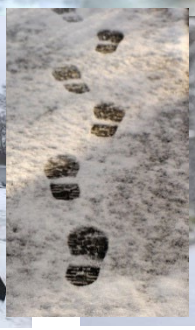
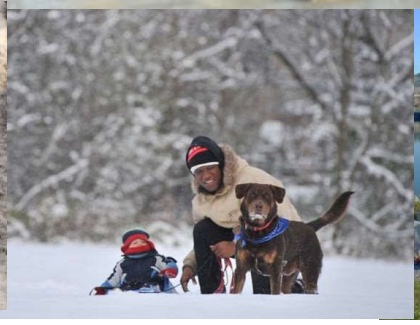
OPERATIONS DEPARMENT
April 8, 2022

Salt Management Plan





REVISION HISTORY

Date	Revised By	Comments
November 2016	KL	Salt Management Plan
January 23, 2018	KL	Update to weather monitoring section of established RWIS stations.
August 12, 2020	CB	Complete document review/update
March 30, 2021	JSD	General updates to road and sidewalk networks, application rates, City departments and initiatives.
March 25, 2022	CB	Update to road and sidewalk networks and City departments and initiatives

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1 INTRODUCTION

In 2001, Environment Canada released an assessment report stating that road salts are entering the environment in large amounts and are posing a risk to plants, animals, birds, fish, groundwater, and lakes and stream ecosystems. Road salts are used in Canada as de-icing and anti-icing chemicals for winter road maintenance with some use as summer dust suppressants. The Government of Canada has not banned the use of road salts or proposed any measures that would compromise or reduce road safety. The environmental risk management strategy for road salts has focused on the development of best practices respecting storage, spreading and disposal, while ensuring that road safety is not negatively impacted.

In response to Environment Canada's initiative to develop measures to manage the risks associated with road salts, the City of Barrie has developed and implemented this document which summarizes the City's road salt management practices. The purpose of this document is to highlight key elements of the City's current practices and identify plans for future implementation that will encompass the best management practices for road salt application and will comply with the proposed federal code of practice. As we search for ways to reduce the usage of salt, the safety of both pedestrians and drivers will remain our top priority.

The City of Barrie has approximately 1553 lane kilometres of road and 619 kilometres of sidewalk that are maintained during the winter. These winter maintenance activities include anti-icing, plowing, salting, and sanding. Snow and ice conditions on the road system have a dramatic impact on public safety, roadway capacity, travel time and economic costs. The City, like other road authorities, must use road salt to maintain safe roads and sidewalks for the people of Barrie during the winter.

Since the Environment Canada report in 2001, the City of Barrie has introduced several changes to its winter maintenance activities to reduce the total amount of salt used to maintain user safety on our roads and sidewalks. Although there is ongoing research into the use of alternatives to conventional road salt (sodium chloride) for winter maintenance, salt continues to be the most cost-effective de-icer available. Due to the adverse effects that salt has on the environment, the City continues to use best practices and explore new methods and technologies to minimize the amount of salt entering the environment while continuing to deliver a safe and effective winter maintenance program.

2 SALT MANAGEMENT POLICY

2.1 PURPOSE AND OBJECTIVE

The Salt Management Plan sets out a policy and procedural framework for ensuring that the City of Barrie continuously improves the management of road salt used in winter maintenance operations. It is based on a comprehensive comparison of past practices against best management practices. The plan sets out specific goals for improving the City's salt management practices.

Any modifications to the City's winter maintenance activities must be carried out in a way that continues to provide road and sidewalk safety and user mobility. The City is committed to exploring new technologies and practices in winter maintenance activities to reduce the amount of salt entering the environment, while ensuring safety is not compromised.

This Plan is dynamic, allowing the City to explore and implement new approaches and technologies in a way that is responsive to fiscal demands and the need to ensure that roadway safety is not compromised.

2.2 RESPONSIBILITIES

Everyone within the City of Barrie and the Operations Department connected to winter road maintenance has some responsibility for developing, implementing, and reviewing the success of the Salt Management Plan and its associated activities. It is through a cooperative effort that the City will reduce the environmental effects of road salt while maintaining a safe transportation network.

2.3 UPDATING

The Salt Management Plan is reviewed annually and updated as needed, as well as when new technologies or practices are added or changed.

2.4 VISION, MISSION AND MANDATE

2.4.1 VISION

The City of Barrie will be recognized as an exceptional example of an environmentally responsible user of pre-wetting using salt brine, anti-icing, and de-icing techniques to provide for safe road and sidewalk conditions during the winter months.

2.4.2 MISSION

The City of Barrie will ensure optimal use of pre-wetting using salt brine, anti-icing, and

de-icing techniques on Barrie roads and sidewalks while striving to minimize salt impacts to the environment.

