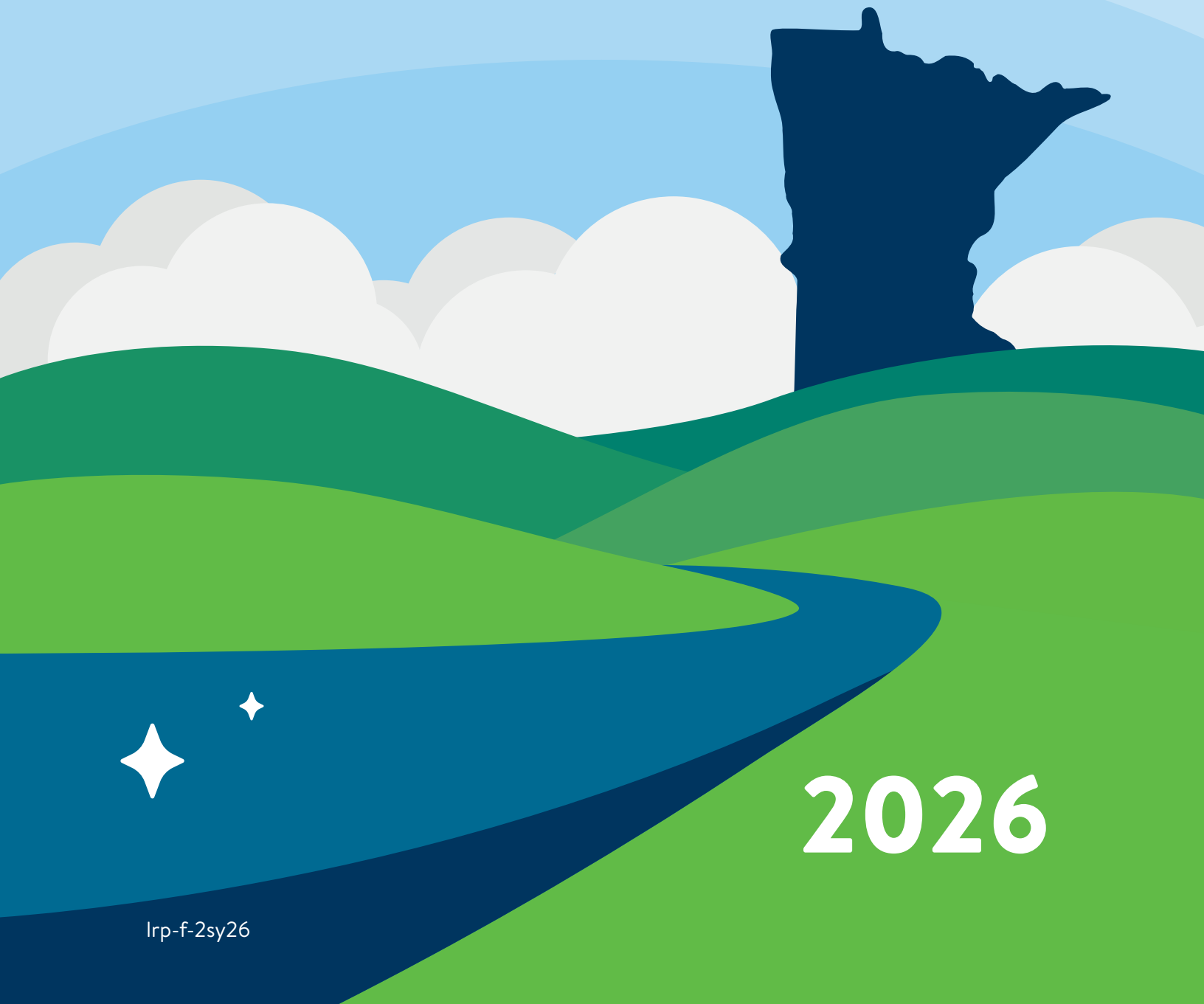
MINNESOTA

Clean Water Fund Performance



2026

lrp-f-2sy26

About this report

CLEAN WATER LAND & LEGACY AMENDMENT

Alternative formats

This report is available in alternative formats upon request. Contact info.pca@state.mn.us or 651-296-6300

More information about measures

More information about the measures summarized in this publication can be found on the Minnesota's Legacy website at www.legacy.leg.mn/funds/clean-water-fund.

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MINNESOTA

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Minnesota Department of Natural Resources (DNR)
Minnesota Department of Agriculture (MDA)
Minnesota Pollution Control Agency (MPCA)
Minnesota Department of Health (MDH)
Minnesota Public Facilities Authority (PFA)

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2026 Clean Water Fund Performance Report

Introduction

Preserving and improving water requires collective action. Water does not follow political boundaries. Water crosses jurisdictions and spans cities, counties, and regions within its watersheds, basins, and recharge areas. Although we can see the journey of water through rivers, lakes, and streams, it also can travel through soils, bedrock, wells, pipes, and treatment systems, a journey typically invisible to most. Because water spans the landscape so widely, many organizations, landowners, and professionals are involved in water work.

The Clean Water Fund provides resources for collaboration and represents Minnesota's commitment to protecting and restoring its water. Minnesotans invested in the health of their drinking water, lakes, streams, and groundwater by overwhelmingly passing the Clean Water, Land and Legacy Amendment in 2008. Through fiscal year 2025, Minnesota's Clean Water Fund has made the following possible:

- Restored water quality in 125 lakes and streams, resulting in their delisting from Minnesota's impaired waters list.
- Awarded $953 million to non-state agency partners for projects that test, protect, and restore Minnesota's water resources.
- Saved over 250 million gallons of water per year with 21,000 water-efficient alternatives incentivized through city and township programs.
- Issued approximately 2,800 loans to landowners to prevent or solve water quality problems.
- Certified 1,511 farms through the state's Agricultural Water Quality Certification Program representing approximately 1,036,200 active acres.
- Increased pesticide testing capacity in the Minnesota Department of Agriculture laboratory, from approximately 19,700 results in 2009 to over 124,500 results in 2024.
- Partnered with more than 50 local partners on nitrate monitoring and reduction projects in vulnerable groundwater areas across the state.
- Engaged over 120,000 visitors with the We Are Water MN exhibit in 35 communities statewide since 2016. Of those surveyed in 2023-2024, 86% indicated an increased awareness of threats to our water resources.
- Secured approximately 1,000 easements that protect 35,000 acres along riparian corridors and within wellhead protection areas.

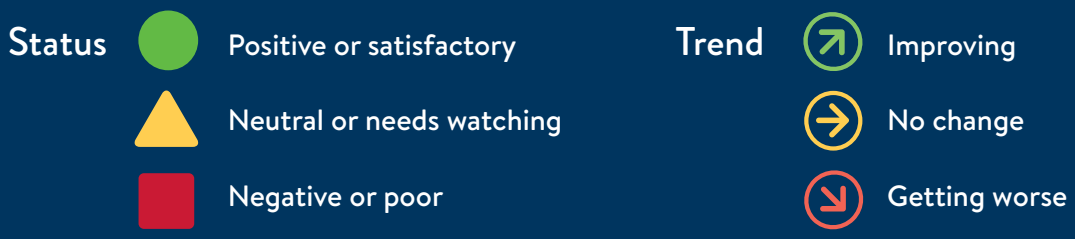
- Repaired over 900 subsurface sewage treatment systems that posed threats to human health.
- Supported projects at 58 municipal wastewater treatment facilities, which reduced phosphorus discharges by over 324,000 pounds per year.
- Developed plans for over 800 of the 970 community water systems in Minnesota to protect drinking water sources, delineated Drinking Water Supply Management Areas (DWSMAs) for 100% of community water systems with vulnerable wells and awarded over 1,200 grants for local source water protection.
- Provided free nitrate testing to 32,000 well owners in areas vulnerable to nitrate contamination through the Township Testing Program.
- Coordinated with tribal governments on monitoring and assessment programs, strategy development for meeting water quality standards, detection of unregulated contaminants, and comprehensive planning.
- Enabled statewide testing for PFAS in drinking water, covering over 99% of Minnesotans that drink water from a community water system.

The Clean Water Fund is often the funding source for science, planning, and public engagement that leads to larger investment from other sources. Every $1 invested from the Clean Water Fund leveraged an additional $1.13 in funding from other sources. In addition, the Clean Water Fund supports programs that provide multiple benefits other than just water quality, such as improved habitat, reduced financial risk for farmers, climate resiliency, greater household affordability for drinking water and sewage treatment, flood reduction, and more.

Over the past decade, the Clean Water Fund has transformed Minnesota's water management framework from a county-by-county system to a watershed-based system. All 80 watersheds in Minnesota have developed Watershed Restoration and Protection Strategy (WRAPS) plans. Together with Groundwater Restoration and Protection Strategies (GRAPS), these WRAPS strategies form a "to-do" list for each watershed to meet water quality standards over time. Using a One Watershed, One Plan (1W1P) approach to prioritization and funding, Clean Water Fund initiatives empower local communities to implement science-based projects and programs across the state. With 54 of 60 1W1P plans approved and being implemented, the remaining six 1W1P plans will be completed by the end of 2027.

Having the Clean Water Fund gives Minnesota a unique structure and incentive for state, local, and regional partners to collaboratively establish priorities, identify challenges, and coordinate investments, monitoring, and evaluation for our waters. With the relationships and coordination forged through the Clean Water Fund, Minnesotans are better equipped to face these challenges and continue taking actions to protect our waters, now and into the future.

Status and trend symbols in this report



2026 Clean Water Fund Report Card

MINNESOTA

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Minnesotans care deeply about the state's natural resources and cultural heritage. In 2008, we voted to increase our sales tax and pass the Clean Water, Land and Legacy Amendment, providing 25 years of constitutionally dedicated funding for clean water, habitat, parks and trails, and the arts.

This report card highlights work done using Clean Water Fund dollars for Minnesota's many water resources. The report card tracks a suite of performance measures that are described in the full report that follows. It provides a qualitative assessment of how well actions are being implemented and what outcomes are being achieved.

Measures are scored according to their status as of the end of fiscal year 2025 (FY25) and for their trend over time. Scores were developed using data-informed professional judgment of agency technical staff and managers. The legend shows the symbols used to describe how measures were scored.

CLEAN WATER LAND & LEGACY AMENDMENT

Investment measures

Measure	Status	Trend	Description
Total Clean Water Fund dollars appropriated by activity	$2.1B has been appropriated to the Clean Water Fund from FY10-27, ranging from $157M in FY10-11 to $318M* in FY24-25.	FY16-17: $228M FY18-19: $212M FY20-21: $261M FY22-23: $257M FY24-25: $343M FY26-27: $303M	For FY10-27, all 80 watersheds benefited from Clean Water Fund supported activities. Implementation activities comprise the largest portion of spending in watersheds statewide. * Increased to $343M through supplemental funding
Total Clean Water Fund dollars per watershed or statewide by activity	All watersheds in the state are benefiting from local and statewide projects.		For FY10-27, all 80 watersheds benefited from Clean Water Fund supported activities. Implementation activities comprise the largest portion of spending in watersheds statewide.

Total Clean Water Fund dollars awarded in grants and contracts to non-state agency partners	$953M was awarded in grants and contracts to non-state agency partners in FY10-25.		About 85% of grant and contract awards are for implementation activities; 47% of total FY10-25 appropriations were awarded to non-state agency partners.
Total dollars leveraged by Clean Water Fund	$915M was leveraged by Clean Water Funds in FY10-25, or $1.13 for every implementation dollar invested.		Required Clean Water match funds were exceeded.

Surface water measures (actions)

Measure	Status	Trend	Description
Percent of monitoring addressing state and local needs	Neutral	No change	Nearly 40% of watersheds met goals for addressing surface water monitoring request needs. Ongoing program development and outreach is aimed to ensure local needs are identified for monitoring
Local partner participation in monitoring efforts	Positive	No change	As of 2025, all programs are meeting participatory goals.
Number of nonpoint source best management practices implemented with Clean Water Funding and estimated pollutant load reductions	Neutral	Improving	Although funding has increased and there is a continued increase in practices and projects being implemented, the total request for projects has remained significantly greater than available funds.
Number of municipal point source construction projects implemented with Clean Water Funding and estimated pollutant load reductions	Positive	No change	Pace of awards is linked to permit cycles, compliance schedules and available Clean Water Funds. Applications exceed currently available funds even after significant infusion of bond funds over the past several cycles.

Surface water measures (outcomes)

Measure	Status	Trend	Description
Rate of impairment/unimpairment of surface water statewide and by watershed: Stream aquatic life	Neutral	No change	Water quality varies greatly by region. In general, good water quality remains where land is intact; where considerable alteration has occurred, water quality is poor. Generally, north central MN has more streams supportive of aquatic life than the southern and northwestern portion of the state.
Rate of impairment/unimpairment of surface water statewide and by watershed: Stream swimming	Neutral	No change	Water quality varies greatly by region. In general, good water quality remains where land is intact; where considerable alteration has occurred, water quality is poor. Generally, southern Minnesota does not have many streams supporting recreation use and it is highly variable in the north portion of the state.
Rate of impairment/unimpairment of surface water statewide and by watershed: Lake aquatic life	Neutral	No change	Water quality varies greatly by region. In general, good water quality remains where land is intact; where considerable alteration has occurred, water quality is poor. Generally, the north half of the state has more lakes supportive of fish communities than southern Minnesota.
Rate of impairment/unimpairment of surface water statewide and by watershed: Lake swimming	Neutral	No change	Water quality varies greatly by region. In general, good water quality remains where land is intact; where considerable alteration has occurred, water quality is poor. Generally, north central MN has many lakes that support recreational use and it is highly variable in the South portion of the state.
Changes over time in key water quality parameters: Lake clarity	Positive	Improving	Lake clarity is improving in more lakes than degrading. Nearly 60% of the lakes with data available, show no trend or no change.
Changes over time in key water quality parameters: Sediment in large rivers	Positive	No change	Sediment in Large Rivers — Over 80% of rivers have no trend detected. There are two more improving trends than declining trends in total suspended solids concentrations.

Changes over time in key water quality parameterss: Nitrate in large rivers	 Neutral	 No change	Nitrate in Large Rivers — Over 80% of rivers have no trend detected. There are three more degrading trends than improving trends in nitrate.
Changes over time in key water quality parameters: Phosphorus in large rivers.	 Positive	 Improving	Phosphorus in Large Rivers — Phosphorus concentration trends are improving more than degrading. Over 60% of rivers have no trend detected.
Changes over time in key water quality parameters: Pesticides in streams.	 Neutral	 Improving	Pesticides in Streams — Detections in streams vary greatly as a result of hydrologic and agronomic conditions; exceedances of pesticide water quality standards are rare. Nine streams once impaired for acetochlor and chlorpyrifos have been removed from the Impaired Waters List. The MDA tests for over 180 pesticides each year to evaluate conditions.
Changes over time in key water quality parameters: Pesticides in lakes.	 Neutral	 Improving	Pesticides in Lakes — No pesticides were detected above a water quality standard since 2018. While pesticides are detected in some lakes, concentrations are very low relative to water quality reference values.
Changes over time in key water quality parameters: Chloride in streams and rivers	 Poor	 Getting worse	Chloride in rivers in streams — Concentrations from are increasing in almost all metro area rivers and streams as of trends through 2019.
Number of previous impairments now meeting water quality standards due to corrective actions	 Poor	 Improving	Despite a rising number of impaired waterbody listings, delistings are on an upward trend, reflecting the success of ongoing water quality improvement projects.
Mercury in fish	 Neutral	 No change	Mercury in game fish is not yet responding to decreases in local mercury emissions. Global emissions have increased. The time lag between emission reductions and response is likely several decades. It is too soon to see a measurable response in fish mercury levels.

Mercury emissions	Neutral	Improving	Significant progress has been made reducing mercury emissions from power plants. Emissions from mercury use in various products saw a decrease in emissions for the 2023 emission inventory, continuing a general downward trend since 2014 Conversely, emission from the mining sector have remained relatively steady since.
Municipal wastewater phosphorus discharge trend	Positive	Improving	Significant phosphorus load reductions have been achieved through regulatory policy, infrastructure investments, improved technology and optimization of operations.

Drinking water and groundwater measures (actions)

Measure	Status	Trend	Description
Number of community water supplies assisted with developing source water protection plans	Positive	Improving	On track to meet planning goals for groundwater and surface water systems.
Number of grants awarded for source water protection	Positive	Improving	Leveraging resources helps to meet increasing demand for grants and to accelerate implementation of source water protection activities.
Number of local government partners participating in groundwater nitrate-nitrogen monitoring and reduction activities	Positive	Improving	New local partnerships continue to be established for nitrate-nitrogen monitoring and reduction activities.
Number of new health-based guidance values for contaminants of emerging concern	Positive	No change	Completed 2 re-evaluations and 2 full evaluations, updated water guidance for 3 CECs, authored 3 publications, provided technical assistance to understand and use water guidance values.

Number of counties completing a county geologic atlas for groundwater sustainability	Positive	Improving	County atlases (including the geologic and groundwater atlases) are being completed at the planned rate, and counties continue to step up to participate. With continued and consistent funding, completion of geologic atlases for all counties is expected around 2035, and completion of groundwater atlases for all counties around 2040.
Number of long-term groundwater monitoring network wells	Poor	Improving	Many areas of the state still lack important groundwater information. Long-term ramp up in monitoring accelerated by Clean Water Fund investments is filling gaps.
Land use in Drinking Water Supply Management Areas	Positive	Improving	There is increasing research, engagement, and activity to target and protect vulnerable areas in DWSMAs.

Drinking water and groundwater measures (outcomes)

Measure	Status	Trend	Description
Changes over time in pesticides, nitrate-nitrogen, and other key water quality parameters in groundwater: Pesticides	Neutral	No change	Variable trends for five common pesticides indicate a mixed signal. Low levels are frequently detected in vulnerable groundwater.
Changes over time in pesticides, nitrate-nitrogen, and other key water quality parameters in groundwater: Nitrate-nitrogen statewide	Poor	Not enough info	In many agricultural areas, drinking water supplies are not vulnerable to surficial contamination and most wells have low levels of nitrate-nitrogen. However, in vulnerable groundwater areas, nitrate contamination is a significant concern.
Changes over time in pesticides, nitrate nitrogen, and other water quality parameters in groundwater: Nitrate-nitrogen southwest region	Poor	Not enough info	In areas where groundwater is vulnerable, nitrate levels can be high. Of the 21 vulnerable townships tested in southwest Minnesota (2013-2019), all townships had 10% or more of the wells over the nitrate-nitrogen 10 mg/L standard.

Changes over time in pesticides, nitrate-nitrogen, and ther key water quality parameters in groundwater: Nitrate-nitrogen Central Sands	Poor	No change	Trend data from the Central Sands Private Well Network shows a slight downward trend in the 90th percentile. However, Township Testing data show a high level of nitrate in some vulnerable aquifers in the Central Sands.
Changes over time in pesticides, nitrate-nitrogen, and other key water quality parameters in groundwater: Nitrate-nitrogen southeast region	Poor	No change	Trend data from the Southeast Minnesota Volunteer Nitrate Monitoring Network shows a downward trend in the median concentration. However, Township Testing data show a high level of nitrate in some vulnerable areas in southeast Minnesota.
Changes over time in source water quality used for community water supplies	Positive	Improving	Current risk management approaches for unregulated contaminants are more proactive and collaborative than the project based approach of the past.
Nitrate concentrations in newly constructed wells	Neutral	No change	Since 1992, there has been a general increase in the percentage of new wells that have nitrate levels above the drinking water standard.
Arsenic concentrations in newly constructed wells	Neutral	No change	The percentage of wells with arsenic above the drinking water standard has remained steady over the past 10 years. Evaluation of ways to reduce this percentage is ongoing and may take years before significant progress is made.
Changes over time in groundwater levels	Positive	Improving	Statewide 95% of the observation wells show either no significant change or upward trends (up 32% from 2014). Portions of the state lack important groundwater information while locally, particularly in the northwest, experienced groundwater declines.
Changes over time in total and per capita water use	Positive	Improving	Water efficiency measured as water use per person continues to increase but it is unclear whether the patterns of water use are due to annual weather changes versus changes in management.

Social measures and external drivers

Measure	Status	Trend	Description
Social Measure- Building local capacity to support and engage in water restoration and protection	Neutral	No change	We Are Water MN is the Clean Water Fund's only dedicated program for building community capacity. Between 2016-2024, We Area Water MN was hosted by 35 organizations in 33 different communities, involved 1,141 community organizations, and reached 120,297 visitors.
External drivers- Important land use	Neutral	No change	There have been major shifts in land cover in Minnesota over the last 70 years. To maintain the state's goal of no-net-loss of wetland quantity, it is essential to continue wetland restorations and maintain low wetland losses.
External drivers- population	Neutral	No change	Minnesota's population has increased steadily since 1950, with most of that growth attributed to urban or suburban counties. As Minnesota's population continues to increase, so too will the demands placed on the state's water resources.
External drivers- climate trends	Neutral	Getting worse	All stations in Minnesota have declining average winter snow depth because of warmer winter conditions, increased thaws, and more winter rain.Even with frequent drought conditions in the 2020s, the amount of precipitation falling on the wettest day of the year continues increasing.

More information about the measures summarized in this publication can be found on the Minnesota's Legacy website at www.legacy.leg.mn/funds/clean-water-fund.

Investment measures

Total dollars appropriated

Measure: Total Clean Water Fund dollars appropriated by activity

Why is this measure important?

This measure illustrates the overall amount of Clean Water Funds allocated in a particular biennium and provides a breakdown of that funding in specific categories to demonstrate spending over time. It is the first of four financial measures, providing context for the others. It is the primary investment that enables resources to be spent on the actions that will ultimately help achieve outcomes.

What are we doing?

State agencies, local government and nonprofit organizations are spending Clean Water Funds on hundreds of projects to protect and restore the state's surface water, groundwater and drinking water.

Project categories include water-quality monitoring and assessment, watershed restoration and protection strategies, protection and restoration implementation activities, drinking water protection activities, and applied research.

What progress has been made?

Voter approval of the Clean Water, Land and Legacy Amendment increased the sales and use tax rate by three-eighths of 1% on taxable sales, starting July 1, 2009 through 2034. Of those funds, 33% were dedicated to the Clean Water Fund.

Over $2.1 billion has been appropriated since the inception of the Clean Water Fund. Figure 1 shows the dollars appropriated by biennium for all funding source categories. Appropriation levels will vary by biennium due to changes in sales tax revenue. Figure 2 shows the appropriations organized by specific categories.

Figure 1. Total dollars appropriated by biennium

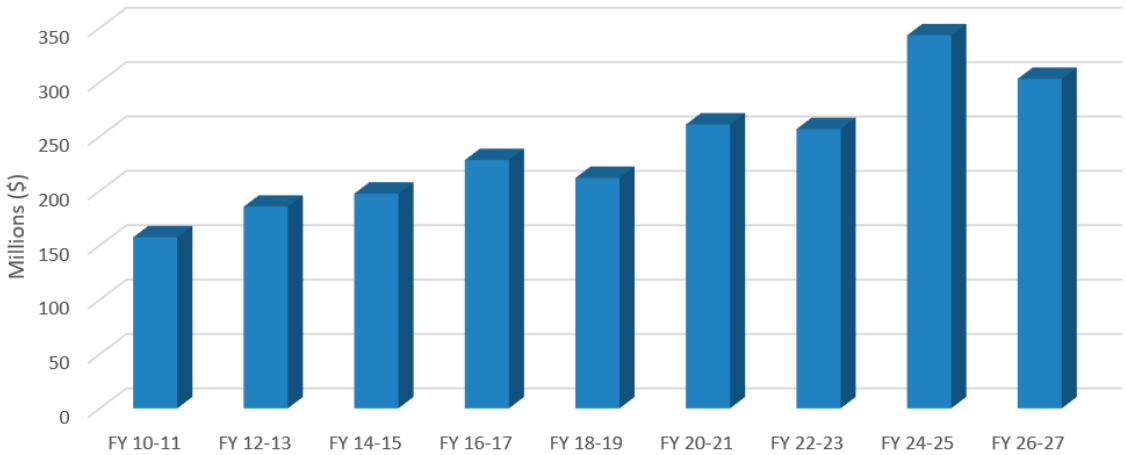
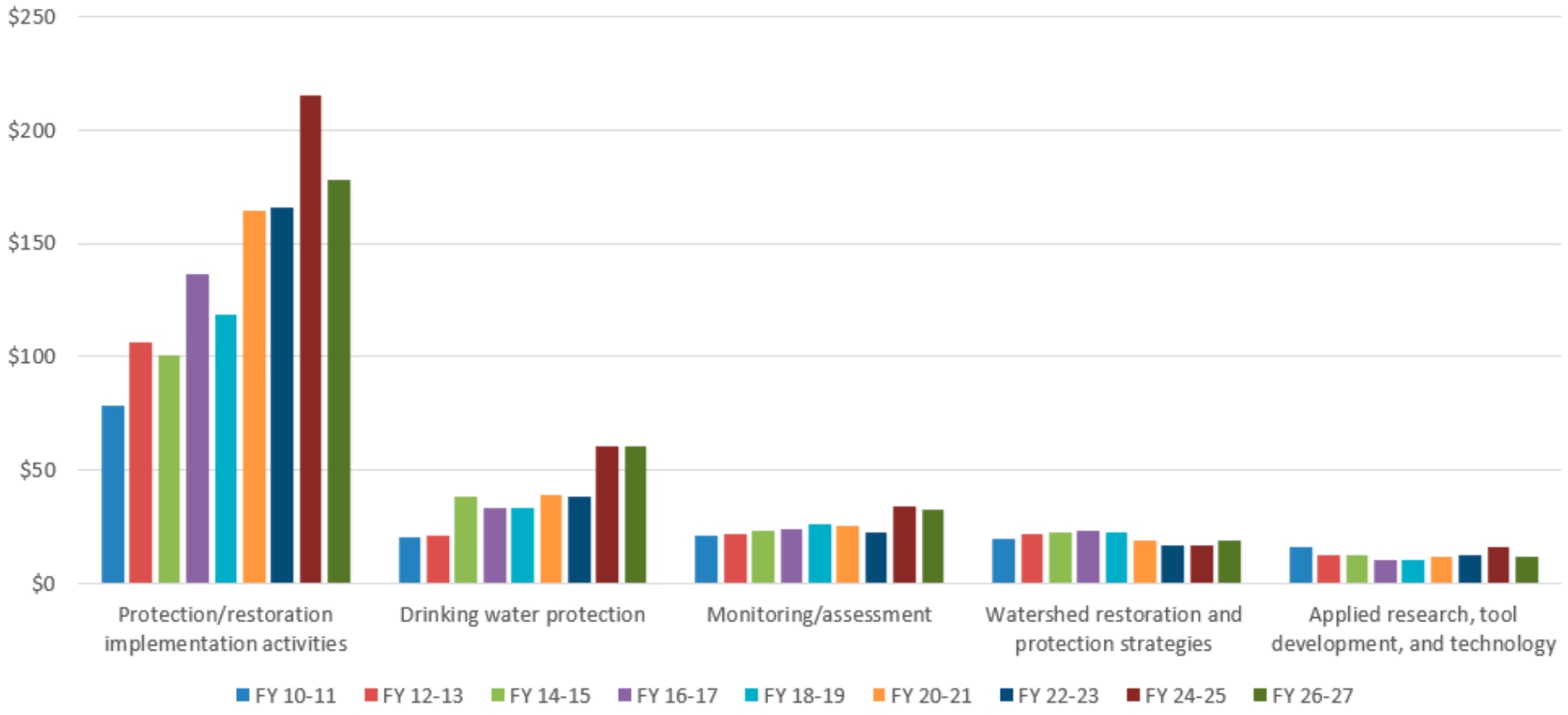


Figure 2. Clean Water Fund appropriations by category



Total dollars invested by watershed or statewide

Measure: Total dollars invested per watershed or statewide for monitoring/assessment, watershed restoration/protection strategies, protection/restoration implementation activities, and drinking water protection

Why is this measure important?

Many Minnesotans want to know how much money from the Clean Water Fund is being invested in their backyard. There is also Clean Water Fund work that has a statewide benefit. This measure tracks Clean Water Fund investments in each major watershed in the state, as well as investments on statewide activities that benefit all watersheds. It shows how the funds are being allocated geographically to support specific activities in four major activity categories:

- Water quality monitoring/assessment
- Watershed restoration/protection strategy development
- Restoration/protection implementation activities
- Drinking water protection

What are we doing?

Thousands of Clean Water Fund-supported projects led largely by local governments are completed and underway across the state. Funded activities include:

- Implementation of practices to clean up wastewater, stormwater, and agricultural runoff.
- Regular testing, assessment, and modeling of water quality in lakes and rivers to help gauge the effectiveness of clean water practices.
- Strategy development and targeting of practices to guide effective watershed restoration and protection, as well as protection of drinking water and groundwater.

State agencies provide technical assistance and administrative oversight for all these activities. They include: Minnesota Board of Water and Soil Resources, Department of Natural Resources, Department of Agriculture, Department of Health, Metropolitan Council, Pollution Control Agency, and Public Facilities Authority.

What progress has been made?

A total of $860 million in completed projects has been expended for all categories of funding tied directly to specific watersheds and $427 million connects back to statewide and regional efforts as a whole, for a total of $1.28 billion for this measure.

Spending varies among the watersheds, depending on the resources of concern, watershed size and complexity, and the technical and administrative capacities of partners in the watershed.

For fiscal years 2010-2025, Clean Water Fund allocations to surface water and drinking water projects are benefiting all 80 watersheds in Minnesota. As noted above, these activities are being implemented by local partners as well as state agencies.

Of the four activity categories, funding for implementation activities comprised the largest portion of spending statewide. However, the costs of implementation can vary significantly by watershed, depending on the type of projects and the problems being addressed.

FY 10-25 Clean Water Fund Dollars by Watershed

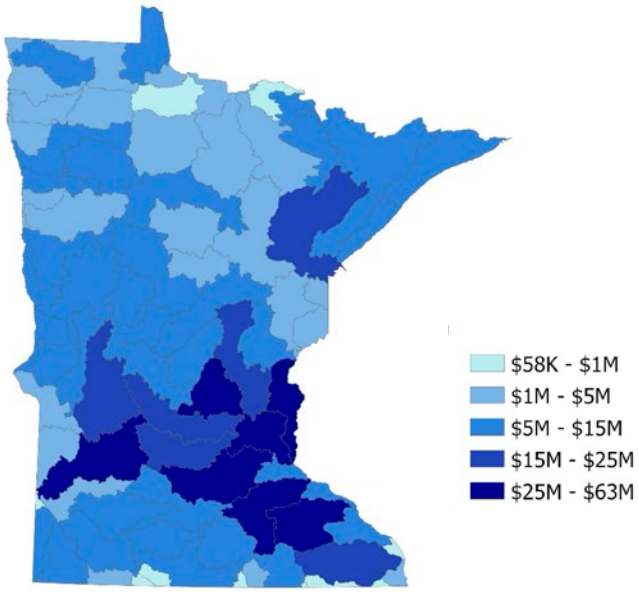


Figure 3. Combined funding for water quality monitoring, watershed restoration and protection strategies (WRAPS) development, implementation, and drinking water protection.

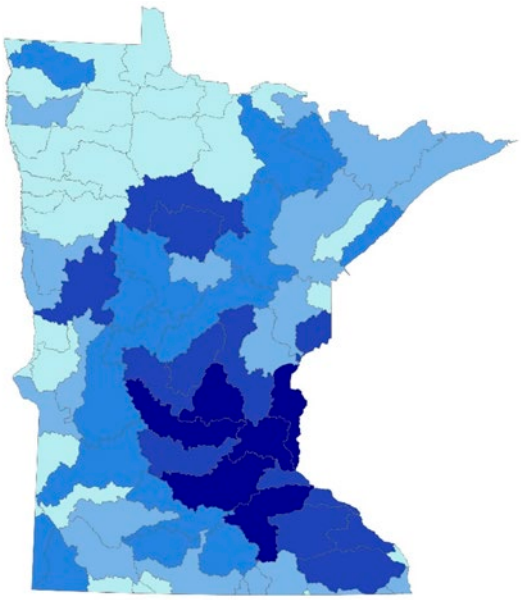


Figure 4. Funding for drinking water protection actions only

These maps represent projects and supporting activities that have been completed to date, as there are several active grants and contracts with prior appropriations which results are not represented in figures 3 and 4. Smaller amounts of funds have been expended in some northern Minnesota watersheds where there is significant amount of protected public lands with relatively good water quality. Also, a few watersheds in northwestern Minnesota and along the Iowa border are very small in size and as an artifact of the mapping process appear to have received less funds, but are similar in funds per unit area with adjoining watersheds.

Learn more

about activities funded by the Clean Water Fund.

Total dollars awarded

Measure: Total Clean Water Fund dollars awarded in grants and contracts to non-state agency partners

Status

$953M was awarded in grants and contracts to non-state agency partners in FY 2010-2025. About 85% ($808 million) of this are for implementation activities.

Why is this measure important?

This measure tracks the amount of Clean Water Funds awarded in grants and contracts to external, non-state agency partners to conduct a wide range of clean water activities. The measure provides context on funding distribution between state, federal and local agencies to perform Clean Water Fund-supported work.

What are we doing?

Thousands of Clean Water Fund-supported projects, led largely by local government units, are underway and being implemented across the state. Non-state agency partners include cities, counties, soil and water conservation districts, watershed management organizations, federal agencies, universities, nonprofit organizations, and private consulting firms working with local and state agencies.

Funded activities include implementation of practices to clean up wastewater, stormwater and agricultural runoff. They also include testing water quality to determine the health of lakes and rivers, strategy development to guide effective watershed restoration and protection, and implementation of source water protection plans for drinking water. Groundwater monitoring is also funded through Clean Water Fund dollars and is used to ensure drinking water and groundwater protection.

For all actions taken by local government units and other partners, state agencies provide monitoring activities, development of watershed protection and restoration strategies, as well as technical assistance and administrative oversight. The agencies include Minnesota Board of Water and Soil Resources, Department of Natural Resources, Department of Agriculture, Department of Health, Metropolitan Council, Pollution Control Agency, and Public Facilities Authority.

