Chloride Reduction Plan

Pinnacle Brook

Unnamed Tributary to Shawsheen River

Town of Tewksbury, MA

Department of Public Works

999 Whipple Road

Tewksbury, MA 01876

June 30, 2021

Updated June 2022

Weston & Sampson

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1.0 INTRODUCTION AND BACKGROUND

The Town is regulated by the 2016 General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) (2016 MS4 Permit), which became effective on July 1, 2018. The 2016 MS4 Permit requires municipalities that discharge stormwater to receiving waters that are impaired for chloride to develop a Chloride Reduction Plan. Section IV, Appendix H of the 2016 MS4 Permit outlines the requirements related to discharges to water quality limited waterbodies where chloride is the cause of impairment, but there is no approved Total Maximum Daily Load (TMDL). In Tewksbury, Pinnacle Brook (MA83-15) and an Unnamed Tributary to the Shawsheen River (MA83-20) are both impaired for chloride without an approved TMDL. Therefore, to comply with the requirements of the 2016 MS4 Permit, the Town must develop a Chloride Reduction Plan for Pinnacle Brook and the Unnamed Tributary to the Shawsheen River by June 30th, 2021. The Chloride Reduction Plan must be fully implemented by June 30th, 2023.

The goal of this Chloride Reduction Plan is to identify specific actions designed to achieve chloride load reductions within the Pinnacle Brook Watershed and the Watershed for the Unnamed Tributary to the Shawsheen River such that these water bodies will meet water quality standards.

The Town is focused on gaining a better understanding regarding how and why chloride is over applied to roadways and parking lots in order to develop best management practices to manage chloride application. The following bullets summarize some key areas where the Town plans to focus chloride reduction efforts:

- Identifying situations that warrant low- or no-salt application;
- Knowing and tracking how much material is being applied during de-icing activities;
- Applying the correct amount of salt for the given conditions as varying weather and pavement conditions can affect how deicers perform;
- Identifying who is responsible for handling snow and ice removal, knowing that privately-owned commercial and industrial parking lots and driveways can contribute significantly to salt loading in impaired waterways;
- Incorporating the latest technologies and practices to most effectively remove snow and ice.

Public safety and potential liability are at the forefront of the Town's concerns when dealing with chloride reduction efforts. The Town is applying an integrated management approach. Innovative techniques for chloride reduction efforts will continue to develop over time; therefore, this implementation plan will be reviewed and modified every five years until the chloride water quality standards in the Pinnacle Brook Watershed and the Watershed for the Unnamed Tributary to the Shawsheen River are met.

1.1 Federal Regulatory Authority

The United States Environmental Protection Agency (EPA) regulates stormwater through the National Pollutant Discharge Elimination System (NPDES) program, which is authorized by the Clean Water Act. The NPDES program requires permitting of stormwater discharges from separate municipal storm sewer systems (MS4s) in urbanized areas and from industrial and construction activities. One hundred percent

of the Town is urbanized and is covered by the MS4 Program.

EPA has residual designation authority under Section 402(p)(2)(E) of the Clean Water Act to designate pollution sources for issuance of individual stormwater permits in order to achieve compliance with water quality standards.

Section 303(d)(1)(c) of the Clean Water Act provides that Total Maximum Daily Load (TMDL) studies must be completed when a water body is not meeting water quality standards. The TMDL must identify the amount of pollutant(s) allowable to meet the state water quality standard.

Section 401 of the Clean Water Act requires that the state water quality agency (MADEP) certify that any federally permitted activity which may result in a discharge will not violate water quality standards. A 401 water quality certificate can contain conditions and monitoring requirements to ensure that the permitted activity will meet the load reductions in the TMDL.

1.2 State Regulatory Authority

MGL c. 85, § 7 provides that "No person shall store sodium chloride, calcium chloride or chemically treated abrasives or other chemicals used for the removal of snow or ice on roadways in such a manner or place as to subject a water supply or groundwater supply to the risk of contamination."

310 CMR 22.00 regulates the storage of chemicals used for snow and ice removal within established wellhead protection zones unless storage is within a structure designed to prevent the generation and escape of contaminated runoff or leachate.

State law also grants municipalities the authority to create bylaws relative to snow and ice control, per MGL c. 40, § 21 (2), (3), and (4).

1.3 Town Regulatory Authority

The Town of Tewksbury's government consists of a Board of Selectmen and a Town Manager. The Department of Public Works is responsible for maintaining town roads, facilities and infrastructure. Various entities within the Town have the responsibility for overseeing implementation of this Chloride Reduction Plan, including the following:

- Brian Gilbert, Director of Public Works
- David Lizotte, Assistant Director of Public Works
- Kevin Hardiman, P.E., Town Engineer
- Arthur G. Markos, Project Manager

Appendix H Part IV.4.b. of the 2016 MS4 Permit, requires that privately maintained facilities that discharge to the MS4: i. Establish an ordinance, bylaw, or other regulatory mechanism requiring measures to prevent exposure of any salt stockpiles to precipitation and runoff at all commercial and industrial properties within the regulated area, and iii. in Part 2.3.6, Stormwater Management in New

Development and Redevelopment, requires establishment of procedures and requirements to minimize salt usage and require the use of salt alternatives where the permittee deems necessary.

To satisfy this requirement, at Town Meeting on June 22, 2020, the following language was adopted as part of Section 19.130.C. Operation and Maintenance Plans, under Chapter 19, Stormwater Management and Erosion Control, of the Town's General Bylaws to aid in chloride reduction in Tewksbury:

Use and Storage of Road Salt

1. Salt usage shall be minimized whenever feasible. Salt alternatives shall be used where deemed necessary by the Town.
2. Operation and Maintenance Plans for commercial or industrial projects must include a provision to prevent the exposure of any salt stockpiles stored on the property to precipitation and/or stormwater runoff.

1.4 Assessment of Progress

The MS4 permit requires the Chloride Reduction Plan to be fully implemented by June 30, 2023. To ensure compliance, the Town will report their progress in implementing this Plan annually in the Town's Annual MS4 Report. When a TMDL is developed for either of these impaired water bodies, this plan will be updated as needed to meet certain requirements of the TMDL, which may be required as part of a future reissuance of the MS4 Permit.

Appendix H of the 2016 MS4 Permit contains requirements related to discharges to certain water quality limited waterbodies. At any time during the permit term, the Town recognizes they may be relieved of additional requirements in Appendix H Part IV.5.a-b. as follows:

a. The permittee is relieved of its additional requirements as of the date when one of the following criteria are met:

   i. The receiving water is determined to be no longer impaired due to chloride by MassDEP and EPA concurs with such a determination.
   ii. An EPA approved TMDL for the receiving water indicates that no additional stormwater controls are necessary for the control of chloride from the permittee's discharge based on waste load allocations as part of the approved TMDL.
   iii. The permittee's discharge is determined to meet applicable water quality standards and EPA agrees with this determination. The permittee shall submit data to EPA that accurately characterizes the concentration of chloride in their discharge during the deicing season (November – March). The characterization shall include water quality and flow data sufficient to accurately assess the concentration of chloride in the deicing season during storm events of multiple sizes and for the duration of the storm events including the first flush, peak storm flow and return to baseflow and include samples collected during deicing activities.

b. In such a case, the permittee shall document the date of the determination, the date of the approved TMDL or the date of EPA concurrence that the discharge meets water quality

standards in its SWMP and is relieved of any additional requirements of Appendix H part IV as of that date and the permittee shall comply with the following:

i. The permittee shall identify in its SWMP all activities implemented in accordance with the requirements of Appendix H Part IV to date to reduce chloride in its discharges, including implementation schedules for nonstructural BMPs.

ii. The permittee shall continue to implement all requirements of Appendix H part IV required to be done by the determination date, date of the approved TMDL, or date of EPA concurrence that the discharge meets water quality standards, including ongoing implementation of identified non-structural BMPs and routine maintenance and replacement of all structural BMPs in accordance with manufacturer or design specifications.

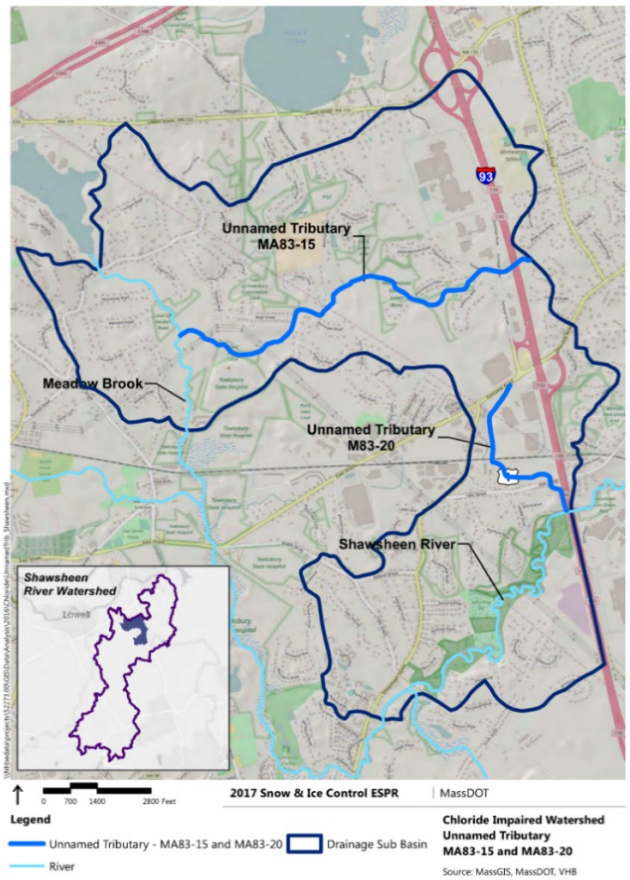
2.0 WATERSHED INFORMATION

The Unnamed Tributary to Meadow Brook, also known locally as Pinnacle Brook, is a stream segment 2.1 miles in length that stretches from a small wetland east of I-93 to the confluence with Meadow Brook (Figure 2-1). The Unnamed Tributary to the Shawsheen River is a stream segment 0.9 miles in length that stretches from Dascomb Road in Andover to the confluence with the Shawsheen River in Tewksbury (Figure 2-1).

