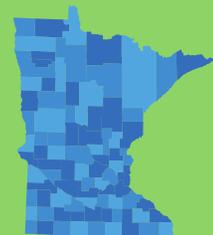


August 2020

# Appendix A: State-level Nutrient Reduction Program Advancements

## 5-year Progress Report on Minnesota's Nutrient Reduction Strategy



# Appendix A- State-level Nutrient Reduction Program Advancements

Appendix A to Minnesota's Nutrient Reduction Strategy 5-year progress report (2020)

## **Authors and Contributors:**

Dave Wall, Rachel Olmanson, Marco Graziani, Greg Johnson (Minnesota Pollution Control Agency)

Matt Drewitz (Minnesota Board of Water and Soil Resources)

Jeppe Kjaersgaard and Margaret Wagner (Minnesota Department of Agriculture)

Joel Larson and Adam Wilke (University of Minnesota Water Resources Center)

Steve Robertson, Mark Wettlaufer (Minnesota Department of Health)

Keith Kloubec (Natural Resources Conservation Service)

Barbara Weisman (Minnesota Department of Natural Resources)

# Minnesota Nutrient Reduction Strategy 5-year Progress Report – Appendix A

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This appendix to the Nutrient Reduction Strategy (NRS) 5-year Progress Report summarizes examples of the most influential programs and initiatives related to nutrient-reduction approaches outlined in Chapter 6 of the 2014 NRS. This document expands on the program progress that is included in section 2 of this progress report: *Programs – Are the NRS strategies progressing?* It is important to note that many of the programmatic advances listed below influence a broad range of nutrient-reducing activities. While many of the programs listed in this document apply to numerous strategies from the 2014 NRS, each program is listed once.

## 1 Implementation of overarching recommended actions

### 1.1 Statewide education and outreach

The NRS recommended a statewide nutrient education/outreach campaign that included several specific educational approaches, such as bringing local watershed staff together with people impacted by nutrients in downstream communities. While a statewide systematic nutrient education and outreach campaign does not currently exist, many nutrient-related educational events and programs have occurred on a statewide basis since 2014 and are noted below. Many of these educational events and programs are applicable to other strategies.

#### 1.1.1 Governor’s 25% by 2025 initiative

In 2017, Minnesota’s Governor Mark Dayton hosted a series of town hall meetings to promote 25% improvements in Minnesota’s water quality by 2025. More than 2,000 people attended these meetings to discuss nutrients and other water pollution issues. The town hall meetings were not only educational, but also provided opportunities to involve stakeholders in identifying solutions (which was also emphasized in the NRS). Attendees provided over 3,500 suggestions on how to improve Minnesota’s water quality by 2025. More information is available at: <https://www.egb.state.mn.us/content/25-2025-overview>.

#### 1.1.2 Interaction between shrimpers and Minnesota farmers

Downstream shrimpers from Louisiana traveled to Minnesota in 2018 to share stories about how upstream management of lands along the Mississippi River affects their livelihood in the Gulf of Mexico. The event provided an opportunity to exchange ideas and learn from each other. A summary of this event can be found at: <https://www.mprnews.org/story/2018/08/28/shrimpers-share-impact-of-dead-zone-in-mississippi-river-in-minnesota-farmers>

#### 1.1.3 Technical Training and Certification Program for conservation professionals

Established in 2015, the Technical Training and Certification Program is a collaborative effort between the Board of Water and Soil Resources, the Natural Resources Conservation Service, the Minnesota Association of Conservation District Employees and the Minnesota Association of Soil and Water Conservation Districts. The program efficiently provides training to develop and maintain a highly trained, technically skilled workforce of natural resource professionals capable of meeting the conservation delivery needs of Minnesota.

#### 1.1.4 Nitrogen Smart Training Program

In 2016, the University of Minnesota Extension Service in partnership with the Minnesota Corn Growers Association started a new “Nitrogen Smart” educational program. From 2016 to 2018, 36 nitrogen fertilizer management educational events were conducted. The events reached over 500 farmers and

over 100 agronomists. When surveyed several months after the events, 75% of farmers indicated that they intended to make a change in the way they manage nitrogen during the next growing season. Estimated nitrogen fertilizer reductions from these changes exceed 2 million pounds per year. An on-line version of the training is also available. More information is available at: <https://extension.umn.edu/courses-and-events/nitrogen-smart>.

### **1.1.5 Formation of the Agricultural (Ag) Water Quality Solutions Workgroup and framework to establish voluntary Farmer-Led Councils**

In fall and winter of 2016, the MDA and Environmental Initiative convened 15 Minnesota agricultural organizations, cooperatives, and companies to create a plan that would significantly improve water quality practices related to agriculture. The Ag Water Quality Solutions Workgroup worked with technical experts across academia, private industry, and government to help find strategies and technologies that would both create significant progress in water quality practices based on the best science available and lead to widespread adoption of those practices. The Ag Water Quality Solutions Workgroup unanimously agreed to a single idea that could improve water quality practices and would also be generally accepted by farmers—to establish and fund voluntary Farmer-Led Councils to implement and demonstrate practices in an area. The group presented a final framework capturing this idea to the Governor in 2017. More information is available at: <https://environmental-initiative.org/work/agricultural-water-quality-solutions/>.

### **1.1.6 University of Minnesota Nutrient and Nitrogen Management Conferences**

The University of Minnesota Extension along with the Minnesota Agricultural Water Resources Center organizes two annual statewide conferences: “The Nutrient Management Conference” started in 2009 and “Nitrogen: Minnesota’s Grand Challenge and Compelling Opportunity Conference” started in 2015. These two conferences bring relevant findings from University of Minnesota research and from others on the agronomic management and environmental stewardship of nitrogen and other nutrients in crop production. The events attract over 400 producers, crop advisors, agency staff and other stakeholders annually. Evaluations consistently show a high level of relevance, satisfaction with the quality of information delivered, and impact of the programs. Surveys show that over 2.5 million acres are being influenced by these two educational programs yearly. Minnesota’s Nutrient Reduction Strategy was highlighted during the most recent conferences. More information at: <https://mawrc.org/events/>

### **1.1.7 Annual Conservation Tillage Conference**

For the last several years, the University of Minnesota has held an annual Conservation Tillage Conference, with support from the state’s soil and water conservation districts and the Minnesota corn and soybean commodity groups. Although it began with a focus on conservation tillage, the conference has grown to provide farmers, crop advisors, and others in the agriculture community with information on a range of soil health topics, including the use of cover crops, nutrient management, and integrating livestock into cropping systems. The name of the conference was recently changed to “Soil Management Summit.” Ninety percent of attendees said they would use the conference information in their work or on their farm during the following year.

### **1.1.8 Agricultural BMP Guidance and Handbooks**

Minnesota’s Agricultural BMP Handbook was updated in 2017. The handbook includes updated BMP descriptions and effectiveness information for over 30 different BMPs and can be found at: <https://wrl.mnpals.net/islandora/object/WRLrepository:2955>.

In addition, MDH and the Minnesota Rural Water Association recently worked with the State NRCS Office to develop an agricultural BMP practices booklet for groundwater *Cropland Conservation Practices for Protecting Groundwater*, which can be found at [https://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcseprd936806.pdf](https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd936806.pdf).

### **1.1.9 Minnesota Public Drainage Manual (MPDM) Update**

The MPDM which was first published in 1991 and updated in 2016, provides detailed information and guidance about Minnesota Statutes, Chapter 103E Drainage law and associated topics. The MPDM is used by a variety of practitioners as a practical guide for navigating Minnesota’s public drainage process. The MPDM is an important reference for drainage authorities, attorneys, engineers, viewers, drainage inspectors, and others involved with Chapter 103E drainage systems. The update includes a newly added chapter on BMPs to provide users with a way to identify and consider applicable BMPs for reducing nutrients and sediment into drainage waters. The MPDM provides guidance but is not rule or law. More information is available at: [https://drainage.pca.state.mn.us/index.php/Main\\_Page](https://drainage.pca.state.mn.us/index.php/Main_Page).

### **1.1.10 DNR workshops and training to lake associations and local government**

The Minnesota Department of Natural Resources (DNR) training program for local government and lake associations concerning lake protection from nutrients was increased. The DNR workshops provided local government staff with specific guidance on phosphorus reduction goals (in pounds per year) for most lakes in their jurisdictions. Workshops also provided training on methods of prioritization for lake protection. In addition, workshops provided strategies to reduce phosphorus loading to lakes through descriptions of successful local government efforts to protect lakes from nutrient pollution.

### **1.1.11 Minnesota’s Water Research Digital Library (MNWRL)**

The Minnesota Department of Agriculture began developing the MNWRL in 2011 in consultation with a wide range of stakeholders. This library houses an inventory of current and past water research that supports water protection, restoration, and management activities across the state in one centralized location. At the end 2018, the library includes nearly 2,800 diverse research articles and scientific reports. The library can be accessed at <https://wrl.mnpals.net/>.

## **1.2 Integrate basin reduction needs with watershed planning goals and efforts**

The state’s Coordinated Watershed Management Approach has continued to advance since the NRS was completed in 2014.

