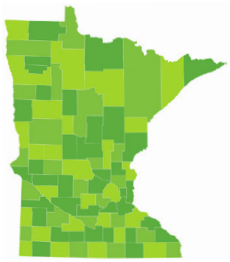
Summary

Statewide Chloride Management Plan

Effectively managing salt use to protect Minnesota's lakes and streams



Reducing chloride at the source is needed throughout the state of Minnesota, not only to restore already impacted waters but also to protect all water resources. There are multiple sources to consider, a variety of options to reduce chloride, and a large geographical area to address. A main purpose of this plan is to provide guidance, resources, and information to individuals and organizations to assist in making the important decisions of the what, how and when for managing chloride.

The Statewide Chloride Management Plan (CMP) outlines a comprehensive strategy to reduce salt (chloride) use from a variety of sources to protect our lakes, rivers, and other water resources. The Statewide CMP incorporates water quality conditions, sources of chloride, salt reduction strategies, protection strategies, and monitoring recommendations as well as measurement and tracking of results.

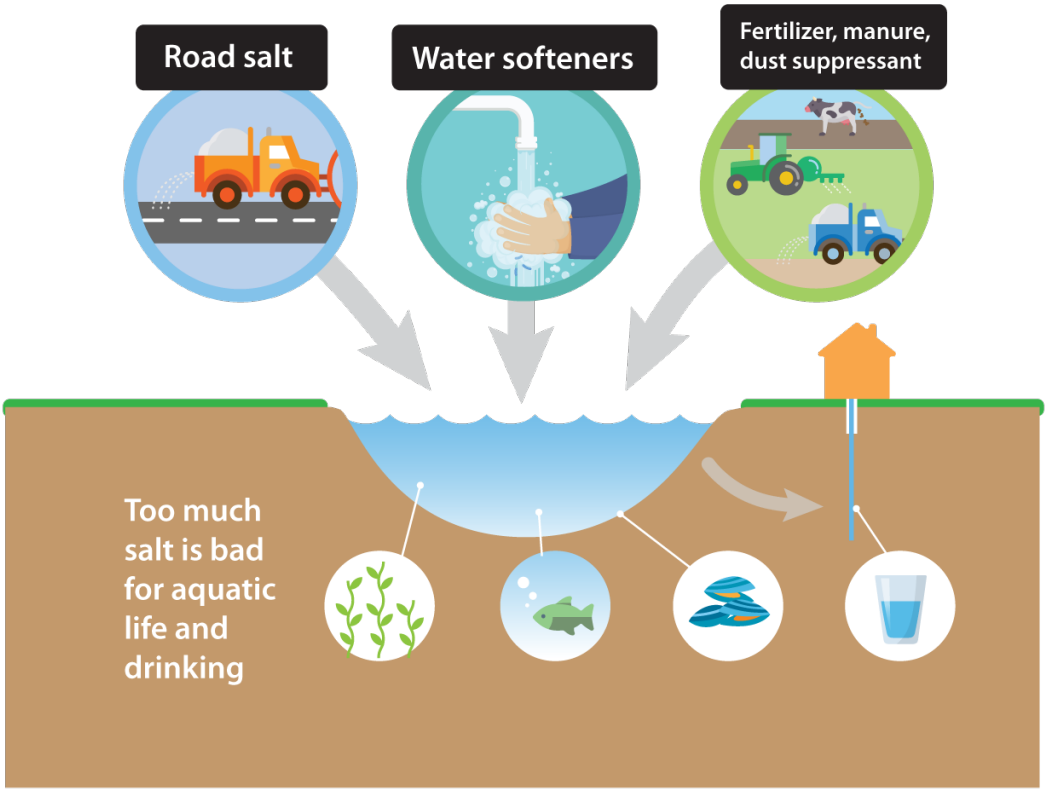
The plan was developed by the Minnesota Pollution Control Agency (MPCA) in partnership with municipalities, counties, watershed districts and other state experts. As part of this effort, the MPCA and partners collaborated to monitor, evaluate, and better understand the level of chloride in lakes, streams, wetlands, and groundwater.

However, water quality is not the only factor driving the need to reduce chloride entering the state's water resources. Improved practices not only reduce chloride impacts on water quality, but they can also lead to long-term cost-savings as a result of purchasing less salt and reduced impacts on vegetation and corrosion of infrastructure and vehicles.

Sources of chloride

Chloride enters lakes, streams, wetlands, and groundwater from a variety of sources, including:

- salt applied to roads, parking lots, trails, and sidewalks for winter maintenance
- water softener brine discharge to municipal wastewater treatment plants (WWTPs)
- water softener discharge to a septic system
- agricultural fertilizer
- industrial discharge
- land application of manure
- land application of WWTP sludge
- dust suppressant



From a statewide perspective, road salt use, fertilizers, and WWTPs make up the predominant sources of chloride.