Interstate 93 runs through the impaired watersheds, shown in Figure 2-1. Salt and winter maintenance activities conducted by the State may be contributing to the chloride impairments, but are not the Town's responsibility. There are also roads owned and operated by the Town of Andover within the impaired watersheds to the east of Interstate 93. Activities conducted by the Town of Andover are not the responsibility of the Town of Tewksbury.

Appendix A includes a map of the two watersheds and the stormwater infrastructure and discharge points owned by the Town within these watersheds.

Figure 2-1. Tewksbury, MA - Chloride Impaired Watersheds



2.1 Paved Surface Inventory

The Town is responsible for winter road maintenance on approximately 23.6 lane-miles of road within these impaired watersheds. A list of streets located within the watersheds of these chloride impaired waterways is included in Appendix B. The Massachusetts Department of Transportation (MassDOT) is currently responsible for winter road maintenance on 0.9 total lane-miles of roadway within Tewksbury which are located within the watersheds of these chloride impaired waterways.

3.0 CURRENT TOWN-WIDE WINTER ROAD MAINTENANCE POLICES

3.1 Current Practices

The Town continues to focus on optimizing their winter operations at the DPW Facility and throughout town through implementation of Best Management Practices focused on salt reduction and improved salt storage. The Town's current Winter Road Maintenance Standard Operating Procedures are included in Appendix C. The Town implements the following winter road maintenance BMPs town-wide:

- Vehicles and equipment have salt spun off inside the salt shed to remove excess salt before washing;
- Vehicles and equipment are washed manually at three power washer locations using only enough water to remove material buildup;
- Washing vehicles and equipment so wash water is infiltrated in the designated wash down area and does not run off the site;
- Cleaning up the salt/sand loading area and the area around the salt/sand pile and loading areas to minimize the potential for salt run-off; and
- Keeping salt under cover as much as possible.

3.2 Equipment

The Town has various types of spreaders, spreader control units, and other equipment that is employed to reduce the amount of deicing materials applied within chloride impaired watersheds.

Plowing Capabilities

The Town currently utilizes eleven (11) larger trucks and seven (7) smaller trucks to move snow from the traveled roadway. The larger trucks are equipped with 11-foot plows, and the smaller trucks are equipped with 9-foot plows.

Salt/Sand and Pre-Wetting Spreaders

The Town currently utilizes twelve (12) larger trucks for applying sand to the roadway. Each truck is equipped with a spreader that is calibrated prior to the deicing season and every month thereafter. The Town also utilizes two (2) trucks to distribute anti-icing products.

3.3 Calibration

The Town calibrates their ground control spreaders on a regular basis.

3.4 Storage and Site Maintenance

The Town stores salt in two separate covered salt sheds at the DPW facility at 999 Whipple Road, which is not located within either of the watersheds of the chloride impaired waterways. Loading areas are swept as needed to prevent salt build-up and runoff. The Town follows best management practices for storage and management of dry salt, pre-wet salt, salt brine, and salt/sand mixtures according to the practices included in Tewksbury's Winter Road Maintenance Standard Operating Procedures, as provided in Appendix C.

4.0 CHLORIDE REDUCTION BMPS FOR CHLORIDE IMPAIRED WATERSHEDS

This section discusses best management practices for chloride reduction that are designed to maintain current safe levels of service while reducing the discharge of chloride to impaired waters. Chloride reduction is dependent on many variables, including degree of implementation, level of operational training, tracking of salt use, type of equipment used and proper equipment maintenance and calibration. The Town recognizes that the best management practices (BMPs) specified in this plan require well-managed operations.

4.1 MS4 Permit Requirements

The Town will perform the following for all municipally owned surfaces within each chloride impaired watershed:

1. Track the amount of salt applied to all municipally owned and maintained surfaces, and report to EPA the amounts used.

2. Develop a comprehensive list of other planned activities for salt reduction on municipally owned and maintained surfaces. Activities will include:

    - Training for municipal staff and/or contractors engaged in winter maintenance activities;
    - Designation of no-salt and/or low salt zones;
    - Street signage to be installed on streets within chloride impaired watersheds;
    - Modification of snow plow and sander routes to have one contractor or town employee use low salt methods for deicing.
    - Operational changes such as pre-wetting, pre-treating the salt stockpile, increasing plowing prior to de-icing, monitoring of road surface temperature, etc.;
    - Adoption of guidelines for application rates for roads and parking lots;
    - Implementation of new or modified equipment providing pre-wetting capability, better calibration rates, or other capability for minimizing salt use;
    - Regular calibration of spreading equipment;
    - Measures to prevent exposure of salt stockpile (if any) to precipitation and runoff; and
    - An estimate of the total tonnage of salt reduction expect by each activity;

3. Provide a schedule for plan implementation with full implementation by the end of the permit term.

This includes immediate implementation of operation and training measures, continued annual progress on other measures, and full implementation of the Plan by the end of the 5-year permit term covered by the 2016 MS4 Permit (June 30, 2023).

Tewksbury also recognizes responsibility for targeting chloride reduction at privately maintained facilities that discharge to the MS4 through implementation of the following:

- Establishing a bylaw or other regulatory mechanism requiring measures to prevent exposure of any salt stockpiles to precipitation and runoff at commercial and industrial properties within the regulated area;
- Supplementing the Town's Commercial/Industrial education program with an annual message to private road salt applicators and commercial and industrial site owners on the proper store and application rates of winter deicing material. The educational materials shall be disseminated in the November/December timeframe and shall describe steps that can be taken to minimize salt use and protect local waterbodies; and
- Establishing procedures and requirements to minimize salt usage and require the use of salt alternatives where the Town deems necessary.

4.2 Salt Reduction BMPs for Implementation

Sections 4.2.1 through 4.2.7 outline the operational changes within chloride impaired watersheds which will be implemented to aid in chloride reduction on municipal roads and at municipal facilities.

4.2.1 Recordkeeping and Salt Accounting Systems

The Town will begin to track the amount of salt applied to all municipally owned and maintained surfaces. The University of New Hampshire has developed a program that can be used by states, municipalities, and private sectors to track and report salt use. Beginning in Permit Year 5 (July 1, 2022 to June 30, 2023), all salt application, whether it be by the Town or the private sector, will be tracked and reported using the UNH Technology Transfer Center Online Tool (https://roadsalt.unh.edu). Tewksbury will use the most recent and accessible online reporting tool for tracking salt usage. The salt tracking tool can be programmed to include target application rates into each of the specific sites that are added in the tool. The Town will designate the watershed for Pinnacle Brook and the watershed for the Unnamed Tributary to the Shawsheen River as their own sites in Tewksbury. Information that the Town will record during winter maintenance practices and report using the online tool includes:

- Site Name;
- Date and Time;
- Temperature;
- Weather;
- Target Application Rate;
- Action Items including: Alternate Chemical, Pre-Treat/Pre-Wet, Anti-Ice, Salt and/or Sand, Clear Walks/Entry/Stairs, Evaluate/Patrol, Plow and Snow Removal; and
- Additional Notes.

The Town recognizes that record keeping is critical to the successful implementation of best management practices. The Town will enter salt application using the UNH tracking tool after the conclusion of each storm.

MassDOT currently tracks all salt usage and application rates for state roads within each of the six districts. In the watersheds with chloride impaired waterways within Tewksbury and Andover, MassDOT applies salt to Interstate 93. There are 0.9 lane miles of Interstate 93 within Tewksbury/Andover that are located within the watersheds for the Unnamed Tributary to Meadow Brook or the Unnamed Tributary to the Shawsheen River. MassDOT is responsible for tracking the salt applied to Interstate 93.

4.2.2 Training

The Town will focus on employee training on the balance between environmental awareness and level of service to the public. Annual training will be conducted for employees involved in winter maintenance practices. Training will include, but is not limited to, the following topics:

- Interpretation of weather and pavement conditions when making decisions;
- Best management practices, including how to correctly calibrate equipment;
- Location of and treatment in environmentally sensitive areas;
- When and how to apply chemicals;

- Use of liquid chemicals for pre-wetting and anti-icing; and
- Record keeping.

