



Clean Water Fund Performance Report

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

2014





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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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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 Amendment¹, 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, approximately \$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 Act² (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."

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

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 percent to the Clean Water Fund; 33 percent to the outdoor heritage fund; 19.75 percent to the arts and cultural heritage fund; and 14.25 percent 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)

³ For more information on the Framework, see Minnesota's Clean Water Tracking Framework; May 2011 Progress Report, available here: www.pca.state.mn.us/index.php/view-document.html?gid=15911



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** to track whether our water is getting cleaner
- **Partnership and leveraging measures** to track local government and citizen actions supported by the Clean Water Fund
- **Organizational performance measures** to track state government-led actions supported by the Clean Water Fund
- **Financial measures** to 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. In the early years of the Clean Water Fund, more progress will be reported in short-term actions taken than long term outcomes.

New measure categories

Social measures

A new category of measures, social measures, are introduced in this report. Social measures track how the Clean Water Fund investment impacts the ability of people and communities to support and engage in local projects.

Social measures focus on the human or social dimension of water resource management. Specifically, factors that influence personal and community decision-making. These factors include public perceptions and collective knowledge regarding an issue, attitudes, awareness, values, skills, economics and societal norms.

Social measures help answer a few key questions: (1) What drives communities to engage in sustainable water resource management? (2) What constrains communities from engaging in water resource protection and restoration? (3) How can resource professionals, policy-makers, and citizens build community capacity to protect and restore Minnesota's water resources now and in the future?

External drivers

Minnesota's landscape and climate are not static but continue to change in response to actions and decisions made at the local, state, regional, national, and even global scale. We often have limited control over these broad-scale changes, referred to as "external drivers", even though they can have a significant impact on the quality and quantity of Minnesota's water as it moves through the water cycle. External drivers are important to track because they may affect the outcome of investments to improve the state's surface water and drinking water resources and may require us to modify how Clean Water funds are spent in the future.

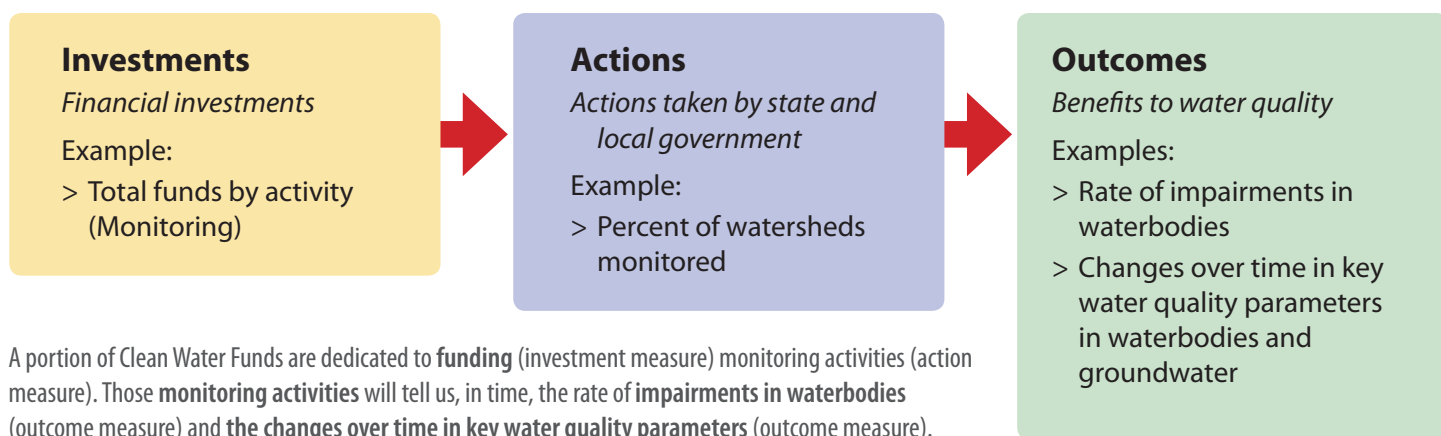
Three categories of external drivers were selected that represent areas where major change is occurring in Minnesota: (1) land-use change, (2) demographic change, and (3) climate change. Among the wide variety of external drivers that are already being tracked, this report highlights six examples where there is a clear linkage to one or more of the Clean Water Fund outcome measures, where trend data is already available, and where data collection is expected to continue in the future. A fourth external driver category that would capture how the pattern of water flow across Minnesota's landscape is changing may be added in future editions of this report.

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 an 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.

Measure connections



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.

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, and what progress has been made.
- A graphic that summarizes the measure's data.
- Measure score for action and outcome measures. The qualitative scores summarize the measure's status.






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 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 2013 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: \$152.2 million FY12-13: \$179.4 million FY14-15: \$194.9M		Appropriation levels will vary by biennium and the strength of the economy. FY10-13 funds have been allocated, while FY14-15 allocations are in progress.
	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 FY10-13, nearly all 81 watersheds benefited from Clean Water Fund supported activities. Implementation activities comprise the largest portion of spending in watersheds statewide.
	Total Clean Water Fund dollars awarded in grants and contracts to non-state agency partners.	\$142.1 million was awarded in grants and contracts to non-state agency partners from FY10-13.		About 84 percent of grant and contract awards are for implementation activities; 43 percent of total FY10-13 appropriations were awarded to non-state agency partners.
	Total dollars leveraged by Clean Water Fund.	\$106 million was leveraged by Clean Water Funds in FY10-13, or \$1.16 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.			We continue to make steady progress at the pace set in 2008.
	Local partner participation in monitoring efforts.			Since 2012, all programs have met local participation goals.
	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 FY10-13 projects was approximately three times greater than available funds.
	Number of municipal point source construction projects implemented with Clean Water Funding and estimated pollutant load reductions.			Pace of awards are linked to permit cycles and compliance schedules, however, demand also varies based on municipal budgets and other competing infrastructure demands.
OUTCOME	Rate of impairment/unimpairment of surface water statewide and by watershed.	Stream 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 if long-term goals will be met.
		Lake swimming		
		Stream aquatic life		
	Changes over time in key water quality parameters for lakes, streams, and wetlands.	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.
		Wetland invertebrates		Wetland invertebrates: Statewide, most wetlands have good quality aquatic insect communities.
		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.
	Number of previous impairments now meeting water quality standards due to corrective actions.			There is much variability in water quality across the state, but many projects are making progress in improving water quality. More water bodies are being listed as impaired relative to the slower rate of water bodies being delisted.
	Trends of mercury in fish in Minnesota.			Mercury in gamefish over the last 30 years shows an improving trend despite large shifts in the trend during shorter periods, demonstrating the need for long-term and consistent monitoring.

Measure		Status	Trend	Description
Surface water measures				
OUTCOME	Trends of mercury emissions in Minnesota.			Significant progress has been made reducing mercury emissions in Minnesota. World-wide scale emissions are increasing.
	Changes over time in municipal wastewater phosphorus discharges.			Significant phosphorus load reductions have been achieved through regulatory policy, infrastructure investments and improved technology. Future reductions will continue to be challenging and expensive as small systems receive limits and tighter discharge permits resulting in extremely low phosphorus concentrations.
Drinking and groundwater measures				
ACTION	Number of community water supplies assisted with developing source water protection plans.			Met target for FY 12-13. On track to meet long-term target of every vulnerable community public water system engaged in source water protection by 2020.
	Number of grants awarded for source water protection.			Increased grant funds have accelerated the implementation of proven strategies for source water protection.
	Number of local government partners participating in Clean Water Fund supported groundwater nitrate-nitrogen monitoring and reduction activities.			Minnesota Department of Agriculture continues to establish new local partnerships for nitrate-nitrogen monitoring and reduction activities.
	Number of new health-based guidance values for contaminants of emerging concern.			Met target for FY 12-13. On track to meet goal of 10 guidance values developed each biennium.
	Number of counties completing a county geologic atlas for groundwater sustainability.			Significant progress has been made completing county geologic atlases and the rate of completion has increased. Counties continue to step up to participate but substantial work remains before all counties in Minnesota are done.
	Number of long-term groundwater monitoring network wells in Minnesota.			Many areas of the state still lack important groundwater information. Long-term ramp up in monitoring accelerated by Clean Water Fund investments is filling gaps.
	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 		Decreasing trends for three and no trend for two common pesticides. Low levels are still frequently detected in vulnerable groundwater.
		Nitrate-Nitrogen statewide 		In many areas, local drinking water aquifers are not vulnerable to surficial contamination and wells generally have low levels of nitrate-nitrogen. However, in certain localized areas it can be a significant concern.
		Nitrate-Nitrogen Central Sands 		Nitrate levels vary greatly within this region; in certain areas of the Central Sands, water quality needs improvement. It is unclear if we will meet long-term water resource needs.
		Nitrate-Nitrogen southeast region 		The Karst region in southeast Minnesota is one area vulnerable to nitrate contamination. In some townships water quality is under intense pressure. It is unclear if we will meet long-term water resource needs in this region.
	Changes over time in source water quality used for community water supplies.		Not enough information for a trend determination at this time.	Water sample collection and laboratory analysis was completed in 2013. Analysis of the results will be conducted in 2014.
	Nitrate concentrations in newly constructed wells.			Although nitrate levels in less than two percent of new wells exceed the drinking water standard for nitrate, there is a slight increase in recent years.
	Changes over time in groundwater levels.			Most indicator wells show no significant trend, but many areas of the state lack important groundwater information and in addition are experiencing groundwater declines.



Investment measures

The four measures contained on pages 8-12 illustrate FY10-13 Clean Water Fund investments to restore and protect surface water and drinking water.

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

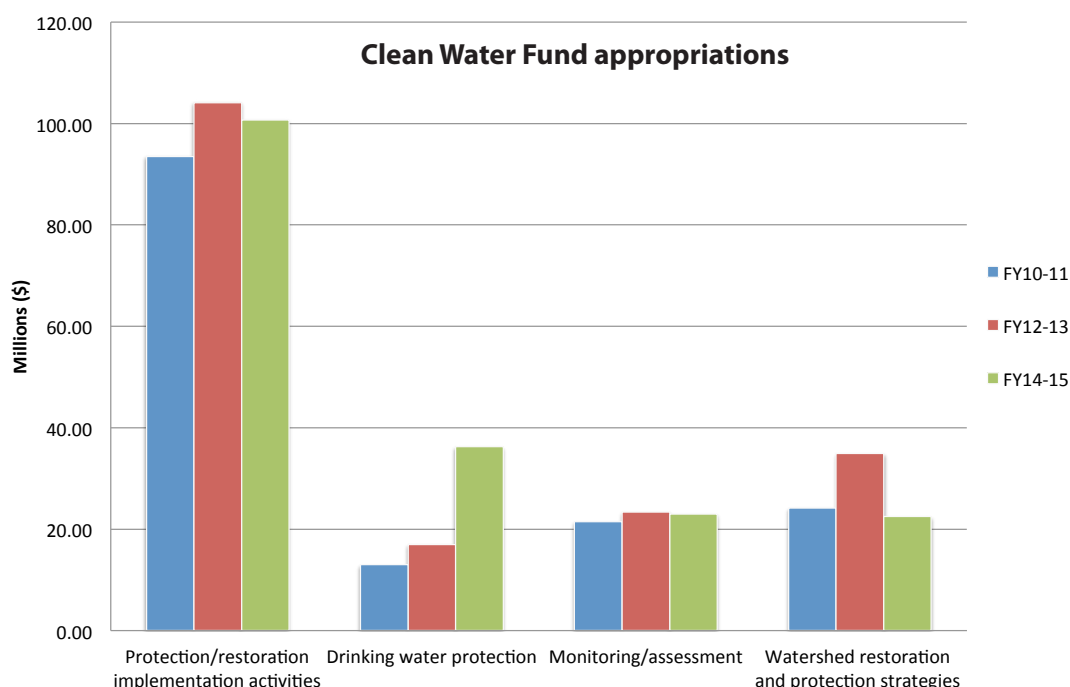
July 1, 2009 through 2034. Of those funds, approximately 33 percent were dedicated to the Clean Water Fund.

Of the sales tax receipts received since 2009, the Minnesota Legislature appropriated approximately \$152.2 million for FY10-11, \$179.4 million in FY12-13 and 194.9 million in FY14-15. 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	Appropriation levels will vary by biennium and the strength of the economy. FY10-13 funds have been allocated, while FY14-15 allocations are in progress.
FY12-13: \$179.4M	
FY14-15: \$194.9M	





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 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, and drinking water protection.

What are we doing?

Hundreds of Clean Water Fund-supported projects led largely by local government are underway across the state. Funded activities include implementation of practices to clean up wastewater and stormwater and agricultural runoff. They also include regular testing of water quality in lakes and rivers to help gauge the effectiveness of clean water practices, and strategy development to guide effective watershed restoration and protection and drinking water and groundwater protection.

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

What progress has been made?

For FY10-13, 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.

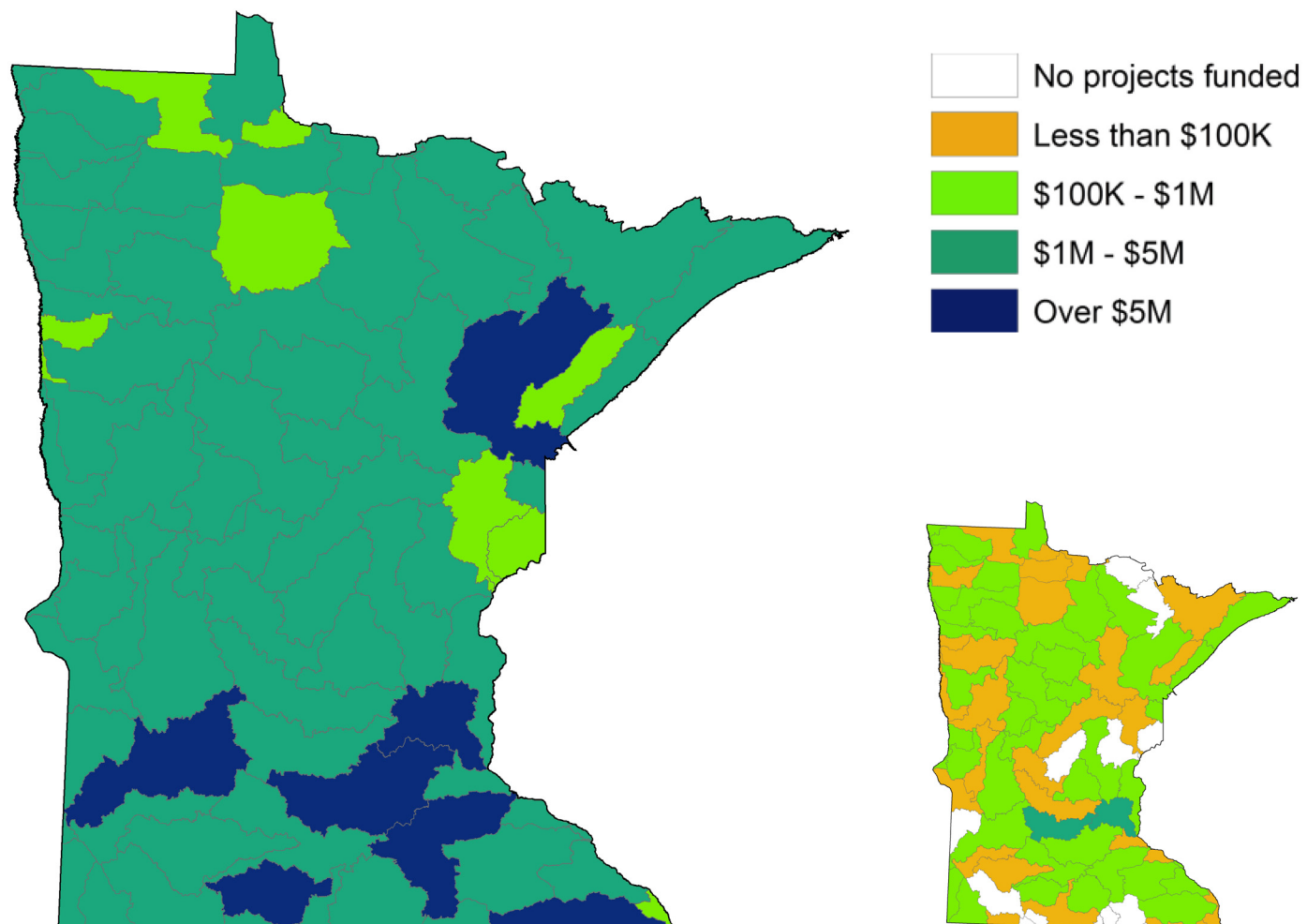
Of the four activity categories, funding for implementation activities comprised the largest portion of spending statewide. However, the costs of implementation can vary significantly by watershed, depending on the type of project and the problem being addressed.

Learn more

- Find information on activities funded by the Clean Water Fund at www.legacy.leg.mn/funds/clean-water-fund.
- Find more information about this measure's data at www.MetadatalzCool.mn.us

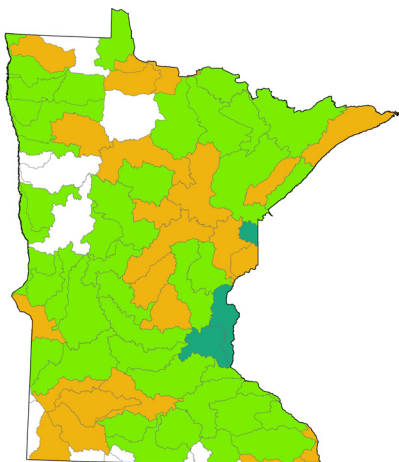
Status	Description
Most watersheds in the state are benefiting from local and statewide projects.	For FY10-13, nearly all 81 watersheds benefited from Clean Water Fund supported activities. Implementation activities comprise the largest portion of spending in watersheds statewide.