2.4.3 MANDATE

The Operations Department must provide safe winter conditions for vehicles and pedestrians as required by level of service policies and funding guidelines approved by the Barrie City Council.

2.5 POLICY STATEMENT

The City of Barrie will provide effective winter maintenance to ensure the safety of users of our road network and sidewalks in keeping with Provincial Legislation and accepted standards while striving to minimize the adverse effects that the use of road salt can have on our environment. To meet this commitment the City of Barrie:

- Will adhere to the guidelines contained within the Salt Management Plan;
- Will review and update annually and as needed the guidelines contained in the Salt Management Plan;
- Will strive to continually improve winter operations through research and implementation of new technologies and developments; and
- Is committed to ongoing staff training and education.

2.6 APPLICATION

This policy is adopted by the City of Barrie Operations Department and applies to all employees involved in Winter Maintenance Operations.

3 WINTER MAINTENANCE ACTIVIES

The following winter maintenance activities are covered under this plan:

- Weather monitoring
- Winter event
- Loader scale
- Salt and sand (loading, storage, application)
- Anti-Icing
- Pre-wetting
- Salt brine production and storage
- Treated salt use and storage
- Organic anti-icing/de-icing liquids
- Material tracking
- Snow storage and disposal liquids

3.1 WINTER EVENT

Winter weather includes various combinations of precipitation, humidity, air and pavement temperatures, wind, and visibility. A successful winter operation employs numerous practices based on the weather conditions.

The prime objective of applying salt on the road surface is to prevent the formation of ice rather than to melt an accumulation. Therefore, salting, whether prior to or during a storm, must be timed appropriately. The exact effective range of salt varies, being dependent on many factors. Salt applied in brine form prior to or in solid form at the beginning of a storm will prevent snow from bonding to the road surface so that the plows are able to remove the snow more effectively. During a storm where plowing is continuous, further salt applications after each pass of the plow will prevent ice formation. Salt applied in the early morning immediately after plowing will have the advantage of any morning sunshine and increased traffic volume to aid the melting process. Speed and safety with a controlled distribution of salt are the important factors in efficient salting.

3.2 LOADER SCALE

During the winter months, all vehicles are loaded by one of two loader operators who track all loads using electronic loader scales. The loader scale tracks the unit number of the vehicle being loaded, as well as the quantity of material loaded. This information can be used to track and verify the amount of salt used by the unit. It has been used to discover electronic spreader devices that have malfunctioned or operators who have used incorrect application rates.

3.3 SALT AND SAND

3.3.1 LOADING

Spreaders are loaded indoors whenever possible to prevent any spilled salt being exposed to precipitation and escaping to the environment. When loading spreaders outside of the storage structure, care is taken to minimize spillage of salt onto the loading pad. Deliveries are placed within the covered storage facility as soon as possible and care is taken when loading spreaders to prevent salt loss.

3.3.2 STORAGE

The City of Barrie has one salt storage facility and one sand storage building. The salt storage facility has the capacity to store approximately 15,000 tonnes of salt and 100 tonnes of treated salt, 24 vehicles, all brine production and pumping equipment, two 30,000 litre double walled storage tanks for brine and two organic liquid tanks. The sand storage building can accommodate approximately 3,500 tonnes of sand/salt mix. Having all

materials under cover and on an impermeable base limits the amount of salt that can escape to the environment due to wind and storm water runoff.

3.3.3 APPLICATON

The City of Barrie uses electronic spreader controls in all City and contracted equipment. The electronic spreader units allow for accurate placement of sand and salt, so that the right amount of material is applied. The application rates are based on the current and forecasted weather conditions, the road classification, and other factors including but not limited to slope, speed limits, and bus or emergency routes. The electronic spreader controls also allow for downloading of activity information for verification. These units are calibrated annually to ensure accuracy.

3.4 ANTI-ICING

Anti-icing is the pro-active application of a chemical to the pavement before a storm or formation of frost to prevent the bonding of ice or snow to the road surface. To accomplish this, the City uses Direct Liquid Application (DLA); salt brine is sprayed on the road surface, the water component of the brine evaporates, and only the salt component remains on the road surface. This kind of treatment can be applied well in advance of a storm (up to two days) provided that the storm does not start out with above freezing temperatures and rain, which will wash the chemical away. Anti-icing reduces the overall application of salt.

3.5 PRE-WETTING

Pre-wetting of the salt as it is being spread onto the roadway increases activation of the chemical process to melt snow and ice. Pre-wetting also reduces the "bounce" that occurs when dry salt is spread on a hard road surface reducing the loss of salt to the roadside and total amount of salt needed. This method reduces the overall costs and environmental impact. All City and contracted units that spread salt are fitted with on board pre-wetting equipment. Pre-wetting settings in the electronic spreader control are set according to different weather conditions and temperatures to ensure the most effective application.

