MEMORANDUM

To: Bassett Creek Watershed Management Commission (BCWMC)
From: City of Plymouth
Subject: Parkers Lake Chloride Reduction Project (PL-7)
Date: July 14, 2022

Background

In May 2020 the Commission received a presentation of the feasibility study for water quality improvements for Medicine Lake and Parkers Lake. This study included a recommendation (Alternative 6) to complete a chloride demonstration project in the northern watershed tributary to Parkers Lake to reduce salt usage and chloride loads to the lake. The specifics of this portion of the project were vague and resulted in the need to further study the area. See page 68 of the feasibility seen here: (https://www.bassettcreekwmo.org/application/files/3316/0398/7260/Mt.Olivet_Parkers_Feasibility_Report_Final_June2020_NoAppendices_.pdf)

In September 2020 the Commission entered into a cooperative agreement with the City of Plymouth for the implementation of this project following development of a list of viable, impactful chloride reduction measures. Since that time, the city facilitated a data evaluation project to further understand how chloride is transported within the sub-watersheds upstream of the lake and possible capital best management practices (BMPs) that could be viable in improving water quality in the lake. With funding from the Hennepin County Chloride Imitative and the City of Plymouth, the city and their consultants facilitated the data evaluation project over the last 1.5 years. In addition to a thorough literature review, a cohort of 14 technical experts from various cities and watersheds participated in 4 workshop sessions from July 2021 to January 2022. The group reviewed chloride and landuse data from multiple watersheds in the Metro area and ultimately developed a list of 24 structural and non-structural best management practices (BMPs) that could be used to reduce or remove chloride from the watershed and Pakers Lake. A copy of the executive summary of this effort is attached and the complete technical findings memorandum is with the online meeting materials.

Plymouth staff refined the list of potential structural BMPs that are viable for city operations and which would be eligible for BCWMC Capital Improvement Funds (see matrix below). Plymouth requests direction from the Commission on which BMPs the City should further analyze for implementation. If the Commission pursues one of these projects the next step would be to hire a consulting firm to update the feasibility study with this alternative, estimate chloride load reductions, prepare estimates including cost benefit, and bring back a 30% preliminary design to the Commission. City staff will provide a brief overview of the data evaluation process and details on these options at the meeting.

City of Plymouth

Matrix of Three BMP Alternatives for Consideration

	Design & Admin. Cost	Operational Cost	LBs Removed Per Year	Remove Impairment	Addresses Source
1A. Grant Program (Impervious Reduction)	Low	Low	Low	Low	Medium
1B. Grant Program (Equipment)	Medium	High	Medium	Low	High
2. On-site Capture	Medium	Medium	Medium	Low	Medium
3. In-lake Removal	High	Low	High	High	Low

Details of Three BMP Alternatives for Consideration

1. Development of a targeted chloride reduction grant program.
Description: This BMP would develop a grant program targeting property owners in the northeast sub-watershed to reduce the amount of salt leaving their site. This program would include implementing low-chloride site design elements [ex. impervious reduction, heating sidewalks, plazas, parking lots, etc.], purchasing/renting chloride reducing equipment [ex. sweepers or liquid deicing sprayers], or both.
Cost*:* Low cost to develop. Total cost variable based on fund availability, demand, and match required.
Potential Reduction*:* Low or high levels of reduction based on cooperation.
Opportunities*:* Reductions at businesses is a challenge, also serves as education, & could be repeatable.
Risks*:* Benefits and maintenance require private cooperation. Unknown if this is a barrier to applicators.
Next Steps*:* Estimate reduction by grant item and participation.
Timeframe*:* 12 - 24 Months