Total FY10-13 Clean Water Fund dollars by watershed

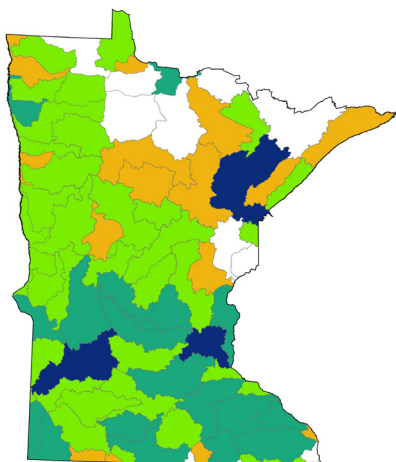


Combined watershed-specific projects, statewide activities and technical assistance that benefit all watersheds

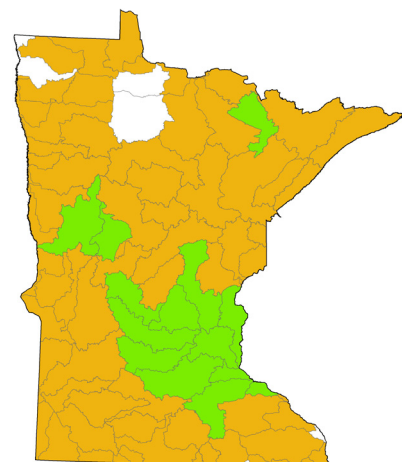
Monitoring and assessment



*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 that are 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, 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 and 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: Board of Water and Soil Resources, Department of Natural Resources, Minnesota Department of Agriculture, Minnesota Department of Health, Metropolitan Council, Minnesota Pollution Control Agency, and Public Facilities Authority.

What progress has been made?

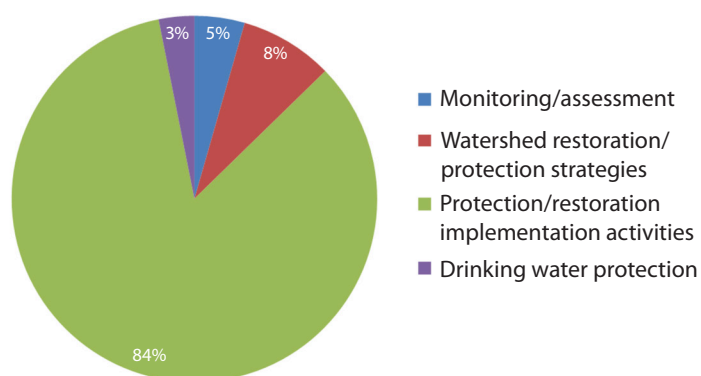
As shown in the pie chart, a total of \$142.1 million in Clean Water Funds were awarded to non-state agency partners from FY10-13, with the largest share of that going to protection and restoration implementation activities. This represents 43 percent of the total \$331.6 million in Clean Water Fund appropriations for FY10-13.

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.

Learn more

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

FY10-13 grant and contract awards by major activity



The percentage of total grant and contract awards (\$142.1 million) in FY 10-13 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.

Status	Description
\$142.1M was awarded in grants and contracts to non-state agency partners in FY10-13.	About 84 percent of grant and contract awards are for implementation activities; 43 percent of total FY10-13 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 Fiscal Years 2012 and 2013, more than \$45 million in competitive state grants 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 \$23 million. During this same time period, approximately \$6.7 million were leveraged from Ag BMP loans.

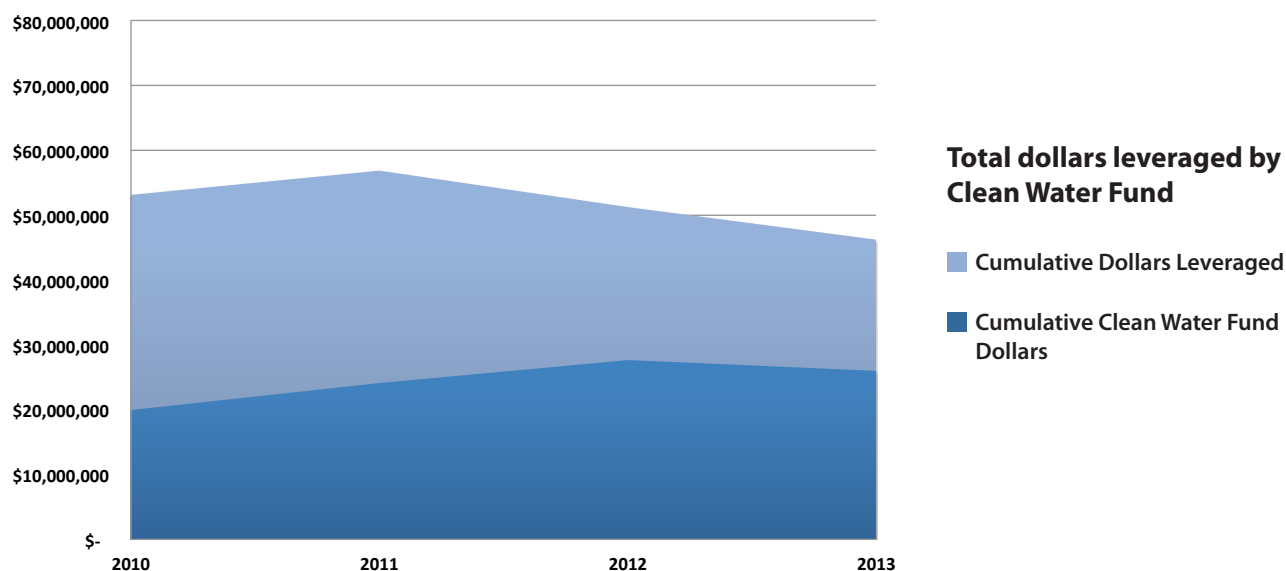
During Fiscal Years 2012 and 2013, more than \$12 million in state grants was awarded to improve municipal wastewater and stormwater treatment, upgrade aging infrastructure, and to help small communities invest in new infrastructure. Local match and leveraged federal funds increased the project dollars by \$13 million.

As a result, during FY10-13, more than \$106 million dollars was leveraged by Clean Water Fund, or \$1.16 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
\$106M was leveraged by Clean Water Funds in FY10-13, or \$1.16 for every implementation dollar invested.	Required Clean Water match funds were met and exceeded.





Surface water quality measures

The eight measures contained on pages 14-31 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, stream and wetland 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 percent of Minnesota lakes and 14 percent 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.

Utilizing Clean Water Fund dollars, state and local partners do intensive sampling and assessment of lakes and streams in all 81 major watersheds. This allows for better protection of Minnesota's healthy waters, and restoration of the polluted ones.

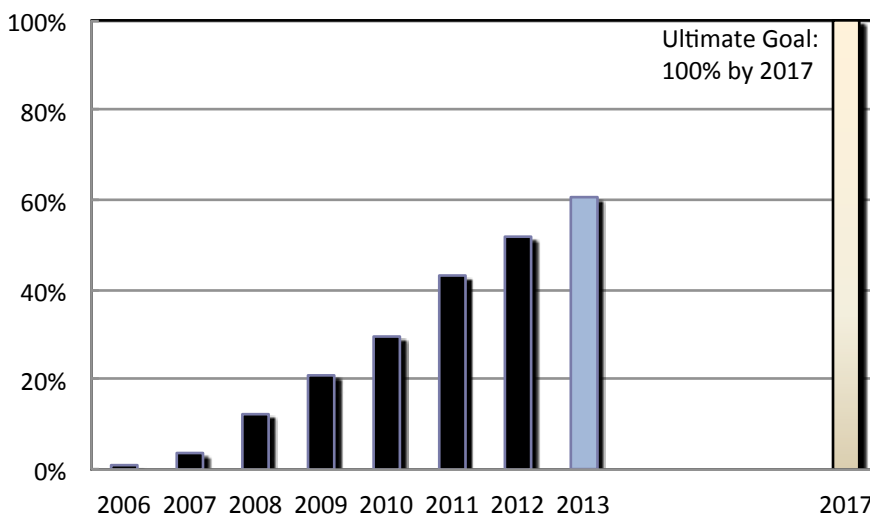


The MPCA and partner organizations evaluate water conditions, establish improvement goals and priorities, and take actions designed to restore or protect water quality on a 10-year cycle.

What are we doing?

The approach is a 10-year rotational cycle where an average of eight of Minnesota's 81 major watersheds are intensively monitored each year for stream water chemistry, biology, and lake chemistry. These data from monitoring activities determine if thresholds to protect

Cumulative percent of watersheds monitored



public health, recreation and aquatic life for any number of pollutants, ranging from bacteria to nutrients, are being met.

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

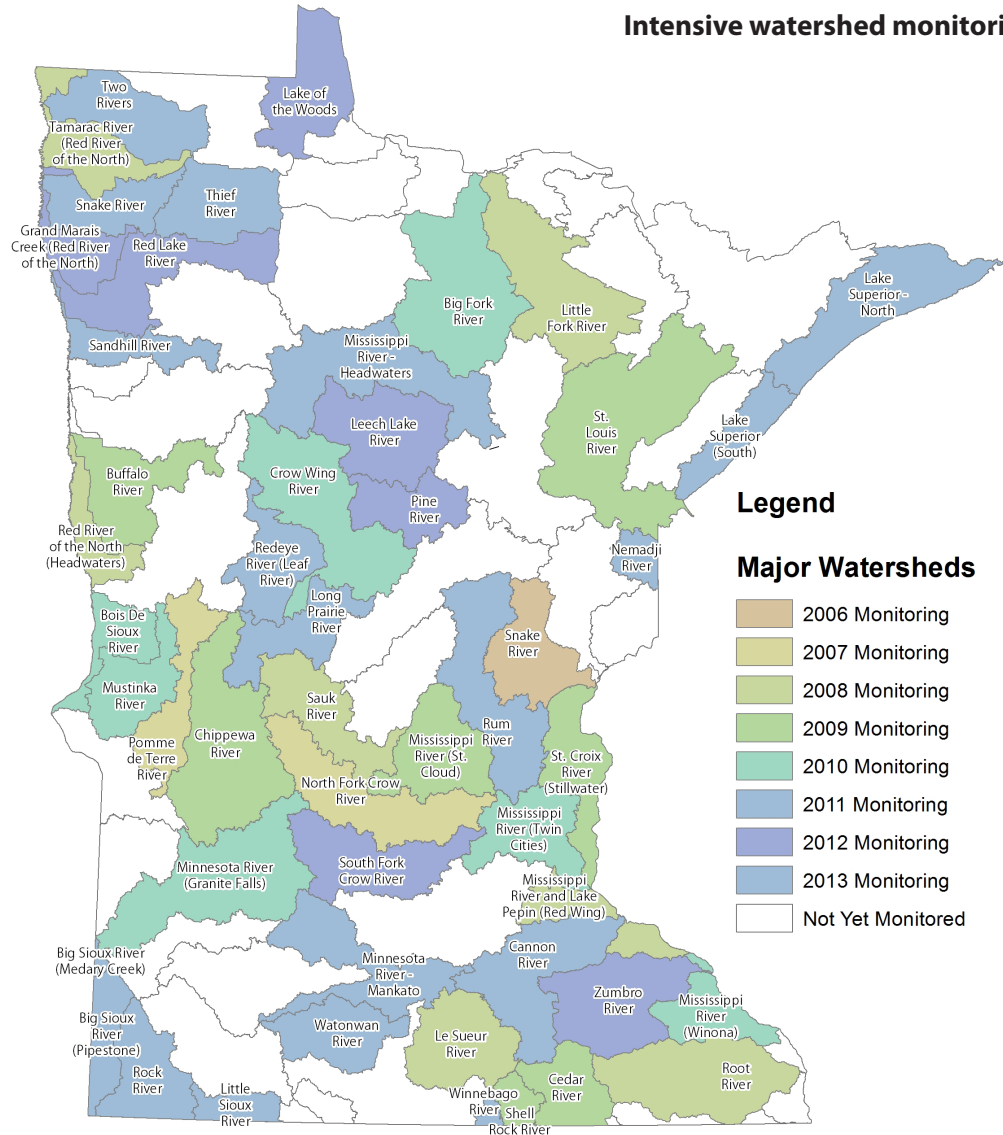
What progress has been made?

The first 10-year cycle began in 2008 and will be completed in 2017. To date, watershed monitoring plans are on track.

- 52 percent of major watersheds are completely monitored.
- 7 additional watersheds were monitored in 2013.

In 2018, a new cycle begins, which means returning to the watersheds that were monitored 10 years earlier. Re-monitoring lakes and stream sites gives a better understanding of whether water quality has improved, declined or remained the same.



Intensive watershed monitoring



State's major watersheds intensively monitored through the Watershed Approach through 2013.

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/index.php/water/water-types-and-programs/watersheds/watershed-overview-map.html
- Learn when the MPCA will be intensively monitoring your watershed: www.pca.state.mn.us/index.php/view-document.html?gid=10232.

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



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 81 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 of the monitoring necessary to comprehensively assess the waters in the state. Local partner participation is crucial to meet water monitoring strategy goals and to build a base of engaged participants for restoration and protection activities that follow the monitoring and assessment of waters.

What are we doing?

MPCA works with local organizations across the state to build capacity for monitoring efforts. Each year, MPCA prioritizes certain lake, river, and stream sites and 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 limited funding opportunities to those watershed that are due for condition monitoring under the agency's 10-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 dataset 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 load monitoring to aid in restoration and protection strategies.

What progress has been made?

Through advertising and expansion of the grant opportunities to include load monitoring, MPCA has been able to meet our goal of a minimum of 75 percent of the sites offered being picked up by local partners.



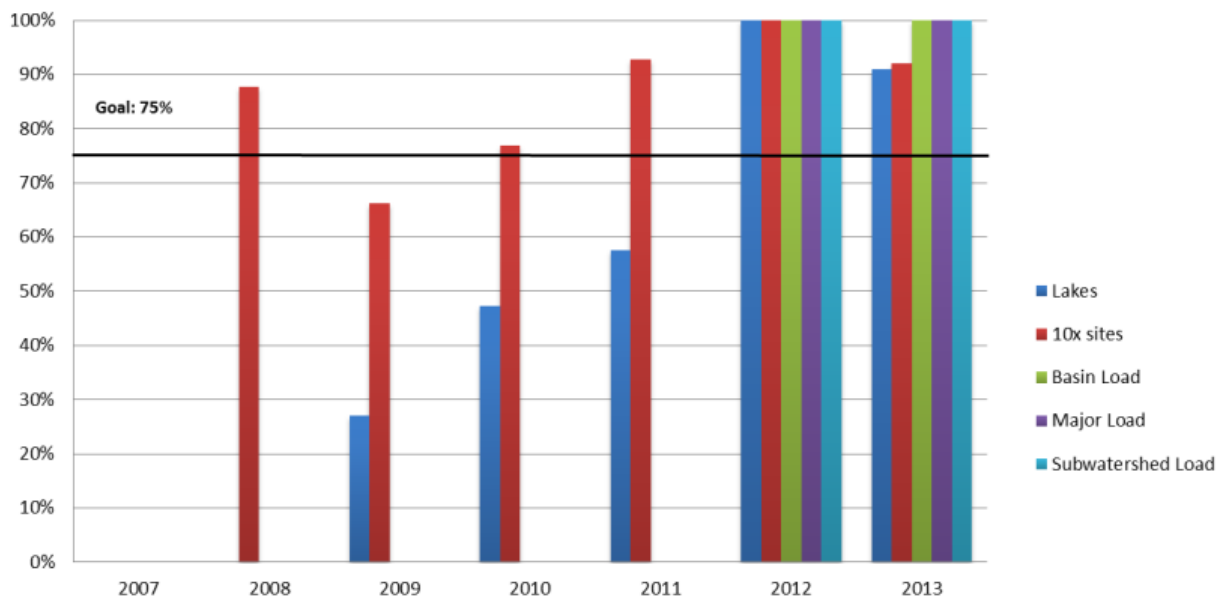
Local partners and volunteers play a crucial role in assessing the health of lakes and streams in Minnesota. Cook County Soil and Water Conservation District (SWCD) conducted sampling (top photo) and trained volunteers (bottom photo) to conduct water quality monitoring in 2013 on 36 lakes and 6 streams in the Lake Superior North watershed.

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/index.php/view-document.html?gid=10232
- Surface Water Assessment Grants: www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/surface-water-financial-assistance/surface-water-assessment-grants.html
- Watershed Pollutant Load Monitoring Grants: www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/streams-and-rivers/watershed-pollutant-load-monitoring-network.html#grants

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

Percent of watershed chemistry monitoring performed by local partners





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. This measure helps us monitor progress towards 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?

