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LEGAL AND POLICY CONSIDERATIONS FOR THE MANAGEMENT OF CHLORIDE

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INTRODUCTION

Many scientific studies have examined the potential risks to human health and natural resources associated with excess chloride in the environment, such as deteriorated ambient water quality, toxicity to aquatic and benthic organisms, adverse effects on vegetation, and even impacts to drinking water supplies. Yet little, if any, of that work has been directed toward developing legal and policy strategies to address the chloride issue.

Building on the framework of the Southeastern Wisconsin Regional Planning Commission's comprehensive Chloride Impact Study for the Southeastern Wisconsin Region, this report examines a menu of responsive legal and policy options available to decision-makers in the Region. These include limiting slip-andfall liability, relying on direct regulatory authority such as the Clean Water Act or corresponding state regulations and municipal ordinances, disseminating relevant information to stakeholders and the public, using alternatives to chloride where feasible, leveraging new policy strategies such as water quality trading, investigating integrated watershed management across jurisdictions, and obtaining economic assistance. This report does not suggest that all of these options are appropriate in every context, nor does it rank them from most to least useful. Those decisions are left to affected communities.

The Chloride Impact Study was initiated due to heightened public concern over the effects of the growing use of road salt and evidence of increasing chloride concentrations in the surface and groundwater within the Region. The findings of this Study are being presented in a series of reports.

Major objectives of the Chloride Impact Study include:

- 1. Documenting historical and existing conditions and trends in chloride concentrations in surface and groundwater in the Southeastern Wisconsin Region
- 2. Evaluating the potential for increased amounts of chloride in the environment to cause impacts to surface water, groundwater, and the natural and built environment in the Region
- 3. Identifying the major sources of chloride to the environment in the Region
- 4. Investigating and defining the relationship between the introduction of chloride into the environment and the chloride content of surface and groundwater
- 5. Developing estimates of chloride loads introduced into the environment under existing conditions and forecasts of such loads under planned land use conditions
- 6. Evaluating the potential effects of climate change on the major sources of chloride under planned land use conditions
- 7. Reviewing the state-of-the-art of technologies and best management practices affecting chloride inputs to the environment and developing performance and cost information for such practices and technologies
- 8. Exploring legal and policy options for addressing chloride contributions to the environment
- 9. Developing and evaluating alternative chloride management scenarios for minimizing impacts to the environment from chloride use while meeting public safety objectives
- 10. Presenting recommendations for the management of chloride and mitigation of impacts of chloride on the natural and built environment

This Report addresses the eighth objective listed above and is organized into two chapters. Following this introduction, Chapter 2 summarizes the sources of chloride to the environment, as a basis for the legal and policy analysis. Chapter 3 describes and examines the various legal and policy options for controlling chloride levels in the environment.

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Chloride enters the environment via numerous routes, from anthropogenic sources such as snow and ice removal practices, salt storage facilities, wastewater treatment facility and septic system effluent, industrial facilities, agricultural operations, oil and gas wells, and natural sources such as atmospheric deposition.

This chapter briefly describes those sources and transmission routes to inform the legal and policy analysis. For a more detailed discussion of chloride sources to the environment, please see accompanying Technical Reports TR-62, *Impacts of Chloride on the Natural and Built Environment*, TR-63, *Chloride Conditions and Trends in Southeastern Wisconsin*, and TR-65, *Mass Balance Analysis for Chloride in Southeastern Wisconsin*.

2.1 PUBLIC AND PRIVATE SNOW AND ICE REMOVAL

Chloride use in the United States has increased significantly since 1950, and the major factor has been the use of salt for deicing during the winter months.¹ Perhaps the most visible source of chloride to the environment, widespread use of salt for snow and ice clearing began around 1960,² as transportation agencies began implementing "bare pavement" policies. Before then, vehicles had navigated snowy and icy conditions using tire chains or studded "winter" tires. But such tires have the potential to damage roadway surfaces, and their use is now prohibited in Wisconsin with very limited exceptions.³

New Hampshire was the first state to adopt a general policy of using salt during the winter of 1941-42.⁴ After World War II, the use of road salt increased because the United States (U.S.) highway system had become essential to the public and the economy. After the 1950s and 1960s, there was another rapid increase in use of road salt, but the use appears to have leveled off in the last 20 years.⁵ Currently, the U.S. puts ten times the amount of salt on roads as it does in processed foods.⁶

The use of deicers on travel surfaces has been extremely effective, "reducing accident rates by a factor of 8 on two-lane highways and [a factor of] 4.5 on multi-lane highways."⁷ This is highly important from a public safety perspective; according to the Wisconsin Department of Transportation (WisDOT), in 2022, 51 people died and 3,940 more were injured in crashes attributed to winter road conditions.⁸

Today, put simply, "[r]oad salts are essential to the transportation and highway maintenance industry in the United States."⁹ Road salt performs two functions when used to clear snow and ice. First, it lowers the freezing point of water, often by several degrees: "The more salt is dissolved in the water, the more the freezing point is

⁵ *Id*. at 18.

⁶ See Mineral Commodity Summaries 2023, 210 U.S. Geological Surv. 148 (2023).

⁷ USGS, Chloride in Groundwater, supra, at 8.

⁸Wisconsin Department of Transportation Program & Policy Analyst-Advanced Jacci Ziebert, to Margaux Serrano, Email (Feb. 27, 2023).

⁹ Curtis A. Cooper et al., *Effects of Road Salts on Groundwater and Surface Water Dynamics of Sodium and Chloride in an Urban Restored Stream*, 121 Biogeochemistry 149, 149 (2014).

¹ John R. Mullaney et al., Chloride in Groundwater and Surface Water in Areas Underlain by the Glacial Aquifer System, Northern United States, U.S. Geological Surv. 2 (2009) [hereinafter USGS, Chloride in Groundwater].

² See Walton R. Kelly et al., Using Chloride and Other Ions to Trace Sewage and Road Salt in the Illinois Waterway, 25 Applied Geochemistry 661, 662 (2010) ("Application of salt as a road deicer in the USA began in earnest around 1960.").

³ Wis. Stat. § 347.45(2).

⁴ Road Salt Use in the United States, Highway Deicing, Transportation Research Board 17 onlinepubs.trb.org/onlinepubs/ sr/sr235/017-030.pdf (last visited July 12, 2023).

depressed."¹⁰ Second, it inhibits ice from forming in the first place, and can prevent snow and ice from bonding to pavement surfaces. During the freezing process, water molecules arrange themselves into a more solid structure. Salt slows that process by adding impurities to the water and disrupting the ability of water molecules to organize.¹¹ Although some alternative deicing substances are available, salt is typically considered the most effective and least costly substance for performing these functions.¹² However, sodium chloride is only effective for this purpose within certain temperature limits. Below about 15 degrees F, the amount of ice melted by sodium chloride deicers is too small and the rate at which it melts is too slow to be of practical use.¹³

Although salt usage for deicing is often considered an issue for state or local governments, it is estimated that up to half of the salt used for winter maintenance enters the environment after being used to treat commercial or residential surfaces under private ownership such as parking lots, driveways, and sidewalks.¹⁴ This complicates the legal and policy analysis due to the relative difficulty of regulating or otherwise influencing private chloride sources as compared to public sector sources.

Deicers can be grouped into two categories: chloride-based and non-chloride-based. Chloride-based deicers include sodium chloride, magnesium chloride, and calcium chloride.¹⁵ For more detailed information on impacts of chloride-based deicers, please refer to TR-62. Non-chloride deicers are used infrequently on pavements due to their cost and availability.¹⁶ In contrast, airports are known for almost entirely using non-chloride deicers on airplanes.¹⁷ For more information about non-chloride deicers, refer to accompanying technical report TR-66, *State of the Art for Chloride Management*.

Non-chloride deicers also come with their own set of negative environmental impacts. For instance, organic deicers such as beet juice, glycols, and acetate compounds contribute to biochemical oxygen demand and can lower dissolved oxygen concentrations in waterbodies. Similarly, abrasives such as sand and cinders can improve traction but also contribute to sediment and suspended solids in waterbodies. Abrasives do not reduce ice accumulation and also lose their effectiveness once they are covered by snow or ice. These impacts may be reasons why they are used less than salts.

As salt deicing has increased, other "best practice" alternatives to salting have become more popular as a way to limit salt use. Businesses and communities have a variety of alternatives that include anti-icing or using infrared thermometers to determine pavement temperature and applying less salt when the pavement temperature is higher.¹⁸ Individuals can limit salt use by shoveling the snow first, maintaining a 3-inch spacing between salt grains, measuring pavement temperature, sweeping up excess salt for reuse, and even asking contractors to limit salt use on their property.¹⁹

¹⁰ Jenny Marder, *How Does Salt Battle Road Ice*?, PBS News Hour (Jan. 18, 2011), https://www.pbs.org/newshour/science/ why-does-salt-melt-road-ice (last visited Nov. 17, 2023).

¹¹ Id.

¹² See Daniel L. Kelting et al., *Regional Analysis of the Effect of Paved Roads on Sodium and Chloride in Lakes*, 46 Water Res. 2749, 2749 (2012).

¹³ Wisconsin Department of Transportation, *Winter Maintenance Frequently Asked Questions*, wisconsindot.gov/Pages/ doing-bus/local-gov/hwy-mnt/winter-maintenance/faq.aspx (last visited Dec. 21, 2023).

¹⁴ See, e.g., New Hampshire Department of Environmental Services, *Environmental Fact Sheet: Road Salt and Water Quality*, WD-WMB-4N.H. (2016) perma.cc/V8VR-3HVC.

¹⁵ Minnesota Pollution Control Agency, *Environmental Impact of Road Salt and Other De-Icing Chemicals*, Minnesota Stormwater Manual (last updated Nov. 23, 2022 3:05pm), stormwater.pca.state.mn.us/index.php/Environmental_impacts_of_road_salt_and_other_de-icing_chemicals [hereinafter *MPCA, Env't Impact of Road Salt*].

¹⁶ Minnesota Pollution Control Agency, *How Salt Works and Overview of Deicing Chemicals*, Minnesota Stormwater Manual, (last edited Nov. 23, 2022 2:44pm), stormwater.pca.state.mn.us/index.php/How_salt_works_and_overview_of_ deicing_chemicals.

¹⁷ Id.

¹⁸ See Lake Champlain Sea Grant Institute, *Reducing Use of Deicing Salt for Businesses & Custodial Staff*, www.uvm.edu/ seagrant/reducing-use-deicing-salt-businesses (last visited Dec. 21, 2023).

¹⁹ See Lake Champlain Sea Grant Institute, *Reducing Use of Deicing Salt for Homeowners*, www.uvm.edu/seagrant/ reducing-use-deicing-salt-homeowners (last visited Dec. 21, 2023).

Deicers can enter the environment during storage, transportation, and application stages.²⁰ In Wisconsin, there has been a steep increase in chloride levels in waterbodies since 2000. In 2000, the Wisconsin Department of Natural Resources (WDNR) measured about 600,000 tons of chloride annually in the state's largest river systems, but by 2018, that number increased to 800,000 tons per year.²¹ The WDNR has designated over 40 lakes and streams within the state as impaired with high chloride concentrations because those waters are not in compliance with the relevant water quality standards.²² As of 2022 in southeastern Wisconsin, there were 34 water bodies that had impairments due to chloride.²³ Currently, the WDNR aims to have municipalities and industries reduce their chloride concentrations through the WPDES permitting program.²⁴

WisDOT purchases an average of 452,000 tons of salt and 21,000 tons of sand per season.²⁵ Some of this amount is used on state highways, and some municipalities purchase salt through the state. While WisDOT facilitates this bulk purchase, it contracts with Wisconsin's counties for salt application to state and interstate highways. In the 2016-2017 winter season, 63 out of 72 counties in the state used anti-icing techniques.²⁶ WisDOT's Highway Maintenance Manual contains recommended deicer application rates for a variety of road conditions and pavement temperatures.²⁷ As already noted, salting is only cost effective if the pavement temperature is above 15-20 degrees F.²⁸ It will take about five times more salt to melt ice when the pavement temperature is 20 degrees F compared to 30 degrees F.²⁹

In 2022, WDNR surveyed Wisconsin communities and businesses about their snow and ice removal practices.³⁰ The results showed that legal concerns—and specifically, slip-and-fall liability—are a significant driver of winter maintenance practices, especially for private contractors and their clients.³¹

²⁰ MPCA, Env't Impact of Road Salt, supra.

²¹ Suzan C. Limberg, *DNR Reminds Wisconsinites to Reduce Salt Use This Winter*, Wis. Dep't Nat. Res. Newsroom (Jan. 11 2021), https://dnr.wisconsin.gov/newsroom/release/40396. This comes from a WDNR study where chloride was monitored at twenty-six of Wisconsin's largest river systems.

²² Shannon K. Haydin, *Reduce Salt Use This Winter*, Wis. Dep't Nat. Res. Newsroom (Jan. 21, 2022), dnr.wisconsin.gov/ newsroom/release/52716#:~:text=Recent%20studies%20have%20shown%20a,impaired%20by%20high%20salt%20 concentrations.

²³ See Wis. Dep't Nat. Res., 2022 Impaired Waters List, apps.dnr.wi.gov/swims/Documents/ DownloadDocument?id=307141807 (last visited Dec. 21, 2023).

