

City of Duluth State of Salt



What is road salt?

Road salt – or rock salt – is halite, the mineral form of sodium chloride (NaCl) as it is naturally mined.

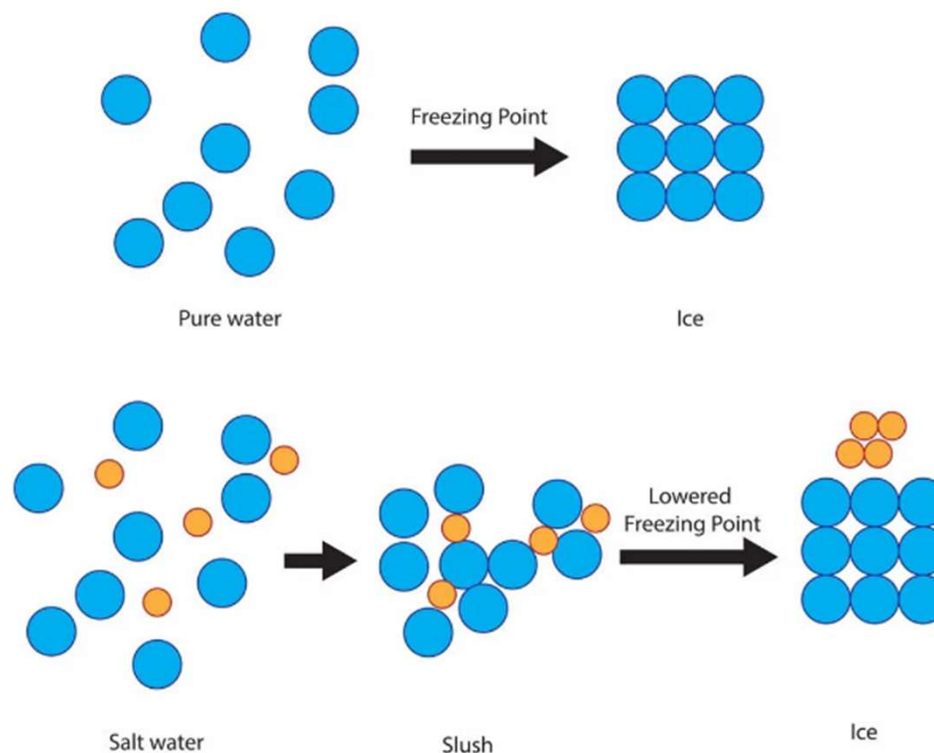
Table salt is just a purified version of the same mineral as, road salt still contains mineral impurities that can make it grey or brown in color.



How Salt works

When water is mixed with salt, the freezing temperature of the solution is lower than 32 F. The salt impedes the ability of the water molecules to form solid ice crystals.

That's why many cities spray a salt solution also known as Brine, before and during winter storms.





How salt activates

- Salt needs help -

By itself, salt is inert, it needs help from the outside sources to make it effective.

- Water – Technically, salt draws out moisture through the process of osmosis.
 - This is important to note when we have cold dry days that lack humidity and moisture.
- Heat - This can come in few different ways
 - Sunlight
 - Road/Air temperature
 - Traffic movement

Effectiveness of salt

| Pavement Temp °F | One Pound of NaCl Melts | Melt Times | |
|------------------|-------------------------|---|--|
| 30 | 46.3 lbs of ice | 5 min | |
| 25 | 14.4 lbs of ice | 10 min | |
| 20 | 8.6 lbs of ice | 20 min | |
| 15 | 6.3 lbs of ice | 1 hour | |
| 10 | 4.9 lbs of ice | Dry salt is ineffective and will blow away before it melts anything | At temps below 10 degrees, it may be more cost-effective to use a chemical other than NaCl |
| 5 | 4.1 lbs of ice | | |
| 0 | 3.7 lbs of ice | | |
| -6 | 3.2 lbs of ice | | |



