Management of Coarse Organics and Chloride in Urban Stormwater

Prior Lake Street Sweeping Experiment + follow-up studies

Edina De-icing Study

Sponsor: EPA/MPCA 319 Program

Greg Johnson, Project Officer

Doug Klimbal

Bruce Wilson

Jessica Vanderwerf Wilson

Jacob Bierman

Ross Bintner

Chris Buyarski

Sarah Hobbie

Paula Kalinosky
Conventional stormwater sampling collects only “suspended solids” – very fine particles and soluble chemicals.

Gross solids (pictured here) are rarely measured.

You should care because gross solids:
1. Clog stormwater systems
2. Add a lot of N and P to stormwater systems
Prior Lake Street Sweeping Project Overview

2-year study:
- 9 routes, 85 total curb-miles
- Varying tree canopy cover and frequency of sweeping (1x, 2x, 4x per month).
- 2,700 curb-miles swept.
- 400 sweeping samples.

A committed partner – the City of Prior Lake – was absolutely critical!
For “high canopy” routes: coarse organics comprised 20% of total solids, 74% of N and 42% of P.
Application 1. Street sweeping planning calculator to optimize street sweeping.
Application 2.
Developing TMDL P reduction Crediting System for Street Sweeping.

- 5 cities (Shoreview, Minneapolis, Forest Lake, and Roseville)
- 2 sweeper types,
- up to 37% canopy

UM study (Sarah Hobbie et al., 2021)

MPCA & Tetra Tech Crediting calculator (in progress)
Application 3. watershed-scale modeling

Land cover map of Capital Region Watershed District

Measured yields for “ISCO” TP and COP
Application 4. Tree planting

Maples (all species)

\[ y = 0.0009x^{2.2} \]

\[ R^2 = 0.995 \]
Count of Daily 3-inch Precipitation Totals and Average Return Per Station

Climate change considerations:
1. More frequent intense storms may convey more coarse solids to drains (Data from Kenny Blumenfeld, DNR)
2. Winter minima are increasing – changing tree species (e.g., ash).
(Data from Kenny Blumenfeld, DNR)
Ongoing study: Quantifying mass of gross solids from streets to rain gardens. (Led by John Chapman)
Adaptive Management to Improve Deicing Operations

- Meltwater to infiltration
- Plow-off
- Meltwater to storm drain
The chloride (Cl) problem in Minnesota

- Salt (mostly NaCl) is an important tool for de-icing.
- Cl cannot be trapped or degraded in BMPs.
- Cl is mobile soils, moves to groundwater.
- Cl is toxic to fish at levels seen in some urban waters.
- Monitoring shows that Cl is rising or not changing; almost never declining.

Stormwater managers throughout MN identified Cl as their #2 concern. (MN Stormwater Research Roadmap)
Goal: Develop and adaptive management: providing snowplow operators with “eyes” into the environment to improve operations.
We had to develop a methodology to measure the movement of Cl.

Meltwater sampler (above);

To right: (A) street site; (B) metal support frame; (D) sampler being installed; and (D) sampler in place, receiving flow.
Key Findings

1. Most large chloride events were short.

A. Temperature and cumulative degree hours increase.
B. Peak Cl occurs before peak flow (elution).
C. Salt mass peaks between peak Cl and peak flow.
2. Nearly all chloride loading occurred in less than 200 hours in each year.
Chloride in road salt can move through watersheds, emerging as baseflow in streams.
Workshop at end of Winter 2017/2018

Data visualization

Other recommendations:
- Improve quality of salt (clumping).
- Download and ponder truck salting data in-house for each event in Adaptive Management setting.
- Measure road temperature directly.
- Continue research statewide.

Purchase of new Joma blades
Climate consideration: More snowfall and more days with T > 32 °F will require more de-icing salt.
Thanks to our partners!