²⁴ See Shannon Haydin et al., *Chlorides Workgroup Recommendations on a Statewide Chloride Strategy*, Report to Water Initiatives Steering Committee (WISC) (Dec. 6, 2022), https://dnr.wisconsin.gov/sites/default/files/topic/Stormwater/ WisconsinStatewideChlorideStrategy.pdf. More information on these permitting programs can be found at: dnr. wisconsin.gov/topic/Wastewater/Permits.html.

²⁵ Wisconsin Department of Transportation, *Winter Facts*, wisconsindot.gov/Pages/doing-bus/local-gov/hwy-mnt/ winter-maintenance/facts.aspx (last visited Dec. 21, 2023).

²⁶ Wisconsin Department of Transportation, *Winter Maintenance at a Glance, It's Only Cold if You're Standing Still*, 2 (2016-2017), https://wisconsindot.gov/Documents/doing-bus/local-gov/hwy-mnt/winter-maintenance/workers/2016-2017annualminireport.pdf.

²⁷ See Wisconsin Department of Transportation, *Highway Maintenance Manual*, Chapter 6, Section 20, Subject 25 (2008) ("Application Rates De-Icing"), available at wisconsindot.gov/Documents/doing-bus/local-gov/hwy-mnt/mntc-manual/ chapter06/06-20-25.pdf.

²⁸ Winter Facts, supra.

²⁹ Id.

³⁰ See Wisconsin Department of Natural Resources, *Winter Maintenance Survey Results*, available at www.surveymonkey. com/stories/SM-XJfjhobmtTXrvfBhuXmbUA_3D_3D/ (communities) and www.surveymonkey.com/stories/SM-uu1knyQwL5cGWqdGiRE2Kw_3D_3D/ (businesses).

³¹ Id.

Some salt used for deicing is transported with runoff to surface waters, and the resulting "[d]etrimental impacts . . . [are] evident on local, regional, and national scales."³² According to some studies, essentially "all chloride ions that enter the soil and groundwater can ultimately be expected to reach surface water."³³ This occurs during deicing, after disposal and melting of snow cleared from roadways, through dispersal by splashing and spray from vehicles, and via wind.³⁴

For a more complete evaluation of the detrimental effects of chloride in the environment, see the accompanying technical reports TR-62 and TR-63.

2.2 WATER SOFTENING

"Water softeners can release . . . large[] amounts of chloride to the environment" through "septic systems, dry wells, or wastewater-treatment facilities."³⁵ One recent study showed that on average, home water softeners discharge about 0.56 pounds of chloride per person per day to wastewater systems.³⁶ However, softener efficiency affects how much chloride is discharged. The softener efficiency, age, type of regeneration, salt dosage, and reserve capacity all may play a role in chloride contributions to either septic systems or the treatment plant.³⁷

Water hardness depends on the amount of calcium, magnesium, and iron ions found in the water source.³⁸ There is neither a state nor national standard for how hard or soft water should be to be suitable for drinking water.³⁹ However, waters with inorganic chemicals in excess of the limits contained in the *Wisconsin Administrative Code* "may be objectionable to an appreciable number of persons."⁴⁰ This code section applies to all public water systems.⁴¹ Therefore, if the WDNR receives complaints, it may require a water supplier to monitor the water it provides.⁴² Should the WDNR determine that the chemical levels in the drinking water are in excess of the standard based on an objection from an appreciable number of people and detrimental to public welfare, the WDNR can require the water supplier to take remedial action "to insure that the public receives the highest quality water practically obtainable."⁴³ Wisconsin has adopted a secondary drinking water standard of 250 milligrams per liter (mg/L) for chloride based on U.S. Environmental Protection Agency (EPA) guidelines for aesthetic effects.⁴⁴

³⁴ Id.

³⁵ USGS, Chloride in Groundwater, supra, at 12.

³⁶ Kathleen Lake et al., *The Reduction of Influent Chloride to Watewater Treatment Plants by the Optimization of Residential Water Softeners*, Madison Metro. Sewerage Dist. 1, xii perma.cc/Y968-RZKZ (last visited Dec. 21, 2023).

³⁷ Softeners are becoming more efficient, and some cities have made recommendations on target efficiencies. For example, the Madison Metropolitan Sewerage District recommends all new softeners to meet or exceed a target efficiency of 4,000 grains per pound. See Madison Metropolitan Sewerage District, Salt Reduction Through Efficient Water Softening, Training Workbook 2020.

³⁸ City of Milwaukee, *Water Hardness*, FAQS-Water Quality and Public Health, city.milwaukee.gov/water/customer/FAQs/ qualityandhealth/Water-hardness.htm (last visited Dec. 27, 2023) [hereinafter *Milwaukee, Water Hardness*]; Michael Harrington et al., *Development of a Reasoned Approach to Chloride Reduction in Michigan's Surface Waters*, Univ. Mich. Sch. for Env't Sustainability 11 (2022).

³⁹ Southeastern Wisconsin Regional Planning Commission TR- 37, *Groundwater Resources of Southeastern Wisconsin*, at 93 (June 2022) [hereinafter SEWRPC TR-37].

⁴⁰ Wis. Admin. Code § NR 809.70(1).

⁴⁴ See Wis. Admin. Code § NR 809.70.

³² Steven R. Corsi et al., A Fresh Look at Road Salt: Aquatic Toxicity and Water- Quality Impacts on Local, Regional, and National Scales, 44 Envt. Sci. & Tech. 7376, 7381 (2010) [hereinafter Corsi et al., A Fresh Look at Road Salt].

³³ Priority Substances List Assessment Report: Road Salts, Env't Can. & Health Can. 1, 1 (2001).

⁴¹ Wis. Admin. Code § NR 809.70(2).

⁴² Wis. Admin. Code § NR 809.71(1).

⁴³ Wis. Admin. Code § NR 809.71(2).

In Wisconsin, both the surface waters and groundwater are generally considered hard or very hard in the central and western parts of the state.⁴⁵ For cities that rely on Lake Michigan as their drinking water source, the natural water hardness is fairly moderate. For example, the hardness of Milwaukee's water averages 137 mg/L, with a reported range between 112-142 mg/L.⁴⁶ Similarly, Kenosha's water hardness averages 138 mg/L.⁴⁷ The natural water hardness of groundwater varies widely, from 317 mg/L (City of Oconomowoc wells),⁴⁸ to 380 mg/L (Village of Jackson wells), to 383-581 mg/L (City of Brookfield wells), to 308-513 mg/L (City of Waukesha wells).⁴⁹

The Southeastern Wisconsin Regional Planning Commission (Commission) has previously prepared a generalized map of hardness in the shallow aquifer of the Southeastern Wisconsin region.⁵⁰ The map shows that most of the region that is dependent on groundwater for water supply is dealing with very hard water.

Commonly, households and corporate facilities employ some mechanism to soften water in order to prevent scale build-up in plumbing and appliances and to allow soap to lather better.⁵¹ Accordingly, there are multiple types of systems available to soften water, as explained below.⁵²

One of the more common systems for household water softening is the use of point of entry ion exchange.⁵³ This system is installed directly at the main water service line, and here water is treated for the entire house or building.⁵⁴ In the point-of-entry ion-exchange water softening systems, calcium and magnesium ions are exchanged with sodium ions, in turn creating softened water and a waste brine.⁵⁵ This exchange of ions depletes the ion exchange resin of sodium. Ion exchange water softeners typically use sodium chloride to recharge the sodium on the resin. The waste brine contains the chloride from the salt used for recharge. The amount of chloride in the waste brine depends on various factors. For example, the amount of calcium, magnesium, and other metals that make up the hardness of the water may impact the amount of chloride found in the waste brine. Particularly, higher magnesium drives up the mass of chloride used, the efficiency of the treatment, and the efficiency of the regeneration. Usually, a high efficiency softener will send 1 milligram (mg) or more of chloride to the wastewater treatment plant for every 1 mg of hardness treated.⁵⁶

Generally, the waste brine from the point-of-entry ion-exchange water softening system is discharged to wastewater treatment plants or onsite wastewater treatment systems such as septic tanks, causing

⁴⁸ City of Oconomowoc, *Oconomowoc Water Utility Annual Water Quality Report*, https://www.oconomowoc-wi.gov/ DocumentCenter/View/8613/2022-Water-Quality-Report?bidId= (last visited Dec. 27, 2023).

⁴⁹ Jackson Water Utility, *Drinking Water Report* 1, 3 (2022) https://villageofjacksonwi.gov/ArchiveCenter/ViewFile/Item/51 (last visited Dec. 27, 2023). *See* City of Brookfield, *What is the Hardness of my City Water?*, FAQs, www.ci.brookfield.wi.us/ Faq.aspx?QID=89 (last visited Dec. 27, 2023). The Waukesha hardness range is found on the monthly water bills of customers of the City of Waukesha.

⁵⁰ SEWRPC TR-37, *supra*, at 92 (Map 24).

⁵¹A Blueprint for Salt Sustainability on the University of Wisconsin-Madison Campus, The University of Wisconsin-Madison Nelson Institute for Environmental Studies, 2019 Water Resources Management Practicum Report 4 (2019), https:// nelson.wisc.edu/wp-content/uploads/wrm-report-2019.pdf.

⁵² See Baishali Bakshi et al., Centralized Softening as a Solution to Chloride Pollution: An Empirical Analysis Based on Minnesota Cities 11 (Table 2) (2021); see also Southeastern Wisconsin Regional Planning Commission TR-66.

⁵³ Bakshi, *supra*, at 2.

⁵⁴ Id.

⁵⁵ Id.

⁵⁶ Minnesota Pollution Control Agency, *Chloride Work Group Policy Proposal for Minnesota*, wq-wwprm 2-24, at 8 (Apr. 2017).

⁴⁵ John R. Mullaney, David L. Lorenz, & Alan D. Arntson, *Chloride in Groundwater and Surface Water in Areas Underlain by the Glacial System, Northern United States*, U.S. Geological Surv. Sci. Investigation Rep. 2009-5086, 41, 1, 12 (2009).

⁴⁶ Milwaukee, Water Hardness, supra.

⁴⁷ Kenosha Water Utility, *2021 Annual Report* 1, 30 (June 2022) www.kenosha.org/images/water/Reports/2021_Annual_ Report_web.pdf.

significant chloride loading.⁵⁷ Wastewater treatment plants may attempt to remove chloride before it is released back into surface water; however, the wastewater treatment plants are not always successful in this attempt due to limited treatment technology and expenses involved.⁵⁸ Similarly, chloride may end up in groundwater due to the inability of septic systems to remove it. Faulty or old water softening systems may contribute elevated levels of chloride to wastewater treatment facilities or septic systems.⁵⁹ Although there are problems that may occur with the point-of-entry ion-exchange water softening system contributing significantly to chloride discharge into ground and surface water, the Wisconsin Plumbing Code may help reduce these risks. For example, the Code requires ion exchange water softeners to be equipped with a water meter or a sensor unless there is a wastewater treatment system downstream of the softener that documents the amount of chlorides received.⁶⁰

There are alternative systems that can be used to soften water. For example, a centralized water softening system allows for water to be softened at a water treatment plant or wastewater treatment plant.⁶¹ A centralized system may approach water softening in various ways.⁶² One approach is ion exchange.⁶³ This is similar to the process involved in the at-home point-of-entry ion-exchange water softening systems where calcium and magnesium ions are exchanged with sodium ions.⁶⁴ Two other approaches for a centralized softening system are the use of reverse osmosis or the use of lime soda.⁶⁵ Centralized softening can have a significant impact on reducing chloride discharges to receiving waters; however, it can be expensive.⁶⁶ Moreover, centralized softening, specifically centralized softening by use of lime, is most efficient when used to soften groundwater, not surface water.⁶⁷

The vast majority of utilities in the Southeastern Wisconsin Region do not employ centralized softening. The 2005 inventories in the Regional Water Supply Plan (SEWRPC PR-52) show the treatment processes at utility plants in the Region. The processes at the water utilities serving Union Grove, the Country Estates Sanitary District, and Elkhorn include ion exchange; those at Williams Bay included lime soda addition, and those at Pell Lake include both ion exchange and lime soda addition. While these processes were implemented to treat for radium, there may have been a water softening side benefit.

2.3 AGRICULTURAL USES

Agricultural operations use salt as a feed additive and in other products such as pesticides and fertilizers.⁶⁸ Researchers have found that improved agricultural practices that use less water could simultaneously reduce salt loading to freshwater.⁶⁹ The Colorado River Basin Salinity Control Program has effectively reduced salt loading to the river by about 1.3 million tons per year, largely through improved irrigation practices.⁷⁰

⁵⁸ Id.

⁵⁹ See Harrington et al., supra, at 14.

60 Wis. Admin. Code SPS § 382(8)(j).

⁶¹ A more detailed discussion of centralized softening is provided in the accompanying TR-66.

⁶² See Bakshi, supra, at 11 (Table 2).

⁶³ Bakshi, *supra*, at 11.

⁶⁴ Id.

⁶⁵ Id.

⁶⁶ Jim Gruenke, *Potential Solutions to Reduce Chloride Output from Water Softeners*, Water Quality Products (May 28, 2021) www.wqpmag.com/softening-conditioning/water-softening/article/10958705/potential-solutions-to-reduce-chloride-output-from-water-softeners.

67 Bakshi, supra, at 14.

⁶⁸ Molly Hunt et al., *Chlorides in Fresh Water*, Univ. R.I. Coll. Env't & Life Sci. 1, 2 (Mar. 2012), https://perma.cc/M3PG-XQRC.