### **1.2.1 Total Maximum Daily Loads (TMDLs)**

The Minnesota Pollution Control Agency (MPCA) has intensively monitored water quality conditions in all 80 watersheds (HUC-8 level). Nearly 700 lakes and over 800 river miles have been identified as impaired due to nutrients. Over 60% of the nutrient-impaired waters have approved TMDL plans that identify the needed reductions in nutrient loading from various sources. River eutrophication standards, which were approved in 2015, are also now being used to assess beneficial uses of flowing waters in the state and has led to identifying additional impaired waters. A large-scale TMDL to address phosphorus reductions in the Lake Pepin watershed is currently underway. More info at: <https://www.pca.state.mn.us/water/total-maximum-daily-load-tmdl-projects>

## 1.2.2 Watershed Restoration and Protection Strategies (WRAPS)

WRAPS have been developed for 53 of 80 watersheds in the state, with most others approaching completion. Of the 40 WRAPS completed prior to 2019, 16 include HUC-8 level nutrient reduction goals that align with the NRS (Limno Tech 2019). Guidance on nutrient load reduction targets for HUC-8 watershed outlets was recently completed, providing specific anthropogenic fair-share nutrient load reduction for each HUC-8 watershed that would cumulatively achieve NRS goals at state borders. Further information on targets can be found linked at <https://www.pca.state.mn.us/water/nutrient-reduction-strategy>

Restoration and protection strategies for groundwater (GRAPS) are being developed for watersheds with elevated nitrate. GRAPS help support groundwater and drinking water protection at the watershed scale. Each GRAPS provides local partners with a description of groundwater resources and issues/concerns so that local watershed stakeholders can consider groundwater protection and restoration needs as they begin the One Watershed, One Plan process. The Minnesota Department of Health has thus far completed GRAPS for 14 watersheds, most of which have elevated groundwater nitrate situations. Additional GRAPS are under development. More information is available at: <https://www.health.state.mn.us/communities/environment/water/cwf/localimplem.html>.

## 1.2.3 One Watershed, One Plan (1W1P)

Local government partnerships based on watershed boundaries use WRAPS, GRAPS, and other information to develop prioritized, targeted, and measurable comprehensive watershed management plans. These comprehensive watershed management plans have now been completed in 12 watersheds, with another 20 currently under development.

Comprehensive watershed management planning through the 1W1P program is rooted in work initiated by the Local Government Water Roundtable, which has membership from Association of Minnesota Counties, Minnesota Association of Watershed Districts, and Minnesota Association of Soil and Water Conservation Districts). In 2013, the Roundtable developed recommendations to BWSR on how local governments could develop plans on a watershed basis. In 2014, BWSR began implementing the 1W1P program on a pilot basis and the program was formally adopted by the BWSR Board on March 23, 2016.

The 1W1P program is one of the key initiatives for Minnesota to help achieve watershed quality restoration and protection goals, including goals set in the Minnesota Nutrient Reduction Strategy. The purpose of the One Watershed, One Plan program is to develop comprehensive watershed management plans that:

- Align local water planning purposes and procedures under Minnesota Statutes §103C and 103D on watershed boundaries to create a systematic, watershed-wide, science-based approach to watershed management.
- Acknowledge and build off existing local government structure, water plan services, and local capacity.
- Incorporate and make use of data and information, including watershed restoration and protection strategies under Minnesota Statutes §114D.26.
- Solicit input and engage experts from agencies, citizens, and stakeholder groups; focus on implementation of prioritized and targeted actions capable of achieving measurable progress.

- Serve as a substitute for a comprehensive plan, local water management plan, or watershed management plan developed or amended, approved, and adopted, according to Minnesota Statutes §103B, 103C or 103D.

According to Minnesota Statutes §103B.801, one of the nutrient-related items that Comprehensive Watershed Management Plans must address is “Surface water and ground water quality protection, restoration, and improvement, including prevention of erosion and soil transport into surface water systems.”

The 1W1P program goals and purpose will help set a planning framework to meet NRS goals and milestones. To learn more about watersheds developing 1W1Ps, go to the interactive map at:

<https://bwsr.state.mn.us/one-watershed-one-plan-participating-watersheds>,

<https://www.pca.state.mn.us/water/watersheds> and for other information go to:

<https://bwsr.state.mn.us/one-watershed-one-plan>.

#### **1.2.4 Watershed Conservation Planning Initiative (WCPI)**

The Minnesota NRCS office entered into a contribution agreement with BWSR to increase landowner and producer readiness to implement conservation practices in seven major watersheds. The purpose of WCPI is to establish a partnership framework for cooperation between NRCS, BWSR and SWCDs on activities that involve the planning and implementation of conservation activities in these watersheds.

Goals of the program include: 1) increase technical capacity of SWCDs to conduct resources assessments and prepare conservation plans within the selected watersheds; 2) target conservation planning assistance to high priority acres in these watersheds; 3) increase landowner readiness and participation in conservation programs; and 4) accelerate conservation practice implementation along with quantifying the environmental benefits. The program budget totals \$3 million and is equally funded by NRCS and BWSR through the Clean Water Fund through December 2021. More info at:

<https://bwsr.state.mn.us/grant-profile-watershed-conservation-planning-initiative>

#### **1.2.5 Section 319 Small Watersheds Focus Program**

The MPCA restructured the Section 319 program in 2018 to provide up to 16 years of grant funding to support implementation through multiple grant cycles for selected small watersheds. Twenty watersheds across the state have been selected thus far as Focus Watersheds that support local goals expressed in local water plans along with overall state priorities. Selected small watersheds receive financial and technical support to sustain and build partner and landowner relationships important for addressing water quality restoration and protection needs. Over \$2.6 million have been awarded annually in recent years. A detailed plan following the U.S. Environmental Protection Agency (EPA) watershed-based planning guidance including nine key elements is completed for each watershed. Upon approval by EPA, watersheds will be prioritized for Section 319 grant funding. This program is intended to make measurable progress for the targeted waterbodies in Focus Watersheds, ultimately restoring impaired waters and preventing degradation of unimpaired waters. Additional information is available at: <https://www.pca.state.mn.us/water/section-319-small-watersheds-focus>.

## **2 Implementation of recommended agricultural strategies**

To achieve the goals and milestones of the NRS, strategies were identified to support the increased adoption of the BMPs identified in Chapter 5 of the NRS. These strategies fall into the following categories: Stepping Up Agricultural BMP Implementation in Key Categories; Support for Advancing BMP Delivery Programs; Economic Strategy Options; Education and Involvement Strategies; Research

Strategies; and Demonstration Strategies. Major advancements since 2014 for these categories are described below. Note that the programs and efforts identified below do not include all efforts, but represent prominent examples of efforts with statewide or regional significance.

### **2.1.1 Minnesota Corn Growers collaborative efforts**

Private industry commodity groups, such as the Minnesota Corn Growers Association, invest heavily in research to improve nutrient management, cover cropping, irrigation, bioreactors, and other agronomic practices that benefit water quality: <http://www.mncorn.org/research/water-quality/>. The Minnesota Corn Growers Association use corn check-off dollars to support research and extension positions at the University of Minnesota who work in several different areas of water quality aspects of corn cropping systems. Minnesota Corn Growers are also involved in several of the collaborative efforts described in this section.

### **2.1.2 Forever Green Initiative**

The Forever Green Initiative brings together researchers from multiple departments at the University of Minnesota, including plant breeding, agronomy, food science and economics, with a goal to develop new high value commodity crops for conservation purposes. Many of these new crops could fit into a corn and soybean rotation thereby providing ground cover from fall to spring where it is otherwise often lacking. Private partners participating in the Forever Green Initiative include General Mills and PepsiCo, amongst others.

The Minnesota Department of Agriculture (MDA) receives Clean Water Funds to support the Forever Green Agricultural Initiative at the University of Minnesota. Research projects are selected through a request for proposal process administered by the University of Minnesota. The MDA oversees the distribution of funds and coordinates reporting on progress results and outcomes. More information is available at: <https://www.forevergreen.umn.edu/> and <https://www.mda.state.mn.us/protecting/cleanwaterfund/forevergreen>.

The Forever Green Initiative hired a Supply Chain Development Specialist and Market Development Opportunity Specialist in 2019.

### **2.1.3 Discovery Farms**

The farmer-led Minnesota Discovery Farms Program is an example of a private-public partnership program within the state of Minnesota. Minnesota Discovery Farms collects field scale water quality information from different types of farming systems across the state. Their mission is to gather water quality information under real-world conditions and engage farmers in “peer to peer” learning to support adoption of key conservation practices. Minnesota Discovery Farms has increased its core farms to eleven farms across different parts of Minnesota. Learning experiences are shared with other farmers through various educational activities. More information is available at: <https://discoveryfarmsmn.org/resources/>.

### **2.1.4 Partnerships such as the Cedar River Watershed Partnership**

Private Industry has collaborated with public entities in local watershed partnership efforts. The Cedar River Watershed Partnership began in 2018 as a unique public-private-nonprofit collaboration, including leadership from Hormel Foods, Land O’Lakes SUSTAIN, and Central Farm Service. The partnership provides farmers with tools and resources to help them adopt new farm management strategies that improve the soil, water and economic health of their farms and address water quality challenges in the

454,000-acre Cedar River Watershed area. More information is available at: <https://environmental-initiative.org/work/cedar-river-watershed-partnership/>.

Another example of a private-led partnership includes Fishers and Farmers Partnership for the Upper Mississippi River Basin. More information is available at: <https://fishersandfarmers.org/>.