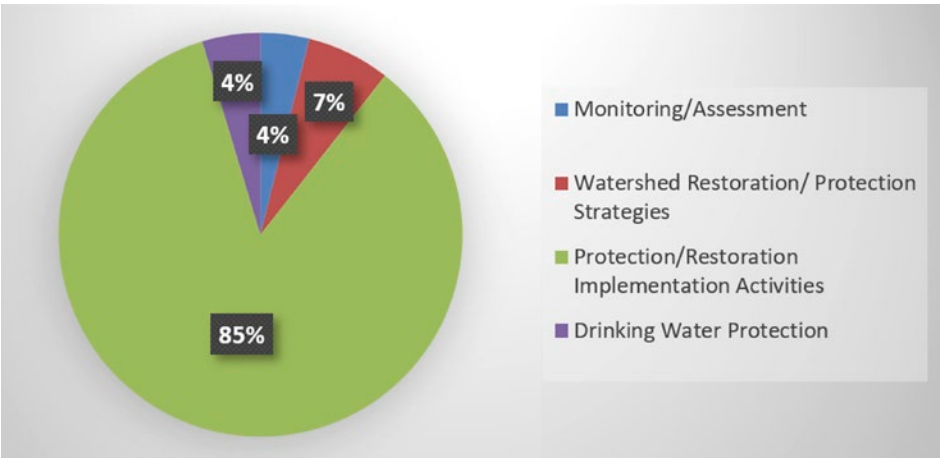


Figure 5. The percentage of total grant and contract awards ($953 million) in FY 10-25 for each major Clean Water Fund-supported activity. Allocations to implementation activities are expected to stay steady or grow in future years as more projects move from strategy development to implementation.

What progress has been made?

As shown Figure 5, a total of $953 million in Clean Water Funds were awarded to non-state agency partners from fiscal year 2010-25, with the largest share of that going to protection and restoration implementation activities. This represents nearly 47% of the total $2.1 billion in Clean Water Fund appropriations for those years.

The balance of remaining appropriations is largely used by state agencies to provide statewide monitoring, watershed protection and restoration strategy development, technical assistance, conservation easements with private landowners, and oversight on Clean Water Fund-supported projects.

Learn more

Find more information about this measure and its data.

Preventing fraud, waste, and abuse of Clean Water Funds

Minnesota State Government agencies administering Clean Water Funds (CWF) seek to do so with the highest level of fiscal responsibility and are participating in steps being carried out across Minnesota to safeguard against fraud, waste, and abuse. Agencies uphold the legal use of funds, receive training on and take measures to mitigate fraud risk, maintain internal controls, and report suspected fraud.·

- **Upholding the legal use of funds:** The Minnesota Constitution (Article XI, Sec. 15) requires that Clean Water Funds supplement rather than substitute traditional sources of funding and projects meet the purpose of the fund. Furthermore, state agencies are required to make sure all expenditures of funds fit within the allowable use of appropriation language and the program descriptions submitted to the Clean Water Council.
- **Training and risk mitigation:** All state agency staff with grant management responsibilities, including those administering CWF grants, are required to complete an initial and then annual grant management training course provided by the Minnesota Department of Administration (Minn. Stat.16B.98 subd 6a). Agencies are also required to carry out pre-award risk assessments in grant awarding procedures (Minn. Stat. 16B.981). Both requirements are newly effective as of July 1, 2025, and complement existing processes to monitor and evaluate grants. For more information, see Policies, Statutes, and Forms / Minnesota.gov.·
- **Internal controls:** Minnesota Management and Budget (MMB) is responsible for maintaining an effective system of internal controls and internal auditing for all executive agencies (Minn. Stat. 16A.057). This system safeguards public funds, ensures programs are administered in compliance with the law, and requires documentation as well as periodic evaluation of internal control procedures.
- **Fraud reporting:** State staff are required to submit a report through agency and external channels when they obtain information or discover evidence of fraud, suspected fraud, financial crime, or possible unlawful use of public money, property or other public resources. Reporting audiences include the Minnesota Bureau of Criminal Apprehension (BCA) under Minn. Stat. 299C.061 subd. 7 and Office of the Legislative Auditor (OLA).

Dollars leveraged

Measure: Total dollars leveraged by Clean Water Fund implementation activities

Status

FY 2010-25, more than $915 million dollars was leveraged by Clean Water Fund, or $1.13 for every implementation dollar invested.

Required Clean Water match funds were exceeded.

Why is this measure important?

This measure describes how many total dollars supplement the Clean Water Fund dollars invested in projects in a given year. Throughout Minnesota, the demand for funding to protect and restore the water resources far exceeds the available state dollars. The ability to use Clean Water Fund dollars to leverage local and other funds means millions more dollars are available – increasing the number of projects that are implemented and making projects more cost effective for communities.

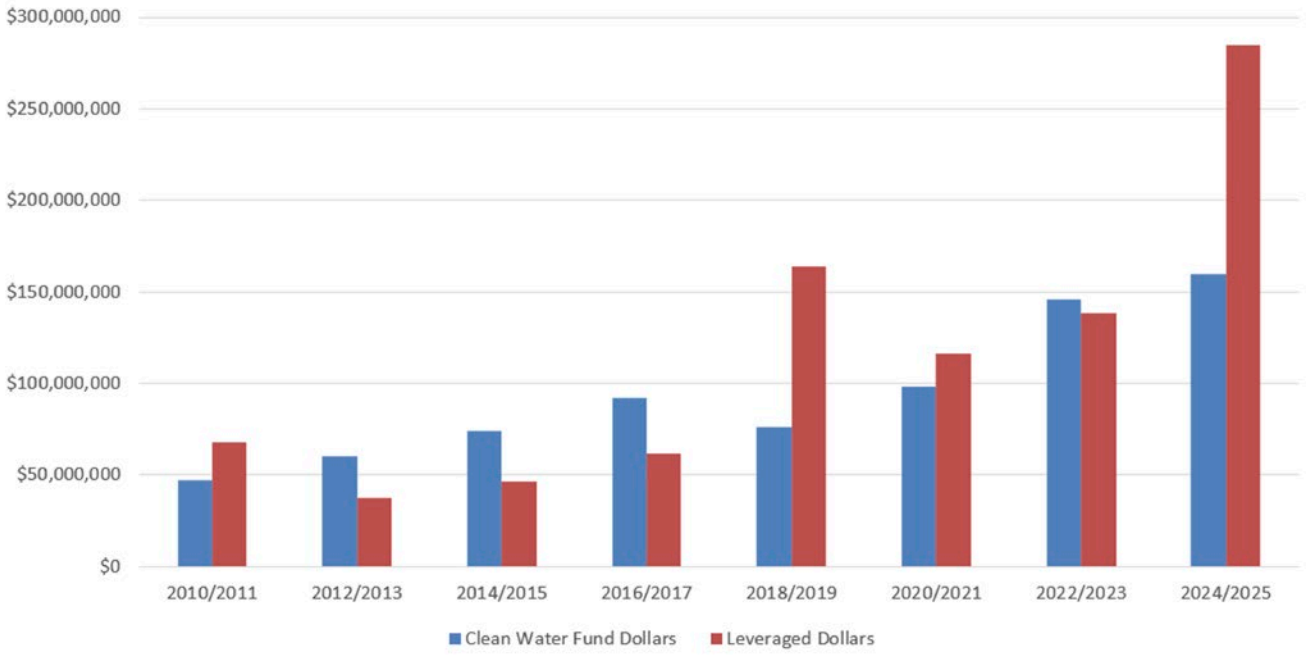
What are we doing?

Clean Water Fund grant programs fund actions to prevent polluted runoff from fields, streets, lawns, roofs and other similar sources. They also fund improvements to municipal wastewater and stormwater treatment. Partnerships between state agencies, various local units of government, and the federal government are critical to implement these water quality improvement activities.

What progress has been made?

During fiscal years 2024 and 2025, more than $155 million in state grants and loans was awarded to local governments (watershed management organizations, soil and water conservation districts, counties, etc.) for projects to reduce runoff from agricultural fields, streets, lawns and other similar sources.

Figure 6. Total dollars leveraged by Clean Water Fund



During fiscal years 2022 and 2023, more than $20 million in state grants was awarded to improve municipal treatment facilities and to help small communities invest in new infrastructure. Local match and other funding sources increased the project dollars by $64.6 million.

As a result, during FY10-25, more than $915 million dollars was leveraged by Clean Water Fund, or $1.13 for every implementation dollar invested (figure 6).

As shown in figure 6, total dollars leveraged stayed relatively flat the FY10-17 even as Clean Water Fund implementation funds increased. This is in part because the Board of Water and Soil Resources has provided additional clarification to grantees on match requirements and tracking, which has resulted in more moderate amounts of leveraged funds being reported over time.

Note: In FY 18-19, changes to the Public Facility Authority grant programs resulted in a significant increase in leveraged funds for the biennium. For FY 20-21, MDA updated their formula for calculating leverage from the AgBMP Loan and the Forever Green Initiatives that more accurately calculated leveraged funds.

Learn more

Clean Water Fund

Surface water measures (actions)

Major watersheds monitored

Measure: Percentage of monitoring addressing state and local needs through surface water monitoring requests

Nearly 40% of watersheds met goals for addressing surface water monitoring request needs. Ongoing program development and outreach is aimed to ensure local needs are identified for monitoring.

Status 

Trend 

Why is this measure important?

Minnesotans want to know that their investments in water quality are making a difference. With the Clean Water Fund, Minnesota now has a comprehensive baseline assessment of conditions across the state. Similar to an annual visit to the doctor, this monitoring shows where work to protect or return the watersheds to healthy conditions is required. In Minnesota, the monitoring has shown that more restoration is necessary in the south and west, and more protection of resources in the north and east.

This data is essential to help develop local plans for targeted implementation activities and with time, will measure resulting changes in water quality. By returning to these watersheds to monitor after ten years, the Minnesota Pollution Control Agency (MPCA) can do a checkup and determine if the targeted implementation is resulting in changes in water quality. Without continued monitoring, there is no way to see if the rivers and lakes are meeting the goal of fishable and swimmable waters.

The MPCA and partner organizations evaluate water conditions, establish improvement goals and priorities, and take actions designed to restore or protect water quality on a 10-year cycle

What are we doing?

The first round of watershed monitoring and assessment is complete. This provides the baseline for determining where waters need protection and restoration. The watershed restoration and protection strategy (WRAPS) document takes the monitoring data and turns it into the specific local strategies needed on the ground to protect and restore waters. This then feeds into local water planning and One Watershed One Plan (1W1P) to target local implementation activities in order to see improvement in water quality.

The MPCA is returning to watersheds to complete the second round of watershed-based lake and stream monitoring, which includes biological, fish contaminant, water quality, and pollutant load sampling. This monitoring is essential to measure progress in restoring and protecting lakes and streams. Additionally, the monitoring will fill gaps to guide local planning and implementation efforts and track long-term changes in water quality and biological communities over time.

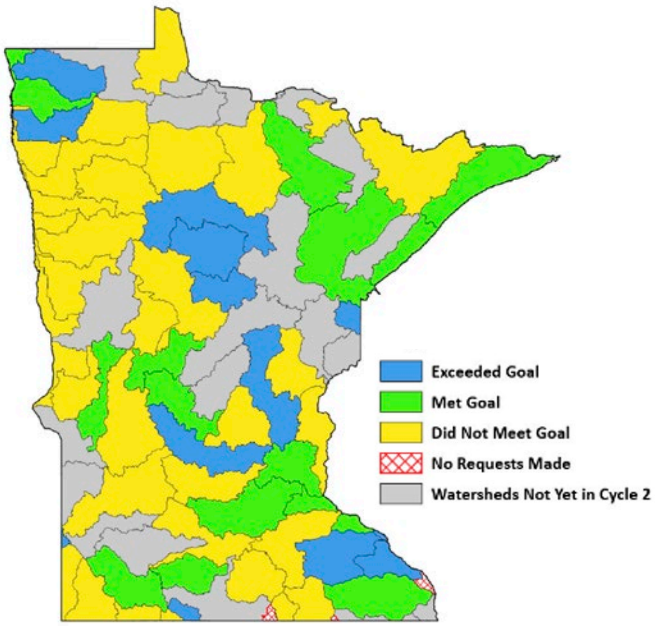


Figure 7. Percentage of requested and approved surface water monitoring request sites relative to the total number of sites per monitoring year is shown on the larger map. Goal is to have 20-30% identified needs addressed through monitoring.

As the MPCA returns to watersheds, the Agency has reduced essential core monitoring to provide monitoring capacity for other needs, such as to support permitting decisions, to address a local monitoring need, or address a gap identified in the WRAPS or 1W1P. MPCA has implemented this modified approach to planning and monitoring in watersheds for the next ten years of watershed monitoring around the state.

What progress has been made?

MPCA has developed a process to solicit other surface water monitoring requests and has worked with partners to determine monitoring needs in these watersheds. The process has been implemented in 61 watershed and adaptations have been made as the process matures. Requests vary across the state due to the unique aspects of each watershed and the needs of each watershed. For example, some watersheds are small or have few to no lakes and there are a few additional local requests. Others are very large, with extensive stream and lake networks and there are many additional local requests. In some, agency-proposed sites meet the needs and there are no additional local requests.

Learn more

- Find more information about this measure and its data
- Find your watershed
- Learn when the MPCA will be intensively monitoring your watershed

Local partners doing water monitoring

Measure: Percentage of watershed chemistry monitoring performed by local partners

As of 2023, all programs are meeting participatory goals.

Status

Trend

Why is this measure important?

Clean Water Fund dollars enable intensive sampling and assessment of lakes and streams in all 80 major watersheds. This allows for better protection of Minnesota's clean waters and restoration of the polluted ones. As noted in statute, one of the purposes of the Clean Water Fund is to provide "...grants, loans, and technical assistance to public agencies and others testing waters..." This measure shows the participation of local partners, citizen volunteers, and students across Minnesota.

The Minnesota Pollution Control Agency (MPCA) alone cannot complete all of the monitoring necessary to comprehensively assess the waters in the state. Local partner participation is crucial to meet water monitoring strategy goals and to build a base of engaged participants for restoration and protection activities that follow the monitoring and assessment of waters.

What are we doing?

MPCA works with local organizations across the state to build capacity for monitoring efforts. Each year, MPCA prioritizes certain lake, river, and stream sites and works with local partners to award contracts to cover the costs of staff, training, equipment, and lab analysis of condition monitoring.

In this way, MPCA is ensuring that the most current and comprehensive dataset is available for assessment and for the development of protection and restoration strategies. By bolstering local capacity, expertise, and equipment inventory, these partners become well suited to carry out future monitoring efforts, such as subwatershed pollutant load monitoring to aid in restoration and protection strategies.

In addition, MPCA supports a volunteer water monitoring program for stream and lake clarity. Over 1,300 volunteers participate annually; the data supports assessment and trend analysis and fosters an engaged citizenry committed to environmental protection and restoration.

Clean Water Fund dollars also support a large environmental education effort in the Red River Basin through the Red River Watershed Management Board. This work exposes hundreds of students to local waterways, provides watershed training to teachers, curriculum development for elementary students, and engages students in biological and continuous monitoring.

What progress has been made?

MPCA has maintained its goal of at least 75% of the offered stream monitoring sites adopted by local partners. The MPCA has seen a decline in the participation with lake monitoring through the surface water assessment grants (SWAG) program. This has been attributed to a lack of staff capacity at the local level to undertake the tasks associated with lake monitoring.

How monitoring by partners happens

During 2024 and 2025, MPCA awarded 26 new SWAG contracts and 9 amendments for monitoring activities across the state. The Watershed Pollutant Load Monitoring Network program executed 16 contracts for work through 2025. Amendments will be issued for time extensions in late 2025. Local partners who received contracts include Tribal Nations, a regional policy making council, counties, educational institutions, joint powers, watershed districts, a non-profit, and soil and water conservation districts.

In the Red River Basin, the Red River Basin River Watch program continues to engage local students through programs like River of Dreams (ROD) and Red River Explorers Paddling Program. Measurable outcomes for both programs are detailed below.

River of Dreams

- Delivery of classroom resources including books, art supplies, and canoes
- Completion of 46 classroom sessions
- Completion of 46 field sessions
- Web design and ROD database with canoe tracking information

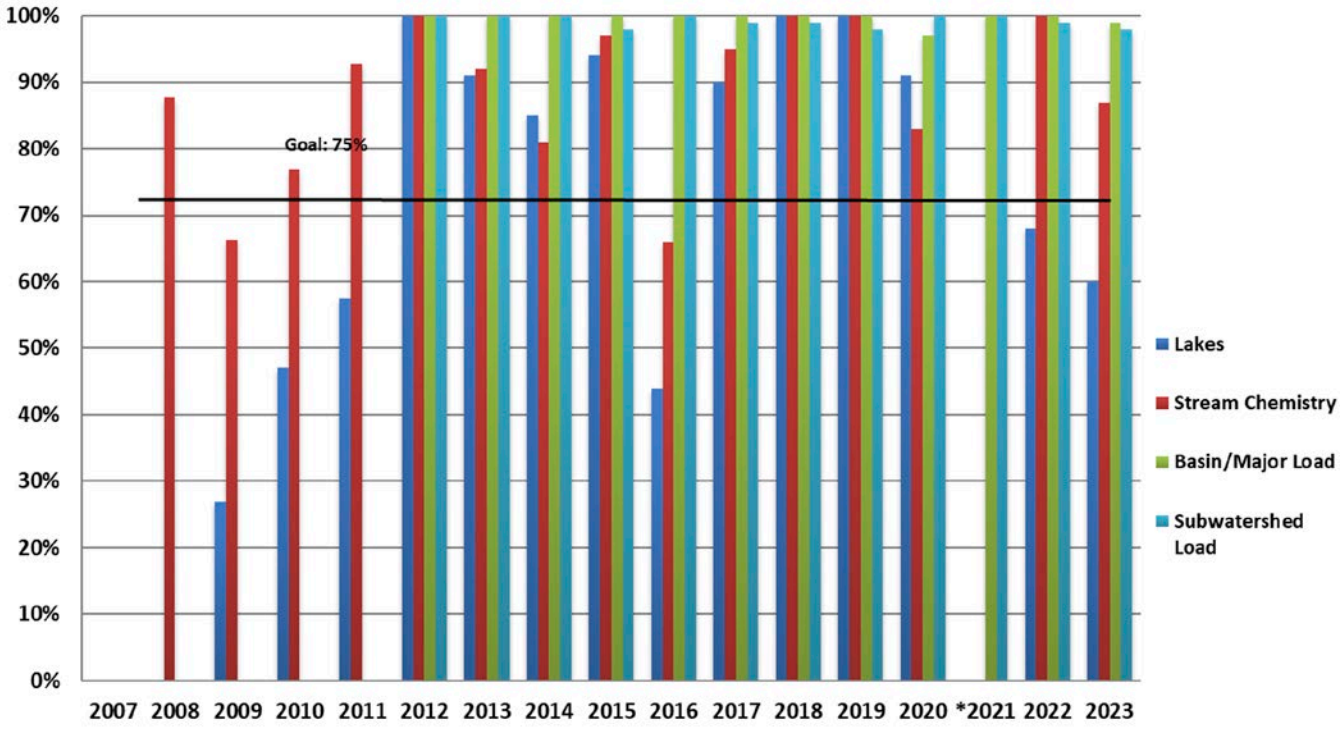
Red River Explorers Paddling Program completed twenty-six guided ecological river excursions with 493 students. Minnesotans benefit from many other local and volunteer monitoring efforts across the state. This interest in water resources has provided information to inform local action and engagement.

Additional activities completed through the Red River Basin Riverwatch program include macroinvertebrate monitoring and STEM education assistance.

Volunteers through the Volunteer Water Monitoring Program provide data on over 1,500 lake and stream locations across Minnesota. These long-term networks have allowed the state to track trends and assess water quality.

Minnesotans benefit from many other local and volunteer monitoring efforts across the state. This interest in water resources has provided information to inform local action and engagement.

Figure 8. Percent of watershed chemistry monitoring performed by local partners



* 2021 has missing data due to Covid-19.

Learn more

- Find more information about this measure and its data
- Find out when the MPCA will be intensively monitoring your watershed
- Surface Water Assessment Grants — Minnesota Pollution Control Agency
- Watershed pollutant load monitoring — Minnesota Pollution Control Agency

Nonpoint source BMP implementation

Measure: Number of nonpoint source best management practices implemented with Clean Water funding, and associated estimated pollutant load reductions

Although funding has increased and there is a continued increase in practices and projects being implemented, the total request for projects has remained significantly greater than available funds.

Status 

Trend 

Why is this measure important?

Minnesotans want their water resources protected and restored. Unfortunately, it can take many years for pollution control practices to result in clean water, particularly at the scale outlined in the Clean Water Roadmap. This measure helps us monitor progress toward the long-term goal of clean water by tracking the actions of people and organizations to implement best management practices, in cities and on the farm. This measure also tracks the estimated amount of pollution those management and conservation practices are expected to reduce.

What are we doing?

The Board of Water and Soil Resources (BWSR) is the primary state agency responsible for nonpoint source implementation and operates in partnership with local partners. Local governments — cities, watershed districts, counties, and soil and water conservation districts — are leading both cleanup and protection efforts across the state. They are working directly with communities, individual landowners, and various non-profit organizations to implement best management practices. These practices include reducing polluted runoff from city streets, agricultural fields, and feedlots; stabilizing stream channels; and upgrading septic systems. See BWSR Clean Water Fund Stories site for more information.

The Minnesota Agricultural Water Quality Certification Program (MAWQCP) is a statewide voluntary opportunity for farmers and agricultural landowners to go through a whole-farm water quality risk assessment with conservation and agronomy professionals. The assessment process examines site-specific water quality vulnerabilities, as well as on-farm management practices including tillage, nutrient management, pest management, irrigation, tile drainage, and conservation practice use. Technical and financial assistance are available to help facilitate the adoption of the risk mitigation strategies which were recommended as part of the assessment process. Participants who agree to adopt and/or maintain a MAWQCP-approved agricultural and conservation management system that meaningfully mitigates water quality risks can become a Water Quality Certified Farm. Certified producers and landowners agree to maintain MAWQCP-approved management of all their acres for the length of their 10-year certification agreement. Certification is a badge of water quality stewardship excellence and represents agricultural lands that are managed in a way that aligns with state agricultural best management practice recommendations around water quality risk mitigation.

Table 9. FY10-25 BWSR grant funded project outcomes

Major basin	Number of mapped BMPs	Sediment reduction (T/yr)	Phosphorus reduction (Lbs/yr)
Minnesota	6,889	88,178	117,222
Upper Mississippi	7,721	75,276	72,008
Missouri	1,002	25,530	17,413
Rainy River	166	1,526	2,061
Red River	7,621	141,871	105,721
St. Croix	1,154	11,323	18,383
Lower Mississippi	4,590	75,424	84,367
Lake Superior	206	8,708	2,902
TOTALS:	**29,349**	**427,835**	**420,086**

What progress has been made?

With funding from the Clean Water Fund, the implementation of practices to improve and protect Minnesota's water resources has accelerated, as has the completion of Total Maximum Daily Load (TMDL) and Watershed Restoration and Protection Strategy (WRAPS) assessments that outline water quality needs. However, funding is not keeping pace with demand.

From 2010-2025 the Clean Water Fund has:

- Funded more than 3,736 grants to protect and restore Minnesota water resources.
- Issued more than 2,797 loans to prevent nonpoint source water pollution or solve existing water quality problems.
- Secured more than 984 easements that will permanently protect approximately 35,235 acres along riparian corridors and within well head protection areas, of which 27,409 acres were supported by Clean Water Funds.
- Repaired 1,010 imminent health threat subsurface sewage treatment systems.

The MAWQCP has 1,177,437 certified acres across 1,653 farms. Each of these certified farms commit to the ongoing use of agricultural best management and conservation practices which meaningfully mitigate water quality risks on their farm over their 10-year certification period. MAWQCP certification has prompted producers to adopt and enhance conservation systems that include 9,133 new water quality risk mitigating practices.

Currently, there are over 400 active MAWQCP applications statewide in varying stages of the MAWQCP's water quality risk assessment process. These farms are implementing the recommended steps needed to mitigate the water quality risks identified through the assessment process so that they can achieve certification.

Figure 10. Clean Water Fund projects 2010-2025 Projects by major basin

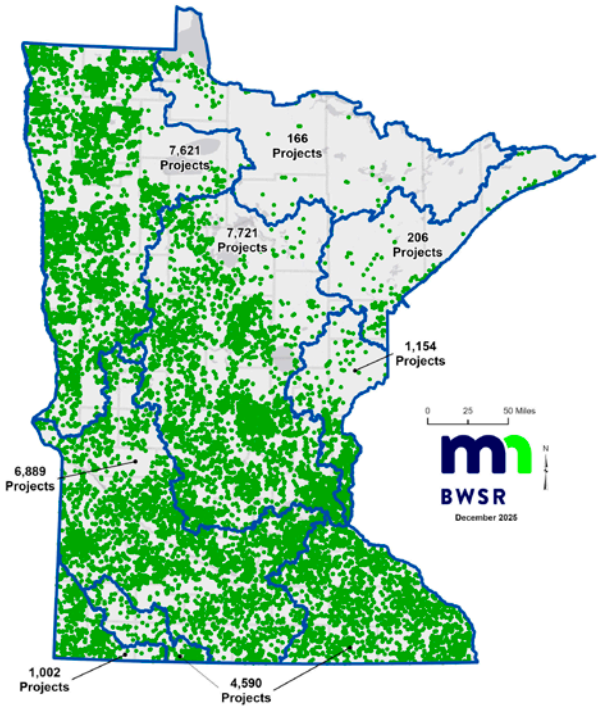
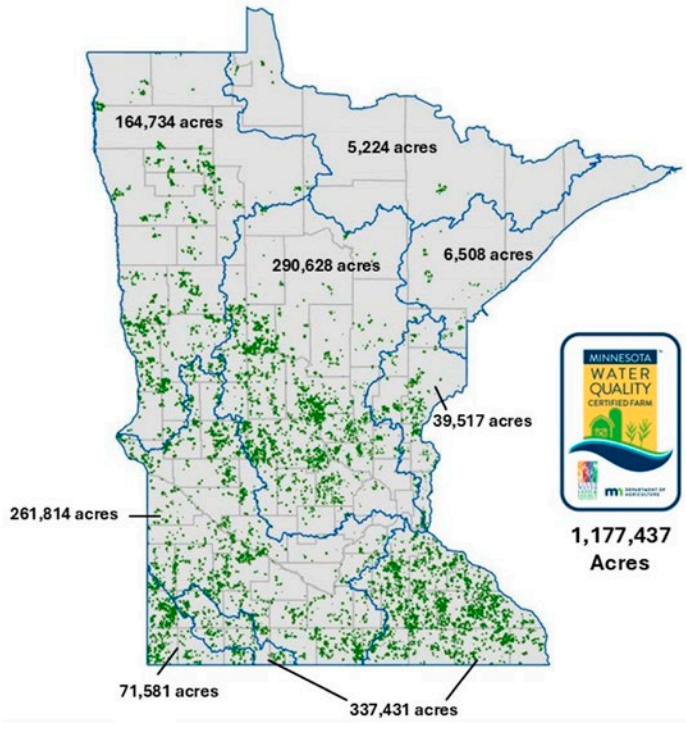


Figure 11. Minnesota Agricultural Water Quality Certification acres, FY14-FY25



Certified producer surveys in 2024 tell us:

- 74% have implemented additional conservation practices since becoming Ag Water Quality Certified.
- MAWQCP inspired 69% to implement conservation practices in the future.
- 58% report MAWQCP increased their ability to implement conservation.

In total, more than 29,349 best management and conservation practices have been installed through BWSR grant programs, resulting in a reduction of about 427,835 pounds of phosphorus and 420,086 tons of sediment across the state.

Learn more

- Clean Water Fund
- BWSR Clean Water Fund Stories
- Agriculture Best Management Practices (BMP) Loan Program
- Minnesota Agricultural Water Quality Certification Program

Municipal infrastructure project implementation

Measure: Number of municipal point source construction projects implemented with Clean Water funding and estimated pollutant load reductions.

Pace of awards is linked to permit cycles, compliance schedules and available Clean Water Funds. Applications exceeds currently available funds even after significant infusion of bond funds over the past several cycles.

Status

Trend

Why is this measure important?

Municipalities across Minnesota are required to upgrade treatment facilities, increase treatment of stormwater runoff, and replace failing septics in order to protect or restore our state's waters. These construction projects help meet required wasteload reductions through implementation of Total Maximum Daily Loads (TMDLs), phosphorus discharge limits and water quality based effluent limits (WQBEL). These reductions are in addition to the major water quality benefits already achieved by municipalities through ongoing investments to replace aging wastewater infrastructure.

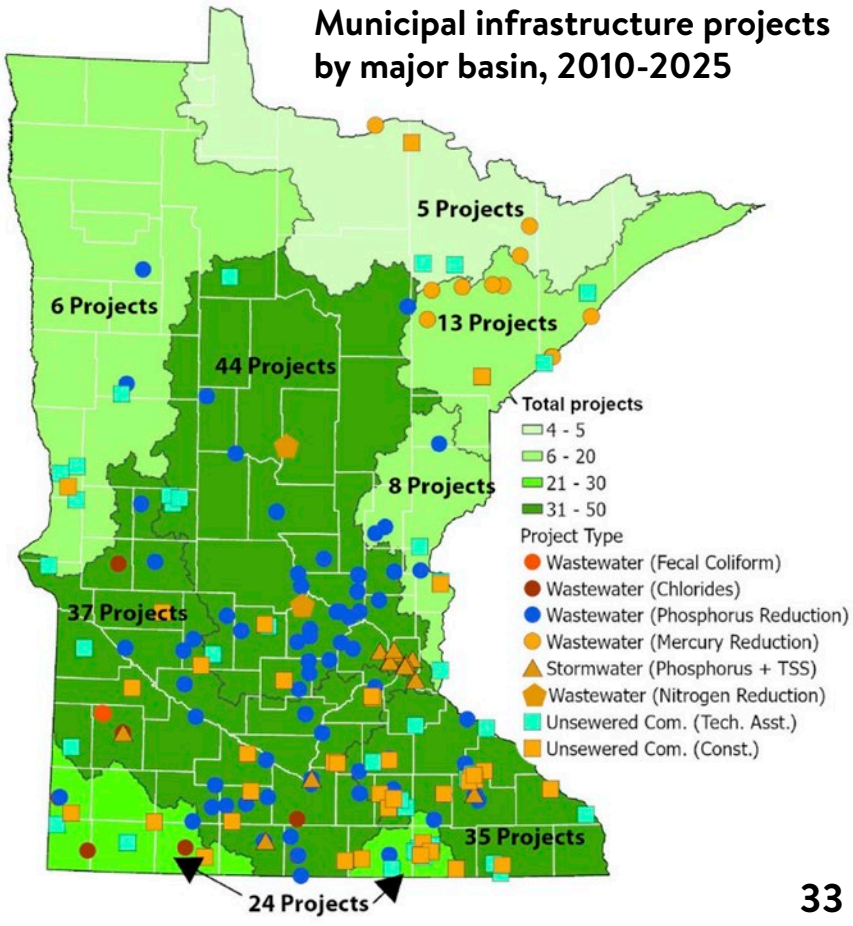
What are we doing?

Cities are required to implement upgrades to their wastewater and stormwater infrastructure to meet tighter discharge standards and specific water quality protection and restoration goals. Small unsewered communities are required to fix noncomplying individual sewage treatment systems or install community systems when new individual systems are not feasible.

The Minnesota Public Facilities Authority (PFA) and the Minnesota Pollution Control Agency (MPCA) jointly administer programs that provide grants and loans from Clean Water Funds to help municipalities pay for these infrastructure improvements. These Clean Water Funds supplement existing state and federal funding so that municipalities can implement these important upgrades more quickly.

Figure 26

Municipal infrastructure projects by major basin, 2010-2025



What progress has been made?

Since 2010, Clean Water Fund dollars have helped 171 projects that implement wastewater and stormwater improvements, including:

- 70 wastewater construction projects to reduce phosphorus discharges to 1 milligram per liter or less, resulting in an estimated total phosphorus reduction of 200,918 pounds per year.
- 14 wastewater construction projects to reduce mercury discharges, resulting in an estimated total reduction of 6,424 milligrams per year.
- 3 wastewater construction projects that will provide treatment to reduce subsurface nitrogen discharges, resulting in an estimated total reduction of 8,498 pounds per year.
- 7 construction projects to reduce chloride discharge, resulting in an estimated total chloride reduction of 27,751 pounds per year.
- 12 stormwater construction projects that will provide treatment to reduce phosphorus discharges by an estimated 1,622 pounds per year and also result in reducing total suspended solids of 133,033 pounds per year.
- 39 small community technical assistance projects to help small unsewered communities evaluate treatment alternatives to address serious water quality and public health problems from non-complying septic systems.
- 35 wastewater construction projects to help small unsewered communities solve their wastewater problems by connecting to existing municipal systems or building their own treatment systems such as community cluster mound systems, resulting in estimated annual reductions in phosphorus of 5,801 pounds and nitrogen of 2,681 lbs. Over 1,200 non-compliant systems have been fixed so far.

Clean Water Funds are targeted to high priority projects based on the MPCA's Project Priority List which ranks projects based on water quality impacts and public health factors. Projects are designed to achieve specific effluent limits and wasteload reductions, and discharges are monitored to verify compliance.

The majority of projects to date have focused on reducing phosphorus discharges from wastewater treatment facilities.

Phosphorus is a nutrient which, when present in excessive amounts, is responsible for water quality impairments due to excess algal growth. River nutrient standards are being implemented across the state and Clean Water Funds are vital in helping to finance the required treatment upgrades. Continued appropriations will be needed to meet the increasing municipal demand for funding to improve treatment facilities across Minnesota.

More information on activities funded by the Clean Water Fund

- Clean Water Fund
- Minnesota Public Facilities Authority (PFA)
- Minnesota Pollution Control Agency (MPCA)

Surface water measures (outcomes)

Surface water health

Measure: Rate of impairment/unimpairment of surface water statewide and by watershed.