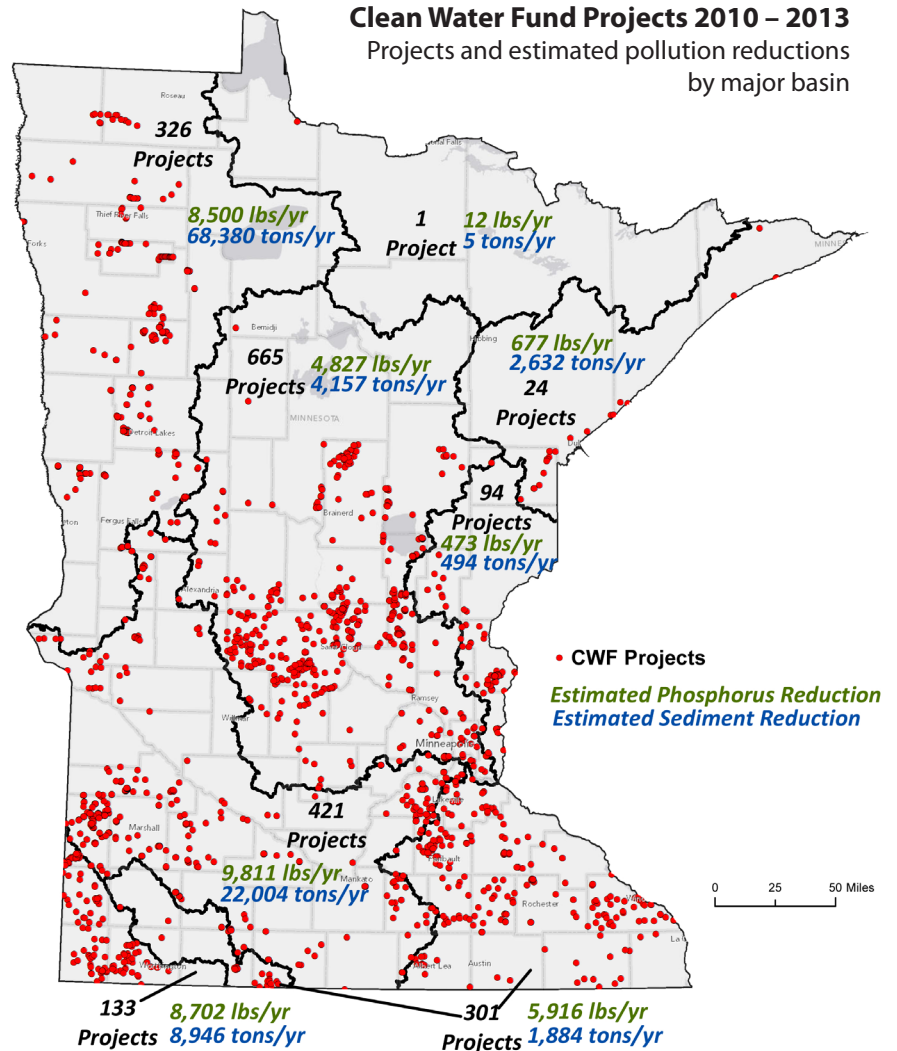
The Board of Water and Soil Resources (BWSR) is the primary state agency responsible for nonpoint source implementation and operates in partnership with local governments. Local governments—cities, watershed districts, counties and soil and water conservation districts—are leading both cleanup and protection 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.

Estimating the environmental benefit of specific management practices can be done numerous 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 improve and refine our estimates, so we can better quantify the environmental benefits of conservation practices.

Clean Water Fund Projects 2010 – 2013

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 9,168 lbs/yr phosphorus reduction and 10,511 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.

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. However, funding is not keeping pace with demand.



From 2010 to 2013 Clean Water Fund has:

- Funded more than 325 grants to protect and restore Minnesota water resources,
- Issued more than 425 loans to prevent nonpoint source water pollution or solve existing water quality problems,
- Secured more than 375 easements that will permanently protect approximately 4,264 acres along riparian corridors and within well head protection areas,
- Repaired 524 imminent health threat Subsurface Sewage Treatment Systems, and
- Fixed 133 feedlots located within riparian shore land areas.

In total, more than 2,400 best management and conservation practices have been installed, resulting in a reduction of approximately 48,000 pounds of phosphorus and 119,000 tons of sediment across the state.

What is next – the future evolution of this measure

In order to ensure that progress is being made in achieving clean water and drinking water goals, it is important that Clean Water funds are invested in ways that address the most pressing water and land resource issues. Current tracking efforts need to be refined to more clearly show that implementation actions are prioritized,

targeted, and achieving measurable results. As more experience is gained in implementing the Watershed Approach, this measure will evolve to better and more consistently track the effectiveness and efficiency of Clean Water funded implementation projects. It is anticipated the framework for this modified measure will be introduced in the 2016 Clean Water Performance Report.

Learn more

- Find more information about this measure and its data at www.legacy.leg.mn/funds/clean-water-fund.
- BWSR clean water stories: www.bwsr.state.mn.us/cleanwaterstories
- AgBMP Loan Program: www.mda.state.mn.us/grants/loans/agbmploan.aspx.
- Clean Water Funded projects: www.legacy.leg.mn/funds/clean-water-fund

Status	Trend	Description
		Although funding has increased and there is a continued increase in practices and projects being implemented, the total request for projects was approximately 3 times greater than available funds.

Municipal infrastructure project implementation

ACTION

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

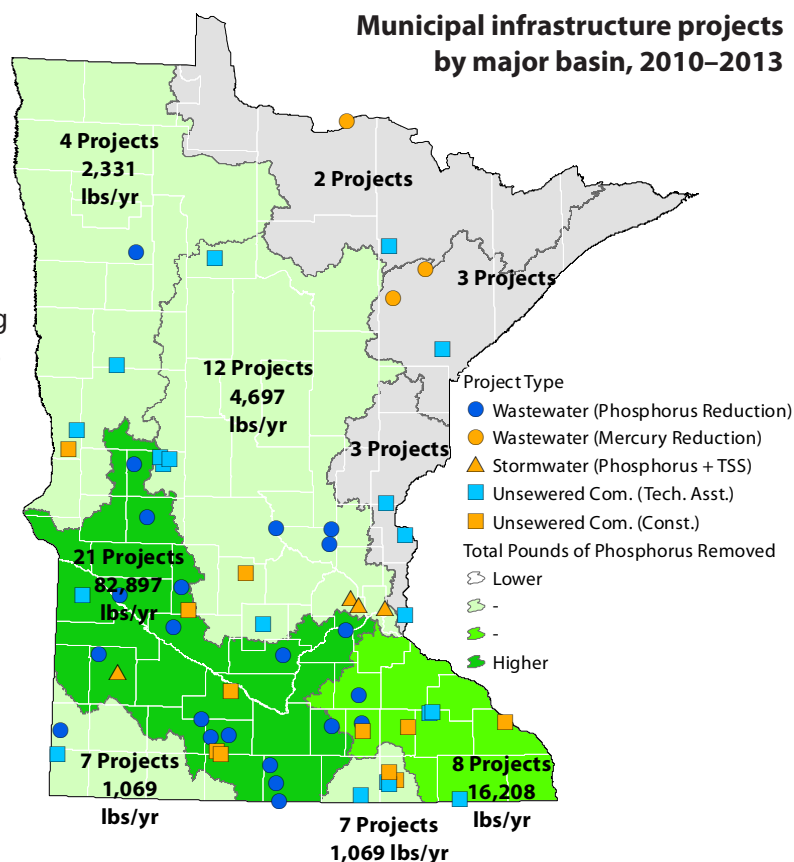
Why is this measure important?

Municipalities across Minnesota are required to replace failing septics, upgrade wastewater treatment facilities and increase treatment of stormwater runoff in order to protect or restore our state's waters. These construction projects help meet required wasteload reductions through implementation of TDMLs and Water Quality Based Effluent Limits (WQBEL). These reductions are in addition to the major water quality benefits already being 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 Clean Water Legacy programs supplement existing state and federal funding so that municipalities can implement these important upgrades more quickly.



What progress has been made?

Since 2010, Clean Water Fund dollars have helped 60 municipalities implement wastewater and stormwater projects, including:

- 22 wastewater construction projects to reduce phosphorus discharges to 1 milligram per liter or less, resulting in a total phosphorus reduction of more than 100,000 pounds per year.
- 3 wastewater construction projects to reduce mercury discharges, resulting in a total reduction of 4,607 milligrams per year.
- 4 stormwater construction projects that will provide treatment to reduce phosphorus discharges by 1,272 pounds per year and also result in significant decreases in total suspended solids.
- 20 small community technical assistance projects to help small unsewered communities identify



Stormwater discharge providing little to no treatment into Crystal Lake.

treatment alternatives to address serious water quality and public health problems from non-complying septic systems.

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

The majority of projects to date have focused on reducing phosphorus discharges from wastewater treatment facilities. Phosphorus is a nutrient which, when present in excessive amounts, is responsible for water quality impairments due to excess algal growth. Stormwater treatment is another area where Clean Water Funds are having an impact by reducing discharges of phosphorus and suspended solids. Stormwater project costs are significant since many of the largest contributing areas are densely developed with limited space and few options for treatment. Cities evaluate a variety of best management practices (BMP's) to select projects that meet the necessary reduction of pollutants and coincide with local land-use plans. Two good examples of stormwater projects that received Clean Water Funds are in the Ramsey-Washington Watershed District and the City of Minneapolis.

The Ramsey-Washington Watershed District implemented a bold and nationally precedent-setting, public-private partnership to construct a \$10 million retrofit of a 32-acre shopping mall parking lot. CWF dollars were used to add tree trenches and rain water capture and reuse. By reducing the site's phosphorus and sediment loads by 60 to 70 percent, the project achieves 33 percent of the load reduction required to restore a small metro lake. This green parking lot design removes 29 pounds of pollutants, but also provides an educational, on-the-ground example of a new approach to stormwater management.





Minneapolis removed a 5 ½ block section of road to create a green way that provides treatment of stormwater prior to discharge into Crystal Lake.

The City of Minneapolis wanted to address a flood-prone area of the city that had little or no treatment of runoff prior to discharge into Crystal Lake, an impaired waterbody. Using CWF dollars, the city installed BMPs to meet load reductions requirements while also providing a public greenway with trails and gardens. The "greenway" project resulted in removing six blocks of city streets and installing a series of bio-filtration basins and rain gardens that treat for pollutants and also provide a neighborhood amenity.

Learn more:

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

Status	Trend	Description
		Pace of awards is linked to permit cycles and compliance schedules; demand also varies based on municipal budgets and other competing infrastructure demands.



Surface water health

OUTCOME

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

Why is this measure important?

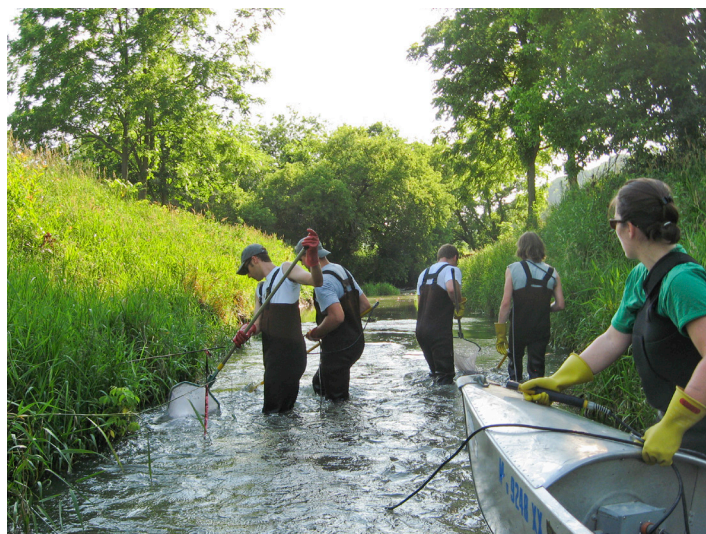
Many Minnesotans want to know if they can swim and fish in their favorite lake or stream. Until recently, a relatively small percentage of lakes and streams had enough water quality information to determine if Minnesota's water goals were being met. In order to determine a waterbody's health, state agencies 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 81 major watersheds are intensively monitored each year for stream water chemistry and biology, and for lake chemistry. 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 2013, 35 out of 81 watersheds have been assessed. An additional seven watersheds will be assessed in 2014. The assessment results are located on the MPCA's



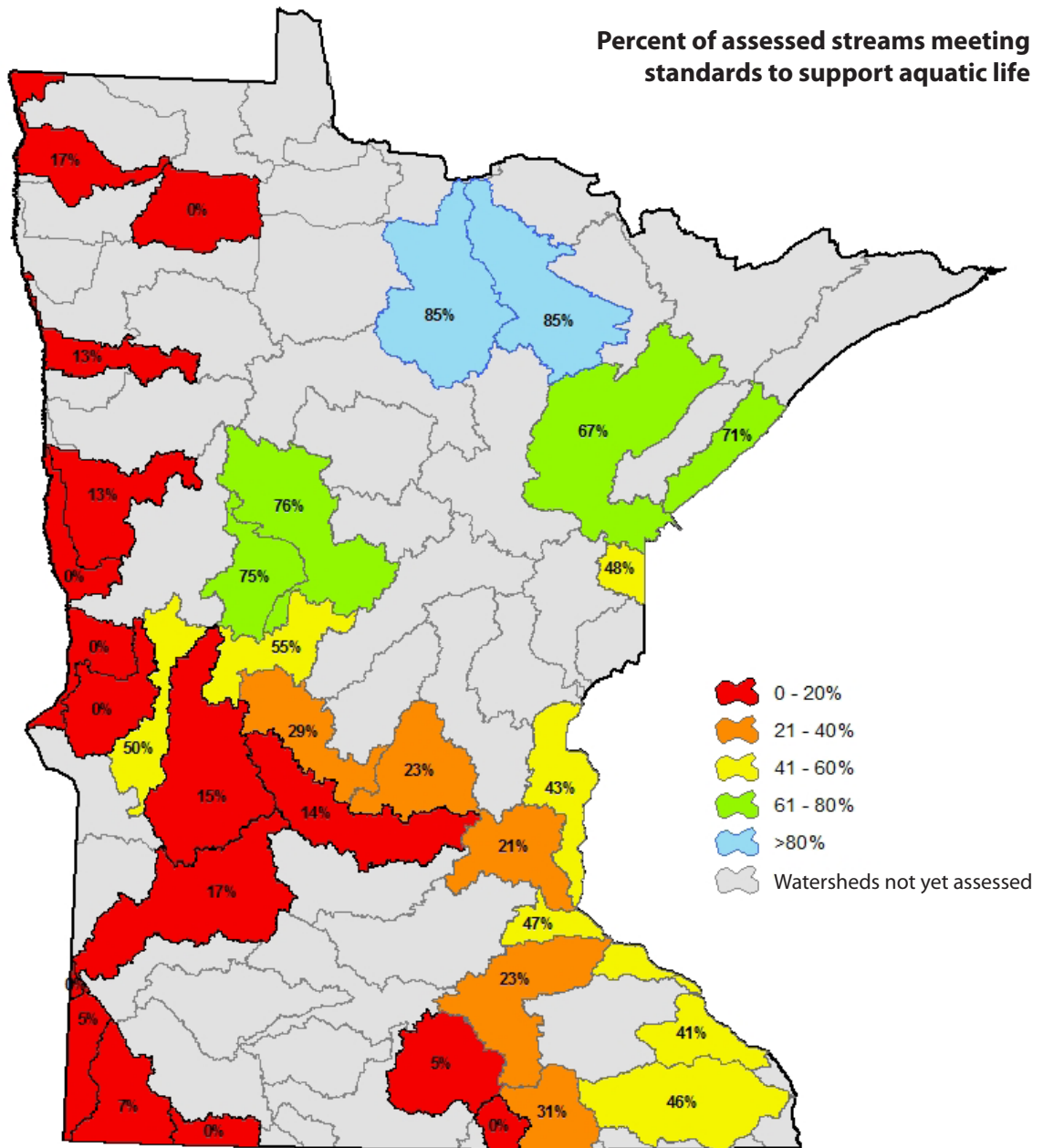
MPCA fish monitoring crew shocking Thompson Creek, Houston County. Fish are used to help determine if streams are meeting aquatic life uses.

Minnesota Watershed web page at www.pca.state.mn.us/watersheds.

Learn more

- Find more information about this measure and its data at www.legacy.leg.mn/funds/clean-water-fund.
- Find water quality assessment results for specific lakes and streams at <http://cf.pca.state.mn.us/water/watershedweb/datasearch/waterSearch.cfm>.
- Visit www.pca.state.mn.us/index.php/view-document.html?gid=10232 to find out when your watershed will be monitored.

Status	Trend	Description
● Stream 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.
● Lake swimming		
● 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, stream and wetland water quality

OUTCOME

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

Why is this measure important?

Water quality in a lake, stream, or wetland 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, stream and wetland 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, streams, and wetlands.

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.

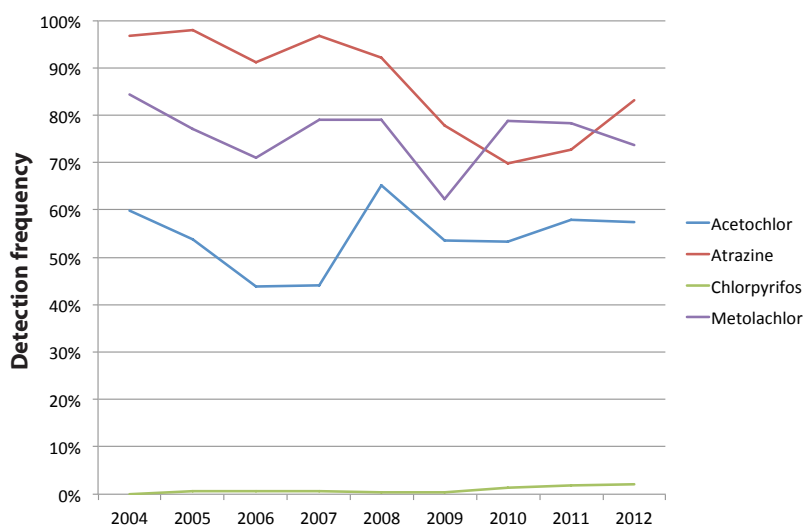
In addition to analyzing data from existing sites, state and local partners are expanding the monitoring network to provide information in new areas or places facing new threats.