Why is road salt a good option

- Tried and true method that has been proven for decades
- It is effective method on almost terrain, both flat and steep/hilly areas
- Works across most temperature ranges
- Low cost per ton vs other de-icing materials and lower chloride alternatives
- Helps increase skid resistance

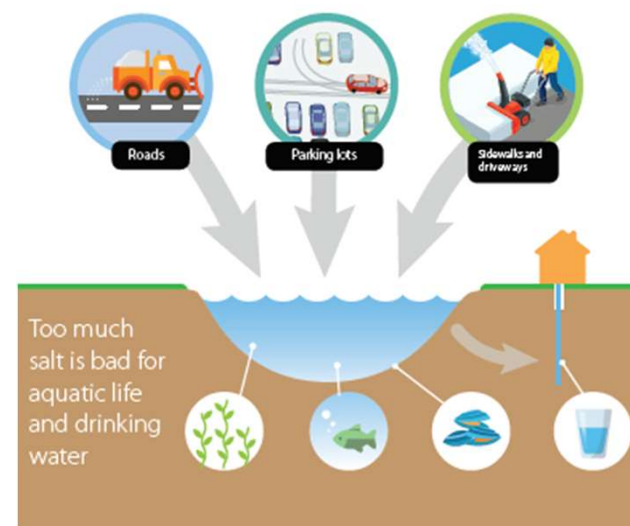


General Impacts of Road Salt

- **1 teaspoon of salt permanently pollutes 5 gallons of water**
 - Once in the water there is no feasible way to remove chloride.
- Corrosive to cars, trucks, and most if not all infrastructure
 - A Fortin Consulting report, prepared for MPCA, found that the embedded cost of infrastructure maintenance increased the price of 1 ton of salt by roughly \$3300.
- Chloride kills roadside plants/trees, sickens pets and wildlife, and contaminates groundwater.
- Regional chloride use as a deicer has led to water quality impairments in local water resources.

It only takes **1 teaspoon** of salt to pollute 5 gallons of water. 

All the salt adds up!



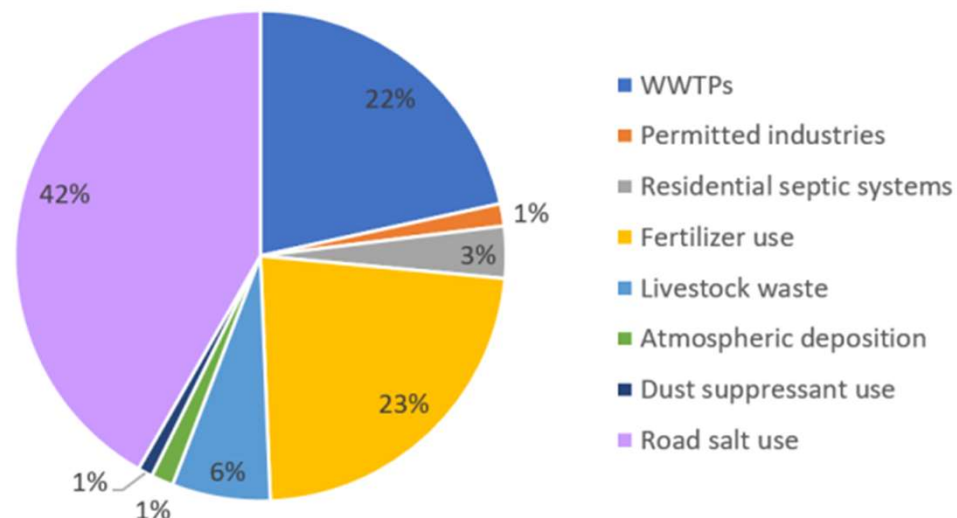
Water Quality Numbers to Know

- Short-term exposure (one hour or more) to concentrations greater than 860mg/L or continued exposure (four days or more) to chloride concentrations greater than 230mg/L can be expected to have detrimental effects on community structure, diversity, and productivity of aquatic life.
- A freshwater stream, lake or wetland is impaired by Chloride if two or more samples exceed 230mg/L within a three-year period or one sample exceeds 860mg/L
- 35,000mg/L
 - Roughly 2.5 cups/5gal of water. Average salinity of seawater.
- 860mg/L
 - Roughly 1 Tablespoon/5gal of water. Water tastes very salty at this concentration.
- 230mg/L
 - Roughly 1 teaspoon/5gal of water. Water tastes salty at this concentration.