Water quality varies greatly by region. In general, good water quality remains where land is intact; where considerable alteration has occurred, water quality is poor.

Status 

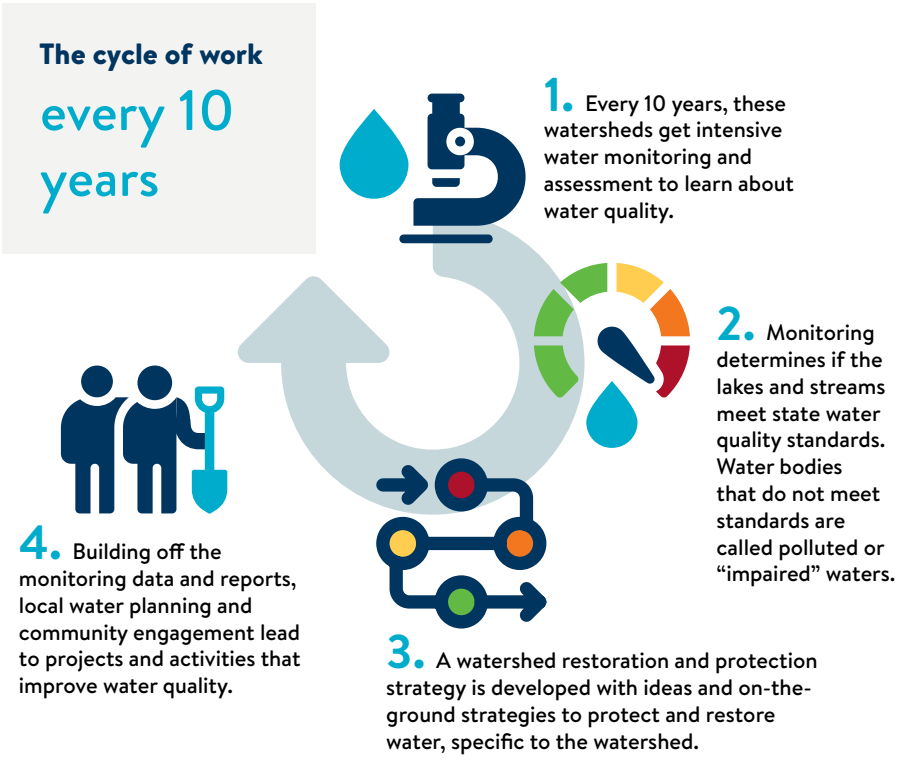
Trend 

Why is this measure important?

Many Minnesotans want to know if they can swim and fish in their favorite lake or stream. Before the Clean Water Fund, few lakes and streams had enough water quality information to determine if Minnesota's water goals were being met. In order to determine a waterbody's health, state agencies need basic water quality information that is obtained through monitoring. Without this basic information, work to develop strategies to reverse water pollution and to protect high quality lakes and streams would be delayed.

What are we doing?

Clean Water Fund investment significantly increased water monitoring and assessment activities. In 2008, the agencies implemented the **watershed approach**. This is a 10-year cycle where approximately eight of Minnesota's 80 major watersheds are intensively monitored each year for stream and lake water chemistry and biology. These data from monitoring activities are then assessed to determine if goals to protect recreational activities such as fishing and swimming, as well as to safeguard fish and aquatic ecosystems, are being met. By considering all lake and stream data for a given watershed at one time, a complete picture of the watershed's overall health develops. State agency and local partners are working together to conduct the intensive monitoring, assess the resulting monitoring information, to develop restoration and protection plans, and assess progress towards water quality goals.



What progress has been made?

As of January 2026, all 80 watersheds have been assessed, and nearly half of the watersheds have had a second update. As monitoring and assessment continues across the state, the new focus is on measuring progress. The assessment results are located on the MPCA's Minnesota Watershed web site.

Aquatic life

Streams are monitored for water chemistry, fish, and aquatic insects to determine if a stream has healthy aquatic ecosystems.

Figure 12. Stream assessments for aquatic life use
Fish, invertebrates, and chemistry

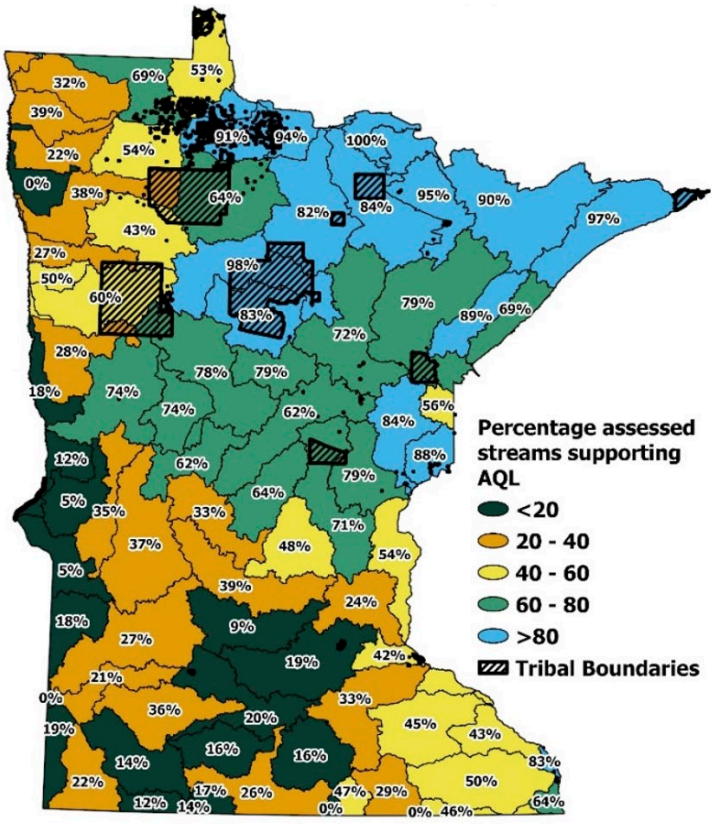
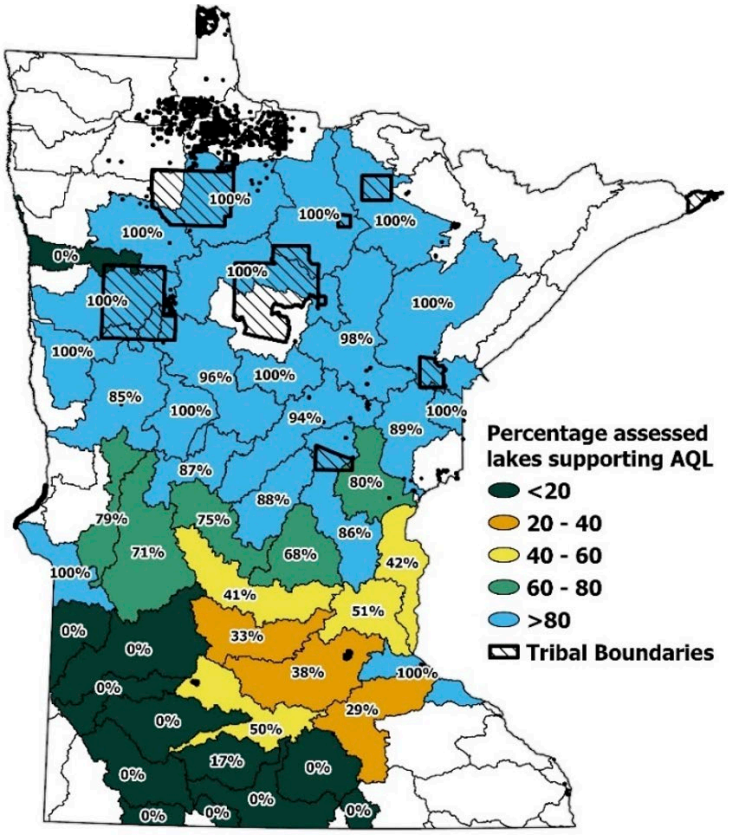


Figure 13. Lake assessments for aquatic life use
Fish IBI



Aquatic recreation

Water monitoring information is also evaluated to determine if lakes and streams are suitable for swimming and other water recreation, and to determine whether consumption of fish should be limited.

Figure 14. Stream assessments for aquatic recreation use

E. Coli bacteria

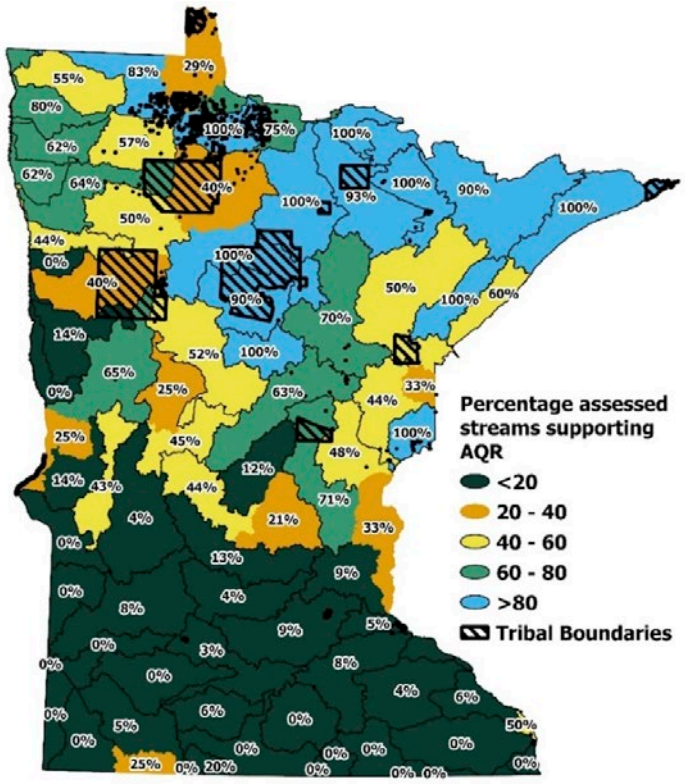
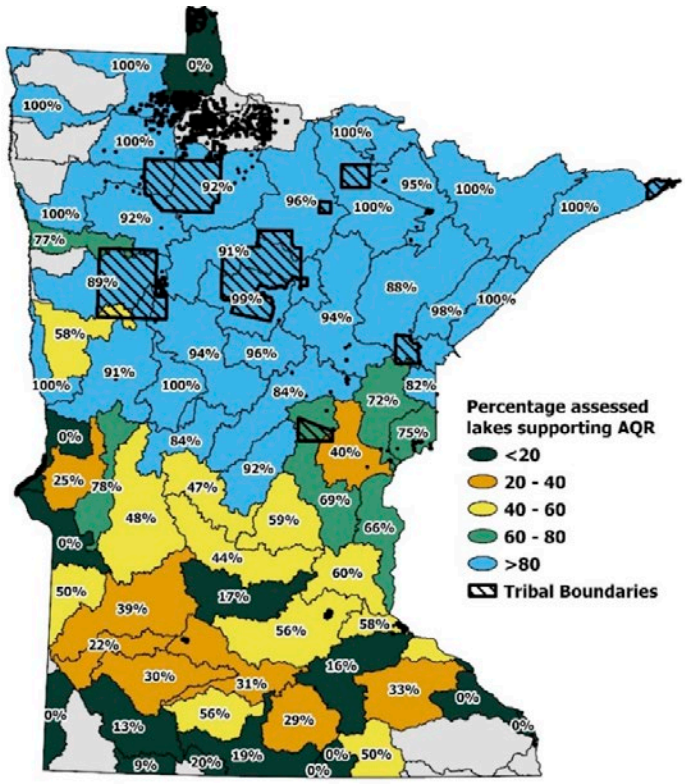


Figure 15. Lake assessments for aquatic recreation use

Eutrophication: phosphorus, chlorophyll-a, and Secchi transparency



Minnesota is working to increase the number of lakes meeting acceptable recreation values and the number of rivers and streams meeting their potential for a healthy fish community by 8% and 7% respectively. These goals were developed as a part of the Clean Water Fund roadmap. This projects the estimated improvement anticipated with the funding made available for targeted implementation over the course of the Clean Water Fund.

While monitoring alone does not yield changes in environmental condition, it does provide the information necessary to target protection and restoration activities in the watershed. It also allows for progress to be measured, as practices are implemented (improvements) or as more land is developed (degradation).

Completion of the first cycle of monitoring resulted in healthy fish communities at 60% of the stations visited. As work is completed to improve conditions on the landscape, the goal is to have 67% healthy fish communities at the stations visited during the span of the Clean Water Fund. Due to COVID, fish sampling was suspended in 2020. Similarly, work to improve conditions in lakes across Minnesota is expected to yield 70% of lakes supporting recreation activities.

Figure 16

Streams: slow increase in the percentage of healthy fish stations across the state, 2008-2024

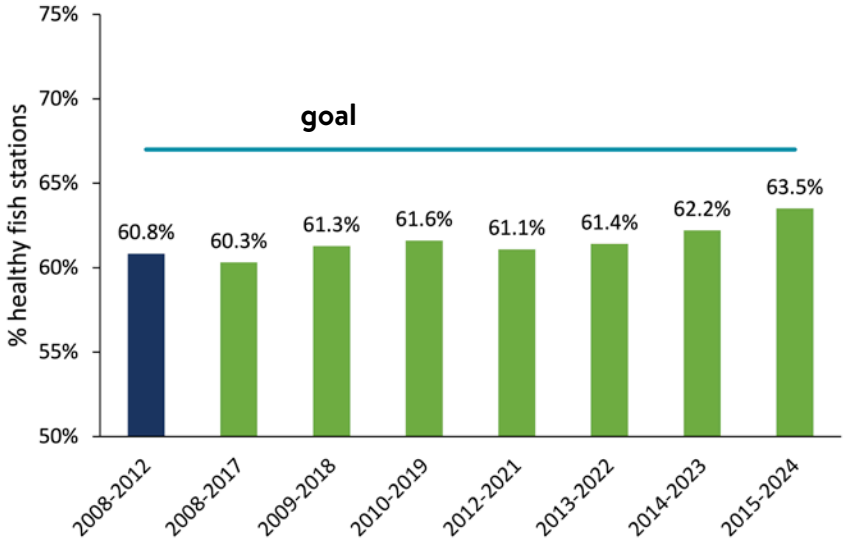
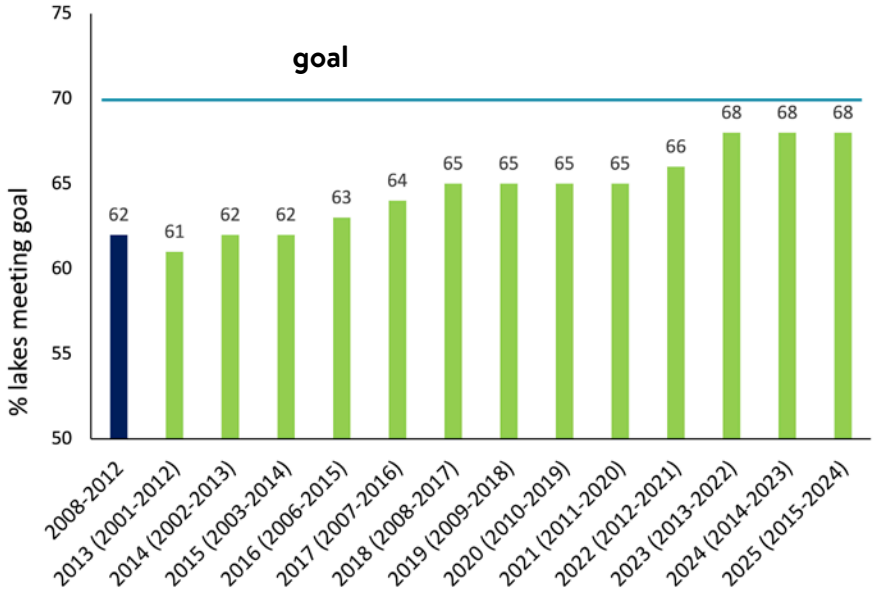


Figure 17

Nearing goal of 70% lakes meeting goal to support recreation activities



Learn more

- Find more information about this measure and its data
- Find water quality assessment results for specific lakes and streams
- Find out when the MPCA will be intensively monitoring your watershed

Lake and stream water quality

Measure: Changes over time in key water quality parameters for lakes and streams.

Why is this measure important?

Water quality in a lake or stream can change depending on a variety of factors ranging from rain quantity or temperature to runoff from agricultural areas, parking lots, roads and lawns. Because of factors like these, waters must be sampled for many years to detect water quality trends. Information gathered over the years is valuable because it gives insights into general water quality patterns and trends across the state.

This helps determine where to target restoration and protection efforts and the effectiveness of current activities to restore polluted waters and protect those that have good water quality.

Parameters	Status and trend
Lake clarity is improving in more lakes than degrading. Nearly 60% of the lakes with data available, show no trend or no change.	
Sediment in large rivers — Over 80% of rivers have no trend detected. There are two more improving trends than declining trends in total suspended solids concentrations.	
Nitrate in large rivers — Over 80% of rivers have no trend detected. There are three more degrading trends than improving trends in nitrate.	
Phosphorus in large rivers — Phosphorus concentration trends are improving more than degrading. Over 60% of rivers have no trend detected.	
Pesticides in streams — Detections in streams vary greatly as a result of hydrologic and agronomic conditions; exceedances of pesticide water quality standards are rare. Nine streams once impaired for acetochlor and chlorpyrifos have been removed from the Impaired Waters List. The MDA tests for over 180 pesticides each year to evaluate conditions.	
Pesticides in lakes — Monitoring has indicated stable pesticide concentrations in lakes, and nearly all detections are low relative to water quality reference values. Pesticide detection frequency and concentrations in lakes are lower compared to streams.	
Chloride in rivers in streams — Concentrations from are increasing in almost all metro area rivers and streams as of trends through 2019.	

What are we doing?

Federal, state, and local organizations have been monitoring Minnesota's lake and stream water quality for decades. Data were collected statewide, and the results of this work were widely reported to support various program goals. Taken together, Minnesota's water quality data paint a picture of general condition and changes in Minnesota's lakes and streams.

This measure tracks those water quality factors that tend to be the largest sources or indicators of pollution. Some of these parameters include:

Lakes

- Total phosphorus
- Chlorophyll-a (algae pigment)
- Secchi (transparency)
- Pesticides

Phosphorus, chlorophyll-a, and Secchi combined indicate whether lake water quality is good for recreation, such as swimming and wading. Pesticides can affect the survival rate of fish, insects, and their food sources.

Rivers and streams

- Total phosphorus
- Nitrate
- Total suspended solids (sediment)
- Chloride
- Fish and invertebrates (aquatic insects)
- Pesticides

Phosphorus, nitrate, suspended solids, chloride, and pesticides in high concentrations affect the survival rate of fish, and their food source, aquatic insects. All of these parameters combined measure the ability of the stream to support healthy fish populations and aquatic ecosystems.

Pesticides

The pesticide data will focus on the five pesticides designated as "surface water pesticides of concern" by the Minnesota Department of Agriculture (MDA), including the herbicides acetochlor and atrazine, and the insecticides chlorpyrifos, clothianidin and imidacloprid. The MDA analyzed for 185 different pesticide compounds in 2024, with many compounds not detected and others detected infrequently.

Acetochlor, atrazine, and chlorpyrifos have MPCA water quality standards available. Currently, there is one river with an acetochlor impairment and ten rivers with a chlorpyrifos impairment. There are currently no atrazine impairments. The MPCA does not have water quality standards available for clothianidin and imidacloprid which are required for an impairment determination in Minnesota. To screen detections for these compounds, the MDA used the USEPA chronic aquatic life invertebrate benchmarks.

In addition to analyzing data from existing sites, state and local partners look to expand the monitoring network to provide information in new areas or places facing new threats, as resources are available.

What progress has been made?

Expansion of the monitoring network is critical to evaluating water quality trends in the state of Minnesota. The following activities are key highlights:

- The Minnesota Pollution Control Agency's (MPCA) Watershed Pollutant Load Monitoring Network began in 2008 to understand long-term trends in water quality concentration and load around the state and currently includes 199 sites (see flow corrected trends maps in Figures 19-21).
- Trend information is available in an interactive form and for download.
- Metropolitan Council monitors and analyzes water quality within the 7-county metropolitan area on lakes, river segments and area streams. In 2021 the Council completed an assessment of chloride in metro area streams, examining concentrations, loads, and long-term trends.
- Participants in the Volunteer Water Monitoring Program have collected lake and stream water clarity information for decades. This program is vital in gathering data for long-term trend analyses.
- All of the watersheds have been comprehensively monitored, providing baseline data for assessments and a starting point for future trends. The second 10-year rotation of watershed monitoring began in 2018 and will provide information to measure progress.
- The MPCA participates in the National Aquatic Resources Surveys for lakes, including a partnership with MDA for pesticide work, and conducted state probabilistic surveys for streams, rivers, and wetlands, providing baseline information.

Though it is tempting to make sweeping statements, most often the story is a complicated mix of seeing improvements in some aspects of water quality and declines in others. There can also be striking differences in water quality trends when comparing the long-term trend (more than 20 years) against the short-term trend (5 to 15 years) for a given lake or stream.

Figure 18. Streams: pollutant concentrations trends in Minnesota

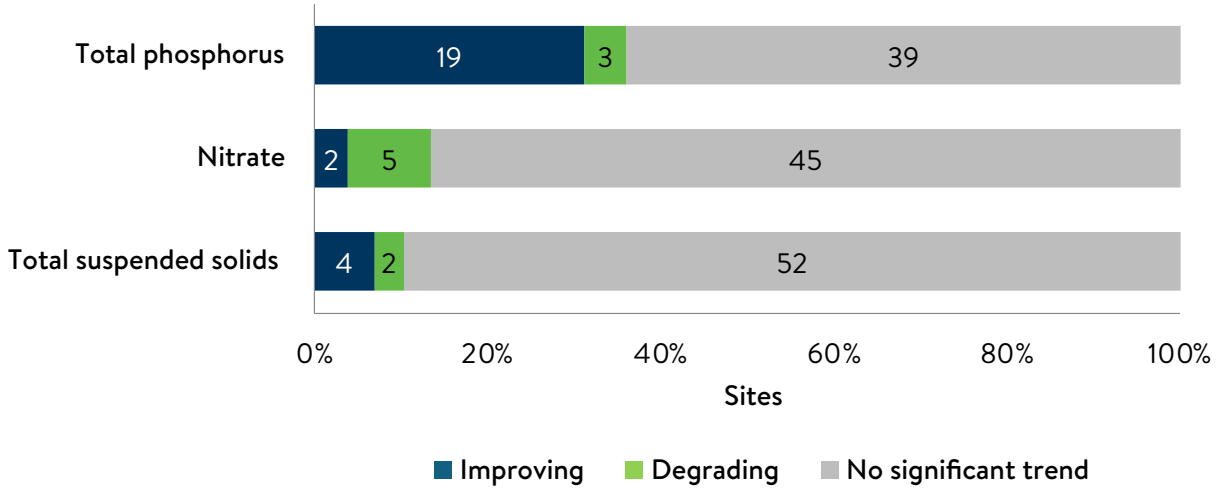


Figure 18 . Where approximately ten years of streamflow and water quality data are available, phosphorus and total suspended solids concentrations in Minnesota's larger rivers are generally decreasing or staying the same, while nitrate concentrations are staying the same or increasing.

Figure 19

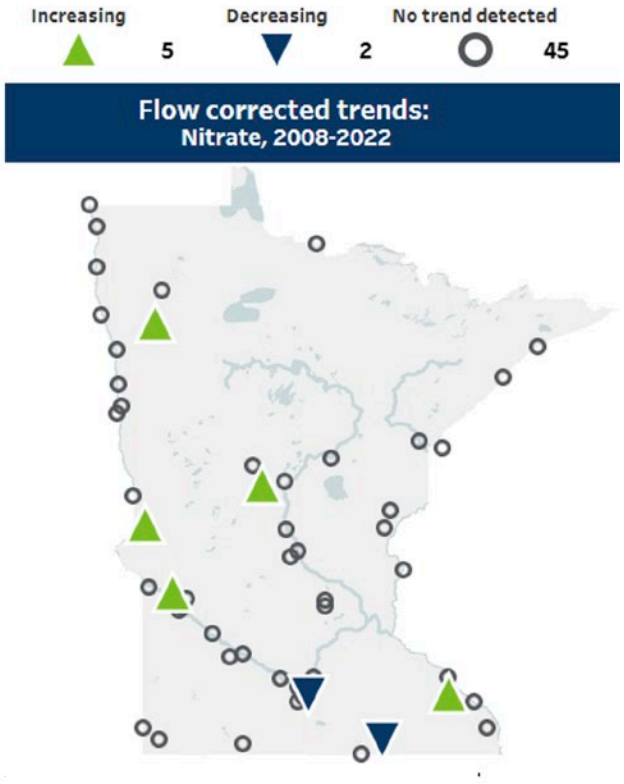


Figure 19. Nitrate trends are generally showing no trend or increasing throughout the state

Figure 20

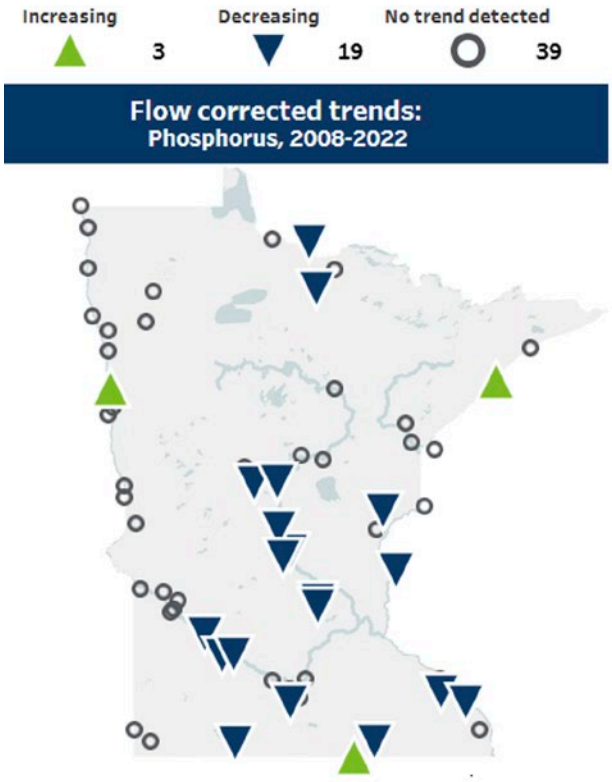


Figure 20. Phosphorus trends are generally decreasing across the state, especially in central and southern Minnesota

Figure 21

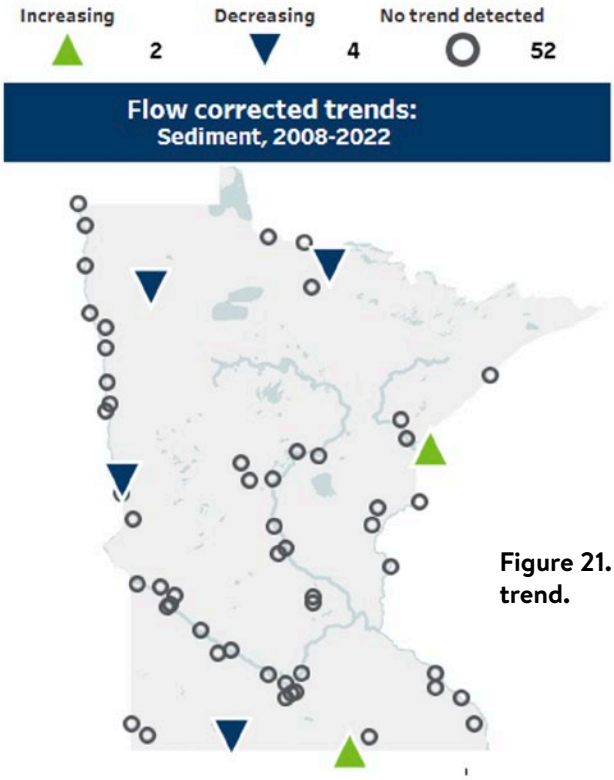


Figure 21. Sediment trends are generally showing no trend.

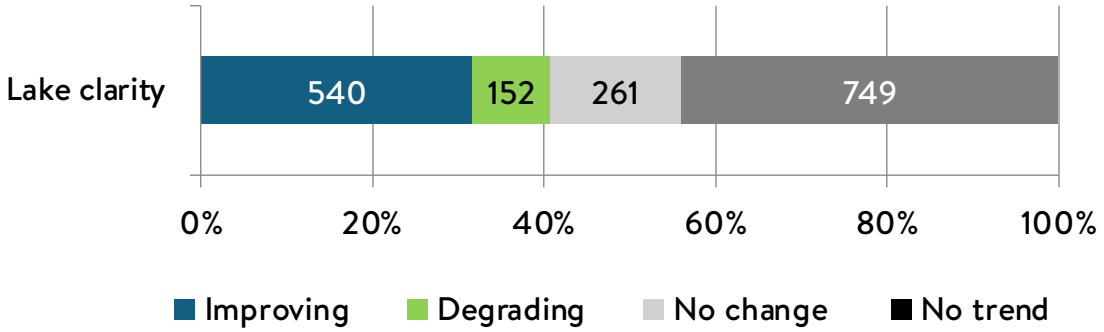


Figure 22. Trends in lake water clarity between 1973 and 2025. While water clarity, in general, is poorer in southern Minnesota, increasing and decreasing lake clarity trends are fairly evenly scattered through north and south-central Minnesota.

Chloride levels have increased in Twin Cities waterbodies. Over two decades, the Met Council studied chloride concentration levels and trends for 18 streams in the seven-county metropolitan area. Regional Assessment of Chloride in Select Twin Cities Metro Streams (1999–2019) — reveals that nearly all the streams are experiencing rising chloride levels.

In addition to the work that MPCA completes annually, the MDA conducts pesticide monitoring at approximately 60 agricultural and urban river and stream sites each year. Although low levels of select pesticides and associated breakdown products are detected frequently in some waterbodies, samples with pesticide levels above water quality standards are rare.

Long-term pesticide monitoring is needed to assess concentrations relative to water quality reference values due to variability in climate, pesticide use, and agronomic factors. The MDA is presenting the percentage of annual statewide samples that had a detection above the numeric component of the applicable MPCA chronic standard or USEPA chronic aquatic life benchmark for each "surface water pesticide of concern." Each detection over the numeric component of the standard or benchmark requires a duration assessment to determine if the detection was an exceedance (considering both the concentration and duration components).

Percent of samples greater than the numeric water quality standard or benchmark

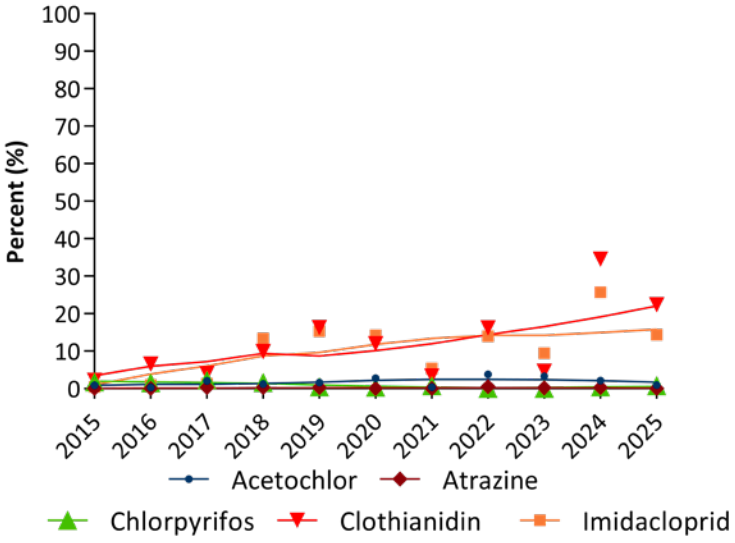


Figure 23. Long-term pesticide monitoring is needed to assess concentrations relative to water quality reference values due to variability in climate, pesticide use, and agronomic factors. Acetochlor, atrazine and chlorpyrifos are infrequently detected over the numeric component of the MPCA chronic standard. Clothianidin and imidacloprid were detected more frequently over the numeric component of the USEPA chronic aquatic life benchmark in years with below normal precipitation (2021) compared to years with above normal precipitation (2024).

From 2015 through 2025, an annual average of 2% of acetochlor samples, and less than 1% of atrazine and chlorpyrifos samples had a detection over the numeric component of the MPCA chronic standard. During this same period, an annual average of 12% of clothianidin and 10% of imidacloprid samples had a detection over the numeric component of the USEPA chronic aquatic life benchmark. Clothianidin and imidacloprid had the most variation year over year, and fewer samples had a detection over the numeric component of the USEPA chronic aquatic life benchmark in years with below normal precipitation (2021) compared to years with above normal precipitation (2024).

The MDA partnered with MPCA to collect statewide lake pesticide water quality data in 2007 and then every 5 years starting in 2012. These data have shown nearly all samples had pesticide levels that were low compared to the MPCA standard or USEPA benchmark. Pesticide levels have remained low and relatively constant throughout all lake pesticide sampling efforts. Statewide lake pesticide sampling will continue every 5 years pending available resources.

Learn more

The MPCA has a rich array of graphics that can be produced for multiple combinations of waterbody types, pollutants/parameters, and monitoring approaches to provide a comprehensive picture of the state of Minnesota's water resources.

- Clean Water Fund
- The MDA put together a pesticide Story Map which provides the public an opportunity to virtually interact with the pesticide data that have been collected in groundwater and surface across Minnesota.

Waters restored

Measure: Number of previous impairments now meeting water-quality standards due to restoration activities.

Despite a rising number of impaired waterbody listings, delistings are on an upward trend, reflecting the success of ongoing water quality improvement projects.

Status

Trend

Why is this measure important?

This measure tracks how actions taken on the ground lead to successful restoration of impaired waters. "Impaired waters" are lakes, streams, or rivers that fail to meet water quality standards due to one or more pollutants such as nutrients, bacteria, mercury, and sediment. High levels of pollution in impaired waters can be unsafe for public health, fish and other aquatic life, as well as damaging to recreational opportunities.