3.6 SALT BRINE PRODUCTION AND STORAGE

The City of Barrie produces its own brine with an automated brine maker. This system ensures an accurate mix of salt and water. The brine, at 23% salt concentration by weight, is used for anti-icing and pre-wetting. Brine produced on site is stored within the salt storage facility in two 30,000 litre double-walled tanks designed to contain the liquid in event of a tank rupture or leak.

3.7 TREATED SALT USE AND STORAGE

Due to the lack of pre-wetting capabilities in the units that clear and treat parking lots and waterfront trails, the City of Barrie uses treated salt as an anti-icing and de-icing agent for these locations. Treated salt is rock salt that is premixed with liquid magnesium chloride. This product has allowed the City to reduce the quantity of material applied in parking lots and trails while still achieving the same result. Due to the product's damp texture, it does not bounce and scatter like dry salt and will not be affected by wind. The treated salt is also used as the salt additive to winter sand, mixed at a rate of 6%. This product allows the City to reduce its overall salt use.

3.8 ORGANIC ANTI-ICING / DE-ICING LIQUIDS

The City of Barrie uses an agricultural liquid product as an additive to brine and as a pre-wetting agent when the temperature is below -12°C. This reduces salt use but is too costly to use exclusively.

3.9 SNOW STORAGE AND DISPOSAL

Snow plowing operations result in the accumulation of snow at the side of roads as windrows or mounds. To maintain capacity for subsequent snowfalls, the City starts snow removal operations when these windrows reach volumes that impact the required minimum width of bicycle lanes and travel lanes as per the minimum maintenance standards. Snow removed from the City's streets is stored at the Operations Centre at 165 Ferndale Drive North. This location has an impermeable pad and a stormwater management pond to manage meltwater. Should snow storage exceed our limit, a snow melter may be used to melt the snow. The effluent is discharged through an oil and grit separator to the stormwater management pond. Additional snow storage is also available at the Environmental Centre at 272 Ferndale Drive North.

4 MONITORING

4.1 WEATHER MONITORING

The City currently has five Road Weather Information Systems (RWIS) stations at the following locations:

- Bayfield Street/Livingstone Street
- Yonge Street/Ashford Drive
- Georgian Drive/Governors Drive
- Veterans Drive/Commerce Park Drive
- Ardagh Road/Mapleton Avenue

These RWIS stations provide internet access to current weather radar information and forecasting specific to the City of Barrie. These stations provide Road Patrollers and Forepersons real-time site conditions, specific weather state and precipitation over the internet including:

- Pavement temperature
- Pavement condition
- Wind speed and direction
- Atmospheric temperature and humidity
- Types of precipitation

The Road Patrol and Foreperson vehicles also have mobile road temperature sensors that read the surface temperatures of the road they are travelling over. This information enables staff to make informed decisions as to when and where winter operations should commence or end, including what material application rates will work best for the forecasted or actual conditions present.

Road Patrollers and Forepersons can also use several weather reporting services such as Environment Canada, local weather forecasts, and internet sources.

As the City expands, it continues to explore the opportunity to install new RWIS stations to provide weather monitoring and forecast information to ensure service levels are consistent throughout the City.

4.2 AUTOMATED VEHICLE LOCATION (AVL)

The City of Barrie has an Automated Vehicle Location (AVL) system that includes tracking equipment installed in all winter maintenance vehicles. The use of AVL allows staff to ensure that all roads have been covered. It provides vehicle tracking and monitoring, twenty-four hours a day, seven days a week, over the internet for as many vehicles as required.

The live system enables City staff to monitor these vehicles. It keeps track of the location and application rate of all material spread. This contributes to the City's ability to control the amount of road salt used on the road surface and ensure our committed level of service is met for our community.

The AVL allows for the recording and analysis of the following:

- Truck speed
- Vehicle location
- Start and finish times
- Wing and plow activation status
- De-icing and anti-icing material tracking

- Spreader controls (on or off and application rate)

4.3 EQUIPMENT CALIBRATION

All City and Contractor winter operation vehicles are equipped with electronic spreader distribution systems. The vehicles are calibrated at the beginning of the season and again when necessary. The following application rates are currently used for salt:

- 50 kg/lane km
- 100 kg/lane km
- 130 kg/lane km
- 150 kg/lane km
- 195 kg/lane km

The average salt application rate for roads is 130 kg/lane km. Vehicle operators can make judgment calls to increase or reduce application rate at different road geometries, i.e. hills, curves, and intersections to address route specific road conditions.