### **2.1.5 Minnesota Agricultural Water Quality Certification Program**

Initiated in 2015, the Minnesota Agricultural Water Quality Certification Program (MAWQCP) is a collaborative effort led by the Minnesota Department of Agriculture in partnership with private industry, federal agencies, and other state agencies. The program certifies farmers for their land in a way that protects water quality. If farmers implement and maintain approved farm management practices, the practices are deemed in compliance with new regulation for a period of ten years. Part of the certification process is an evaluation of the nutrient management practices; including a check to ensure that nutrient BMPs are followed. By 2020, the MAWQCP certified more than 900 farmers representing over 600,000 acres of certified land. These producers have installed over 1,800 new practices in the state, resulting in over 46,000 pounds of phosphorus and over 75,000,000 million pounds of sediment from entering waterways and streams. In addition, new nutrient management practices have increased as a result of the MAWQCP in the last few years, with approximately 2,000 acres added in 2018 alone. More information is available at: <https://mda.state.mn.us/environment-sustainability/minnesota-agricultural-water-quality-certification-program>.

### **2.1.6 4R Certification led by Private Agricultural Industry**

In 2020, the Minnesota Crop Production Retailers Association (MCPR) is launching a 4R Nutrient Stewardship program for agricultural retailers. This voluntary, industry-led certification program consists of 39 science-based best management practices and nutrient standards that will be audited annually by third party auditors. The certification program, which has been in development for the past couple years, will be governed by an eleven-member board called the Minnesota Nutrient Stewardship Council (MNNSC) and administered by MCPR. This approach provides a science-based framework for plant nutrition management and sustained crop production, while considering specific individual farms' needs.

### **2.1.7 Working Lands Watershed Restoration Feasibility Study and Program Plan**

In 2018, the Minnesota Board of Water and Soil Resources (BWSR), in collaboration with many others, completed a feasibility study and plan for a future Working Lands Watershed Restoration Program – a program that would provide incentives for landowners to plant perennials and cover crops that improve water quality. The report includes an overview of promising crops and livestock enterprises, including perennial grasses and winter annual cover crops that keep roots in the soil and vegetation on the land throughout the year, improving soil health and wildlife habitat, storing carbon, and capturing excess nitrogen.

The study was directed by the 2016 Minnesota Legislature with the goal of improving water quality by increasing living cover on the landscape at a watershed scale. Since completion of the feasibility study, BWSR staff have focused efforts on encouraging establishment of living cover in vulnerable wellhead protection areas, where change in land cover across relatively small areas can measurably improve drinking water quality. More information is available at: <https://bwsr.state.mn.us/planning/WLWRP/wlwrp.html>.

### **2.1.8 Red River Basin Initiative – Landowner Permanent Easements and Storage**

The NRCS launched the Red River Basin Initiative (RRBI) in 2011, which covers parts of Minnesota, North Dakota and South Dakota, to reduce the frequency and severity of flooding, reduce erosion, and improve water quality and wildlife habitat through voluntary conservation efforts on private lands. The program aimed to create 30,000 acre-feet of floodwater storage and restore 25,000 acres of wetlands with conservation easements by its completion in 2018.

More information is available:

<https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/initiatives/?cid=stelprdb1117397>

### **2.1.9 Re-Invest in Minnesota (RIM)**

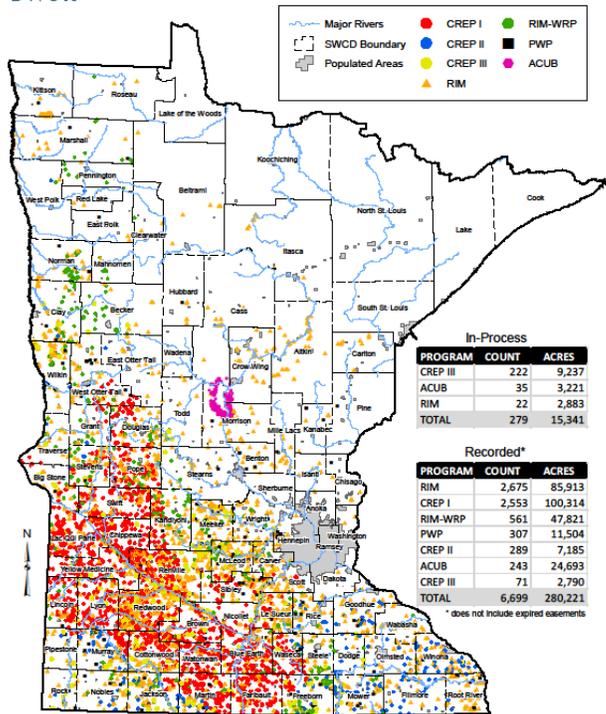
Landowners have received assistance through the Re-Invest in Minnesota (RIM) Reserve Conservation Easement program for over 30 years. By the end of 2018, nearly 7,000 easements were recorded on almost 300,000 acres statewide during the life of the program (Figure 1).

RIM stand-alone easements have been funded primarily from Capital Funding (bonding), but with the passage of the Clean Water, Land and Legacy Amendment in 2009, funding for RIM has been accelerated primarily due to the Clean Water Fund (water quality) as well as the Outdoor Heritage Fund (habitat).

- *Before Minnesota’s Conservation Reserve Program (CREP):* Wetlands and their associated uplands, as well as buffers, were the primary agricultural RIM easements from 2014 to the start of Minnesota CREP funding. In addition, RIM was used in the forested areas of Northern Minnesota for a variety of protection efforts including wild rice lakes, surface source water, and habitat.
- *During Minnesota’s CREP:* In the 54 county Minnesota CREP area, RIM easements have focused solely on agricultural land that are combined with CRP as a part of Minnesota CREP. In addition, RIM grasslands efforts have been utilized in the western half of the state. RIM also continues to be used in the forested areas of Northern Minnesota. Information on Minnesota’s CREP is provided in section 2.1.20.



**Reinvest in Minnesota (RIM) Reserve  
Conservation Easements (by Type)  
Active Easements through February 7, 2019**



**Figure 1. RIM easements through February 2019.**

**2.1.10 Minnesota Office for Soil Health**

In 2018, the Minnesota Board of Water and Soil Resources (BWSR) and the University of Minnesota Water Resources Center (WRC) initiated the Minnesota Office for Soil Health (MOSH). A fulltime State Soil Health Specialist was hired in 2019.

The purpose of MOSH is to support increasing awareness and benefits of soil health and soil conservation through research and outreach that expand the tools and skills of Minnesota’s conservation delivery community. The mission of MOSH is to 1) protect and improve soil resources and water quality by developing the knowledge, skill, and ability of local conservationists to more effectively partner with landowners and other stakeholders and 2) to promote sustainable soil and land management. An emphasis is placed on the importance of soil health and identifying the water quality and economic impacts of applied land and water management practices. More information is available at: <https://www.wrc.umn.edu/mosh>.

**2.1.11 Minnesota’s Buffer Law**

In 2015, a Minnesota Buffer Law was passed, requiring 50-foot perennial vegetative buffers along lakes, rivers, and streams (by November 1, 2017) and 16.5 feet along public ditches (by November 1, 2018). The law provides flexibility for landowners to install alternative practices with equivalent water quality benefits. Grants provided financial assistance that included landowner technical and financial support, equipment purchases and other supportive activities. SWCD progress reports are encouraging, with over

99% compliance with buffers along lakes, rivers and streams, and over 90% compliance with public ditch buffers. More information is available at: <https://bwsr.state.mn.us/minnesota-buffer-law>.

### **2.1.12 DNR’s “Innovative Shoreland Standards Showcase”**

The DNR recently updated their website to promote examples of innovative shoreland practices and ordinance development across the state. The current shoreland rules were last updated in 1989 and do not address emerging problems with declining water quality and habitat loss due to contemporary shoreland development, or the effects of climate change. These examples emphasize that shoreland communities can do more to develop riparian vegetation management standards to protect the water bodies they live on. See the showcase at:

[https://www.dnr.state.mn.us/waters/watermgmt\\_section/shoreland/innovative-standards.html](https://www.dnr.state.mn.us/waters/watermgmt_section/shoreland/innovative-standards.html).

### **2.1.13 Nutrient Management Initiative**

The Nutrient Management Initiative is a program offered by the Minnesota Department of Agriculture to engage farmers and their crop advisors in evaluating on-farm practices that improve fertilizer efficiency for corn. The program evaluates economic outcomes and offers financial support to the participating farmers and their crop advisors, thereby minimizing the economic risk of trying a new practice. New opportunities have also been added recently for cover crop on-farm trials.

Participants of the nutrient management initiative can select a new fertilizer use practice to compare to their normal practice over three replicated trials. Practices available to select include; changing the nitrogen rate, testing of timing of nitrogen application or nitrogen stabilizer products, or cover crops. Crop and nutrient management information and yield data is collected from each trial plot and the nitrogen use efficiency is estimated. The program also offers an advanced option where six nitrogen rates are replicated three times to enable the estimation of the economic optimum nitrogen rate.

From 2015 to 2018, a total of 466 trials in fields covering over 32,000 acres have helped provide greater producer assurance related to changing nutrient practices for economic and environmental outcomes. An average of 33 crop advisors have participated each year since 2015. More information is available at: <https://www.mda.state.mn.us/protecting/cleanwaterfund/onfarmprojects/nmi>.