Although Minnesota's impaired waters list is growing as the state monitors and assesses more watersheds, so too is the list of waters that are improving. Cleanup efforts can take several years to decades to complete, but there are many examples of impaired waters that have been restored.

Trout collected just upstream of the project during a MN DNR Fisheries electrofishing survey.

What are we doing?

Pollution problems are initially identified through water quality monitoring, followed by studies and plans to determine what restoration activities are needed. Local governments — cities, watershed management organizations (WMO), counties and soil and water conservation districts (SWCDs) — are leading these cleanup efforts, working closely with organizations, landowners and citizens. These actions include upgrading wastewater treatment plants and septic systems; reducing polluted runoff from city streets, agricultural fields and feedlots; and implementing other on-the-ground best management practices (BMPs).

What progress has been made?

Ultimately, the target is to restore all impaired waters in Minnesota. The Minnesota Pollution Control Agency began listing impaired waters in 1992; since 2002, the agency has delisted 125 previously impaired lakes and river segments because they are now meeting water quality standards due to restoration activities.

A recent example is the Kabekona River, a premier trout stream in north-central Minnesota that is planned to be removed impaired waters list in 2026 following a decade of local restoration. After 2016 monitoring revealed unsafe levels of E. coli for swimmers and anglers, the Hubbard County Soil and Water Conservation District used DNA tracking to identify the sources of E. coli and narrowed it down to a specific area where cattle had access to the river. Success relied on years of relationship-building between the farmer, the county, and partners to transition the herd to a solar-powered watering system and install

an exclusion zone that protected the riverbanks from erosion. Second, project partners planted new vegetation along the stream to stabilize the land and reduce soil erosion.

The project's completion was driven by a robust grassroots effort at the local level. Community members donated to the cause motivated by a shared history of fishing the stream and a desire to support their neighbors. This collaborative approach proved successful and recent data confirms that bacteria levels are now consistently safe.

Many other waters are improving

In most cases, the 125 success stories are the result of several years of diligent efforts at the local level both prior to and with Clean Water Funds.

Though not ready for delisting yet, many more lakes and streams are making restoration progress. Statewide, many have realized considerable improvements in recent years from work ranging from restoring wetlands and stabilizing streambanks to addressing septic system and feedlot issues. These actions result in improvements such as greater clarity and reduced algae. Although full restoration of Minnesota's waters will take time, Clean Water Fund investments are helping to accelerate the pace of these activities.

Learn more

Clean Water Fund

Find your watershed and restoration projects

Minnesota's Impaired Waters List

Hubbard SWCD staff and Trout Unlimited volunteers installing a stabilization planting along the Kabekona River. This area was high traffic for Cattle and had minimal vegetation. A mix of wetland shrubs and seeds mixes were planted.

Mercury trends

Measure: Trends of mercury in fish and mercury emissions in Minnesota.

Mercury in fish: Mercury in game fish is not yet responding to decreases in local mercury emissions. Global emissions have increased. The time lag between emission reductions and response is likely several decades. It is too soon to see a measurable response in fish mercury levels.

Status ▲

Trend →

Mercury emissions: Significant progress has been made reducing mercury emissions from power plants. Emissions from mercury use in various products saw a decrease in emissions for the 2023 emission inventory, continuing a general downward trend since 2014 Conversely, emission from the mining sector have remained relatively steady since.

Status ▲

Trend ↗

Why is this measure important?

Many Minnesota lakes and rivers contain contaminants, primarily mercury, which accumulate in fish and may pose a risk to humans as well as fish-eating wildlife. Because air pollution is the primary source of mercury, reducing mercury in fish requires large reductions in mercury emissions from sources in Minnesota and throughout the world. To evaluate if Minnesota waters are getting cleaner, we can track mercury emission levels over time through periodic emissions inventories and then measure how fish mercury levels respond. Because of the large variation in mercury concentrations from year to year within and among lakes, long-term trends of mercury in fish are necessary to see if pollution control efforts are sufficient.

What are we doing?

The Minnesota Department of Natural Resources (DNR) is leading efforts to track mercury levels in fish. The DNR collects fish from approximately 110 lake and river sites annually throughout Minnesota and prepares samples for testing. Each year, thousands of walleyes, northern pike, panfish, and other species are tested; Clean Water funding has expanded the number of sites tested each year. The Minnesota Pollution Control Agency (MPCA) and DNR select sites, with input from Minnesota Department of Health (MDH), where samples should be collected; the Department of Agriculture's (MDA) laboratory analyzes the samples.

Decades of monitoring has shown that

1. most fish contain some mercury,
2. the average mercury level generally increases from south to north in Minnesota, and
3. panfish have lower mercury levels than top predator fish. This is the basis for MDH statewide guidelines for eating fish.

MPCA scientists have also evaluated whether the average concentration of mercury in walleyes and northern pike in Minnesota lakes is changing with time. The trend analysis initially focused on 1982 to the present and has been reported on in previous versions of the Clean Water Fund Performance Report. However, a re-examination of the data showed that fish sampling efforts prior to 1990 were concentrated on lakes in northern Minnesota, a region where mercury concentrations are generally higher than the state average (see #2 above), and that a long-term trend analysis could be biased if the pre-1990 samples were included. As a result, MPCA scientists are now only using walleye and northern pike collected since 1990 to determine how mercury concentrations in lakes are changing over time.

What progress has been made?

Figure 24 shows the current fish-mercury trend. Data from lakes starting with 1990 as the baseline year show an upward trend in average mercury concentration. The increase, 0.33% per year on average, is small but statistically significant from zero slope. Minnesota's water standard for mercury in edible fish tissue – 200 parts per billion (ppb) – is shown for reference on the figure, because it is the threshold above which lakes and streams are impaired. The standard protects humans for consumption of one meal per week of fish caught in Minnesota.

Figure 25. Mercury trend in Northern Pike and Walleye: 1990-2024

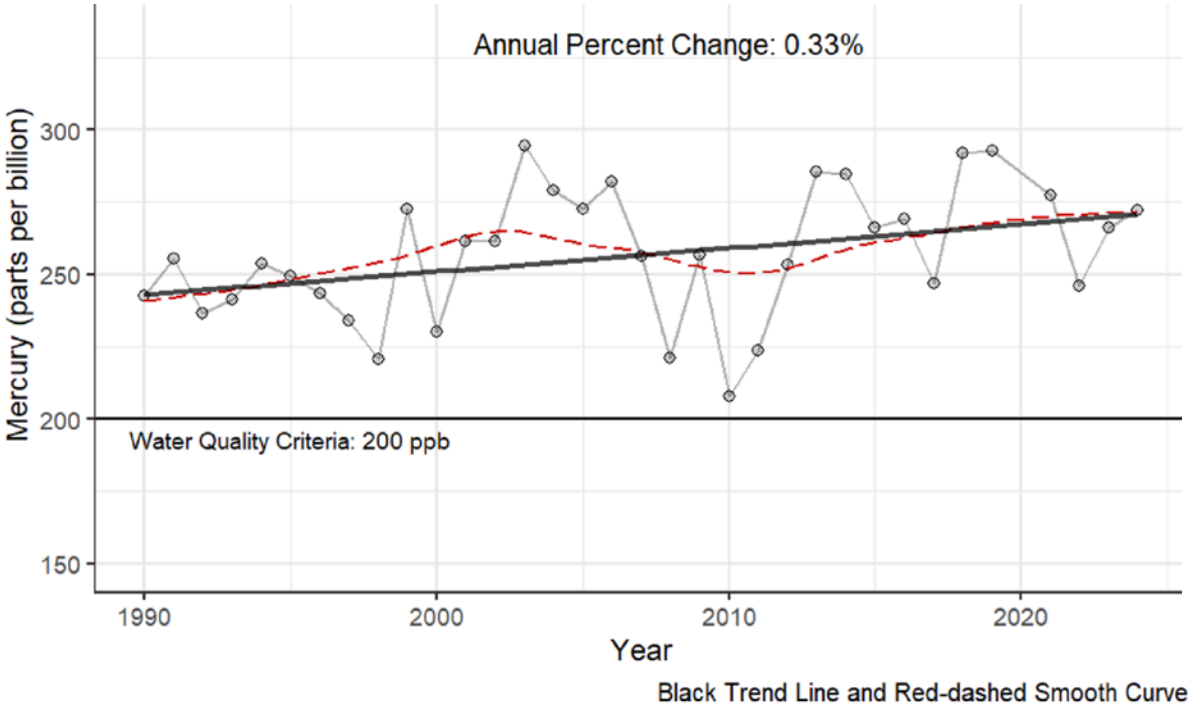


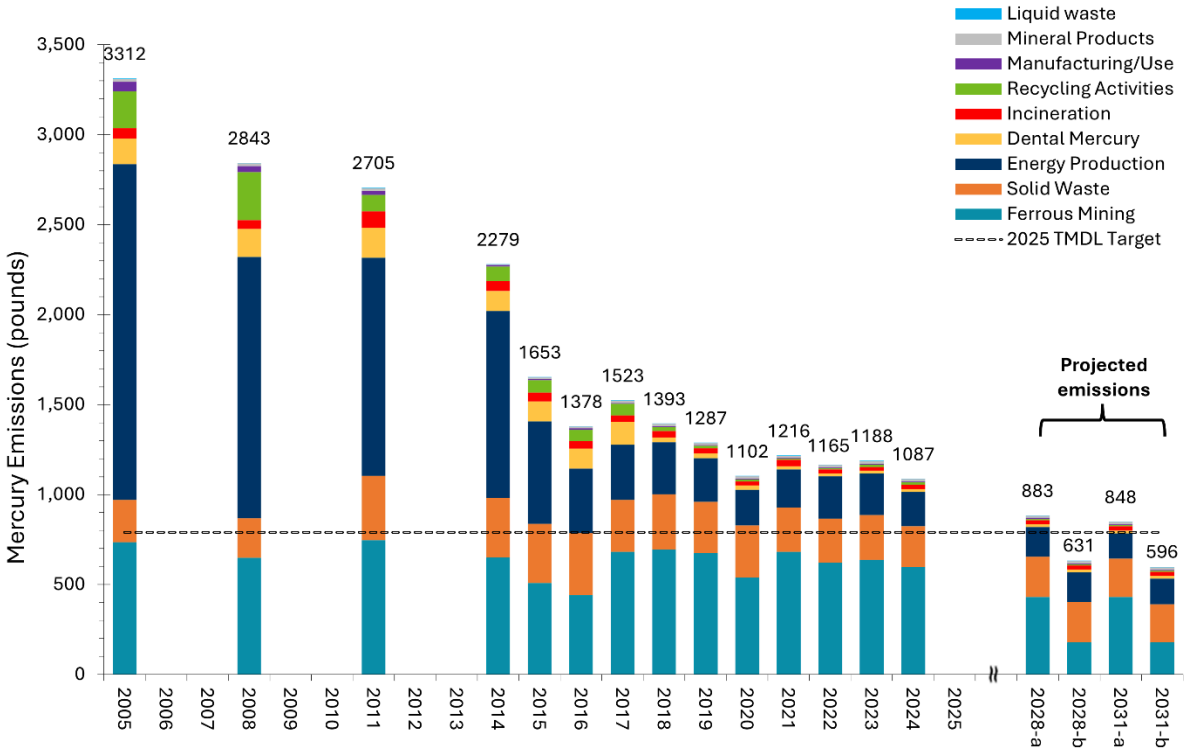
Figure 24. The current mercury in fish tissue trend from 1990 to 2024. The trend analysis focuses on Northern Pike and Walleye fish species. Lakes with at least five Northern Pike or Walleye were selected for mercury in fish tissue analysis. Trends are not evaluated for rivers because of the uncertainty of specific sample collection locations from year to year. The results of the analysis starting with 1990 as the baseline year show an upward trend in average mercury concentration. The increase of 0.33% (0.003302) per year on average, is small but statistically significant from the zero slope. Minnesota's water standard for mercury in edible fish tissue – 200 parts per billion (ppb) – is shown for reference in the figure, because it is the threshold above which lakes and streams are designated as impaired.

The fish-mercury trend is not tracking the trend in mercury emissions. Although there have been substantial decreases in mercury emissions in Minnesota (see below), the United States, and Europe, the estimated global mercury emissions between 2010 and 2015 increased 22%. Many monitoring studies have reported increasing mercury levels in fish and wildlife, especially at higher latitudes. It has been most commonly attributed to climatic changes in temperature and precipitation leading to increasing availability of mercury to food webs.

Mercury TMDL

In 2007, MPCA finalized a statewide mercury total maximum daily load (TMDL) study that determined the air emissions reductions necessary to meet water quality standards and protect people from consuming mercury-contaminated fish. The TMDL set a goal of 93% reduction in mercury from all human sources including air emissions from outside of Minnesota using 1990 as the baseline. Reaching the 93% emissions reduction goal in the TMDL would substantially lower mercury in fish and make them safer to eat in about 75% of our waters. For the remaining 25%, more work is needed to understand why these waters remain high in mercury despite lower emissions.

To accomplish the air emission reductions specified in the mercury TMDL, the MPCA and stakeholders created an implementation plan that set a 2025 mercury emission target of 789 pounds per year for mercury emission sources in Minnesota. The emission reduction goal for Minnesota sources led the MPCA to adopt rules that established mercury emissions reductions for certain sources in Minnesota. Mercury emissions inventories have been developed to track progress. The MPCA also conducts fish tissue analysis



a - This projection is based on the taconite industry meeting the MACT mercury limit (emissions limit of 1.4×10^{-5} lb/LT).
b - This projection is based on the taconite industry meeting the required 72% reduction specified in Minn. R. 7007.0502.

Figure 25. Minnesota mercury air emissions and projections. The largest reductions come from the energy production sector as utilities retire coal-fired electricity generating units. To meet state goals for mercury emission reductions that are expected to lower mercury in fish and make them safer to eat, reductions will also be needed from taconite (ferrous) mining and from mercury in commercial products.

to understand how mercury levels in fish are changing over time. The MPCA cannot control or regulate emission sources outside the state and continues to work with EPA on reductions across the nation and around the world.

Figure 25 displays the annual mercury emissions from sources in Minnesota broken down by sector and year, and projections for two future years and scenarios based on expected future reduction actions. The largest reductions in upcoming years are expected in energy production and ferrous mining (taconite). Energy production reductions are expected due to planned retirement of coal-fired electricity generating units through 2031. Ferrous mining reductions are expected from the implementation of mercury control technologies in 2027 as required by EPA's new mercury limits in the national emission standards for taconite iron ore processing.

Despite these anticipated reductions, MPCA projects the state will not meet the mercury TMDL implementation plan's 2025 statewide reduction goal. Meeting that goal will require significant reduction of mercury emissions from the taconite mining sector and further reductions from mercury use in products.

Mercury regulations

Minnesota recently became the latest state to enact stringent regulations to phase out the sale of mercury-containing fluorescent lightbulbs beginning January 1, 2025. Fluorescent lightbulbs are the latest addition to the list of products like older thermostats, thermometers, and other mercury-containing products that are banned in Minnesota. The MPCA has been conducting outreach and social media campaigns to raise awareness that these household items contain mercury to prevent these items from ending up in the trash. Ending the sale of mercury-containing lightbulbs and encouraging Minnesotans to bring these types of items to their nearest household hazardous waste collection site should lead to reduced mercury emissions from products.

To accelerate development of mercury controls at taconite facilities, MPCA sought and received funding in 2023 to find innovative solutions to protect our environment and support Minnesota mining. The funding provides $16.7 million to taconite facilities in the state to support pollution reduction actions and research on mercury emissions, sulfate discharges, and greenhouse gas emissions. The funding is available to taconite facilities through June 2027.

Since 2017, the Minamata Convention on Mercury has provided the foundation for mercury emissions reductions globally, with reductions negotiated by the United Nations Environment Program. Minnesota is doing its part and has taken significant steps towards achieving mercury emission reductions.

Partnerships

Minnesota also continues to work with others through partnerships such as the Great Lakes Commission. At its 2021 annual meeting, the Great Lakes Commission adopted an updated policy resolution supporting mercury pollution monitoring, research, and reduction in the Great Lakes-St. Lawrence River basin. The resolution was unanimously passed by all commission member states and provinces: Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Ontario, Pennsylvania, Québec, and Wisconsin. The resolution:

States the multiple ecological, social, and economic benefits of the Great Lakes and St. Lawrence River for the United States and Canada.

Asserts that mercury pollution harms these benefits and the health of communities throughout the region, specifically noting that disadvantaged communities and other vulnerable populations are at higher risk and generally experience disproportionate effects from mercury contamination.

Acknowledges that while governments in the United States and Canada at all levels – tribes, states, provinces, and federal governments – are acting to reduce mercury use and emissions, there is more that can be done. In addition, changes in climate and weather patterns are likely to impact where mercury comes from and where it ends up.

Offers suggestions and support for actions to understand and reduce mercury pollution.

The resolution is available in full on the commission's policy resolution webpage. An issue brief was also prepared to accompany the resolution and is available on the commission's webpage.

Learn more

- Mercury research and reduction initiative
- Fish Consumption Advice (MDH)
- Fish consumption advice (DNR)
- United Nations Global Mercury Assessment

Municipal wastewater phosphorus trend

Measure: Municipal wastewater phosphorus discharge trend

Significant phosphorus load reductions have been achieved through regulatory policy, infrastructure investments, improved technology and optimization of operations.

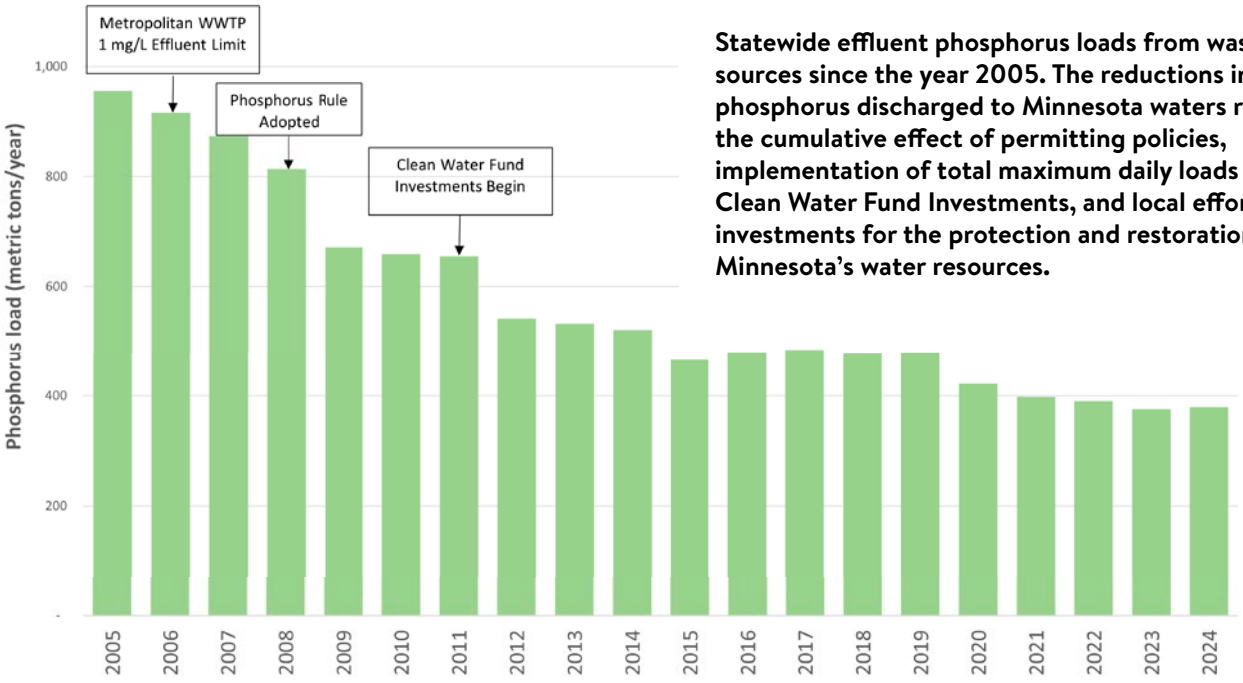
Status

Trend

Why is this measure important?

Phosphorus continues to be a significant challenge for meeting Minnesota's water quality goals. This measure shows trends in the amount of phosphorus being discharged from municipal wastewater treatment facilities. These regulated entities provide treatment for contaminated water from homes, businesses and industries. Wastewater treatment facilities are required to remove phosphorus and many other pollutants to levels that protect water quality.

Figure 27. Statewide wastewater phosphorus load reductions

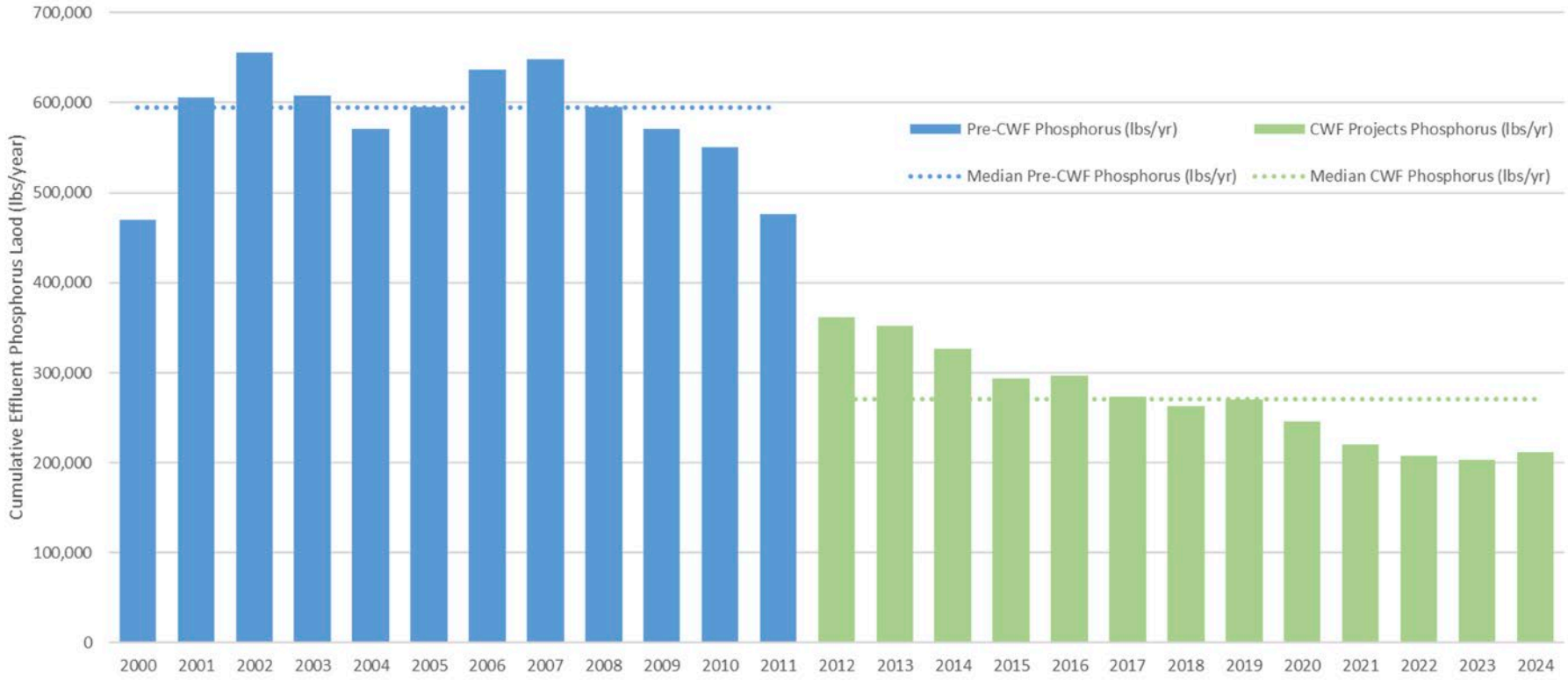


Statewide effluent phosphorus loads from wastewater sources since the year 2005. The reductions in phosphorus discharged to Minnesota waters reflect the cumulative effect of permitting policies, implementation of total maximum daily loads (TMDLs), Clean Water Fund Investments, and local efforts and investments for the protection and restoration of Minnesota's water resources.

What are we doing?

Regulatory policies implemented over the past 20 years (see graph above) have resulted in the reduction of phosphorus discharged by wastewater treatment facilities. The treatment plant improvements needed to achieve these reductions are expensive, particularly for smaller cities. Clean Water Funds have helped cities make the required infrastructure investments to meet phosphorus wasteload reductions mandated through the implementation of total maximum daily loads (TMDLs) and water quality based effluent limits (WQBELs).

Figure 28. Phosphorus load reductions at CWF wastewater treatment facilities



Since 2010, almost $65 million in Clean Water Fund grants have helped finance 63 municipal wastewater treatment upgrades to meet required phosphorus reductions. The availability of these Clean Water Fund grants help cities implement these treatment improvements on an expedited time schedule.

What progress has been made?

Over the past 12 years, municipal wastewater phosphorus discharges statewide have been reduced by 55% compared to the projected effluent loads that would have resulted from previous permitting policies. Overall, these combined efforts have led to a steady decline of phosphorus pollution and major improvements in water quality. Continued implementation of river nutrient standards is expected to result in further reductions in wastewater phosphorus loads in coming years.

Sixty of those CWF awards have funded upgrades, consolidation projects or unsewered area connections affecting 58 wastewater treatment facilities. Figure 28 shows cumulative effluent phosphorus loads discharged by those 58 WWTFs. The blue columns represent phosphorus discharged by that select group of facilities in the years before the first CWF projects came online. The green columns represent phosphorus discharged by that select group of facilities in the years after the first CWF project came online. The dotted lines represent the median cumulative effluent phosphorus load discharged by these facilities during those two respective time periods. The gap between the two dotted lines represents a cumulative effluent phosphorus reduction of 324,295 lbs per year.

In total, 99 Clean Water Fund phosphorus reduction awards since 2010 have facilitated wastewater treatment facility upgrades, unsewered area improvements and municipal wastewater consolidation projects.

Learn more

For information on activities funded by the Clean Water Fund visit:

- Clean Water Fund
- Minnesota Public Facilities Authority (PFA)
- Minnesota Pollution Control Agency (MPCA)

Drinking water and groundwater measures (actions)

Source Water Protection Plans and implementation

Measure: Number of community water systems assisted with developing Source Water Protection Plans

On track to meet planning goals for groundwater and surface water systems.

Status

Trend

Why is this measure important?

People in Minnesota obtain drinking water from groundwater, lakes, and rivers. The Minnesota Department of Health (MDH) works with public water systems and communities to protect the sources of their drinking water. Some examples of threats to drinking water sources include unused wells, urban pollutants, agricultural nutrients, storage tanks, lawn nutrients and chemicals, hazardous waste, and uncontrolled land development. Source water protection is important because it:

- Protects human health
- Keeps costs down — pollution prevention is often less expensive than remediation and treatment
- Ensures sustainable water supplies for future generations

What are we doing?

MDH requires source water protection planning for all community and noncommunity water systems that use groundwater, although the level of engagement varies based on their population. Additionally, some systems that use surface water have voluntarily developed Source Water Protection Plans. MDH is expanding the surface water program to provide more support to those systems.

Source Water Protection Plans identify the land area that supplies water, assess the vulnerability of that area to contamination, and identify actions to reduce the risk of threats. Protection areas, also known as Drinking Water Supply Management Areas (DWSMAs), cover approximately 1.2 million acres or 2% of the state's total land area. Within the DWSMAs, approximately 492,000 acres are vulnerable (at higher risk for contamination).

What progress has been made?

The program has delineated DWSMAs for all community water systems in the state with vulnerable wells and is in the process of delineating areas for remaining non-vulnerable systems. An approved DWSMA is the first step on the ladder of progressive steps a system can take to protect the land area that supplies water to its source.

The Source Water Protection Program has several targets through 2034:

- Conduct ongoing source water protection planning and implementation for the state's vulnerable community water systems.
- Complete first-generation Source Water Protection Plans for the remaining community water systems.
- Complete revised Source Water Assessments for all 23 surface water systems.
- Complete Source Water Intake Protection Plans.
- Complete pilot source water protection planning for 10 non-community water systems with at-risk populations.

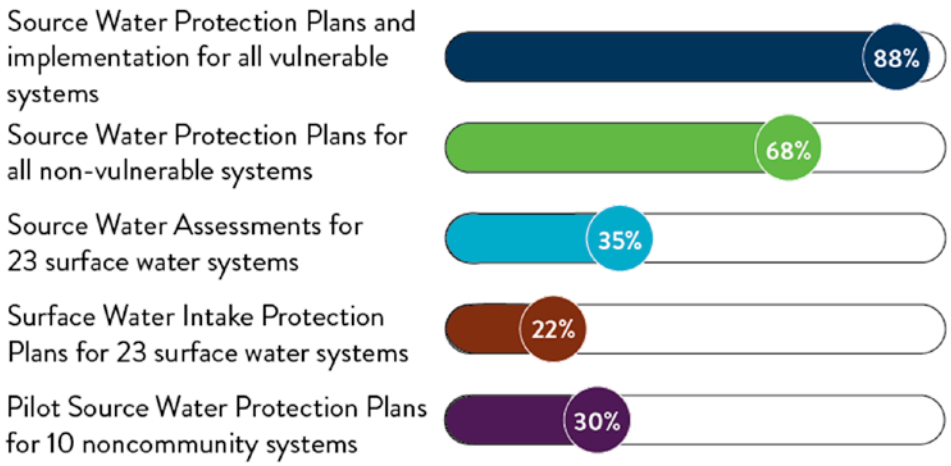


Figure 29. Progress towards these strategic goals can be seen in this figure. The Source Water Protection Program has long been engaged in planning for vulnerable and nonvulnerable community water systems using groundwater. Although progress continues to be made, better data acquired on the total number of systems accounts for the slight decrease in completion percentages. Surface water planning is a newer effort, and several communities are currently preparing these plans with MDH.

Learn more

Minnesota Department of Health Source Water Protection

Source Water Protection Grants

Measure: Number of grants awarded for source water protection

Leveraging resources helps to meet increasing demand for grants and to accelerate implementation of source water protection activities.

Status

Trend

Why is this measure important?

People in Minnesota get their drinking water from groundwater, lakes, and rivers. The Minnesota Department of Health (MDH) works with public water systems and communities to identify strategies to protect the source(s) of their drinking water. Grant dollars – often matched with other funds – can enable public water systems to take action. Prior to the Clean Water Fund, there was no financial assistance for public water systems to implement actions identified in their Source Water Protection Plans.

What progress has been made?

MDH continues to work towards its goal of meeting community demand for Source Water Protection Grants. The demand for these grants has grown over the past several years and often exceeds available funding. MDH anticipates the demand will continue to increase with the number of Source Water Protection Plans approved. Since the grants program started in 2010, MDH has awarded $10.4 million.

In 2025, the Source Water Protection Grants Program launched a new online system for applying for grants. The new database allows for streamlining of the grants application process. Applicants can track progress of their grants online, collaborate with MDH staff or others on their application, complete reporting requirements, and more. Due to the time and effort required to migrate data and set up the new system, it was not feasible to hold the spring round of grants in 2025. The funding for that round was made available in fall of 2025 in addition to the fall base funding amount and will be reflected in the next performance report.

Number of grants awarded by year

Year	Grants awarded	Funds awarded
2010	11	$92,000
2011	117	$714,000
2012	70	$421,000
2013	63	$356,000
2014	94	$585,000
2015	74	$563,000
2016	76	$473,000
2017	97	$569,000
2018	103	$701,000
2019	99	$825,000
2020	108	$754,000
2021	112	$902,000
2022	118	$973,000
2023	144	$1,188,000
2024	105	$845,107
2025	58	$499,360
TOTAL	**1,286**	**$10.4 million**

What are we doing?

MDH administers three types of grants to public water systems: competitive, Implementation, and transient grants. Public water systems are eligible for different grants based on their customer base and whether they have a Source Water Protection Plan.

Learn more

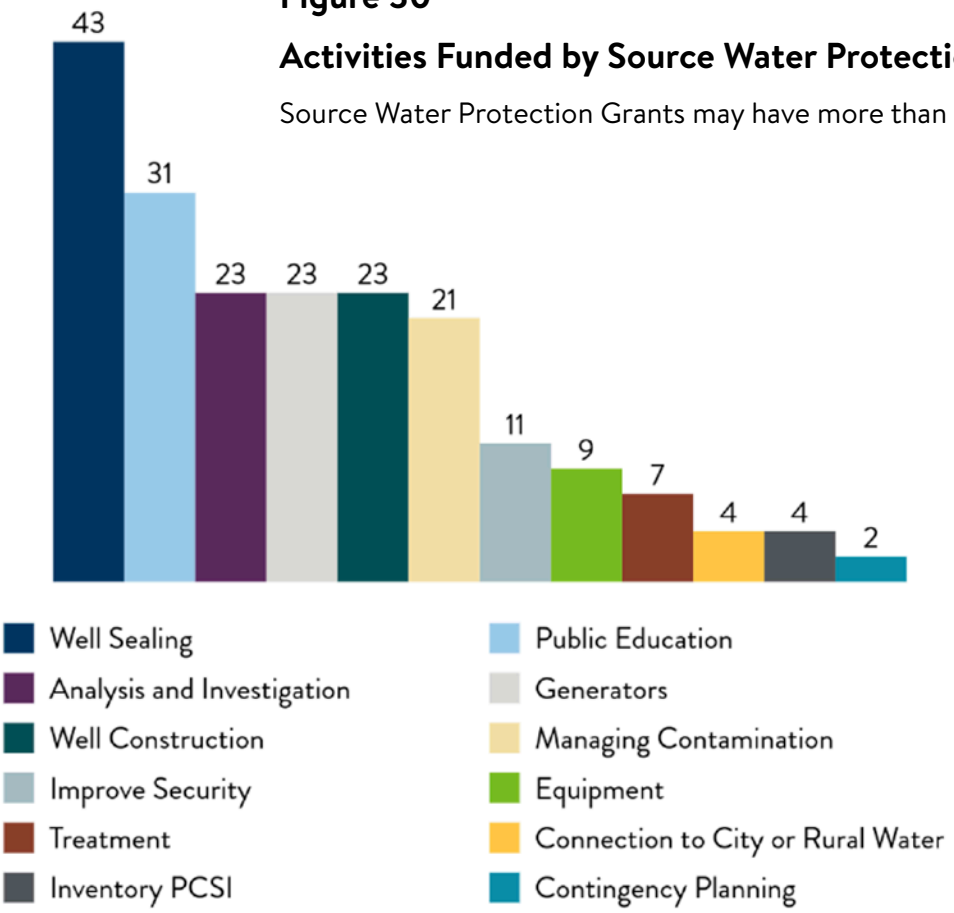
- About source water protection grants from MDH
- Grant information for applicants (MDH)

MDH recognized the community of Cobden for its efforts to protect its source of drinking water with a Source Water Protection Award.