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 Major Watershed Load Monitoring network began in 2008. Baseline watershed yield information is now available.
- MDA's monitoring for presence and concentration of pesticides in the state's groundwater and surface water began in 1985 and 1991, respectively. In 2010 MDA expanded its laboratory capability and now collects more surface water pesticide samples than ever before.

2004 – 2012 MDA statewide pesticide detection frequency



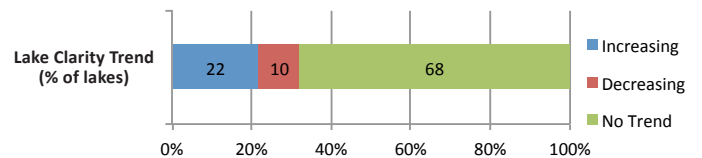
- For more than 15 years, volunteers in the Citizen Lake and Stream Monitoring programs have collected lake and stream water clarity information. These volunteer programs are vital in gathering data for long-term trend analyses.
- The MPCA participated in the National Aquatic Resources Surveys for lakes, 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 10-year rotation of intensive watershed monitoring begins in 2018.
- The Comprehensive Wetland Assessment program gave a baseline of the condition of depressional wetlands for 2007-2009. Results from the next survey will be reported in 2014.

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.

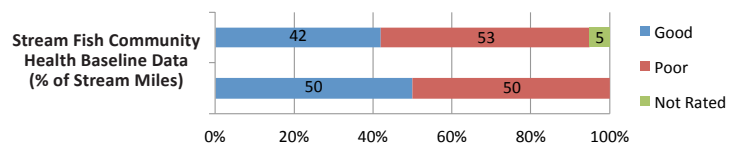
Learn more

- The MPCA has a rich array of graphics that can be produced for multiple combinations of waterbody types, pollutants/parameters, and monitoring

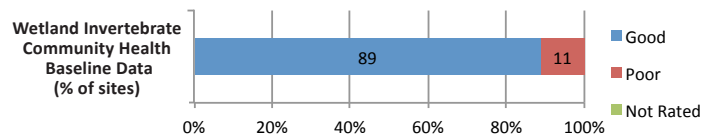
approaches to provide a comprehensive picture of the state of Minnesota's water resources. See www.legacy.leg.mn/funds/clean-water-fund.



Trends in lake water clarity between 1973 and 2012. 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.



Wetland invertebrate communities across the state are doing well overall; those sites not faring as well are mostly in the former prairie region of the 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 or no changes 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.
● Wetland invertebrates		Wetland invertebrates: Statewide, most wetlands have good quality aquatic insect communities.
● 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 led to successful restoration of an impaired water. An “impaired water” is a lake, stream or river that is not meeting federal water-quality standards due to one or many pollutants, such as nutrients, bacteria, mercury and sediment. High levels of pollution in an impaired water 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 we monitor and assess more of the state’s watersheds, so too is the list of waters that are improving. Cleanup efforts can take several years to decades to complete, but there are many examples of impaired waters that have been restored.

What are we doing?

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

What progress has been made?

Ultimately, the target is to restore all impaired waters in Minnesota. The Minnesota Pollution Control Agency (MPCA) began listing impaired waters in 1998; since that time 33 previously impaired lakes and river segments are now meeting water quality standards due to corrective actions.

One notable success story is the recovery of Powderhorn Lake, located in south Minneapolis. Long considered an extreme example of an algae-covered lake suffering from stormwater runoff in a heavily urbanized area, it has made a dramatic comeback over the past 10 years and was delisted from the Impaired Waters List in 2012.

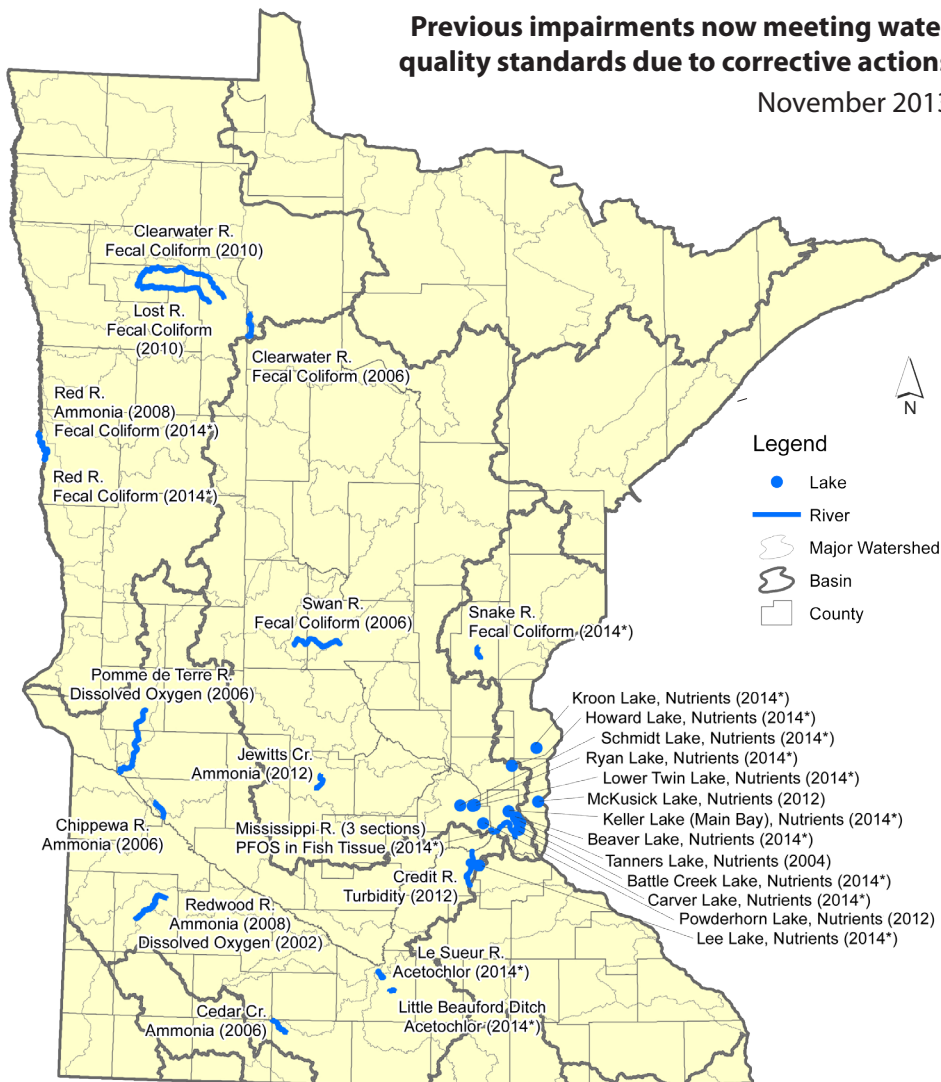


Powderhorn Lake in south Minneapolis was successfully restored and delisted from the Impaired Waters List in 2012.

This was accomplished through a long-term partnership between the Minneapolis Park and Recreation Board, the City of Minneapolis, Save our Lake, and the Powderhorn Park Neighborhood Association. Investments were made for the installation of BMPs designed to reduce phosphorus such as; aggressive efforts to reduce in-lake sources, shoreline native plant restoration, fish and goose management and a wide variety of stormwater controls.

Previous impairments now meeting water quality standards due to corrective actions

November 2013





Many other waters are improving

In most cases, the 33 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 numerous lakes and streams making restoration progress. For example, a 2008 study of 15 large lakes (more than 1000 acres) in Crow Wing County showed that two-thirds of these lakes are improving or maintaining water quality, despite increasing development and recreational pressures. This is due to a wide range of management activities during the past few decades. Although full restoration of Minnesota's waters will take time, the Clean Water Fund investments will help accelerate the pace of these activities.

Learn more

- Find more information about this measure and its data at www.legacy.leg.mn/funds/clean-water-fund.
- Find your watershed and restoration projects at: www.pca.state.mn.us/jsrid8f.
- Crow Wing County Large Lakes Assessment, 2008: www.co.crow-wing.mn.us/index.aspx?NID=705.

* To be proposed by MPCA for delisting in the next listing cycle. Delisting proposals are subject to public comment and EPA approval.

Status	Trend	Description
		There is much variability in water quality across the state, but many projects are making progress in improving water quality. More water bodies are being listed as impaired relative to the slower rate of water bodies being delisted.

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, we can track mercury emission levels over time through periodic emissions inventories and then measure how fish mercury levels respond. Because of the large variation in mercury concentrations from year to year within and among lakes, long-term trends of mercury in fish are necessary to see if pollution control efforts are sufficient.

What are we doing?

The Minnesota Department of Natural Resources (DNR) is leading efforts to track mercury levels in fish. The DNR collects fish from approximately 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 has shown that (1) most fish contain some mercury, (2) the average mercury level generally increases from south to north in Minnesota, and (3) panfish have lower mercury levels than top predator fish. This is the basis for MDH statewide guidelines for eating fish. Sampling previously tested waters to look for trends in fish-mercury levels has been a priority in the last two decades.

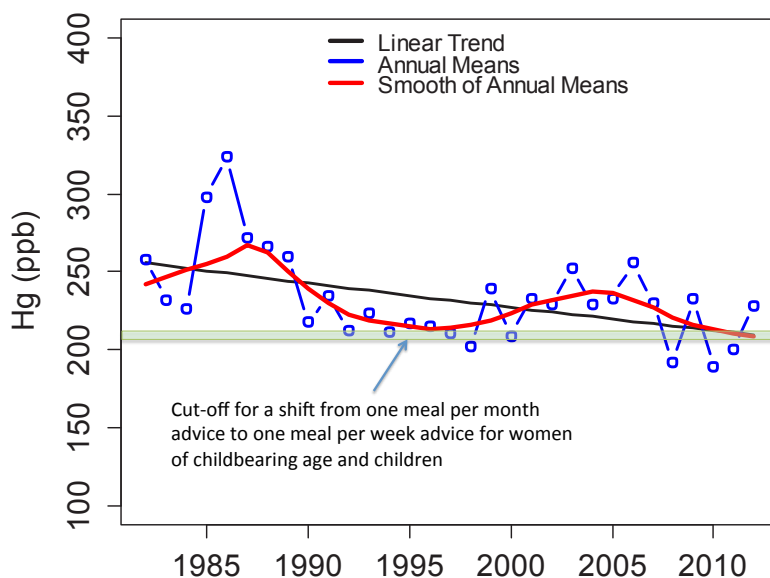
What progress has been made?

Between 1982 and about 1996, a clear downward trend in mercury concentrations in northern pike and walleyes was observed. The trend was reversed in the 1990s and continued to rise until 2007, but again turned downward since then (Figure 1). The linear trend over 31 years (1982-

2012) has been a decrease of 0.7 percent per year. Current mercury concentrations shown in Figure 1 are approaching the point where 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 percent reduction in mercury input from all human sources. Minnesota receives 90 percent 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. 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. Since 1990, removing mercury from latex paint, requiring mercury controls on municipal waste combustors, banning small onsite incinerators, mercury in batteries, and disposal of mercury-containing

Figure 1 – Trend of mercury in northern pike and walleye from Minnesota lakes



products has reduced mercury emissions in Minnesota by more than 70 percent.

To reach the 93 percent 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 (Figure 2) 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 are based on calculated projections, while 2025 represents the emissions target for each sector.

Learn more

- Find more information about this measure and its data at www.legacy.leg.mn/funds/clean-water-fund.
- Fish Contaminant Monitoring (DNR or MPCA): www.pca.state.mn.us/sbiz6b0.

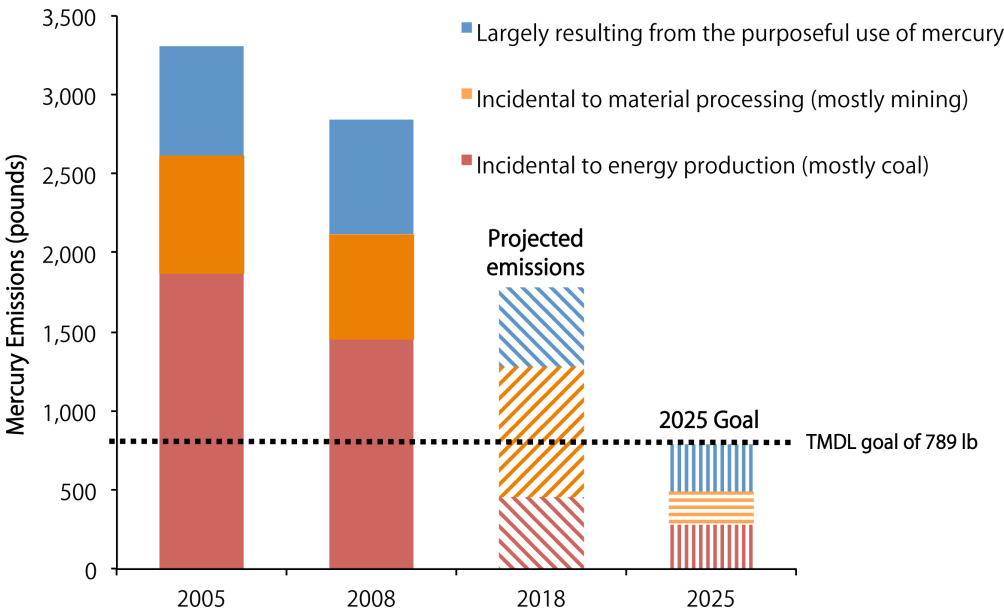


Figure 2 - Mercury emissions from Minnesota sources; 2005 and 2008 are based on measured and calculated inventories

- Fish Consumption Advice (MDH): www.health.state.mn.us/divs/eh/fish/index.html.
- Fish Consumption Advice (Lake Finder): www.dnr.state.mn.us/lakefind/index.html.
- Mercury TMDL Implementation Plan: www.pca.state.mn.us/tchyc1
- UNEP Mercury Emissions Inventory: www.unep.org/hazardoussubstances/Mercury/MercuryPublications/ReportsPublications/tabid/3593/Default.aspx.

	Status	Trend	Description
Mercury in fish	●	↗	Mercury in gamefish 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 in Minnesota although on a world-wide scale emissions are increasing.



Municipal wastewater phosphorus changes

OUTCOME

Measure: Changes over time in municipal wastewater phosphorus discharges

Why is this measure important?

Under natural conditions phosphorus (P) is typically scarce in lakes and streams. The past 100 years of human activities have resulted in excessive loading of phosphorus into many freshwater systems. This can cause water pollution by promoting excessive growth of algae, particularly in lakes, turning them green and suffocating fish and other aquatic life in serious cases. Approximately 10 percent of the phosphorus load to Minnesota waters comes from point sources such as over 1,000 municipal and industrial wastewater treatment facilities.

This measure shows trends in the amount of phosphorus being discharged from municipal wastewater treatment plants. These regulated facilities must treat water that goes down the drain from our homes and businesses. They are required to clean up phosphorus, as well as many other pollutants, to levels that protect water quality.

What are we doing?

Regulatory actions taken over the past 10 years (see graphic next page) have resulted in the reduction of phosphorus discharged by wastewater treatment facilities. The treatment plant improvements needed to achieve these reductions are expensive, particularly for smaller cities. Clean Water Legacy funding has helped cities make the required infrastructure investments to meet phosphorus wasteload reductions mandated through the implementation of TMDLs and WQBELs (Water Quality Based Effluent Limits).

Since 2010, \$13 million in Clean Water Fund grants have helped 22 municipalities finance wastewater treatment upgrades to meet required phosphorus reductions. These grants leveraged an additional \$17 million in other funding for these infrastructure improvements. The availability of these Clean Water Fund grants help cities implement these treatment improvements on an expedited time schedule.

What progress has been made?

Over the past 13 years, municipal wastewater phosphorus discharges statewide have been reduced by 80 percent compared to the projected increases that would have resulted from previous permitting policies. Overall, these combined efforts have led to a steady



The Willmar Wastewater Treatment Facility upgrades reduced phosphorus discharge to Hawk Creek by 88 percent.

decline of phosphorus pollution and major improvements in water quality.