The relative significance of each source of chloride is dependent on the watershed. For highly developed urban areas, winter maintenance activities are typically the primary source.

In rural areas, residential and commercial water softening represent the largest point sources of chloride to the environment. In a 2019 report, University of Minnesota researchers estimated that roughly 65% of all chloride passing through WWTPs, or

136,000 tons of chloride annually, comes from residential or commercial water softening processes. In other rural areas, dust suppressants, fertilizers, and animal manure can also be a significant source of chloride.

Trends in surface and groundwater

Minnesota has found elevated chloride concentrations throughout the state. Recent reports have identified 221 river miles, 55 acres of wetlands, and 1,400 acres of lake surface area in Minnesota that are impaired by chloride. But only a fraction of all waterbodies have been assessed for chloride. Minnesota lists 50 waterbodies as impaired by chloride, 41 of which have approved Total Maximum Daily Load (TMDL) studies.

In the Twin Cities metro area, chloride concentrations have been increasing in the Minnesota River, St. Croix River, and Mississippi River since 1985, with the highest observed concentrations typically occurring downstream of urban influence. There is additional evidence of increasing concentrations in 59 waterbodies throughout the state within the last 10 years.

In 2016, the MPCA finalized the Twin Cities Metropolitan Area (TCMA) Chloride Management Plan (CMP) and the TCMA Chloride TMDL, which is a predecessor to this Statewide Chloride Management Plan (Statewide CMP). The TCMA CMP focused largely on the impacts of winter maintenance activities in the 7-County metropolitan area.

The Statewide CMP presented here focuses not only on winter maintenance activities and water softening, but includes information and guidance on other chloride applications that take place year-round, such as dust-suppressants and fertilizers that include chloride.

The trend of increasing chloride concentrations in lakes, wetlands, streams, and groundwater is expected to continue but through this plan we hope to slow down the rate of impairment. With today's technology, treating waters already contaminated by chloride is impractical and cost-prohibitive.

The problem with salt

Chloride persists in the environment: Once chloride is in water, the only way to remove it is reverse osmosis, which is not economically feasible. This means that chloride will continue to accumulate in the environment over time. A University of Minnesota study found that about 78% of salt applied for winter maintenance in the Twin Cities metro area is either transported to groundwater or remains in the local lakes, streams, wetlands, groundwater, and soil.

Harmful animals and aquatic life: Low levels of chloride can be found naturally in lakes and streams, and chloride is essential for aquatic life to carry out a range of biological functions. But high concentrations of chloride can kill fish, invertebrates, and even some plant species. Chloride can also harm pets and wildlife if they consume deicing materials by eating them directly, licking their paws, or by drinking snow melt and runoff.

The MPCA has adopted the United States Environmental Protection Agency's recommended water quality criteria for chloride:

- acute (short-term) exposure is 860 mg/L
- chronic (long-term) exposure is 230 mg/L

At levels exceeding the water quality standard of 230 mg/L, chloride is toxic to aquatic life.

Contaminating groundwater and drinking water: About 75% of Minnesotans rely on groundwater for their drinking water supply. Groundwater monitoring data collected by the MPCA from 2013-2017 found that 16% of monitoring wells tested in shallow sand and gravel aquifers in the Twin Cities metro area exceeded the state chronic standard for surface waters of 230 mg/L for chloride. Deicing salt application, in particular, is resulting in high chloride concentrations in groundwater. Groundwater also contributes flow to lakes, wetlands, and streams, and can release elevated concentrations of a number of pollutants into surface waterbodies.

Drinking water infrastructure is also susceptible to increased concentrations of chloride. Lead and copper pipes become more corrosive as chloride levels reach a certain threshold, which can cause human health concerns and reduce the lifetime of infrastructure.

Damage to infrastructure and vehicles: Water quality isn't the only concern related to high levels of chloride in the environment. Chloride can damage road and bridges, increasing maintenance and repair costs. It can also damage vehicles due to corrosion to parts such as brake linings, frames, bumpers. Estimates of damage to infrastructure, automobiles, vegetation, human health, and the environment due to road salt range from $803 to $3,341 per ton of road salt used.

Key challenges in reducing salt use

Reducing chloride use comes with a number of challenges: meeting the public's winter travel expectations, providing potable water suitable for public preferences and appliance operations, and economic losses in agricultural and industrial settings.

Currently, there are no environmentally safe and cost-effective alternatives that are effective at melting ice on paved surfaces, and few options to eliminate chloride use in water softening and agriculture. Therefore, the continued use of salt as the predominant deicing agent for public safety and its use in water softening and agricultural settings is expected.

Road salt: A key challenge in reducing road salt use is balancing the need for safety with the public's growing expectation for clear, dry roads, parking lots, trails, and sidewalks throughout the mix, severity, and duration of Minnesota winters. The Minnesota Department of Transportation (MnDOT) and many cities, counties, and others have made notable progress in improving winter maintenance while reducing salt use.