### **2.1.14 Development of Soil Erosion Prediction Tool**

The BWSR, the University of Minnesota, and Iowa State University have been working together since 2016 to develop a long-term program to systematically provide cover crop, crop residue, land cover and soil erosion data in Minnesota counties with at least 30% agricultural land use. The goal is to quantify and track this information on multiple scales and to calculate estimated average annual and daily soil loss due to wind and water erosion. The BWSR contracted with the University of Minnesota to provide more comprehensive snapshots of crop residue cover levels and cover crop practices in Minnesota.

One of the major components of Minnesota’s crop residue and cover crop satellite imagery project is to deploy the Daily Erosion Project (DEP) web application in Minnesota. The Daily Erosion Project application provides data on the following parameters in an easy to use geospatial interface (<https://www.dailyerosion.org/>): precipitation, runoff, soil erosion (detachment), soil erosion (hillslope soil loss), along with wind erosion to be added in the future. The DEP will be utilized to help track soil loss by water and wind erosion on an annual basis and Minnesota will have ability to look at trends in the data over time. Data from this project will be useful in looking at regional, county, and watershed scale comparisons. This project is moving from prototype development into production mode in 2020 and 2021.

### **2.1.15 Nitrogen Fertilizer Management Plan/Groundwater Protection Rule**

Minnesota completed a Nitrogen Fertilizer Management Plan in 2015, which focuses on groundwater nitrate reduction strategies. One part of that plan outlined a phased strategy to mitigate high groundwater nitrate. The plan can be found at: <https://www.mda.state.mn.us/pesticide-fertilizer/minnesota-nitrogen-fertilizer-management-plan>.

In addition, MDA adopted a groundwater protection rule in 2019 that outlines how an initial voluntary approach can become regulatory in high-nitrate drinking water supply management areas where fertilizer BMPs are not adopted or groundwater nitrate levels increase. The new rule also restricts nitrogen fertilizer applications in the fall and on frozen soils in both vulnerable groundwater areas and drinking water supply management areas with elevated nitrate. More information is available at: <https://www.mda.state.mn.us/nfr>. An interactive map of vulnerable groundwater is available here: <https://mnag.maps.arcgis.com/apps/webappviewer/index.html?id=47a342afe6654640b935c8e76023da92>.

### **2.1.16 Multipurpose Drainage Water Management**

Minnesota has approximately 19,150 miles of drainage ditches and extensive untallied miles of subsurface tile installed and maintained under what currently is Minn. Stat. ch. 103E Drainage law. These systems are owned by the benefited property owners and administered by a county, joint county, or watershed district drainage authority.

Minnesota drainage law §103E.015, subd. 1 was amended in 2014 to require drainage authorities to consider multipurpose water management criteria before establishing a drainage project, such that the projects provide adequate drainage capacity while reducing downstream peak flows and flooding, reducing erosion and sedimentation, improving water quality and improving aquatic habitat. The Multipurpose Drainage Management (MDM) program is part of BWSR's competitive Clean Water Fund grants. Examples of MDM practices include, but are not limited to:

- Side inlet controls (NRCS Practice Standard 410 Grade Stabilization Structure)
- Grassed Waterway (NRCS Practice Standard 412 Grassed Waterway)
- Storage and Treatment Wetland Restoration
- Controlled subsurface drainage (NRCS Practice Standard 587 Structure for Water Control)
- Saturated Buffer (NRCS Practice Standard 604 Saturated Buffer)
- Bioreactor (NRCS Practice Standard 605 Denitrifying Bioreactor)
- Water and Sediment Control Basin (NRCS Practice Standard 638 Water and Sediment Control Basin)

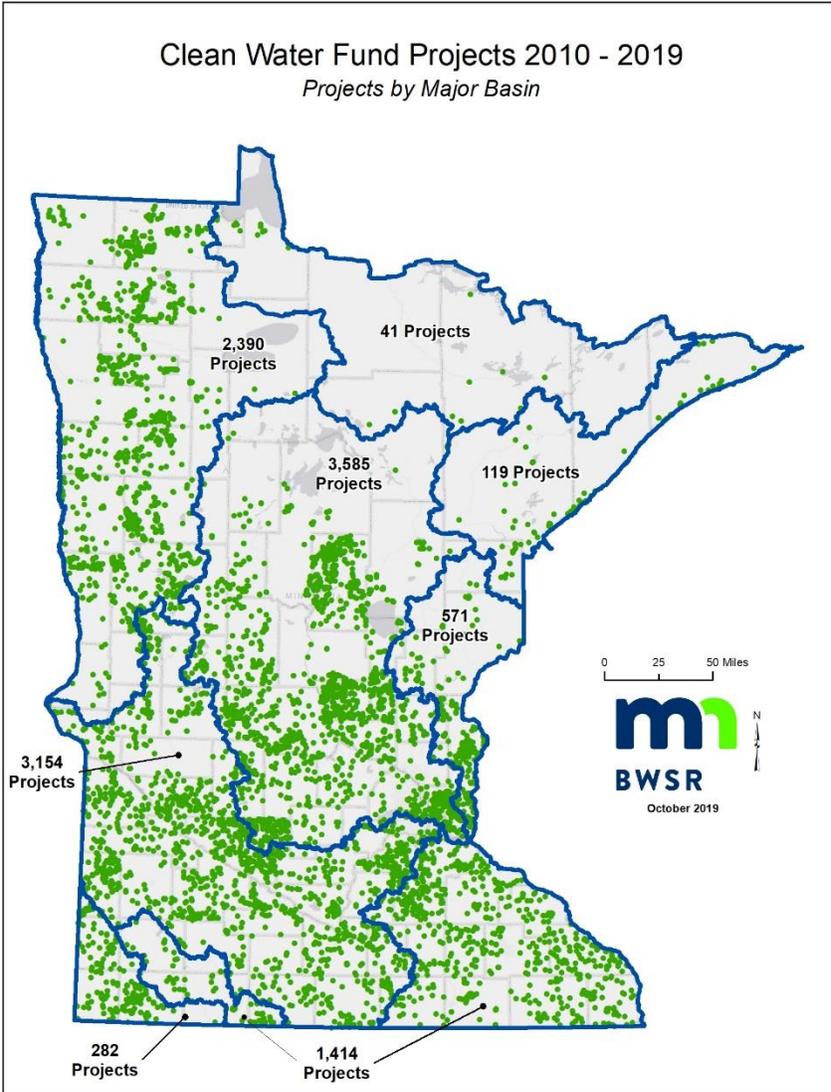
More information is available at: <https://bwsr.state.mn.us/grant-profile-multipurpose-drainage-management>.

### **2.1.17 Center for Changing Landscapes**

The Center for Changing Landscapes at the University of Minnesota has studied social and economic factors that influence conservation program success. Project findings can be found at: <https://umn.maps.arcgis.com/apps/Shortlist/index.html?appid=8ea0c0a8d3b34eb0a68af0b4a71e5d07>.

### 2.1.18 Clean Water Fund

Minnesota citizens committed to a 25-year Clean Water Legacy funding initiative as part of the State’s role in that partnership. During the past five years, Minnesota’s Clean Water Legacy funding provided \$50 to \$74 million per year for implementing practices to restore and protect waters. This money helps support local capacity to implement BMPs for nonpoint and point source pollution reductions. Practices extend beyond agriculture and also include BMPs for stormwater, septic systems, stream bank stabilization, etc. Agricultural BMPs funded through the Clean Water Legacy Fund since 2010 are provided in Figure 2.



**Figure 2. Projects funded by the Clean Water Fund 2010-2019**

Beginning in 2015, the Minnesota State Legislature provided Clean Water Funds to the BWSR for grants to invest in building the capacity of local SWCDs. This grant targets four resource concern areas—Soil Erosion, Riparian Zone Management, Water Storage and Treatment, and Excess Nutrients—and supports increased capacity by funding expenses in the following categories: Staffing, Cost Share/Incentives, Technology/Capital Equipment, and Operations. This program has greatly improved

the technical capacity of our SWCD staff to meet future needs and to implement critical conservation practices to meet Minnesota’s water quality goals. More information on the Clean Water Fund is available at: [2018 Minnesota Clean Water Legacy Report](#).

### 2.1.19 Watershed Based Funding Implementation Program

The BWSR is moving towards providing more systematic Clean Water Funding for local water management authorities on a watershed basis. The watershed-based funding model is intended to provide local governments throughout Minnesota with efficient, transparent and stable funding. To achieve this, BWSR envisions transitioning from project by project competitive grants to a coordinated watershed funding approach designed to increase water management outcomes, enhance accountability, and improve consistency and efficiency across the state. This approach will depend on comprehensive watershed management plans developed under the 1W1P Program or the Metropolitan Surface Water Management Act to provide assurance that actions are prioritized, targeted, and measurable. The efficiencies created by this change will benefit both organizations and landowners by streamlining processes, which will allow more projects to be implemented in a timely manner and ensure limited resources are spent where they are needed most. Watershed-based funding may also provide greater opportunities for local governments to leverage federal and private funding.