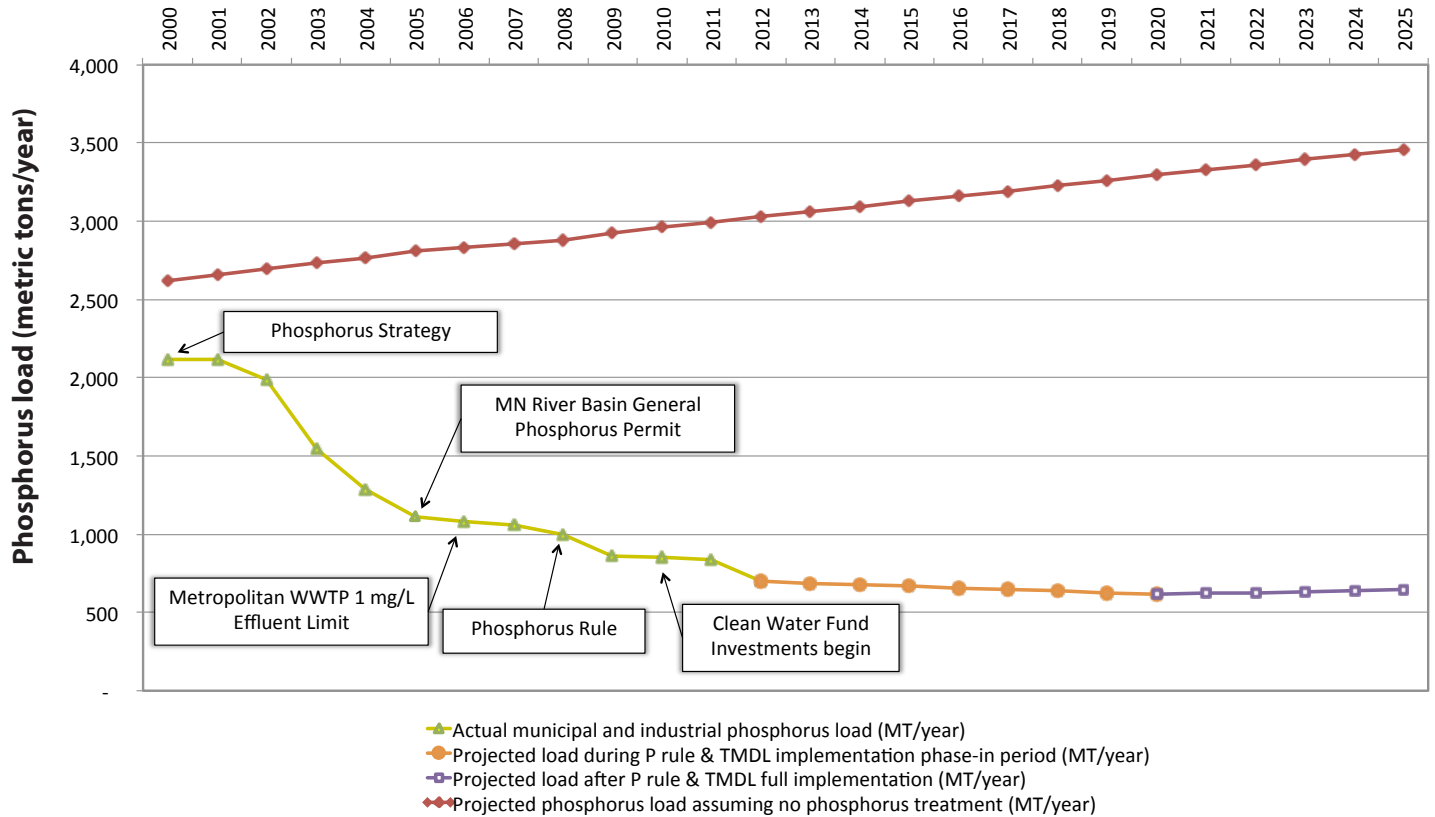
Learn more

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

- www.legacy.leg.mn/funds/clean-water-fund
- www.bwsr.state.mn.us/cleanwaterstories
- 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. Future reductions will continue to be challenging and expensive as small systems receive limits and tighter discharge permits resulting in extremely low phosphorus concentrations.

Municipal wastewater phosphorus trends



This graphic estimates statewide municipal wastewater treatment facility phosphorus reductions since the year 2000 and projects future reductions based on the implementation of current permitting policies.



Drinking and groundwater measures

The eleven measures contained on pages 33-51 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

Outcomes

8. Groundwater quality
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 are used for drinking water. Source water protection prevents 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 to contaminating a source of public drinking water
- Sustainable water supplies are ensured for future generations' health and economic needs.

What are we doing?

Source water protection plans can be developed for groundwater wells or surface water and are required for all public water systems that use groundwater. Some systems that use surface water have voluntarily developed source water protection plans. These plans protect source water used for drinking water by identifying the land area that supplies water to the well or intake, the vulnerability of that area, and implementing appropriate land and water resource management strategies.

Communities receive assistance with source water protection from several partners. The Minnesota Department of Health (MDH) is the primary agency responsible for source water protection; it provides technical assistance and reviews and approves source water protection plans. However, the Minnesota Department of Agriculture, Minnesota Department of Natural Resources, Minnesota Pollution Control Agency, Metropolitan Council, Board of Water and Soil Resources, federal agencies, watershed districts, and neighboring communities all provide vital information and management tools.



Water from the Mississippi River moves through a series of lakes to this intake for the St. Paul Regional Water Services water treatment plant. Twenty-five percent of Minnesotans receive water in their homes from rivers, lakes or other surface water sources.

Clean Water Fund support increases the number of communities MDH is able to assist. In the 2012-2013 biennium, the four planners funded through the Clean Water Fund provided technical assistance to 217 community water supplies. This more than doubles the previous technical assistance MDH provided, including support to local source water protection plan committees and meeting with them to collaborate in plan development and implementation.

The Clean Water Fund has also improved the quality of source water protection plans and implementation by supporting more robust water resource evaluation and management, more detailed contaminant assessment, and grants to communities to support plan implementation.

What progress has been made?

MDH staff have been working towards the goal of having every community water supply in Minnesota engaged in source water protection by the year 2020. The experience gained in this effort has led us to conclude that such a goal was not realistic, even with the additional resources



provided by the Clean Water Fund. Instead, MDH efforts will be prioritized using risk-based criteria to target community water supplies based on population served and vulnerability of the source. About 433 of the 919 community water supplies are considered “vulnerable.” Out of a total of 320 source water protection plans approved at the end of FY 2013, 253 are for vulnerable systems. The goal is to engage each one of these vulnerable systems in source water protection activities by 2020. These efforts will reach the vast majority of Minnesotans who receive water from a community water supply system.

The chart below shows the modest increase in the number of communities that MDH has brought into the source water protection program since Clean Water funding has become available and the program has begun to ramp up. The dashed line starting in 2013 shows

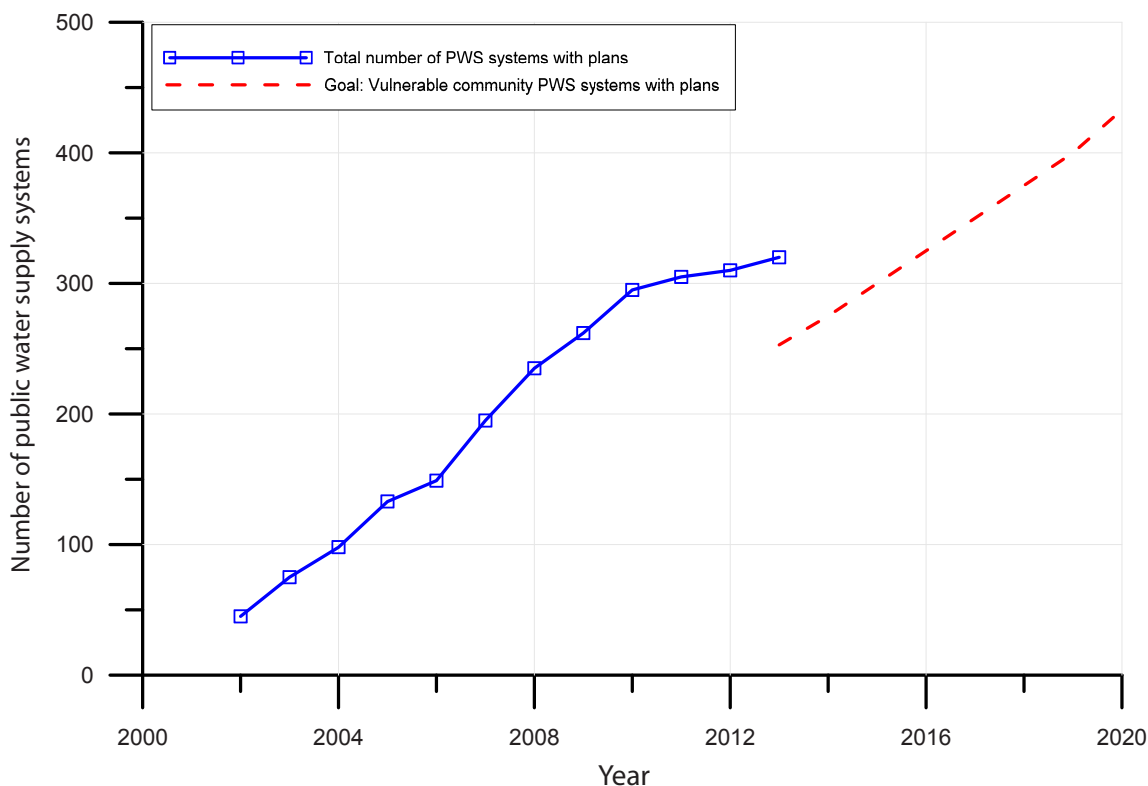
the number of vulnerable communities that MDH is projecting to be added through the year 2020.

Learn more

- Find more information about this measure’s data at www.MetadatazCool.mn.us
- About source water protection at www.health.state.mn.us/divs/eh/water/swp/index.htm.

Status	Trend	Description
		Met target for FY 12-13. On track to meet long-term target of every vulnerable community public water system engaged in source water protection by 2020.

Progress on source water protection planning in Minnesota





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 our sources of drinking water. In Minnesota, we use a series of strategic safeguards to protect drinking water from source to tap. In this economically challenging time, a modest grant, sometimes matched with other funds, can enable a local water supplier to take concrete 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.

Grants made possible through the Clean Water Fund are used by public water suppliers across the state to implement source water protection strategies that are part of an approved plan or document.

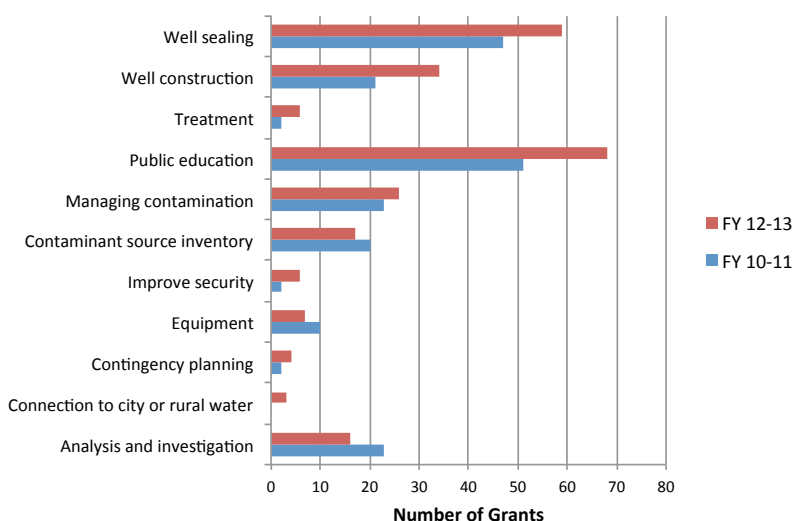
Typical source water protection actions include:

- Sealing a well
- Constructing a new well
- Installing a monitoring well
- Well inspection (video log, gamma log)
- Educating the public about drinking water protection
- Updating well inventory
- Updating contaminant source inventory
- Upgrading membrane filters
- Managing fuel storage tanks
- Connection to rural water
- Cleaning up illicit dumping near well
- Supporting property owner’s efforts to manage nitrogen
- Spill prevention and emergency response plan

What progress has been made?

Individual public water supply systems are expected to implement 75 percent 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 a range of implementation efforts. Demand for grants to implement source water protection plans continues to grow.

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.
- Source water 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 (referred to as nitrate) is a water-soluble compound made up of nitrogen and oxygen. It can occur naturally in groundwater at levels typically in the range of 0 to 3 parts per million (ppm). Human activities such as sewage disposal, livestock production, and crop fertilization can elevate the level of nitrate in groundwater. The drinking water standard for nitrate is 10 ppm; above this level nitrate can have negative effects on human health, specifically for infants under the age of six months. Nitrate has been found above the 10 ppm drinking water standard in Minnesota groundwater (specifically drinking water), mainly in areas where well construction or surface geology (type of bedrock or soil) allows the rapid movement of nitrate from the land surface down to groundwater resources.

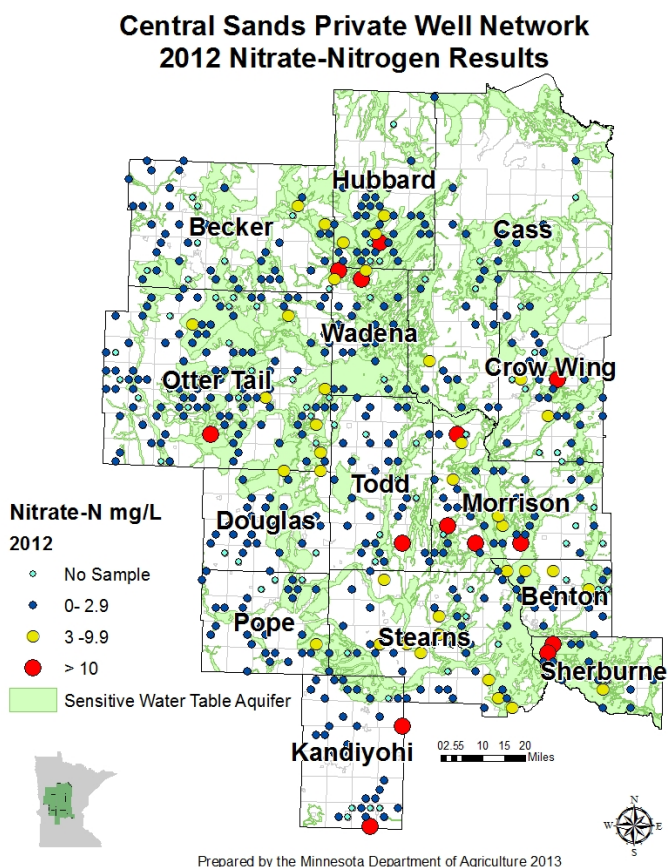
Areas of the state that are most vulnerable to nitrate contamination are the Central Sands region in central Minnesota and the Karst region in southeast Minnesota. In the Central Sands region, coarse-textured (sandy) soil and shallow groundwater allows for rapid movement of nitrate into groundwater; in the Karst region fractured bedrock covered by shallow soil allows for rapid nitrate movement.

Minnesota's Clean Water Fund is being used for activities that help identify potential sources of nitrate contamination and evaluate and implement practices to reduce nitrate in groundwater. State agencies work closely with local government units (LGUs) on nitrate monitoring and reduction activities to ensure the Clean Water Fund is spent on projects important to community members and to benefit from the LGU's expertise and knowledge of local issues.

What are we doing?

The Minnesota Department of Agriculture (MDA) focuses its work on nitrate contamination of groundwater from nitrogen fertilizer use. It is working with 20 LGUs on nitrate monitoring and reduction projects and 14 LGUs on nitrate testing clinics. In general, the LGU is responsible for administrative tasks and the coordination of the project while the MDA provides technical and design support. Here are a few examples:

- The MDA partnered with the East Otter Tail Soil and Water Conservation District (SWCD) to carry out a series of irrigation workshops and expand programs that promote proper crop irrigation and nitrogen management. This partnership provides Minnesota irrigators with the knowledge, tools and technology to make informed management decisions.
- In Central Minnesota, the MDA partnered with 14 counties to establish a Private Drinking Water Well Monitoring Network. This network provides a better understanding of nitrate trends in the region and is used to educate private well owners about the quality of their drinking water.
- The MDA partnered with Pope County SWCD, Stearns County SWCD, Prairie Lakes Co-op



This map shows nitrate-nitrogen analysis results from the Central Sands Private Well Monitoring Network in 2012. The health standard for nitrate-nitrogen in drinking water is 10 mg/L.

and the University of Minnesota to accelerate agricultural research and education at the Rosholt Farm in Westport, Minnesota. The goals are to assess nitrogen loss resulting from different fertilizer application rates, application timing, and application methods and to revise nitrogen fertilizer recommendations for irrigated sandy soils.

- The MDA partnered with Dakota County Water Resources Department and the University of Minnesota on a companion study of the nitrogen fertilizer study on the Rosholt Farm in Westport.
- The MDA coordinates walk-in style water testing clinics with the goal of increasing public awareness about nitrate levels in private well water. Clinics are run by local government units with technical support and equipment from the MDA.

What progress has been made?

Each of the LGUs working with MDA is making valuable contributions toward improving nitrogen management. Here are accomplishments for the projects noted above:

- The MDA and East Otter Tail SWCD have hosted seven irrigation workshops in central Minnesota. All workshops have been well attended by local farmers and crop advisors. The MDA also installed four weather stations with four more to be installed in the spring.
- The MDA and East Otter Tail SWCD also support an on-farm adaptive nitrogen management program that encourages producers to implement management actions, monitor results, and to use the results to adjust future nitrogen management. This program is focused around the corn basal stalk nitrate test (BSNT). In 2011, a total of 23 producers enrolled 52 fields in this program. In 2012, participation nearly doubled with a total of 44 producers and 53 fields.
- As of December 2011, a total of 1,555 well owners in the Central Sands Private Well Monitoring Network project filled out a survey about their well (construction type, well depth and age) and sent in a sample to be analyzed for nitrate. In 2013, approximately 500 well owners volunteered to participate in the long-term monitoring network.



MDA staff, Luke Stuewe, in front of a recently installed weather station located at the Rosholt Farm in Westport, Minnesota. Weather information such as precipitation, air temperature, and wind speed can help local farmers plan their water and nitrogen management.

- 2013 marks the third full year of data collection at the Rosholt Farm. There were multiple field days, all well attended by farmers, agricultural suppliers, academic researchers, LGUs, state agency staff and private industry representatives.