The impact of climate change on salt use is uncertain. Shorter snowfall and freezing seasons may result in reduced salt use. Yet, more frequent snow events, more extreme events, and potentially more frequent ice storms may result in greater needs for deicing roads, particularly in the more populated parts of the state.

Water softening: We need to educate the public on the balance between ***necessity*** and ***preference*** with water softening practices. Certain commercial or residential appliances require or operate more effectively with softened water, however, the specific degree of softening can often be calibrated to individual preferences. Additionally, some municipalities offer softening prior to distribution, and many older in-home softening units are less efficient than newer models. These various factors often lead to more chloride use than is necessary to meet specific needs and tastes.

Other sources: Similar cost-benefit challenges exist for all sources, including the balance between agricultural fertilizer applications and downstream chloride transport, and the balance between industrial process efficiency and chloride discharge.

Despite these challenges, reduced use of salt is likely to result in direct cost-savings to winter maintenance organizations and private applicators. Improved efficiency and adjusted water softening practices can also have economic benefits on a residential and municipal scale.

How can this plan help me reduce my chloride use?

This plan provides guidance, resources, and information to individuals and organizations to help them make the important decisions of what, how, and when for managing chloride.

Performance-based approach for reducing chloride

The over-arching implementation strategy identified in this report is a performance-based approach to reducing chloride. This approach allows stakeholders and regulators flexibility in the type of BMPs and the timing of implementation. It also allows individuals and organizations an opportunity to develop specific chloride management strategies that are practical for their individual situations.

Chloride Management Plan Purpose – Scope – Audience

Purpose

- **Highlight the impacts of chloride on statewide water quality**
- **Develop an appreciation of the competing demands of level of service and reduced salt usage**
- **Set performance-based goals for restoration and protection**
- **Inform and guide implementation of improved winter maintenance practices and policy needs**
- **Educate on demonstrating the benefits of efficient residential and commercial water softening**
- **Demonstrate the success and economic benefits of improved practices**

Scope

- **Status and trends of chloride levels in lakes, wetlands, streams, and groundwater**
- **Sources of chloride**
- **Restoration and protection goals**
- **Implementation and strategies to reduce chloride impacts**
- **Educational and training resources**
- **Continued monitoring, tracking, and adaptive management**

Audience

- **Local working groups (local governments, watershed management groups, soil and water conservation districts)**
- **Winter maintenance groups (MnDOT, local governments, private applicators, commercial property owners, residents)**
- **Elected officials and policy makers**
- **Permit holders**
- **State agencies (MPCA, MnDOT, DNR, BWSR, etc.)**

The performance-based approach doesn't focus on specific numbers to meet, but rather on making progress through the use of BMPs. Progress is measured in terms of the progress made and BMPs implemented.

Prioritization and critical areas: Where do I start?

Road salt and water softening are two large statewide sources of chloride in the environment, and many of the current reduction strategies focus on these two sources. This plan also identifies critical watersheds and locations around the state based on road density and potential demand for water softening, where chloride loadings are to be expected high and therefore implementation efforts to reduce chloride should be focused. For the protection of surface and ground waters, implementation is encouraged statewide.

Organizations interested in reducing the amount of chloride entering our water resources should begin with an effort to fully understand the problem:

- Know what the primary sources of chloride are in your community.
- Determine your organization's role in contributing, preventing, or slowing the growing trend of increased chloride in surface and groundwater.
- Understand local water resources and conditions, both surface water and groundwater. Addressing these considerations can help determine priorities and critical areas.

Implementation strategies

The statewide CMP provides the overall framework for the implementation strategies that are necessary to protect and restore our water resources. **Section 5.4** of this plan provides the implementation activities for specific audiences and all sources of chloride.

Local priorities should be set with a plan in place within 1-2 years after this Statewide CMP is published. Local priorities will vary by various stakeholder groups and audiences.

General performance-based timeline for chloride management

By years 3-5, an implementation plan should be set and successes and progress should begin to be monitored.

Years 6-10 should be spent sharing successes and revising any necessary components of the localized plan.

Find your section of the plan

This plan was developed to be used by many different audiences and organizations. Every organization will have different priorities based on their local watershed conditions, the role of their organization in the watershed or state, and their organization's specific needs or goals.

Because the Statewide CMP is meant to be used as a reference document to help you or your organization reduce chloride use, **Section 5** of the plan may be the most useful sections for you to revisit as you develop and implement chloride reduction strategies. This section and subsections lay out implementation strategies for how each person or organization can reduce chloride based on the types of activities with which they are involved. Example strategies and timelines are also provided as templates.

Full report

To view the full draft report on public notice, please visit the MPCA Public Notice Webpage or https://www.pca.state.mn.us/water/draft-statewide-chloride-management-plan

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MINNESOTA POLLUTION CONTROL AGENCY

CLEAN WATER LAND & LEGACY AMENDMENT