⁶⁹ M. Canedo-Arguelles et al., Saving Freshwater from Salts, 351 Science 914, 916 (2016).

⁷⁰ Id.

⁵⁷ Bakshi, *supra*, at 2.

Potassium chloride fertilizers are the most commonly used potassium fertilizers because of their many advantages. They are low in cost, contain a higher amount of potassium compared to other fertilizers, and can be dissolved in water for spray or fertilization applications.⁷¹ Studies have shown that applying this type of fertilizer to soils with inadequate potassium can improve crop yields and quality.⁷² However, these types of fertilizers can also be disadvantageous depending on their chemistry, behavior in soils, and nutrients supplied in addition to the potassium.⁷³ One study even demonstrated that while potassium fertilizer application maximizes yield and crop quality, it cannot be sustained because there are negative consequences related to agricultural productivity, food safety, and soil degradation.⁷⁴

Chloride-containing compounds are also often found in agricultural disinfectants and pesticides. "Sodium chloride is one of two active ingredients in a disinfectant used to treat feeding and watering appliances, [as well as] equipment and premises in poultry operations."⁷⁵ Sodium chloride is also the active ingredient used in polyethylene pellets used to prevent slugs and snails from entering gardens.⁷⁶

2.4 WASTEWATER TREATMENT FACILITIES

Although most researchers have concluded that winter deicing runoff is the dominant source of chloride in surface waters, other studies reveal that treated wastewater can be a major chloride source.⁷⁷ Chloride is "non-reactive," meaning that there is little or no loss when chloride in wastewater passes through wastewater treatment facilities or septic systems.⁷⁸ Instead, chloride "remain[s] in solution."⁷⁹ This is because it "cannot be removed using standard wastewater treatment technology;⁸⁰ therefore, chloride that arrives in wastewater passes through treatment plants and enters natural water bodies or groundwater as treated effluent."⁸¹ Part of this is due to decentralized water softening, as already discussed. But chloride can also enter the waste stream from food, beverages, and cleaning products.⁸² An average person consumes about 4.7 pounds of salt per year, and releases about 2.9 pounds of that to wastewater discharges.⁸³

As explained above, chloride from water softening goes to municipal wastewater treatment facilities or private onsite wastewater treatment systems, eventually ending up in surface water or groundwater.⁸⁴ Most wastewater treatment plants in the Southeastern Wisconsin Region discharge into surface waters, with a

⁷² See L. Ren, et al., *The Value of KCL as a Fertilizer with Particular Reference to Chloride: A Mini Review*, Int'l Potash Inst. E-ifc no. 40, at 9 (Mar. 2015).

⁷³ Blaylock, *supra*.

⁷⁴ See S.A. Khan, et al., *The Potassium Paradox: Implications for Soil Fertility, Crop Production and Human Health*, Univ. III. Urbana-Champaign Dep't Nat. Res. & Sci. (2013).

⁷⁵ U.S. Environmental Protection Agency Office of Prevention, Pesticides and Toxic Substances, *R.E.D. Facts: Organic Halides*, EPA-738-F-93-015, 1993.

⁷⁶ Id.

⁷⁷ See Kelly et al., Using Chloride, supra, at 671.

⁷⁸ USGS, Chloride in Groundwater, supra, at 8.

⁷⁹ Corsi et al., A Fresh Look at Road Salt, supra, at 7376.

⁸⁰ See, e.g., AECOM/Madison Metropolitan Sewerage Commission, Chloride Compliance Study—Nine Springs Wastewater Treatment Plant (2015) (discussing additional treatment technology necessary for chloride removal) (available at www. madsewer.org/wp-content/uploads/2021/12/STUDY-2015-District-Chloride-Compliance.pdf).

⁸¹ Lake et al., *supra* note 3, at xi.

⁸² USGS, Chloride in Groundwater, supra, at 8. A Michigan study suggests that household products contribute around 2,956 tons per year of chloride. If taking into account failed septic systems, the number would be around 3,286 tons per year of chloride. See Harrington et al., supra, at 15.

⁸³ *Id*. at 12.

⁸⁴ See infra ch.1, section B.

⁷¹ Alan Blaylock, *Potassium Fertilizers: Muriate of Potash or Sulfate of Potash?*, eKonomics, https://nutrien-ekonomics. com/news/potassium-fertilizers-muriate-of-potash-or-sulfate-of-potash/ (last visited Dec. 27, 2023); Mosaic, *Potassium Chloride*, https://www.cropnutrition.com/resource-library/potassium-chloride/ (last visited Dec. 27, 2023).

few that discharge into shallow groundwater.⁸⁵ Meanwhile, almost all private onsite wastewater treatment systems discharge into shallow groundwater, and the biochemical activity in the discharge field is part of the treatment process.⁸⁶

In the Southeastern Wisconsin Region, there are forty-four public wastewater treatment plants and eight private wastewater treatment plants.⁸⁷ Seventeen of these public plants and one private plant discharge effluent into Lake Michigan or its tributary streams. The remaining twenty-seven public plants and seven private plants discharge treated effluent into streams, watercourses, and groundwater in the Fox, Des Plaines, and Rock River Basins.⁸⁸

With the multitude of contributing sources, wastewater treatment facilities receive a large amount of chloride per day.⁸⁹ For example, the Nine Springs Wastewater Treatment plant, in Madison, receives nearly 220,000 pounds of salt per day.⁹⁰ Removing chloride from water using these facilities is expensive and the technology to do so is limited.⁹¹ One method to remove chloride, reverse osmosis, can have capital costs of \$28 million per 1 million gallons per day of flow.⁹² There are also secondary consequences to reverse osmosis treatment, such as an increase in energy use, waste disposal costs, and operator training needed.⁹³

Some wastewater treatment facilities have difficulty meeting the chloride effluent limits in their discharge permits, and as discussed in more detail in Chapter 3, are granted variances from their limits by the WDNR. These variances typically set site specific objectives to reduce chloride loads.⁹⁴ In Wisconsin, most of the facilities that have chloride variances are in the southern and eastern part of the state, where limestone and dolomite aquifers are located and naturally produce hard water.⁹⁵

2.5 INDUSTRIAL SOURCES – FOOD PROCESSING

Some industries, especially food processing and chemical manufacturing, use or generate significant amounts of chloride and chloride salts.⁹⁶ Chloride discharges from publicly owned wastewater treatment facilities may include these industrial sources as well.⁹⁷

Sodium chloride is regulated for food processing under 21 CFR 182.70 and is considered a "substance generally recognized as safe."⁹⁸ It has a variety of uses within the food industry that include food flavoring,

⁸⁶ See id. at 40.

⁸⁷ Id.

⁸⁸ Id.

⁸⁹ Development and Implementation of Water Quality Standard Variances, 3400-2022-02 Wisconsin Department of Natural Resources i, 31 (1st ed.) (July 19, 2022).

⁹⁰ Madison Metropolitan Sewerage District, *Curbing Salt Use to Protect Our Freshwater Resources*, Pollution Prevention Chloride, www.madsewer.org/pollution-prevention/chloride/ (last visited Dec. 27, 2023).

⁹¹ Bakshi, *supra*, at 4.

⁹² Chloride Work Group Policy Proposal for Minnesota, supra, at 9.

⁹³ Id.

⁹⁴ Development and Implementation of Water Quality Standard Variances, supra, at 1.

⁹⁵ *Id*. at 31.

⁹⁶ Gregory E. Granato, et al., U.S. Geological Surv., Rep No. 2015-1080, *Methods for Evaluating Potential Sources of Chloride in Surface Waters and Groundwaters of the Conterminous United States* 2 (2015).

⁹⁷ Id. at 21; USGS, Chloride in Groundwater, supra, at 3 fig. 1, 5, 8.

⁹⁸ Calcium Chloride—A Useful Preservative and Food Additive, Chemgrit SA, www.chemgritsa.co.za/post/calcium-chloride-a-useful-preservative-and-food-additive (last visited Dec. 27, 2023).

⁸⁵ See Southeastern Wisconsin Regional Planning Commission, *Prospectus for a Chloride Impact Study for the Southeastern Wisconsin Region* 40, 41 (Map 10) (Mar. 2016).

preservation, fermentation, and for manufacturing a wide range of products.⁹⁹ The 2020-2025 Dietary Guidelines for Americans recommends no more than 2,300 mg of sodium per day. However, the average sodium intake for the U.S. population is 3,393 mg/day, significantly higher than the recommended amount.¹⁰⁰ Most human sodium intake comes from processed food as opposed to table salt. Sodium is added to food for reasons including flavor enhancement, preservation of freshness, and texture and appearance improvement.¹⁰¹ Similarly, calcium chloride is used as a food additive because it can help extend shelf life and maintain desirable texture and flavor properties.¹⁰²

In Wisconsin, chloride is commonly used in the cheesemaking process in multiple ways. The first is through the brining process. Once the cheese is submerged in a brine solution, the flavor is preserved and the cheese itself is preserved. Brine can also be injected into the cheese during the process. Second, in a process known as dry salting, the curds are mixed with salt and left to sit while the salt is absorbed into the cheese. Third, the use of softened water introduces additional salt. Fourth, milk used in the process contains some salt, and the last way is through chemicals to help remove phosphorus. On average, every pound of cheese made consists of two percent salt. In addition, up to fifty percent of the salt used during the cheesemaking process can be lost in brine waste. The chloride byproduct is typically disposed of by sending it to municipal wastewater treatment plants. Some companies, however, share the brine solution waste with nearby communities for deicing in the winter months. Currently, the cheesemaking industry does not have a viable alternative for salt in its production process.

2.6 OTHER INDUSTRIAL SOURCES

Two other industrial sources that are less common in Wisconsin contribute to chloride discharge: the oil and gas industry and the steel industry. Sodium chloride content varies among geological formations and drilled wells.¹⁰³ However, the average sodium concentration in brine¹⁰⁴ from oil and gas fields is about 30,000 mg/L.¹⁰⁵ In June 2016 the EPA banned oil and gas operators from delivering wastewater to municipal sewage treatment plants.¹⁰⁶ Consequently, oil and gas operators now discharge the wastewater from fracking in offsite injection wells.¹⁰⁷

Similarly, the steel industry "is one of the largest energy-intensive and water-intensive process industries," using thousands of gallons of water per ton of steel.¹⁰⁸ Specifically, the cooling water used in the steel

⁹⁹ Sodium Chloride, ChemicalSafetyFacts.org (updated Oct. 14, 2022) www.chemicalsafetyfacts.org/chemicals/sodium-chloride.

¹⁰⁰ U.S. Dep't Agric., *Dietary Guidelines for Americans, 2020-2025*, 46 (Dec. 2020) www.dietaryguidelines.gov/sites/ default/files/2020-12/Dietary_Guidelines_for_Americans_2020-2025.pdf.

¹⁰¹ CDC, *Key Messages on Sodium and Sodium Reduction*, 1 (Mar. 2021), www.cdc.gov/dhdsp/docs/sodium-reduction-key-messages-508.pdf.

¹⁰² Occidental Chem. Corp., *Food Processing*, Calcium Chloride, www.oxycalciumchloride.com/applications/food-processing#:~:text=Calcium%20chloride%20is%20used%20as,desirable%20texture%20and%20flavor%20properties (last visited Dec. 29, 2023).

¹⁰³ Lindsey Konkel, *Salting the Earth: The Environmental Impact of Oil and Gas Wastewater Spills*, 124-12 Env't Health Persp. A231, A231 (Dec. 2016).

¹⁰⁴ Brine in this context is the water that comes out of the well with crude oil. Water Environment Federation, WSEC-2017-FS-013 IWWC, *Produced Water: Oil and Gas Terminology Glossary*, 1 (2018) www.wef.org/globalassets/assets-wef/ direct-download-library/public/03---resources/wsec-2017-fs-013-iwwc-og-glossary---final---5.21.18.pdf. The brine is commonly referred to as produced water in the oil and gas industry. *Id*.

¹⁰⁵ M.K Steele & J.A. Aitkenhead-Peterson, *Long-Term Sodium and Chloride Surface Water Exports from the Dallas/Fort Worth Region*, 2474 Dep't Soil & Crop Sci. Tex. A&M Univ. 3021, 3031 (2011).

¹⁰⁶ Konkel, *supra*, at A231.

¹⁰⁷ Id.

¹⁰⁸ Valentina Colla et al., Sustainable Reverse Osmosis Application for Wastewater Treatment in the Steel Industry, 130 J. Cleaner Prod. 103, 104 (2016). See Alberto Conejo et al., A Review of the Current Environmental Challenges of the Steel Industry and its Value Chain, 259 J. Env't Mgmt. 100, 100 (Apr. 2020).

production process has a high chloride concentration.¹⁰⁹ Recently, the steel industry has improved its water management. For example, it is now a common practice to use recycled wastewater in the steel production process.¹¹⁰ By using the recycled wastewater, it is necessary to remove excess chloride due to its corrosive effects on steel, and so reverse osmosis is a possible method used to remove the chloride.¹¹¹

Another industry that commonly uses a large amount of chloride is the leather tanning industry.¹¹² This industry, which was mainly popular due to German immigrants, flourished in the nineteenth and twentieth centuries.¹¹³ Historically, Wisconsin, and in particular Milwaukee, had been known for its leather industry; however, this industry has become less prominent in Wisconsin and the United Sates in recent decades.¹¹⁴

The tanning process consists of three phases: (1) pickling, (2) tanning, and (3) basification.¹¹⁵ The first phase, the pickling phase, is where the most chloride is used.¹¹⁶ Pickle float consists of a 6% solution of sodium chloride, and chloride residue from this phase stays in the water source used in the other tanning phases of the tanning process.¹¹⁷ In total, the chloride concentration from leather tanning water discharge is around 20,000 mg/L.¹¹⁸

¹¹⁴ See Id.