4.2.3 Designated Low-Salt Zones

Municipally maintained streets within each of the chloride impaired watersheds will be designated as Low Salt Zones. A list of these streets is included in Appendix B. Salt application rates in the Low Salt Zones will be consistent with the dispensing rates outlined in Section 4.2.4. The Town will modify existing snow plow and sander routes to have one contractor or town employee use low salt methods for deicing. Signage will also be installed on streets within the chloride impaired watersheds to further identified the Low Salt Zones.

4.2.4 Operational Changes

The Town recognizes that knowing current and expected conditions is essential for planning snow and ice control operations. Weather and road conditions change constantly and will be monitored. Temperature and weather changes, pavement temperatures, traffic and road surfaces can all affect road conditions. The decision to initiate treatment can only be made if accurate information is available. Treatment options below may be modified as necessary to address road conditions as they develop.

Increased Mechanical Removal of Snow Prior to De-Icing

The Town will remove as much snow as possible using mechanical means (plowing, blowing, shoveling, etc.) with the onset of a storm and prior to applying de-icing agents to reduce the need for road salt.

Roadway Pre-Treatment

The Town will pre-treat roadway surfaces with anti-icing agents, such as brine, prior to precipitation to prevent the formation of bonded snow and ice to the roadway surface.

Pre-Treatment of Salt

The Town will apply pre-wetting agents on salt piles to help them work more efficiently and to reduce road salt scatter and bounce.

Monitoring Road Surface Temperature and Salt Application Rate

The Town will monitor road surface temperature during storm events to find the correct treatment options for those certain circumstances. Road salt is only applied when pavement temperatures are above 15 degrees Fahrenheit. Table 4-1 includes recommended application rates for de-icing at different pavement temperatures. The below application rates will be followed in all Low Salt Use areas, or areas that are located within the watersheds impaired for chloride. A list of Low Salt Use streets is included in Appendix B.

Table 4-1. Application Rates for Deicing						
Pavement Temp. (°F) and Trend (↑↓)	Weather Condition	Maintenance Action	Application Rates in lbs/1000 square foot area			
			Salt Pre-wetted/Pretreated with Salt Brine	Salt Pre-wetted/Pre-Treated with Other Blends	Dry Salt	Winter Sand (abrasives)
>30° ↑	Snow	Plow, treat intersections only	0.75	0.5	0.75	Not recommended
>30° ↑	Freezing Rain	Apply chemical	1.25	1.0	1.5	Not recommended
30° ↓	Snow	Plow & apply chemical	1.25	1.0	1.5	Not recommended
30° ↓	Freezing Rain	Apply chemical	1.5	1.25	1.75	Not recommended
25-30° ↑	Snow	Plow & apply chemical	1.25	1.0	1.5	Not recommended
25-30° ↑	Freezing Rain	Apply chemical	1.5	1.25	1.75	Not recommended
25-30° ↓	Snow	Plow & apply chemical	1.25	1.0	1.5	Not recommended
25-30° ↓	Freezing Rain	Apply chemical	1.75	1.5	2.25	3.25
20-25° ↑	Snow or Freezing Rain	Plow & apply chemical	1.75	1.5	2.25	3.25 for freezing rain
20-25° ↓	Snow	Plow & apply chemical	2.0	2.0	2.75	Not recommended
20-25° ↓	Freezing Rain	Apply chemical	2.5	2.0	3.0	3.25
15-20° ↑	Snow	Plow & apply chemical	2.0	2.0	2.75	Not recommended
15-20° ↑	Freezing Rain	Apply chemical	2.5	2.0	3.0	3.25
15-20° ↓	Snow or Freezing Rain	Plow & apply chemical	2.5	2.0	3.0	3.25 for freezing rain
0-15° ↑ ↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	3.0	Not recommended	5.0 spot treatment
<0°	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	4.5	Not recommended	5.0 spot treatment as needed

4.2.5 Equipment

The Town has various types of spreaders, spreader control units, and other equipment that is employed to reduce the amount of deicing materials applied in the chloride impaired watersheds. The Town does not have plans to purchase new winter maintenance equipment, but as equipment improvements become available to the Town in the future, chloride reduction devices will be prioritized. Information on future potential chloride reduction practices, and other background information regarding chloride reduction and salt use are included in Appendix G.

4.2.6 Calibration

Sand/salt spreaders that are used within the watershed of chloride impaired water bodies will be calibrated prior to the deicing season and every month thereafter. Anti-icing dispensers and pre-wetting devices will be calibrated prior to the deicing season and recalibrated every month thereafter. Recalibration will be done if any changes are made to the equipment or if a different deicing material is used. In addition to manufacturer specifications, see Appendix D for Hydraulic-Run Spreader Calibration and Appendix E for Pony Motor-Run Spreader Calibration. A record will be kept of the calibration results with the vehicle and referred to for the application settings recommended for various weather conditions.

4.2.7 Storage and Site Maintenance

The Town stores salt at the DPW facility at 999 Whipple Road, which is not located within either of the watersheds of the chloride impaired waterways. The Town will continue to follow best management practices for storage and management of dry salt, pre-wet salt, salt brine, and salt/sand mixtures according to the practices included in Tewksbury's Winter Road Maintenance Standard Operating Procedures, as provided in Appendix C.

Snow Storage and Disposal

The Town does not typically haul snow from one location to dispose of it in another location. During snow removal operations within the watersheds of chloride impaired water bodies, the Town will ensure that:

- Snow is not pushed or dumped into waterbodies or wetlands, into stormwater drainage swales or ditches, or on top of catch basins.
- Snow is not stored near drinking water areas, waterbodies, or wetlands.
- Snow storage is not located in areas that are unstable, areas of potential erosion, or high points where snow may melt and collect debris as runoff before it enters the stormwater system.

4.3 Estimated Percent Chloride Reduction Potential by BMP type

Estimated percent reductions outlined in the matrix below are dependent on many factors. Weather severity, road surface condition, equipment type, proper calibration of equipment, operator skill and training level, all contribute to the success of efficiently and effectively using chlorides within impaired watersheds.

Table 4-2 outlines recommended practices in which information is most readily available for achievable reductions without decreasing the level of service. Estimated reduction percentages were derived by the New Hampshire Department of Environmental Services from a combination of literature review, information provided by equipment manufacturers, and other states' experience implementing reduction programs.

Table 4-2. Chloride BMPs Reduction Potential		
Chloride Reduction BMPs	Definition	Potential % Chloride Reduction
Pre-Wetting	Application of salt brine or proprietary chemical to dry salt as it is being applied to the roadway	20% - 30%
Pre-Treating	Application of salt brine or proprietary chemical to dry salt either before, during, or after it has been loaded into the truck	10% - 30%
Anti-Icing	Application of salt brine or proprietary chemical up to 48 hours in advance of onset storm.	10% - 30%
Equipment Calibration	Ensures equipment application of chloride is accurate	5-20%
Training, Improved Storage and Handling Practices	Training staff about various best management practices, improving storage and handling practices for loading and unloading salt	10% - 25%*

Note % reduction assumed does not take into account existing practices.
* Highly dependent on existing procedures and level of adoption.

4.4 Privately Maintained Surfaces

The Town recognizes that measures must be taken by private road salt applicators and commercial and industrial property owners in order to reduce their chloride application. Sections 4.4.1 through 4.4.3 outline the existing practices the Town has implemented to minimize exposure of salt on private parcels to precipitation. These practices will be continued in the chloride impaired watersheds.

4.4.1 Regulatory Mechanism for Salt Stockpiles

Section 19.130 of the Town's General Bylaws requires measures to prevent exposure of any salt stockpiles to precipitation and runoff at all commercial and industrial properties.

The bylaw also includes language which gives the Town the authority to require the use of salt alternatives where it is deemed necessary.

4.4.2 Commercial/Industrial Education Program

The Town distributes an annual flyer to businesses and homeowners which includes information on the proper storage and application rates of winter deicing material and steps that can be taken to minimize salt use and protect local water bodies.

4.4.3 Regulatory Mechanism for Salt Use and Salt Alternatives

Section 19.130 of the Town's General Bylaws includes language which gives the Town authority to require the use of salt alternatives where it is deemed necessary. The Town also developed Winter Road Maintenance Standard Operating Procedures, which are implemented throughout Tewksbury by Town staff and contractors who handle winter road maintenance.

4.5 Public Education

The goals of the public engagement related to the Chloride Reduction Plan include:

- Altering existing public expectation and demand for state and local road and public and private parking lot winter maintenance. This includes changing the perception that bare pavement is necessary during storm events and education to the driving public about the issues surrounding excessive salt use and the environment.

The Town posts public education materials relating to stormwater on their website and has created a chloride specific flyer to be handed out to private road salt applicators, and commercial and industrial site owners on the proper storage and application rates of winter deicing material. The Town also posts content regarding stormwater pollution on social media and public access TV. The public education materials are included in Appendix F.