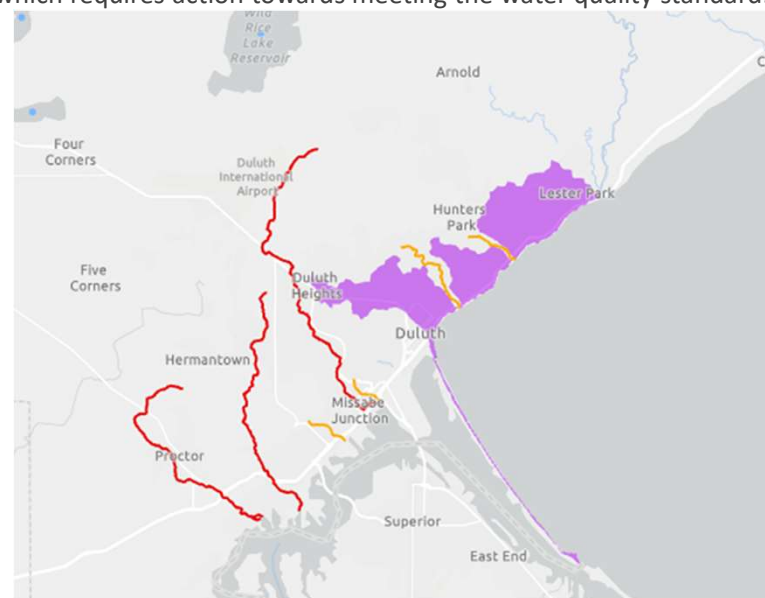
Chloride Sources

- Chloride sources in Minnesota Statewide come from a variety of sources. This makes chloride reduction a complicated task.
- In Duluth, our chloride sources are different. With little to no agriculture in our impaired watersheds and very little local water softening the vast majority comes from the use of chlorides in winter maintenance.



Local Environmental Impacts

- The City of Duluth and other local MS4 communities/jurisdictions, will be required to act and implement chloride reduction strategies to reduce the impact of chloride on water resources.
- MPCA allocates a Total Maximum Daily Load (TMDL) to MS4 communities, which requires action towards meeting the water quality standard.
- Current Chloride Impairments in Duluth
 - Miller Creek
 - Max Result 1,510 mg/L
 - Monitoring wells near Kohls exceed 500mg/L in shallow ground water.
 - Kingsbury Creek
 - Max Result 559mg/L
 - Keene Creek
 - Max Result 874mg/L
- High Risk for Impairment
 - Merritt Creek
 - Max Result 756mg/L
 - Coffee Creek
 - Max Result 230mg/L
 - Chester Creek
 - Max Result 330mg/L
 - Tischer Creek
 - Max Result 211mg/L