2. Construct pilot on-site collection system.
Description: This BMP would plan, construct, and monitor an on-site chloride effluent collection system at the Plymouth or MnDOT public works facility (in northeast sub-watershed) to reduce the amount of salt leaving the site. This pilot is expected to involve using connectivity to collect the highest concentrated effluent into an on-site storage facility. Effluent would be tested to be either discharged into the sanitary sewer, diluted, and used in irrigation, or concentrated and cleaned to be used in the brine making process.
Cost: Medium cost to develop. Medium cost to construct. Medium operational.
Potential Reduction*:* Highest at storage facilities.
Opportunities: *Locating would be easier at storage facility.*
Risks: Unknown levels leaving the site and ability to use/discharge effluent. Permitting needs unknown.
Next Steps*:* Engage with MnDOT & MCES, begin sampling effluent, & topo survey.
Timeframe: 18 - 36 Months

3. Complete a lake dilution / effluent removal project.
Description: This project would be specific to Parkers Lake and would address the existing elevated chloride levels in the lake through dilution or by removing and moving the chloride laden-water. This project would look at introducing additional clean water into the lake strategically to dilute chlorides downstream, remove chloride effluent and transport for irrigation, or remove chloride effluent and transport to the Mississippi river which is able to accommodate the additional loading.
Cost*:* High cost to develop. High cost to complete. No operational.
Potential Reduction*:* 1-time removal.
Opportunities*:* Could result in removal of lake from impaired waters list. Could remove from watershed.
Risks: Relies on others to reduce loading to the lake (similar to Alum Treatment), permitting needs unknown, special care to not impact aquatic life.
Next Steps: Initiate lake study, engage with MCES, begin additional sampling in-lake.
Timeframe: 36-60 Months

Executive Summary

Parkers Lake Chloride Facilitation and Data Evaluation Project

Project Overview and Purpose

The City of Plymouth in partnership with the Hennepin County Chloride Initiative (HCCI) convened a cohort of individuals with technical experience in studying chloride transport and loading of local waterbodies in Hennepin County. The overall goal of the cohort was to use peer data to provide resources to Plymouth and the HCCI on trends in chloride transport by land use and the risks and opportunities of various best management practices that could be implemented to reduce chloride loading to Parkers Lake. The group met over a six-month period to share data, review consistencies and inconsistencies in their respective data based on land use, and look at the likely success of potential best management practices which could be further studied for implementation.

Parkers Lake is an approximately 100-acre recreation lake located in Plymouth within the Bassett Creek Watershed Management Commission (BCWMC) watershed boundary. The lake is on the impaired waters list for chloride and has commonly exceeded the state standard for chronic chloride concentration. The lake outlet elevation is relatively high compared to typical lake levels, thus hydraulically the group treated the lake as land locked.

Available Data

Plymouth has been monitoring in-lake chloride levels in Parkers Lake since 2000 and began monitoring outlets into the lake in 2013, including adding additional sites in 2019. Land uses to the south of the lake are primarily residential, northwest are primarily park and multifamily, and northeast are industrial/commercial.

Cohort members presented data from Shingle Creek, Nine Mile Creek, Bassett Creek, Sweeney Lake, the Ridgedale Mall Stormwater Ponds upstream of Crane Lake, Southdale Mall, preliminary data from the Minnesota Pollution Control Agency (MPCA), as well as articles and resources from cohort members.

Literature review of best management practices included (1) dilution of chloride currently in Parkers Lake, (2) capture and reuse of high-saline runoff for brine deicing applications, and (3) capture of high-saline runoff in above-ground storage tanks.

Transport by Land Use for Targeting Education & Outreach

After reviewing and evaluating chloride monitoring data from the cohort, the following land use items emerged as being useful in reviewing chloride transport in the county and targeting chloride reduction outreach.

- *Residential:* Chloride rates/acre were consistently the lowest contributors of chloride across multiple datasets and rates in general were consistent. Continued education to residents and local public works agencies on the importance of correctly applying deicing chemicals should keep these levels low.

- *Medium Density (Townhomes):* Chloride rates/acre were higher than residential, but data was inconsistent between available datasets. This indicated that general assumptions on loading cannot always be made. For homeowner association scenarios with private applicators, it would be expected that similar strategies to Industrial/Commercial may be effective.