4.6 Additional Chloride Reduction Information

This plan designates the practices which are feasible in Tewksbury and will be implemented by the Town to provide chloride reduction within the watersheds with impaired water bodies. However, additional operational BMPs and equipment improvements may become available to the Town in the future which could also provide chloride reduction. Information on future potential chloride reduction practices, and other background information regarding chloride reduction and salt use are included in Appendix G.

5.0 IMPLEMENTATION SCHEDULE

The information presented in Table 5-1 outlines objectives of the Chloride Reduction Implementation Plan as well as targeted dates for implementation of each item.

Table 5-1. Chloride Reduction Plan Implementation Timeframes		
Objective: Creation of Educational Manuals, Training Programs and Procedural/Operational Strategies		Implementation Date
1	Training and Certification Program for Municipal Staff	2023 and ongoing
2	Develop training for inexperienced drivers, such as high school students	2023 and ongoing
3	Reduce driving speed limits during inclement weather conditions	2023 and ongoing
4	Develop and adopt a formal snow and ice removal policy	2023 and ongoing
5	Revise the site plan review process to include designs and/or management strategies that may decrease chloride use in chloride impaired watersheds	2023
6	Require mandatory training for employees and contracted staff that assist with winter maintenance	2023 and ongoing
7	Review and update the Town's Winter Road Maintenance Standard Operating Procedures annually	2022 and ongoing
8	Report Annually Salt Usage	2023 and ongoing
9	Implement operational changes such as pre-wetting, pre-treating the salt stockpile, increasing plowing prior to de-icing, monitoring of road surface temperature, etc.	2023 and ongoing
10	Provide an estimate of total tonnage of salt reduction from each activity.	2023 and annually in MS4 Annual Report

5.1 Prioritization

The Town recognizes the importance of prioritizing the areas as well as the BMPs that will have the greatest impact in chloride load reduction in these watersheds. The highest priority areas for the Town are the roadway and parking surfaces within the watersheds tributary to Pinnacle Brook and the Unnamed Tributary to the Shawsheen River and the Town will begin implementing BMPs in these areas first. The areas nearest the brook will have the most acute impact on water quality and the amount of chloride in the brook because of the short attenuation time.

6.0 REFERENCES

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APPENDIX A

Chloride Impaired Watersheds and Stormwater Discharge Points

PINNACLE BROOK

UNNAMED TRIBUTARY TO SHAWSHEEN RIVER

N

- Town-Owned Outfall
- Catch Basins
- Roads in Chloride Impaired Watersheds
- Pinnacle Brook - MA83-15
- Unnamed Tributary to the Shawsheen River - MA83-20
- Culvert
- Storm Main
- Pinnacle Brook Watershed
- Unnamed Tributary to Shawsheen River Watershed
- Hydrologic Connection
- Marsh/Bog
- Wooded marsh
- Open Water
- Reservoir (with PWSID)

0.25 0 0.25
Miles

FIGURE 1

TOWN OF TEWKSBURY
CHLORIDE REDUCTION PLAN

CHLORIDE IMPAIRED WATERSHEDS

JUNE 2021 SCALE: NOTED

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APPENDIX B

Low Salt Use Street Inventory

Tewksbury, MA - Inventory of Streets in Watersheds with Chloride Impaired Waterways	
ANTHONY ROAD	LEVEL LANE
APACHE WAY	LOWE STREET
BALLARD STREET	LYNNES WAY
BARRY DRIVE	MAGNA VISTA CIRCLE
BLIGH STREET	MAPLE STREET
BONNIE LANE	MARTHA AVENUE
BRADFORD ROAD	MEADE STREET
BRECKENRIDGE ROAD	MEREDITH ROAD
BRENTWOOD ROAD	MILL STREET
BRIANA LEE CIRCLE	MITCHELL G DRIVE
BRITTANY LEE WAY	MOONLIGHT DRIVE
CAPTAIN CIRCLE	OLD STAGECOACH ROAD
CARDIGAN ROAD	OVERLOOK DRIVE
CART PATH ROAD	PENNACOOK ROAD
CARTER STREET	PETERSON WAY
CATAMOUNT ROAD	PINNACLE STREET
CLEVER LANE	POLARIS LANE
COMPASS LANE	REDGATE ROAD
DAVID STREET	ROCKVALE CIRCLE
DIKE COURT	ROCKVALE ROAD
DOUGLAS ROAD	ROUILLARD CIRCLE
DUNVEGAN ROAD	ROUNSEVELL ROAD
EAST STREET	SHADY LANE
ELLIS AVENUE	SHAWSHEEN AVENUE
EMILY ROAD	SHAWSHEEN STREET
FIELDSTONE CIRCLE	SHEFFIELD ROAD
GREYLOCK ROAD	SOUTH STREET
HEATHER ROW	STARR AVENUE
JENNIES WAY	SUNSET CIRCLE
JILLS WAY	TANAGER ROAD
JUDIQUE ROAD	TRINITY COURT
KEARSAGE STREET	TRUMAN AVENUE
KENDALL ROAD	VALE STREET
KINGFISHER ROAD	WHITEGATE ROAD
LANAKA ROAD	WHITTEMORE STREET
LANCASTER DRIVE	WILLIAM G DRIVE
LEIGHTON LANE	WINTER LANE

APPENDIX C

Tewksbury Winter Road Maintenance Standard Operating Procedures

Winter Road Maintenance

Standard Operating Procedures

Town of Tewksbury, MA

Department of Public Works

999 Whipple Road

Tewksbury, MA 01876

Updated June 30, 2020

Table of Contents

Winter Road Maintenance – Town of Tewksbury, MA

Introduction

The Town utilizes its own equipment and personnel along with contractors to handle winter road maintenance, which includes snow plowing, snow removal and salt/sand spreading.

Personnel

The Town's Department of Public Works Highway Division and Water & Sewer Division are responsible for snow and ice removal. Employees performing the procedures in this SOP shall attend yearly stormwater pollution prevention training (IDDE training), private contractors will also be provided with materials to inform them about the risks of stormwater pollution during winter road operations.

Equipment

The municipality owns and maintains ice control and snow removal equipment listed in Table 2. Equipment maintenance shall be conducted consistent with the Vehicles and Equipment maintenance. The wash bay/ area is located at: **999 Whipple Rd, Tewksbury, MA 01867**

- **Plows**
  When conditions warrant, plows are installed on the **11** larger trucks to move snow from the traveled roadway. Average time to install a plow is approximately **20** minutes. **7** smaller trucks are available for plowing of residential streets and clearing public lots.

- **Spreaders**
  When conditions warrant, sand spreaders are installed on the **12** larger trucks to spread sand on the traveled roadway. Each sand spreader is calibrated prior to the deicing season and every month thereafter. Sand spreaders dispense **a variable amount for each storm and weather event.**

- **Anti-Icing Dispensers and Pre-Wetting Devices**
  The municipality has **2** pieces of equipment for this task. Each is a **1000** gallon truck-mounted dispenser for anti-icing chemical application. The tanks are mounted on **2** Trucks distributes anti-icing product onto town streets and bridges utilizing spray nozzles in accordance with this SOP. Anti-icing dispensers are calibrated prior to the deicing season. Anti-icing dispensers shall be calibrated to apply **20** gallons per lane mile. Pre-wetting application shall be calibrated to dispense rates are **8** gallons of pre-wet liquid to 1 ton of salt. Sand spreaders dispense **a variable amount for each storm and weather event.**

Public Works Equipment List

Equipment Number	Make	Description	Additional Equipment	Primary Use
20	*Ford 550*	*Dump Truck*	*4 Yard Sander* *9 Ft Plow*	*Salting and Plowing*
60	*Ford 550*	*Dump Truck*	*4 Yard Sander* *9 Ft Plow*	*Salting and Plowing*
50	Mack	6 Wheel Dump Truck	8 Yard Sander 11 Ft Plow	*Salting and Plowing*
51	Mack	10 Wheel Dump Truck	12 Yard Sander 11 Ft Plow 11 Ft Wing Plow	*Salting and Plowing*
52	Western Star	10 Wheel Dump Truck	12 Yard Sander 11 Ft Plow 11 Ft Wing Plow	*Salting and Plowing*
53	Mack	6 Wheel Dump Truck	6 Yard Sander 11 Ft Plow	*Salting and Plowing*
54	Western Star	10 Wheel Dump Truck	12 Yard Sander 11 Ft Plow 11 Ft Wing Plow	*Salting and Plowing*
55	Mack	6 Wheel Dump Truck	6 Yard Sander 11 Ft Plow	*Salting and Plowing*
56	Mack	6 Wheel Dump Truck	6 Yard Sander 11 Ft Plow	*Salting and Plowing*
57	Peterbuilt	6 Wheel Dump Truck	10 Yard Sander 10 Ft Plow 1000 GAL Tank	*Salting and Plowing*
58	Mack	6 Wheel Dump Truck	6 Yard Sander 11 Ft Plow	*Salting and Plowing*
59	Mack	6 Wheel Dump Truck	6 Yard Sander 11 Ft Plow	*Salting and Plowing*
79	Volvo	6 Wheel Dump Truck	1000 GAL Tank	*Salting and Plowing*

Materials

The major materials are used in snow and ice controls are coarse sand, coarse salt, anti-icing agent, road salt. These materials are stockpiled in advance of an event and are immediately available when needed and stocks are replenished between events.