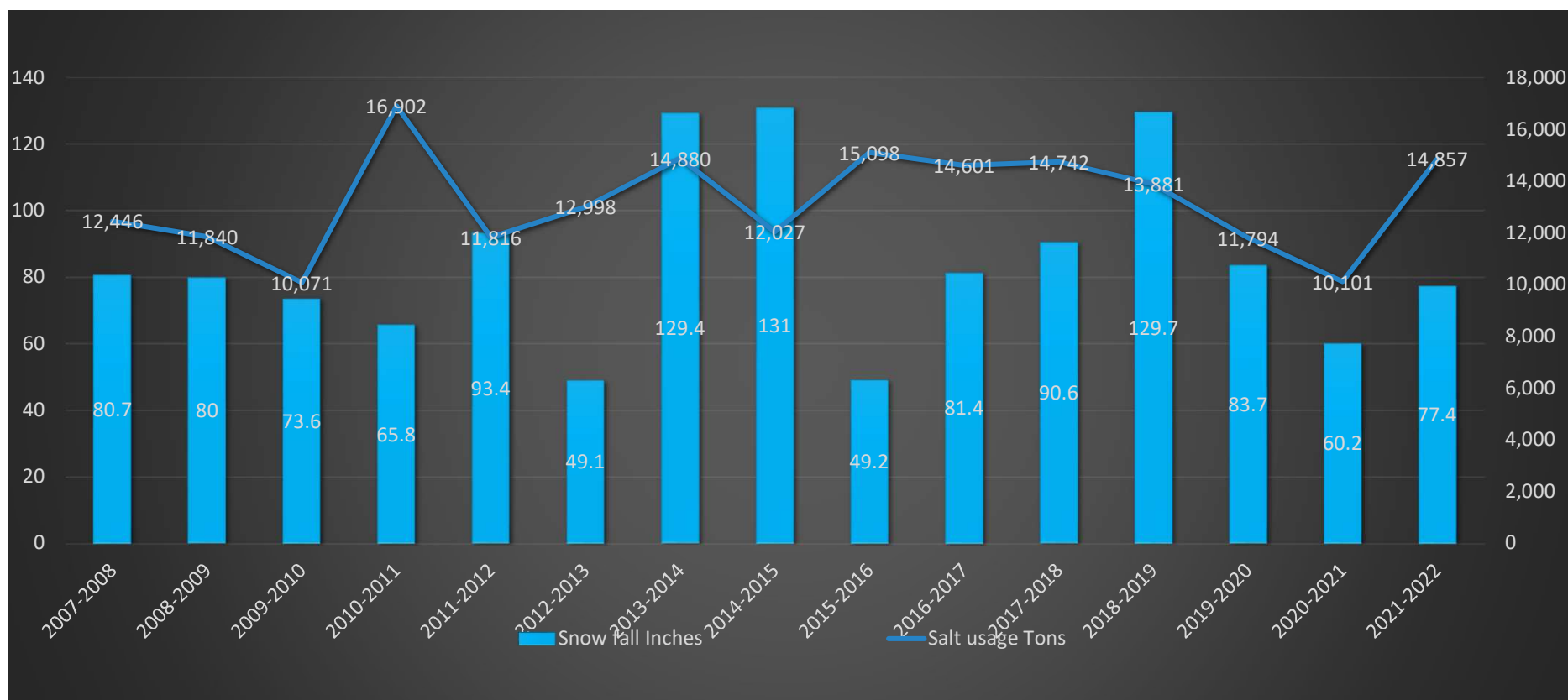
City of Duluth snapshot: 2009-2022

- Average snowfall: 84.11 inches
- Average yearly salt use: 13,594 ton
- 530 Centerline miles
- 12 year average Salt cost per ton: \$56.73
- Average yearly cost of salt: \$870,125
- Average yearly sand use 8,410 ton
- Average cost per ton: \$10.79
- Average yearly cost of sand: \$90,711
- 35 FTE Operator staff – down from 47 in the late 90's





Snowfall and Yearly Salt/Sand Usage



Challenges we face

- Currently no alternative deicer without some negative impacts to the environment and cannot be treated or filtered with traditional BMPs
- Street Maintenance has 35 staff to perform all activities from snow removal to potholes
- Fear of slip and fall lawsuits
- Public expectations are difficult if not impossible to meet
- We basically have 3 different micro-climates through the City. These climates create different needs using different applications, making it a very dynamic problem
- Aging snow removal fleet of equipment with lack of funding to have a sustainable replacement cycle
- Lack of funding to purchase and implement new technologies and tactics that would aid in chloride reduction efforts
- Public expectations that all streets should be free of ice and snow all the time



Things to think about

Is the issue of “clean safe streets to drive on in winter”, a social issue or is it a public safety need?