Learn more

- Find more information about this measure and its data at www.legacy.leg.mn/funds/clean-water-fund.
- MDA Clean Water Fund groundwater protection: www.mda.state.mn.us/protecting/cleanwaterfund/gwdwprotection.aspx.
- Nitrogen Fertilizer Management Plan: the state's blueprint for minimization of the impacts of nitrogen fertilizer on groundwater: www.mda.state.mn.us/en/chemicals/fertilizers/nutrient-mgmt/nitrogenplan.aspx

Status	Trend	Description
●	➔	MDA continues to establish new local partnerships for nitrate-nitrogen monitoring and reduction activities.

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?

There are frequently reports in the news about chemicals being found in the environment, our food and water and in us. New or improved laboratory methods for measuring chemicals, new chemicals, and expanded uses for existing chemicals have led to finding more contaminants in more places. 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. Contaminants of emerging concern can include medications, cosmetics, plastics, and other chemicals.

What are we doing?

MDH is developing health based-guidance for contaminants of emerging concern that tell Minnesotans at what level a chemical can safely be in their drinking water. For each contaminant reviewed, a citizen-friendly

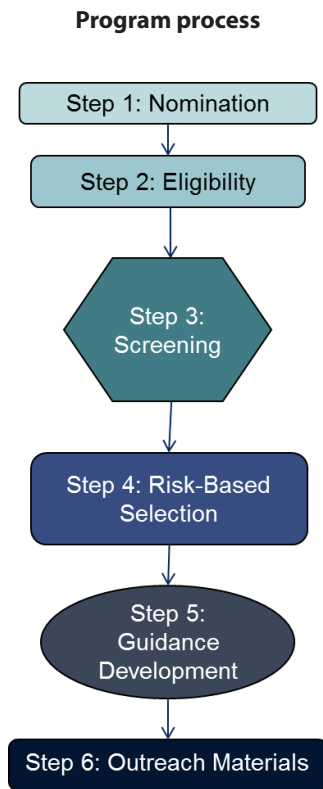
information sheet is published that describes the contaminant and the health-based guidance value, how Minnesotans might be exposed, and action that can reduce exposure. Additionally, MDH awards grants and contracts to conduct special projects which help evaluate chemicals in cases where there is not currently enough information to conduct a full review. Partnerships have been formed with other state agencies, including the Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Agriculture (MDA), to evaluate the results of their water monitoring studies. MPCA is monitoring for contaminants of emerging concern in both Minnesota surface and groundwater using Clean Water Fund dollars.

What progress has been made?

Through the end of FY12-13, 66 chemicals were nominated to the MDH Contaminants of Emerging

MDH Health-Based Guidance Values FY12-13 (parts per billion in water)	
Chemical Name	MDH Guidance
Bisphenol A (BPA) (plasticizer)	100 ppb
Butyl benzyl phthalate (phthalate)	100 ppb
Dibutyl phthalate (phthalate)	20 ppb
Microcystin-LR (algal toxin)	0.04 ppb
Propyl paraben (paraben)	Not applicable
Skatol (fragrance)	Not applicable
Sulfamethazine (antibiotic)	100 ppb
Sulfamethoxazole (antibiotic)	100 ppb
Triclocarban (anti-bacterial)	100 ppb
Tris(1,3-dichloroisopropyl) phosphate (flame retardant)	0.8 ppb

Concern (CEC) through a nomination process open to the public and interested parties. (Step 1: Nomination, see Process diagram). 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 (Step 2: Eligibility). In FY12-13, 26 nominated chemicals were



further screened. During Screening (Step 3: Screening), chemicals are ranked based on the best available toxicity and exposure data. Factors included in the toxicity ranking are: the chemical's potency, the severity of the potential health effects, and other concerns such as carcinogenicity. Factors included in the exposure ranking are: the likelihood of the chemical to be present in drinking water, the volume of the chemical that is produced and/or released, and any available monitoring data. Ten contaminants were selected for full review (Step 4: Risk-Based Selection) in FY 12-13 and health-based guidance was developed for each (Step 5: Guidance

Development). You can see the FY 12-13 list of reviewed contaminants and the corresponding guidance values in the table on the previous page. A guidance value is the concentration of the contaminant (parts per billion in water) that can be consumed in drinking water with little to no health risk.

For some contaminants of emerging concern, people will have a much greater exposure from using a personal care product or taking a medication than from drinking it in water. As a result, MDH completed a research study on how to better estimate the sources and combinations of exposure and is working on special research on understanding risks from medications in water. MDH also found that the potential impacts to plants and animals that live in water can be different and/or more significant than potential direct impacts to humans. Information sheets (Step 6: Outreach Materials) now include environmental effects of contaminants and research is being conducted on how to include ecological risk in screened chemicals. MDH is expanding chemical screening methods and building laboratory capacity to analyze contaminants of emerging concern in water. In FY12-13 an outreach and education grant program gave funds to local units of government and non-profit organizations to create and disseminate creative and effective materials that educate the public on contaminants of emerging concern in Minnesota waters. The outcomes of these grants will help shape future outreach efforts.

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 FY 12-13. On track to meet goal of ten 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 upwellings 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 which 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 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 and emergency response to contaminant releases.

This measure tracks the extent to which information about both geology and aquifers has been collected in Minnesota.

What are we doing?

County geologic atlases are a cooperative effort between the Minnesota Geological Survey (MGS) and the Minnesota Department of Natural Resources (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?

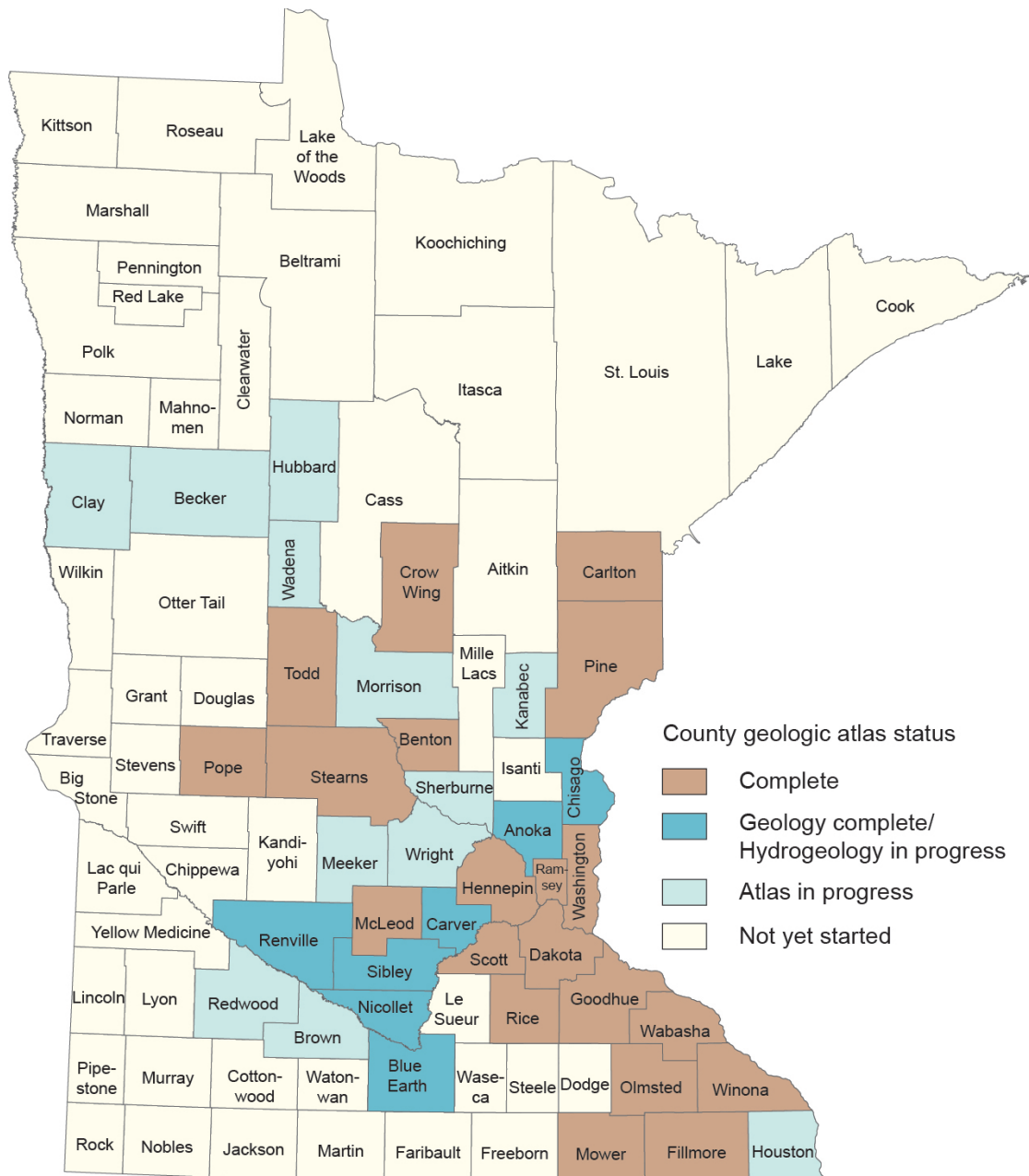
So far, 20 county geological atlases have been completed, representing 16.4 percent of the state (60 percent of the population) and 19 more are underway representing 13.3 percent of the state (20 percent of the population). As is shown in the figure on the next page, the Minnesota Geological Survey has finished the geological assessments in seven 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. The pace at which progress was being made was one or two atlases completed per year. The new Clean Water Legacy funding is allowing the effort to be accelerated and supports expanded detailed data collection for atlases. At the current level of funding, county geologic atlases should be completed for the remaining 48 counties in 10 to 15 years.

Learn more

- Find more information about this measure at www.dnr.state.mn.us/waters/groundwater_section/mapping/index.html
- Point of Contact: Jan Falteisek, P.G., Supervisor, County Geologic Atlas Program. Contact information: jan.falteisek@state.mn.us

Status	Trend	Description
●	↗	Significant progress has been made completing county geologic atlases and the rate of completion has increased. Counties continue to step up to participate but substantial work remains before all counties in Minnesota are done.

Status map of county geologic atlas program





Long-term monitoring network wells

ACTION

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

Why is this measure important?

About 75 percent 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 meet its growing needs, but many parts of the state lack basic information about the availability and quality of groundwater.

Since it is underground, we can’t see groundwater to observe its condition. Monitoring wells provide a ‘window’ into our aquifers, allowing us 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 be sure 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 between 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 our understanding of aquifer conditions across the state and improve local capacity to improve private and public drinking water supply infrastructure development.

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 currently being monitored in 913 wells, about 13 percent of the estimated 7,000 wells needed to provide three to four wells in every township.

The Minnesota Pollution Control Agency manages a statewide network of 210 groundwater quality monitoring wells to determine whether non-agricultural pollution is present and to track any trends in pollution. 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 over 100 regulated and unregulated chemicals, including nitrate, chloride, and volatile organic compounds. This network currently is being enhanced, which should result in a completed network of about 270 wells.

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 ramp up in monitoring accelerated by Clean Water Fund investments is filling gaps.

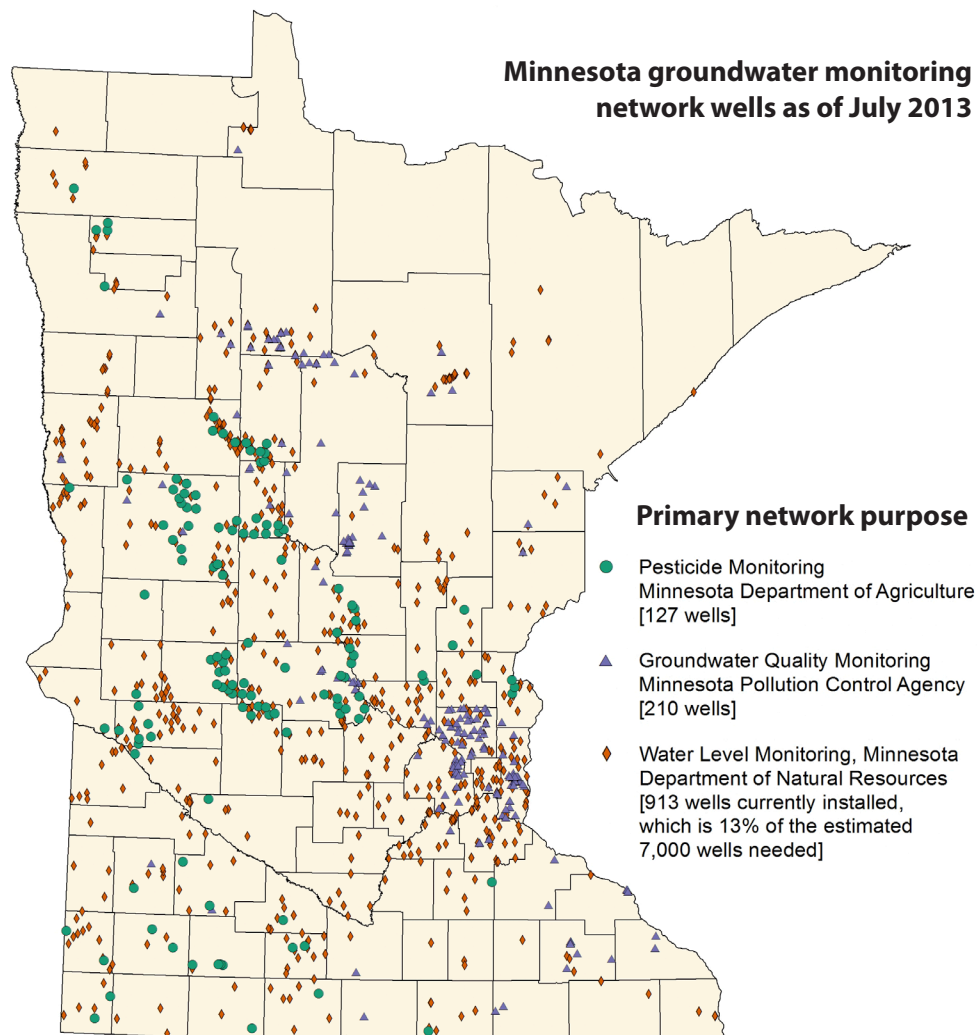
What progress has been made?

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 approximately 70,000 wells over the next six years in an additional 280 townships.

Learn more:

- Find information on activities funded by the Clean Water Fund at www.legacy.leg.mn/funds/clean-water-fund.
- For more about this measure's data: www.MetadatalzCool.mn.us
- MPCA groundwater monitoring and assessment: www.pca.state.mn.us/gp0r93f
- 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





Unused groundwater wells sealed

ACTION

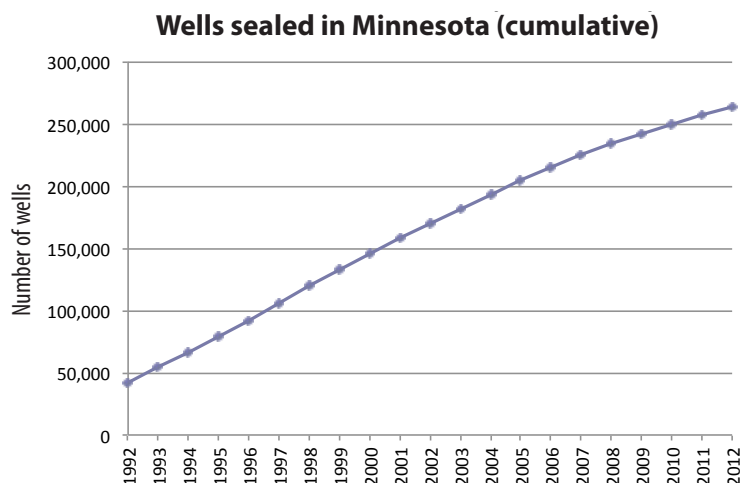
Measure: Number of unused groundwater wells sealed

Why is this measure important?

Unused wells that have not been properly sealed can be a source of groundwater contamination, potentially affecting nearby drinking water wells. They may threaten the quality of the water in city water wells, 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, or it may have become contaminated. A well may be “lost” or abandoned when property changes hands, or when use of the land changes; for instance, from agricultural to industrial or residential.

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 surface water runoff, contaminated water, or improperly disposed waste 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 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 FY12. 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. Over 200 wells were sealed with the FY12 funds.

Clean Water Funds were also made available in FY13 to seal 29 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 typically located near active public water supply wells.

What progress has been made?

Ultimately the goal is to seal all unused wells in Minnesota to protect public health and our groundwater resources. Unused wells continue to be identified on a regular basis through property transfers and other activities. It is very difficult to estimate the number of wells that remain to be sealed. In addition, wells continue to be taken out of service for a variety of reasons, including old wells that are no longer functioning properly, an inadequate water supply, contamination, or as public water supplies are provided in areas where previously only private wells existed. There will likely not be an end to the need to seal wells. The Clean Water Funds do provide assistance and will increase the number and rate at which wells are sealed in the state.

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 and protect human health. We also use many chemicals for cleaning clothes, maintaining cars and homes, and improving our 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 our 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-nitrogen (referred to as nitrate). Results are reported to chemical management groups, farmers and the general public to inform decisions about which chemicals to use and how to use them.

The Minnesota Pollution Control Agency (MPCA) manages a network of groundwater monitoring wells that measure ambient (or background) conditions for non-agricultural parameters, including nitrate, chloride, volatile organic compounds, and emerging contaminants. The network is focused on two aquifers that are especially vulnerable to man-made contamination—the sand and gravel and Prairie du Chien-Jordan aquifers.

