Clean Water Fund
Performance Report

A report of Clean Water Funds invested, actions taken and outcomes achieved

2016

CLEAN WATER LAND & LEGACY AMENDMENT

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February 2016

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 Pollution Control Agency

MNDNR

MINNESOTA DEPARTMENT OF AGRICULTURE

MDH Minnesota Department *of* Health

Minnesota Board of Water & Soil Resources

PFA Minnesota Public Facilities Authority

METROPOLITAN COUNCIL

Water Resources Center

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Table of contents

Clean Water Fund Performance Report

About this report

Minnesotans care deeply about the state's natural resources and cultural heritage. Since the first decades of statehood, Minnesota has responded to many water quality and other natural resource challenges. For instance, through state, federal and private actions, we have made great strides in protecting drinking water supplies and reducing industrial pollution. However, these investments have not kept pace with the scope of water quality challenges.

In 2008, Minnesotans demonstrated a renewed commitment to clean water. We voted to increase our sales tax and pass the Clean Water, Land and Legacy Amendment[1], providing 25 years of constitutionally-dedicated funding for clean water, habitat, parks and trails, and the arts.

With that vote came high expectations for results. Minnesotans want to know if our water quality is improving, declining or staying the same. Minnesotans also want to know if our drinking water is safe and will be available for future generations. We want to know if investments from the Clean Water Fund are making a difference. Each year until 2034, about $85 million from the Clean Water Fund will be invested in various water management activities—from testing and assessing the state's lakes, streams and groundwater, to installing conservation practices on the ground to protect and restore our waterbodies. This work is being done by thousands of people, from state policy makers to local landowners.

How will we know if these dollars are making a difference? How will we know how much progress has been made after 5, 10 and 25 years?

Developing a tracking framework

Tracking the connections between dollars invested, water resource management actions taken, and clean water outcomes achieved is the charge of a multi-agency team (Team) that was assembled after the Clean Water Legacy Act[2] (Act) was passed by the state legislature in 2006. The Act required agencies to "establish and report outcome-based performance measures that monitor the progress and effectiveness of protection and restoration measures."

1 Clean Water, Land and Legacy Amendment: In 2008, Minnesota's voters passed the Clean Water, Land and Legacy Amendment (Legacy Amendment) to the Minnesota Constitution to: protect drinking water sources; to protect, enhance, and restore wetlands, prairies, forests, and fish, game, and wildlife habitat; to preserve arts and cultural heritage; to support parks and trails; and to protect, enhance, and restore lakes, rivers, streams, and groundwater. The Legacy Amendment increases the state sales tax by three-eighths of one percent beginning on July 1, 2009 and continuing until 2034. The additional sales tax revenue is distributed into four funds as follows: 33% to the Clean Water Fund; 33% to the Outdoor Heritage Fund; 19.75% to the Arts and Cultural Heritage Fund; and 14.25% to the Parks and Trails Fund.

2 Clean Water Legacy Act: First enacted in 2006, the legislative purpose of the Clean Water Legacy Act as amended is "to protect, enhance, and restore water quality in lakes, rivers, and streams and to protect groundwater from degradation, by providing authority, direction, and resources to achieve and maintain water quality standards for groundwater and surface waters including the standards required by section 303(d) of the federal Clean Water Act, United States Code, title 33, section 1313(d) and other applicable state and federal regulations." (Minnesota Statutes 114D.10)

The Team developed Minnesota's Clean Water Tracking Framework (Framework) in response to the new requirement[3]. Development of the Framework and its suite of outcome-based performance measures continued after the Legacy Amendment was passed by voters in 2008, and was enhanced to track Clean Water Fund investments and outcomes.

The Framework includes a set of performance measures that will convey the most meaningful information about clean water activities to key audiences across Minnesota. These performance measures generally fall into the following categories:

- **Environmental and drinking water measures** track whether our water is getting cleaner.
- **Partnership and leveraging measures** track local government and citizen actions supported by the Clean Water Fund.
- **Organizational performance measures** track state government-led actions supported by the Clean Water Fund.
- **Financial measures** track how much and where Clean Water Fund money is being spent.

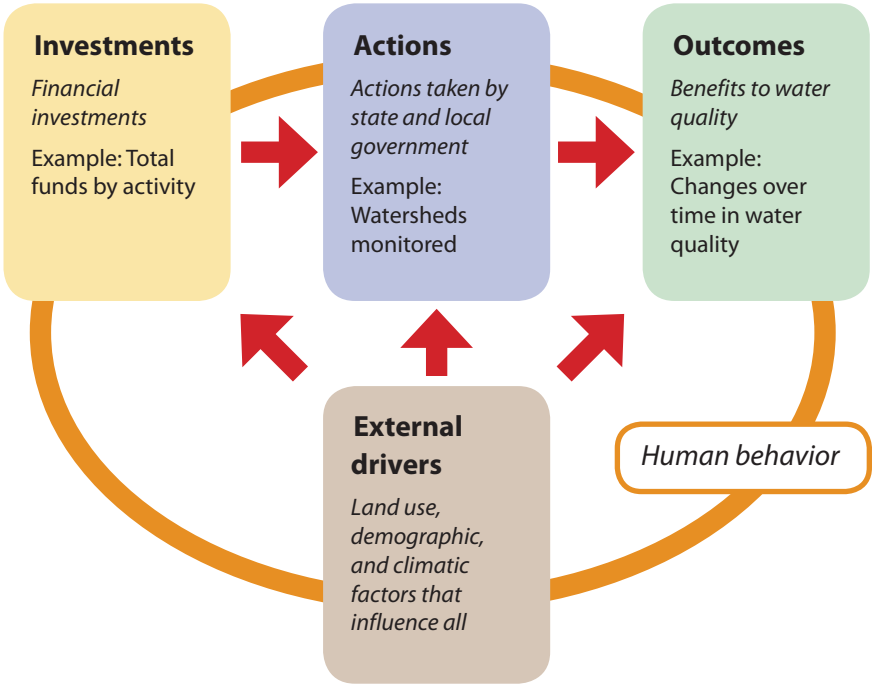
The Framework also describes the connection between short-term activities and long-term results. The multi-agency Team grouped the measures into three other categories: financial investments, actions taken, and outcome measures. Together these measures track how Clean Water Fund investments result in actions taken and ultimately, clean water outcomes achieved. External drivers will impact the progress of achieving the clean water outcomes and will be presented in the report. In the early years of the Clean Water Fund, more progress will be reported in short-term actions taken than long-term outcomes.

The pace of progress and lag times

We recognize that people are hungry for immediate results. However, managing water resources is an ongoing task and some clean water outcomes may take several years or several decades to measure. The lag time between when actions are taken and environmental improvements are observed depends on the scale of the problem and trends in external drivers. For example, reducing the inputs of phosphorus to a lake may take years to be reflected in lake phosphorus concentrations. Also, multiple years of monitoring may be necessary before an improving trend can be confirmed. As a result, after best management practices are implemented, it may take years or decades before environmental improvement is achieved in a degraded river, lake or groundwater source. Progress may also be hard to measure when best management practices are implemented to protect high quality resources. In cases where maintaining existing water quality conditions is the goal, no long-term change in the environmental outcome would represent success. Ongoing monitoring efforts will provide critical information to track our progress and identify where implementation efforts need to be adjusted.

Additionally, while the goal of the Framework is to clarify connections between Clean Water Funds invested, actions taken and outcomes achieved, it is important to note that there are many other water resource management activities underway. These activities have various sources of funding. It would be impossible to measure everything in one report or project. The Team acknowledges that environmental outcomes may not all be directly related to only Clean Water Fund investments, but rather, a result of the many activities that are underway.

3 For more information on the Framework, see Minnesota's Clean Water Tracking Framework; May 2011 Progress Report, available here: https://www.pca.state.mn.us/sites/default/files/wq-gen1-05a.pdf



Measure connections

A portion of Clean Water Funds are dedicated to funding (investment measure) monitoring activities (action measure). Those monitoring activities will tell us, in time, the rate of impairments in waterbodies (outcome measure) and the changes over time in key water quality parameters (outcome measure). External drivers will influence investments, actions, and outcomes and will change the rate of progress independent of the actions implemented by Clean Water Fund activities. Human behavior influences all aspects of restoring and protecting water quality, and changing behavior is a key component of Clean Water Fund activities.

Future Measure Development Underway: Targeting

It is important that Clean Water funds are spent in ways that address the most pressing water and land resource issues and that the implementation actions funded are prioritized, targeted, and are achieving measurable results. Agencies that receive Clean Water funds recognize that our current performance tracking can be improved to demonstrate how we are targeting our efforts to be more effective. Because of the wide range of water resource plans currently being used to inform implementation proposals, a consistent, state-wide targeting measure cannot be reported yet. Once the Watershed Restoration and Protection Strategies and the watershed plans created under the One Water One Plan program are finalized, representing the success of targeting efforts throughout the state should be more feasible. It is anticipated the framework for this modification will be introduced in the 2018 Clean Water Fund Performance Report.

Report organization

Measure profiles provide a snapshot of how Clean Water Fund dollars are being spent and what progress has been made. These profiles are organized into three sections: investment measures, surface water quality measures and drinking and groundwater protection measures. The Clean Water Fund Performance Report includes those measures where data are currently available. More information on other measures will be released over time.

Each measure profile page includes the following:

- Measure type: investment, action, or outcome
- Measure narrative: why the measure is important, what state agencies are doing, what progress has been made
- A graphic that summarizes the measure's data
- Measure scores for action and outcome measures and qualitative scores that summarize the measure's status

Minnesota's Clean Water Roadmap Goals: Tracking the Progress Being Made

The seven agencies with Clean Water Fund (CWF) responsibility developed the Minnesota's Clean Water Roadmap in 2015. This report frames and provides initial goals for how the state's surface water and groundwater resources will be enhanced. It focuses on where Minnesota wants to be in the future and how we can gauge our progress on our way there.

The Clean Water Fund Performance Report, this report, is updated every two years. Thus, it can be used to track actions Minnesotans are taking that will help achieve the goals outlined in the Clean Water Roadmap. For example, targets can be set and progress tracked for the amount of monitoring completed, the level of participation by local partners, and the number of projects implemented with nonpoint and point-source funding, as well as for the environmental outcomes achieved. Nine action measures in this report have been highlighted because of their connections with Roadmap goals (table below). Those measures provide a snapshot of how Clean Water work is organized and aligned to meet the water quality targets outlined in the Clean Water Roadmap.

Category	Statewide goal	Linked CWF performance measure
Lake water quality	8% increase in the percentage of lakes with good water quality	Major watersheds monitored (page 16) Watersheds monitored by local partners (page 19) Nonpoint source BMP implementation (page 21) Municipal infrastructure project implementation (page 23)
River and stream water quality	7% increase in the percentage of rivers and streams with healthy fish communities	Major watersheds monitored (page 16) Watersheds monitored by local partners (page 19) Nonpoint source BMP implementation (page 21) Municipal infrastructure project implementation (page 23)
Groundwater quality	50% decrease in the number of new wells that exceed arsenic drinking water standard 20% decrease in nitrate levels in groundwater	Source water protection plans (page 36) Nitrate monitoring and reduction by local partners (page 40) Groundwater quality (page 51)
Groundwater quantity	Less than 10% of sites affected by groundwater pumping will have declining trend in groundwater levels	County geologic atlases (page 45) Long-term monitoring network wells (page 47)

Learn more

- Minnesota's Clean Water Roadmap can be found at: www.legacy.leg.mn/sites/default/files/resources/Clean_Water_Report_web2.pdf

2016 Clean Water Fund Report Card

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.

The following report card highlights work done using Legacy amendment 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.

The legend shows the symbols used to describe how measures were scored. Measures are scored according to their status as of the end of fiscal year 2015 (FY15) and for their trend over time. Scores were developed using data-informed professional judgment of agency technical staff and managers.

Report Card Legend

Action Status Scores	
●	We are making good progress/meeting the target
▲	We anticipate difficulty; it is too early to assess; or there is too much variability across regions to assess
■	Progress is slow/we are not meeting the target; or the activity or target is not commensurate with the scope of the problems

Outcome Status Scores	
●	Water quality is high – we are on track to meet long-term water resource needs and citizen expectations
▲	Water quality needs improvement or it is too early to assess – it is unclear if we will meet long-term water resource needs and citizen expectations; and/or water quality varies greatly between regions
■	Water quality is under intense pressure – long-term water resource needs and/or citizen expectations exceed current efforts to meet them

Trend	
↗	Improving trend
→	No change
↘	Declining trend

Clean Water Fund Report Card

	Measure	Status	Trend	Description
	Investment measures			
INVESTMENTS	Total Clean Water Fund dollars appropriated by activity	FY10-11: $152.2M FY12-13: $179.4M	FY14-15: $182.5M FY16-17: $228.3M	Appropriation levels will vary by biennium and the strength of the economy. FY10-15 funds have been allocated, while FY16-17 allocations are in progress.
INVESTMENTS	Total Clean Water Fund dollars per watershed or statewide for 1) monitoring/assessment, 2) watershed restoration/protection strategies, 3) protection/restoration implementation activities, and 4) drinking water protection	Most watersheds in the state are benefiting from local and statewide projects.		For FY10-15, all 80 watersheds benefited from Clean Water Fund supported activities. Implementation activities comprise the largest portion of spending in watersheds statewide.
INVESTMENTS	Total Clean Water Fund dollars awarded in grants and contracts to non-state agency partners	$240.1M was awarded in grants and contracts to non-state agency partners in FY10-15.		About 80% of grant and contract awards are for implementation activities; 47% of total FY10-15 appropriations were awarded to non-state agency partners.
INVESTMENTS	Total dollars leveraged by Clean Water Fund	$154M was leveraged by Clean Water Funds in FY10-15, or 96 cents for every implementation dollar invested.		Required Clean Water match funds were met and exceeded.
	Surface water measures			
ACTION	Percent of major watersheds intensively monitored through the watershed approach	●	→	Steady progress is being made at the pace set in 2008.
ACTION	Local partner participation in monitoring efforts	●	→	Since 2012, all programs have met local participation goals.
ACTION	Number of nonpoint source best management practices implemented with Clean Water funding and 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 three times greater than available funds.
ACTION	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 and compliance schedules; demand is growing with the improving economy and expanded eligibilities.
OUTCOME	Rate of impairment/unimpairment of surface water statewide and by watershed	▲ Stream/lake swimming ▲ Stream aquatic life	Not enough information for a trend determination at this time.	Water quality varies greatly by region. Watersheds yet to be assessed will influence the statewide impairment/unimpairment rate. It is unclear whether long-term goals will be met.
OUTCOME	Changes over time in key water quality parameters for lakes and streams	● Lake clarity	Not enough information for a trend determination at this time.	Lake clarity: There are improving trends in lake water clarity in more lakes than not.
		▲ Stream fish		Stream fish: Fish community health varies greatly by region, but statewide percents of poor vs. good fish community health are similar.
		▲ Pesticides in streams		Pesticides in streams: Detections in streams vary greatly as a result of hydrologic and agronomic conditions; concentrations above water quality standards are rare.
		▲ Pesticides in lakes		Pesticides in lakes: Detections in lakes vary by region; detections in lakes have been well below water quality standards.
OUTCOME	Number of previous impairments now meeting water quality standards due to corrective actions	■	→	Although many projects are making progress in improving water quality, more waterbodies are being listed as impaired relative to the slower rate of waterbodies being restored.
OUTCOME	Trends of mercury in fish in Minnesota	▲	↗	Mercury in game fish over the last 30 years shows an improving trend despite large fluctuations during shorter periods, demonstrating the need for long-term and consistent monitoring.
OUTCOME	Trends of mercury emissions in Minnesota	▲	↗	Significant progress has been made reducing mercury emissions from power plants and is expected from the mining sector. To meet Minnesota's 2025 emissions goal, further reduction of mercury use in various products will be necessary.

	Measure	Status	Trend	Description
	Surface water measures			
	Municipal wastewater phosphorus discharge trend			Significant phosphorus load reductions have been achieved through regulatory policy, infrastructure investments, and improved technology. Further reductions will continue to be challenging and expensive as small systems receive limits and tighter discharge permits .
	Drinking and groundwater measures			
ACTION	Number of community water supplies assisted with developing source water protection plans			Met target for FY14-15. On track to meet long-term target of every vulnerable community public water system engaged in source water protection by 2020.
ACTION	Number of grants awarded for source water protection			Increased funds accelerate implementation of proven strategies for source water protection.
ACTION	Number of local government partners participating in groundwater nitrate-nitrogen monitoring and reduction activities			New local partnerships continue to be established for nitrate-nitrogen monitoring and reduction activities.
ACTION	Number of new health-based guidance values for contaminants of emerging concern			Met target for FY14-15. On track to meet goal of 10 guidance values developed each biennium.
ACTION	Number of counties completing a county geologic atlas for groundwater sustainability			Significant progress has been made. Counties continue to step up to participate but substantial work remains before all counties are done.
ACTION	Number of long-term groundwater monitoring network wells in Minnesota			Many areas of the state still lack important groundwater information. Long-term monitoring accelerated by Clean Water Fund investments is filling gaps.
ACTION	Number of unused groundwater wells sealed			While Minnesota leads the nation in the number of sealed wells, continued effort is needed to address the estimated 250,000 to 500,000 unused, unsealed wells remaining.
OUTCOME	Changes over time in pesticides, nitrate-nitrogen and other key water quality parameters in groundwater	Pesticides 		Variable trends for five common pesticides indicate a mixed signal. Low levels are still frequently detected in vulnerable groundwater.
OUTCOME		Nitrate-Nitrogen statewide 	Not enough information for a trend determination at this time.	In many areas, drinking water aquifers are not vulnerable to surficial contamination. Wells may have low levels of nitrate-nitrogen. In some areas it can be a significant concern.
OUTCOME		Nitrate-Nitrogen Central Sands 		A significant percentage of wells from the township testing program exceed the drinking water standard for nitrate in localized sensitive areas in the Central Sands.
OUTCOME		Nitrate-Nitrogen southeast region 		In one county with considerable karst geology, two of 11 townships in the township testing program had more than 10% of wells exceed the drinking water standard for nitrate.
OUTCOME	Changes over time in source water quality used for community water supplies		Not enough information for a trend determination at this time.	Identifying correlations between drinking water contaminants is a significant step in trend analysis of source water quality.
OUTCOME	Nitrate concentrations in newly constructed wells			Although nitrate levels in less than 2% of new wells violate the drinking water standard, there has been a slight increase in recent years.
OUTCOME	Changes over time in groundwater levels			Most observation wells show no significant trend, but many areas of the state lack important groundwater information while some areas experienced groundwater declines.
	Social measures and external drivers			
DRIVERS	Social measures		Not enough information for a trend determination at this time.	In recent years, state agencies have developed and piloted the Social Measures Monitoring System. This work integrates social science into Clean Water Fund projects.
DRIVERS	External drivers			The external drivers identified continue to alter land-water interactions across Minnesota impacting how Clean Water funds need to be invested.

Clean Water Fund Report: Highlights

In the first six years of Clean Water funding, state agencies have distributed the funds across Minnesota with major investments in all 80 watersheds. Restoration and protection spending was focused in watersheds with more significant water quality challenges (page 11).

Agencies are making solid progress in both surface water and groundwater quality. Examples include improving sewer systems (page 23) and implementing activities to reduce nitrate in drinking water (page 36).

The Legacy Amendment has accelerated the implementation of practices to improve and protect Minnesota's water resources, although funding is not keeping pace with demand (page 21). In total, more than 4,600 best management and conservation practices have been installed, resulting in a reduction of about 79,000 pounds of phosphorus and 120,000 tons of sediment going to waters across the state.

Clean Water funding has ramped up efforts to collect key information statewide needed to develop restoration and protection strategies, and to target implementation dollars:

- The Minnesota Dept. of Natural Resources has completed 22 County Geologic Atlases with new or updated atlases in progress for 27 additional counties (page 45). At the current level of funding, atlases should be completed statewide in 10 to 15 years.
- The Minnesota Pollution Control Agency is on track to complete intensive water monitoring of all 80 major watersheds by 2018 (page 16). Since the 2014 Performance Report, the agency has started monitoring in 19 more watersheds.
- The Minnesota Department of Agriculture began the Township Testing Program for well water in 2013 and is on track to complete the first round of nitrate testing in private wells by 2019 (page 56). By 2019, the MDA will offer free nitrate testing in 250-300 townships with vulnerable groundwater.

Changes in human behavior, such as decisions on land use and product selection, are needed to change water quality for the better, as demonstrated by these measures:

- Water monitoring is showing correlations between impaired waters and agricultural land use (pages 26 and 28).
- To reach the state goal for mercury reductions in order to decrease levels in fish, Minnesota will need to see further reductions of mercury in products such as fluorescent lamps and dental amalgam (page 32).
- Chloride is increasing in urban areas across the state, emphasizing the need to reduce salt in winter road and water softener treatments (page 53).

Because water quality is so dependent on human behavior, the Performance Report includes more information on social measures this year, providing a baseline for tracking social science data in meeting Minnesota's clean water goals (page 61). This section highlights four specific efforts undertaken to strengthen the capacity of Minnesota communities to take on this work.

Investment measures

The four measures contained on pages 10-14 illustrate Clean Water Fund investments to restore and protect surface water and drinking water for fiscal years 2010-2017 (FY10-17).

Investments

1. Total dollars appropriated
2. Total dollars invested by watershed or statewide
3. Total dollars awarded
4. Dollars leveraged

This report establishes a baseline for future actions and outcomes to be evaluated. It is a work in progress to be improved in future years based on the input and feedback received from stakeholders and the public.

Total dollars appropriated

INVESTMENT

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 and drinking water protection activities.

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 one percent on taxable sales, starting July 1, 2009 through 2034. Of those funds, about 33% were dedicated to the Clean Water Fund.

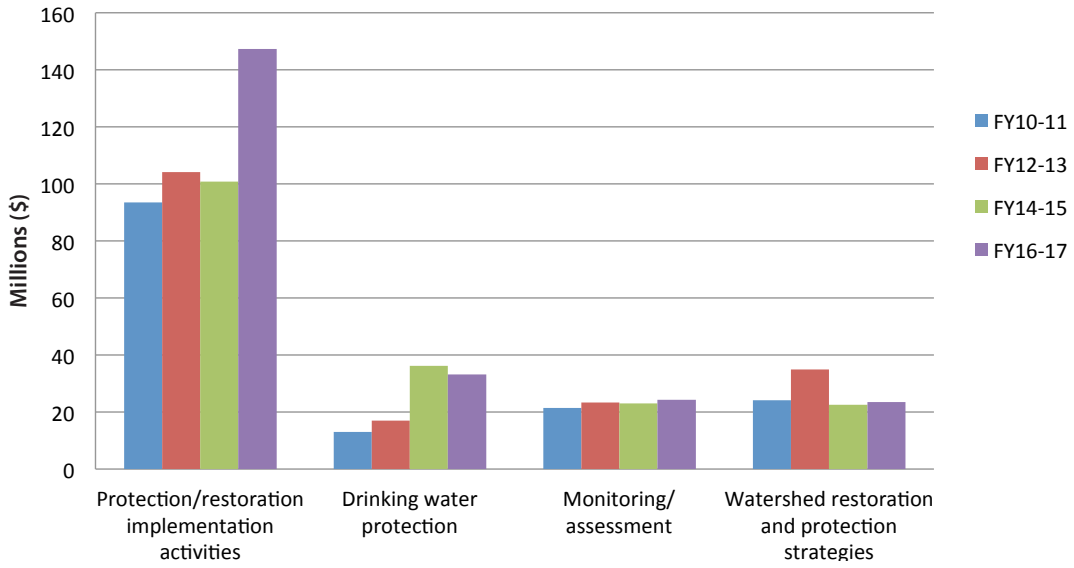
Of sales tax receipts received since 2009, the Minnesota Legislature appropriated approximately $152.2 million for FY10-11, $179.4 million for FY12-13, and $182.5 million for FY14-15. This is a total of $514 million. The chart below shows how that was appropriated.