- **Sand**
  Sand is used as an abrasive for traction on slick roadways. Very little to no sand used in Town. Sand is stored in the covered facility located at the **DPW Yard.** Loading areas and yards are swept **daily after each use** to prevent sand build-up and run-off.

- **Salt**
  Salt is used to expedite the melting of snow and ice from the street surface and also to keep the ice from forming a bond to the street surface. Approximately **5000** tons of **Road Salt** are anticipated to be used per year and are ordered from **suppliers** prior to each deicing season. Salt is stored in the covered facility located at: **DPW Yard.** Loading areas and yards are swept **daily after each use** to prevent salt build-up and run-off.

- **Anti-icing and Pre-Wetting Chemical**
  Approximately **2300** gallons of **Liquid Calcium** is estimated to needed for pre-wetting. These chemicals are stored at **DPW Yard** in gallon storage tanks equipped with appropriate spill control.

- **Salt Alternatives**
  Currently No Salt Alternatives are being used at this time but the town is exploring options

Procedures

Anti-Icing and Pre-Wetting

- Whenever possible, the anti-icing product is applied to the roadway prior to the beginning of a storm to prevent snow from bonding to the roadway surface, and also used when heavy frost or black ice is expected to be an issue for commuters. **DPW Director or Highway Foremen** will instruct staff when anti icing is appropriate. Anti-icing will not be done prior to freezing rain or when pavement temperatures are below **32** degrees F.

- Prior to anti-icing application, equipment will be checked to ensure proper working order and ensure proper calibration of equipment. All fluid levels will be checked and filled to proper levels, all lights must be in working order. A visual walk-around inspection of the truck or equipment must be made. Any repairs must be made and reported to a supervisor or mechanic before leaving the yard.

- Anti-icing chemical will only be applied to priority routes. The priority routes list is found here:

Chandler St.	Vale St.	Chapman Rd.	Andover St.
Pond St.	South St.	Astle St.	River Rd.
East St	Salem St.	Pike St.	Fiske St.
Shawsheen St.	Brown St.	N. Billerica Rd.	International Way
Livingston St.	Lake St.	Woburn St.	Catamount Rd
Maple St.	Hill St.	French St.	Trull Rd.
Lowe St.	Bridge St.	Marston St.	
Ballard St.	Whipple Rd.	North St.	

- Anti-Icing vehicle optimal speed is **15 MPH**

- Before parking any truck or equipment after use, all fluid levels will be checked and filled. All minor repairs will be done by the operator. Any repairs the operator cannot perform will be written up on the proper forms and turned in to **Mechanic Foreman** and they will determine importance and will assign the repairs according to schedule. All deicing chemical will be washed from equipment at the wash bay or designated wash area.

Salt Application

- Whenever conditions warrant, salt is applied to the roadway prior to accumulation of snow to prevent compacted snow from bonding to the roadway surface. **Highway Foreman** will instruct staff when salt application is appropriate. Salting will not be done when pavement temperatures are above **32** degrees F or below **15** degrees F.

- Prior to salt application, equipment will be checked to ensure proper working order and ensure proper calibration of equipment. All fluid levels will be checked and filled to proper levels, all lights must be in working order. A visual walk-around inspection of the truck or equipment must be made. Any repairs must be made and reported to a supervisor or mechanic before leaving the yard.

- The standard salt application speed is: **15** mph.

- Follow the prioritized route or schedule. This schedule is located at: **DPW Ofiice**

- Before parking any truck or equipment after use, all fluid levels will be checked and filled. All minor repairs will be done by the operator. Any repairs the operator cannot perform will be written up on the proper forms and turned in to **Mechanic Foreman** and they will determine importance and will assign the repairs according to schedule. All deicing chemical will be washed from equipment at the wash bay or designated wash area.

Snow Plowing

- As the storm develops and **2-4** inches of snow has accumulated, all of the drivers and available equipment will begin to plow their assigned routes.

- Prior to plowing operations, equipment will be checked to ensure proper working order. All fluid levels will be checked and filled to proper levels, all lights must be in working order. A visual walk-around inspection of the truck or equipment must be made. Any repairs must be made and reported to a supervisor or mechanic before leaving the yard.

- Avoid plowing, pushing, blowing or storing excess snow, deicer, or other debris in or near creeks, watercourses or storm drainage systems.

- Reduce plowing speed in sensitive areas (near creeks, wetlands or other water courses) to prevent snow and deicing materials from entering waterways.

- The standard plowing speed is: **15** mph.

- Follow the prioritized route or schedule. This schedule is located at: **DPW Office.**

- Before parking any truck or equipment after use, all fluid levels will be checked and filled. Blades or bolts, which need replacing, will be taken care of unless told to do otherwise. Chains that need repairs will be repaired. All minor repairs will be done by the operator. Any repairs the operator cannot perform will be written up on the proper forms and turned in to **Mechanic Foreman** and they will determine importance and will assign the repairs according to schedule. All deicing chemical will be washed from equipment at the wash bay or designated wash area

Record Keeping and Documentation

- Maintain a master schedule of prioritized snow and sanding routes and the miles or roads plowed or sanded. **DPW Office**

- Keep copies of manufacturer's recommendations for equipment calibration, plowing speed and salt/sand application rates. **DPW Office**

- Keep records of the amounts of salt, sand, liquid deicer, and salt alternatives applied per season**. DPW Office**

- Keep a list of all employees trained in the facility's Stormwater Pollution Prevention binder or computer file

APPENDIX D

Hydraulic-Run Spreader Calibration

Hydraulic-Run Spreader Calibration

NH Best Management Practices

WHY CALIBRATE?

You can't reduce your salt use if you don't know how much salt you actually use! The goal of calibrating is to know how much material you are putting down on a roadway or parking lot for every setting on your truck that you use. This is why calibrating your equipment is the first step to reducing salt use and saving money!

REMEMBER:

Each truck must be independently calibrated for each material it will be used to spread (the salt calibration chart *will* be different than the sand calibration chart).

Calibrations should be preformed annually, or after a spreader is serviced.

CALCULATIONS:

There are a few simple calculations you must perform in order to complete the calibration. Once all of the necessary data is recorded, head back inside and warm up! Refer to the reverse side of this fact sheet for calculation instructions.

Step 1: Load the Truck

Partially load the truck. Half of a full load should be more than adequate for calibration purposes.

Step 2: Set Your Controls

Gate Height: Set the gate height to its lowest practical setting (~ 2"). This should be kept constant throughout the calibration process. If you find that not enough material is dispensed with this setting, try 2.5" to 3".

Engine Speed: Warm the truck up and run the engine at the typical rate seen during spreading (approximately 2000 rpm).

Step 3: Measure Spread Width

Measure the width that the material covers during spreading. Do this for each conveyor/auger setting you are calibrating. Round your numbers to the nearest half foot and record them in column "**W**" of the calibration chart (see reverse side).

Step 4: Collect & Weigh Material

You will need either a sheet of canvas, a tarp, or a bucket to collect the material that is dispensed from the spreader, as well as a scale. Weight the object you are using to collect the material in, and record that value in the purple box above the discharge rate column. Collect material for 1 minute. Weigh the collected material and subtract the weight of the tarp/canvas/bucket. Record this value in the first purple column of the calibration chart. Do this 3 times for each conveyor/auger setting that is typically used. Average these three values together and record in the orange column in the calibration chart.

Step 5: Perform Calculations

Go inside and calculate your discharge rate using the calibration chart for each truck speed and conveyor/auger setting you normally use. Refer to the reverse side of this fact sheet for calculation instructions. The formula you will be using is shown below:

$$D = \frac{B \times C}{A}$$

Step 6: Distribute Completed Calibration Cards!

Put a copy of the calibration chart in the truck you just calibrated. Also, leave a copy of the calibration chart in the office so you have a copy incase the original is damaged.

Produced in partnership with:

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

New Hampshire DOT

Technology Transfer Center
New Hampshire LTAP at UNH

Calibration Chart (Hydraulic Type)

Material: _____ Truck/Spreader ID: _____

Date: _____ Performed by: _____

Tarp/Canvas/Bucket Weight: _____

Conveyor or Auger Setting	W	A	Discharge Rate (lb/min.)			B	D					
	Spread Width (ft.)	5.28 × W	Run 1	Run 2	Run 3	Average Discharge Rate *((Run1 + Run2 + Run3)/3)*	Pounds of Material Discharged per 1000 square ft. *(D = B × C ÷ A)*					
							5 mph (C = 12)	10 mph (C = 6)	15 mph (C = 4)	20 mph (C = 3)	25 mph (C = 2.4)	30 mph (C = 2)
1												
2												
3												
4												
5												
EX	14	5.28 × 14= **73.92**	87	92	93	(87+92+93)÷3= **90.67**	12 × 90.67 ÷ 73.92= **14.72**	6 × 90.67 ÷ 73.92= **7.36**	4 × 90.67 ÷ 73.92= **4.91**	3 × 90.67 ÷ 73.92= **3.68**	2.4 × 90.67 ÷ 73.92= **2.94**	2 × 90.67 ÷ 73.92= **2.45**

Calculation Instructions: Multiply the spread width from column **W** by **5.28** and record the answer in column **A**. For each conveyor/auger setting, add **Run 1**, **Run 2**, and **Run 3** together. Divide the result by **3** and record in column **B** to get the average discharge rate. To find the pounds of material discharge per 1000 square feet, you must know the number of minutes it takes to travel one mile at every truck speed you intend to calibrate for. These numbers are designated as variable "**C**". The "**C**" value for each travel speed is shown in red under that given speed. Multiply column **B** by the "**C**" value for that speed and divide by the **A** column to find the number of pounds of material discharged per 1000 square feet for the given speed. Record these numbers in the **D** columns. The full equation is shown here:

$$D = \frac{B \times C}{A}$$

APPENDIX E

Pony Motor-Run Spreader Calibration

Pony Motor-Run Spreader Calibration

NH Best Management Practices

WHY CALIBRATE?

