical Reduction Effort (ACRE) Plan is a 2022 Board priority; and
WHEREAS, the 2020-2030 Dakota County Groundwater Plan identified reduction of agricultural chemical contamination as a high priority (strategy 1B1); specifically, tactic 1B1 states that the County will develop an ACRE Plan; and

WHEREAS, the purpose of ACRE is to reduce agricultural chemicals in groundwater to levels that no longer pose threats to human health and the environment; and

WHEREAS, the ACRE Plan was developed through extensive research on current Minnesota programs and other state programs focused on improving water quality from agricultural operations, completion of a groundwater nitrate model; a robust stakeholder engagement process, and guidance provided by the County Board, County Planning Commission, and an Agricultural Advisory Group; and

WHEREAS, by Resolution No. 22-289 (July 19, 2022), the County Board authorized the release of the draft ACRE Plan for a 45-day public review period from July 20 to September 3, 2022; and

WHEREAS, comments were received from county residents and five organizations during the public review period resulting in no substantial changes to the ACRE Plan; and

WHEREAS, the Dakota County Planning Commission reviewed the revised ACRE Plan on September 22, 2022, and recommended the adoption of the ACRE Plan to the Physical Development Committee of the Whole.

NOW, THEREFORE, BE IT RESOLVED, That the Dakota County Board of Commissioners hereby adopts the Dakota County Agricultural Chemical Reduction Effort (ACRE) Plan.

STATE OF MINNESOTA
County of Dakota

	YES		NO
Slavik	X	Slavik	
Gaylord	X	Gaylord	
Halverson	X	Halverson	
Atkins	X	Atkins	
Workman	X	Workman	
Holberg	X	Holberg	
Hammann-Roland	X	Hammann-Roland	

I, Jeni Reynolds, Clerk to the Board of the County of Dakota, State of Minnesota, do hereby certify that I have compared the foregoing copy of a resolution with the original minutes of the proceedings of the Board of County Commissioners, Dakota County, Minnesota, at their session held on the 18th day of October 2022, now on file in the County Administration Department, and have found the same to be a true and correct copy thereof.

Witness my hand and official seal of Dakota County this 18th day of October 2022.



Clerk to the Board