This program began as a pilot in 2017 and BWSR will be working with local, State, and Federal partners to finalize this program by 2021. For more information on this program:

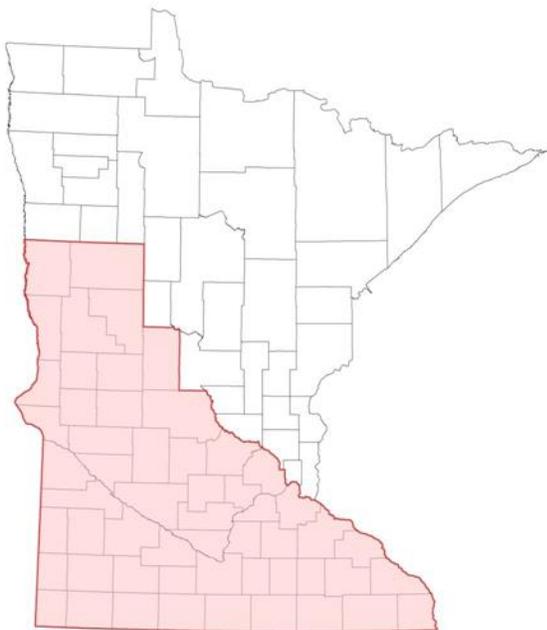
<https://bwsr.state.mn.us/watershed-based-funding-implementation-program>.

### 2.1.20 Minnesota Conservation Reserve Enhancement Program (CREP)

The Minnesota CREP began in 2017 with a goal of creating 60,000 acres of buffers, restored wetlands, and protected wellheads for drinking water. CREP is funded through USDA and State of Minnesota funds: approximately \$350 million from USDA and \$150 million from the State of Minnesota. Landowner sign-ups began in May 2017. During the landowner sign-up period of May 2017 through August 2018, a

total of 290 applications received funding, representing 12,186 acres. Over 90% of the CREP practice acreages were for wetlands. Due to new federal Farm Bill negotiations and the federal government shutdown, no further sign-ups occurred for the remainder of 2018. More information is available below and at:

<http://www.bwsr.state.mn.us/crep/>.



**Background:** Beginning in early 2014 The Board of Water and Soil Resources (BWSR) started discussions with local, state and federal agencies and organizations about the need to formulate a third Conservation Reserve Enhancement



Program (CREP) in Minnesota (CREP I and CREP II protected over 107,000 acres). The discussions led to a

two-year effort that ended in Governor Mark Dayton submitting the Minnesota CREP proposal to the USDA Secretary for funding consideration on 100,000 acres in December of 2015. The proposal focused on both water quality and habitat concerns in a 54-county area of southern and west central Minnesota.

The proposal was based on those watershed areas identified in the NRS as high priority for nitrogen and phosphorus load reductions. It also incorporated groundwater protection efforts by targeting land within Drinking Water Supply Management Areas with high and very high vulnerability to drinking water contamination.

The proposal for Minnesota CREP focused on four main Conservation Practices (CPs) that have been identified through the federal CRP:

- Grass Filter Strips (CRP CP 21)
- Wetland Restoration – 100-year Floodplain (CRP CP 23)
- Wetland Restoration – Non-floodplain (CRP CP 23a)
- Wellhead Protection Areas (CRP CP 2)

In January of 2017, the Minnesota CREP Agreement was signed by MN Governor Mark Dayton and U.S. Department of Agriculture Acting Secretary, Mike Scuse.

CREP is:

- Voluntary
- Locally-driven
- Targeted to the most environmentally sensitive acres

The four primary objectives of the Minnesota CREP are to protect 60,000 acres of the highest priority areas across 54 counties. It will:

- Target riparian areas and marginal agricultural land
- Restore hydrology, increase infiltration and provide flood mitigation
- Provide habitat for wildlife, non-game species and pollinators
- Reduce nitrate loading in drinking water supplies

Approximately \$140 million of State funding has been appropriated to BWSR for Minnesota CREP. The remaining \$10 million to reach the \$150 million goal as well as an additional \$25 million needed for lands tied to Minnesota CREP that are not eligible for CRP are expected to be secured during the next few years.

The majority of acres funded during the first year (2017-2018) are for floodplain wetlands, especially non-100 year floodplain wetlands.

### **2.1.21 USDA Programs**

- **Mississippi River Basin Healthy Watershed Initiative (MRBI)** – The MRBI uses several Farm Bill programs, including the Environmental Quality Incentives Program (EQIP) and the Agricultural Conservation Easement Program (ACEP), to help landowners sustain America’s natural resources through voluntary conservation. The overall goals of MRBI are to improve water quality, restore wetlands and enhance wildlife habitat while ensuring economic viability of agricultural lands. Historically, Minnesota has had several small watersheds in this program.
- **National Water Quality Initiative (NWQI)** – NWQI aims to accelerate voluntary, on-farm conservation investments and focused water quality monitoring and assessment resources

where they can deliver the greatest benefits for clean water. Now in its eighth year, the NWQI is a partnership among the National Resources Conservation Service (NRCS), state water quality agencies and the EPA to identify and address impaired water bodies through voluntary conservation. NRCS provides targeted funding for financial and technical assistance in small watersheds most in need and where farmers can use conservation practices to make a difference. In Minnesota, NWQI work has been conducted in Seven Mile Creek in the Minnesota River basin and Whiskey Creek in the Red River basin. More information is available at: <https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/water/?cid=stelprdb1047761>.

- **Regional Conservation Partnership Program (RCPP)** – The Regional Conservation Partnership Program (RCPP) promotes coordination of NRCS conservation activities with partners that offer value-added contributions to expand our collective ability to address on-farm, watershed, and regional natural resource concerns. Through RCPP, NRCS seeks to co-invest with partners to implement projects that demonstrate innovative solutions to conservation challenges and provide measurable improvements and outcomes tied to the resource concerns they seek to address. Minnesota had 10 implementation RCPP projects and 1 technical assistance RCPP in 2019. Several of these projects focused on water quality and nutrient reductions.
- **Conservation Stewardship Program (CSP)** – In 2019, almost \$21 million was obligated into CSP contracts in Minnesota. This was a reduction from past years as a result of allocations changes made in the 2018 Farm Bill. The top activities planned on Agricultural lands in CSP for 2019 were associated with nutrient and pest management activities.
- **Environmental Quality Incentives Program (EQIP)** – Through EQIP, NRCS provides agricultural producers with financial resources and one-on-one help to plan and implement conservation practices. Using these practices can lead to cleaner water and air, healthier soil and better wildlife habitat, all while improving agricultural operations. Through EQIP, you can voluntarily implement conservation practices, and NRCS co-invests in these practices with the customer. Minnesota NRCS spent almost \$27 million in EQIP in 2019, which was above the five-year funding average of \$23 million. The top conservation practices funded in 2019 were Cover Crops, Waste Storage Facilities & Roofs and Covers, Conservation Cover and Residue and Tillage Management, No-Till.
- **Agricultural Conservation Easement Program** – The Agricultural Conservation Easement Program helps landowners, land trusts, and other entities protect, restore, and enhance wetlands, grasslands, and working farms and ranches through conservation easements. Under the Agricultural Land Easements component, NRCS helps American Indian tribes, state and local governments and non-governmental organizations protect working agricultural lands and limit non-agricultural uses of the land. Under the Wetlands Reserve Easements component, NRCS helps to restore, protect and enhance enrolled wetlands.
- **Emphasis on Source Water Protection** – The 2018 Farm Bill emphasized the importance of source water protection by prioritizing ten percent of the conservation title activities for this purpose. A key aim of this effort is to address nutrient issues affecting drinking water sources.

### 2.1.22 2018 Nitrate Report and Research on the Social Costs of Nitrogen

The 2018 Nitrate Report is updated annually by the Drinking Water Protection Section at the Minnesota Department of Health. The report includes information on Community Public Water Systems with source water nitrate levels of at least 3 milligrams per liter. The report contains information on water quality in drinking water, sources of drinking water, costs to address nitrate in public water systems. More information is available here:

<https://www.health.state.mn.us/communities/environment/water/docs/nitrate.pdf>

While costs to address nitrate in public water systems is well documented in reports such as the 2018 Nitrate Report, the social costs including damage costs to air, water, and climate, are not very well understood. Examples of recent research into this topic include:

- “The social costs of nitrogen” Keeler et al. 2016<sup>1</sup>. This study proposes a framework to understanding social costs of nitrogen that considers how each form of nitrogen causes damages at specific locations as it cascades through the environment. Results of the framework confirm that the social cost of nitrogen is not universal but depends where the nitrogen moves and the location, vulnerability, and preferences of populations affected by nitrogen. Results demonstrate the potential of integrated biophysical and economic models to better show the costs and benefits of nitrogen and help inform nitrogen management more efficiently.
- “Land-use changes and costs to rural households: a case study in ground water nitrate contamination” Keeler et al. 2014<sup>2</sup>. This study used a groundwater well contamination model to cost estimates for well remediation, replaces, and avoidance behaviors to estimate potential loss of economic value due to nitrate contamination in southeastern Minnesota from recent land use change (grassland to agricultural land). The study estimated a \$0.7–12 million cost (present values over a 20-year period) needed to address the increased risk of nitrate contamination of private wells.

### **2.1.23 Research on Cover Crops to Reduce Producer Risks**

The Environmental Initiative is working with Minnesota stakeholders to explore and design a research program to:

- Demonstrate, with sound actuarial data, that cover crops increase resiliency for farmers, at a level that induces the Risk Management Agency to adjust rates favorably for farmers that are using cover crops
- Demonstrate to lenders, crop insurance agents, etc. that cover crops have an economic benefit that can be captured

Through this work, the farm financial system will gain a better understanding of how on-field soil-health practices can mitigate crop insurance risk. The Cover Crop Insurance Incentive Project is undertaken in partnership with NRDC and support from The Walton Family Foundation. More information is available at: <https://environmental-initiative.org/work/cover-crop-insurance-incentives/>.