You can't reduce your salt use if you don't know how much salt you actually use! The goal of calibrating is to know how much material you are putting down on a roadway or parking lot for every setting on your truck that you use. This is why calibrating your equipment is the first step to reducing salt use and saving money!

REMEMBER:

Each truck must be independently calibrated for each material it will be used to spread (the salt calibration card *will* be different than the sand calibration card).

Calibrations should be preformed annually, or after a spreader is serviced.

CALCULATIONS:

There are a few simple calculations you must perform in order to complete the calibration. Once all of the necessary data is recorded, head back inside and warm up! Refer to the reverse side of this fact sheet for calculation instructions.

Step 1: Load the Truck

Partially load the truck. Half of a full load should be more than adequate for calibration purposes.

Step 2: Set Your Controls

Gate Height: Set the gate height to its lowest practical setting to start (approximately 1" to 1.5"). After the truck is calibrated for the lowest gate setting, calibrate for each 1/2" increment greater than the lowest setting. Continue until all gate settings you use are calibrated.

Engine Speed: Set the pony motor speed to the maximum setting, or to the setting you would normally use.

Step 3: Measure Spread Width

Measure the width that the material covers during spreading. Do this for each gate setting you are calibrating. Round your numbers to the nearest half foot and record them in column "**W**" of the calibration chart (see reverse side).

Step 4: Collect & Weigh Material

You will need either a sheet of canvas, a tarp, or a bucket to collect the material that is dispensed from the spreader, as well as a scale. Weight the object you are using to collect the material in, and record that value in the purple box above the discharge rate column. Collect material for 1 minute. Weigh the collected material and subtract the weight of the tarp/canvas/bucket. Record this value in the first purple column of the calibration chart. Do this 3 times for each gate opening that is typically used. Average these three values together and record in the orange column in the calibration chart.

Step 5: Perform Calculations

Go inside and calculate your discharge rate using the calibration chart for each truck speed and gate setting you normally use. Refer to the reverse side of this fact sheet for calculation instructions. The formula you will be using is shown below:

$$D = \frac{B \times C}{A}$$

Step 6: Distribute Completed Calibration Cards!

Put a copy of the calibration card in the truck you just calibrated. Also, leave a copy of the calibration card in the office so you have a copy incase the original is damaged.

Produced in partnership with:

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

New Hampshire DOT

Technology Transfer Center
New Hampshire LTAP at UNH

Calibration Chart (Pony Motor Type)

Material: _____ Truck/Spreader ID: _____

Date: _____ Performed by: _____

Tarp/Canvas/Bucket Weight: _____

Gate Opening	W	A	Discharge Rate (lb/min.)			B	D					
	Spread Width (ft.)	5.28 × W	Run 1	Run 2	Run 3	Average Discharge Rate *((Run1 + Run2 + Run3)/3)*	Pounds of Material Discharged per 1000 square ft. *(D = B × C ÷ A)*					
							5 mph (C = 12)	10 mph (C = 6)	15 mph (C = 4)	20 mph (C = 3)	25 mph (C = 2.4)	30 mph (C = 2)
1”												
1.5”												
2”												
2.5”												
3”												
EX	14	5.28 × 14= **73.92**	87	92	93	(87+92+93)÷3= **90.67**	12 × 90.67 ÷ 73.92= **14.72**	6 × 90.67 ÷ 73.92= **7.36**	4 × 90.67 ÷ 73.92= **4.91**	3 × 90.67 ÷ 73.92= **3.68**	2.4 × 90.67 ÷ 73.92= **2.94**	2 × 90.67 ÷ 73.92= **2.45**

Calculation Instructions: Multiply the spread width from column **W** by **5.28** and record the answer in column **A**. For each gate setting, add **Run 1**, **Run 2**, and **Run 3** together. Divide the result by **3** and record in column **B** to get the average discharge rate. To find the pounds of material discharge per 1000 square feet, you must know the number of minutes it takes to travel one mile at every truck speed you intend to calibrate for. These numbers are designated as variable “**C**”. The “**C**” value for each travel speed is shown in red under that given speed. Multiply column **B** by the “**C**” value for that speed and divide by the **A** column to find the number of pounds of material discharged per 1000 square feet for the given speed. Record these numbers in the **D** columns. The full equation is shown here:

$$D = \frac{B \times C}{A}$$

APPENDIX F

Public Education Materials

CHLORIDE POLLUTION IN STORMWATER

Did you know – **stormwater runoff**, or the rain and snowmelt that falls on the streets and is collected by storm drains, is one of the most significant sources of pollution in our waterways?

Did you know – multiple water bodies in Tewksbury are **impaired** for chloride, which means that the concentrations of chloride in these water bodies are higher than state Water Quality Standards?

Did you know– many **winter maintenance** activities like salt application, deicer storage, and snow removal contribute to stormwater pollution and can harm water quality?

Here's how Tewksbury businesses can help reduce stormwater pollution:

Employee Training

Updating current winter maintenance practices to reduce chloride pollution in stormwater will only be successful if the operators and supervisors responsible can properly implement them. Formal training should be held annually to make sure everybody is up to date on the latest practices.

Snow and Ice Removal

Any road salt, sand, or deicing chemical used in your parking lot is eventually carried to waterways by melting snow. Businesses should use these chemicals carefully and ensure they are properly stored when not in use. When possible, use natural deicing products that are not toxic to plants and animals.

Salt and Chemical Deicer Storage

Uncovered storage of road salt and chemical deicers are a significant potential contributor to stormwater pollution. All stockpile storage areas should be located in a covered area. All storage areas should be inspected regularly to ensure no material is exposed to stormwater.

Loading and unloading of materials can result in accidental spills and stormwater pollution. These activities should be performed in a covered area if possible. Any spills should be cleaned up and the area swept to prevent pollution.

Salt Usage Tracking

Businesses should track the application of road salt during the winter months. Different equipment uses varying amounts of salt. It is important to know how much salt you are using. This will help measure progress toward meeting water quality standards.

Operation and Maintenance Stormwater Best Management Practices (BMPs)

There are several winter maintenance BMPs that can be adapted to help reduce chloride pollution of stormwater runoff. Industrial and commercial properties with on-site stormwater management systems should consider implementing the following practices: pre-wetting, pre-treating, anti-icing, use of salt spreader controls, regular equipment calibration, use of asphalt temperature sensors, and follow improved storage and handling guidelines.

Questions?

More information is available at: www.tewksbury-ma.gov/

APPENDIX G

Additional Chloride Reduction Information

Current Winter Road Maintenance Policies – Mass DOT and Private Owners

Massachusetts Department of Transportation (MassDOT)

MassDOT owns and maintains three state roads in Tewksbury including I-495, I-93 and Route 38 (Main Street). The following documents reflect MassDOT policies on snow and ice management in Massachusetts:

- *MassDOT Snow and Ice Control Program: 2017 Environmental Status and Planning Report;*
- *Highway Salt Remediation Program Fact Sheet;*
- *MassDOT Snow and Ice Control Program: Annual Report 2019-2020;*
- *MassDEP Snow Disposal Guidance; and*
- *Massachusetts Stormwater Handbook.*

MassDOT has recently revised its contractor agreements and reimbursement rates to compensate contractors for acquiring pre-wetting equipment and closed-loop controllers in order to be much more efficient with deicing chemicals. All contractors must have closed-loop ground speed controllers in their spreader trucks as well as pre-wetting equipment with a flow meter. Rented equipment must also be calibrated by an approved, third-party calibrator and be inspected by MassDOT personnel prior to, and throughout, the winter season. All closed-loop systems must be able to report material use data including: pounds or tons of material applied, types of material, gallons of liquid dispensed, miles traveled, location of dispensed material, lane-miles applied, time of application, and application rates. The revised compensation rate also accounts for the extra time involved with data reporting with closed-loop controllers.