¹¹⁵ Zhang, *supra*, at 1055.

¹¹⁷ Id. at 1055.

¹¹⁸ Id. at 1056.

¹⁰⁹ Colla, *supra*, at 105.

¹¹⁰ See Colla, supra, at 104.

¹¹¹ See Colla, supra, at 103.

¹¹² Chunxiao Zhang et al., A Salt-Free and Chromium Discharge Minimizing Tanning Technology: The Novel Cleaner Integrated Chrome Tanning Process, 112 Journal of Cleaner Production 1055, 1055 (2016).

¹¹³ John Gurda, *Hides and Hemlock: Milwaukee's Tanneries Had a Strong Connection with Manitowoc County*, Milwaukee Journal Sentinel (Nov. 4, 2021), https://www.jsonline.com/story/opinion/2021/11/04/milwaukee-tanneries-had-firm-connection-manitowoc-county/6270084001/.

¹¹⁶ The pickling phase reduces the swelling of the skins or hides. *Id.* at 1056.

LEGAL AND POLICY STRATEGIES TO CONTROL CHLORIDE DISCHARGES

Elevated chloride concentrations in the environment pose serious risks to human health and the environment. Reports of drinking water supplies contaminated with chloride have emerged in a number of locations.¹¹⁹ The United States Geological Survey (USGS) has called chloride contamination of drinking water supplies "[t]he primary concern for water quality" related to chloride.¹²⁰ A recent USGS study identified chloride contaminations above the EPA secondary maximum containment level (SMCL) in about 1.7% of drinking water wells.¹²¹ This contamination can result in human health impacts, deterioration of the biotic environment, degraded water quality, influences on soil structure and vegetation, and other negative consequences. These impacts are more fully described in TR-62.

Yet to date, little or no legal incentives or policies exist to avoid overuse of chloride. To the contrary, overapplication and overuse of deicing salt has historically been the "safe" strategy in light of potential concerns about legal liability. That may change, however, given recent reports of citizen-instituted lawsuits against municipalities and private property owners for over-application of salt and the resulting environmental harms.

For example, in 2017, residents of Brighton, Michigan sued General Motors claiming that the company's use of road salt to clear ice from its nearby Milford proving grounds resulted in groundwater contamination causing health impacts and property damage.¹²² The complaint alleged that General Motors "released hundreds of thousands of tons of salt . . . over the last several decades, leading to extremely high concentrations of sodium and chloride in surface and groundwater" that "migrated . . . in[to] water used by Plaintiffs." ¹²³ The citizens alleged damages under two state laws—the Michigan Natural Resources and Environmental Protection Act and the Michigan Environmental Protection Act—and under common law theories including fraud, negligence, trespass, private nuisance, and public nuisance.¹²⁴ The suit appears to have been resolved out of court.

In another case, a citizen alleged that the City of Omaha had overapplied salt in a floodplain—tantamount to open dumping of solid waste—and in the process violated the Resource Conservation and Recovery Act (RCRA).¹²⁵ The court ultimately dismissed the lawsuit because it found the City's salt application practices to be consistent with the intended purpose of the product, and therefore not the equivalent of unlawful "discarding" under RCRA.¹²⁶ On appeal, the City again prevailed, with the Eighth Circuit concluding that the district court correctly determined that the salt application did not rise to the level of discarding solid waste.¹²⁷

In contrast, some manure-spreading operators have recently been held liable under RCRA where the loads applied were far in excess of spreading requirements.¹²⁸ Because the manure applications were completely untethered to applicable best management practices and crop fertilization needs, the manure ceased to

¹²⁰ USGS, Chloride in Groundwater, supra, at 2.

¹²¹ *Id*. at 15.

¹²² See generally Class Action Complaint & Jury Demand, Moore v. Gen. Motors, No. 2017-29670-CE (Mich. Cir. Ct. filed Nov. 30, 2017).

¹²³ Id. at 5 (abbreviation omitted).

¹²⁴ Id. at 17–23.

¹²⁵ Krause v. City of Omaha, No. 8:15CV197, 2015 WL 5008657, at *3 (D. Neb. Aug. 19, 2015).

¹²⁶ *Id*. at *4.

¹²⁷ Krause v. City of Omaha, 637 Fed. App'x 257, 258 (8th Cir. 2016).

¹²⁸ Cmty. Ass'n for Restoration of the Env't v. Cow Palace, 80 F. Supp. 3d 1180, 1221 (E.D. Wash. 2015).

¹¹⁹ See S.V. Panno et al., Database for the Characterization and Identification of the Sources of Sodium and Chloride in Natural Waters of Illinois, III. State Geological Survey 1 (2015) ("[Chloride] has adversely affected municipal and private water supplies in Illinois and other states").

be a "useful product" and became "solid waste" for RCRA purposes.¹²⁹ The plaintiff in the Omaha case, who represented himself, did not make similar arguments related to the over-application of salt as compared to best practices, but certainly could have (and future plaintiffs might).

In another recent case, a citizen-plaintiff alleged that his property had been rendered undevelopable because the municipality's over-application of salt contaminated the groundwater underlying his property.¹³⁰ The court dismissed the suit because it found no imminent harm to human health or the environment, a requirement for RCRA liability.¹³¹ It is conceivable that the court would have reached a different outcome if the groundwater was actively being consumed on the property—although, concerns over chloride are somewhat stronger in connection with environmental impacts than with human health impacts.

Because chloride is so difficult to remove using traditional water and wastewater treatment approaches, use reduction (or put differently, optimization) appears to be the only effective management strategy.¹³² However, "management or mitigation of this issue is complex. Solutions would require consideration of environmental, political, economic, and safety issues."¹³³ The report addresses these issues next.

Specifically, this chapter analyzes several legal and policy strategies for addressing excess chloride concentrations in surface waters and groundwater, and, where possible, identifies successful efforts underway using the identified strategy. These options include:

- Limiting liability
- Other direct regulatory strategies—i.e., relying on the Clean Water Act (CWA), state regulations, municipal ordinances, and mandated best practices
- Informational strategies
- Chloride alternatives
- Water quality trading
- Integrated watershed management
- Economic measures and assistance

The intent of these measures should be to encourage optimization, not elimination, of chloride usage. Moreover, the report does not propose a "one-size-fits-all" strategy to suit every situation; rather, the goal is to provide a menu of options for policymakers seeking to address chloride issues.

3.1 LIMITING LIABILITY

As it relates to chloride reduction, fear of "slip-and-fall" liability is one of the most-cited reasons for overapplication of winter deicers, especially on private property. This concern could be partially alleviated by granting a liability waiver against damages associated with snow and ice conditions to contractors certified for deicing best management practices, absent extreme circumstances such as intentional wrongdoing. A waiver addresses the widespread liability fears common to most deicing contractors and their customers, which undoubtedly lead to significant over-application of deicing salt.

¹²⁹ Id.

¹³¹ *Id*. at *2–3.

¹³³ Id. at 7382.

¹³⁰ Scotchtown Holdings v. Town of Goshen, No. 08-CV-4720(CS) 2009 WL 27445, at *1 (S.D.N.Y. Jan. 5, 2009).

¹³² Accord Corsi et al., A Fresh Look at Road Salt, supra at 7376 ("currently, reduction in usage appears to be the only effective road-salt-runoff management strategy").

The primary example of a liability waiver is New Hampshire's "Green SnowPro" program, administered by the New Hampshire Department of Environmental Services (NHDES).¹³⁴ The program includes multiple levels of deicing certification options. An individual who performs snow and ice removal services but does not hire employees may earn an Individual Certification.¹³⁵ Larger organizations with one or more employees may earn a Master Certification, which serves as an umbrella for the whole company.¹³⁶ However, all employees applying salt must undergo initial and refresher training.¹³⁷ The organization's employees may obtain either an individual certificate or a subordinate certificate to qualify under the master certificate. The organization must ensure that all employees operating with a subordinate certificate under its master certificate receive the required training, and the organization must provide the required record keeping on behalf of all commercial applicators working under the master certificate.¹³⁸

A person who seeks certification under the Green SnowPro program must complete several prerequisite steps. First, the person must complete the training course, which includes four to five hours of classroom instruction on efficient and environmentally friendly winter maintenance practices.¹³⁹ The training covers basics of salt reduction, including equipment calibration, anti-icing, brine making, pre-wetting with brine, efficient application rate changes,¹⁴⁰ and effective plowing techniques, among other things.¹⁴¹ The next step is a thirty-minute examination covering the program topics.¹⁴² If the person receives a passing score on the exam, the person is eligible to apply for the Voluntary Salt Applicator Certification and Liability Protection Program.¹⁴³

Certified persons must also track salt use and report the results to a salt accounting system on an annual basis.¹⁴⁴ This record keeping includes the statutory requirement for the contractor to "keep a written record describing its winter road, parking lot and property maintenance practices. The written record shall include the type of de-icing materials used, the rate or quantity of deicing materials used, the dates of treatment, and the weather conditions for each event requiring de-icing."¹⁴⁵ The tracking program is intended to hold applicators accountable and to document salt usage from year to year. However, there is no requirement that a certified individual or company documents salt application volume decreases over time.

In addition to the initial requirements for Green SnowPro certification, the program includes several ongoing tasks that certified persons must complete for recertification. For example, the program requires annual re-application.¹⁴⁶ Certified applicators must complete a refresher training every two years.¹⁴⁷

In exchange for completing the certification program and complying with its ongoing requirements, certified applicators receive general protection against liability for damages arising from snow and ice conditions. Specifically, pursuant to the waiver, commercial salt applicators that were certified by NHDES, and the

¹³⁴U.S. Envtl. Prot. Agency, New Hampshire Road Salt Reduction Program Protects Personal Safety and the Environment, NONPOINT SOURCE NEWS-NOTES, Jan. 2016, at 9, 9, perma.cc/65RW-L55A [hereinafter EPA, Green SnowPro].

¹³⁵ *Id*. at 10.

¹³⁶ Id.

¹³⁷ April 5, 2023 Salt Wise webinar. Some larger firms have had staff members certified as trainers and conduct annual training of all employees. *Id*.

¹³⁸ N.H. RSA § 489-C:2.

¹³⁹ Green SnowPro Training and NHDES Certification, U.N.H. Tech. Transfer Ctr., https://perma.cc/X2ZQ-FWES.

¹⁴⁰ Program leaders continue to stress the importance of making and maintaining good records for companies operating under the waiver. April 5, 2023 Wisconsin Salt Wise webinar.

¹⁴¹ Green SnowPro Training and NHDES Certification, U.N.H. TECH. TRANSFER CTR.

¹⁴² Id.

¹⁴³ Id.

¹⁴⁴ See EPA, Green SnowPro.

¹⁴⁵ N.H. REV. STAT. ANN. § 508:22(II) (2017).

¹⁴⁶ See N.H. CODE ADMIN. R. ANN. Env-Wq 2203.04(c)(2)(c), 2203.06 (2017); see also N.H. REV. STAT. ANN. § 489-C:2.

147 N.H. CODE ADMIN. R. ANN. Env-Wq 2203.06(a)(2)(b).

property owners or managers who hired them, are granted liability protection against such damages so long as the applicators used the "best management practices for winter road, parking lot, and sidewalk maintenance adopted and published by the [New Hampshire] [D]epartments of [T]ransportation and [E] nvironmental [S]ervices."¹⁴⁸ However, the waiver does not apply if a court finds that the certified contractor acted with "gross negligence or reckless disregard of the hazard."¹⁴⁹ Certified persons are "presumed to be acting pursuant to the best management practices in the absence of proof to the contrary."¹⁵⁰ The liability waiver proved to be a significant incentive for applicators to become certified, and quickly became the cornerstone of the program.

The New Hampshire program carries several advantages. It stresses the need to balance both environmental and safety concerns and motivates increased participation in several ways.

Liability waiver. First, the liability protection for program participants and those who hire them is unlike any other chloride reduction program. It addresses one of the greatest fears of deicing contractors, along with those who hire them and those who insure them: that they will be held liable for accidents resulting from remaining snow and ice that should have been removed.¹⁵¹ Without such an incentive, over-application of salt is perceived to be the safe strategy for deicing contractors.¹⁵²

Environmental and Process Improvements. Preliminary evaluative metrics show significant progress. According to NHDES, by the end of 2017, over 1,000 individuals had been trained and certified under the New Hampshire program, mostly in the private sector.¹⁵³ Preliminary water quality data show a downward trend in aquatic chloride levels, and annual reports from certified contractors show salt applications decreasing by 30%.¹⁵⁴ These reductions in applications would result in corresponding cost savings for contractors and their clients.

Cost savings due to forced efficiencies. The training offers an opportunity for "efficiency-forcing" as participants learn best management practices.¹⁵⁵ In turn, this leads to cost savings for participants as salt use decreases.