Learn more

Find more information about this measure and its data at www.legacy.leg.mn/funds/clean-water-fund

Status	Description
FY10-11: $152.2M FY12-13: $179.4M FY14-15: $182.5M FY16-17: $228.3M	Appropriation levels will vary by biennium and the strength of the economy. FY10-15 funds have been allocated, while FY16-17 allocations are in progress.

Clean Water Fund appropriations



Total dollars invested by watershed or statewide

INVESTMENT

Measure: Total dollars invested per watershed or statewide for: 1) monitoring/assessment, 2) watershed restoration/protection strategies, 3) protection/restoration implementation activities, and 4) 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?

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

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

For FY10-15, Clean Water Fund allocations to surface water and drinking water projects are benefiting most of the watersheds of the state. As noted above, these activities are being performed by local partners as well as state agencies.

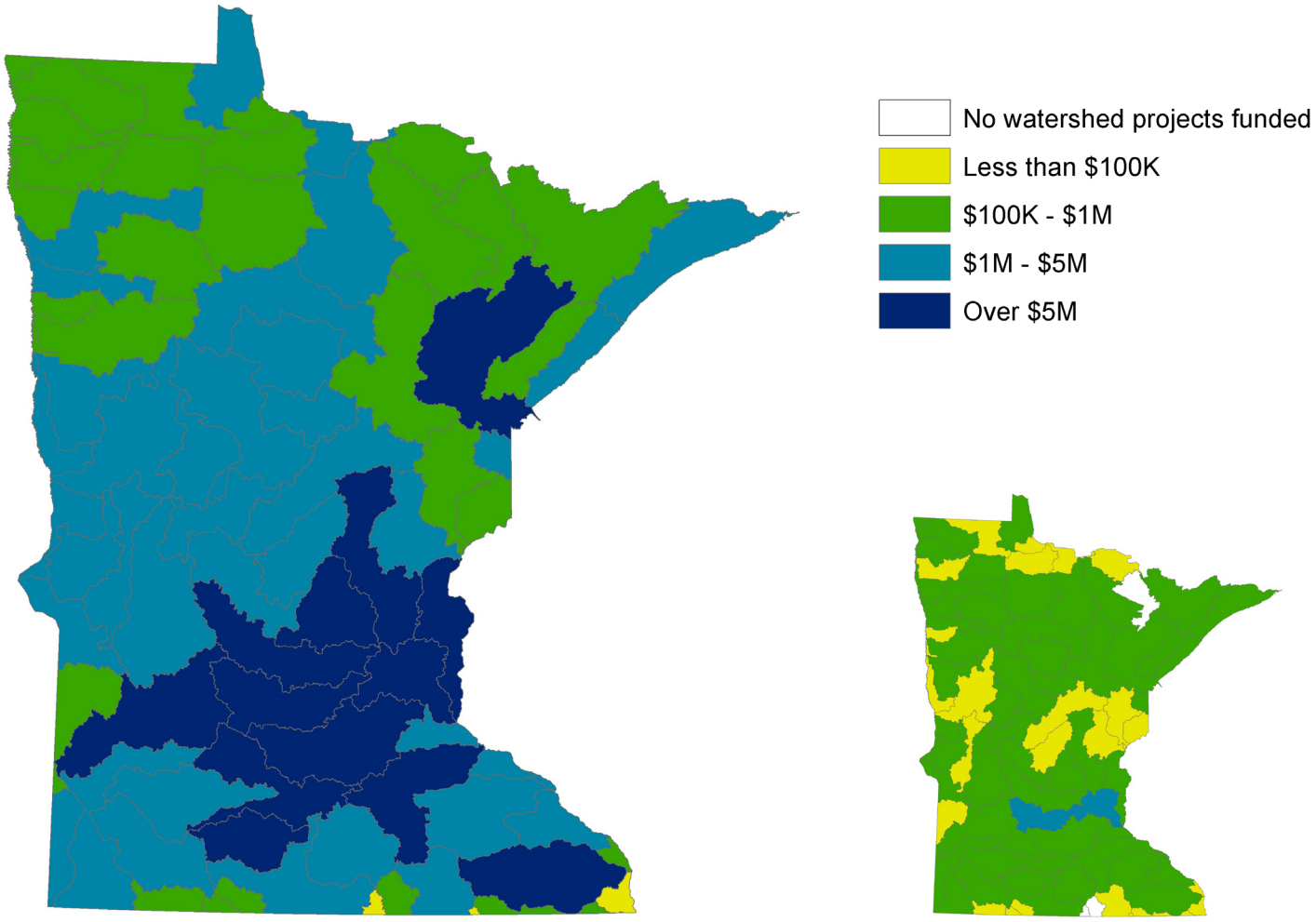
Of the four activity categories, funding for implementation activities comprised the largest portion of spending statewide. However, the costs of implementation can vary significantly by watershed, depending on the type of project and the problem being addressed.

Learn more

- Find information on activities funded by the Clean Water Fund at: www.legacy.leg.mn/funds/clean-water-fund

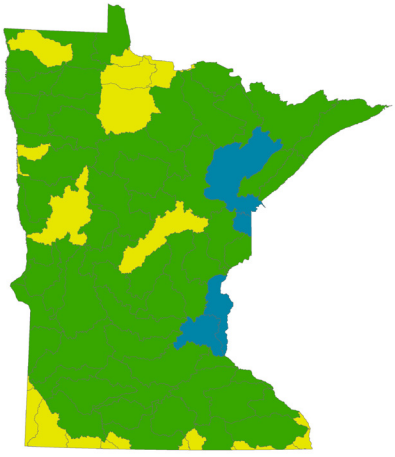
Status	Description
Most watersheds in the state are benefiting from local and statewide projects.	For FY10-15, all 80 watersheds benefited from Clean Water Fund supported activities. Implementation activities comprise the largest portion of spending in watersheds statewide.

Total FY10-15 Clean Water Fund dollars by watershed

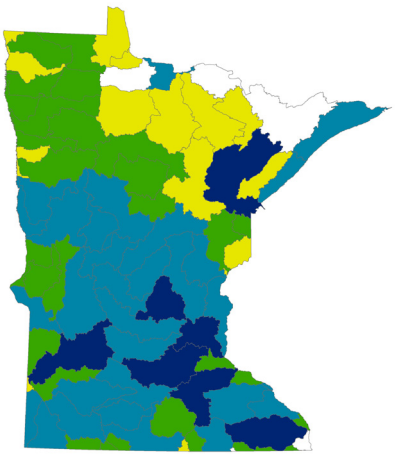


Combined watershed-specific projects, statewide activities, and technical assistance that benefit all watersheds

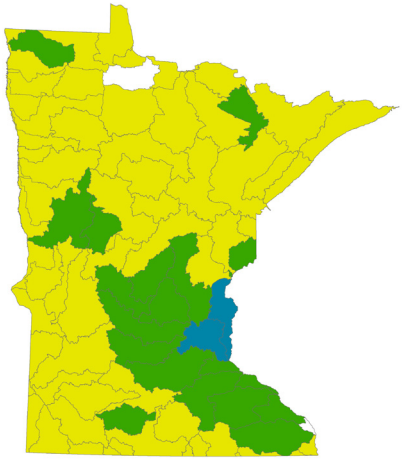
Monitoring and assessment



Watershed restoration/ protection strategies



Protection/restoration implementation activities



Drinking water protection

Total dollars awarded

INVESTMENT

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

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?

Hundreds of Clean Water Fund-supported projects, led largely by local government units, are underway 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.

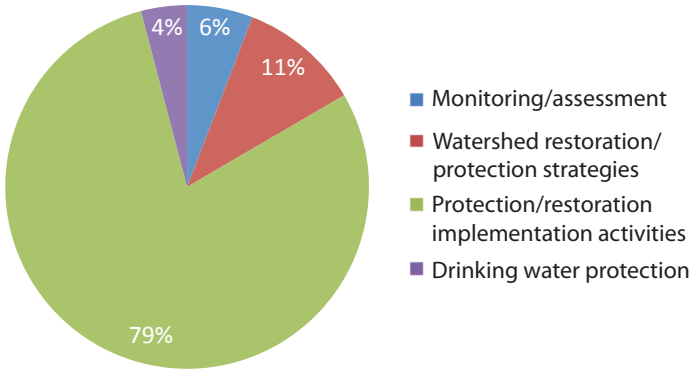
For all activities taken by local government units and other partners, state agencies provide monitoring activities, development of watershed protection and restorations strategies, as well as technical assistance and administrative oversight. The agencies include: Minnesota Board of Water and Soil Resources,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

What progress has been made?

As shown in the pie chart, a total of $240.1 million in Clean Water Funds were awarded to non-state agency partners from FY10-15, with the largest share of that going to protection and restoration implementation activities. This represents 47% of the total $514 million 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, and oversight on Clean Water Fund-supported projects. Note: Due to law, some funds are allocated in phases, and thus, over time the information in this measure will change.

FY10-15 grant and contract awards by major activity



The percentage of total grant and contract awards ($240.1 million) in FY 10-15 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.

Learn more

Find more information about this measure and its data at www.legacy.leg.mn/funds/clean-water-fund

Status	Description
$240.1M was awarded in grants and contracts to non-state agency partners in FY10-15.	About 80% of grant and contract awards are for implementation activities; 47% of total FY10-15 appropriations were awarded to non-state agency partners.

Dollars leveraged

INVESTMENT

Measure: Total dollars leveraged by Clean Water Fund implementation activities

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 dollars. The ability to use state funds to leverage local and federal dollars 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 with state agencies and various local units of government are critical to implement these water quality improving activities.

What progress has been made?

During FY14-15, more than $76 million in state grants and loans was awarded to local governments (watershed management organizations, SWCDs, counties, etc.) for projects to reduce runoff from agricultural fields, streets, lawns, and other similar sources. Local match and leveraged federal funds increased the project dollars available by $44.6 million.

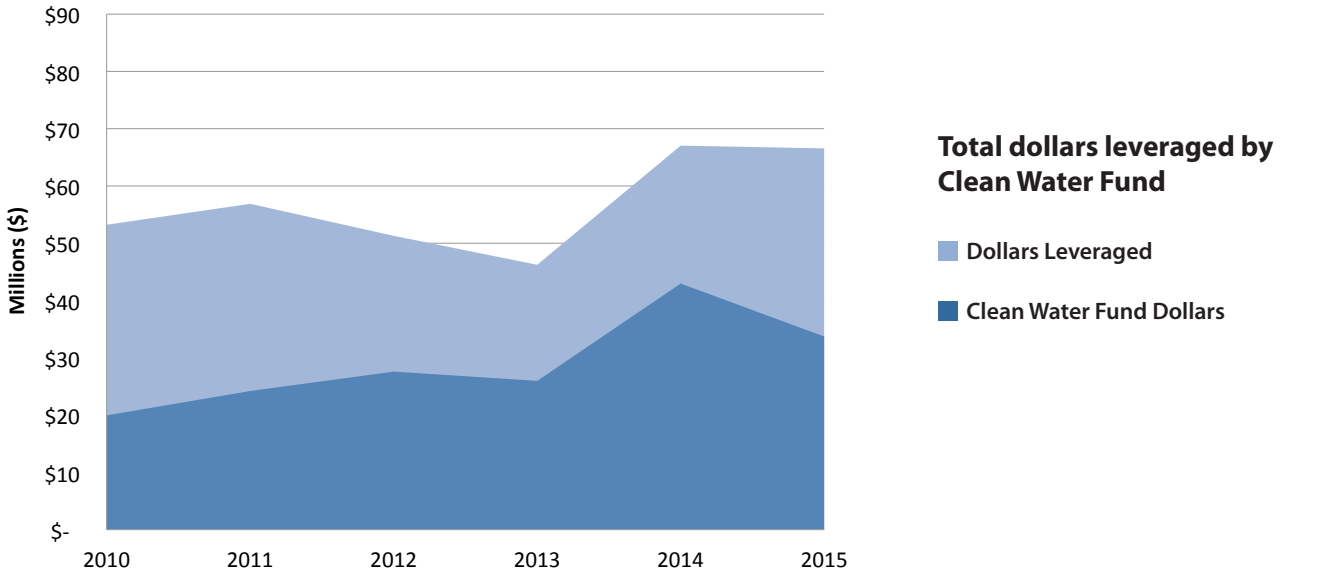
During FY14-15, more than $18 million in state grants was awarded to improve municipal wastewater and stormwater treatment, upgrade aging infrastructure, and to help small communities invest in new infrastructure. Local match and leveraged federal funds increased the project dollars by $15 million.

As a result, during FY10-15, more than $154 million dollars was leveraged by Clean Water Fund, or 96 cents for every implementation dollar invested.

Learn more

Find information on activities funded by the Clean Water Fund at www.legacy.leg.mn/funds/clean-water-fund

Status	Description
$154M was leveraged by Clean Water Funds in FY10-15, or 96 cents for every implementation dollar invested.	Required Clean Water match funds were met and exceeded.



Surface water quality measures

The nine measures contained on pages 16-34 illustrate important Clean Water Fund-supported actions and outcomes undertaken to protect Minnesota's surface water quality.

Actions

1. Major watersheds monitored
2. Watersheds monitored by local partners
3. Nonpoint source best management practice implementation
4. Municipal infrastructure project implementation

Outcomes

5. Surface water health
6. Lake and stream water quality
7. Waters restored
8. Mercury trends
9. Municipal wastewater phosphorus changes

This report establishes a baseline against which future actions and outcomes can be evaluated. It is a work in progress to be improved in future years based on the input and feedback received from stakeholders and the public.

Major watersheds monitored

ACTION

Measure: Percent of state's major watersheds intensively monitored through the Watershed Approach

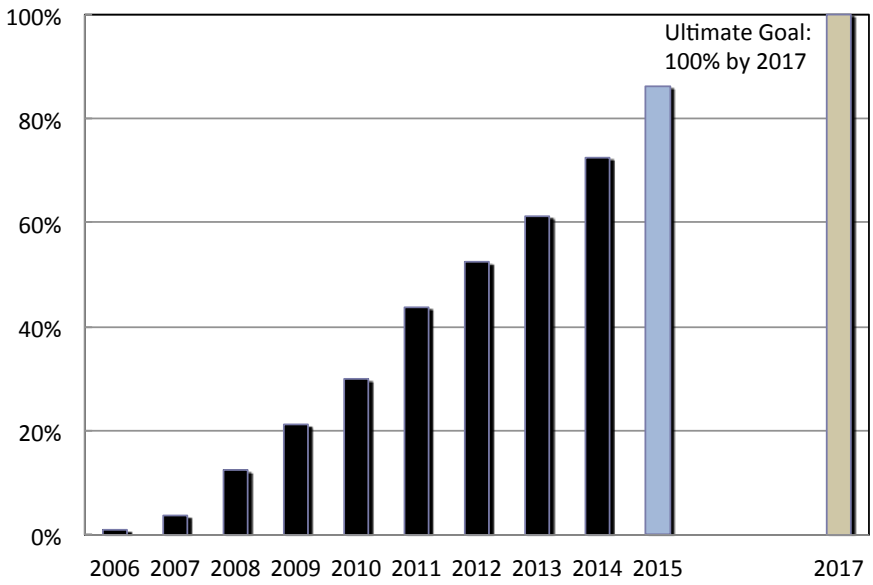
Why is this measure important?

As of 2006, only 18% of Minnesota lakes and 14% of streams were monitored for basic water quality. The information gathered from monitoring is vital in determining if water quality standards to protect public health, recreation and aquatic life are being met.

To gain a better understanding of what was going on with Minnesota waters, as well as assess and monitor a larger number of water bodies, the Watershed Approach was created. This is a more strategic approach to water management.

Using Clean Water Fund dollars, state and local partners do intensive sampling and assessment of lakes and streams in all 80 major watersheds. This allows for better protection of Minnesota's healthy waters, and restoration of the polluted ones.

Cumulative percent of watersheds monitored



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 ten year cycle.

What are we doing?

The approach is a ten year rotational cycle where an average of eight of Minnesota's 80 major watersheds are intensively monitored each year for stream and lake chemistry and biology. These data from monitoring activities determine if thresholds to protect public health, recreation and aquatic life for any number of pollutants, including bacteria, nutrients, and sediment, are being met.

Monitoring on Minnesota's large rivers is also underway. Sampling has occurred on the Mississippi, Minnesota, and Red Rivers to assess the health of the river systems.

Once water quality assessments are made, the monitoring data gathered serves as a starting point in determining the sources and magnitude of pollution reductions needed for polluted waters, or as a baseline to set protection measures for those waters that are not polluted.

What progress has been made?

The first ten year cycle began in 2008 with the goal to be completed in 2018. To date, watershed monitoring is on track:

- 73% of major watersheds are completely monitored
- 11 additional watersheds were monitored in 2015

In 2018, a new cycle begins, which means returning to the watersheds that were monitored ten years earlier.

Re-monitoring lakes and stream sites gives a better understanding of whether water quality has improved, declined or remained the same as practices are implemented and/or land use changes.

Status	Trend	Description
●	→	Steady progress is being made at the pace set in 2008.

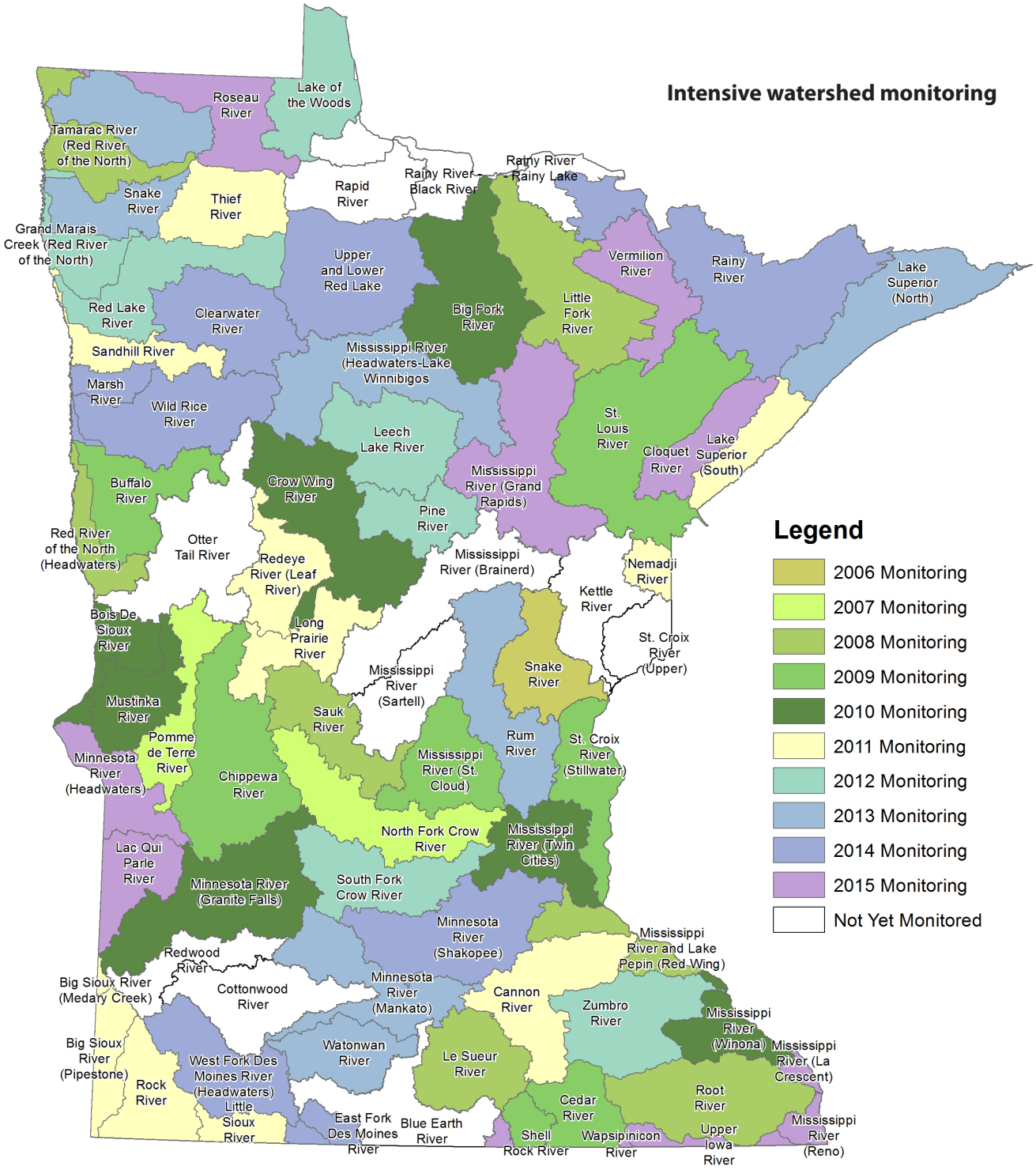
Learn more

- Find more information about this measure and its data at www.legacy.leg.mn/funds/clean-water-fund
- Find your watershed at: www.pca.state.mn.us/water/watersheds
- Learn when the MPCA will be intensively monitoring your watershed: www.pca.state.mn.us/water/watershed-approach-restoring-and-protecting-water-quality

Connection with Minnesota's Clean Water Roadmap

Goals: An 8% percent increase in the percentage of lakes with good water quality, and a 7% increase in the percentage of rivers and streams with healthy fish communities.

This measure will support the Roadmap goals by aiding the targeting of actions to protect and improve water quality. Monitoring changes in environmental conditions provides the information to direct protection and restoration activities in watersheds. Monitoring also measures changes as practices are implemented or as more land is developed.



State's major watersheds intensively monitored through the Watershed Approach through 2015.

Watersheds monitored by local partners

ACTION

Measure: Local partner participation in monitoring efforts

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 and citizen volunteers through two agency-run ambient monitoring grant programs.

The Minnesota Pollution Control Agency (MPCA) alone cannot complete all the monitoring necessary to comprehensively assess Minnesota waters. 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 invites local partners to apply for funding to cover the costs of staff, training, equipment, and lab analysis of condition monitoring. Since 2012, MPCA has focused funding opportunities to those watersheds that are due for condition monitoring under the agency's ten year intensive watershed monitoring cycle, so the efforts of local partners are coordinated with efforts at the state level. In this way, MPCA is ensuring that the most current and comprehensive data set is available for assessment and for the development of protection and restoration plans. 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.

Status	Trend	Description
●	→	Since 2012, all programs have met local participation goals.

Local partners and volunteers play a crucial role in assessing the health of lakes and streams in Minnesota. The Headwaters Science Center (HSC) conducts sampling (top photo) and gives students experience assisting with water quality monitoring efforts (bottom photo). In 2013 the Headwaters Science Center and its affiliated volunteers/schools sampled four stream sites in the Mississippi River Headwaters Watershed.