MassDOT has expanded its in-house training program for employees on an annual basis. MassDOT requires all employees involved in SICP activities (e.g., foremen, route coordinators and equipment operators) to attend annual operations training, which generally involves a half-day or full-day workshop. In 2016, each District had at least two operations training sessions. In addition, the Districts schedule separate "tailgate" training sessions at various depots for both state personnel and contractors. These "tailgate" training sessions are generally shorter in length and rotate around to different depots each year. The training focuses on equipment calibration and settings, MassDOT's policies and expectations, as well as safety and environmental considerations. MassDOT is going to provide a summary of outreach and training efforts undertaken since the 2017 ESPR process within the 2022 ESPR.

Private Sector Owners and Maintainers

The parking lot and private driveway owners and/or maintainers typically do not have snow and ice removal policies. Each parking lot or road is managed differently, based on the property owner's objectives. Currently there is no commitment from private parking lot owners or maintainers to reduce salt used in impaired watersheds.

In New Hampshire, to assist the private contractor/commercial property sector, the NH Legislature passed legislation (RSA 508:22) in 2013, which granted limited liability protection to property owners for "damages arising from insufficiencies or hazards caused by snow and ice" if they hired a Certified Green SnowPro™ contractor to manage their Chapter 2: Environmental Protection and Remediation 2-25 2017 Final Snow and Ice Control Environmental Status Planning Report (ESPR) for parking lots and roadways. To obtain certification, participants must attend a one-day training workshop, pass an exam and participate in a two-hour recertification program every two years. To maintain certification, contractors

must report their annual salt usage through an online reporting system. More information on the NH Green SnowPro™ Program can be found at: http://des.nh.gov/organization/divisions/water/wmb/was/saltreduction-initiative/salt-applicator-certification.htm.

A similar certification/training/reporting program will likely be needed in Massachusetts for the municipal and private contractor sectors to improve application and storage practices in watersheds of chloride-impaired receiving waters. To establish a similar type of Certification Program in Massachusetts, stakeholders will need to be engaged early and appropriate legislation, regulations and perhaps funding would be required to accomplish this effort.

Identification of Key Issues With Salt Use

It is important to understand how and why chloride is over applied to roadways and parking lots in order to develop best management practices to manage chloride application. The following five key issues summarize the primary reasons behind over application of road salt.

1. Not being able to readily identify those situations that warrant low- or no-salt application. Certain situations include:

    - Those instances when pavement or ambient temperatures are warm enough or rising to suggest that snow and ice will not accumulate in parking lots.

    - Extreme cold, where the application of road salt would not aid in melting the snow. Furthermore, it is suggested that application of road salt at 15°F is not recommended because it could cause brief melting and then refreezing, resulting in an icy road.

2. Not knowing and/or tracking how much material is being applied. It is important to understand that each vehicle or piece of equipment can apply different amounts of deicer. There are a multitude of variables that can affect the amount of salt applied. A salt tracking program is discussed in Section 5.1 of this document.

3. Applying more salt than is necessary to achieve desired results. It is important that managers and drivers are educated on how much material is needed to obtain the desired results. Gaining an understanding of how deicers work under a variety of weather conditions and pavement temperatures is key to reducing the amount of salt applied. Applicators need to determine and record appropriate application rates.

4. Potential liability is a concern when handling snow and ice removal, which can sometimes lead to over application of chloride. Privately owned commercial parking lots and driveways contribute significantly to salt loading in impaired waters.

5. Decisions are often made without knowledge of new technologies and practices. Ongoing training is important for all managers, supervisors, operational staff and hired contractors so that they remain aware of the latest technologies, and how they can best limit salt use for snow and ice management tasks. Training saves time and money and increases knowledge and safety. The University of New Hampshire's Technology Transfer Center offers a multitude of training opportunities that cover the types of snow and ice removal methods, types of material, how much material is needed and the right place and time for application, as well as many other topics.

Water Quality Criteria

In 1988, EPA published recommended Ambient Water Quality Criteria for chloride for the protection of aquatic life based on limited toxicity studies conducted and reported in the literature prior to 1985. The recommended water quality criterion for chronic exposure was established at 230 mg/L based on a four-day average concentration not to be exceeded more than once in a three-year period. The recommended acute water quality criterion was established at 860 mg/L based on a one-hour average concentration not to be exceeded more than once in a 3-year period. With regards to drinking water, MassDEP set a health guidance level of 20 mg/L for sodium within 310 CMR 22.16A of MassDEP Drinking Water Regulations. They recommend remedial measures for private or public wells that exceed 20 mg/L of chloride.

Chloride Reduction BMPs - Operational

Mechanical Removal

Increasing mechanical removal is one of the best ways to limit salt use. Mechanical removal should begin with the onset of the storm and continue throughout the storm. If de-icing chemicals are to be used, the primary goal is to remove as much snow or loose ice before applying chemicals. This maintains the chemical's effectiveness without concern for excessive dilution. Most snow removal policies in Massachusetts call for plowing to begin if there has been at least a 4-inch accumulation of snow on the road surface. Revisions should be made to incorporate more aggressive mechanical removal so accumulation on roads and parking lots does not occur. Anti-icing prior to the storm event should also be accompanied with mechanical removal to be most effective.

Pre-Wetting

Pre-wetting is a term referring to a liquid deicer (brine or proprietary chemical) that is applied to a solid-based deicer in order to create a quicker reaction time for the solid deicer to begin melting snow and ice. Salt does not work until it is in solution, so it is recommended that all dry salt be pre-wetted regardless of the temperature. By introducing moisture into salt prior to application, the results are a quicker melting action, reduced bounce and scatter of material, and a reduced application rate. Pre-wetting is typically done by adapting spreader trucks with saddle tanks and spray nozzles which apply approximately 8-10 gallons/ton of a liquid to solid deicer.

Pre-Treating

Pre-treating of dry salt can be done before, during, or after it has been loaded into the truck. Pre-treatment is done by applying salt brine or a proprietary chemical to dry salt.

Anti-Icing

Anti-icing is a preventative or proactive strategy which involves placing snow and ice control chemicals on the roadway up to 48 hours in advance of the onset of a storm. Application of an anti-icing material is designed to prevent and/or weaken the precipitation's bond to the pavement, making removal of snow or ice easier than with traditional deicing methods, and buys critical response time. The applied chemical remains on the pavement surface and activates when precipitation begins.

Chloride Reduction BMPs – Equipment

Sensors: Truck Mounted or Hand-Held

Knowing the pavement temperature is essential to making the right decision for treatment options. Most weather stations measure conditions thirty feet in the air which can differ significantly from the surface of the roadway. The two most common types of sensors are Mobile Freeze Point/Salinity Sensors and Mobile Pavement Temperature Sensors.

Hand-held infrared temperature sensors can only be used when the vehicle is stopped or moving slowly, and the truck-mounted temperature sensors take measurements while the truck is moving. A hand-held temperature sensor can be purchased for as little as $100 from an auto parts store and is an inexpensive addition to the decision-making toolbox. Salometers are used to determine the percent salinity of brine mixtures and are critical to have while operating a pre-wetting/anti-icing program.

Automated Vehicle Location (AVL)

AVL collects real time data and equipment location through GPS receivers, transmitters and software. Data is used to track salt use, rationalize the number of trucks being used and to demonstrate prudent usage.

Ultimately, it may be possible to program the GPS enabled controllers using georeferenced data, to automate applications and/or prevent redundant or unnecessary applications based on local weather and road data. GPS/AVL equipment provides data including:

- Material application rates;
- Amount of material applied;
- Road and air temperature; and
- Vehicle position and speed information.

This information can be used for planning purposes and monitoring of plan implementation.

Plowing Capabilities

Proper plowing of the road is essential to controlling the road conditions. Snow plowing with the proper blade needs to remove as much snow as possible prior to the application of chemicals. Any plow blade improvements that can make plowing more effective can lead to reduced labor and equipment costs as well as less deicing chemical usage. Snow and ice that is left on the pavement will only work to dilute the chemical that has been applied and decrease the effectiveness. Additional applied chemical will have little benefit if the snow is not adhering to the pavement surface when plowing is the appropriate operation.

Newer plow blades have become lighter and more flexible. There are a multitude of plow types, including one-way front plows, reversible plows, deformable moldboard plows, underbody plows, side winds, expandable plows, and plows specifically designed for slush removal. Plows are hydraulically controlled and can have quick-change buffer systems allowing for a fairly short time to mount or dismount. Manufacturers have also developed plows that are hydraulically extendable. These extendable plows allow for width adjustment from 9-12 feet depending on lane width. Underbody plows are highly recommended since they can be used in conjunction with one-way front

plows, side wing plows, and rear wing plows. They provide downward pressure and can scrape the roadway clean for the best snow removal results.

Ground Speed Operation

There are three factors in determining a truck's salt application rate: gate opening, speed of the spreader belt, and the travelling speed. Ground speed-oriented spreaders keep application rates constant because the belt speed in the spreader corresponds to truck speed. Incorporating ground speed controls is one of the most critical changes that can be made to achieve salt reduction. Calibration and monitoring of the spreader control is important for the accuracy of your application rates.