Figure 30

Activities Funded by Source Water Protection Grants (2024-2025)

Source Water Protection Grants may have more than one activity.



Nitrate monitoring and reduction by local partners

Measure: Number of local government partners participating in Clean Water Fund supported groundwater nitrate-nitrogen monitoring and reduction activities

New local partnerships continue to be established for nitrate-nitrogen monitoring and reduction activities.

Status

Trend

Why is this measure important?

Nitrate-nitrogen is one of the most common pollutants in Minnesota's groundwater. Some townships in sensitive areas of the state had more than 40% of tested wells showing elevated nitrate levels.

Nitrate comes from many sources, including fertilizers, manure, septic systems, landfills, and natural decomposition of organic matter. Nitrate occurs naturally in groundwater at levels typically in the range of 0 to 3 milligrams per liter (mg/L). Human activities can raise the level of nitrate in groundwater. The drinking water standard for nitrate-nitrogen is a maximum concentration of 10 mg/L. Nitrate above this level can have negative effects on human health, especially infants under the age of six months.

Groundwater is most vulnerable to nitrate contamination in the Central and Southeast regions of Minnesota. Areas in Central Minnesota are vulnerable because of widespread sandy soil. Southeastern Minnesota is vulnerable because of shallow bedrock, sinkholes, and underground caves (referred to as karst geology). Also, certain types of wells — shallow wells, hand-dug wells, tile wells, and improperly grouted wells — are vulnerable to nitrate contamination.

Minnesota's Clean Water Fund is being used for activities that help identify the severity and magnitude of nitrate contamination. Funds are also used to evaluate and implement practices at the local level to reduce nitrate in groundwater. State agencies work closely with many partners on nitrate monitoring and reduction activities. Building and maintaining these partnerships is essential to effectively address groundwater concerns.

> "Nobles SWCD is glad to be working together with partners to address the challenge of elevated nitrogen levels in community drinking water. Local relationships combined with funding to support change are keys to finding solutions to this challenge."
>
> — Scott Runck, Nobles SWCD Manager

What are we doing?

The Minnesota Department of Agriculture (MDA) focuses its work in areas where there is elevated nitrate-nitrogen in groundwater. The MDA has worked with more than 60 local partners on nitrate monitoring and reduction projects, a total of 42 in the last two years. In general, the MDA provides technical and financial support, and the local partners provide coordination and contribute knowledge, skills, and expertise about local conditions and issues.

The goal of our partnerships is to increase knowledge and awareness about nitrate issues and foster a greater willingness by farmers to adopt and maintain best management practices to reduce nitrate leaching loss from cropland.

These partnerships continue to grow and offer new opportunities to further the work addressing nitrate in groundwater.

This profile focuses on four current activities — the progress of implementing the Groundwater Protection Rule, private well testing, the irrigation specialist position, and a local partnership.

Groundwater Protection Rule

The Groundwater Protection Rule (GPR), effective in 2019, minimizes potential sources of nitrate pollution to the state's groundwater and protects drinking water. The rule restricts the application of nitrogen fertilizer in the fall and on frozen soils in areas vulnerable to contamination, and it outlines steps to reduce the severity of the problem in areas where nitrate in public water supply wells is already elevated.

In areas where Drinking Water Supply Management Areas (DWSMA) have elevated nitrate the MDA is working with local partners to form local advisory teams with farmers, agronomists, and other community members. The teams are involved in reviewing and advising the MDA on appropriate farm management practices to reduce nitrate leaching losses in the DWSMA.

Long-term private well monitoring networks

The MDA is working with two volunteer long-term private well monitoring networks to determine the trend of nitrate levels in regional drinking water over time. The networks were established in the Southeast and West Central ("Central Sands"), regions of the state where groundwater is most vulnerable.

This work is done in partnership with local governments and individual private well owners. A total of 23 counties are included in the networks (9 in southeast, 14 in Central Sands). Selection of individual wells was random, and each participant is encouraged to submit a water sample each year. Participants receive a sample kit from a certified lab with instructions on how to collect and submit the sample. Sampling began in 2006 in the southeast network, and 2011 in the Central Sands network.

Irrigation specialist

Nitrate losses from irrigation of nitrogen demanding crops (such as corn, potatoes, and edible beans) is a potential source of nitrate in groundwater, especially on irrigated sandy soils. The MDA supports an irrigation specialist position through a contract with University of Minnesota Extension. The irrigation specialist performs research, develops guidance, and provides education on irrigation and nitrogen best management practices for Minnesota irrigators. Many farmers, particularly those newly implementing irrigation or adopting new irrigation technology, benefit from increased education, training, and direct support.

Local partnership with Pipestone and Nobles County SWCDs

The MDA began working with Nobles and Pipestone County Soil and Water Conservation Districts (SWCDs) on the Groundwater Protection Rule (GPR) in 2019. The MDA has provided funding for SWCD staff to assist with the implementation of the GPR including the coordination of the local advisory team and the promotion of best management practices and alternative management practices to reduce nitrate leaching.

What progress has been made?

Groundwater Protection Rule

There are currently 17 active local advisory teams in DWSMAs where nitrate-nitrogen exceeds 8.0 mg/L in the community water supply wells. In consultation with the local advisory teams, the MDA has approved a list of nitrogen fertilizer best management practices (BMPs) and alternative management tools to protect groundwater in twelve of the DWSMAs. These practices will need to be adopted on at least 80% of cropland within the DWSMA. The MDA works closely with local partners to raise awareness about required practices and encourage adoption of BMPs. The MDA will conduct a follow-up survey in no less than three growing seasons and if practices are not adopted the DWSMA could move to a regulatory phase under the Groundwater Protection Rule.

Long-term private well monitoring networks

Although there can be variability in the sampled population and nitrate-nitrogen concentration in individual wells from year to year, on a regional scale most wells have water that is below the health risk limit of 10 mg/L. In 2024, 247 private wells were tested in the Central Sands network, 91.1% of the results were less than 3 mg/L, 6.9% were between 3 and less than 10 mg/L, and 2.0% were greater than 10 mg/L. In the Southeast network, 376 private wells were sampled, 68.6% were less than 3 mg/L, 21.5% were between 3 and less than 10 mg/L, and 9.8% were greater than 10 mg/L. Results are shared directly with well owners and summarized in a regional report.

Nitrate levels are showing a downward trend. In the Central Sands, the downward trend is evident in the 90th percentile, while in the Southeast network, the trend is in the 50th percentile. Further analysis will be completed in 2026.

Irrigation specialist

Dr. Vasu Sharma with the U of M's Department of Soil, Water, and Climate has held the irrigation specialist position since 2019. Through her research and outreach efforts she has conducted focus groups, published blog posts on irrigation best management practices, and participated in 151 outreach events to reach over 6,500 farmers, crop consultants, and co-op dealers. She also played a key role in the collaboration of the 26 local government unit partners and the Mille Lacs Band of Ojibwe that led to a federal grant award of $3.5 million. The project funds a precision irrigation cost-share program to upgrade irrigation systems in Minnesota to protect groundwater from nitrate leaching. The success of that initial award led to another award of $11.16 million. These federal funds were awarded through the US Department of Agriculture Natural Resources Conservation Service Regional Conservation Partnership Program (RCPP).

In addition, Dr. Sharma provides the irrigation management training required for the Minnesota Agricultural Water Quality Certification Program Irrigation Endorsement through the Minnesota Irrigator Program (MIP). The MIP program is offered annually to early irrigation technology adopters and SWCD technical staff. Presenters from academia, industry, and agencies provide presentations about installation and use of new irrigation technology.

Dr. Sharma maintains an active research program that is relevant and meaningful for irrigation crop production in Minnesota. The research informs her extension programming and education activities. Projects include optimizing irrigation water application rates in fields with different soil types, evaluating the interactions between nitrogen fertilizer application rates and irrigation water application rates, and an ongoing study evaluating interactions between cover crops and irrigation water management with - as

a first in Minnesota - tillage practices under irrigation. The research projects are funded by Clean Water Funds via the MDA, the Ag Fertilizer Research and Promotion Council (AFREC), the Minnesota Corn Research and Promotion Council, and the Irrigator Association of Minnesota.

Working together to deliver technical and financial assistance

The MDA's partnership with Nobles and Pipestone County SWCDs and coordination with the cities of Adrian and Ellsworth, Minnesota Rural Water, and Minnesota Department of Health supported the establishment of practices to protect the community drinking water supplies in Adrian and Ellsworth.

Working with the MDA and sharing information with farmers: SWCD staff serve as a local point of contact for questions related to the Groundwater Protection Rule (GPR), nutrient management, and groundwater issues. Funding has allowed SWCD staff the time to coordinate and participate on the local advisory teams. They add value to the team and in turn are informed of the GPR process and state resources to support farmers.

Changes to protect Adrian and Ellsworth drinking water: The SWCD staff have trusted relationships with cropland owners. Through outreach and data sharing they helped connect the cropland owners to practices and state funding to implement protective changes.

The changes include the sealing of three abandoned wells, the establishment of 29 acres of perennial hay, and the planting of fall cover crops on 94 acres. Four acres of land converted to perennial hay near Adrian's community well will remain this way through 2029. Computer modeling of cropland near these communities estimates that converting from a corn and soybean rotation to a perennial hay crop can reduce nitrate leaching below the root zone by 64-84%. The addition of a fall cover crop can reduce nitrate leaching by 13-20%.

Field of perennial crops in Ellsworth.

Learn more

- Groundwater Protection Rule
- Long-term Private Well Networks
- Water Quality and Irrigation Research at Rosholt Farm
- Local Weather Data and Irrigation Scheduler
- Irrigation Partnerships to Protect Groundwater (RCPP Project)

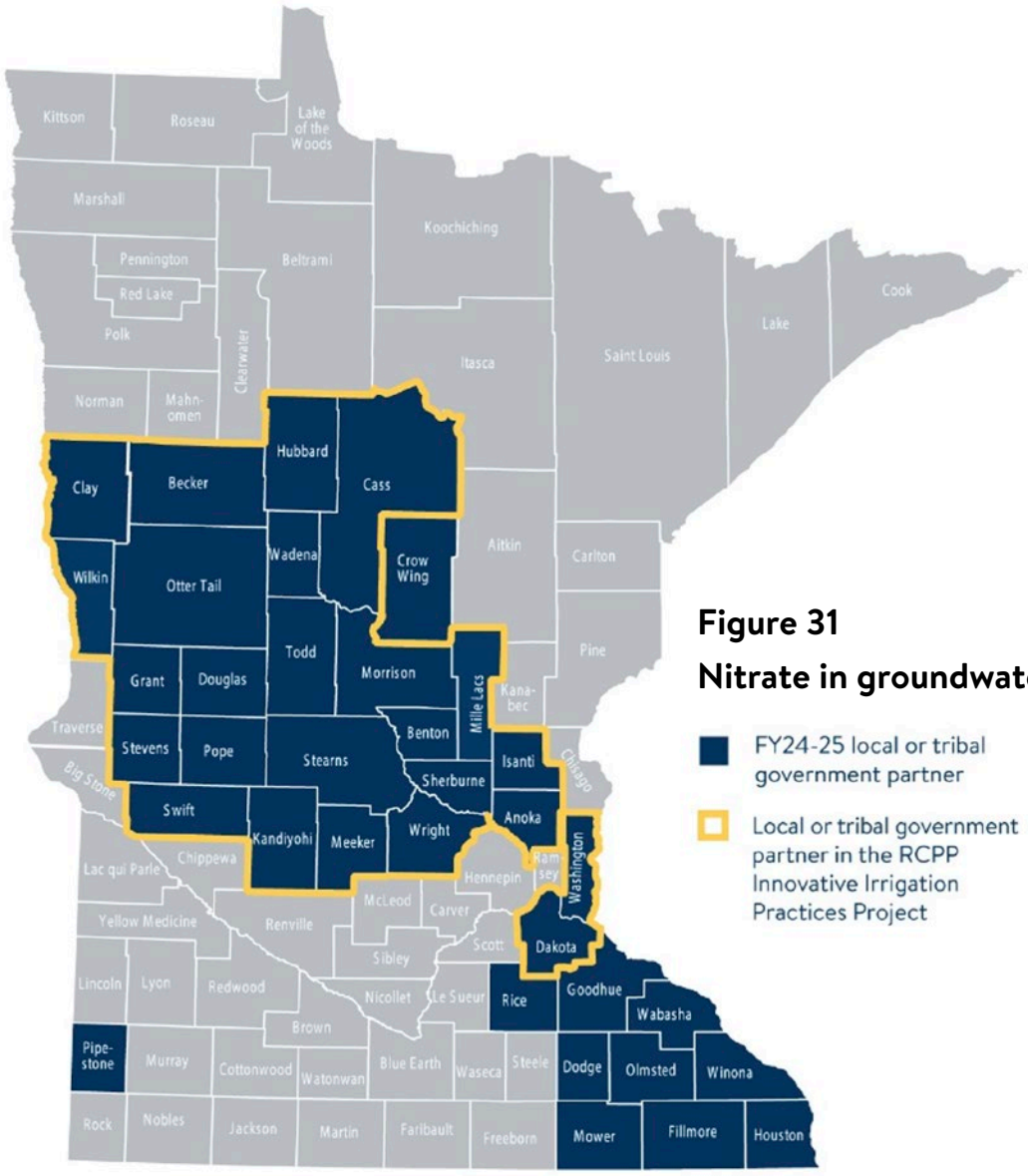


Figure 31

Nitrate in groundwater partnerships

FY24-25 local or tribal government partner

Local or tribal government partner in the RCPP Innovative Irrigation Practices Project

Contaminants of emerging concern

Measure: Develop health-based water guidance values and advance methodology for contaminants of emerging concern

Completed 2 re-evaluations and 2 full evaluations, updated water guidance for 3 CECs, authored 3 publications, provided technical assistance to understand and use water guidance values.

Status

Trend

Why is this measure important?

Contaminants of emerging concern (CECs) are chemicals released into the environment, often from consumer products and personal care products, that may not have been previously assessed for risk to human health. Understanding the risk from these types of chemicals when they are present in Minnesota's waters is critical to preventing health effects in people and for removing contamination from the environment. The CEC Initiative staff in the Health Risk Assessment Unit at the Minnesota Department of Health study CECs in water and develop risk assessments and health-based water guidance values. These values aid state agencies in their work to protect and maintain clean water for all Minnesotans, and to provide context for private well owners and the general public for CEC exposures through water. Very few states have similar programs.

The development of water guidance values represents a meaningful indicator of public health protection. Hundreds of CECs have been found in Minnesota waters. The vast majority of these CECs have no health-based water guidance values to understand any health risks associated with exposures to these compounds. Without this toxicological and risk assessment information, Minnesotans may not be informed of these new risks.

The need for new guidance is ongoing as there are tens of thousands of chemicals in commerce and the vast majority have little or no toxicology information publicly available. These chemicals find their way into Minnesota waters and are more frequently being detected there, in part because new analytical capabilities can measure them at very low concentrations. Historically, approximately 70% of all health-based guidance values developed by the CEC Initiative lack federal water guidance values.

What are we doing?

HRA toxicologists and exposure scientists research nominated chemicals with a goal of developing health-based water guidance for CECs. Nominations are evaluated to determine which chemicals pose the largest threat to Minnesotans based on both toxicity and potential for exposure. Using a weight of evidence approach, HRA identifies a concentration of a chemical that has little to no risk of negative health impacts, even for sensitive populations such as fetuses, infants, pregnant women, and children. We are enhancing the chemical review process to integrate health equity and environmental justice to ensure that the guidance is protective of all populations in Minnesota.

What progress has been made?

The CEC Initiative reviewed per- and polyfluoroalkyl substances (PFAS) family chemicals and tributyl phosphate during the 2024-2025 fiscal years (FY24-25). The CEC Initiative also reviewed lithium, but was unable to develop a guidance value due to limited toxicological studies. PFAS are a family of human-made chemicals that have been widely used for decades and do not breakdown in the environment. The CEC Initiative is a nationally respected leader in the development of health-based guidance values for PFAS due to their historical use in Minnesota.

In addition to developing guidance for contaminants, the CEC Initiative provides toxicological and risk assessment support for communities, private well owners, MDH and other state agencies, and the general public affected by water contamination. The CEC Initiative also regularly presents their work at scientific meetings across the country and participates in CEC-related state and federal workgroups.

Publications

The CEC team contributed to the following scientific publications during FY24-25:

- Bogdan, A. R.; Klos, K. S.; Greene, C. W.; Huset, C. A.; Barry, K. M.; Goeden, H. M. **Per- and polyfluoroalkyl substances (PFAS) in powdered infant formula: potential exposures and health risks.** J. Environ. Expo. Assess. 2024, 3, 14. http://dx.doi.org/10.20517/jeea.2024.08
- Greene, C. W.; Bogdan, A. R.; Goeden, H. M. **A revised and improved toxicokinetic model to simulate serum concentrations of bioaccumulative PFAS**. J. Environ. Expo. Assess. 2024, 3, 12. http://dx.doi.org/10.20517/jeea.2024.09.
- Greene, C. W., Valcke, M., Soshilov, A. A., Levallois, P., and Goeden, H. M. **A review of common approaches to determining allocation factors and relative source contribution factors for drinking water contaminants: caveats and areas for improvement. Regulatory Toxicology and Pharmacology, 2025**: 105886. https://doi.org/10.1016/j.yrtph.2025.105886

Contaminants reviewed

MDH completed a full review of tributyl phosphate, a re-evaluation of PFOS and PFOA, and a review for lithium that did not result in developing a guidance value during FY24-25. The CEC team also started full reviews of trifluoroacetate (TFA) and *o*-toluidine during this period. Re-evaluations for PFOA and PFOS were developed using newly-available human health data from epidemiological studies, making them more similar to full reviews than simpler re-evaluations. Re-evaluating existing health-based guidance ensures Minnesota

Table 32

MDH health-based guidance values FY 24-25

Micrograms per liter (µg/L) in water

Contaminant	MDH Guidance
Perfluorooctane Sulfonate (PFOS)	0.0023 (noncancer)
PFAS family	0.0076 (cancer)
Perfluorooctanoate (PFOA)	0.00024 (noncancer)
PFAS family	0.0000079 (cancer)
Tributyl Phosphate	4 (noncancer)

guidance is up to date with the latest risk assessment methodology and includes the most recent available scientific data. From the CEC Initiative's inception through the FY24-25 biennium, over 200 contaminants were nominated for review, of which 165 were screened for toxicity and exposure information.

Technical assistance and presentations

The CEC team also regularly provides expert technical assistance related to contaminants of emerging concern and health based-guidance values to researchers, state agency programs, and the general public. During the FY 24-25 biennium, the CEC team completed more than 40 expert technical assists and participated in 54 presentations. The CEC team also responded to inquires from colleagues across the state, the public, and press over phone and email.

Partnerships

An obstacle to developing full chemical reviews each biennium is lack of publicly available toxicity information. The CEC Initiative is addressing this by partnering with U.S. Environmental Protection Agency (EPA) scientists. We are working to identify and develop new workplan development methods that incorporate nontraditional sources of data to identify and screen chemicals for both toxicity and exposure risk. This is a multi-year project focusing on emerging contaminants that lack data typically used in standard risk assessments. This partnership has already created a prototype of an automated workflow to perform exposure screenings much faster than can be done manually, which resulted in a scientific publication.

One accomplishment of the CEC Initiative in the last biennium was to partner with other programs within the Environmental Health (EH) Division at MDH to help better understand and communicate health risk from elevated levels of chemicals in Minnesota drinking water, especially for formula-fed infants.

Learn more

- Find more information about this measure and its data
- MDH Contaminants of Emerging Concern information

County Atlas program

Measure: Number of counties completing a county geologic atlas for groundwater sustainability.

County atlases (including the geologic and groundwater atlases) are being completed at the planned rate, and counties continue to step up to participate. With continued and consistent funding, completion of geologic atlases for all counties is expected around 2035, and completion of groundwater atlases for all counties around 2040.

Status 

Trend 

Why is this measure important?

Approximately 75% of Minnesotans get their water for drinking and other needs from groundwater. A stable, long-term and reliable source of high-quality groundwater is an economic benefit to communities. County atlases provide detailed information about an area's geology and groundwater that help communities find reliable water sources and manage them to maintain availability and quality for generations. Without informed water supply planning, groundwater pumping or land-use changes could impact water quality and availability and degrade surface waters (wetlands, lakes, rivers and unique groundwater fed resources, such as trout streams and fens).

The county atlases are routinely used to make informed decisions related to water, natural resources and land-use planning. Typical applications include:

- long-term water supply planning and well construction design
- wellhead protection planning
- groundwater modeling
- identification of valuable natural resources and planning for their use and protection
- planning for landfills, septic systems, industrial sites and feedlots
- emergency response to contaminant releases
- research and community education

When completed, the county atlases are an economic benefit for a county and communities within it. This measure tracks the extent to which county atlases are available in Minnesota.

What are we doing?

The Minnesota Geological Survey (MGS) and the Department of Natural Resources (DNR) prepare the county atlases to convey valuable geologic and groundwater information to private organizations, agriculture, industry, academia, citizens and government units at all levels, particularly to local governments. The county atlases provide "information infrastructure". MGS focuses on county geology, and DNR focuses on county groundwater resources.

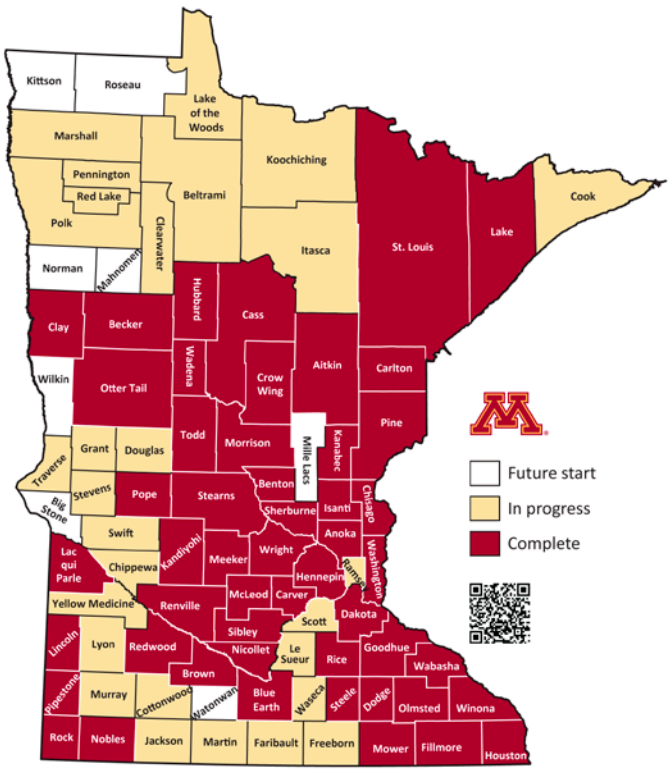
The Clean Water Fund supports enhanced research to improve the quality of county atlases and to accelerate their completion. Local participation is a primary factor in determining which counties are chosen for this work, while groundwater sensitivity, water demand and the size of the population served are also considerations. The counties are asked to provide in-kind services in support of the atlas.

What progress has been made?

In total, MGS county geologic atlases are complete or underway for 79 counties and DNR groundwater atlases are complete or underway for 52 counties. The long-term goal is to complete an atlas (both geologic and groundwater) for every county in Minnesota. The Clean Water Fund supports expanded data collection for atlases, such as the use of sophisticated geological coring by the MGS. The completion of special high-quality drilling and coring to obtain detailed geologic information was most recently supported in Stevens and Traverse counties (fiscal year 25).

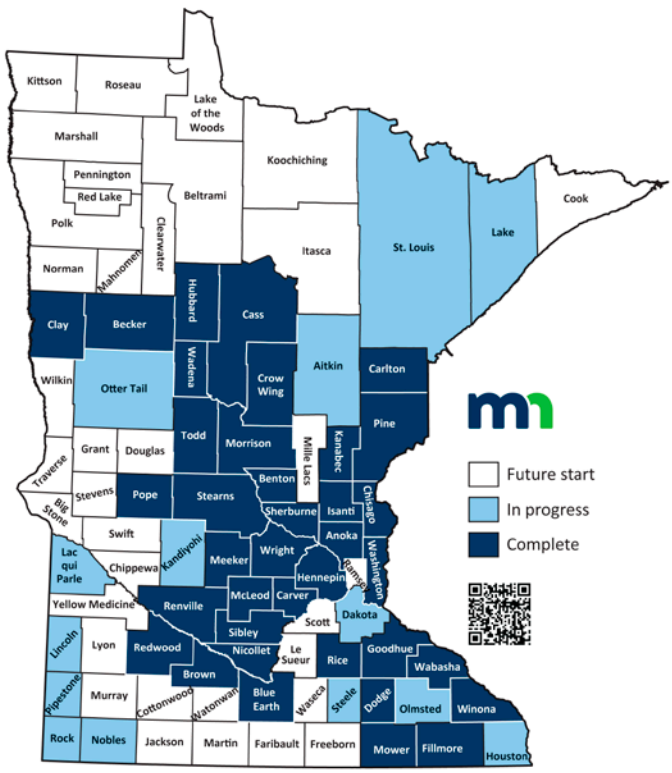
DNR county groundwater atlas staff used Clean Water support to conduct specialty groundwater dye tracing and nitrate monitoring in the karst region of southeast Minnesota. This work was in collaboration with the Filmore County Soil and Water Conservation District, the University of Minnesota (UofM), and Olmsted County. Enhancements to the Minnesota groundwater tracing database (MGTD) are also underway through a contract with the MGS.

Figure 33. Geology atlas status



Map of Minnesota counties showing the status of progress on county geologic atlases (used with permission from the Minnesota Geological Survey).

Figure 34. Groundwater atlas status



Map of Minnesota counties showing the status of progress on county groundwater atlases.

Long-term Monitoring network wells

Measure: Number of long-term groundwater monitoring network wells in Minnesota

Many areas of the state still lack important groundwater information. Long-term ramp up in monitoring accelerated by Clean Water Fund investments is filling gaps.

Status

Trend

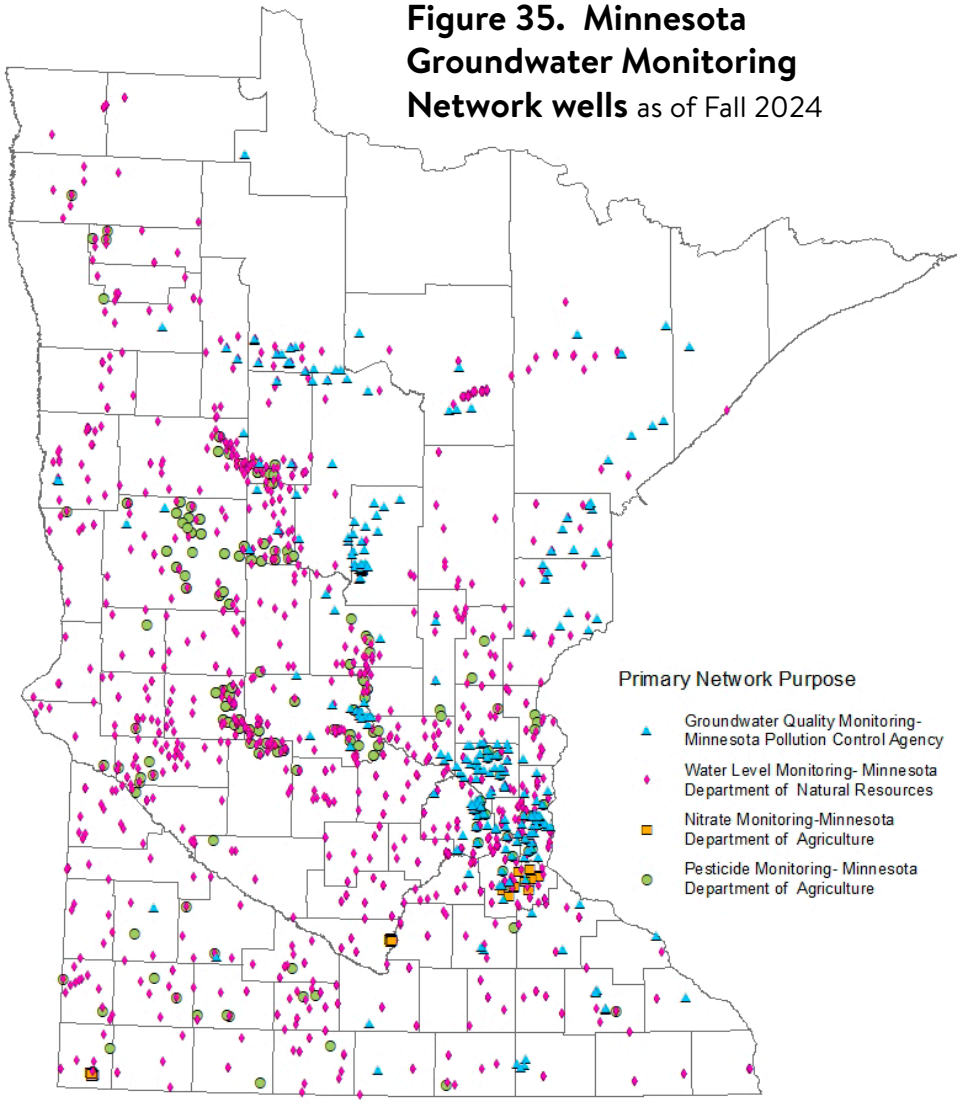
Why is this measure important?

About 75% of Minnesota's drinking water comes from groundwater, which is pumped from the state's many and varied aquifers. Groundwater also supports agriculture, industry, and natural resources that define Minnesota's quality of life. Minnesota is relying more and more on groundwater to meet its growing needs, but many parts of the state lack basic information about the availability and quality of groundwater.

Since it is underground, people can't see groundwater to observe its condition. Monitoring wells provide a "window" into aquifers, providing a way to see groundwater levels and measure water quality. This information is essential to better inform investments in water supply infrastructure and efforts to protect public health and natural resources.

To provide a safe and reliable drinking water supply at the lowest cost, well drillers and well owners should know the depth of the closest safe-quality groundwater. They should also know how much groundwater levels and quality fluctuate during wet and dry seasons, to ensure that pumps in wells don't go dry and to understand potential health risks. Groundwater monitoring information is also important for protecting wetlands, developing total maximum daily loads (TMDLs) for streams, and for preventing the migration of contamination plumes.

Figure 35. Minnesota Groundwater Monitoring Network wells as of Fall 2024



This measure tracks the number of wells used for long-term monitoring of groundwater conditions. Well installation, water quality sampling, and water level measurement are coordinated among state agencies, and wells are used for multiple purposes whenever feasible. Other monitoring wells exist, but they are used for short-term contamination or remediation events.

What are we doing?

While Minnesota's groundwater monitoring network is still inadequate for understanding groundwater conditions in portions of the state, it is improving. Clean Water Fund investments accelerate efforts to fill gaps in understanding aquifer conditions across the state and improve local capacity to improve private and public drinking water supply infrastructure development.

The Minnesota Department of Natural Resources manages a statewide network of water level observation wells, in partnership with Soil and Water Conservation Districts and various volunteers. Data from these wells are used to determine long-term trends, interpret impacts of pumping and climate, plan for water conservation, and otherwise manage the water resource. DNR monitors aquifer levels in 1,257 wells with an ultimate goal of 1,500 total wells monitored. The Minnesota Pollution Control Agency manages a statewide network of about 254 groundwater quality monitoring wells to determine whether non-agricultural pollutants are present and to track trends in pollutant concentrations. These wells are primarily installed in urban aquifers that are most susceptible to pollution from human activities. Water samples are collected annually to determine the concentrations of more than 100 regulated and unregulated chemicals, including nitrate, chloride, and trace elements. The Minnesota Department of Agriculture (MDA) manages a network of about 142 groundwater quality monitoring wells across the state, primarily in agricultural areas, with the purpose of determining the impacts of pesticides and fertilizers on vulnerable groundwater. Additionally, the MDA network also includes 13 domestic wells and 13 springs, not illustrated on the map. The MDA maintains an additional 25 monitoring wells for the purpose of monitoring nitrate in Drinking Water Supply Management Areas with high nitrate concentrations.

What progress has been made?

The current statewide groundwater monitoring network includes approximately 1,583 monitoring wells. The ultimate goal is a network of approximately 2,000 state-owned and managed long-term groundwater monitoring wells.

The DNR continues to increase the number of wells that are installed for determining water levels. While the MDA has added wells to determine the impacts of pesticides and fertilizers on vulnerable groundwater.

Protecting vulnerable drinking water sources

Measure: Protective land uses in Drinking Water Supply Management Areas

There is increasing research, engagement, and activity to target and protect vulnerable areas in DWSMAs.

Status

Trend

Why is this measure important?

Safe and sufficient sources of drinking water are a key water resource management priority across the state of Minnesota. Source water protection planning and implementation efforts aim to identify priority areas for management, assess vulnerabilities and threats in those areas, and target resources for implementation to mitigate risks.

Protection of drinking water sources is particularly important within Drinking Water Supply Management Areas (DWSMAs), areas that contribute groundwater used for drinking water. There are approximately 1.2 million acres of land in DWSMAs in Minnesota, and about 41% (492,000 acres) is vulnerable to contamination. The total number of vulnerable acres changes over time as community DWSMAs are delineated and amended.