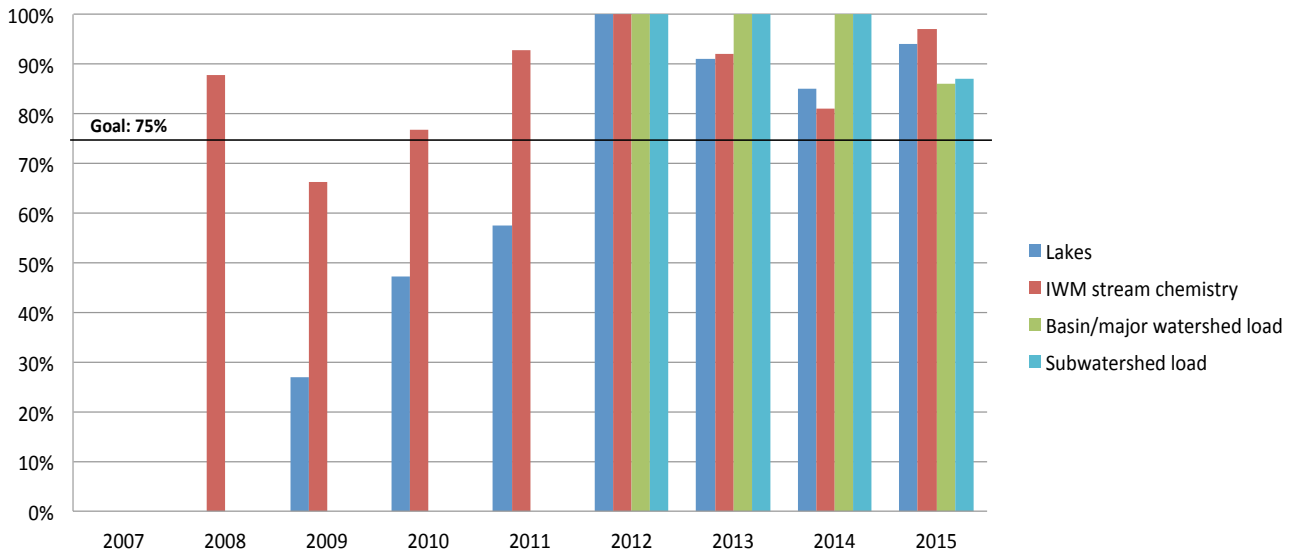
What progress has been made?

Through advertising and expansion of the grant opportunities to include load monitoring, MPCA has met its goal of a minimum of 75% of the sites offered being monitored by local partners.

Learn more

- Find more information about this measure and its data at www.legacy.leg.mn/funds/clean-water-fund
- Find out when the MPCA will be intensively monitoring your watershed: www.pca.state.mn.us/water/watershed-approach-restoring-and-protecting-water-quality
- Surface Water Assessment Grants: www.pca.state.mn.us/water/surface-water-assessment-grants
- Watershed Pollutant Load Monitoring Grants: www.pca.state.mn.us/water/watershed-pollutant-load-monitoring-network#grants

Percent of watershed chemistry monitoring performed by local partners



Connection with Minnesota's Clean Water Roadmap

Goals: An 8% percent increase in the percentage of lakes with good water quality, and a 7% increase in the percentage of rivers and streams with healthy fish communities.

This measure will support the Roadmap goals by aiding the targeting of actions to protect and improve water quality. Monitoring changes in environmental conditions provides the information to direct protection and restoration activities in watersheds. Monitoring also measures changes as practices are implemented or as more land is developed.

Nonpoint source BMP implementation

ACTION

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

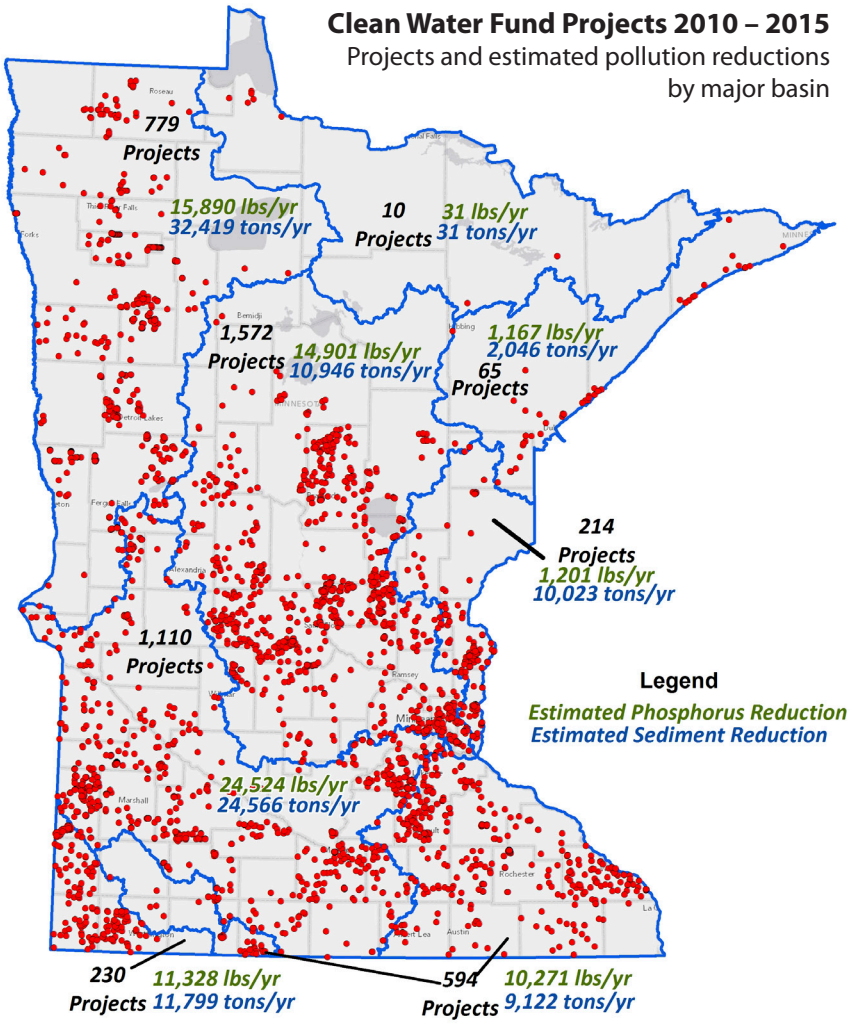
Why is this measure important?

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 governments. 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.

Clean Water Fund Projects 2010 – 2015
Projects and estimated pollution reductions by major basin



This includes only features that were mapped in eLINK. Projects that were reported but not mapped are not reflected. An additional 4,913 lbs/yr phosphorus reduction and 3,727 tons/year sediment reduction were reported for non-mapped projects in eLINK. This map includes project data from Clean Water Funds.

Note: Pollution reductions are estimates only and do not reflect physical measurements.

The Minnesota Agricultural Water Quality Certification Program (MAWQCP) is a voluntary opportunity for farmers and agricultural landowners to take the lead in implementing conservation practices that protect our water. Farmers and landowners who implement and maintain approved farm management practices are certified and in turn obtain regulatory certainty for a period of ten years. Producers interested in becoming certified also receive priority status for technical and financial assistance.

In practice, the MAWQCP brings producers together with local soil and water conservation district staff and agronomy professionals to fix risks to water quality when they are found via a whole-farm assessment.

Estimating the environmental benefit of specific management practices can be done many ways.

The most common are to develop computer models, use values from scientific literature, or base estimates on the best professional judgment of experts. Regardless of the method used, some uncertainty remains in every estimate. As a result, there are several ongoing research efforts to better quantify the environmental benefits of conservation practices.

What progress has been made?

With funding from the Clean Water, Land and Legacy Amendment, the implementation of practices to improve and protect Minnesota's water resources has accelerated as has the completion of TMDL and WRAPS assessments that outline water quality needs. As a result, funding is not keeping pace with demand.

From 2010 to 2015 the Clean Water Fund has:

- Funded more than 630 grants to protect and restore Minnesota water resources.
- Issued more than 620 loans to prevent nonpoint source water pollution or solve existing water quality problems.
- Secured more than 4,790 easements that will permanently protect approximately 6,458 acres along riparian corridors and within well head protection areas.
- Repaired 552 imminent health threat Subsurface Sewage Treatment Systems.
- The Minnesota Agricultural Water Quality Certification Program has certified more than 36,171 acres on 62 farms across Minnesota, adding 176 new conservation practices to the landscape (services are now available statewide after being piloted in four sub-watersheds since June 2014).

In total, more than 4,600 best management and conservation practices have been installed, resulting in a reduction of about 79,000 pounds of phosphorus and 120,000 tons of sediment across the state.

Learn more

- Find more information about this measure and its data: www.legacy.leg.mn/funds/clean-water-fund
- BWSR clean water stories: www.bwsr.state.mn.us/cleanwaterfund/stories/
- AgBMP Loan Program: www.mda.state.mn.us/grants/loans/agbmploan.aspx
- Minnesota Agricultural Water Quality Certification Program: www.mda.state.mn.us/awqcp

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

Connection with Minnesota's Clean Water Roadmap

Goals: An 8% percent increase in the percentage of lakes with good water quality, and a 7% increase in the percentage of rivers and streams with healthy fish communities.

This measure will support the Roadmap goals by tracking reductions in phosphorus and sediment as a result of implementation activities. State-funded nonpoint implementation projects and associated pollutant reductions are tracked and will be analyzed on the major river basin scale.

Municipal infrastructure project implementation

ACTION

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

Why is this measure important?

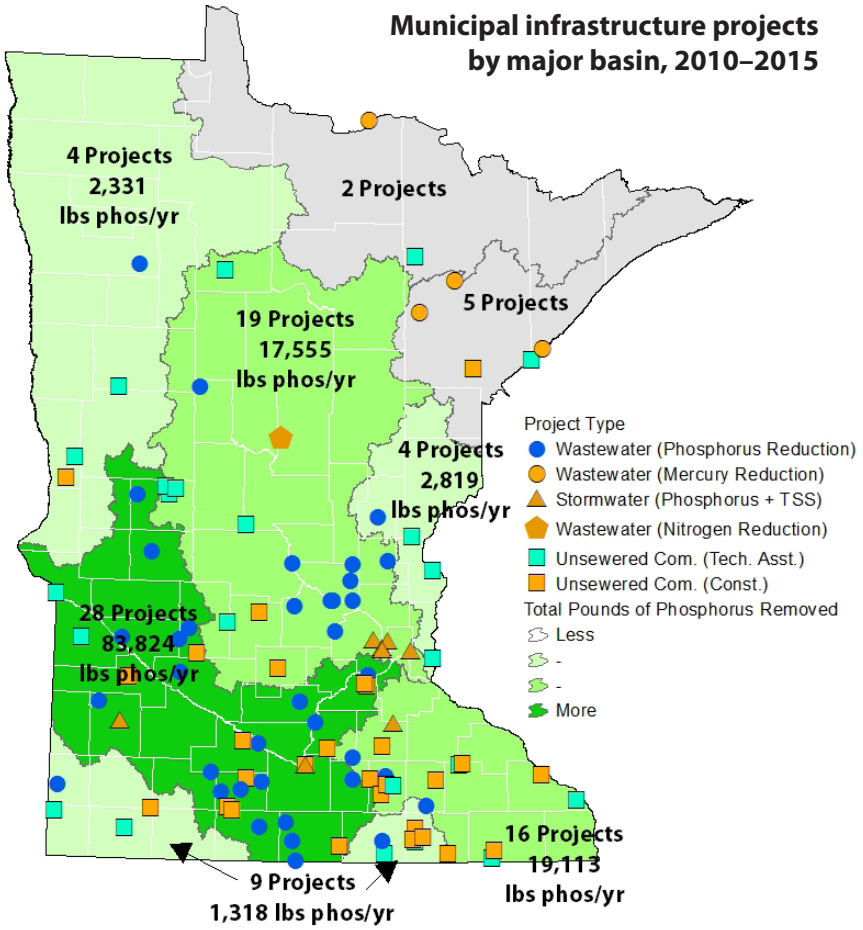
Municipalities across Minnesota are required to replace failing septic systems, upgrade wastewater treatment facilities and increase treatment of stormwater runoff to protect or restore our state's waters. These construction projects help meet required wasteload reductions through implementation of TDMLs, nitrogen discharge limits and Water Quality Based Effluent Limits. These reductions are in addition to the major water quality benefits already achieved by municipalities through ongoing investments in wastewater and stormwater infrastructure.

What are we doing?

Cities are required to implement expensive 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 appropriate.

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

Municipal infrastructure projects by major basin, 2010–2015



What progress has been made?

Since 2010, Clean Water Fund dollars have helped 87 municipalities implement wastewater and stormwater projects, including:

- 30 wastewater construction projects to reduce phosphorus discharges to 1 milligram per liter or less, resulting in a total phosphorus reduction of more than 121,606 pounds per year.
- 4 wastewater construction projects to reduce mercury discharges, resulting in a total reduction of 4,610 milligrams per year.
- 1 wastewater construction project that will provide treatment to reduce nitrogen discharges, resulting in a total reduction of 1,675 pounds per year.
- 7 stormwater construction projects that will reduce phosphorus discharges by 1,358 pounds and total suspended solids by 43,550 pounds per year.
- 24 technical assistance projects to help small unsewered communities identify treatment options to address serious water quality and public health problems from non-complying septic systems.
- 21 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.

Clean Water funding is 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. The number of stormwater project that address phosphorus and total suspended solids are expected to increase in the coming years as a result of Total Maximum Daily Load waste load allocations to cities with a National Pollutant Discharge Elimination System (NPDES) permit. In addition, chloride limits are now being included in NPDES permits if monitoring reports have demonstrated issues.

Phosphorus is a nutrient that causes algae when levels are excessive, impairing the water for aquatic life and recreation. River nutrient standards are rolling out across the state in the coming years, and Clean Water funding will be vital in helping to finance the required treatment upgrades.

Program improvements over the past few years have resulted in streamlining by consolidating programs as well as expanding eligibility for 10 mg/L nitrogen to protect drinking water and aquifers. These modifications have led to an increase in project types as well as accelerating the overall pace of awards.

The Rockford Wastewater Treatment Facility built a chemical feed building as part of its work to reduce phosphorus discharge into the Crow River.

Learn more:

- Find more information about this measure and its data at www.legacy.leg.mn
- Minnesota Public Facilities Authority (PFA): www.mn.gov/deed/pfa
- Minnesota Pollution Control Agency (MPCA): www.pca.state.mn.us/water/wastewater-and-stormwater-financial-assistance

Status	Trend	Description
●	→	Pace of awards is linked to permit cycles and compliance schedules; demand is growing with the improving economy and expanded eligibilities.

Connection with Minnesota's Clean Water Roadmap

Goals: An 8% percent increase in the percentage of lakes with good water quality, and a 7% increase in the percentage of rivers and streams with healthy fish communities.

This measure will support the Roadmap goals by tracking reductions in phosphorus and sediment as a result of implementation activities. State-funded point implementation projects and associated pollutant reductions are tracked through permit limits and will be analyzed on the major river basin scale.

Surface water health

OUTCOME

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

Why is this measure important?

Many Minnesotans want to know if they can swim and fish in their favorite lake or stream. Until recently, a relatively small percentage of lakes and streams had enough water quality information to determine if Minnesota's water goals were being met. In order to determine the health of a waterbody, state agencies need basic water quality information that is obtained through monitoring. Without this basic information, work to develop plans to reverse water pollution and to protect high quality lakes and streams has been delayed.

What are we doing?

Clean Water funding significantly increased water monitoring and assessment activities. In 2008, the MPCA 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 and to develop restoration and protection plans.

What progress has been made?

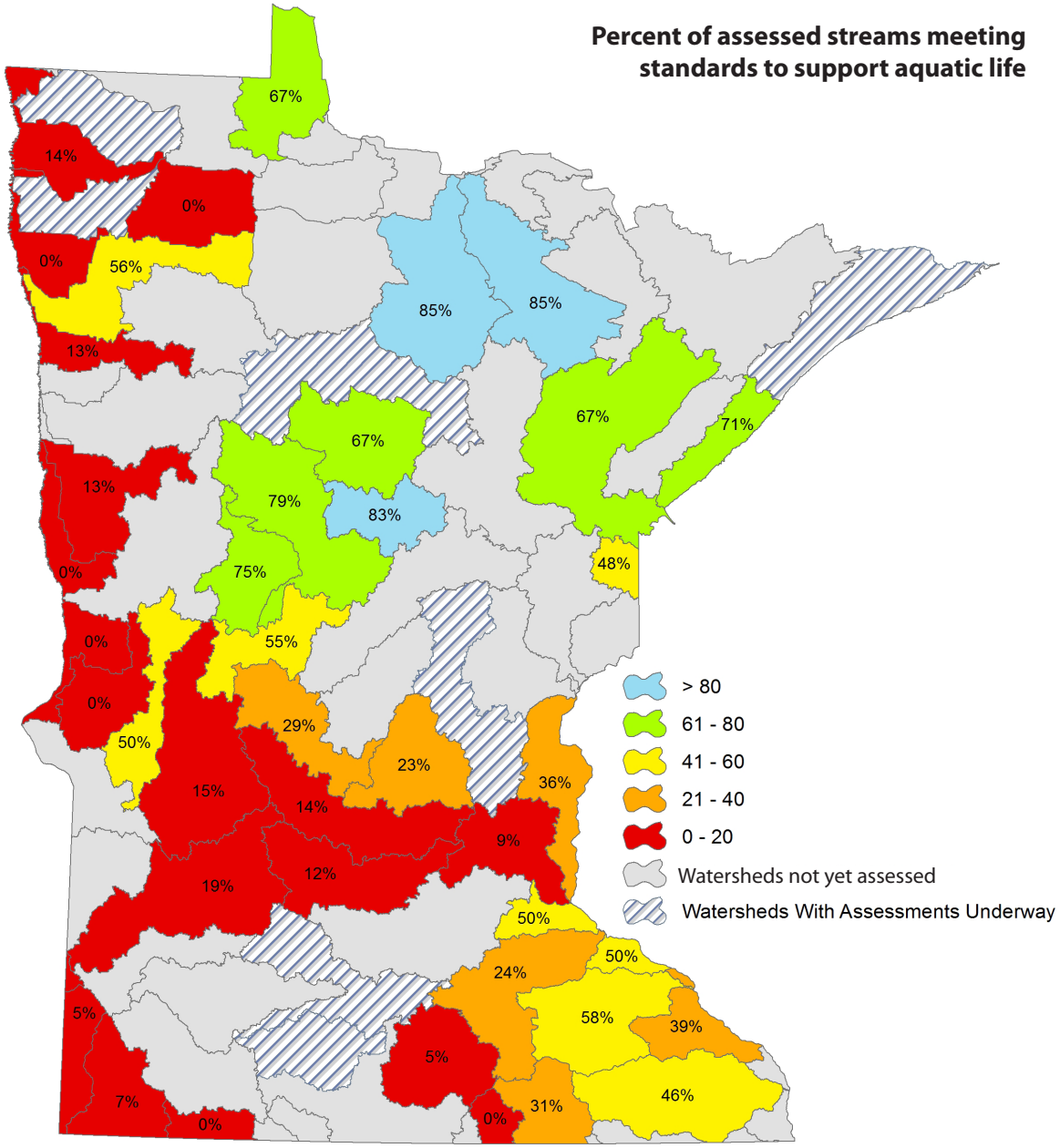
As of June 2015, 49 out of 80 watersheds have been assessed. An additional nine watersheds will be assessed in 2016. The assessment results are located on the MPCA's Minnesota watershed webpage at www.pca.state.mn.us/water/water-quality-condition-monitoring.

MPCA water chemistry crews sample streams and lakes across Minnesota to determine if recreation and aquatic life are supported.

Learn more

- Find more information about this measure and its data at www.legacy.leg.mn/funds/clean-water-fund
- Visit www.pca.state.mn.us/water/watershed-approach-restoring-and-protecting-water-quality to find out when your watershed will be monitored

Status	Trend	Description
▲ Stream/lake swimming	Not enough information for a trend determination at this time.	Water quality varies greatly by region. Watersheds yet to be assessed will influence the statewide impairment/unimpairment rate. It is unclear whether long-term goals will be met.
▲ Stream aquatic life		



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

Lake and stream water quality

OUTCOME

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.

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.

Streams

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

Phosphorus, nitrate, suspended solids 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.

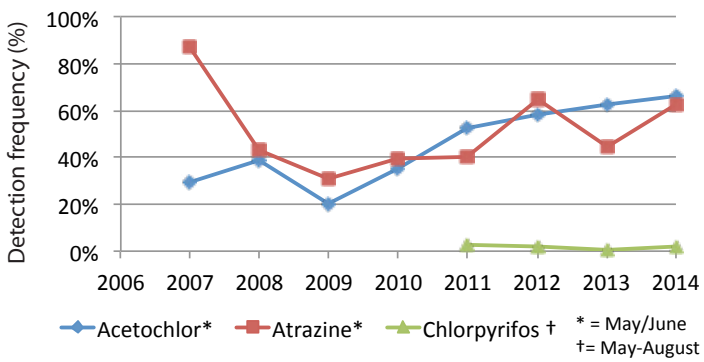
In addition to analyzing data from existing sites, state and local partners are expanding the monitoring network to provide information in new areas or places facing new threats.

What progress has been made?

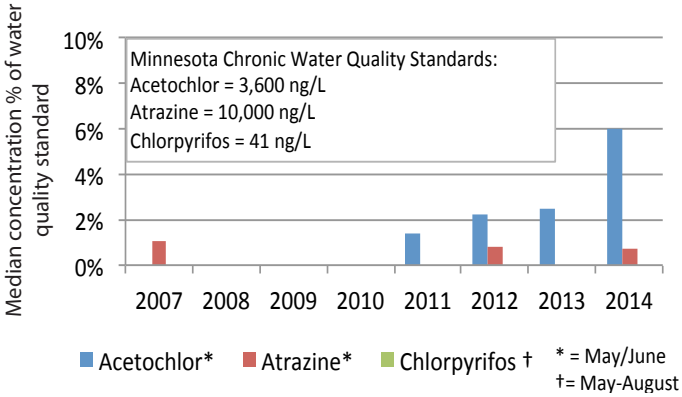
Expansion of the monitoring network is critical to evaluating water quality trends in the state of Minnesota. The following activities are key highlights:

- MPCA's Watershed Pollutant Load Monitoring network began in 2008 and was fully implemented at 200 sites in 2015. Baseline watershed yield information is now available and trend information will be available for selected sites in the 2018 report.
- The MDA has been monitoring for the presence and concentration of pesticides in the state's groundwater and surface water since 1985 and 1991, respectively. In 2010 and again in 2013, MDA expanded its laboratory capability and has the ability to look for over 133 pesticide compounds at very low concentrations.

2006 – 2014 detection frequency of pesticides of concern in surface water statewide



Median concentrations of pesticides of concern in surface water statewide

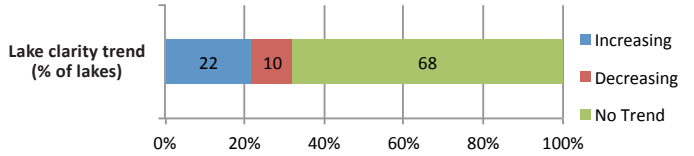


- For more than 17 years, volunteers in the Citizen Lake and Stream Monitoring programs have collected lake and stream water clarity information. These volunteer programs are vital in gathering data for long-term trend analyses.
- The MPCA participated in the National Aquatic Resources Surveys for lakes, including a partnership with MDA for pesticide work, and conducted state probabilistic surveys for streams, rivers, and wetlands, providing baseline information.
- More than half of the watersheds have been comprehensively monitored providing baseline data for assessments and a starting point for future trends. The second ten year rotation of intensive watershed monitoring begins in 2018.