Salt/Sand and Pre-Wetting Spreaders

The total amount of deicing chemical used for winter maintenance significantly influences the type of spreader equipment needed. Accurate spreader controls are needed to account for material being applied and should be consistent based on a full or near empty load. The spreader needs to be able to operate under a variety of conditions including very low temperatures, high moisture, and be resistant to corrosion. Hoppers should be constructed so that excess salt can be removed from the spreader and so that they can be removed during the off season so the vehicle can be used for other purposes. Spreaders designed with discharge at the rear can allow for a slide-in capability that can be mounted and dismounted. Various types of spreaders include hopper spreaders, tailgate spreaders, reverse dumping spreaders, and spreaders that are variations of these. Slide-in spreaders tend to be the most cost effective with a longer useful life and are easy to maintain and clean away salt residue. They use a conveyer chain and chute system for material applications either with a spinner or direct drop to the road surface. Slide-in spreaders also can handle a pre-wetting system.

Zero Velocity Spreaders (ZVS) can optimize the use of deicing material by controlled distribution. Material is dispensed at the same velocity as the forward motion of the truck; the two velocity components essentially cancel each other out causing the salt to drop on the road as if the vehicle was standing still. This helps reduce bounce and scatter and reduces the required volume of deicing material. ZVS also have the capability to pre-wet. There have been some mechanical complications while pre-wetting under certain conditions.

Pre-Wetting Spreaders

Pre-wetting is typically done by adapting spreader trucks with saddle tanks and spray nozzles which apply approximately 8-10 gallons/ton of a liquid to a solid deicer. It is most common for salt brine at 23% concentration to be sprayed onto solid salt as it passes through the spreader chute. Plow and spreader trucks looking to add pre-wet capabilities require investment to purchase the saddle tanks, pumps and nozzles that can apply a liquid at the spreader's spinner. As with any chemical application, calibration is critical to controlling the amount applied to the roadway.

Some of the most common types of liquid spreaders are spinner type, distribution bar with nozzles, chassis-mounted, slip-in, and tow-behind. During the initial start-up programs, modifications of existing equipment may be the most economical approach. Some highway agencies have been successful in modifying asphalt distribution trucks, liquid fertilizer spreaders and spreaders used for weed control.

Salt Slurry Spreaders

Salt slurry applicators generally combine the beneficial aspects of pretreatment and prewetting by increasing the liquid to solid ratio and applying granular road salt material in a semi-solid or liquid paste. This salt slurry results in a more activated and concentrated application that "sticks" to the roadway. Slurry spreaders have been shown to require less salt and deliver a quicker response time because the material was already in near liquid or dissolved form.

Front End Loader Weighing System

MassDOT recently pilot-tested the use of computerized front-end loader scales at select depots to evaluate whether these devices might improve the tracking of deicer material used by vehicle and spreader routes. Currently, these devices can help to validate the material usage reporting and perhaps identify some of the variables involved with tracking material usage using closed-loop controllers and/or with recording bucket loads manually by front-end loader operators. The results of the additional ongoing testing will help to determine whether the potential benefits of front-end loader scales to improve the material usage reporting process will outweigh the potential added costs to install these devices.

Table A-2 outlines best management practices which Tewksbury does not currently utilize and their achievable chloride reductions without decreasing the level of service. Estimated reduction percentages were derived by the New Hampshire Department of Environmental Services from a combination of literature review, information provided by equipment manufacturers, and other states' experience implementing reduction programs.

Table A-1. Additional Chloride BMPs Reduction Potential

Chloride Reduction BMPs	Definition	Potential % Chloride Reduction
Zero-Velocity Spreaders	Spreader ejects salt particles at the same velocity of the forward motion of the truck's travelling speed; allowing salt to drop as if the spreading vehicle was standing still.	10% - 50%
Groundspeed Oriented Spreader Controls	Allows accurate dispensation of prescribed salt application rates irrespective of vehicle speed. Controls can be integrated to automatically vary application rate with ground temperature. Controller units can integrate GIS and wirelessly download application rate data for review.	10% - 30%*
In-Cab Air/Ground Temp. Sensor	Installation of pavement and air temperature sensors with in-cab readout	1% - 10%*

Note % reduction assumed does not take into account existing practices.

* Highly dependent on existing procedures and level of adoption.

Chloride Reduction BMPs – Storage and Site Maintenance

Although the Town does not currently store any de-icing materials within the watersheds that are impaired for chloride, this section outlines some of the best management practices which the Town will consider if their winter maintenance storage practices change in the future.

In addition to managing how salt is applied to parking lots and roadways, it is also important to manage how dry salt, pre-wet salt, salt brine, salt/sand mixtures, and snow piles are stored and handled. This section was adapted from the Massachusetts Stormwater Handbook and NHDES Fact Sheet WD-DWGB-22-30.

Chloride storage facilities can contribute to both surface and groundwater contamination. The location of a storage facility should not be in an area that is environmentally sensitive. Avoid areas where there are wells, reservoirs, or within the footprint of stratified drift aquifers.

Ideally deicing material storage facilities should be completely enclosed, with storage and working areas on impervious surfaces such as asphalt or coated concrete. Buildings should have concrete foundations and can be designed using dome, barn, or fabric style structures.

There should be stormwater drainage controls to prevent runoff water and snow melt from contacting or running through loading and material storage areas. Overhead cover to protect material from exposure to snow and rain should be installed to minimize runoff and inventory loss. A fixed roof is preferred over a tarp because it is difficult to keep storage piles completely covered with tarps during winter months and storm events.

As a general practice, site drainage should direct clean stormwater away from the operations and storage areas to keep the stockpiles as dry as possible. In new facilities or facilities that are being retrofitted, drainage that is contaminated with salt should be directed to a wastewater treatment facility (subject to municipal approval), collected for use in pre-wetting activities or sent for proper disposal.

<u>Salt Storage Structures</u>

- All salt and sand/salt mixtures should be stored on pads of impermeable asphalt or concrete. Storage and loading areas should have an impermeable floor constructed of asphalt, concrete or other suitable material that extends around the buildings and work area exterior. The area should be sloped away from the structure to prevent stormwater from entering the loading areas or structure.
- Concrete pads and walls should be treated to prevent concrete deterioration.
- Structure hardware should be galvanized, and concrete block buildings should be waterproofed inside.
- If using a three-sided building, the exposed salt at the open end should be covered.
- Stormwater and snowmelt runoff should be properly controlled. Building floors and storage pads should be sloped to prevent ponding and allow any water to drain away from the storage piles.

<u>Onsite Management: Delivery/Handling/Loading</u>

- All sand and sand/salt mixtures temporarily out in the open should be covered to prevent salt from being washed or blown from the pile.

- If a permanent covered work area is not possible, then storage and handling activities should be conducted on impermeable (bituminous) pads. Any deicing materials left outdoors should be completely covered with waterproof tarpaulins.
- All surplus materials must be removed from the site when winter activity is finished.
- Working areas should be bermed and sloped to allow snow melt and stormwater to drain away from the area. In some cases, it may be necessary to channel water to a collection point, such as a sump, holding tank, or lined basin for collection.
- Storage and distribution should only be conducted during the fall/winter season.
- Spreaders should not be overloaded such that material spills off the vehicle. A plan for loading operations to prevent overfilling vehicles and eliminating material spillage during transportation should be developed and implemented.
- Salt spilled at the storage yard and loading areas should be collected and returned to the storage pile.
- Annual inspection and repairs should be carried out prior to the start of each season.
- Ongoing inspection of storage structures, work areas, and deicing liquid storage tanks should be carried out during the season.
- Solid bagged materials should be stored securely, indoors if possible.
- Spreaders should only be washed at a location where the wash water is properly managed.
- Liquid storage tanks should be designed such that a plumbing failure will not result in release of the contents. Backflow prevention may be necessary on some plumbing applications.

Snow Storage and Disposal

The following guidelines are adapted from the MassDEP Snow Disposal Guidance. Snow Disposal is necessary, but we must select safe places to dump plowed snow. Snow dumps are kept out of water bodies due to the litter and debris content. Litter and debris do not belong on the land surface either; after the snow melts, all litter and debris must be collected and disposed of properly.

1. Site Selection
    - Within water supply Zone A and Zone II, avoid storage or disposal of snow and ice containing deicing chemicals that has been collected from streets located outside these zones.
    - Avoid storage or disposal of snow or ice in Interim Wellhead Protection Areas (IWPA) of public water supply wells, and within 75 feet of a private well, where road salt may contaminate water supplies.
    - Avoid dumping snow into any waterbody, including rivers, the ocean, reservoirs, ponds, or wetlands.
    - Avoid dumping snow on MassDEP-designated high and medium-yield aquifers where it may contaminate groundwater.
    - Avoid dumping snow in sanitary landfills and gravel pits.
    - Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage systems including detention basins, swales or ditches.

2. Site Preparation and Maintenance
    - A silt fence or equivalent barrier should be placed securely on the downgradient side of the snow disposal site.
    - Wherever possible maintain a 50-foot vegetated buffer between the disposal site and adjacent waterbodies to filter pollutants from the meltwater.

- Clear debris from the site prior to using the site for snow disposal.
- Clear debris from the site and properly dispose of it at the end of the snow season, and no later than May 15.