Land use within DWSMAs is a key consideration for source water protection management. Activities or features on the land can affect the quality of underlying groundwater and nearby surface water used for drinking water supply. Active management of land use is a key tactic for securing the protection of these resources. Yet Minnesota Department of Health (MDH) and PWSs have limited ability to influence land use in DWSMAs, since much of the land within DWSMAs is privately owned and outside of municipal jurisdiction.

What are we doing?

MDH has a long-term goal to promote land use that is beneficial to water quality in DWSMAs and other areas of drinking water significance. There is no single approach or measure that sums up the variety of ways in which we measure progress towards this goal. This report describes some of the metrics.

MDH works with communities, PWSs, and other state and local partners to promote land use that is mutually beneficial. MDH helps communities identify vulnerable areas within their DWSMAs and plan and implement activities that prevent contamination. Strategic partnerships with other stakeholders in DWSMAs, such as private landowners, can also create opportunities to protect drinking water sources.

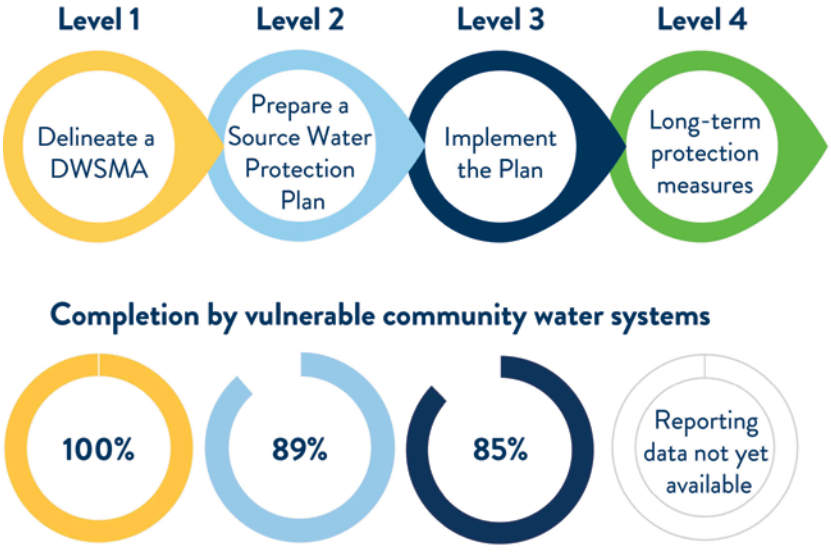


Figure 36. Levels of protection and completion by vulnerable community water systems.

Note: Level 3 includes preliminary data from a small number of audited systems. Workflow to produce more representative numbers in process.

The Source Water Protection (SWP) program at MDH created a framework defining four levels of protection: 1) Delineating a DWSMA; 2) Preparing a SWP Plan; 3) Implementing the Plan; and 4) Securing long-term protection of the DWSMA. Most PWSs progress through these levels sequentially. By encouraging protective land use in DWSMAs, MDH and PWSs can prevent or mitigate contamination of drinking water sources.

What progress has been made?

MDH provides direct programmatic support to communities through Levels 1 and 2 of the framework but relies on communities and partners to implement Level 3 and 4 activities. MDH is currently able to report on Levels 1, 2, and 3, and is developing metrics and processes to track systems' and partners' progress through Level 4.

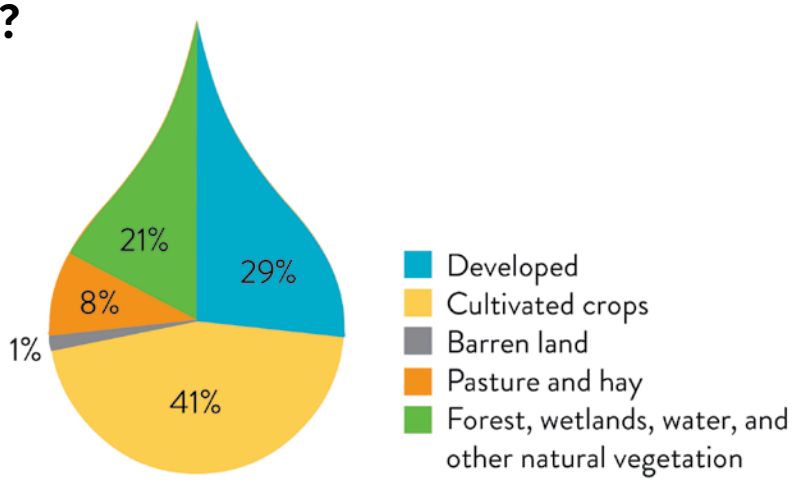


Figure 37. Land use in vulnerable Drinking Water Supply Management Areas

MDH is assessing available data sources to measure and evaluate long-term protection of the vulnerable areas within DWSMAs. MDH will work with state and local partners to create the tools and plan needed to advance this initiative. These resources will allow MDH, PWSs, and other partners to identify and prioritize appropriate protection measures for the diverse DWSMAs in the state, and measure progress accordingly.

Existing land use across vulnerable DWSMAs provides a glimpse of the opportunities and challenges associated with achieving long-term protection measures for these areas. Approximately 29% of land in DWSMAs statewide has protective use that benefits water quality (i.e., lands that are forested or used for low impact agriculture like pasture and hay production). Planning and implementing land use changes with decision-makers is a locally led process that takes time. MDH seeks to work with local decision makers as well as state and regional partners to tailor implementation towards protective activities that are appropriate based on the land uses in a DWSMA. For example, in rural areas where DWSMA acres are dominated by agricultural lands, partners at the federal Natural Resource Conservation Service (NRCS) and at MDA seek to incentivize practices that are protective of water quality.

Table 38. Examples of land uses or land use interventions protective of drinking water

Partner interventions to protect drinking water	Total acres in vulnerable acres (out of 492,000)
MDA Water Quality Certification Program	13,031
Groundwater protection practices enrolled in NRCS	34,100*
Conservation easements	6,205

Existing land uses that are generally protective of drinking water	Total acres in vulnerable acres (out of 492,000)
Publicly owned forested lands	5,947
Privately owned forested lands	52,739
Publicly owned land in Twin Cities Metropolitan Area	18,696

* Data not updated this biennia due to capacity constraints at the federal level.

What are the challenges and limitations?

A challenge in tracking changes in land use over time is the availability of data. Statewide data on land use is available through the National Land Cover Database (NLCD). These data show generalized land uses such as forestry, wetlands, agriculture, and urban development. These land use categories are an insufficient indicator for drinking water protection since they do not account for the array of best management practices (BMPs), activities, and programs that safeguard drinking water sources. For example, conservation practices can mitigate contamination in agricultural areas but may not change land use classification in the NLCD. This is also true for stormwater BMPs that can reduce contamination from runoff in urban areas. Additionally, updated NLCD data is typically released every five years.

This measure is expected to change over time as partnerships are made and different sources of data become available. While MDH is working with partners to develop reporting metrics, a recommendation is to support policy initiatives among Minnesota Executive Branch agencies and their partners to share data on land use protections in DWSMAs. Making these data available would help local implementers plan activities to protect Minnesota drinking water now and in the future.

Learn more

Protecting vulnerable drinking water sources

Drinking water and groundwater measures (outcomes)

Groundwater quality

Measure: Changes over time in pesticides, nitrate-nitrogen, and other key water quality parameters in groundwater

Why is this measure important?

Chemicals are commonly used to control pests, support food production, manage lawns, protect human health, and keep our roadways free of ice and snow. People also use many chemicals for cleaning clothes, maintaining cars and homes, and improving lives.

Unfortunately, the benefits of pesticides, fertilizers, and other chemicals are balanced against potential impacts to the state's sensitive groundwater resources. It is only with highly detailed and sophisticated monitoring that the impacts of chemical use to groundwater resources can be understood and managed.

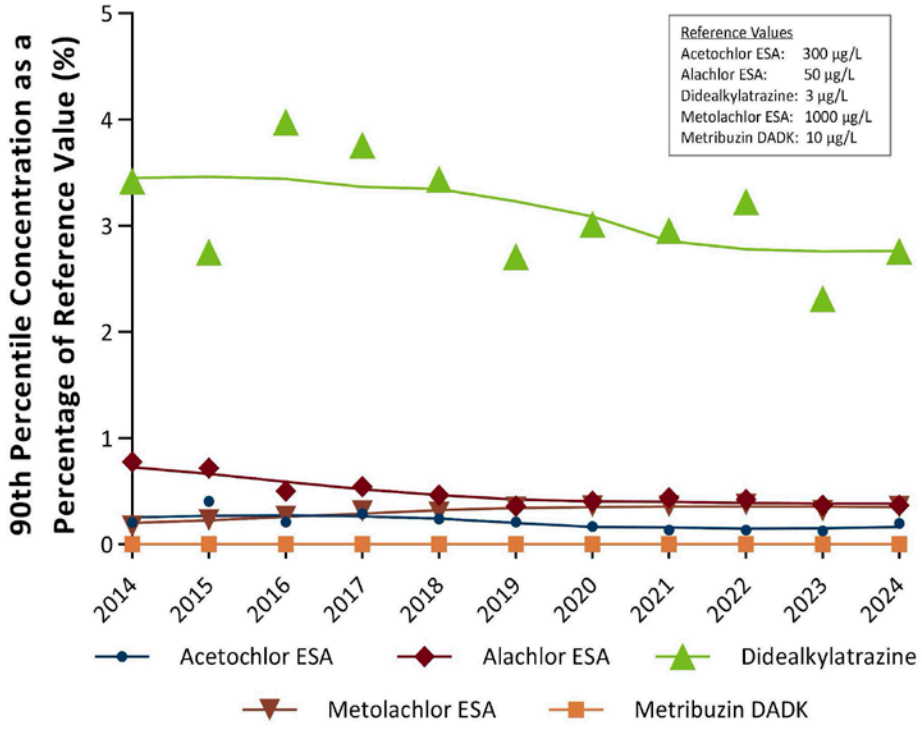
Parameters	Status and trend
Pesticides — Variable trends for five common pesticides indicate a mixed signal. Low levels are frequently detected in vulnerable groundwater.	
Nitrate-nitrogen statewide — In many agricultural areas, drinking water supplies are not vulnerable to surficial contamination and most wells have low levels of nitrate-nitrogen. However, in vulnerable groundwater areas, nitrate contamination is a significant concern.	 Not enough data
Nitrate-nitrogen southwest region — In areas where groundwater is vulnerable, nitrate levels can be high. Of the 21 vulnerable townships tested in southwest Minnesota (2013-2019), 100% of them were determined to have 10% or more of the wells over the nitrate-nitrogen 10 mg/L standard.	 Not enough data
Nitrate-nitrogen Central Sands — Trend data from the Central Sands Private Well Network shows a slight downward trend in the 90th percentile. However, Township Testing data show a high level of nitrate in some vulnerable aquifers in the Central Sands.	
Nitrate-nitrogen southeast region — Trend data from the Southeast Minnesota Volunteer Nitrate Monitoring Network shows a downward trend in the median concentration. However, township testing data show a high level of nitrate in some vulnerable areas in southeast Minnesota.	

What are we doing?

The Minnesota Department of Agriculture (MDA) samples groundwater wells in urban and agricultural settings. The MDA water samples are analyzed for many pesticides (185 starting in 2022) as well as nitrate. Results are used as feedback in the fertilizer and pesticide management process and are reported to farmers and the general public. The MDA and advisory committees use monitoring results to inform management decisions.

The Minnesota Pollution Control Agency (MPCA) samples a network of wells, primarily in urban settings, that measure ambient (or background) conditions for a large number of non-agricultural chemicals, including nitrate, chloride, volatile organic compounds, per- and polyfluoroalkyl compounds (PFAS), and emerging contaminants. The network is focused on two aquifers that are especially vulnerable to man-made contamination — the sand and gravel and Prairie du Chien-Jordan aquifers.

Figure 39. Pesticide concentration summary statistics in relation to reference values



The 90th percentile concentration for each commonly detected pesticide breakdown product was calculated and compared as a percentage of the reference value for each pesticide. The 90th percentile is the point where most of the readings are lower, and only the highest 10% are above it. For example in 2014 the 90th percentile concentration for Alachlor ESA was 0.388 micrograms per liter, the reference value for Alachlor ESA is 50 micrograms per liter. The 90th percentile is 0.78% of the reference value. The data is presented this way to illustrate how low the concentrations are and to also allow comparisons to be made between the different pesticides.

The Minnesota Department of Health (MDH) has many roles in protecting groundwater from contamination. The MDH's primary roles include ensuring wells are properly constructed and sealed, monitoring drinking water to ensure the state's public water systems meet federal and state guidelines, monitoring for emerging contaminants, evaluating contaminated sites to ascertain what chemicals are present, and determine whether exposure to those chemicals may pose risks to human health.

Figure 40. Statewide groundwater common detection pesticide detection frequency

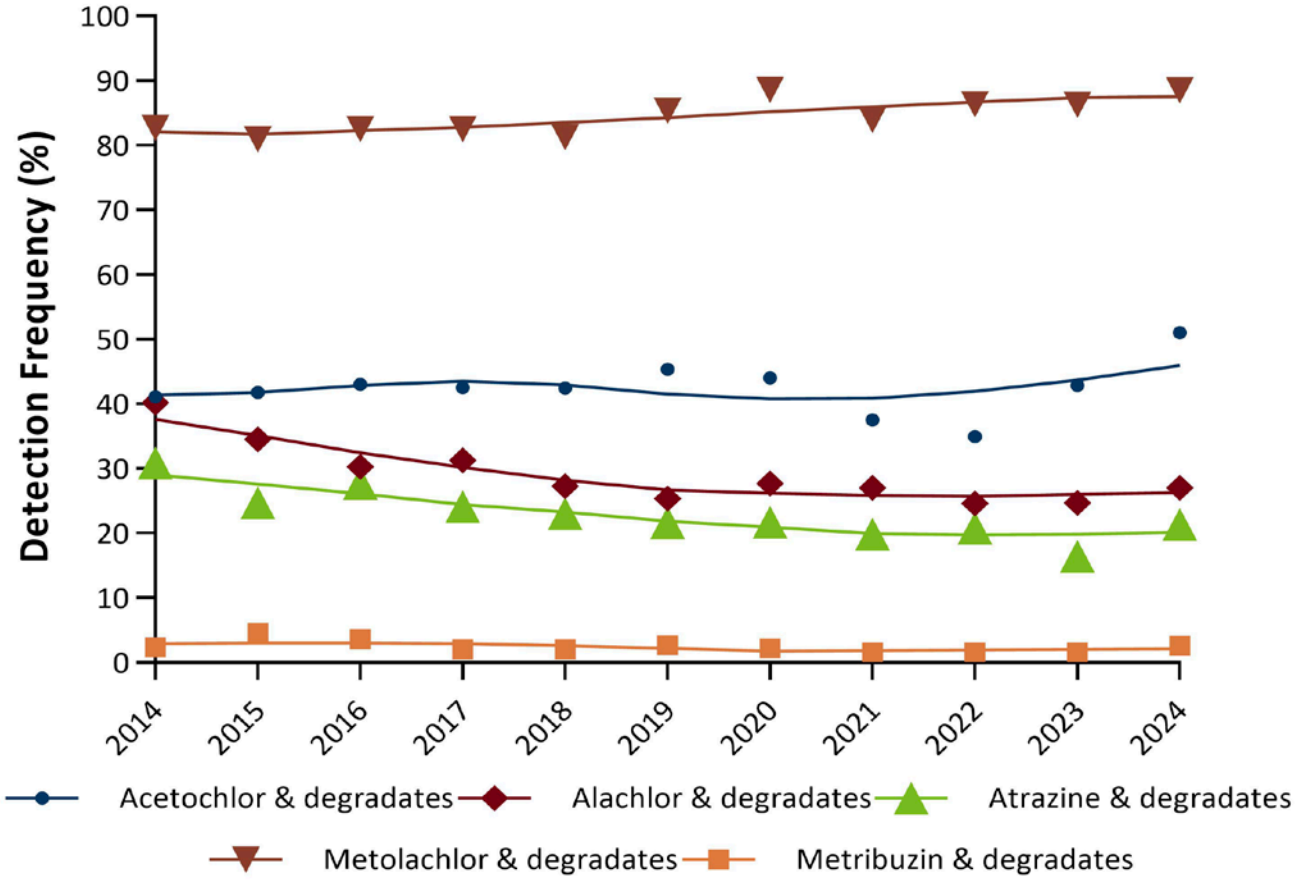


Figure 40. Detection frequency shows how often a pesticide was found in the samples. It is the percentage of all samples in which the pesticide was detected, regardless of whether the amount was high or very low.

What progress has been made?

The MDA began its monitoring program in 1985 and currently samples more than 167 monitoring wells, naturally occurring springs, and private drinking water wells throughout the state. Pesticide concentrations in groundwater rarely exceed drinking water standards in monitoring wells or private drinking water wells. Five pesticides have been detected frequently enough to be placed in the "common detection" category: acetochlor, alachlor, atrazine, metolachlor, and metribuzin. These pesticides are being tracked, and best management practices are promoted to minimize environmental impacts.

The MDA's groundwater monitoring program was not designed to determine nitrate concentration status and trends in drinking water. Nitrate concentrations in the very shallow, highly sensitive groundwater monitoring wells sampled adjacent to agricultural fields in this program frequently exceed health risk levels. However, this is not the situation with every well or all the regions monitored. The MDA's groundwater monitoring program was designed as an early detection system. To more accurately determine nitrate trends across the state, the MDA relies on regional and township monitoring programs.

Private well testing for nitrate

In 2008, the Southeast Minnesota Water Resources Board and the MPCA, MDA and MDH established the Southeast Minnesota Volunteer Nitrate Monitoring Network. This region was selected because of its sensitive and complex geology. This network of 675 private drinking water wells, representing nine counties and several aquifers, was designed to provide nitrate concentration data. Through 2024, 7,663 samples have been analyzed for nitrate, and an average of 9.3% of the wells exceeded the drinking water standard of 10 milligrams per liter (mg/L). The percentage of wells exceeding the drinking water standard for each sampling round ranged between 7.5% and 14.6%. This work continues as an ongoing effort. There is a downward trend in the 50th percentile of this network.

In 2011, homeowners in 14 counties in central Minnesota (an area of the state with sandy soil that is vulnerable to nitrate contamination) participated in a monitoring project, and a subset of these wells has been sampled annually since that time. Through 2024, 5,175 samples have been collected as part of the annual monitoring, and an average of 2.7% of wells have water with a nitrate concentration equal to or greater than the drinking water standard of 10 mg/L. There is a slight downward trend in the 90th percentile of this network.

In 2013, the MDA began sampling private wells on a township scale as part of the Township Testing Program. Through 2020, the MDA has sampled private wells in 344 townships in 50 counties in cooperation with local partners. The goal of the project is to sample wells throughout the state in areas where groundwater is most vulnerable to contamination. Through 2020 about 32,217 wells have been sampled, and 9.1% of the wells have nitrate exceeding the drinking water standard, although this percentage can be much higher in some townships.

Private well pesticide sampling

The Private Well Pesticide Sampling (PWPS) Project is a follow-up program to the Township Testing Program. The primary goal of the PWPS Project is to provide information to homeowners and the public about the presence of pesticides in private drinking water wells. Homeowners who had nitrate detections in their wells as part of the Township Testing Program may have had their wells sampled for nitrate and pesticides as part of the PWPS Project Phase 1 (2014 – 2020), when about 6,350 wells in 50 counties were sampled. Concentrations were generally low and were typically below drinking water standards. However, 3% of the 1,841 wells that were sampled during Phase 1 were found to have a pesticide concentration above the human health reference value for total cyanazine (parent plus degradates). Cyanazine is a corn herbicide that has not been registered for use in Minnesota since 2002, cyanazine degradates were not able to be added to the analytical list until 2019. In the summer of 2021, the MDA began revisiting counties sampled prior to 2019, through targeted sampling based upon previous results, to evaluate private drinking water wells in these areas for atrazine and cyanazine degradates as part of Phase 2. From 2019 through 2024 approximately 5,095 wells were sampled, and 238 wells had a concentration that exceeded the health reference value for total cyanazine.

The MPCA continues to track chloride concentration trends in groundwater. The agency's continued commitment to annual monitoring has increased its ability to determine whether groundwater quality has changed. The number of wells that have enough data to determine trends in the MPCA's monitoring network increased from 35 in 2011 to 171 in 2023. Analysis of data from 2013-2023 continued to show

that chloride contamination is seeping into the aquifers used for drinking water. Chloride concentrations increased in about 20% of the sampled water wells. The majority of the water wells with upward trends were located in the Twin Cities metropolitan area.

In addition to ensuring state and federal standards for drinking water are met, the MDH has led various efforts to characterize emerging contaminants and PFAS in public drinking water, including the past Unregulated Contaminants Monitoring Project and the Statewide PFAS Monitoring Project. The MDH has established the Drinking Water Ambient Monitoring Program (DWAMP), which provides permanent program capacity to sample for contaminants of emerging concern and other chemicals in public and private drinking water on an annual basis. Water quality data collected through DWAMP will be used to characterize aquifer systems and vulnerable drinking water sources as well as identify potential threats to drinking water sources and human health.

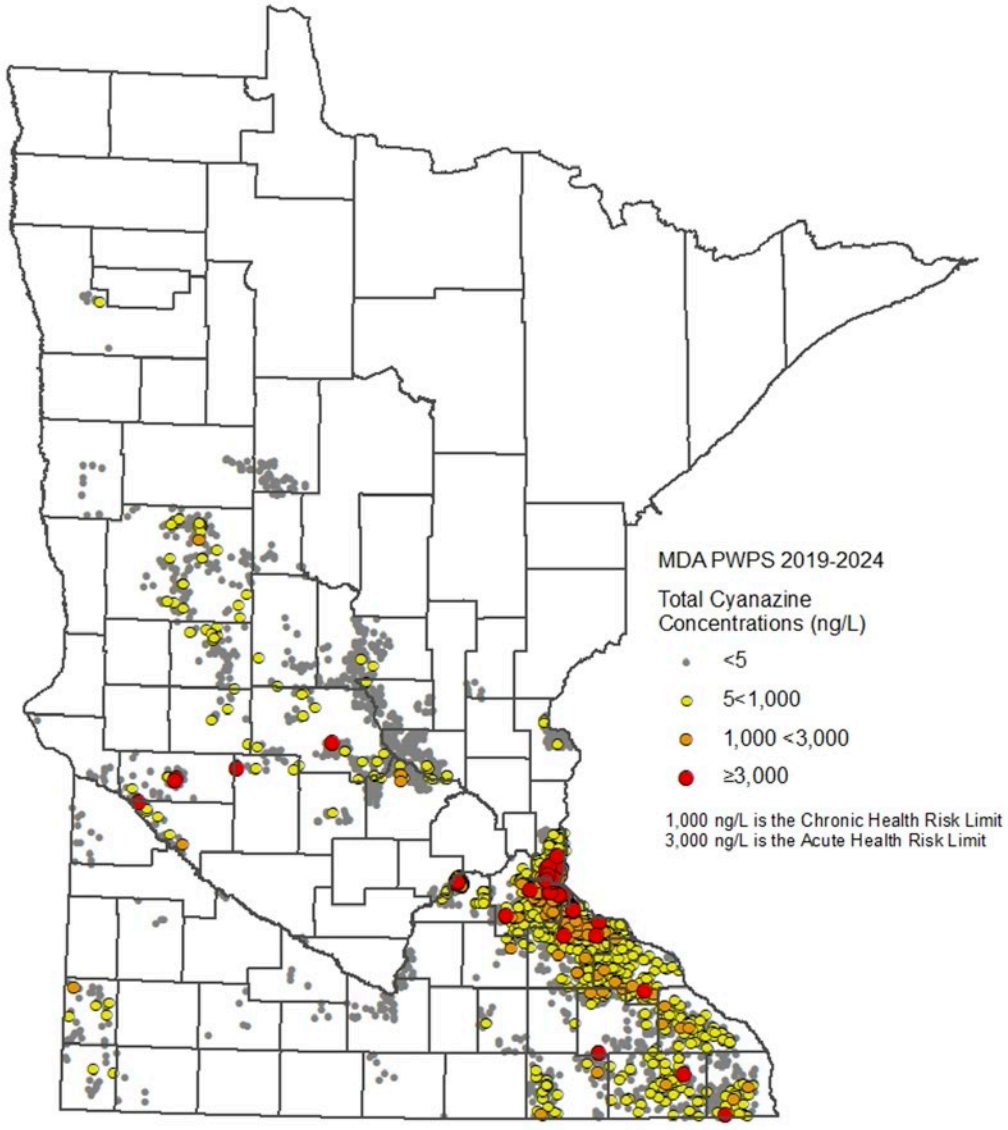


Figure 41. Private Well Pesticide Sampling (PWPS) Project Phase 2 results (2021-2022). Wells that tested positive for cyanazine during Phase 1 of the Private Well Pesticide Sampling (PWPS) project received follow-up testing for cyanazine breakdown products. The total cyanazine concentration reported is the sum of cyanazine and the known degradates. Cyanazine is an herbicide that contains cyanide (atrazine + cyanide).

Learn More

- Clean Water Fund
- The MDA Pesticide Monitoring Programs
- Southeast Minnesota Volunteer Nitrate Monitoring Network
- Central Sands Private Well Network
- Township Testing Program
- The MDA groundwater data through the Water Quality Portal
- Private Well Pesticide Sampling Project
- PFAS Testing of Public Water Systems at MDH

Source water quality for community water systems

Measure: Source water quality used for community water systems

Current risk management approaches for unregulated contaminants are more proactive and collaborative than the project-based approach of the past.

Status

Trend

Why is this measure important?

Minnesotans use both surface water and groundwater as drinking water sources. When source water does not meet the standards of the Safe Drinking Water Act (SDWA), community water systems (CWSs) use treatment processes to make the water safe to drink.

Testing the source water before it goes through a treatment process is one measure of our efforts to protect drinking water. Understanding source water quality and chemistry also improves our understanding of groundwater aquifers, variables that might affect the treatment process, and the pollutants that can contaminate source water.

What are we doing?

Minnesota Department of Health (MDH) has several projects that are supported by Clean Water Fund to supplement routine SDWA monitoring. Under the federal SDWA, EPA establishes drinking water quality standards. These are called Maximum Contaminant Levels (MCLs). MCLs are enforceable limits for water delivered by public water systems. EPA has established MCLs for approximately 100 contaminants.

Thousands of other chemicals are used in our modern, industrial world. Some end up in the environment and in drinking water sources. Contaminants that do not have MCLs are unregulated, and there are no enforceable standards for unregulated contaminants under the SDWA. MDH has several programs and activities to support partners with risk assessment for unregulated contaminants. These include the Contaminants of Emerging Concern (CEC) Framework, which provides guidance on CEC detections in drinking water, as well as the CEC Initiative, which investigates the health risks of CECs in water.

Unregulated Contaminant Monitoring Project

The Unregulated Contaminant Monitoring Project (UCMP) began in 2019 and tested for CECs in drinking water sources across the state. This project helped us understand where unregulated contaminants occur and at what levels. We also learned how treatment affects some CECs detected in source water. The project was funded by the Environment and Natural Resources Trust Fund (ENRTF) and supported by Clean Water Fund.

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

MDH completed UCMP in 2022. The samples were analyzed for over 500 distinct CECs across different contaminant classes. The majority of CECs were not detected. A new paper was published in June of 2025 describing the results and potential health implications (Emerging Contaminants in Source and Finished Drinking Waters Across Minnesota (U.S.) and Potential Health Implications).

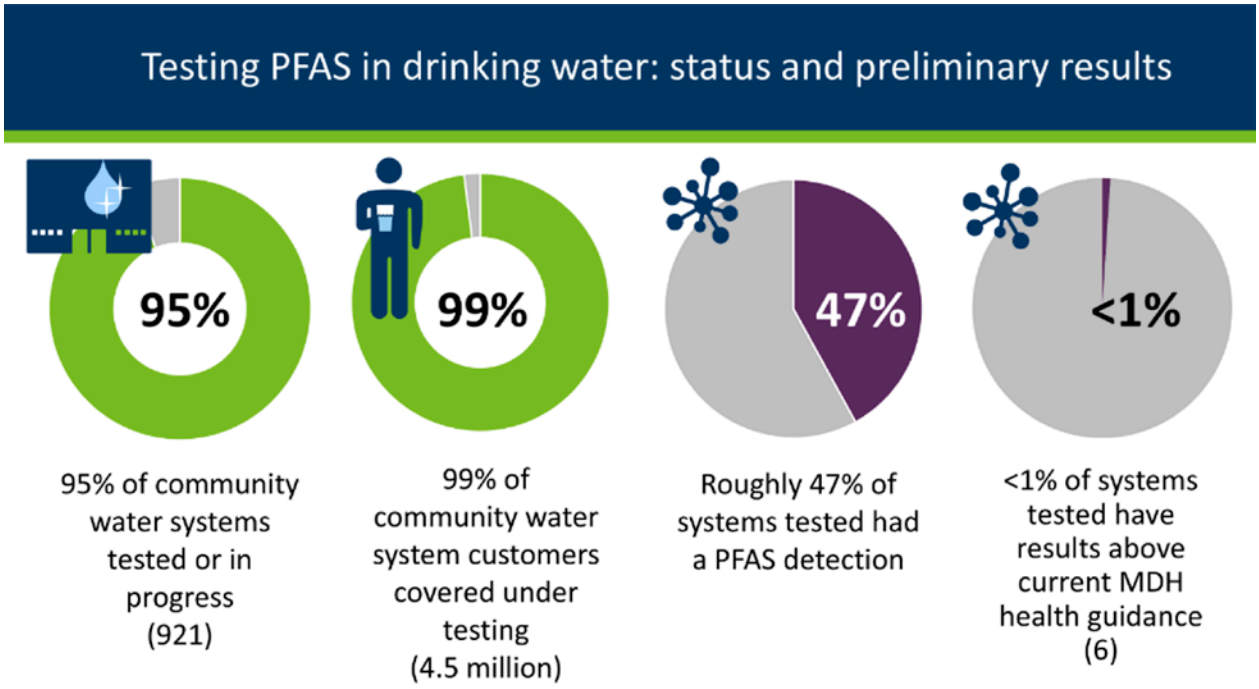


Figure 42: Overview of Statewide PFAS Testing Results

Drinking Water Ambient Monitoring Program

MDH launched a new program in 2024 to advance scientific study of contaminants in drinking water sources. The Drinking Water Ambient Monitoring Program (DWAMP) proactively tests for CECs and other priority contaminants in drinking water sources such as aquifers, lakes, and rivers. The program builds upon MDH's past CEC monitoring and is administered through the Source Water Protection Program. DWAMP also coordinates with other state agency programs on CECs in water resources to best target, prioritize, and maximize its efforts.

The overarching goals of DWAMP are to:

1. Address concerns about public health exposure to CECs.
2. Support data-driven water resource management decisions by characterizing water quality conditions in drinking water sources.

There are four primary sampling objectives that make up the DWAMP program:

1. **CEC framework follow-up monitoring**
   Sampling for CECs at CWSs where they have been detected at low levels in previous monitoring but have not had any follow up action.

2. **CEC horizon scanning**
   Proactive investigative monitoring for emerging contaminants at selected community and non-community water systems.

3. **Surface water monitoring**
   Seasonal sampling and cyanotoxin monitoring at surface water bodies that supply drinking water systems.

4. **Watershed-scale characterization**
   Sampling at a selected group of (primarily) private wells within target watersheds to identify areas and aquifers that are vulnerable to contaminants at the ground surface.

2024 progress

The CEC follow-up objective focused on 1,4-dioxane sampling in 2024. Results showed that 4 of the 89 systems sampled had concentrations exceeding 25% of the Health Risk Limit (HRL) in one of their entry points, representing an increase from prior sampling. No results exceeded 50% of the HRL, the action level that triggers quarterly follow-up monitoring under MDH's CEC Framework. Read more in our report: 1,4-Dioxane Monitoring 2024 (PDF).

For the CEC horizon scanning objective, samples were taken at PWSs to investigate for the presence of an array of PFAS and pesticides. Data analysis is ongoing, and a report will be available on our website when complete.

All water bodies supplying surface water were sampled for general chemistry parameters, and each was sampled once for cyanotoxins. Since these samples were not taken at the treatment plant, analysis focused on describing conditions and seasonal trends of the water sources. Read more in our report, Surface Water Monitoring 2024 (PDF).

The watershed-scale characterization focused on three watersheds in 2024: Yellow Medicine, Root River, and North Fork of the Crow. Private wells (and a few PWSs) were sampled for nitrate, manganese, arsenic, bacteria, PFAS, and general chemistry parameters. Private wells were also sampled for lead at the kitchen tap at the well owners' request. Data analysis is ongoing, and reports will be available on our website when complete.

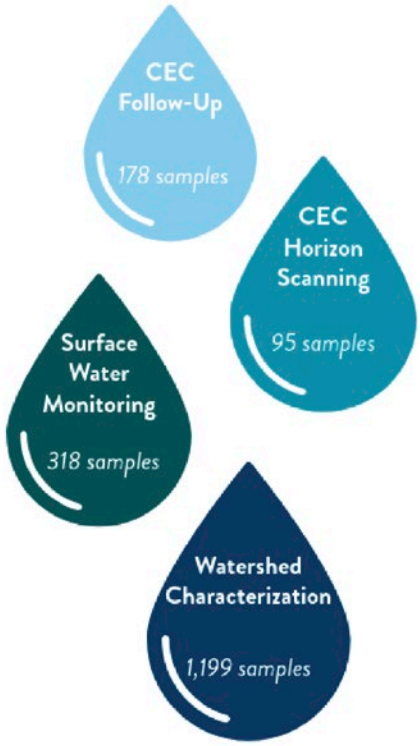


Figure 43. Number of samples analyzed by DWAMP in 2024. One sample includes all chemicals analyzed by one laboratory method from one well. Number of samples analyzed by DWAMP in 2024. One sample includes all chemicals analyzed by one laboratory method from one well.

2025 update

The 2025 sampling season has primarily focused on a more robust cyanotoxin monitoring effort, including bi-weekly or monthly sampling at a subset of surface water systems, and samples of both source and treated drinking water. Additionally, routine cyanazine monitoring — a long-standing effort in collaboration with the Minnesota Department of Agriculture — has been incorporated into DWAMP.

