Impact of Deicing Salt on Maine Streams

A DEP Issue Profile

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Salt levels in streams and rivers have been on the rise in the U.S. At least a third of U.S. streams and rivers have gotten saltier over 25 years (Vernimmen 2018)[1]. In Maine, deicing salt is a major pollutant to some streams, and of concern to others. This document is a summary of Maine Department of Environmental Protection findings about how salt use in developed areas has adversely impacted aquatic life of some streams in Maine, and provides some strategies to keep in mind to help address the issue. Preventing contamination of groundwater and other freshwater with chloride is of special concern as there are no practical techniques to remove salt from freshwater.

High chloride in streams and groundwater

When salt or salted sand (sand is often combined with salt) is added to parking lots and roadways during snow or ice storms, nearby streams are affected in several ways. During melt events, and during the salting, high levels of chloride are detected in the stream. The chloride readings often exceed acute criterion (860 mg/l) during these times. In areas where intensive salting has occurred over time, the groundwater can become contaminated. During the drier time of the summer, if the groundwater is contaminated with salt, high chloride levels are found in the stream when it is fed mostly by groundwater rather than stormwater. The chloride readings often exceed the chronic criterion (230 mg/l) during these times.

In intermittent streams which cross regularly salted roads, the conductivity (measured as a proxy for chloride) changes in base flow and groundwater observed downstream of the road show a marked increase (up to 25-30 times greater on the downstream side). The effect can continue for miles downstream. (Holden 2016)[2]

Salt is a major pollutant to some streams in Maine located in developed areas with parking lots and roadways. Figure 1 shows chloride levels in streams in Maine. Streams in population centers show levels above the chronic water quality criteria level (230 mg/l).

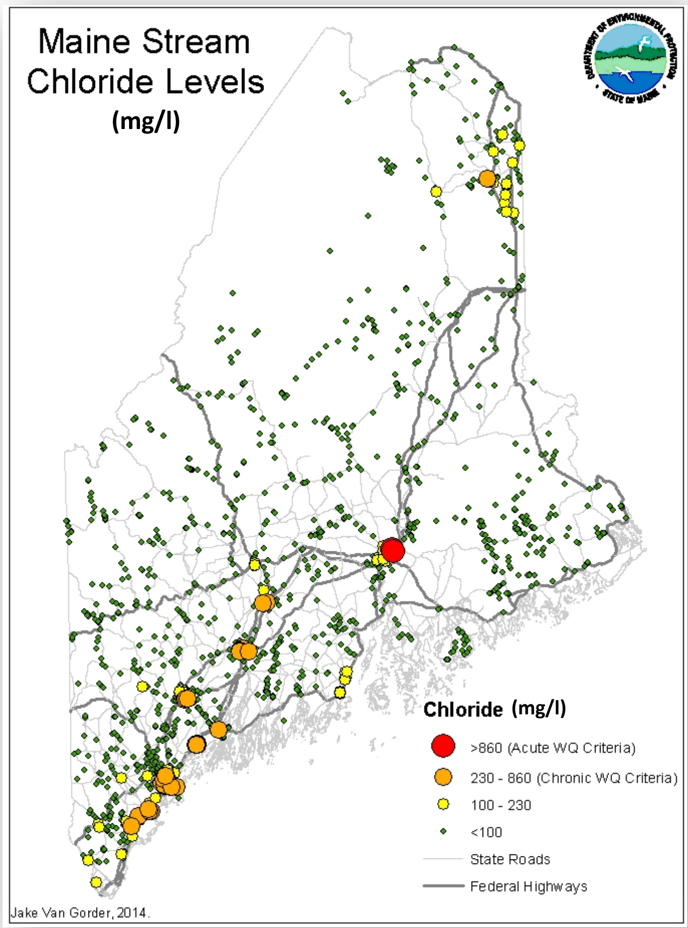

Figure 1. Chloride levels in streams in Maine.

Aquatic organisms are impacted, especially during summer

Important sensitive aquatic macroinvertebrates (bugs with a portion of their life cycle in water such as dragonflies, mayflies, and stoneflies) cannot live in streams with toxic levels of chloride. These macroinvertebrates are an important food source for fish and are representative of the health of the ecosystem. Wetland amphibians and invertebrates can be negatively impacted by even moderate salt contamination.

During the summer months, the organisms are more active than during the winter/early spring runoff events and the hit of high chloride is for a longer period when it is from groundwater. Because of this, contaminated baseflow is of the greatest concern to vulnerable streams.

There are other negative impacts

Salt used on roads, parking lots and walkways can cause other environmental and economic impacts. Contaminated groundwater is a concern for drinking well water (drinking water standards are 250 mg/l), particularly for those near salt-sand piles, and right next to highly-salted roads or parking lots. High salt in drinking water sources can also mobilize metals in water supply pipes (Vernimmen 2018)[1].

Salt-tolerant invasive plants such as common reed, purple loosestrife, and narrow-leaf cattail often replace native species in chloride contaminated wetlands. Deicing salt can also mobilize heavy metals in soils and decrease heavy metal retention in stormwater treatment systems. Deicing salt corrodes infrastructure, equipment, and vehicles. Information about the economic impacts, public safety concerns, and further discussion of environmental impacts is available in the *Maine Environmental Best Management Practices Manual for Snow and Ice Control* *(2015)*[3].

Small perennial streams in developed areas are most vulnerable

Streams which are most vulnerable to being impacted by salt are small, first order streams in the watershed of heavily salted development or an area zoned for such development. Development which is often heavily salted includes commercial, institutional and office parking lots, highways, and highway exits/entrances. Streams with historic or current sand/salt storage in their watershed are also vulnerable. Historic sand/salt piles which may not even be there anymore may have contaminated the groundwater years ago. Larger streams are not as vulnerable since there is more dilution from non-contaminated watershed areas. Streams which dry up in the summer are also not as vulnerable since they are not fed by groundwater year-round.