The following application rates are currently used for sand:

- 500 kg/lane km
- 650 kg/lane km

4.4 RECORD KEEPING

All City staff involved in winter maintenance activities, including foremen, patrollers, equipment operators, and contracted staff are required to record all activities, including material usage and location. This information is used to calculate and keep track of salt usage and distribution across the City.

4.5 OPERATOR TRAINING

To be eligible to operate winter maintenance equipment the operator must be on the approved operators list. To be placed on this list they must have a valid DZ driver's license or higher and have attended the City of Barrie’s comprehensive winter control training seminar prior to the start of the winter season. Topics covered in this training seminar reflect the Winter Operations Plan and any other important information.

Operators, patrollers, forepersons, supervisors, and technical staff also attend the Ontario Good Roads Association’s Snow School or parts of the Association of Road Supervisors of Ontario Winter Operations Series.

5 INITIATIVES

The Operations Department will continue to seek the optimal use of pre-wetting, anti-icing and de-icing techniques on City roads and sidewalks while maintaining safe surfaces for pedestrian and vehicular traffic and striving to minimize salt impacts to the environment. The following are a list of initiatives that have been completed, are ongoing or completed annually or are scheduled to be implemented in the future based on resource availability:

Completed Initiatives:

- Implemented a procedure that captures road gradients and curves from as-built drawings and incorporates them into the appropriate GIS layer on the Spatial Data Engine (SDE).
- Conducted a microclimate analysis within the City boundary to determine where additional RWIS stations provide the most value-added services to the Corporation.

Ongoing/Annual Initiatives:

- Implement City Winter Operations Plan including staff training for source water protection areas and smart on use of salt.
- Provide operational support to the Infrastructure Planning Group in reviewing transportation infrastructure that receives winter maintenance services to better identify users of the system (e.g. vehicles, bicycles, e-bikes, pedestrians, etc.). This occurs at a minimum every five years and incorporate user data and winter maintenance considerations into the Transportation Master Plan.
    - Winter maintenance walkway enhancements for pedestrian travel.
    - Continued plans for active transportation winter maintenance.
- Perform an annual review of transportation infrastructure that receives winter maintenance services, specifically priority plow (and salt/sand) routes to identify opportunities for improvement and propose changes in service. This includes all road segment planning classification (Arterial, Collector, and Local), MMS class, gradient, zoning, proximity to points of interest (schools, vulnerable sector community, churches, and community buildings) and environmental vulnerability of the surrounding area.
    - Additions made to salt routes
    - King St. (Reid to Reid) and Hollyholme Farm Road (Mapleview W to King) were converted from secondary to priority due to increased development occupancy.
- track the volume of anti-icing/de-icing materials used for parking lots, Barrie Environmental Center, and Parks using loader scale (effective November 2020).
- Provide public education regarding salt application best management practices and the City's winter maintenance program through the City’s website, promotional materials, the local newspaper, informational pamphlets, ads through City run social media outlets, etc.

- Participate in the Ontario Road Maintenance Group to keep current on industry practices. Share and learn from the established group about the innovated winter operations practices and applied materials to reduce negative environmental impacts.
- Review Road Patrol routes to ensure a representative sample of roads is patrolled.
- Plowing is used as the primary technique to clear roads, reducing the amount of de-icing material applied to surfaces.
    - Three combination units were added to the fleet and began operation in November 2021.
    - Through Attrition, tandem axle salt/sand trucks will be replaced with combination units.
    - Winter route review. Three additional priority routes will come online for November 2022 and 3 additional secondary routes will come online November 2023. Shortened routes will decrease time required to plow streets and reduce salt usage.
    - Priority routing system under review. Implementing 2-stage LOS of priority routes underway. Identified in 2021; work occurring in 2022, and routes will be ready by November 2022.
- Current and future City operations facilities are designed and constructed in accordance with the Transportation Association of Canada's Best Practices related to the effective management of road salt.
    - Redevelopment planning of 165 Ferndale North was ongoing through 2021. This includes a new salt storage building.

Future Initiatives:

- Conduct field data collection and assist the GIS Branch in preparing a city-wide map of road curvatures.
- Perform analysis and research in establishing areas for direct liquid application routes with the use of additives.
- Update Global Positioning System devices used by City plows, sanders, and contractor vehicles to incorporate Salt Vulnerable Area maps and track salt application within these areas.
- Determine where to Install road watch sensors on bridges throughout the City to improve transportation infrastructure winter maintenance services.
- Engage with post-secondary institutions that are currently performing research on winter maintenance practices.

6 CLOSING

The City’s Salt Management Plan, the trial of new materials, equipment, and technologies has provided a positive step towards reducing our salt usage, while maintaining the same level of service the public has come to expect.

The Operations Department will continue to measure and evaluate these benefits for operational improvement, cost savings, and environmental benefits on a yearly basis or as need dictates.