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<sup>1</sup> Keeler, B., J. Gourevitch, S. Polasky, Forest Isbell., Chris. Tessum, Jason. Hill, and Julian. Marshall. 2016. The social costs of nitrogen. Published 5 October 2016, Sci. Adv. 2, e1600219 DOI: 10.1126/sciadv.1600219

<sup>2</sup> Bonnie Keeler, B. and Stephen. Polasky. 2014. Land-use change and costs to rural households: a case study in groundwater nitrate contamination. Environ. Res. Lett. 9 (2014) 074002, (10pp).

### 2.1.24 MDA Clean Water Research Program

Since 2008, MDA has announced nine requests for research proposals. Goals of the Research Program include: (1) Identify underlying processes that affect water quality, (2) Evaluate the effectiveness of agricultural BMPs, and (3) Develop technologies to target BMPs to critical areas of the landscape. Many research projects are funded through this program. See <https://www.mda.state.mn.us/environment-sustainability/clean-water-research-program> for more information.

A few examples of recent research projects funded by MDA are noted below; however, research at the University of Minnesota includes many additional research projects related to nutrients:

- **Integrated Landscape Management for Agricultural Production and Water Quality.** The objective of this project is to quantify the individual and combined impacts of in-field, edge-of-field, and in-stream management practices on water quantity and quality at the small watershed scale in southern Minnesota. This is accomplished by measuring the individual and cumulative response to cover cropping, bioreactors, constructed wetlands and drainage ditch management on the hydrology, nitrate, phosphorus and sediment. The monitoring data is used in a watershed-scale (HUC-8) computer simulation model to help scale the impact of the practices to identify optimal combinations for water quality improvement. The project started in 2017 and is scheduled to end in 2020. More information is available at: <https://www.mda.state.mn.us/integrated-landscape-management-agricultural-production-water-quality>.
- **Measuring and modeling watershed phosphorus loss and transport for improved management of agricultural landscapes.** The objective of this project is to evaluate sources and dynamics of phosphorus mobilization within predominantly agricultural small watersheds. The temporal and spatial levels of phosphorus loss was monitored for two years within the Le Sueur Basin. The information is used in computer simulation models to quantify conservation practices' impact on the mobilization of dissolved or particulate phosphorus from agricultural fields within the watershed or remobilization of stored phosphorus in discharge or sediment. The project started in 2015 and ended in 2018.
- **Analyzing and optimizing denitrification in agricultural surface waters.** The objective of this project is to identify and examine areas within a watershed non-floodzone, floodzone, and in-channel that are more effective at denitrification. Denitrification is influenced by many environmental variables and the rate of denitrification varies considerably across the landscape and time of the year. A combination of laboratory and outdoor experiments were used to evaluate different conditions. Findings suggest that denitrification rates at a site that is periodically inundated in a ditch with a constructed floodplain has higher rates of denitrification than at a location that is periodically inundated in a trapezoidal-shaped ditch. An added benefit is to slow the flow to allow sediment to settle and reduce phosphorus loading. Examples of practices to accomplish this include two-stage ditches or ditch level water level control. The project started in 2013 and ended in 2017.

### 2.1.25 Metropolitan Council/University of Minnesota Evaluation of Sludge Incinerator Ash as a Phosphorus Source for Crop Production

Metropolitan Council Environmental Services is funding a multi-year field study by the University of Minnesota, Department of Soil, Water, and Climate to evaluate sewage sludge incinerator ash as a phosphorus fertilizer. The project is considering impacts on plant growth, soil characteristics, and soil

microbial population. The project is collecting data through the 2019 growing season. Results and conclusions will be available the summer of 2020.

### 2.1.26 Root River Field to Stream Partnership

The Root River Field to Stream (RRFSP) project uses both edge-of-field and in-stream monitoring to characterize water quality in three study areas (sub-watersheds) within the Root River watershed. Sub-watersheds selected for this study are less than 5,000 acres and represent the diversity of farming practices and geologic landscapes in the larger Root River watershed. Flow and water quality monitoring is conducted at the outlet of each sub-watershed. One to two edge-of-field monitoring stations are installed in each sub-watershed to characterize sediment and nutrient loss. While this project has a very limited geographic extent, many of the findings and approaches have a much broader applicability to nutrient reduction work in the state.

Phase I of this project (2010-2016) provided baseline information about water quality, timing, and intensity of runoff, as well as an inventory of existing conservation practices. During Phase II (2017-2020), 100% of the farmers participated in a walkover process to help identify high-risk areas on their farms, and most have installed at least one new conservation practice since then. Farmers and researchers used data gathered throughout the baseline period (Phase I) to identify which practices were best suited for their locale and have the greatest potential to benefit water quality. Monitoring at multiple scales, including cataloging new practices being installed, will continue through at least 2023 to track the performance of prioritized and targeted practices and detect changes in water quality.

Conservation practices installed as a result of the RRFSP field walkover process (2017-2018):

- Over 75,000 feet of grassed waterways
- 14 new water and sediment control basins and catchment ponds
- Rehabilitation of an outdated flood control structure (capacity to store 23 million gallons of runoff at the principal reservoir and nearly 70 million gallons at the emergency spillway)
- Feedlot improvements including an increase in manure storage to reduce manure applications on frozen soil, fixing three milk house wastewater systems, and abandonment of two feedlots in high-risk locations

Over 50% of the highest priority conservation concerns, identified during field walkovers, were addressed by the end of 2017. A local nutrient management specialist is working with 13 producers who apply manure within the study watersheds to ensure application rates are applied at agronomic rates and manure management BMPs are being followed. In collaboration with researchers from the University of Minnesota, on-farm nitrogen rate and timing demonstrations have been conducted since 2015 within two study watersheds to develop nitrogen fertilizer rates that are specific to those landscapes and soil types.

A demonstration field in one study watershed will demonstrate the use of integrating an edge-of-field prairie strip with nitrogen rate and timing BMPs to achieve an estimated 30% reduction in total nitrogen load. This estimate will be validated statistically with additional years of on-farm runoff monitoring data. Since 2010, the RRFSP project manager and collaborators have given over 50 presentations and about the project at local, regional, and national meetings and conferences reaching nearly 3,000 individuals, and hosted over 60 field days. The RRFSP has been featured in 35 articles and 21 publications and reports. More recently, an 8-minute video and two podcasts were developed highlighting project results and walkover approach: <https://www.youtube.com/watch?v=QTKMf9joxGA>. More information is available at: [www.mda.state.mn.us/rrfsp](http://www.mda.state.mn.us/rrfsp).

### **2.1.27 The Red River Valley Drainage Water Management Project**

The Red River Valley Drainage Water Management Project was established in 2015 to evaluate and demonstrate the benefits of subsurface conservation drainage practices on nitrate-nitrogen and phosphorus exports from agricultural fields and provide educational opportunities for farmers, drainage industry representatives, local and regional technical staff, policy makers and other stakeholders.

To meet these objectives, two controlled drainage systems and one saturated buffer has been installed at two field locations along with edge-of-field monitoring equipment. Monitoring began in 2017 and is scheduled to go through 2023. The controlled drainage systems resulted in a nitrogen loss reduction of 33% based on monitoring data from 2017 and 2018. No reduction in phosphorus losses through the subsurface drains was observed. An 89% nitrate removal efficiency in subsurface drainage was observed in the saturated buffer during the 2018 monitoring season. Phosphorus retention in the saturated buffer was not monitored, but the long-term phosphorus retention capacity is generally considered low.

Education and outreach activities are an important part of the project. Since 2016, project collaborators have given over 30 presentations about the project at local, regional and national meeting and conferences reaching over 1,400 individuals, hosted 12 field days and two U.S. congressional visits. More information is available at: [www.mda.state.mn.us/redrivervalleydwm](http://www.mda.state.mn.us/redrivervalleydwm).

### **2.1.28 Clay County Drainage Site**

The Clay County drainage site is designed to evaluate the environmental impact of surface and subsurface drainage from crop production in a cold climate. This site is located at a private farm and includes six subsurface plots and one surface runoff plot, each approximately 22 acres in size. The soils, topography and crop rotation across the demonstration site represents field characteristics common in the most productive agricultural areas of northwest Minnesota. After collecting baseline information from 2011 – 2015, the focus shifted to managing the plots with controlled drainage and quantifying the water quality impacts of this change in management. The monitoring for this demonstration site is ongoing. More information is available at:

[www.mda.state.mn.us/protecting/cleanwaterfund/onfarmprojects/claycounty](http://www.mda.state.mn.us/protecting/cleanwaterfund/onfarmprojects/claycounty).

### **2.1.29 BWSR Grant and Cover Crop Demonstration Program**

In 2019, during the first Special Session, the Minnesota Legislature, passed Chapter 2, article 2, Sec. 7(b) (Clean Water Fund Appropriations) which provided funding for grants to local government units to protect and restore surface water and drinking water; to keep water on the land; to protect, enhance, and restore water quality in lakes, rivers, and streams and to protect groundwater and drinking water. Based on this legislation, BWSR authorized staff to develop a demonstration program to provide opportunity to increase the establishment of cover crops and related tillage practices in targeted areas on the landscape where there will be water quality benefits to surface and/or ground water.