Other planned sampling efforts, including watershed-scale characterization, pesticide sampling, and a microbe investigation, were pushed to the 2026 sampling season due to ongoing laboratory contract negotiations and reduced staffing capacity.

More information

Visit the MDH website for reports and additional information: Drinking Water Ambient Monitoring Program

Nitrate and arsenic concentrations in new wells

Measure: Nitrate and arsenic concentrations in newly constructed wells

Since 1992, there has been a general increase in the percentage of new wells that have nitrate levels above the drinking water standard.

Status  **Trend** 

The percentage of wells with arsenic above the drinking water standard has remained steady over the past 10 years. Evaluation of ways to reduce this percentage is ongoing and may take years before significant progress is made.

Status  **Trend** 

Why is this measure important?

Groundwater is the main source of drinking water for three out of four Minnesotans. About one in five Minnesotans (1.2 million people) get their drinking water from a private well. Both arsenic and nitrate are found in Minnesota groundwater at levels that can cause short-term and long-term health effects.

Consuming water high in nitrate can affect how blood carries oxygen and can cause a condition called methemoglobinemia (also known as blue baby syndrome). This condition can result in serious illness or death. Bottle-fed babies under six months old are at the highest risk of getting methemoglobinemia. Drinking water with arsenic in it over many years can increase the risk of cancer and other serious health effects.

Nitrate is a naturally occurring compound made of nitrogen and oxygen. Natural levels of nitrate in Minnesota groundwater are usually below 3 milligrams per liter milligrams (mg/L). Levels of nitrate greater than 3 mg/L are associated with human-made sources of nitrate. Sources include fertilizers, animal wastes, and human sewage. These sources can contaminate the groundwater. Shallow wells in areas with sandy soils or karst geology are more vulnerable to nitrate. Improper well construction or a damaged well can also allow nitrate to reach otherwise protected groundwater sources.

Arsenic occurs naturally in rocks and soil across Minnesota and can dissolve into groundwater. The way glaciers moved across Minnesota affects where arsenic is found in sediment and groundwater. Because of the complex nature of arsenic occurrence, it is very difficult, and in some cases impossible, to avoid arsenic when constructing a new well.

Radium is a naturally occurring radionuclide in rocks and soil that can get into groundwater. Radium is found in public water supply wells, commonly in the Mount Simon and Jordan aquifers. The drinking water standard for Radium is 5 pCi/L. Radium in well water puts private well users in contact with low doses of radiation that can lead to a higher cancer risk over many years.

What are we doing?

Nitrate

Current laws require that wells are located and constructed in a way that provides a sanitary source of drinking water and protects groundwater quality. In addition, Minnesota Department of Health (MDH), Minnesota Department of Agriculture (MDA), and other partner agencies help well owners and farmers properly manage nitrate sources (such as fertilizers and septic systems) to help reduce input of nitrate into groundwater. Each time a new well is drilled, nitrate levels (along with arsenic and coliform bacteria) are measured to verify that the water is safe to use. If nitrate levels are higher than the drinking water standard of 10 mg/L, MDH informs the well owner of options to reduce their risk. MDA and local governments occasionally offer clinics for residents to have their well water tested for nitrate.

With Clean Water Funds, the MDA Township Testing Program tests for nitrate in townships that have vulnerable geology and a large percentage of row crop agriculture. The results of this testing will guide efforts to reduce nitrate in groundwater through the Nitrogen Fertilizer Management Plan. Other activities funded by the Clean Water Fund, including the Agriculture Water Quality Certification Program, nutrient management assistance and funding for cover crops, and other best management practices reduce input of nitrate to groundwater.

Arsenic

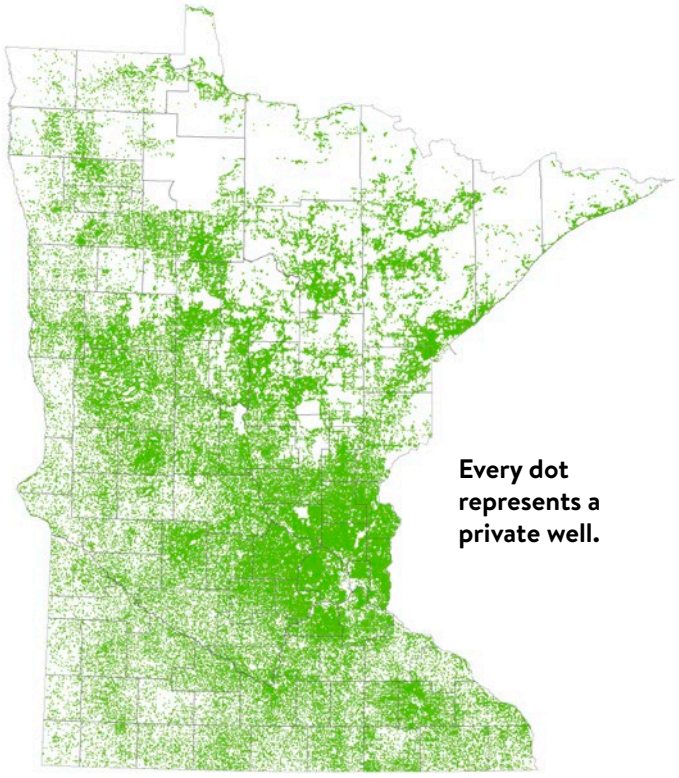
If arsenic is detected in the initial water sample after a well is constructed, MDH informs the well owner of options to reduce their risk. Clean Water Funds made it possible for MDH to collaborate with the U.S. Geological Survey (USGS) to better understand the occurrence and distribution of arsenic in groundwater. The project helps identify the best approach for collecting the initial well water sample to get an accurate measure of long-term arsenic concentrations. Understanding how the arsenic concentration changes over time helps homeowners plan water treatment options.

Radium

MDH has completed a final report on the occurrence of Radium in Minnesota wells and is developing guidance on how to protect homeowner health from radiation exposure.

Figure 44

County Well Index, located private wells



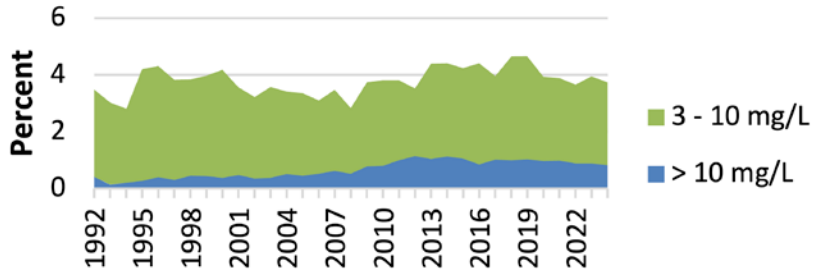
Education and outreach

MDH is also using Clean Water Funds to improve education and outreach to private well owners. The goal is to increase private well testing and help private well owners take action to reduce their exposure to unsafe levels of contaminants, such as arsenic and nitrate.

What progress has been made?

Nitrate

Figure 45. Nitrate in new drinking water supply wells



The goal is that all new wells have nitrate levels below 3 mg/L. About 3% of new wells in Minnesota have nitrate levels above level of 3 mg/L and below the drinking water standard of 10 mg/L. About 1% of new wells have a nitrate level above the drinking water standard. However, the MDA Township Testing Program, which tests wells that are vulnerable to groundwater contamination, found a much higher percentage of wells in the central and southeastern regions of the state that have elevated levels of nitrate. The townships tested had a high percentage of land in row crop agriculture and the geology in these regions make it easier for nitrate to travel into groundwater.

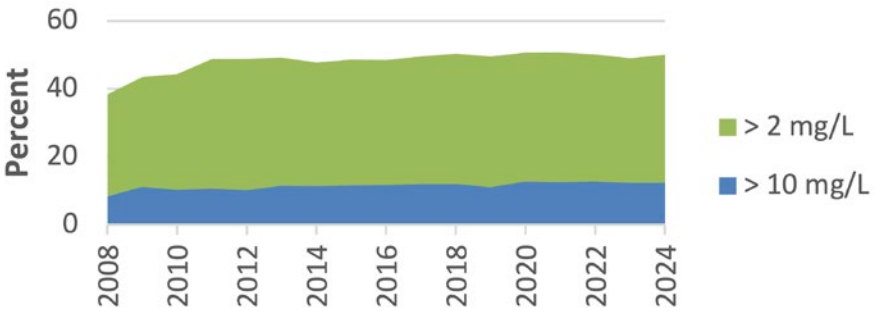
The low statewide percentages of new wells with nitrate show that the well code is effective in reducing nitrate contamination risks for most wells. However, it is important that the owners of wells with elevated nitrate take actions to reduce their risk. Because concentrations of nitrate can change over time, well owners should periodically test their water, even if their water had a low level of nitrate initially. There are also many older wells that may have never been tested.

As shown below, there has been a general upward trend in the percentage of new wells with nitrate levels higher than the drinking water standard over the past 18 years.

It is not clear if there is a relationship between this trend and actual nitrate levels in groundwater since new well construction is not uniformly distributed across the state and the number of new wells is not consistent from year to year. This measure cannot tell us the specific causes of nitrate contamination. However, through Clean Water Fund activities that address and manage nitrate sources, nitrate concentrations in groundwater across the state should eventually decline. This measure should reflect that decline.

Arsenic

Figure 46. Arsenic in new drinking water supply wells



The goal for this measure is to reduce the percentage of new wells exceeding the drinking water standard for arsenic by 50%. Fifty one percentage of new wells in Minnesota drilled since 2008 have arsenic. About 11% of new wells have arsenic levels above 10 micrograms per liter (µg/L) — the drinking water standard for community water systems.

In 2014, MDH and USGS started collaborating to better understand the occurrence and distribution of arsenic in groundwater. No activities to date have had a direct influence on reducing the percentage of new wells with arsenic. As we learn more about arsenic in groundwater, MDH will develop guidance for well contractors to reduce the likelihood that arsenic is in a new well.

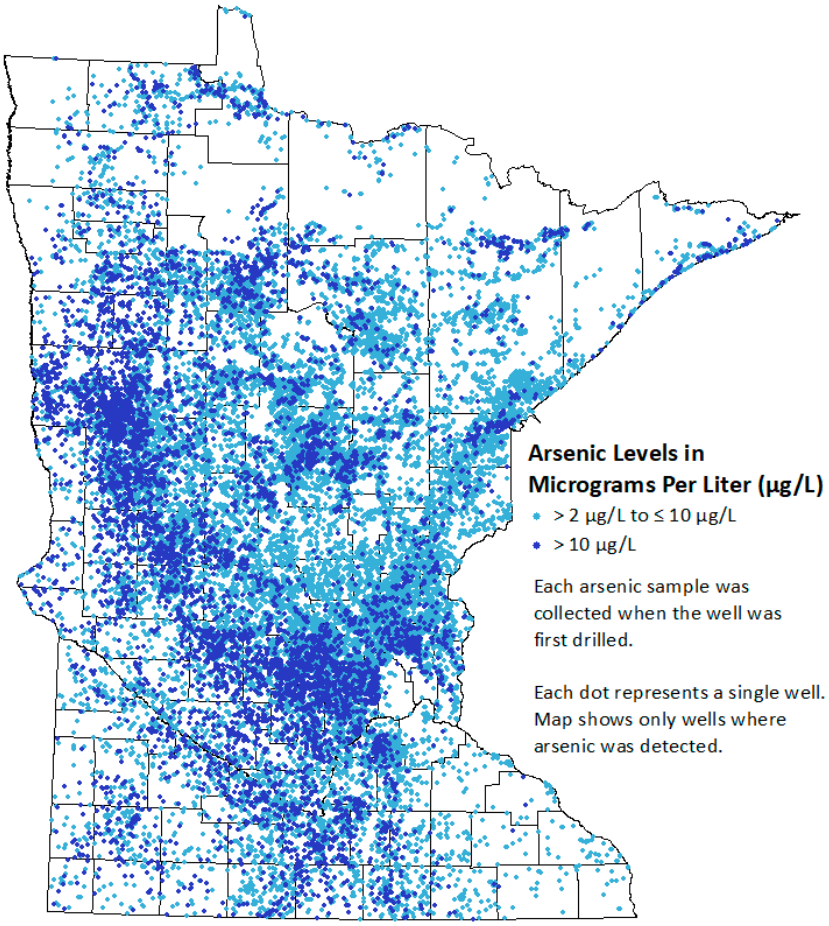
Radium

In 2018-2021, MDH sampled 97 wells for gross alpha, an indicator of naturally-occurring radiation, at five sites across southeastern and central Minnesota. Wells that had some level of gross alpha were resampled for combined radium 226/228. Of the 48 resampled wells, 25% had elevated combined radium 226/228 above the drinking water standard of 5 pCi/L.

Learn more

- Find more information about this measure and its data
- Nitrate in Drinking Water (MDH)
- Arsenic in Drinking Water (MDH)

Figure 47. Total arsenic concentrations in new private residential wells (2008-2022)



Groundwater levels

Measure: Changes in groundwater levels over time.

Statewide 95% of the observation wells show either no significant change or upward trends (up 32% from 2014). Portions of the state lack important groundwater information while locally, particularly in the northwest, experienced groundwater declines.

Status **Trend**

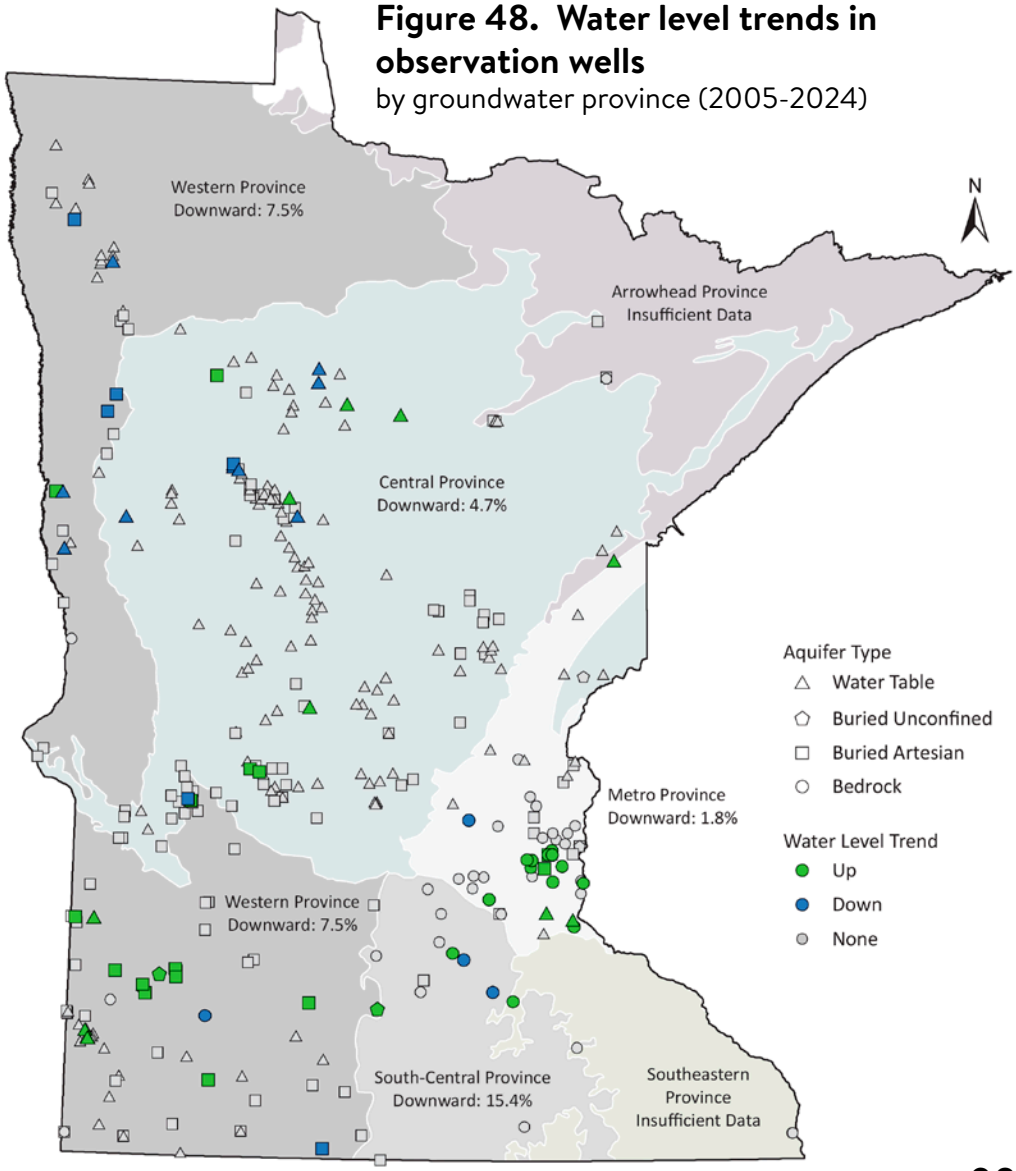
Why is this measure important?

Approximately three out of every four Minnesotans rely on groundwater for their drinking water. Minnesota's numerous aquifers also support agriculture, industry, and the natural resources (streams, wetlands, and lakes) that define Minnesota's quality of life. While the state's reliance on groundwater increases, many areas of the state lack basic information about the availability of groundwater.

This information supports the evaluation of water supply planning efforts to protect natural resources, prevent well interference, and sustain drinking water sources for future generations.

Environmental conditions and human activities both play significant roles in shaping groundwater levels. Shifts in precipitation patterns driven by climate change, along with continued agricultural tiling and urban development, alter how water infiltrates the ground and how quickly it runs off the landscape. Groundwater pumping can further influence the direction and movement of subsurface flow. As groundwater levels rise or fall, the streams, fens, wetlands, springs, and lakes connected to these aquifers respond accordingly. Wells are affected as well, declining groundwater levels can lead to well interference, creating

Figure 48. Water level trends in observation wells
by groundwater province (2005-2024)



local water supply shortages and imposing financial burdens on both private and public well owners.

Every day, decisions are made about water supply development, water appropriation, watershed management, and land use. Effective management depends in part on understanding how weather patterns and human-driven pressures influence groundwater levels over both seasonal cycles and long-term trends.

Period of analysis	Statewide	Metro	Central	Western	South-central
1993- 2012	63% (295)	44% (43)	66% (185)	76% (58)	Insufficient data
1997- 2016	81% (341)	73% (52)	86% (203)	74% (72)	Insufficient data
2000- 2019	94% (310)	100% (45)	97% (181)	83% (68)	Insufficient data
2003- 2022	93% (404)	96% (51)	96% (191)	88% (127)	88% (29)
2005-2024	95% (374)	98% (57)	95% (192)	93% (106)	85% (13)

Table 49. Percentage of wells showing upward or no-clear water-level trends for each analysis period and province. Values are reported as percent of wells exhibiting the trend, followed by the number of wells analyzed. Arrowhead and southeast provinces are not shown due to insufficient data.

What are we doing?

To monitor this "hidden" resource the Minnesota Department of Natural Resources (DNR) manages a statewide network of groundwater-level observation wells. Traditionally water levels were measured monthly by Soil and Water Conservation Districts and other volunteers, however this network is being converted to continuous monitoring using automated sensors that measure levels every hour and then store the data until retrieved by staff. In the past, it was common for our monthly readings to miss the annual high and low water levels in a well. The use of automated sensors, monitoring every hour, means that we now have a significantly better chance of capturing both the timing and full magnitude of annual water level changes. Data from these wells are used to determine long-term trends, quantify recharge, interpret impacts of pumping and climate, plan for water conservation, and manage the water resource. The water level data are available online and are used by hydrologists and water managers to evaluate water supply questions at local and regional scales (see link below).

Data are insufficient to assess Minnesota's groundwater conditions in all portions of the state, however the number of monitoring wells is being expanded to enhance our ability to detect trends. Since 2024, through a combination of Clean Water Funds and other state and federal sources, an additional 23 wells have been added to the network bringing the total wells in the DNR water level monitoring network to 1,257. This total represents a mixture of expanded geographic coverage, the installation of wells into aquifers previously not monitored, and the sealing and/or replacement of old and/or redundant wells that were not providing reliable data.

What progress has been made?

To evaluate groundwater level trends, the DNR compiled water level data from observation wells with sufficient measurements in at least 15 out of a previous 20-year period. An analysis is then completed that uses the annual minimum water level, i.e., the lowest water level recorded for the year in an observation well, for determining trends. This analysis technique categorizes the data into three types of trends: data exhibiting an upward trend, data exhibiting a downward trend, or data with no-clear trend. The latest analysis, covering the period from 2005-2024, includes 336 DNR monitored wells. The latest analysis incorporates water level data from an additional 38 wells that are monitored by permittees, bringing the total wells included in the analysis to 374 statewide. The wells monitored by permittees are installed in close proximity to their active production wells. While DNR observation wells are designed to monitor "background" water levels, the data collected by permittees allow DNR hydrologists to compare both the local and regional aquifer response to high volume pumping. Incorporating these permittee wells into the analysis broadened the statewide geographic coverage and allows site specific monitoring of aquifers pumped by high-capacity users. Statewide, the 2005-2024 trend analysis showed water elevations in approximately 95% of the 374 observation wells exhibited upward or no-clear trend while only 5% showed a downward trend (Figure 48). Figure 48 includes trend values calculated for each groundwater province. The majority of wells in the metro province (98%), the Central Province (95%) and the Western Province (93%) have water levels that mimic the Statewide trend. Water elevations in the south-central wells trend slightly less exhibiting an 85% upward or no-trend pattern. The Arrowhead and southeast provinces are not displayed due to insufficient data.

Trends

This analysis has now been completed five times and cover the following periods: 1993-2012, 1997-2016, 2000-2019, 2003-2022 and 2005-2024. A comparison of the five analyses offers a view of how overall groundwater trends have changed over the past few decades. The original analysis, completed for the period from 1993-2012, indicated that statewide, water levels in 63% of the 295 wells selected for analysis showed rising or no clear trend, while 37% indicated a downward trend. Analysis of water levels from 1997-2016 showed water levels in 81% of the 341 sampled observation wells showing no clear or an upward trend, while 19% exhibited a downward trend. The 2000-2019 analysis showed a continuing improvement with 94% of the 310 wells showing rising or no trends and only 6% of the wells with a downward trend. The analysis completed 2 years ago (2003-2022) showed 93% of the 404 sampled wells continued to trend upward or show no clear trend. The current analysis, covering 2005-2024, highlighted a slight increase in the number of wells with water levels exhibiting a rising or statistical no-trend. Table 49 summarizes both the Statewide and regional, by groundwater province, trends over the five periods of analysis.

Most of the water elevation data included in each 20-year analysis exhibit no-clear trend. It is possible to compare how the trend analysis of individual wells has changed over time. In the latest analysis, a total of 21 wells exhibit downward trends. Eighteen of the 21 wells have exhibited downward trends in one or more of the earlier analysis. Seven of the 21 wells have exhibited downward trends four or five times. DNR hydrologists have identified probable causes for the downward trends in several wells located in the northwest part of the state and are working with local partners to address the trend. DNR staff will be investigating the source of the water level declines in those wells with multiple years of downward trends.

Groundwater-level information is becoming better integrated into water supply planning, which supports work to reduce the environmental, economic, and public-health risks created by unsustainable aquifer decline. In the Twin Cities metropolitan area, regional planning policies are being revised to address declining aquifer levels.

Groundwater Management Areas

Statewide, the DNR has established Groundwater Management Areas (GWMAs) where additional planning and monitoring is needed to ensure that growing water demands do not cause unsustainable seasonal or long-term groundwater declines. Clear standards for sustainability of aquifers and the surface water features they support are being established and implemented in the near future. The GWMA program has established partnerships between DNR, Pollution Control Agency, Department of Health, Department of Agriculture, Board of Water and Soil Resources, Metropolitan Council, and many local stakeholders.

Learn more:

- Department of Natural Resources: Cooperative Groundwater Monitoring (CGM)
- Department of Natural Resources: Groundwater Management Areas

Water efficiency

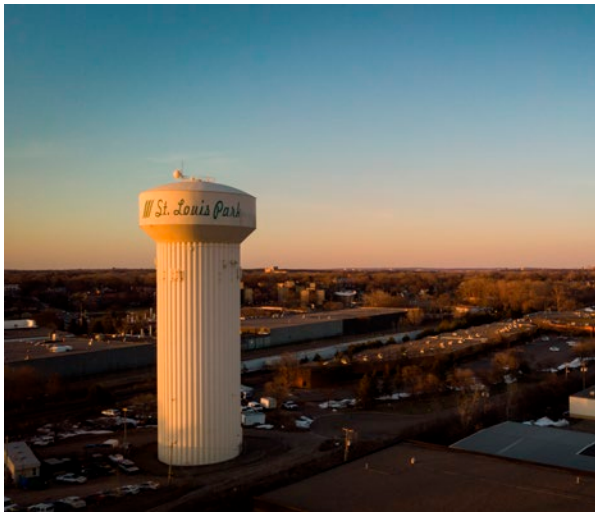
Measure: Total gallons per person per day

Water efficiency measured as water use per person continues to increase but it is unclear whether the patterns of water use are due to annual weather changes versus changes in management.

Status

Trend

Why is this measure important?



This measure describes how much permitted water (groundwater and surface water) is used in Minnesota – as an annual statewide total and per person. As Minnesotans, we get much more from our water than drinking and washing. Water also helps to provide power, irrigate crops, run industrial processes, service health care facilities, and support our state's rich natural environment. And every drop of water that people move from one place to another for a variety of uses comes with a cost — such as the energy to move it, the infrastructure to treat it, and the impact to the source from which it was taken. Being good stewards means getting the most value out of the water we use, taking care not to waste it, and putting it back into the environment sustainably.

What are we doing?

The Minnesota Department of Natural Resources (DNR) is responsible for managing water withdrawal (appropriation) permits in Minnesota. Current laws require those who use large amounts of water to take practical actions to use water efficiently. Various water efficiency targets have been established since the Clean Water, Land and Legacy Amendment was passed. The following metrics and results are from the DNR Water Conservation Reporting System for public water suppliers statewide. To ensure meaningful trend analysis, the DNR uses a "Gold Club" of 86 utilities (out of 342 utilities serving over 1,000 people) that have reported reasonable data through the Water Conservation Reporting System each year:

- In 2024 Gold Club utilities reporting the information required to calculate water losses had an average water loss of 8.62% compared to 9.29% in 2022.
- In 2024, 77% of the Gold Club utilities reporting the information required to calculate residential water use per gallon per capita per day (RGPCD) reported an RGPCD of less than 75, which is the state's goal. For Gold Club utilities, 87% met the goal in 2022.
- In 2024, the Gold Club utilities reported an average per capita demand reduction of 7.19% compared to 5.59% in 2022
- In 2024, 83.7% of the Gold Club utilities reported a maximum daily use less than 2.6 times that of average daily use, compared to 80.2% of them in 2022.

In the Twin Cities metropolitan area, the Metropolitan Council (Met Council) has identified a regional target for total per person water use of 90 gallons/day, on average, for community water systems. The

DNR, the Minnesota Department of Agriculture (MDA), the University of Minnesota (U of M), and the Met Council are using the Clean Water Fund to accelerate the implementation of water efficiency measures and progress toward these goals. Examples:

- U of M Technical Assistance Program Water Conservation Program
- U of M Extension Turfgrass Science Program
- Freshwater Society Water Stewards Program (with resources for water conservation)
- Met Council Water Efficiency Grant Program

What progress has been made?

Between 2010 and 2022, while population increased, total water use has decreased by approximately 22%. This is likely due to a combination of factors including more efficient appliances and technology for commercial processes as well as suppliers' focus on leak detection and maintenance. Power generation drives a significant portion of this water use. Power generation is not a consumptive water use. This person per day water use is significantly higher than most municipal water suppliers' metrics because it includes all water for all purposes across the state distributed across the total state population.

Table 50. Minnesota water use 2012-2024

Year	Total MN water use (gallons per day)	Total MN population	Gallons per person per day
2012	3,682,228,800	5,368,972	685
2014	3,474,456,459	5,453,218	637
2016	3,372,221,158	5,528,630	609
2018	3,178,799,171	5,629,416	564
2019	2,904,713,342	5,680,337	511
2020	2,776,064,658	5,706,494	487
2022	2,902,092,877	5,801,769	500
2024	2,573,675,657	5,842,388	440

Learn more:

- Clean Water Fund
- Minnesota water use data
- Great Lakes Compact
- Irrigation outreach and on-farm nitrogen management in central Minnesota
- Freshwater Society Water Stewards Program
- U of M Technical Assistance Program Water Conservation
- Met Council Water Efficiency Grant Program

Social measures and external drivers

Social measure

Measure: Building local capacity to support and engage in water restoration and protection.

What are social measures?

Social measures track how Clean Water Fund investments affect people and communities, specifically their ability to support and engage in local projects. Tracking social measures provides valuable information about how well education, outreach, and civic engagement strategies are working.

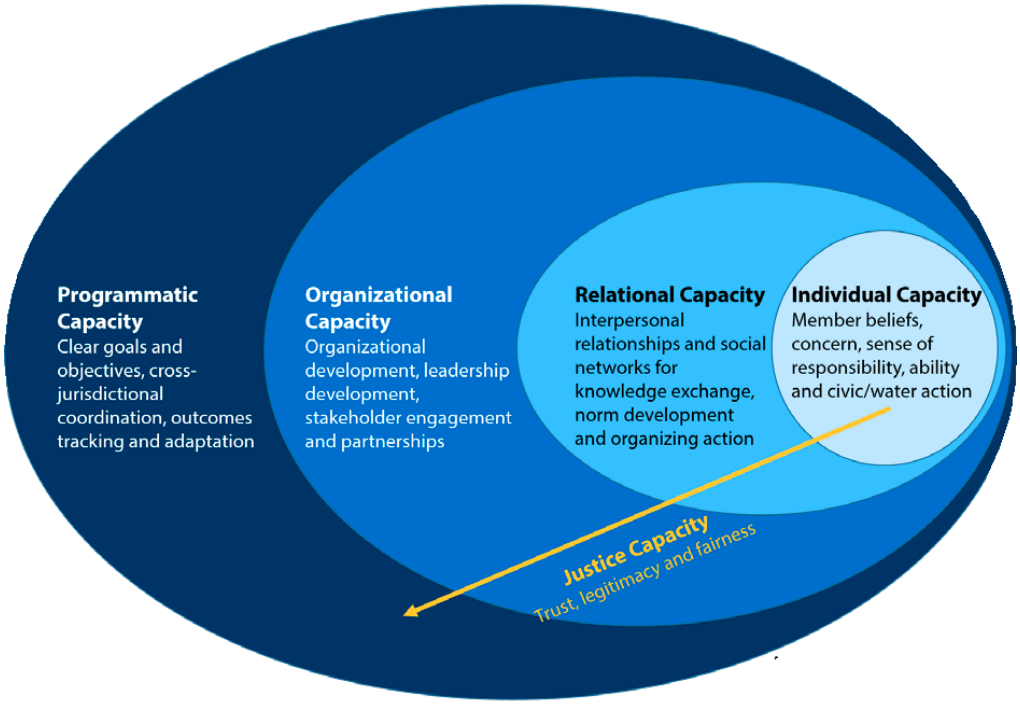
Social measures are a way of integrating social science into Clean Water activities. They can help answer questions about what motivates people and communities to take positive actions as well as the barriers and constraints that prevent or limit action. Understanding and measuring these factors helps state agencies and their partners be more strategic when engaging and partnering with the public to address water quality and quantity and evaluating the success of those efforts. Previous reports provide a description of the Social Measures Monitoring System (SMMS) and how state agencies have worked together to pilot the application of this framework to Clean Water Fund projects. Beginning in 2020, we have highlighted We Are Water MN.

Below is a graphic that illustrates the four main components of social measures — individual, relational, organizational, and programmatic capacity.

We Are Water MN is the Clean Water Fund's only ongoing program focused exclusively on building community capacity. Communities also protect water resources and plan for the future through local water management plans and the One Watershed, One Plan process. The Clean Water Council aims to increase the number of Minnesotans who understand their role in sustaining healthy lakes, rivers, and wetlands — and who act on that understanding. Early engagement allows communities to shape policy decisions and implementation plans, and fosters greater ownership of the actions needed to meet water quality goals.

Figure 55

Community Capacity Model



We Are Water MN

Why is this measure important?

We Are Water MN is dedicated to building community capacity. It builds individual, relational, and organizational capacity for participation in clean water through education and network building at the local level.

The program is built upon the theory that building community capacity to protect water requires building relationships between community members, organizations, and sectors. We Are Water MN achieves these goals through three key activities:

1. **Building a network of partnerships**

2. **Hosting a traveling exhibit**

3. **Designing public events**

The program is a partnership of the Minnesota Humanities Center, Minnesota Pollution Control Agency, Minnesota Historical Society, University of Minnesota Extension, Board of Water and Soil Resources, and the Minnesota Departments of Agriculture, Health, and Natural Resources. It is hosted by local organizations that participate in 6-12 months of support and planning before the traveling exhibit arrives in their location.

We Are Water MN began in 2016 and uses the Minnesota Humanities Center's equity-based approach to community engagement, the Absent Narratives Approach™, that increases partnerships with communities and fosters equitable practices within systems. Practicing the Absent Narratives Approach™ as a framework for building relationships leads to the outcomes for water protection and restoration described in the Social Measures Monitoring System (SMMS), such as:

Positive interpersonal relationships within communities that promote information exchange, build trust, foster shared identity, and promote common awareness, concern, and sense of responsibility for water.

Networks that can promote positive social norms and share a vision for and participate in water stewardship.

An increased and broadened community awareness of local water issues because visitors to the exhibit and public programming come from more diverse backgrounds than one host organization could convene on its own.

What are we doing?

In 2023-2024, the state partners worked with ten local organizations, located in diverse regions of the state:

- Sherburne Soil and Water Conservation District, Becker
- Leech Lake Tribal College, Cass Lake
- Hartley Nature Center, Duluth
- Stearns County Soil and Water Conservation District, Holdingford
- Somali Museum of Minnesota, Minneapolis
- Chisago County Water Resources, North Branch
- Happy Dancing Turtle, Pine River
- Roseau County Historical Society, Roseau
- Shakopee Mdewakanton Sioux Community, Shakopee
- ArtReach St. Croix, Stillwater

What progress is being made?