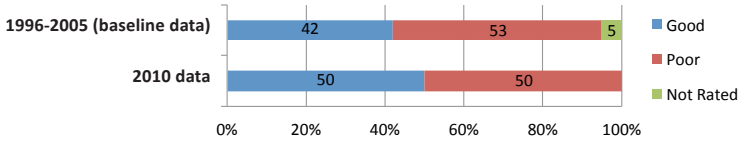
Though it's tempting to make sweeping statements, most often the story is a complicated mix of seeing improvements in some aspects of water quality and declines in others.

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. See www.legacy.leg.mn/funds/clean-water-fund.



Trends in lake water clarity between 1973 and 2014. 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. Water clarity has stayed the same in two-thirds of the lakes presented here.



Fish community health in streams is best in the northeast and southeast, and gradually declines moving toward the west and southwest. These data provide a baseline from which to measure change.

Status	Trend	Description
● Lake clarity	Not enough information for a trend determination at this time.	Lake clarity: There are improving trends in lake water clarity in more lakes than not.
▲ Stream fish		Stream fish: Fish community health varies greatly by region, but statewide percents of poor vs. good fish community health are similar.
▲ Pesticides in streams		Pesticides in streams: Detections in streams vary greatly as a result of hydrologic and agronomic conditions; concentrations above water quality standards are rare.
▲ Pesticides in lakes		Pesticides in lakes: Detections in lakes vary by region; detections in lakes have been well below water quality standards.

Waters restored

OUTCOME

Measure: Number of previous impairments now meeting water quality standards due to corrective actions

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 from several years to decades to complete, but there are many examples of impaired waters that have been restored.

Beaver, Carver, Keller, and Battle Creek lakes near St. Paul, MN

What are we doing?

Pollution problems are initially identified through water quality monitoring, followed by studies and plans to determine what corrective actions 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).

Keller Lake was successfully restored and removed from the Impaired Waters List.

What progress has been made?

Ultimately, the target is to restore all impaired waters in Minnesota. The Minnesota Pollution Control Agency (MPCA) began listing impaired waters in 1992; since that time 36 previously impaired lakes and river segments are now meeting water quality standards due to corrective actions.

One notable success story is the restoration of Beaver, Keller, Carver, and Battle Creek lakes in the Ramsey-Washington Metro Watershed District (RWMWD). The lakes were added to the impaired waters list—Beaver, Keller and Battle Creek lakes in 2002 and Carver Lake in 2008 – as result of nutrients entering the lakes through stormwater runoff.

Due to corrective actions, the lakes were removed from the impaired waters list in 2014. This was accomplished through the implementation of many lake management plans by local partners, which directed and focused the restoration efforts for the lakes. Specific plan elements

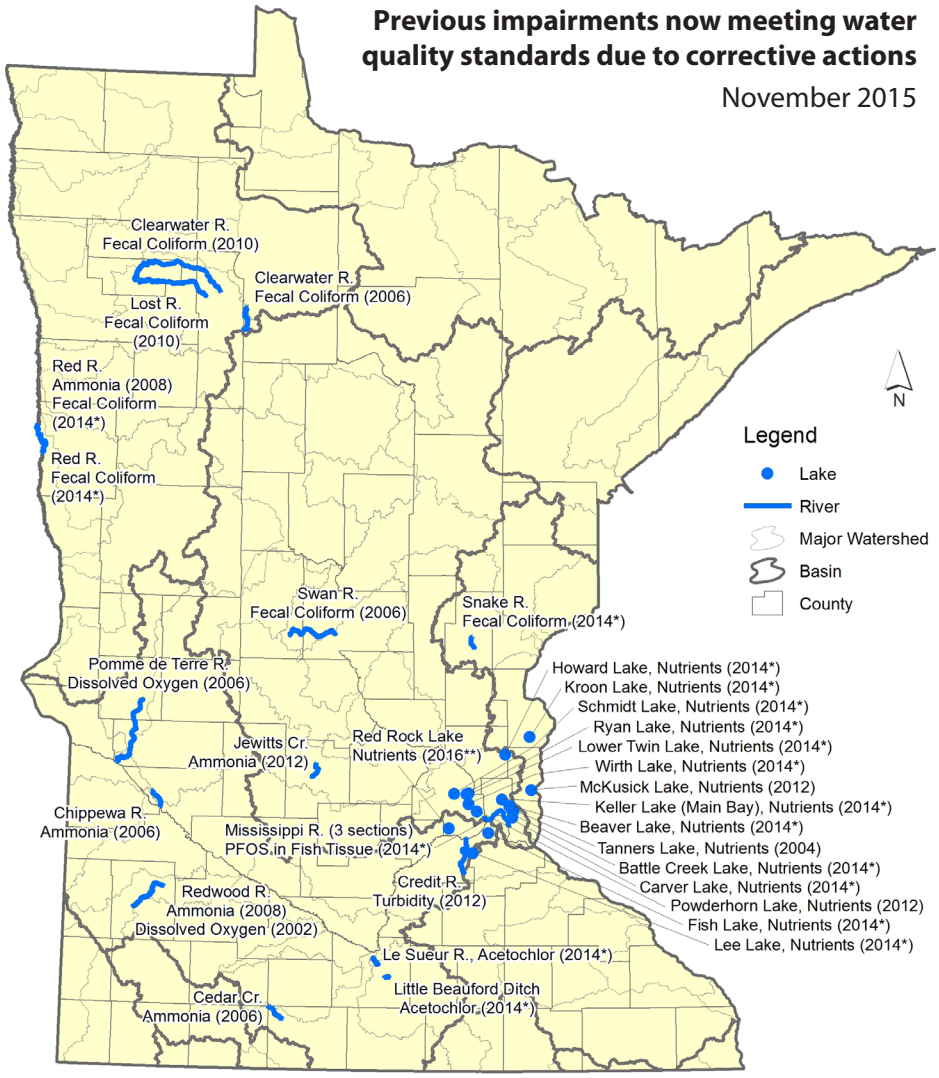
included implementing BMPs, stricter stormwater treatment standards, and the adoption of the Volume Reduction Strategy in 2006 by the RWMWD. The strategy protects water quality by requiring that construction projects greater than 1 acre retain 90% of stormwater runoff from impervious surfaces.

Many other waters are improving

In most cases, the 36 success stories depicted on this map are the result of several years of diligent efforts at the local level both prior to and with Clean Water funds. However, the map does not give a sense of the many lakes and streams making restoration progress. Examples include Lake Volney and Shaokotan Lake, both southern Minnesota lakes that have realized considerable improvements in recent years. Work ranging from restoring wetlands and stabilizing streambanks to addressing septic system and feedlot issues has resulted in improved 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.

Previous impairments now meeting water quality standards due to corrective actions

November 2015



** Proposed during the 2014 listing cycle. Currently under review for EPA approval.*

*** To be proposed by MPCA for delisting in the 2016 cycle. List is subject to change.*

Learn more

- Find more information about this measure and its data at: www.legacy.leg.mn/funds/clean-water-fund
- Find your watershed at: www.pca.state.mn.us/water/watersheds
- Lake Shaokotan: www.pca.state.mn.us/news/lake-shaokatan-prairie-lake-improving-water-quality
- Lake Volney: www.pca.state.mn.us/water/meet-our-volunteers

Status	Trend	Description
■	→	Although many projects are making progress in improving water quality, more waterbodies are being listed as impaired relative to the slower rate of waterbodies being restored.

Mercury trends

OUTCOME

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

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, the state 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 about 150 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), Minnesota Department of Health (MDH), and U.S. Forest Service provide input on where samples should be collected. The Department of Agriculture's (MDA) laboratory analyzes the samples.

Decades of monitoring have shown that:

- Most fish contain some mercury
- The average mercury level generally increases from south to north in Minnesota
- Panfish have lower mercury levels than top predator fish

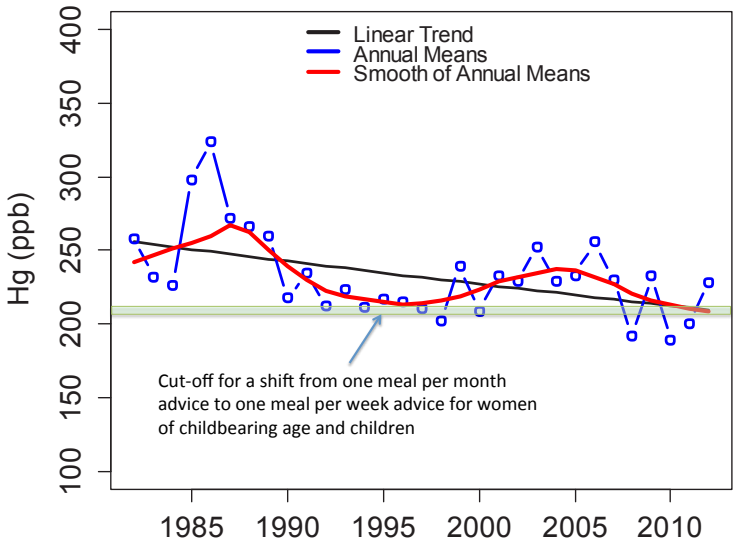
These data are the basis for MDH statewide guidelines for eating fish. Sampling previously tested waters to look for trends in fish-mercury levels has been a priority in the last two decades.

What progress has been made?

From 1982 to about 1996, the state observed a clear downward trend in mercury concentrations in northern pike and walleyes. The trend reversed in the 1990s and continued to rise until 2007. Since then, levels are decreasing again (see chart below). The linear trend over 31 years (1982-2012) has been a decrease of 0.7% per year. Current mercury concentrations shown below are approaching the point where fish consumption advice for women of childbearing age and children would change from one meal per month to one meal per week. However, this change in consumption guidelines for northern pike, walleye and other predator fish depends on sustained significant reductions in mercury. The fish mercury trend analysis will be updated in 2018 and every five years thereafter.

To achieve the necessary reductions of mercury in the fish, Minnesota's Statewide Mercury TMDL established a goal of a 93% reduction in mercury input from all human sources. Minnesota receives 90% of its mercury pollution from outside the state. Rapid economic growth in Asia and India since 1990 has contributed to increased global emissions of mercury, despite mercury emissions in North America and Europe being cut to half since 1990.

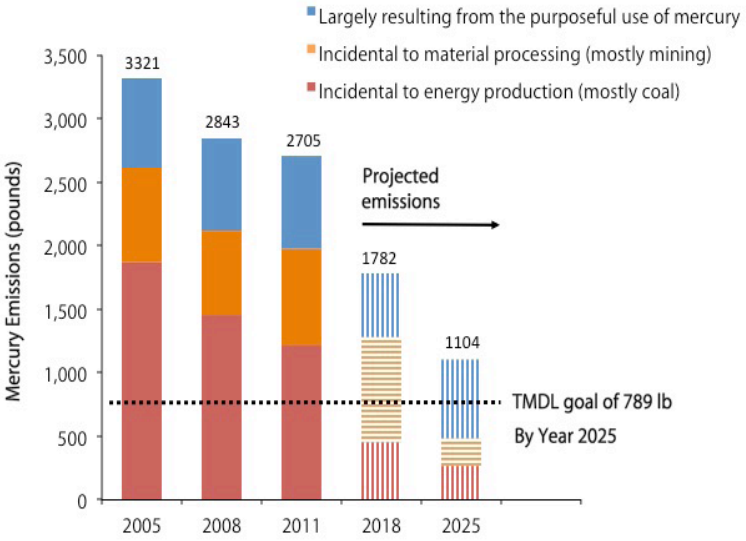
Trend of mercury in northern pike and walleye from Minnesota lakes



The United Nations Environment Program is negotiating reductions among all countries of the world. Minnesota is doing its part, and has taken significant steps towards achieving the identified mercury air emission reductions. Mercury emissions in Minnesota have decreased by more than 70% since 1990 due to efforts such as removing mercury from latex paint, requiring mercury controls on municipal waste combustors, and banning small onsite incinerators, mercury in batteries, and disposal of mercury-containing products.

To reach the 93% reduction goal, air emissions of mercury from all sources in Minnesota must be reduced to 789 pounds per year (Figure 2). Minnesota's Statewide Mercury TMDL Plan has set a strategy and timeline to achieve that goal by 2025.

The graphic at right shows dramatic mercury emission reductions from the coal-fired electric power generation sector between 2005 and 2018. The reductions account for the Mercury Reduction Act of 2006 including power plant conversions from coal to natural gas. The non-ferrous mining sector's emissions are expected to increase by 2018 as new facilities come on line and mercury control technology is tested. New controls for mercury emissions at non-ferrous mining facilities are expected to be in place before 2025. Emissions inventory numbers for 2018 and 2025 are based on calculated projections, while the dotted black line represents the emissions goal for 2025. Reductions are needed from the category named "Largely resulting from the purposeful use of mercury" in order to meet the overall goal. This sector includes mercury containing products such as fluorescent lamps, mercury switches, dental amalgam, thermometers, etc. MPCA continues to focus reduction efforts on mercury in products which impact the emissions within this category.



Mercury emissions from Minnesota sources; 2005 and 2008 are based on measured and calculated inventories.

Learn more

- Mercury research and reduction initiative: www.pca.state.mn.us/quick-links/mercury-research-and-reduction-initiative
- Fish Consumption Advice: www.health.state.mn.us/divs/eh/fish/ (MDH) www.dnr.state.mn.us/lakefind/index.html (DNR)
- Mercury TMDL: www.pca.state.mn.us/water/statewide-mercury-reduction-plan
- UNEP Mercury Emissions Inventory: www.unep.org/chemicalsandwaste/Mercury/tabid/434/Default.aspx

	Status	Trend	Description
Mercury in fish	▲	↗	Mercury in game fish over the last 30 years shows an improving trend despite large fluctuations during shorter periods, demonstrating the need for long-term and consistent monitoring.
Mercury emissions	▲	↗	Significant progress has been made reducing mercury emissions from power plants and is expected from the mining sector. To meet Minnesota's 2025 emissions goal, further reduction of mercury use in various products will be necessary.

Municipal wastewater phosphorus trend

OUTCOME

Measure: Municipal wastewater phosphorus discharge trend

Why is this measure important?

Reducing phosphorus in their discharges continues to be a significant challenge for Minnesota's municipal wastewater treatment facilities. This measure shows trends in the amount of phosphorus being discharged these 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.

What are we doing?

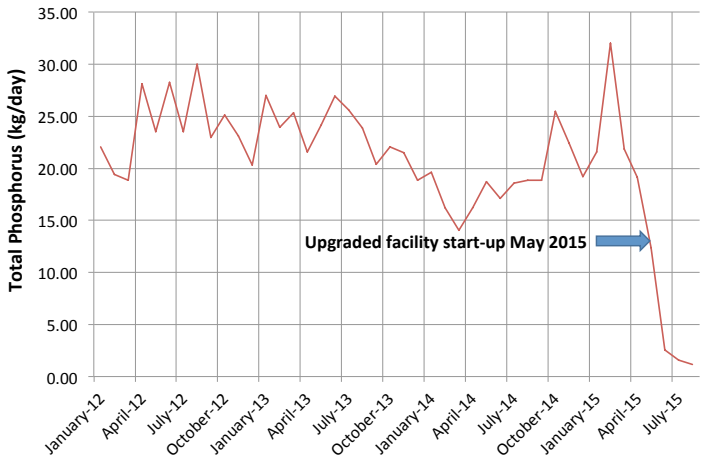
Regulatory policies implemented over the past 15 years (see graphic next page) have resulted in less phosphorus discharged by wastewater treatment facilities. The treatment plant improvements needed to achieve these reductions are expensive, particularly for smaller cities. Clean Water funds have helped cities invest in the infrastructure needed to meet phosphorus reductions by Total Maximum Daily Load studies and Water Quality Based Effluent Limits (WQBEL).

Since 2010, $20 million in Clean Water Fund grants have helped 30 municipalities finance wastewater treatment upgrades to meet required phosphorus reductions. These grants leveraged an additional $56 million in other funding for these infrastructure improvements. Clean Water Fund grants help cities implement these treatment improvements on an expedited time schedule.

What progress has been made?

Over the past 15 years, municipal wastewater phosphorus discharges statewide have decreased by 70%. Overall, efforts have led to a steady decline of phosphorus pollution and major improvements in water quality. Implementation of newly adopted river nutrient standards is expected to drive further reductions in wastewater phosphorus loads in coming years.

In 2015 the Cambridge Wastewater Treatment Facility upgrades reduced phosphorus discharge to the Rum River by 92%.



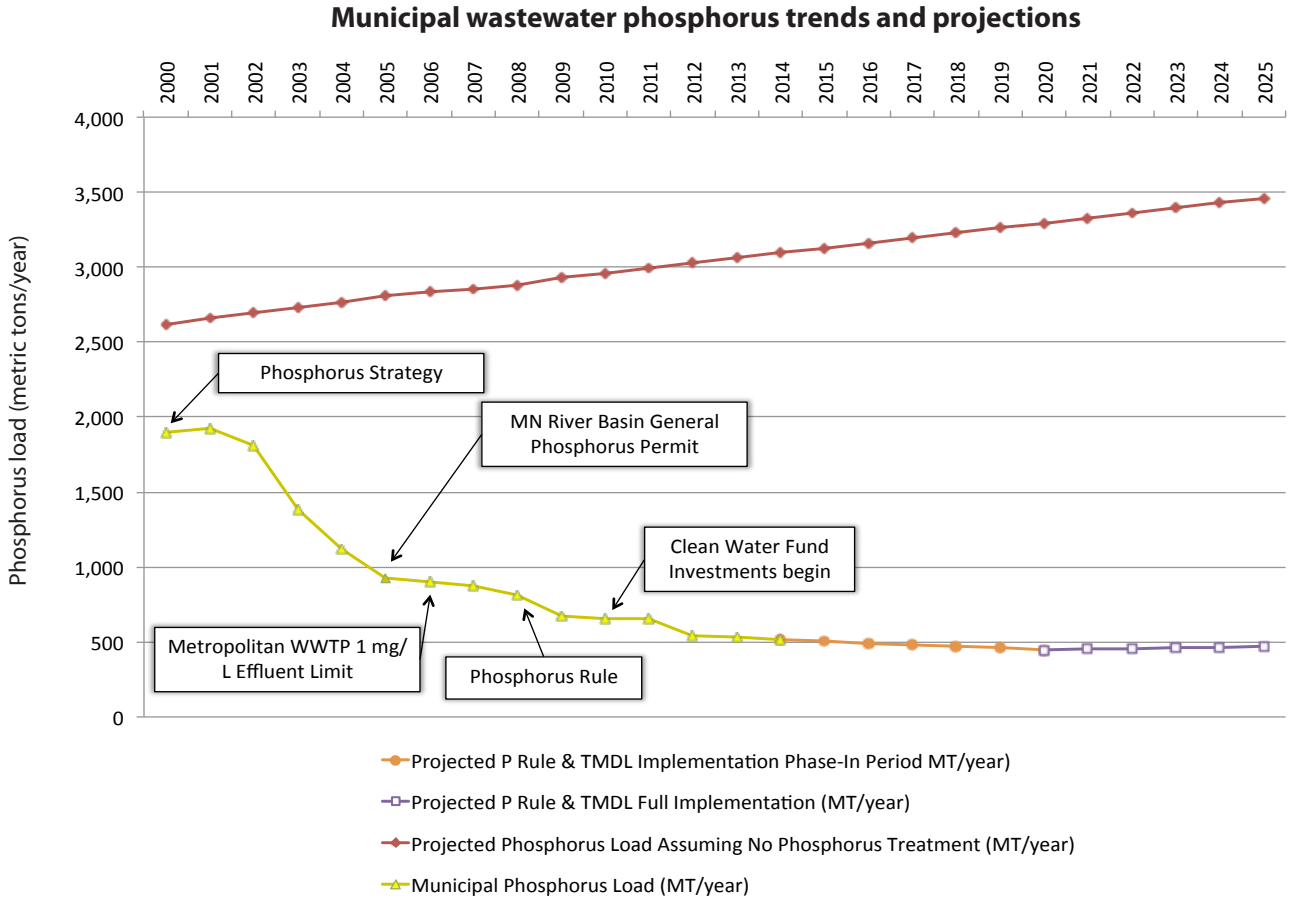
Cambridge Wastewater Treatment Facility phosphorus load

Learn more

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

- www.legacy.leg.mn/funds/clean-water-fund
- www.bwsr.state.mn.us/cleanwaterfund/
- www.mda.state.mn.us/protecting/cleanwaterfund.aspx

Status	Trend	Description
●	↗	Significant phosphorus load reductions have been achieved through regulatory policy, infrastructure investments, and improved technology. Further reductions will continue to be challenging and expensive as small systems receive limits and tighter discharge permits.



Estimated statewide reductions in phosphorus from municipal wastewater treatment facilities since the year 2000 and projections of future reductions based on current permitting policies, implementation of Total Maximum Daily Load (TMDL) requirements , and Clean Water Fund Investments.

Drinking and groundwater measures

The 11 measures contained on pages 36-59 illustrate important Clean Water Fund-supported actions and outcomes undertaken to protect Minnesota's drinking water supplies.

Actions

1. Source water protection plans
2. Source water protection grants
3. Nitrate monitoring and reduction by local partners
4. Contaminants of emerging concern
5. County geologic atlases
6. Long-term monitoring network wells
7. Unused groundwater wells sealed
8. Groundwater quality

Outcomes

9. Source water quality for community water supplies
10. Nitrate concentrations in new wells
11. Groundwater levels

Source water protection plans

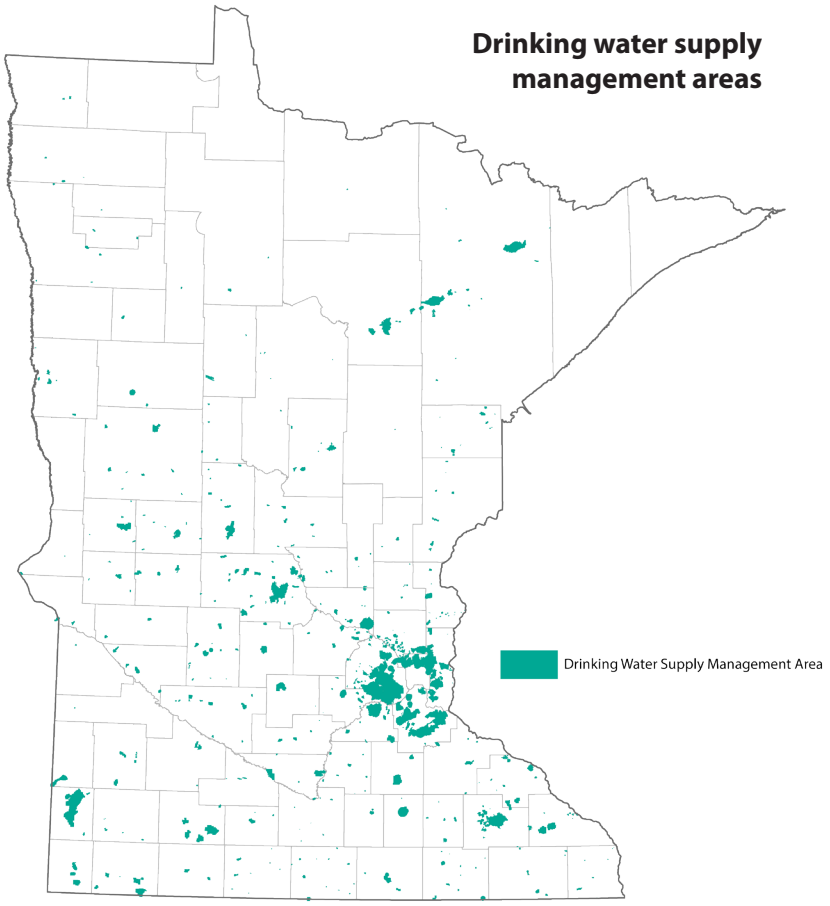
ACTION

Measure: Number of community water supplies assisted with developing source water protection plans

Why is this measure important?