Maine salty stream examples

Topsham Fair Mall Stream, Topsham – Chloride concentrations in the middle and upper portion of this small, 1.4 mile stream are constantly above the chronic pollution threshold during summer baseflow periods, and nearly so in winter. In the winter, they were over the acute threshold about 2% of the time, coinciding with salt application during storm periods. Measurement of specific conductivity (as a proxy for chloride) along the stream and in seeps into the stream indicated the source of chloride is the groundwater from the area which drains a commercial development and heavily traveled roads. The town now requires salt management plans for certain new development.

Trout Brook, South Portland & Cape Elizabeth – One segment of this 2.5 mile stream is impaired primarily due to chronically high chloride. A plume of elevated underground conductance indicates the likely source of contamination is a former municipal sand/salt pile which wasn't located on pavement. The pile has been moved to another location and covered, but the groundwater plume continues to contaminate the stream.

SOME STRATEGIES TO TRY TO REDUCE THE IMPACT

Since there are currently no practical techniques to remove salt from water, the recommended best management practices (BMPs) are focused on trying to reduce the amount of salt needed and used, and to keep salty water out of the groundwater.

Follow BMP manual techniques

Follow or require the use of BMPs for snow and ice control product selection, application processes, application equipment, loading and washing, per the Maine Environmental Best Management Practices Manual for Snow and Ice Control (2015)[3]. Cover sand/salt piles and manage loading area to reduce runoff from becoming contaminated with salt.

Develop salt management plan and reduce area to be salted

Develop, or require the development of a salt management plan, to ensure BMPs are used, and only areas that truly need to be salted are. Consider whether all of the impervious area needs to be plowed and salted, or if some of the area could be out of service for the winter. For instance, after the busy holiday season, consider only plowing the area of a commercial parking lot that is actually used during that time period.

For developments currently being planned, consider reducing the number of parking spaces and/or reducing road widths. If there are municipal requirements, consider revising those requirements to allow for fewer parking spaces or smaller road widths in certain areas.

Consider putting the parking lot under the building, which would eliminate the need to plow or salt the parking area, reduce the polluted runoff from the lot and allow for other use of the additional acreage.

Reduce infiltration of salty water in vulnerable areas

While stormwater BMPs that infiltrate, or simply allowing stormwater to infiltrate, are recommended for treating nutrients, metals, and other pollutants, when chloride impact to a small stream is the biggest current or future concern, infiltration is discouraged.

Avoid infiltrating salty water. For instance, don't plow onto pervious areas, and capture salty runoff so it goes to the stormwater system. Since stormwater systems can often have leaks which would allow salty water to exfiltrate into the groundwater, ensure the stormwater system in vulnerable areas is secure. Stormwater ponds should be lined so the salty water doesn't infiltrate.

Infiltrate clean, non-salty water (e.g. roof runoff) since infiltration is still a good practice if the water is not salty. The non-salty water will help flush the groundwater, and any contaminated water with it. It also will not be adding to the volume of salt-laden water that needs to be managed.

For new development being planned, don't allow or encourage (through infiltration BMPs) future infiltration of areas likely to be salted.

Think outside the box

Since the use of salt on roads, parking lots and walkways is increasing, and the impact to Maine's freshwater streams has only recently been realized, think outside the box for solutions! Following are a few examples of "outside the box" BMPs and strategies.

A FEW OUTSIDE THE BOX EXAMPLES

<u>Solar parking canopies</u>

The canopy provides protection from the elements (and therefore reduction of salt use) and shaded parking in summer, along with the benefit of producing energy.

Solar parking canopy being installed in 2017 on top level of the Fore Street Parking Garage, Portland, Maine.

Photo: John Capron

Timber-frame solar canopy in Stowe, Vermont.

Photo: Mike Polhamus/VTDigger

Solar canopies on retail parking lot of REI in Framingham, MA.

Photo: http://www.skylinesolaraz.com/p18.htm

A FEW MORE OUTSIDE THE BOX EXAMPLES

Heated sidewalks

Home2 Suites in the South Portland Maine Mall area has heated outdoor sidewalks, reducing the need for shoveling and salt.

Heated sidewalks and roads

Downtown Holland, Michigan has 10.5 acres of heated sidewalks and streets, making it the largest publicly-owned snowmelt system in the country, and eliminating the need for salting or snow removal in those areas. The tubing system beneath the sidewalks and roads uses waste-heat cooling water from the city's power plant, cooling the water prior to release to the lake and keeping the sidewalks and streets free of snow.

Photos: Shandra Martinez

Snow tire requirement

In Quebec, snow tires are required during winter. This reduces the expectation of completely cleared roads, reducing the use of salt, and has reduced accidents.

References

[1]Vernimmen, T. (2018). Freshwater is getting saltier, threatening people and wildlife. *Scientific American*, December 6, 2018. www.scientificamerican.com/article/freshwater-is-getting-saltier-threatening-people-and-wildlife/

[2]Holden, M. and J. Hopeck. (2016). Migration of a conservative contaminant: Infiltration, fracture conduits, and re-emergence of chloride in wells and streams. *The Maine Sustainability and Water Conference*, Augusta, Spring 2016.

[3]Maine Snow and Ice Control Best Practices Working Group. (2015). *Maine Environmental Best Management Practices (BMP) Manual for Snow and Ice Control*. www.maine.gov/mdot/mlrc/docs/technical/2015-08-17-June2015FINAlversion.pdf.