- *Industrial/Commercial:* Chloride rates/acre here were the highest of all watershed monitoring entering the lake, which was consistent with other largely impervious areas. No correlation was found between the analyzed data sets on a rate/acre. A best management practice which was discussed as potentially being effective for these areas is the creation of a special use district or joint powers agreement to streamline deicing activities and make sure certified operators were being used. This tool used in conjunction with outreach and education may be beneficial.

- *Park/Institutional:* Data specific to this landuse was unable to be strictly segregated, but a best management practice that was discussed was the type of fertilizer being used on large, manicured turf areas (such as ballfields). Typical fertilizers include Potassium Chloride (KCL) as a source of supplementing potassium into the soil. This is typically used because the percentage of K per unit weight is higher than other compounds typically blended with fertilizer. Sulfate and Nitrate are other more common additives but result in higher application rates to meet K goals. Targeted chloride education could also be to those than maintain turf, especially upstream or adjacent to lakes.

- *Local & County Right-of-Way:* The amount of chloride/lane mile/year varies by agency, but through new technology and training public works agencies have shown that de-icing applications can be reduced from levels 5-years ago. Levels varied from 4.9 to 25.1 tons/mile/year with two larger agencies able to apply between 4.9-5.9 tons/mile/year. Using achievable targets could be a good additional outreach tool to agencies. A water quality monitoring snapshot of county data did not show a significant contributor to the lake chloride levels in this situation, but similar targets could be set for counties with more data.

Within monitoring locations where land uses are mixed it was difficult to find any underlying trends without adding further monitoring locations. The MPCA chloride transport tool would provide a good

resource until further study is completed. Generally speaking, the data supports current thinking that with more impervious surface the more chloride is applied and thus transported to the lake.

Although the following items above emerged from discussions of the data, one clear take away is that the sampling/monitoring frequency and procedure as well as method of evaluating data are not consistent between agencies which could result in variability in data.

Best Management Practice Opportunities

The cohort brainstormed and brought outside resources into the group to establish 23 different BMPs for discussion and consideration. Throughout evaluation there was consensus that reducing the use of chloride is the best way to solve the problem, and the group believed continuing education efforts, training, and limited liability legislation would be impactful. Although having the most impact these efforts may hit a point of diminishing returns, thus structural BMPs of a capital improvement nature were discussed in the greatest detail. The group selected six as having the highest likelihood of reducing the concentration of chloride in Parkers Lake. The selected BMPs are a combination of source reduction practices and in-lake chloride reduction. Many of these BMPs would require outreach and education to market the programs. The BMPs selected were:

1. Development of low-chloride design or private sweeper investment grant program
2. Construction of publicly available salt recycling or reuse center
3. Construction of publicly available brine tank
4. Development of watershed business district or JPA for joint winter maintenance
5. Development of on-site storage tank for chloride-contaminated effluent
6. Lake dilution

Cohort discussion and literature review indicated the following general conclusions about these BMPs:

	Design & Administration Captial Cost	Ongoing Opperational Cost	Potential Chloride Loading Reduction	Potential Addressing Chloride in Lake	Addresses Chloride Source	Level of Community Involvement	Potential Hurdles	Notes
1. Grant Program	L	L	L	L	ML	H	ML	HCCI interviews indicate access to equipment is not a barrier.
2. Recycling/Reuse Center	ML	ML	L	L	ML	H	ML	Small case studies show limited use.
3. Public Brine Tank	MH	H	ML	L	ML	H	MH	
4. District/JPA	L	L	MH	MH	MH	H	ML	Requires either political or business support.
5. On-Site Collection	MH	ML	MH	MH	L	L	MH	Disposal of effluent would need to be coordinated.
6. Lake Dilution	H	L	L	H	L	L	H	Disposal of effluent would need to be coordinated.

Notes:
L = Low, ML = Medium Low, MH = Medium High, H = High