Marketing advantages. Further, there is a significant marketing advantage for certified entities. The most direct aspect of this is that the liability waiver extends to those who hire certified contractors.¹⁵⁶ This means that a private entity hiring a contractor to keep, for example, its parking lot free of snow and ice can simultaneously gain the peace of mind of liability protection simply by hiring a certified contractor. Certified contractors will no doubt also market themselves as "green" to distinguish themselves from competitors. Certified contractors can use the Green SnowPro program logo on their website and related marketing materials to demonstrate to current and potential clients their certification.

Insurance advantages. Insurance companies in New Hampshire appear willing to give discounts if a business hires a certified snow removal contractor.¹⁵⁷ Insurers issuing policies in New Hampshire have already begun

¹⁴⁸ N.H. REV. STAT. ANN. § 508:22(I).

¹⁴⁹ Id.

¹⁵⁰ Id.

¹⁵¹ Kamal Hossain & Liping Fu, Optimal Snow and Ice Control of Parking Lots and Sidewalks, Univ. of Waterloo 7 (2015).

¹⁵² Id.

¹⁵³ Green SnowPro Training and NHDES Certification, U.N.H. TECH. TRANSFER CTR.

¹⁵⁴ Interview with Patrick Woodbrey, Salt Reduction Coordinator, N.H. Dep't of Envtl. Servs. (Mar. 8, 2016); see also EPA, Green SnowPro, (citing "anecdotal information pointing to reductions in the amount of salt applied. . . . Many contractors have told us they've been able to use less" (quoting Patrick Woodbrey)).

¹⁵⁵ Eric Williams, *Become a Certified Green SnowPro*, UNH T2, Fall 2011, at 1, 6.

¹⁵⁶ See N.H. REV. STAT. ANN. § 508:22(I) (2017) (extending liability waiver to owners, occupants, and lessees of land maintained by a certified contractor).

¹⁵⁷ EPA, Green SnowPro at 10.

advising contractors on how best to limit liability under the program.¹⁵⁸ For example, one major insurer has told its insureds to fully document—with written records and photographs—treatment dates, times, and subsequent inspections, because under the statute, a certified person is assumed to be adhering to best practices only "in the absence of proof to the contrary."¹⁵⁹

Despite these advantages, the New Hampshire program administrators have identified several ongoing challenges that should be addressed if the program is replicated elsewhere.

Financial stability. Program administrators expressed uncertainty about the continued financial viability of the Green SnowPro program if the current fee structure remains unchanged. Currently, the training course costs \$150 (for individual certificates) or \$250 (for master certificates).¹⁶⁰

Difficulties in program adoption and uptake. Program administrators noted the difficulty in passing the statutes to create the liability waiver program. To do so took four legislative sessions, and in the end, the program survived only as a late addendum to a budget bill.¹⁶¹ After passage, program administrators stressed the need to find early program "champions" who are willing to invest the time and money needed to become certified under the program.¹⁶² The administrators conceded that it took some time for insurance companies and business owners, who hire salt applicators, to realize the benefits of this certification.¹⁶³ Finally, the danger of higher-than-desired program attrition exists due to the voluntary nature of the recertification path.

Legal strength of liability waiver. So far, the liability waiver program has withstood legal challenges, and it was "developed in close coordination with legal experts and insurance companies."¹⁶⁴ More complex legal battles could arise in the future. For example, a certified person (or her insurance carrier) defending a slip-and-fall case would likely file a motion to end the case, citing the liability waiver statute. The plaintiff would no doubt produce evidence related to the parking lot or sidewalk conditions around the time of the injury. The success or failure of the claim would likely depend on whether the certified person followed best practices. The case could turn on photographs or documentary evidence of the certified person's winter maintenance practices.

In addition to case-specific challenges based on questions of material fact, a more general (and perhaps constitutional) challenge to the statute could arise. For example, the statutory waiver could be challenged as a deprivation of a plaintiff's right to substantive due process, or a violation of state and federal rights to equal protection.

The innovative nature of New Hampshire's Green SnowPro program makes it a likely candidate for duplication in other places.

Pending proposals. A bill pending in the Wisconsin Legislature would create a program extremely similar to New Hampshire's: in short, program-certified commercial deicing contractors that implement best practices and maintain records would receive limited liability protections from slip and fall claims, as would their

¹⁶¹ Interview with Patrick Woodbrey, *supra*.

¹⁶² *Id*.

¹⁶³ Id.

¹⁶⁴ The most recent challenge was dismissed upon appeal. *See Rogers v. Chartwell Management*, 2023-0016 (N.H. 2023).

¹⁵⁸ See generally THOMAS BROTHERS, LIBERTY MUT. INS., LIMITING SNOW PLOWING LIABILITY (2014) (discussing best practices for snow removal companies).

¹⁵⁹ N.H. REV. STAT. ANN. § 508:22(I) ("All commercial applicators, owners, occupants, or lessees who adopt such best management practices shall be presumed to be acting to the best management practices in the absence of proof to the contrary.").

¹⁶⁰ New Hampshire Department of Environmental Services, New Hampshire Voluntary Salt Applicator (Green SnowPro) Certification Guide, available at www.des.nh.gov/sites/g/files/ehbemt341/files/documents/gsp-certification-guide. pdf.

customers.¹⁶⁵ Similar legislation has been introduced in the Minnesota Legislature.¹⁶⁶ Maryland has enacted programs reducing salt application to roadways¹⁶⁷ and is working on a voluntary certification program for deicer applicators.¹⁶⁸

3.2 OTHER DIRECT REGULATORY STRATEGIES

Several potential regulatory strategies are examined here, including direct regulation under the Clean Water Act (CWA), mandated or incentivized best management practices, and municipal ordinances.

The Clean Water Act. The CWA prohibits the addition of any pollutant from a point source to waters of the United States without a permit.¹⁶⁹ Wisconsin has enacted water quality standards for chloride pursuant to the CWA.¹⁷⁰ The associated surface water numerical criteria for chlorides are 395 mg/L for chronic exposure and 757 mg/L for acute exposure.¹⁷¹ However, there is some evidence that these limits should be lower in order to minimize impacts to aquatic organisms.¹⁷²

Chloride limitations are included in many permits issued pursuant to the CWA, and for Wisconsin dischargers that are unable to meet these requirements, chloride variances may be granted which mandate source reduction measures.¹⁷³ In Wisconsin, chloride variances are authorized in Wis. Stat. § 283.15. Chapter NR 106 of the *Wisconsin Administrative Code* sets forth the process for setting effluent limits, which states that chloride source reduction activities are often preferable to end-of-pipe treatment.¹⁷⁴

When chloride discharge levels are too high, the WDNR may issue variances to single facilities in lieu of enforcement. The variance is customizable and includes a site-specific plan and goals to reduce pollution.¹⁷⁵ Most of the approved chloride variances are to dischargers in the southern and eastern parts of Wisconsin, where limestone and dolomite aquifers often produce hard water.¹⁷⁶

Another option under the CWA is the preparation of a Total Maximum Daily Load (TMDL) for chloride discharges to a particular receiving water. Under the CWA, states must develop and adopt criteria that are sufficient to protect the designated uses of waters within their borders.¹⁷⁷ The criteria may include narrative

¹⁶⁶ Minnesota H.F. 820 (2023); Minnesota S.F. 755 (2023).

¹⁶⁷ Maryland Reduces Use of Road Salts to Protect the Environment and Public Health (Jan. 18, 2019), available at news. maryland.gov/mde/2019/01/18/maryland-reduces-use-of-road-salts-to-protect-the-environment-and-public-health/ (last visited Sept. 8, 2023).

¹⁶⁸ Managing Chloride in Maryland's Waters, presentation by Gregorio Sandi, Maryland Dep't of the Environment (Nov. 20, 2020), available at www.mwcog.org/file.aspx?&A=zrYK4q6SEpfk%2B57y0L8rDLD%2B3l0lkD%2B9kYR0AOSohSk%3D (last visited Sept. 8, 2023).

¹⁶⁹ CWA, 33 U.S.C. §§ 1311(a), 1342(a)(1).)

¹⁷⁰ See Development and Implementation of Water Quality Standards Variances, Wisconsin Department of Natural Resources, 3400-2022-02, 1st ed. (July 19, 2022) [hereinafter WDNR, Development and Implementation of WQS Variances].

¹⁷¹ *Id.* Chronic toxicity is "the ability of a substance to cause an adverse effect in an organism that results from exposure to the substance for a time period representing that substantial portion of natural life expectancy of that organism." *Id.* Acute toxicity is "the ability of a substance to cause mortality or an adverse effect in an organism *that* results from a single or short-term exposure to the substance." Wis. Admin. Code § NR 105.03.

¹⁷² See, e.g., W.D. Hintz, et al. "Current Water Quality Guidelines Across North America and Europe Do Not Protect Lakes from Salinization," Proceedings of the National Academy of Sciences, 119:e2115033119 (2022).

¹⁷³ The permittee must demonstrate that attaining the water quality standard is not feasible. The variance may be approved based on one or more of factors listed in Wis. Stat. § 283.15(4). WDNR, *Development and Implementation of WQS Variances, supra*.

¹⁷⁴ Wis. Admin. Code NR 106.83(2)(a)(3).

¹⁷⁵ WDNR, Development and Implementation of WQS Variances.

¹⁷⁶ Id.

¹⁷⁷ See 40 CFR 131.11(a)(1).

¹⁶⁵ Wisconsin 2023 S.B. 52.

statements and specific numerical values.¹⁷⁸ Those waters that do not meet the standards are classified as "impaired" and are reported to EPA pursuant to Section 303(d) of the Act.¹⁷⁹ The next step is for the state to develop a TMDL designed to meet the water quality criteria, considering pollutant inputs from both point and nonpoint sources.¹⁸⁰ Pollutant budgets are assigned to each discharger to the water.¹⁸¹ Pollutant reductions required to meet these budgets are added as a condition in discharge permits.¹⁸² EPA must approve the final TMDL pollutant allocation.¹⁸³

Best Management Practices for Water Softening Systems and Wastewater Treatment Facilities. At least some of the chloride entering wastewater treatment facilities comes from the use of residential water softeners.¹⁸⁴ Unlike other chloride source pathways that depend on action by governmental or corporate entities, the use of softeners is almost entirely discretionary on the part of private citizens. To develop a strategy to reduce chloride from residential water softeners, it is important to evaluate softeners on a case-by-case basis on a variety of metrics including regeneration frequency (time-initiated or demand-initiated), the age of the softener, and when the softener was last calibrated.¹⁸⁵

Several policy options are available to reduce chloride inputs from water softening. For example, state plumbing codes could require higher-efficiency or on-demand softeners when a water softening system is replaced or installed. Likewise, at the residential level, a municipality could evaluate the potential for a rebate program to install high-efficiency softeners or residents could be encouraged to purchase higher efficiency or on-demand softeners at the time of sale.¹⁸⁶ At municipal water facilities, operators could evaluate blending of softened water with unsoftened water to reduce the amount of water softening required.¹⁸⁷ At commercial facilities with water softeners, operators could evaluate the potential for local brine reuse as a deicer instead of discharging to the wastewater treatment plant.¹⁸⁸

Finally, industrial dischargers to wastewater treatment facilities should "train plant personnel to be more aware of salt conservation, emphasizing simple, cost-effective housekeeping measures."¹⁸⁹ "For example, spilled salt can be cleaned up as a solid waste [or reused] rather than flushed down the floor drain."¹⁹⁰

Winter Road Maintenance Level of Service. Recommended deicer application rates vary from state to state, with little guidance from the United States Department of Transportation. This section will focus on the deicing responsibilities for Wisconsin roadways.

The transportation level of service considerations could be addressed in a salt management plan (SMP) providing guidelines for proper training of service providers, development and implementation of winter road condition models, route optimization, road weather information systems, and use of pre-wetting

¹⁸⁰ Id.

¹⁸¹ Id.

¹⁸² *Id.* The WDNR can either add the conditions upon permit reissuance or can reopen existing permits and add the condition. Typically, WDNR has added or updated permit conditions upon reissuance.

¹⁸³ Id.

¹⁸⁴ See Chapter I, Section 1.2.

¹⁸⁵ WDNR, Development and Implementation of WQS Variances

¹⁸⁶ Minnesota Statewide Chloride Management Plan, Minn. Pollution Control Agency, wq-s1-94. [hereinafter MPA, Minn. Statewide Management Plan].

¹⁸⁷ Id.

¹⁸⁸ Id.

¹⁸⁹ Wis. Admin. Code NR 106.90(2)(c).

¹⁹⁰ Id.

¹⁷⁸ 40 CFR 131.11(b).

¹⁷⁹ See Overview of Total Maximum Daily Loads (TMDLs), U.S. Env't. Prot. Agency, www.epa.gov/tmdl/overview-total-maximum-daily-loads-tmdls (last visited Aug. 25, 2023).

treatment.¹⁹¹ The SMP is generally agency-based and aims to achieve "safety, environmental protection, continual improvement, fiscal responsibility, accountability, measurable progress, communication, and a knowledgeable and skilled workforce."¹⁹² Overall, the management plan is most effective when it is periodically updated and revised.¹⁹³

A main area to focus on in the SMP is route optimization, where treatment may vary by roadway type, such as residential roadways receiving less treatment than highways. Another option is targeted use, with deicing applications made on high traffic or difficult to navigate areas such as at intersections or on hills. The agency responsible for deicing varies by county and roadway. This can make it difficult to implement best management practices consistently. In some areas, municipal roads are governed by the Department of Public Works;¹⁹⁴ in other places, the highway departments are responsible for winter road maintenance.¹⁹⁵ This may lead to different practices. The WisDOT is technically responsible for ice control on state and federal highways and the Interstate system, but it delegates that duty to the counties. In addition, responsible agencies may use different winter road maintenance equipment and deicers, provide different types and levels of staff training, and apply different levels of service to similar types of roads.

