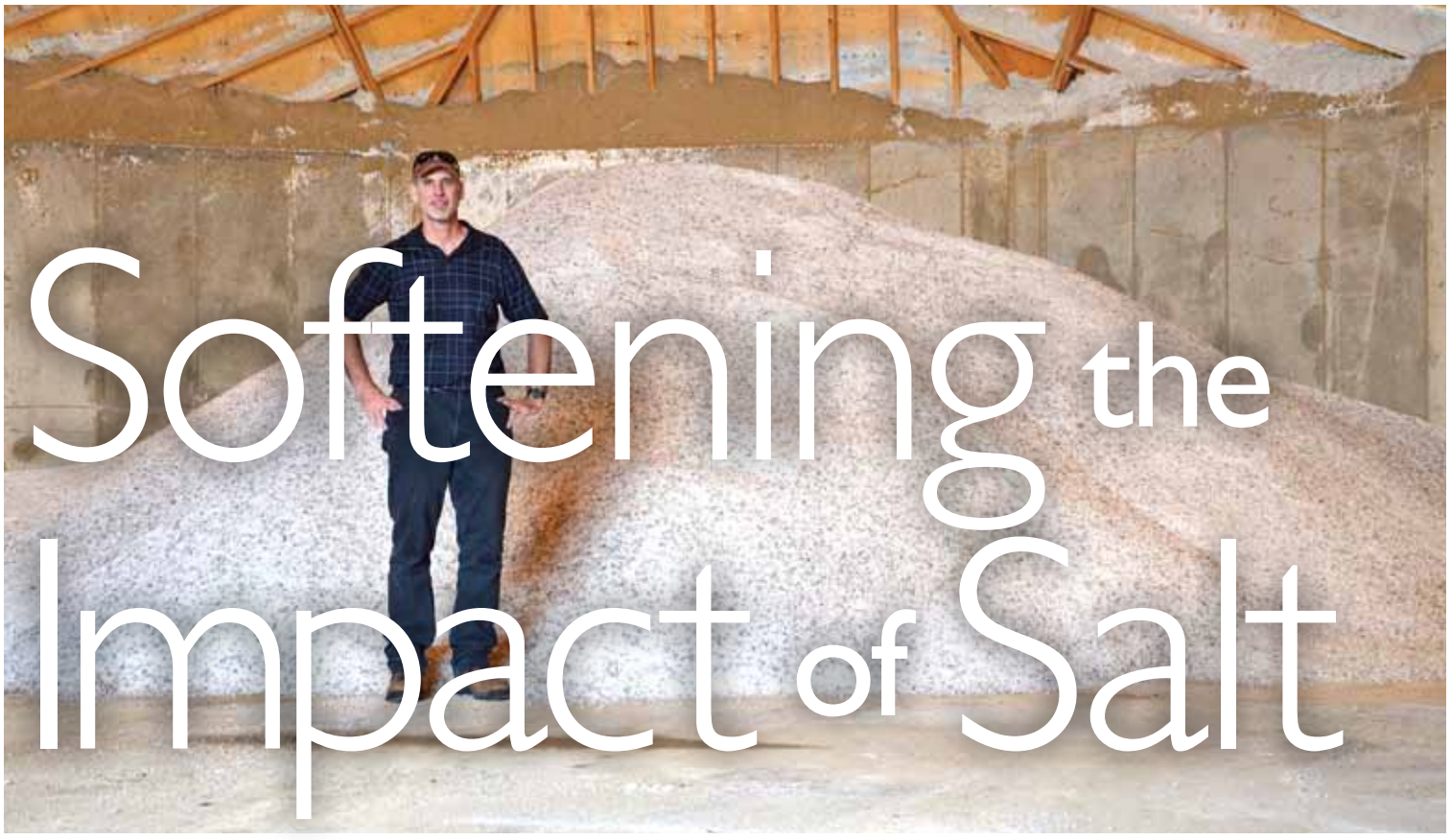

Softening the Impact of Salt

Wisconsin wastewater treatment plant works to reduce salt at the source

By Emily Jones

An MMSD employee stands next to 900 lb of salt—less than arrives at the wastewater treatment plant each day.

Treating Wisconsin's hard water can be hard on the environment.

The salt used in water softeners ends up in water bodies, threatening fish and other wildlife. The salt concentration at the bottom of Lake Wingra in Madison, Wis., is nearly that of low-sodium soup.

Salt reaches these water bodies through wastewater treatment plants. Madison Metropolitan Sewerage District (MMSD), which provides wastewater treatment for the Madison area, receives more than 100 tons of salt at its plant every day. MMSD is unable to remove salt from wastewater, so it passes through the plant and into local streams.