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

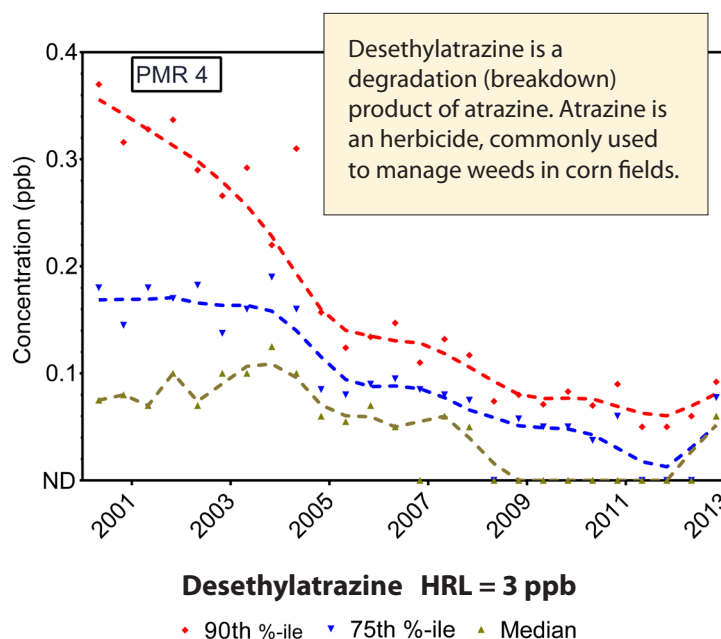
What progress has been made?

Since 1985, the MDA has continuously improved its groundwater monitoring program. The MDA is currently sampling over 170 monitoring wells, naturally occurring springs and private drinking water wells throughout the state. Although concentrations remain well below health

risk levels, five pesticides have been detected frequently enough to be placed in "common detection". This list includes acetochlor, alachlor, atrazine, metolachlor and metribuzin. These pesticides are being tracked and alternative management practices are promoted whenever levels rise.

Currently, the concentrations of acetochlor, alachlor and atrazine are declining, while there is no clear trend in metolachlor or metribuzin concentrations (figure below). Detailed analyses of monitoring results are available (see link under "Learn more" section).

MDA's groundwater monitoring program was not designed to determine nitrate concentration status and trends. Nitrate concentrations in the very shallow, highly sensitive groundwater monitoring wells sampled in this program exceed health risk levels at many locations. However, this is not the situation with every well or all the regions monitored. MDA's groundwater monitoring program is an early detection system; MDA relies on data from private well monitoring networks to determine regional nitrate trend information.



This is an example of results from MDA's monitoring program and displays the trend in desethylatrazine concentration over time. Results are from Pesticide Monitoring Region (PMR) 4, which encompasses a 14-county area in central Minnesota.

In 2008, the Southeast Minnesota Water Resources Board and several partners (MPCA, MDA and MDH) began collecting data from the “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 a stratified-random distribution across nine counties and several aquifers, was designed to provide nitrate concentration data.

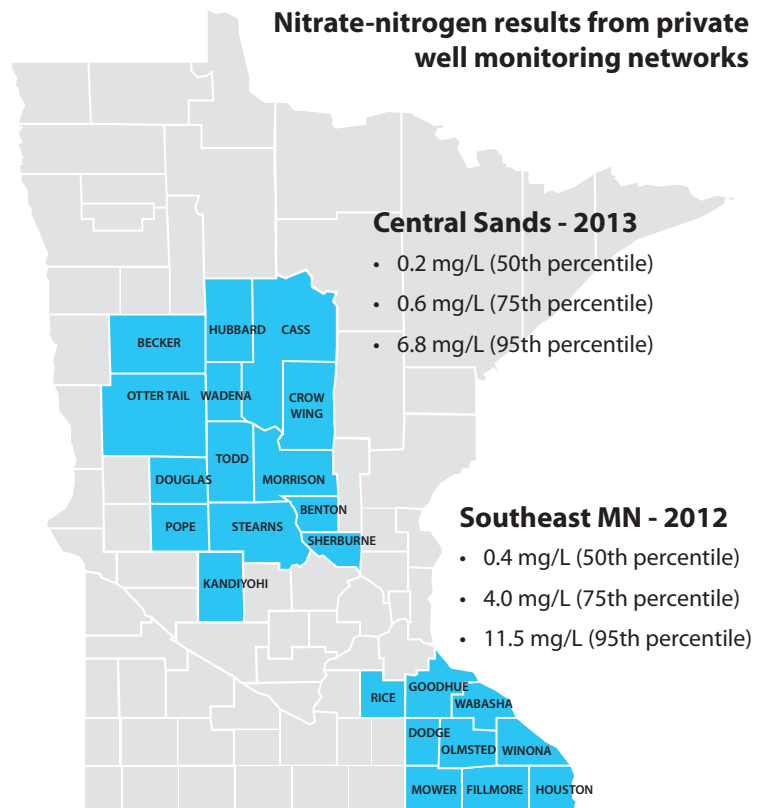
Recently, MDA initiated a program for monitoring nitrate trends in private drinking water wells in Central Minnesota, an area of the state with sandy soil that is vulnerable to nitrate contamination. In 2011, homeowners from 14 counties were randomly chosen to participate in this project and had their water tested for free. In 2012, a subset of these homeowners volunteered to participate in a long-term monitoring network. Approximately 500 wells were sampled for nitrate; these wells will continue to be monitored annually and used to determine regional nitrate trends.

The MPCA is continuing progress on its ambient groundwater monitoring network to track trends in groundwater quality. More than 60 new wells were added in 2010-2011 and 18 new wells in 2012.






Learn more

- MDA’s Pesticide Monitoring and Assessment: www.mda.state.mn.us/en/chemicals/pesticides/maace.aspx.
- Central Sands Private Well Network: www.mda.state.mn.us/en/protecting/cleanwaterfund/gwdwprotection/characterizingnitrates.aspx

- MDA and MPCA groundwater data portal (Environmental Data Access or EDA): www.pca.state.mn.us/index.php/data/groundwater.html.



This map shows summary statistics from two private well monitoring networks in Minnesota. The 50th percentile (75th, 95th) is the value below which 50 percent (75%, 95%) of the observed values fall. The health standard for nitrate-nitrogen in drinking water is 10 mg/L.

	Status	Trend	Description
Pesticides			Decreasing trends for three and no trend for two common pesticides. 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, local drinking water aquifers are not vulnerable to surficial contamination and wells generally have low levels of nitrate-nitrogen. However, in certain localized areas it can be a significant concern.
Nitrate-Nitrogen Central Sands			Nitrate levels vary greatly within this region, in certain areas of the Central Sands water quality needs improvement. It is unclear if we will meet long-term water resource needs.
Nitrate-Nitrogen southeast region			The Karst region in southeast Minnesota is one area vulnerable to nitrate contamination. In some townships water quality is under intense pressure. It is unclear if we will meet long-term water resource needs in this region.



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 the source water quality statewide. The General Water Chemistry Project, in process from 2010 to 2014, will provide a current overview of source water quality statewide. The study is focused on source water from 919 groundwater systems and 41 surface water systems with testing for more than 25 contaminants.

Initial sampling tells us a number of things about Minnesota's community water supplies:

- 482 systems remove iron and manganese
- 636 systems disinfect using chlorine
- 280 systems do not require chlorine disinfection
- 9 systems treat to reduce nitrate, and
- 12 systems treat for specific manmade contaminants.

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.

What progress has been made?

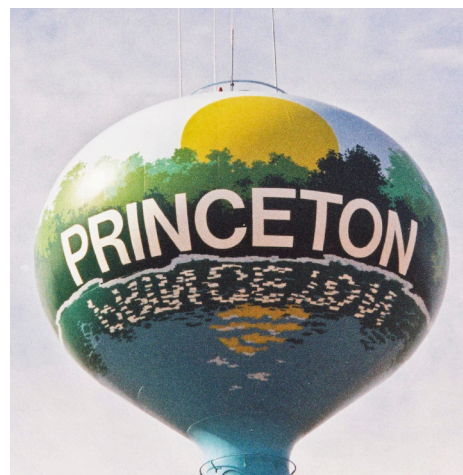
Water chemistry data will be made available in 2014 with a summary characterizing statewide trends by 2015. This data will provide a

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

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



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

Status	Trend	Description
●	Not enough information for a trend determination at this time.	Water sample collection and laboratory analysis was completed in 2013. Analysis of the results will be conducted in 2014.

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. Approximately 20 percent of Minnesotans rely on private wells for their primary drinking water source. Nitrate is a common contaminant found 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 statutes and rules require that wells are 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 (MDA) and other partner agencies help well owners and farmers properly manage nitrate sources such as fertilizers and septic systems to help to 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. Well





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.

testing clinics where residents can get their wells tested for nitrate are offered by local governmental units and the MDA. Several activities funded by the Clean Water Fund are intended to address nitrate in groundwater or reduce input of nitrate to groundwater.

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 two percent. New wells with concentrations above the drinking water standard of 10 mg/L is even less, typically around one percent. For comparison, approximately five percent 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 very important that the owners of these 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

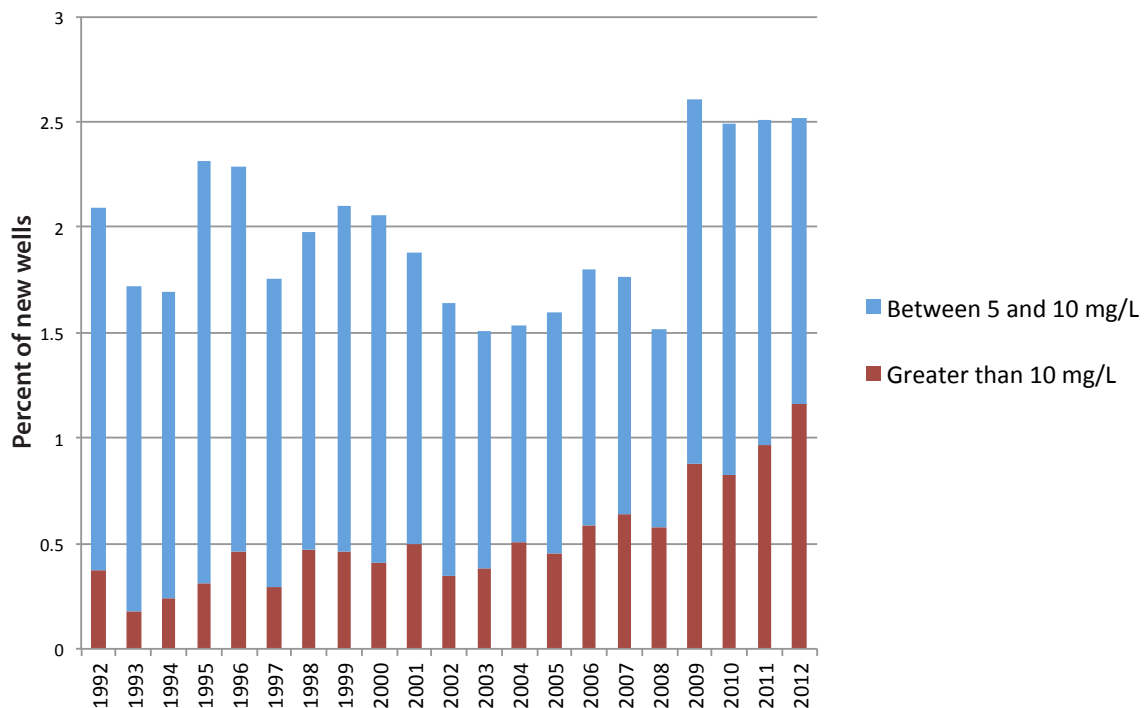
new wells exceeding the drinking water standard. It is not clear if there is a relationship between this trend and actual nitrate levels in groundwater across the state as new well construction is not uniformly distributed across the state and the number of new wells is not consistent from year to year. 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 two percent of new wells exceed the drinking water standard for nitrate, there is 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.
- Find out more at www.health.state.mn.us/divs/eh/

Nitrate in new wells





Groundwater levels

OUTCOME

Measure: Changes over time in groundwater levels

Why is this measure important?

About 75 percent 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 meet 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.

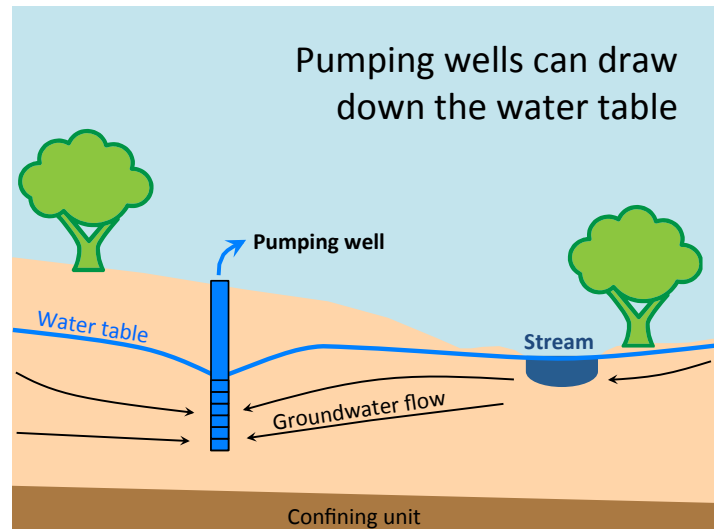
Groundwater levels are affected by several stresses including drought and floods, changes in land use, and pumping by wells. Changes in groundwater levels cause changes in the streams, fens and wetlands, springs, and lakes connected to them. Wells are also affected. When groundwater levels decline, pumps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

What are we doing?

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.

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.

Data is insufficient to assess Minnesota’s groundwater conditions in portions of the state, but it is improving.



What progress has been made?

Statewide, 63 percent of 27 indicator wells in the groundwater level monitoring network currently have no significant trend over the 20-year analysis period, and 37 percent have a downward trend. The Clean Water Fund leverages existing programs to accelerate efforts to improve the management of groundwater quantity and support long-term aquifer sustainability.

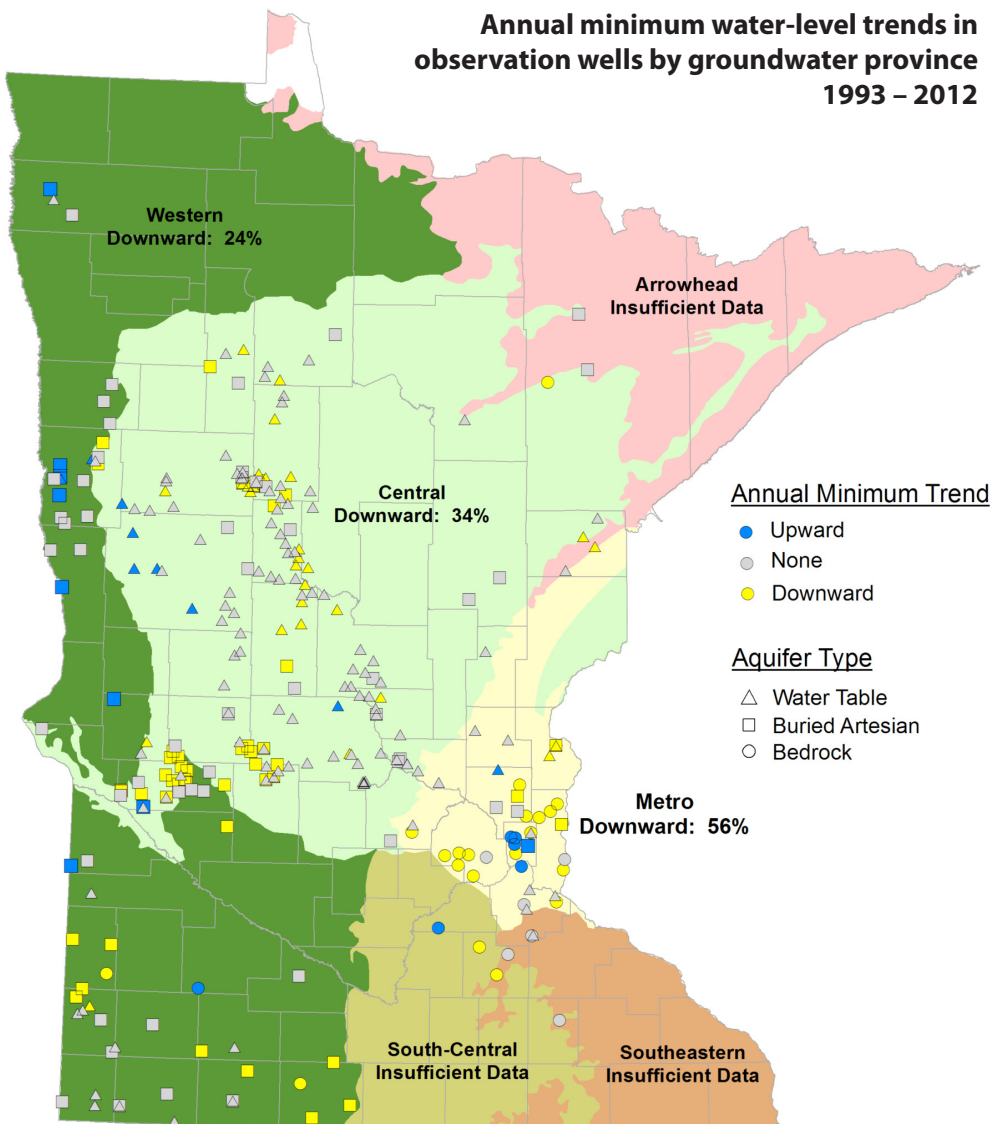
Groundwater-level information is becoming better integrated into water supply planning, which supports work to reduce the environmental, economic, and public-health risks that unsustainable aquifer decline creates. In the Twin Cities Metropolitan Area, regional planning policies are being revised to address declining aquifer levels. Statewide, the DNR is developing a process to establish Groundwater Management Areas (GMAs) where additional planning is needed to ensure

Status	Trend	Description
●	➡	Most indicator wells show no significant trend, but many areas of the state lack important groundwater information and in addition are experiencing groundwater declines.

that growing water demands do not cause unsustainable groundwater declines. Clear standards for sustainability are also being established.