Wisconsin's county highway departments have the authority to determine the appropriate response for winter weather events for county highways in compliance with certain guidelines.¹⁹⁶ Some examples of management practices beyond route optimization that could be effective in treating winter roads while using less chloride include using a liquid brine solution instead of solid salt.¹⁹⁷ The application of the blended liquid brine products should be tailored to the specific air and road conditions present at the time of application.¹⁹⁸

Applicators, counties, and municipalities have the option of creating their own brine blend or purchasing pre-blended brine.¹⁹⁹ By creating their own brine, an agency has control of what goes into the blend and may reduce the costs of producing the blend by using locally sourced byproducts.²⁰⁰ However, a preblended brine can reduce an agency's liability and reduce the amount of time for staff to mix brine.²⁰¹ Using pre-blended brine could also reduce the storage capacity an agency needs for winter maintenance materials.²⁰² Brine applied before the storm event has proven to be effective in reducing salt use by fifty percent, along with corresponding cost savings.²⁰³

Other effective roadway management practices include reducing speeds of the truck during application and proper transportation of salt before use.²⁰⁴ First, the truck should apply salt at the speed of no more

¹⁹² Id.

¹⁹³ Id.

¹⁹⁴ Street Maintenance, City of Racine, www.cityofracine.org/Street-Maintenance/; www.waukeshacounty.gov/DPW/ dpw-divisions/ (last visited Aug. 25, 2023); *About Snow and Ice Control Operations*, City of Milwaukee, city.milwaukee. gov/dpw/operations/snowoperationstatus/About (last visited Aug. 25, 2023).

¹⁹⁵ *Highway Division*, Walworth County WI, www.co.walworth.wi.us/331/Highway-Division (last visited Aug. 25, 2023); *Highway Department*, Washington County Wis., www.washcowisco.gov/departments/highway_department (last visited Aug. 25, 2023).

¹⁹⁶ See Winter Maintenance, Wis. Dep't Transp., wisconsindot.gov/Pages/doing-bus/local-gov/hwy-mnt/wintermaintenance/default.aspx (last visited Aug. 25, 2023).

¹⁹⁷ Laura Fay & Karalyn Clouser, *Alternative Methods for Deicing*, Clear Roads, CR 18-05 (May 2020).

¹⁹⁸ See Id. Table 2 sets forth the differences in temperature and weather conditions along with how salt, either liquid or solid, should be applied to roads.

¹⁹⁹ Fay & Clouser, Alternative Methods for Deicing, supra.

²⁰⁰ Id.

²⁰¹ Id.

- ²⁰² Id.
- ²⁰³ Id.
- ²⁰⁴ Id.

¹⁹¹ See Syntheses of Best Practices – Road Salt Management, Transportation Association of Canada (April 2013).

than thirty-five miles per hour, with the ideal speed being twenty-five miles per hour.²⁰⁵ By applying salt at a lower speed, salt is less likely to bounce and scatter into unintended areas.²⁰⁶ Second, salt should be properly stored and transported to reduce waste and improper placement. The *Wisconsin Administrative Code* sets out the storage requirements for highway salt. The Code requires salt storage facilities to be constructed in a manner which prevents any runoff into waters of the state.²⁰⁷ The resulting requirements include provision of a roof that sufficiently prevents contact between road salt and precipitation and wind that could potentially transport salt into surface or groundwaters.²⁰⁸

WisDOT could encourage Wisconsin counties to optimize salting practices for their winter road maintenance. For example, Carver County, Minnesota²⁰⁹ reduced its salt use by 800 tons per year by implementing smart salting.²¹⁰ The county calibrated all of its equipment, began using prewetted salt, and purchased a 5,000 gallon tank to gear up for liquids.²¹¹ The following year, the Carver County Board adopted a Snow and Ice Policy which continued the smart salting practices while also prioritizing education for drivers on proper salting practices. Carver County also began buying trucks equipped with side tanks, eliminated more of its manual controllers, and reviewed salt application amounts for each route.²¹² A year later, it purchased a brine salting tank system and truck that was capable of using salt brine.²¹³ Carver County also cut down the use of rock salt and transitioned to treated salt, which has better melting capabilities at colder temperatures and adhesion to roads.²¹⁴ Through these advancements, educational efforts, and focusing salt placement on hills, curves, and intersections, Carver County significantly decreased its salt use.²¹⁵

Funding to Convert Trucks from Salting to Brining. Using liquid brining for anti-icing and deicing can save money, reduce salt use, and be more efficient for winter road maintenance.²¹⁶ While \$1,000 worth of rock salt used in granular form can clear 86 lane miles, a brine made from the same amount of salt can clear 224 lane miles.²¹⁷ An example of savings by use of salt brine comes from Jefferson County, Wisconsin. Jefferson County cut its salt use by 30-40% or nearly 4,500 tons when switching to exclusively liquid brine for its winter maintenance.²¹⁸ This in turn saved taxpayers \$500,000 in the winter of 2019-2020.²¹⁹ Similarly, cities in Minnesota started using salt brine and other best management practices to reduce their salt use, leading to cost savings. For example, the City of Waconia, Minnesota switched from a 1:1 sand:salt use to salt

²⁰⁷ Wis. Admin. Code Trans 277.04(3)(a)(2).

²⁰⁸ Wis. Admin. Code Trans 227.04(3)(b).

²⁰⁹ MPA, Minn. Statewide Management Plan, supra.

²¹⁰ *Id*.

²¹¹ Id.

²¹² Id.

²¹³ Id.

²¹⁴ Id.

²¹⁵ Id.

²¹⁶ The calculation used to understand the cost and benefit is B/C= ((Benefit (\$/In-mi/storm)) x (Salt Brine Routes (In-mi) x (Storms over 10 years))/ (Cost (\$ over 10 years)). Boris Claros, et al., *Evaluation of Winter Maintenance with Salt Brine Applications in Wisconsin*, Dep't Civ. & Env't Eng'g Traffic Operations & Safety Lab'y Univ. Wis. Madison, WIS DOT ID no. 0092-20-53 (Dec. 2021).

²¹⁷ Wisconsin Department of Transportation, Wis. SaltWise, Success Stories, www.wisaltwise.com/Success-Stories (last visited Aug. 25, 2023).

²¹⁸ Want to Reduce Road Salt Impacts on Ecosystems and Infrastructure? Just Add Water., Univ. Wis. Madison, Water Blogged (Feb. 7, 2019) [hereinafter UWisMad, Reduce Road Salt Impacts]. See The Cost of Salt Has More than Doubled Since 2006, Wis. SaltWise, wisaltwise.com/lt%27s-Getting-Pricey.

²¹⁹ The Cost of Salt Has More than Doubled Since 2006, supra. According to Jefferson County's highway commissioner, Bill Kern, the county by 20222 has had a total savings of \$1.6 million since it switched to exclusively using a brine solution in 2018. Jenny Gross, *Road Salt Works. But It's Also Bad for the Environment*, N.Y. Times (Jan. 7, 2022).

²⁰⁵ See id.; see also Winter Facts, Wis. Dep't Transp., https://wisconsindot.gov/Pages/doing-bus/local-gov/hwy-mnt/ winter-maintenance/facts.aspx. (last visited Aug. 25, 2023).

²⁰⁶ Fay & Clouser, Alternative Methods for Deicing, Clear Roads, CR 18-05 (May 2020). supra.

and liquid anti-icing practices, changed its equipment, and considered air and pavement temperatures.²²⁰ Waconia has reduced its salt use by 70% since it implemented its plan in 2010, and as of 2022, the yearly savings on winter road maintenance is \$8,600.²²¹

The use of a liquid brine solution not only reduces salt use, but it also allows for even distribution of the solution on the pavement surface and reduces the wait time for the salt to start working.²²² Rock salt often takes a while to work as salt in its solid form has very little impact on melting ice or preventing the road from freezing.²²³ Once the rock salt mixes in with moisture on the road, creating a brine solution, melting occurs.²²⁴ The time for rock salt to begin working may be up to two hours.²²⁵ In contrast, solid salt mixed beforehand with water to create a liquid brining solution will decrease the time necessary for the melting properties to start working.²²⁶

While converting trucks from salting to brining can provide a significant financial benefit to a county or municipality, it requires an initial capital investment. Federal grants provide opportunities to fund conversion costs.²²⁷ Additionally, counties may save money by making a conscious effort to track air and pavement temperatures and responding as needed.

Placement of Snow. Proper winter maintenance includes designating areas for snow placement and installing snow fences.²²⁸ Snow piles should not be placed near receiving waters or on permeable soils.²²⁹ Rather, snow should be placed on slopes less than six percent²³⁰ and where meltwater discharges into less vulnerable receiving waters.²³¹ Snow fences are relatively inexpensive for keeping snow off of roads, and municipalities could launch programs that provide incentives to farmers and landowners to install snow fences.²³²

Communities Buying Back Salt. Municipalities could buy back salt from private applicators and residents to prevent overapplication at the end of the winter or improper salt storage. Similarly, municipalities could trade unused bags of residential salt at the end of the winter season with materials commonly used in spring maintenance.²³³ This trade could be for mulch, plants or trees, or a bag of compost.²³⁴

²²¹ Success Stories: Salt Reduction and Cost Savings Examples, Minn. Pollution Control Agency (last visited Nov. 23, 2022). https://stormwater.pca.state.mn.us/index.php?title=Success_stories:_salt_reduction_and_cost_saving_examples.

²²² U Wis. Mad, *Reduce Road Salt Impact, supra*.

²²³ Id.

²²⁴ Id.

²²⁵ Id.

²²⁶ Id.

²²⁷ Safe Streets and Roads for All (SS4) Grant Program, U.S. Dep't Transp., www.transportation.gov/grants/ SS4A#:~:text=The%20Bipartisan%20Infrastructure%20Law%20(BIL,roadway%20deaths%20and%20serious%20injuries. This grant focuses on projects that reduce traffic fatalities (last visited Aug. 25, 2023).

²²⁸ Snow fences are a non-chemical solution to snow maintenance where fencing is strategically placed to protect roadways and sidewalks from blowing and drifting snow. MPA, *Minn. Statewide Management Plan, supra.* Snow fences can be structural, which are built from plastic or wood, or living, which comes from planting trees, shrubs, and native grasses nearby each other. Laura Fay, et al., *Strategies to Mitigate the Impacts of Chloride Roadway Deicers on the Natural Environment*, Nat'l Coop. Highway Rsch. Program, Synthesis 449 (2013) [hereinafter Fay, *Strategies to Mitigate Impacts of Chloride*].

²²⁹ MPA, Minn. Statewide Management Plan, supra.

²³⁰ Slopes of less than 2% are preferred. *Guidance and Recommendations for Storing Transported Snow and For On-Site Snow Storage*, Minn. Stormwater Manual, stormwater.pca.state.mn.us/index.php?title=Guidance_and_recommendations_for_storing_transported_snow_and_for_on-site_snow_storage (last visited Aug. 23, 2023).

²³¹ Id.

²³² See MPA, *Minn. Statewide Management Plan, supra.* The cost for a snow fence is around \$1.39 per square feet of fence. Fay, *Strategies to Mitigate Impacts of Chloride, supra.*

²³³ Id.

²³⁴ Id.

²²⁰ MPA, Minn. Statewide Management Plan, supra.

City Ordinance. Many cities have ordinances that address proper winter maintenance. These ordinances usually require residents to properly remove snow and ice from sidewalks following a winter event.²³⁵ However, the City of Madison, Wisconsin implemented additional requirements for residential winter maintenance. The current ordinance for snow and ice removal also requires salt and other chemical melting agents to be used "only to the extent necessary to treat the ice so that the ice can be removed."²³⁶ The ordinance further requires excessive salt and chemical melting agents to be removed from the sidewalk following ice or snow melt, and the salt "shall not unreasonably accumulate on the sidewalk following ice melt or snow removal."²³⁷ Failure to follow the ordinance by a private homeowner may result in a fine.²³⁸

3.3 INFORMATIONAL STRATEGIES

Environmental law and policy figures have long advocated the value of transparency and increased public consciousness of the environmental consequences of various policy and individual decisions. Some environmental laws, such as the National Environmental Policy Act (NEPA), are almost entirely non-substantive, yet have been highly influential as information-forcing tools. These strategies are no less applicable in the context of chloride policy development. They may be targeted to the public at large, or to chloride users in particular, to encourage the optimal usage of chlorides for a variety of purposes.