Source water refers to water from streams, rivers, lakes, or aquifers that is used for drinking water. Source water protection is a science-driven planning and implementation process to prevent contaminants from entering a public water supply at levels that could negatively impact human health. Successful source water protection activities have many benefits:

- Human health is protected.
- Costs are reduced; the cost of pollution prevention is less than the cost of remediation.
- Risk is reduced; property owners are less likely to become responsible parties liable for contaminating a source of public drinking water.
- Sustainable water supplies are ensured for future generations' health and economic needs.
- Approved source water protection plans are recognized as local water resource plans and can be used to obtain grant funding for implementation activities.



There are 1.22 million acres of drinking water supply management areas in Minnesota.

What are we doing?

Source water protection plans are required for all community and some non-community public water systems that use groundwater. Some systems that use surface water have voluntarily developed source water protection plans.

The plans protect the source of drinking water by identifying the land area that supplies water to the well or intake, assessing the vulnerability of that area to contamination, and identifying appropriate land and water resource management strategies.

The map to the right shows all the protection areas across the state that are managed by public water systems with approved wellhead protection plans. This totals about 1.22 million acres, of which about 350,000 acres are particularly vulnerable (less than 0.5% of total land area of the state).

What progress has been made?

MDH is working toward the goal of engaging all vulnerable community systems in source water protection planning by 2020. There are 963 community systems in the state, 505 of which are vulnerable – or at higher risk for contamination. Targeting high-risk, high-population systems addresses the greatest public health need.

The Clean Water Fund has accelerated source water protection plan development efforts since its inception. As of the end of FY15, the following metrics provide a snapshot of program performance:

- 438 community public water systems with source water protection plans in place, covering more than 85% of the population served by all community public water supplies in the state.
- 62 and 64 source water protection plan approvals in FY14 and FY15, respectively.
- 104 public water supply systems engaged in first time plan development effort; an additional 104 public water systems are engaged in amending existing plans.

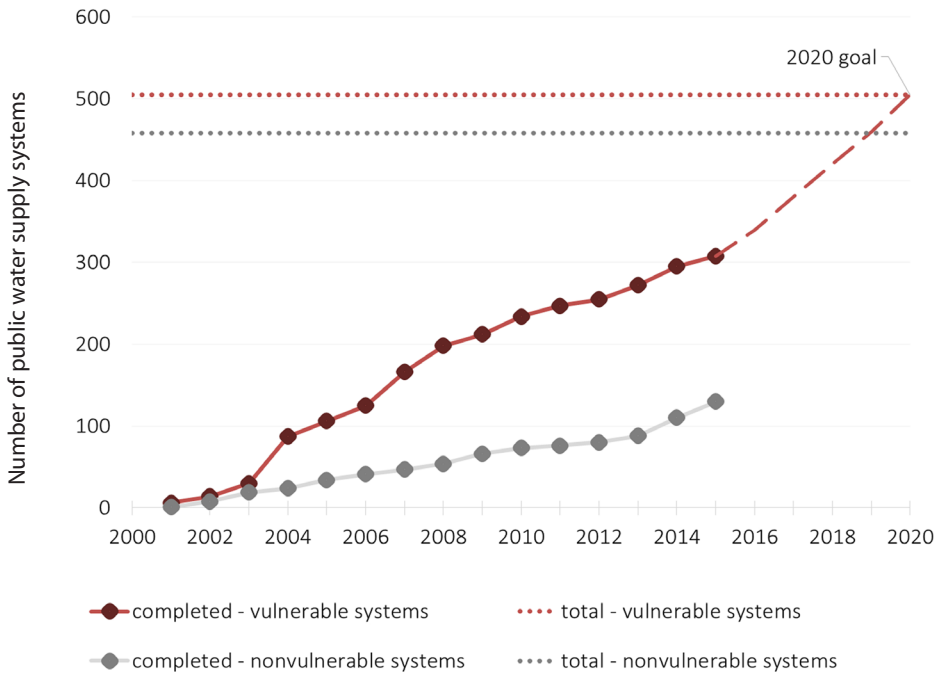
The chart shows the progress of source water protection efforts for community public water systems in Minnesota. Wellhead protection plans are implemented for ten years. Minnesota's Wellhead Protection Rule requires plans to be amended every ten years to address current issues and concerns. Plan amendments comprised about 33% of staff workload at MDH in 2015.

Learn more

- About source water protection at: www.health.state.mn.us/divs/eh/water/swp/index.htm

Status	Trend	Description
▲	↗	Met target for FY14-15. On track to meet long-term target of every vulnerable community public water system engaged in source water protection by 2020.

Minnesota vulnerable and non-vulnerable community public water systems engaged in wellhead protection – FY 2001-2015



Connection with Minnesota's Clean Water Roadmap

Goals: 20% decrease in nitrate levels in groundwater, 50% decrease in the number of new wells that exceed arsenic drinking water standard.

This measure will support the Roadmap goals by identifying actions that will prevent nitrate and arsenic contamination of groundwater sources of drinking water. These plans include information that public water suppliers need to know, including the area on the land surface that contributes water to the well, potential sources of contamination, and steps that can be taken to prevent contamination.

Source water protection grants

ACTION

Measure: Number of grants awarded for source water protection

Why is this measure important?

"An ounce of prevention is worth a pound of cure" is certainly true when it comes to protecting sources of drinking water. Minnesota uses a series of strategic safeguards to protect drinking water from source to tap. In this economically challenging time, modest grants, sometimes matched with other funds, can enable local water suppliers to take actions proven to protect the source of their drinking water.

What are we doing?

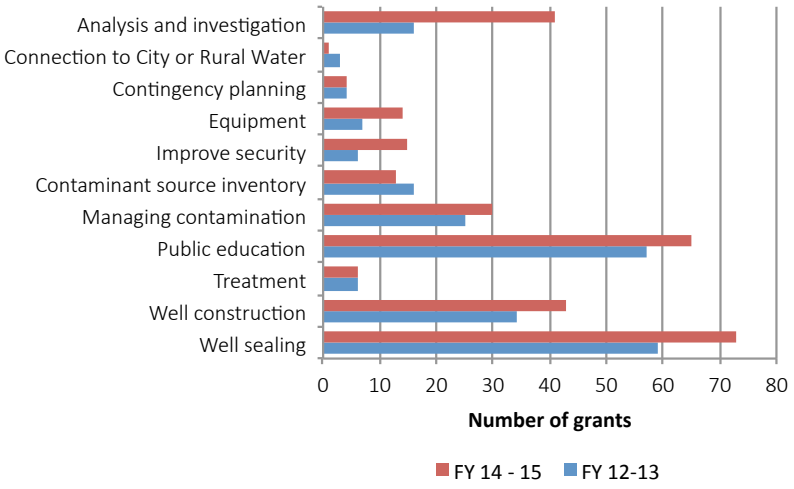
Public water suppliers work with the Minnesota Department of Health and community stakeholders to identify source water protection strategies in wellhead protection plans (groundwater), intake protection plans (surface water), and other documentation.

What progress has been made?

Individual public water supply systems are expected to implement 75% or more of the strategies in their source water protection plan. Prior to the Clean Water Fund, no financial assistance was available for implementation of source water protection plans. Source water protection grants remove financial obstacles that interfere with implementation efforts. The goal is to increase the reach of the grants program and involve more public water supply systems in a broad range of implementation efforts. Demand for grants to implement source water protection plans continues to grow.

Since inception of the Source Water Protection Grant program, more than $2.8 million has been distributed statewide for local, community-based implementation efforts to safeguard and secure drinking water supplies.

Source water protection grant activities



Learn more

- About source water protection grants at www.health.state.mn.us/divs/eh/water/dwp_cwl/grants/index.html
- Protection grant information for applicants at www.health.state.mn.us/divs/eh/water/swp/grants/index.html

Status	Trend	Description
●	↗	Increased funds accelerate implementation of proven strategies for source water protection.

Nitrate monitoring and reduction by local partners

ACTION

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

Why is this measure important?

Nitrate-nitrogen is one of the most common pollutants in Minnesota's groundwater. In some areas of the state, a large number of private wells can have 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 from 0-3 milligrams per liter (mg/L). Human activities can raise the level of nitrate in groundwater. The drinking water standard for nitrate is 10 mg/L, because above this level nitrate can negatively affect human health, specifically infants under 6 months of age.

Groundwater is most vulnerable to nitrate contamination in the central and southeastern regions of Minnesota. Areas in central Minnesota are vulnerable because of widespread sandy soil. Southeast Minnesota counties are 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 more 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.

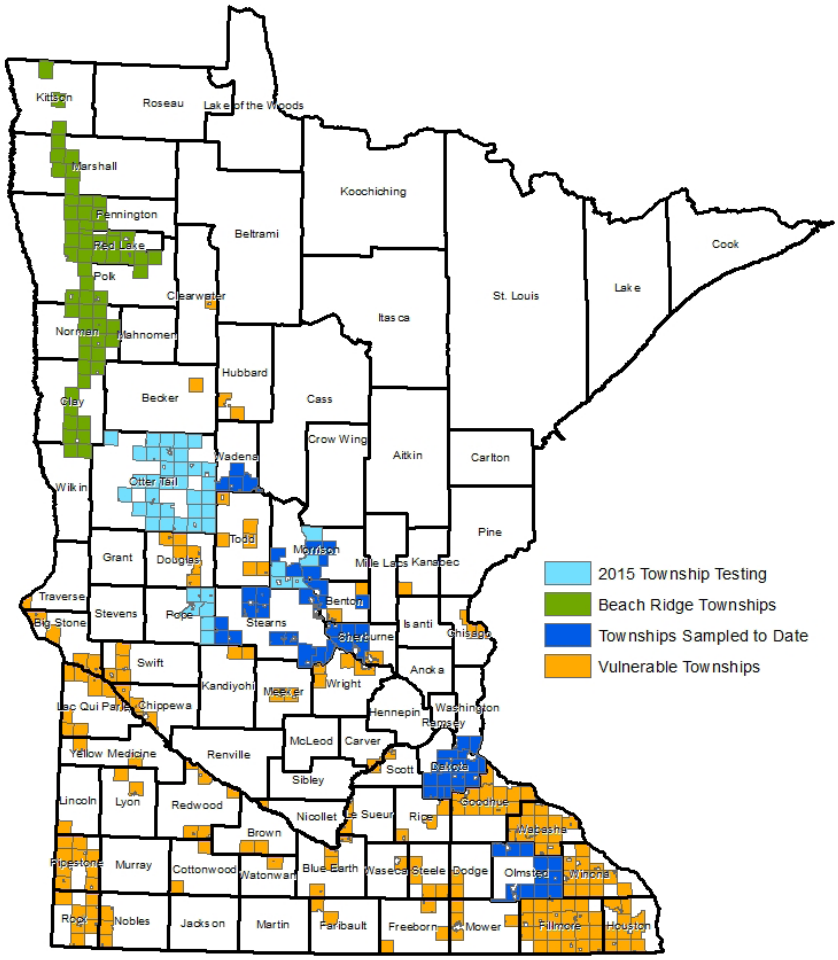
What are we doing?

The Minnesota Department of Agriculture (MDA) focuses its work in areas where there is nitrate contamination of groundwater from nitrogen fertilizer use. It is working with 25 local partners on nitrate monitoring and reduction projects. In general, the MDA provides technical support and the local partners provide coordination and contribute knowledge, skills and expertise about local issues.

This profile focuses on two of those activities – private well testing and irrigation management. The goal of these activities is to increase knowledge and awareness about nitrate issues and foster a greater willingness by farmers to adopt and maintain best management practices.

Township Testing Program

The MDA designed a Township Testing Program to determine current nitrate concentrations in private wells on a township scale. The MDA identified townships throughout the state that are vulnerable to groundwater contamination and have significant row crop production (see map). These are the areas prioritized for private well testing.



The MDA plans to offer nitrate testing to up to 70,000 private well owners, within about 280 townships, between 2014 and 2019.

Results from all wells that participate in a township are summarized and help guide the type of response necessary to address nitrate in groundwater.

Irrigation Management in Central Minnesota

The MDA has partnered with the East Otter Tail Soil and Water Conservation District to carry out a series of irrigation workshops and expand programs that promote proper water and nitrogen fertilizer management. The irrigation workshops build knowledge and awareness of local nitrate issues and build capacity to address current and future concerns.

Partners have hosted nine irrigation workshops in central Minnesota. These are well attended workshops that have received positive feedback on evaluations. More than 87% of participants indicated they gained information at the event that would help them manage water use in the coming year.

The MDA also supports an On Farm Nitrogen Management Program for farmers to compare and evaluate practices that may help to reduce nitrate losses from fields. Management changes focus on nitrogen rates and timing. This education and outreach is in response to an expansion in the number of acres of irrigated agriculture in the region. This program is offered by the East Otter Tail SWCD with financial support from the MDA.

What progress has been made?

Township Testing Program

About 105 townships in 10 counties were sampled by the end of 2015. Counties that have participated include Benton, Morrison, Wadena, Dakota, Stearns, Sherburne, Olmsted, Washington, Otter Tail, and Pope. While monitoring alone does not yield changes in environmental conditions, it does provide the information necessary to direct protection and restoration activities. Local data are essential when talking about groundwater contamination, and promoting nitrogen best management practices. It is the starting point for all implementation activities.

Attendees at an irrigation workshop participate in an activity for determining soil moisture by hand.

Irrigation Management in Central Minnesota

Attendance at winter irrigation workshops has grown annually with more than 350 individuals attending since the first workshop in 2011. The workshops help create critical connections among producers, conservation professionals, University of Minnesota Extension and state agencies. These connections can increase the capacity of individuals to adopt behaviors that improve water quality.

The On Farm Nitrogen Management Program has grown steadily since it began in 2011. More than 260 fields have enrolled across five counties. Over the life of the program 90% of participants report they have made a nitrogen management change. These numbers are a strong indication that the information provided by the program is having an impact on farmers' behavior.

The East Otter Tail SWCD has been an exceptional partner to help deliver these programs and expand groundwater protection in this region. The willingness of the board, manager, and staff to expand their outreach in the agricultural arena and take on local ownership has been paramount to the success of this programming.

Learn more

- Township Testing and the Nitrogen Fertilizer Management Plan: www.mda.state.mn.us/nfmp
- Irrigation Outreach and On Farm Nitrogen Management in Central Minnesota: www.mda.state.mn.us/protecting/cleanwaterfund/gwdwprotection/irrigationworkshops.aspx

Status	Trend	Description
●	↗	New local partnerships continue to be established for nitrate-nitrogen monitoring and reduction activities.

Connection with Minnesota's Clean Water Roadmap

Goals: 20% decrease in nitrate levels in groundwater, 50% decrease in the number of new wells that exceed arsenic drinking water standard.

This measure will support the Roadmap goals by tracking partnerships that support nitrate reduction activities in the most vulnerable areas of the state. Nitrate testing in private wells provides information to target protection and restoration activities. Private well testing allows for change to be measured, as programs and practices for managing nitrogen fertilizer are implemented.

Contaminants of emerging concern

ACTION

Measure: Number of new health-based guidance values for contaminants of emerging concern

Determining how much of a chemical is safe to drink over a lifetime is an essential step in ensuring our drinking water protects people's health.

Why is this measure important?

Individuals and industry use tens of thousands of chemicals in a vast array of products and applications, including household products and cleaners, personal care products, medications, and manufacturing ingredients. Frequently, Minnesotans hear news about chemicals being found in our lakes, rivers, and groundwater.

Often, chemicals we never suspected end up in places we never expected. Every year new chemicals are developed and existing chemicals are being used in new ways. The science and technology required to detect and measure contaminants in the environment has also improved, giving us new information about which chemicals are in the environment and at what levels. For many of these contaminants, it is unknown how much is safe to drink, raising questions and causing uncertainty among Minnesotans. The Minnesota Department of Health (MDH) seeks to answer these questions by evaluating the safety of contaminants of emerging concern in drinking water.

What are we doing?

MDH develops health based-guidance for contaminants of emerging concern that tell Minnesotans the level of a contaminant (parts per billion in water) that can be consumed in drinking water with little or no health risk. For each contaminant reviewed, a citizen-friendly information sheet is published that describes the contaminant and the health-based guidance value, how Minnesotans might be exposed, and action that can reduce exposure. MDH conducts or awards contracts for special projects intended to fill information gaps so that MDH can evaluate and communicate about chemicals even when the science and available data are still emerging.

Partnerships have been formed with other state agencies, including the Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Agriculture (MDA), to help these agencies evaluate the results of their water monitoring studies. MPCA is monitoring for contaminants of emerging concern in Minnesota surface waters and groundwater using Clean Water Fund dollars.

MDH Health-Based Guidance Values FY14-15
micrograms per liter (µg/L) in water

Chemical Name	Guidance
Acrylamide (flocculent)	0.2 µg/L
Bisphenol A (BPA) (plasticizer)	20 µg/L
Chlorpyrifos (pesticide)	0.6 µg/L
Chlorpyrifos-oxon (pesticide degradate)	0.4 µg/L
Desvenlafaxine (pharmaceutical)	20 µg/L
Di (2-ethylhexyl) phthalate (DEHP) (phthalate)	7 µg/L
Isobutanol (solvent and biofuel)	300 µg/L
Nonylphenol (detergent degradate)	20 µg/L
Triclosan (antimicrobial)	50 µg/L
Venlafaxine (pharmaceutical)	10 µg/L

What progress has been made?

Through the end of FY14-15, 91 chemicals were nominated to the MDH Contaminants of Emerging (CEC) Program through a nomination process open to all Minnesotans. Some nominated chemicals are ineligible for CEC review because there is insufficient data for a review or because those chemicals will be reviewed by a different program within the agency. In FY14-15, information was compiled for 21 newly nominated chemicals and a few previously assessed chemicals for which new information was available. Chemicals are evaluated based on the best available toxicity and exposure data. Factors included in the toxicity evaluation are:

- The chemical's potency
- The severity of associated health effects
- Other concerns, such as carcinogenicity

Factors included in the exposure evaluation are:

- The likelihood of the chemical to be present in drinking water
- The volume of the chemical that is produced and/or released
- Any available monitoring data

Based on the results of the toxicity and exposure evaluation or due to program need, 10 contaminants were selected for full review or re-review in FY14-15 and health-based guidance was developed for each.

In FY14-15, rapid assessment values for pesticides and pharmaceutical water screening values were developed from a shortened assessment process that uses alternative methods, limited data, or less review than is used for developing other MDH health-based guidance. Such assessment methods allow scientists to more quickly evaluate a large group of contaminants with similar information (such as that available on drug labels and pesticide registrations). These assessments are intended to be more protective (i.e. lower) than other MDH health-based guidance. There are currently rapid assessments for 167 pesticides and water screening values for 119 pharmaceuticals.

These assessments may have specific purposes. For example, the pharmaceutical water screening values are not definite estimates of risk, but can be used to:

- Prioritize contaminants for development of health-based guidance values (full review by MDH)
- Guide environmental monitoring efforts
- Inform the development or refinement of laboratory analytical methods to measure contaminants in water
- Provide health context to levels of contaminants detected in the environment

Learn more

- Find more information about this measure and its data at www.legacy.leg.mn/funds/clean-water-fund
- MDH Contaminants of Emerging Concern (CEC) program information: www.health.state.mn.us/cec

Status	Trend	Description
●	→	Met target for FY14-15. On track to meet goal of 10 guidance values developed each biennium.

County geologic atlases

ACTION

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

Why is this measure important?

Minnesotans rely on groundwater for drinking water as well as industrial and agricultural uses. Spring-fed wetlands, streams and lakes – and the plants and animals that call them home – depend on upwelling of groundwater too. Groundwater and surface water are linked, forming a large, interconnected water system. While surface water is easy to observe and monitor, the groundwater part of the system is more challenging. Because it lies beneath the surface and can't be seen, understanding groundwater requires specialized study of geology (underground soils and rock) and aquifers (layers of permeable rock and soil materials that hold water that can be extracted from a well). In many parts of Minnesota, these studies have not been completed. The DNR is charged with ensuring long-term sustainable use of Minnesota's groundwater. This means allowing for human uses while ensuring enough groundwater to sustain surface waters and future generations. Without good information, managing this important resource is challenging.

A county geologic atlas is a series of maps and accompanying explanation that describe the location and size of an area's aquifers and other important information like direction of water flow, sensitivity to pollution, and connection to surface water resources. Atlas information is used in planning and environmental protection efforts at all levels of government. Source water protection and well-sealing programs are examples of local programs that need geologic and groundwater information. Other typical uses include providing information for permit applications and plans, along with emergency response to contaminant releases.

This measure tracks the extent to which information about both geology and aquifers in county geologic atlases is available in Minnesota.

What are we doing?

County geologic atlases are a cooperative effort between the Minnesota Geological Survey (MGS) and DNR. The MGS completes Part A (geology) which is followed by DNR completing Part B (groundwater). Funding for the work comes from multiple sources and has varied over time. The Clean Water Fund supports enhanced research to improve the quality of county geologic atlases and to accelerate their completion in areas where they are needed most. Individual counties self-select for completing a county geologic atlas by making a commitment to provide in-kind services such as locating wells from Minnesota Department of Health well records. Counties may also provide a cash match.

What progress has been made?

So far, 22 county geological atlases have been completed, representing 17.9% of the state (63.2% of the population) and 24 more are underway representing 32.5% of the state (24.3% of the population). Four older atlases are being revised. The first County Geologic Atlas, Scott County, was revised by the MGS in 2006. As is shown in the figure on the next page, the Minnesota Geological Survey has finished the geological assessments in 11 counties where the DNR is now conducting the groundwater portion of the assessment.

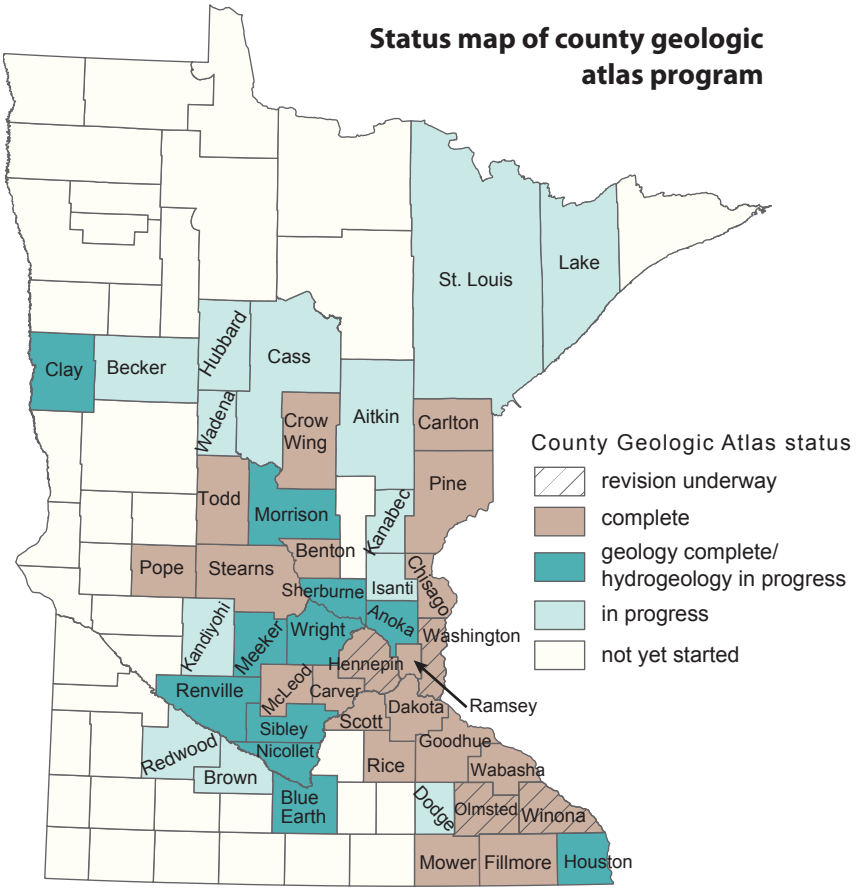
The long-term goal is to complete a county geologic atlas for every county in Minnesota. Before Clean Water Legacy funding, one or two county atlases were completed per year. The new Clean Water Legacy funding is accelerating the effort and supporting expanded collection of detailed data for atlases. At the current level of funding, county geologic atlases should be completed for the remaining 41 counties in 10 to 15 years.