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 our groundwater conditions.



Learn more:

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



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 contained on pages 55-59 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.

It is increasingly evident to scientists, policy makers, state agencies and community groups that citizens must actively get involved in water resource management for water quality improvements to occur. Effectively engaging and involving citizens in water resource management requires education, outreach and civic engagement. These activities build interest and personal investment in clean water and provide citizens with the necessary knowledge, tools and resources to protect and restore waters now and in the future.



State agencies currently support education, outreach and civic engagement in order to meet clean water goals. Social measures will track the outcomes of these investments. Tracking social measures over time can help:

- Determine whether Clean Water Fund activities are building capacity and supporting a community's ability to engage in water resource protection and restoration and;
- Evaluate the impact and ultimately the success of education, outreach and civic engagement.

A Social Measures Monitoring System will be launched in the coming months to provide a consistent, science-based yet flexible approach to tracking this investment in a wide range of projects.

The goal of establishing a Social Measures Monitoring System is to more strategically integrate social science information into Clean Water projects and programs and develop work plans that acknowledge and couple the biophysical and social aspects of water resource management. This is important because biophysical data describe the extent and nature of pollution problems and may suggest what practices will give the best clean water results. However, encouraging the public to get actively involved in protecting and restoring water resources requires an understanding of human or social factors such as public perceptions, collective knowledge, personal values, skills, economics and societal norms. These factors influence personal and community decision-making.

Social science data are the basis for social measures

Social science is about people and their interactions with one another as individuals, through social groups and in society as a whole. Social science data can be collected using multiple methods including surveys, interviews, and focus groups as well as other assessment tools such as stakeholder analysis and asset mapping.

We will use social science tools to:

- Assess community readiness and community capacity to address water quality issues.
- Identify barriers and constraints to public participation in clean water activities and leverage community assets to address water quality.
- Optimize the involvement of stakeholders and the public.
- Understand what water and related natural resources mean to local residents so that watershed protection and restoration messages can be framed most persuasively.
- Identify what motivates local residents and institutions to become actively involved in planning, adopting and promoting conservation practices.

Social science information can help to plan more effectively for the contextual differences in watersheds and to understand ways to encourage citizens to take a more active role in addressing nonpoint source pollution.

- Design processes and programming that supports citizen involvement to improve water quality, enhances collective problem solving and motivates people to stay actively involved.

Measuring outcomes

Many projects already consider the social or human dimension of water resource management and are applying social science tools to water quality projects. For example, state agencies are convening citizens earlier in the watershed planning process, asking interested stakeholders to help identify knowledge gaps and prioritize concerns, and working with local partners on community readiness assessments before beginning to work on environmental issues. These are examples of how different state agencies are using social science tools to more strategically plan for and engage the public and interested stakeholders.

While simply counting the number of projects that use an integrated approach is important to demonstrate effort, it is ultimately more important to determine the impact or outcome of that effort. A Social Measures Monitoring System will provide a measurement framework focused on outcomes.

To date there has been no systematic, statewide effort to compile or synthesize social data on community capacity for addressing water resource management. The Social Measures Monitoring System will begin to address this need. Given the approach is new, it will continue to evolve as it is implemented and refined. The approach will be modified based on what is learned with input from various perspectives.

The next steps are to take this concept and break it down into manageable processes for state agencies, local partners and consultants to gather meaningful results to be included in the 2016 Clean Water Performance Report. Future Clean Water Performance Reports will include specific social measures that take into account community capacities

including 1) individual knowledge and decision-making, 2) relationships between individuals, 3) organizations that influence the community and water resources, and 4) programs designed to support community and water resource goals. There will be social measures that correspond to these four aspects of community capacity. Progress at the project level, across Minnesota's Clean Water funded projects, will be rolled up for each social measure to understand outcomes and trends over time.

It's not about just counting the number of meetings that occur and the number of people that attend; it is about assessing the outcomes of those meetings. Are trust and relationships being enhanced at these meetings to motivate communities to partner with agencies and organizations to work together on water quality concerns? Was there a change in awareness, knowledge, attitude or behavior?



Open dialogue and information sharing among interested citizens at a Map Party in the Le Sueur River watershed



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 in 7-county Metro area
- wetland coverage

Demographic changes:

- population size and proportion in "metro" counties

Climatic changes:

- average Minnesota temperature
- average Minnesota precipitation

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.

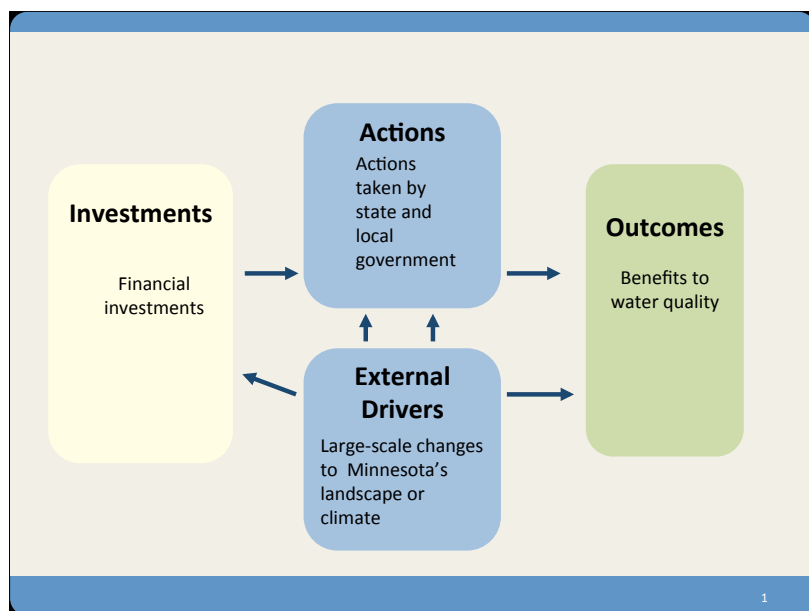


Fig 1. Expected relationships of external drivers to investments, actions, and results

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: Though the total acres of agriculture land use in Minnesota has remained relatively constant over time, the crops grown (land cover) have undergone a significant transformation. As shown in Fig. 2, there have been major shifts in land cover in Minnesota over the last 70 years. The number of acres planted in small grains or in hay have declined and been replaced by increases in corn and soybean acreage. The roughly nine million acres where agricultural land use has changed represents about 16 percent 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.

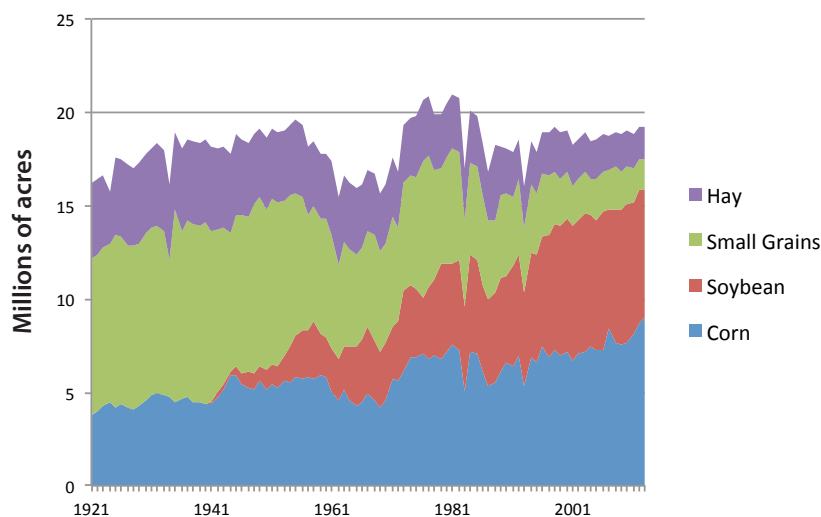


Fig 2. Agricultural land use trends

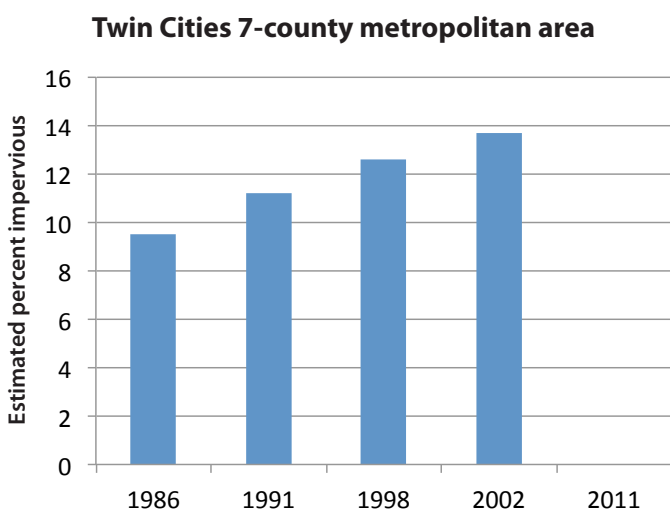


Fig 3. Change in percent of land surface covered by impervious surfaces

Impervious surface in Twin Cities 7-county 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, over half of Minnesota's population lives in the Twin Cities metropolitan area. As Minnesota's population continues to increase and becomes more urban/suburban (see Demographic Changes Section below) the amount of impervious surface continues to increase. Figure 3 shows this trend for the seven-county Metro area between 1986 and 2002. The Metropolitan Council is currently reassessing impervious surface coverage using 2011 data which will allow the trend shown in Figure 3 to be updated.

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 approximately half of the state's wetlands have been lost and in many parts of southern Minnesota well over 90 percent of the original wetlands have been drained. Because of the benefits associated with wetlands, Minnesota adopted a "no net loss" of wetland policy in 1991 and in 2006 initiated a rigorous, long-term monitoring 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.

Restoring wetlands may be an important BMP used 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.

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 Figure 4, 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 water demand and associated impacts to groundwater and surface water

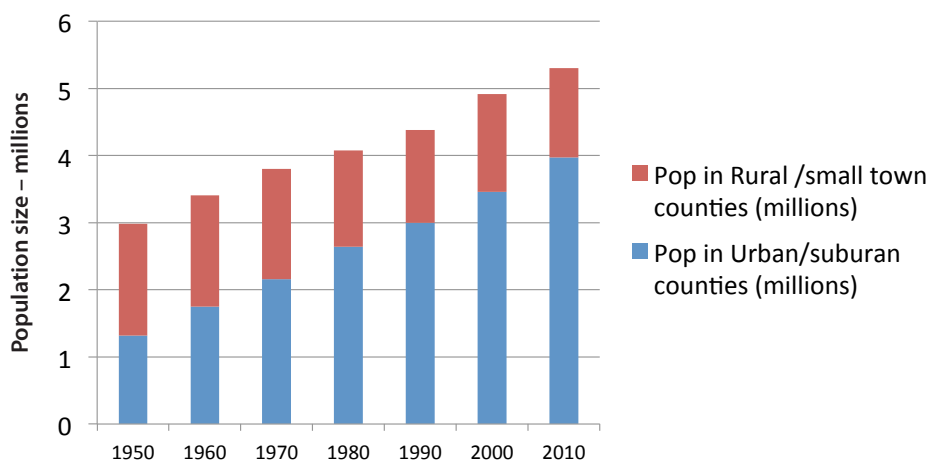


Fig 4. Change in Minnesota's population and urban/suburban vs. rural distribution since 1950

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 or not it can be taken up by plants or 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 over the period between 1895 and 2012 (Figs 5 & 6). These figures emphasize what we all know: that weather in Minnesota may vary dramatically from year to year. For example, almost a 10 degrees 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, average statewide temperature has increased at a rate of 1.5 degrees Fahrenheit per century; average statewide precipitation has increased at a rate of 2.85 inches per century. While it may be difficult to predict exactly how these trends will impact a specific water body, this information will be critical during the development of protection and restoration strategies and the selection of implementation projects to anticipate changes in climatic patterns that are likely to occur.

Minnesota temperature, January—December

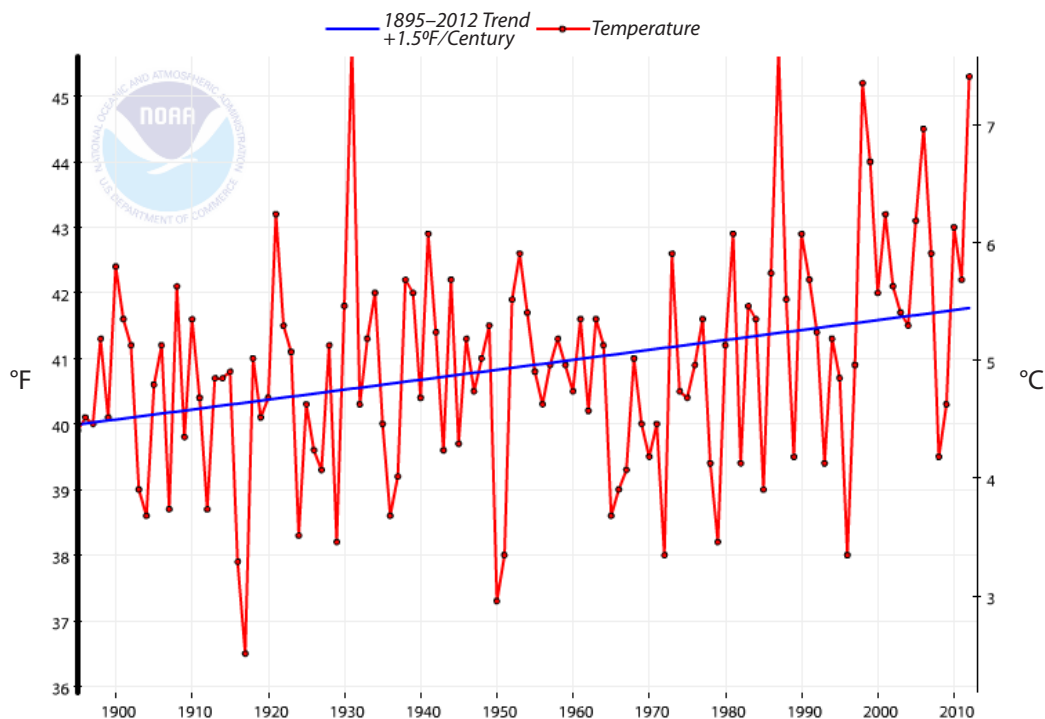


Fig 5. Year-to-year changes long-term trend in average annual Minnesota temperature from 1895 to 2012

Minnesota precipitation, January—December

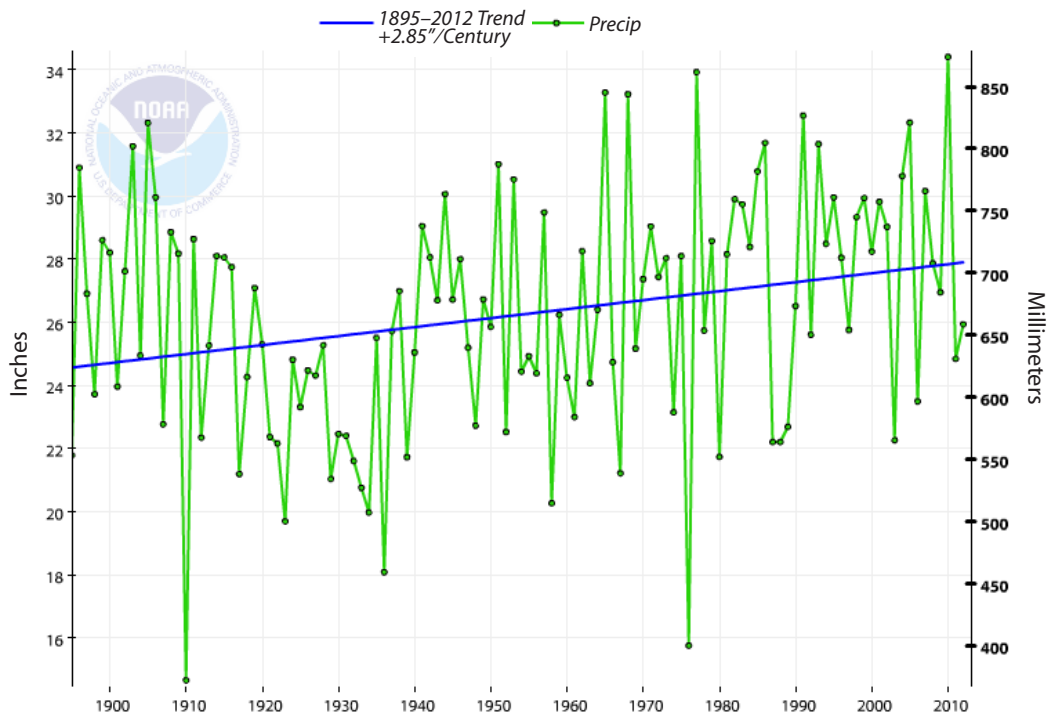


Fig 6. Year-to-year changes and long-term trend in average annual Minnesota precipitation from 1895 to 2012

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.



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

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