Broad-based communications intended for the public at large tend to emphasize actual data showing the widespread overuse of chlorides (especially in the context of road salt and water softeners), and also illustrate strategies that empower ordinary citizens to take actions to reduce that usage. For example, "Wisconsin Salt Wise" is a general online outreach effort created in 2015 pursuant to a partnership between Dane County; the City of Madison; the Madison Metropolitan Sewerage District; the City of Madison Water Utility; Public Health Madison Dane County; the University of Wisconsin-Madison Environment, Health, and Safety Department; and the Madison Area Municipal Storm Water Partnership.²³⁹ The program has recently expanded to include the whole state. Its partners outside of Dane County include the WDNR, the City of Milwaukee, Waukesha County, Superior Fox-Wolf Watershed Alliance, and Root-Pike Watershed Initiative Network.²⁴⁰

The Salt Wise program interactively educates the public about the overuse of deicing salt. The Salt Wise website features statistics that put the quantity of road salt used in perspective: it notes, for example, that it only takes one teaspoon of road salt to pollute five gallons of water.²⁴¹ The website also provides objective information about salt usage: in 2015, Wisconsin used almost 670,000 tons of salt on its highways alone.²⁴² To make this statistic more relatable, the site illustrates other things that weigh 670,000 tons; for example: 53,500 school buses or 121,800 elephants.²⁴³

Salt Wise also educates viewers on how to optimize their personal salt use. The website is broken down into several distinct categories, dependent on a person's role in the community. The categories are: homeowners, municipal, motorists, emergency medical services (EMS), and salt applicators.²⁴⁴ In each section, the Salt Wise website gives guidance, advice, and illustrations relevant to each intended audience.

²³⁶ Madison Gen. Ordinance 10.28(1).

²³⁷ Id.

²³⁸ *Id.* The first offense can cost a total of \$124 and the second offense can cost a total of \$187. This total includes both the fines and court costs. *City Updates Salt Use Ordinance for Public Sidewalks, Lots*, City of Madison (Dec. 15, 2022) https://www.cityofmadison.com/news/2022-12-15/city-updates-salt-use-ordinance-for-public-sidewalks-lots.

²³⁹ Municipal Salt Resources, Wis. Salt Wise Partnership. *Municipal Salt Resources*, Wis. SaltWise Partnership, perma. cc/2CRM-F6D9.

²⁴⁰ See The WI Salt Wise Partnership, Wisconsin SaltWise, www.wisaltwise.com/About-Us (last visited Aug. 9, 2023).

²⁴¹ See Be Salt Wise, Wis. Salt Wise Partnership, https://perma.cc/WQM3-YM52.

²⁴² Id.

²⁴³ Id.

²⁴⁴ Id.

²³⁵ See Milwaukee City Ordinance 116-8; Waukesha City Ordinance 6.12; Walworth Cnty. Snow Removal Ordinance No. 05132014-2.

The website also offers printable handouts so that the public can share the information with others. The Wisconsin Salt Wise Partnership also offers workshops on effective winter maintenance of parking lots, driveways, sidewalks, and trails.

Another set of informational strategies includes more detailed communications that are targeted at salt users themselves. Many of these are government and municipal users. There are nearly 100,000 miles of local roads in Wisconsin, and every year over one billion dollars is spent to maintain them.²⁴⁵ In 1983, the Wisconsin Transportation Information Center (TIC) was created to help local highway officials manage this large road system and road budget.²⁴⁶ The Federal Highway Administration, WisDOT, and University of Wisconsin-Extension provide the funding, education, and technical assistance necessary for the TIC to operate.²⁴⁷ The TIC provides training to help Wisconsin local officials effectively maintain roads and improve street and highway safety. While the Wisconsin Salt Wise website is effective as a public tool for education regarding salt use, the TIC offers a more technical informational tool.

Minnesota offers Smart Salting training to help improve operator effectiveness and chloride reduction while keeping roads safe.²⁴⁸ The program offers individual training, organizational training, and property management training depending on the scenario. This program reports that participating organizations were able to reduce their salt use between 30%-70% while also preventing chloride contamination in bodies of water.²⁴⁹ Minnesota Pollution Control Agency (MPCA) tracked this program's effectiveness in Dakota County through two winters. MPCA found that in the first winter after the training, Dakota County applied 14,175 tons of salt for 35 snow events, an average of 405 tons per event. During the following winter, Dakota County applied less salt: 9,585 tons for 27 events, an average of 355 tons per event.²⁵⁰ Minnesota also keeps track of salt reduction in its Stormwater Manual.²⁵¹

3.4 CHLORIDE ALTERNATIVES

As discussed in Chapter 2, most non-chloride-based deicers also have negative environmental impacts. Thus, this section will focus on green infrastructure options that may reduce the need to use deicers.

Green infrastructure. Green infrastructure is a diverse group of strategies that manages stormwater at its source, while delivering environmental, social, and economic benefits.²⁵² Stormwater runoff occurs when rain or snowmelt flows over hard surfaces such as roads, driveways, and parking lots, instead of soaking into the ground. In addition to road salt, stormwater runoff collects oil and other pollutants such as heavy metals, nutrients, sediment, and pathogens as it flows to the storm sewer system and is discharged to local waterways.²⁵³ Green infrastructure practices are intended to force precipitation to slowly percolate back into the ground, or capture it for later reuse, rather than quickly transporting it to surface waters as traditional stormwater infrastructure does.²⁵⁴ To do so, green infrastructure can include vegetation, soils, and other

²⁴⁶ Id.

²⁴⁷ About TIC, Univ. Wis. Madison Transp. Info. Ctr., https://perma.cc/9AW4-GMLH.

²⁴⁸ Smart Salting Training, Minn. Pollution Control Agency, https://www.pca.state.mn.us/business-with-us/smart-saltingtraining (last visited Aug. 25, 2023).

²⁴⁹ Id.

²⁵⁰ Id.

²⁵¹ Success Stories: Salt Reduction and Cost Saving Examples, Minn. Stormwater Manual, stormwater.pca.state.mn.us/index. php?title=Success_stories:_salt_reduction_and_cost_saving_examples (last visited Aug. 23, 2023).

²⁵² See Roopika Subramanian, *Rained Out: Problems and Solutions for Managing Urban Stormwater Runoff*, 43 Ecology L.Q. 421, 432 (2016) (describing how green infrastructure solves "[s]ome of the central problems related to urban stormwater runoff, such as flooding, increased flow, and velocity of flow"); *What is Green Infrastructure*?, U.S. Env't Prot. Agency, perma.cc/M868-ZCBV.

²⁵³ See Subramanian, *supra*, at 424; *What is Green Infrastructure*?, *supra*.

²⁵⁴ Green Infrastructure: A Strategy for Restoring the Great Lakes and Great Communities, Sierra Club, perma.cc/4H2L-VWA7.

²⁴⁵ Workshops & Training, Univ. Wis. Madison Transp. Info. Ctr., perma.cc/7HUE-JGEM.

elements and practices that mimic and restore natural processes in urban environments.²⁵⁵ Some of these practices may be effective in reducing chloride use and transport to waterways.²⁵⁶

Chloride-specific aspects of green infrastructure use. Green infrastructure practices will only be successful at reducing chloride applications to the extent that they can direct water away from impervious surfaces, thus preventing pooling and freezing. Once salt is applied, it is difficult to prevent its movement to waterways; green infrastructure is valuable because it reduces the application requirement in the first place.

Permeable pavement is typically used as a stormwater control mechanism that is intended to allow stormwater to quickly infiltrate below the pavement surface without pooling or freezing.²⁵⁷ As a result of this rapid surface drainage, permeable pavement has been expected to require less application of deicing substances.²⁵⁸ A study done at the University of New Hampshire reported that once a porous asphalt lot was installed, it required 75% less deicing material compared to traditional asphalt lots.²⁵⁹ The study also reported that porous asphalt often did not require any deicing material application because it provided better traction compared to traditional pavement.²⁶⁰ However, several communities in the Region have reported that permeable pavements installed in their jurisdictions required chloride-based deicing efforts similar to non-permeable pavements. One community reported that permeable pavements limit ice formation on the pavement, thus reducing the need for intermittent salt use. In light of these differing experiences, it is not possible to endorse any definitive statements about the effectiveness of permeable pavements in reducing chloride use and transport to waterways in the Region.

Other community-based efforts. Other community-based green infrastructure practices may also yield reductions in chloride transport to waterways. They can be implemented at the neighborhood scale and include rain barrels, rain gardens, green roofs, and downspout disconnections.²⁶¹ Rain barrels are containers that capture water from a roof so that it can be used later on lawns, gardens, and indoor plants.²⁶² Rain gardens "are shallow, vegetated basins that collect and absorb runoff from rooftops, sidewalks, and streets."²⁶³ Green roofs are a layer of plant material on a flat roof that absorbs water and are especially effective in urban areas where space restraints limit the use of other practices.²⁶⁴ Lastly, downspout disconnections involve rerouting rooftop drainage from discharging directly to the storm sewer system to rain barrels or permeable areas.²⁶⁵ All of these green infrastructure practices are simple to install at the residential or neighborhood level.

²⁵⁸*Id. at 5.*; See generally Robert M. Roseen et al., Assessment of Winter Maintenance of Porous Asphalt and Its Function for Chloride Source Control, J. TRANSP. ENGINEERING, 2013, 04013007 (examining the performance of porous asphalt in freezing conditions for reduction of road salt application).

²⁵⁹ Id.

²⁶⁰ Id. at 5.

²⁶¹ What is Green Infrastructure, supra.

²⁶⁴ Id.

²⁶⁵ Id.

²⁵⁵ What is Green Infrastructure, supra.

²⁵⁶ David Strifling, *Reducing Chloride Discharges to Surface Water and Groundwater: A Menu of Options for Policymakers*, 48 Envtl. L. 167, 203 (2018).

²⁵⁷ Permeable Pavements, Stormwater Best Mgmt. Prac., U.S. Env't Prot. Agency 1, 1, www.epa.gov/system/files/ documents/2021-11/bmp-permeable-pavements.pdf (last visited Aug. 23, 2023).

²⁶² Soak Up the Rain: Rain Barrels, U.S. Env't Prot. Agency, https://perma.cc/RKN2-G692.

²⁶³ What is Green Infrastructure, supra.

3.5 WATER QUALITY TRADING

Water quality trading is a market-based approach to reduce pollutant transport to receiving waters. Trading programs generally allow regulated dischargers to meet permitting requirements or water quality standards by purchasing credits from another discharger of the same pollutant in the same watershed. Typically, trades occur between a point source facing high compliance costs and a nonpoint source subject to no permit requirements.²⁶⁶

The EPA has long supported water quality trading as a way to help meet permit requirements under the Clean Water Act, but it had largely allowed states to take the lead in implementing such programs. As a result, each state program operates differently, and some states have no trading program at all. However, in July 2023, the EPA announced that trading programs have not been adopted "to their fullest potential," and so it plans to propose a new federal rule that would clarify the requirements for state programs.

The Wisconsin Legislature has authorized water quality trading in Wisconsin,²⁶⁷ and the WDNR has published extensive guidance establishing the rules for water quality trading in Wisconsin.²⁶⁸ The option to trade is available to municipal and industrial WPDES permit holders to demonstrate compliance with water quality based effluent limits (but not technology based effluent limits) in permits. Trading can be used whether or not a TMDL has been established for the receiving water for the traded pollutant; where a TMDL exists, it essentially creates a cap-and-trade system.

Under the Wisconsin program, trades must result in improved water quality.²⁶⁹ This is achieved by requiring a higher pollutant load reduction at the discharger's point of compliance than would be achieved without trading. In practical terms, this involves the use of trade ratios in which more than one pound of pollutant reduction must be achieved by the credit provider to offset a pound of the pollutant discharged by the permit holder.

It is not yet clear whether any revisions to the Wisconsin program will be necessary as a result of the forthcoming federal rule.

Wisconsin's trading program has largely been used to facilitate trades related to phosphorus pollution. Phosphorus trades have largely been between wastewater treatment plants as point sources (as the credit buyer) and agricultural sources (as the credit seller). Trades involving chloride would likely involve different trading partners (most likely wastewater treatment plants and MS4 permittees) and perhaps lower transaction costs.

As required by 2019 Wisconsin Act 151, the Wisconsin Department of Administration has contracted with a third party to operate a single clearinghouse for trading of water quality credits. Activities conducted by this clearinghouse include producing credits by entering into contracts with third parties to undertake water pollution reduction activities, maintaining a bank of credits, selling credits, verifying credit amounts with the WDNR, establishing a centralized registry of all credits generated, and verifying that all such credits have been incorporated into discharge permits.²⁷⁰

²⁶⁷ Wis. Stat. §283.84.

²⁶⁹ Wis. Stat. § 283.84.

²⁷⁰ This clearinghouse can be accessed at wiclearinghouse.org.

²⁶⁶ In Wisconsin, however, trades can occur between a point source and a nonpoint source, or between two point sources.

²⁶⁸ Wis. Dep't Nat. Res., *Guidelines for Implementing Water Quality Trading in WPDES Permits*, Guidance No. 3800-2020-0010, (2nd edition) (June 1, 2020).

3.6 INTEGRATED WATERSHED MANAGEMENT

Recent studies have advocated management of water resources using an integrated approach at the watershed level, necessarily crossing traditional geopolitical and agency boundaries.²⁷¹ Generally, this "integrated watershed management" or "one water" methodology aims to coordinate development and management of water and related resources so as to maximize economic and social welfare without compromising environmental sustainability.²⁷² Although its precise scope and content remains unclear, implementation of the approach requires innovative and cooperative governance mechanisms. It may play a role in the implementation of innovative technologies and policies such as green infrastructure or water quality trading. Effective intergovernmental cooperation in these areas could lead to both environmental and technological advances, including improvements related to chloride management.