Status	Trend	Description
●	↗	Significant progress has been made. Counties continue to step up to participate but substantial work remains before all counties are done.

Learn more

- Find more information about this measure at: www.dnr.state.mn.us/waters/groundwater_section/mapping/index.html
- Point of Contact: Stephen Thompson, P.G., Supervisor, Hydrogeology and Groundwater Unit, stephen.thompson@state.mn.us

Status map of county geologic atlas program



Connection with Minnesota's Clean Water Roadmap

Goal: Less than 10% of sites affected by groundwater pumping will have declining trend in groundwater levels

This measure will support the Roadmap goals by tracking Minnesota's progress toward every county having comprehensive descriptions of geology and groundwater. County geologic atlases provide critical information for regulating groundwater pumping so that its availability is sustainable with no long-term declines.

Long-term monitoring network wells

ACTION

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

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.

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. Aquifer levels are being monitored in 958 wells, an increase of 45 wells since the last Performance Report. An estimated 7,000 wells are needed to adequately monitor levels across the state.

The Minnesota Pollution Control Agency manages a statewide network of about 250 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 volatile organic compounds. The agency is still adding wells to the network, which will have about 275 wells when complete.

The Minnesota Department of Agriculture (MDA) also manages a network of 127 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.

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

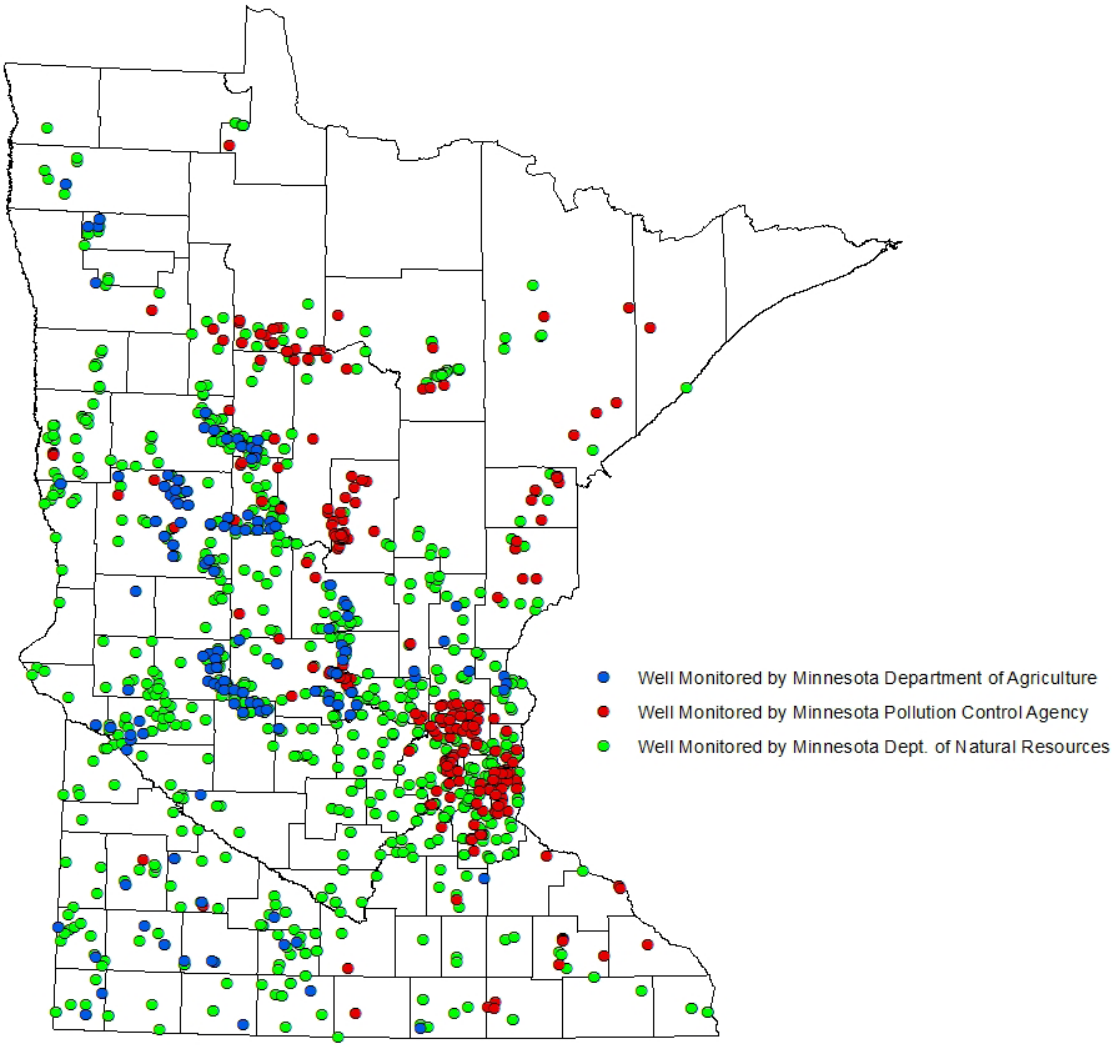
What progress has been made?

The current statewide groundwater monitoring network includes 1,239 wells. The ultimate goal is a network of approximately 7,400 state-owned and managed long-term groundwater monitoring wells.

Information from the long-term monitoring network has been used to target Clean Water Fund investments in high-priority areas. For example, MDA has developed a strategy to fill gaps in the long-term monitoring network by partnering with private well owners to monitor about 70,000 wells over the next six years in an additional 280 townships.

Learn more:

- Information on activities funded by the Clean Water Fund: www.legacy.leg.mn/funds/clean-water-fund
- MPCA groundwater monitoring and assessment: www.pca.state.mn.us/water/condition-groundwater-monitoring
- DNR groundwater level monitoring program: www.dnr.state.mn.us/waters/groundwater_section/obwell/index.html
- MDA monitoring & assessment: www.mda.state.mn.us/chemicals/pesticides/maace.aspx



Connection with Minnesota's Clean Water Roadmap

Goal: Less than 10% of sites affected by groundwater pumping will have declining trend in groundwater levels.

This measure will support the Roadmap goals by tracking long-term monitoring well networks that measure progress in reducing nitrate and avoiding arsenic in groundwater used for drinking water. Sampling results from these established networks, along with volunteer private well networks and related studies, also advance scientific understanding of nitrate and arsenic concentrations across Minnesota.

Unused groundwater wells sealed

ACTION

Measure: Number of unused groundwater wells sealed

Why is this measure important?

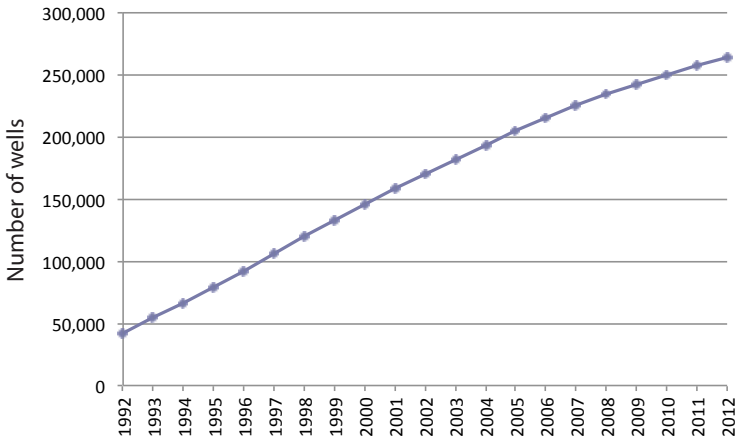
Unused wells that have not been properly sealed can be a source of groundwater contamination, potentially threatening the quality of the water in wells that provide city water, wells that serve local businesses, and private wells that serve individual homes. Groundwater is the main source of drinking water for three out of every four Minnesotans.

A well may be taken out of service for a variety of reasons:

- It may no longer operate properly or provide enough water
- May have become contaminated
- Has been replaced by extension of public water supplies

A well that is no longer in use needs to be properly sealed to protect groundwater and drinking water supplies.

Wells sealed in Minnesota (cumulative)



The layers of rock and soil that lie between an aquifer and the land surface, or between aquifers, typically act as natural barriers against the spread of contamination. However, an unused, unsealed well can provide an open channel between the surface and an aquifer or between a shallow aquifer and a deeper aquifer, allowing contaminants to reach an uncontaminated aquifer.

What are we doing?

Wells are sealed under a variety of circumstances every day. More than 250,000 wells have been sealed in Minnesota since 1974. Clean Water Funds provide an incentive for sealing unused wells. Funds for sealing private wells were made available as part of the Board of Water and Soil Resources (BWSR) Clean Water Fund Competitive Grant program in FY14. These funds were awarded to local governments so they can provide a 1:1 matching grant to well owners to seal their unused wells. Priority is given to sealing wells in areas near public water supply wells; large diameter, multi-aquifer wells; and wells in areas with known groundwater contamination.

FY15 Clean Water Funds were provided directly to well owners as a 1:1 match to seal unused public water supply wells. These wells are typically larger and deeper than private wells and can be much more expensive to seal. They can also pose a significant threat to public water supplies as they are usually located near active public water supply wells.

What progress has been made?

More than 170 wells private wells were sealed with the FY14 funds and 15 unused public water supply wells with FY15 funds. Ultimately the goal is to seal all unused wells in Minnesota.

Learn more:

Find information on this measure at:
www.health.state.mn.us/divs/eh/wells/sealing/index.html

Status	Trend	Description
●	↗	While Minnesota leads the nation in the number of sealed wells, continued effort is needed to address the estimated 250,000 to 500,000 unused, unsealed wells remaining.

Groundwater quality

OUTCOME

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.

What are we doing?

The Minnesota Department of Agriculture (MDA) samples groundwater wells in urban and rural agricultural settings. MDA water samples are analyzed for many pesticides 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.

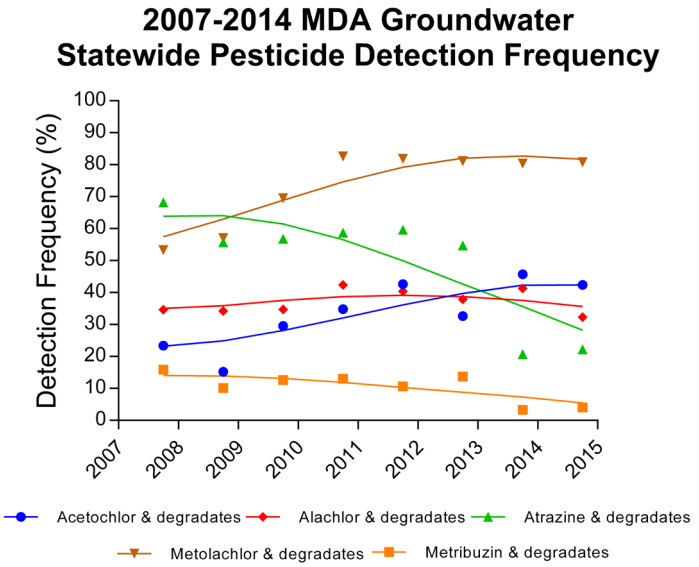
The Minnesota Pollution Control Agency (MPCA) samples a network of wells primarily in urban settings that measure ambient (or background) conditions for a large number of non-agricultural chemicals, including nitrate, chloride, volatile organic compounds, and emerging contaminants. The network is focused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

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

What progress has been made?

Since 1985, the MDA has continuously improved its groundwater monitoring program. The MDA is currently sampling more than 160 monitoring wells, naturally occurring springs, and private drinking water wells throughout the state. In 2013-2014, no samples exceeded the health risk level for any pesticides. Although concentrations remain below health risk levels, 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.

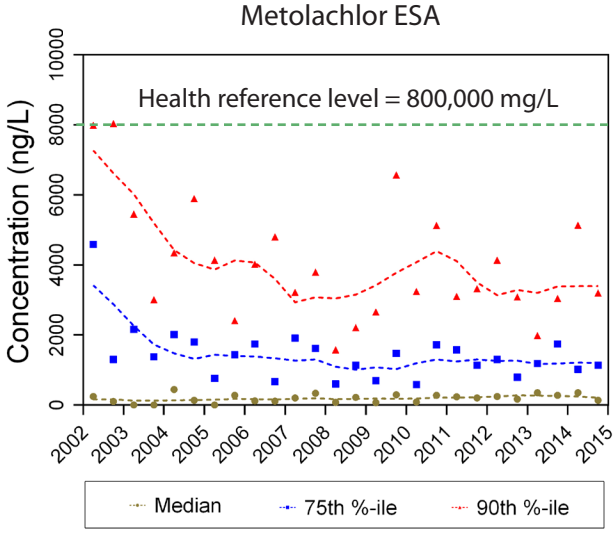
Currently, the frequency of detection of alachlor, atrazine, and metribuzin appear to be declining, while the frequency for acetochlor and metolachlor appears to be stable after increasing in recent years.



This is an example of results from the MDA's monitoring program and displays the trends in the statewide levels of common detection compounds and their degradate concentrations over time.

Pesticide Monitoring in Central Sand Plain
2002 - 2015

Metolachlor ESA



Metolachlor ESA (a Metolachlor degradate) was the most commonly detected pesticide compound in 2014. Concentration time-trend data for Metolachlor ESA is presented using the median, 75th percentile, and 90th percentile concentration values for 2002 through 2014. The median values indicate no trend in concentrations over time. The 75th and 90th percentiles have shown a decline since 2002, but have been relatively stable since 2005. This data set represents Pesticide Monitoring Region 4 (PR4) in the Central Sand Plain.

The MDA's groundwater monitoring program was not designed to determine nitrate concentration status and trends. To most accurately determine nitrate trends across the state, the MDA relies on regional and township monitoring programs.

In 2008, the Southeast Minnesota Water Resources Board and several partners (MPCA, MDA and MDH) began collecting data from a volunteer nitrate monitoring network. This region was selected as a pilot 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 2012, 3,245 samples have been analyzed for nitrate and an average of 10.7% of the wells exceeded the drinking water standard (10 mg/L). The percentage of wells exceeding the drinking water standard for each sampling round ranged between 7.6 and 14.6 %. This work continues as an ongoing effort.

In 2011, the MDA began a volunteer monitoring network in 14 counties in Central Minnesota (an area of the state with sandy soil that is vulnerable to nitrate contamination). 2014 results are similar to previous years with less than 3% of the 550 wells tested having nitrate levels above 10 mg/L standard.

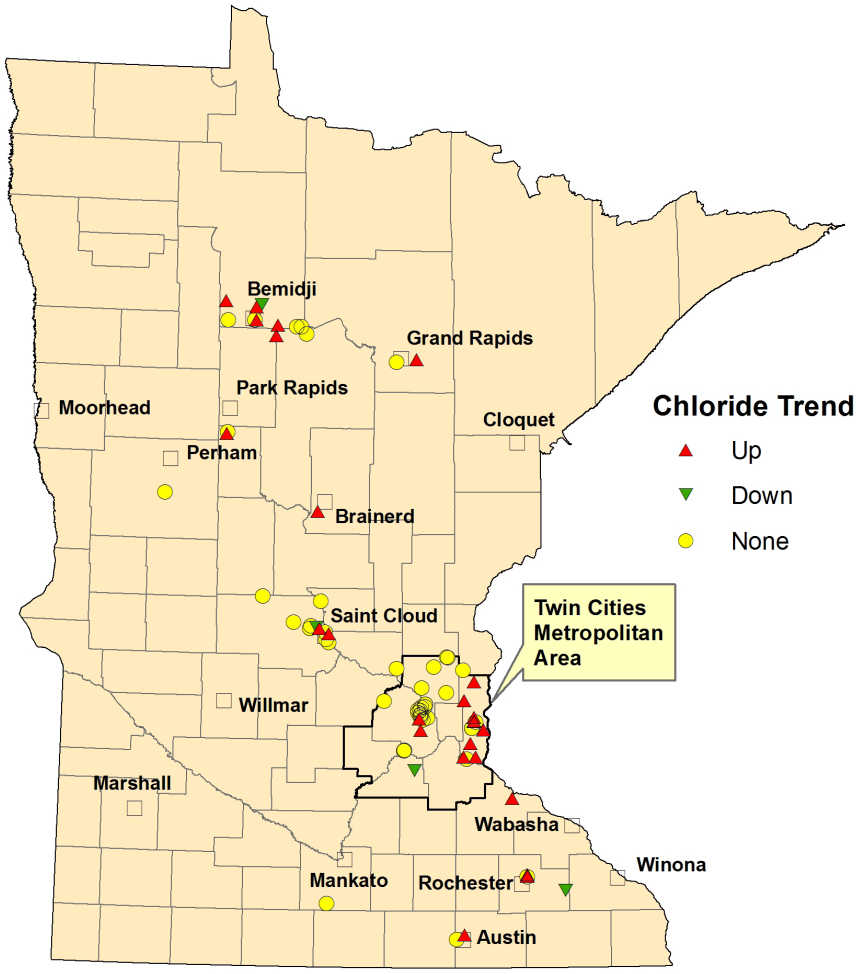
	Status	Trend	Description
Pesticides	▲	→	Variable trends for five common pesticides indicate a mixed signal. Low levels are still frequently detected in vulnerable groundwater.
Nitrate-Nitrogen statewide	▲	Not enough information for a trend determination at this time.	In many areas, drinking water aquifers are not vulnerable to surficial contamination. Wells may have low levels of nitrate-nitrogen. In some areas it can be a significant concern.
Nitrate-Nitrogen Central Sands	■		A significant percentage of wells from the township testing program exceed the drinking water standard for nitrate in localized sensitive areas in the Central Sands.
Nitrate-Nitrogen southeast region	▲■		In one county with considerable karst geology, two of 11 townships in the township testing program had more than 10% of wells exceed the drinking water standard for nitrate.

In 2013, the MDA began sampling private wells on a township scale as part of the Township Testing Program. To date the MDA has sampled private wells in 58 townships in eight 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. To date more than 8,000 wells have been sampled and 13% of the wells have nitrate exceeding the drinking water standard, although this can be much higher in some townships. In 2015, 44 additional townships were sampled, but those results are not yet available.

The MPCA is continuing progress on enhancing its ambient groundwater monitoring network to track trends in groundwater quality. Since 2010, about 150 new monitoring wells were added to the network, which now includes more than 250 wells.

The MPCA's monitoring has discovered that salt, likely from de-icing pavement, contaminates many of Minnesota aquifers, especially in the Twin Cities Metropolitan Area (TCMA). Too much chloride (a part of salt) makes drinking water taste salty and the state's streams, lakes, and wetlands unsuitable for certain types of aquatic life. Since 2004, the MPCA has tested more than 650 wells across the state for chloride. This work documented that the sand and gravel aquifers in the TCMA were contaminated and had concentrations as high as 8,900 mg/L. This is almost 40 times greater than the amount recommended by the U.S. Environmental Protection Agency for drinking water, and 27% of the wells tested in the TCMA exceeded this limit.

The map at right shows the trends in chloride contamination across the state.



Chloride concentration trends in the state's ambient groundwater, 1987-2014.

Learn more

- MDA's Pesticide Monitoring and Assessment: www.mda.state.mn.us/chemicals/pesticides/
- Central Sands Private Well Network: www.mda.state.mn.us/centralsandsnetwork
- Township Testing Program: www.mda.state.mn.us/townshiptesting
- MDA and MPCA groundwater data portal (Environmental Data Access or EDA): http://cf.pca.state.mn.us/data/edaGwater/index.cfm#

Connection with Minnesota's Clean Water Roadmap

Goals: 20% decrease in nitrate levels in groundwater, 50% decrease in the number of new wells that exceed arsenic drinking water standard.

This measure will support the Roadmap goals by tracking long-term monitoring well networks that measure progress in reducing nitrate and avoiding arsenic in groundwater used for drinking water. Sampling results from these established networks, along with volunteer private well networks and related studies, also advance scientific understanding of nitrate and arsenic concentrations across Minnesota.

Source water quality for community water supplies

OUTCOME

Measure: Changes over time in source water quality used for community water supplies

Why is this measure important?

Minnesotans use both surface water and groundwater as sources for drinking water. When this source water (raw, untreated water) does not meet the standards of the Safe Drinking Water Act, community water suppliers add treatment to make the water safe to drink.

Testing the raw water before it goes through a treatment process is one measure of our efforts to protect drinking water at the source, whether it's surface water or groundwater. Understanding the source water quality and chemistry also improves our understanding of groundwater aquifers, variables that might affect the treatment process, and the potential for pollutants to contaminate the source water.

What are we doing?

On a regular basis, a community water supplier or a Minnesota Department of Health (MDH) engineer submits treated water to a certified laboratory to be tested for more than 100 contaminants. Although there is no similar requirement for testing the source water, testing is often done to determine the suitability of the source or what type of treatment may be necessary.

In the 1980s, MDH conducted a baseline study to understand source water quality statewide. From 2010-14, the General Water Chemistry Project provides a current overview of source water quality statewide. The study focused on source water from 919 groundwater systems and 41 surface water systems with testing for more than 25 contaminants. Future monitoring is essential to better understand trends in human-made contaminants.

An initial look at the data shows a strong correlation between nitrate in groundwater in Minnesota and:

- Chlorides
- Iron and manganese
- Strontium
- Dissolved oxygen
- Oxygen reduction potential

Although this study is not funded by the Clean Water Fund, the study provides data about the condition of source waters and will measure the effectiveness of other activities financed through the Clean Water Fund, such as wellhead protection planning and nitrogen reduction practices in agriculture.

80% of Minnesota residents rely on public water systems instead of private wells. Public water systems supply our homes, schools, hospitals and workplaces.

What progress has been made?

Water chemistry data will be made available in 2014 with a summary characterizing statewide trends by 2015. These data will provide a snapshot of current source water quality, easily accessible water chemistry to respond to potential contamination events, and a better understanding of water quality throughout Minnesota's aquifers.

Year after year, Minnesota has an outstanding record of ensuring safe drinking water through compliance with the Safe Drinking Water Act. However, taking safe drinking water for granted could prevent us from taking steps to protect our drinking water sources for future generations. Ongoing source water quality monitoring will help us to identify gaps in our drinking water protection efforts.

Learn more

- MDH website on monitoring and testing of drinking water in Minnesota: www.health.state.mn.us/divs/eh/water/factsheet/com/sampling.html

Status	Trend	Description
●	Not enough information for a trend determination at this time.	Identifying correlations between drinking water contaminants is a significant step in trend analysis of source water quality.