Priority for this demonstration program was given to new adoption of cover crops and associated reduced tillage practices through identifying and addressing local hurdles to implementation through the following key efforts:

- Building local knowledge
- Facilitating partnerships
- Demonstrating clean water benefits
- Identifying methods to increase long term implementation and sustainability
- Scope and scale of adoption in targeted areas

BWSR had \$1 million available for the program and received 18 proposals requesting \$3.8 million. Five grants were awarded and will be receiving state funding between \$125,000 and \$250,000, paying for an estimated 5,000 acres of new cover crop establishment. BWSR will evaluate the effectiveness of this demonstration program before developing a long-term cover crop and soil health implementation program. More info at: <https://bwsr.state.mn.us/cover-crop-demonstration-grants-initiative>.

### 2.1.30 Demonstration Practices in Public Water Supply Recharge Areas

The MDA has established a number of local monitoring projects in public water supply recharge areas in Central Sands communities such as the cities of Verndale, Cold Spring, Perham, as well as other communities. These projects aim to create a better understanding of BMPs and their use to improve drinking water quality by local growers. Presently, the Minnesota Department of Health (MDH) and MDA are working with the University of Minnesota to monitor groundwater quality changes where the perennial crop intermediate wheatgrass (Kernza) is being established as a potential alternative to traditional annual row crops in highly vulnerable wellhead protection areas.

## 3 Implementation of recommended wastewater strategies

The Phosphorus Strategy, Rule, and eutrophication standards discussed in the NRS have and will continue to influence phosphorus reductions in wastewater. To address nitrogen in wastewater, the NRS provided a series of steps. The steps are intended to build the knowledge base and generate the data necessary to support informed decisions and investments. Descriptions of each major advancement follow.

### 3.1 Wastewater Phosphorus

Eutrophication standards for lakes (2008) and rivers (2015) has continued to be a major driver affecting wastewater facility phosphorus effluent limits. Phosphorus effluent limit reviews have been completed for half of the watersheds throughout Minnesota. Total phosphorus effluent limits have been set for 271 wastewater facilities, which represent 89% of the waste discharge stream. Between 2005 and 2017, wastewater point source phosphorus discharges were reduced 72% in areas draining toward the Mississippi River and 58% in areas draining to the Red River and Lake Winnipeg. More information at: <https://www.pca.state.mn.us/water/phosphorus-wastewater> and [Wastewater phosphorus loads interactive map](#) and [2018 wastewater discharges report to the Legislature. A 2020 report that includes wastewater discharges can be found at https://www.pca.state.mn.us/sites/default/files/lrp-ear-1sy20.pdf](#) Wastewater Nitrogen

For wastewater nitrogen, the NRS established a five-step process that began with requiring wastewater effluent nitrogen monitoring at permitted facilities. In 2014, the MPCA developed a [Minnesota NPDES Wastewater Permit Nitrogen Monitoring Implementation Plan](#). The implementation plan addresses recommended monitoring and data collection and provides the foundation for development and implementation of the remaining wastewater strategies. Minnesota recently added wastewater nitrogen monitoring at more than 450 wastewater facilities, representing 94% of the domestic effluent wastewater flow.

The next step for nitrogen identified in the NRS was to develop nitrogen management plans that could be incorporated into permits based on anticipated nitrate standards for protection of aquatic life. In 2014, these nitrogen standards were awaiting further national scientific studies to support standards development. Those studies have advanced; and as final reports are made available the MPCA anticipates incorporating new information into a nitrate standards development process.

### 3.1.1 Point-nonpoint Trading

Point-nonpoint trading is a potential cost-effective strategy for reducing nutrient loads to surface waters through a market-based approach. Point-nonpoint trading has advanced in Minnesota during the past five years, and new trading opportunities are currently being considered in several parts of the state. More information is available at: <https://www.pca.state.mn.us/water/water-quality-trading>

### 3.1.2 Regulatory Certainty (for Wastewater)

MN Statute §115.426 was signed into law by Minnesota Governor Dayton in 2016. This statute authorizes the MPCA to hold fixed total phosphorus and nitrogen limits for up to 20 years for wastewater facilities that voluntarily accept a total nitrogen effluent limit and employ biological nutrient removal technologies to meet nitrogen and phosphorus effluent limits.

## 4 Implementation of recommended strategies to address miscellaneous sources

The NRS did not recommend significant *new* strategies to reduce loads from subsurface sewage treatment systems, urban/suburban stormwater, feedlots, and sediment; however, continuation of existing programs was identified as a strategy. Descriptions of each major advancement follow.

### 4.1 Subsurface sewage treatment systems

Subsurface sewage treatment systems (SSTS) inspections are conducted for a variety of reasons including: point-of-sale, land use permits, building permits, conditional use permits, variances, and complaints. If a SSTS is determined to be an imminent public health threat, the owner has 10 months to upgrade per M.S. 115.55, subd. 5a. An annual report issued by the MPCA describing progress and updates is available by searching for “SSTS annual report” on the MPCA webpage. The 2018 Annual SSTS report was released in August 2019 (MPCA 2019). Since 2014, the fraction of septic systems with direct outlets to the land surface has continued to decrease, and now represents less than 5% of all septic systems (down from 11% in 2008). In addition, several small community sewage treatment systems have been fixed.

The MPCA has recently updated its SSTS program website based on input from local government and other SSTS stakeholders around the state. The website has improved navigation and updated content. In addition, the University of Minnesota Onsite Sewage Treatment Program (OSTP), through support from the Minnesota Department of Health, has offered educational homeowner classes that cover how septic systems function and required maintenance and testing. Over the past two years, more than 700 people attended the course. During that same time period, the OSTP also offered training to more than 3,800 septic system professionals across the state to help them receive and retain their certification to work on these systems.

More information on the septic system program in Minnesota is available at: <https://www.pca.state.mn.us/sites/default/files/wq-wwists1-58.pdf> and <https://www.pca.state.mn.us/water/subsurface-sewage-treatment-systems>.

### 4.2 Feedlots and manure

Runoff from feedlots, manure storage and land application of manure are regulated and inspected by the MPCA and 50 counties delegated by the State to administer the program for non-concentrated animal feeding operations (CAFOs), referred to as “delegated counties.” All feedlots must meet feedlot

runoff and manure application requirements, including agronomic rates of application and setbacks from waters. As the size of the feedlot and associated manure production increases, additional requirements are added. These additional requirements include record-keeping of manure spreading, manure and soil testing, manure storage requirements, and nutrient planning. Inspections are conducted by MPCA and delegated counties using a risk-based approach that focuses on feedlots in watersheds with impairments for bacteria and nutrients, open-air animal holding and manure storage areas, and feedlots located within vulnerable areas. Inspections are conducted for a variety of reasons, many of which are not related to nutrients. Because proper land-spreading of manure is particularly important for minimizing nutrients in waters, the MN Feedlot Program has continued to advance inspections of land application of manure practices, conducting 1,697 land application inspections during the five-year period, 2014-18. See also: <https://www.pca.state.mn.us/quick-links/feedlots>.

In addition, beginning in 2018, the feedlot regulatory program implemented an improved inspection checklist and developed a more rigorous QA/QC for compliance rate data (available on MPCA's Feedlot website).

In a separate effort, the Environmental Working Group developed a mapping tool for Minnesota that shows where the potential for over-application of nutrients (combined fertilizer and manure) is most likely. The map can be accessed at <https://www.ewg.org/interactive-maps/2020-manure-overload/map-nitrogen/>. The associated journal article can be found at <https://www.mdpi.com/2073-4395/10/4/480>.

Lastly, the University of Minnesota hired a manure and water quality specialist in 2017 to further develop education and research in manure management for feedlots and land-application sites. A guide for land application of manure was developed in 2019 by the University of Minnesota. On-going research will provide farmers with better information to plan for available nutrients from manure sources.

### 4.3 Stormwater

Many advances in the urban stormwater program have been made since the development of the NRS, as summarized below. More information on the urban stormwater program in Minnesota is available at: [www.pca.state.mn.us/stormwater](http://www.pca.state.mn.us/stormwater).

#### 4.3.1 Municipal Separate Storm Sewer System (MS4) General Permit

The MS4 general permit became effective August 1, 2013; a new permit is expected to be re-issued in 2020. Compliance with a series of minimum control measures as a result of MS4 permit implementation will contribute to nutrient reductions. One of these measures includes requirements for discharges to impaired waters with an EPA-approved TMDL that includes an applicable wasteload allocation (WLA). This permit requirement is currently being implemented in 145 regulated MS4s with TMDLs that address eutrophication, or phosphorus. Of these 145 MS4s, 78 were required to submit annual reports summarizing progress toward meeting WLAs. Reductions in these regulated areas will work towards meeting both local water quality standards and downstream goals. With the 2020 permit reissuance, 230 regulated MS4s will have a nutrient or sediment WLA and will be required to report progress on meeting these WLAs annually. More information is available at: <https://www.pca.state.mn.us/water/municipal-stormwater-ms4>.

### **4.3.2 Construction Stormwater General Permit (CGP)**

The Minnesota State CGP was reissued and became effective on August 1, 2018. The number of issued construction stormwater permits ranged between 2,000 and 2,500 per year between 2015 and 2019. The CGP applies to new developments and redevelopments that result in one or more acre of land disturbance. From a nutrient reduction perspective, the CGP addresses both construction activities (e.g., erosion control) and post-construction water quality requirements. The permit includes post-construction treatment requirements. The permit states that one inch of stormwater runoff from new impervious areas will be retained on-site via infiltration, harvesting or reuse, unless prohibited. More information is available at: <https://www.pca.state.mn.us/water/construction-stormwater>.