Faced with regulatory, environmental and financial pressures to reduce salt, MMSD hopes to prevent it at the source. By using outreach, incentives, permits and research, MMSD aims to protect water quality and keep sewer bills low.

From Softener to Stream

Once salt is in wastewater, it is virtually impossible to remove. Although they typically are unable to remove salt, wastewater treatment plants are required by law to keep chloride, a component of salt, below a certain limit. MMSD eventually will be required to meet a chloride limit of 395 mg/L in its treated wastewater. However, chloride concentrations have been on the rise at the treatment plant due to increased development, decreased water use and increased road salt use.

Salt removal technologies are available but expensive. MMSD commissioned a study to estimate the cost of upgrading its facility to remove salt. The projections were dramatic, ranging from $400 million to $2.3 billion for the project lifespan, which would translate into much higher sewer bills for community members. Rather than install expensive treatment technology, MMSD is working to keep salt out of water in the first place. Its daily reduction goal is 20,000 lb of chloride—the equivalent of keeping 833 40-lb bags of water softener salt out of the sewer each day.

Measuring Potential

Water softeners are the largest source of salt to MMSD's treatment plant, so reducing softener salt has the biggest potential for overall salt reduction. The average water softener

An MMSD employee troubleshoots a conductivity reader for manhole monitoring.

likely could use a tune-up, if not a replacement, which could reduce its salt use.

In 2013 and 2014, MMSD worked with several partners to measure salt reduction after improvements to household water softeners. This study, sponsored in part by the Water Quality Research Foundation, was the first to use direct wastewater monitoring to determine chloride reductions resulting from optimizing or replacing water softeners. The study focused on homes in four residential sections of MMSD's service area. Residents in those sections were surveyed about their home water use and softening, and MMSD staff took initial water quality readings through manhole monitoring to determine the baseline chloride levels in the sewer.

To measure the effects of improvements, residents in one area were offered free water softener optimization, and residents in another area were offered free high-efficiency softeners to replace old ones. Local water quality companies were key partners, offering their services and funding. After the water softener improvements, monitoring was conducted again to compare new chloride levels with levels before improvements and in areas where improvements had not been made. Because of issues with initial monitoring data and differences between study areas, comparisons were imperfect, but they gave researchers a basis to estimate the chloride reductions resulting from the improvements.

Results indicated that household softener improvements can reduce chloride contributions to the sewer system. Before softener improvements, houses in the study area contributed an average of 0.255 kg of chloride (0.9 lb of salt) per day to the sewer system. On average, optimizing softeners resulted in a 27% reduction in chloride, and replacing softeners resulted in a 47% reduction. These values are comparable to similar studies and provide a basis for MMSD and other water and wastewater authorities to estimate residential chloride contributions and potential reductions.

However, these reductions come at a cost. Softener optimization or replacement was free to the selected residents, as project partners funded the cost of improvements. Average costs in the study ranged from $180 per kilogram of chloride ($81 per pound) for softener optimization to $2,164 per kilogram ($1,176 per pound) for softener replacement.

Applying Lessons

MMSD now is equipped with more data to inform its work to reduce chloride. It also refined a monitoring technique to help generate consistent results, which will be useful to wastewater entities measuring chloride reduction.

While the study provided valuable insight about the costs and effects of improving softeners, those improvements actually need to occur for MMSD to see salt reductions. Encouraging these improvements with monetary incentives is a major part of MMSD's salt reduction approach.

MMSD began with incentives directly to water quality companies through a mini-grant program in 2014. Through this program, two local companies used MMSD grants to upgrade residential softeners. Like the household study, the projects funded by these grants indicated that water softener replacement can result in significant reductions in salt use.

Residential softener improvement is just part of MMSD's strategy. Household softeners contribute a fraction of the chloride that reaches the wastewater treatment plant, with large industrial and commercial facilities contributing a more, and thus representing potential for larger reductions.

In 2015, MMSD began offering grants for chloride-reducing projects, targeted to large salt users. To incentivize the most cost-effective projects, the grants were based on the estimated cost per pound of chloride reduced—the lower the cost per pound, the higher priority the project.

After marketing the grants to dozens of large facilities in MMSD's service area, the programs resulted in three funded salt reduction projects, the results of which are expected in spring 2016. Although the programs drew fewer applicants than MMSD hoped, they provided lessons to apply to future programs. In spring 2016, MMSD used these lessons and input from local water quality companies to develop a simplified rebate program for salt reductions, now available on MMSD's chloride reduction website.

Reducing salt will be a challenge, but MMSD is encouraged by early successful salt reductions and the support of local partners. If successful, MMSD's community can achieve cleaner water at a lower cost. **WQP**

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