Nitrate concentrations in new wells

OUTCOME

Measure: Nitrate concentrations in newly constructed wells

Why is this measure important?

Groundwater is the main source of drinking water for three out of every four Minnesotans. About 20% of Minnesotans rely on private wells for their primary drinking water source. Nitrate is a common contaminant in some wells in Minnesota. If an infant is fed water or formula made with water that is high in nitrate, a condition called "blue baby syndrome" (or "methemoglobinemia") can develop. If nitrate levels in the water are high enough and prompt medical attention is not received, death can result.

Nitrate (NO_3) is a naturally occurring chemical made of nitrogen and oxygen. Natural levels of nitrate in Minnesota groundwater are usually quite low: 1-3 milligrams per liter (mg/L) of nitrate-nitrogen. However, where fertilizers, animal wastes, or human sewage are concentrated on the ground surface, nitrate may seep down and contaminate the groundwater. Elevated nitrate levels in groundwater are often caused by runoff from barnyards or feedlots, excessive use of fertilizers, or malfunctioning or failing septic systems. Shallow wells in areas of the state with sandy soils or karst geology are more susceptible to nitrate from these sources. Also,improper well construction or a damaged well can also allow nitrate to reach otherwise protected groundwater sources.

What are we doing?

Current laws require that wells be located and constructed in a way that provides a sanitary source of drinking water and protects groundwater quality. In addition, the Minnesota Department of Health, the Minnesota Department of Agriculture 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 are measured to verify that the water is safe to use. If nitrate levels exceed the drinking water standard, well owners are informed of options to solve the problem. The agriculture department and local governments offer clinics for residents to have their well water tested for nitrate. Several activities funded by the Clean Water Fund are intended to address nitrate in groundwater or reduce input of nitrate to groundwater.

New private wells that are properly constructed, such as this one, can help to protect groundwater sources from contamination, such as nitrates. This well still needs to have finished landscaping.

What progress has been made?

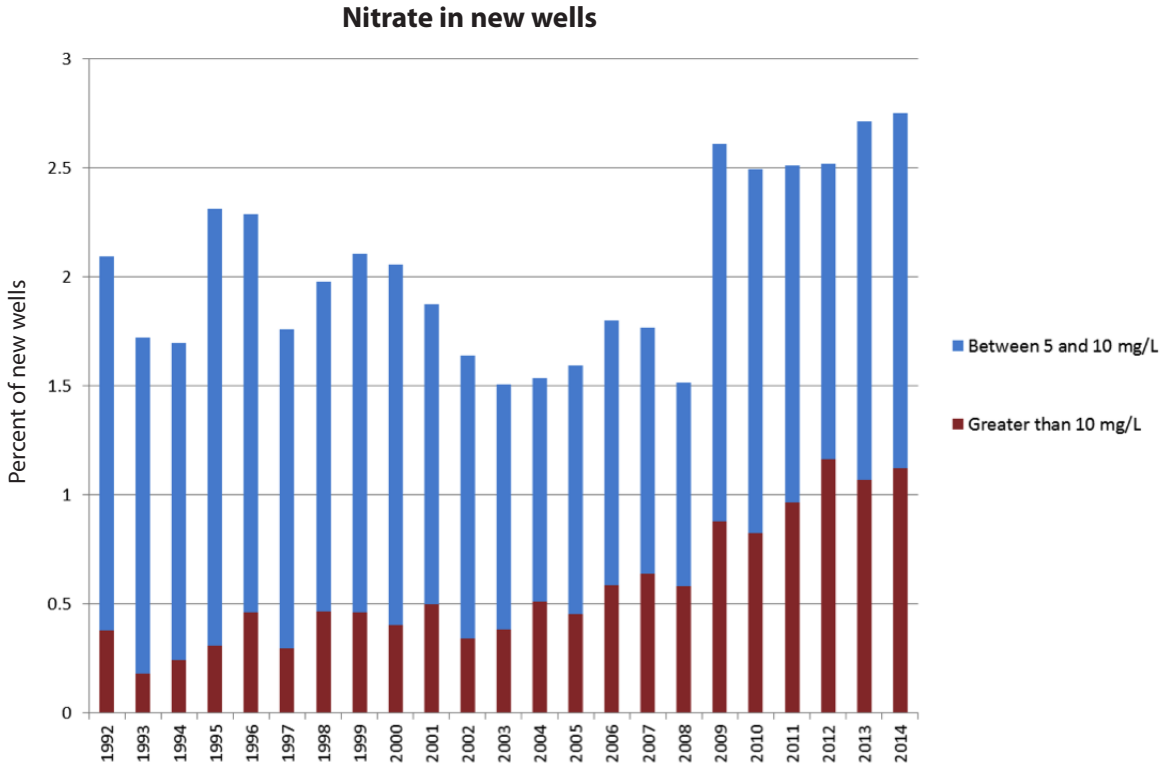
The level of naturally occurring nitrate in groundwater is quite low. The goal is that all new wells have no to low levels of nitrate. The percentage of new wells with nitrate detected above 5 mg/L is small, around 2%. New wells with concentrations above the drinking water standard of 10 mg/L is even less, around 1%. For comparison, about 5% of all wells, including those constructed prior to the well code, exceed 10 mg/L. While these low percentages in new wells show that the well code is effective in assuring water safe from nitrate for most wells, it is still important that the owners of these relatively few contaminated wells take other steps to obtain safe drinking water. There has also been a slight upward trend in the percent of nitrate in new wells exceeding the drinking water standard. It is not clear if there is a relationship between this trend and actual nitrate levels in groundwater across the state as 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 or measure the overall trend in groundwater nitrate. However, through many of the activities funded by the Clean Water Fund which are targeted at addressing and managing nitrate sources such as agricultural best management practices, nitrate concentrations in groundwater across the state eventually should decline and the effects should be reflected in this measure.

Status	Trend	Description
▲	↘	Although nitrate levels in less than 2% of new wells violate the drinking water standard, there has been a slight increase in recent years.

Learn more

- Find more information about this measure and its data at www.legacy.leg.mn/funds/clean-water-fund
- Nitrates in well water: www.health.state.mn.us/divs/eh/wells/waterquality/nitrate.html



Groundwater levels

OUTCOME

Measure: Changes over time in groundwater levels

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 our quality of life. Minnesota is relying more and more on groundwater to meets its growing needs, but many parts 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.

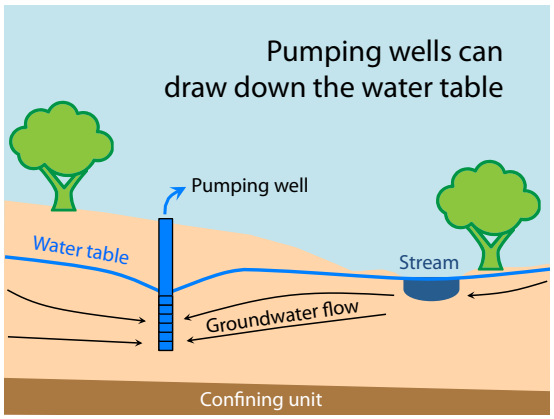
Groundwater levels are affected by several stresses including drought and floods, changes in land use, and pumping by wells. Changes in groundwater levels cause changes in the streams, fens and wetlands, springs, and lakes connected to them. Wells are also affected. When groundwater levels decline, pumps in wells may go dry, causing local water supply emergencies and costing private and public well owners money.

Decisions about water supply development and appropriation, watershed management, and land use are made daily. The success of these decisions depends, in part, on knowledge about seasonal and long-term declines in groundwater levels – to efficiently manage water supplies and to protect surface waters.

What are we doing?

The Minnesota Department of Natural Resources (DNR) manages a statewide network of groundwater-level observation wells, in partnership with Soil and Water Conservation Districts and volunteers. The statewide network of groundwater level observation wells provides information about seasonal and long-term changes. Data from these wells are used to determine long- term trends, interpret impacts of pumping and climate, plan for water conservation, and manage the water resource. Results are published in a variety of publications that can help water managers evaluate water supply questions at local and regional scales.

To evaluate changes in groundwater levels over time the DNR compiled records from wells with at least 20 years



of data in each of Minnesota's six groundwater provinces (see figure on next page). The annual minimum level in the observation wells was selected as the indicator of groundwater changes over time. The annual minimum water level is the lowest water level recorded for the year. Statewide, 57% of 295 observation wells in the groundwater level monitoring network with sufficient data had no significant trend over the 20 year analysis period, and 35% had a downward trend. Downward trends can result from drier climate conditions in the later years of the analysis period or to increased groundwater use.

The trend data were compiled for the 2014 Clean Water Fund Performance Report and will be updated after five years. Results were insufficient to assess Minnesota's groundwater conditions in some groundwater provinces, but the number of monitoring wells is being expanded to enhance the ability to detect trends. About 40 to 60 new wells are being installed annually with about 1,000 wells in the monitoring network currently. Once new wells have ten years of data, their groundwater trends will be added to the figure shown on the next page.

Status	Trend	Description
▲	↘	Most observation wells show no significant trend, but many areas of the state lack important groundwater information while some areas experienced groundwater declines.

What progress has been made?

Clean Water Funds are leveraging existing programs to accelerate efforts to improve the management of groundwater quantity and support long-term aquifer sustainability.

Groundwater level information is becoming better integrated into water supply planning, which supports work to reduce the environmental, economic, and public-health risks associated with declines in aquifer water levels. Since the 2014 Clean Water Fund Performance Report, the state has revised regional planning policies to address declining aquifer levels in the Twin Cities Metropolitan Area. Statewide, the DNR is establishing Groundwater Management Areas (GMAs) where additional planning is needed to ensure that growing water demands do not result in seasonal or long-term groundwater declines. The state is also establishing clear standards for sustainability.

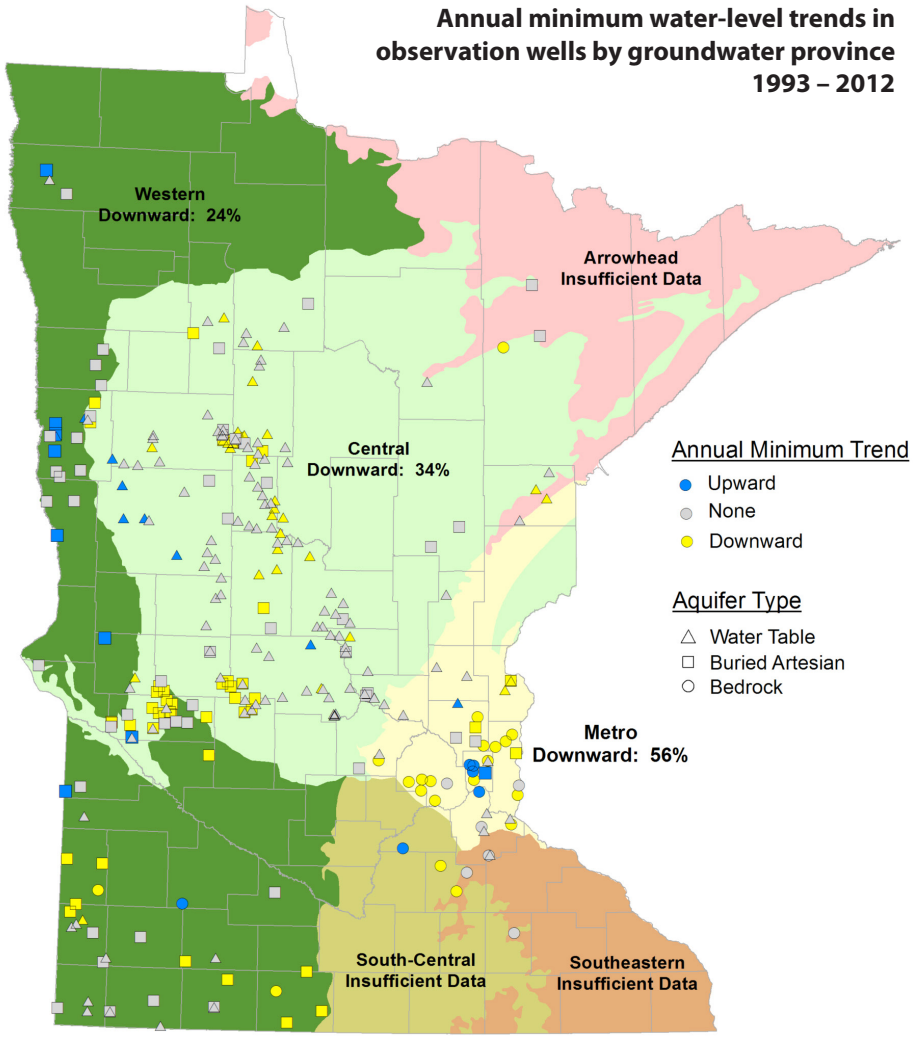
The emerging GMA program is creating new partnerships between DNR, Pollution Control Agency, Department of Health, Department of Agriculture, Board of Water and Soil Resources, Metropolitan Council and many local stakeholders. Efforts are underway in the North and East Metro, the Straight River, and the Bonanza Valley area of West-Central Minnesota.

As shifts in land use and related water use occur, groundwater level monitoring networks will document how water levels respond. Where predictive groundwater models exist, such as in the Twin Cities Metropolitan Area, measured groundwater levels can be compared against predicted water levels to understand how management changes can shift the long-term outlook for groundwater conditions. Groundwater models are in development or are planned for GMAs and other areas of groundwater-quantity concern.

Learn more:

- Find more information on activities funded by the Clean Water Fund at: www.legacy.leg.mn/funds/clean-water-fund
- DNR groundwater level monitoring program: www.dnr.state.mn.us/waters/groundwater_section/obwell/index.html
- Met Council's water supply planning program: www.metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning.aspx

Annual minimum water-level trends in observation wells by groundwater province 1993 – 2012



Social measures and external drivers

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.

External drivers

External drivers are changing factors influencing the quality and quantity of water in Minnesota's lakes, rivers, wetlands, and aquifers that may impact our ability to achieve our Clean Water goals. External driver trends on pages 61-70 were selected to represent areas where major change is occurring in Minnesota.

1. Land-use changes
2. Demographic changes
3. Climatic changes

Social measures

How the Clean Water Fund investment impacts the ability of people and communities to support and engage in local projects

Why are social measures important?

Science makes it clear that the greatest factor affecting water resources is what people do on the land. About 75% of Minnesota's land is privately owned. While some land use activities are regulated, many are voluntary. In order to mobilize Minnesotans to take voluntary actions to protect and restore Minnesota's waters, we need to better understand and address the drivers of positive actions as well as the barriers and constraints that exist.

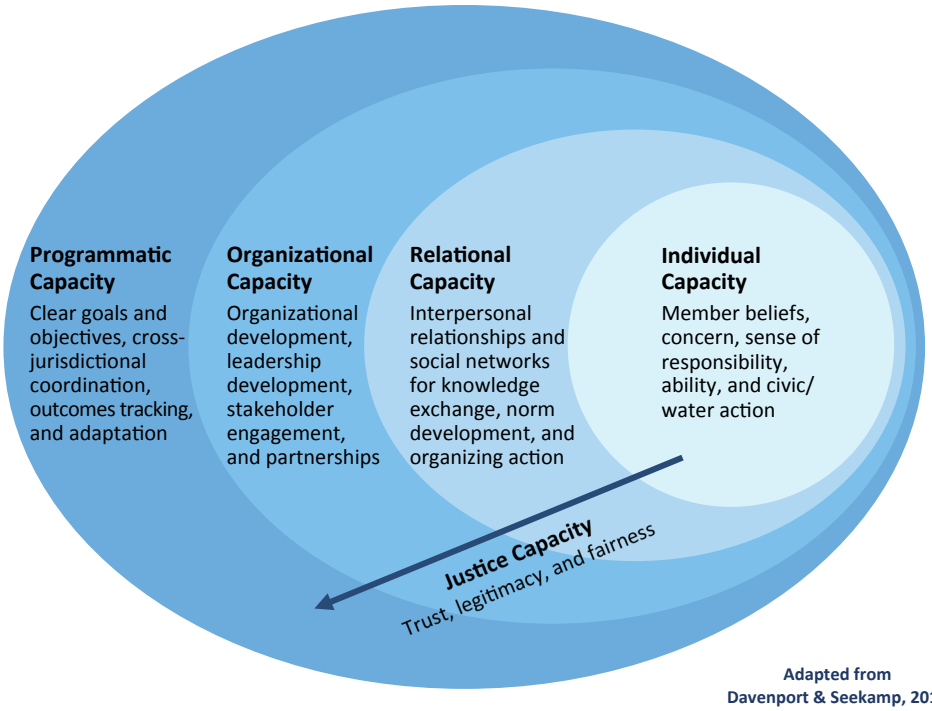
Within water resource management, social and biophysical sciences complement each other. Biophysical data describe the extent and nature of pollution problems and suggest technical solutions. Social science data provide information about public perceptions, knowledge, values, skills, economics and societal norms such as expected behaviors. These factors determine if people will take voluntary actions to protect and restore Minnesota's waters. Understanding social factors and using social indicators help state agencies to be more strategic when engaging the public to address water quality and evaluating if those efforts are successful.

Social Measures Monitoring System (SMMS)

To inform the integration of social science within Clean Water funded projects, state agencies are piloting the Social Measures Monitoring System (SMMS). The SMMS is a scientific approach that provides a common set of social outcome statements that can be used by each state agency. Outcome statements* provide an initial starting point for projects. They help direct project planning and can guide the selection of social science tools/ methods and individual performance measures.

The SMMS represents different measures of community capacity, as depicted in the figure at right, and integrates justice as an overarching principle.

Community capacity model



Adapted from Davenport & Seekamp, 2013

The purpose of the SMMS is to introduce scientific method to the human dimension of watershed management and to standardize data collection and ways of measuring progress. Social data can be gathered at the beginning of projects to provide a baseline and focus project goals, and throughout implementation to evaluate progress and adapt as necessary. Data can also be collected after the project for a final evaluation.

* Link to social outcomes statements is available under "Learn More"

What are we doing?

Over the past few years, state agency staff have been working together, and with the University of Minnesota, to apply the Social Measures Monitoring System to a project within each agency. Each pilot project below is different, in terms of representing specific program goals and project scale, but the SMMS provides a common starting point for consistency across agencies.

What progress has been made?

KAP surveys help evaluate program impacts
Community capacity measure - individual capacity

The Minnesota Department of Agriculture (MDA) conducted Knowledge, Attitudes and Practices (KAP) surveys during the pilot phase of the Minnesota Agricultural Water Quality Certification Program (MAWQCP). Survey results are being used to inform program delivery and develop new outreach materials. For example, the MAWQCP used results to customize two sets of outreach strategies, one for owner-operators and one for farm renters. Educational materials are focused on filling knowledge gaps and addressing specific barriers identified in the surveys.

The MDA conducted KAP surveys (1,453 sent with 474 returned or 33% response) in three watersheds where the MAWQCP was being piloted. Questions were developed through small group discussions with farmers and conservation professionals and focused on local agricultural practices and water quality. This initial survey served two functions:

1) It helped set a baseline for future evaluation; and

2) It identified barriers that may impact the adoption of conservation practices.

Survey results suggest that soil erosion is a concern for many landowners, but local water quality is not. Similarly, soil erosion is an important factor in agricultural decision making, while water quality is less of a consideration. This result indicates a disconnect between soil loss at the field scale and its downstream effects. Future outreach materials will link soil erosion and water quality and focus on the multiple benefits of individual practices.

KAP surveys will be repeated in 2016 to evaluate program results and impacts. Using data collected before (2014) and after (2016) the pilot phase of the MAWQCP, the MDA will evaluate if:

- Knowledge about conservation practices has increased, and by how much
- Attitudes have shifted and barriers have been removed
- Producers have adopted and are maintaining new practices

The MDA will use the second round of data to inform program activities and help identify areas for improvement. This type of evaluation can help to ensure that the program is effective.

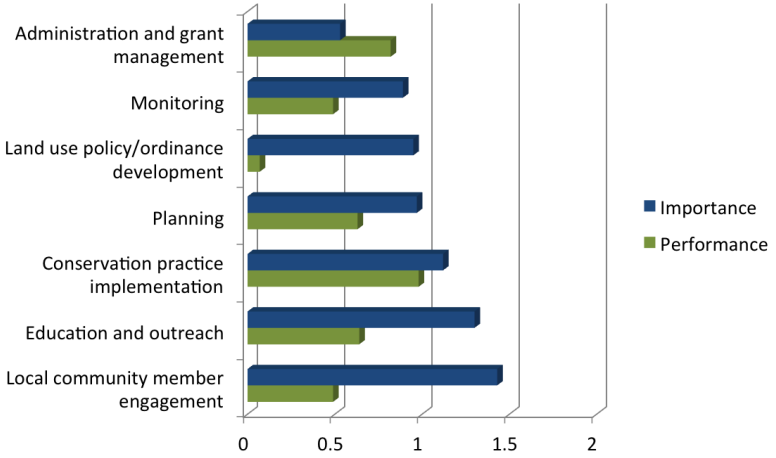
Assessing local capacity to protect drinking and groundwater
Community capacity measures - individual, relational, organizational and programmatic

The success of state-level clean water initiatives depends heavily on local government participation. To determine how best to work with local government, the Department of Natural Resources and the University of Minnesota conducted the first-ever statewide survey of staff at Minnesota's Soil and Water Conservation Districts (SWCD). The intent was to better understand SCWD staff's capacity to address local groundwater quality and quantity issues. Of the state's 359 SWCD staff, 188 or 52% responded to an in-depth survey that asked about their individual knowledge and

confidence to address local groundwater issues and other social factors that could affect their ability to protect groundwater.

The key finding from the statewide survey is that SWCD staff feel that outreach, education, and community organizing are the most important ways to protect groundwater – more important than implementation of conservation practices. Yet while community outreach and engagement activities surfaced as very important, the survey showed that SWCD work is primarily focused on processing paperwork and on-the-ground projects.

Importance and performance of groundwater protection actions by Minnesota SWCD staff



SWCD staff expressed the need to "grow" more local ability to address groundwater issues. Almost 78% of SWCD staff said that they needed support in helping a wide range of audiences better understand their groundwater – and what can be done to ensure there is enough clean water for long-term sustainable use. To grow this local understanding and support, 70% of SWCD staff said they needed more money for outreach activities.

The survey results were also used to tailor the content of four groundwater workshops for SWCD staff in greater Minnesota. Two subsequent surveys (pre-and post-workshop) showed a statistically significant improvement in staff's knowledge about groundwater and confidence to address issues with landowners and farmers.

Evaluating and informing the notification and outreach efforts of the Minnesota Beach Program
Community capacity measure- individual capacity

Recreational water illness outbreaks have been increasing in the United States since 1978. From 2011-2012, swimming in untreated water (lakes, rivers, etc.) resulted in at least 479 cases of illness and 22 hospitalizations (Centers for Disease Control and Prevention, 2012). Bacteria, viruses, and other organisms can get into the water from environmental sources or when people sick with diarrhea go swimming.

The Minnesota Lake Superior Beach Monitoring and Notification Program (Beach Program) strives to give people the knowledge and skills necessary to recreate safely in water and take care of local beaches. Minnesota Department of Health staff interviewed people at Duluth beaches in August of 2014 to see if notification and outreach efforts are working, and to find ways to improve them in the future. Seventy beachgoers were asked questions about their knowledge, perceptions regarding risk, preferences for outreach methods and information, and ways that they had received beach advisory notifications in the past.