There has been consistent delivery and statewide reach with this capacity building and water education program. Yearly evaluations and ongoing assessments are an important part of the We Are Water MN program. At the end of 2023, an in-depth retrospective evaluation was conducted to understand the long-term effects of the program on partner organizations and the communities they serve. Organizations that hosted the exhibit in 2016-2023 were invited to complete a survey and interview.

Results of the evaluation indicate that the We Are Water MN program has ripple effects that continue to impact host sites for many years after they've hosted the exhibit and shows evidence of organizational capacity built as described in the SMMS. New partnerships continued, lessons learned helped communities work through difficult conversations, and organizational focus broadened to include accountability for water resource problems and solutions.

Host communities – Building organizational capacity

Participating in We Are Water MN led to enduring organizational capacities in collaborative decision-making, meaningful community engagement, membership diversity, and access to water information, learning, and knowledge.

One of the state's oldest historical societies, Becker County Museum, hosted the exhibit in 2017. They have since expanded the museum to include a children's science floor with a STEM focus and plan to add a natural sciences area.

> *"Natural resources and our water quality has inadvertently become a little bit of an underlying mission, and that certainly started with [We Are Water MN] and listening to people talk about the importance of and their memories of water and what role it's playing in their life."*
>
> **— Becky Mitchell, Becker County Museum**

Host communities – Building relational capacity

While in the program, the host organizations focus on developing their own local networks. The program encourages them to connect with organizations outside their existing partnerships and with individuals or organizations representing traditionally absent narratives. A robust network of over 400 partnerships were engaged in 2023-2024, 74% of which were new partnerships.

Together, these local networks design a minimum of four public events that build people's relationship with and responsibilities to water. In 2023-2024, there were 125 events, an average of nearly 13 events per host site.

The relationships formed through We Are Water MN provide a foundation for future work.

> *"Not only did we have the opportunity to connect with new partners, partners we connected through this partnership have partnered with one another. This was a really cool opportunity for those involved."*
>
> **— Brittany Lenzmeier, Stearns County Soil and Water Conservation District**

Visitors – Building individual capacity

More than 43,000 visitors attended the exhibit in 2023-2024. In addition, nearly 5,000 attended one of the 125 host site events. Visitors to the exhibit are asked to complete a survey describing how their awareness of water issues changed after viewing the exhibit and their willingness to adopt pro-environmental behaviors. For both questions, visitors could select all responses that applied to them.

Overall, the traveling exhibit provides a way to engage visitors and increase knowledge and awareness about local water resources. Survey results indicate that most respondents learned something new and reported they are going to take action for water resources.

Table 56. We are Water MN 2023-2024 visitor survey results (224 completed surveys)

Awareness of water issues	Percent who agree
I learned something new about our water resources	89%
I increased awareness regarding threats to our water resources	86%
I was exposed to a perspective different from my own regarding water resources	77%

Willingness to adopt pro-environmental behaviors	Percent who agree
I will change how I personally use water	72%
I will share what I learned with others	84%
I will get involved with local organizations working to protect water resources	42%

We Are Water MN 2016-2025

Between 2016-2025, We Area Water MN was hosted by 40 organizations in 37 different communities, involved 1,263 community organizations, reached 124,031 visitors, and strengthened 8 state agencies' relationships with each other and their ability to do meaningful community engagement.

Figure 57

We Are Water MN host locations

Local stories come to life in audio, on inspiration panels, and through quotes across the exhibit. Exhibit visitors listening to audio stories in Chisago County.

Land use and demographics

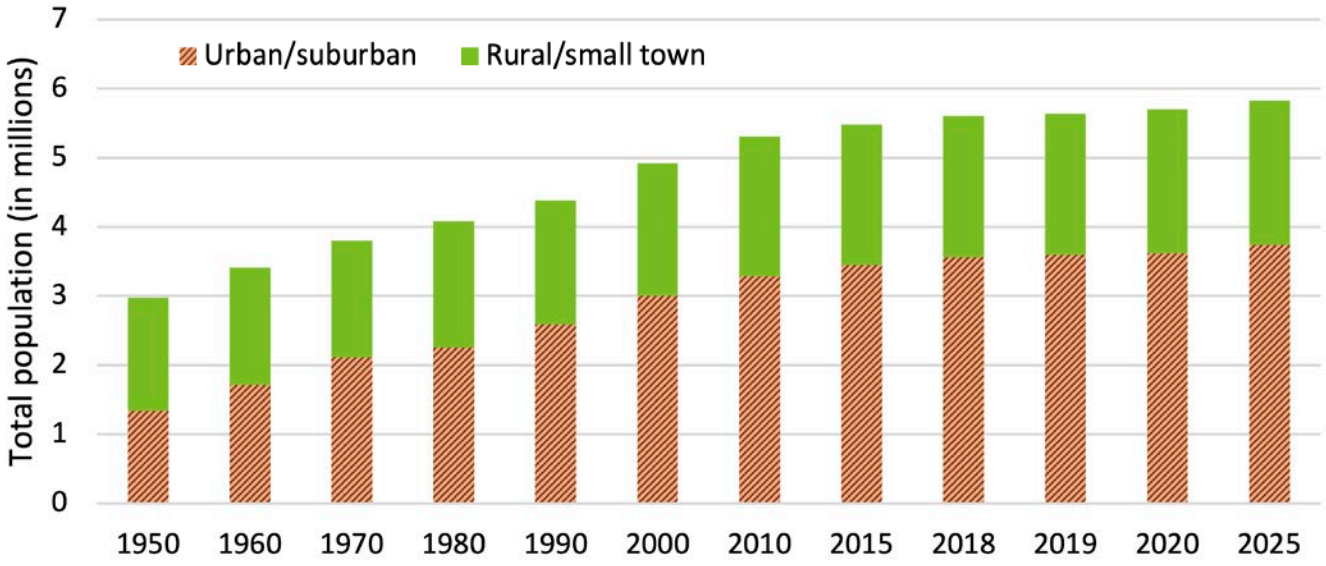
Land use: There have been major shifts in land cover in Minnesota over the last 70 years. To maintain the state's goal of no-net-loss of wetland quantity, it is essential to continue wetland restorations and maintain low wetland losses.

Population: Minnesota's population has increased steadily since 1950, with most of that growth attributed to urban or suburban counties. As Minnesota's population continues to increase, so too will the demands placed on the state's water resources.

Status  **Trend** 

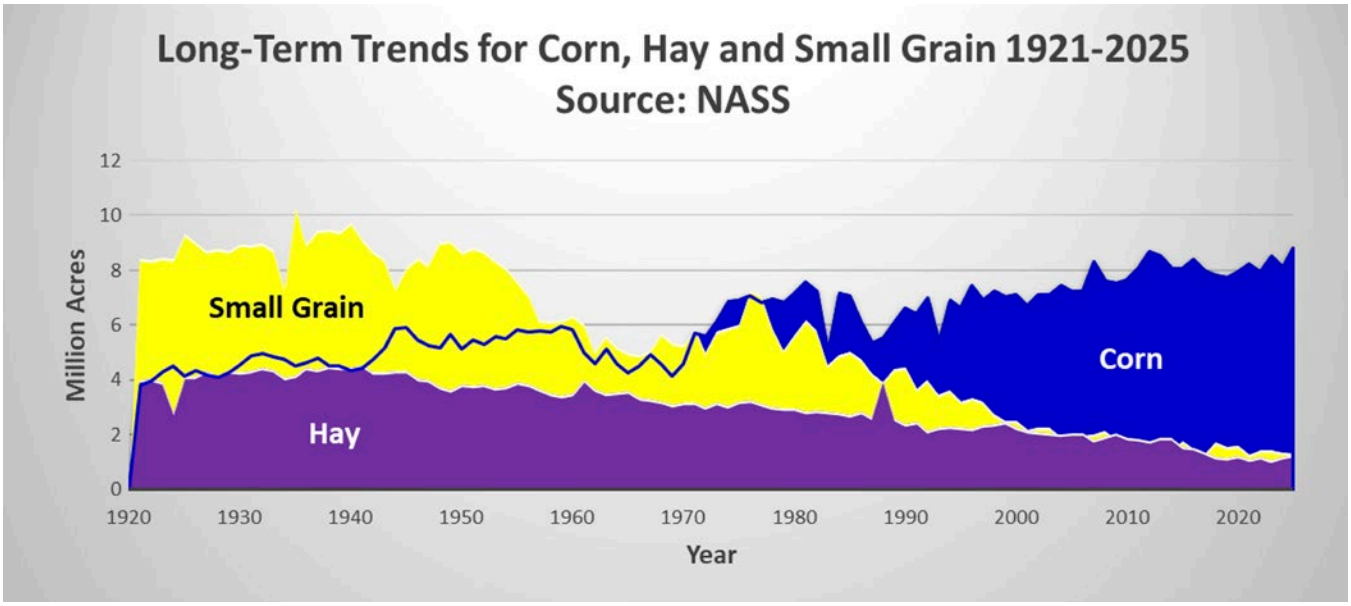
Demographic changes

The size and makeup of Minnesota's population can stress water resource quality in terms of demand for water and how those uses impact the quality and quantity of water that is returned to the environment. As shown in the figure below, Minnesota's population has increased steadily since 1950, with most of that growth attributed to urban or suburban counties. This shift reflects more impervious surface that has the potential to impact surface water quality and quantity, increased water demand and associated impacts to groundwater and surface water supplies and an expanded volume of treated wastewater being discharged back into the environment. As Minnesota's population continues to increase, so too will the demands placed on the state's water resources. These changes may require modifications to current water quality actions and strategies.



Agricultural land use

Though the total area of agricultural land use in Minnesota has remained relatively constant over time, the crops grown (land cover) have undergone a significant transformation. There have been major shifts in land cover in Minnesota over the last 70 years (Figure). Acres planted in small grains and hay have declined by several million acres, while corn and soybean acreage has expanded by a similar amount. These cropping changes have altered the time of year and extent to which the land is covered by a growing crop. This affects soil erosion, fertilizer use, nutrient uptake, and soil moisture, and may increase nutrient and sediment discharge to surface waters and leaching into groundwater.



Change in wetland coverage

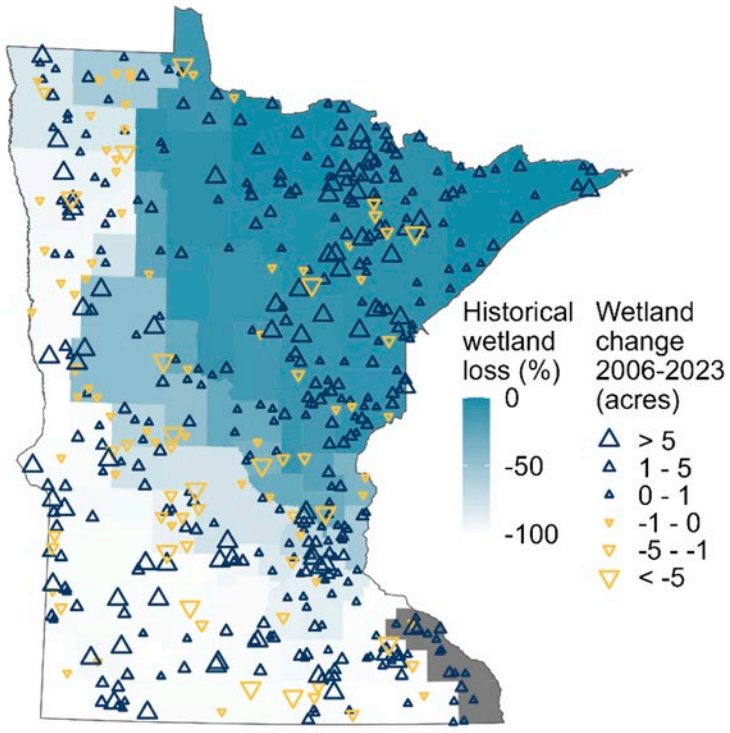
Wetlands are critical to Minnesota's water quality because they provide water storage, hold back runoff and reduce the intensity of flood peaks, reduce the concentration of various pollutants in runoff water, and contribute to groundwater recharge. The abundance of wetlands has changed significantly in many parts of Minnesota. Since the 1800s, it has been estimated that about half of the state's wetlands have been lost. In many parts of southern Minnesota, well over 90% of the original wetlands have been drained.

Because of the benefits associated with wetlands, Minnesota adopted a "no net loss" of wetland policy in 1991, and in 2006 initiated a rigorous, long-term monitoring programs to track changes in wetland quality (MPCA) and quantity (DNR) over time. The DNR's monitoring effort uses aerial imagery to assess changes in wetland and deepwater area in 3,750 1-square-mile plots, randomly located across the state. This random sample is used to estimate statewide and regional changes. Imagery has been analyzed through 2023.

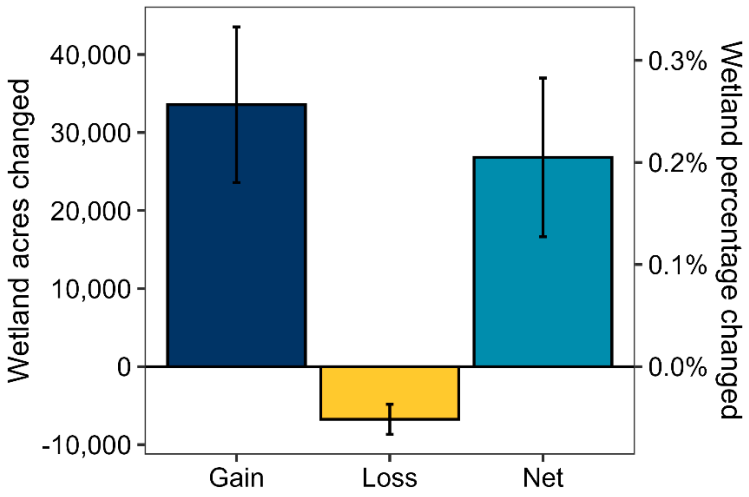
Minnesota had the following estimated changes in statewide wetland/deepwater between 2006 and 2023:

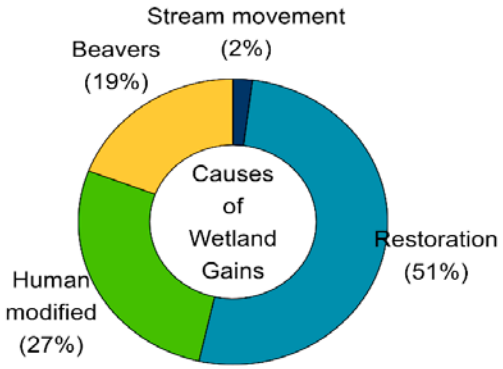
- A gain of 33,568 acres, which is a 0.26% increase from baseline acreage,
- A loss of 6,754 acres, which is a 0.05% decrease from baseline acreage, and
- A net change of 26,814 acres, which is a 0.20% increase from baseline acreage.

Of the 33,568 acres gained between 2006 and 2023, 51% were restorations. Other human modifications, including excavation and berms to make ponds for various purposes, produced 27% of the new wetland area. Beaver activity produced 19% and movement of streams or rivers (e.g., oxbow creation or loss, sediment deposition or slumps) produced 2%.



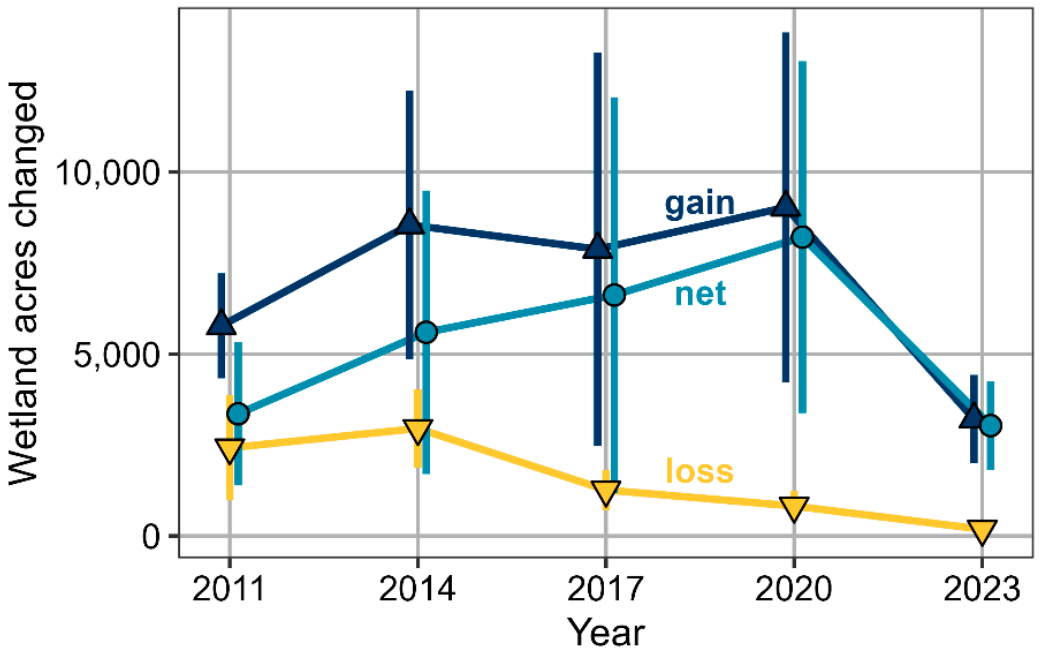
Change in wetland and deepwater acreage between 2006 and 2023 within plots monitored by the DNR (triangles), with counties shaded by estimated historical wetland loss (Anderson and Craig, 1984; grey shading indicates no data).





Left panel: Estimated statewide change in wetland and deepwater acreage between 2006 and 2023 (left axis: acres, right axis: percentage change, error bars: 95% confidence intervals). Right panel: causes of wetland and deepwater area gained between 2006 and 2023.

Wetland gains increased over the first two cycles of the monitoring program, maintained consistent levels, and then declined in the most recent monitoring cycle, reaching the lowest gains observed so far. Wetland losses have generally declined over the monitoring program, leading to net positive wetland change. To maintain the state's goal of no-net-loss of wetland quantity, it is essential to continue wetland restorations and maintain low wetland losses.



Estimated changes in statewide wetland and deepwater area at the end of each monitoring cycle (error bars: 95% confidence intervals).

Climate change

Status 

Trend 

Measure 1: Departure of statewide combined average annual temperature and precipitation from 20th century averages

Status: 2025 was much warmer and slightly wetter than 20th century averages. No year since 1989 has been both cool and dry compared to the 20th century.

Measure 2: Average snow depth December through February

Status: Many communities have seen increased snowfall in recent decades, but all stations in Minnesota have declining average winter snow depth because of warmer winter conditions, increased thaws, and more winter rain.

Measure 3: Heaviest rainfall of the year

Status: Even with frequent drought conditions in the 2020s, the amount of precipitation falling on the wettest day of the year continues increasing.

Climate and Minnesota's water resources

Climate is a fundamental driver of Minnesota's water supply and influences the strategies that Minnesotans will need in order to achieve restoration and protection goals. The amount and timing of precipitation, and the amount of moisture lost through evapotranspiration, determines whether water evaporates quickly, replenishes soil and groundwater resources, is taken up by plants, or runs off directly into lakes, rivers, and wetlands. Precipitation patterns, therefore, are strongly linked to overall water availability and can control water demand for outdoor uses like agricultural and residential irrigation.

Likewise, Minnesota's temperature patterns control the length of the summer growing season, rates of evaporation, the warmth of surface waters, the duration of ice cover on rivers and lakes, the timing of winter and spring snow melt, and many of the chemical, physical, and biological processes that shape the state's aquatic resources.

Overview of climate trends and projections

Minnesota's climate is inherently variable, meaning that temperature and precipitation patterns often exhibit distinct season-to-season, year-to-year, and even multi-year swings and shifts that can significantly affect the amount water on the land, in the soils, and deeper in the ground. The high variability that we expect from Minnesota's climate can make it difficult to notice where, when, and how climatic conditions have changed in our state. However, over 130 years of consistent climate data make it clear that widespread changes, outside the range of normal variations, are already underway in Minnesota.

In the past several decades, our state has seen increased rainfall, increased snowfall, heavier downpours, heavier snows, and substantial warming, especially during winter and at night. Winter rain is now more common than at any other time on record, which, combined with warmer winters, has decreased the average depth of snow cover. Significant drought does not show long-term increases in frequency, severity, or geographic coverage in Minnesota, but it has dominated growing seasons of the early 2020s, and the state has had unusual fluctuations between wet and dry extremes in recent years. Drought should be expected to be both a regular feature of our climate, as well as one whose impacts may increase over time.

An overwhelming base of scientific evidence projects that through the end of this century Minnesota will experience even warmer winters and nights, and even larger precipitation events — along with the

likelihood of increased summer heat and longer dry spells. Planning for the future of Minnesota's water must account for the likelihood of both wet and dry hydroclimatic extremes.

Wetter and warmer conditions

Minnesota has become wetter and warmer in the past several decades. Each of the ten combined wettest and warmest years on record occurred after 1998 (Figure 51). In fact, all but two years since 1970 have been some combination of wetter and/or warmer than 20th century averages. Minnesota's wettest year on record occurred in 2019, with the warmest year on record occurring in 2024. Although the climate will vary from year to year, with occasional cool or dry years, climate scientists expect precipitation and temperature to continue increasing through the 21st century.

Figure 51. Wetness and warmth compared to 20th century

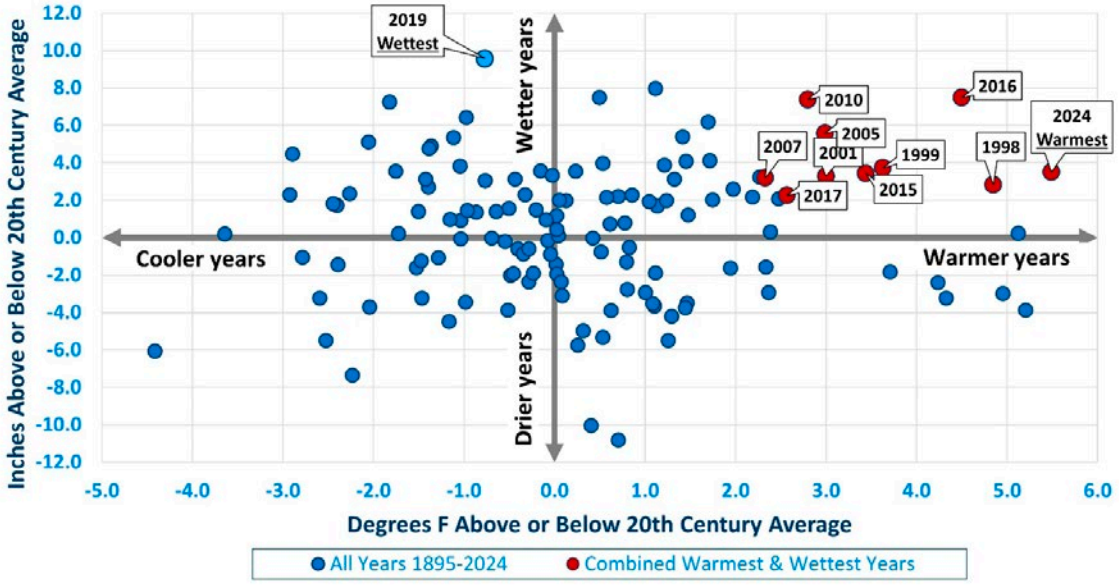


Figure 51. Plot of annual temperature and precipitation departures from 20th century averages in Minnesota, with the combined warmest and wettest years shown in red and labeled. Produced by Minnesota State Climatology Office; data courtesy of NOAA National Centers for Environmental Information.

Increasing total precipitation but with recent dry years too

Minnesota's climate swings regularly from relatively dry to relatively wet periods, but on average, the state has become about 3.5 inches wetter annually since 1895. Minnesota experienced its wettest decade on record in the 2010s and its wettest year on record in 2019.

During the first half of the 2020s, however, dry conditions and drought have been much more common than in recent decades. Annual precipitation for the state plunged below 30-year averages each year from 2020 through 2023, resulting in typical accumulated precipitation deficits of around 15 inches during that period. Although precipitation totals surged in 2024, the first half of the decade has seen an average of 14% less precipitation than the 2010s.

The dry period of the early 2020s is too short to reverse the trend towards increased wetness that has been ongoing for over five decades. Additionally, the early 2020s had more precipitation than virtually all other historical dry years in Minnesota. Even when accounting for the recent drop in annual precipitation totals, therefore, the long-term trend towards more precipitation continues.

Enhanced wet and dry extremes

Minnesota had more heavy precipitation in the 2010s than at any other time on record, with stations setting numerous all-time and statewide precipitation records. The excessive precipitation flooded communities and rivers, damaged infrastructure, and left water standing in fields.

Since the 2010s, Minnesota's hydroclimate has become much more variable, with alternating extremes of wetness and dryness affecting the state at different times (Figure 52). These wet and dry periods have varied in their timing, geographic extent, and magnitude. As a result, Minnesota has experienced multiple episodes of significant drought and significant flooding in a short amount of time, at scales ranging from localized to statewide. Some areas have swung from the worst levels of drought on the US Drought Monitor, to historic or even unprecedented flooding in less than a year's time.

Figure 52. Percent of Minnesota covered by wet or dry categories based on 9-month standardized precipitation index

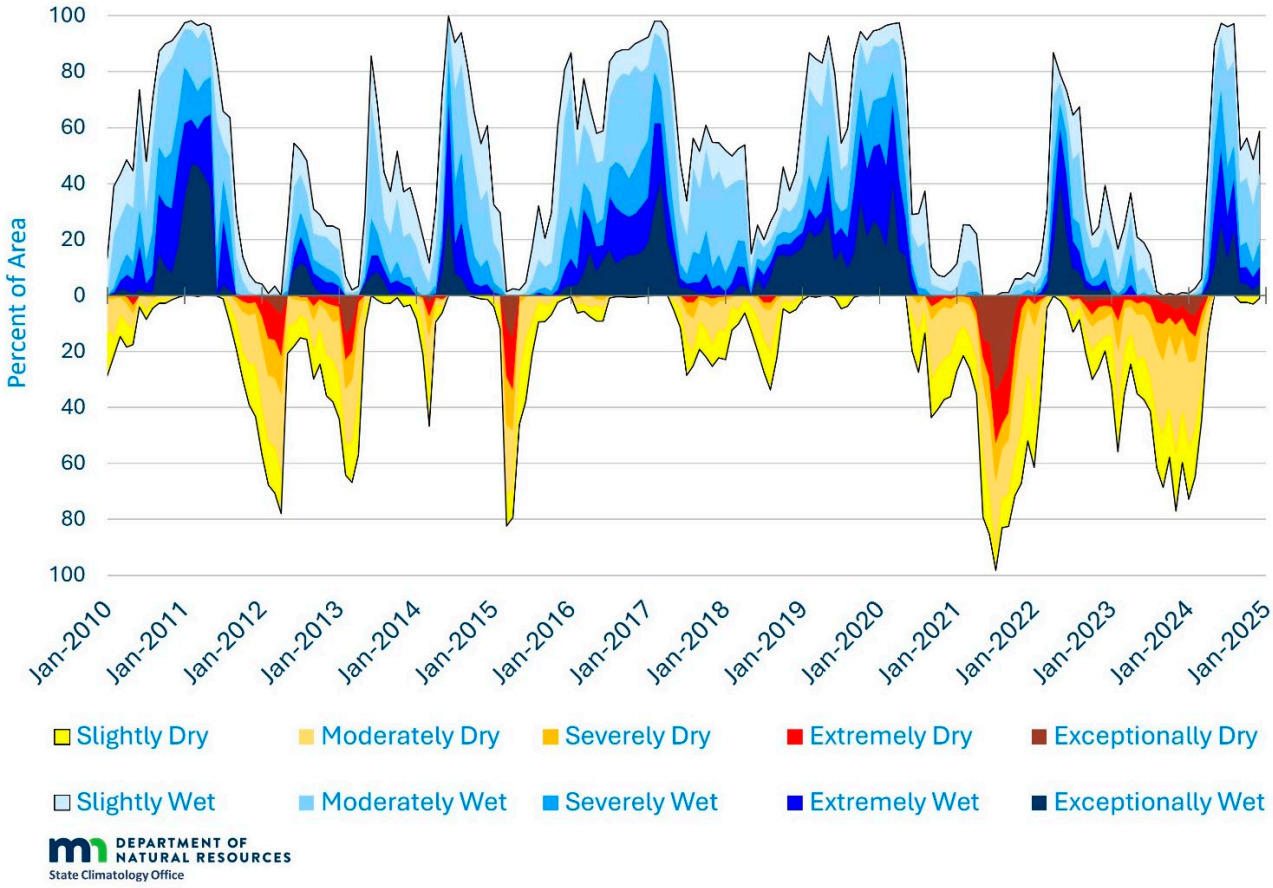


Figure 52. Proportion of Minnesota covered by different levels of wetness and dryness since 2010, using the 9-month Standardized Precipitation Index. Produced by Minnesota State Climatology Office; data from NOAA, National Integrated Drought Information System.

The Rainy River example of extremes

As an example, from May through August of 2021, the Rainy Lake and Rainy River area received just half its normal precipitation and ended up with the worst drought conditions since 1980. The next 9 months (September through May), however, were by far the wettest on record for that period, exceeding normal precipitation by 80%. Rainy Lake rose to its highest levels in 115 years of record, with historic flooding on the Rainy River and on Lake of the Woods.

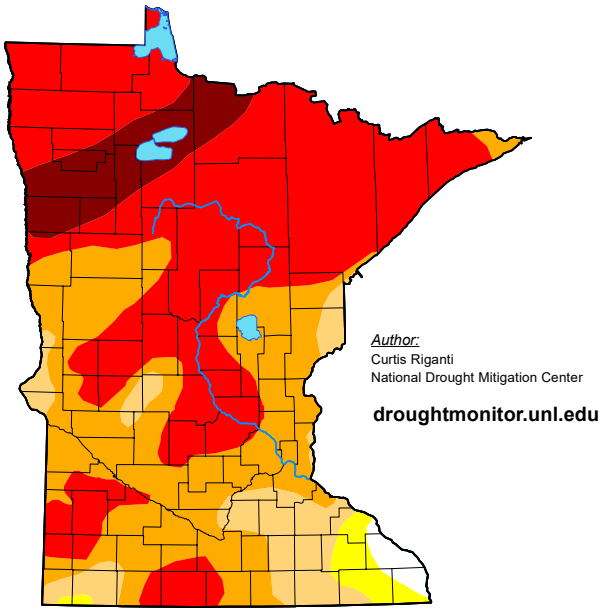


Figure 53. U.S. Drought Monitor map for August 24, 2021. Dark red band across northwestern Minnesota extends through part of the Rainy River and indicates "Exceptional Drought," the highest level possible and the worst drought conditions in the area since 1980.

Historic flooding of the Rainy River just 10 months later, in June 2022, following several months of excessive precipitation falling in the basin. Courtesy of Z. Moore.

Climate projections for Minnesota show greater extremes of precipitation and also longer dry spells throughout the century. Planning for the future should account for even greater extremes of wetness and dryness than Minnesota has experienced recently.

Warmer but not hotter, yet

Minnesota is warming quickly but mostly during nights and winter. Annual temperatures have climbed by an average of 3.3 degrees F since 1895, but winters have warmed by 5.5° F and winter nights have warmed by 6.9° F, while summers have warmed by just 2.0° F, and summer daytime high temperatures have decreased slightly in southern Minnesota (Figure 54). Although the records go back to 1895, the vast majority of temperature increases have occurred since 1970.

Winter cold extremes have become less frequent and less severe, while the state has observed no change in the frequency or severity of summer high temperature extremes. Extremes of humid heat have begun increasing, however, with many record and near-record heat index values observed in Minnesota in the 2010s and 2020s. Climate model projections are virtually unanimous that hotter summers will arrive by

the middle of this century (if not sooner), and recent trends suggest that humid heat waves will continue increasing in frequency and intensity. Winter is likely to continue warming faster than summer throughout the century.

Figure 54. Total temperature change since 1895

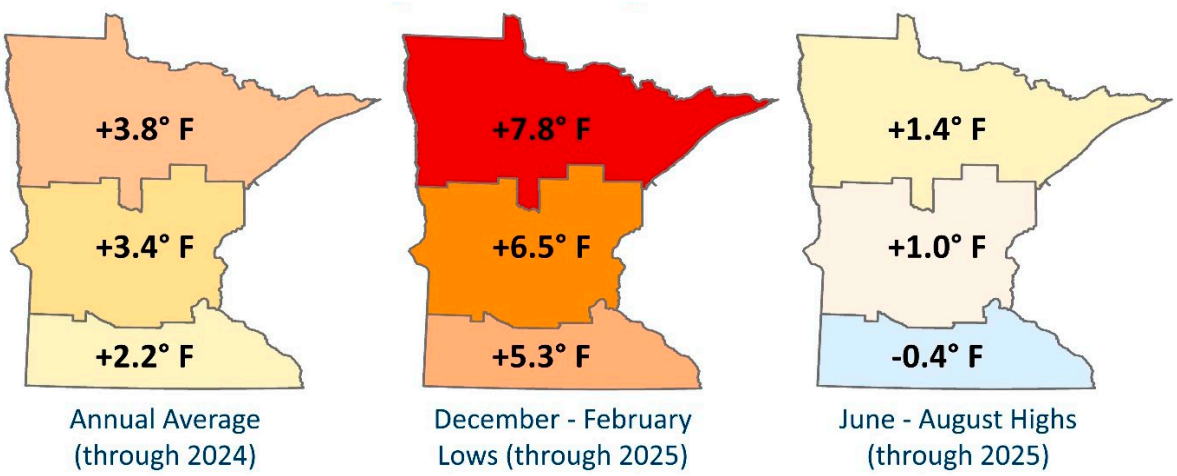


Figure 54. Temperature Change by Region Since 1895. Produced by Minnesota State Climatology Office; data courtesy of NOAA National Centers for Environmental Information.


MINNESOTA