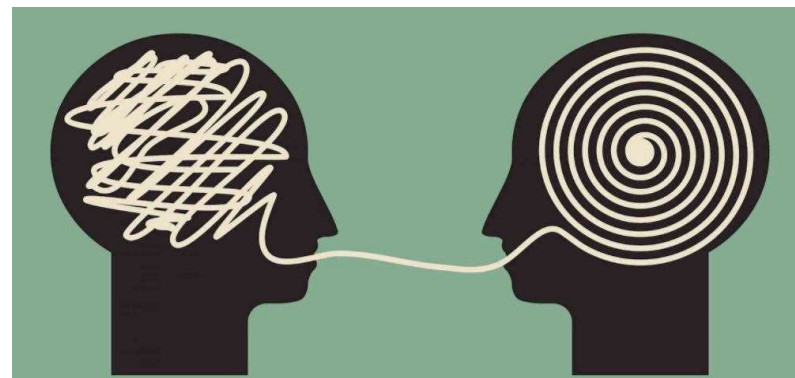
There is a potential for operational cost saving on material purchases through usage reduction.

This is an endeavor for the long-term view, and investment for the future.

How do we as a community value clean water?

No one in the room has lived in a time where chloride wasn't being used for winter maintenance.

What can we learn from other communities?





Look around, who is making a difference?

City of Grand Rapids – Jeff Davies Director

- Switched to mostly salt and liquid and went from 2000cuyd sand to 100cuyd
- Uses brine alternatives
- Does not treat low volume areas with chloride based de-icers when temps are 0 or below
- Clear constant communication to the public of what to expect during snow events

City of Prior Lake

- Upgrade to precision controllers and sanders
- Used anti-icing and pre-wetting along with on-site pre-mix liquid and bulk-ingredient storage
- 42% reduction in salt; \$2,000 per event estimated cost savings

City of Shoreview

- Stopped using a salt/sand mixture and moved to straight salt mixes
- Implemented the use of calcium chloride in the pre-wetting tanks to reduce the amount of rock salt
- All applicators and supervisors attend annual training through the MPCA
- 44% reduction since 2006; \$24,468 savings in 2014

Short term solutions we're phasing in

- Annual in-depth training for operators on spreading systems and associated technology
- Expanded plow training to include;
 - Current environmental data on local impacts on environment
 - MS4 Permit and how it effects our plowing operations
 - MPCA led Smart Salting Courses for operators and senior leadership
 - Operator mentors to instill team building and comradery
- New GPS/AVL system to collect real-time data of material usage
- Upgraded brine generators for all truck locations, allowing for more accurate brine solutions, thus reducing some breakdowns in truck mounted brine applicators
- Internal application rates for granular and liquid deicers





Long term solutions - we need your help

- Progressive winter parking restrictions - enforcement and implementation
- Adequate and long term funding to support the replacement snow removal equipment within a sustainable lifecycle
- Funding to support additional Winter Maintenance staff and purchases of new technologies and tactics that would aid in chloride reduction efforts
- Support and propose more in-depth Limited Liability Legislature for slip and fall lawsuits involving snow and ice conditions
- Design and research more smart infrastructure: anti icing systems, heated coils
- Create and support a local chloride management ordinance that will help address known sources of chloride pollution and provide standards that private winter maintenance professionals will need to follow.
- Create and deploy an aggressive media campaign to educate the public on the science and facts around snow removal and de-icing
- Require certification for private contractors similar to the Department of Agriculture pesticide certification program
- Hold true to our Snow and Ice Policy when political/business/constituent pressure is applied

Goals & Shared Vision

Set realistic and achievable goals

Continue to develop and collaborate with other entities to meet these goals.

Understand the public safety needs and limitations while effectively communicating new ideas clearly and directly

Understand the environmental conditions so we can take action to prevent over treatment and chloride pollution, leading to the de-listing of impaired waters in our region

Be a leader and a resource in Northern MN by reducing road salt usage and lowering chloride levels in water resources





Strive to be stewards of our Environment

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