Findings from the survey have spurred preliminary plans to shift the focus of outreach from webpages to more staffing tables at beaches and increased use of social media. Depending on funding, results from this survey will be used to expand the study to more people and to include more in-depth questions. Any modifications to outreach activities resulting from the survey will be evaluated.

Assessing watershed readiness to work collaboratively: a collaborative decision-making processes
Community capacity measure - organizational capacity

As the Board of Soil and Water Resources (BWSR) transitions local water management planning to align with major watershed planning boundaries, five pilot watersheds were selected to develop watershed-based plans. The local governments in these pilots have not collectively worked together across jurisdictional boundaries on water management planning. Assessing a watershed's community readiness for collaborative decision-making and plan development of One Watershed, One Plan (1W1P) is key to this initiative.

For 1W1P, community readiness is defined as the degree to which Local Government Units (LGUs) are ready to take action together on water resource issues. To measure the level of readiness, BWSR and University of Minnesota Extension developed the Community Readiness. This assessment draws from community readiness research, BWSR's Performance Review and Assistance Program, and a Community Readiness Assessment developed for MDA by UMN Extension. It focuses on six dimensions of readiness:

1. Relationships among LGUs
2. Program capacity
3. Barriers affecting collaboration
4. Watershed leadership
5. Issue awareness
6. Community attitudes

The Whitewater River Watershed Project convened a series of Water Quality Summits in the Mississippi River-Winona watershed that resulted in lively discussions about water quality. The discussions provided valuable input for developing strategies to restore and protect streams in this southeast Minnesota drainage area. (Photo courtesy of the Whitewater River Watershed Project)

A recent survey of LGUs found that 90% of local government staff indicated additional skill building for collaboration and partnership development is important to support LGUs in effectively developing shared watershed plans. A Community Readiness Assessment collects data necessary to show an LGU's baseline readiness for partnering and collaborative decision-making. Upon completion of the 1W1P process, additional data are collected and analyzed to inform strategies for strengthening the LGU's ability to work together and address barriers to collaboration and assess strengthened watershed partnerships. BWSR is using these data to support partnership development which enhances collaboration and relationships fundamental to plan development and future implementation.

Re-imagining Public Participation as a Project Management Approach
Community capacity measures - individual, relational, organizational, programmatic, justice

MPCA program development specialists are working with project managers, local partners and others to overcome difficulties achieving earlier, more diverse and active public participation. This goal is key to building local relationships and trust during MPCA's watershed work that could be leveraged later by BWSR and other agencies during protection and restoration implementation. Trusting community members can lend continuity to the multi-agency process and add value at each step of the ten year cycle.

Templates, worksheets, briefing sheets, coaching curriculums, and outcomes and cost tracking tools have been developed to help users in work planning, implementation, progress tracking and reporting. They are organized into

decision trees and matrices, and have benefited from user testing and feedback. These resources introduce a scientific method to the human dimension of watershed management and standardize data collection and ways of analyzing the status of human factors.

Staff, leadership and partners involved in this development project are showing how the new resources and development process:

- Supports the full range of public participation through improved standards for public meetings; fresh insight into more participatory and interactive education and outreach; and emerging practices in civic organizing that rally people around the common good
- Helps personnel integrate public participation with greater ease, clarity and confidence based on social science theory and progress tracking
- Encourages program managers to make objective and meaningful resource and policy decisions based on consistently tracked project results

The next step is to incorporate project management guidance and cost tracking protocols into program infrastructure through:

- Systems for managing and reporting social outcomes data
- Practices aimed at addressing gaps identified during project scoping
- A means of ensuring contractor accountability to specific program needs and emerging standards of practice
- A project management website organized according to the new resources developed

Conclusion

The SMMS provides a strategic, social science-based approach for planning, implementing, and evaluating outreach, education, and civic engagement activities. As these examples illustrate, social science data can help clarify what information is needed to address clean water issues, who is responsible for what water protection or restoration actions, and how to engage with partners to achieve success. In the absence of data about community capacities to address clean water efforts, state agencies may be resigned to carrying out technical solutions without local support. For this reason, collecting and using social science data and analysis are critical to meeting Minnesota's clean water goals.

Results from these initial projects suggest that state agencies need to continue to advance the integration of social science into Clean Water Fund projects.

Status	Trend	Description
▲	Not enough information for a trend determination at this time.	In recent years, state agencies have developed and piloted the Social Measures Monitoring System. This work integrates social science into Clean Water Fund projects.

Learn More

- Davenport, M.A., & Seekamp, E. (2013). A multilevel model of community capacity for sustainable watershed management. Society and Natural Resources: An International Journal, 26(9), 1101-1111
- Margaret Wagner, Minnesota Department of Agriculture, margaret.wagner@state.mn.us, 651-201-6488
- Cindy Hilmoe, Minnesota Pollution Control Agency, cynthia.hilmoe@state.mn.us, 651-757-2437

External drivers

Important land use, population and climate trends

The trends outlined in this section represent important land use, population, and climate-related changes that may influence the quality and quantity of water in Minnesota's lakes, rivers, wetlands, and aquifers. Because these factors are changing in ways that may impact our ability to achieve our Clean Water goals, they are referred to as external drivers. The external drivers highlighted in this report track changes occurring within Minnesota as a result of regional, national, or even international activities. The broad scale at which these external drivers operate means that they cannot be solely managed through the Clean Water planning process, yet they can have a significant impact on the quality and quantity of Minnesota's water resources.

External driver categories

Land-use changes:

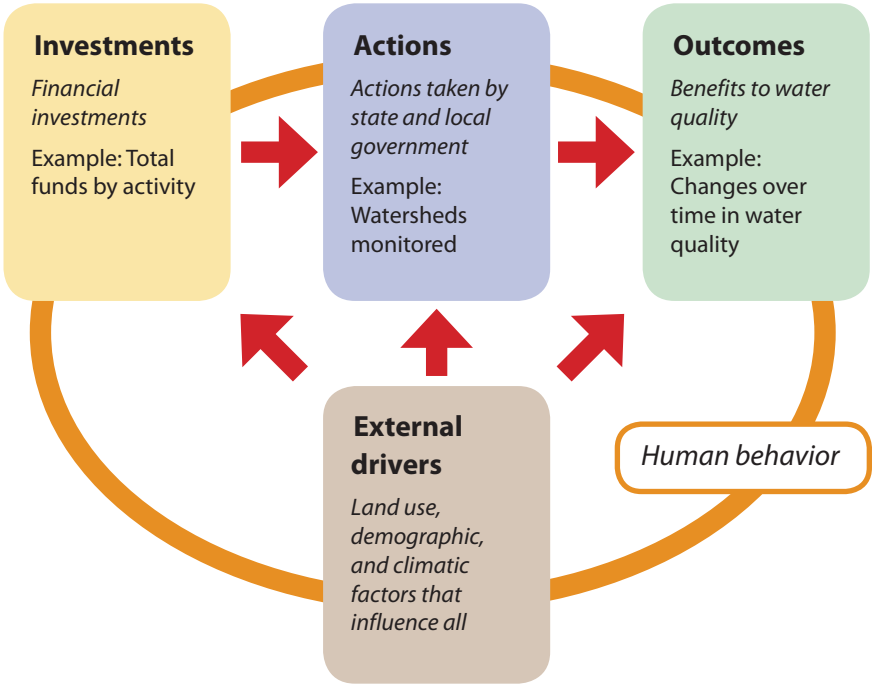
- Agricultural land use
- Impervious surface urban/suburban communities
- Wetland coverage

Demographic changes:

- Population size and proportion in urban/suburban counties

Climatic changes:

- Average Minnesota temperature
- Average Minnesota precipitation



Expected relationships of external drivers to investments, actions, and results

Understanding how external drivers are changing over time provides important context for many of the Clean Water outcome measures highlighted in this report because those trends may increase or hamper Minnesota's ability to achieve its Clean Water goals. Tracking external drivers can also provide important information to help enhance the effectiveness of protection and restoration actions that are implemented. By understanding how Minnesota's landscape and climate are changing, Clean Water partners can fine-tune where money is invested and what actions are taken to enhance successful outcomes (see figure above). Tracking external drivers will help Clean Water partners adapt their actions over time, enhancing water quality and drinking water outcomes.

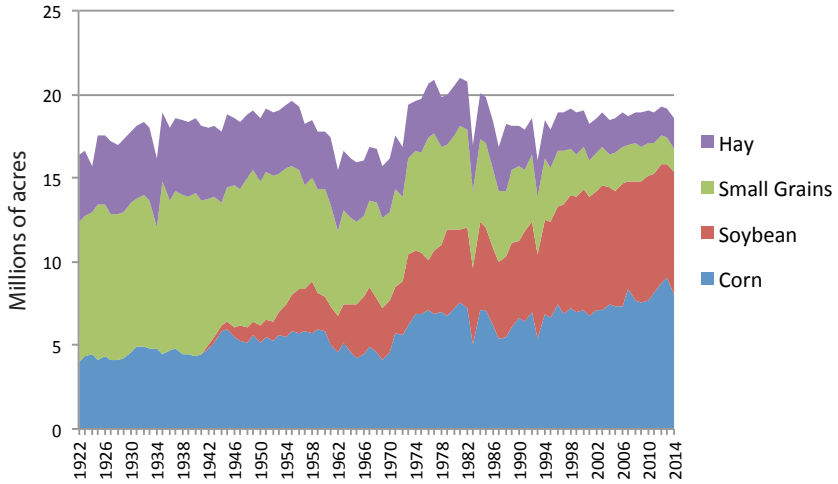
It is important to note that the relationship between the external driver and the water quality or drinking water outcome of interest is often complex and may vary from location to location. Just because one of the external driver categories highlighted in this section increases over time does not mean that water resource quality will decline. For example, increased adoption of BMPs or other actions by state and local governments may more than offset the change.

Of the many categories of external drivers that could be highlighted, this section focuses on a few selected land use, population and climate changes. The specific trends represented on the following pages were chosen because they represent major external driver categories and are reliably and routinely updated at a state-wide scale over time.

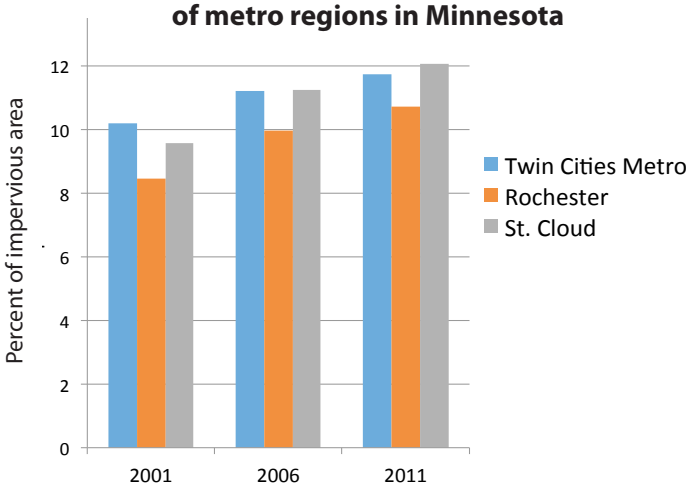
Land-use changes

How land in Minnesota is used is critical to understanding how much of the precipitation that falls reaches the state's lakes, rivers, and wetlands or percolates into the state's aquifers. Likewise, land use has a major influence on the quantity and quality of runoff. The major land-use categories highlighted below were chosen to reflect agriculture's major role in the Minnesota landscape, the continued growth of urban/suburban centers and the water quality challenges associated with impervious surface, and Minnesota's desire to stop the loss of additional wetland acres.

Agricultural land use: Just under half of Minnesota (26 million acres) is considered farm land of which about 20 million acres is used to grow crops. Though the total acres of crop land in Minnesota has remained relatively constant over time, the crops grown (land cover) have undergone a significant transformation. As shown in the figure at right, there have been major shifts in land cover in Minnesota over the last 70 years. The number of acres planted in small grains or hay has declined and been replaced by increases in corn and soybean acreage. The roughly 9 million acres where agricultural land use has changed represents about 16% of the state. These cropping changes have altered the time of year and extent the land is covered by a growing crop. This impacts soil erosion risk, fertilizer needs, nutrient capture, and soil moisture management. These changes in agricultural land cover can result in impacts to water quality in the form of nutrient and/ or sedimentation into surface waters or leaching into groundwater.



Agricultural land use trends; only major crop acreage shown



Change in percent of land surface covered by impervious surfaces

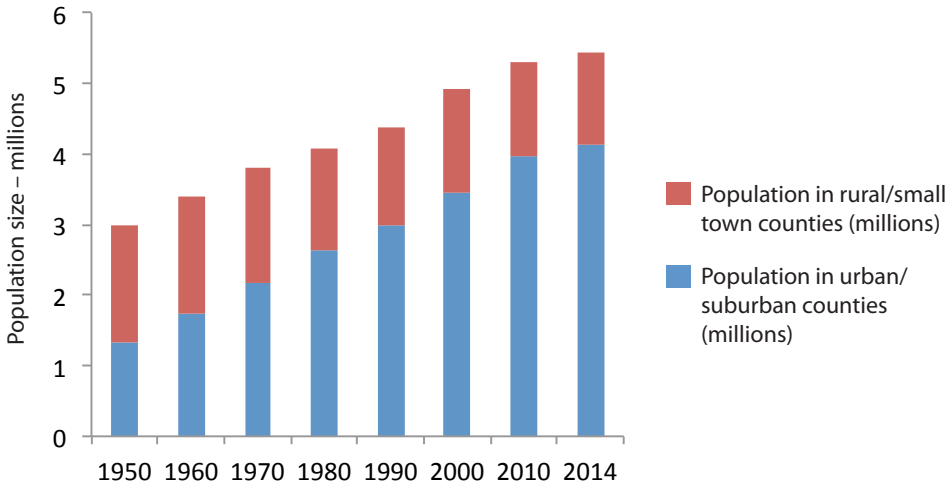
Impervious surface in metropolitan area: Water quality impacts associated with impervious surfaces are often particularly significant. Because precipitation that falls on impervious surfaces typically does not soak into the ground, runoff volumes are high and the moving water has a greater potential to carry pollutants and cause erosion. Although on a statewide scale the amount of impervious surface makes up only a small percentage of the land area, in urban/ suburban watersheds it is much more significant. Currently, well over half of Minnesota's population lives in the corridor between Rochester, the Twin Cities metropolitan area, and St. Cloud. The figure at left shows trends of impervious surfaces for the three areas from 2001 to 2011. For each community, the amount of impervious surface present has increased, amplifying water quality pollution risks.

As Minnesota's population continues to increase and becomes more urban/ suburban (see Demographic Changes

Section below) further increases in the amount of impervious surface are likely. The amount of impervious surface in other Minnesota communities can be assessed at mndnr.gov/whaf/explore.

Change in wetland acreage: Wetlands provide water quality and drinking water benefits. Wetlands are important 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 and 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 1999, and in 2006 initiated a rigorous, long-term monitoring program to track changes in wetland quality and quantity over time. Between 2006 and 2008 the monitoring effort assessed wetland abundance in almost 5,000 plots across Minnesota to serve as a baseline. Every three years those same sites will be reassessed to track the amount of change that is occurring. During the first trend interval, 2009 – 2011, a slight increase in wetland coverage was observed in some regions of Minnesota; no change was observed in other regions. Preliminary analysis of the data from the second trend interval, 2012 – 2014, suggests that there was essentially no change in the statewide wetland acreage, similar to the previous reporting period.

Restoring wetlands may be an important practice in Minnesota to slow down runoff and trap pollutants before they reach downstream lakes and streams. The wetland tracking effort described above will help document those changes at a landscape scale. Over time, the pattern of wetland loss may be reversed and wetland quantity may increase in some parts of the state.



Change in Minnesota's population and urban/suburban vs. rural distribution since 1950

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 above, Minnesota's population has increased steadily since 1950 along with the proportion of the population living in urban/suburban counties. This shift reflects more impervious surface that has the potential to impact surface water quality and quantity, increased 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, changes that may require modifications to current water quality actions and strategies.

Changing climate patterns

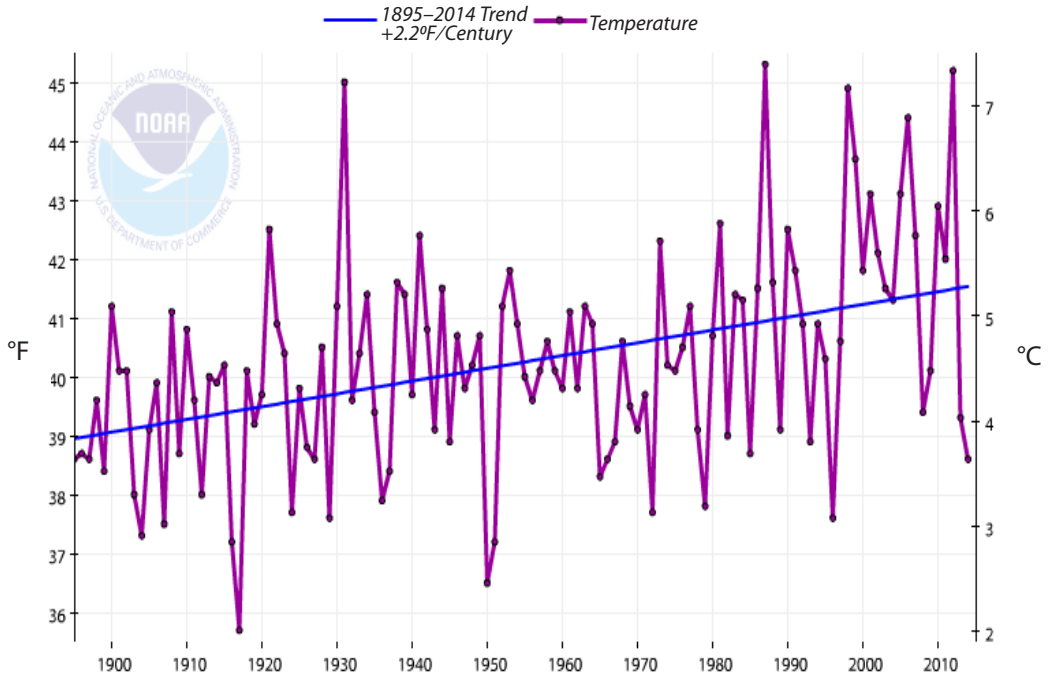
Climate has a significant influence on the condition of Minnesota's water resources, as well as the strategies that Minnesotans will need to employ to achieve restoration and protection goals. The amount and timing of precipitation influences how much water soaks into the ground – changing whether it can be taken up by plants, replenish soil

and groundwater resources, or if it runs off directly in the nearby lakes, rivers, and wetlands. Precipitation patterns also control water demand for outdoor uses such as agricultural and residential irrigation. Likewise, Minnesota's temperature patterns affect the length of Minnesota's winter - controlling the period when lakes and streams are covered by ice, the length of the summer growing season, how warm surface waters become, as well as many of the chemical, physical, and biological processes that shape how the state's aquatic resources behave.

There are many indications that Minnesota's climate patterns are changing. This document highlights how temperature and precipitation have changed between 1895 and 2012. The figures below and on the following page emphasize that weather in Minnesota may vary dramatically from year to year. For example, almost a 10 degree Fahrenheit difference in statewide average temperature has been observed between the coldest years and the warmest. Likewise, average statewide precipitation for the wettest years recorded is more than double that measured for the driest years.

The figures also show long-term trends that need to be accounted for as we develop plans and make investments to protect and restore Minnesota's aquatic resources. Over the period shown, the average statewide temperature has increased at a rate of 2.2 degrees Fahrenheit per century; average statewide precipitation has increased at a rate of 2.50 inches per century. Examining these statewide patterns in more detail, both seasonally and geographically, will likely be necessary to help inform the development of protection and restoration strategies and the selection of implementation projects to anticipate changes in climatic patterns. For example, according to Minnesota's state climatologist, much of the temperature increase observed in Minnesota has been caused by a rapid warming of our

Minnesota temperature, January—December



Year-to-year changes long-term trend in average annual Minnesota temperature from 1895 to 2014

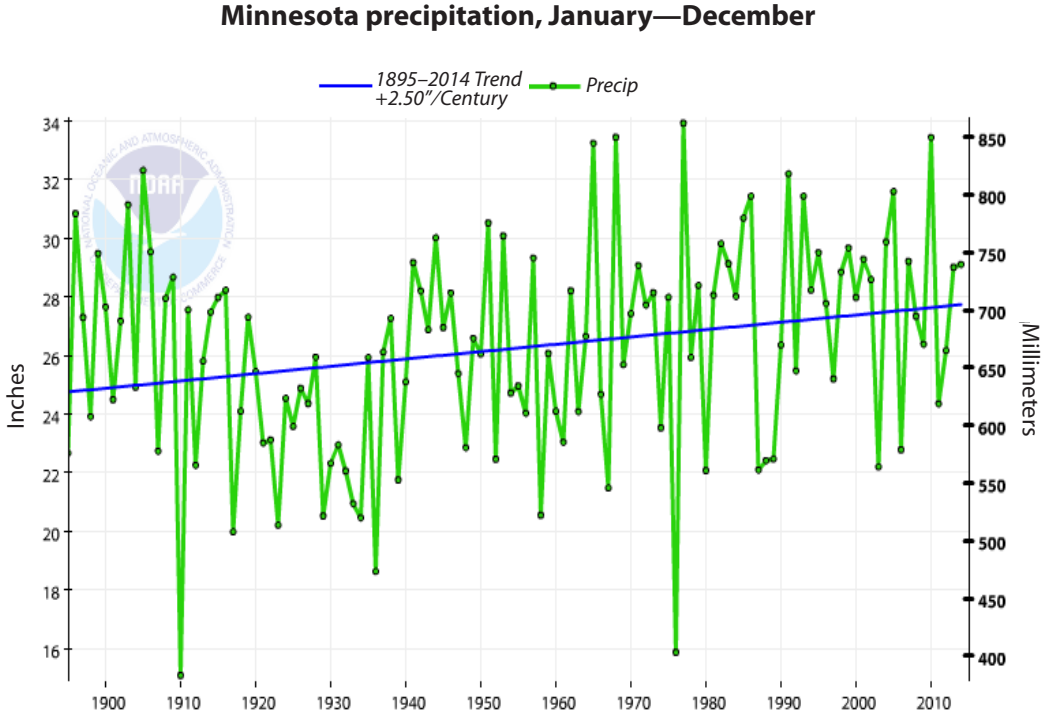


Fig 6. Year-to-year changes and long-term trend in average annual Minnesota precipitation from 1895 to 2014

coldest temperatures. Winter temperatures are warming considerably faster than summer temperatures, and daily minimum temperatures are warming faster than daily maximum temperatures. The trend is most pronounced in Minnesota's northernmost counties.

Changing hydrologic flow patterns

The land use, population, and climatic external driver categories listed above may all influence the patterns of water flow and water use in Minnesota. Nevertheless, adding a category that directly measures those changing hydrologic flow patterns would be valuable because of the key role of hydrology in determining water quality status. For example, knowing the proportion of precipitation that runs off the landscape in rivers and streams is critical for making many water resource decisions. If sources of hydrological data are identified that are reliably and routinely updated at the state-wide scale and that reflect how hydrological flows are changing, an additional external driver category may be added to future editions of this report.

Status	Trend	Description
▲	→	The external drivers identified continue to alter land-water interactions across Minnesota impacting how Clean Water funds need to be invested.

This report and future updates can be found on the Minnesota's Legacy website:

www.legacy.leg.mn/funds/clean-water-fund