Integrated water resources management approaches have been known by many names, and differ in scope and content along a spectrum of potential structures including information sharing, informal planning, and even shared management.²⁷³ It may also include informal or non-traditional watershed groups (as often form in connection with the agricultural sector).²⁷⁴ Proponents may create groups to facilitate watershed-based decision making, such as watershed planning councils or interagency working groups. In any format, however, the approach is intended to address the interlinked nature of water resources—surface water and groundwater, point and nonpoint sources, storm water and wastewater management, water quality and water quantity, all may be considered under the integrated approach.²⁷⁵

In concept, multiple agencies or agencies from multiple jurisdictions (local, state, and federal) work together within a utility footprint—at city scale, in a watershed, or even regionally—to address a broad range of water-related issues of which chloride pollution could be one.

An integrated approach often has several advantages. It is flexible and allows for adaptive management as a core principle of its use. It can be a broad, inclusive process that involves diverse stakeholders and can complement or supplement traditional regulatory approaches. In some forms, it can provide incentives for regulated entities to meet environmental goals as an alternative to enforcement strategies.

Yet the integrated approach also faces certain difficulties. The most direct involve lack of funding and administrative inertia or reluctance to cooperate. Partly for these reasons, the concept's precise application or structure in a particular context is often poorly defined. When efforts bog down, partial integration can lead to increased fragmentation through the creation of additional entities without full control but holding some stake in regulatory outcomes.

The integrated approach may bear on several aspects of chloride reduction efforts, including the general control of nonpoint source pollution and the implementation of green infrastructure approaches. Chloride control efforts need to evaluate, understand, and optimize discharges from a wide range of sources; as discussed above, chloride emanates from both nonpoint and point sources, and from many different industries. In these contexts, while it may be difficult to suggest an aggressive integrated management approach to deal only with the chloride issue, chloride should be part of the portfolio to be addressed where integrated management is pursued. At a minimum, informational sharing strategies should be pursued between agencies.

²⁷² This definition is closely modeled on that adopted by the Global Water Partnership. See Jan Hassing, et al., U.N. Educ., Sci. & Cultural Org., Integrated Water Resources Management (IWRM) In Action 3 (2009), perma.cc/SQ4M-TDQD.

²⁷³ See, e.g., Neil S. Grigg, Integrated Water Resources Management, Water Encyclopedia, perma.cc/7VSK-PV7N (noting "functional integration" and "conjunctive use").

²⁷⁴ *Id.*; Effective Util. Mgmt. Steering Grp., *Taking the Next Step: Findings of the Effective Utility Management Review Steering Group* 11, 15, perma.cc/T7M7- YCPS.

²⁷¹See, e.g., Keith S. Porter, *Good Alliances Make Good Neighbors: The Case for Tribal-State-Federal Watershed Partnerships*, 16 Cornell J.L. & Pub. Pol'y 495, 502, 504–05 (2007); A. Dan Tarlock, *Putting Rivers Back in the Landscape: The Revival of Watershed Management in the United States*, 14 Hastings W.-NW J. Env't L. & Pol'y 1059, 1061 (2008) (referring to "ideal of integrated watershed management" and explaining the importance of the watershed as a planning and regulatory tool).

The Chicago Area Waterway System (CAWS) Chloride Initiative (CAWS Initiative) is one of the few integrated management efforts to have addressed chloride pollution.²⁷⁶ In July 2015, the Illinois Pollution Control Board set a water quality standard of 500 mg/L chloride in most CAWS waterways, effective July 2018.²⁷⁷ Led by the Metropolitan Water Reclamation District of Greater Chicago (MWRD), the CAWS Initiative participant organizations also include municipal, industrial, highway, wastewater treatment, and regulatory groups.²⁷⁸ Ultimately, the efforts are intended to further the goal of meeting the new standards by "assessing current water conditions, documenting current road deicing activities, developing a pollutant minimization plan, identifying opportunities to reduce road salt runoff while maintaining public safety, and then implementing the plan and documenting progress."²⁷⁹ The CAWS Initiative is ongoing, and the results will likely be used in preparing technical reports to be used for discharger variance petitions.²⁸⁰

3.7 ECONOMIC MEASURES AND ASSISTANCE

Bipartisan Infrastructure Law. On November 15, 2021, Congress passed the Infrastructure Investment and Jobs Act.²⁸¹ The Act aims to "rebuild America's roads, bridges, expand access to clean drinking watertackle the climate crisis, advance environmental justice, and invest in communities that have often been left behind."²⁸² The Act will invest \$55 billion to expand access to clean drinking water across the country and water infrastructure and \$110 billion in additional funding to repair roads, bridges, and other transformational projects.²⁸³ While the scope of these projects remains unclear, there is the possibility that some components could reduce chloride transport to waterways as part of larger transportation or wastewater projects.

For example, Wisconsin, among other states, may apply for the grant programs made available under the Bipartisan Infrastructure Law. The Safe Streets for All program allows states to compete for \$6 billion in funding toward 'vision zero' plans to improve road and traffic safety.²⁸⁴ This grant could potentially be used to purchase more efficient deicing trucks or trucks that have tanks for brining for winter road maintenance.

Wisconsin is expected to receive a total allotment of \$56,920,000 in 2023 for funding from the Bipartisan Infrastructure Law supplemental CWSRF allotment.²⁸⁵

Great Lakes Restoration Initiative. Another program that may provide funding for chloride management is the Great Lakes Restorative Initiative.²⁸⁶ The goal of this program "is to restore and maintain the chemical, physical, and biological integrity of the Great Lake Basin Ecosystem."²⁸⁷ The major focus areas of restoration include nonpoint source pollution impacts on nearshore health, habitats and species, and foundations for

²⁷⁶ More information on the Chicago Area Waterway System Chloride Initiative can be found at www.cawswatershed. org/chlorides.

²⁷⁷ See generally Salt Inst. v. III. Pollution Control Bd., No 1–15–2003, 2016 WL 5853625 (III. App. Ct. Sept. 30, 2016) (affirming the Illinois Pollution Control Board's 500 mg/L chloride standard).

²⁷⁸ Hold the Salt!, Friends Chi. River, https://perma.cc/4RTL-PN75.

²⁷⁹ See https://cawswatershed.org/about/ (last visited Dec. 31, 2023)

²⁸⁰ See *Salt Inst.*, 2016 WL 5853625, at *3–6 (discussing potential availability of variances from chloride water quality standard).

²⁸¹ Infrastructure Inv. & Jobs Act, Pub. L. No. 117-58 (Nov. 15, 2021).

²⁸² Fact Sheet: The Bipartisan Infrastructure Deal, The White House (Nov. 6, 2021), www.whitehouse.gov/briefing-room/ statements-releases/2021/11/06/fact-sheet-the-bipartisan-infrastructure-deal/ (last visited Aug. 23, 2023).

²⁸³ Id.

²⁸⁴ *The Bipartisan Law Will Deliver for Wisconsin*, U.S. Dep't Transp., www.transportation.gov/sites/dot.gov/files/2022-01/ BIL_Wisconsin.pdf (last visited Aug. 9, 2023).

²⁸⁵ Memo from Radhika Fox, U.S, Env't Prot. Agency (Feb. 24, 2023), www.epa.gov/system/files/documents/2023-02/ FY23%20CWSRF%20BIL%20Allotments%20Memo_February%202023.pdf.

²⁸⁶ The White House, A Guidebook to the Bipartisan Infrastructure Law., supra.

²⁸⁷ Id.

future restoration actions.²⁸⁸ Eligible uses are "addressing toxic substances and areas of concern, reduction of nonpoint source pollution . . . reduction of runoff contributing to [harmful algal blooms], ecosystem and wetland restoration, storm water treatment and control, . . . and more."²⁸⁹

CWA Funding. The Bipartisan Infrastructure Law also provides additional funds to the Clean Water State Revolving Funds (CWSRF) and Drinking Water State Revolving Funds (DWSRF).²⁹⁰ Both of these programs may provide funding for projects necessary to reduce chloride entering the environment.

CWSRF provides funds for a wide variety of water infrastructure projects.²⁹¹ Among these projects, there are funds available for public, private, or nonprofit entities that implement a state nonpoint source pollution management plan.²⁹² Under the CWSRF, financial assistance may be in the form of subsidized loans, additional subsidies to reduce existing loans, or a combination of assistance in order to keep project costs low.²⁹³ In Wisconsin, the WDNR helps with the application and provides other assistance related to the CWSRF.²⁹⁴

The Safe Drinking Water State Revolving Loan Fund. The DWSRF provides financial assistance to help water systems and states achieve the health protection objective of the Safe Drinking Water Act.²⁹⁵ Some of the program's objectives include improving drinking water treatment, fixing leaky or old pipes, improving source of water supply, replacing or constructing finished water storage tanks, and other infrastructure projects that are needed to protect public health.²⁹⁶ The EPA will provide a grant to the state, and the state then contributes an additional 20 percent to match the federal grants.²⁹⁷ The states are responsible for the operation of their DWSRF programs.²⁹⁸

Projects have been funded that have reduced chloride discharges. For example, the Redwood Falls Water System, located in Minnesota, constructed a new facility which uses reverse osmosis treatment for water softening.²⁹⁹ The facility was designed "to reduce the amount of salt needed for water softening in homes and to reduce the amount of chlorides discharged into the Minnesota River."³⁰⁰

WisDOT Funding. Although there are no specific grants or loans in Wisconsin for the reduction of chloride use, the WisDOT has funded high-capacity brine makers for the past five years.³⁰¹ The WisDOT pays for the brine maker and storage in the initial setup.³⁰²

²⁸⁸ Id.

²⁸⁹ Id.

²⁹⁰ See Id.

²⁹¹ Clean Water State Revolving Fund, U.S. Env't Prot. Agency, https://www.epa.gov/cwsrf (last visited Aug. 23, 2023).

²⁹² . Id.

²⁹³ Environmental Loans, Wis. Dep't Nat. Res., https://dnr.wisconsin.gov/aid/EIF.html (last visited Aug. 23, 2023).

²⁹⁴ Id.

²⁹⁵ How the Drinking Water State Revolving Fund Works, U.S. Env't Prot. Agency, https://www.epa.gov/dwsrf/how-drinking-water-state-revolving-fund-works (last visited Aug. 23, 2023).

²⁹⁶ Id.

²⁹⁷ Id.

²⁹⁸ Id.

²⁹⁹ Drinking Water State Revolving Fund Eligibility Handbook, EPA (2017), www.epa.gov/sites/default/files/2019-10/ documents/dwsrf_eligibility_handbook_june_13_2017_updated_508_version.pdf.

³⁰⁰ Id.

³⁰¹ Wis. Dep't Trans. Winter Maint. Eng'g Cody Churchill, to Laura Herrick, Email (Jan. 13, 2023).

³⁰² So far, the Wisconsin Department of Transportation has funded thirty-five brine makers, and more requests have come in. Wis. Dep't Trans. Winter Maint. Eng'g Cody Churchill, to Laura Herrick, Email (Jan. 13, 2023).

WisDOT has recently offered a winter readiness payment where counties that meet all requirements of its Highway Maintenance Manual get a payout per truck.³⁰³ The process for receiving funding so far has left it up to the counties to invest in equipping trucks with brining dispensing equipment and constructing buildings to store the trucks.³⁰⁴ Nevertheless, the counties are paid back for their investment by WisDOT based on equipment rates.³⁰⁵ The majority of the state funding for this conversion to brining goes to counties as they deice the state and interstate roads for WisDOT.³⁰⁶

Other programs. MPCA additionally administers several programs to help assist organizations looking to reduce salt use and chloride pollution.³⁰⁷ Some of these programs include grant and loan funding for communities that target reductions from businesses and industrial water softening systems.³⁰⁸ First, the Minnesota GreenCorps places AmeriCorps members around the state to assist in many environmental efforts, including salt reduction and chloride pollution mitigation.³⁰⁹ Second, the GreenStep Cities program is a free and voluntary challenge to help cities achieve sustainability and quality-of-life goals with salt reduction being one of the recommended best practices.³¹⁰ Third, there is the Small Business Environmental Assistance through which MPCA currently offers zero-interest loans to businesses to upgrade their equipment to help reduce salt use.³¹¹ Lastly, MPCA offers Clean Water Partnership zero-interest loans to local government and tribal communities to help implement practices that reduce non-point source pollution, which includes chloride.³¹² The Wisconsin Legislature and Wisconsin state agencies could consider authorizing similar programs in Wisconsin.

3.8 CONCLUSION

Without question, the foregoing policy options will not all be appropriate in every context. After evaluating community-specific considerations, policy makers may choose one or more to reduce the problem of chloride transport to surface waters and groundwater. This work is not intended to suggest the elimination of chloride use in its most visible forms (deicing and water softeners). Rather, it suggests that such use be optimized. Optimization carries "triple bottom line" benefits for the environment (in chloride reductions); for the economy (in cost savings on chloride expenditures and personnel hours); and for society (in improved public health).

³⁰³ <i>Id</i> .
³⁰⁴ Id.
³⁰⁵ Id.
³⁰⁶ Id.
³⁰⁷ Statewide Chloride Resources, Minnesota Pollution Control Agency, www.pca.state.mn.us/business-with-us/statewide- chloride-resources (last visited Aug. 9, 2023).
³⁰⁸ Id.
³⁰⁹ Id.
³¹⁰ Id.
³¹¹ <i>Id</i> .
³¹² <i>Id</i> .
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