### **4.3.3 Industrial Stormwater Multi-Sector General Permit (MSGP)**

Minnesota's industrial stormwater MSGP was re-issued in 2020. This permit addresses stormwater generated on industrial properties and requires a series of benchmark and effluent monitoring activities for various pollutants, depending on the type of industrial activity. Effluent limitations are required for certain categories of industrial activity (e.g., sector C1 Phosphate Subcategory of Agricultural Chemicals includes a phosphorus effluent limit for stormwater discharges). There are currently 3,920 industrial stormwater permits in the state. More information is available at: <https://www.pca.state.mn.us/water/industrial-stormwater>.

### **4.3.4 Stormwater Technical Assistance**

In 2014, the MPCA developed a new Stormwater Manual WIKI website to serve as a user-friendly guide to direct users to more specific information about stormwater BMPs. The Minnesota Stormwater Manual provides detailed information on stormwater management approaches and BMPs recommended for use in Minnesota. The manual also includes newsletters, webinars, training/workshop opportunities, and tools permittees can use to quantify pollutant/volume reductions related to stormwater BMPs, such as the Minimal Impact Design Standards (MIDS) Calculator and MPCA Simple Estimator Tool. The manual is kept up-to-date via a wiki format and includes the most recent and relevant information. The manual is found at [https://stormwater.pca.state.mn.us/index.php?title=About the Minnesota Stormwater Manual](https://stormwater.pca.state.mn.us/index.php?title=About_the_Minnesota_Stormwater_Manual).

### **4.3.5 Stormwater Research and Demonstration**

In 2016, the Minnesota Stormwater Research Council (MRSC) non-profit was formed to:

- Facilitate the completion of needed applied research that enables more informed decisions about the use, management and protection of our water resources in urbanized areas.
- Periodically assess the status of research, identify consensus research priorities, and communicate these to Minnesota's public and private research agencies and organizations.
- Promote coordination of research goals, objectives and funding among the research agencies and organizations.

In 2018, the MSRC developed a Stormwater Research Road Map and Framework that includes priority research needs for stormwater: <https://www.wrc.umn.edu/stormwaterroadmap>.

There are several information gaps with respect to managing phosphorus in urban stormwater runoff that are currently being addressed. The MPCA is currently gathering information and developing guidance on several topics:

- Development of a street sweeping credit
- Phosphorus export from constructed stormwater ponds
- Identifying bioretention media that retains phosphorus
- Identifying amendments that retain phosphorus

The University of Minnesota is currently conducting research related to phosphorus fate and transport in urban stormwater and stormwater management systems:

- Correlating street sweeping material collected by municipalities with phosphorus removal
- Bioretention media
- Alum in ponds
- Understanding the dynamics of phosphorus behavior in constructed stormwater ponds

More information on the Stormwater Research and Technology Transfer Program can be found at: <https://www.wrc.umn.edu/projects/stormwater>.

#### 4.4 Sediment reduction

Near-channel sources of sediment, such as bluffs, streambanks and ravines, contribute significant amounts of phosphorus to downstream waters, and controlling these sources is important for long term phosphorus reduction needs in many areas of the state.

##### 4.4.1 Sediment Reduction Strategy

The NRS recognized the linkages between sediment and phosphorus reductions and referenced a Sediment Reduction Strategy that was under development in 2014. The Strategy, completed in January 2015, outlines approaches for watersheds to consider when addressing sediment reduction. More information is available at: <https://www.pca.state.mn.us/water/sediment-reduction-strategy-minnesota-river-basin-and-south-metro-mississippi-river>.

##### 4.4.2 Standardizing Approaches to Targeting and Prioritizing Watershed Upland Sediment Reduction and Channel Restoration and Advancing Floodplain Culvert Technologies at Road and River Crossings

The DNR clean water specialists are in the process of adopting a standardized approach to working with local partners in sediment-impaired major watersheds. The approach involves prioritizing subwatersheds for intensive, multi-year stream stability and sediment supply studies, and conducting these studies where there is local support and staff capacity. Completed studies (such as in the Little Cannon subwatershed) quantify in-channel vs. upland sources of sediment in each catchment in the subwatershed. This information enables DNR to recommend where to begin restoration efforts (which catchments) and which types(s) of restoration to focus on. Where stream channel work is indicated, these studies also provide specific information and cost estimates to aid restoration project planning, design, and execution based on natural channel design principles that improve watershed health and resilience. Effectiveness monitoring protocols for completed projects are being piloted (such as for a completed Cascade Creek restoration project near Rochester).

For more information on DNR's work to evaluate sites for floodplain culverts to capture sediment-laden waters, see the "Designing Resilient Watercourse Infrastructure" tab at: [https://www.dnr.state.mn.us/climate/climate\\_change\\_info/what-dnr-doing.html](https://www.dnr.state.mn.us/climate/climate_change_info/what-dnr-doing.html), and technical webpage: <https://www.dnr.state.mn.us/eco/streamhab/geomorphology/index.html>.

## 4.5 Implementation of protection strategies

The NRS states that protection strategies are needed in watersheds that are subject to changes in agricultural and land use practices, as well as vulnerable groundwater drinking water supplies in Minnesota. In addition, protection strategies for both new nitrogen sources and for soil phosphorus increases from land use changes are both important elements that WRAPS and local water planning (e.g., through One Watershed One Plan) should address.

### 4.5.1 Red River Watershed Management Board: Red River Basin Water Storage Projects

The Red River Basin Commission (RRBC) Basin-wide Flow Reduction Strategy has a long-term goal of reducing flows by 20% along the Red River. More information on the Basin-wide Flow Reduction Strategy can be found within the Long Term Flood Solutions report developed by the RRBC at: <https://www.redriverbasincommission.org/>.

Since the formation of the Red River Watershed Management Board (RRWMB) in the late 1970s, the RRWMB has helped fund water storage projects in the Minnesota portion of the Red River Basin. An emphasis has been placed on a portion of the storage being gated, so that longer detention times can be achieved. This allows for flood volume to be reduced along the Red River during the time of peak flow, and for the storage volume to be released at a more opportune time. Projects implemented since 2014, however, have been predominately urban flood control and not storage based. The following impoundments were completed in recent years:

- Buffalo Red River Watershed District (outside of RRWMB) - Manston Slough. This project includes a low-hazard classification dam with more than 4,000 acre-feet of storage and 1,150 acres of wetland restoration.
- Roseau River Watershed District - Roseau Wildlife Management Area. This project includes a mix of upland and wetland habitat and three impoundments. It stores up to 8,000 acre-feet.
- Bois de Sioux Watershed District - North Ottawa Impoundment. This impoundment controls 75 square miles in the Rabbit River Watershed and stores up to 17,200 acre-feet.

Eight new projects are in various stages of design, engineering, permitting, environmental review, and funding. These eight projects will add an expected additional 80,000+ acre-feet of storage (approximately) to the past projects that already added over 180,000 acre-feet of storage.

### 4.5.2 Source Water Protection Program

The MDH works with public water suppliers, Federal, State and local partners to monitor and evaluate the effectiveness of implementation activities needed to improve drinking water quality. Agricultural best management practices are implemented in the recharge areas of public water system wells with the assistance of the MDA. In 2017, the Minnesota legislature appropriated funds to MDH to develop a surface water Source Water Protection (SWP) program to protect public water supply systems that rely on surface water for their source of drinking water.

The MDH SWP Program for surface waters is currently working with the City of Fairmont as the first pilot community to update their Source Water Assessment and develop a surface water SWP Plan. A main driver for Fairmont is their experience with high nitrate levels in their raw water supply from Budd Lake in 2016. The Cities of Mankato, Moorhead and Virginia are projected to be the next pilot communities to

update their SWA and develop a SWP Plan. More information about the MDH SWP Grants Program can be found at: <https://www.health.state.mn.us/communities/environment/water/swp/grants.html>.

#### **4.5.3 Guidance for Lake and Stream Protection in WRAPS and 1W1P**

The Minnesota Pollution Control Agency in collaboration with numerous other state agencies recently developed a guidance document for incorporating lake protection activities into watershed plans. The guidance was developed to provide a uniform starting point in which state and local partners can begin to set lake phosphorus concentration goals and prioritize lakes for protection efforts in the HUC-8 watersheds. Part 1 of this framework describes a five-step process for identifying lakes that are vulnerable to water quality degradation within a HUC-8 watershed, and a process for prioritizing those lakes for immediate action. Part 2 of the guidance includes selected reference materials and an overview of key considerations related to lake protection. The guidance document is available: <https://www.pca.state.mn.us/sites/default/files/wq-ws4-03c.pdf>.

An additional document was created by the MPCA and other state agencies that outlines protection prioritization of lakes and streams in Minnesota. Stream and lake protection and prioritization tools were developed as part of this process. More information is available: <https://www.pca.state.mn.us/sites/default/files/wq-ws1-29.pdf>.

The DNR's lake phosphorus sensitivity index has also been recently refined for watershed use in prioritizing lakes for immediate protection efforts. "Lakes of phosphorus sensitivity significance" can be viewed at <https://gisdata.mn.gov/dataset/env-lakes-phosphorus-sensitivity>.